



CS311 Assignment 2

“Operating System”

Sem 1, 2025

—

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Section A - Virtualization Software

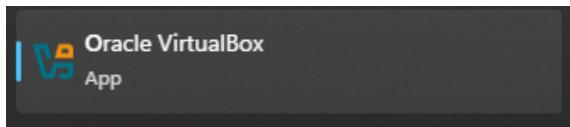
Part 1 - Setting up Android - Bliss OS (v-14.10.3)

Follow the instructions in the video.

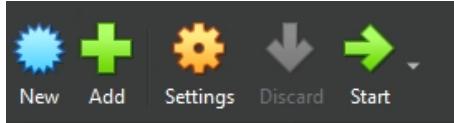
- **Video Link:** <https://youtu.be/4YFBadm1PU?si=0HmIEsWYrW1iQypb>

Part 2 - Setting Up Windows Server 2022 Data Center (Desktop Experience)

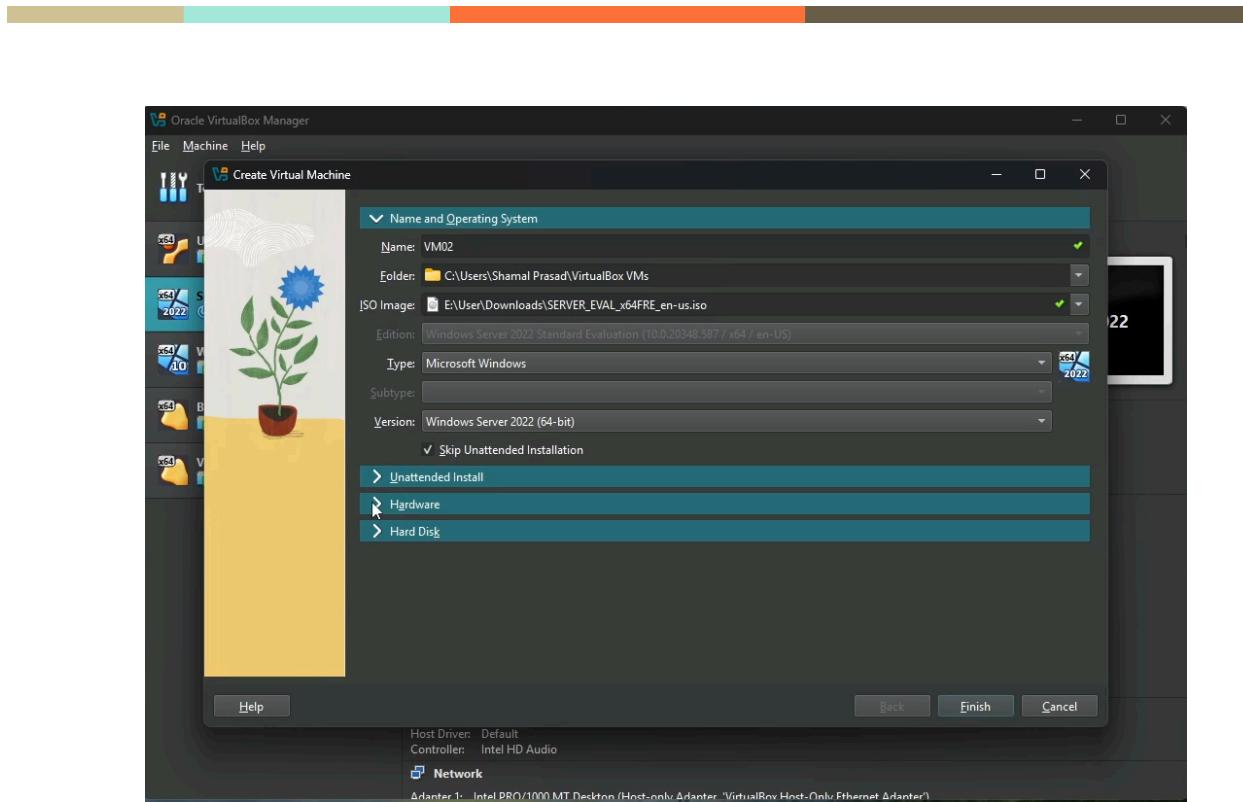
Step 1: Launch Oracle Virtualbox.



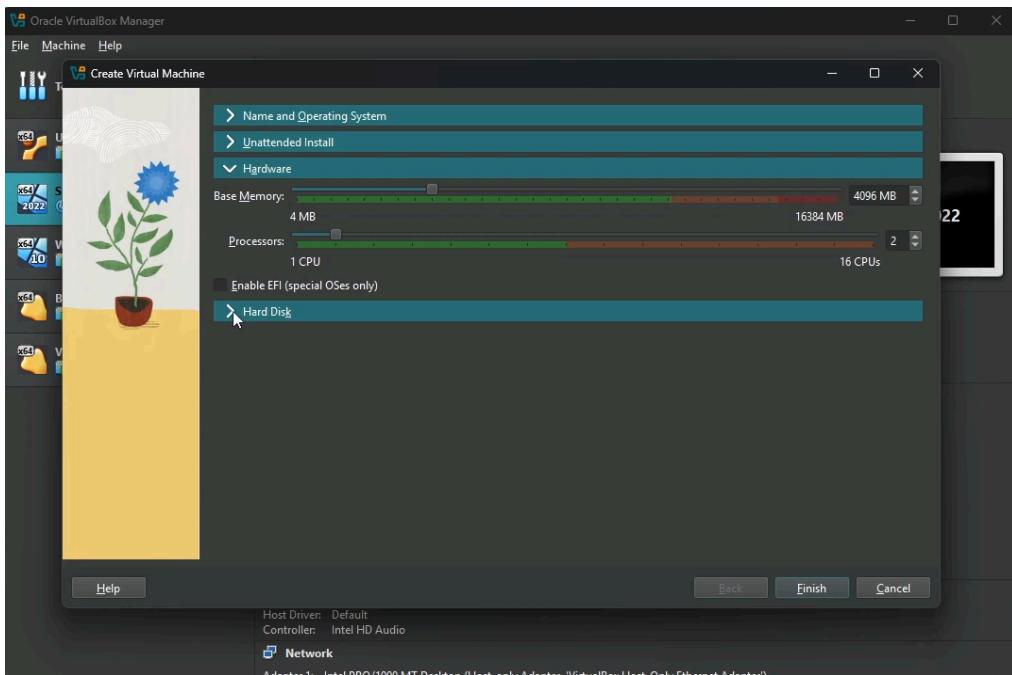
Step 2: In the VirtualBox Manager window, click the "New" button to start the process of creating a new virtual machine.



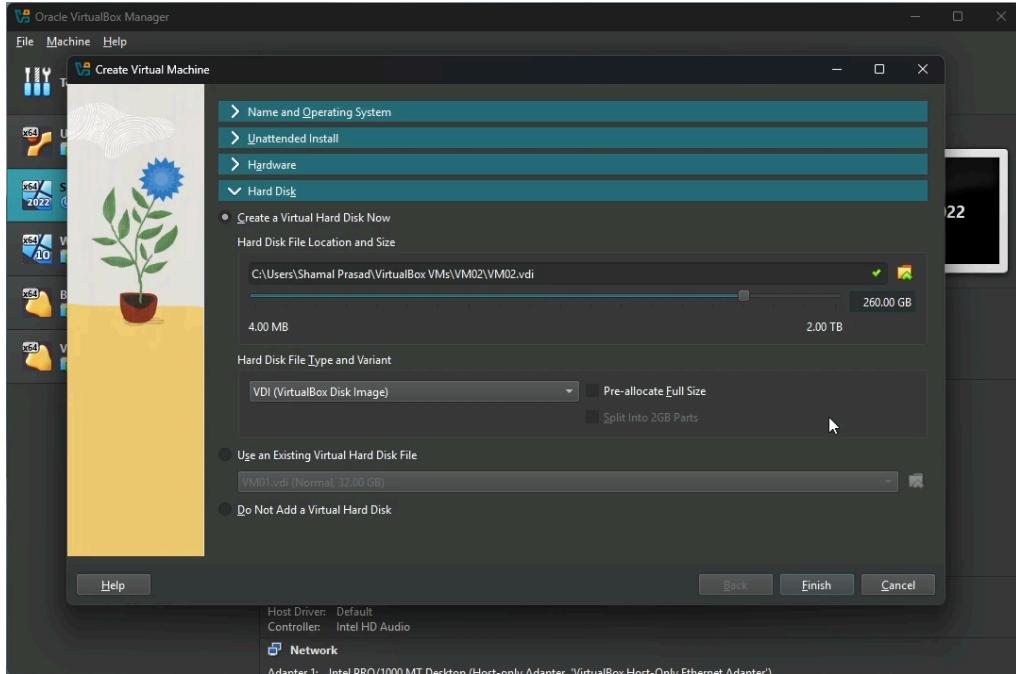
Step 3: In the Create Virtual Box Machine, enter the name of the guest OS, in our case its VM02. Click the drop down menu for the ISO image and select your desired ISO image that contains the OS that you want to install. Ensure that the Skip Unattended Installation is checked.



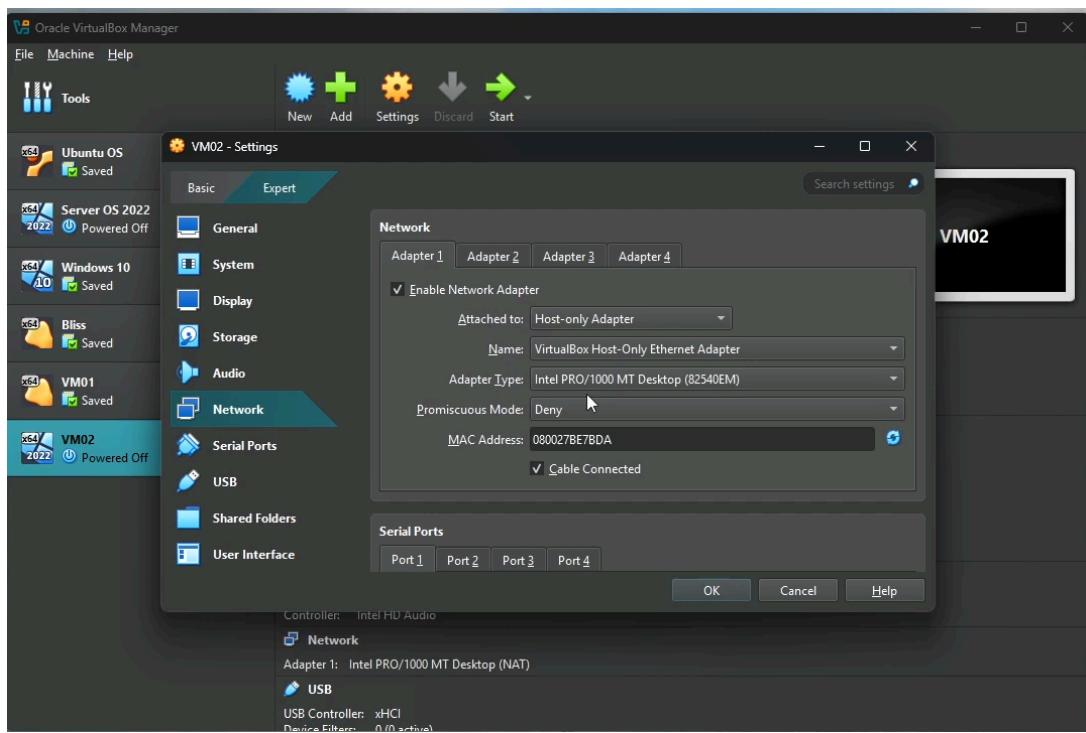
Step 4: Configure the hardware by choosing the right amount of memory and CPU cores to ensure the system runs smoothly. Minimum amount of required RAM should be 2GB. But you can allocate more than that as you see fit, we have allocated 4GB of RAM due to our personal computers Hardware being sufficient to do so. Just ensure to not over allocate as it will hinder the performance of your main computer. The core can be left at 1 as it is enough or 2 if your personal system can handle it.



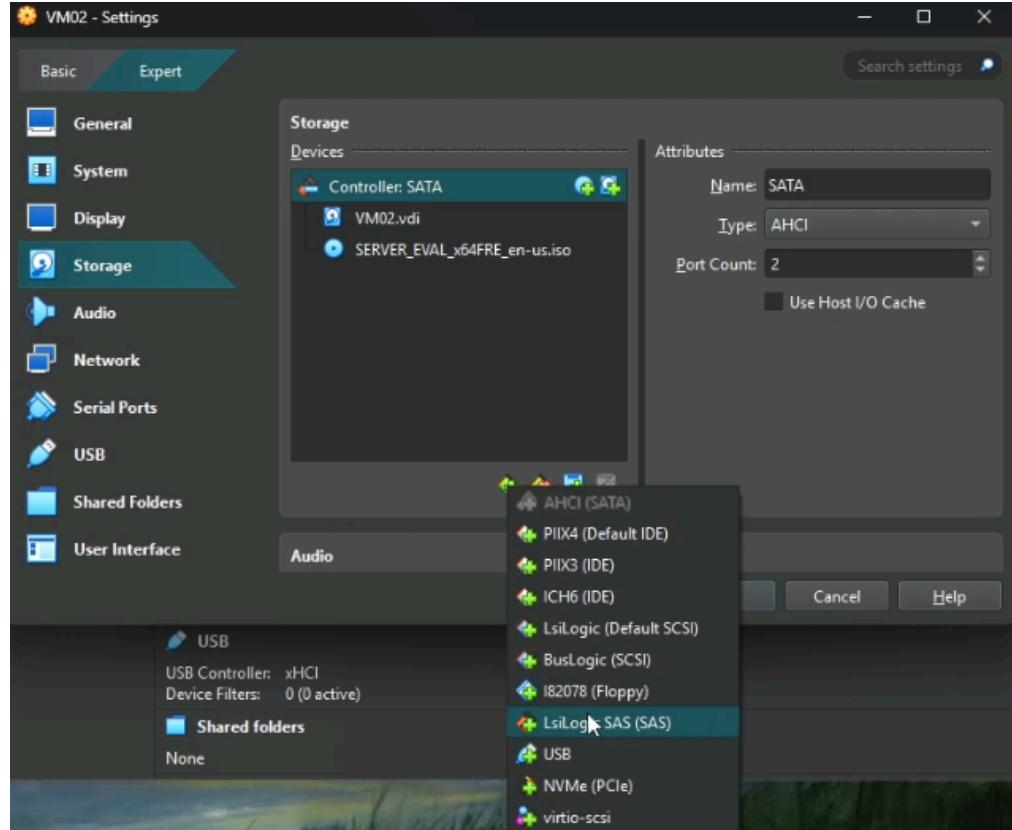
Step 5: Configure the size of the hard drive that the OS can use, changing the slider or typing the value out. Around 260 GB of space should be enough for the server OS as it will be used in the configuration of the system and create necessary partitions. Once allocated, click Finish.



Step 6: Before running the Server OS, some settings need to be changed. Open the Settings in the VirtualBox Manager window and locate the network setting and ensure you are on Expert Mode. Once on the Network tab, change the network adapter to Host-only Adapter and click OK.

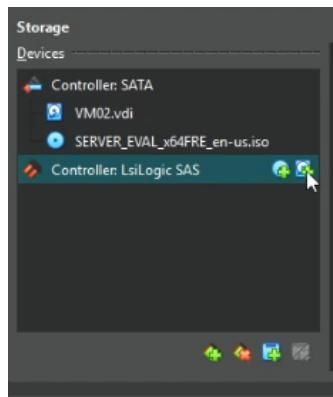


Step 7: While in the settings of the VirtualBox Manager, you can also create and allocate your drives that you will use to Configure your RAID 1 or RAID 5. Locate the storage option in the settings. Add another storage controller of type LsiLogic SAS.

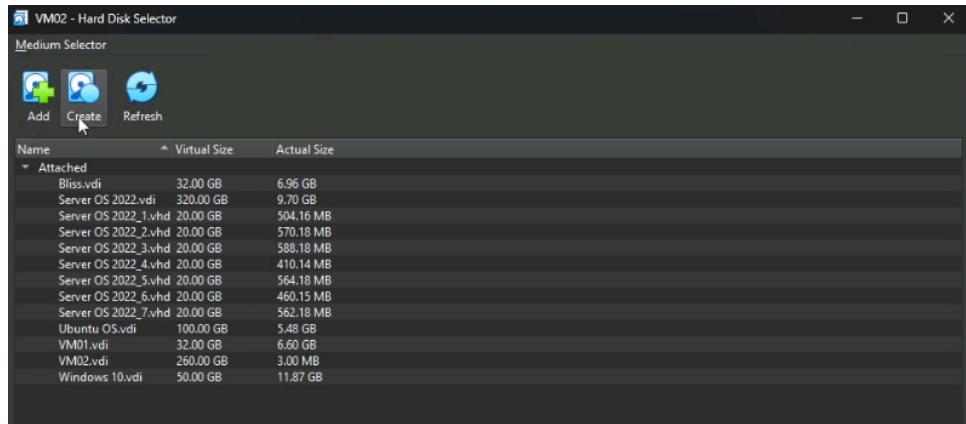


Step 7.1: After you have added the controller, you can now create and add new harddrives to it. On the right side of the controller you will see 2 buttons, the one on that appears like a hard drive will be used to create and add a hard drive, the other one beside it will be used to create a cd drive. Press on the one that appears like a hard drive.

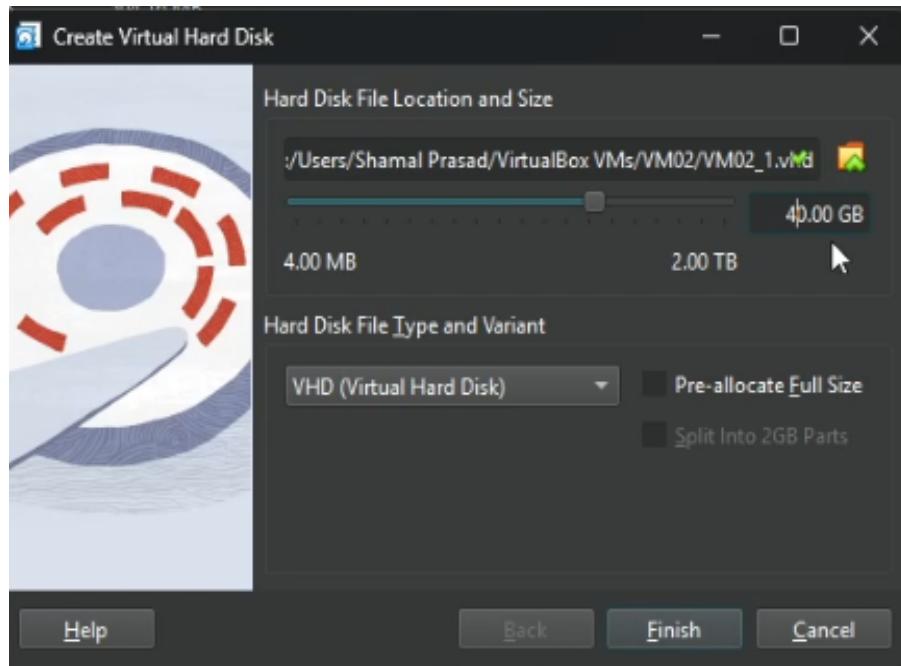
You will see a screen as presented below.



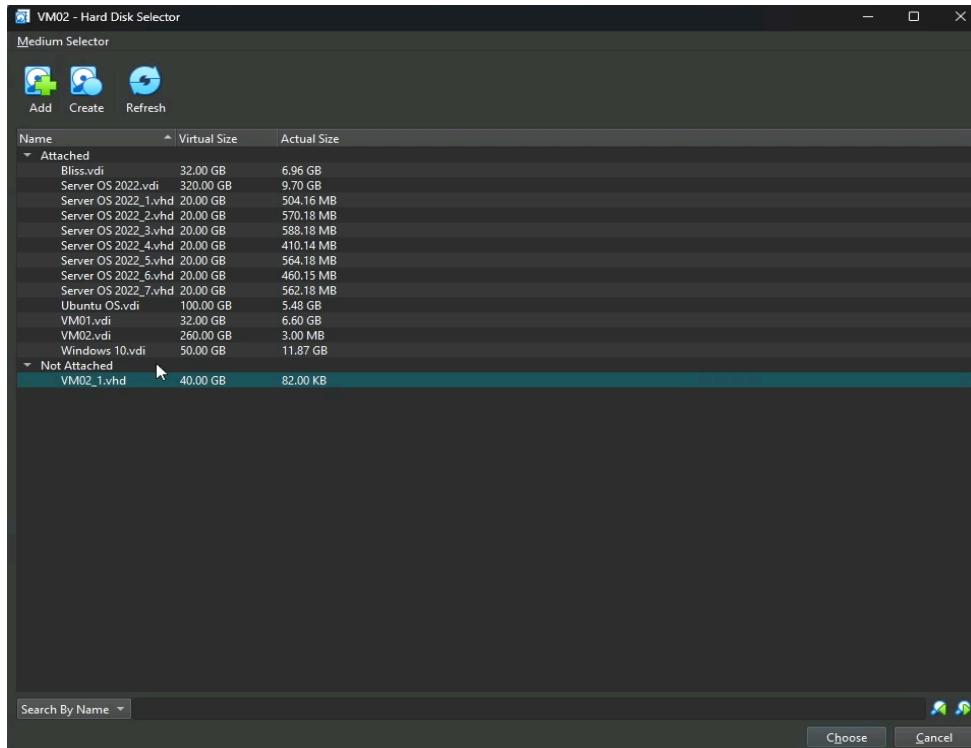
Step 7.2: Press the create button to create a new hard drive. You should see a screen similar to the one shown below.



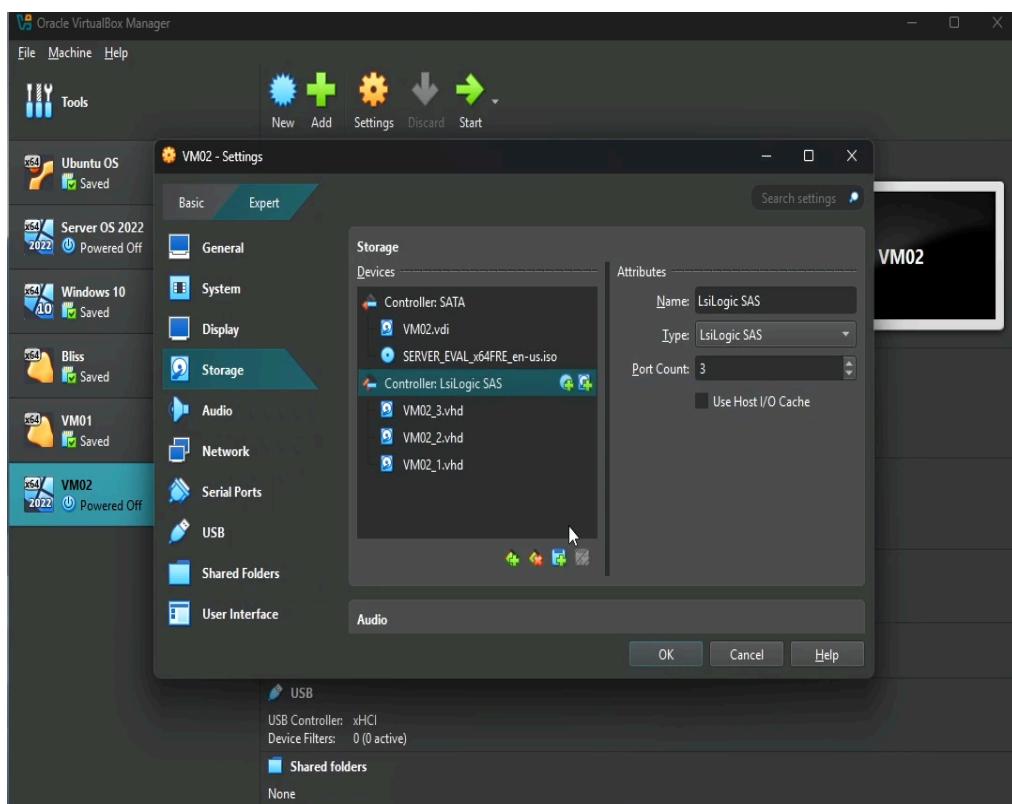
Step 7.3: Select the size of the hard drive by moving the slider and ensure the hard disk variant is selected as “Virtual Hard Disk (VHD)” before pressing finish to create a new drive. After creating the drive, you see the screen below.



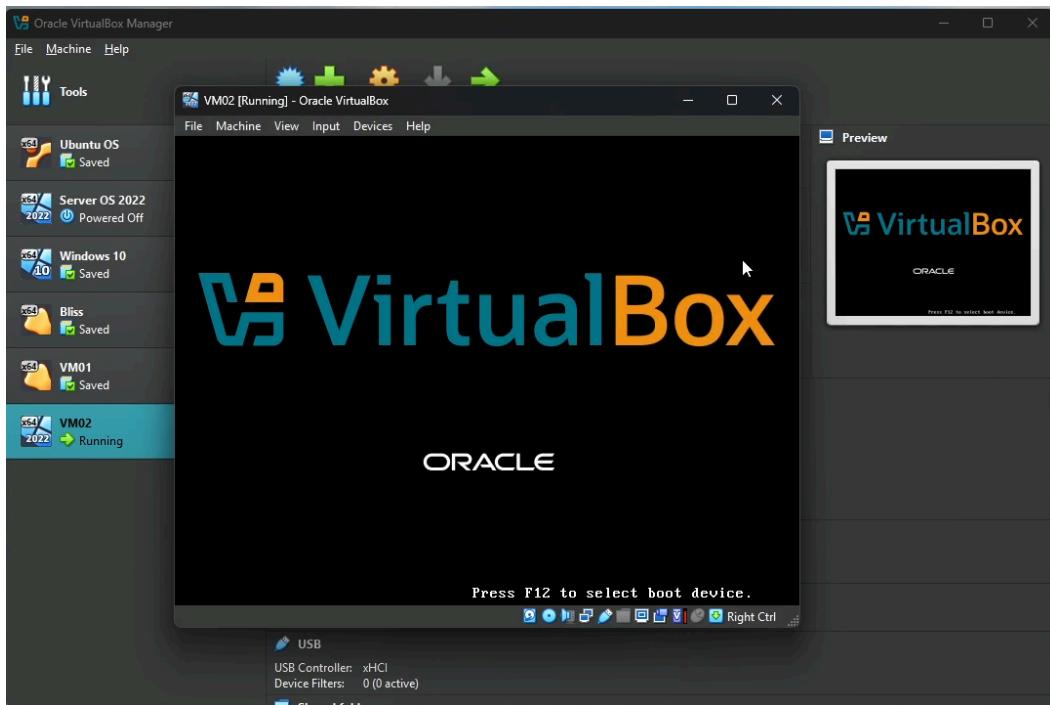
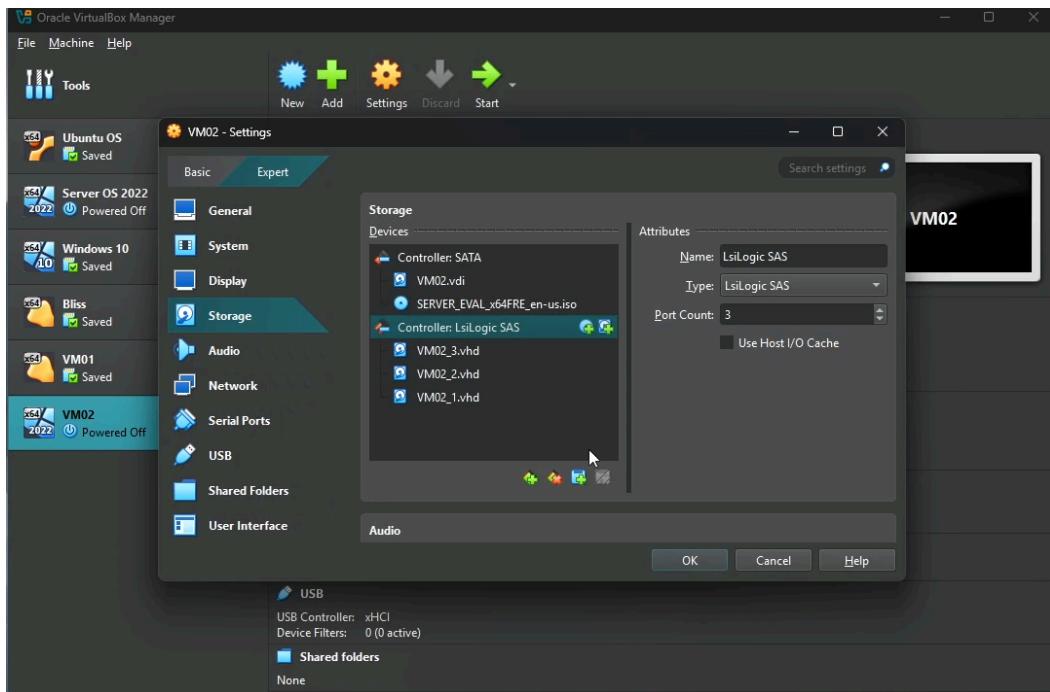
Step 7.4: Select the newly created drive to add it to the controller by double clicking on the non attached drive. You will see the drive added to the controller as below.



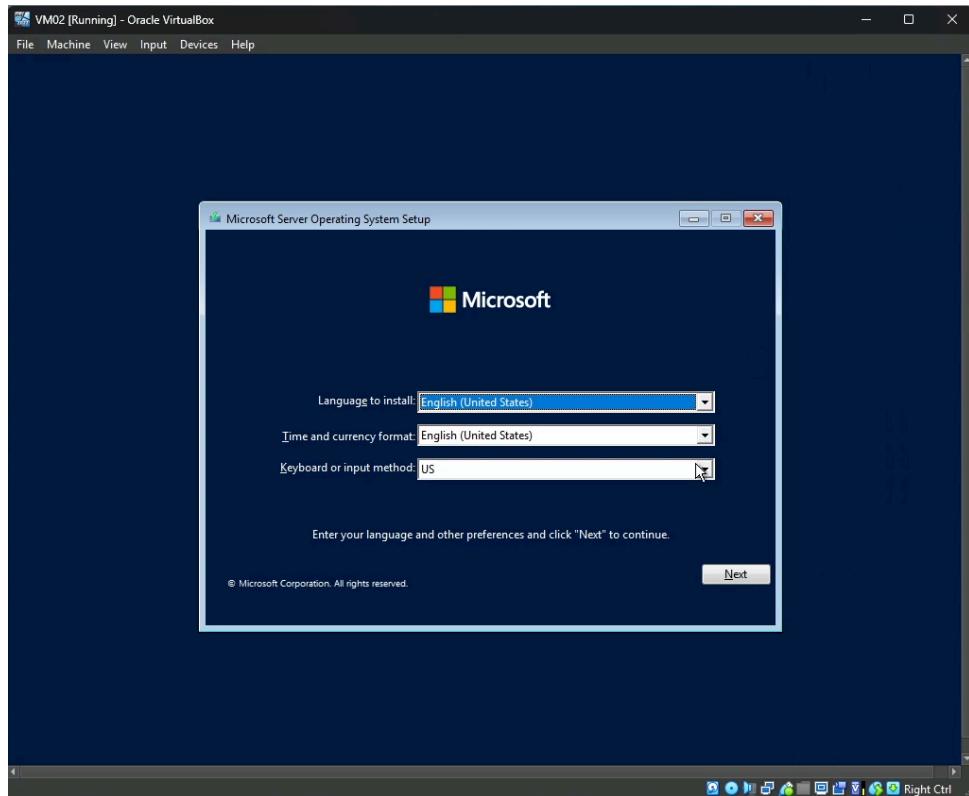
Step 7.5: repeat steps 7.1 to 7.4 to create and add another 2 hard drives to the controller. Your final screen should be seen below. Press OK to save and close the screen.



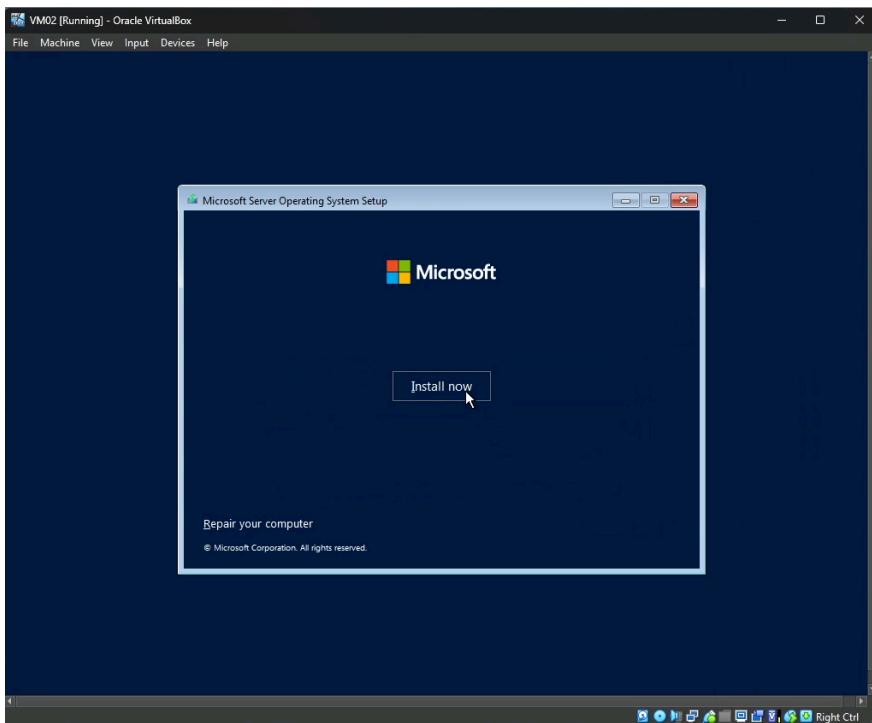
Step 8: Once you have configured the setting, you can now go ahead and start the OS by clicking the start Arrow in the VirtualBox Manager window at the top.



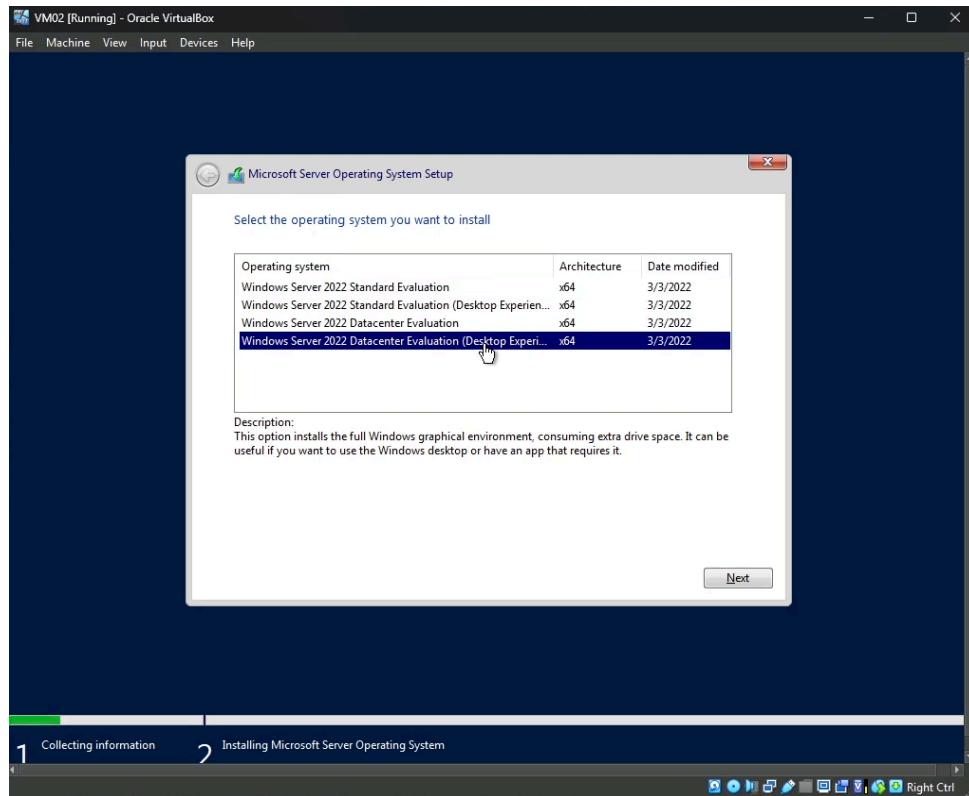
Step 9: Now the OS setup and installation process will begin. Follow the setup instructions and fill in information as required. Click Next.



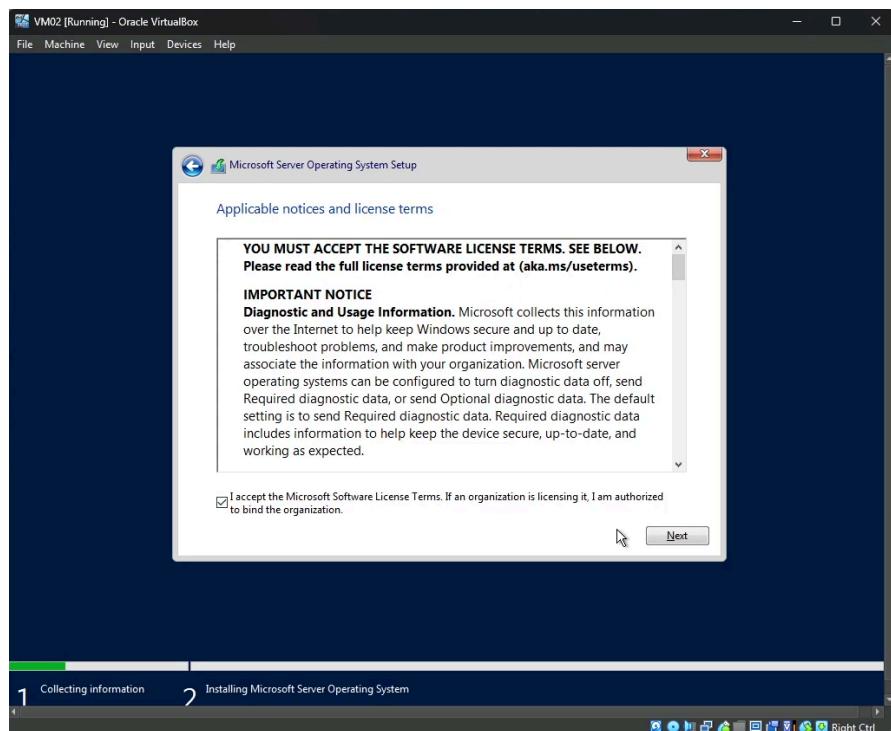
Step 10: Press Install Now.



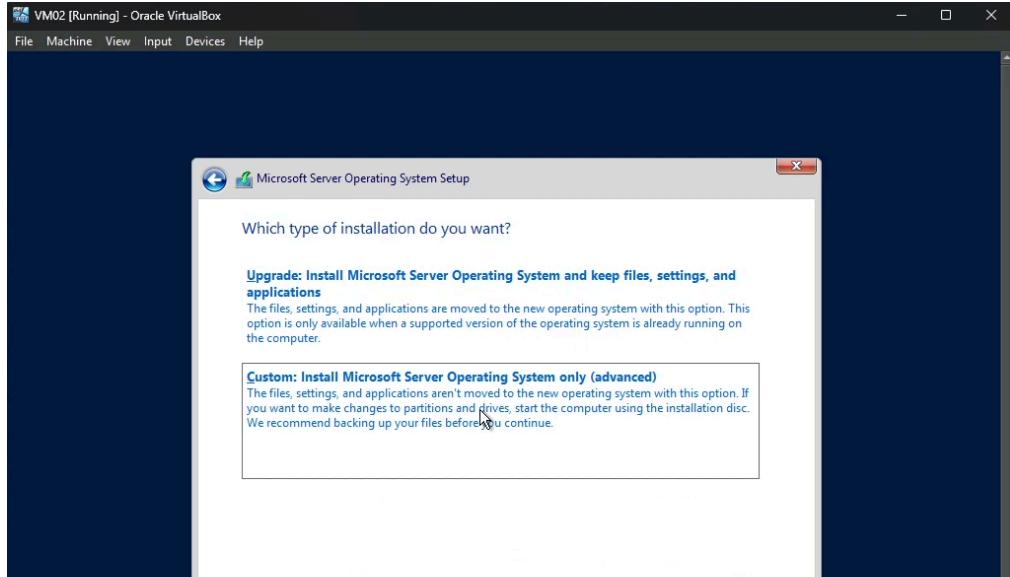
Step 11: Select Windows Server 2022 Datacenter Evaluation (Desktop Experience) and click Next.



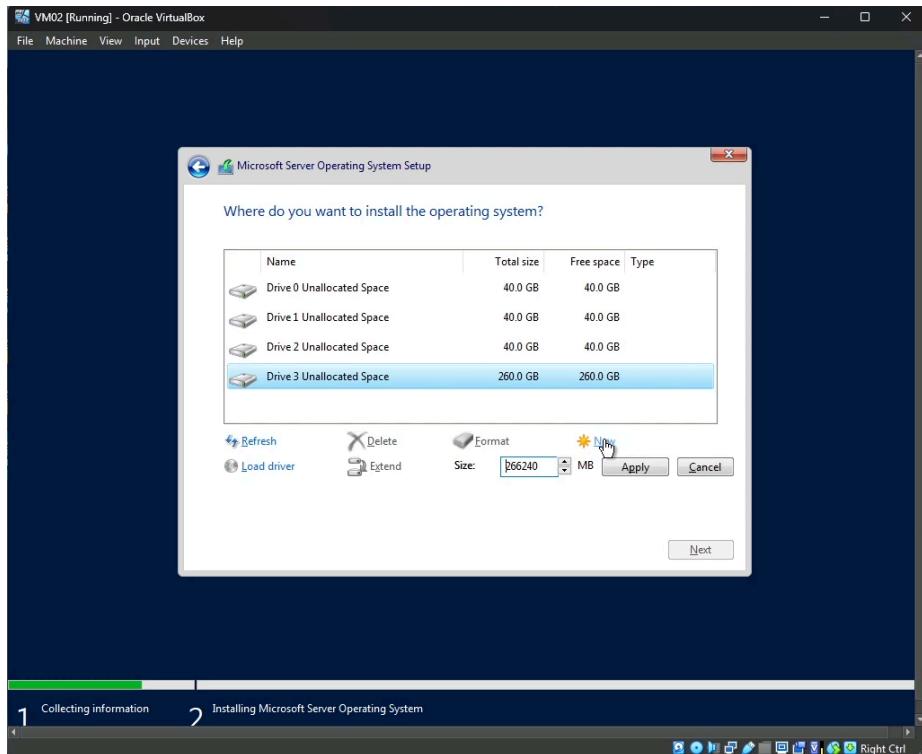
Step 12: Check the License Agreement Box and Click Next.



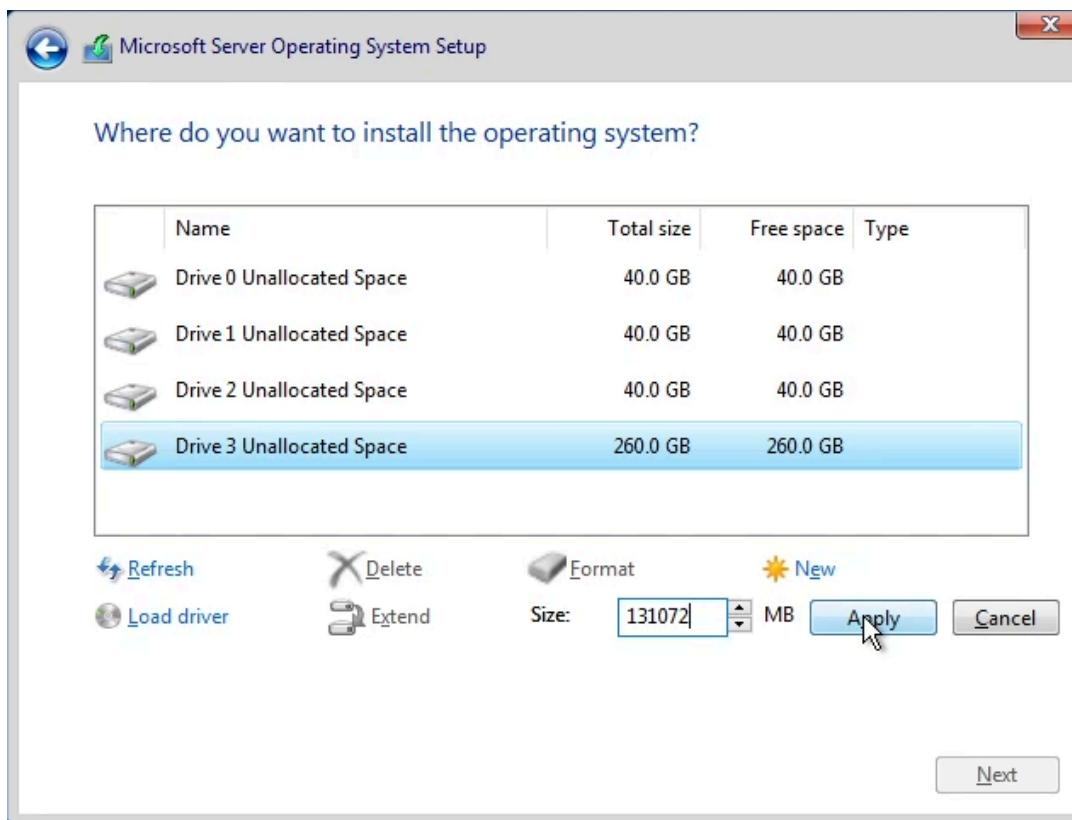
Step 13: Choose the custom installation type as it will install the OS from the very beginning, the other option is repair the OS if it has encountered an error. You can select the following option by double clicking on the option.



Step 14: Select your main drive, which should only be the one with 260 GB of space and press in new in the options below to create a new partition of size 128 GB.



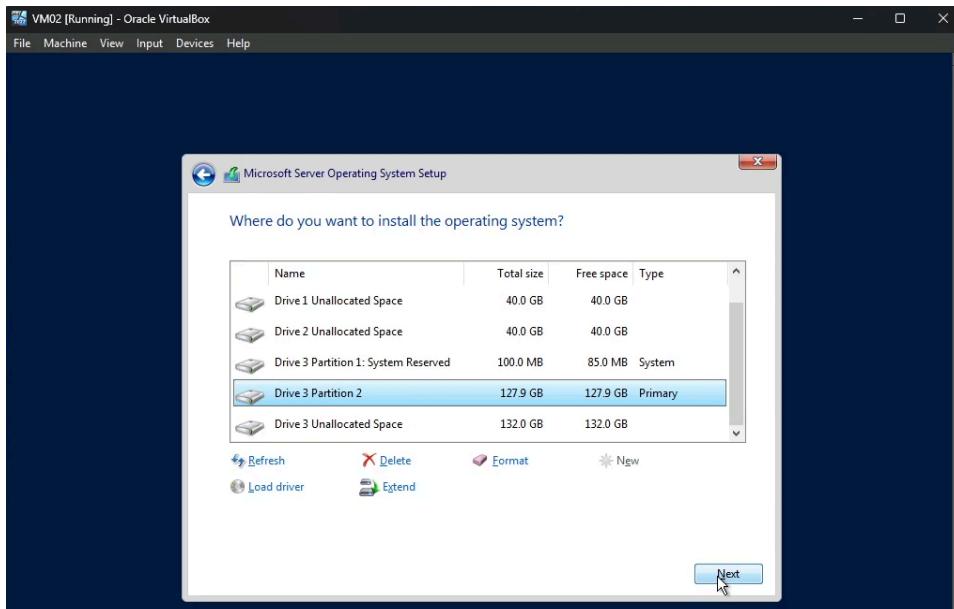
Step 15: To create a partition of size 128 GB, enter the value of 131072 MB to create the partition of the required size. Then press apply.



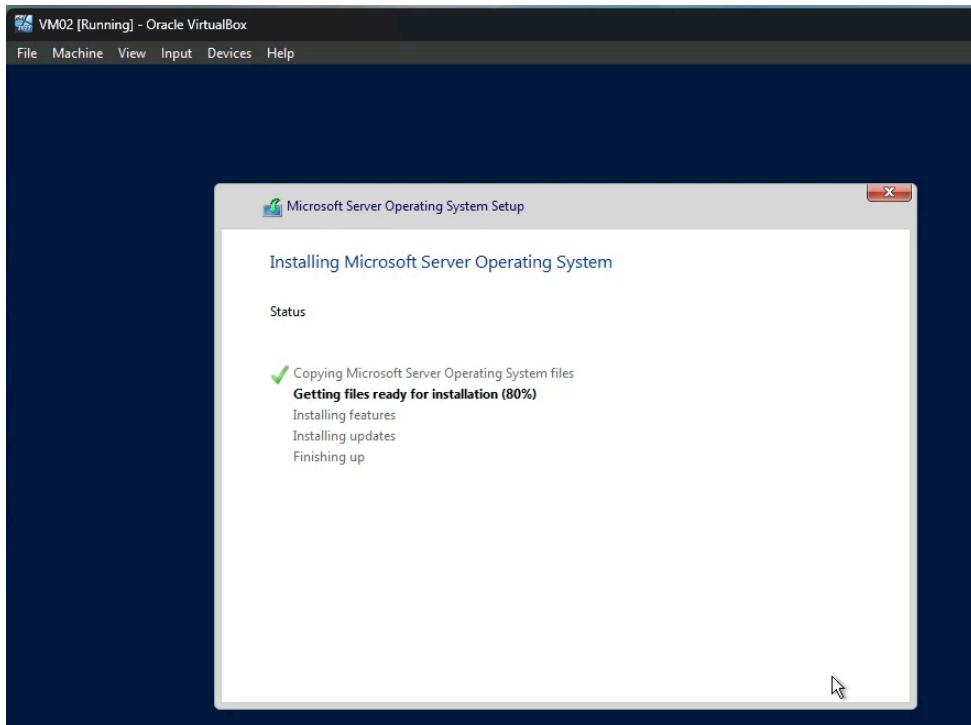
Step 16: You will be presented with a dialog box stating that Windows OS will create additional partitions for other services. Press OK. Note: the main partition will fall below 128 GB as the new partitions will be taken from it.

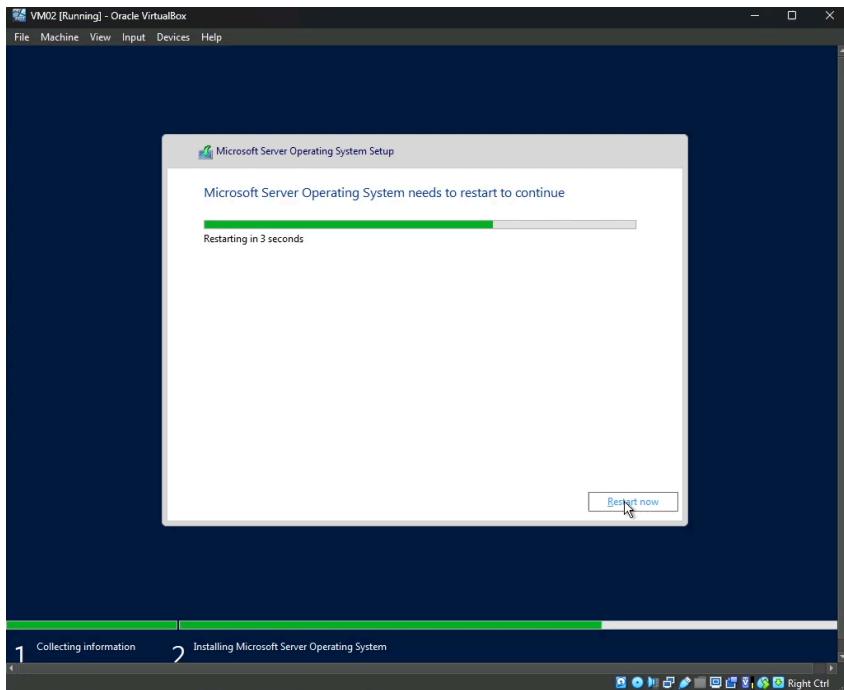


Step 17: Select the partition that has the type of primary and press Next.

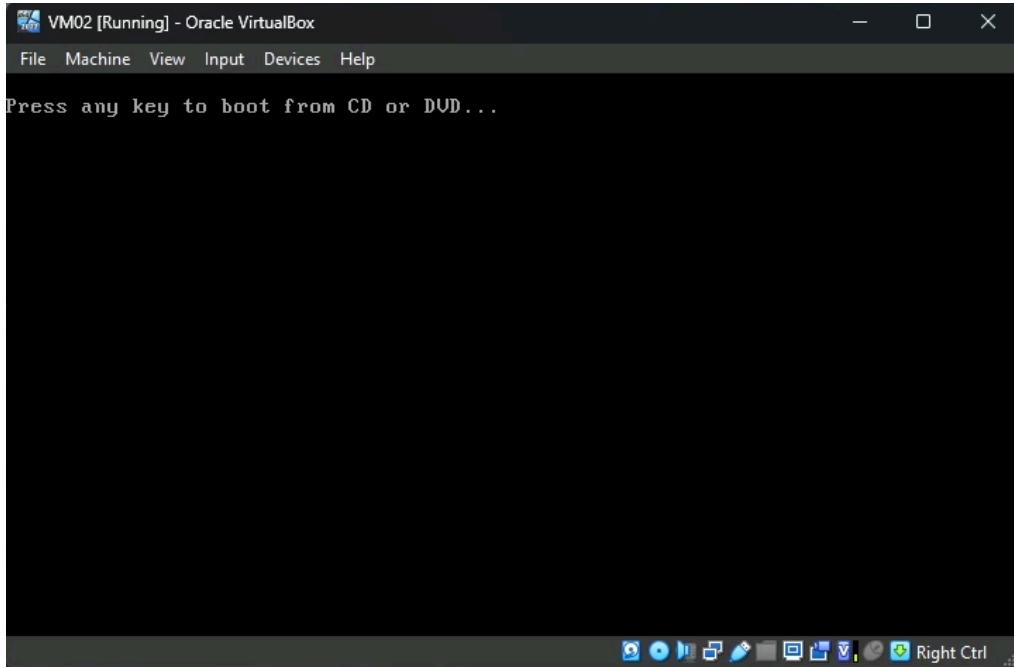


Step 18: Wait for the installation to complete and at the end of the installation, the OS will reboot itself.

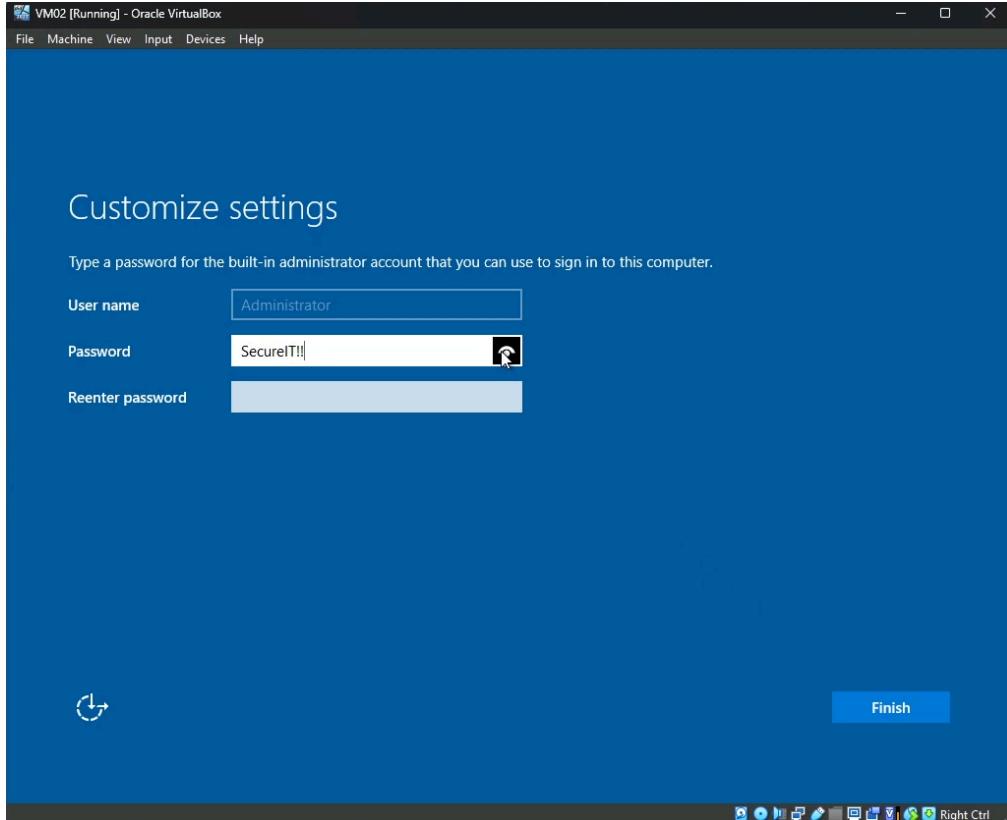




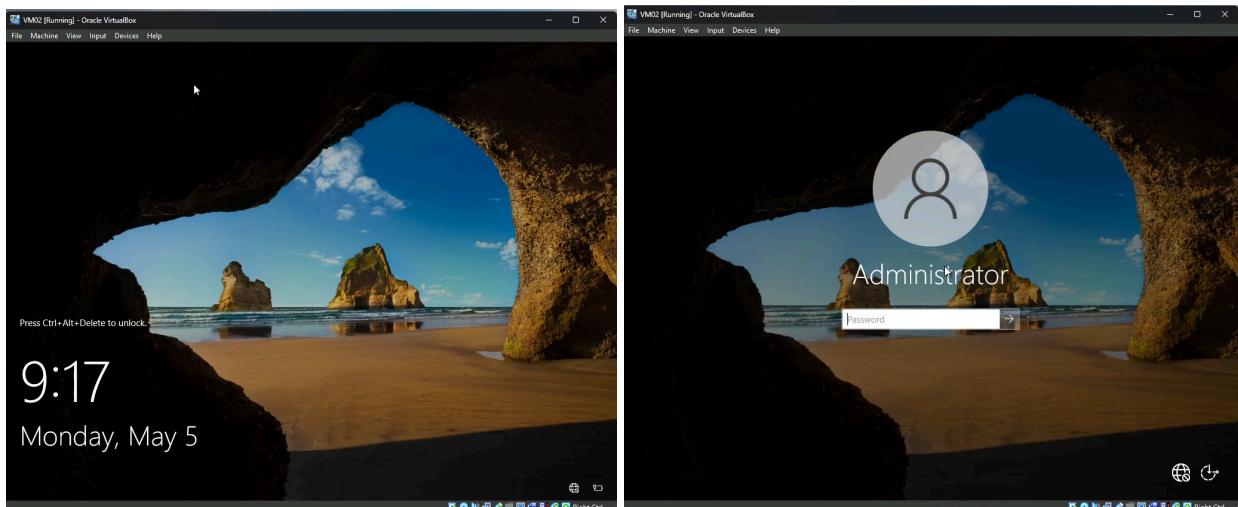
Step 19: During the Screen shown below, **DO NOT** press anything and wait, the OS startup will begin automatically.

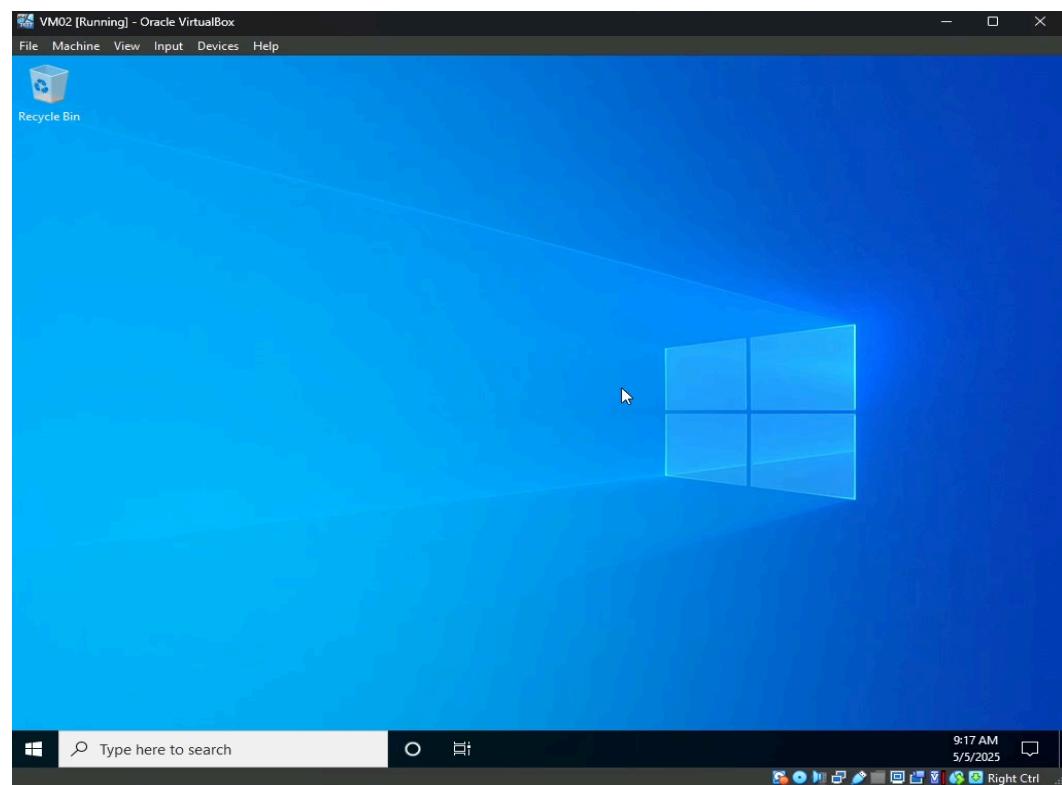


Step 20: After the setup process you will be directed to the screen shown below where you will need to set up a password for the Administrator account, which in our case is “SecureIT!!”. Create your password and press Finish.



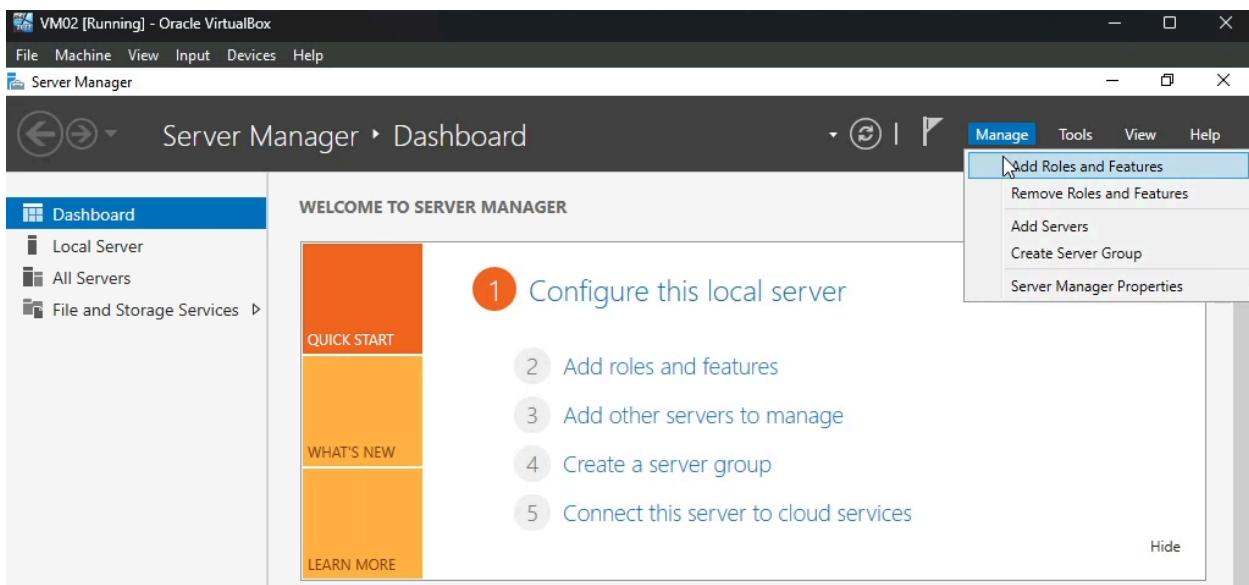
Step 21: Sign in to your Admin Account.





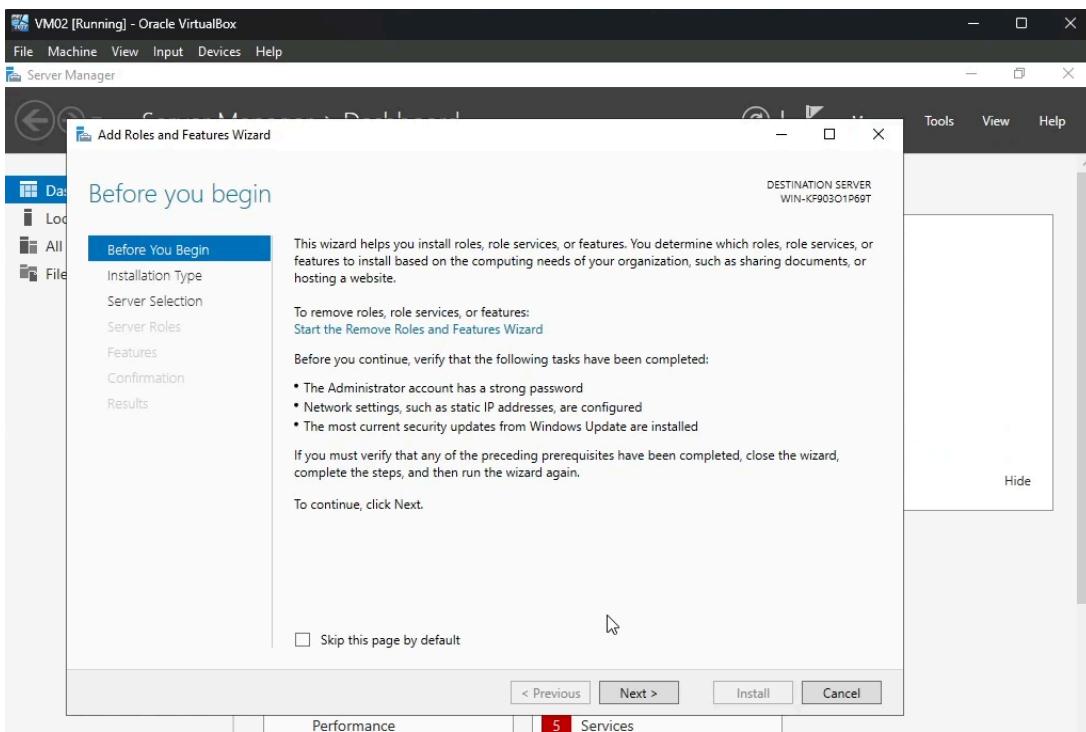
Setup Primary domain for Windows Server

Step 1: Open the Server Manager Program and press Manage that located to the top right corner of the program.

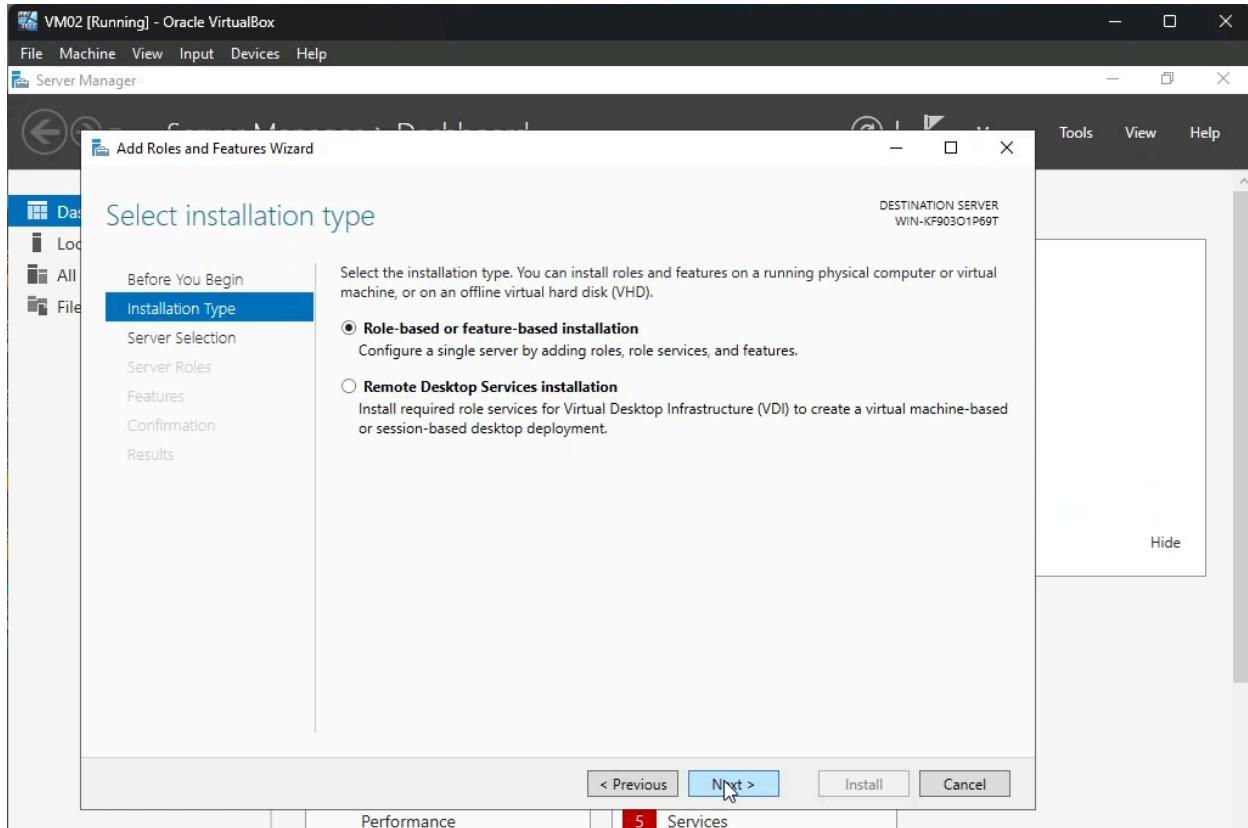


Next, click the “**Add Roles and features**” option to start the setup process of adding a user role and its related features to the server.

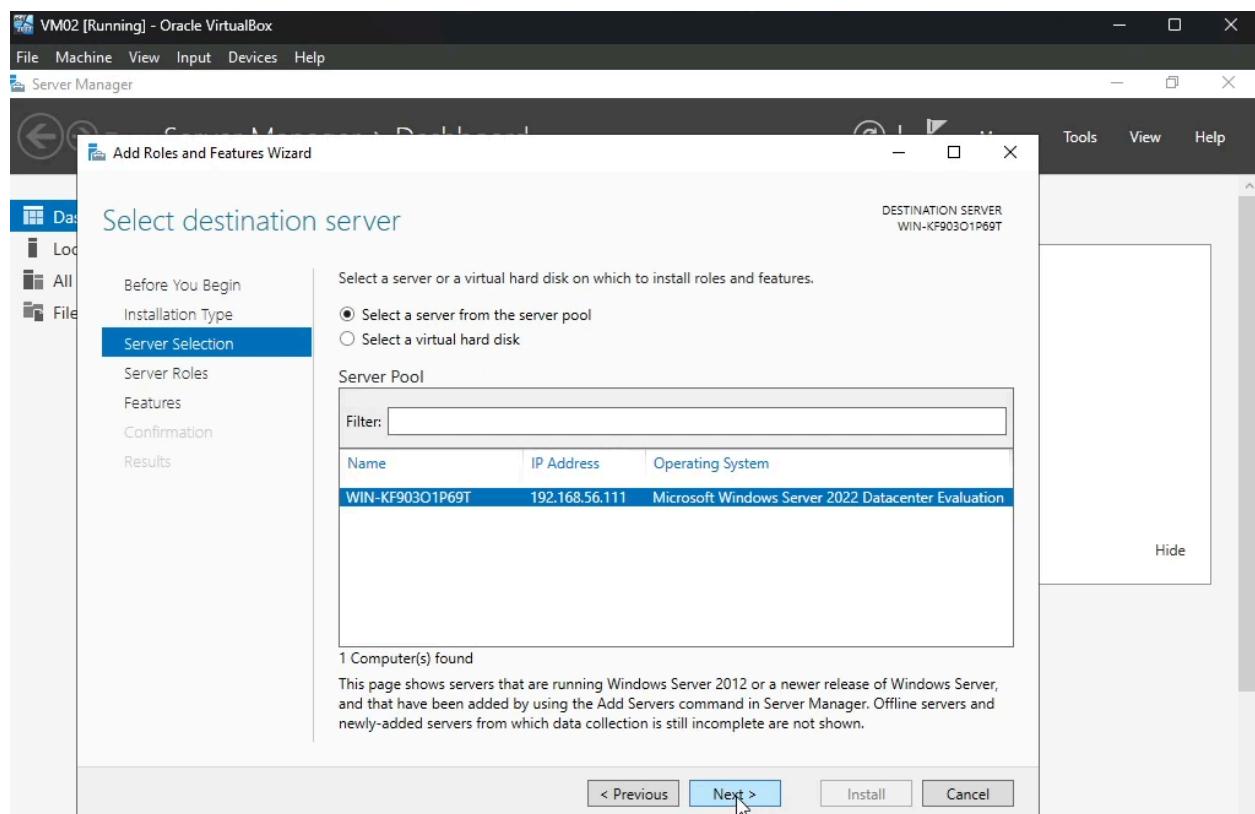
Step 2: This setup wizard will guide you through adding Roles and features to your server. Click Next.



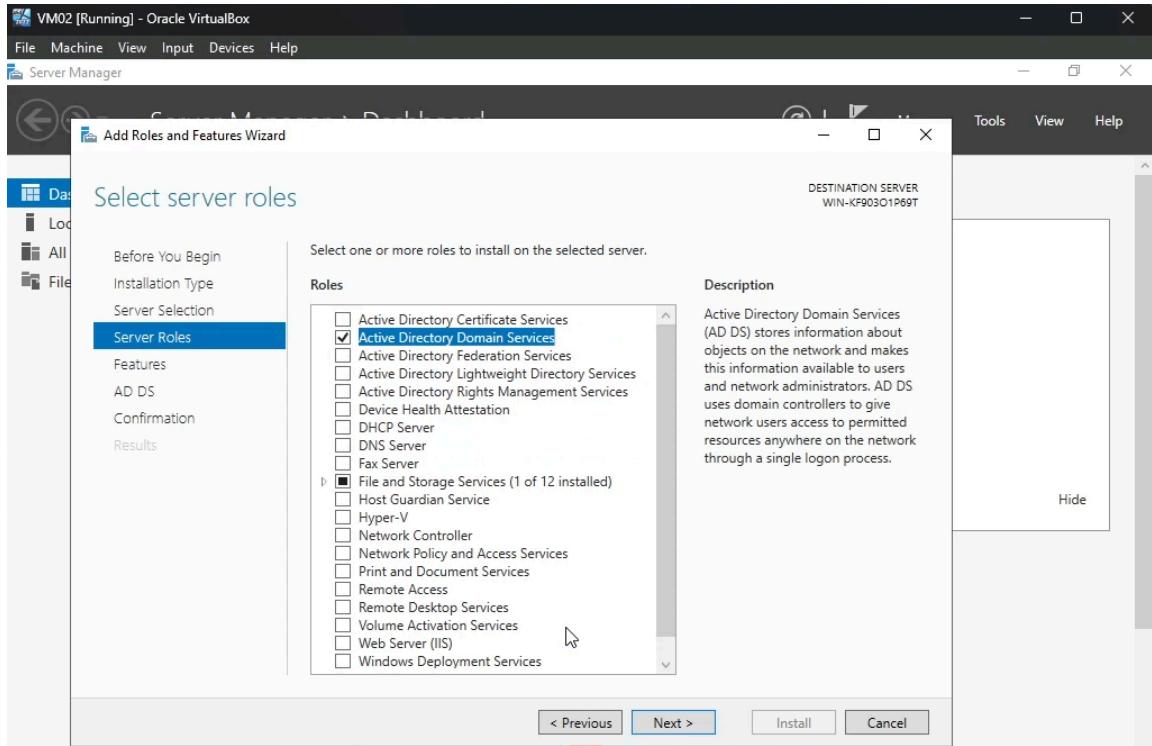
Step 3: For your installation type select the first radio button from the top and click next.



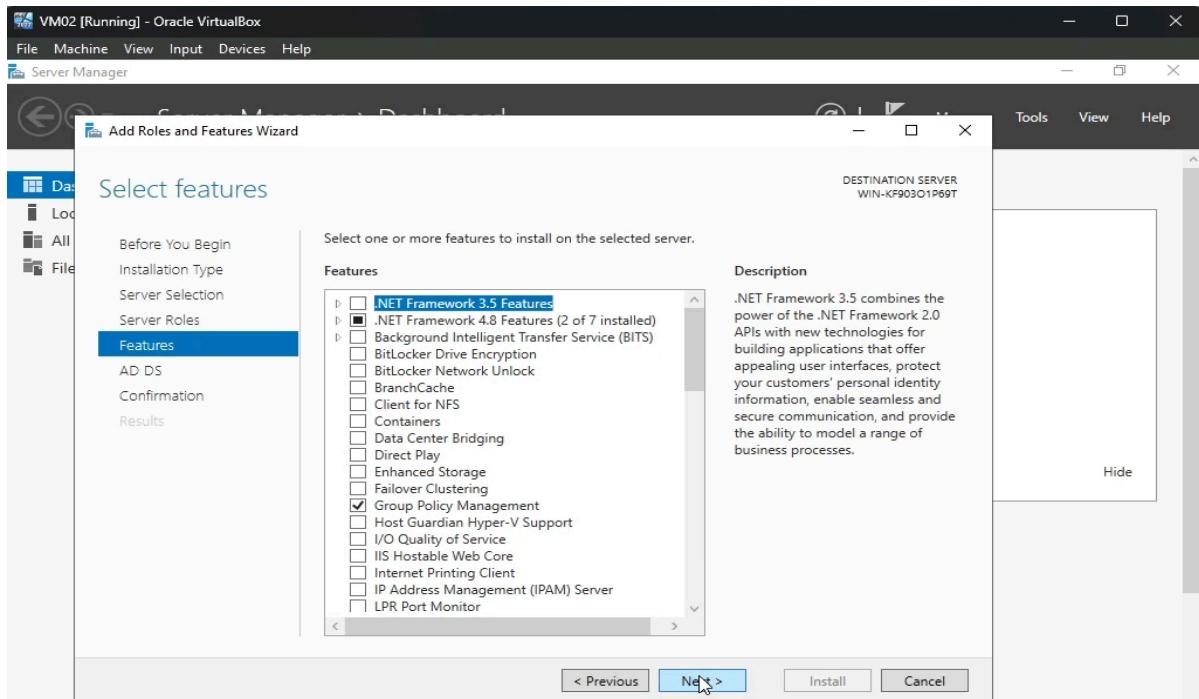
Step 4: Select your server destination drive where the installation will be downloaded to. Click Next.



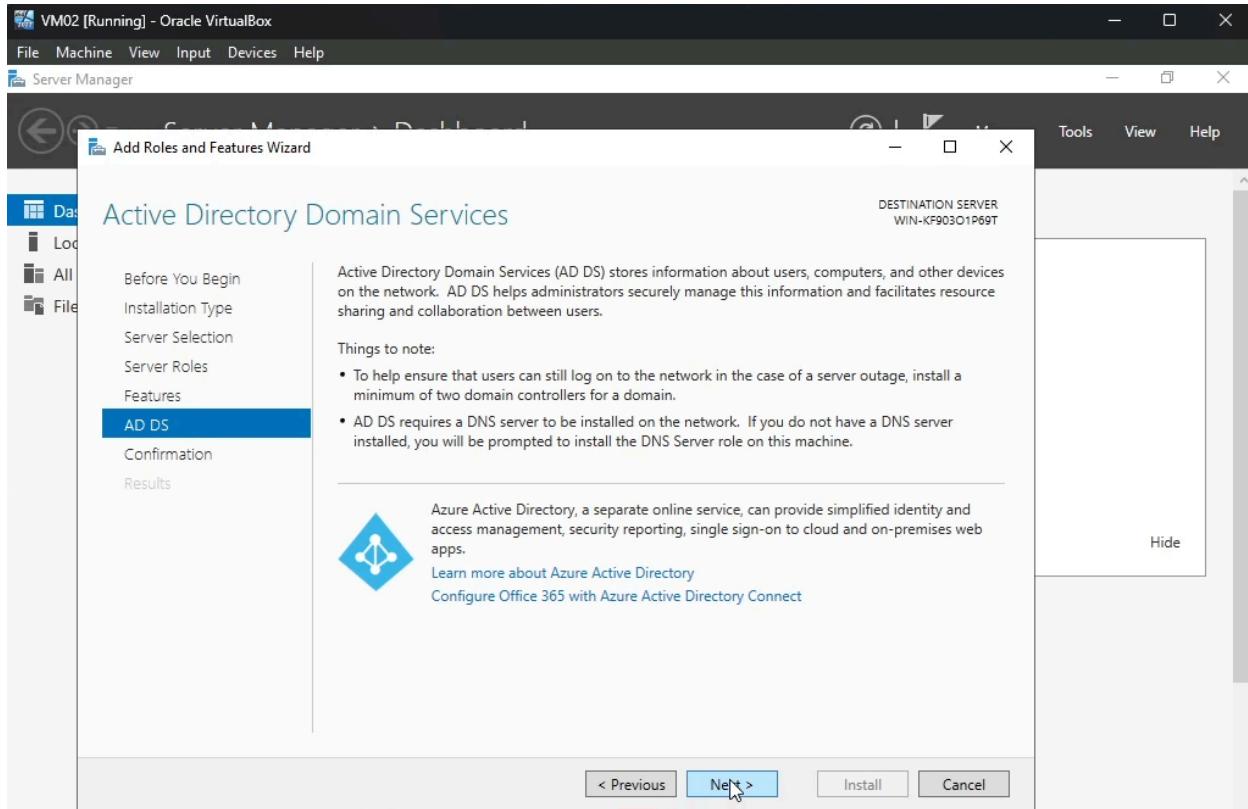
Step 5: For your server roles screen, ensure that the Active Directory Domain Services checkbox is checked and press Next.



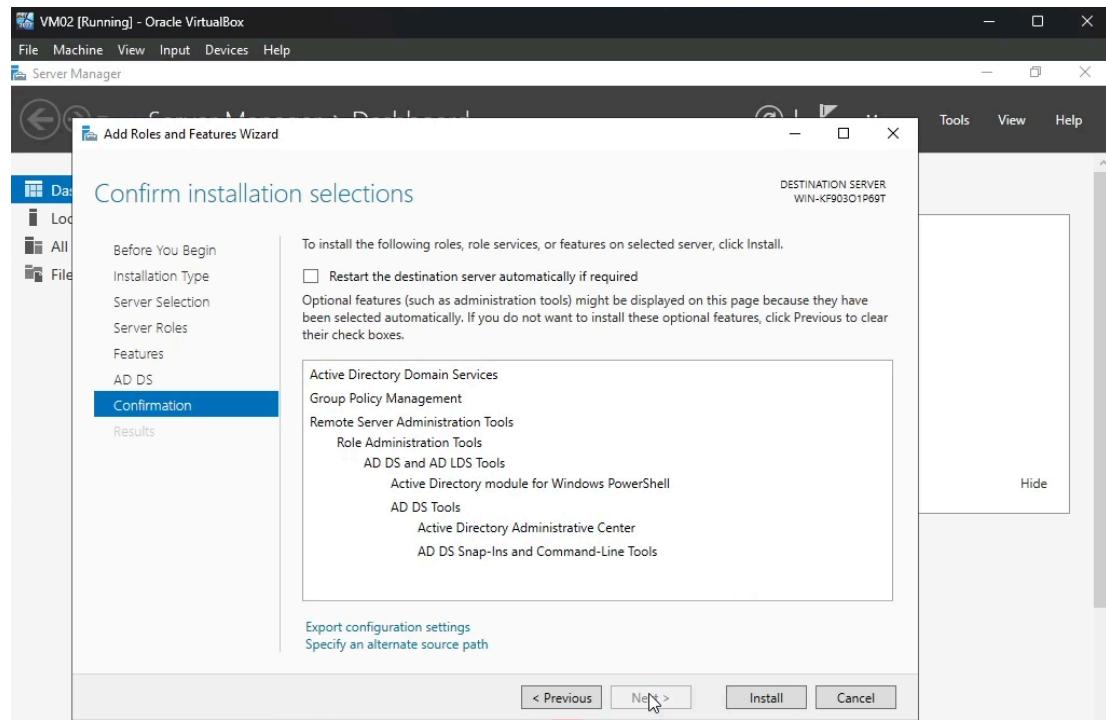
Step 6: For your server feature screen, you don't have to really select anything for now so just go ahead and press Next. **Note:** We will come back to this screen to install BitLocker Encryption so if you wish to install it now you can do so.



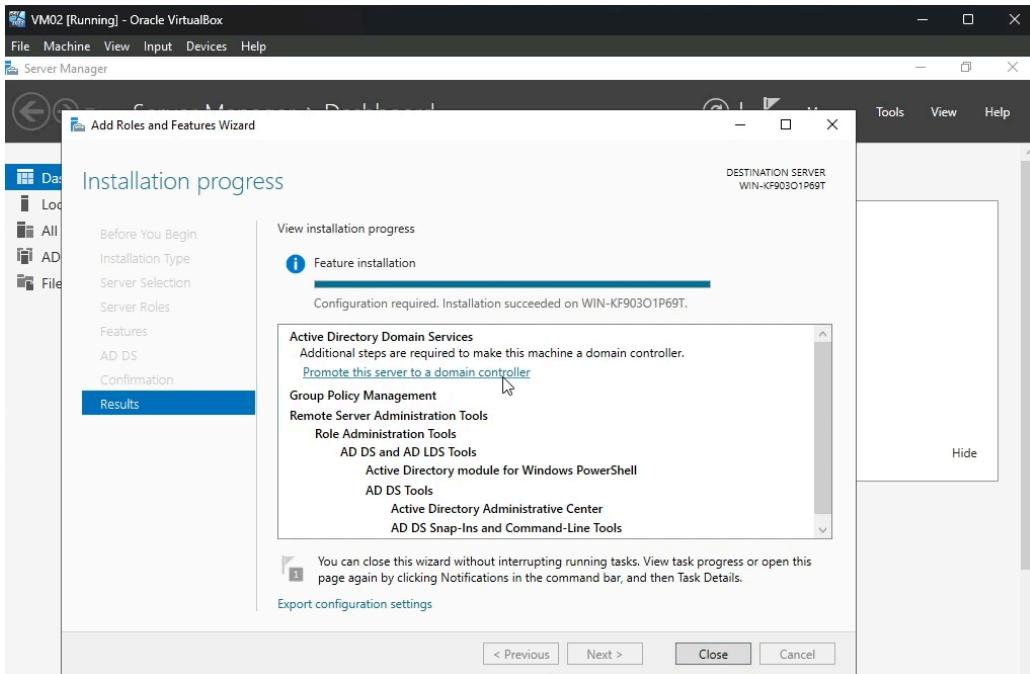
Step 7: The following screen gives you information about Active Directory Domain Services and anything important you should take note of. Click Next.



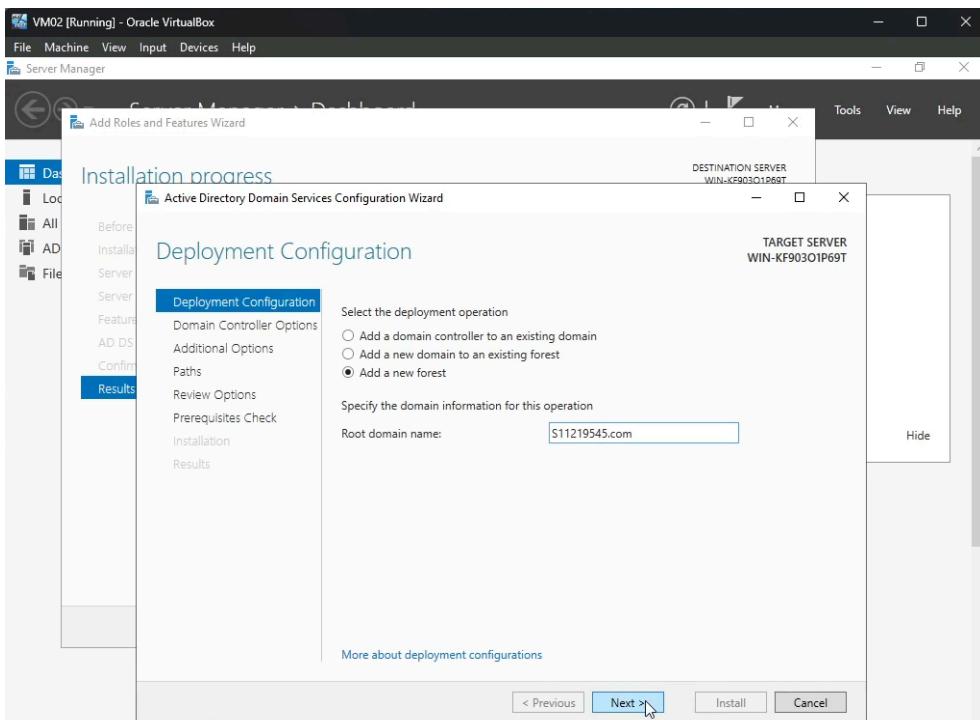
Step 8: The next screen just gives a brief rundown of what selections you have made and what features are about to be installed. Press install to begin the installation process.



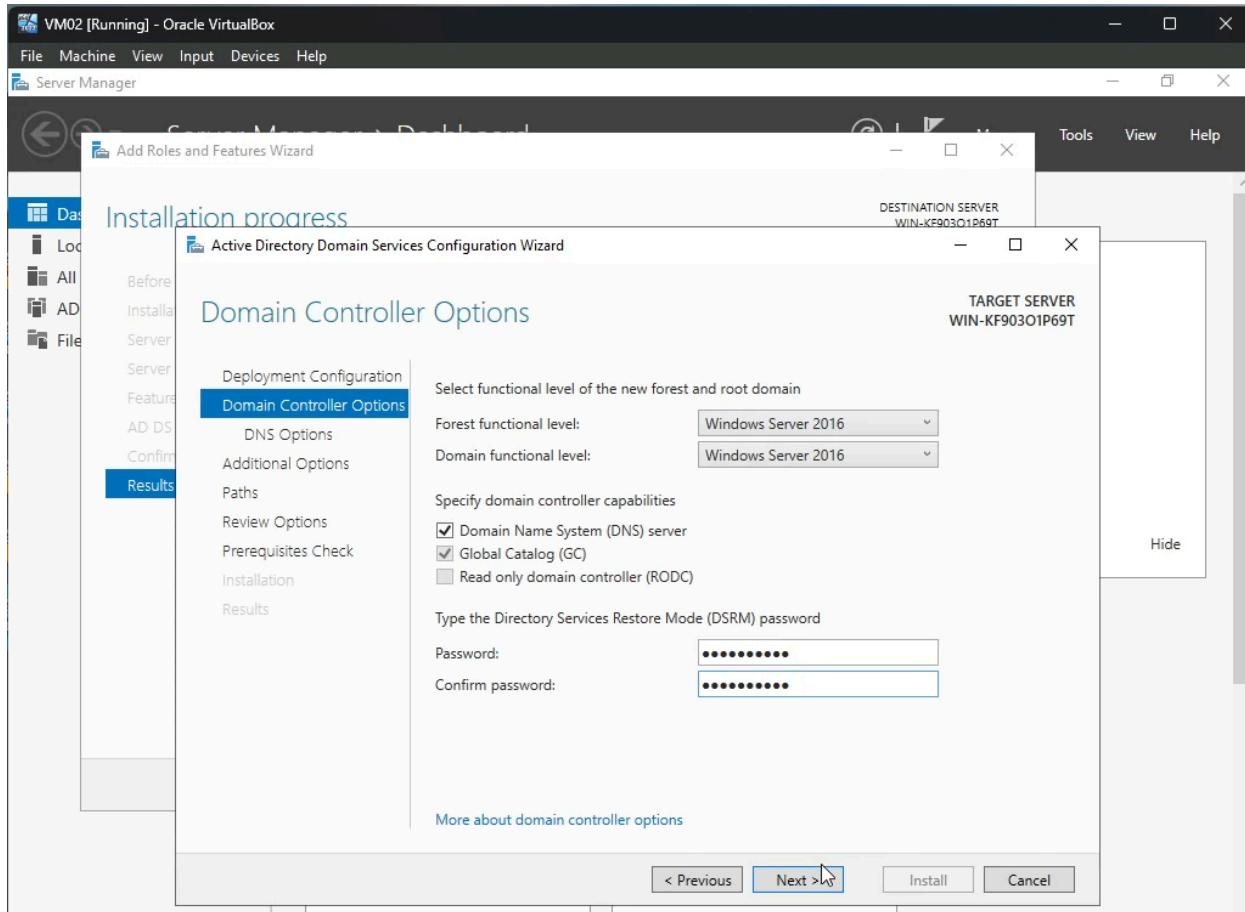
Step 9: After the installation has completed, the installation wizard will ask you to promote the following server to a domain controller. Click on the blue link to be directed to the Deployment Configuration screen.



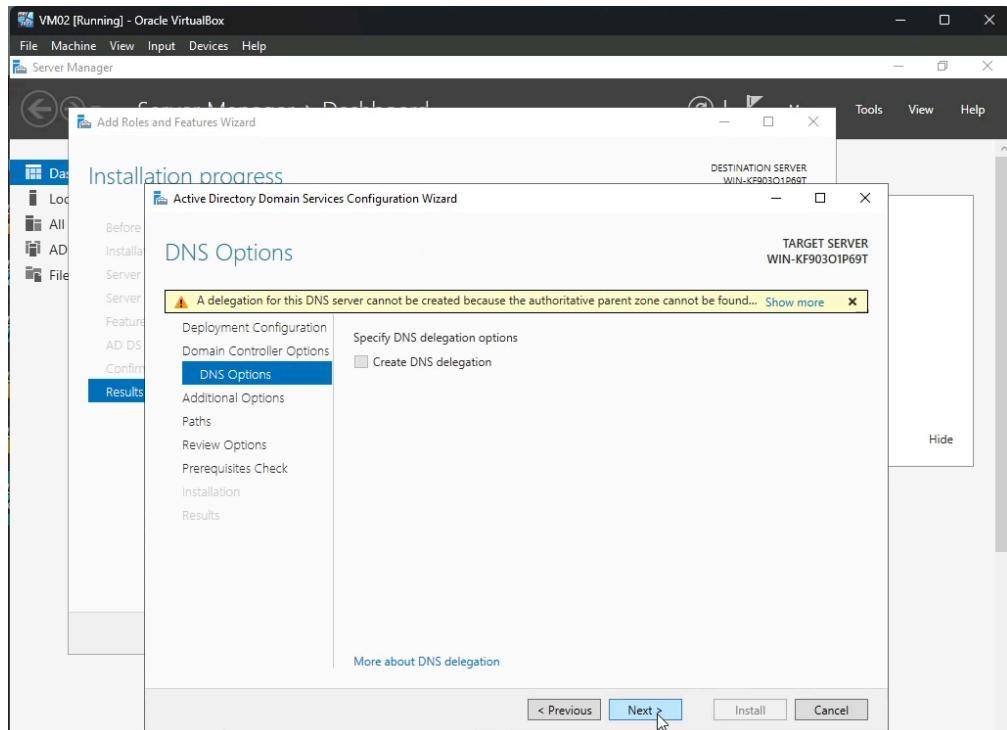
Step 10: Select the add a new forest radio button and add your root domain name. Root domain name could be anything but it must end with ".com", in our case we will use our Student ID Number , just like in the screen shown below. Click Next.



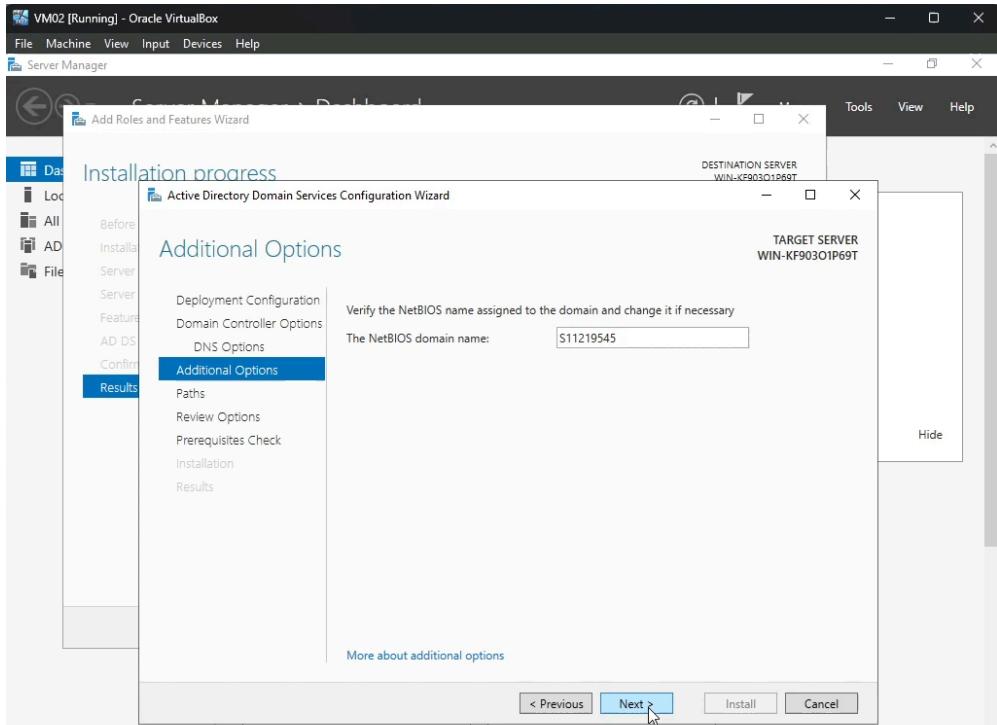
Step 11: Create a password for the domain controller. Once created, press Next.



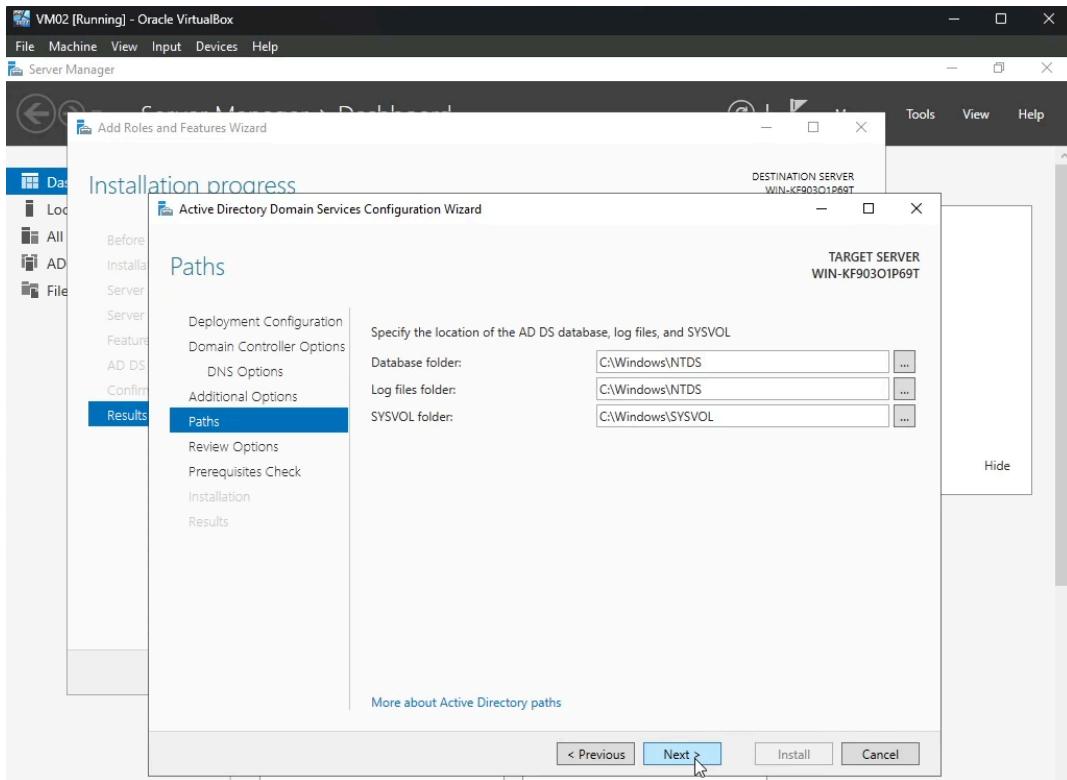
Step 12: For your DNS option nothing needs to be changed or enabled so go ahead and press Next.



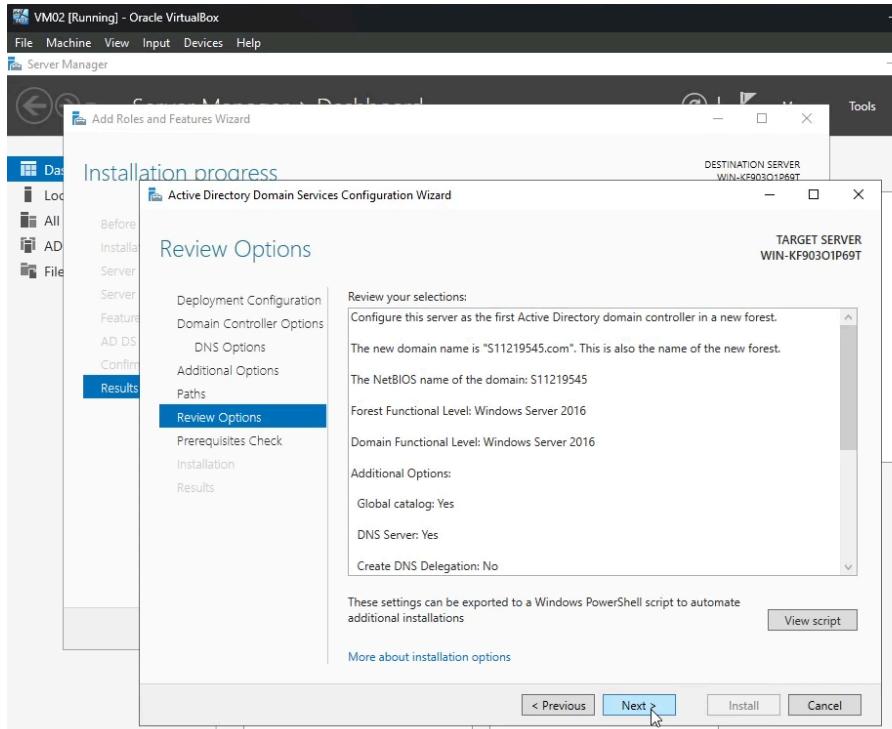
Step 13: Your NetBIOS name will be configured automatically so no input from your side is needed hence, press Next.



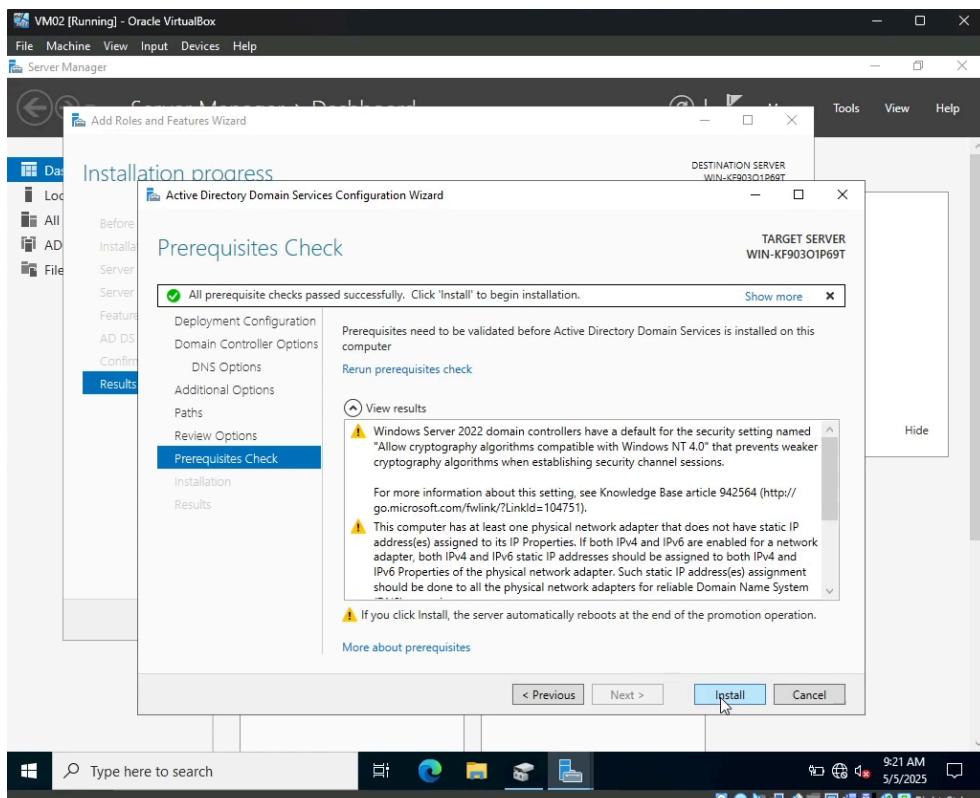
Step 14: For your path, you can use the default ones provided by the setup wizard for simplicity, unless you want to change it. Go ahead and press next.



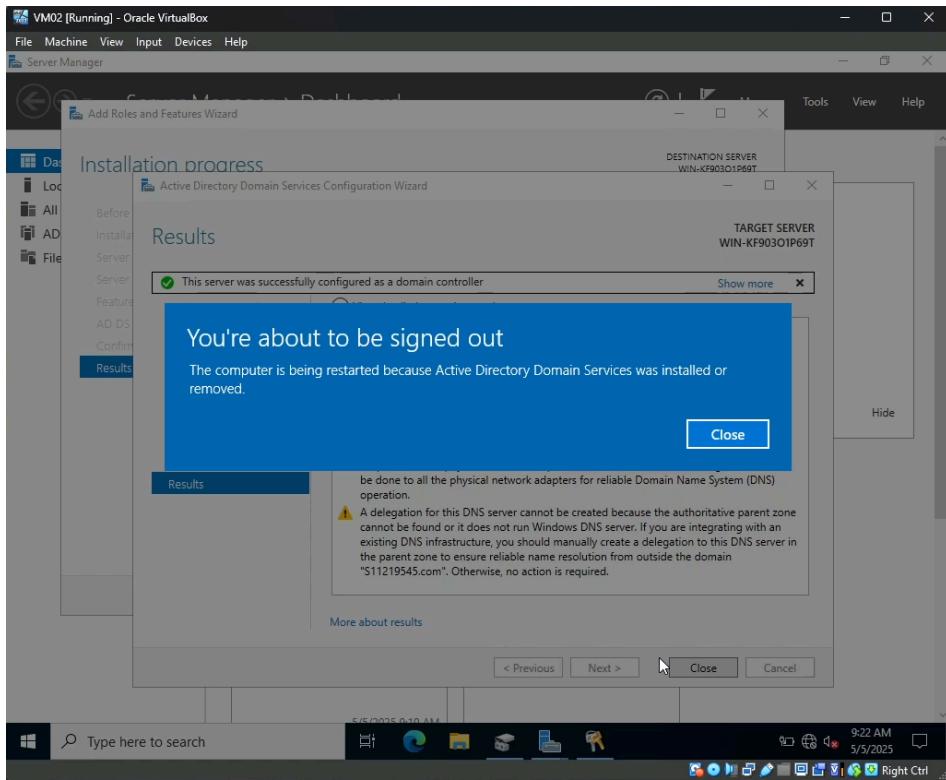
Step 15: The next screen shows you the options you have chosen and you can go through it to ensure you are installing the right items. Press Next.



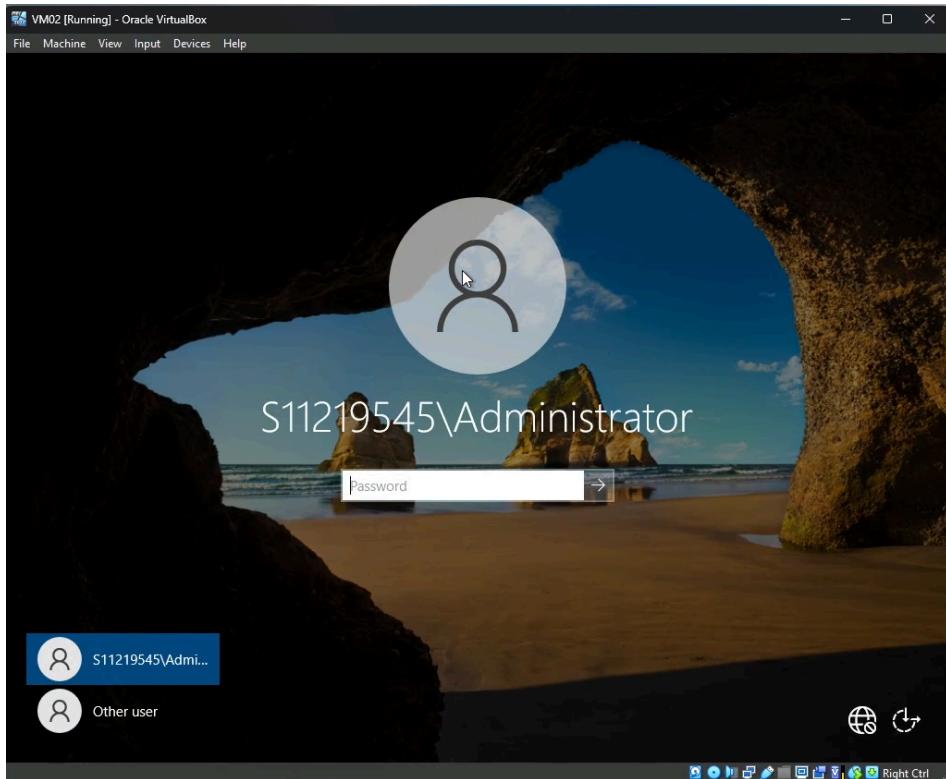
Step 16: The following screen is the last checkpoint to verify the items and to check whether the server is compatible. After this screen the final installation will occur. If everything is in order, press Next.



You will be prompted to restart at the end of the installation, go ahead and perform the reboot.

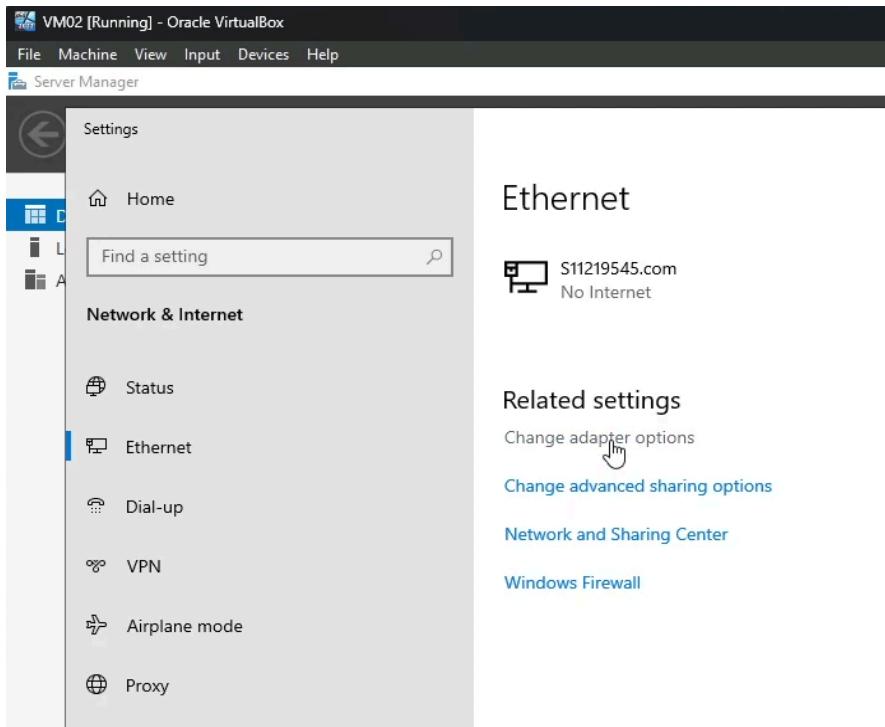


After the reboot, you should be able to see the following screen.

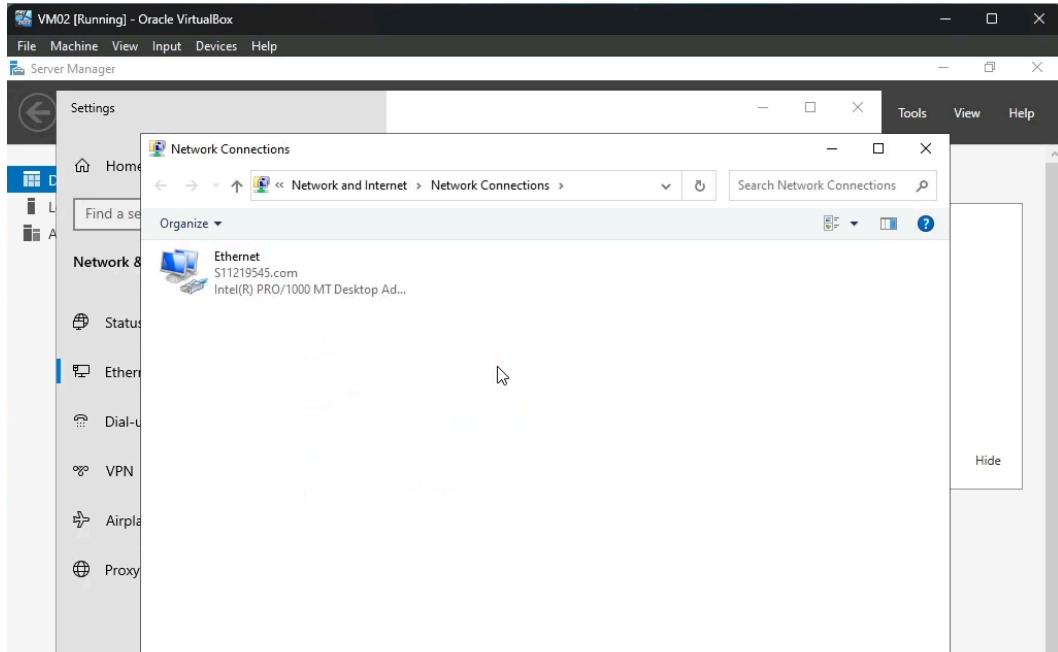


Setup Network IP Address

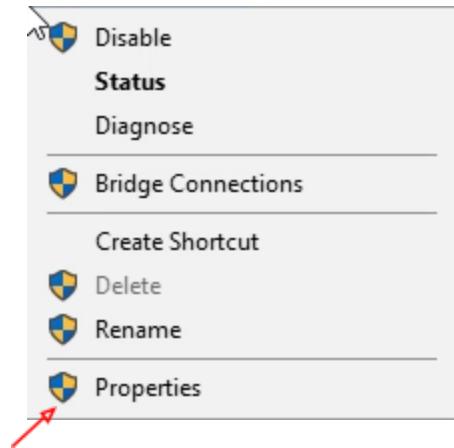
Step 1: Open your settings, of the windows OS and navigate or search in the search bar Ethernet settings. You should reach a screen as shown below.



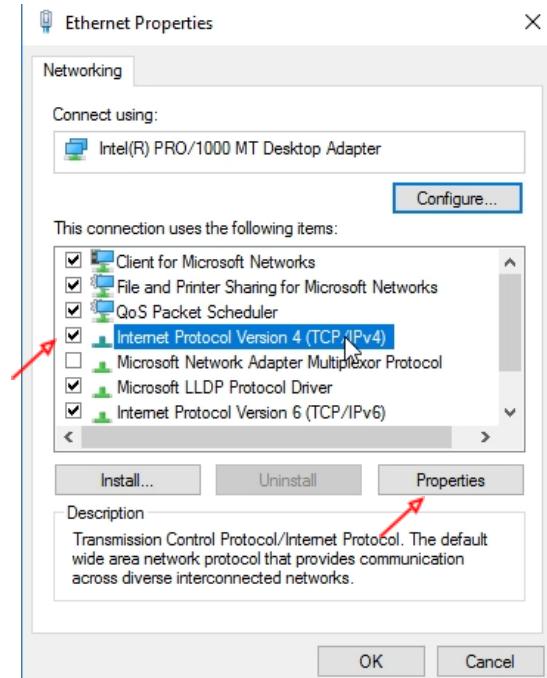
Step 2: Select the change adapter option by clicking on and you will be presented with a screen shown below.



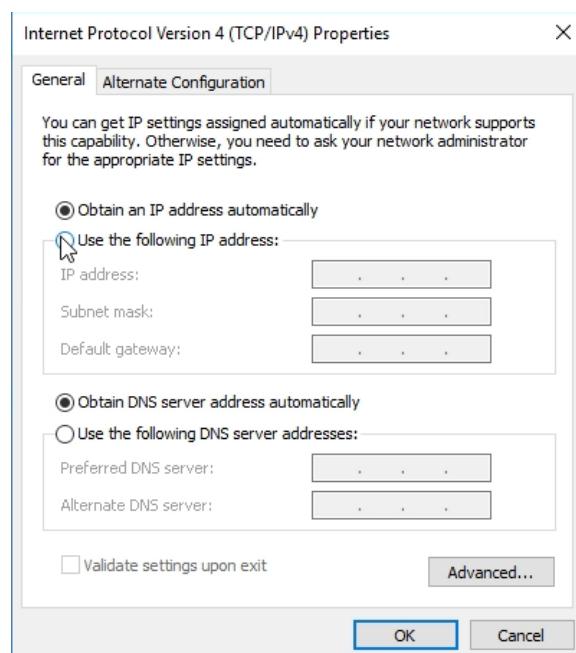
Step 3: Position your mouse over the Ethernet icon and press right click on your mouse. You should see a menu similar to the one below.



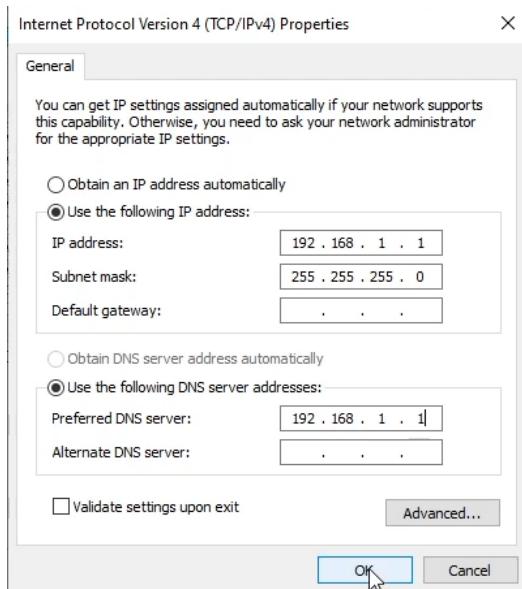
Click on Properties to view and change certain properties of the Ethernet network adapter. You should now see the window box as shown below.



Click on “internet Protocol Version 4”(IPv4) and then click on the properties button.



Step 4: On the last screen shown above, type in your IP address and subnet mask.



Once you have entered it, you can press OK to save the entered information.

Extending Primary Drive with Unallocated Space

Step 1: Open the command prompt and type in the following command shown in the prompt below.

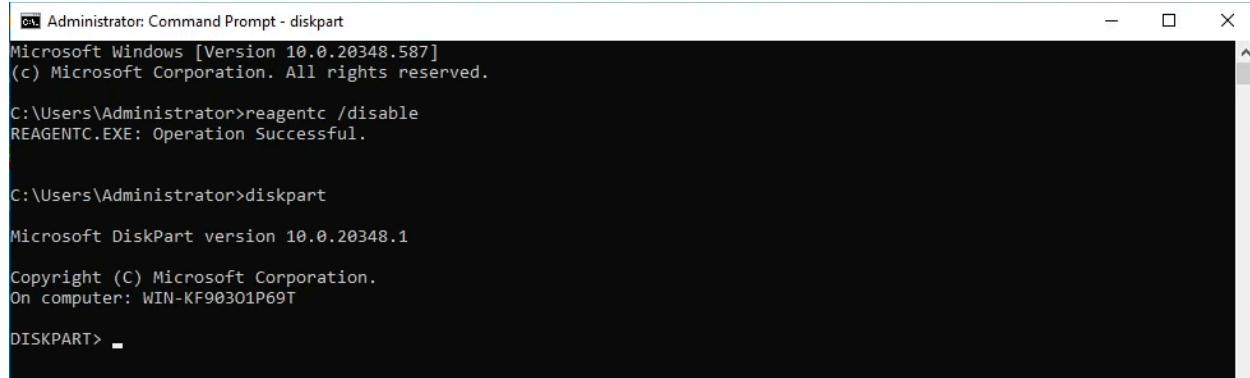
The screenshot shows an 'Administrator: Command Prompt' window. The command typed is 'reagentc /disable'. A red arrow points to the word 'Successful.' in the output. The output text is as follows:

```
Administrator: Command Prompt
Microsoft Windows [Version 10.0.20348.587]
(c) Microsoft Corporation. All rights reserved.

C:\Users\Administrator>reagentc /disable
REAGENTC.EXE: Operation Successful.

C:\Users\Administrator>
```

Step 2: Type in command diskpart to switch from normal command prompt to diskpart command prompt.



```
Administrator: Command Prompt - diskpart
Microsoft Windows [Version 10.0.20348.587]
(c) Microsoft Corporation. All rights reserved.

C:\Users\Administrator>reagentc /disable
REAGENTC.EXE: Operation Successful.

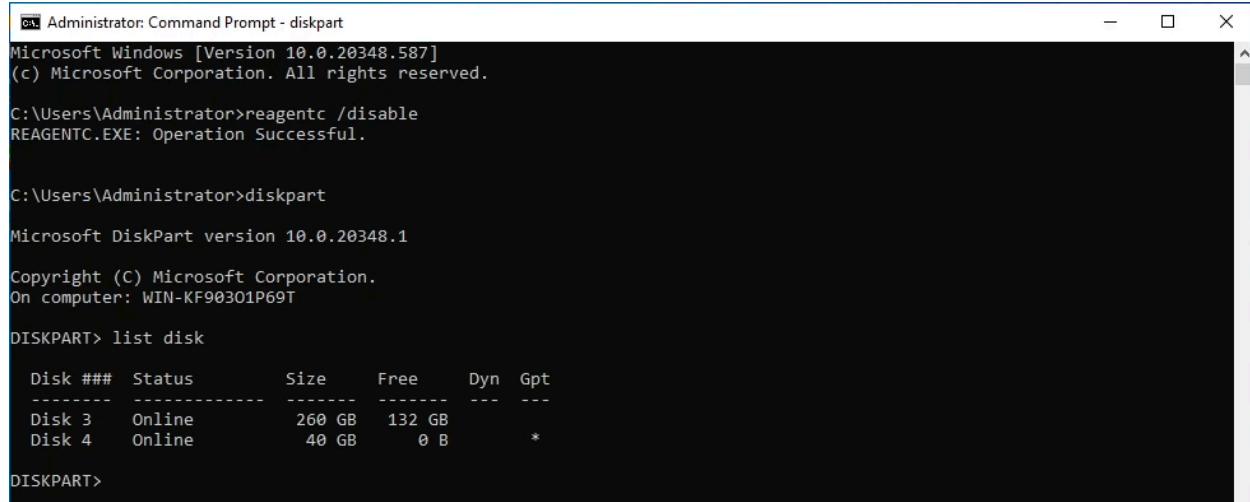
C:\Users\Administrator>diskpart

Microsoft DiskPart version 10.0.20348.1

Copyright (C) Microsoft Corporation.
On computer: WIN-KF90301P69T

DISKPART>
```

Step 3: Type in the command list disk to show all available hard drives in the system.



```
Administrator: Command Prompt - diskpart
Microsoft Windows [Version 10.0.20348.587]
(c) Microsoft Corporation. All rights reserved.

C:\Users\Administrator>reagentc /disable
REAGENTC.EXE: Operation Successful.

C:\Users\Administrator>diskpart

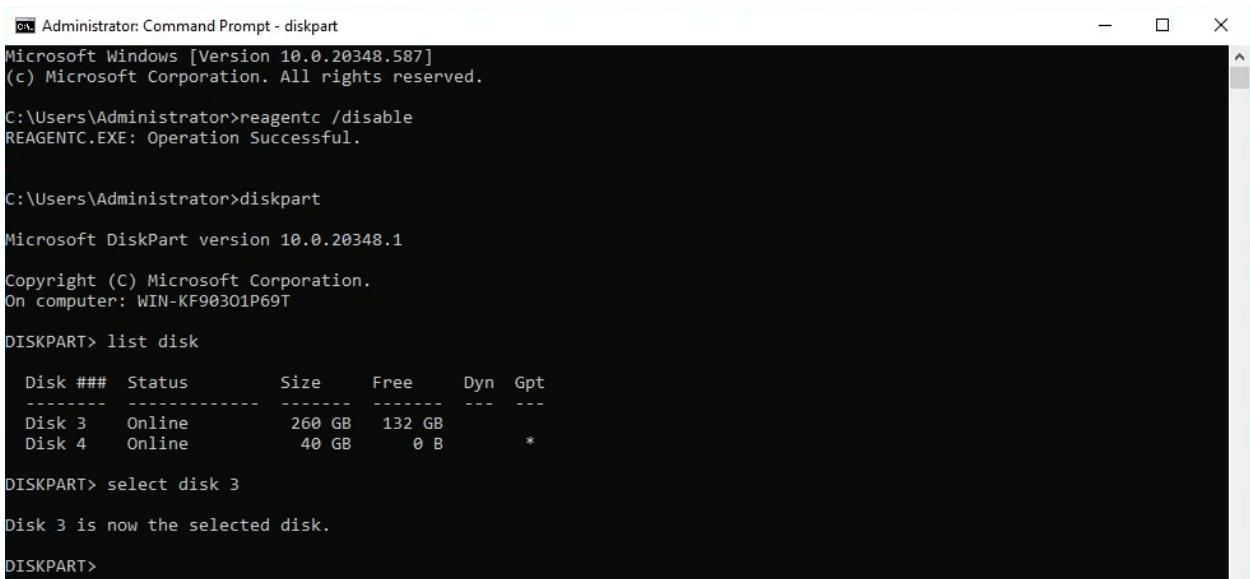
Microsoft DiskPart version 10.0.20348.1

Copyright (C) Microsoft Corporation.
On computer: WIN-KF90301P69T

DISKPART> list disk

Disk ### Status      Size     Free     Dyn  Gpt
----- -----
Disk 3   Online       260 GB   132 GB
Disk 4   Online        40 GB    0 B      *
```

Step 4: Type in the command to select the drive that has the C drive that you are trying to extend as shown below. In our case it's Disk 3.



```
Administrator: Command Prompt - diskpart
Microsoft Windows [Version 10.0.20348.587]
(c) Microsoft Corporation. All rights reserved.

C:\Users\Administrator>reagentc /disable
REAGENTC.EXE: Operation Successful.

C:\Users\Administrator>diskpart

Microsoft DiskPart version 10.0.20348.1

Copyright (C) Microsoft Corporation.
On computer: WIN-KF90301P69T

DISKPART> list disk

Disk ### Status      Size     Free     Dyn  Gpt
----- -----
Disk 3   Online       260 GB   132 GB
Disk 4   Online        40 GB    0 B      *

DISKPART> select disk 3

Disk 3 is now the selected disk.

DISKPART>
```

Step 5: Type in the command list partition to show all available partitions in the hard disk.

```
Administrator: Command Prompt - diskpart
REAGENTC.EXE: Operation Successful.

C:\Users\Administrator>diskpart

Microsoft DiskPart version 10.0.20348.1

Copyright (C) Microsoft Corporation.
On computer: WIN-KF90301P69T

DISKPART> list disk

Disk ###  Status     Size      Free      Dyn  Gpt
-----  -----
Disk 3    Online     260 GB   132 GB
Disk 4    Online     40 GB    0 B       *

DISKPART> select disk 3

Disk 3 is now the selected disk.

DISKPART> list partition

Partition ###  Type          Size      Offset
-----  -----
Partition 1  Primary        100 MB   1024 KB
Partition 2  Primary        127 GB   101 MB
Partition 3  Recovery       524 MB   127 GB

DISKPART>
```

Step 6: Type in command to select the partition that contains the Recovery files. In our case its partition 3

```
Administrator: Command Prompt - diskpart
Microsoft DiskPart version 10.0.20348.1

Copyright (C) Microsoft Corporation.
On computer: WIN-KF90301P69T

DISKPART> list disk

Disk ###  Status     Size      Free      Dyn  Gpt
-----  -----
Disk 3    Online     260 GB   132 GB
Disk 4    Online     40 GB    0 B       *

DISKPART> select disk 3

Disk 3 is now the selected disk.

DISKPART> list partition

Partition ###  Type          Size      Offset
-----  -----
Partition 1  Primary        100 MB   1024 KB
Partition 2  Primary        127 GB   101 MB
Partition 3  Recovery       524 MB   127 GB

DISKPART> select partition 3

Partition 3 is now the selected partition.

DISKPART>
```

Step 7: Type in the command to delete the partition so that the C drive(drive with OS) and the unallocated space are right beside each other. Enter the command as shown below.

```

Administrator: Command Prompt - diskpart

RETAIN      - Place a retained partition under a simple volume.
SAN         - Display or set the SAN policy for the currently booted OS.
SELECT     - Shift the focus to an object.
SETID      - Change the partition type.
SHRINK     - Reduce the size of the selected volume.
UNIQUEID   - Displays or sets the GUID partition table (GPT) identifier or
               master boot record (MBR) signature of a disk.

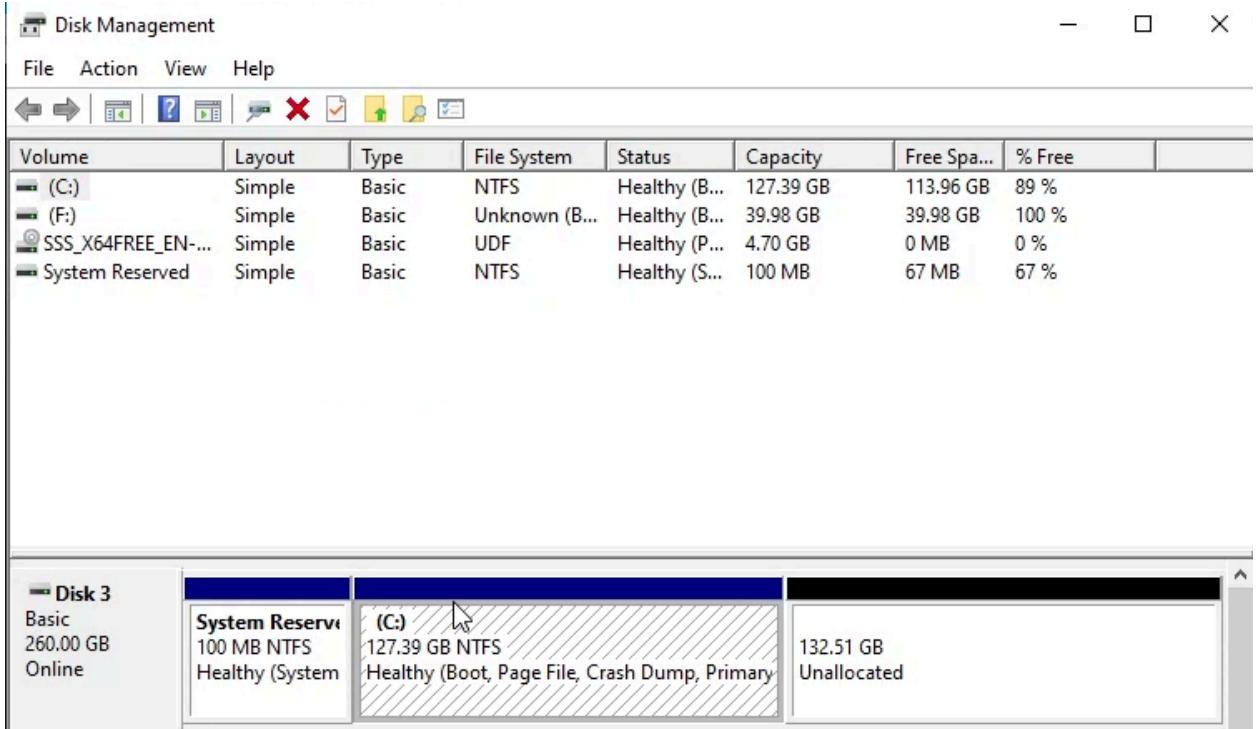
DISKPART> delete partition override

DiskPart successfully deleted the selected partition.

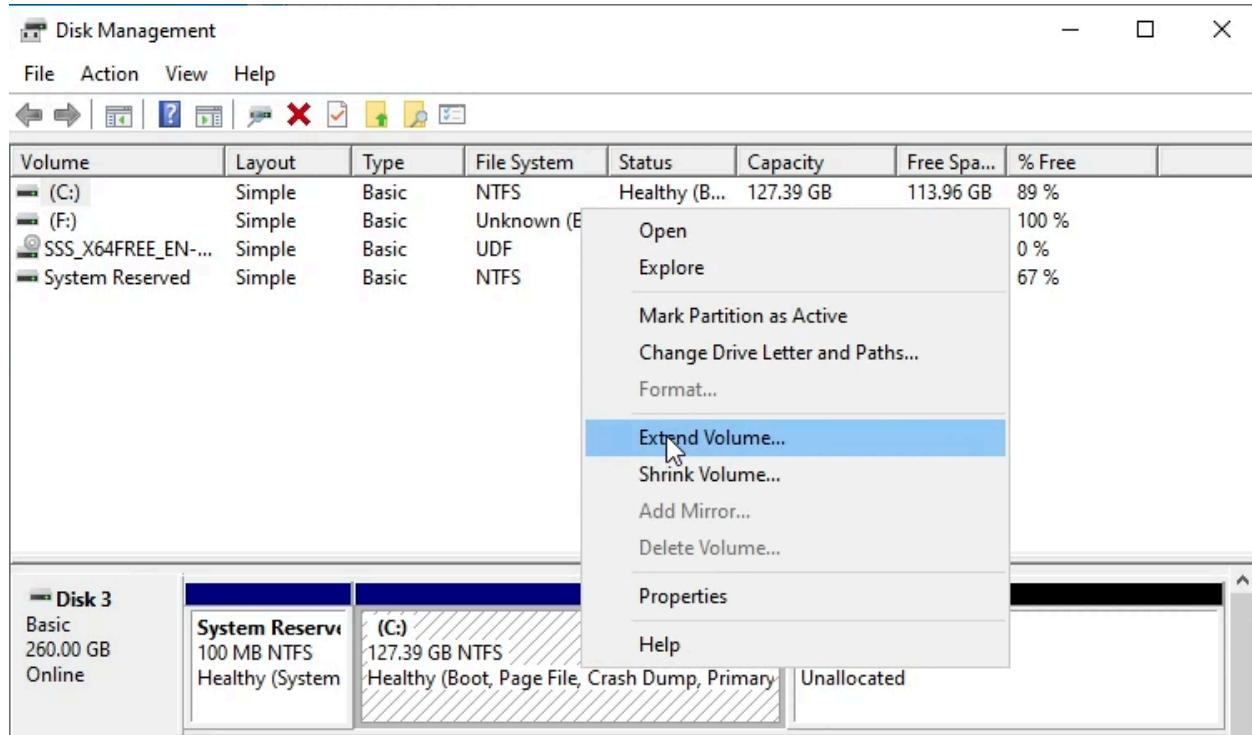
DISKPART> .

```

Step 8: Now open the disk management program and check to see if the partition was deleted and the C drive(drive with OS) and the unallocated space are right beside each other.



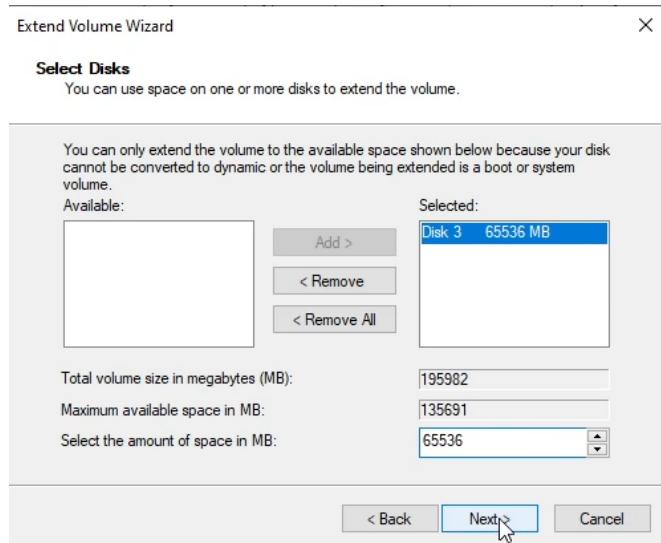
Step 9: Right click on the C drive and select Extend Volume. Click on that option.



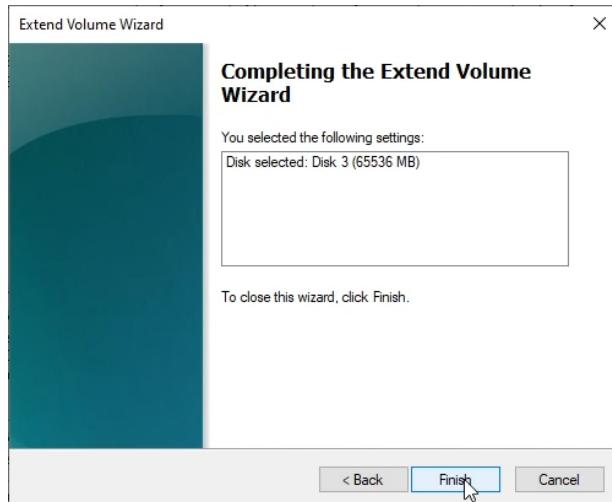
Step 10: You will be presented with the Extend Volume Wizard. Click Next.



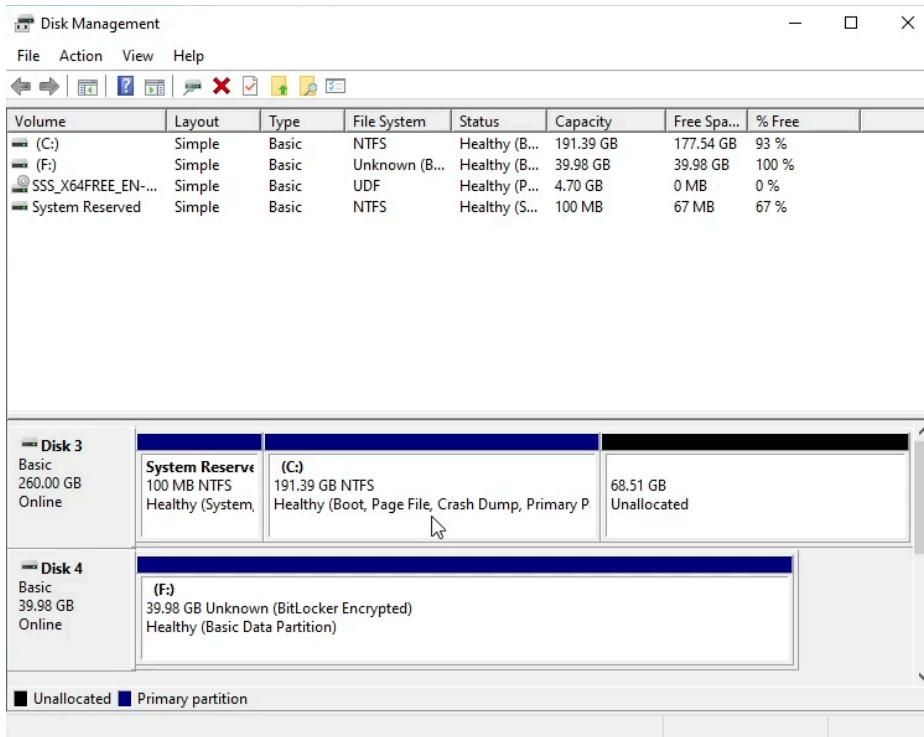
Step 11: The unallocated partition will be selected by default. Enter the amount of space you wish to transfer from the unallocated partition to the partition of the C drive. In our case it's 65536 MB which is approximately 64 GB. Click Next.



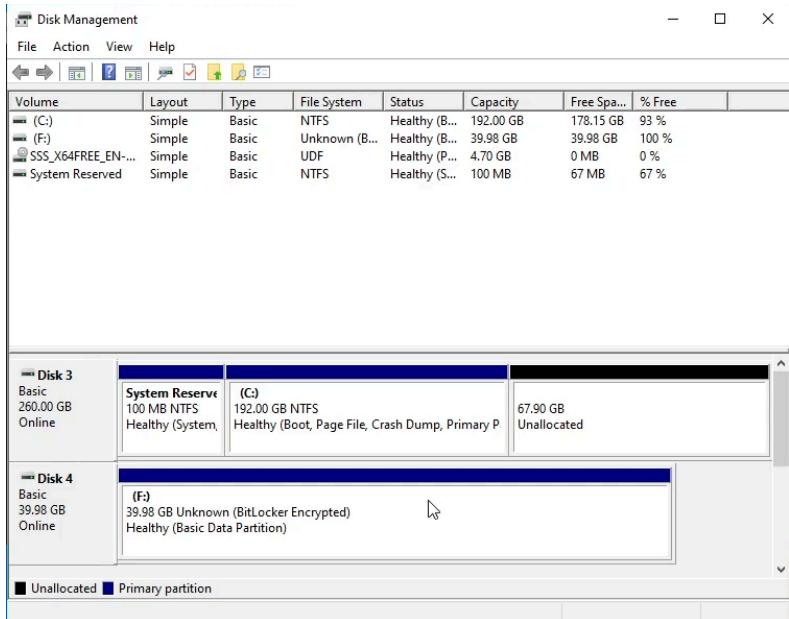
Step 12: The following screen just informs you that you have chosen to extend the C drive by that much space using the unallocated partition. Go ahead and press Finish.



After which you will notice that the unallocated partition has grown smaller and the C drive has been extended.



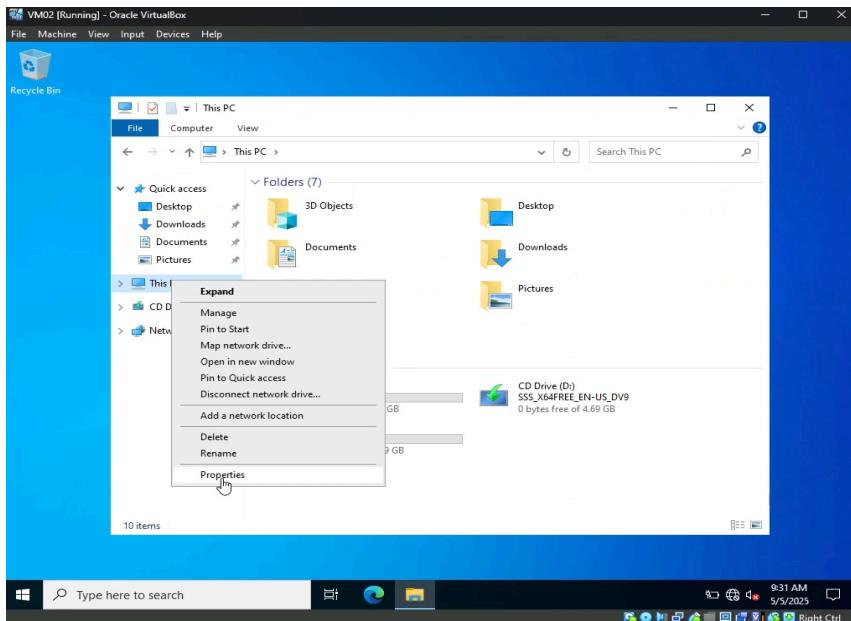
If you wish to allocate more space to the C drive, follow steps 9 to 12. Since setting up the OS creates reserved partitions and reduces the capacity of the C drive, you can use this method to replace the space that was taken by reserved partitions, from the unallocated space. So in a perfect system we would have the partitions as shown below.



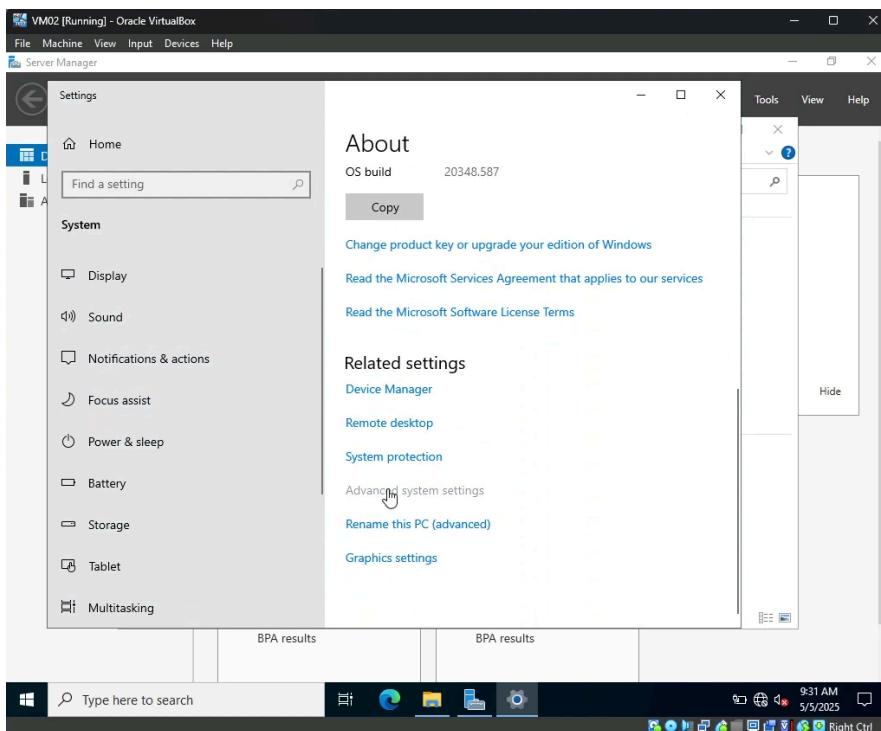
Having extra unallocated space allows one to distribute storage space to partitions as they see fit.

Configuring Virtual Memory for Page Caching

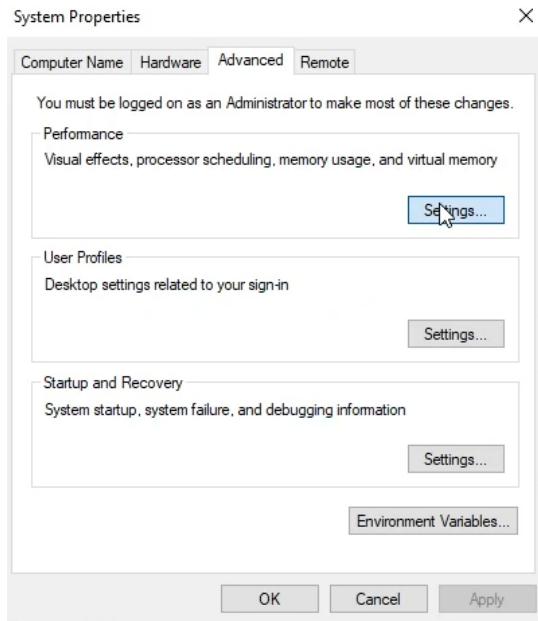
Step 1: Open File Explorer, right click on This PC and select the Properties option.



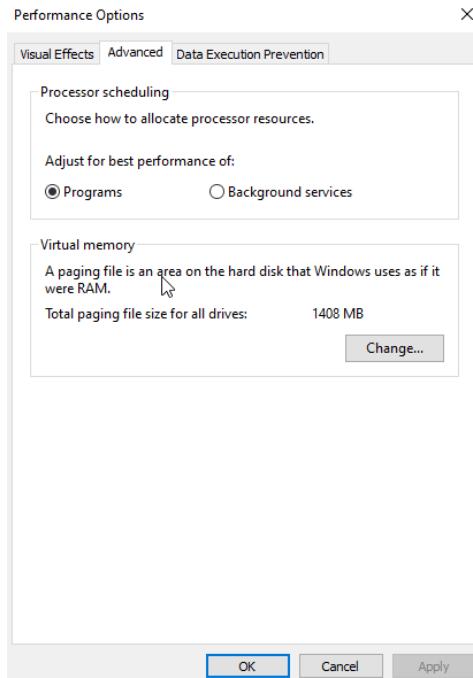
Step 2: In the About section, scroll to the end of the menu and select an option called Advance System Setting.



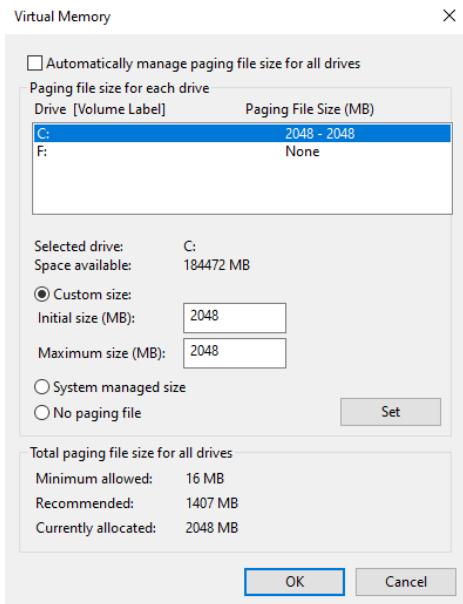
Step 3: Under the Performance section, press the Settings button.



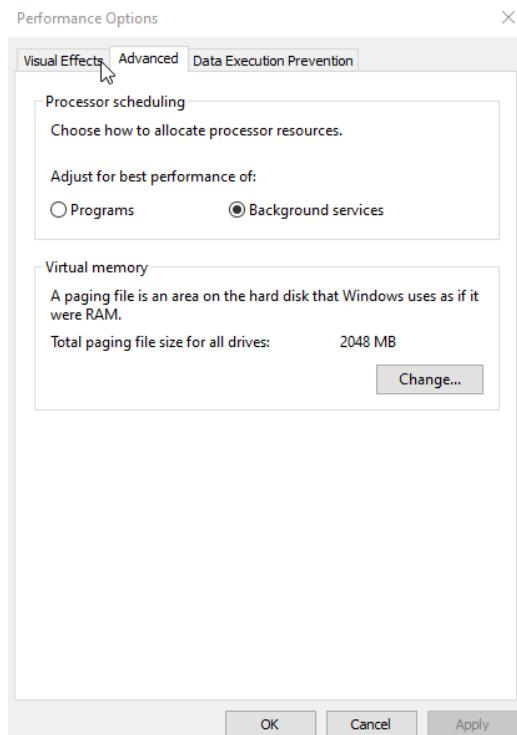
Step 4: Go to the Advanced tab in the performance window and click on change under the virtual memory section.



Step 5: Make changes to the window as shown in the screen shot.

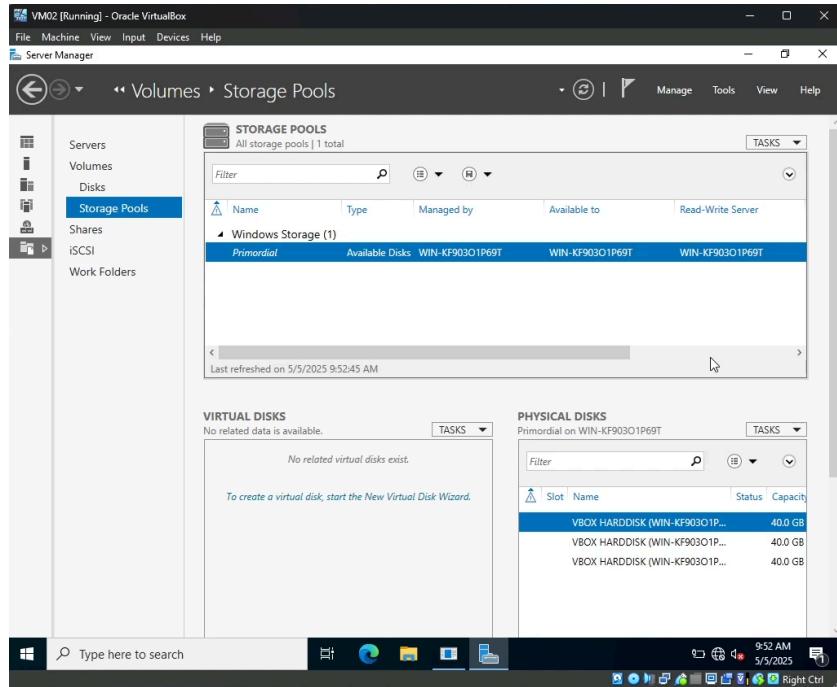


The final screen will appear as such after performing a reboot:

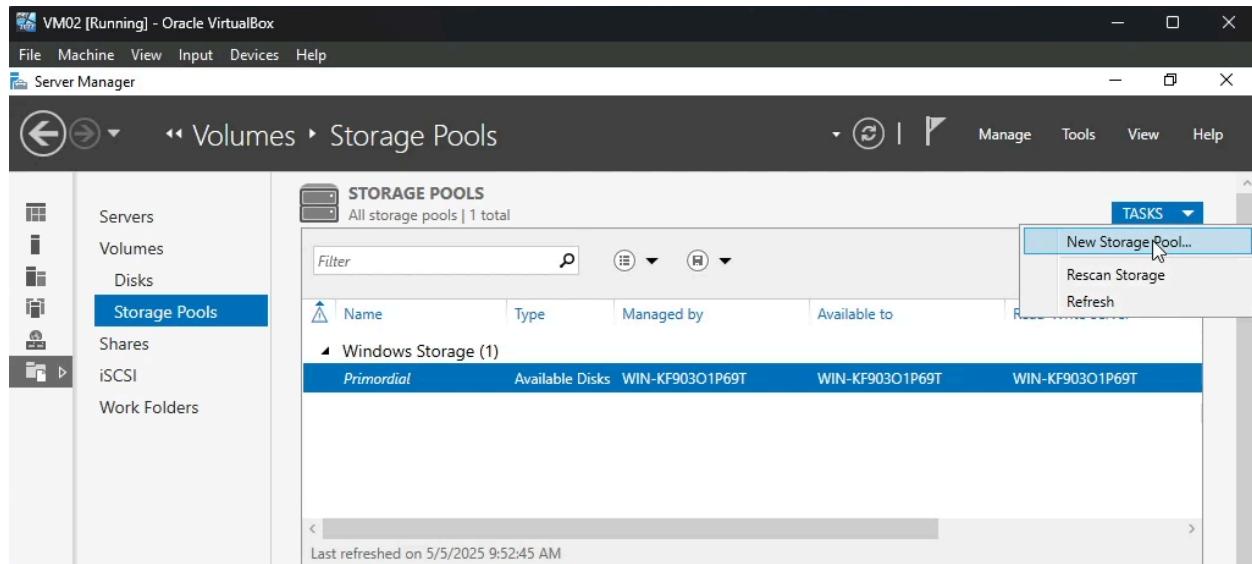


Storage Pool and RAID Setup

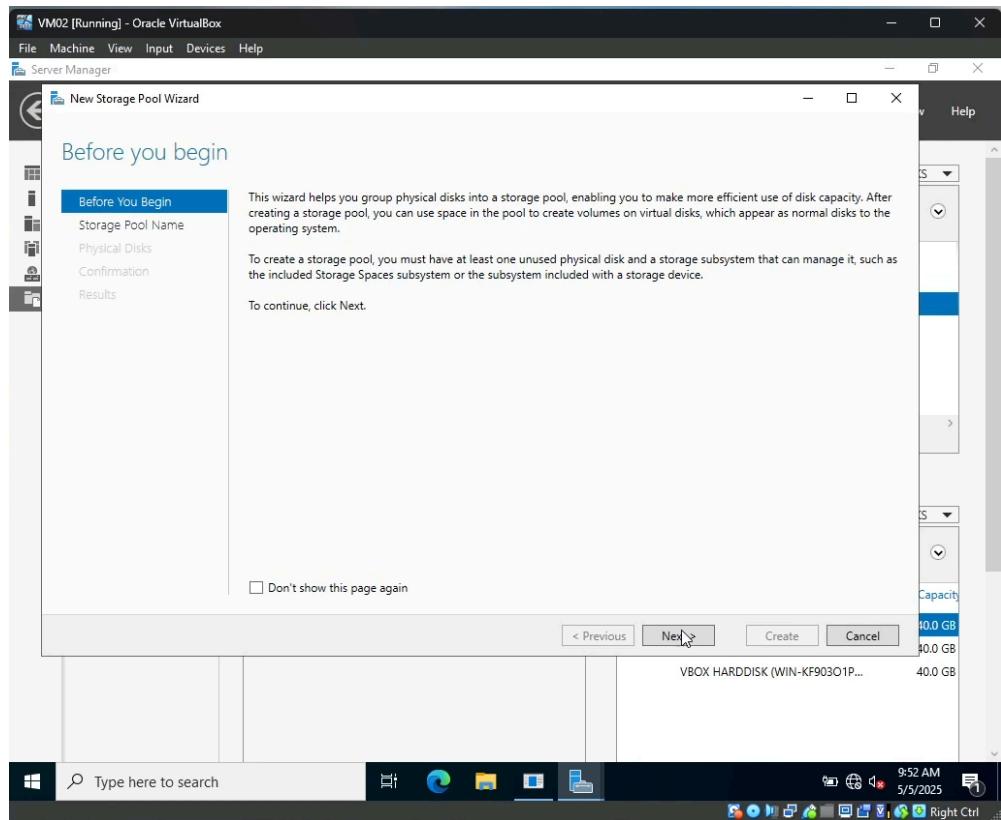
Step 1: Open Server Manager and locate the File and Storage Services option.



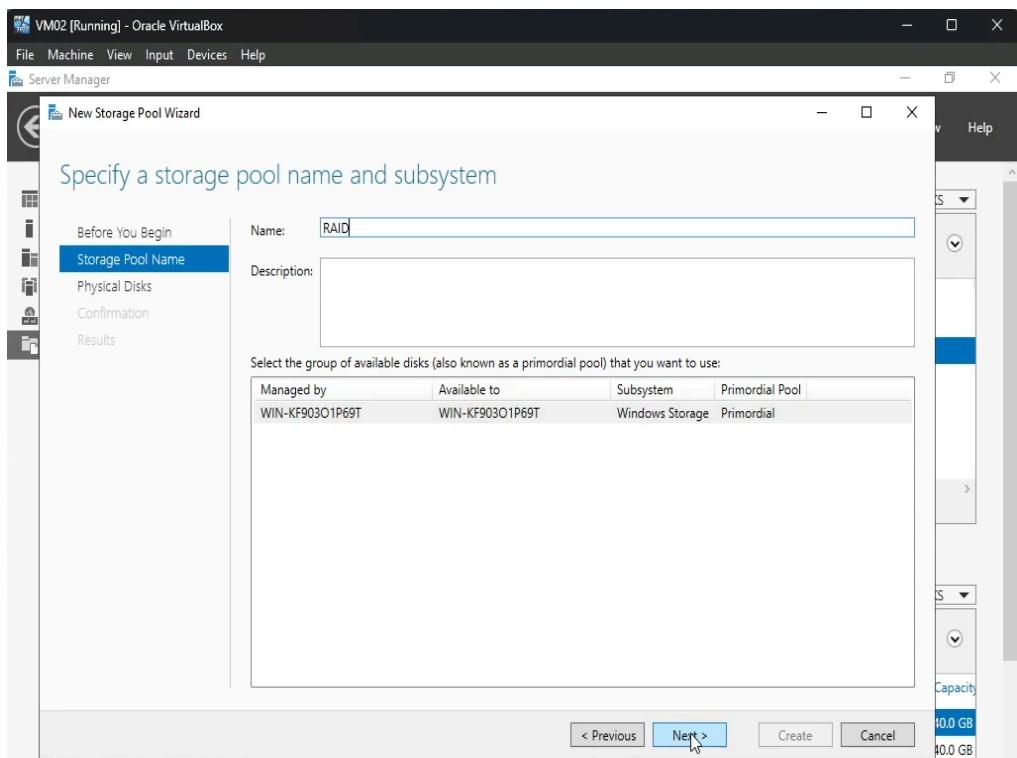
Step 2: To create a new Storage Pool, click the button named Tasks on the top right corner of the screen and select New Storage Pool.



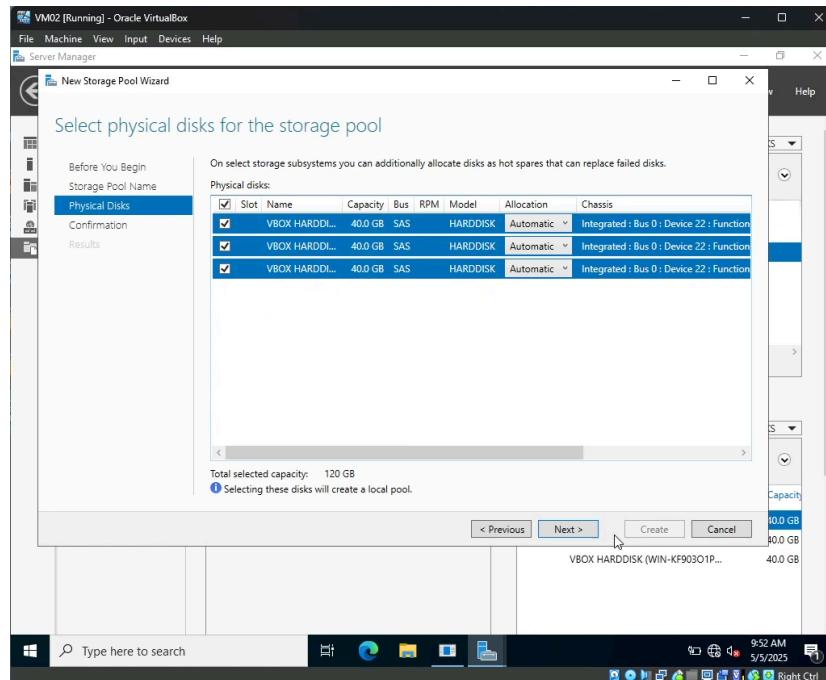
Step 3: A new Storage Pool wizard will open. It will inform you what the purpose of storage pools is and some requirements. Click Next.



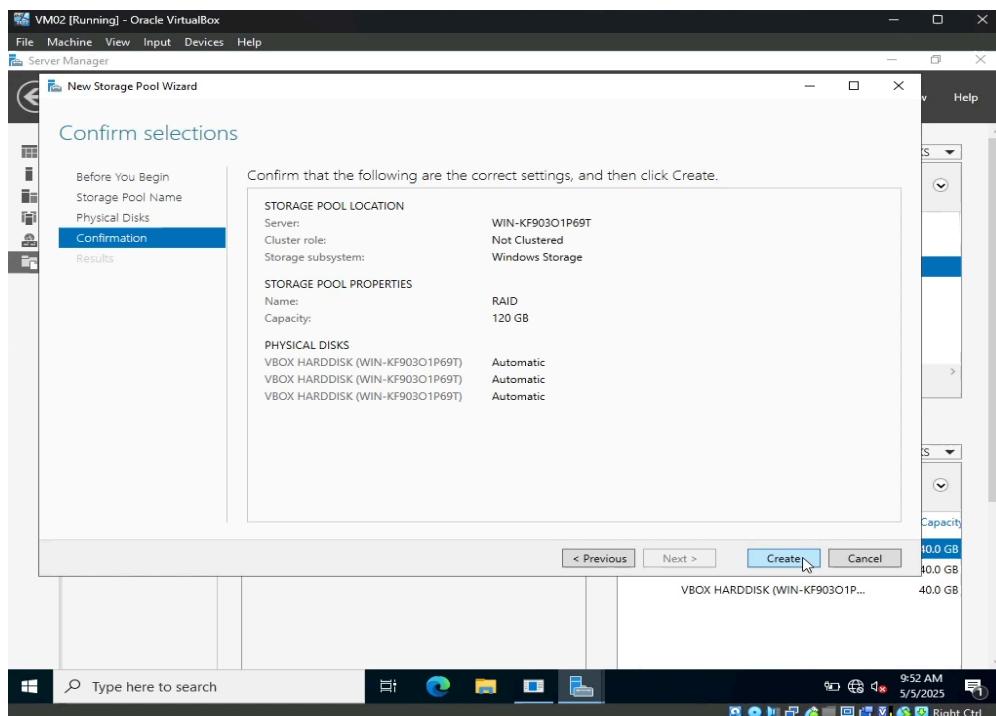
Step 4: Enter the name of the storage pool and select the primordial drive which has your OS. Click Next.



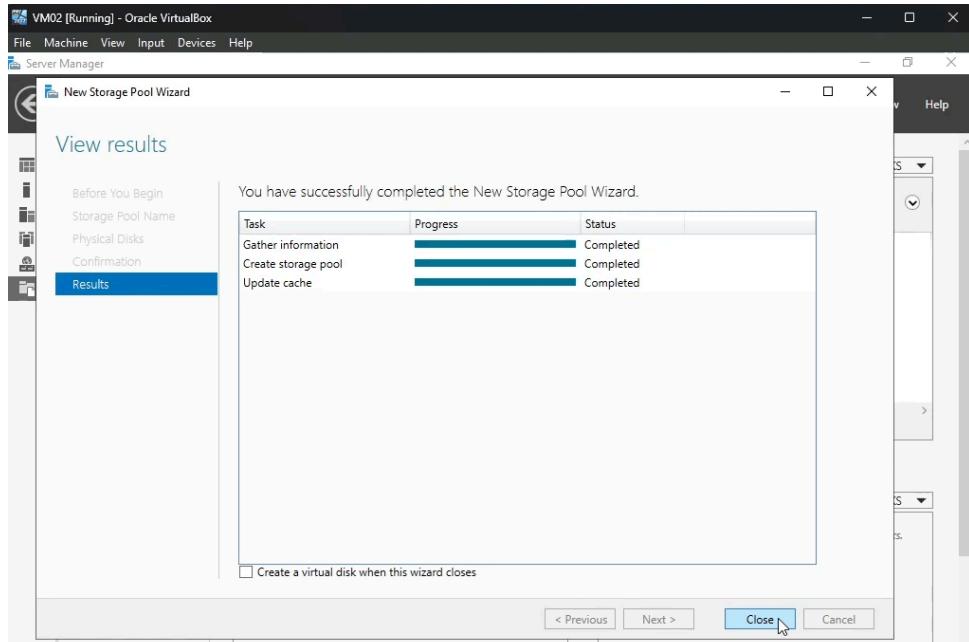
Step 5: Select all the physical drives that you wish to choose to create your storage pool with. Storage pool allows you to combine 2 or more drives and combine its storage capacity and treat it as one large virtual disk. In our case we have chosen 3 drives (3 physical drives) for RAID 1 which needs a minimum of 2 drives but the third drive can be used for stripping in the future. RAID 5 requires 7 physical drives if you are trying to configure through Server Manager. After selecting the physical drives, click Next.



Step 6: This screen just shows a summary of the options you have chosen. If everything looks right, press Create to make the new storage pool.

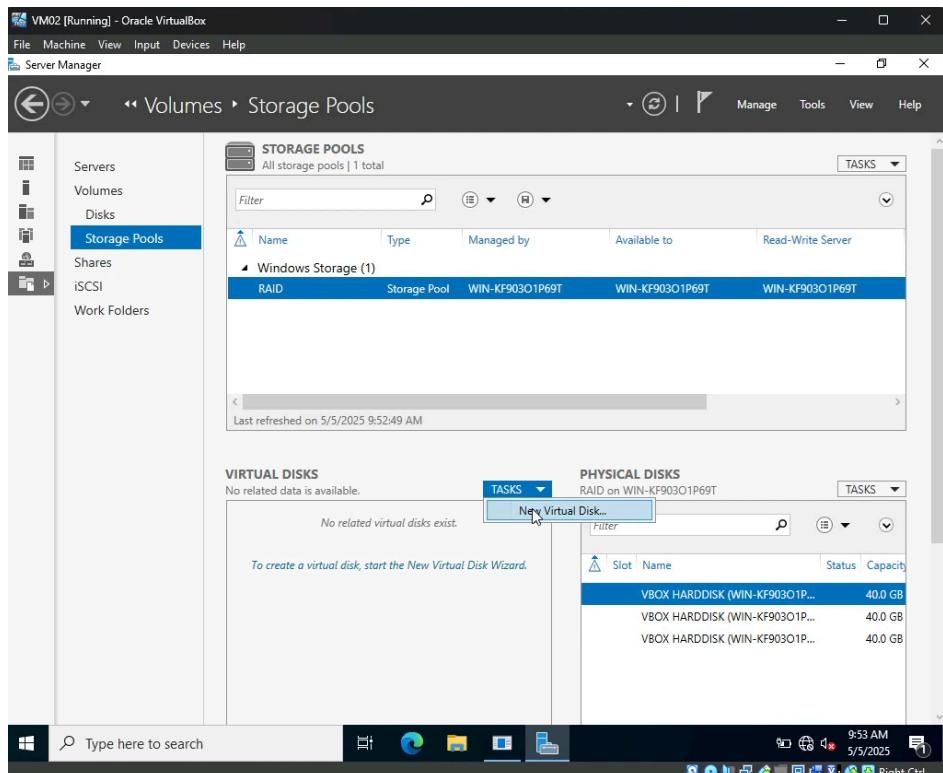


Step 7: Once the storage pool has been created, you will see a screen similar to the one below.

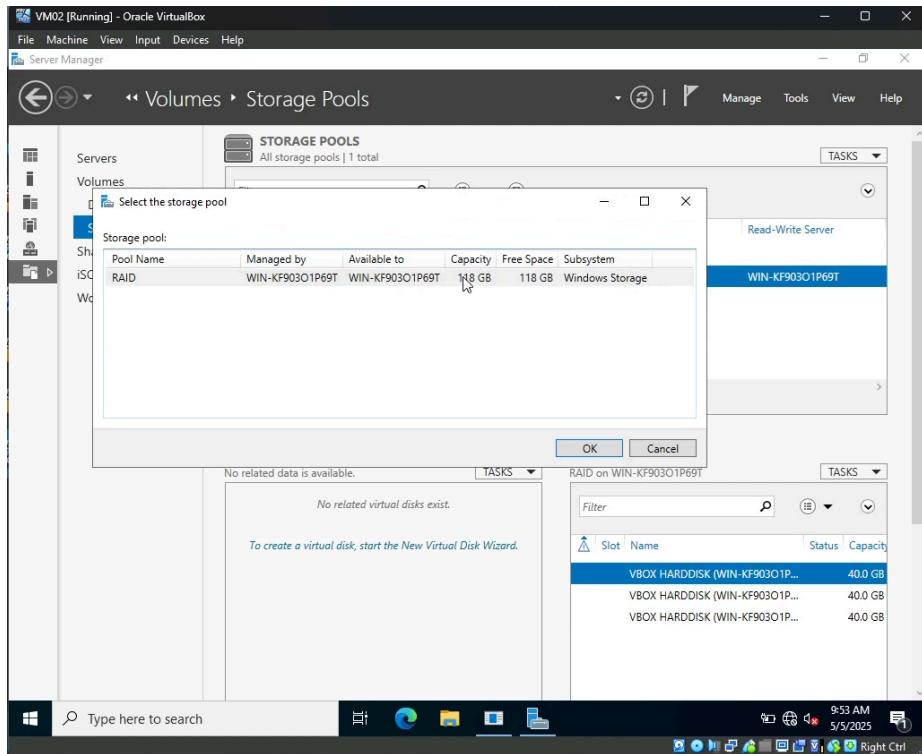


You can now press on close.

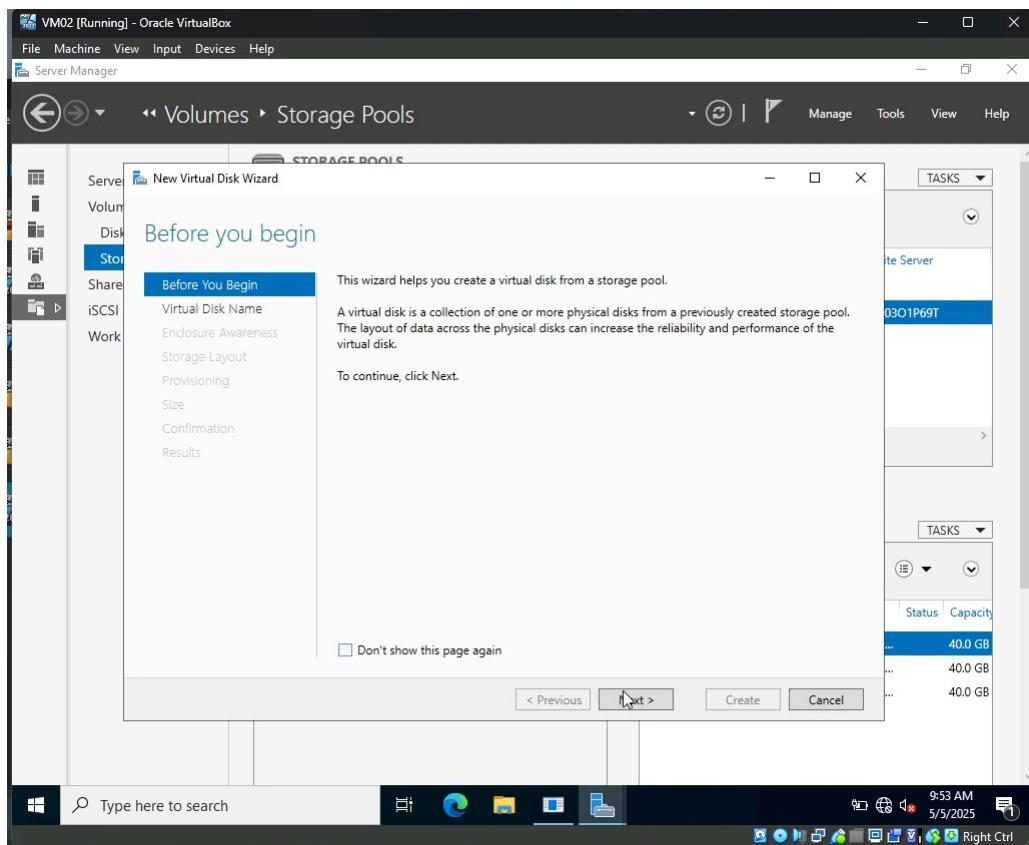
Step 8: You now have to create a virtual disk that will serve as a drive for either RAID 0, RAID 1 or RAID 5. Select the new storage pool you have chosen and make sure it is highlighted. Then under the virtual disk subheading, in the top right corner you will see an option called Tasks, press it and select the option New Virtual Disk.



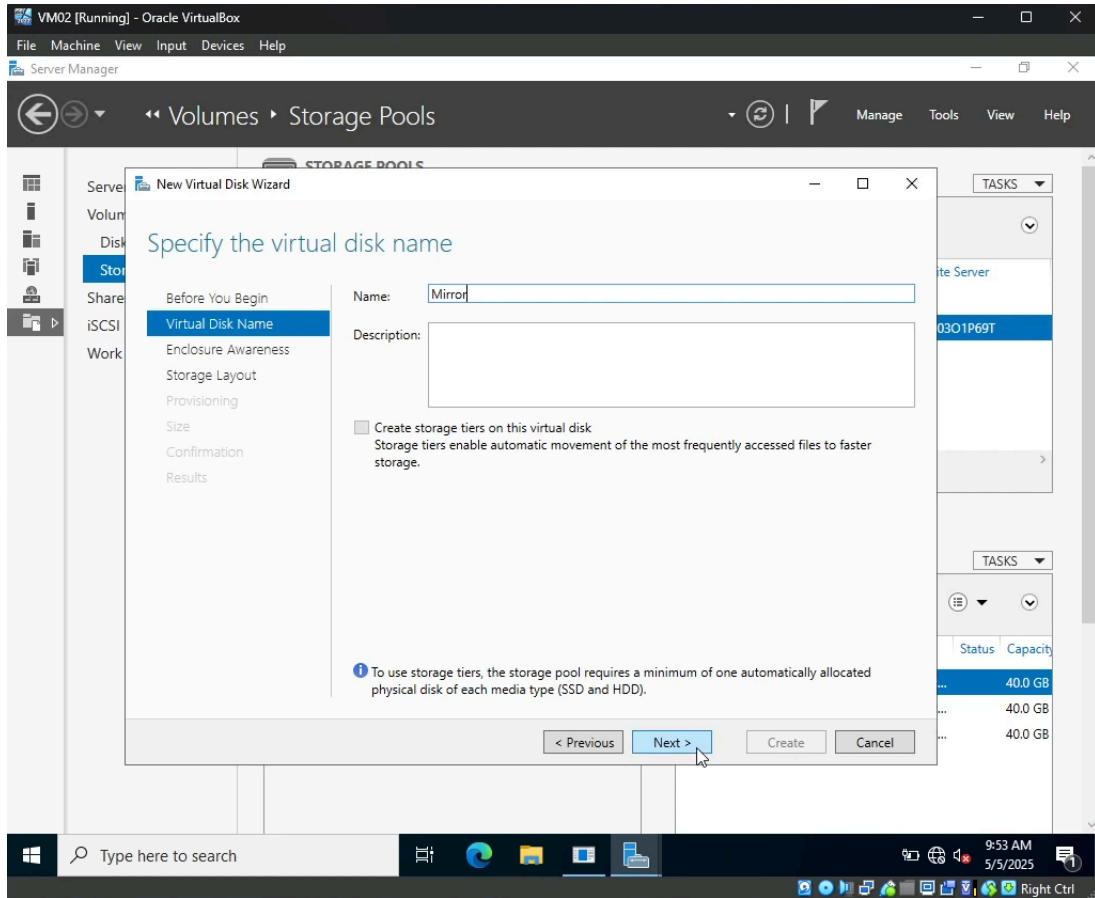
Step 9: You will be asked to select a storage pool, select the one you want to use for RAID and click OK.



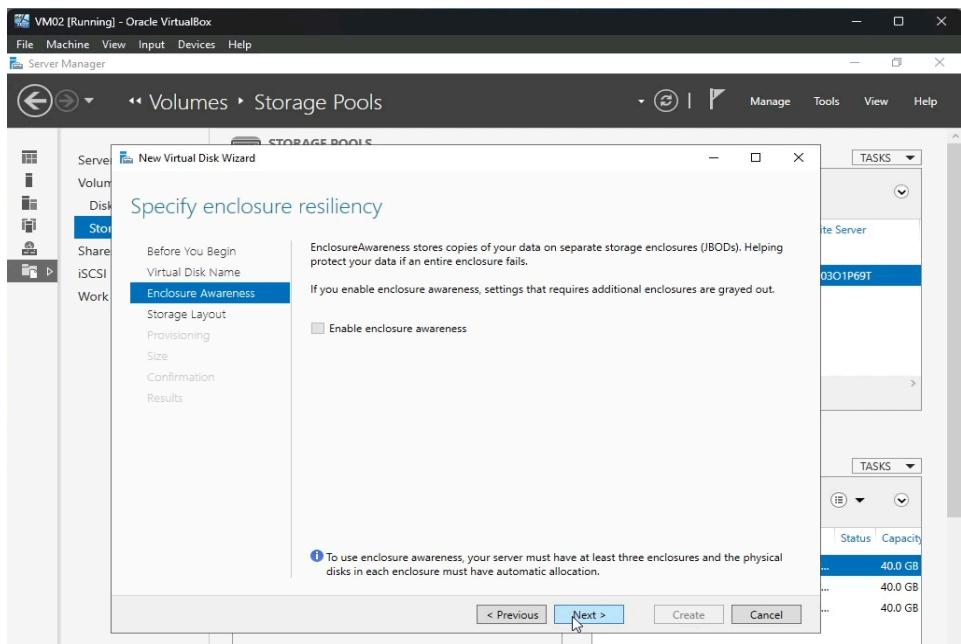
Step 10: A new virtual disk wizard will open. It will inform you what the purpose of a virtual disk is and some requirements. Click Next.



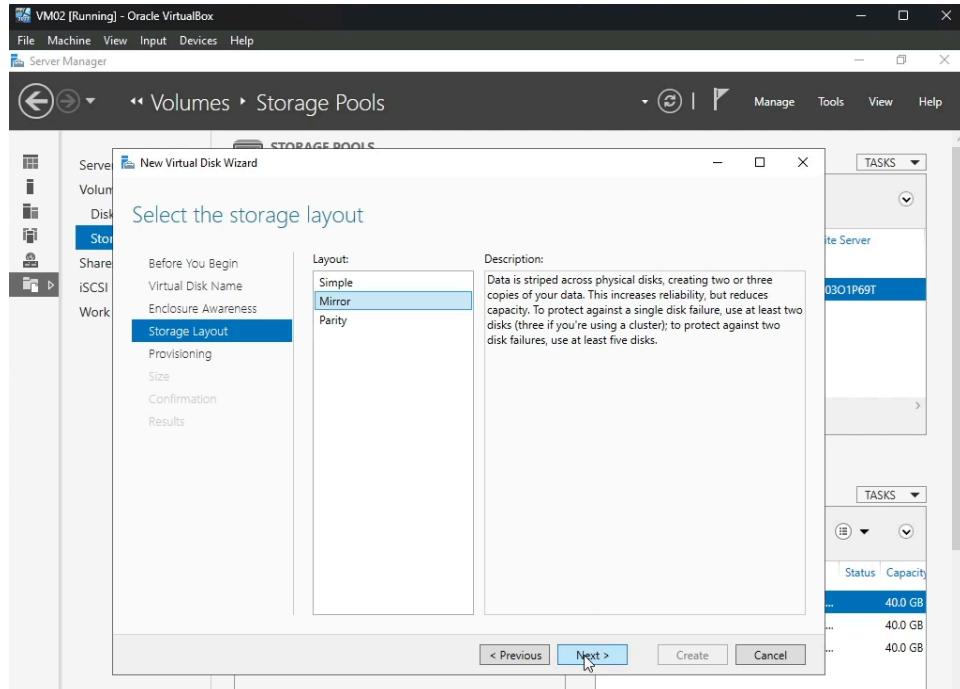
Step 11: Give a name to your virtual disk and a description if you want to. Click Next.



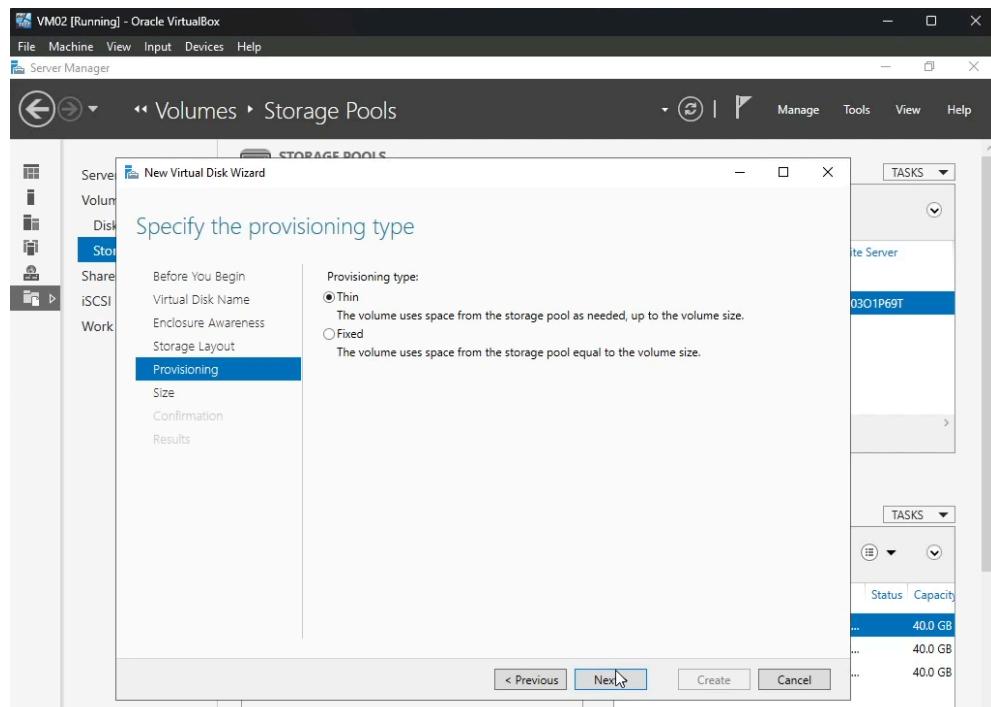
Step 12: This screen gives information about enclosure resiliency, which is not so important for our case so go ahead and press Next.



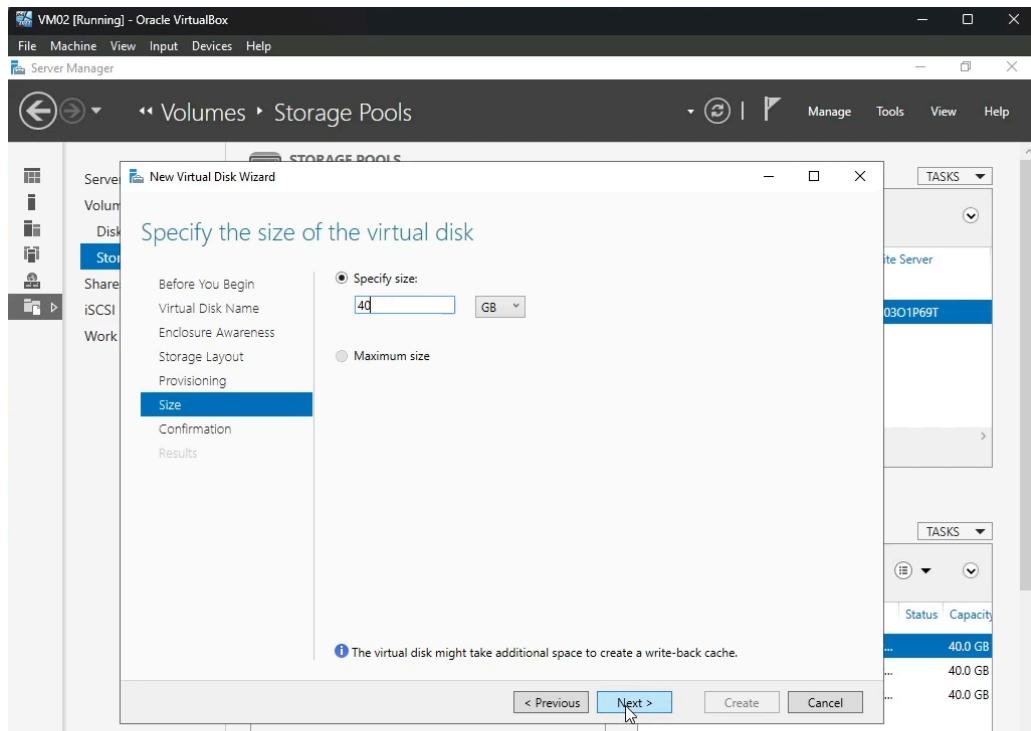
Step 13: In this screen you will choose what type of RAID you want your virtual drive to have. Simple is RAID 0, Mirroring is RAID 1 and Parity is RAID 5. In our case we will go with RAID 1 as it requires minimum 2 drives while RAID 5 requires 7 drives to configure. Select Mirror and press Next.



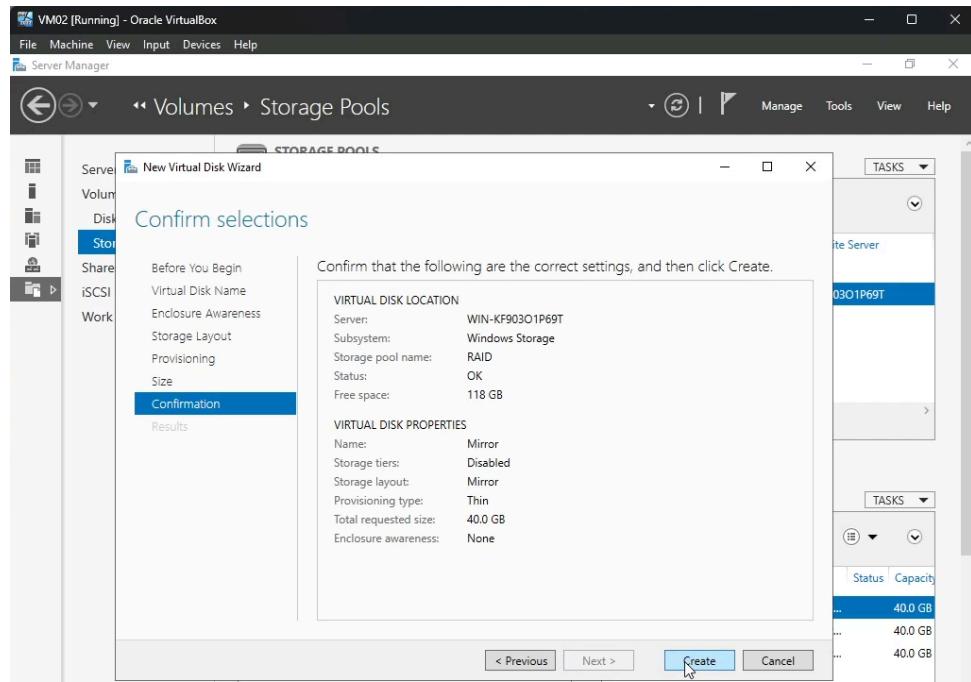
Step 14: For provision type select Thin as it will make more efficient use of the storage in the drives. Click next.



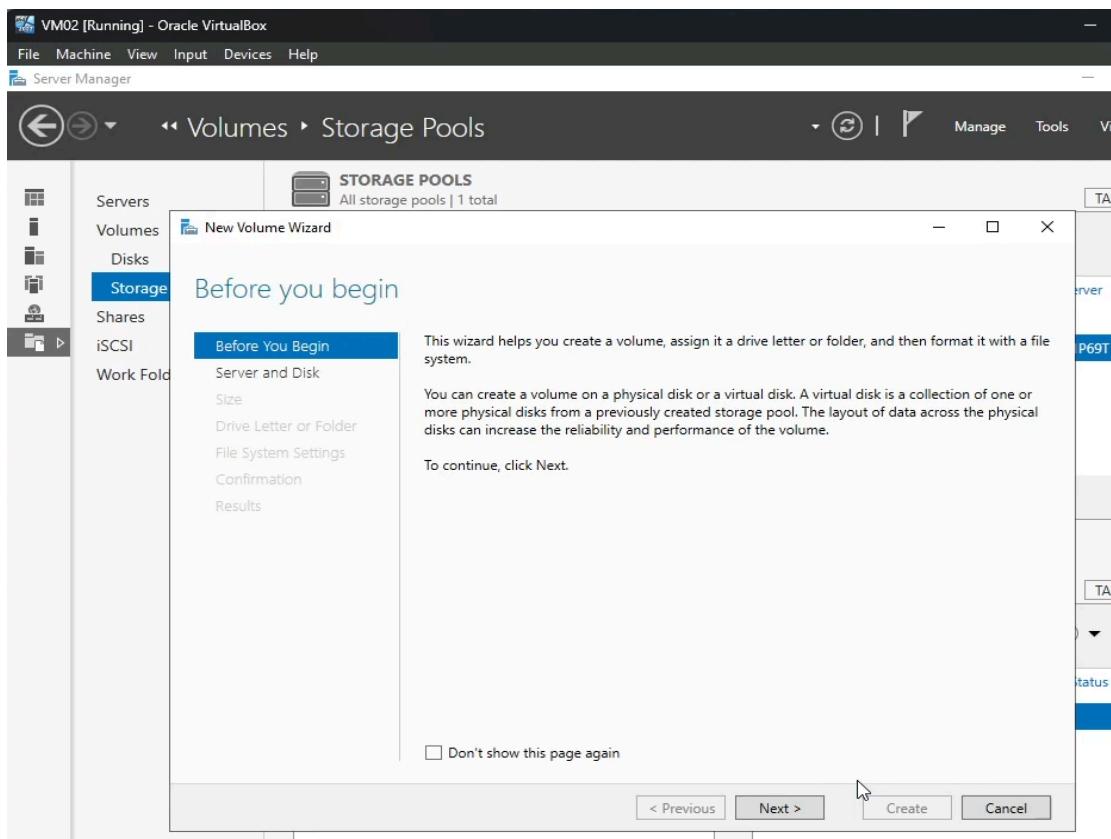
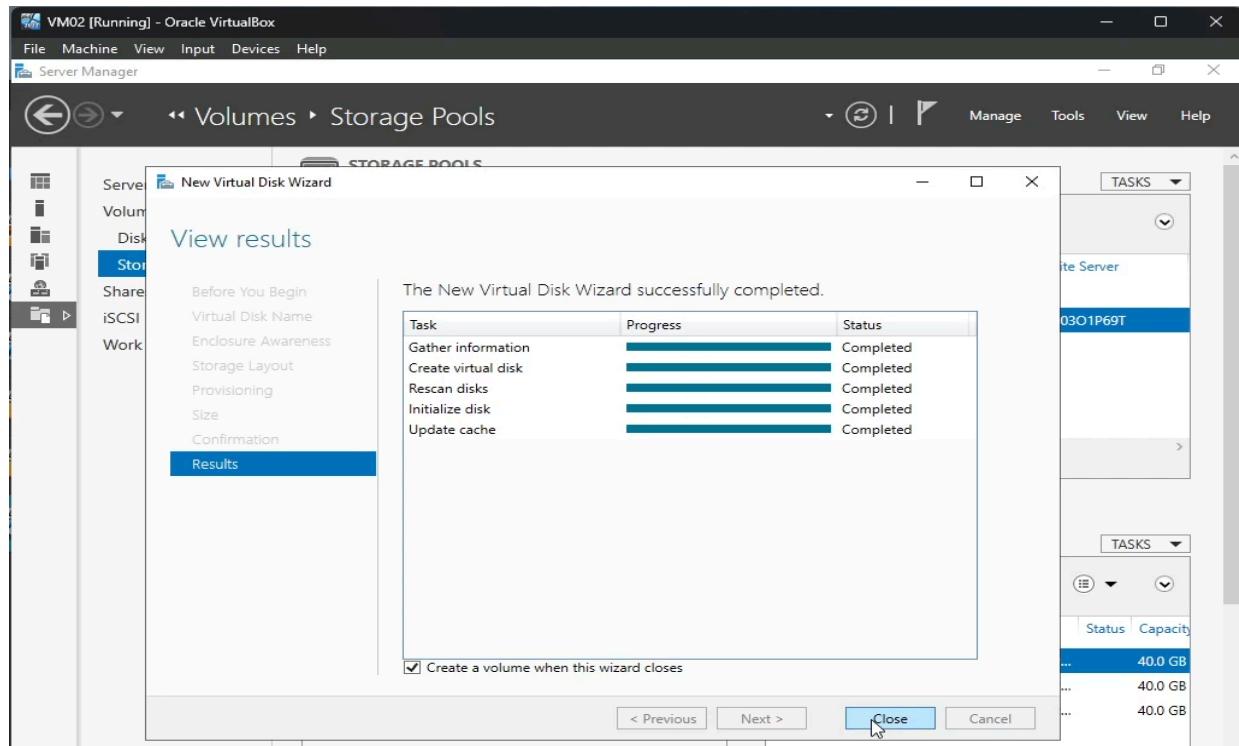
Step 15: Enter the size of the virtual drive that you want to create and press Next.



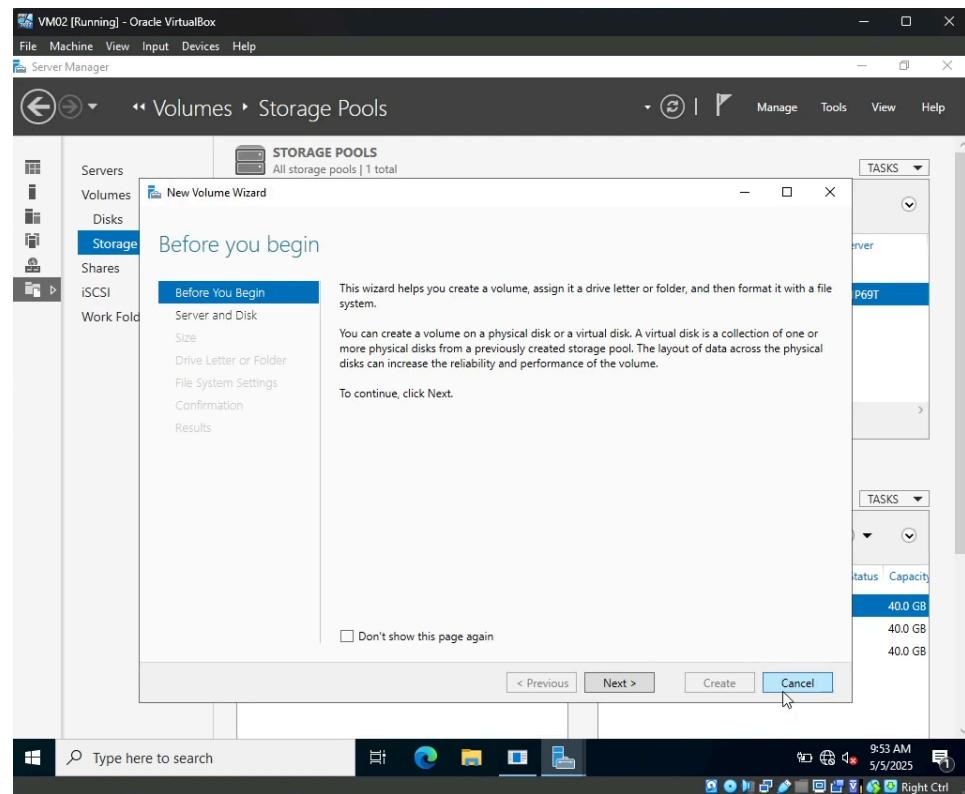
Step 16: This screen shows the summary of the options you have chosen, if everything looks alright, go ahead and press Create.



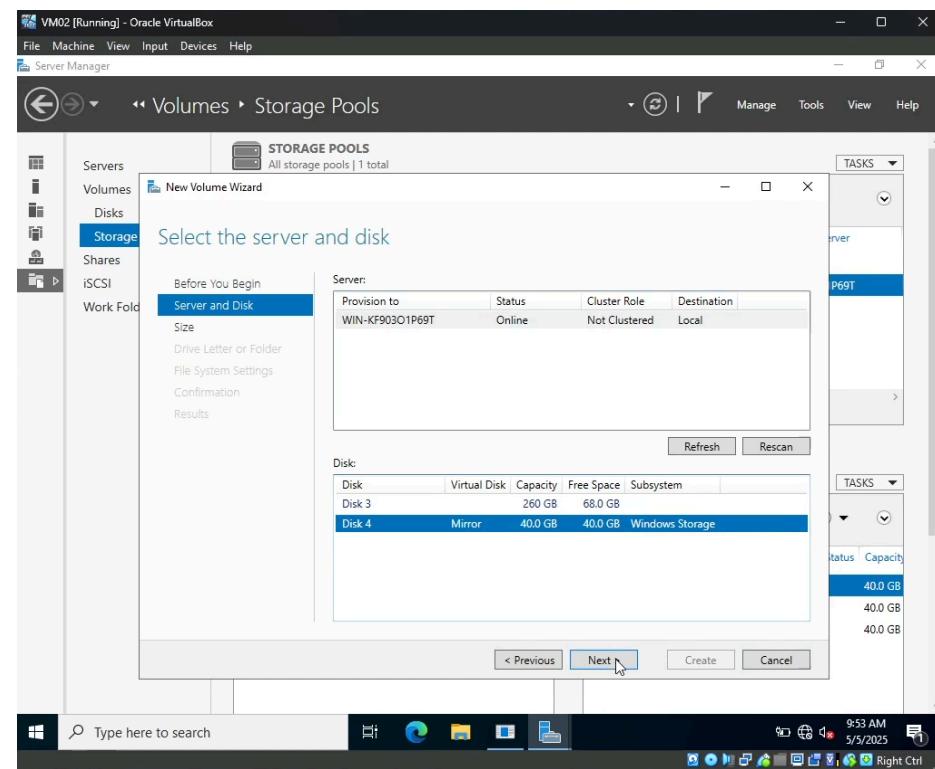
Step 17: Once the virtual disk has been created you will need to create a new volume. Before you press close, make sure the checkbox to create a new volume is selected to close the new virtual disk wizard and open the new volume wizard.



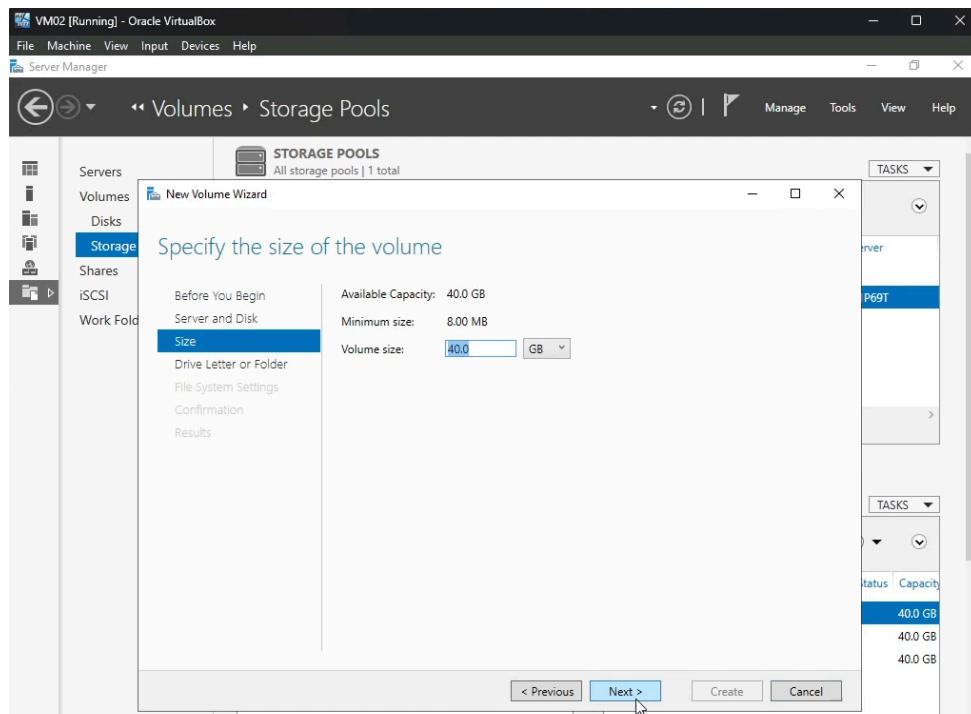
Step 18: The following screen gives a bit of information regarding creating a new volume. Click Next.



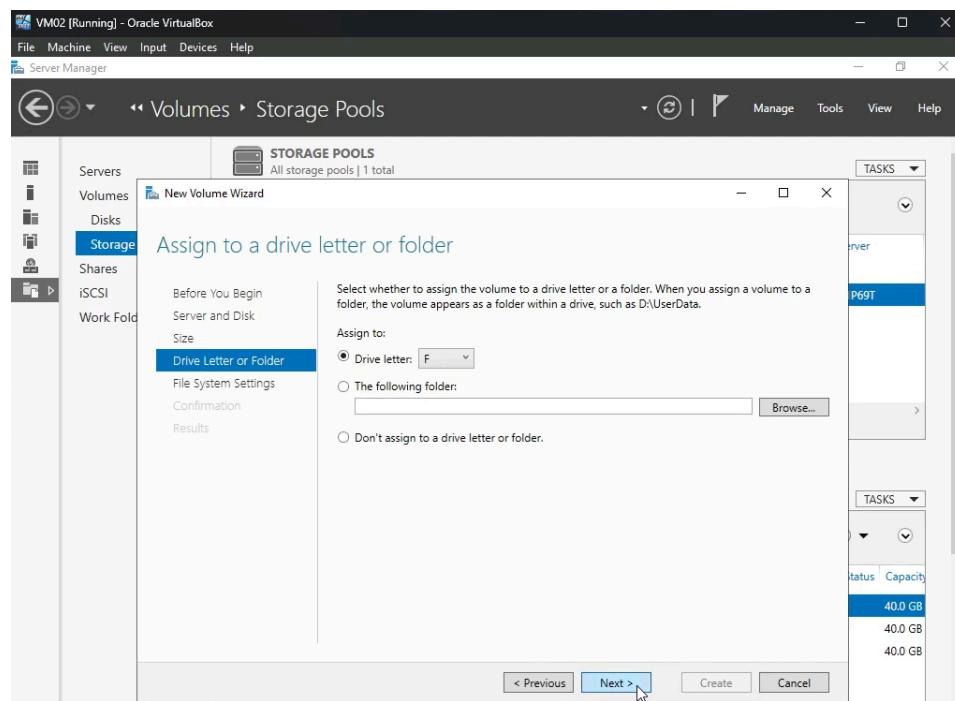
Step 19: Select the virtual disk you have just created and click Next.



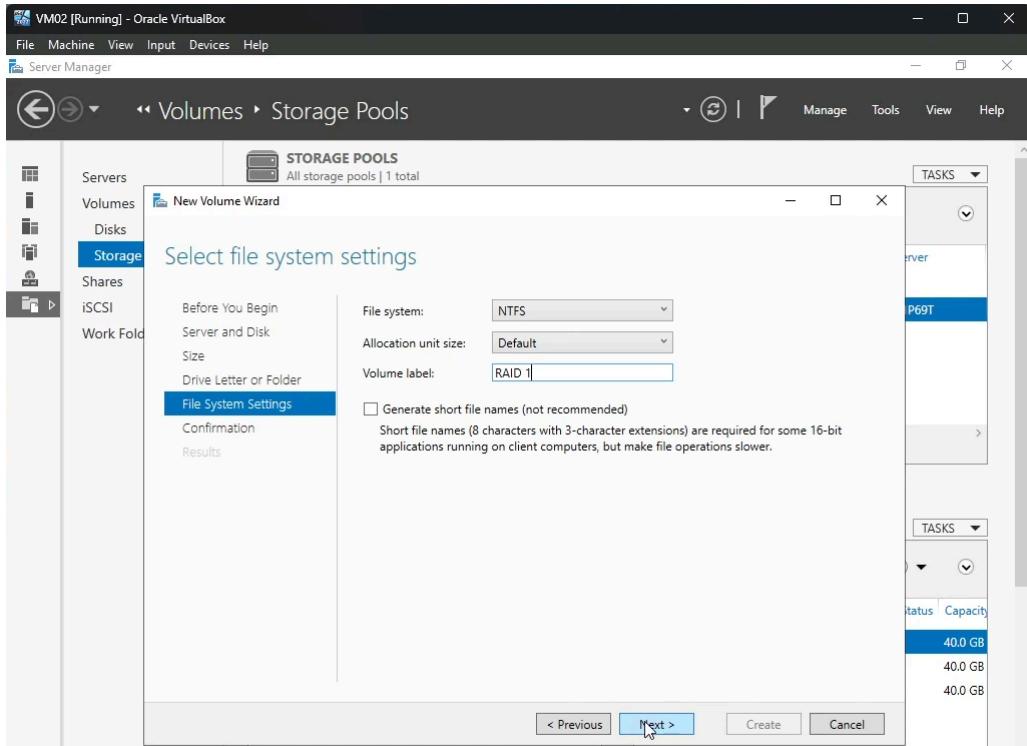
Step 20: Enter the amount of the virtual disk you would like to allocate and press Next.



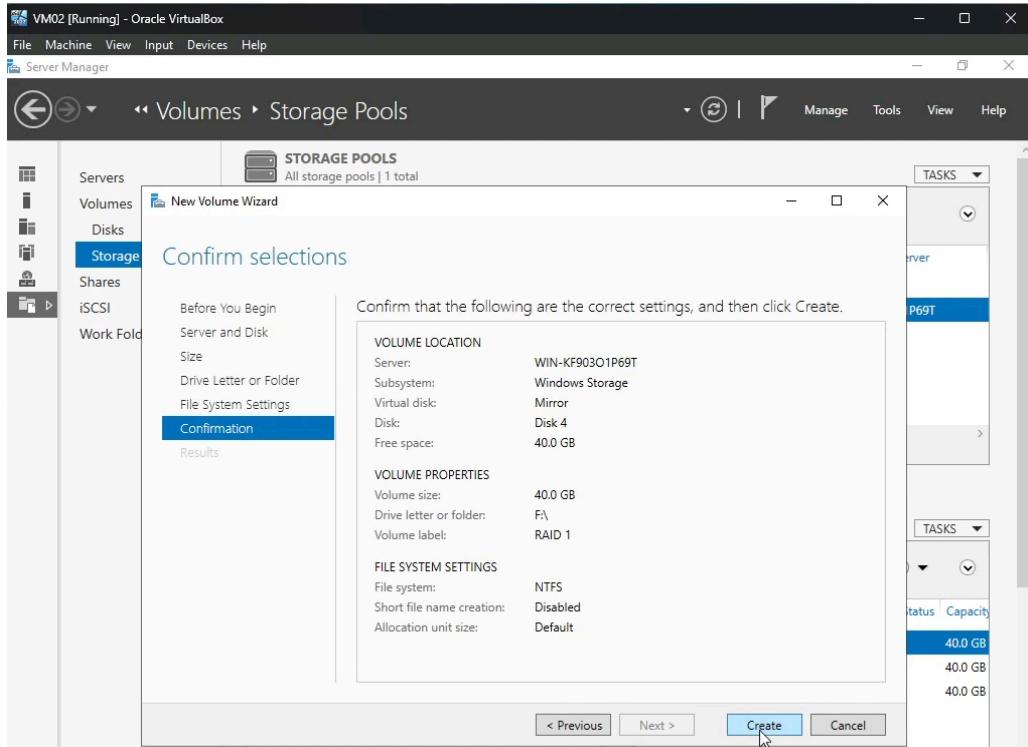
Step 21: Assign the drive/volume the letter of your choice and click Next.



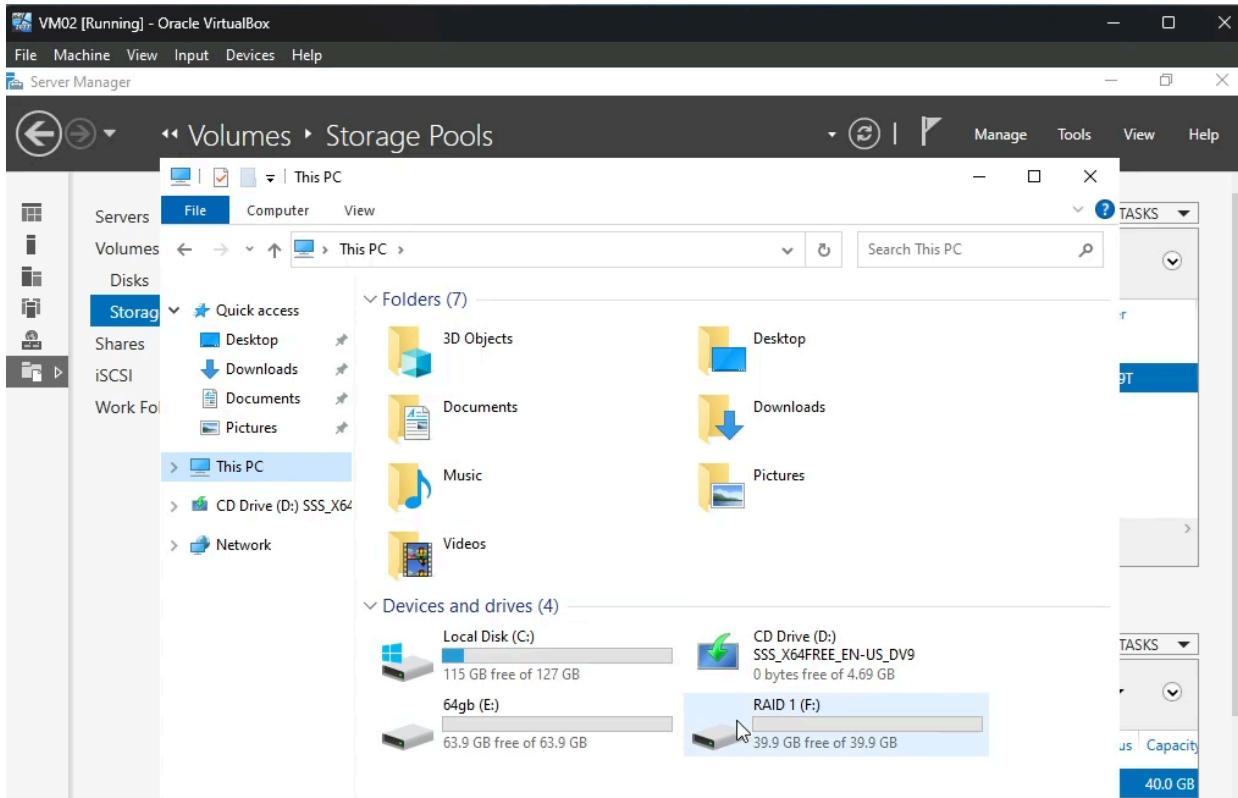
Step 21: Change the name of the volume if you would like to and press Next.



Step 22: This screen just shows a summary of the options you have chosen to make a new volume . If everything looks right, click Create.



If you open your file Explorer now, you should see the new volume you have just created.



Why RAID 1 Over RAID 5?

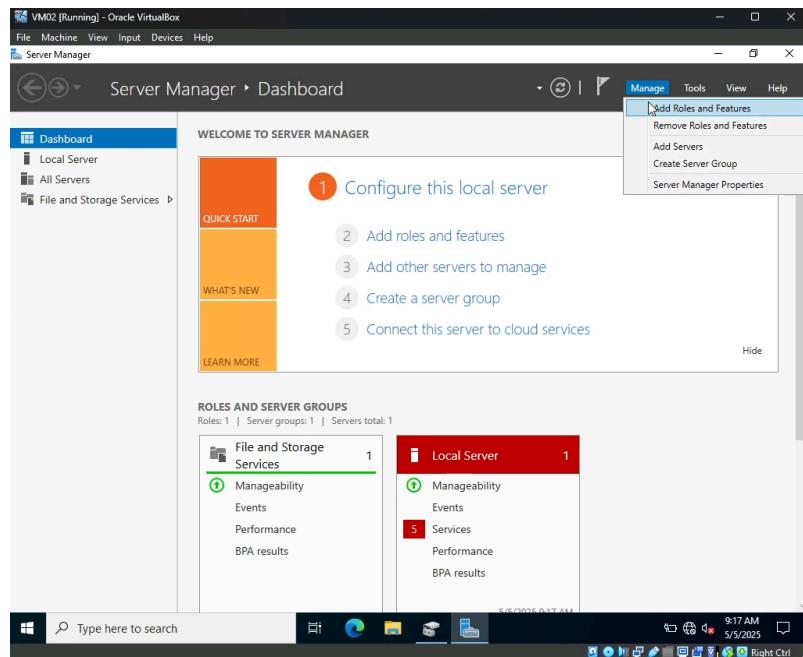
RAID 1 has many features that allows it to outperform RAID 5. Some of which include, firstly, ***fault tolerance***, in RAID 1 if a drive fails, the system can still function without any performance drops as the system will simply switch to the second drive that is in backup, whereas in RAID 5 if one drive fails, the system enters a degraded mode and slows the performance down as the setup tries to rebuild itself, however, if another drive fails during the rebuild process, then RAID 5 will fail completely.

Moreover, when it comes to the ***rebuild performance***, RAID 1 is faster to bounce back from failure as it needs to switch to the second drive which holds the exact copy of the data, whereas RAID 5 has to do complex parity calculation to rebuild the lost data, which takes time.

Finally, when it comes to critical infrastructure, such as a banking system, RAID 1 has a faster read/ write speeds and is able to handle sudden bursts of transactional workloads which RAID 5 struggles to do due to the parity calculation reducing write speeds heavily. RAID 1 is highly used for critical infrastructure for organisations who cannot afford to have downtimes.

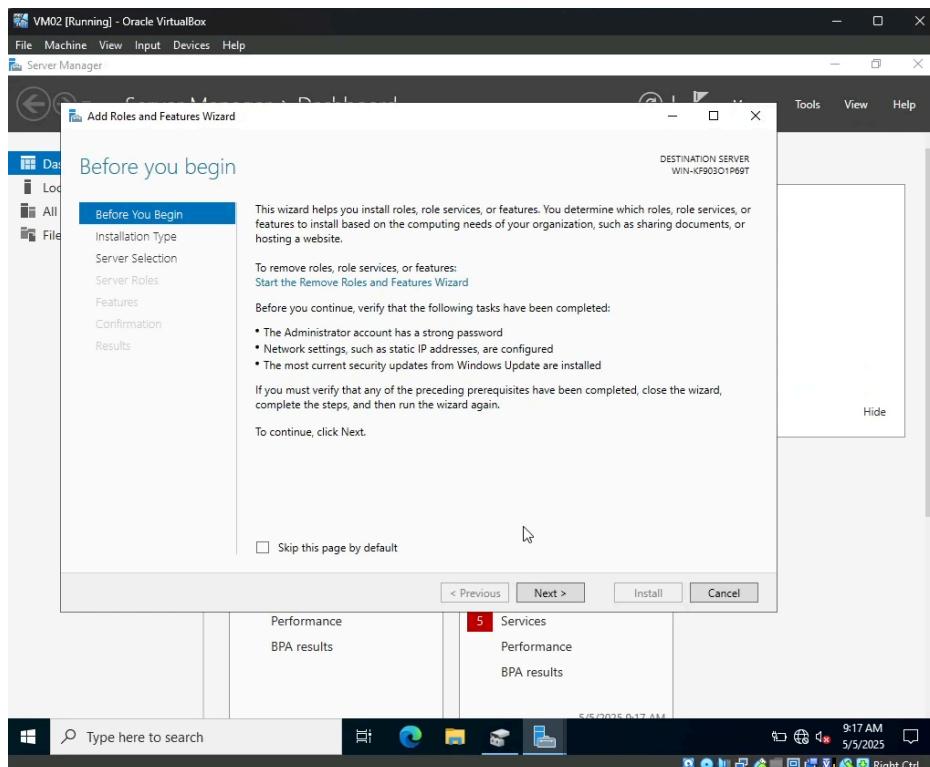
Setting Up BitLocker Encryption for New RAID 1 Drive

Step 1: Open the Server Manager Program and press Manage that located to the top right corner of the program.

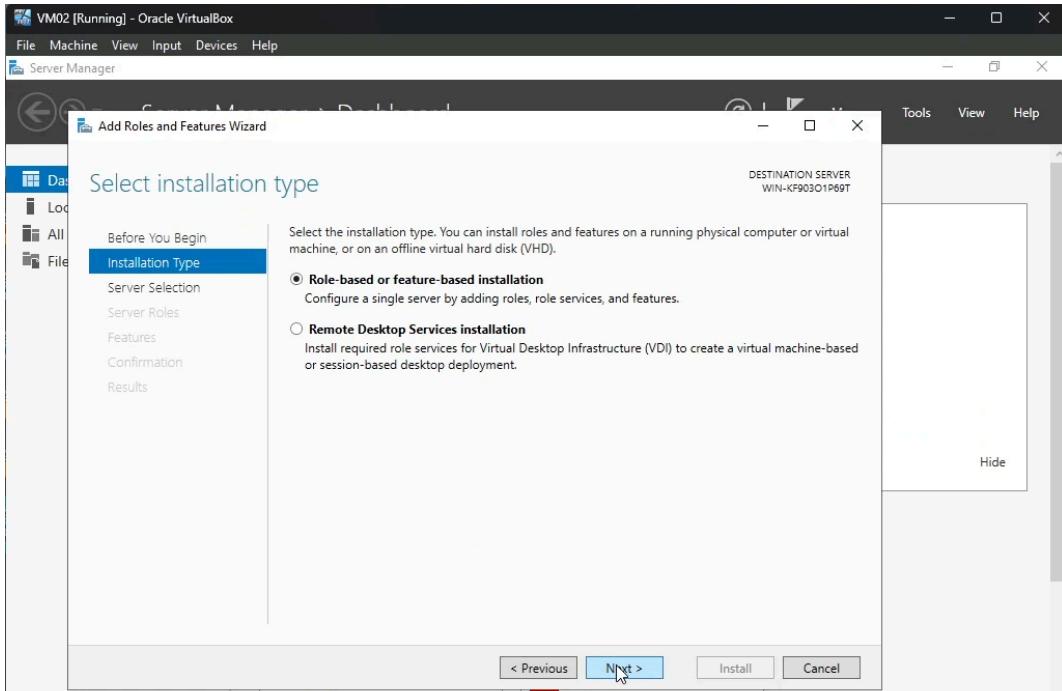


Next, click the “Add Roles and features” option to start the setup process of adding a user role and its related features to the server.

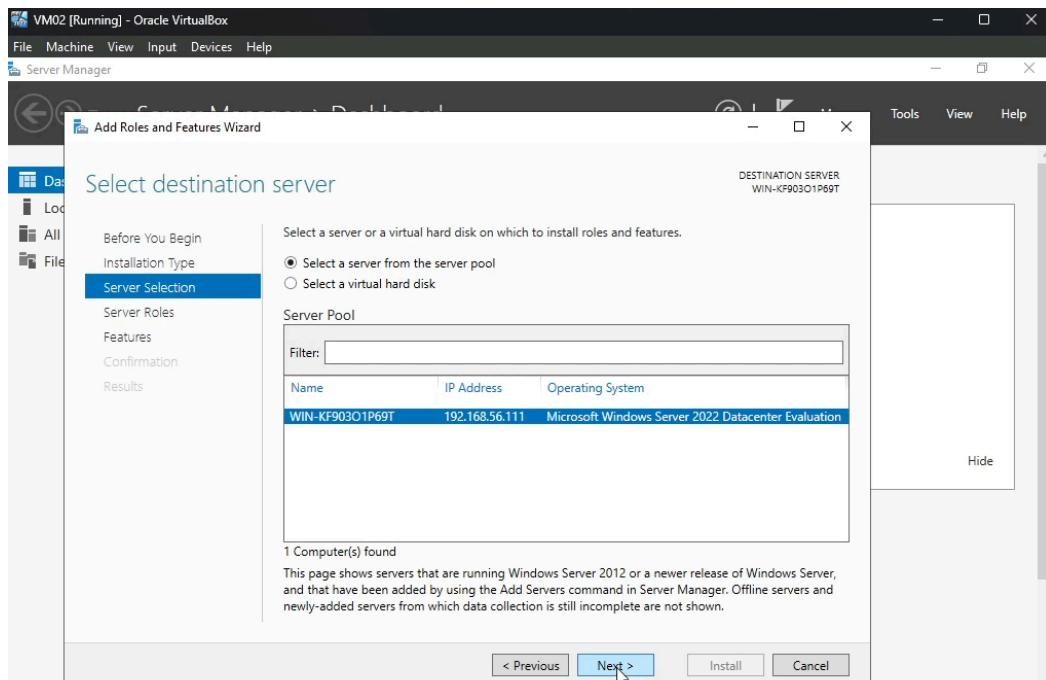
Step 2: This setup wizard will guide you through adding Roles and features to your server. Click Next.



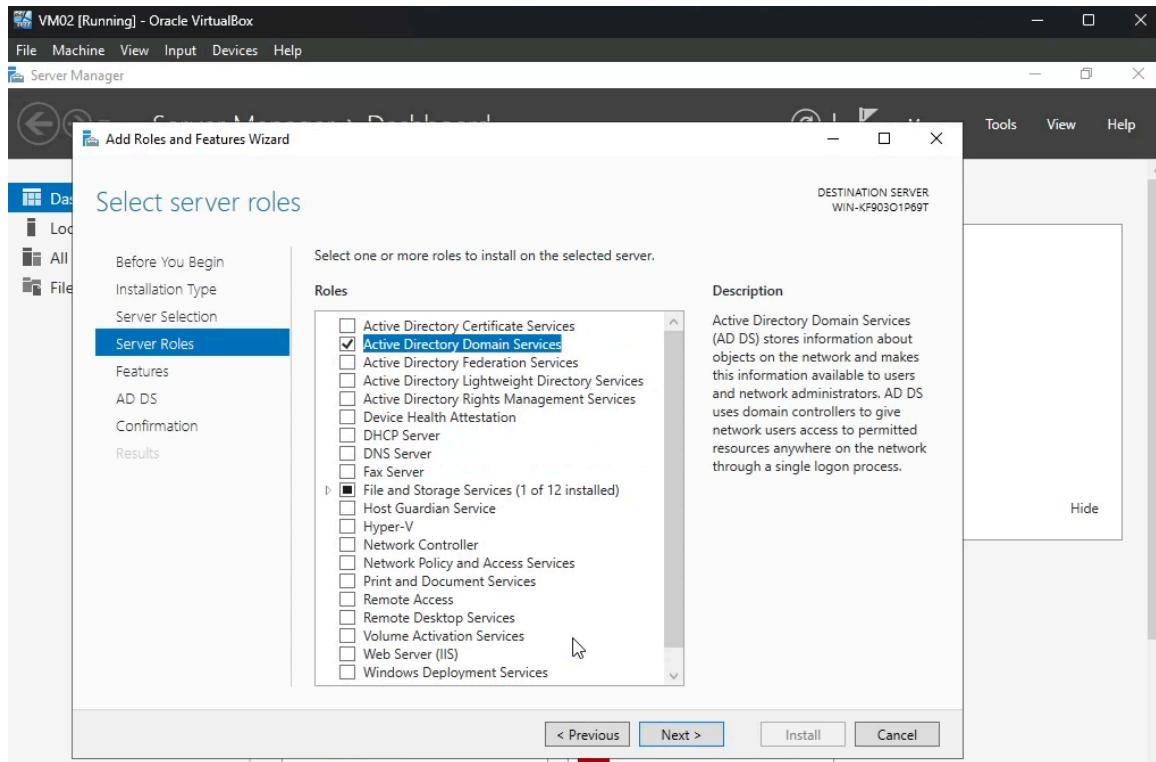
Step 3: For your installation type select the first radio button from the top and click next.



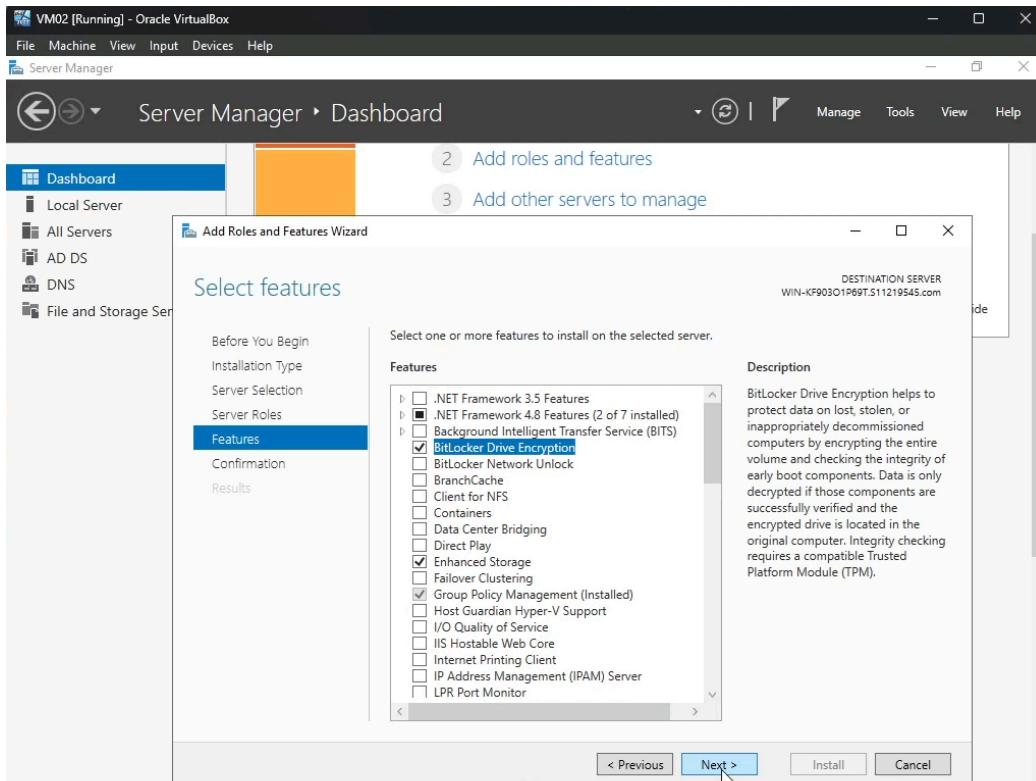
Step 4: Select your server destination drive where the installation will be downloaded to. Click Next.



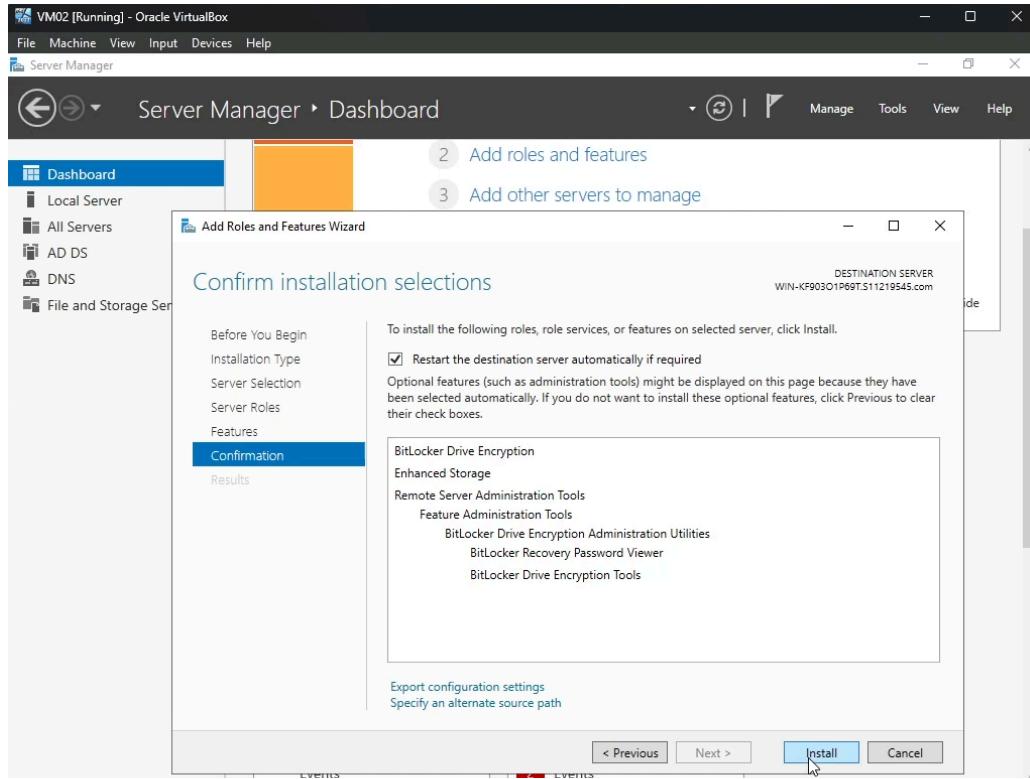
Step 5: For your server roles screen, you don't have to really select any options so just press Next.



Step 6: For your server feature screen, select the BitLocker Encryption checkbox and install the feature press Next.

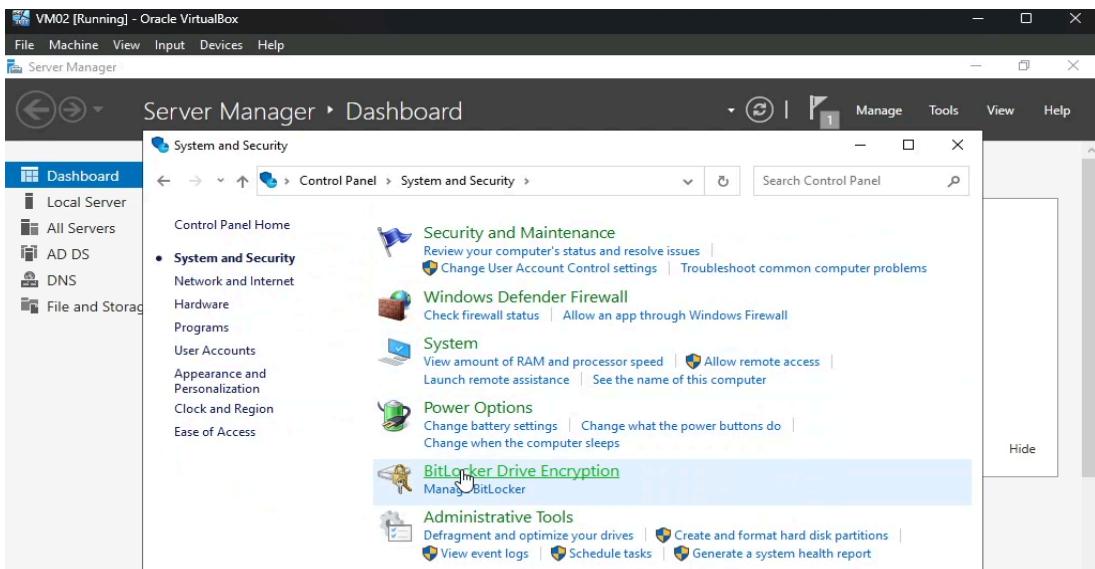


Step 7: The next screen just gives a brief rundown of what selections you have made and what features are about to be installed. Press Install to begin the installation process.

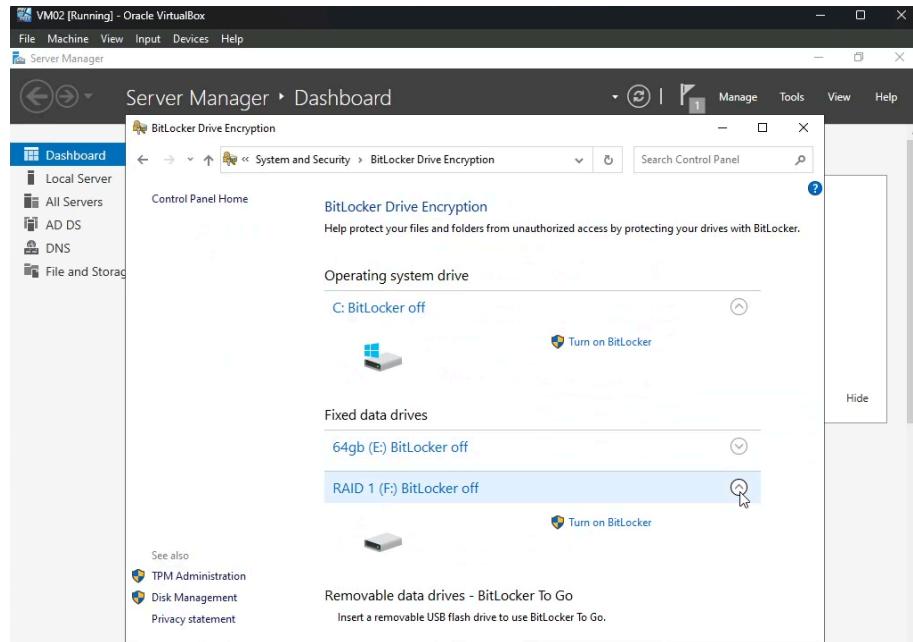


Once the installation is finished, you must restart the server for the features to be fully installed.

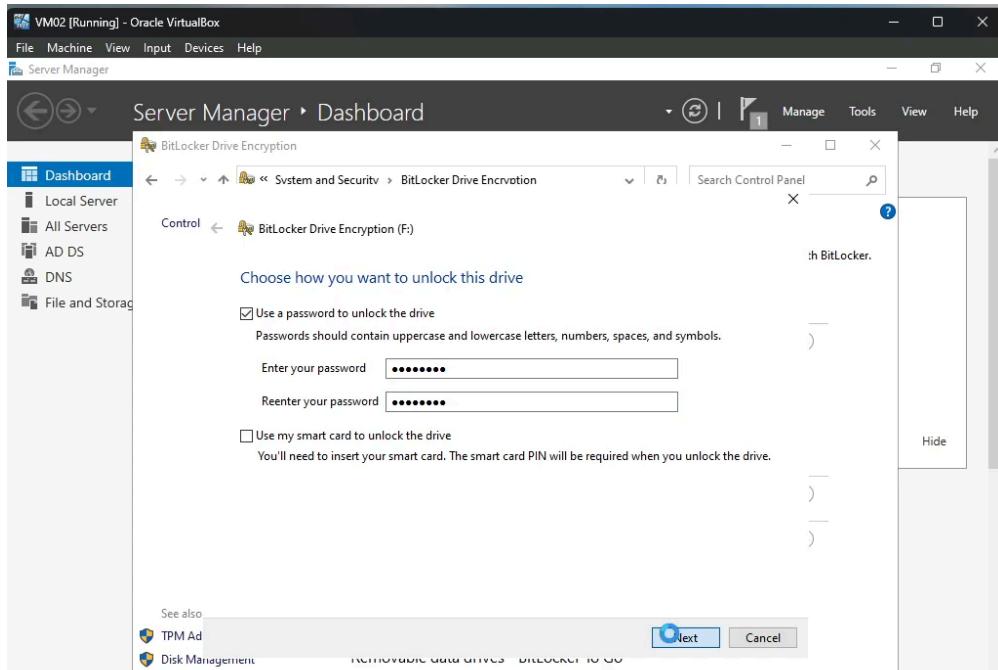
Step 8: Once you have restarted your server, open the control panel and navigate to the Bitlocker Encryption which can be found under the System and Security menu.



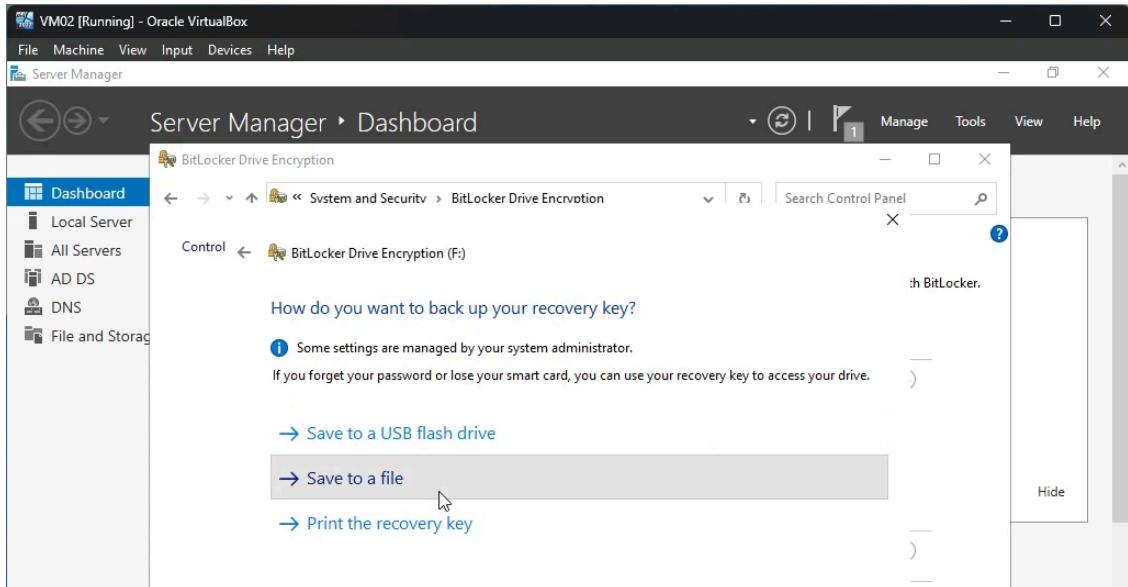
Step 9: Look for the drive you want to encrypt, in our case it's the RAID 1 drive we just created. Press on the option to turn on BitLocker.



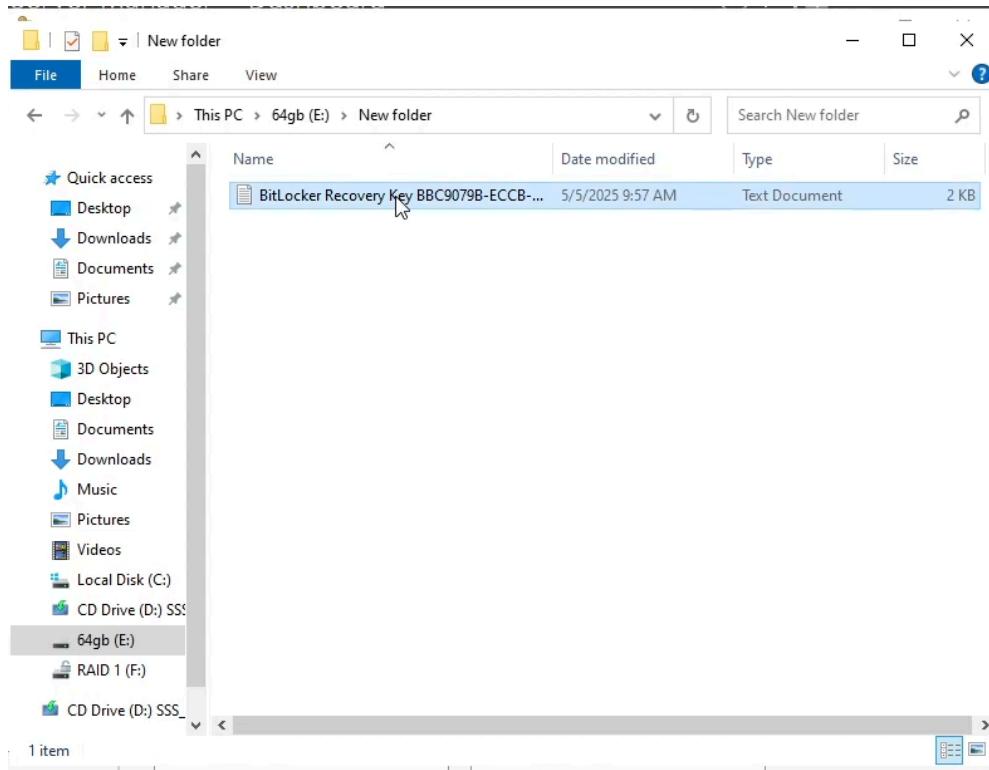
Step 10: Check the box to use password to unlock the drive and enter your password. Once done, click Next.



Step 11: Select the option to save Save to a file.

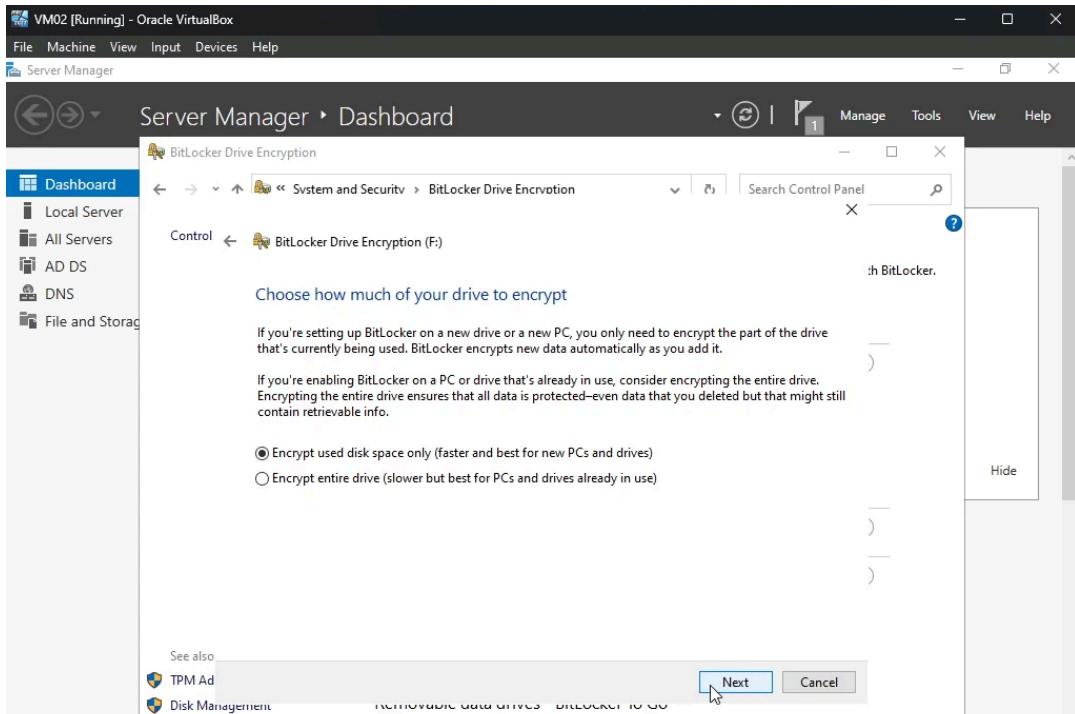


Decide a location to start the recovery key that is not on the drive that you are encrypting.

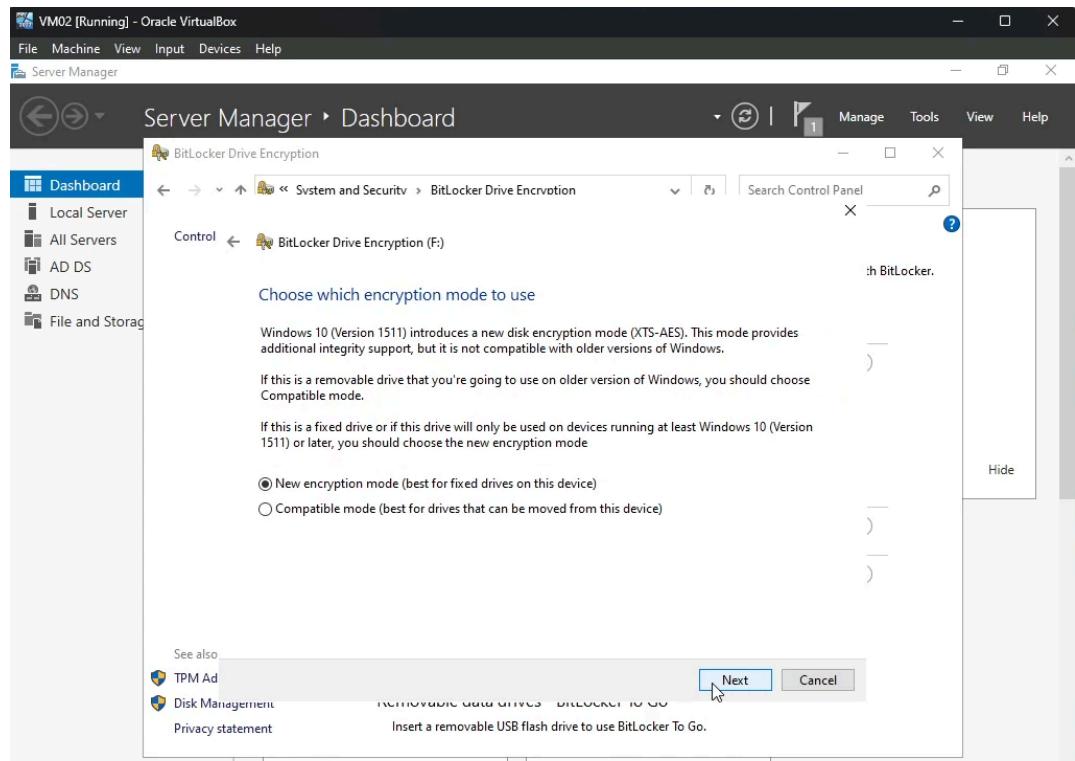


Once done click Next.

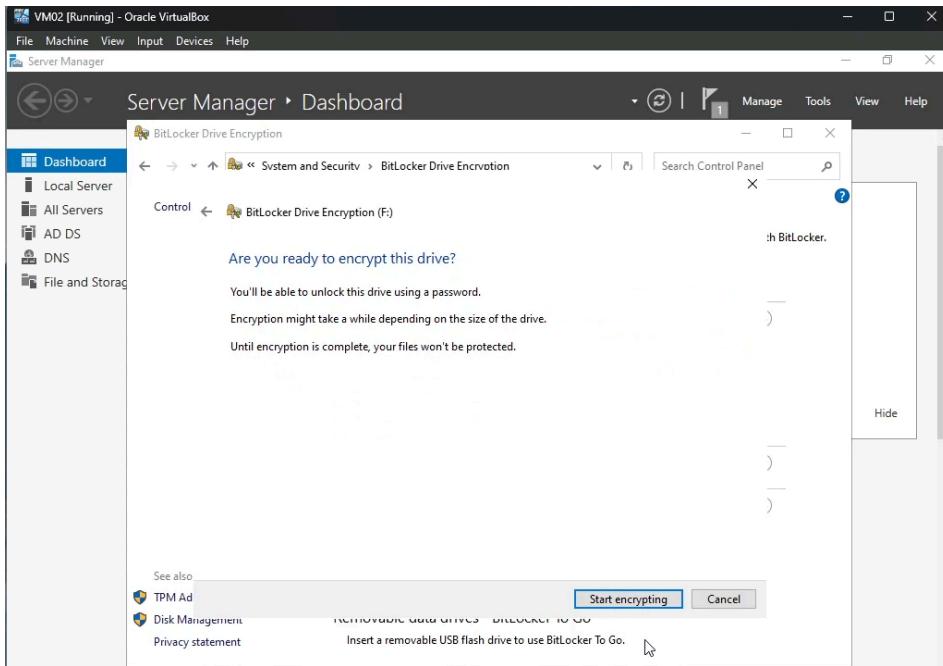
Step 12: Select the first radio button to select how much of the drive you want to encrypt. Click Next.



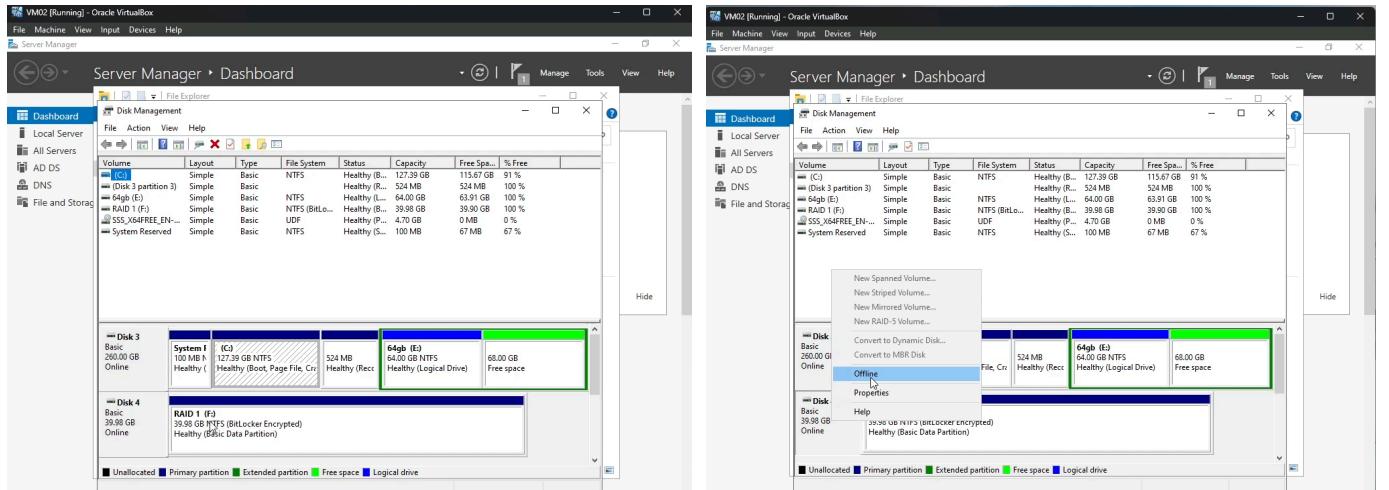
Step 13: For the encryption mode, choose the first radio button which is new encryption and press Next.



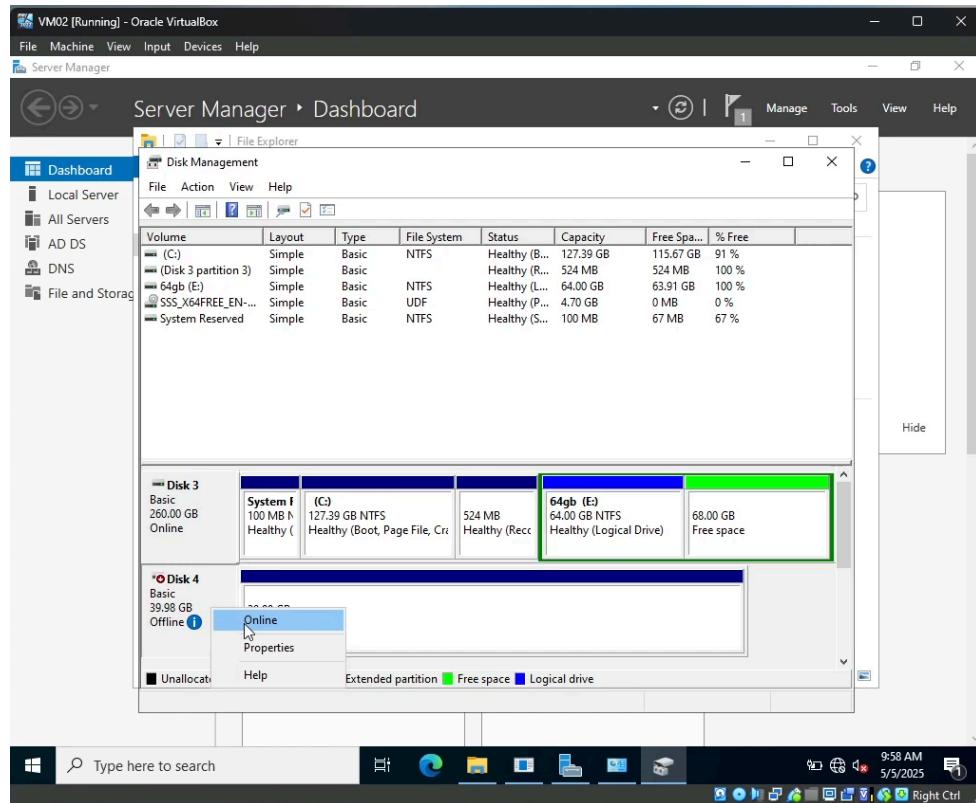
Step 14: When you are ready to start encrypting, press the Start Encrypting button.



Step 15: Now to test whether BitLocker works, open your Disk Management and locate the drive that you have encrypted. Right click on the Disk and select the option to make it offline.

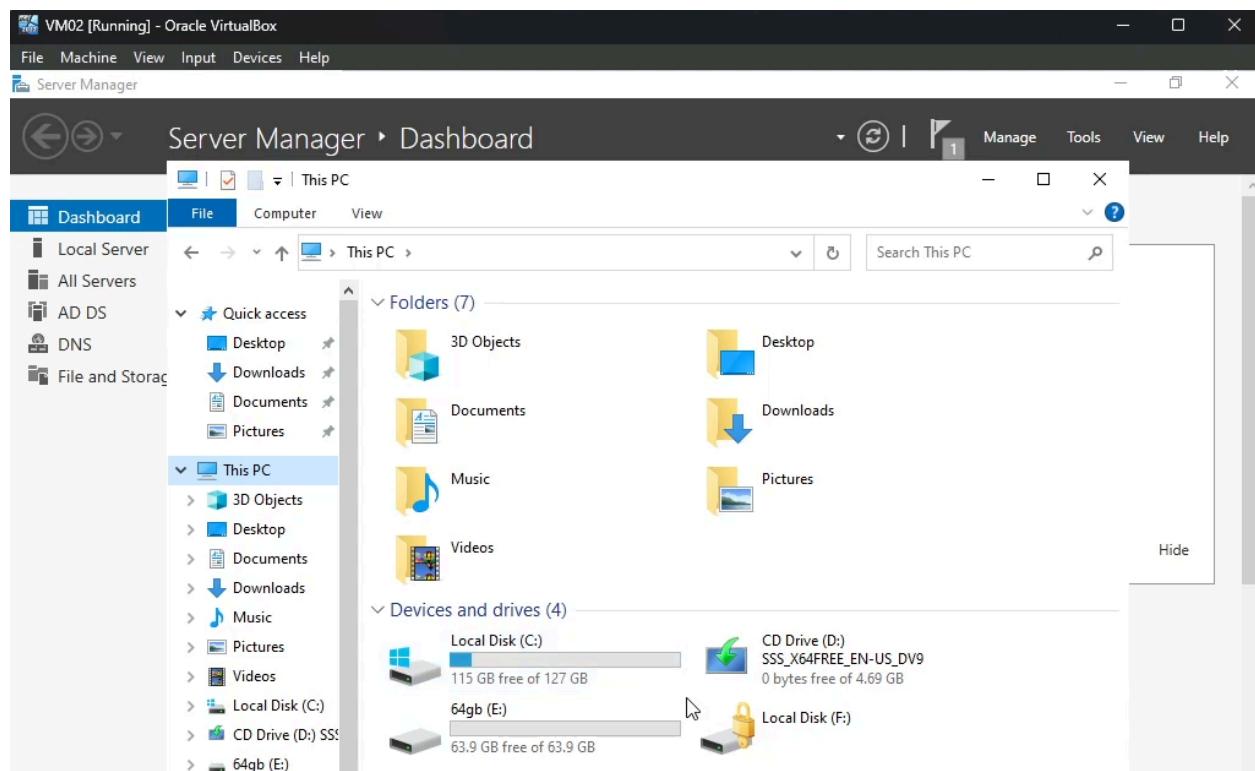


Step 16: After the drive has gone offline, the drive should look like this:

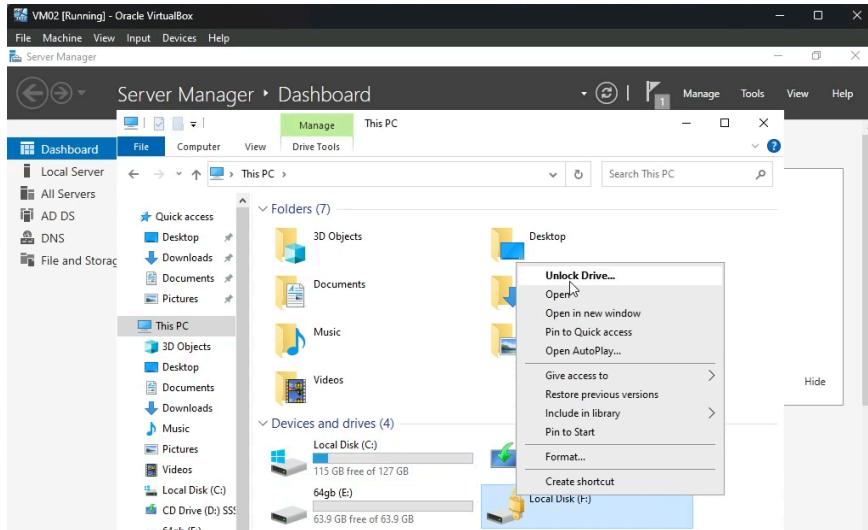


Right click on the drive and select the option to turn the drive online.

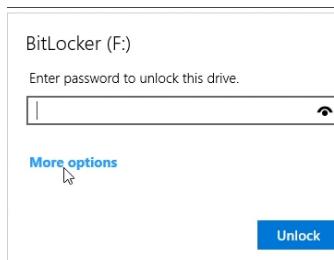
Once done the drive should be online and in the File Explorer program, the drive should now have a lock on it.



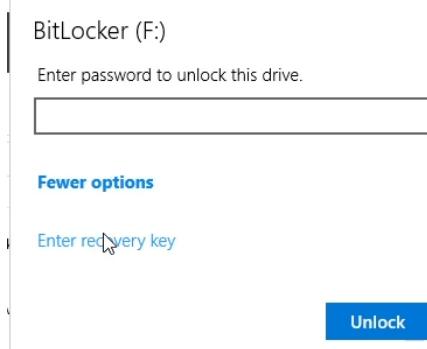
Step 17: On the locker drive, right click on it to show the options and select the option to unlock the drive.



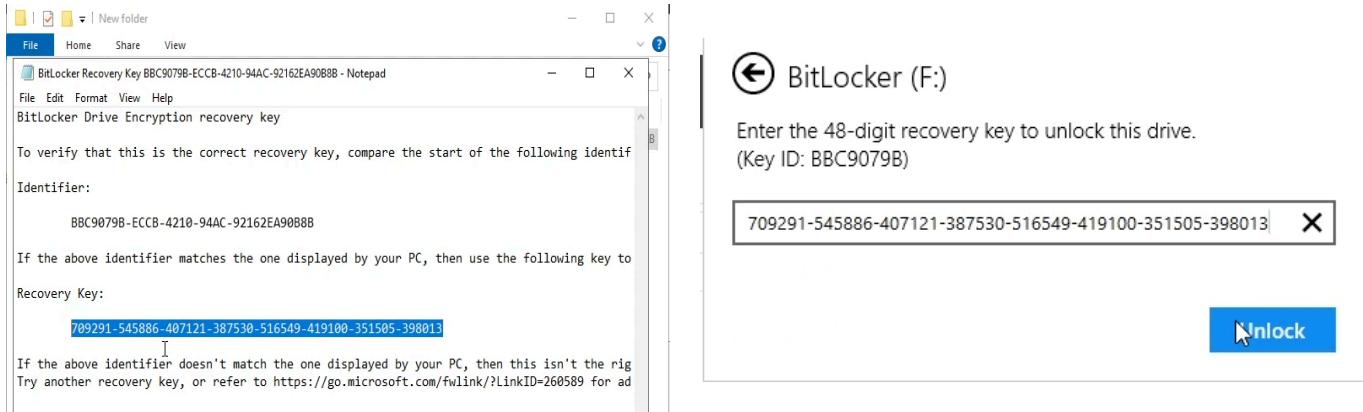
Step 18: You will be prompted to enter your password to unlock the drive.



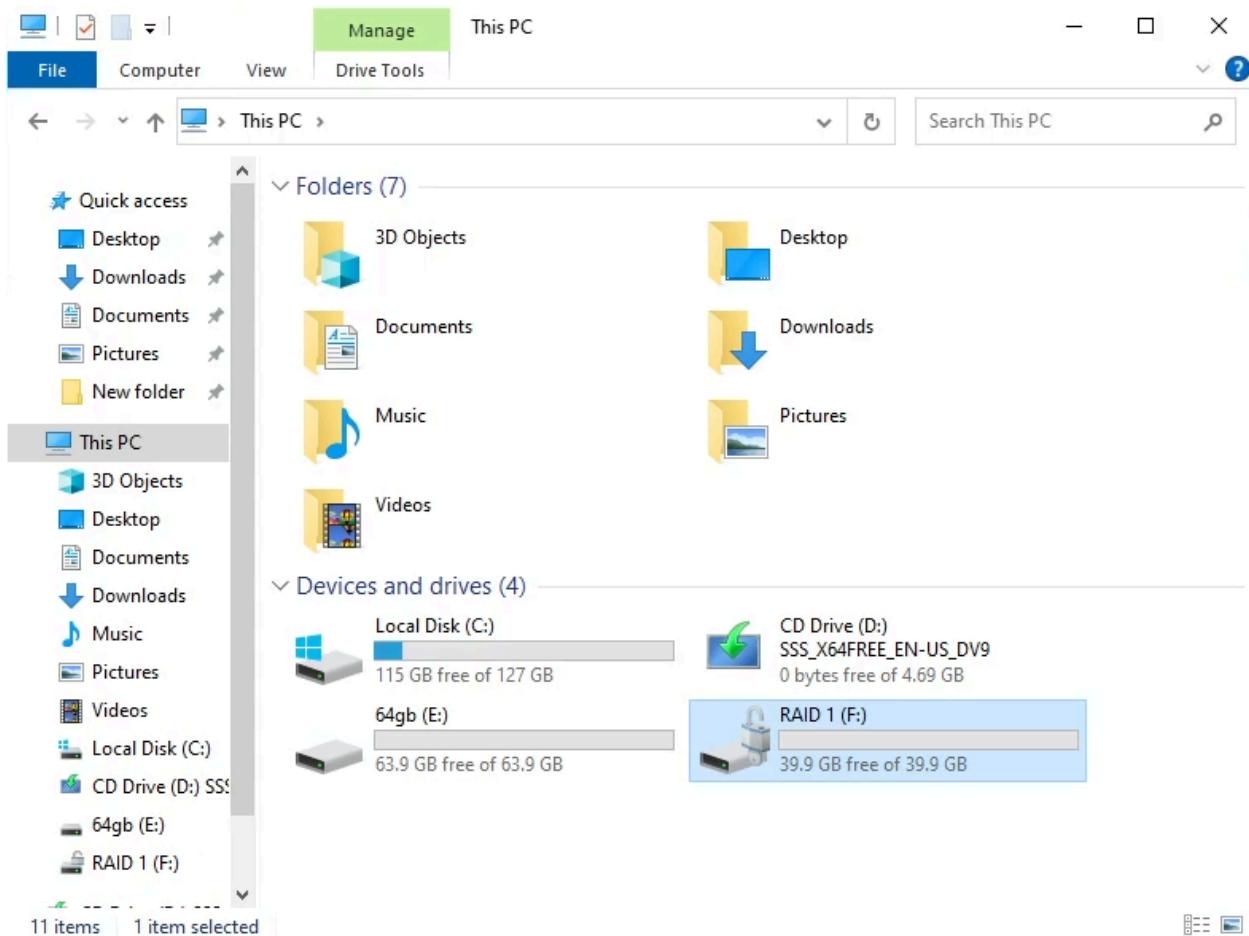
Press More options to reveal the recovery key option and press the enter recovery key option.



You will then be prompted to enter your recovery key. Open the file which contains the recovery key and copy and paste it into the textbox and press Unlock.



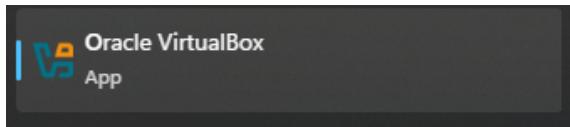
Your drive should not be unlocked and the drive will appear as shown in the screen below.



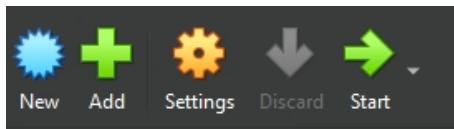
Part 3 - Setting Up Windows 10 Professional

Installing Windows Pro

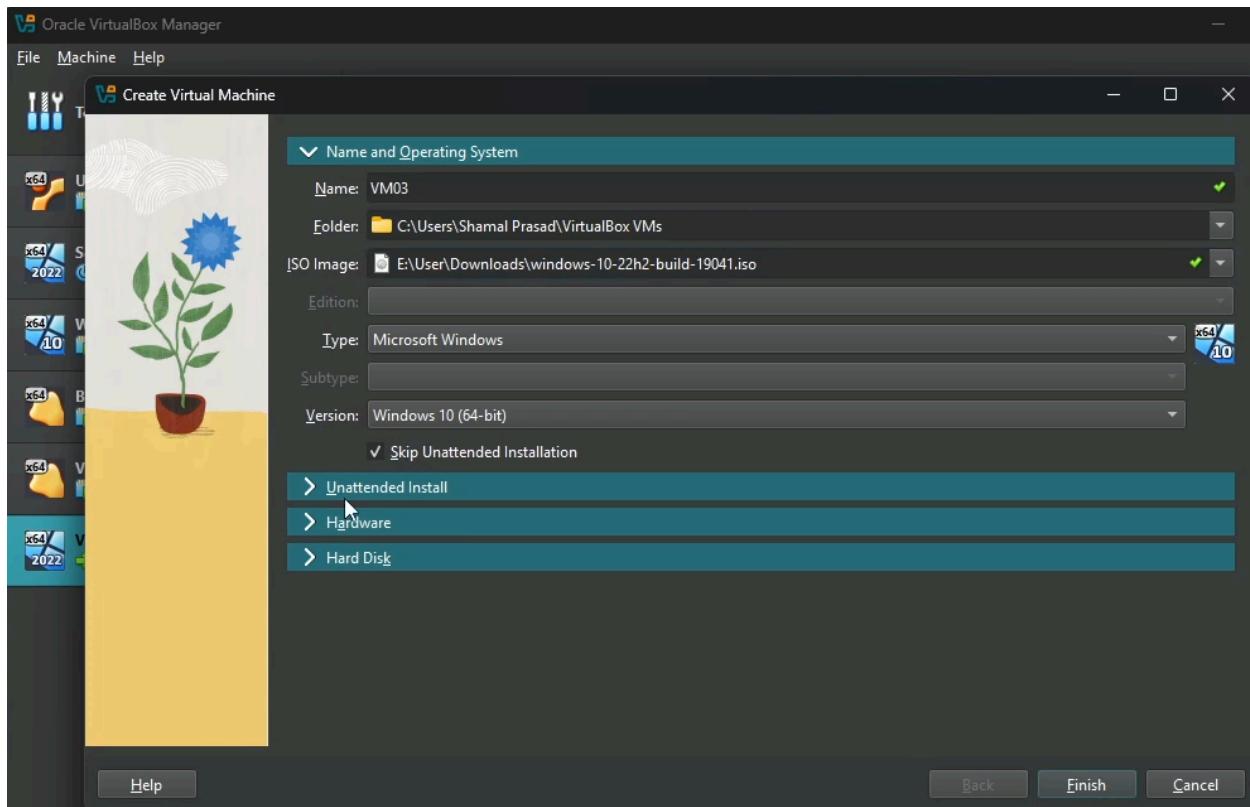
Step 1: Launch Oracle Virtualbox.



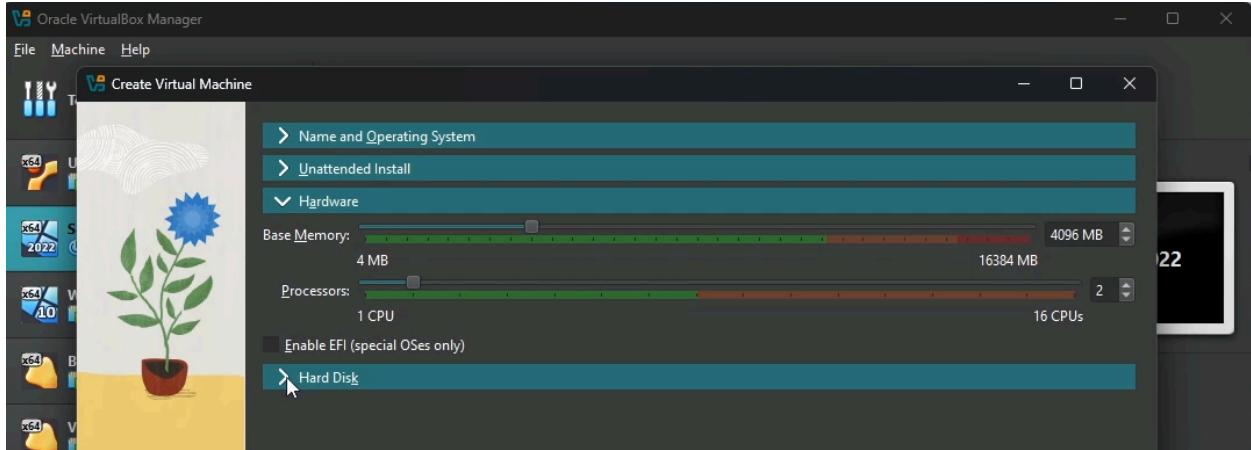
Step 2: In the VirtualBox Manager window, click the "New" button to start the process of creating a new virtual machine.



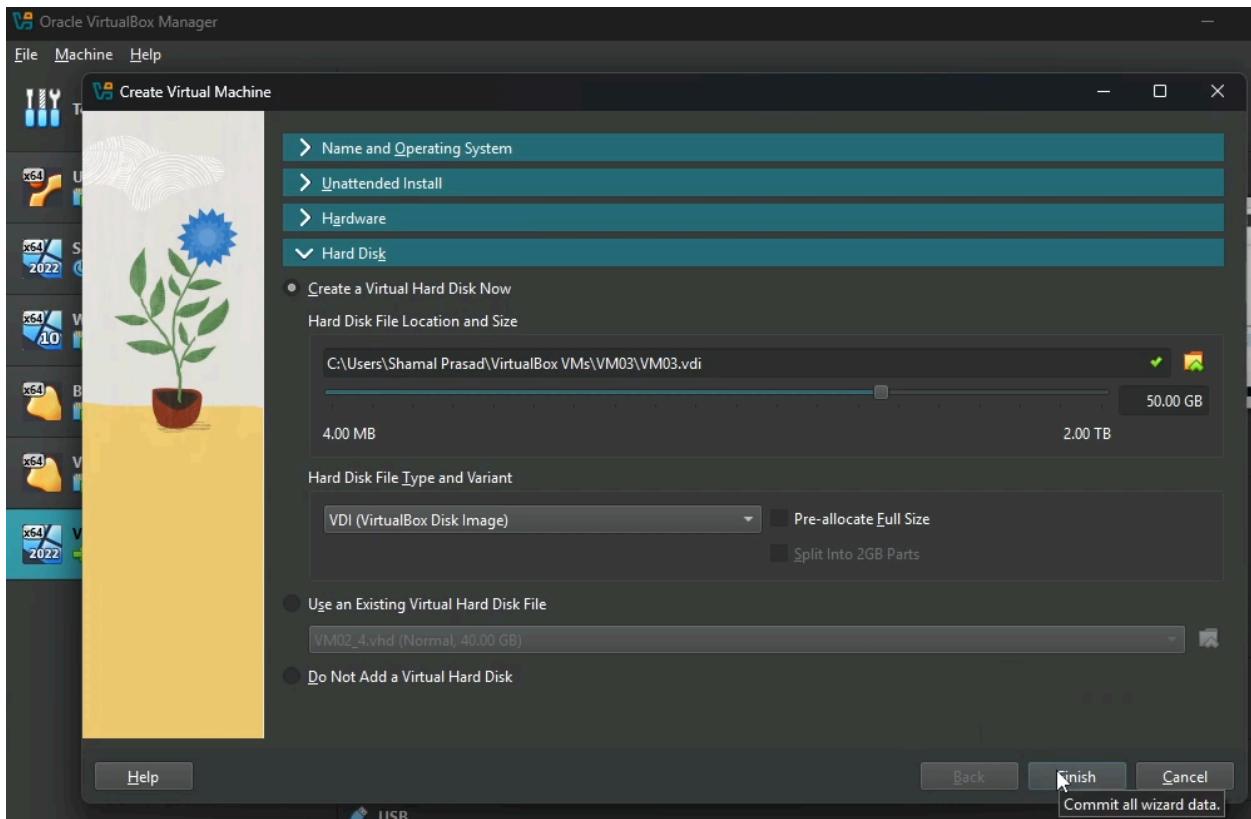
Step 3: In the Create Virtual Box Machine, enter the name of the guest OS, in our case its VM03. Click the drop down menu for the ISO image and select your desired ISO image that contains the OS that you want to install. Ensure that the Skip Unattended Installation is checked.



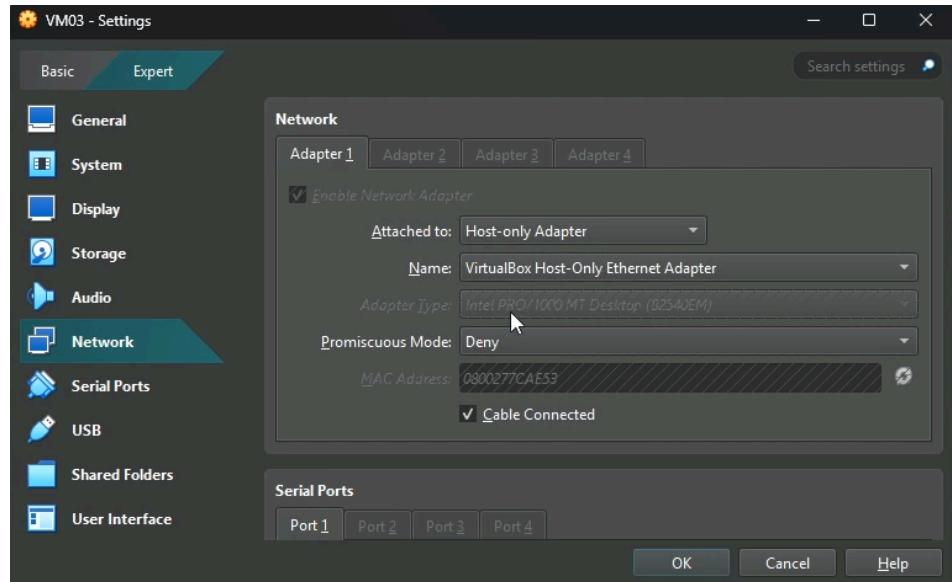
Step 4: Configure the hardware by choosing the right amount of memory and CPU cores to ensure the system runs smoothly. Minimum amount of required RAM should be 2GB. But you can allocate more than that as you see fit, we have allocated 4GB of RAM due to our personal computers Hardware being sufficient to do so. Just ensure to not over allocate as it will hinder the performance of your main computer. The core can be left at 1 as it is enough or 2 if your personal system can handle it.



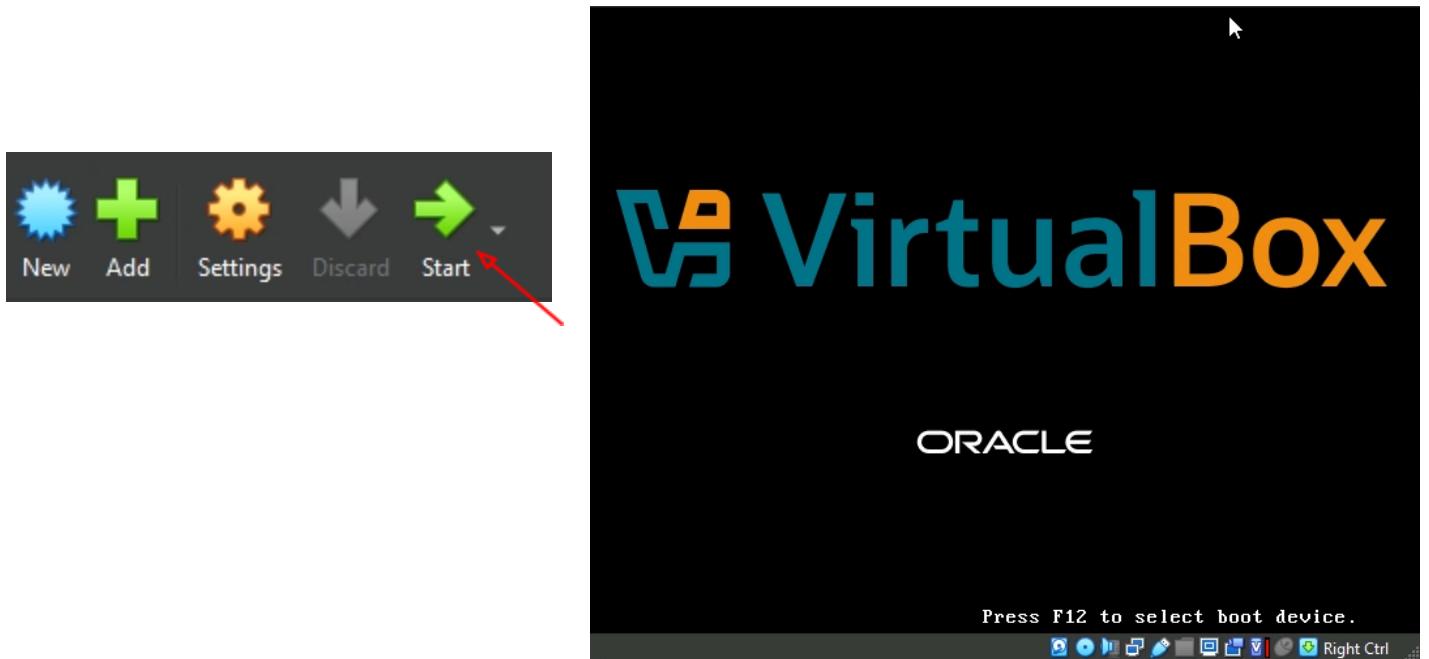
Step 5: Configure the size of the hard drive that the OS can use changing the slider or typing the value out. Around 50 Gb of space should be enough for the OS. Once allocated, click Finish.



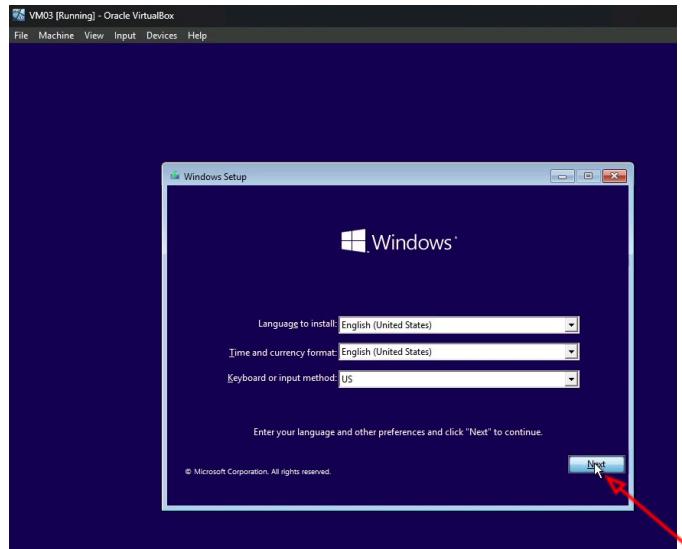
Step 6: Before running the Server OS, some settings need to be changed. Open the Settings in the VirtualBox Manager window and locate the network setting and ensure you are on Expert Mode. Once on the Network tab, change the network adapter to Host-only Adapter and click OK.



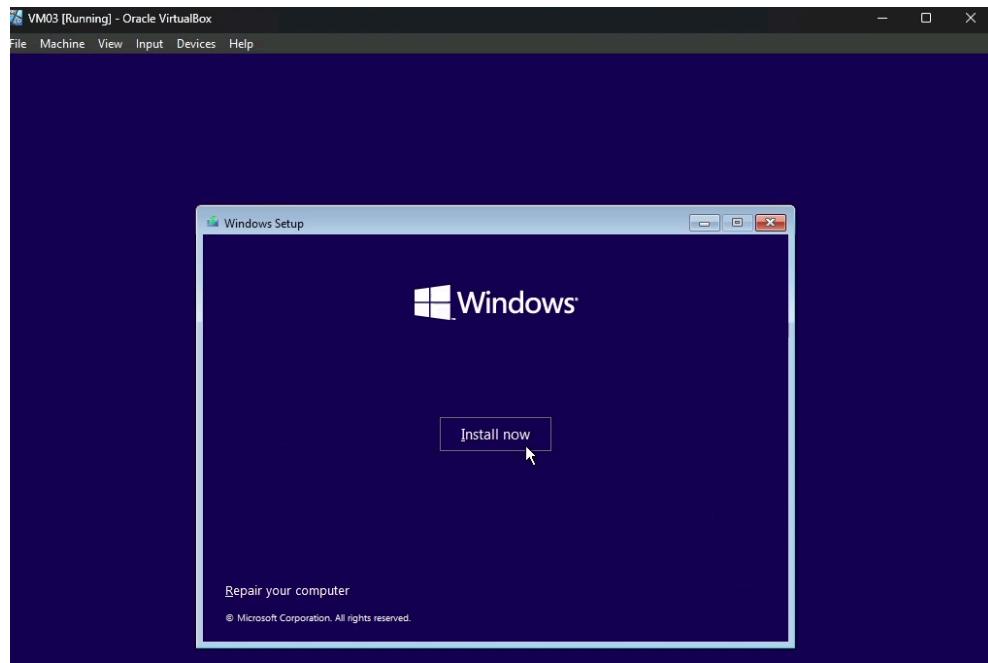
Step 7: Once you have configured the setting, you can now go ahead and start the OS by clicking the start Arrow in the VirtualBox Manager window at the top.

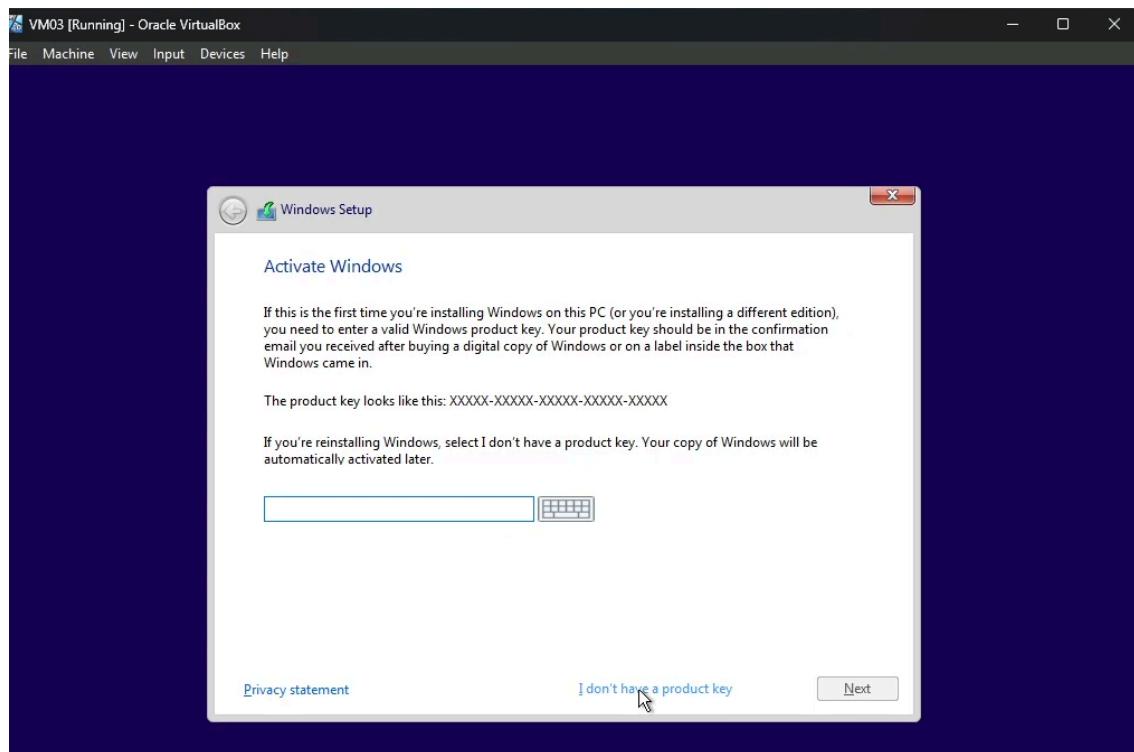
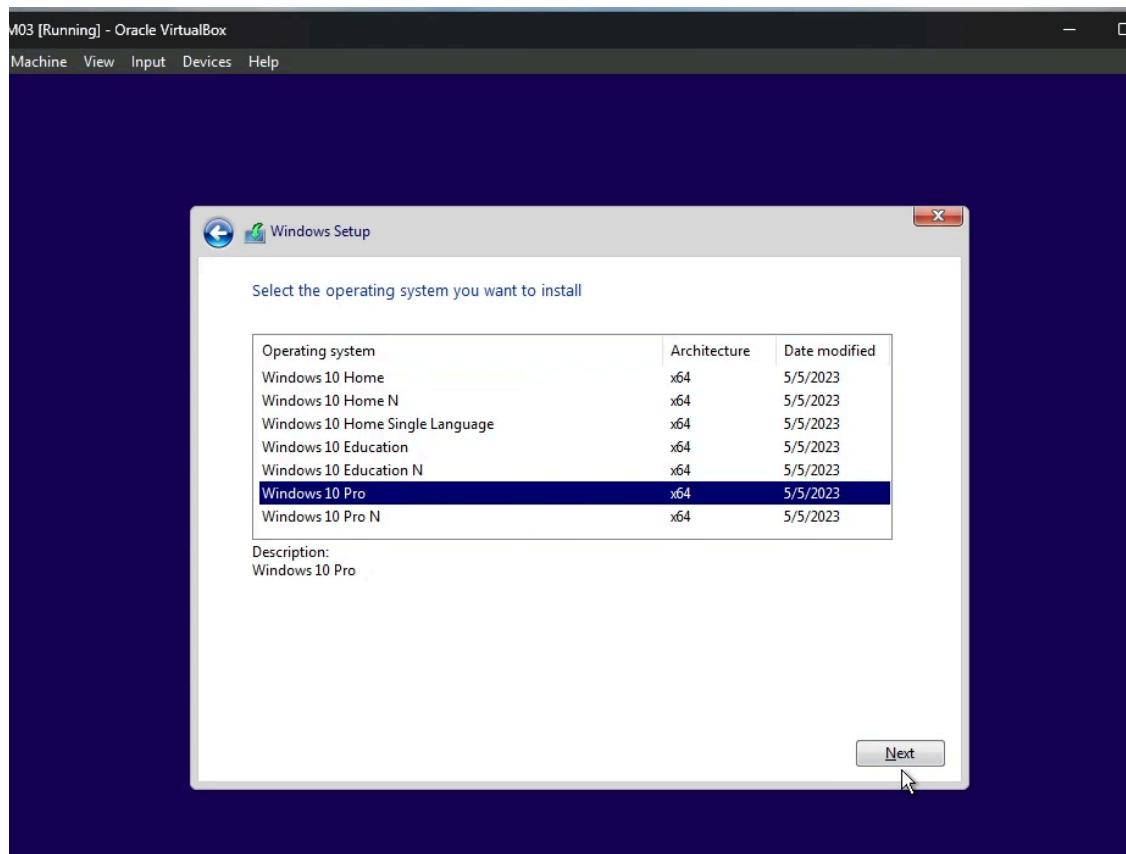


Step 8: Now the OS setup and installation process will begin. Follow the setup instructions and fill in information as required. Click Next.

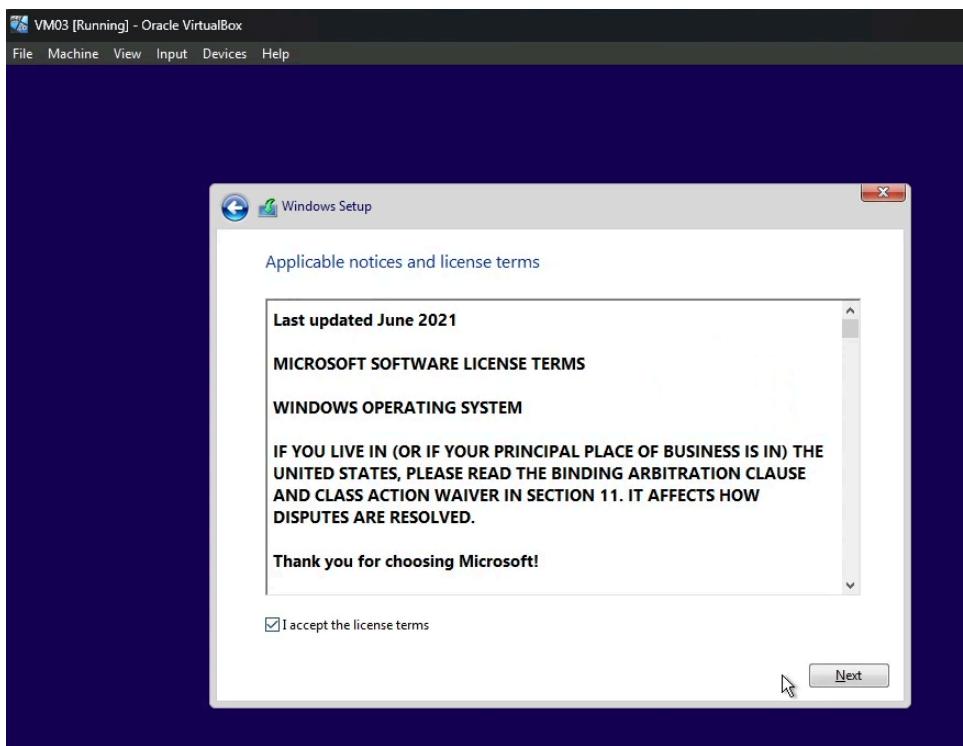


Step 9: Press Install Now.

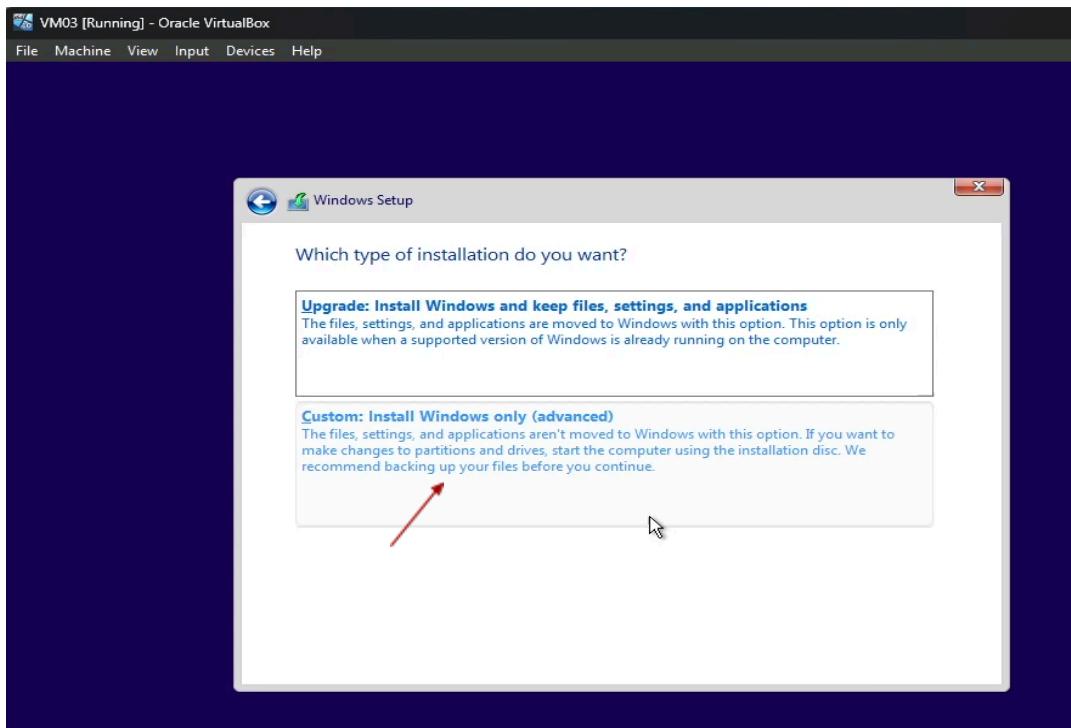


Step 10: Select the option “I Don’t have a Product Key.**Step 11:** Select Windows 10 Pro Edition and press Next.

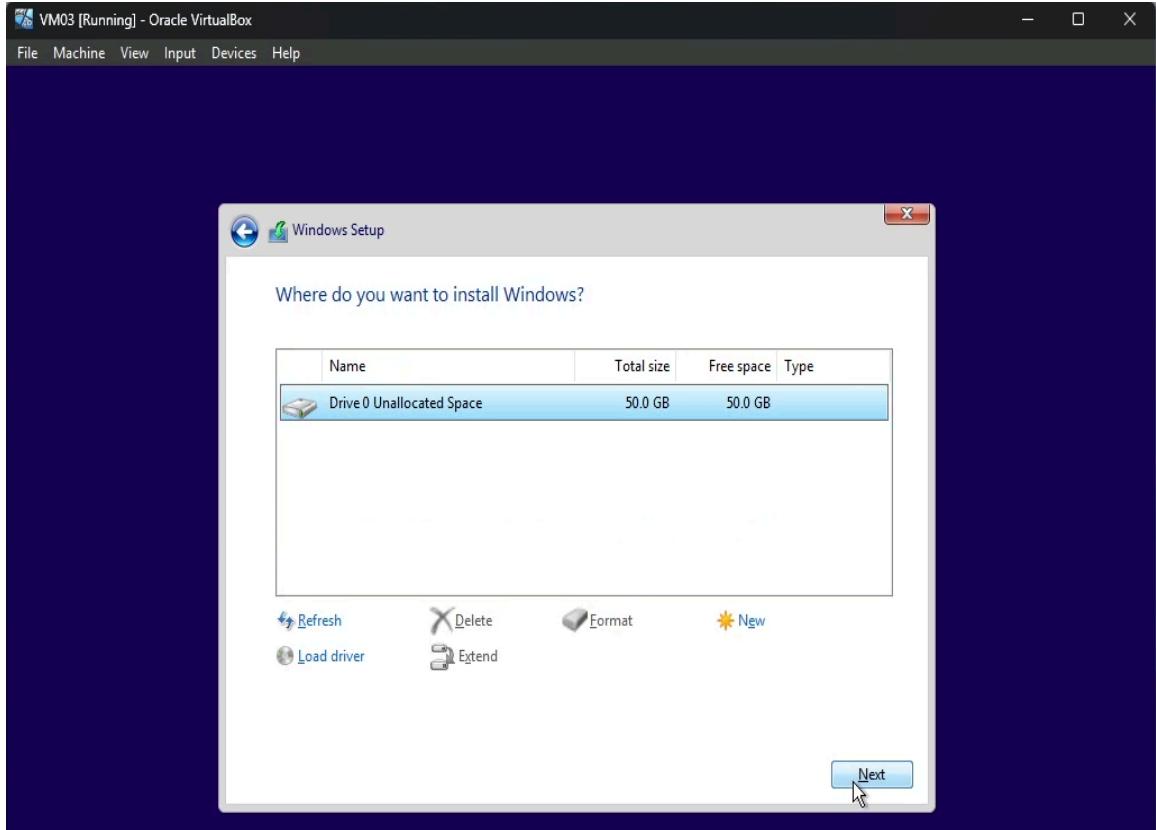
Step 12: Check the License Agreement Box and Click Next.



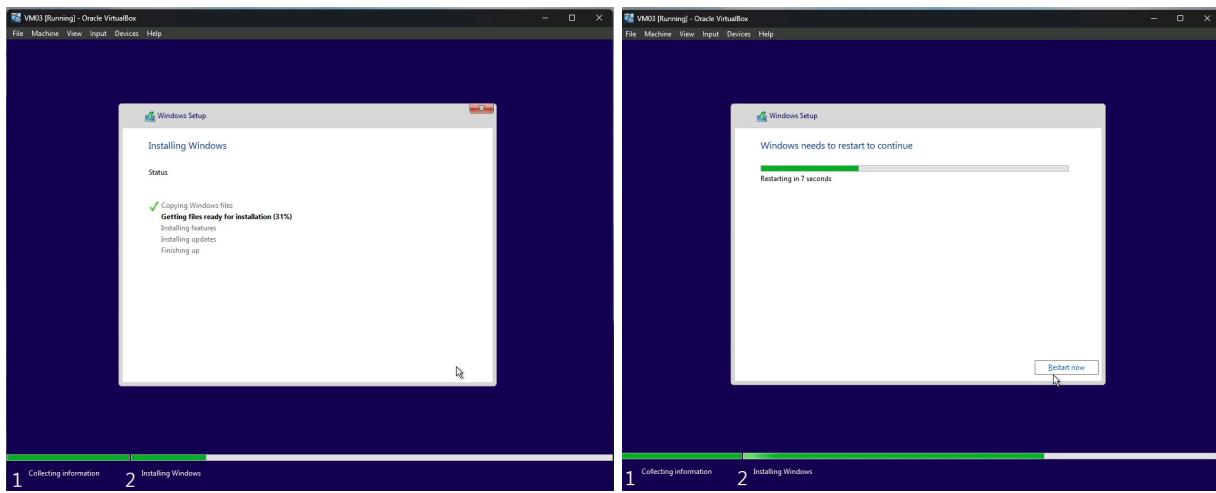
Step 13: Choose the custom installation type as it will install the OS from the very beginning, the other option is repair the OS if it has encountered an error. You can select the following option by double clicking on the option using your mouse.



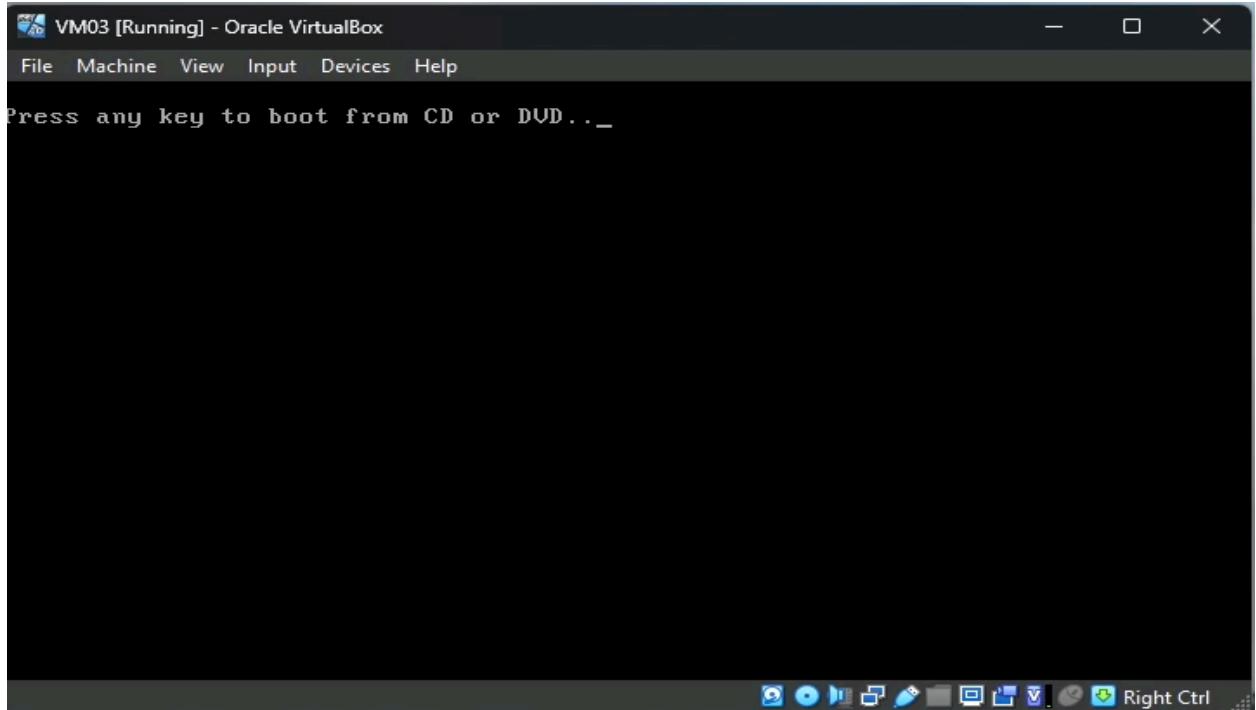
Step 14: Select your main drive partition, which should only be one, and click Next.



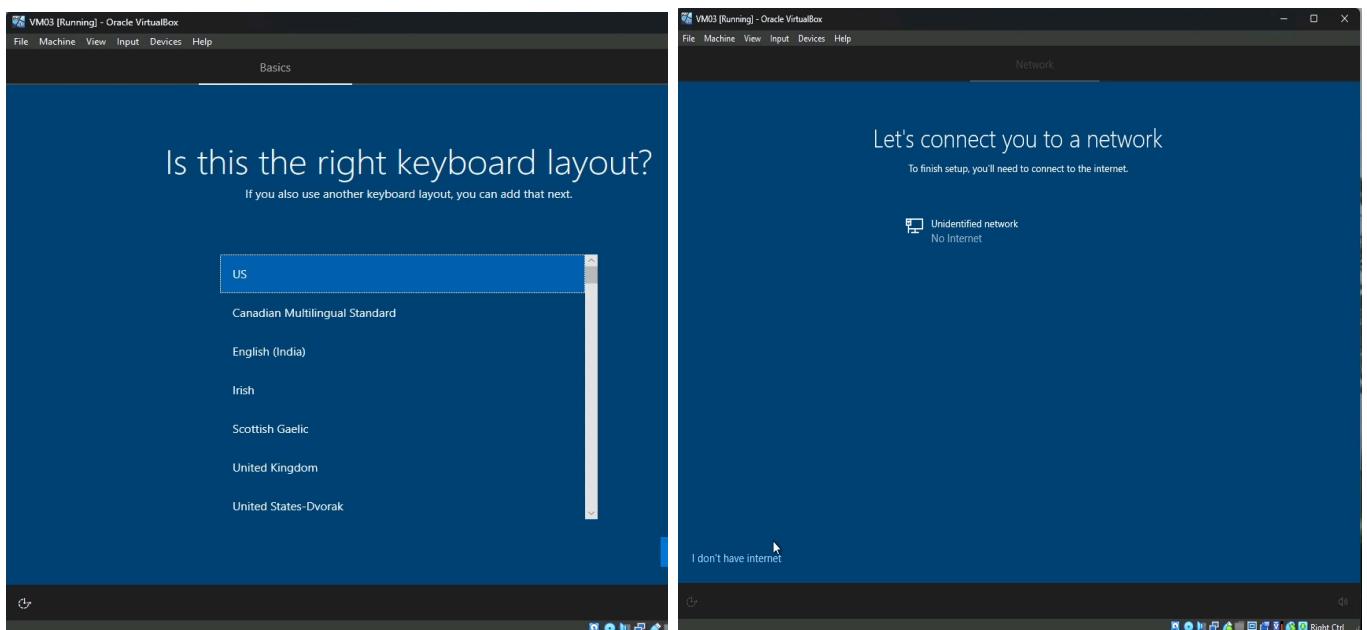
Step 15: Wait for the installation to complete and at the end of the installation, the OS will reboot itself.

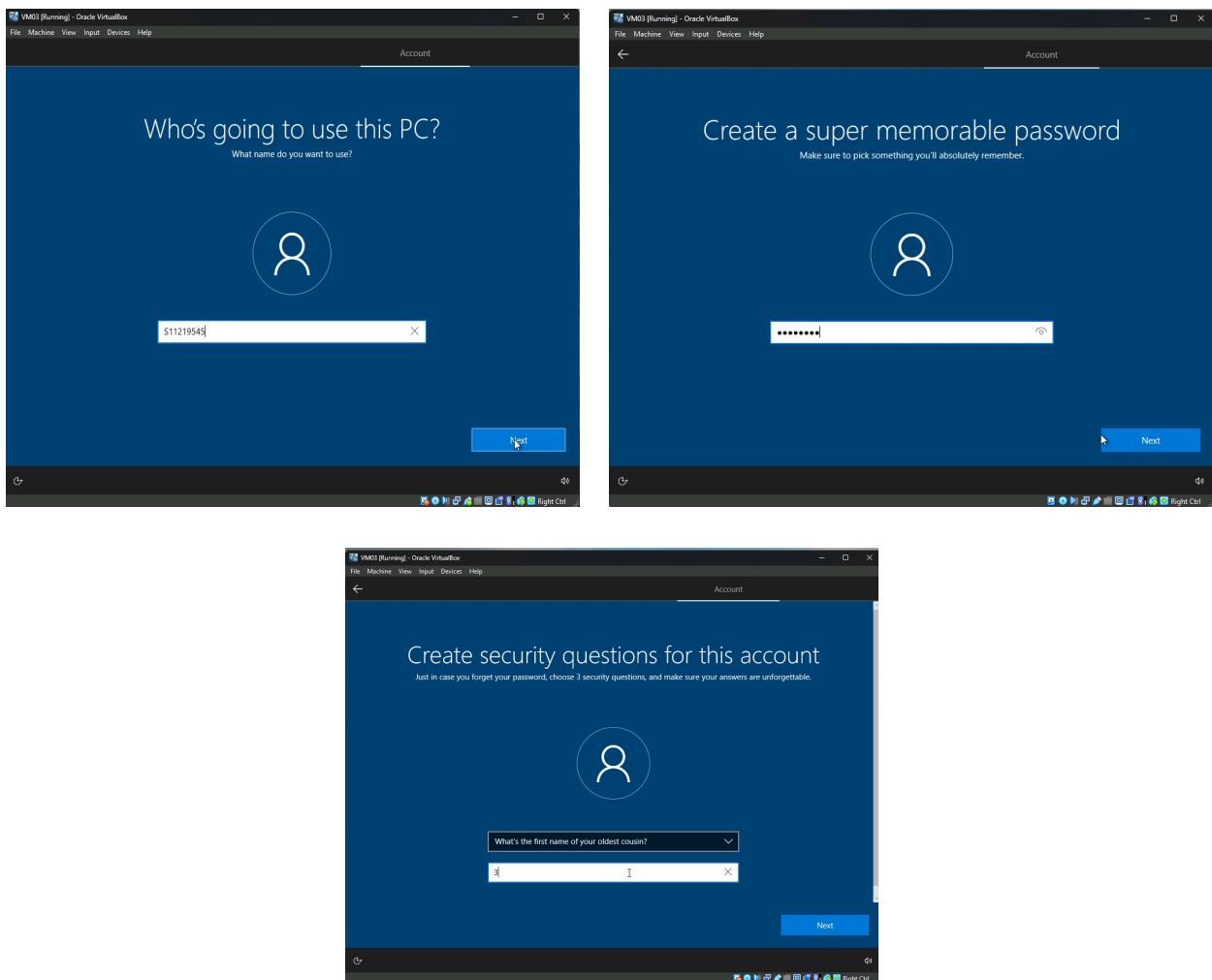


Step 16: During the Screen shown below, **DO NOT** press anything and wait, the OS startup will begin automatically.

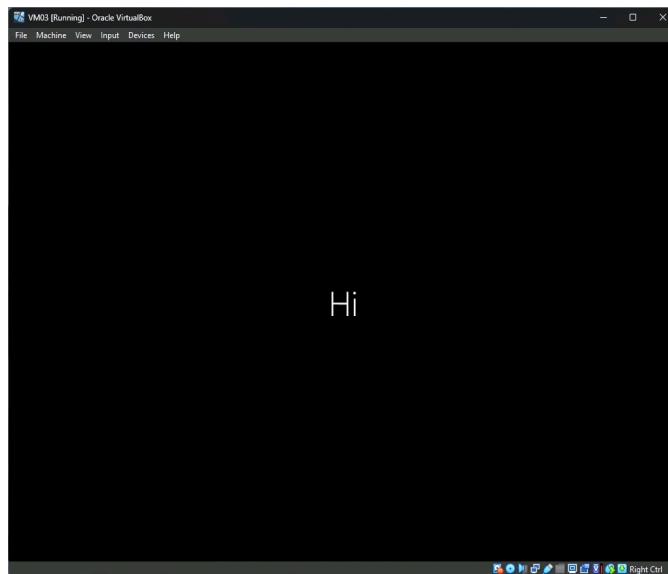


Step 17: After the setup process you will be directed to the screen shown below where you will need to select your region, keyboard layout, network connection, name of the user, user password and 3 security questions.

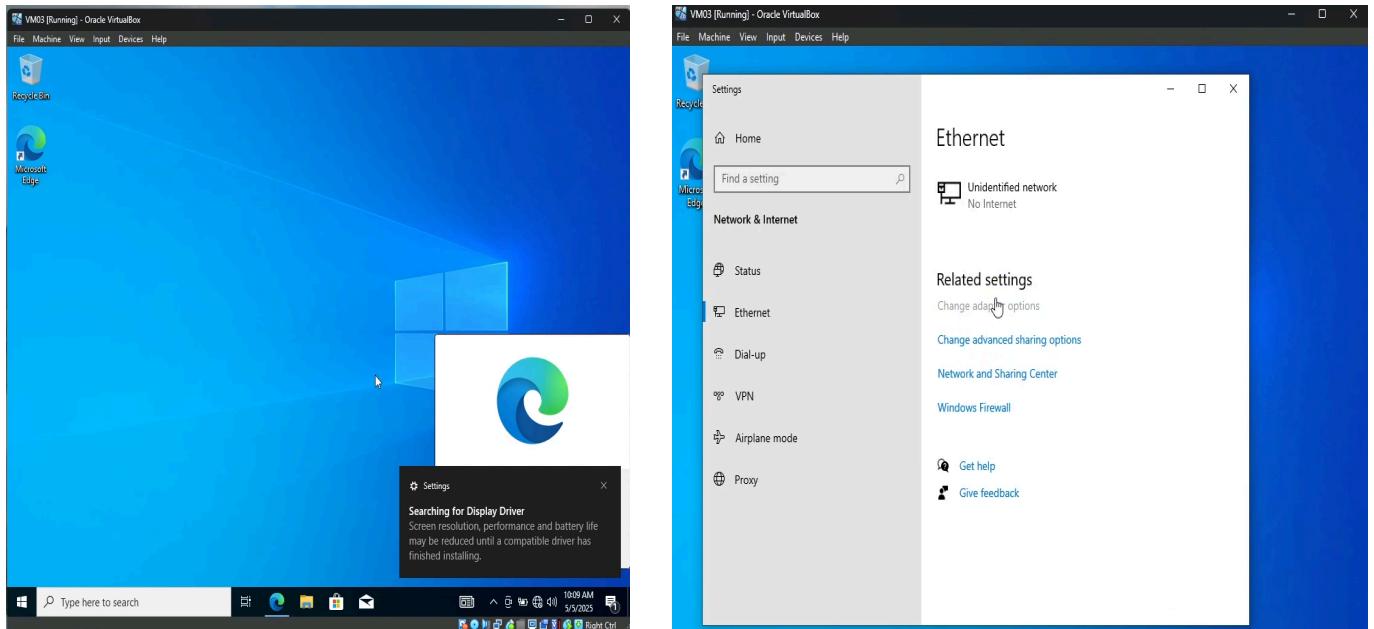




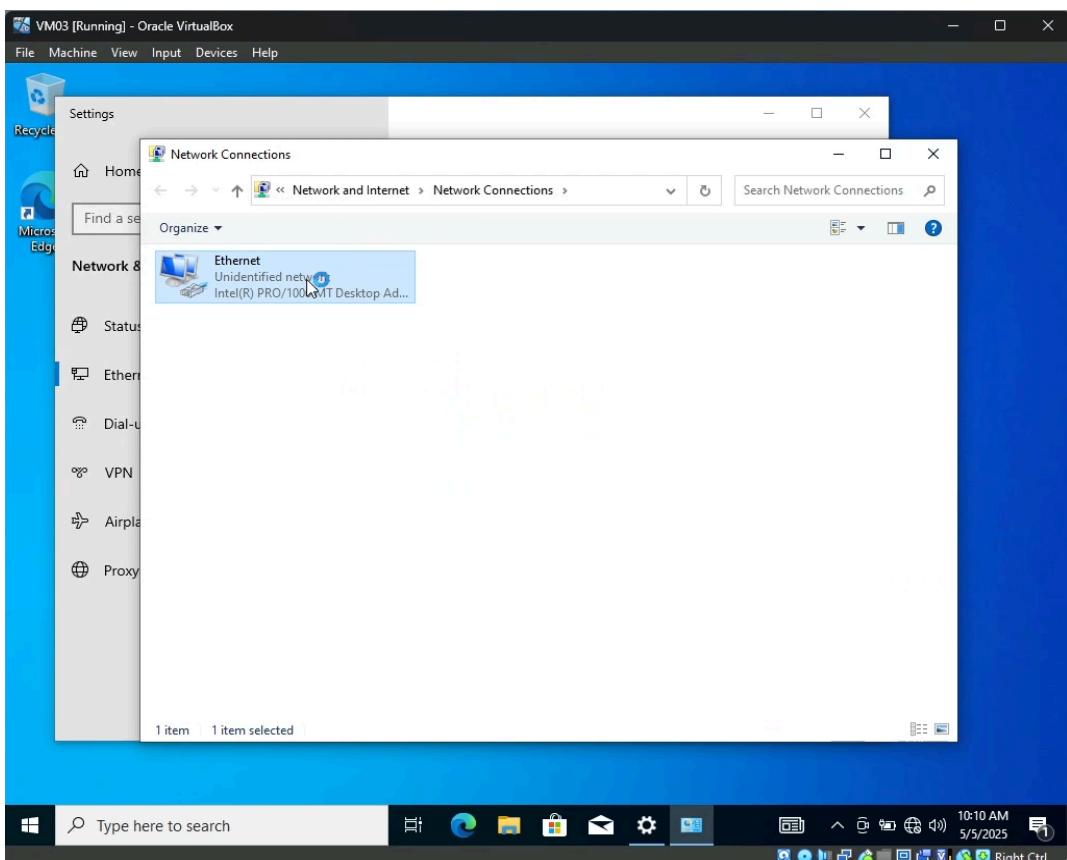
After doing the following steps, you will see a screen as shown below where the OS will finish setting up.



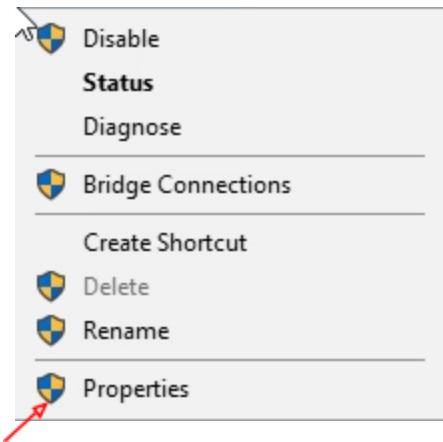
Step 18: Open your settings, of the windows OS and navigate or search in the search bar “Ethernet settings”. You should reach a screen as shown below.



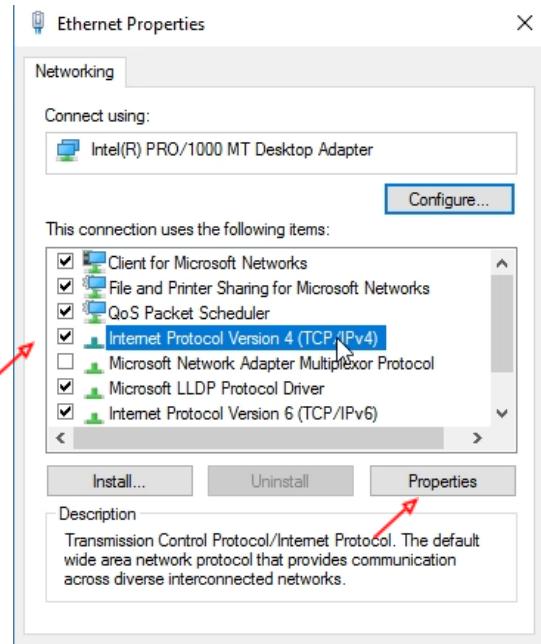
Step 19: Select the change adapter option by clicking on and you will be presented with a screen shown below.



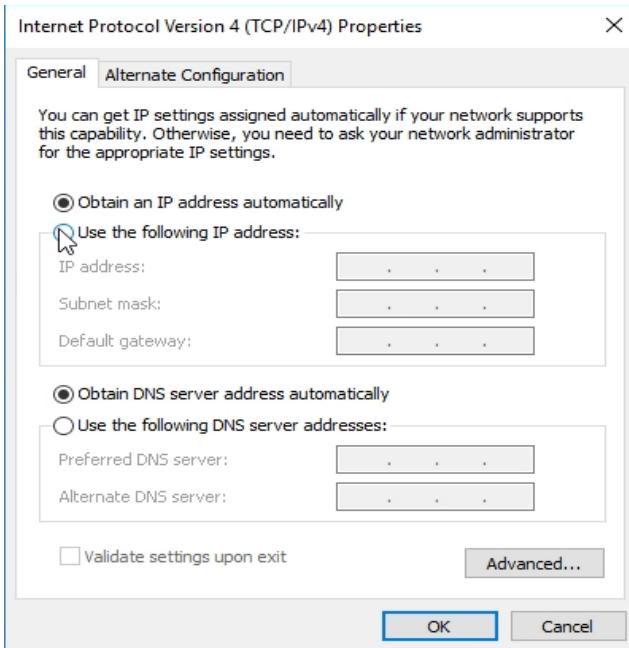
Step 20: Position your mouse over the Ethernet icon and press right click on your mouse. You should see a menu similar to the one below.



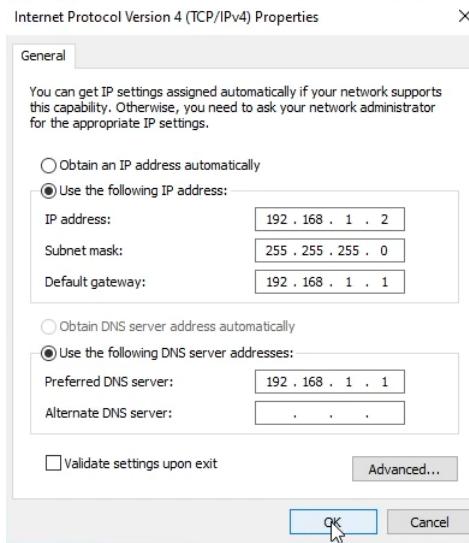
Click on Properties to view and change certain properties of the Ethernet network adapter. You should now see the window box as shown below.



Click on “internet Protocol Version 4”(IPv4) and then click on the properties button.



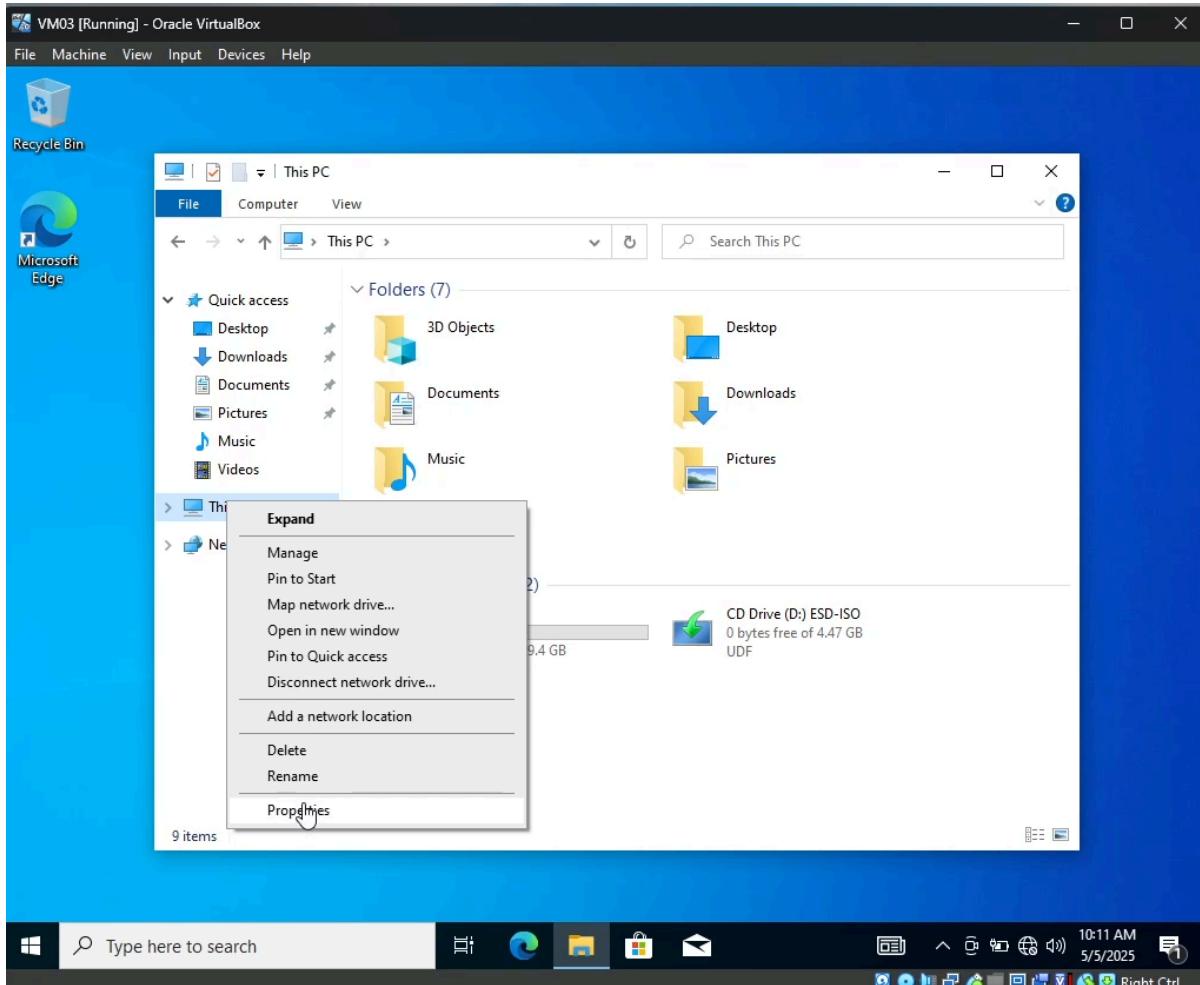
Step 21: On the last screen shown above, type in your IP address and subnet mask.



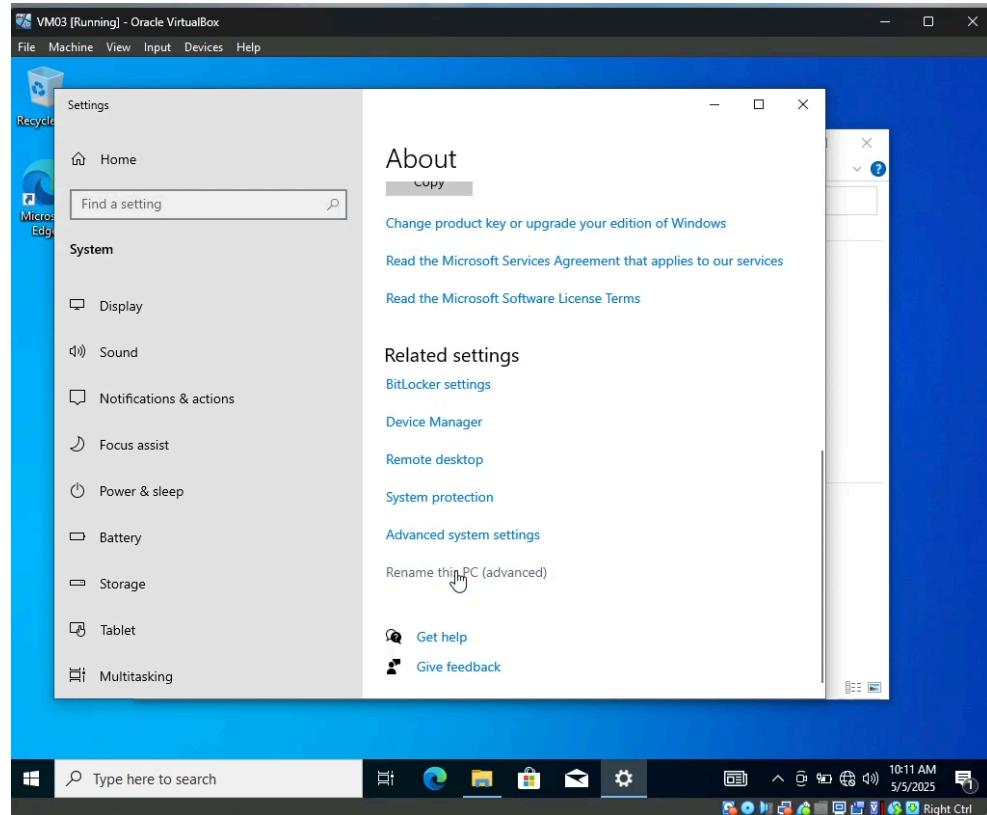
Once you have entered it, you can press OK to save the entered information.

User Login Setup

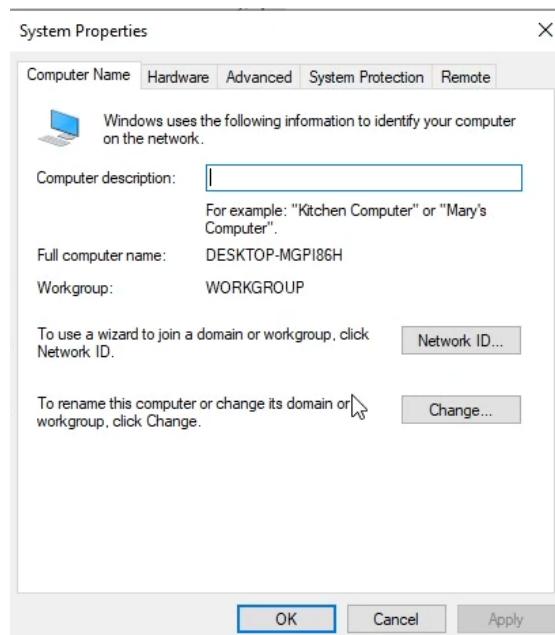
Step 1: Open File Explorer program, right click on This PC and select the Properties option.



Step 2: In the About section, scroll to the end of the menu and select an option called Rename This PC(Advanced).



It should open the System Properties Window as shown below.

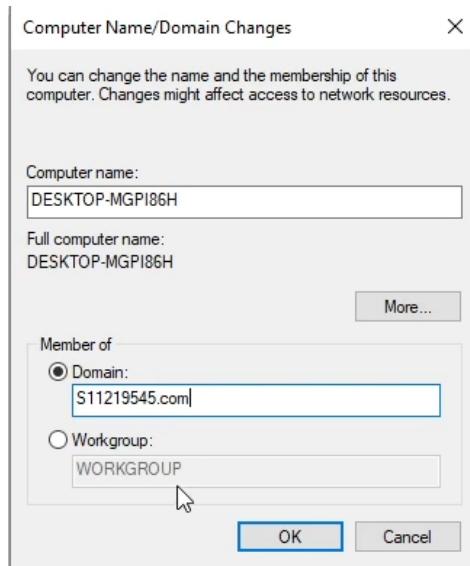


Step 3: Press the change button to rename the PC or to change its domain.

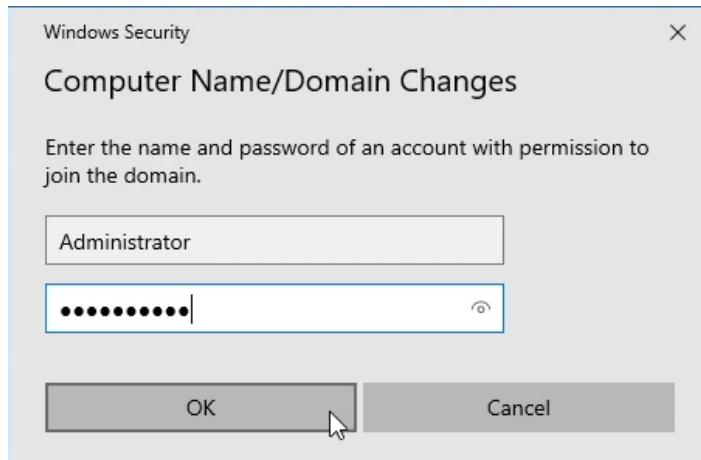
To rename this computer or change its domain or workgroup, click Change.

Change...

Step 4: In the “Member of” section, choose the **Domain** radio button and type in your domain name of your server and press OK.



Step 5: Enter your username and password for your server OS and press OK.

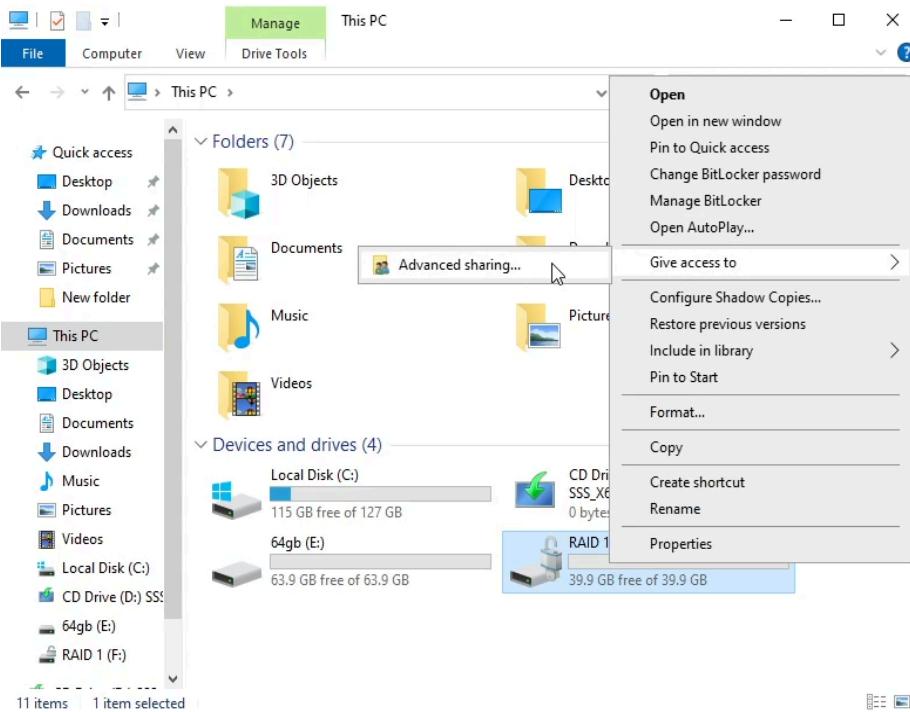


You will need to restart your PC for the effects to take change.

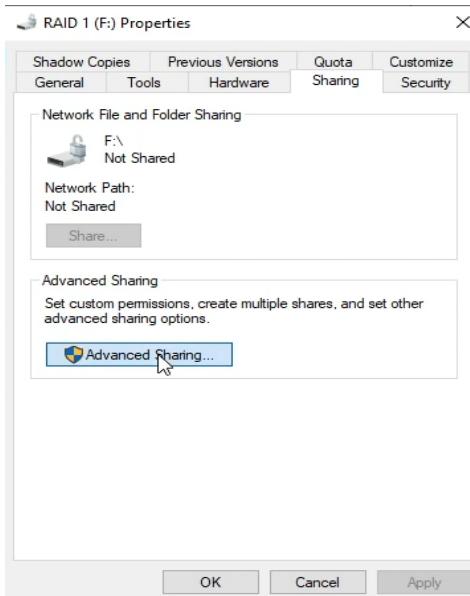
Testing RAID Setup

On Server Side

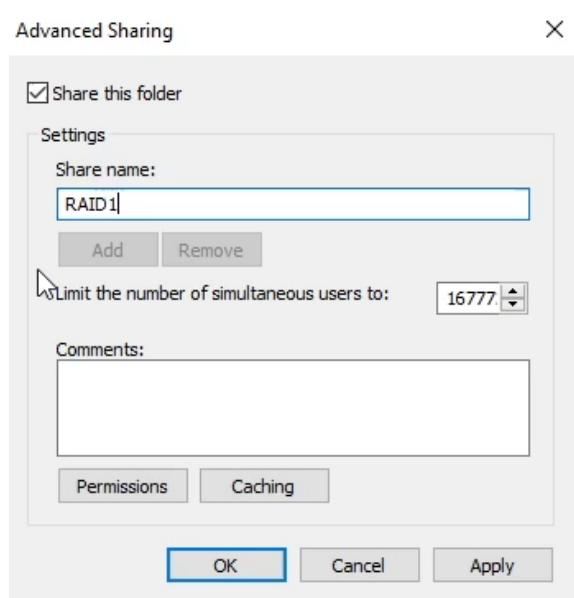
Step 1: Open your File Explorer on the server and locate the RAID drive, right click on it and select the and put your mouse on the “Give access to” option, which will reveal the Advance Sharing option. Press on Advance Sharing .



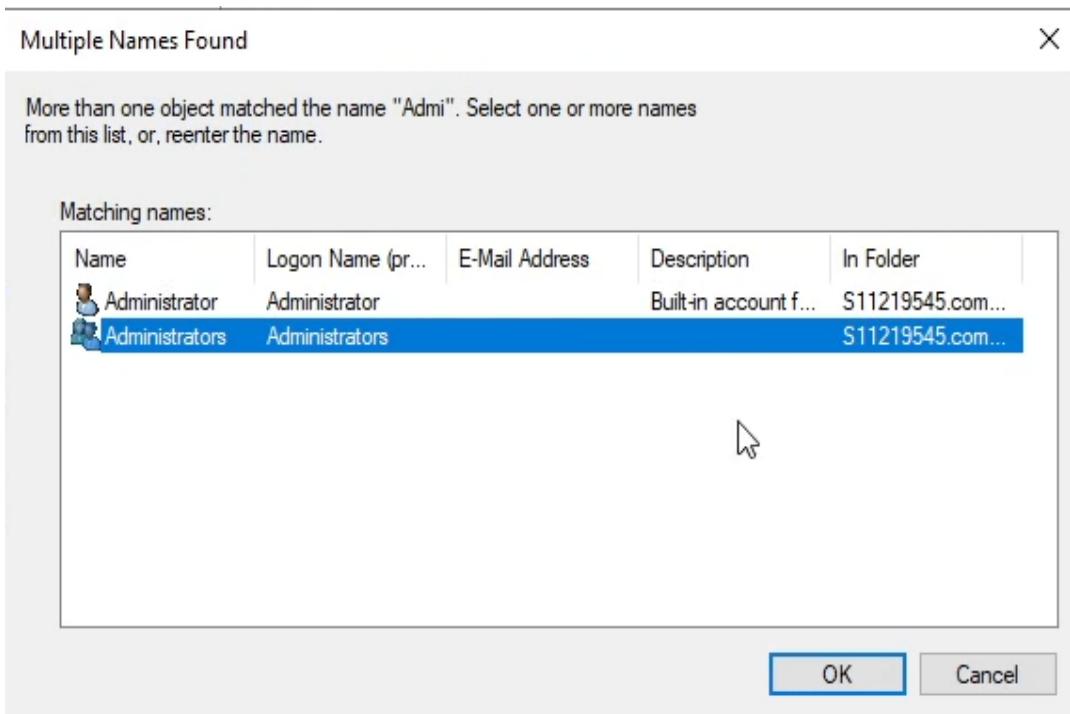
Step 2: Under the advance sharing section, press on Advance Sharing.



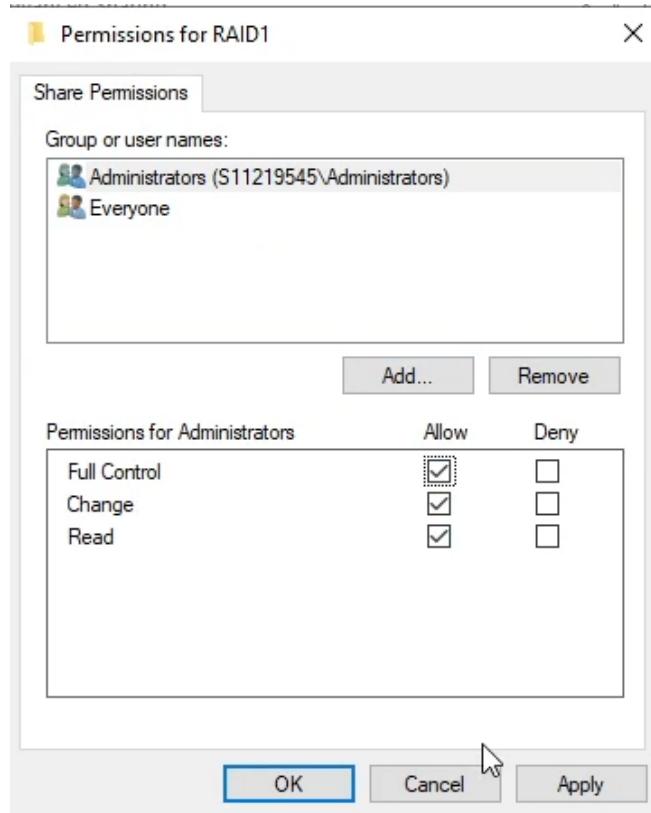
Step 3: Ensure the share this folder checkbox is checked and you can either use the default name of the drive or you can set a custom one. Once done, press the permission button.



Step 4: Use the add button to add the Administrator as shown below.

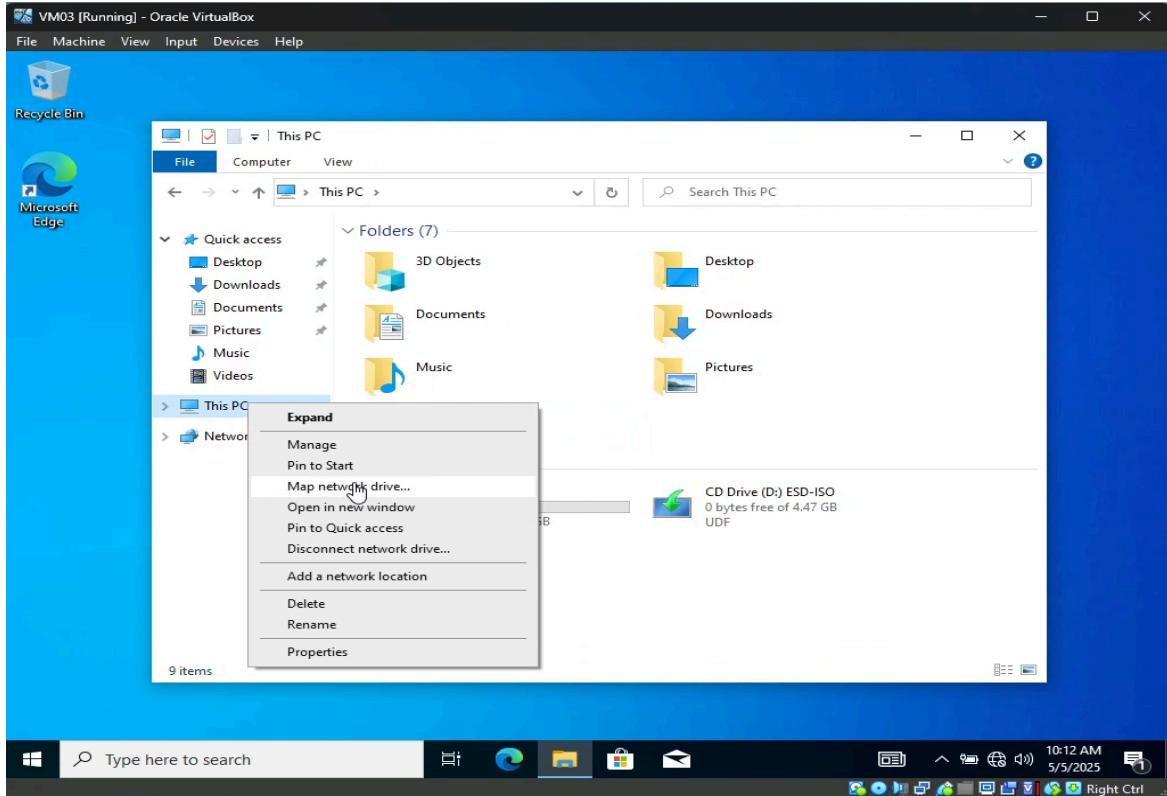


Once added you can give them full permission. Press Apply and then press OK.

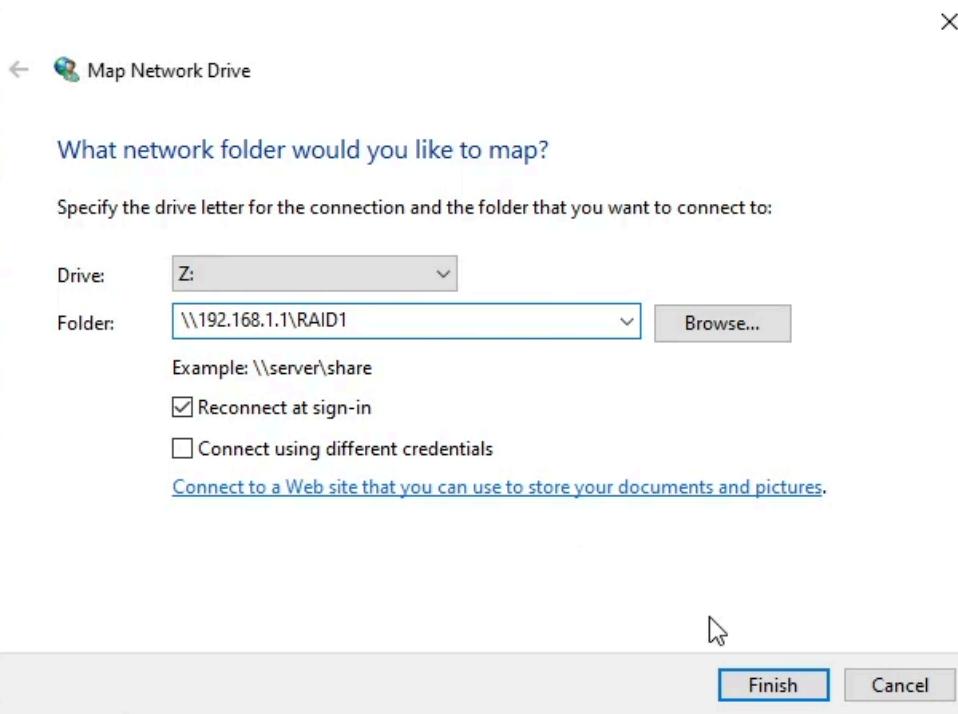


On Client Side

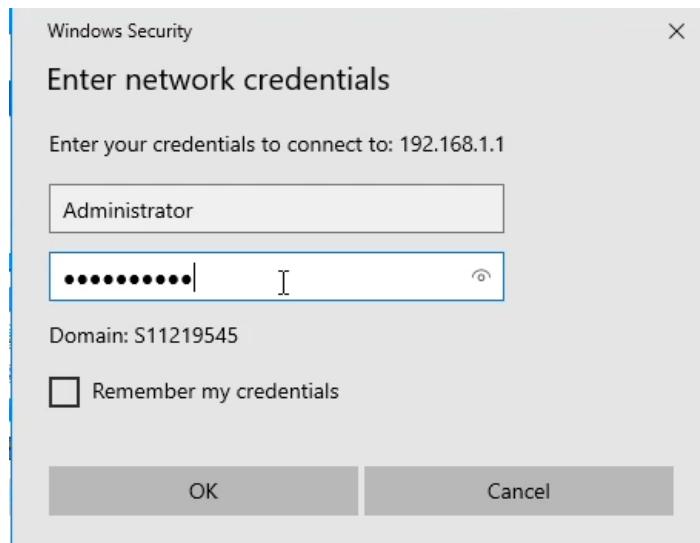
Step 1: Open File Explorer, right click on This PC and select the Map network drive option.



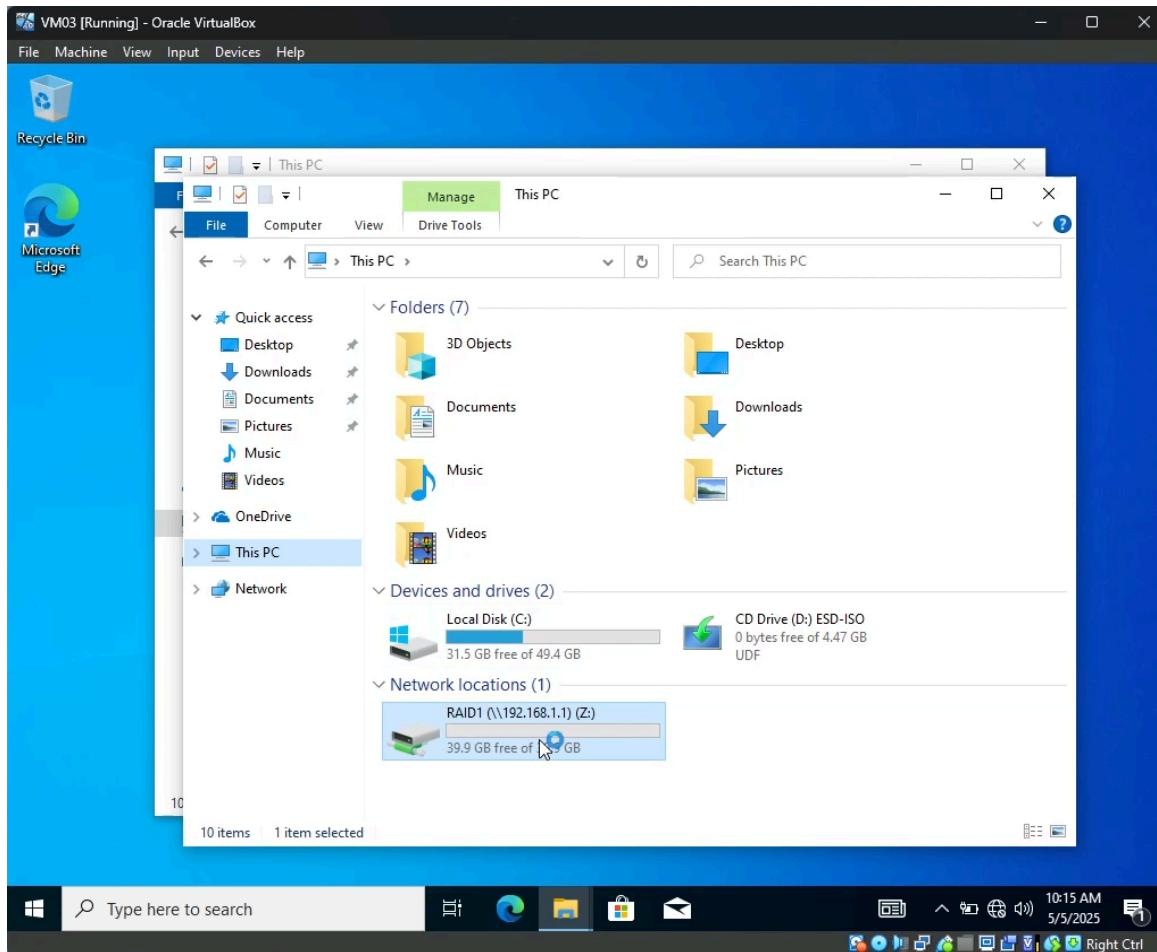
Step 2: Type in the network address of the server, followed by the name of the shared folder. Press finish and you will be prompted to enter your credential details.



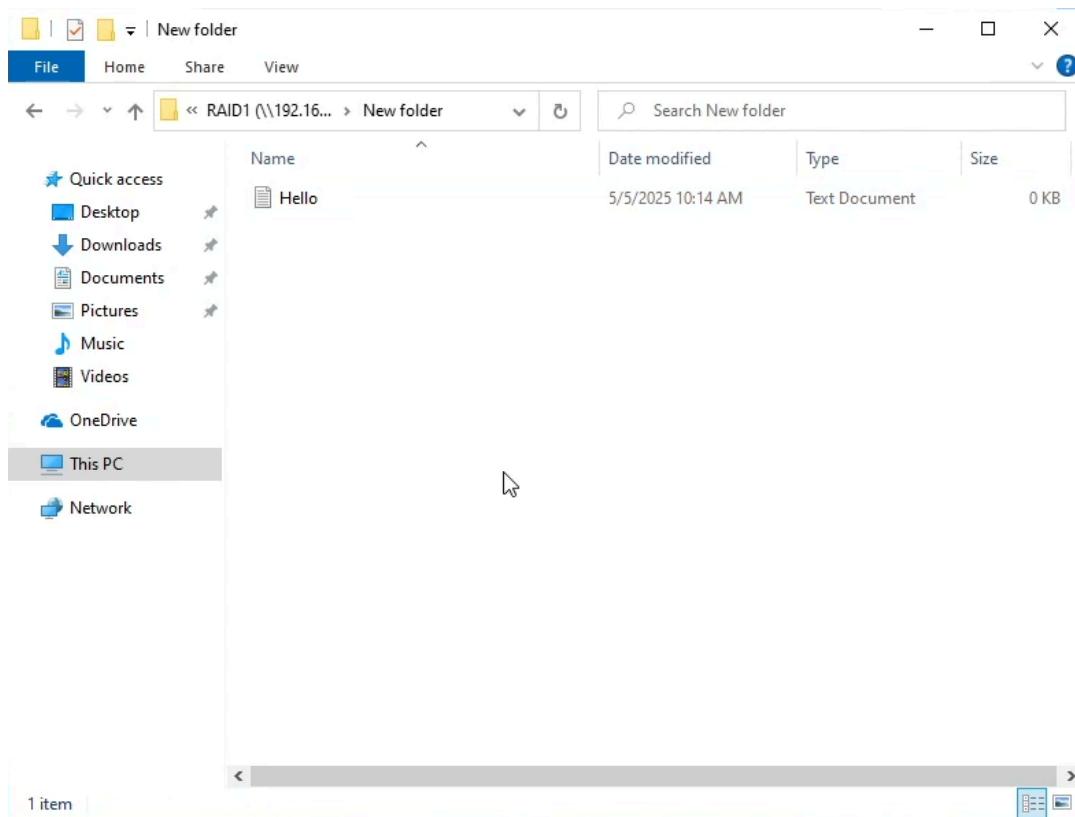
Enter your server credential and Press OK.



Step 3: You will now be able see the mapped drive in file explorer. If you are unable to then check if your Network Discovery and file sharing is on and then repeat and process.



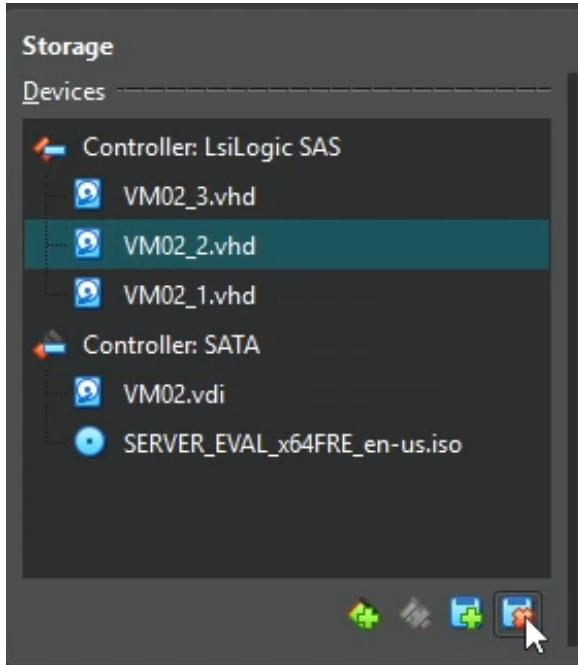
Step 4: In the RAID drive, create a folder and store a file in that folder.



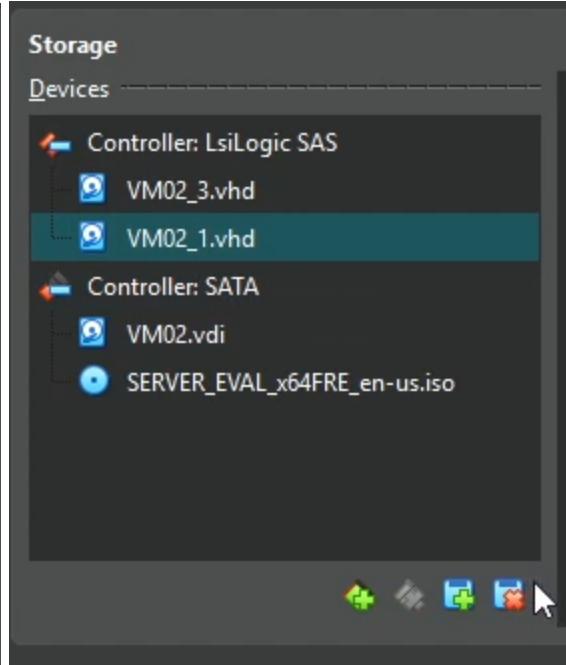
On Server side

Step 1: Turn the server off and open the Settings in the VirtualBox Manager window for VM02. Navigate to the storage section of the setting. From the LsiLogic SAS controller, remove one hard drive.

Before:



After:



Step 2: Turn on the server and open Server Manager. Navigate to the File and Storage Services and go to the Storage Pools option.

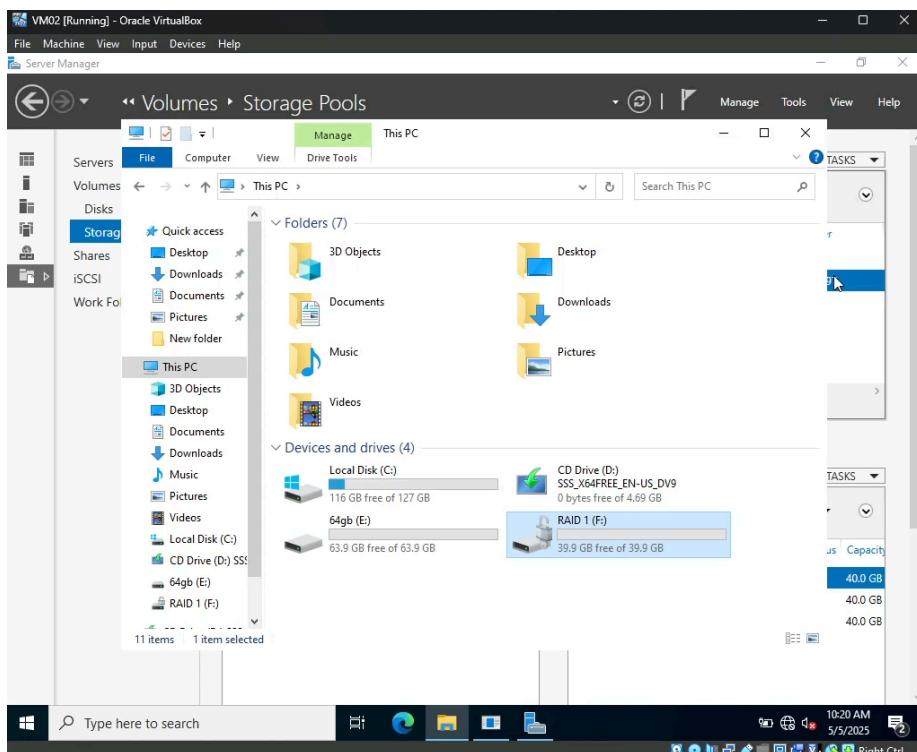
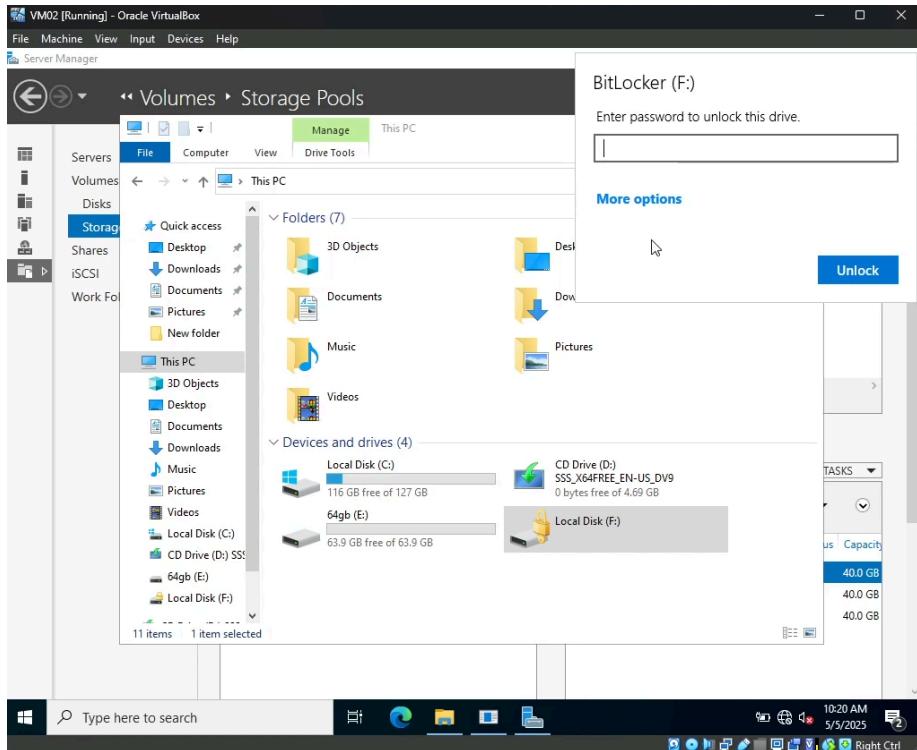
Name	Type	Managed by	Available to	Read-Write Server
Windows Storage (1)	RAID	Storage Pool	WIN-KF903O1P69T	WIN-KF903O1P69T

Name	Status	Layout	Provisioning	Capacity	Allocated
Mirror	Mirror	Thin	RAID	40.0 GB	2.25 GB

Slot	Name	Status	Capacity
1	VBOX HARDDISK (WIN-KF903O1P...	Normal	40.0 GB
2	VBOX HARDDISK (WIN-KF903O1P...	Normal	40.0 GB
3	VBOX HARDDISK (WIN-KF903O1P...	Normal	40.0 GB

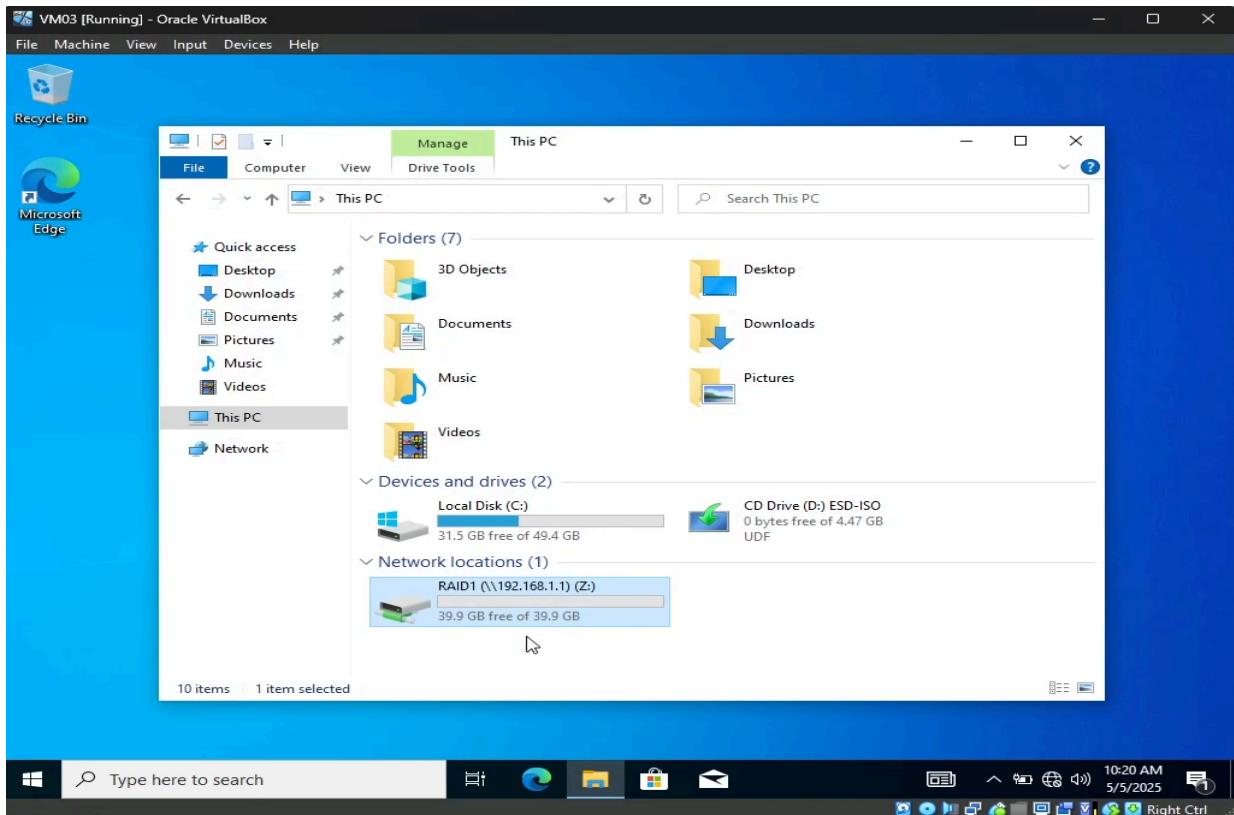
You will see that the Mirror virtual disk has been degraded and in the physical disk one of the hard drives has failed.

Step 3: Since our Mirror drive is BitLocker Encrypted, we will need to unlock it.

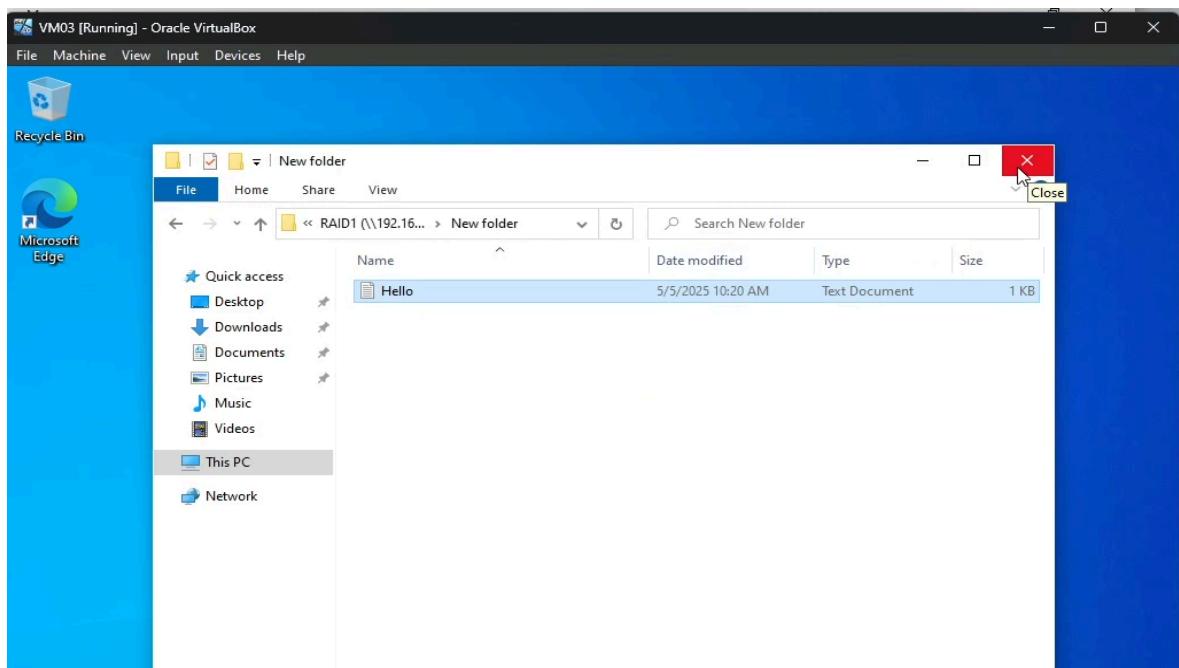


On client side

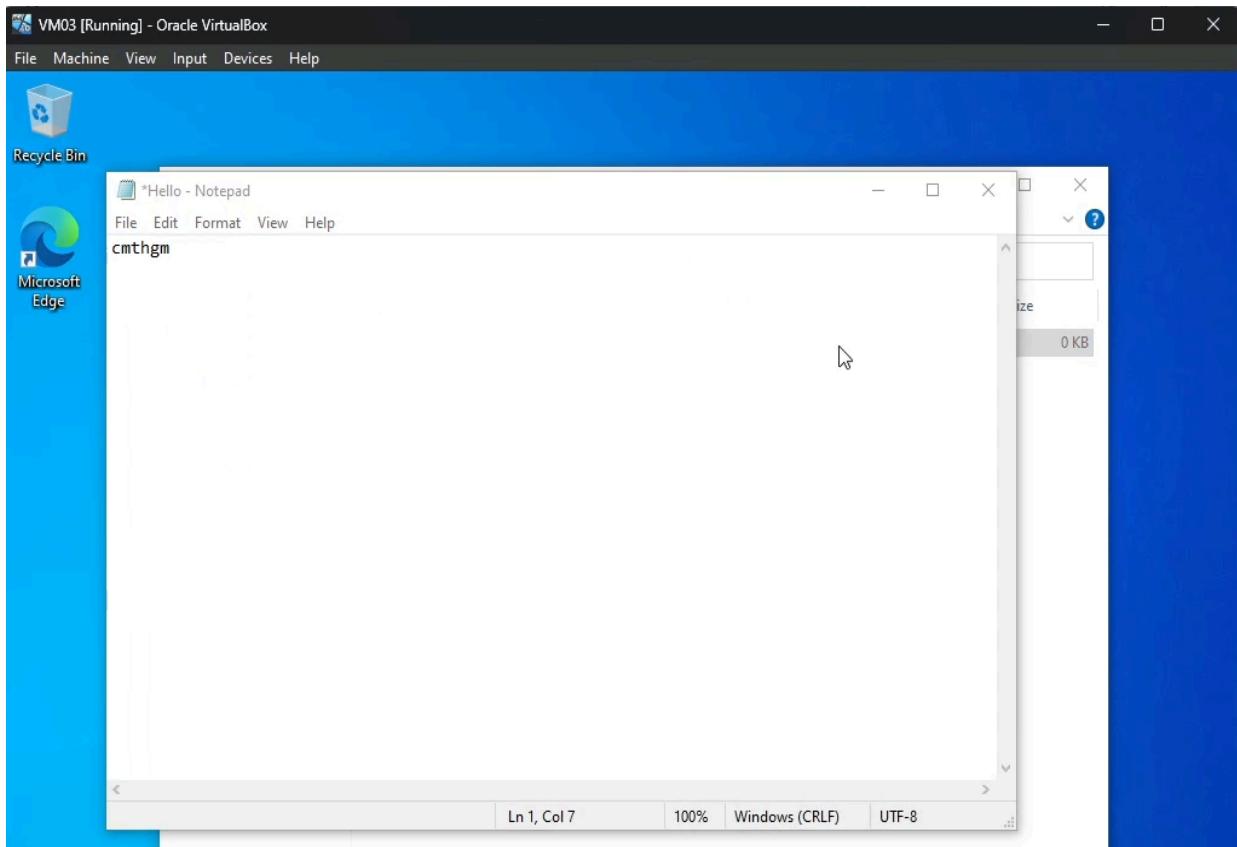
Step 1: Open the File Explorer and locate the RAID 1 drive. Try to enter it, if you can enter it, the drive is still functional even after the failure of one of the drives in the storage pool, if you can't then your RAID 1 drives redundancy has failed.



Step 1.1: Open the drive and locate the file you created.



Step 1.2: Try to open it.



Hence, the content of the RAID drive is viewable even after one of the drives is failing.

Usage Evaluation

1. RAID

RAID is a storage technology that combines multiple drives to enhance the performance and/or redundancy of the computer system. There are 4 main types of RAID, namely RAID 0, RAID 1, RAID 5, RAID 10.

RAID 0, also known as stripping, combines 2 or more hard drives and increases the performance of the drive setup but offers no form of redundancy in cases of disk failure (Awati, 2022). This drive setup is only useful for storing temporary data that you have no fear in using and not for important data that you do not want to lose.

RAID 1, also known as mirroring, uses minimum 2 drives and creates a clone of a drive and copies and stores it on another drive. This setup allows some form of redundancy where if one drive fails, the system can still function normally as the second copy of the drive is active and functional, but if the second drive fails, data is lost completely (Sheldon, 2022). RAID 1 is useful for critical infrastructure such as a banking system which requires data redundancy but also requires high performance.

RAID 5, also known as parity, strips data from multiple drives and stores it across many drives along with parity. If a drive fails in this configuration, then the RAID will attempt to recreate the lost data using parity, but if too many drives fail then RAID 5 may not be able to recreate the lost data, also when a drive fails while RAID 5 is rebuilding, the entire configuration may fail (Awati, 2022). This setup is useful for concurrency of data between many servers.

RAID 10, also known as stripping and mirroring, allows for data redundancy and performance. It uses four drives, 2 of which are used in stripping and the other 2 if used to mirror the first 2 drives that were stripped (Sullivan, 2022). Commonly used in content delivery networks.

2. Storage Pools

Storage pools are used to group together multiple physical drives and use them as a single logical drive and physical drives can be of mixed sizes. Storage pools can then be used to create virtual disk and volumes to create RAID setups (Microsoft, 2023). Best used for creating Network Attached Storage (NAS).

3. BitLocker

BitLocker is a full disk encryption solution designed to prevent unauthorized access to data stored in the drive (Glide, 2024). This drive is most likely stolen as BitLocker auto locks the drive if the drive detaches from the system or goes offline. When setting up BitLocker on a drive, a recovery key is created and when a scenario arises where the drive gets encrypted, then the recovery key can be used to unlock the drive. The recovery keys need to be kept safely and must not fall in the wrong hand. This is useful for both home and enterprise use cases where a drive needs to be secured against unauthorized access.

4. Virtual Memory(Paging)

Virtual memory is a memory management technique that uses a piece of the hard drive as primary memory or RAM (Kirvan, 2021). This prevents cases where the system runs out of memory trying to process multiple tasks in a low RAM system. The typical use cases of using paging is using in systems that have low RAM capacity to run memory hungry applications, such as video games, video editing softwares, etc. Using this method is more cost effective than buying new RAM as high capacity and performance RAM are not cheap. However, it should be noted that paging is slower than using RAM as hard drives are typically slower than RAM. This means that if your system has very low RAM, virtual memory will not be able to help your systems over performance in terms of speed. Virtual memory is good when there is a one off chance where data is too much to be stored in RAM, not when the data has to be stored in virtual memory constantly.

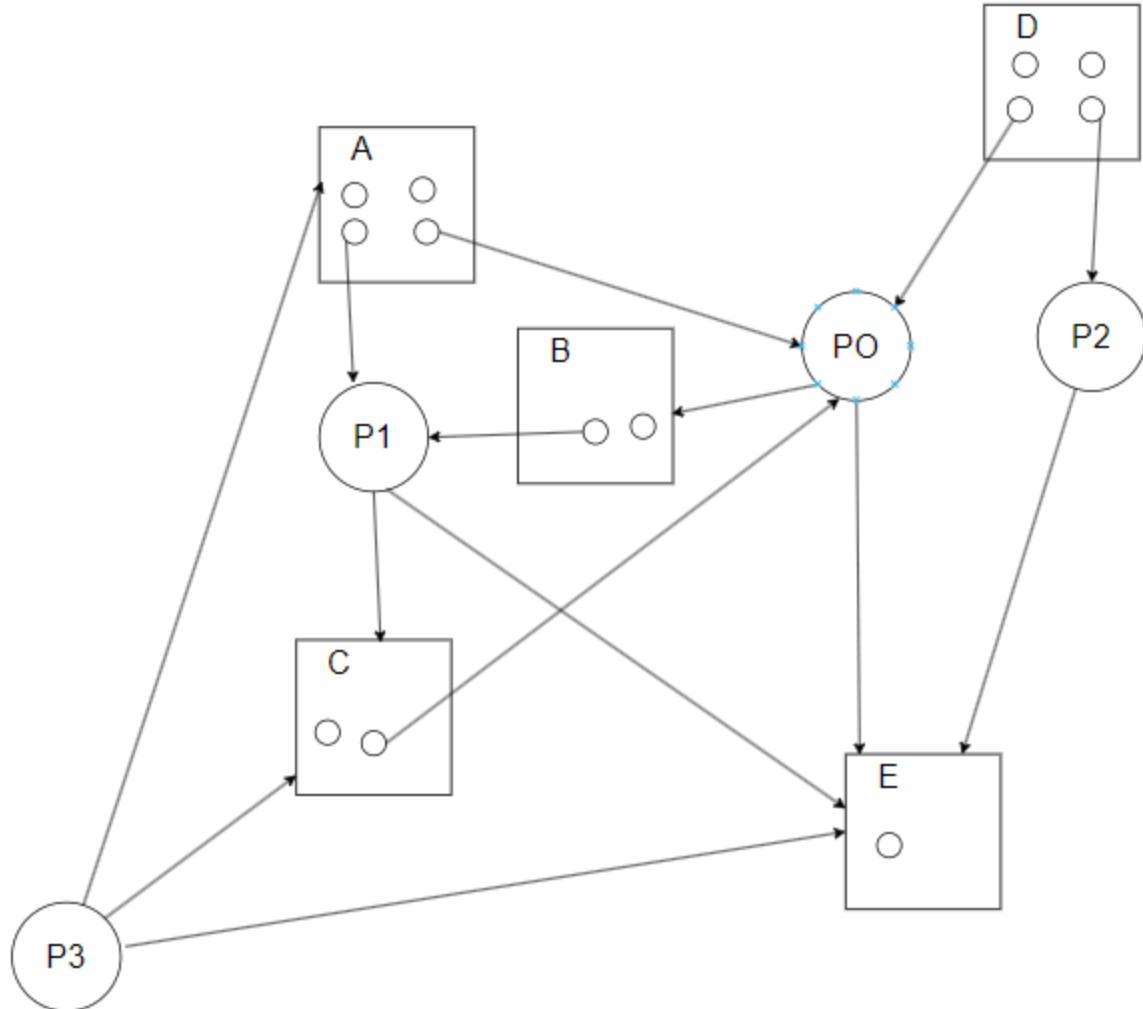
5. Disk Partitioning

Disk partitioning is the process of splitting a drive's total capacity into multiple sections of different sizes (Kirvan, 2022). The benefits of doing this is that it allows a user to create different partitions to store different data files, for example, one partition can hold OS files, another your personal documents, another one can hold software, this improves file organisation and allows the OS to more quickly search partitions to get files, rather than having to search the entire drive. Moreover, you can choose to use BitLocker Encryption on one partition of the drive rather than the entire drive. In incase of any error in any partition, it will not take out the entire drive, if the partition is storing low critical data files, else if the partition is storing critical datafile, then the entire drive might fail.

Section B

Scenario 1

Part A - Resource Allocation graph



Part B - Deadlock Detection Algorithm

Processes	Request \leq Work = Availability	Decision	Work + Allocation = New Work
PO	$01001 \leq 21121$	True	$21121 + 10110 = 31231$
P1	$00101 \leq 31231$	True	$31231 + 11000 = 42231$

P2	$00001 \leq 42231$	True	$42231 + 00010 = 42241$
P3	$10101 \leq 42241$	True	$42241 + 00000 = 42241$

Execution Sequence : PO -> P1 -> P2 -> P3

Part C - Conclusion

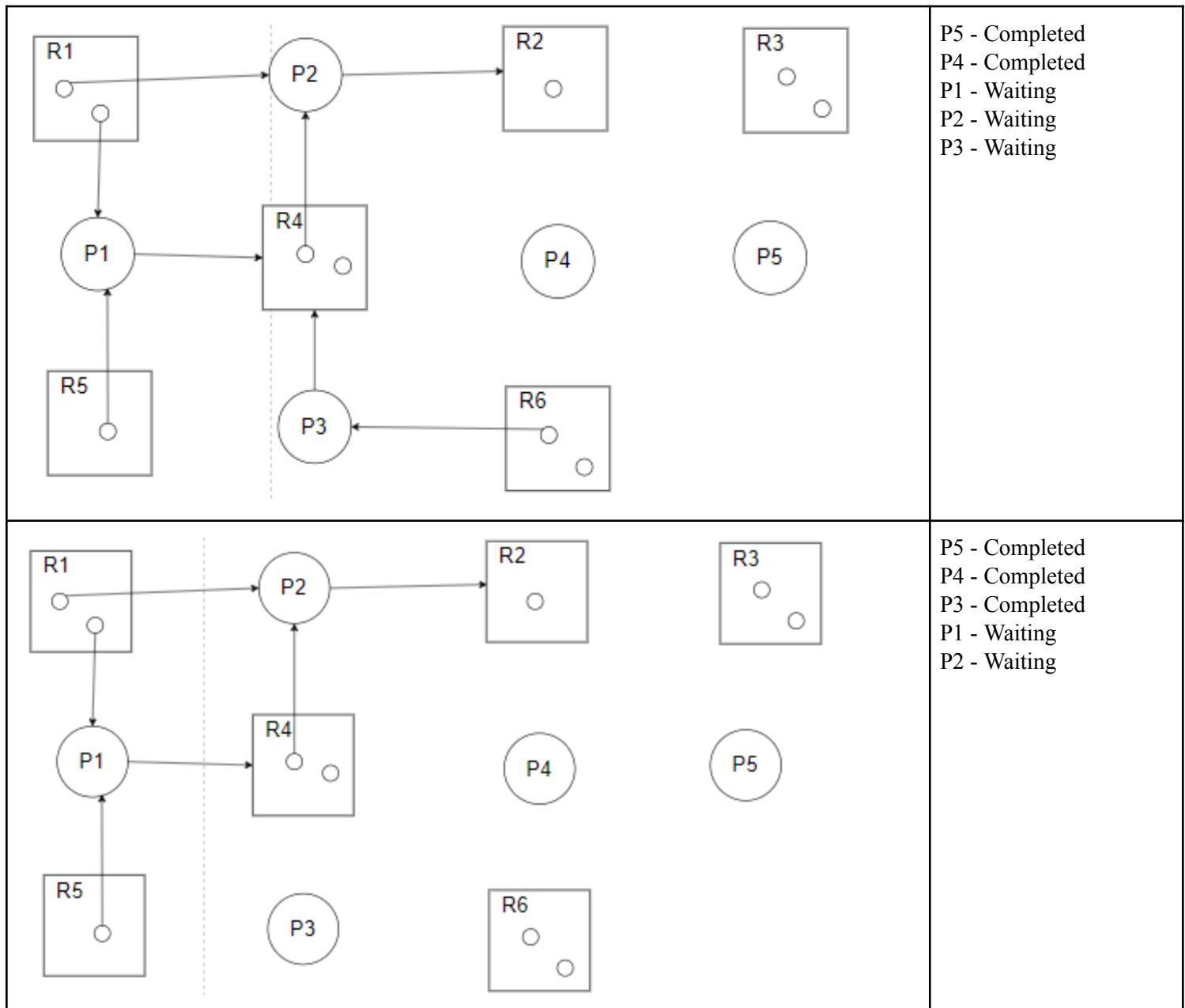
Therefore, after conducting the deadlock detection algorithm above, it can be seen that no processes are involved in a deadlock and are in a safe state due to the existence of the execution sequence : PO -> P1 -> P2 -> P3.

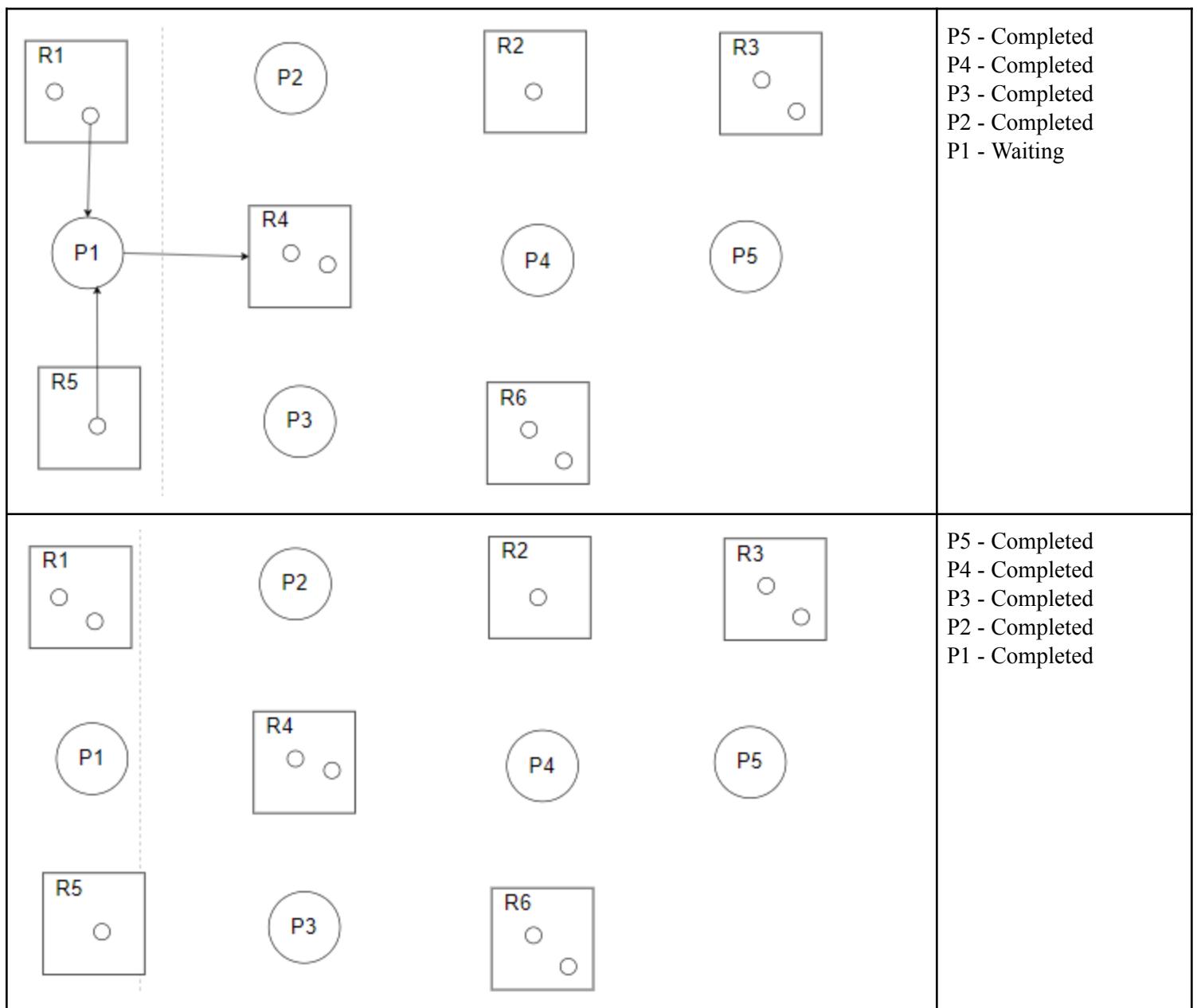
Scenario 2

Part A - Matrix

Part B - Deadlock Detection Algorithm

Resource Allocation Diagram	Process State
<pre> graph LR R1[R1] --> P2((P2)) R1[R1] --> P1((P1)) R5[R5] --> P1((P1)) P1((P1)) --> R4[R4] P2((P2)) --> R1[R1] P2((P2)) --> R4[R4] P3((P3)) --> R4[R4] R4[R4] --> P4((P4)) R4[R4] --> P3((P3)) R2[R2] --> P4((P4)) R6[R6] --> P4((P4)) R6[R6] --> P3((P3)) P4((P4)) --> R3[R3] P5((P5)) --> R3[R3] </pre>	P1 - Waiting P2 - Waiting P3 - Waiting P4 - Waiting P5 - Waiting
<pre> graph LR R1[R1] --> P2((P2)) R1[R1] --> P1((P1)) R5[R5] --> P1((P1)) P1((P1)) --> R4[R4] P2((P2)) --> R1[R1] P2((P2)) --> R4[R4] P3((P3)) --> R4[R4] R4[R4] --> P4((P4)) R4[R4] --> P3((P3)) R2[R2] --> P4((P4)) R6[R6] --> P4((P4)) R6[R6] --> P3((P3)) P4((P4)) --> R3[R3] P5((P5)) --> R3[R3] </pre>	P5 - Completed P1 - Waiting P2 - Waiting P3 - Waiting P4 - Waiting





Execution Sequence : P5 -> P4 -> P3 -> P2 -> P1

Part C - Conclusion

Therefore, after conducting the deadlock detection algorithm above, it can be seen that no processes are involved in a deadlock and are in a safe state due to the existence of the execution sequence : P5 -> P4 -> P3 -> P2 -> P1.

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