Setting up a virtual home lab

I created a virtual IT home lab from the ground up using open-source software on my personal computer.

In the early 2000s, building an IT lab typically involved purchasing physical servers or repurposing old hardware. While this provided valuable hands-on experience, advancements in technology now offer a more efficient and cost-effective solution: setting up a virtualized IT lab using free tools and resources.

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Introduction to Virtualization

Virtualization is a technology that enables the creation of multiple simulated environments or dedicated resources from a single physical hardware system. It enhances computing efficiency, scalability, and flexibility by allowing multiple operating systems and applications to run independently on the same physical machine.

Core Concepts of Virtualization

1. **Virtual Machines (VMs)**
   Virtual machines are software-based emulations of physical computers. Each VM operates with its own operating system and applications, functioning independently as if it were a separate physical device.
2. **Hypervisors**
   A hypervisor is the software layer that enables virtualization by managing and allocating hardware resources to VMs. There are two main types:
   - **Type 1 (Bare-metal Hypervisors):**
     Installed directly on the physical hardware, offering high performance and efficiency.
     Examples: VMware ESXi, Microsoft Hyper-V.
   - **Type 2 (Hosted Hypervisors):**
     Runs on top of a host operating system, suitable for desktop or development environments.
     Examples: Oracle VirtualBox, VMware Workstation.

Host and Guest Virtual Machines

In a virtualized environment, the **top-level computer** is referred to as the **host machine**. This is the physical computer that runs the virtualization software (hypervisor) and provides resources such as CPU, memory, and storage to the virtual machines.

The **three computers below** represent **guest virtual machines (VMs)**. These are software-based emulations of physical computers that operate within the host system. Each guest VM functions like a standalone computer, capable of performing standard operations such as:

- Starting and shutting down
- Restarting and entering sleep mode
- Installing and updating software

Types of Virtualizations

There are several types of virtualizations, each serving a specific purpose.

- **Windows Server Virtualization**
  Enables multiple server instances to run on a single physical server, improving resource utilization and reducing hardware costs.
- **Desktop Virtualization**
  Allows users to access a desktop environment remotely, often used in virtual desktop infrastructure (VDI) setups.

- **Storage Virtualization**
  Combines physical storage from multiple devices into a single, centralized virtual storage pool.
- **Network Virtualization**
  Creates virtual networks that function independently of the underlying physical network, enhancing flexibility and security.

Benefits of Virtualization

- **Cost Savings**
  Reduces the need for physical hardware, lowering capital and operational expenses.
- **Improved Efficiency**
  Maximizes hardware utilization by running multiple workloads on a single system.
- **Scalability**
  Easily add or remove virtual machines based on demand, supporting dynamic workloads.
- **Isolation**
  Each virtual machine operates independently, enhancing system stability and security.
    - .

Virtualization Software

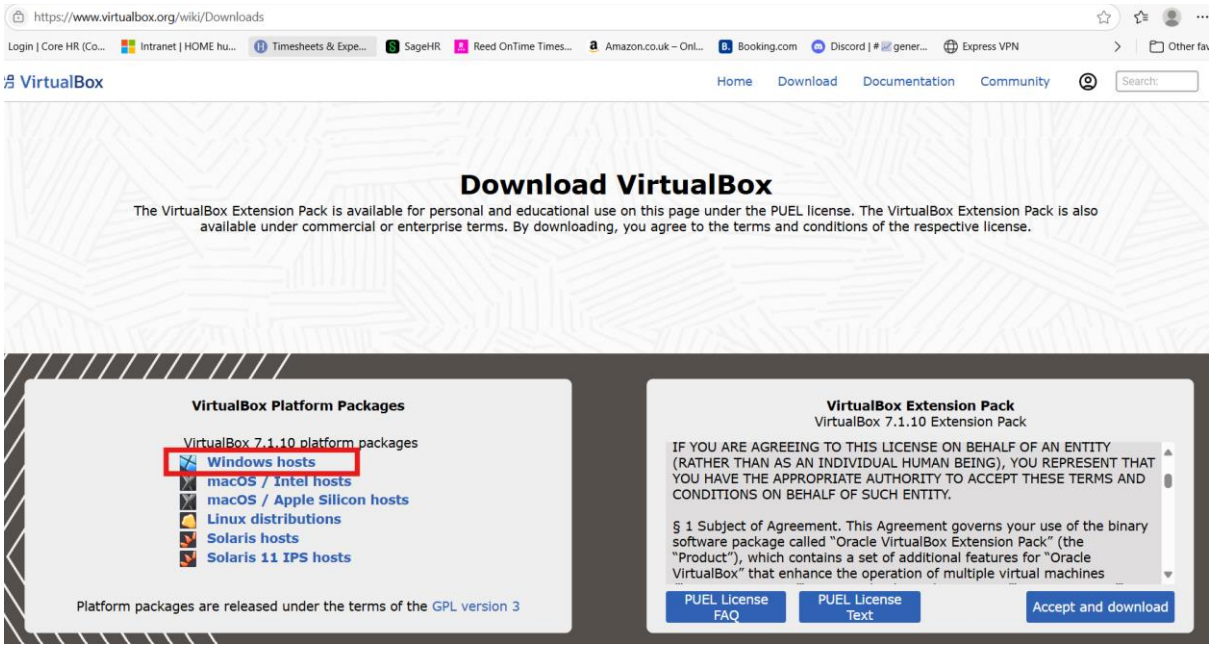
There are numerous virtualization platforms available, and choosing the right one depends largely on your operating system and specific needs. There is no single "best" option — each has its strengths.

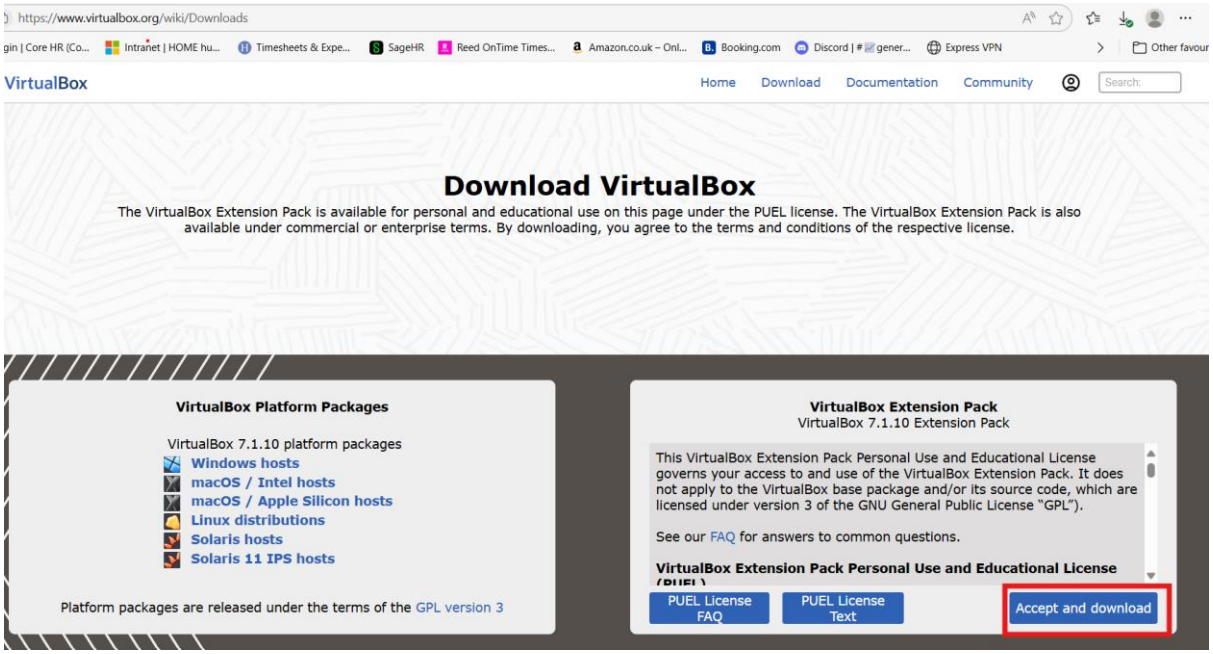
For this setup, we'll use Oracle VM VirtualBox, a free and open-source virtualization tool that supports both Windows and Linux. However, you're free to use any virtualization software you prefer, as the setup steps are generally similar across platforms.

Downloading and Installing VirtualBox

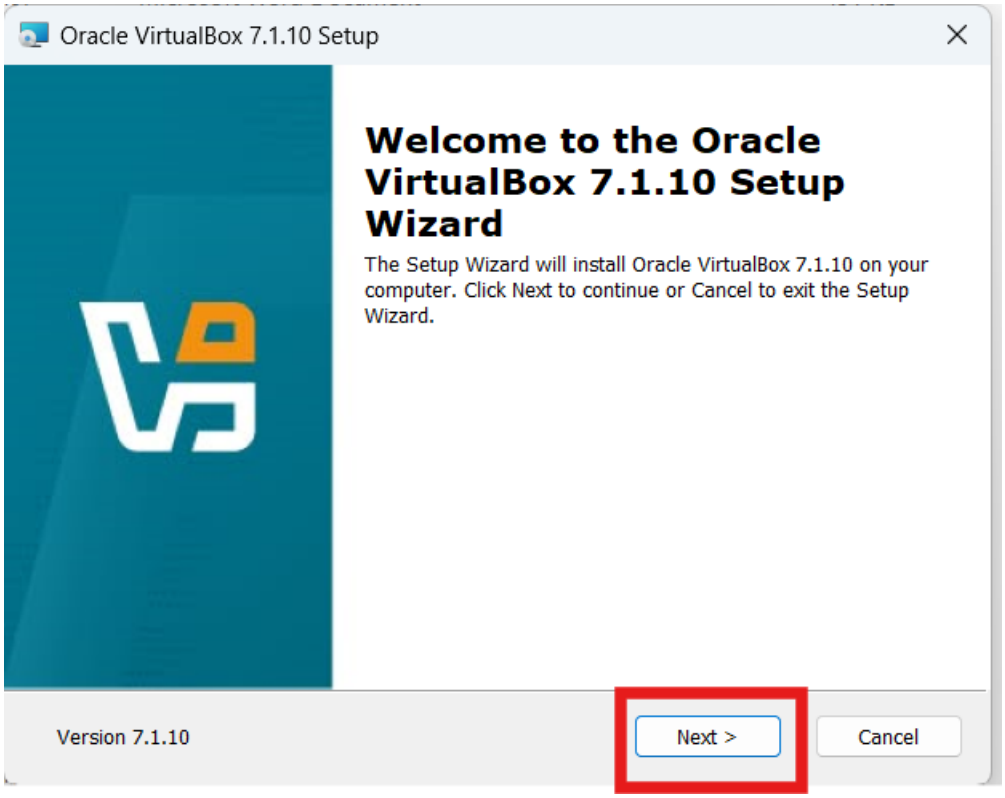
To get started:

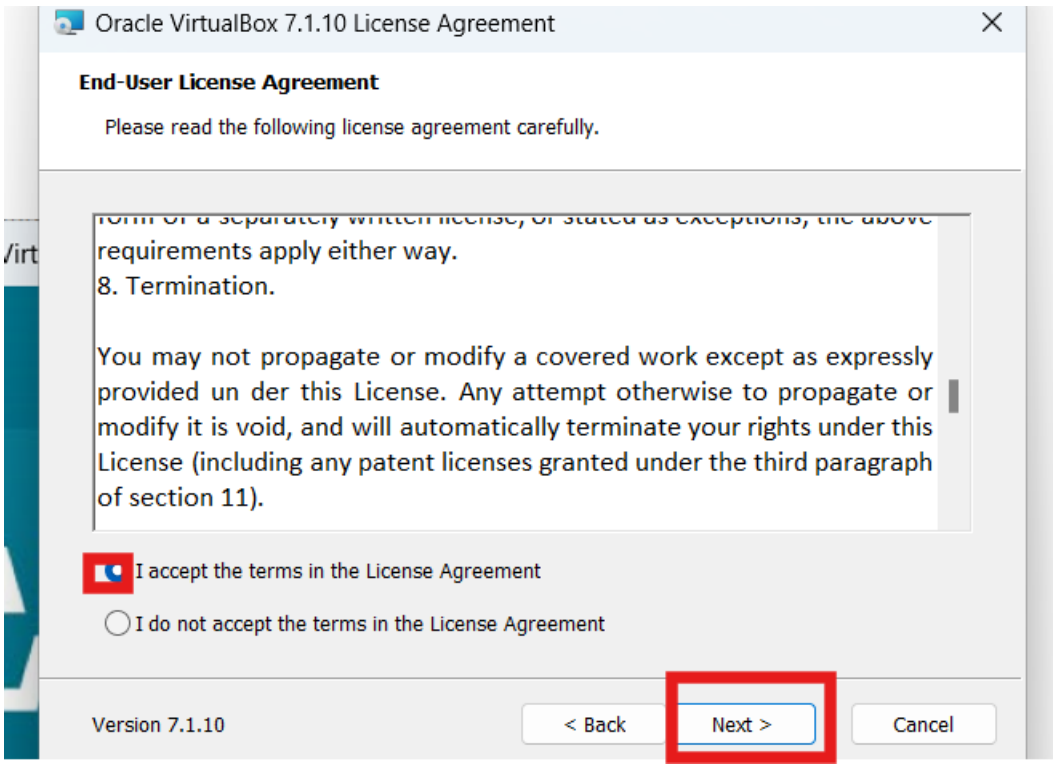
1. **Download VirtualBox**
   Visit the official VirtualBox download page and select the version compatible with your operating system or click this link Downloads – Oracle VirtualBox

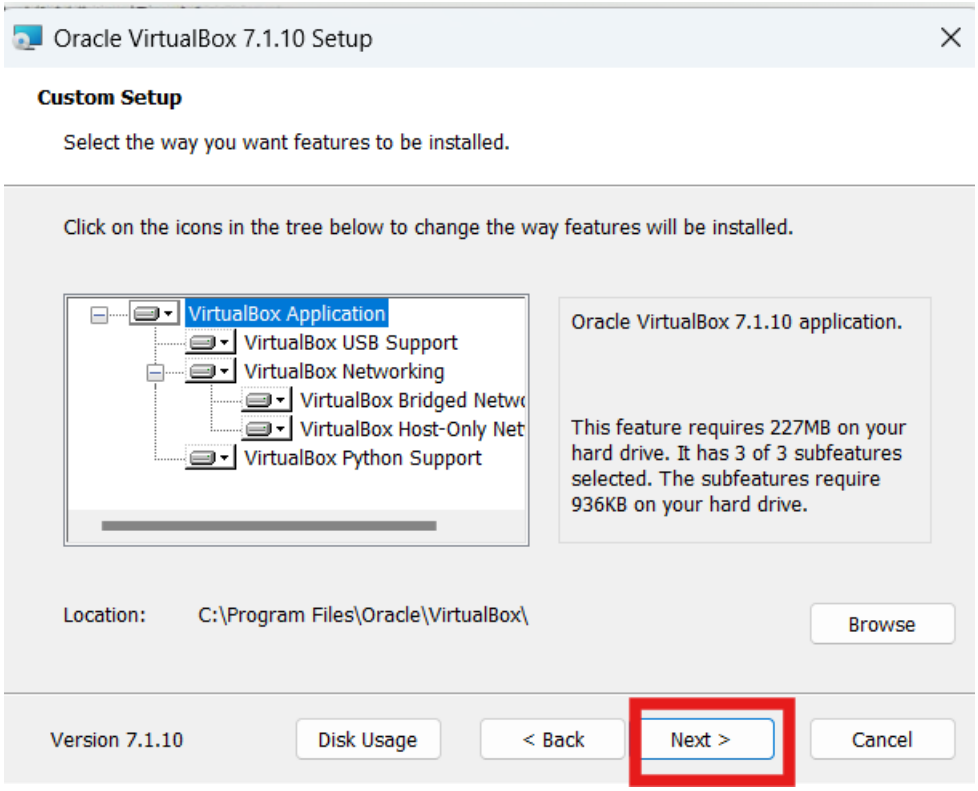




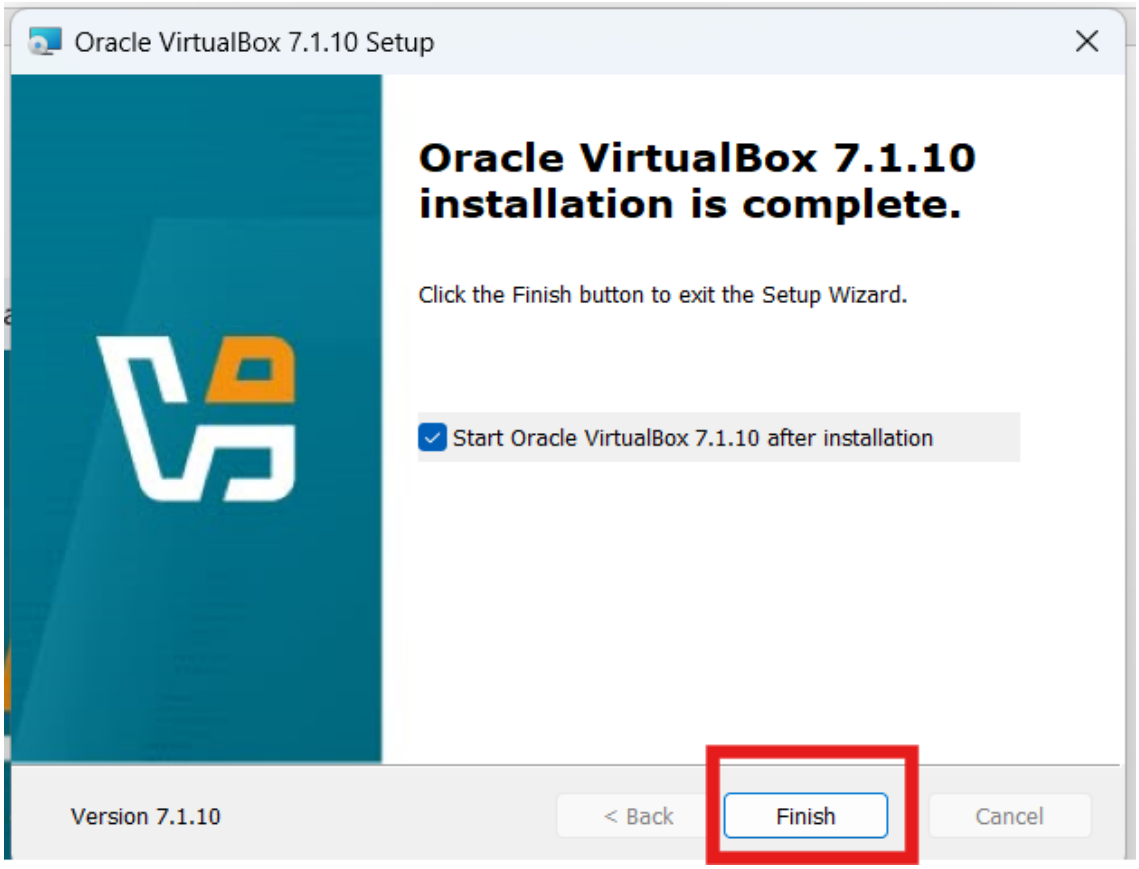
2. **Install VirtualBox**
   Once the download is complete, run the installer and follow the on-screen instructions to complete the installation.


Oracle VirtualBox 7.1.10 Setup
Welcome to the Oracle VirtualBox 7.1.10 Setup Wizard
The Setup Wizard will install Oracle VirtualBox 7.1.10 on your computer. Click Next to continue or Cancel to exit the Setup Wizard.
Version 7.1.10
Next >
Cancel

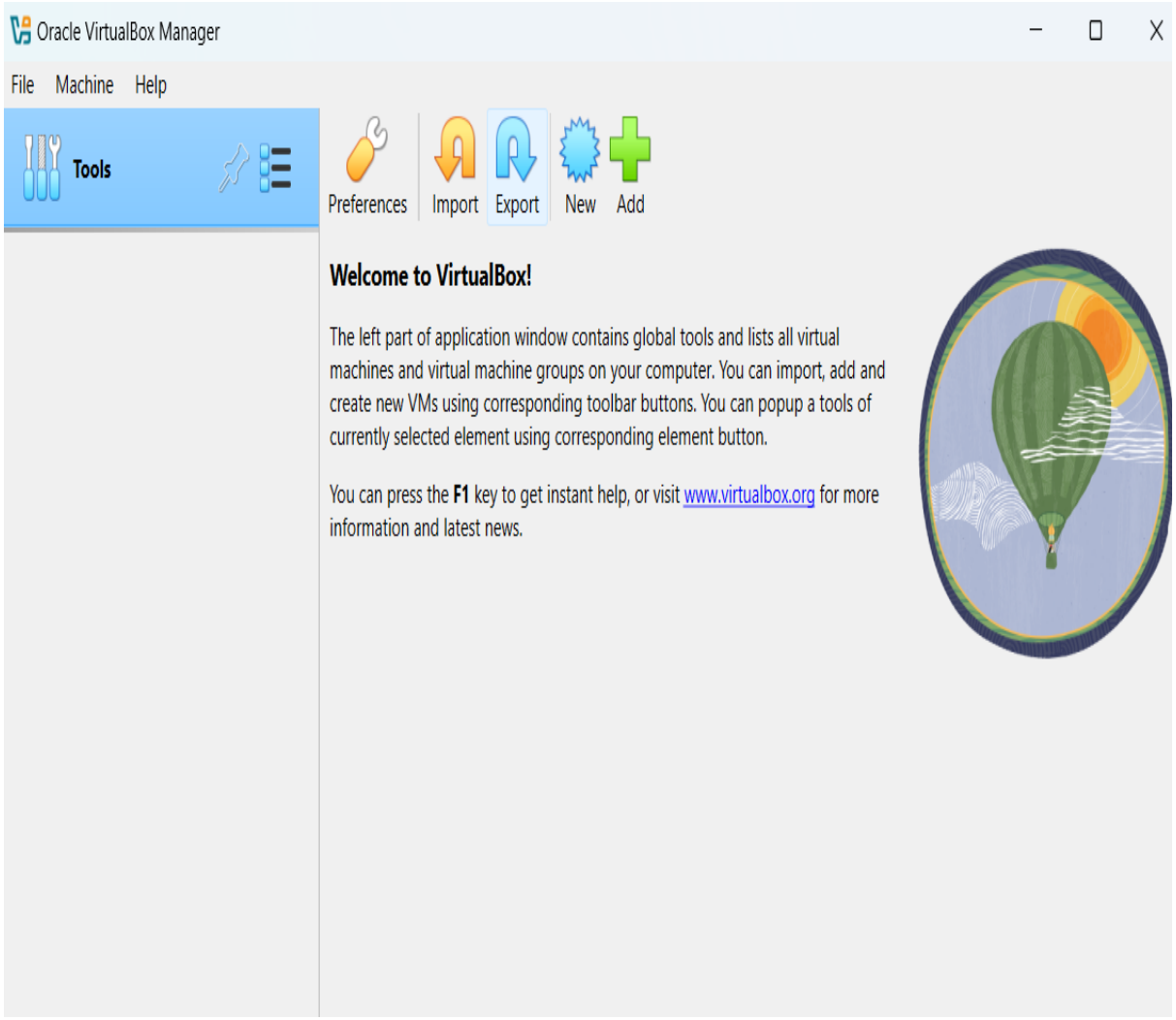

Oracle VirtualBox 7.1.10 License Agreement
End-User License Agreement
Please read the following license agreement carefully.
requirements apply either way.
8. Termination.
You may not propagate or modify a covered work except as expressly provided un der this License. Any attempt otherwise to propagate or modify it is void, and will automatically terminate your rights under this License (including any patent licenses granted under the third paragraph of section 11).
I accept the terms in the License Agreement
I do not accept the terms in the License Agreement
Version 7.1.10
< Back
Next >
Cancel


Oracle VirtualBox 7.1.10 Setup
Custom Setup
Select the way you want features to be installed.
Click on the icons in the tree below to change the way features will be installed.
VirtualBox Application
VirtualBox USB Support
VirtualBox Networking
VirtualBox Bridged Netwo
VirtualBox Host-Only Net
VirtualBox Python Support
Oracle VirtualBox 7.1.10 application.
This feature requires 227MB on your hard drive. It has 3 of 3 subfeatures selected. The subfeatures require 936KB on your hard drive.
Location:
C:\Program Files\Oracle\VirtualBox\
Browse
Version 7.1.10
Disk Usage
< Back
Next >
Cancel

Click Next



Click Finish and launch VirtualBox.



Installing VirtualBox complete

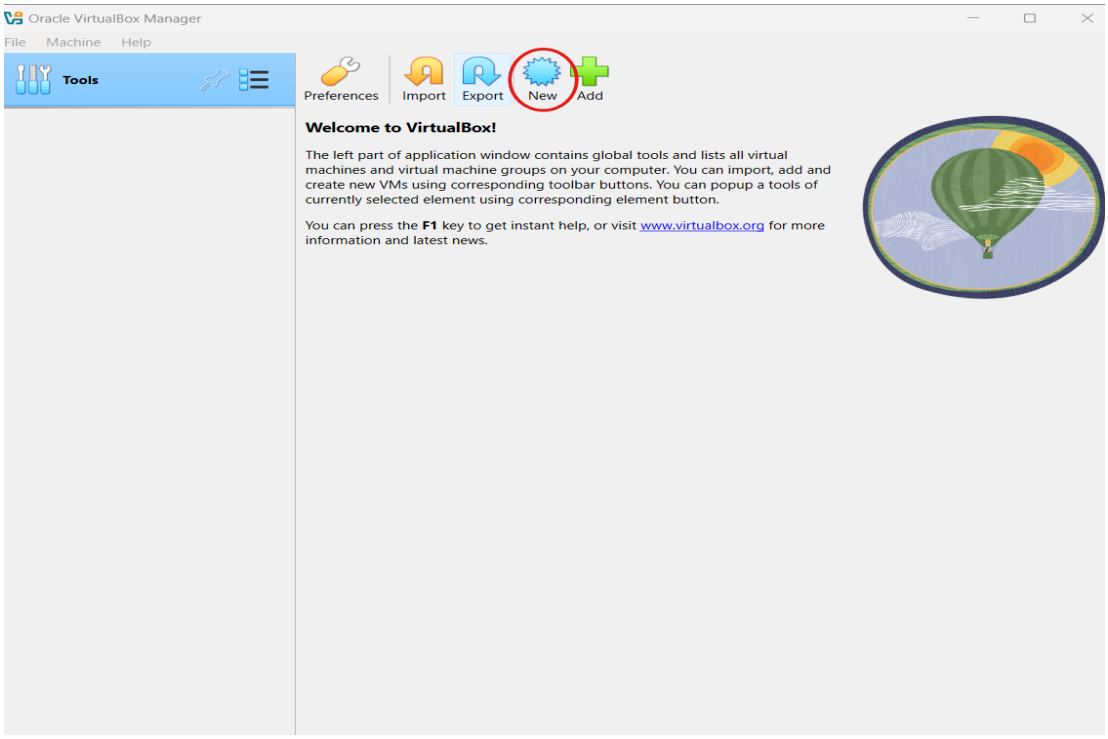
Creating a Virtual Machine

Once your virtual network is configured, you can proceed to create a Virtual Machine (VM) in VirtualBox. Follow these steps:

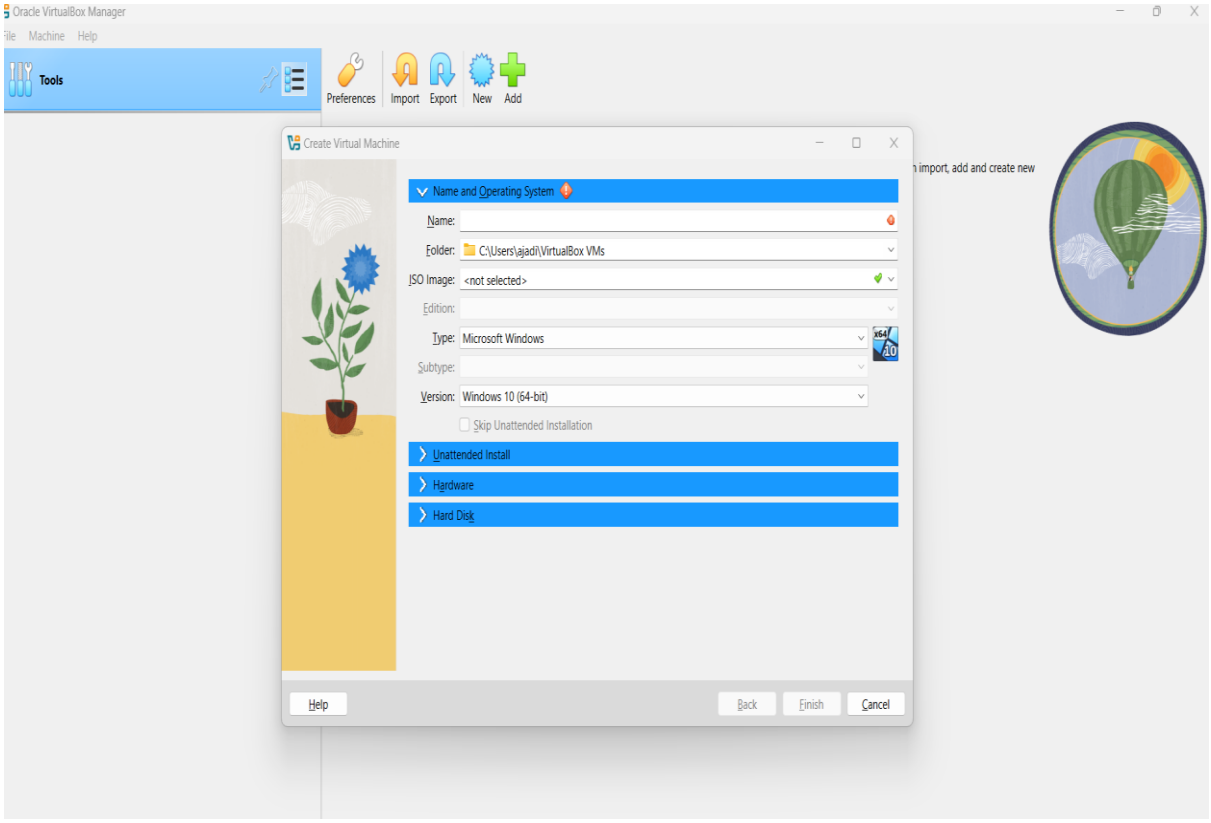
1. **Open VirtualBox Manager.**
2. **Click the "New" button** in the toolbar to begin the VM creation process.

3. **Enter the VM name**, select the operating system type and version.
4. **Allocate memory (RAM)** based on the requirements of the OS you plan to install.
5. **Create a virtual hard disk** or use an existing one, then configure its size and format.

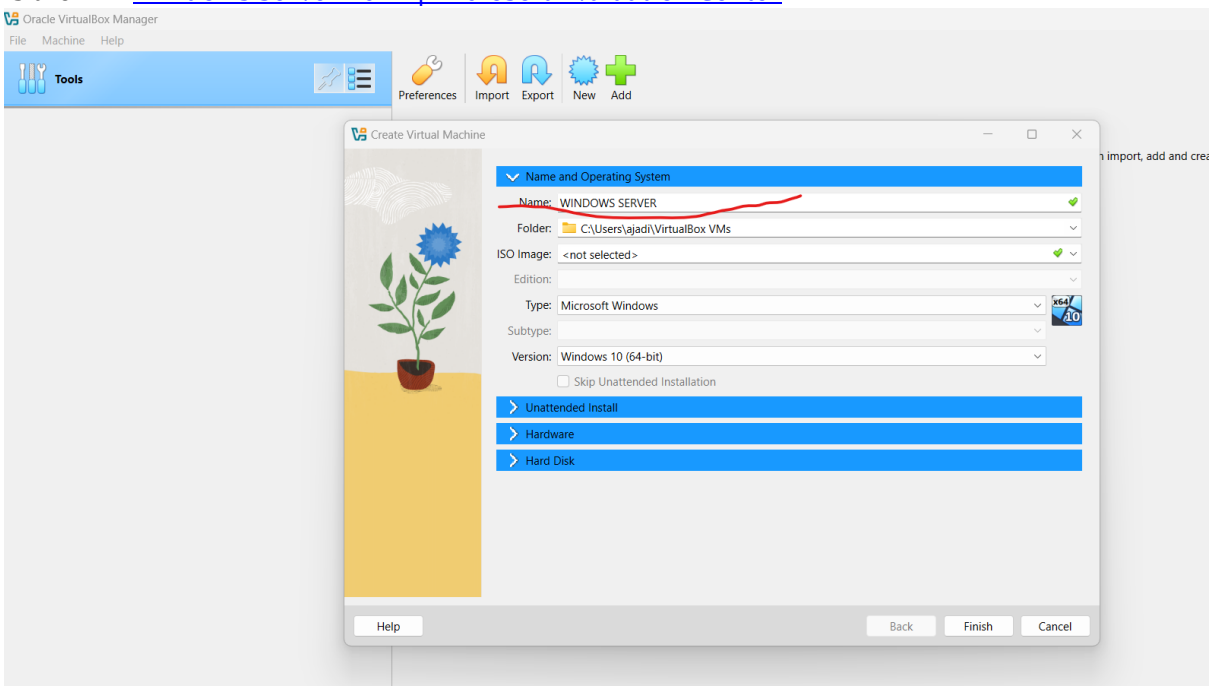
After completing these steps, your virtual machine will be ready for operating system installation.

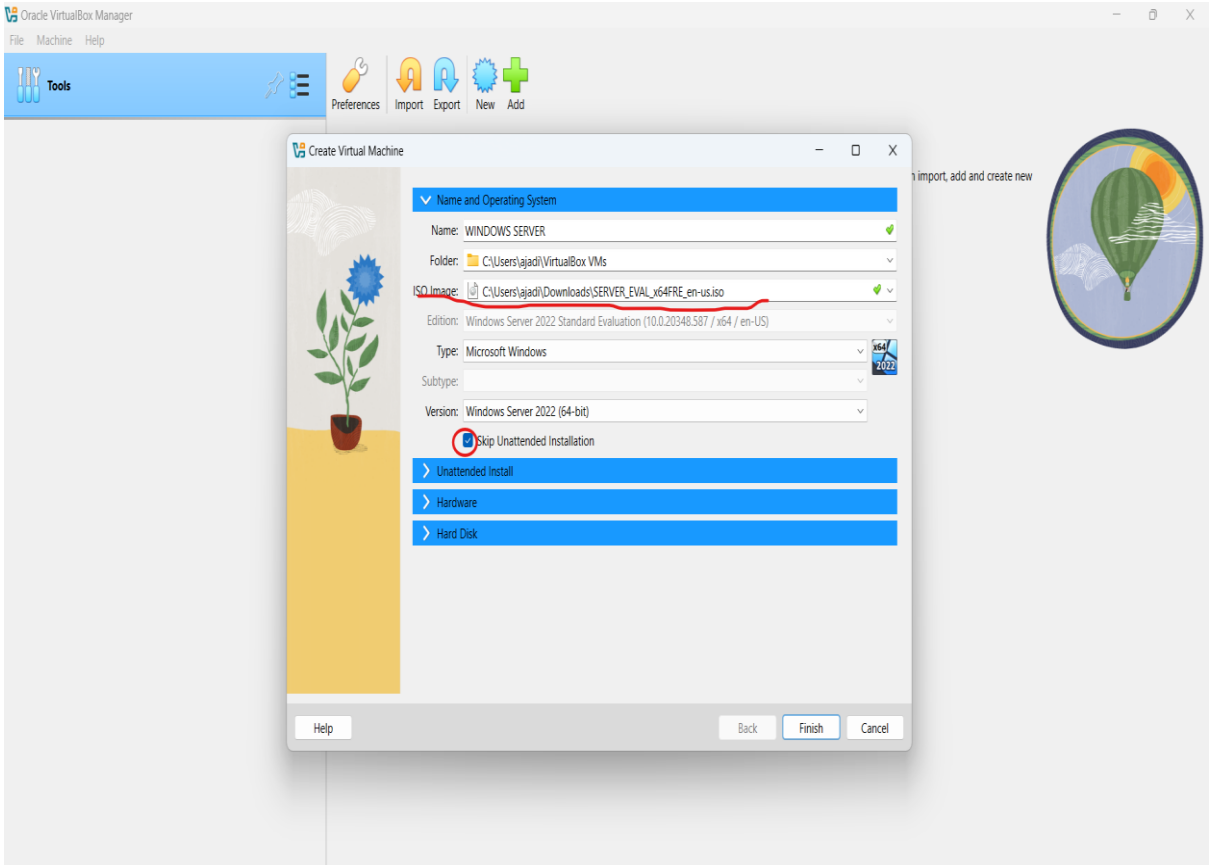


A box will pop-up like the one below

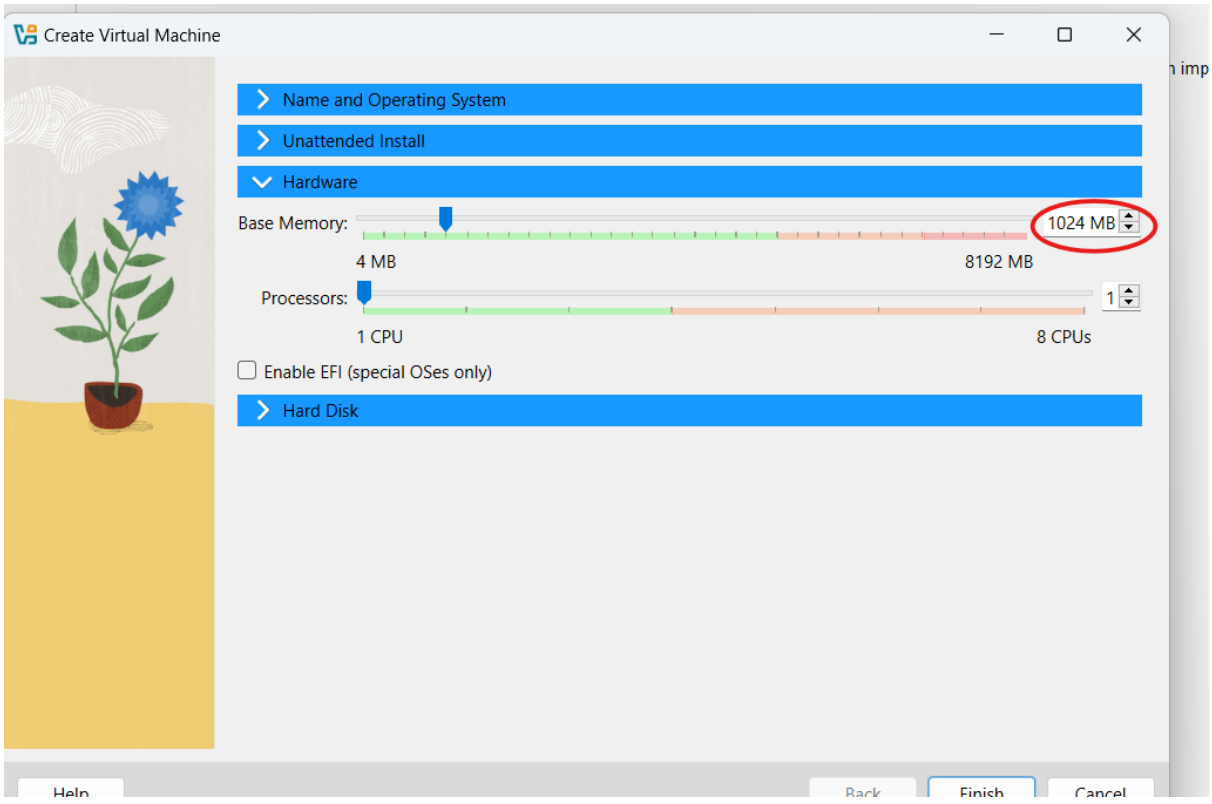


Name your OS and then mount your ISO file on the VM which you must have downloaded, here is the link [Windows Server 2022 | Microsoft Evaluation Center]

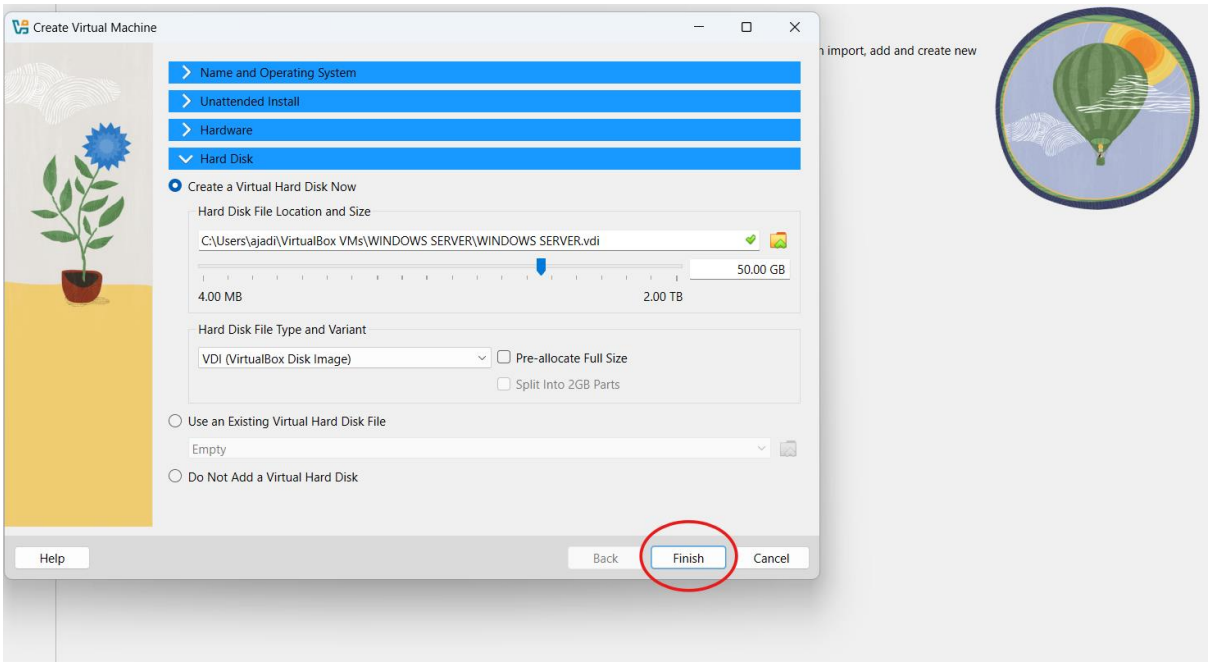




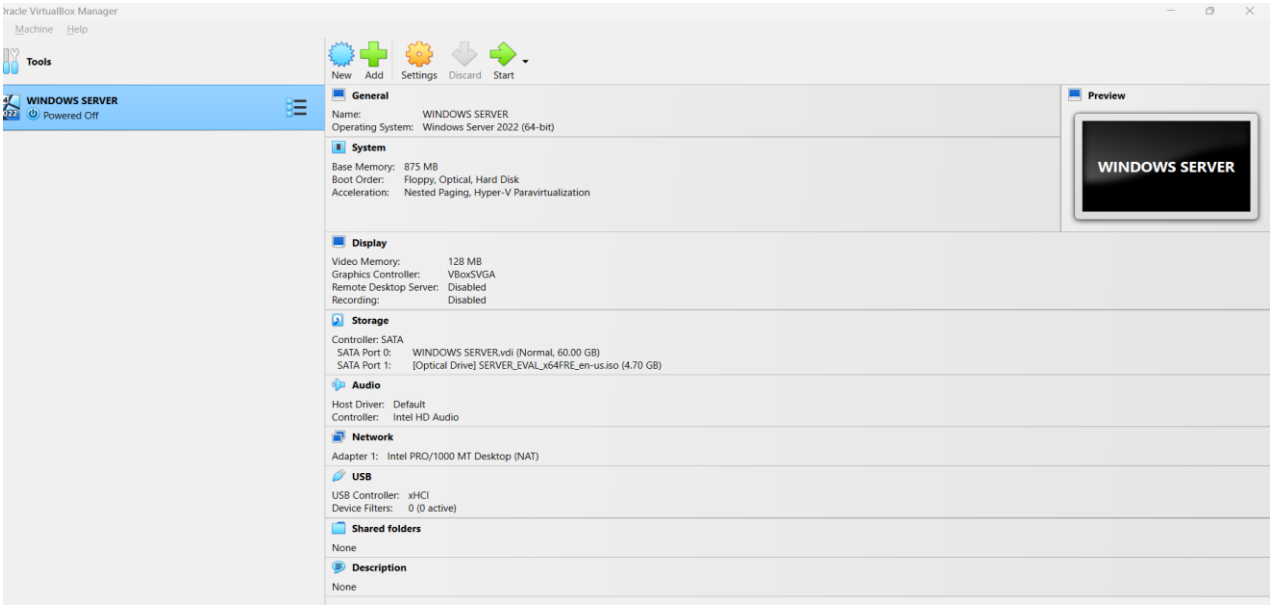
Tick the unattended installation, then click on hardware and adjust the base memory to 1024MB



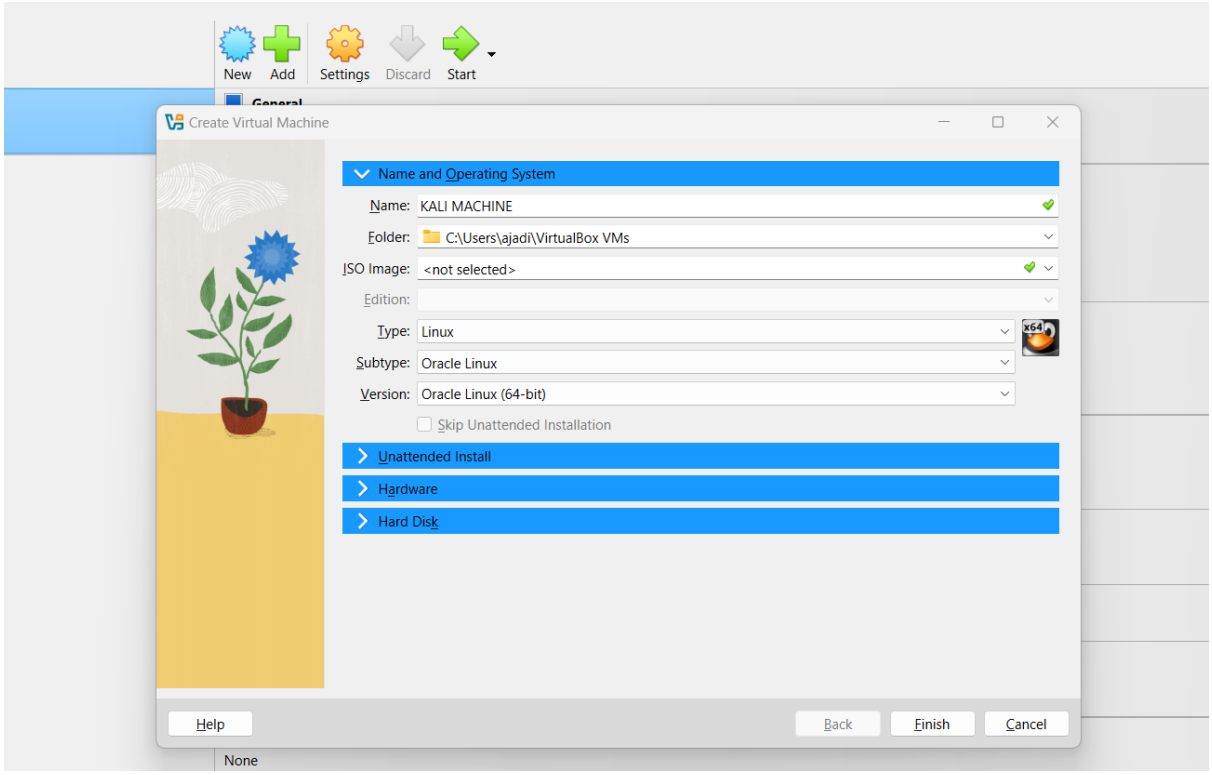
Then click on Finish

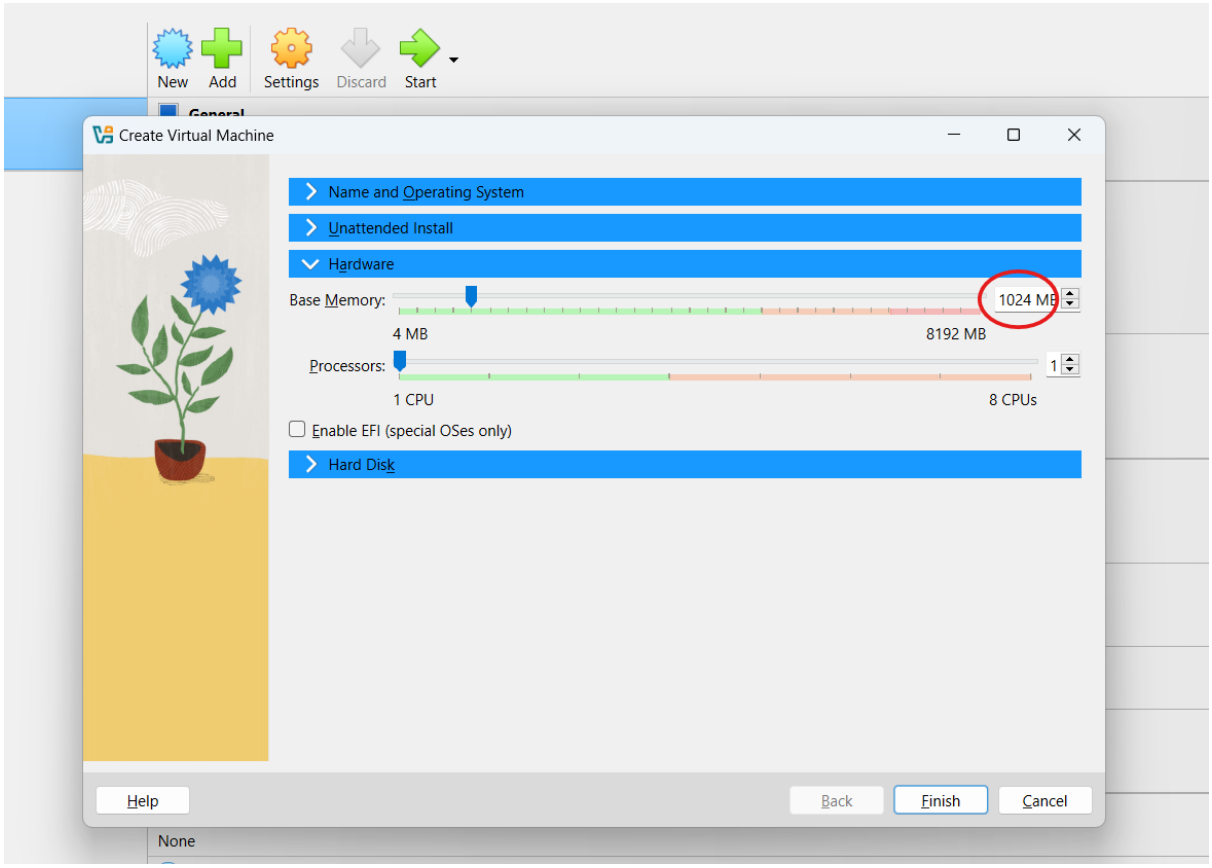


Now you will see WINDOWS SERVER listed on the VirtualBox dashboard/manager in the below diagram. Before we start the VM we can modify the settings of the VM if we want or you might want to assign more processors or change the networking adapters.

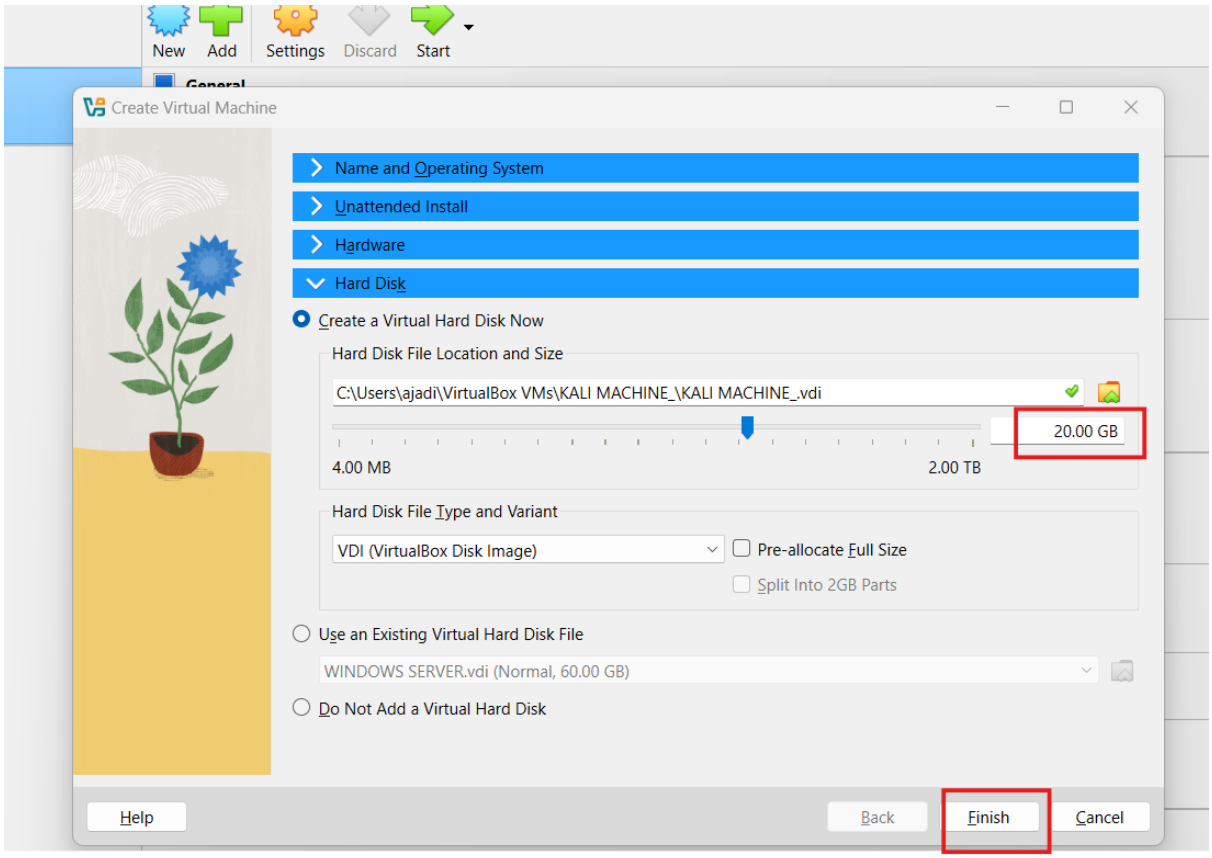


Next,
we mount the Kali Linus onto the VM and name it kali machine follow the same step as you mount the windows server. Here is the link : [kali-linux-2025.1c-virtualbox-amd64.7z]

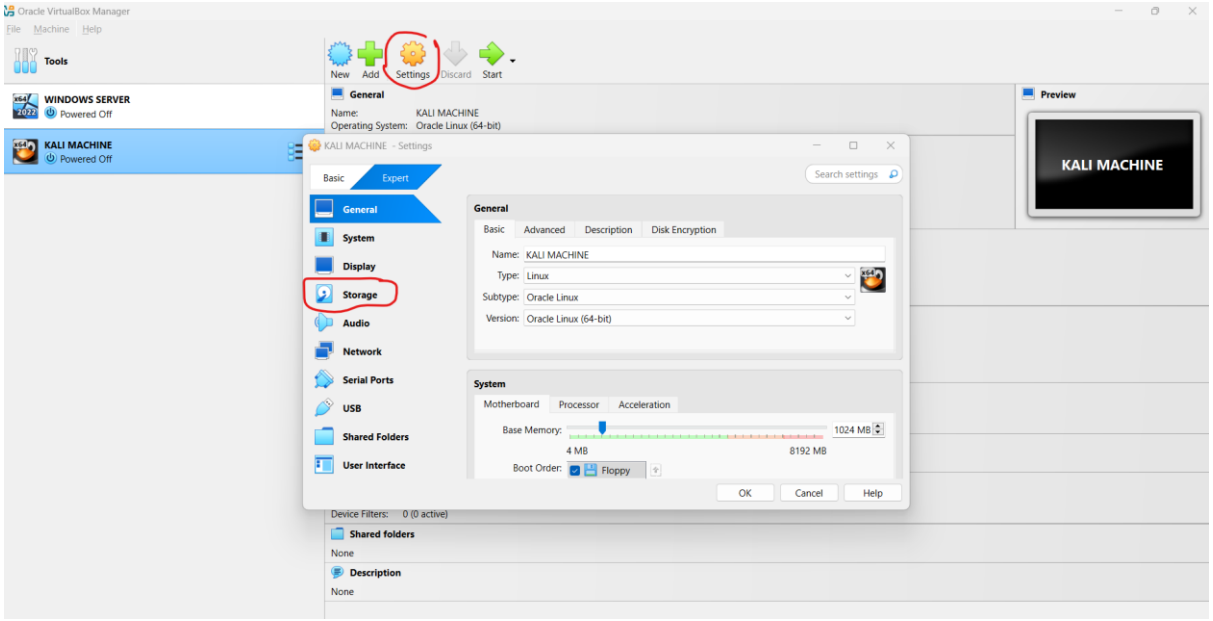




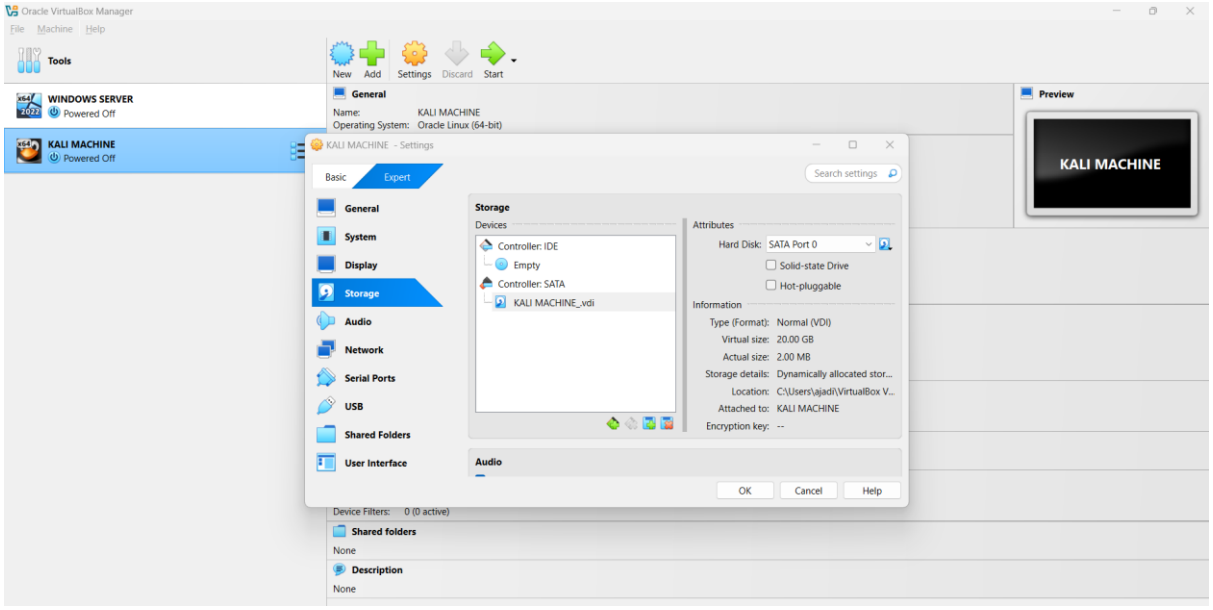
Adjust the base memory as you wish and the CPU.

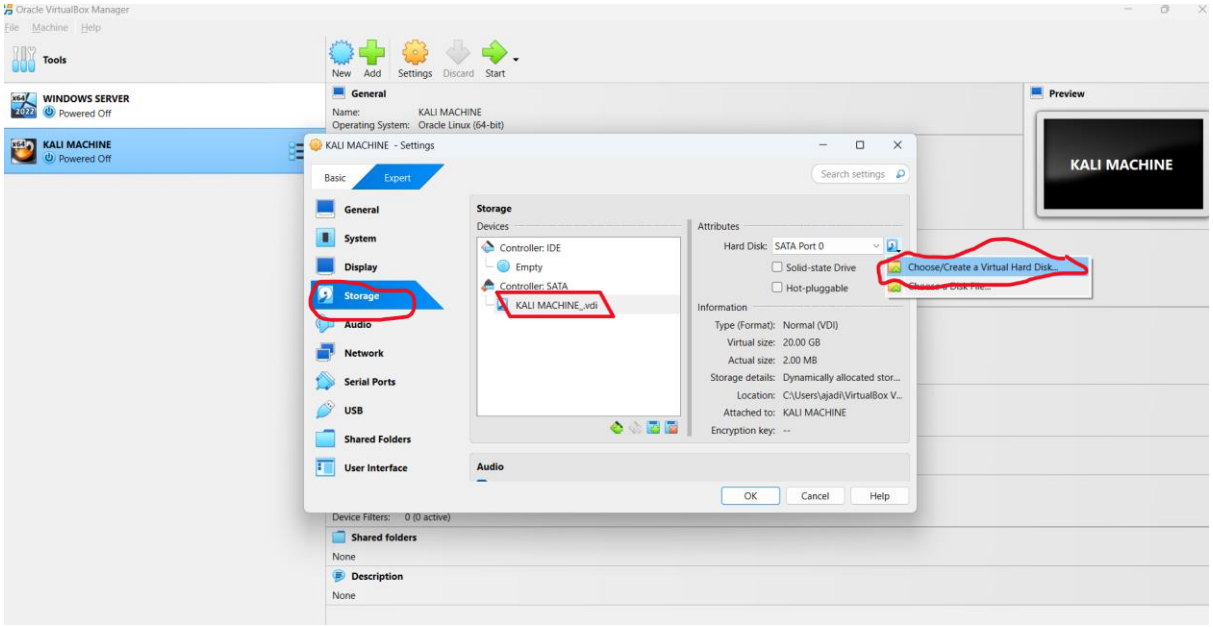

New
Add
Settings
Discard
Start
Create Virtual Machine
Name and Operating System
Unattended Install
Hardware
Hard Disk
Create a Virtual Hard Disk Now
Hard Disk File Location and Size
C:\Users\ajadi\VirtualBox VMs\KALI MACHINE_\KALI MACHINE_.vdi
20.00 GB
4.00 MB
2.00 TB
Hard Disk File Type and Variant
VDI (VirtualBox Disk Image)
Pre-allocate Full Size
Split Into 2GB Parts
Use an Existing Virtual Hard Disk File
WINDOWS SERVER.vdi (Normal, 60.00 GB)
Do Not Add a Virtual Hard Disk
Help
Back
Finish
Cancel

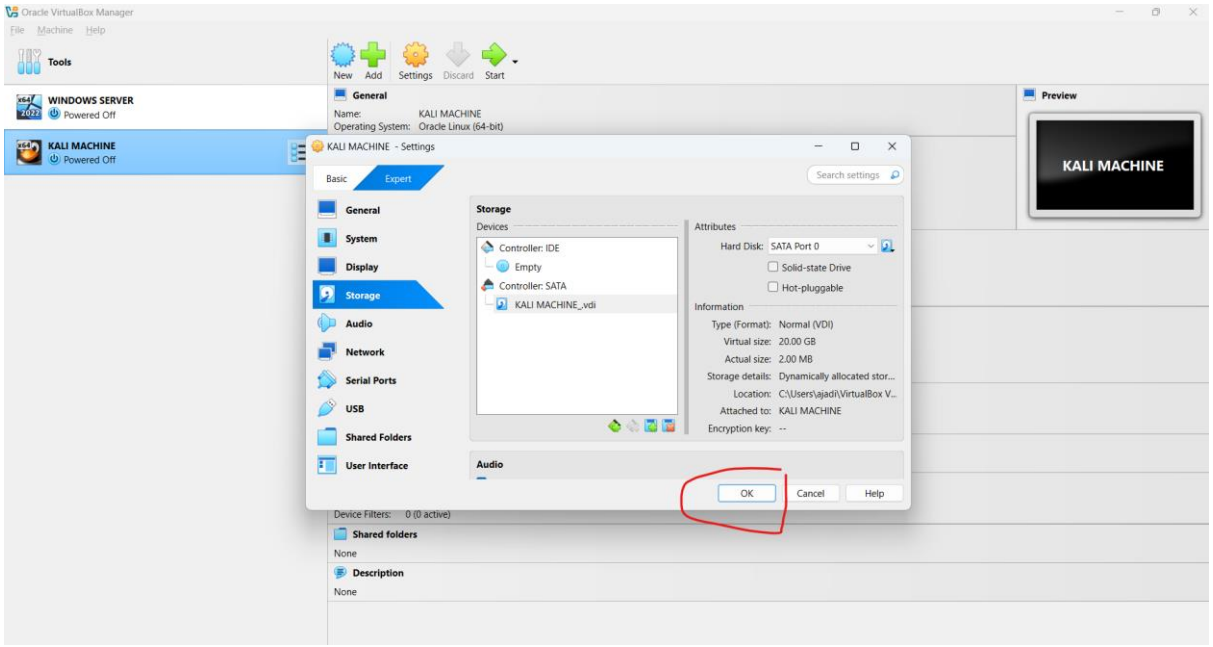
Oracle VirtualBox Manager
File
Machine
Help
Tools
New
Add
Settings
Discard
Start
WINDOWS SERVER
Powered Off
KALI MACHINE
Powered Off
General
Name: KALI MACHINE
Operating System: Oracle Linux (64-bit)
System
Base Memory: 1024 MB
Boot Order: Floppy, Optical, Hard Disk
Acceleration: Nested Paging, PAE/NX, KVM Paravirtualization
Preview
KALI MACHINE
Display
Video Memory: 16 MB



Follow the diagram

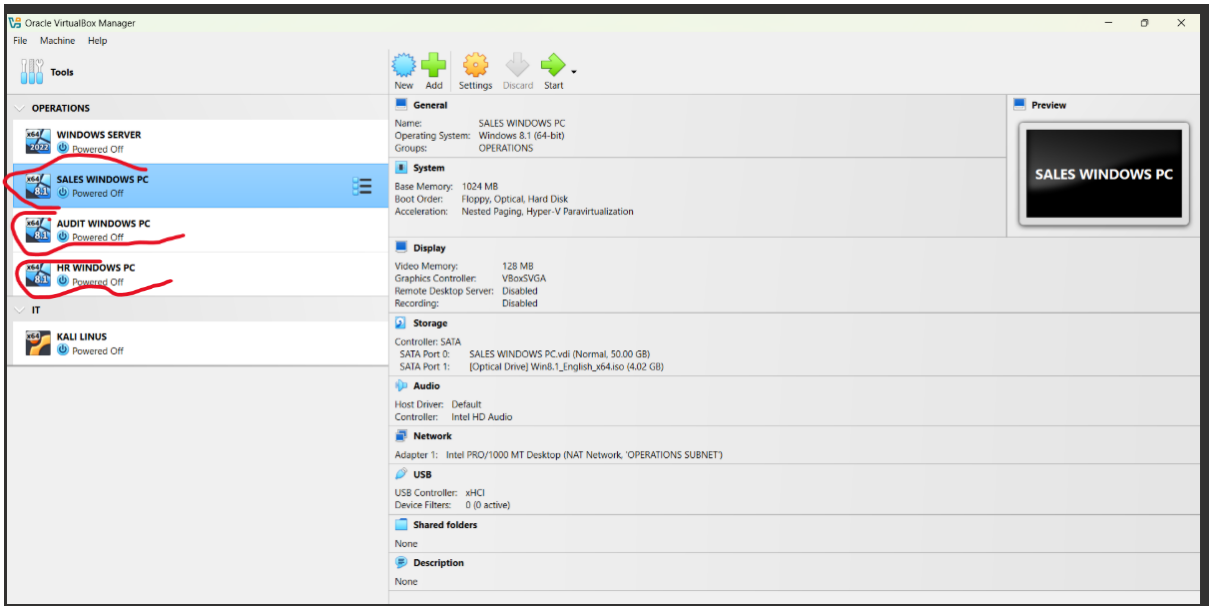






Next we need to mount WINDOWS 8 on our Virtual Machines. Here is the link:
[Download Windows 8.1 Update (KB2919355) from Official Microsoft Download Center]

Please follow the same process as the previous and below pic is what you will have



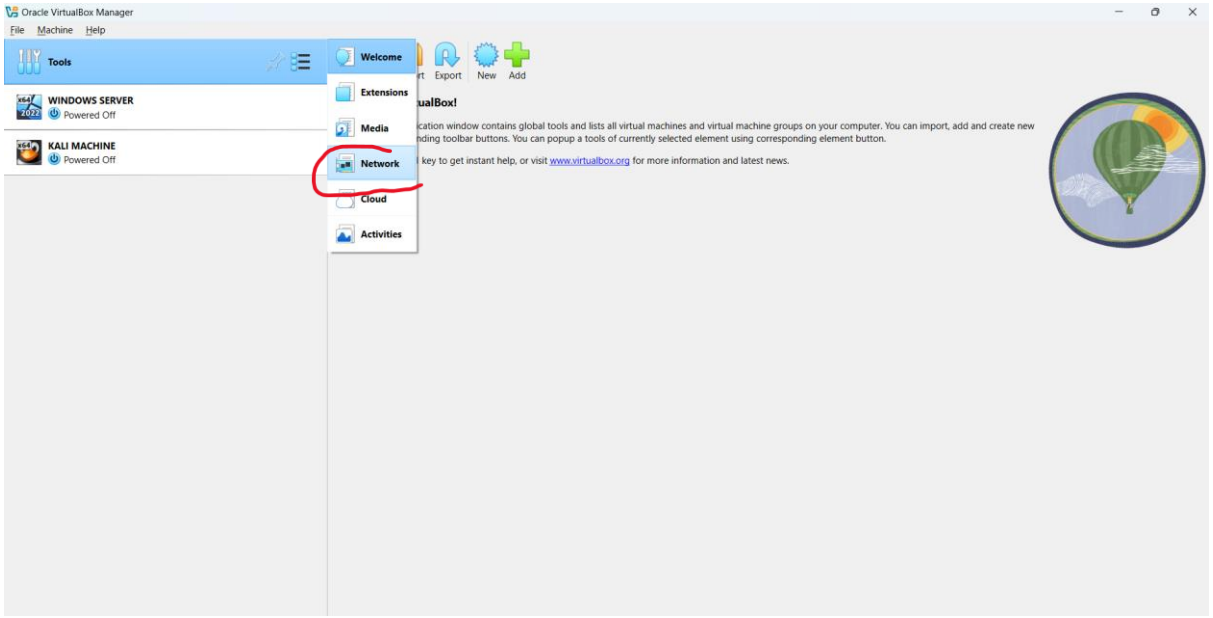
That's it installing virtual systems.

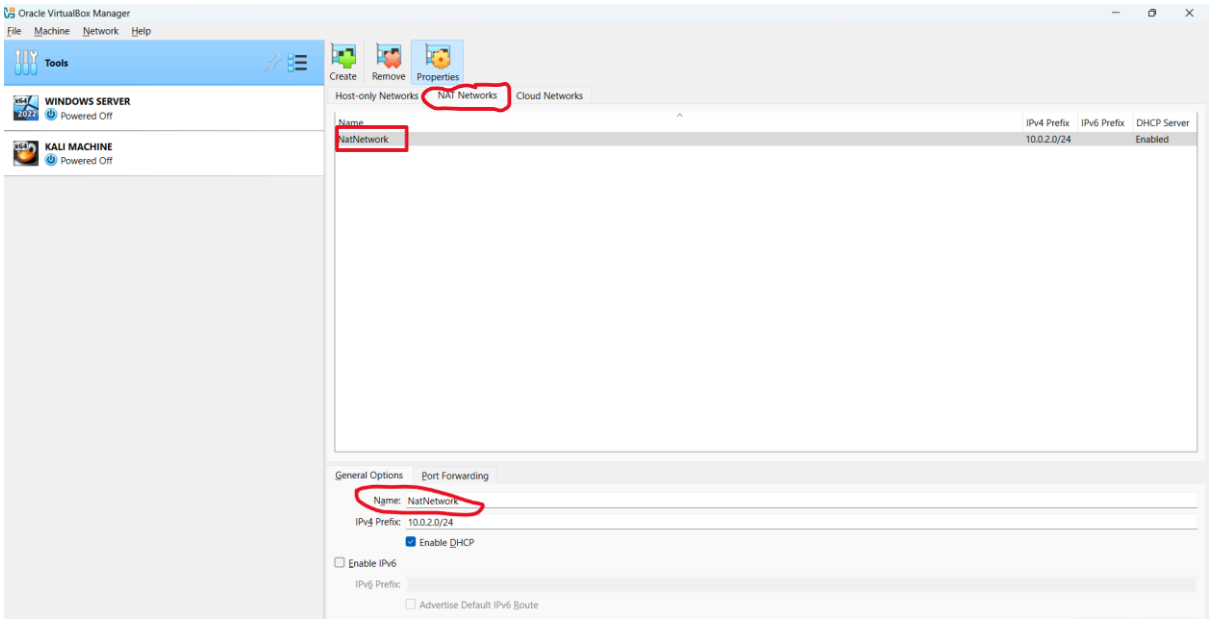
Below is the explanation of how to mount them on the same network.

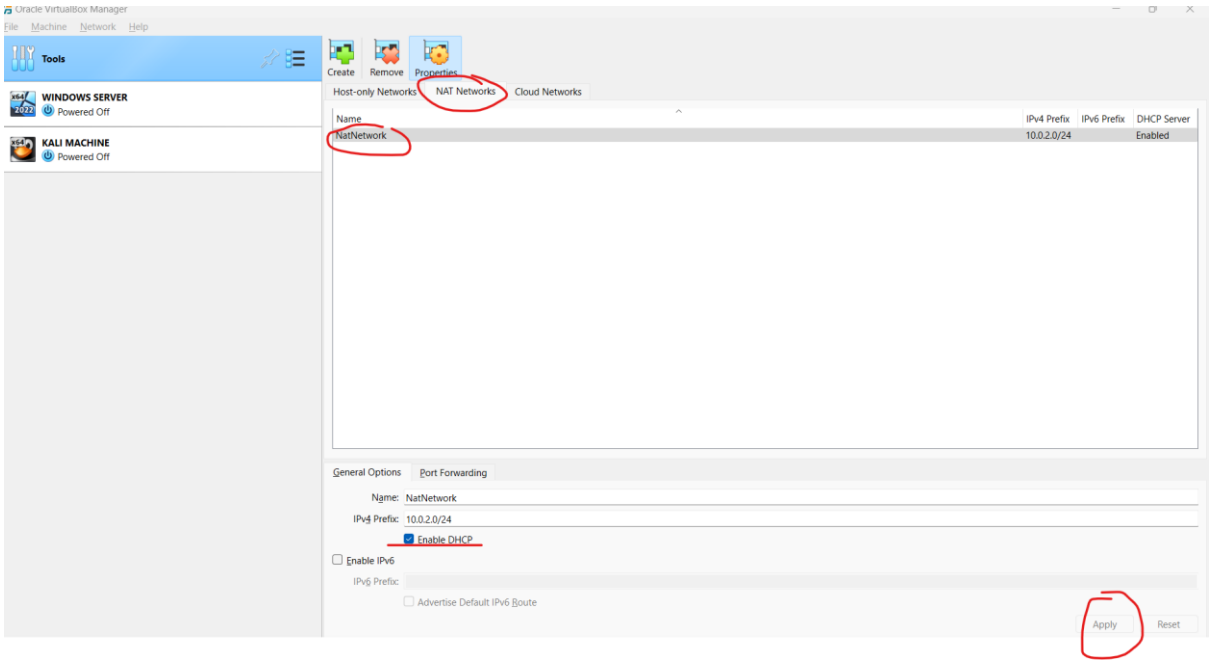
Creating a Virtual Network with VirtualBox

Virtual Networks allow you to connect your VMs to whatever you want.

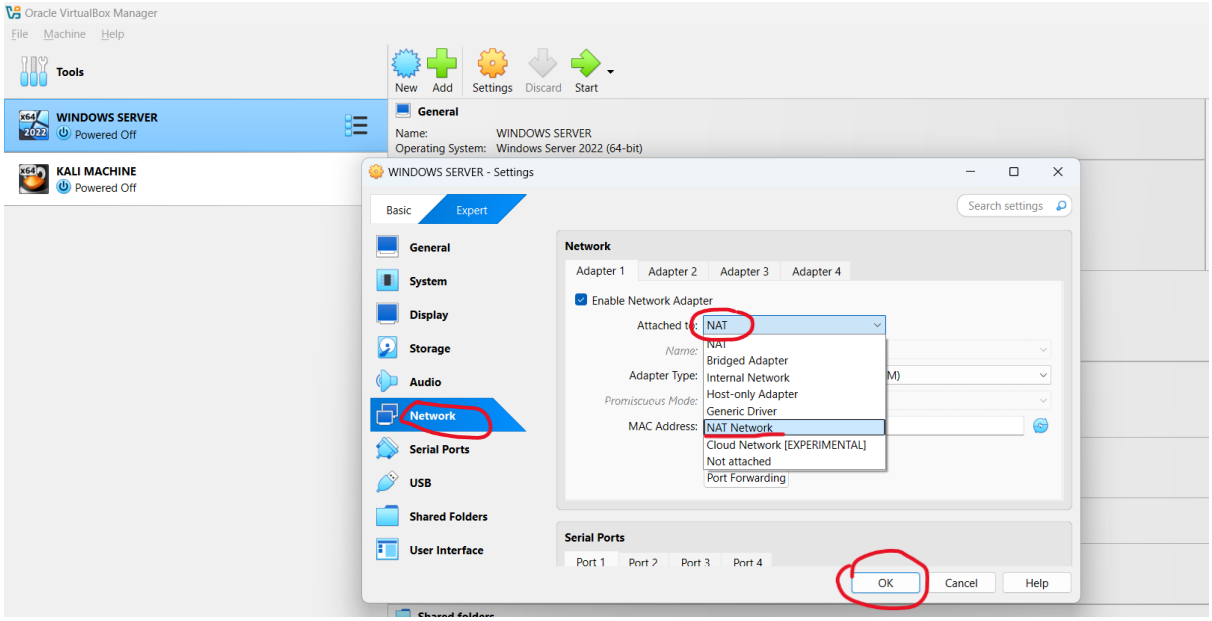
There is different network type however in this project we are creating a NAT network type – you will see different types of networks as we go along but our focus is NAT network. Only use this type if your lab will only have one VM.



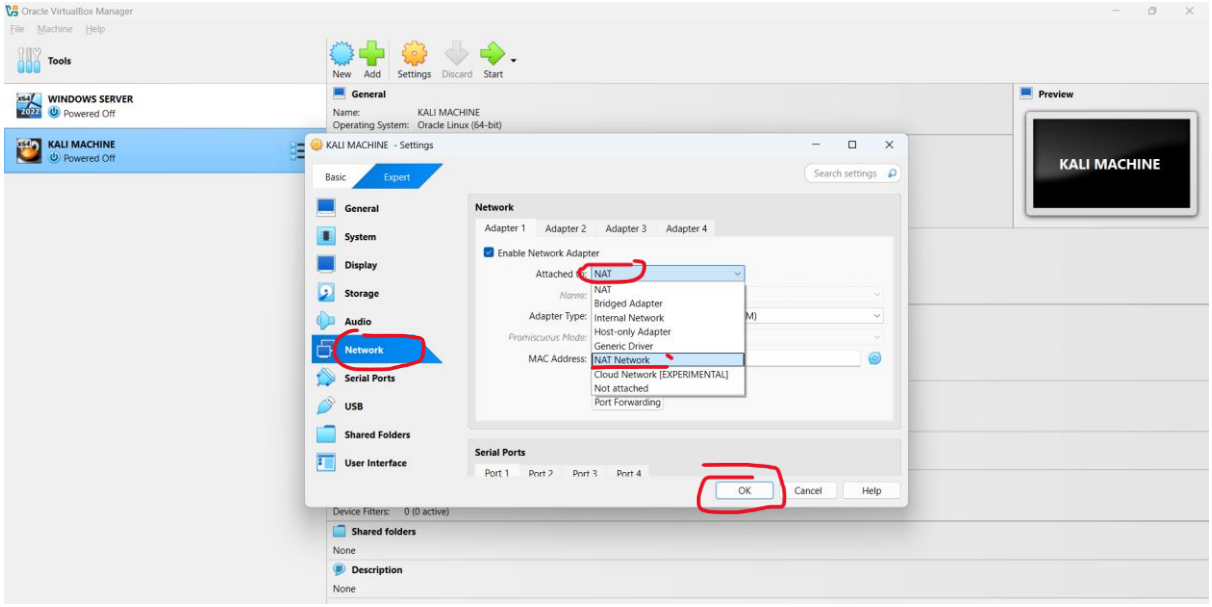


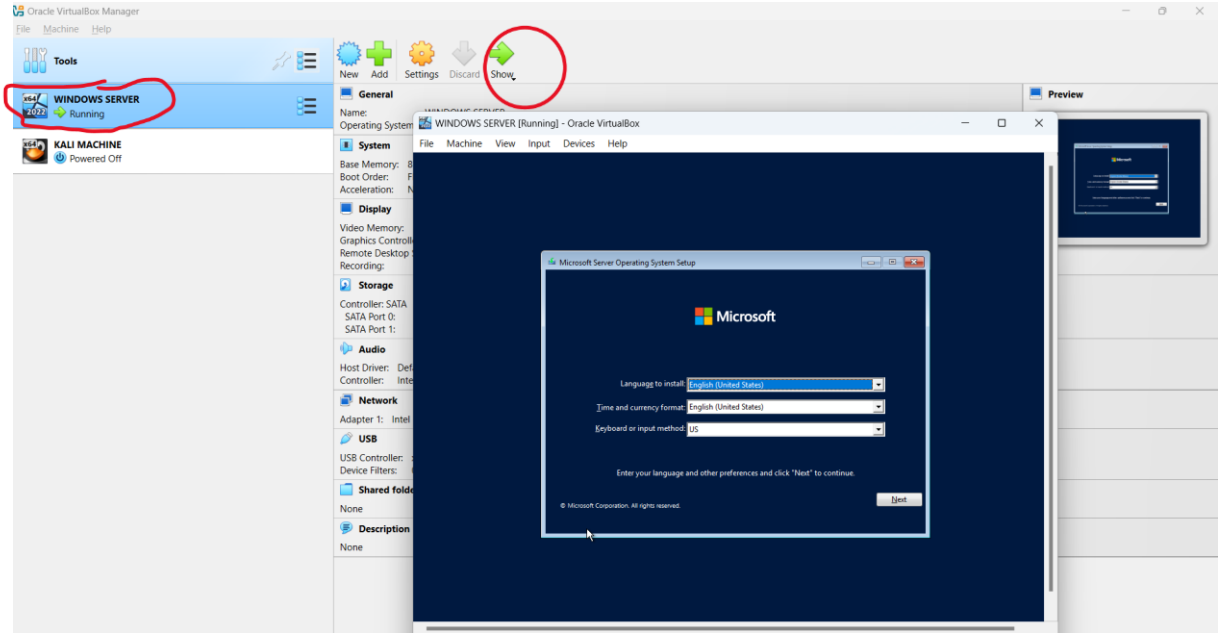


Configure the Networking tab for your chosen network type for all your VMs. Again, the easiest solution is to create and use a NAT Network.



Same for Kali machine and all the windows 8





Now you can run through your OS installation and complete your virtual home lab setup. That's it and hope this help someone!