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Network Operating Systems and Services (ACCA5023)

Research, Build and Deploy a Virtualised Enterprise Network

Hypervisor Architecture and Suitability

Virtualisation works by using software called a hypervisor to divide up a computer's physical hardware and share it between multiple virtual machines (VM's). Instead of one OS controlling the whole machine, the hypervisor manages certain resources, including CPU, memory and storage and allocates them to each VM. There are two main types of hypervisor; Type 1 and Type 2.

Choosing the correct hypervisor type is critical. [1] Type 1 hypervisors run directly on the physical hardware. Since there is no host operating system working underneath them, they tend to have lower overhead and a smaller attack surface. This means that they will have a better performance and improved security. For environments where scalability and security are critical; Type 1 hypervisors are usually the ideal choice. [2]

Type 2 hypervisors, like Oracle VM VirtualBox, run on top of a host OS like Windows. They are easier to install and use, particularly on standard desktop or laptop hardware. They are ideal for educational use where convenience and accessibility are more important than performance. [3]

For the NOSS2026 topology, which includes Windows Server 2022, a Debian server and an Active Directory domain (SWANSEA.ACCA), a Type 1 hypervisor would technically provide better performance and separation between systems. However, considering hardware limitations and a controlled scale, using a Type 2 hypervisor is a more realistic choice. It supports both Windows and Linux virtual machines effectively and still allows you to configure the internal networking required to simulate a multi-site environment.

IP Addressing and Network Communication

IP addressing is what makes communication possible across different networks. It provides each device with a logical address so that data can be transferred further than its local network. [4] When a host sends data, the packet includes both a source and destination IP address. Routers analyse this information and forward data to the relevant location.

Switches and routers have different roles in this process. Switches operate at Layer 2 of the OSI model and forward frames using MAC addresses, but only within the same subnet. [5] Routers operate at Layer 3 and examine IP addresses to move the signals between separate networks. This difference is especially important in multi-site setups where communication between locations depends on correct IP addressing and accurate gateways.

IPv4 is the most used addressing system. It uses 32-bit addresses written in dotted-decimal format. Although IPv4 faces address exhaustion, it is still heavily used in networks.

IPv6 was then introduced to solve the exhaustion and scalability issues. It uses 128-bit hexadecimal addresses, which means there is a larger address space and improves scalability. Although, many enterprise networks continue to rely on IPv4 because it is familiar, compatible with existing systems, and easier to manage. [6]

Subnetting is used to divide a larger network into smaller sections. This reduces unnecessary broadcast traffic and strengthens security boundaries. [7] Variable Length Subnet Masking (VLSM) builds on this by allowing address space to be allocated based on the number of hosts needed, rather than following set class-based structures.

Within the NOSS2026 topology, VLSM allows separate subnets to be assigned to Swansea and London while conserving address space. Careful IP planning has a direct impact on performance, scalability, and overall network management.

Routing Strategy and Suitability

Routing controls how packets move between different networks. Static routing involves manually entering routes into a router's routing table. This gives full administrative control and predictable behaviour, but it does not automatically adapt if the network changes [8]. In contrast, dynamic routing protocols such as RIP and OSPF automatically exchange topology information between routers, recalculating optimal paths in response to network changes. While dynamic protocols enhance scalability and resilience, they introduce computational overhead and configuration complexity.

In the context of the NOSS2026 topology, routing decisions must consider network scale, administrative overhead, and functional requirements. The environment consists of two defined site networks (Swansea and London) with limited routing nodes and controlled traffic patterns. Under such conditions, static routing provides sufficient determinism without the operational complexity associated with dynamic protocols. Furthermore, the Debian server's role as a DHCP relay does not inherently require dynamic routing, as relay operations depend on directed forwarding rather than route discovery mechanisms.

Although dynamic routing would be more appropriate in a geographically distributed enterprise with multiple redundant links, the constrained scope of this implementation favours static configuration. This approach reduces misconfiguration risks and aligns with the educational objective of demonstrating foundational routing principles before

progressing to more advanced automated routing architectures in future expansion scenarios.

Critical Evaluation of Network Services

Enterprise network environments rely on coordinated services to maintain security, manageability, and operational continuity. DHCP automates IP address allocation, reducing administrative error and preventing address conflicts in expanding networks. Centralised management becomes particularly critical in multi-site deployments where manual addressing would introduce scalability limitations and inconsistency.

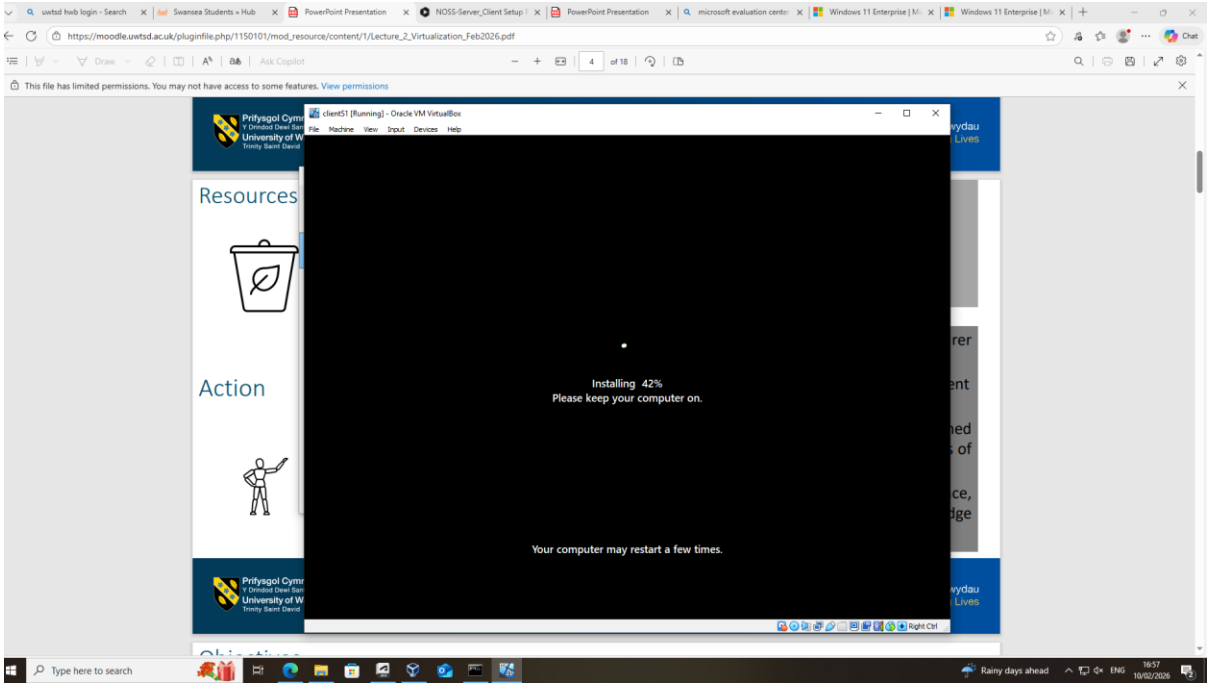
Active Directory Domain Services (AD DS) provides identity management, authentication, and policy enforcement across organisational units. Within the NOSS2026 topology, deploying AD DS supports structured access control, group policy management, and integration with domain-joined clients. This centralisation enhances security posture by reducing reliance on local accounts and enforcing uniform policy configurations. [9]

Certificate Authorities (CAs) strengthen trust relationships within enterprise networks by issuing digital certificates used for encryption, authentication, and secure communication protocols. In domain environments, certificates underpin services such as secure LDAP and VPN authentication, reinforcing confidentiality and integrity.

Virtual Private Networks (VPNs) extend secure connectivity across geographically dispersed sites by encrypting traffic over public networks. Although VPN implementation may be expanded in subsequent coursework, its strategic importance lies in enabling secure inter-site communication between Swansea and London without exposing internal resources.

Collectively, these services contribute to a layered security architecture. Their effectiveness depends not merely on deployment but on correct integration, access control configuration, and ongoing management within the virtualised infrastructure. [10]

Practical Work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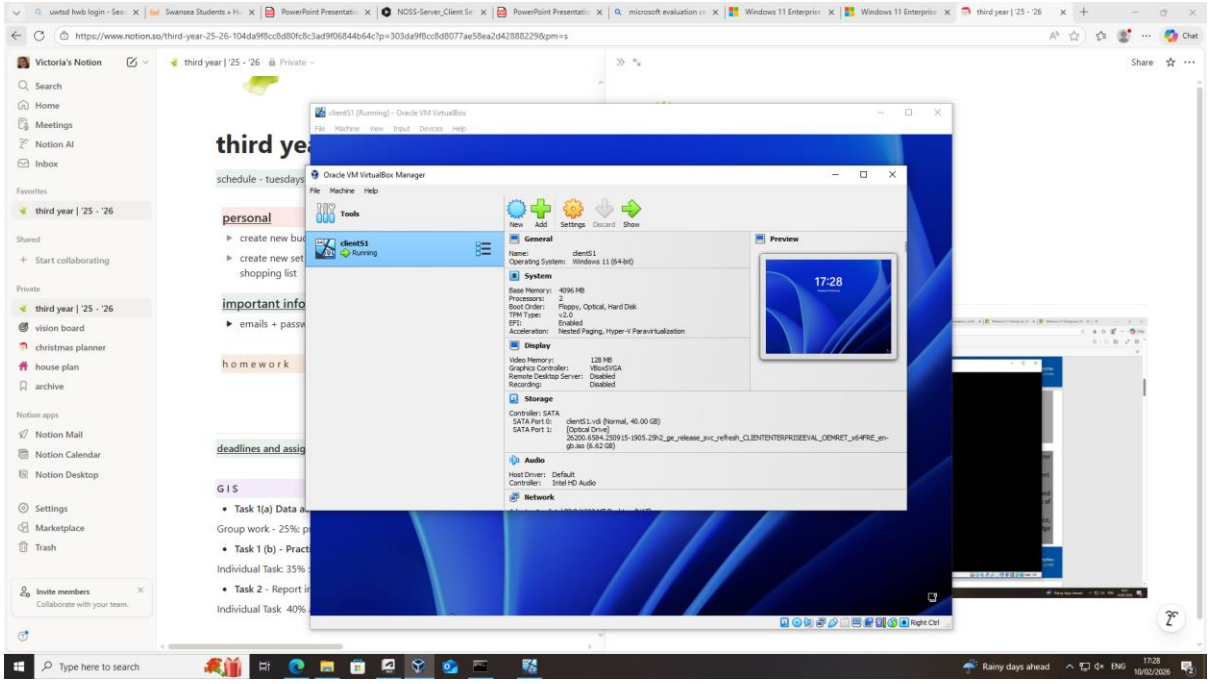
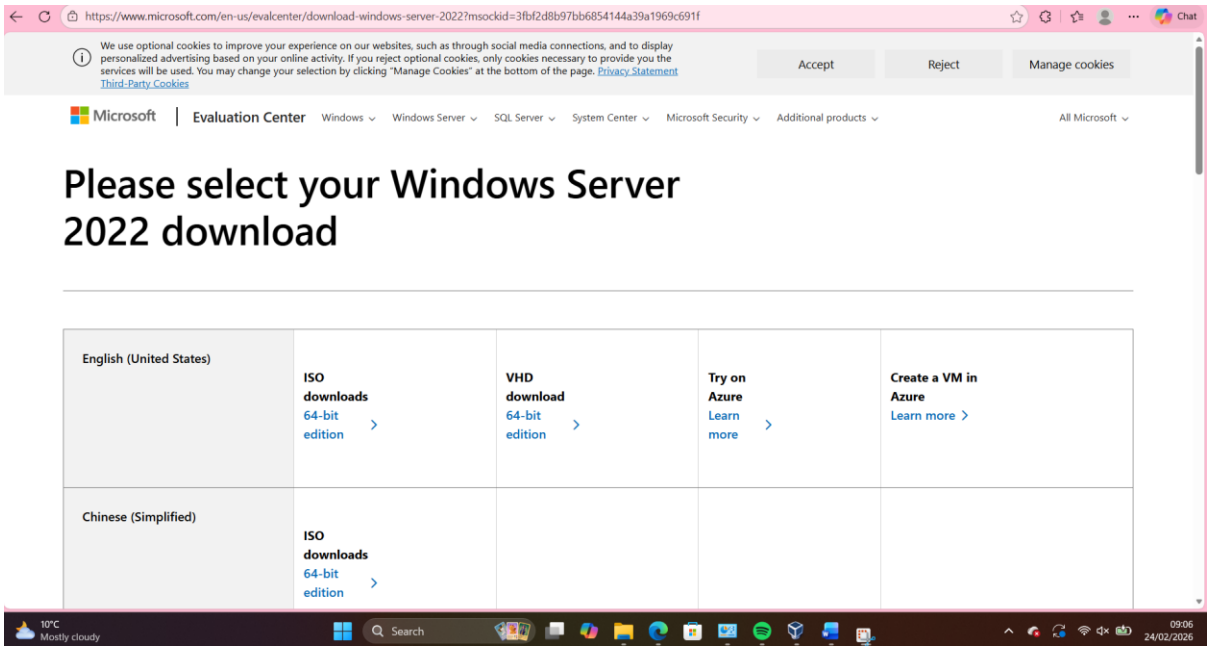
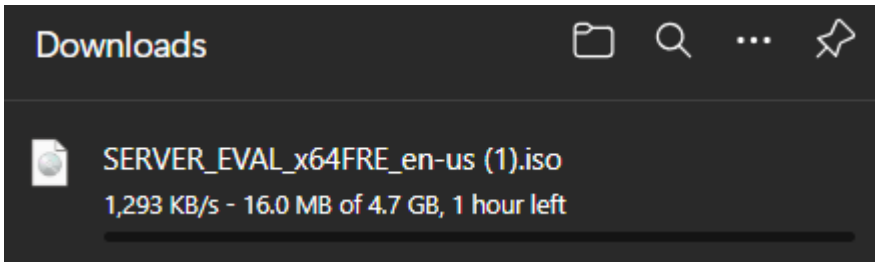
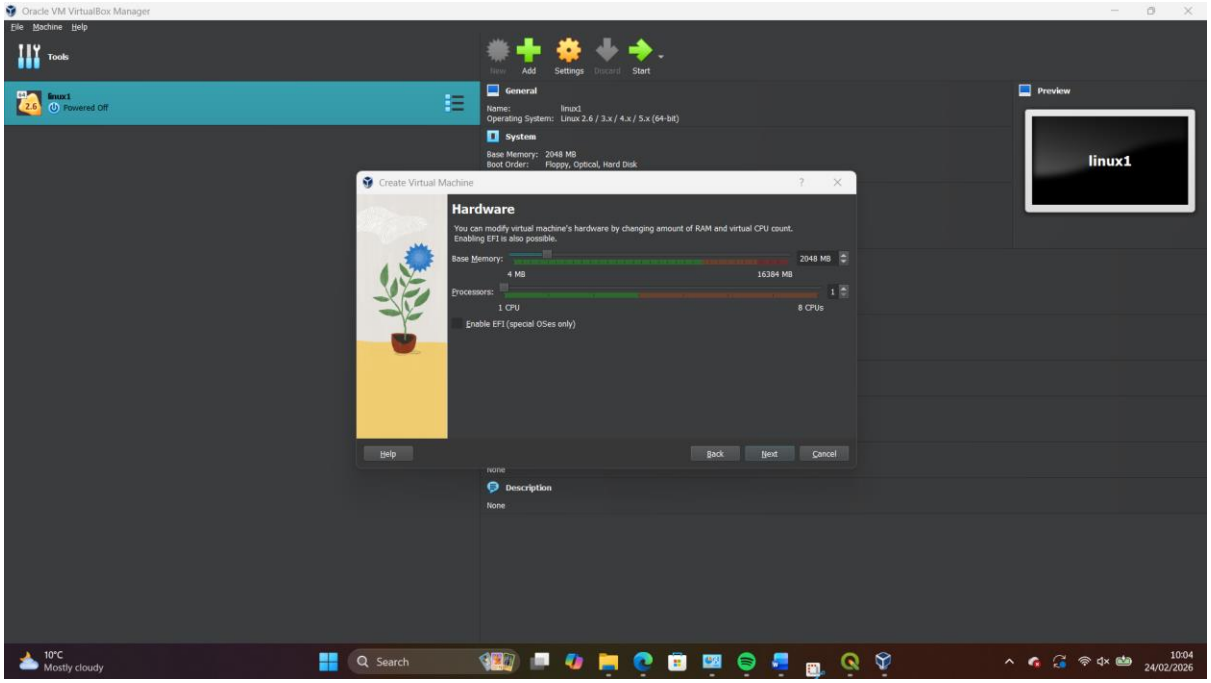
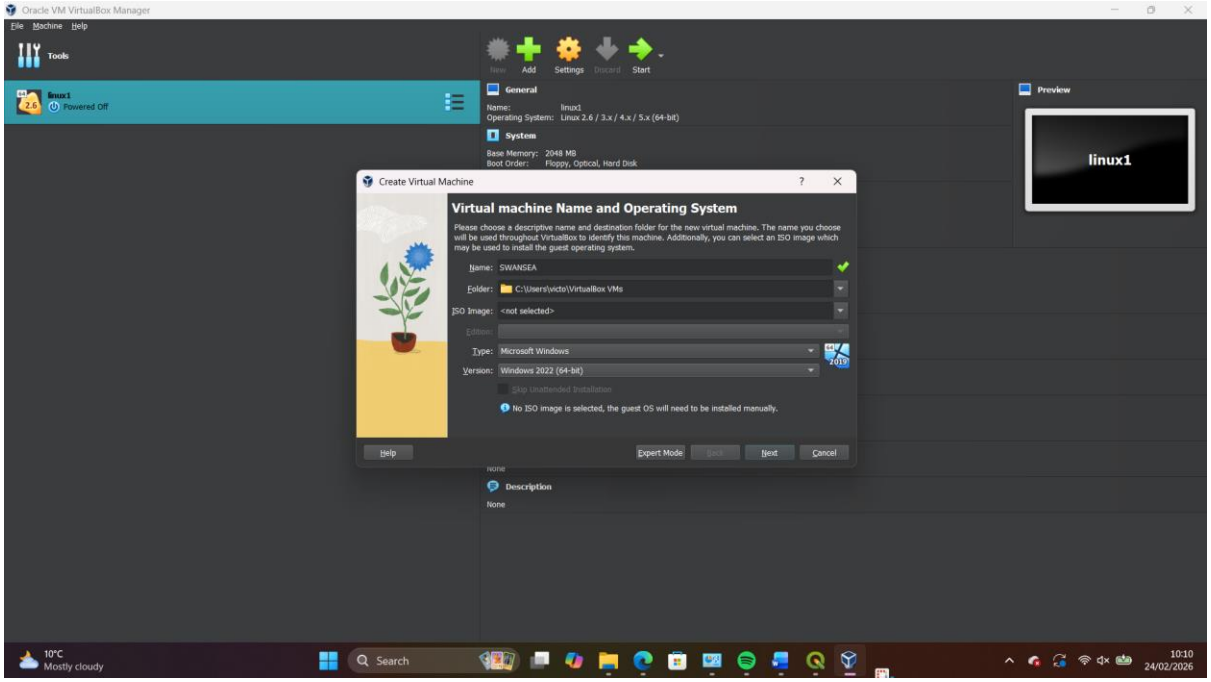
This file has limited permissions. You may not have access to some features. View permissions
Resources
Action
client51 [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
Installing 42%
Please keep your computer on.
Your computer may restart a few times.
Right Ctrl
Type here to search
Rainy days ahead
ENG
16:57
10/02/2026

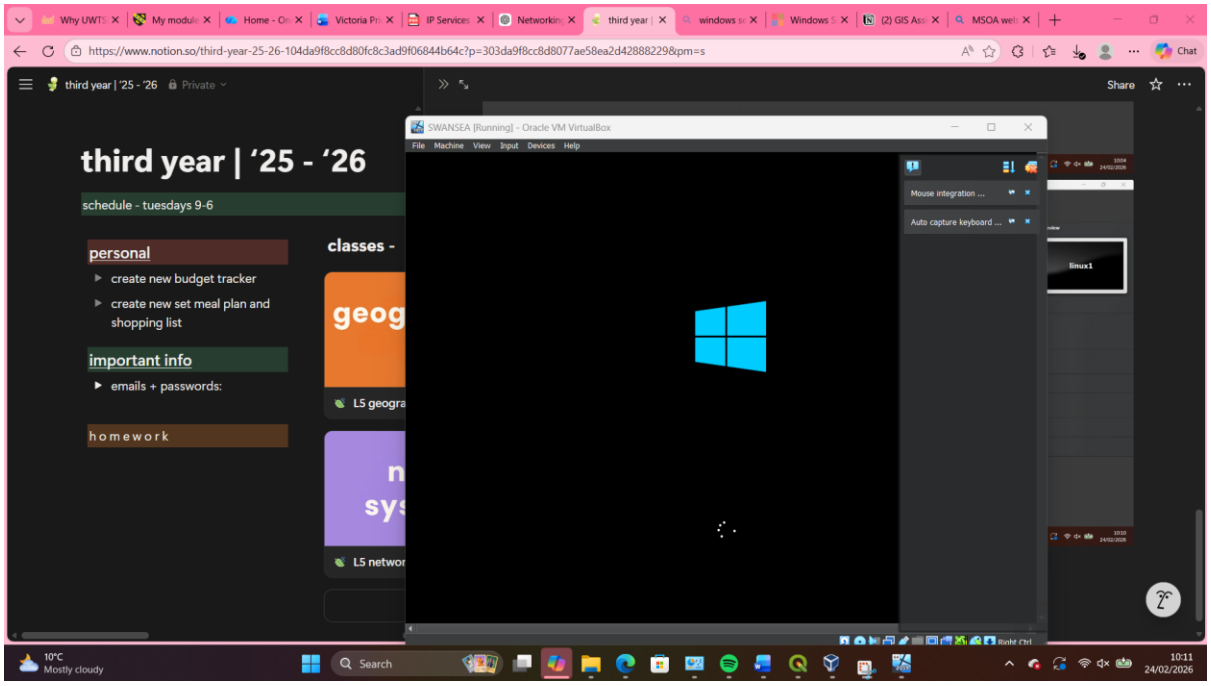

Oracle VM VirtualBox Manager
Tools
clientS1
Running
General
System
Display
Storage
Audio
Network
Preview
17:28

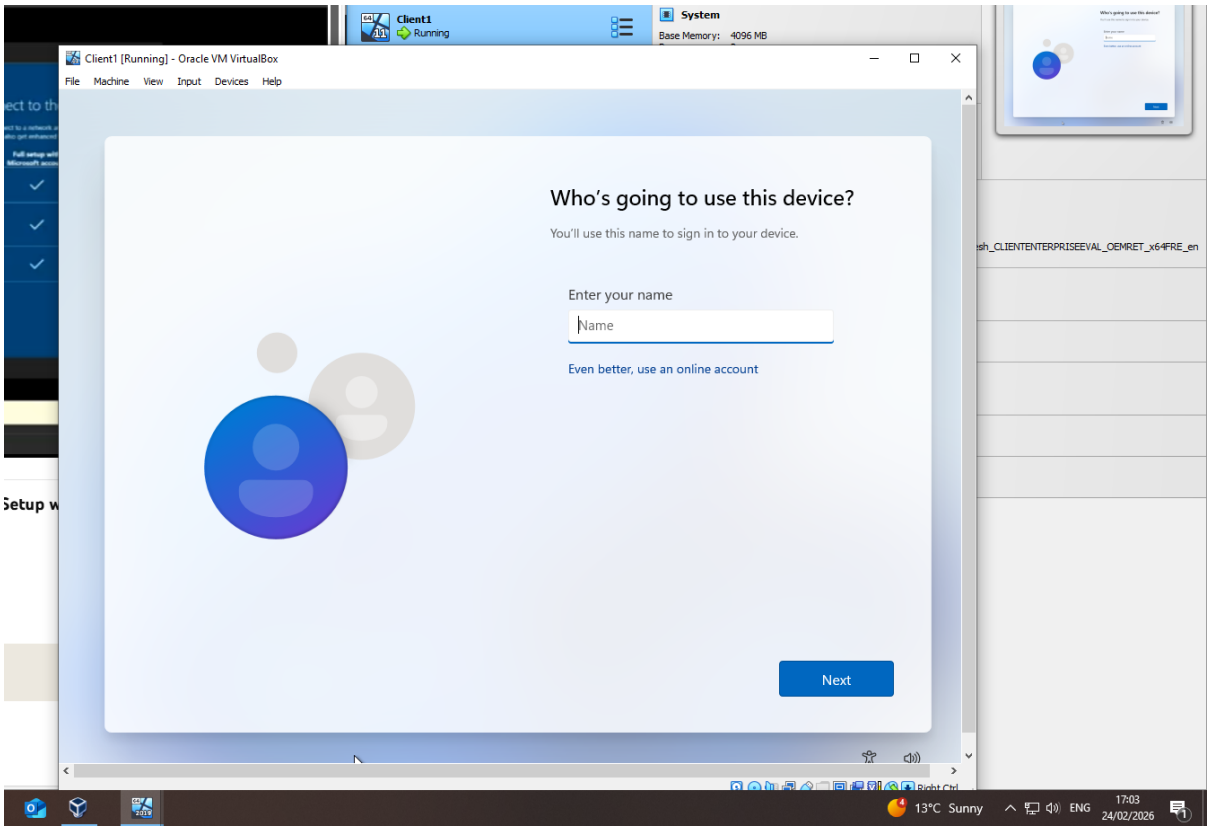

https://www.microsoft.com/en-us/evalcenter/download-windows-server-2022?msockid=3fbf2d8b97bb6854144a39a1969c691f
We use optional cookies to improve your experience on our websites, such as through social media connections, and to display personalized advertising based on your online activity. If you reject optional cookies, only cookies necessary to provide you the services will be used. You may change your selection by clicking "Manage Cookies" at the bottom of the page. Privacy Statement Third-Party Cookies
Accept
Reject
Manage cookies
Microsoft
Evaluation Center
Windows
Windows Server
SQL Server
System Center
Microsoft Security
Additional products
All Microsoft
Please select your Windows Server 2022 download
English (United States)
ISO downloads 64-bit edition
VHD download 64-bit edition
Try on Azure Learn more
Create a VM in Azure Learn more
Chinese (Simplified)
ISO downloads 64-bit edition

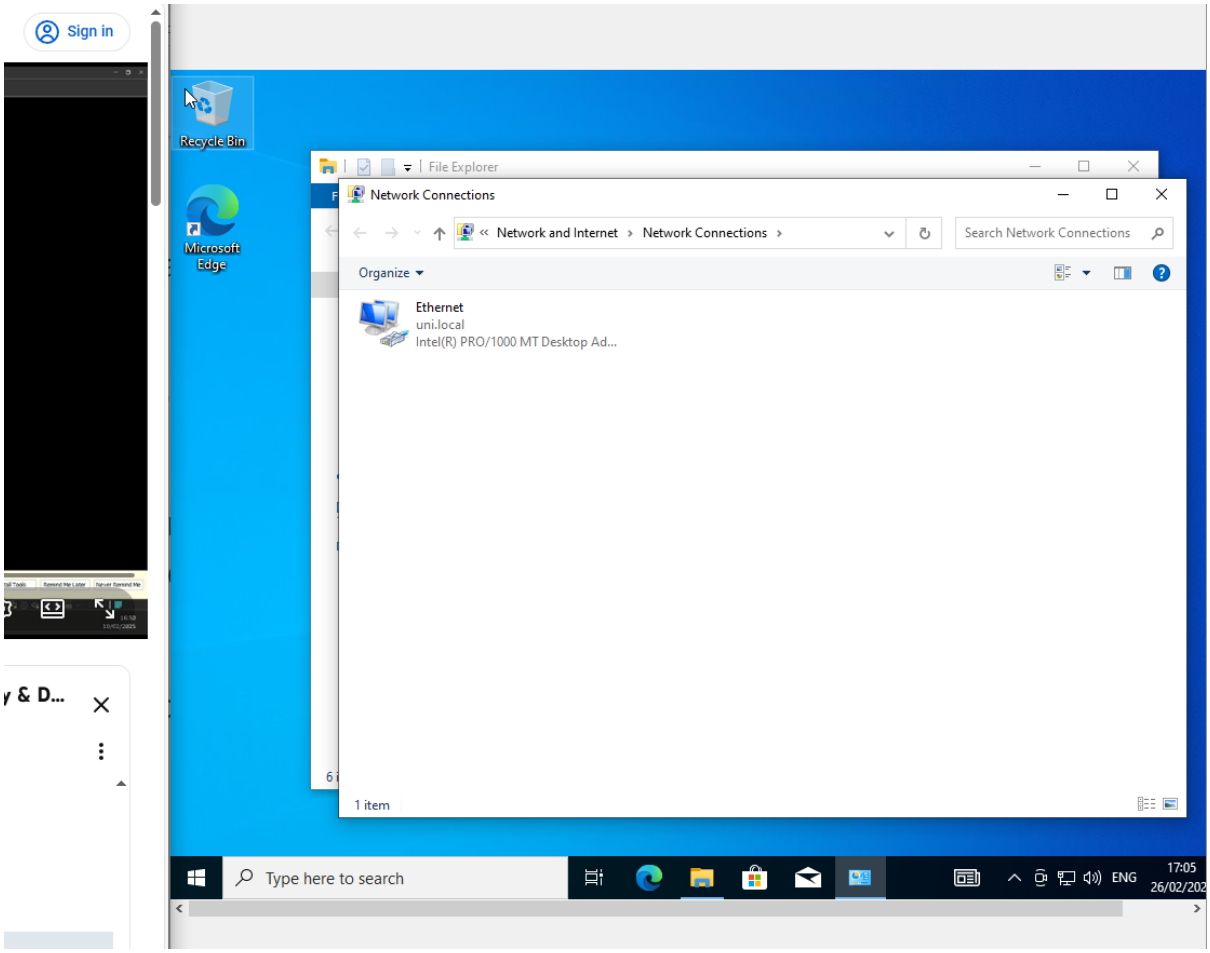

Downloads
SERVER_EVAL_x64FRE_en-us (1).iso
1,293 KB/s - 16.0 MB of 4.7 GB, 1 hour left

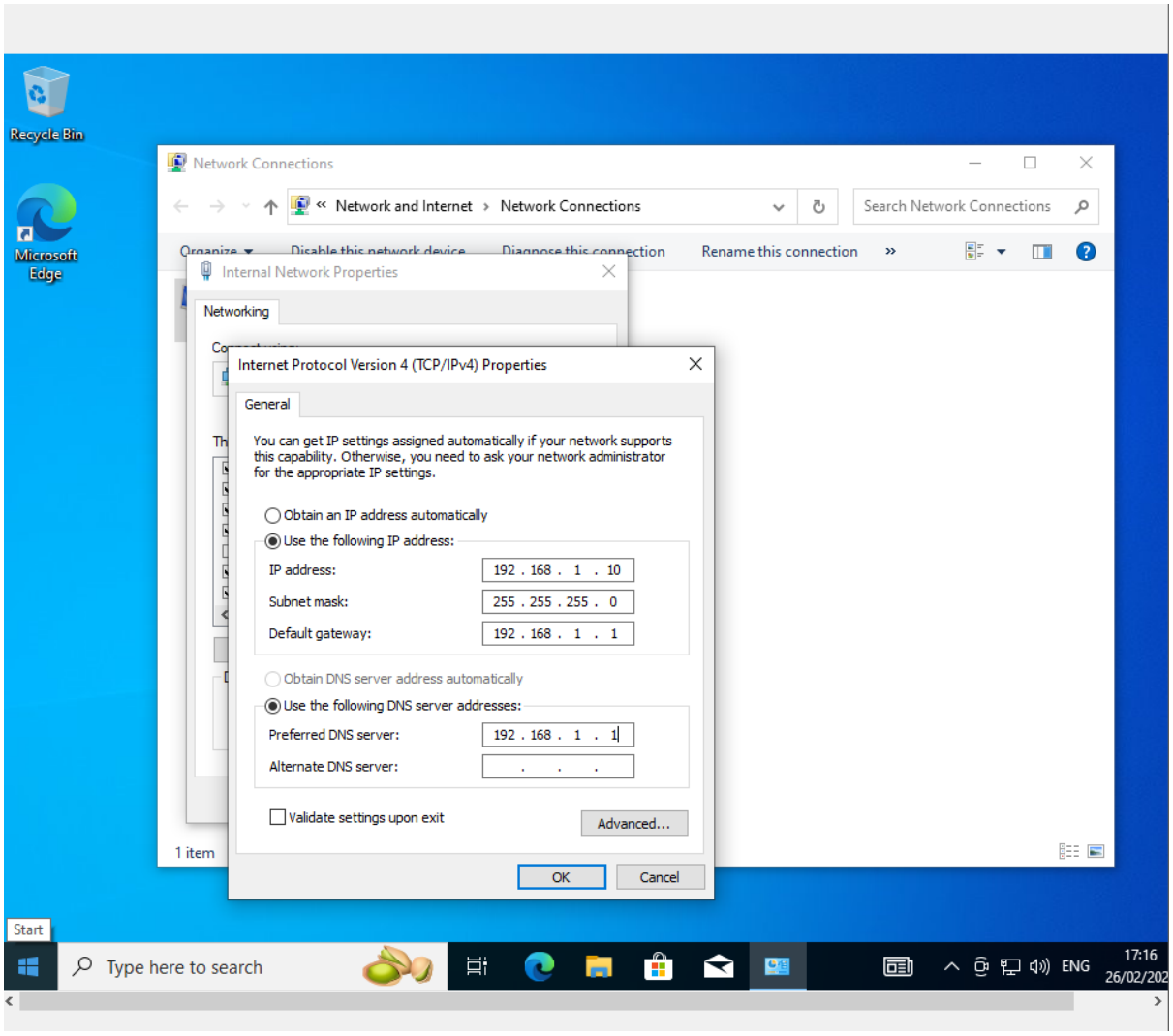

Oracle VM VirtualBox Manager
File Machine Help
Tools
linux1
Powered Off
New Add Settings Discard Start
General
Name: linux1
Operating System: Linux 2.6 / 3.x / 4.x / 5.x (64-bit)
System
Base Memory: 2048 MB
Boot Order: Floppy, Optical, Hard Disk
Preview
linux1
Create Virtual Machine
Hardware
You can modify virtual machine's hardware by changing amount of RAM and virtual CPU count.
Enabling EFI is also possible.
Base Memory: 2048 MB
4 MB
16384 MB
Processors: 1
1 CPU
8 CPUs
Enable EFI (special OSes only)
Help
Back
Next
Cancel
Description
None
10°C
Mostly cloudy
Search
10:04
24/02/2026

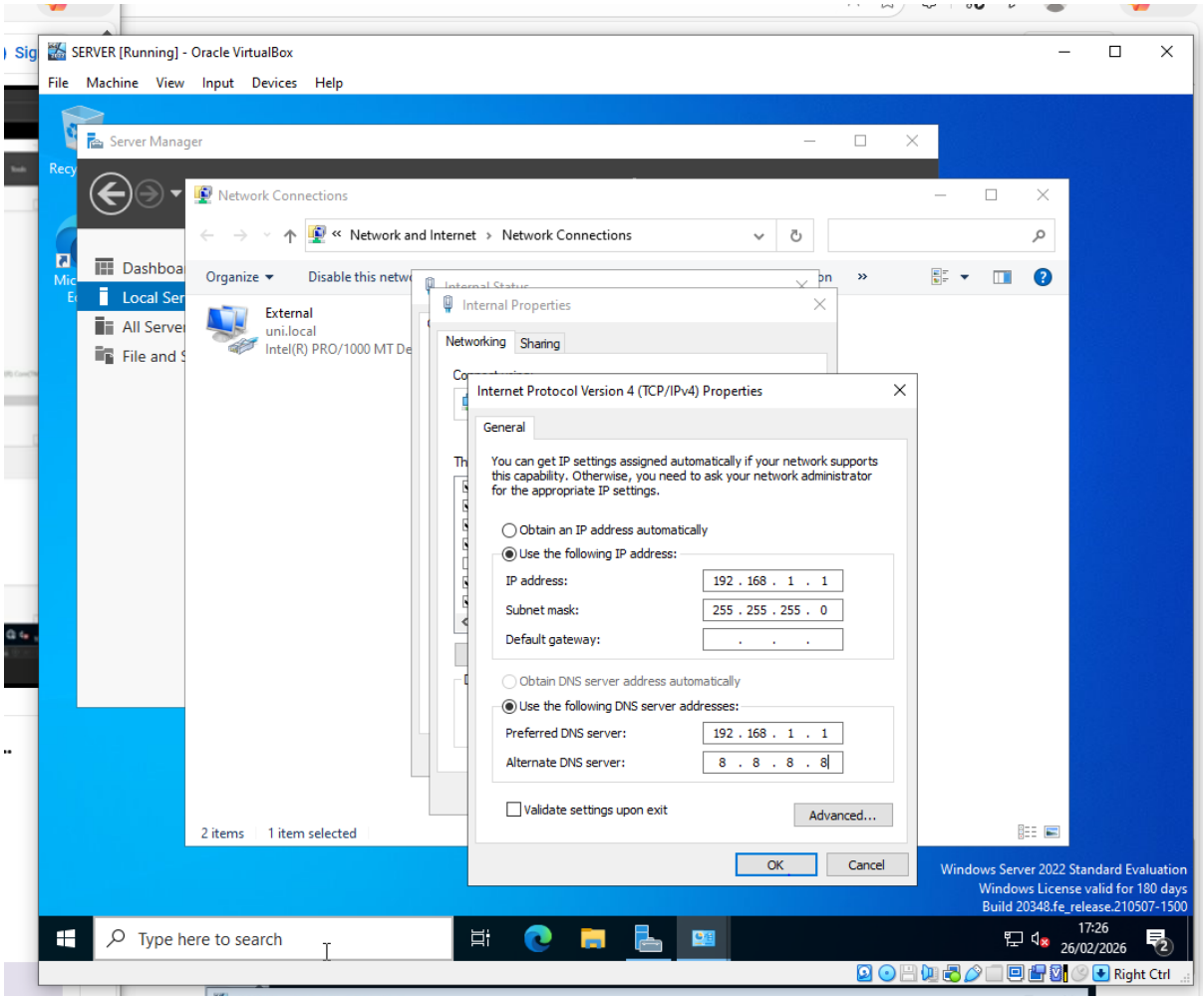

Oracle VM VirtualBox Manager
File Machine Help
Tools
linux1
Powered Off
New Add Settings Discard Start
General
Name: linux1
Operating System: Linux 2.6 / 3.x / 4.x / 5.x (64-bit)
System
Base Memory: 2048 MB
Boot Order: Floppy, Optical, Hard Disk
Preview
linux1
Create Virtual Machine
Virtual machine Name and Operating System
Please choose a descriptive name and destination folder for the new virtual machine. The name you choose will be used throughout VirtualBox to identify this machine. Additionally, you can select an ISO image which may be used to install the guest operating system.
Name: SWANSEA
Folder: C:\Users\victo\VirtualBox VMs
ISO Image: <not selected>
Edition:
Type: Microsoft Windows
Version: Windows 2022 (64-bit)
Skip Unattended Installation
No ISO image is selected, the guest OS will need to be installed manually.
Help
Expert Mode
Back
Next
Cancel
Description
None
10°C
Mostly cloudy
Search
10:10
24/02/2026

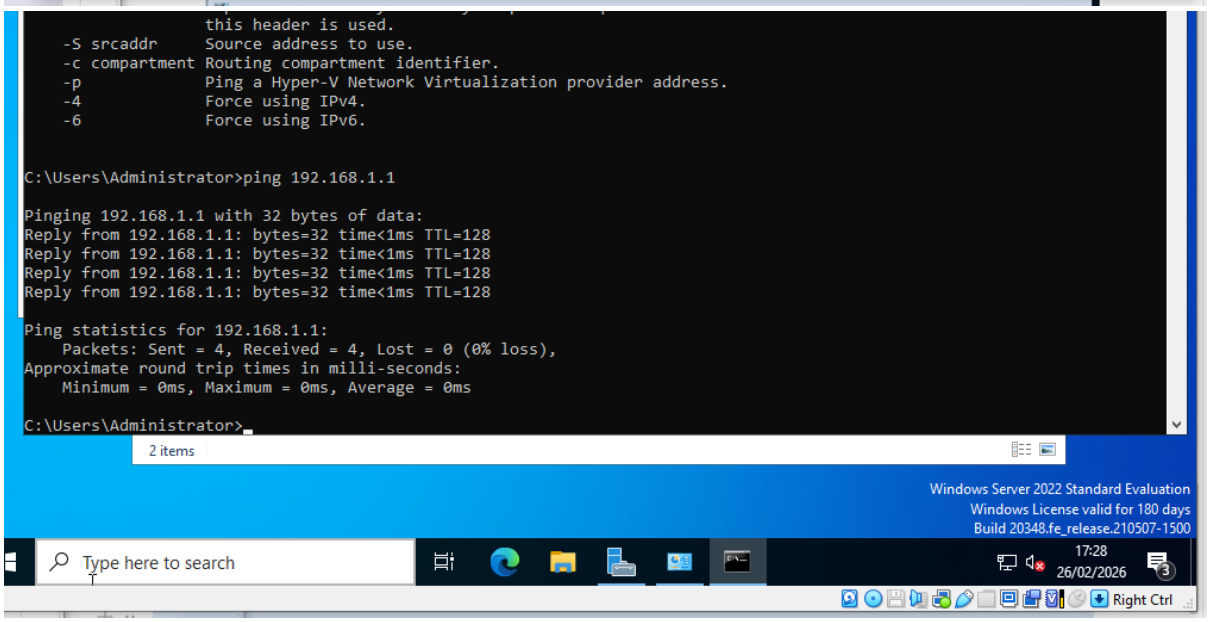

third year | '25 - '26
schedule - tuesdays 9-6
personal
create new budget tracker
create new set meal plan and shopping list
important info
emails + passwords:
homework
classes -
SWANSEA [Running] - Oracle VM VirtualBox


Client1 [Running] - Oracle VM VirtualBox
Who's going to use this device?
You'll use this name to sign in to your device.
Enter your name
Name
Even better, use an online account
Next


Sign in
Recycle Bin
Microsoft Edge
File Explorer
Network Connections
Network and Internet › Network Connections ›
Search Network Connections
Organize
Ethernet
uni.local
Intel(R) PRO/1000 MT Desktop Ad...
1 item
Type here to search
ENG
17:05
26/02/202


Recycle Bin
Microsoft Edge
Network Connections
Network and Internet › Network Connections
Search Network Connections
Organize
Disable this network device
Diagnose this connection
Rename this connection
Internal Network Properties
Networking
Internet Protocol Version 4 (TCP/IPv4) Properties
General
You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.
Obtain an IP address automatically
Use the following IP address:
IP address: 192 . 168 . 1 . 10
Subnet mask: 255 . 255 . 255 . 0
Default gateway: 192 . 168 . 1 . 1
Obtain DNS server address automatically
Use the following DNS server addresses:
Preferred DNS server: 192 . 168 . 1 . 1
Alternate DNS server:
Validate settings upon exit
Advanced...
OK
Cancel
1 item
Start
Type here to search
ENG
17:16
26/02/202


SERVER [Running] - Oracle VirtualBox
File Machine View Input Devices Help
Server Manager
Network Connections
Network and Internet › Network Connections
Organize
Disable this netw
External
uni.local
Intel(R) PRO/1000 MT De
2 items
1 item selected
Internal Properties
Networking
Sharing
Internet Protocol Version 4 (TCP/IPv4) Properties
General
You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.
Obtain an IP address automatically
Use the following IP address:
IP address: 192 . 168 . 1 . 1
Subnet mask: 255 . 255 . 255 . 0
Default gateway:
Obtain DNS server address automatically
Use the following DNS server addresses:
Preferred DNS server: 192 . 168 . 1 . 1
Alternate DNS server: 8 . 8 . 8 . 8
Validate settings upon exit
Advanced...
OK
Cancel
Windows Server 2022 Standard Evaluation
Windows License valid for 180 days
Build 20348.fe_release.210507-1500
Type here to search
17:26
26/02/2026
Right Ctrl


this header is used.
-S srcaddr Source address to use.
-c compartment Routing compartment identifier.
-p Ping a Hyper-V Network Virtualization provider address.
-4 Force using IPv4.
-6 Force using IPv6.
C:\Users\Administrator>ping 192.168.1.1
Pinging 192.168.1.1 with 32 bytes of data:
Reply from 192.168.1.1: bytes=32 time<1ms TTL=128
Reply from 192.168.1.1: bytes=32 time<1ms TTL=128
Reply from 192.168.1.1: bytes=32 time<1ms TTL=128
Reply from 192.168.1.1: bytes=32 time<1ms TTL=128
Ping statistics for 192.168.1.1:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
Minimum = 0ms, Maximum = 0ms, Average = 0ms
C:\Users\Administrator>
2 items
Windows Server 2022 Standard Evaluation
Windows License valid for 180 days
Build 20348.fe_release.210507-1500
Type here to search
17:28
26/02/2026
Right Ctrl

Reflection

The deployment of the virtualised network environment highlighted the importance of structured planning and systematic troubleshooting. During the initial configuration and set up of the server, my systems were continuously crashing. I was able to get to the stage of IP configuration before my system would shut down before being able to proceed with the next stages of the set up.

Potential causes of the shutdown issues I was facing could have been the RAM allocation in the Oracle VM that I gave for the server and client.

I am unhappy with how far I was able to get in this task. I am dedicated to increasing my knowledge on Network Configuration for future tasks. I faced a myriad of issues configuring my network, understanding how the systems should work and fully understanding the task at hand.

I have improving to do when it comes to time allocation and ensuring that I have a comprehensive knowledge of the task and the systems required to complete the task. Additionally, I will be aiming to improve my practical skills when it comes to IP addressing, subnetting and routing.

Citations

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