

University of Wales
Trinity Saint David
BIRMINGHAM

MODULE: Network and Operating System and Services

ASSIGNMENT: Component 1 Research, Build and Deploy a Virtualised Enterprise Network

CODE: ACCA5023

STUDENT: Joaquin Alexander

SURNAME: Canales Garcia

ID: 2427434

LECTURER: Md Abrar Jahin Almazi Bipon

SUBMISSION: 25/02/2026

Contents

TASK 1 RESEARCH REPORT 3

Hypervisor: 3

IP Addressing: 5

Routing: 6

Network Services: 6

TASK 2 TECHNICAL DOCUMENTATION 7

Scenario 7

VIRTUAL BOX 9

WINDOWS SERVER 2022 11

WINDOWS CLIENT 18

DEBIAN CLIENT 26

DEBIAN SERVER 28

TASK 3 PERSONAL & TECHNICAL REFLECTION 38

References 39

TASK 1 RESEARCH REPORT

Hypervisor:

Hypervisor
is a special software that gives the capability to create multiple virtual machines and run this machines on a single physical computer at the same time, we could say that is a manager that sits between the hardware and the operating system, making sure that each virtual machine gets CPU, memory, storage and network resources as needed without interfering with others.

Type 1
Is called bare metal hypervisor and this one run directly on the hardware. They are used in data centres and cloud platforms because they offer strong performance and security as an example we have Microsoft Hyper V, VMware ESXi and Xen.

Type 2
This kind of hypervisor is called hosted and run on top of a regular operating system, like an app. These are common for personal or development use, VirtualBox and VMware Workstation are the most common used.

Hypervisors are important because they make virtualization possible. And this means that better hardware use, easy system management, improved isolation between work loads and the flexibility to run different operating systems on the same machine they are also the backbone of the cloud computing services like Azure, AWS, and Google Cloud rely heavily on hypervisors to host millions of virtual machines.

In conclusion an hypervisor is a lightweight software that lets multiple virtual machines run on a single physical computer it sits between the hardware and the operating system dividing resources like CPU, memory, storage and network so each virtual machine has its own dedicate components, type one hypervisor run direct into the hardware which makes fast and secure these are used in data centres and cloud platforms, type two hypervisor run on top of a normal operating system, making easier to use for personal or development work.

Reflect on which hypervisor type is suitable for this topology (e.g., hosting the Windows Server 2022 and Debian Server) based on features, hardware requirements, advantages, scalability, security, and compatibility.

Reflection
Checking the information about the network that we are going to work with: two sites, mixed operating systems, Windows server 2022 and Debian, domain services and routing between subnets, the most suitable hypervisor type is type 1 bare metal.

Why type 1 hypervisor suits this topology

Performance and hardware efficiency.

Both servers in Birmingham (windows) and London (Debian) will run domain services, routing and authentication and possibly file or application roles and these workloads benefit from direct access to hardware, a type 1 runs directly on the host machine, minimizing overhead and giving each virtual machine more stable performance.

Security and insolation.

This topology spans two locations and includes cross site communications over a router link, type one hypervisors provide stronger isolation between virtual machines and the host, reducing the attack surface. This is especially important when hosting domain controllers or Linux servers that manage authentication and network services.

Scalability.

If the network grows with more clients and additional servers or new services type one hypervisors can scale cleanly and we can add more virtual machines allocate resources dynamically and cluster host for high availability.

Compatibility.

Windows Server 2022 and Debian run smoothly on all major type 1 hypervisors, type 2 hypervisors like VirtualBox are better suited for labs or personal testing, not production style topologies.

Enterprise Features.

Snapshots live migration, virtual networking, VLANs, and failover clustering are standard in type 1 platforms, and this is ideal for multi-site environments.

Enhanced Topology

If we take an enhance topology that means multiple subnets, cross site routing, mixed OS servers and the likelihood of future expansion type 1 hypervisor become the best option because is stronger and the enhanced design increases the demands on performance, insolation and manageability and a bare metal platform is built for this.

Type 1 hypervisor is the best option in real life but for educational purpose of this assignment we are going to use type 2 hypervisor.

IP Addressing:

Ip addressing is how data moves around the internet, during the group activity we discussed that when one computer sends data to another, the information is broken into packets and each packet contains a source IP address and a destination IP address letting routers to forward it across multiple networks until this information reaches the correct device, without IP address, the internet would have no way to identify where data originates or where it should be delivered.

IPv4 address uses 32-bit structures, and it is written in doted decimal format.

(192.168.1.10)

IPv6 introduces to address IPv4 exhaustion, uses a 128-bit hexadecimal format.

(2001:0db8:84a2::9a1e:0260:6344)

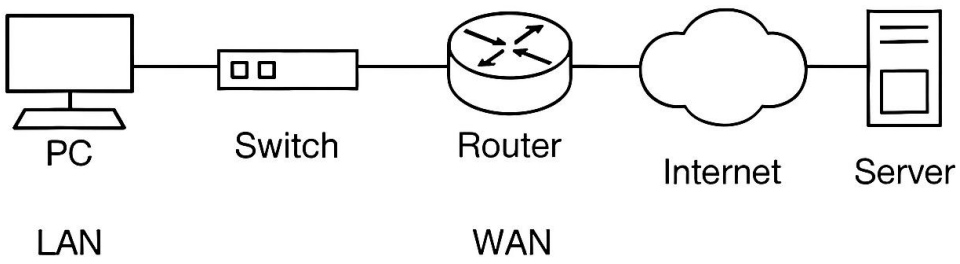
Offering a vastly group of more unique addresses and improved routing efficiency.

Subnetting allows networks to be divided into smaller segments:

Network: 192.168.1.0/24
Subnet 1: 192.168.1.0/26
Subnet 2: 192.168.1.64/26

This improves security, reduces broadcasting traffic and ensures efficiency using IP space.

Routers use IP addresses to forward packets between networks, while switches operate within a single network using MAC addresses, togethers they ensure smooth data flow across local and global networks.



IP addressing enables identification, routing, subnetting and scalability making modern networking functional and reliable.

Routing:

Routing protocols determinate how data packets travel across the network, they ensure efficient delivery by selecting optimal paths based on metrics like hop count, bandwidth or latency. Static routing involves manually configuration paths that remains in fixed unless is updated by an administrator. Its secure and predictable but lacks adaptability. Dynamic routing uses protocols like OSPF, EIGRP or BGP to automatically adjust routes in response to network changes.

Routers act like traffic controllers; they forward packets based on IP addresses and routing tables. Switches operate within local networks, directing traffic using MAC addresses.in our topology Debian server acts as a DHCP relay, forwarding IP requests across subnets, while Windows Server 2022 likely handles domain services.
Given to this set up static routing may suit the topology simplicity and predictability, specially if the network is stable and centrally managed. However, if scalability or fault tolerance is a priority, dynamic routing offers better resilience and automation.

Summarize your understanding of routing protocols, focusing on their purpose, how they operate, and the differences between static and dynamic routing.

Reflect on which routing approach suits the topology's setup, considering the Debian Server's role as a DHCP Relay and the Windows Server's connectivity.

Network Services:

Making research on network services is clear that modern network services such as VPNs, DHCP, AD DS, and Certificate Authorities work together to create a secure, scalable and well managed infrastructure. Rather than viewing these services in insolation, researchers increasingly emphasise their interdependence. VPN technologies are now expected to integrate seamlessly with identity services, using certificate-based authentication to strengthen remote access security this shift highlights a broader trend: organisations are moving away from password centric models toward identity driven architectures.

DHCP, although often seen as a basic service, plays a strategic role in maintaining consistency across distributed networks. Automated address allocations reduce configuration drift and support policy-based management which becomes essential when devices authenticate against AD DS actual studies argue that poorly governed DHCP scopes can undermine directory reliability, especially in hybrid environments where cloud and on premises identities coexist.

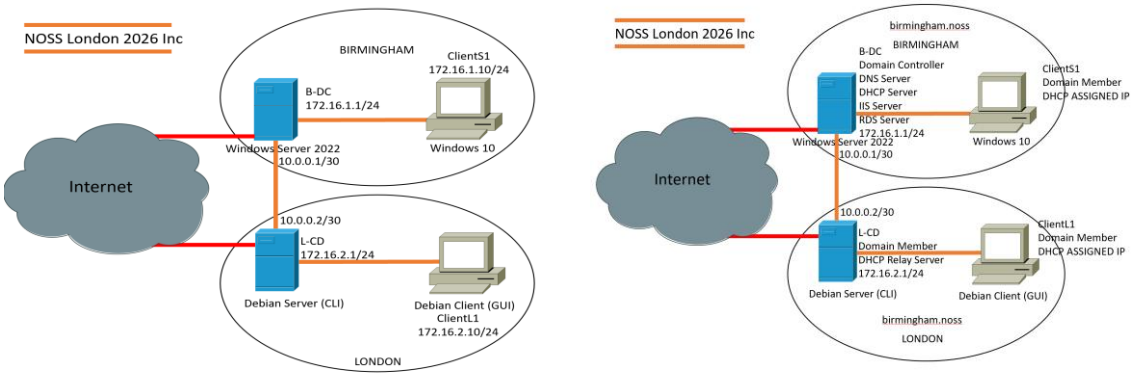
Active directory domain services remain central to enterprise identity management, but best practices now stress minimising privilege, insolating domain controllers, and enforcing certificate-based trust relationships. This is where certificate authorities become critical. A well-designed PKI underpins secure communication, device trust, and VPN authentication. However, literature warns that misconfigured Cas can introduce systemic vulnerabilities, make governance and audit essential components of PKI management.

Overall, all these services contribute to a cohesive security posture: DHCP ensures consistency, AD DS enforces identity, VPN extend secure access, and Cas provide cryptographic trust. Their effectiveness depends not only on configuration but on disciplined operational practices.

TASK 2 TECHNICAL DOCUMENTATION

Scenario

Assume, you have been hired as an IT Tech by a Multinational Corporation called NOSSLONDON2026. NOSSLONDON2026 operates currently at two locations: Birmingham and London. You are asked to do research and implement the network as given in the topology.



Topology Enhanced

Critical Details

Windows Server: Standard Desktop Version

System Configuration: Language: English US, Time Format: London UK

Username: Administrator

Password: NotebooK@123

Debian Server: CLI

Username: localadmin

Password: NotebooK@123

Complete the following tasks:

Research on the given topics

Build and deploy a virtual network based on the above topology

This is an Individual Task. This assessment comprises of both research and practical implementation. This task continues to the next coursework as well.

Research work:

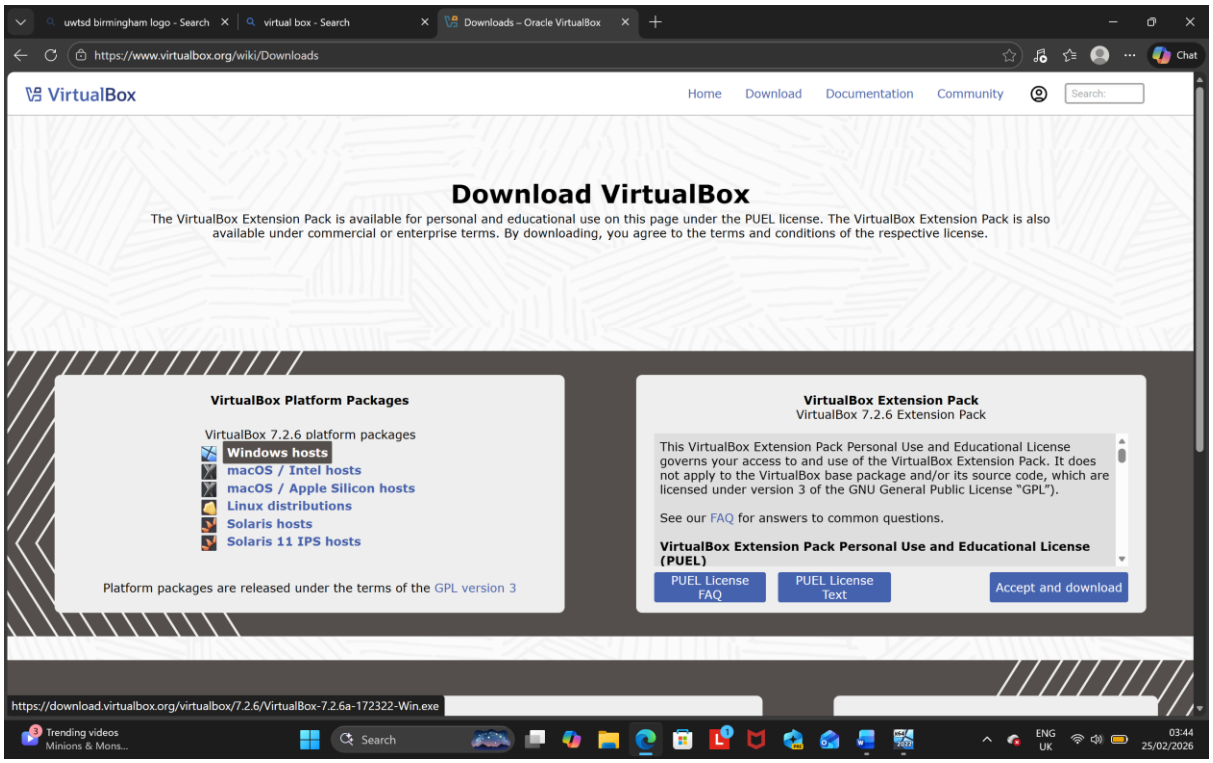
Use appropriate referencing style to in-text cite your research work.

Try to review recent academic/ industry credible literatures and reflect on your understanding on the concepts covering the areas requested by summarizing the topics given and writing critical appraisals.

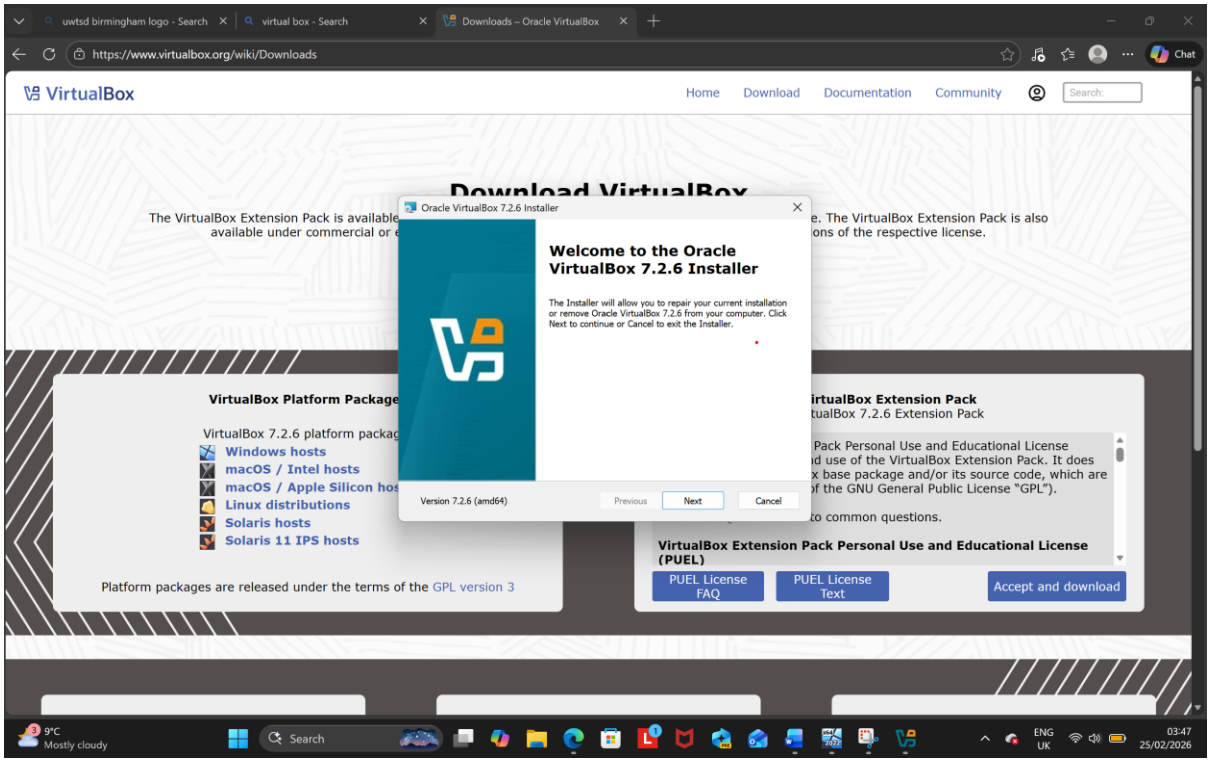
Don’t answer the research questions “what is what”.

Practical work: Complete the task and document it with necessary screenshots.

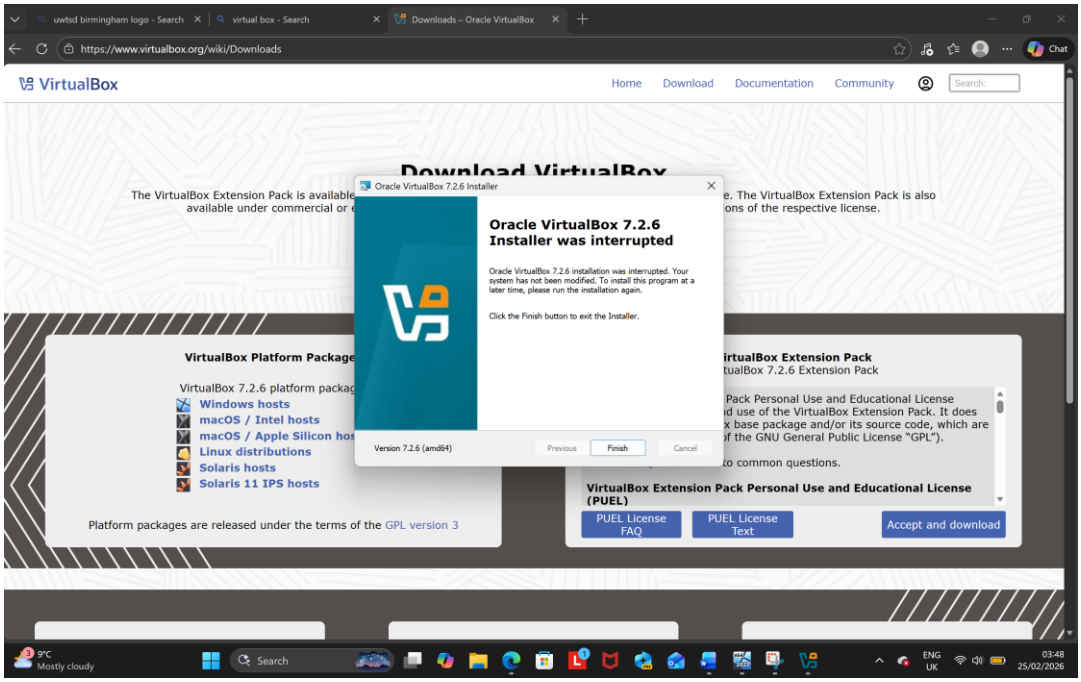
VIRTUAL BOX



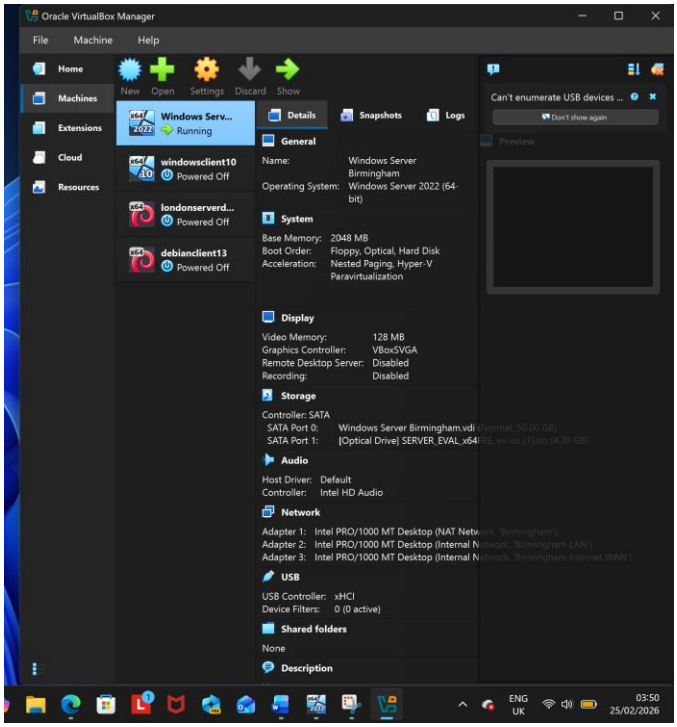
First we need to download virtual box and we can download on this site: Downloads – Oracle VirtualBox select windows host click and it will start to download the file after we need to install in the pc.



It will show us a small window with the option next to install.

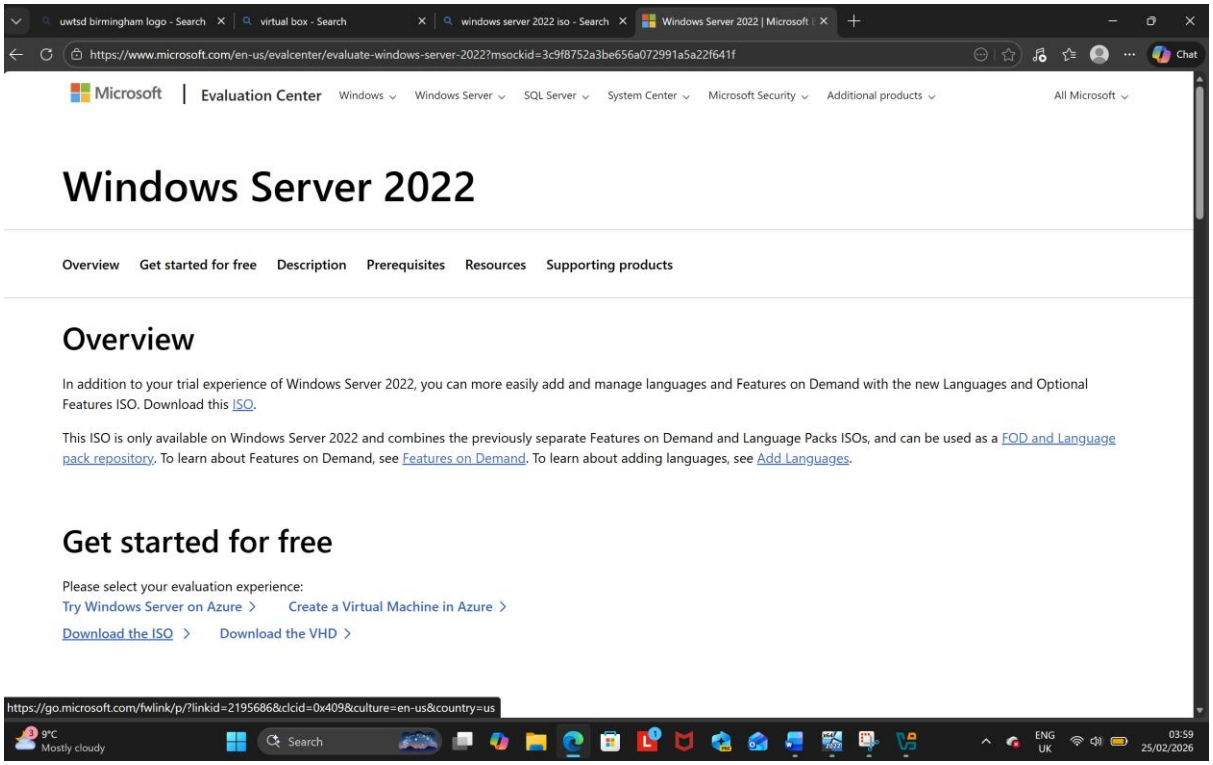


After that it will show that the installation is finished and we can open the program with double clik on the desktop icon of virtualbox.

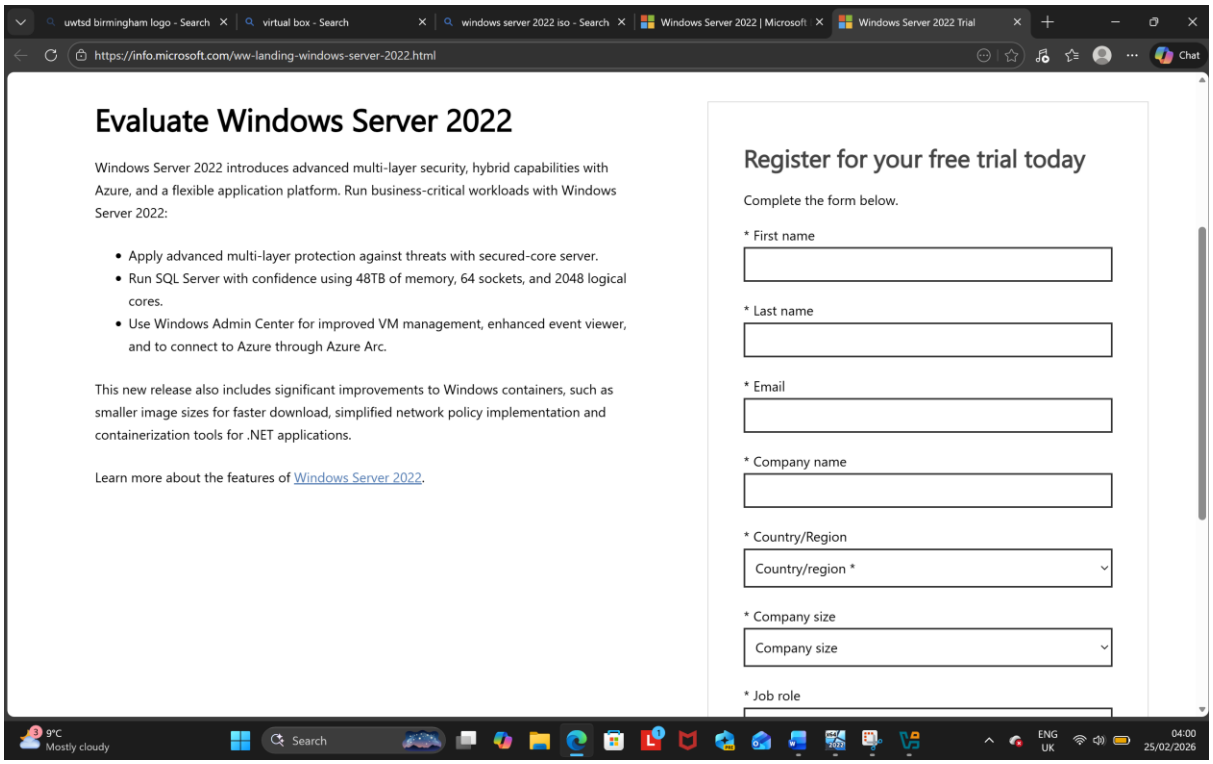


Virtualbox is a program that help us to create virtual machines inside your own computer and you can install different operating systems without affectingyour own computer, you can install Windows systems and macOS without buying a new laptop or pc, you can try and isntall different operating systems using them to work or surf on websites and if you have a problem with a virus it just only affect to the virtual machine not your own laptop, people that work in programing use this environment to try, run and check if his apps work well on different environments and systems before they launch his apps.

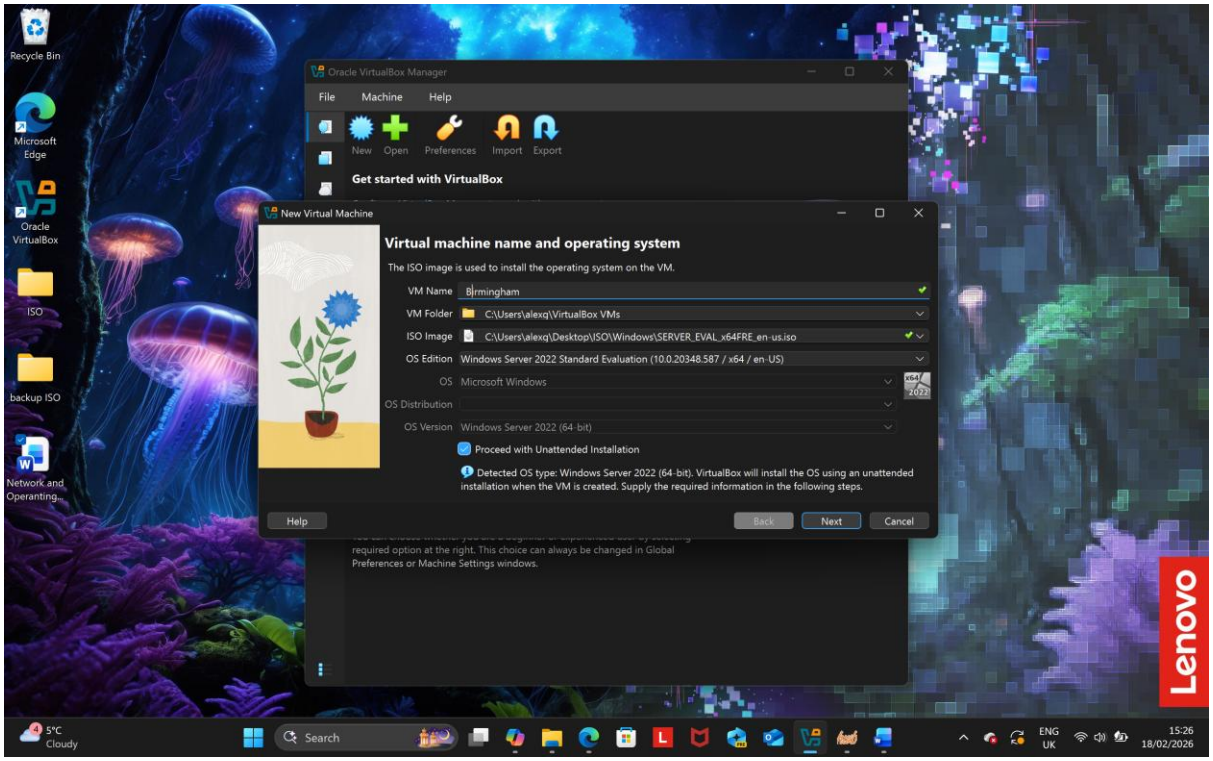
WINDOWS SERVER 2022



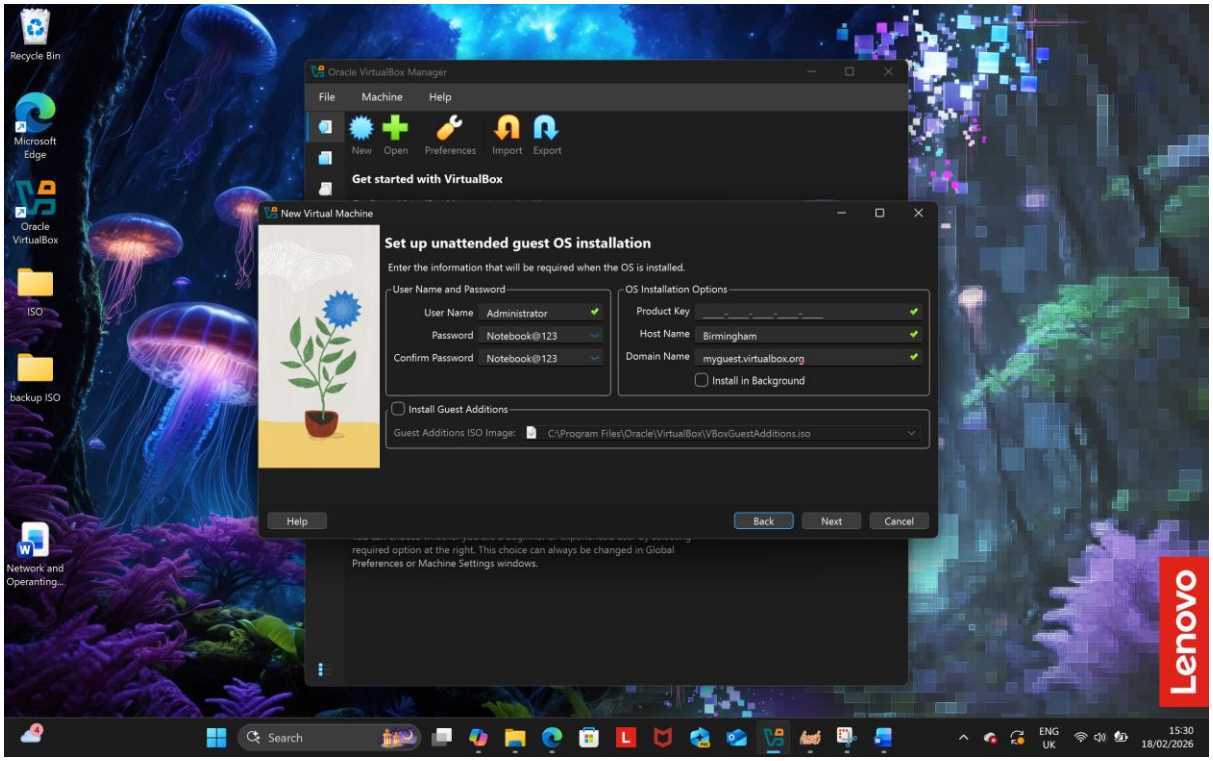
We will need windows server for this assignment and we download the ISO file direct from the website of windows : [Windows Server 2022 | Microsoft Evaluation Center] giving click on the iso file download.



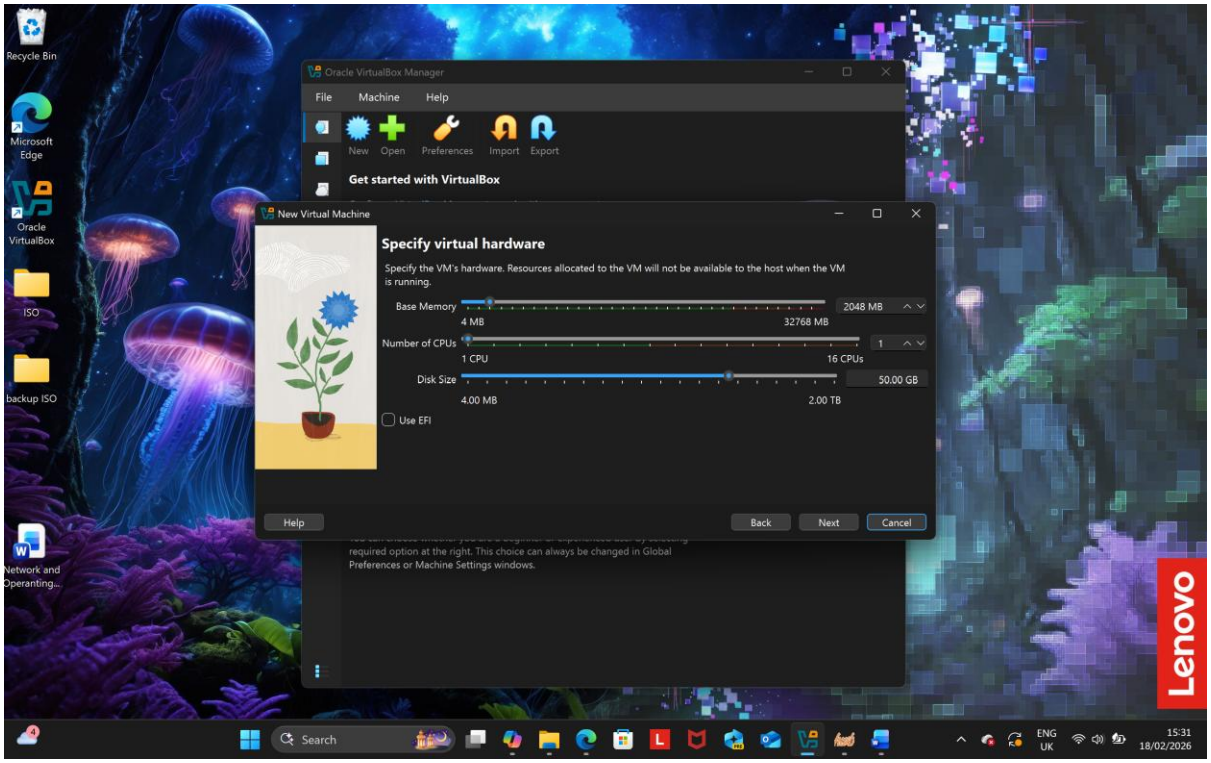
We need to fill a form and then it will start whith the download.



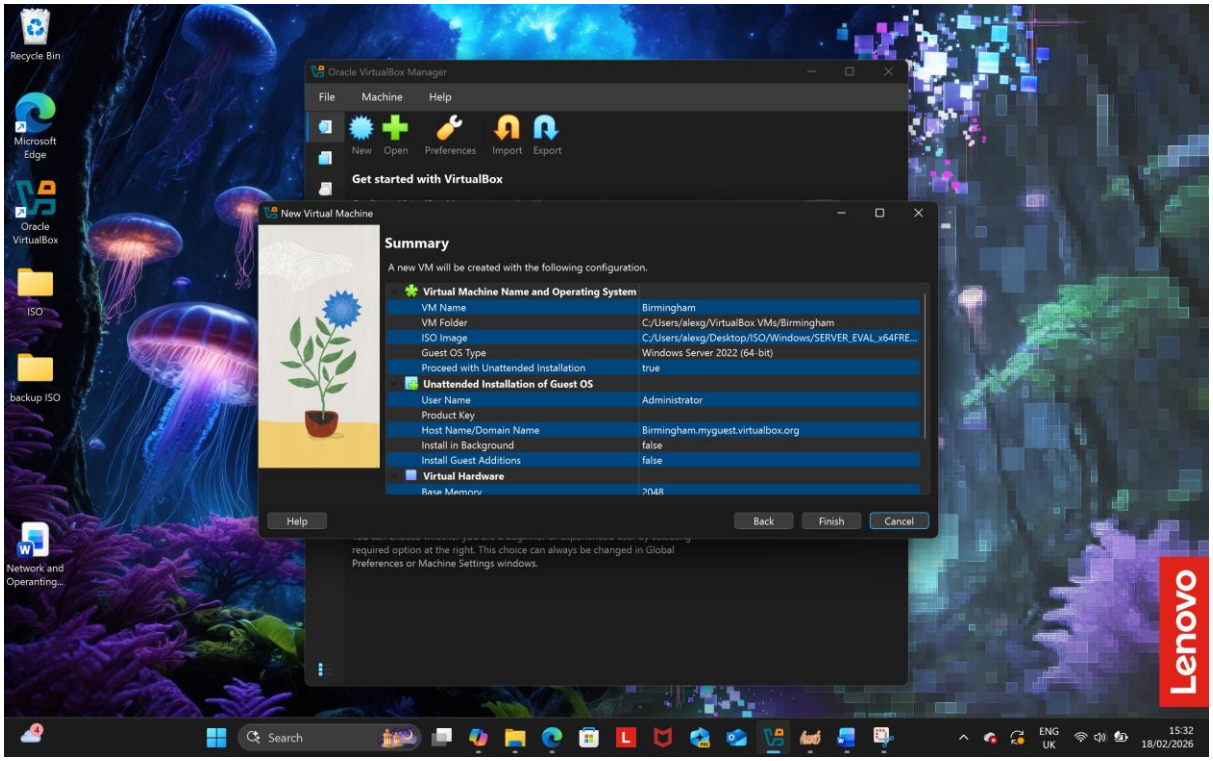
After we download the ISO file of windows server we are going to create the windows server virtual machine, first we need to click on new then it will show us the scheenshot where we need to asign a name of the virtual machine by default it shows a folder where the information is going to be saved and after that we need to choose the iso file that we are going to use to create this virtual machine and for that we are going to select the ISO file that we already have downloaded we need to click on next.



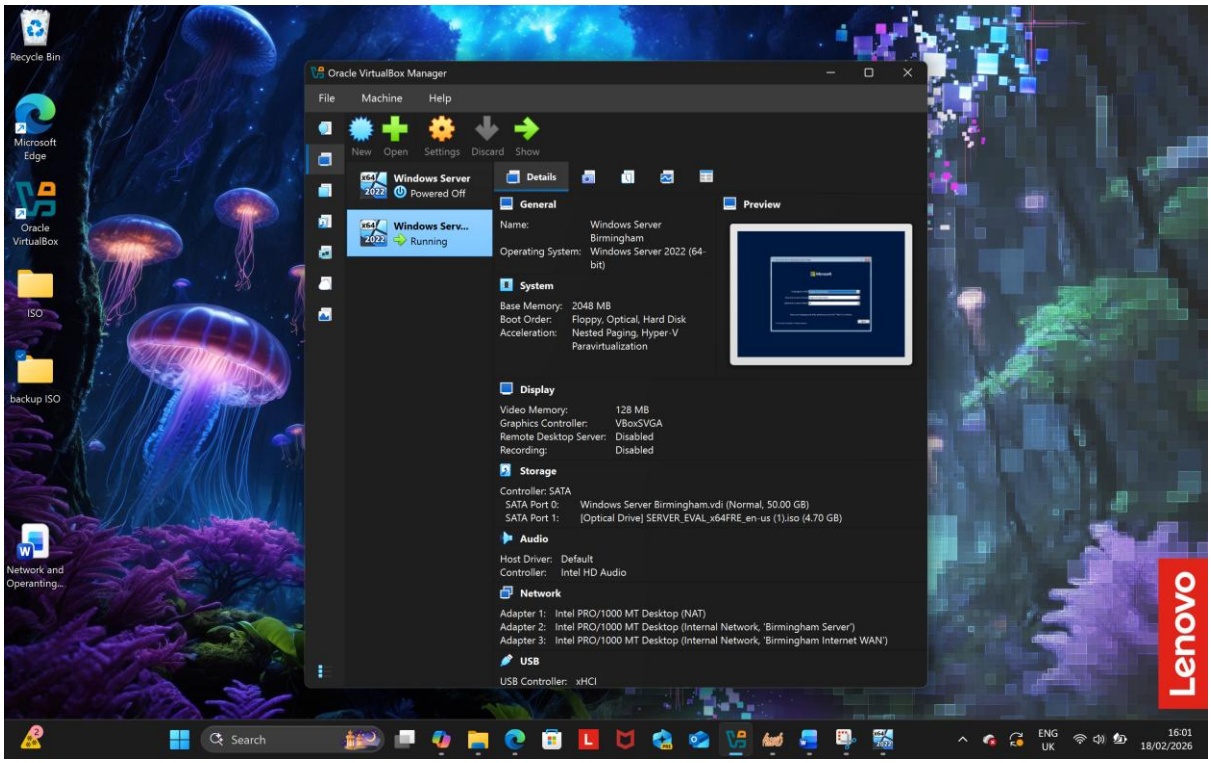
Now we need to create the user name and the password as a user name we write Administrator and for password Notebook@123 click on next.



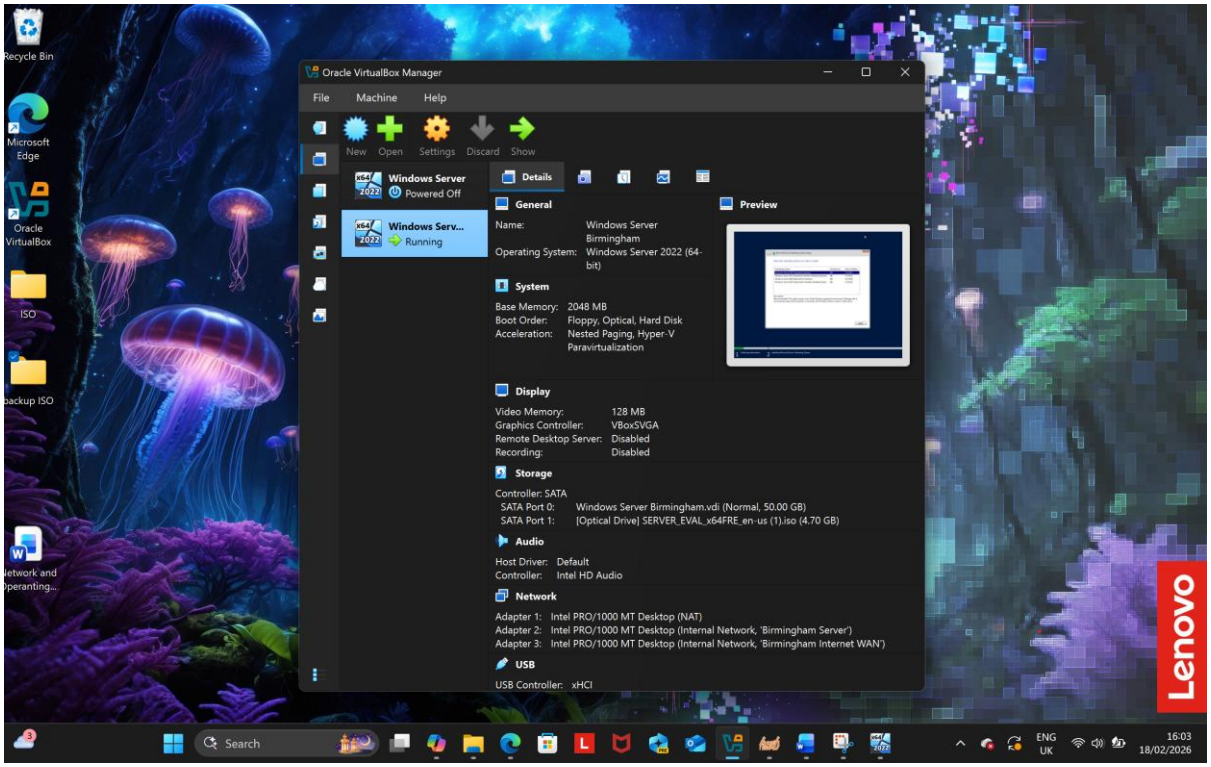
Now we are going to change the base memory number of cpus and disk size to run the program in this virtual machine we can add more or reduce depends of the system needs.



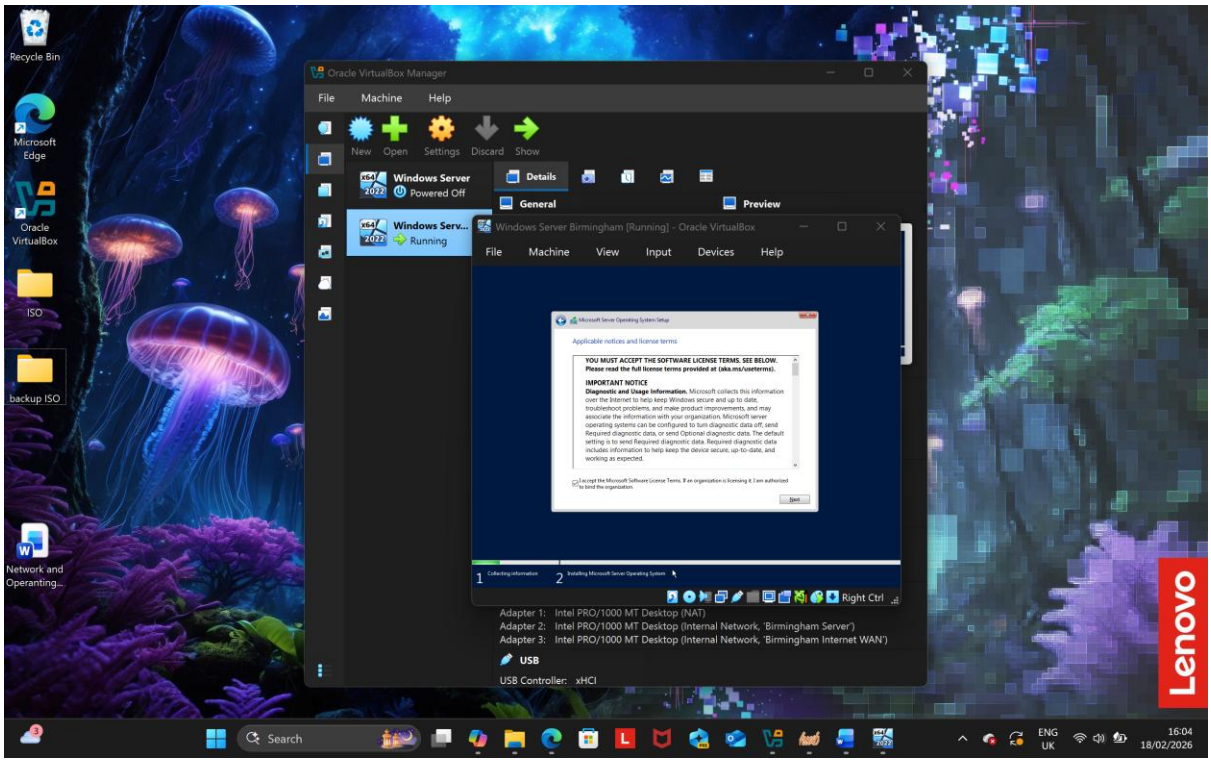
Now it will show the configuration that we already made on the system of this server that we are going to create with all the previous configuration that we already made.



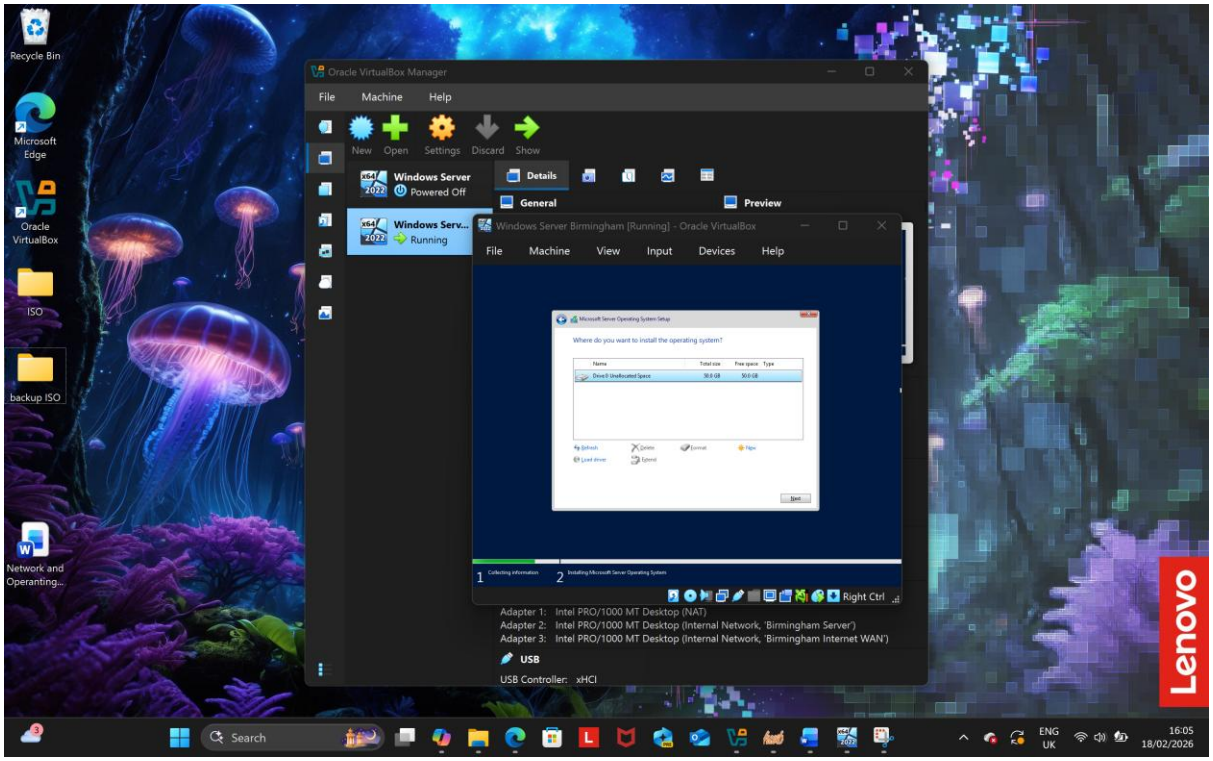
When we run this virtual machine it will use the ISO file to create the windows server machine inside virtualbox it will ask all the normal information when you install a normal windows server we will choose language country and many other settings.



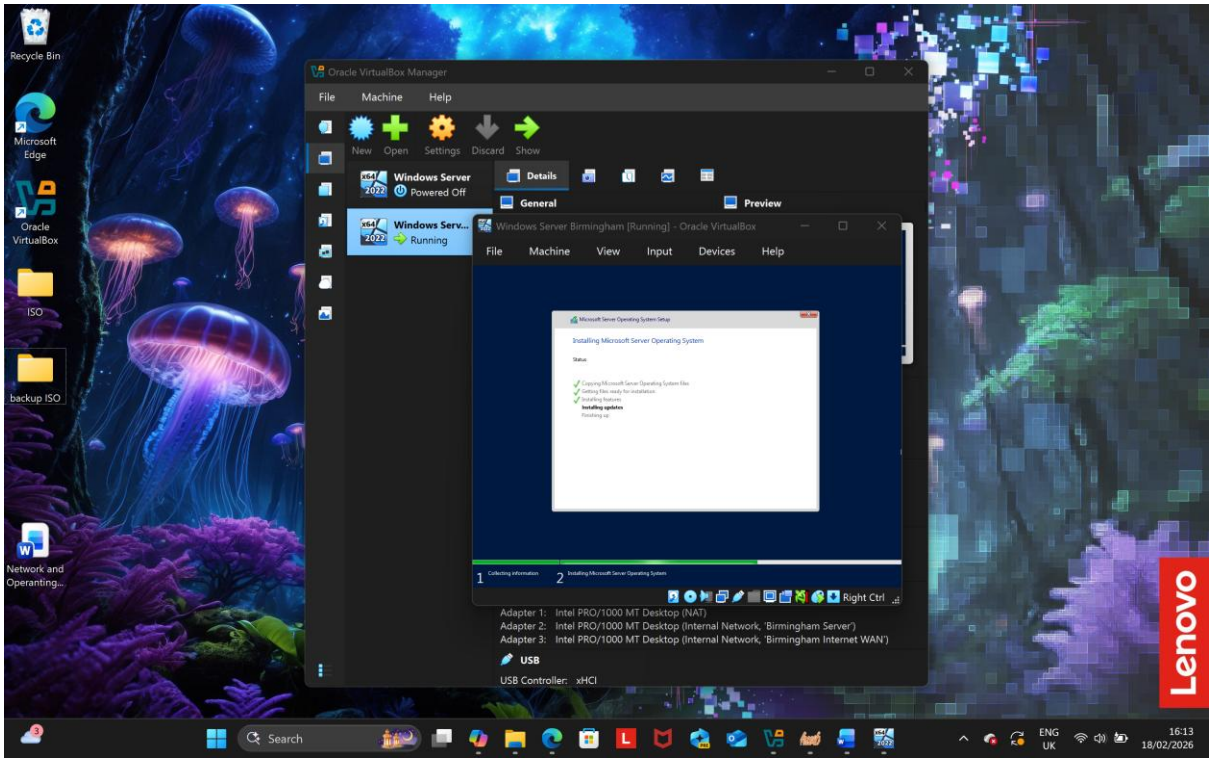
Operating system set up in this part it will ask what kind of windows server you want to install if is the full version or just a version that doesn't have all the configuration.



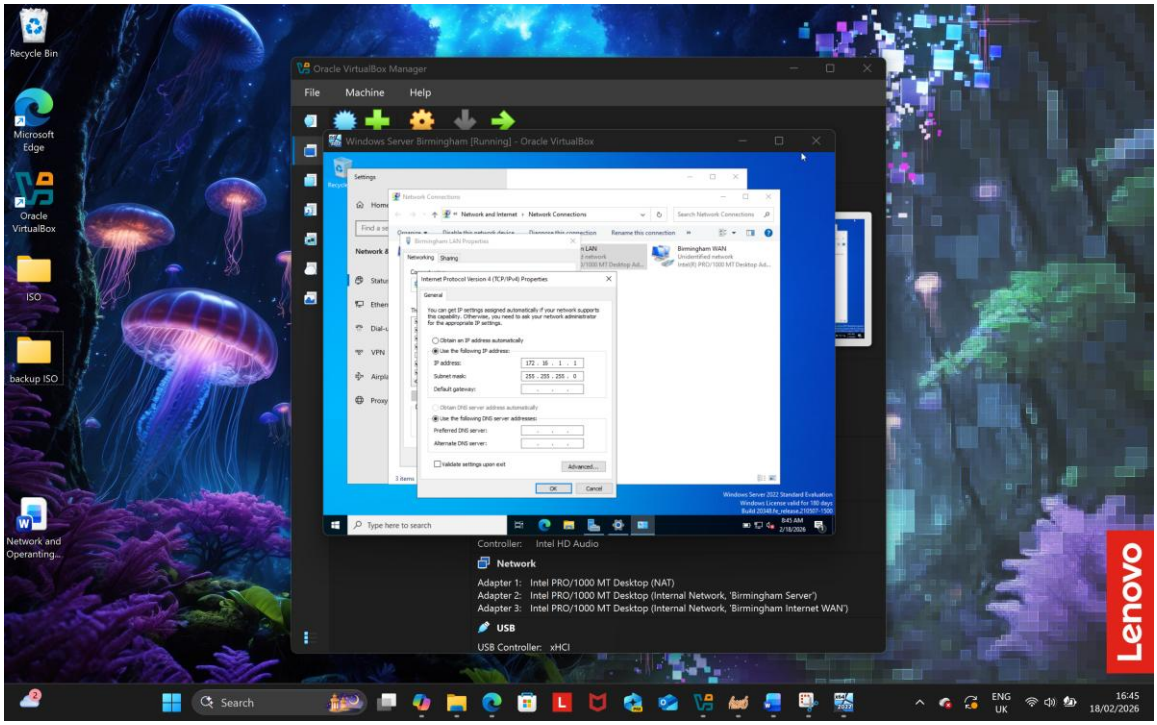
We will need to check the box of accepting terms and conditions next and we select custom installation.



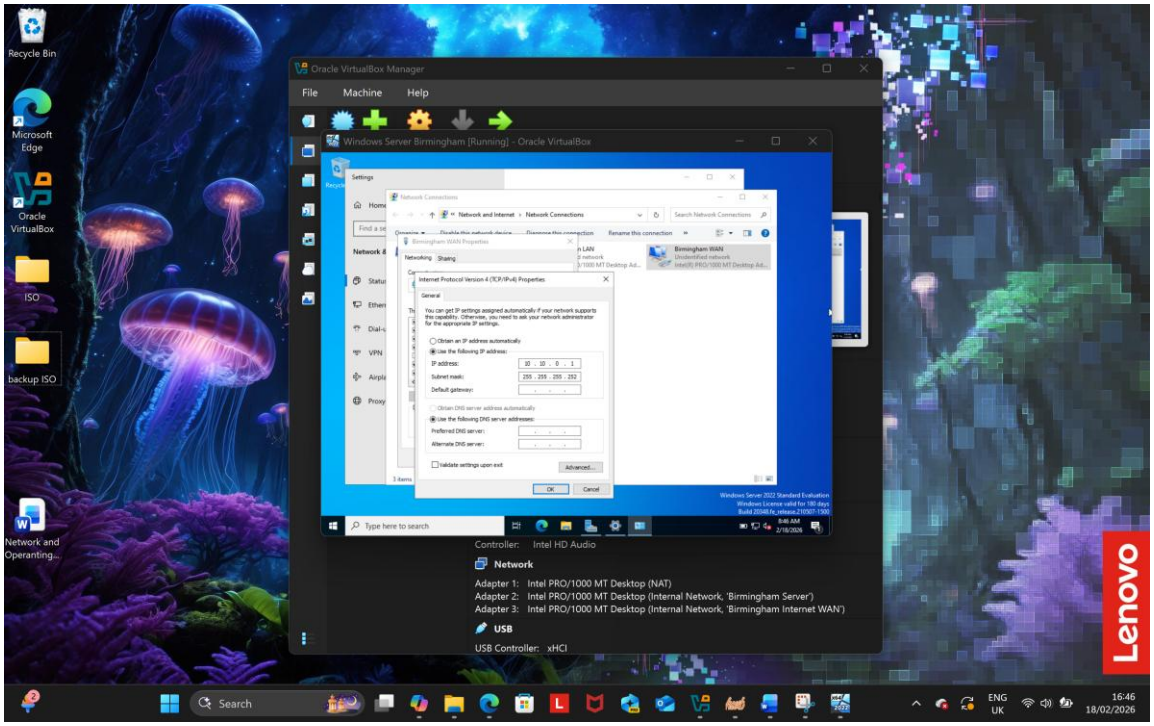
We choose where we are going to install the system it will appear different kind of disk or just one disk, it could be a partition or just a new disk we can choose where we want to install the system, then we click on next.



On this screenshot windows is Installing windows server 2022 and running different kind of process some of them are copying microsoft server operating system files, getting files ready for instalation, installing features, installing updates, and finishing up.

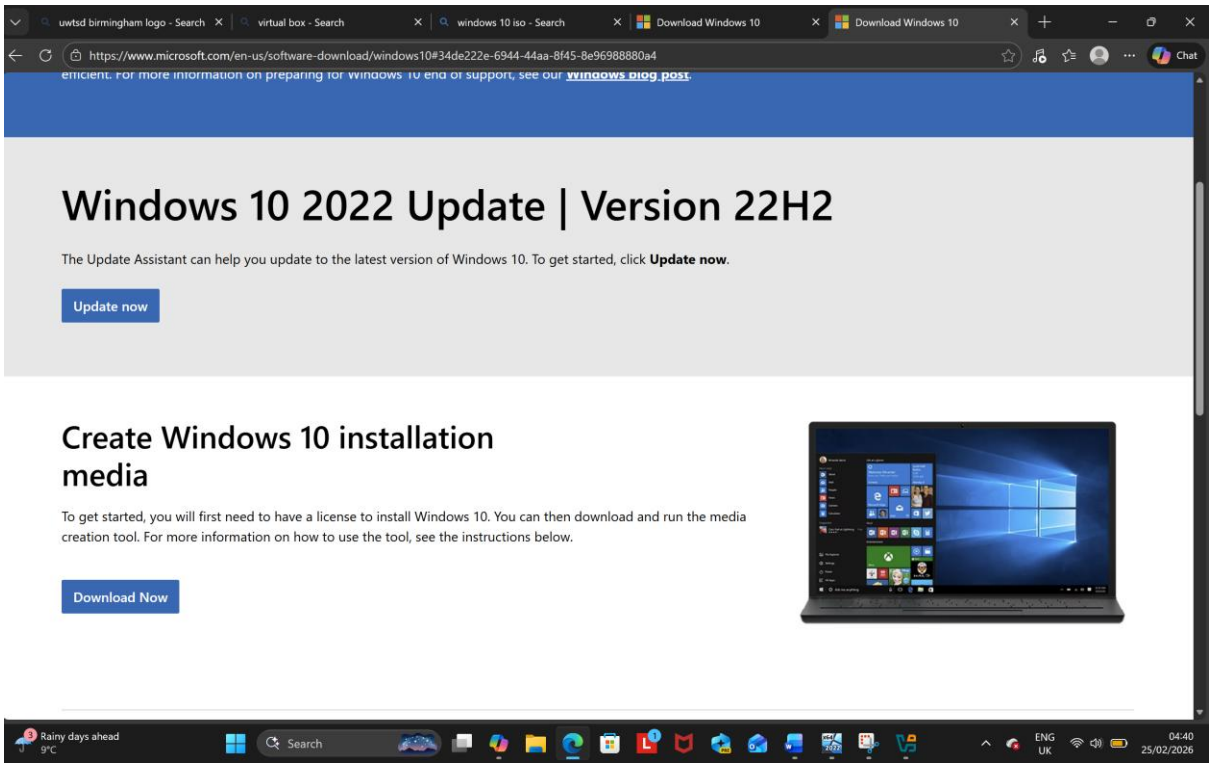


Configurating LAN ip and subnet mask for this configuration we went to settings, then network connections, we change the name of one to birmingham LAN and we configurate the ip address selecting the ipv4 on the network and click on properties and we type the ip address 172.16.1.1 subnet mask 255.255.255.0 select ok and it will save the configuration.

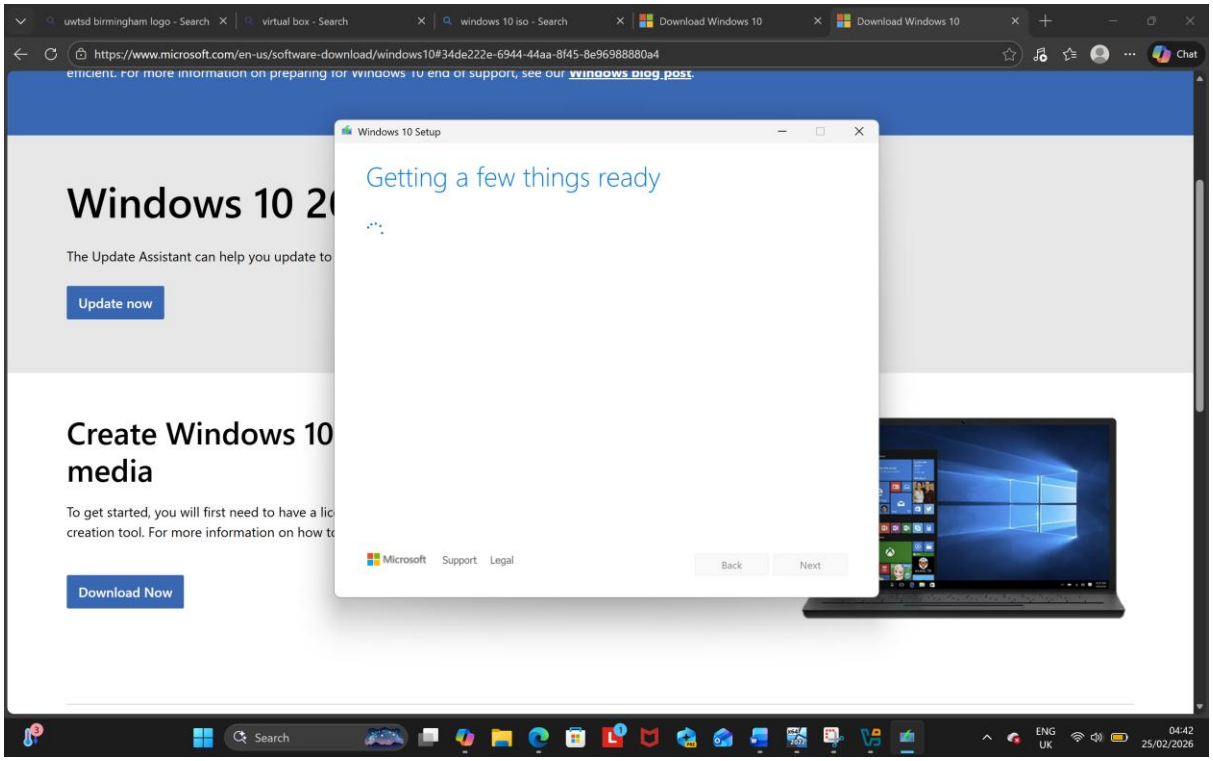


Configurating WAN IP and subnet mask on the next network connection we need to click rigth rename and we change the name to WAN and ok after that we click rigth again and we click on properties and we configurate the ip address 10.10.0.1 and the subnet mask 255.255.255.252 click in ok and it willl be saved the configuration.

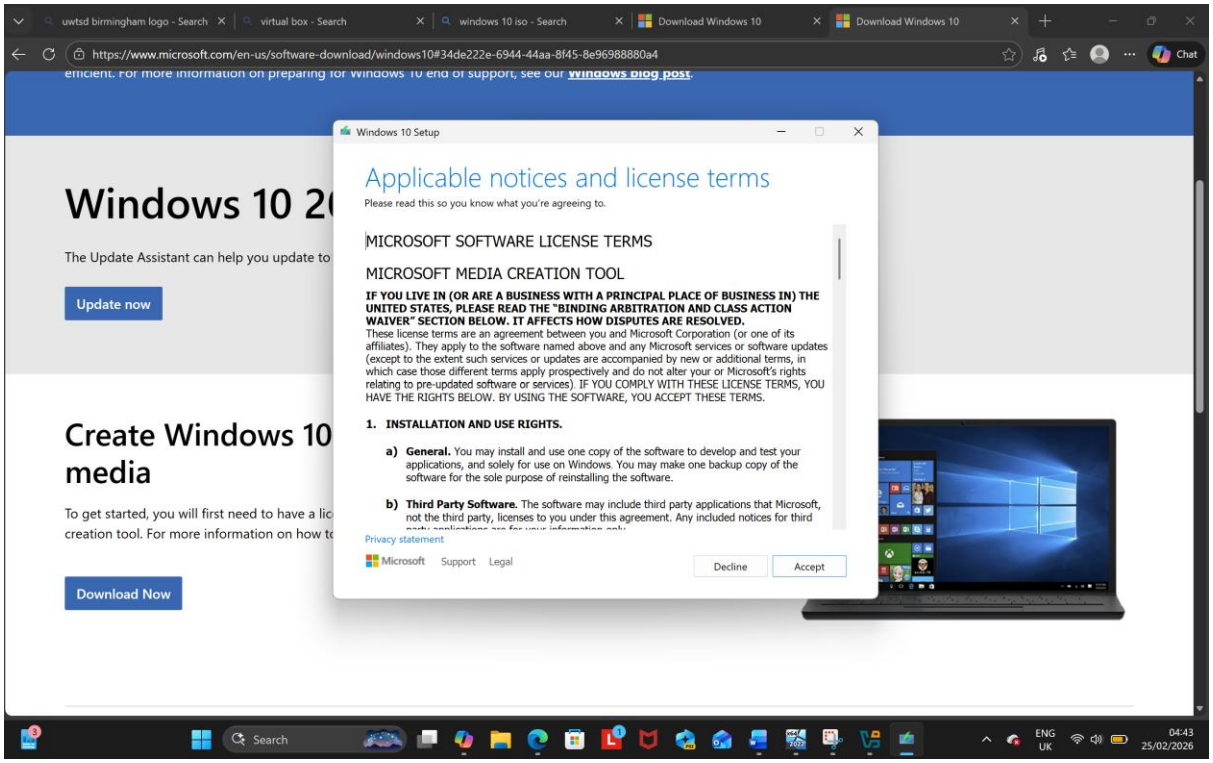
WINDOWS CLIENT



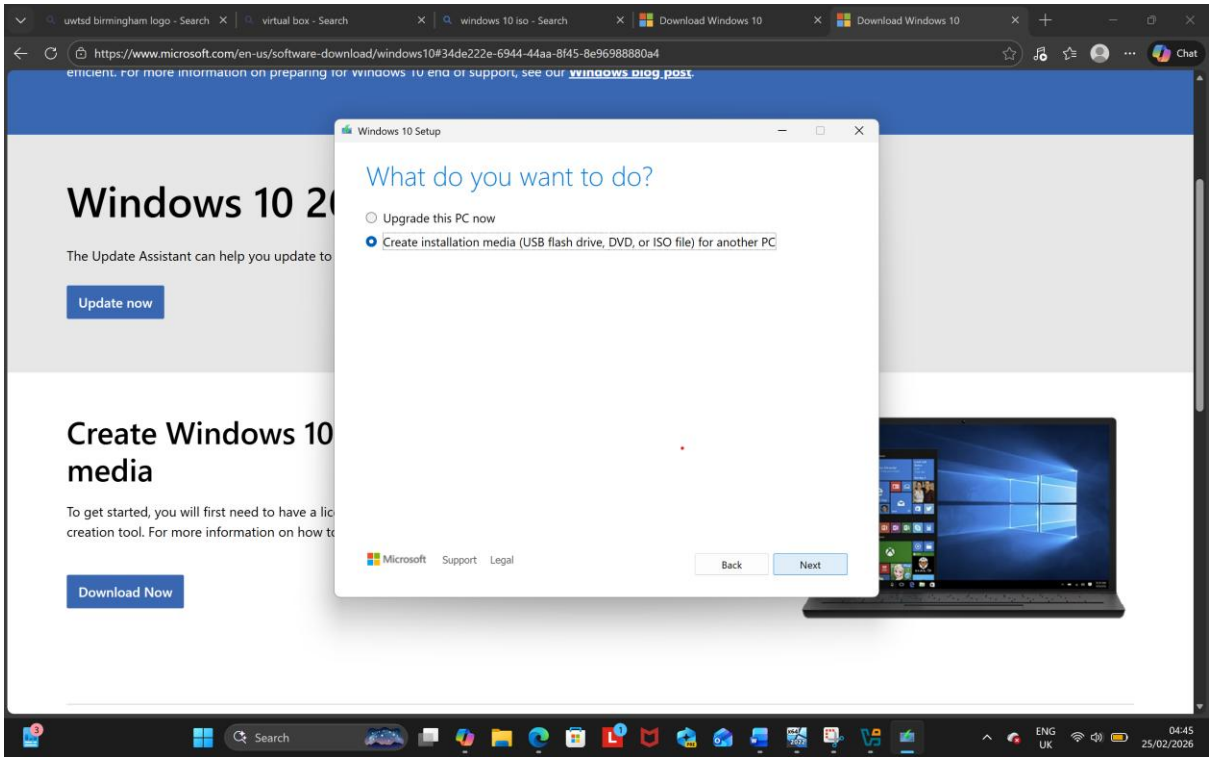
First you will need to download media creation tool from: [Download Windows 10](#) after that you need to double clik on the file that you downloaded and it will start the downloading process.



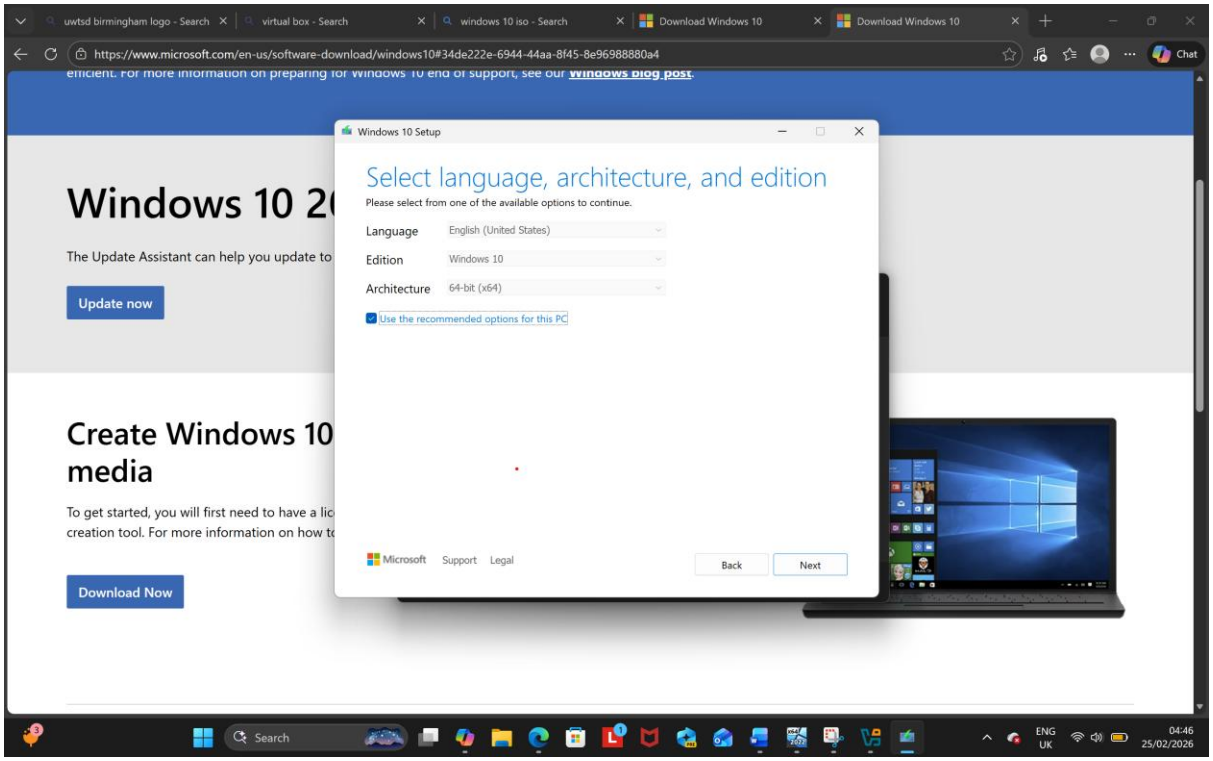
After a few minutes if will show you notices and licence terms you need to accept.



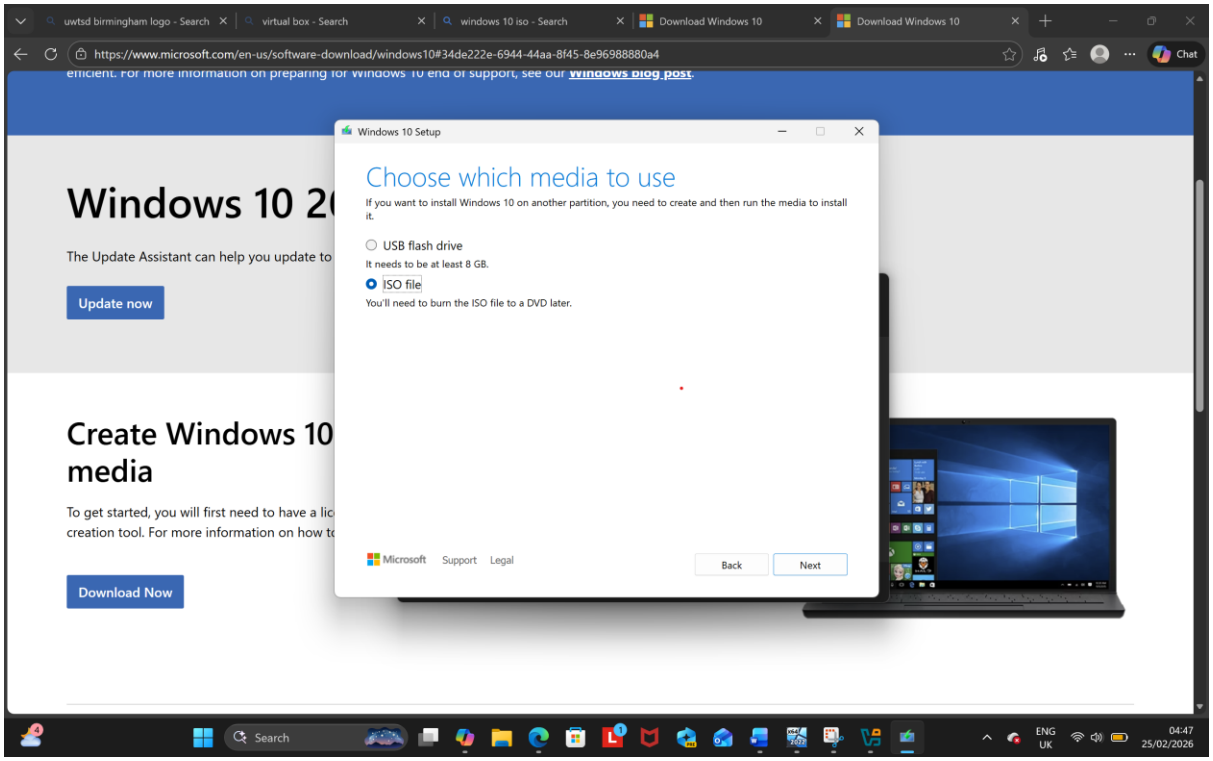
Accept notinces and license terms.



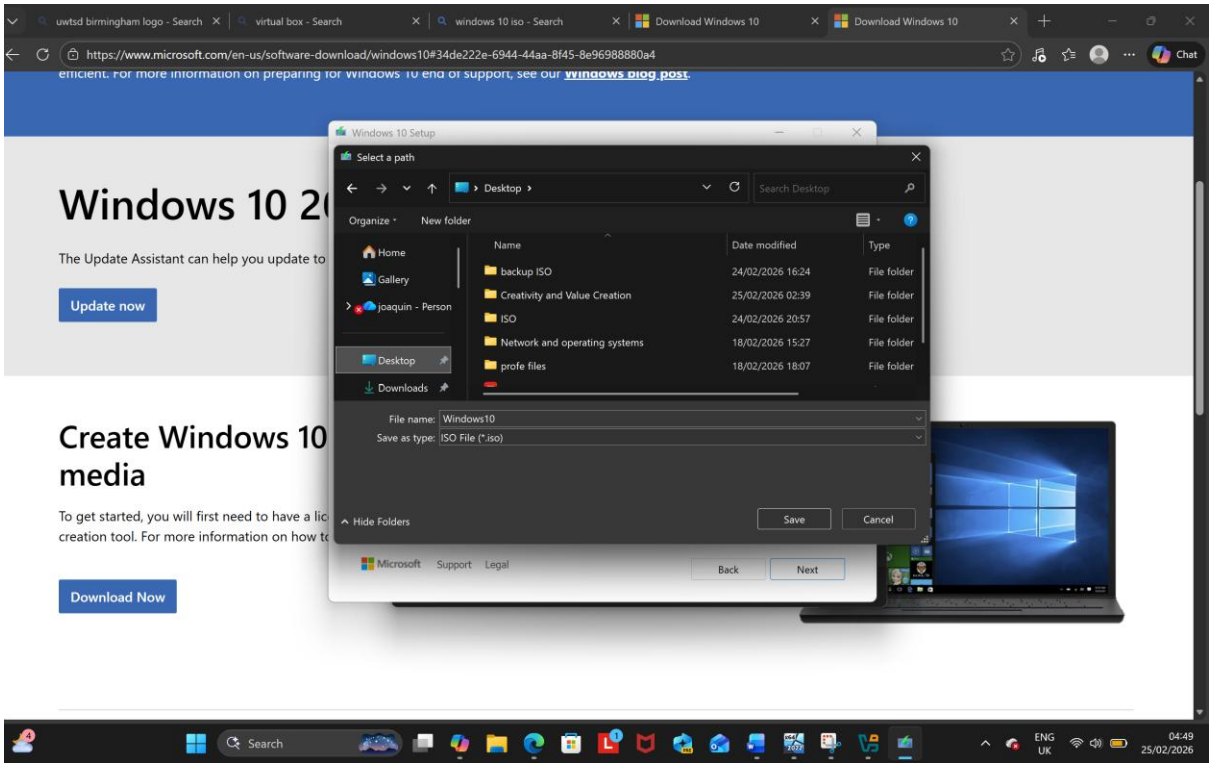
Select create installation media iso file that is the option to download the iso file with the windows 10 version in ISO format click on next.



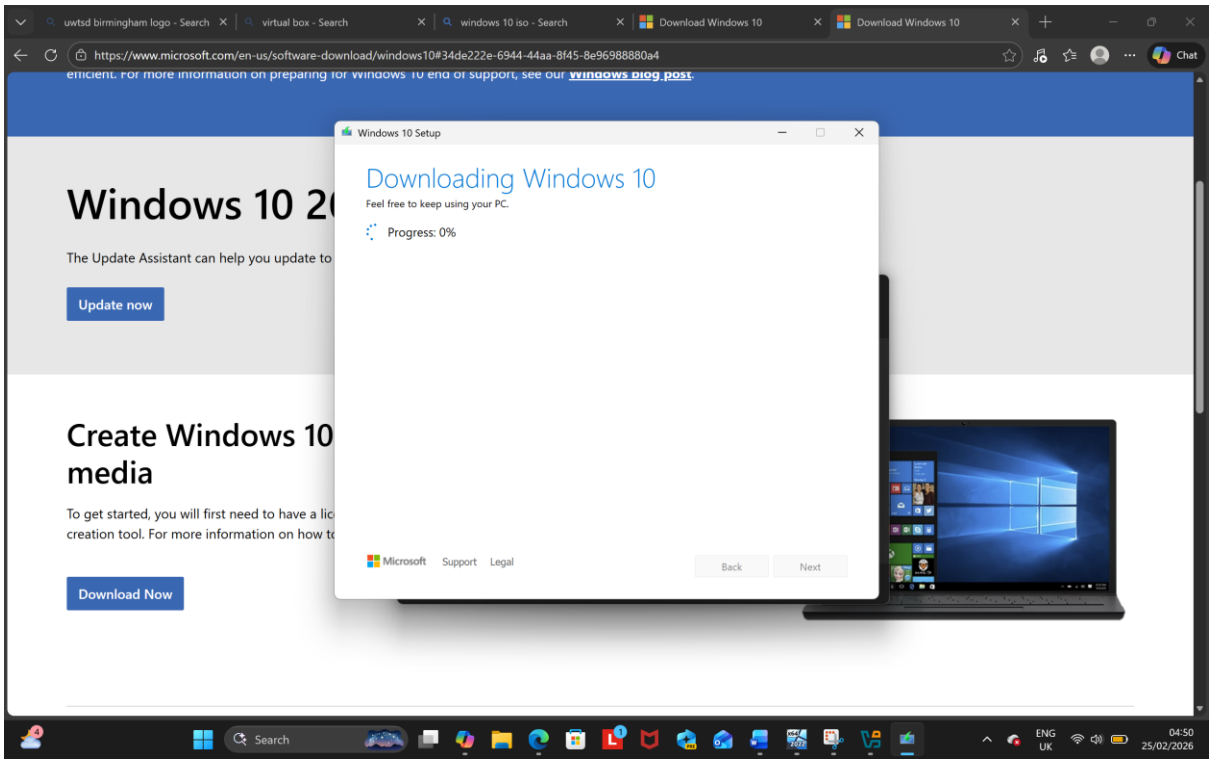
In this part you will need to select the language, edition and architecture and after you click on next.



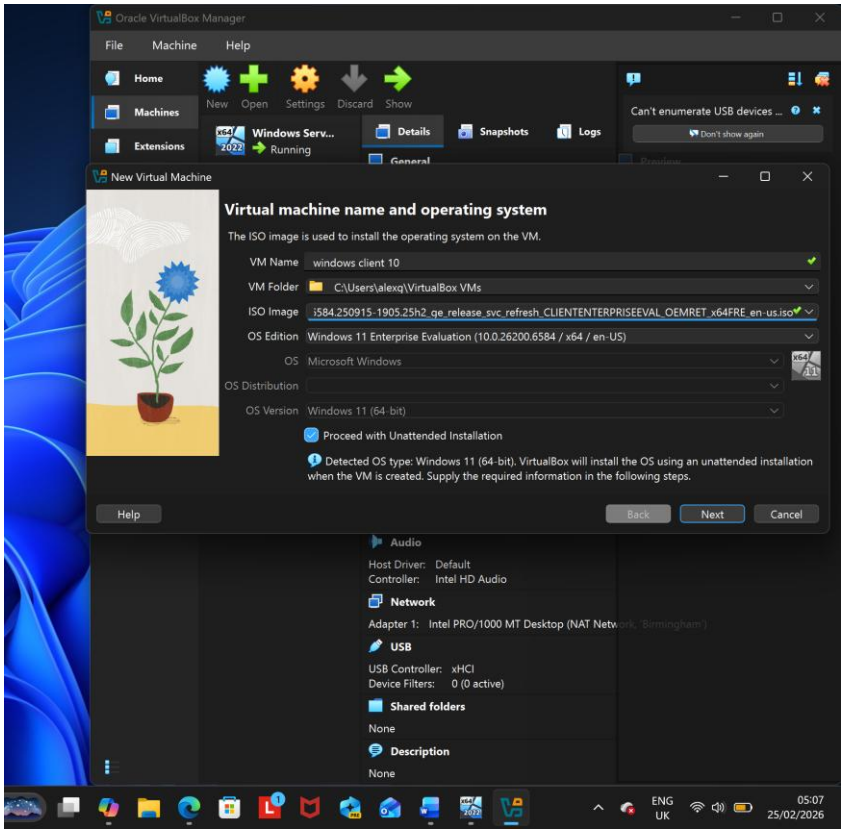
Select ISO file again to create this typpe of file and then click on next.



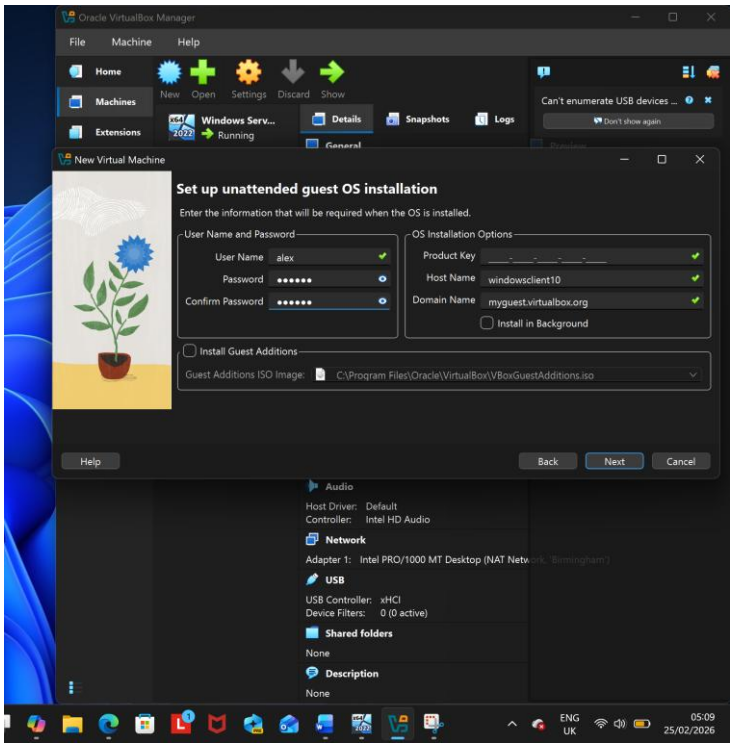
Select the place where you wanna save the file desktop or any other folder then click on save.



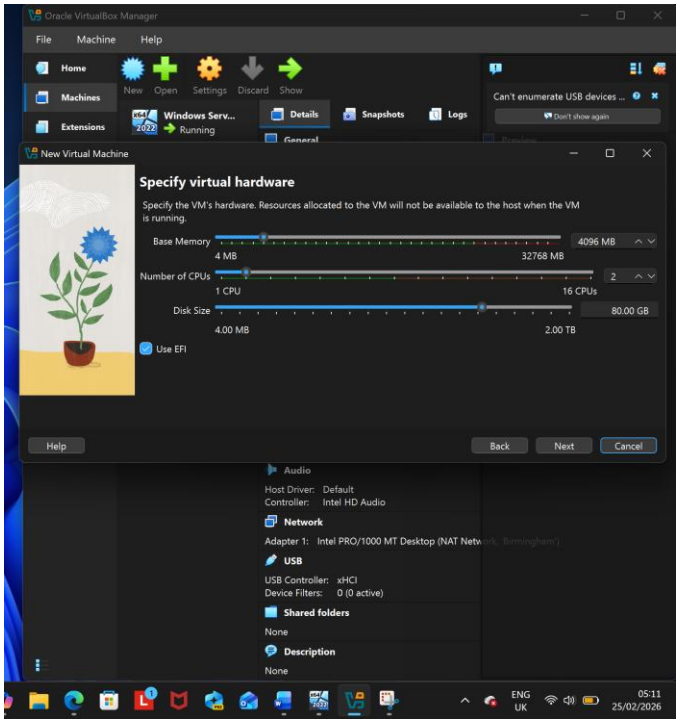
It will start the downloading process, after that you will have the ISO file of windows 10 in the folder or the place that you have choosen to save this file.



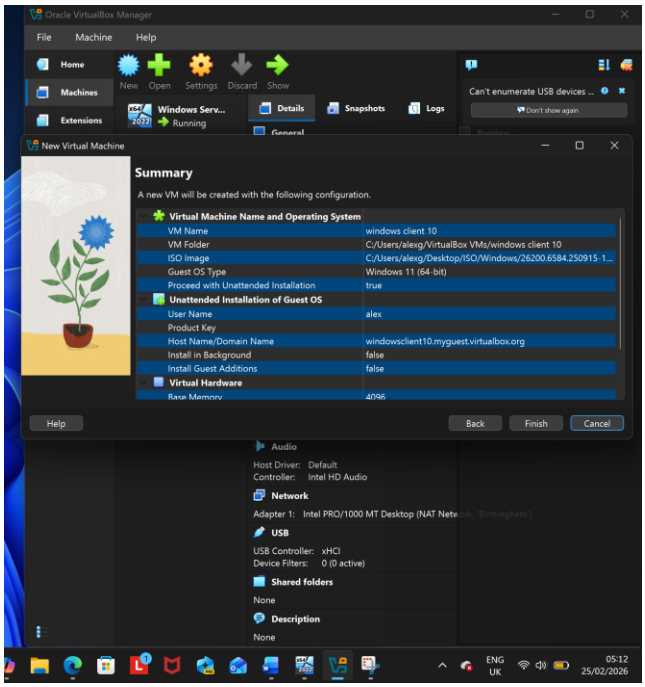
Now we are going to create the windows client using ISO of windows 10 for this we are going to click on new type the name of this virtual machine, select the ISO file of windows 10 and click on next.



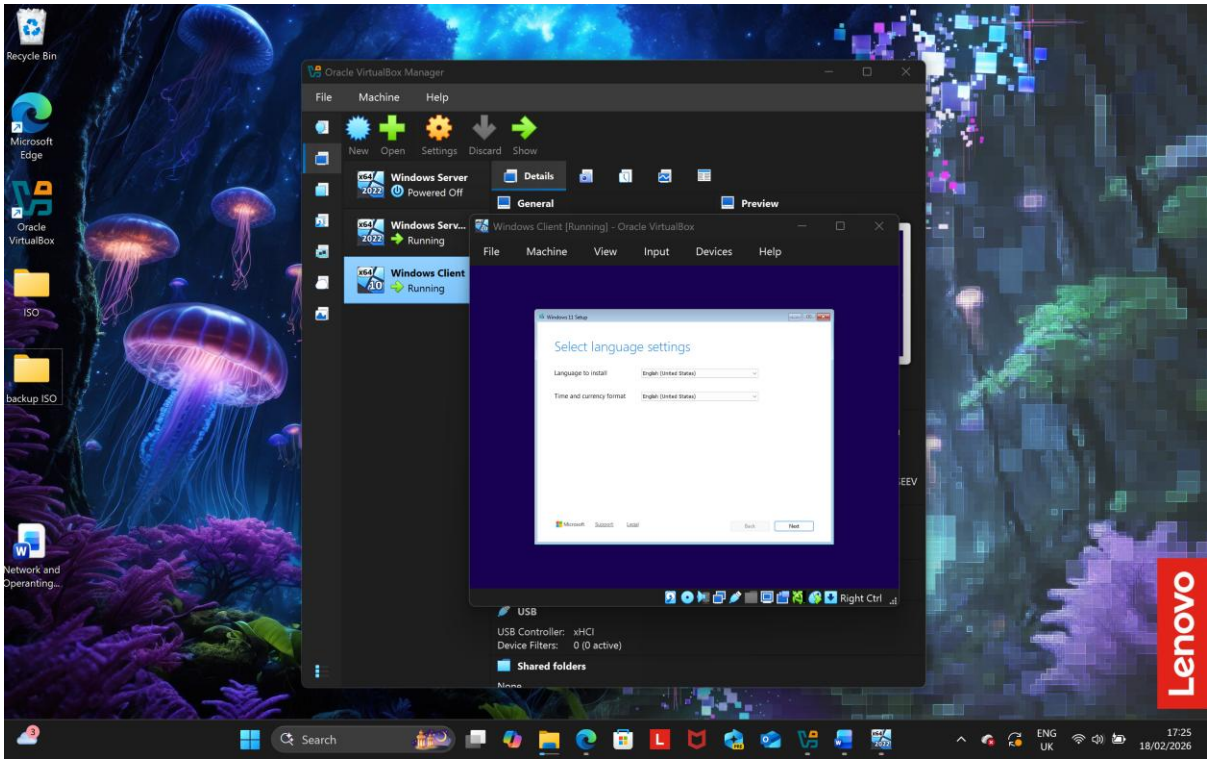
Now we need to create a username and password, type a username and password without space to avoid any error on the virtual machine, click on next.



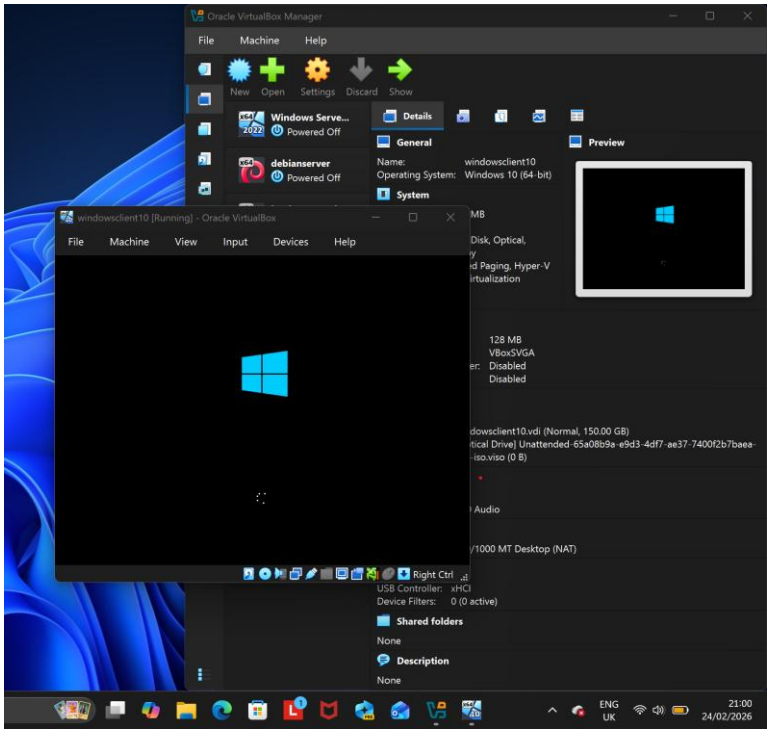
In this part we are going to assign memory, cpus, and disk size to create the virtual machine thiw will depend of the system and the capacity of your laptop, if the system needs more ram or memory to install and if your laptop support.



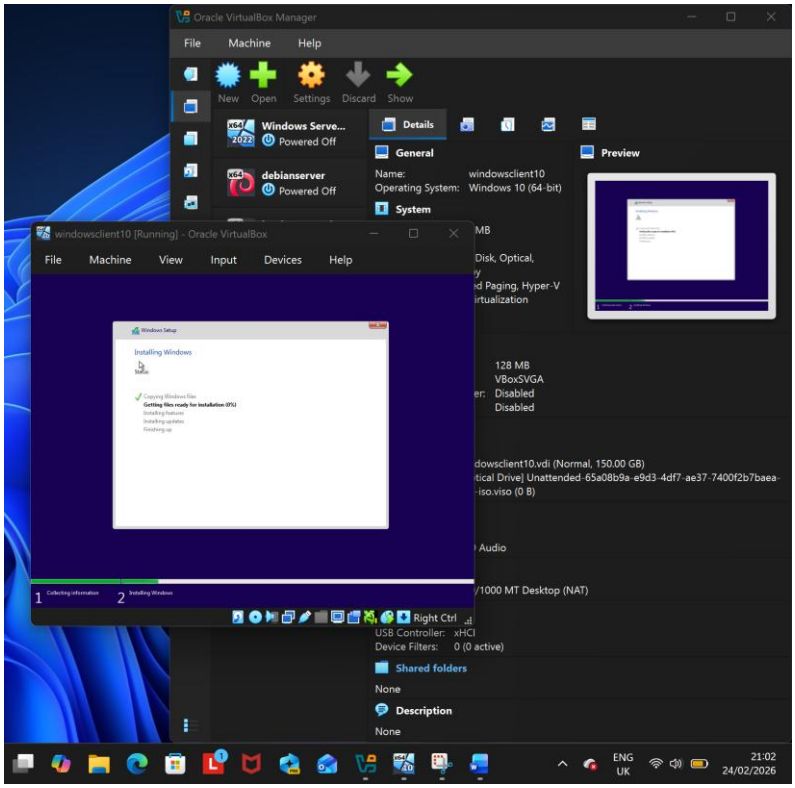
Now we will have a general description of the virtual machine that we are creating, click in finish and it will start the installation.



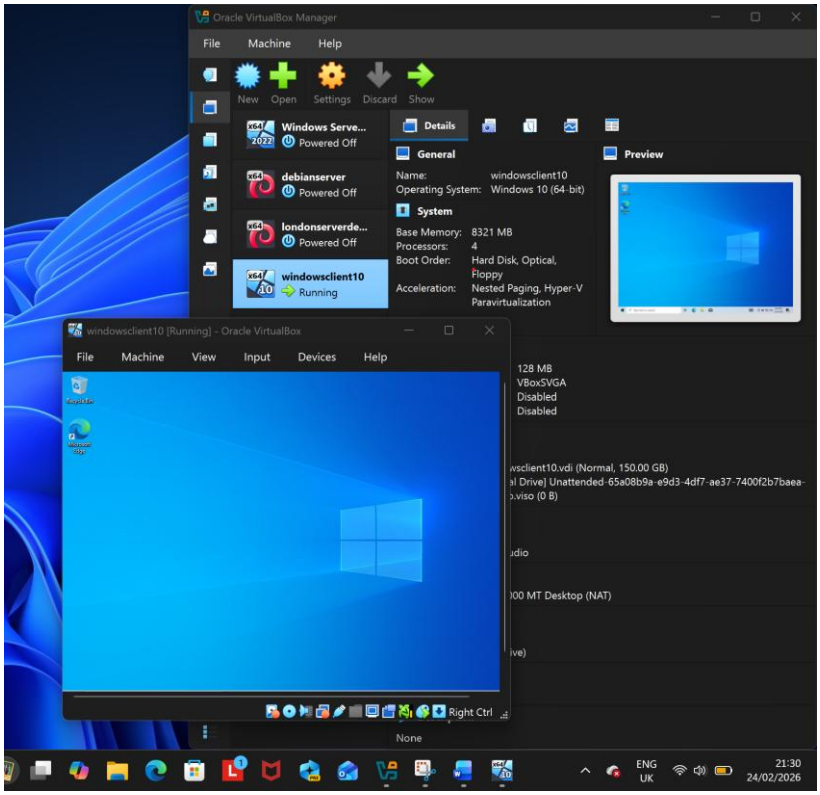
During the installation we need to apply some settings like language and time as we can see on the screenshot.



Open and is gonna start the installation

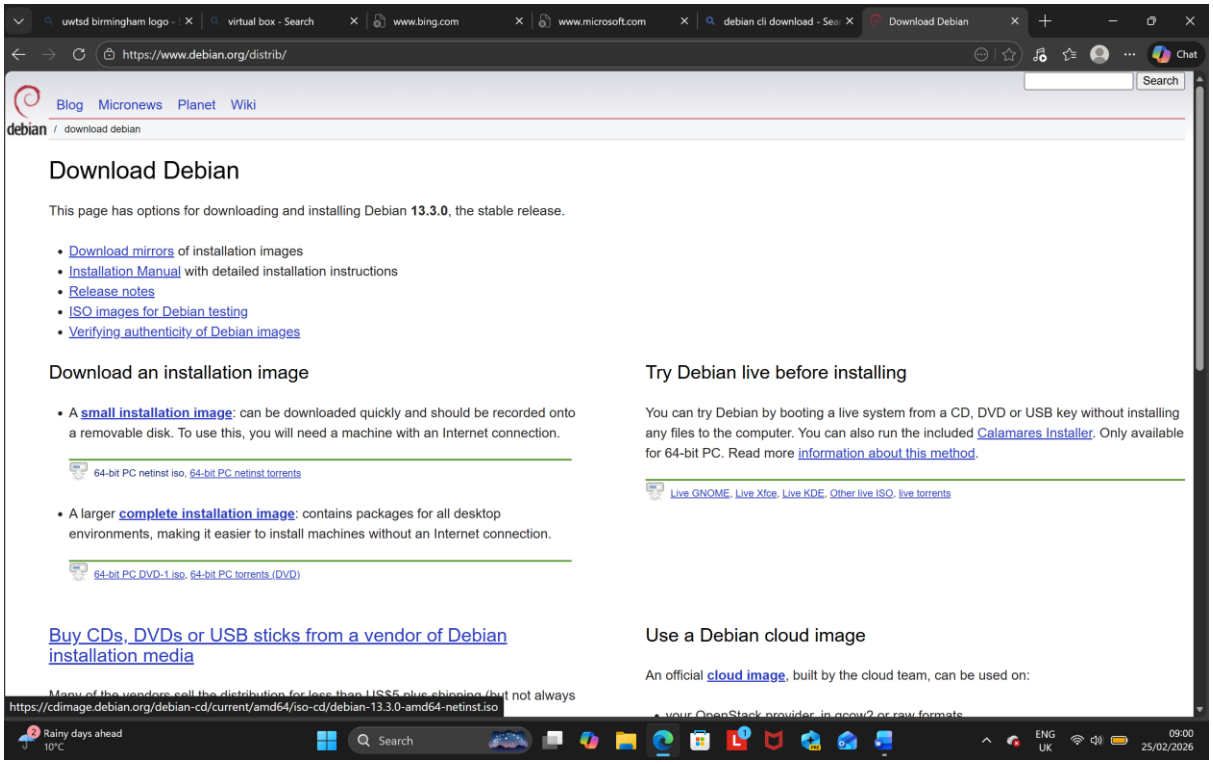


Installing windows 10 in this part windows ins going to install windows files, getting files ready for installation, installing features, installing updates and finishing up.

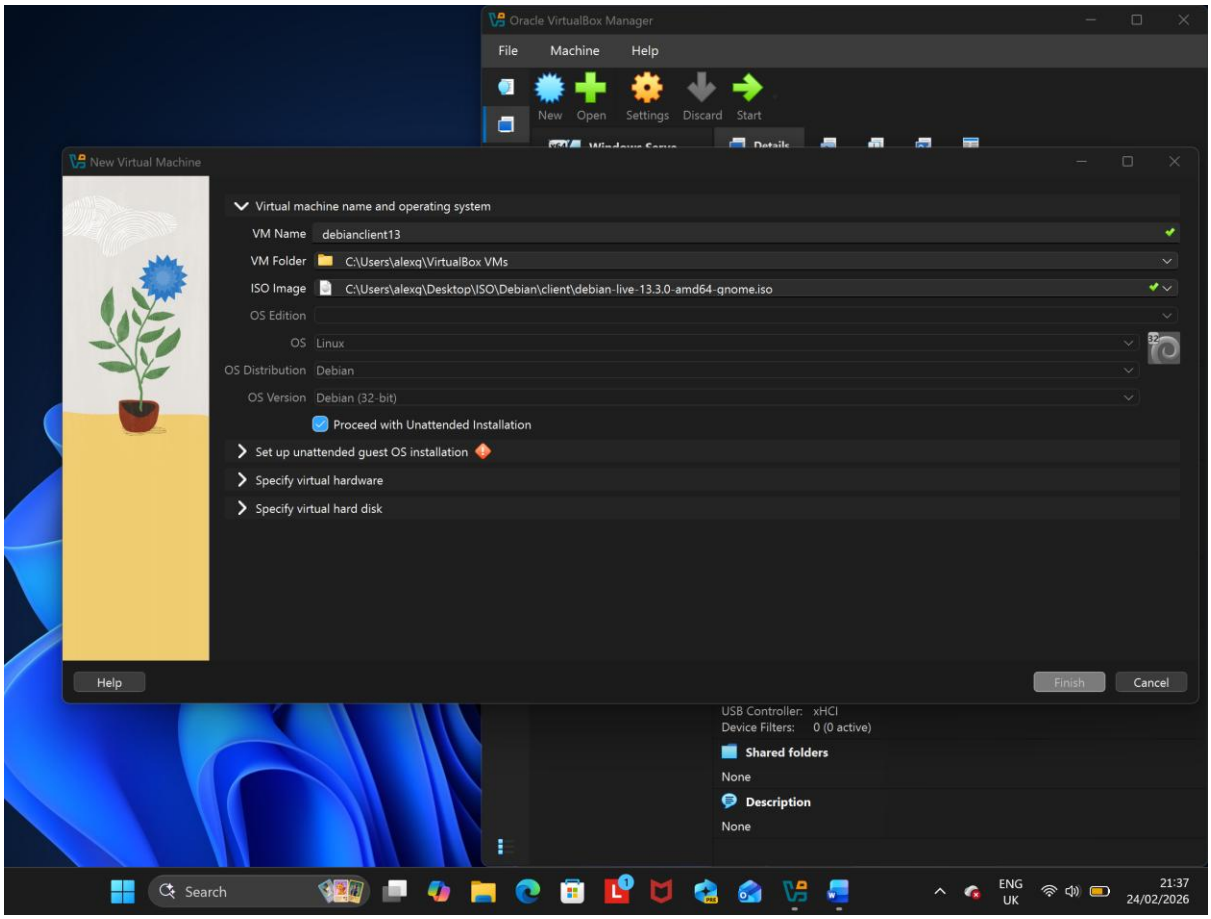


When its finish is gonna ask for password and is done we have windows 10 installed

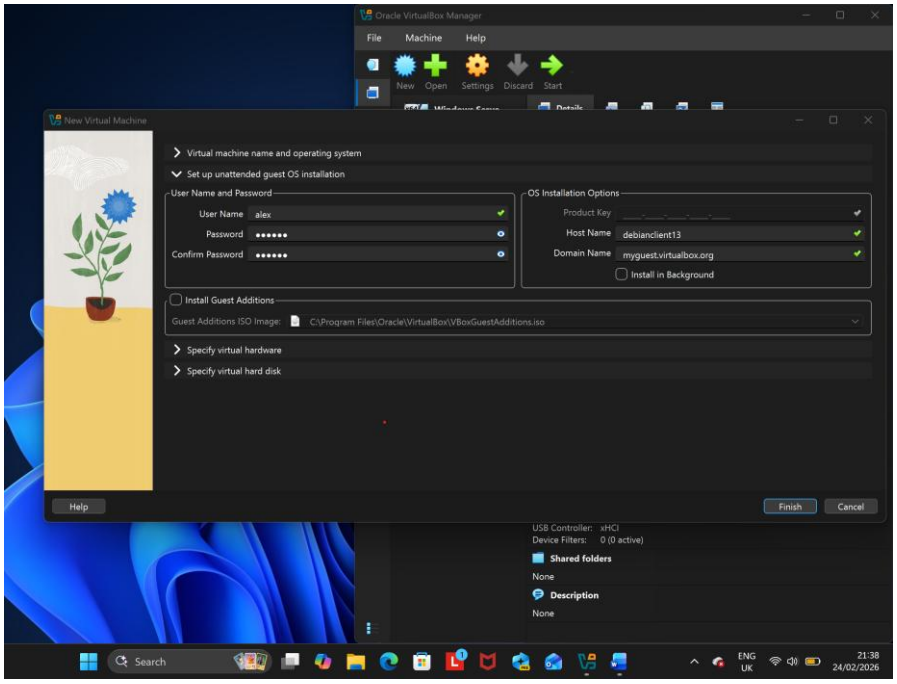
DEBIAN CLIENT



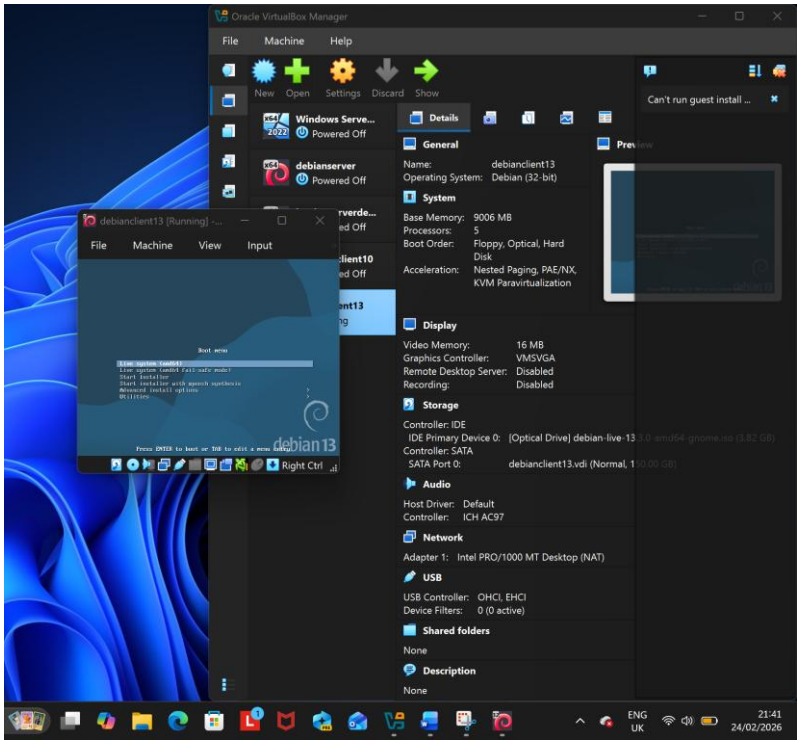
For debian client you deen to acces to this website: Download Debian select the ISO file of debian 64 bits that we need.



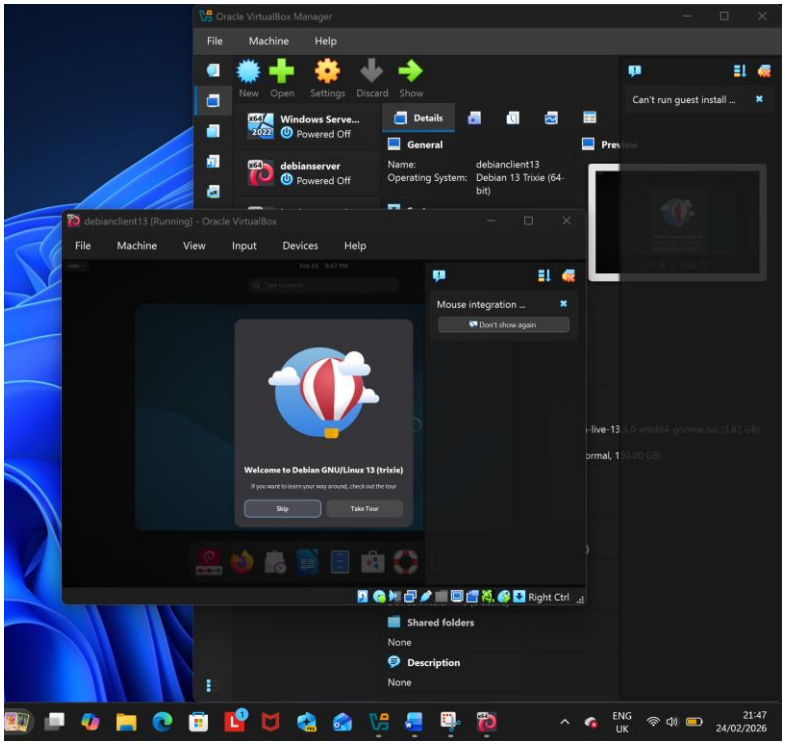
Now we need to open virtualbox create and we need to add a name for the virtual machine select the ISO file and then clik in finish.



Is going to ask to configurate the username and the password I configurate this whith the name of alex and after we need to click on finish.

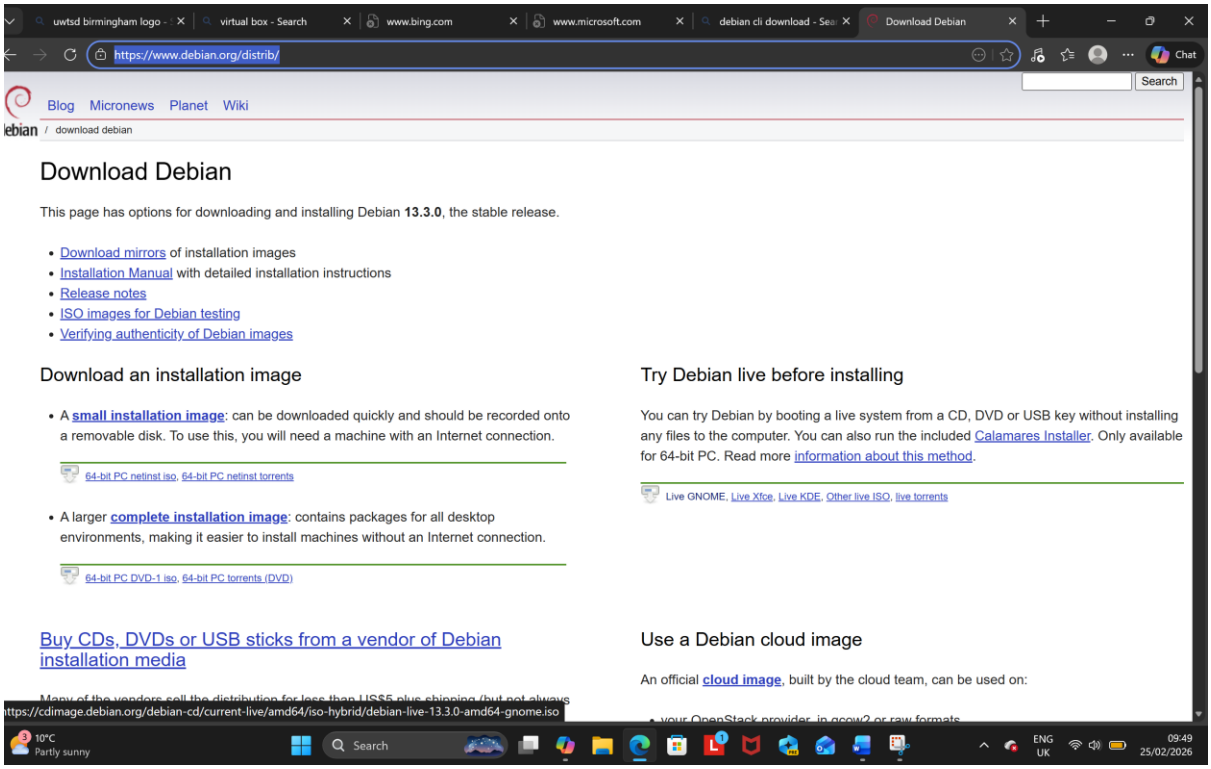


When we click on finish debian it will start whith the installation we need to click or press enter on the first option.

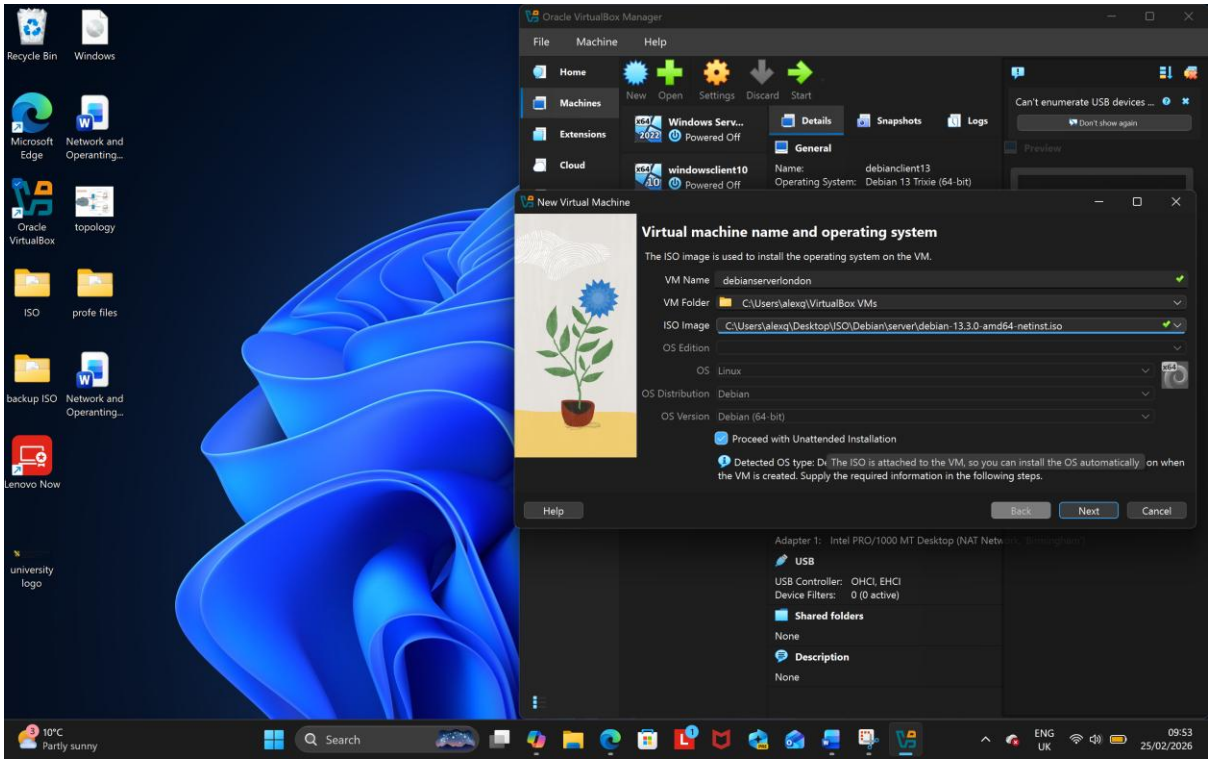


Is very quick and easy to install a dbeian client is going to ask us if we want to do the tour we can skip and it will finish the installation.

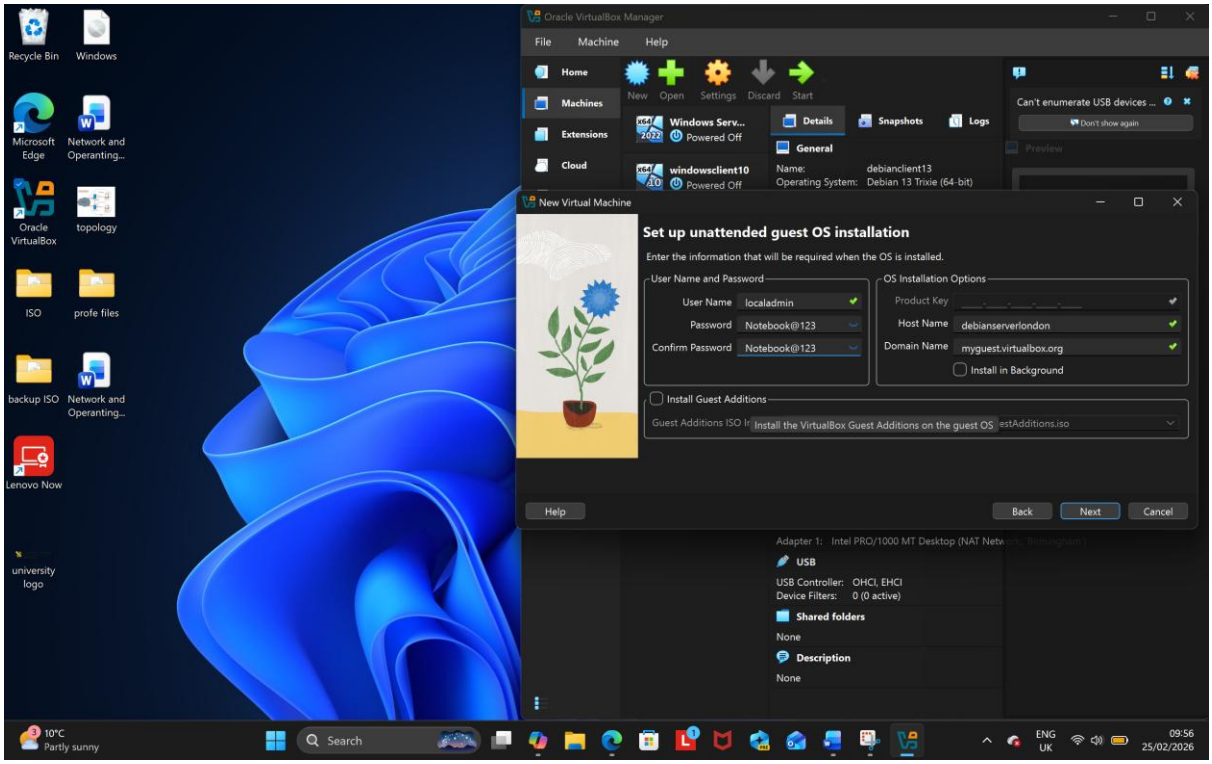
DEBIAN SERVER



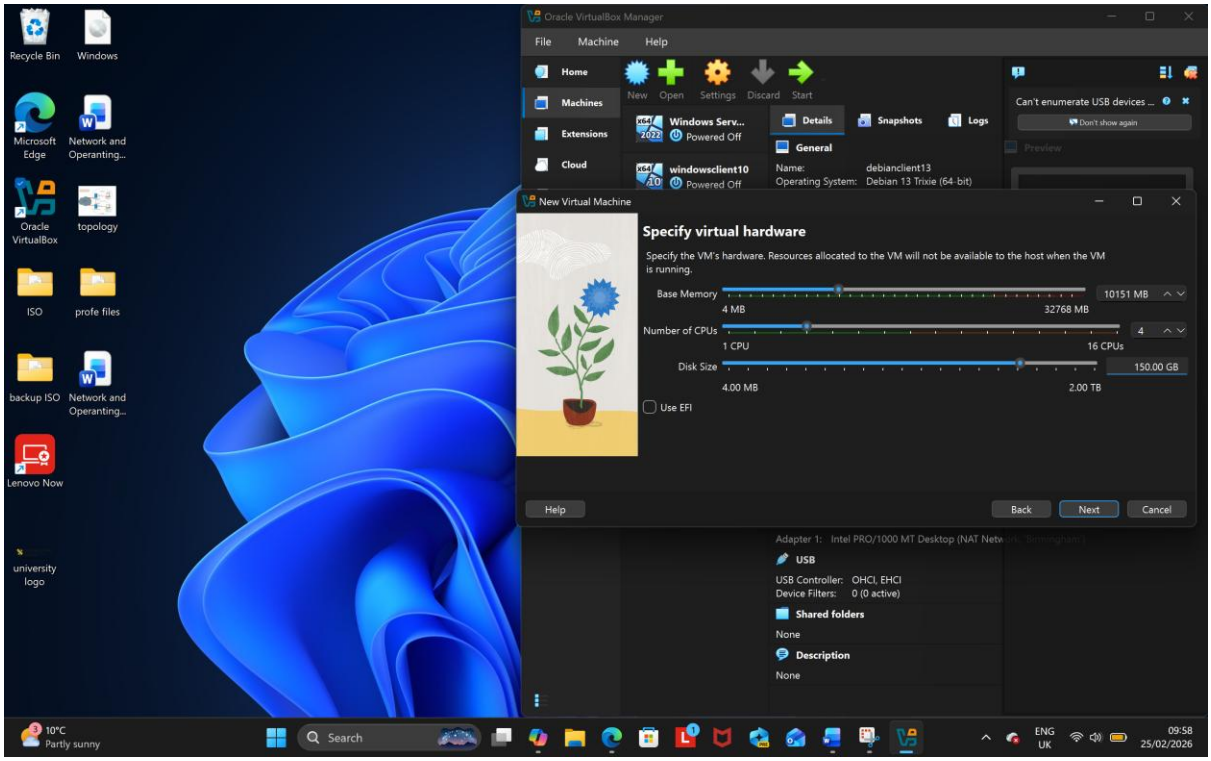
In this screenshot we are going to download Debian Server: Download Debian is the link with the name of live GNOME that's the one that is going to download the ISO file.



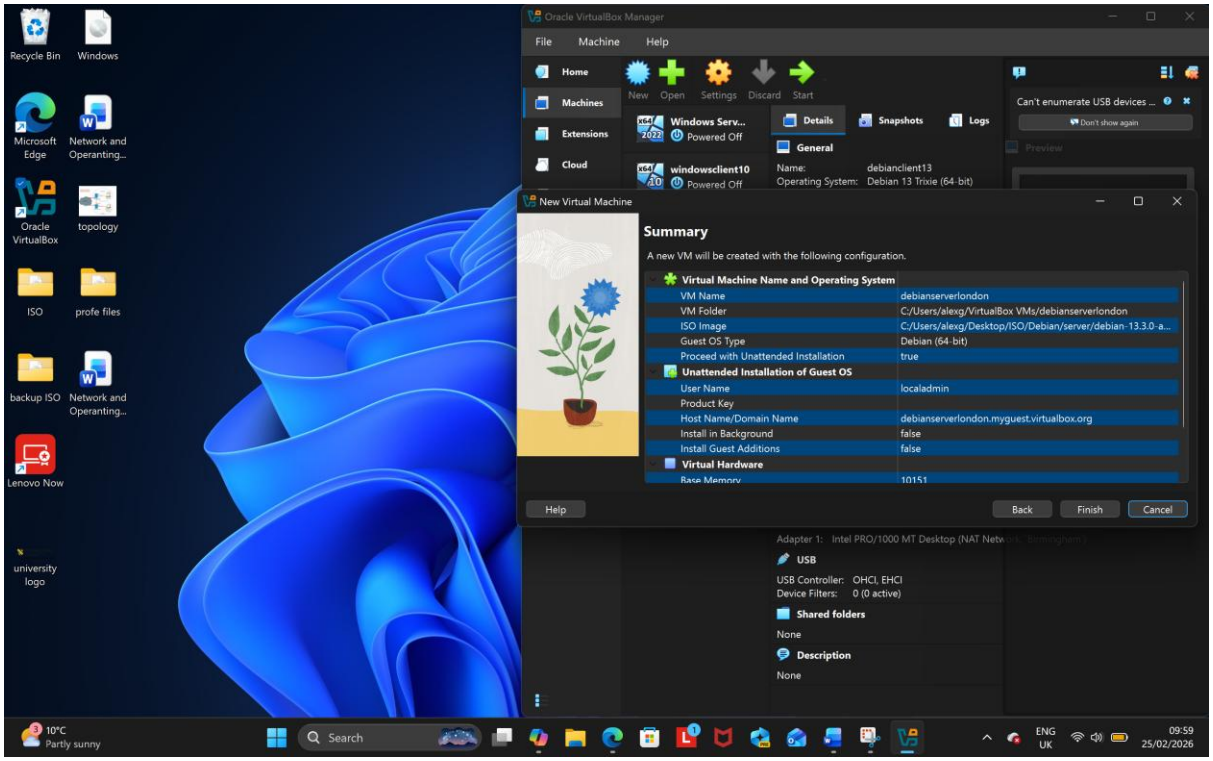
For debian server we are going to clikc on create add a name for this virtual machine and then select the iso file of server for debian click in finish and it will start the installation.



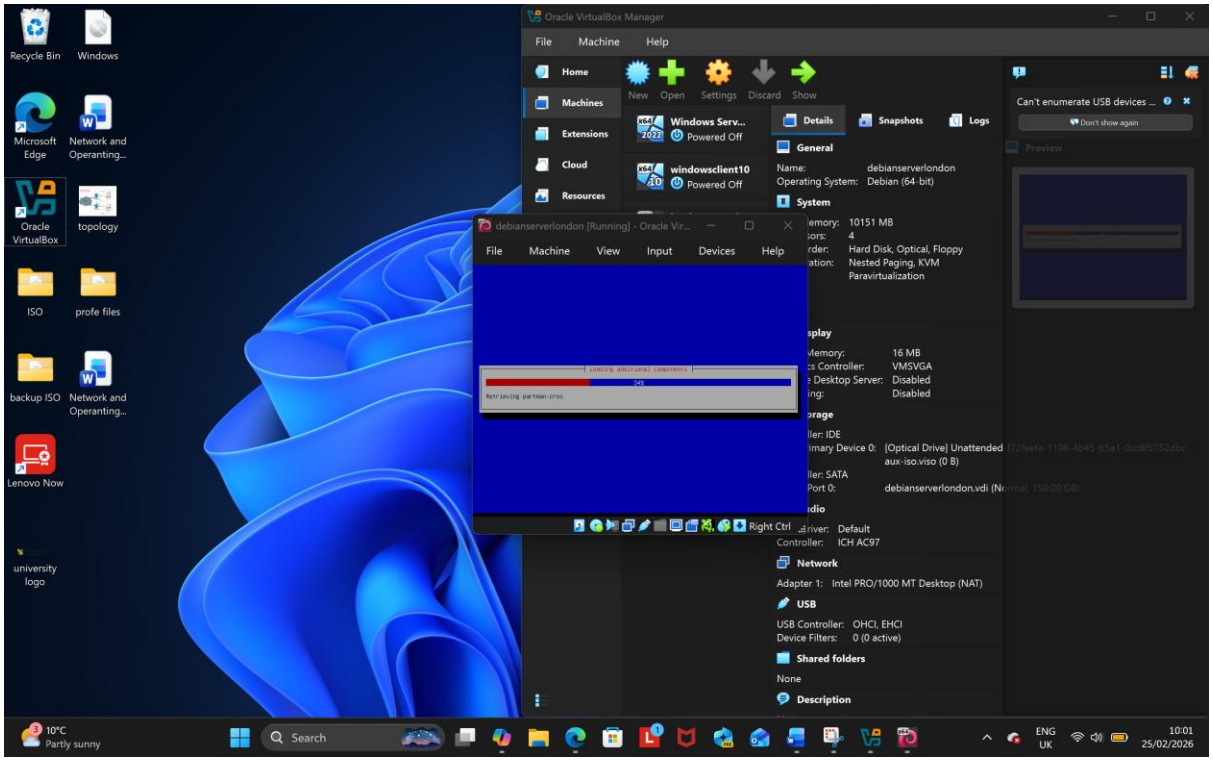
now we need to configurate the user and the password that we are going to use as user localadmin and in password Notebook@123 and we click on next.



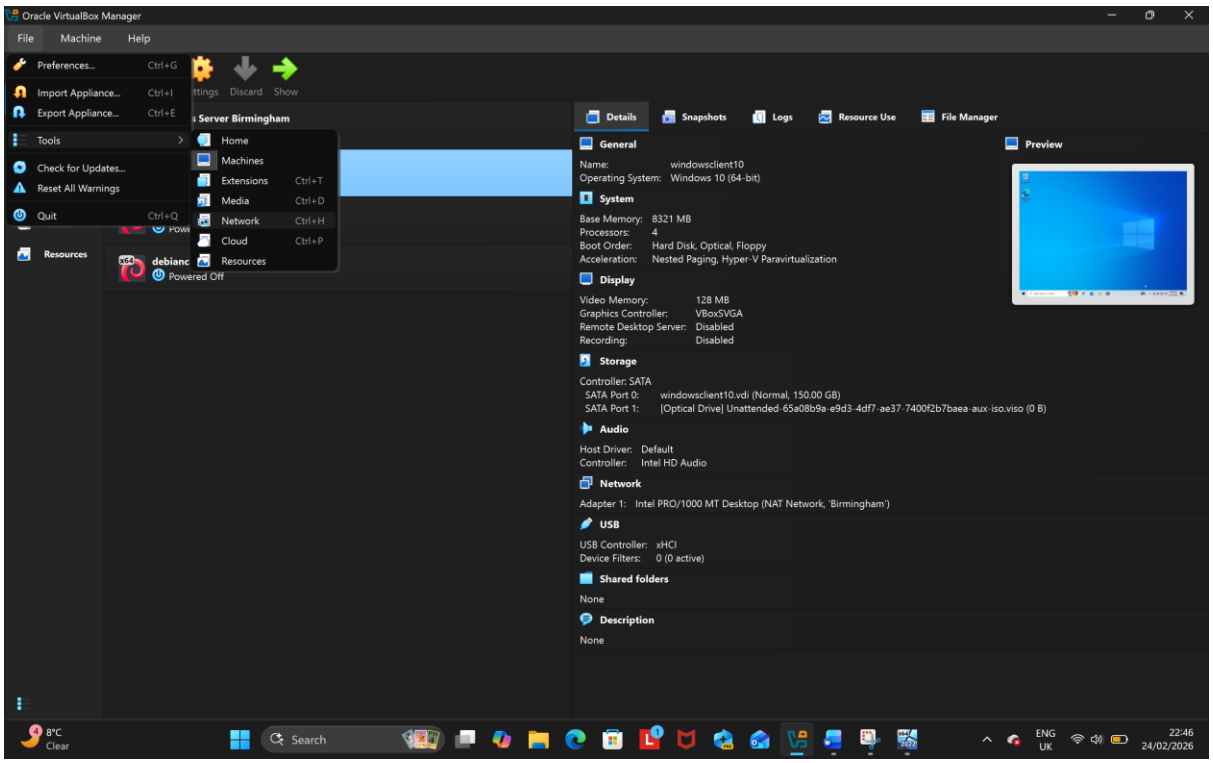
Now we are going to configurate memory, cpus and disk size and click on next.



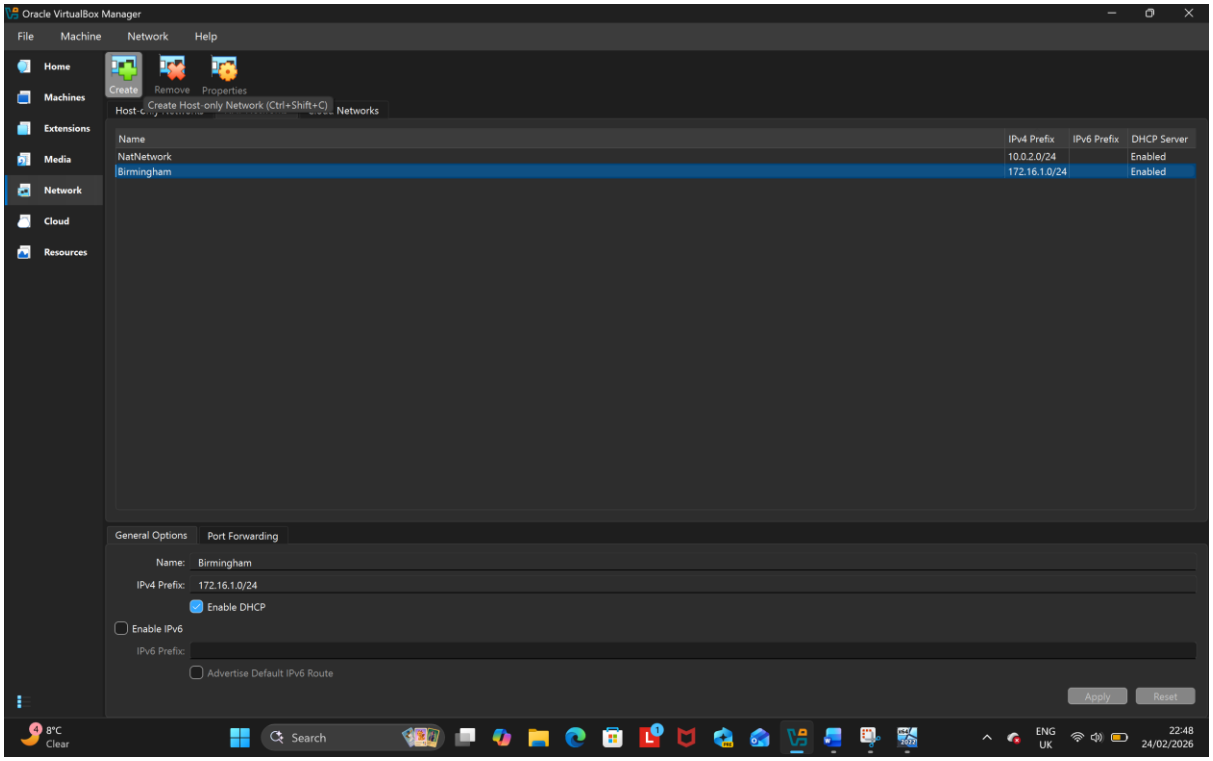
now we are going to have a preview of the configurations and the virtual machine that we are going to create, click on finish.



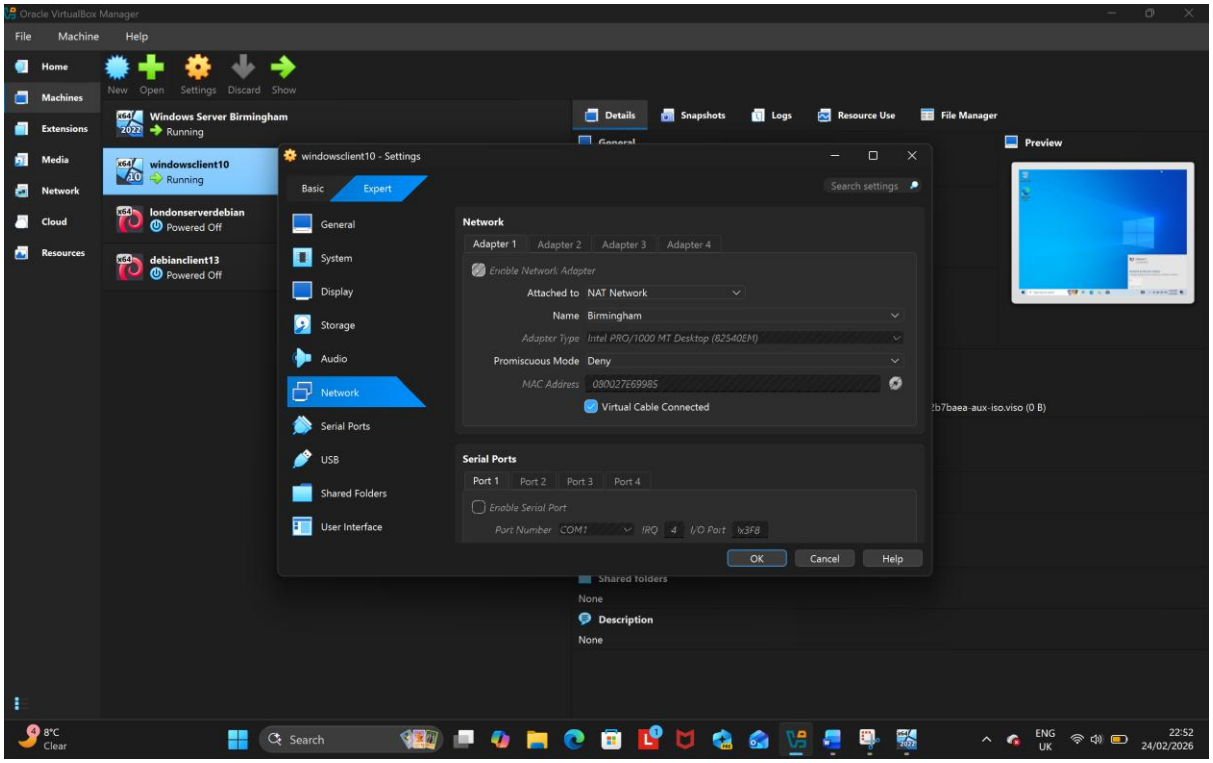
now is installing the system



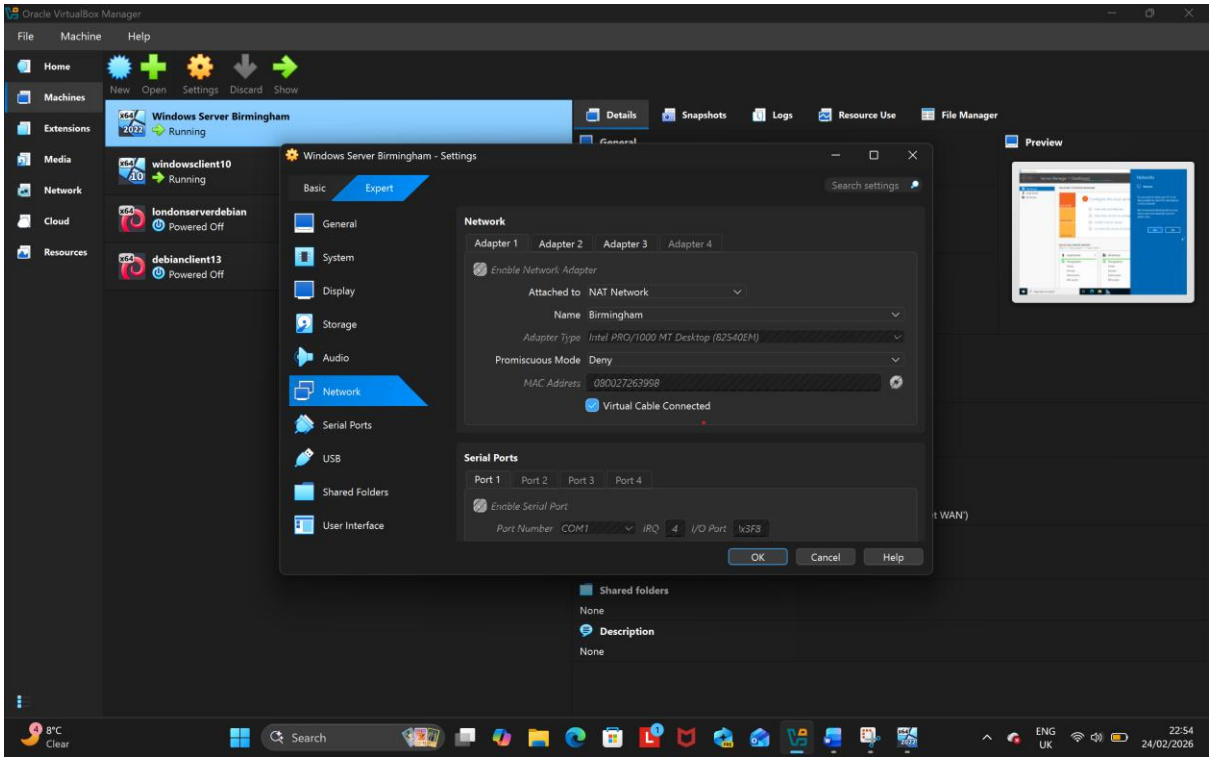
Now we are going to create the conectioon between server and windows 10 by LAN Birmingham 172.16.1.0/24 for that we need to go file tools and network click in NAT networks



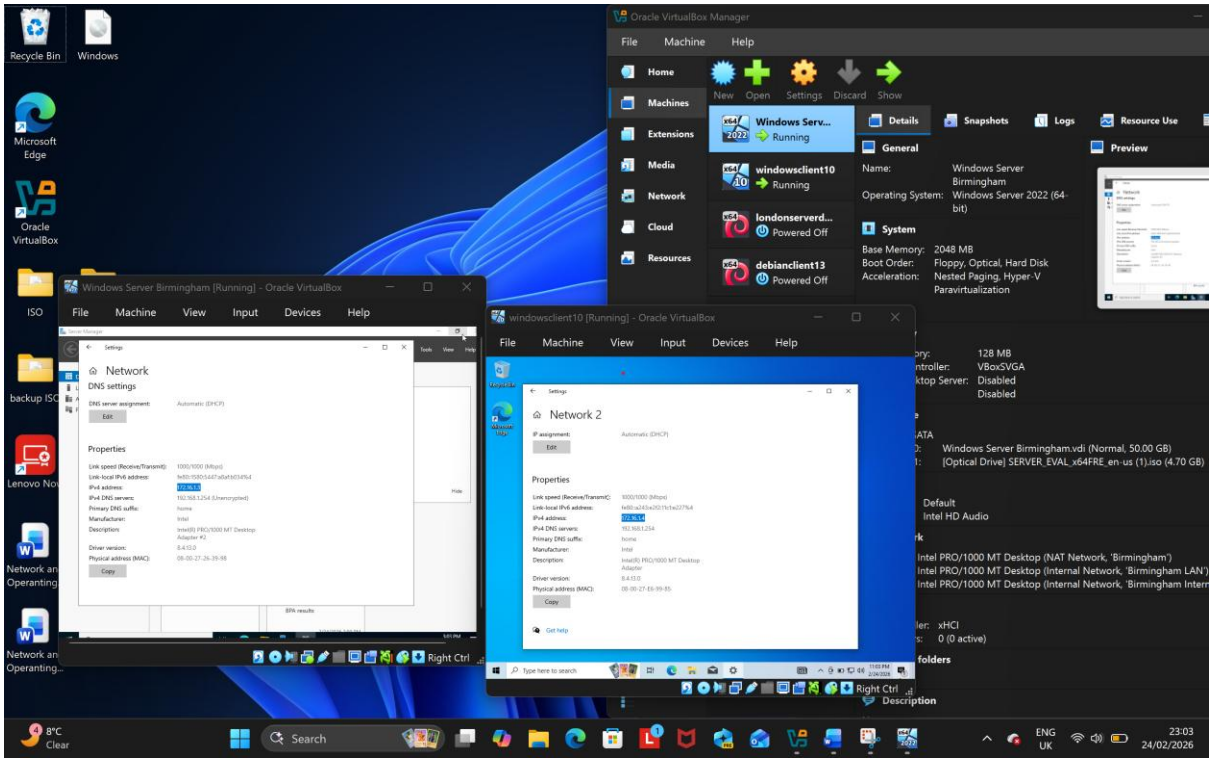
Click in create is going to create a new network now we need to give a new name to this network Birmingham name and type the ip 172.16.1.0/24



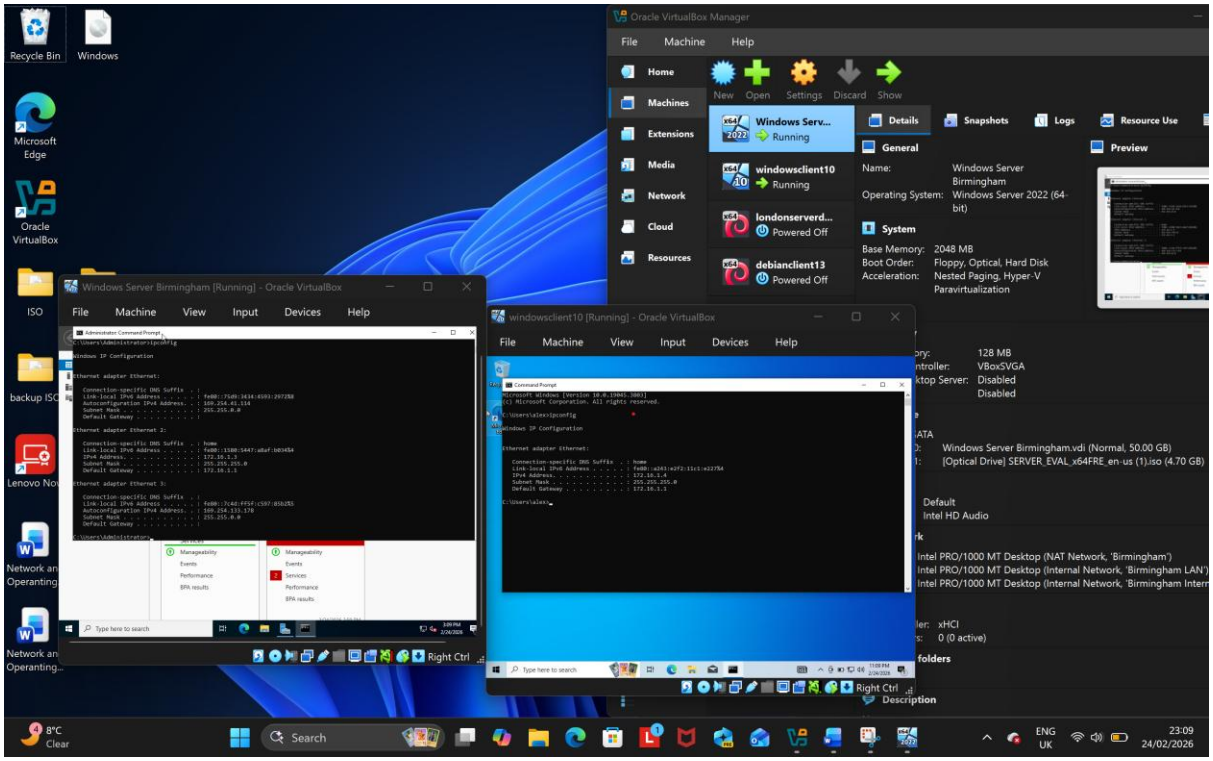
Now we are going to conect both machines to the network click on the virtual machine then properties and network we are going to choose attached to NAT Network name of the network Birmingham for windows 10 and server we are going to do the same



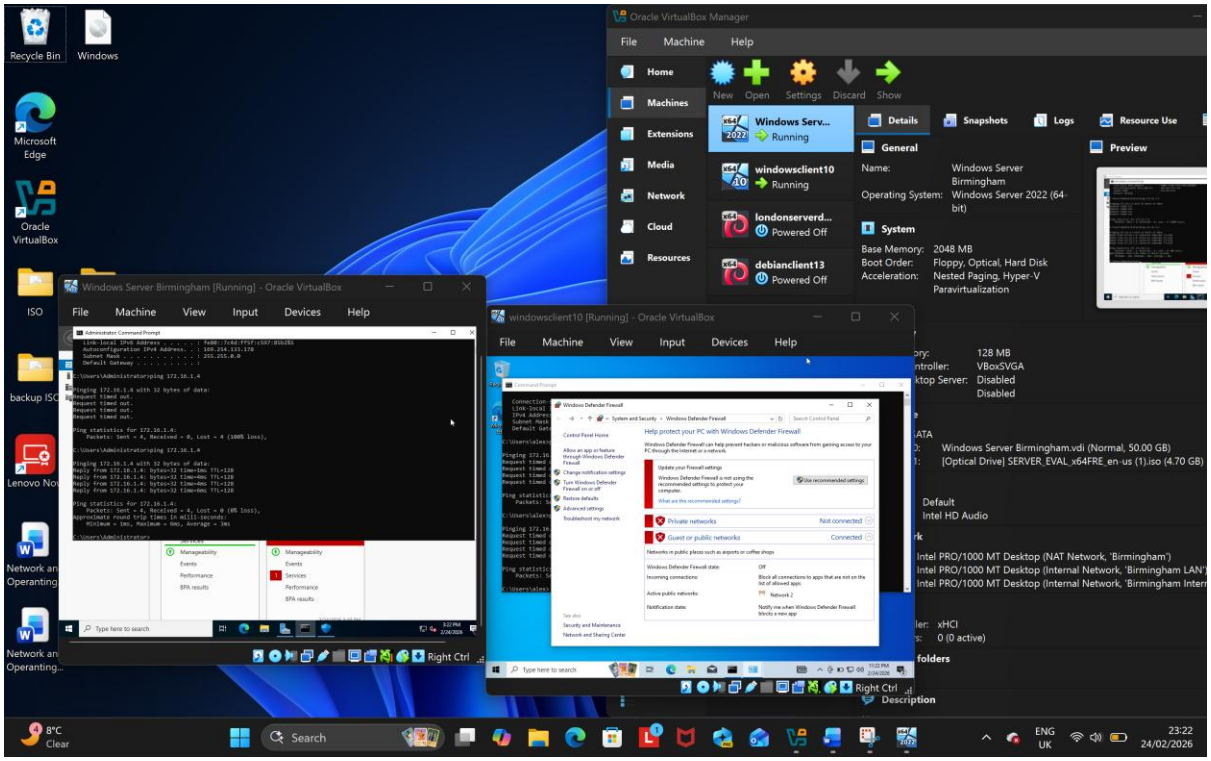
Server conection to the network Birmingham



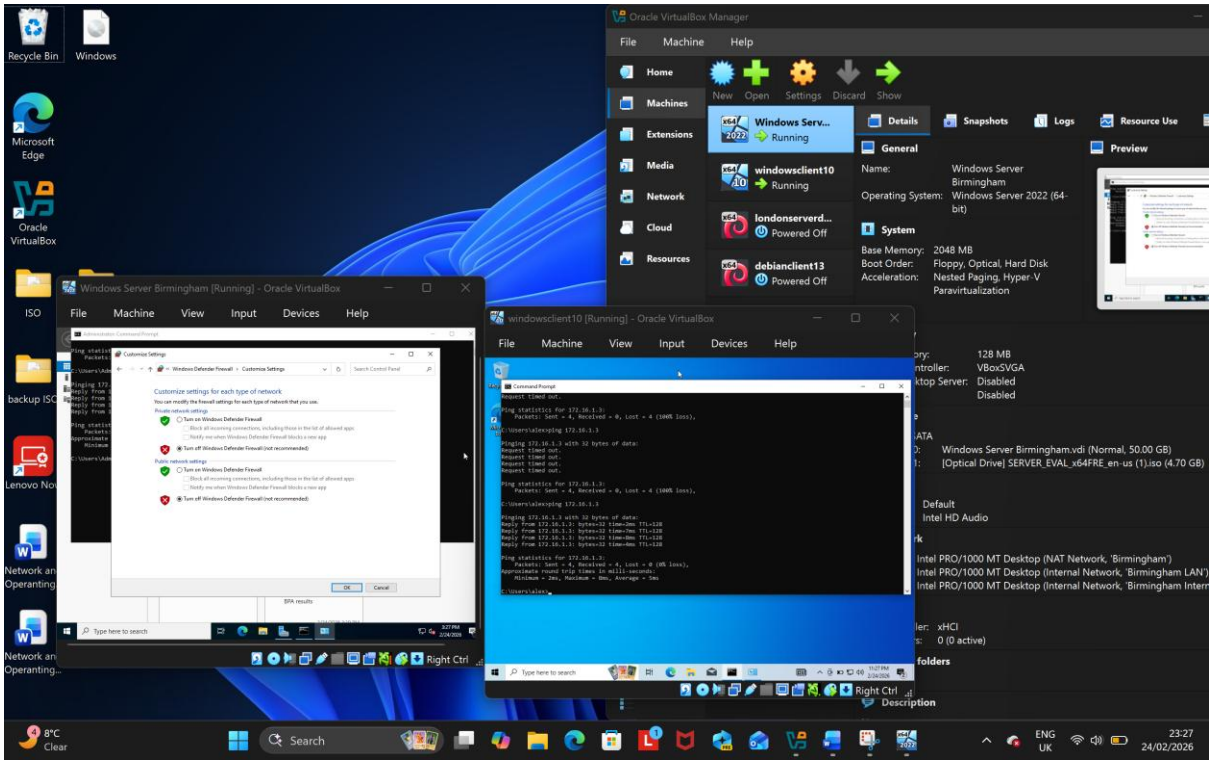
Now we are going to check if the Ip address are inside the network checking the Ip address on each machine click on internet icon then click on network and internet settings click on properties scroll down and we will see the Ip address 172.16.1.4 and 172.16.1.3



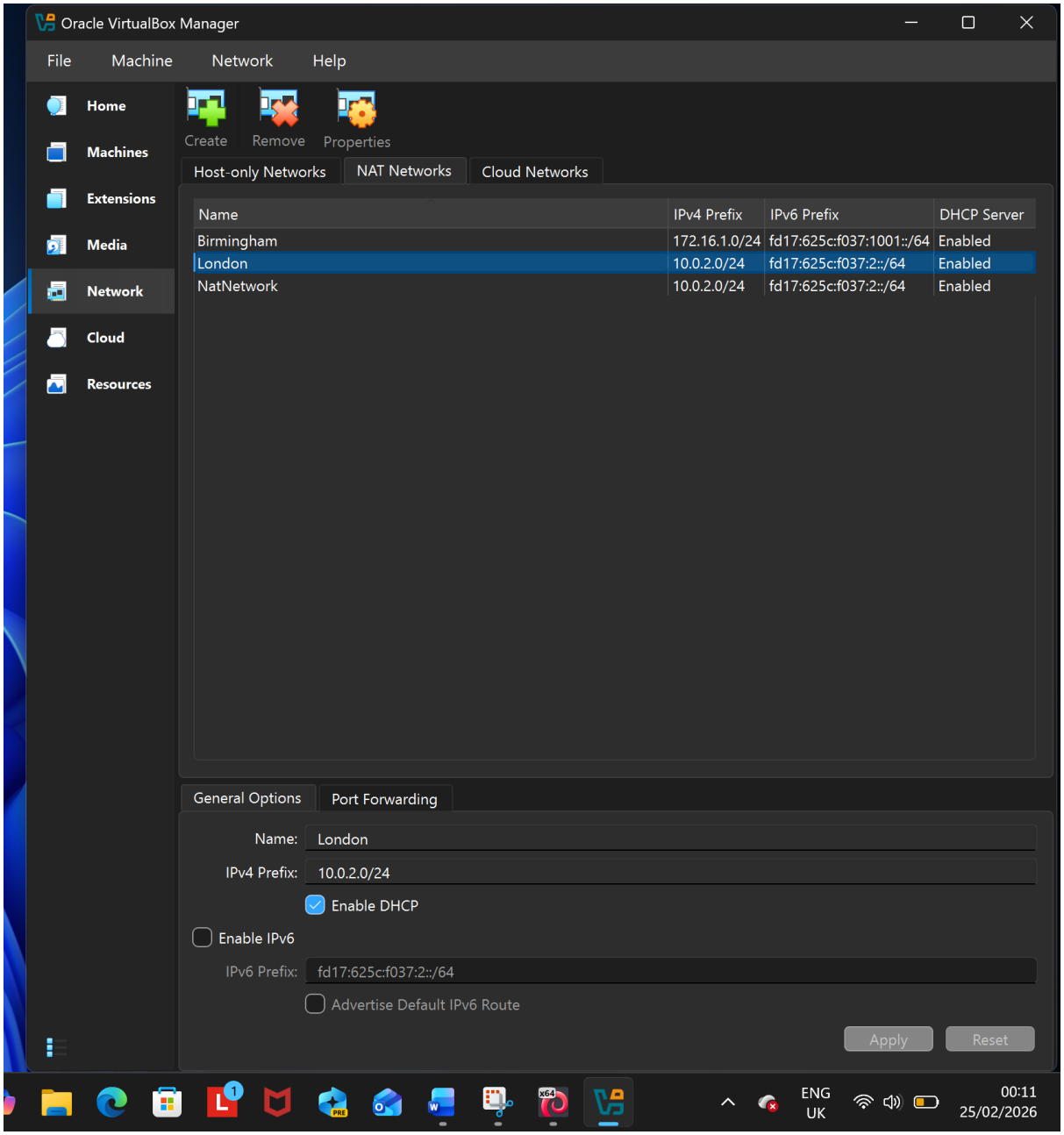
Now we check the ip address using ipconfig on CMD and when we make ping we receive the ip 172.16.1.4 and 172.16.1.3



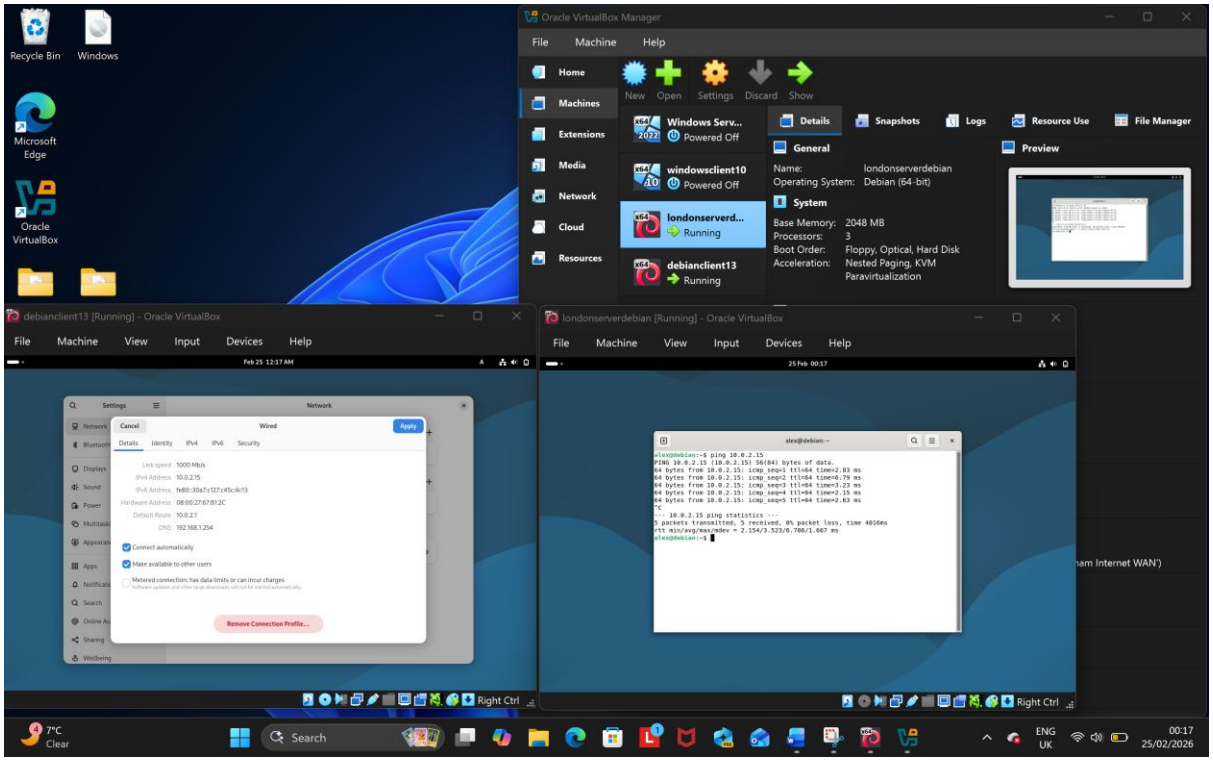
In this image we can see that windows server have conection with windows 10 we makae ping in cmd from windows server to windows 10 and we received the packets at the beginning we had a issue because firewall of windows was activated and that generates an issue for the conection but we turn off the firewall to implement the conection



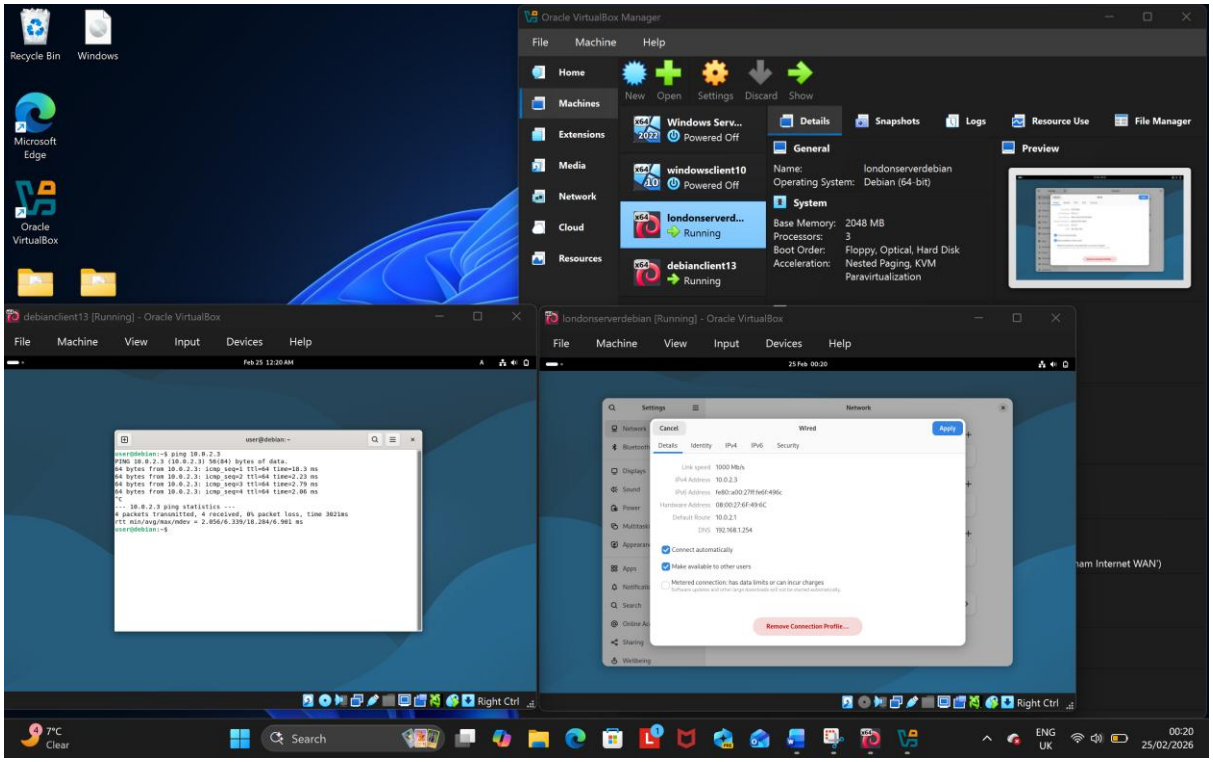
In the last image we can check that we are making ping from windows 10 to windows server and we received the 4 packets of the ping at the beginning we had an issue because windows firewall was activated to protect the conection but when we turned off windows firewall the conection was succesfull



Now weare going to create a new NAT going to file tools network and create the new conecction with the name of london we type the name London and we asign the ip 10.0.2.0/24 and then we select apply to create the new connection point.



In this screenshot we can see the ping from server to the client machine we ping 10.0.2.15 and we received response that show that there is a conection server and client debian virtual machines



Now we ping from clien to server debian machines and we ping 10.0.2.3 that is the ip of the server and we received conection.

TASK 3 PERSONAL & TECHNICAL REFLECTION

In my own experience in the moment that I worked in this assignment the most difficult thing that I experience is the environment of this programs I already used it 10 years ago but the codes that we use to prove the connection and all the configurations and settings that we need to do was difficult for me as an example at the beginning in class for me was difficult to find the correct sources to download the files that I use in this assignment I'm talking about the ISO files second the laptop that I was using at that time was just 4GB of RAM and 128GB of storage so was difficult for me to run VirtualBox and then try to run the ISO files at the end I got a new laptop with better specifications but I was running low on time to do the assignment I checked all the classes and I try to do my best with the knowledge that we get on class another barrier that I found was that at the moment of installation of the ISO files sometimes I get and error and I needed to download again a different ISO file to try the installation again after that have the knowledge of what tipe of configuration we will need to do that when the virtual machine start the installation don't get any error and finish all the configuration of the installation of the program, another issue was at the moment to configurate the connections by code or by GUI sometimes I get error some ip doesn't connect and I make a research on internet to check what could be happening I run some codes and finally I get the connection of the two ping between clients and servers at the end I change some configuration on the systems and finally I get the connection at the same time when I try to do the connection and I got an error and I found on internet that the firewall of windows was giving me the error that because of that both virtual machines didn't connect to finish I learn a lot about connection systems and use virtual box to install different kind of software's and operating systems and is really great that we have this program to develop network configurations and create new machines without need to buy a new one with a new system.

References

[1] J. Li et al., “A Survey on Hypervisor Security: Vulnerabilities, Attacks, and Defences,” ACM Computing Surveys, vol. 55, no. 4, pp. 1–37, 2023.

[2] A. S. Tanenbaum and D. Wetherall, Computer Networks, 5th ed. Pearson, 2013.

[3] Microsoft Corporation, “Best Practices for Active Directory Security,” Microsoft Learn, 2025. [Online]. Available: https://learn.microsoft.com/en-us/security/compass/active-directory-security (learn.microsoft.com in Bing)

[4] S. Hagen, IPv6 Essentials, 4th ed. O’Reilly Media, 2023.

[5] Microsoft Corporation, “Active Directory security best practices,” Microsoft Learn, 2024.