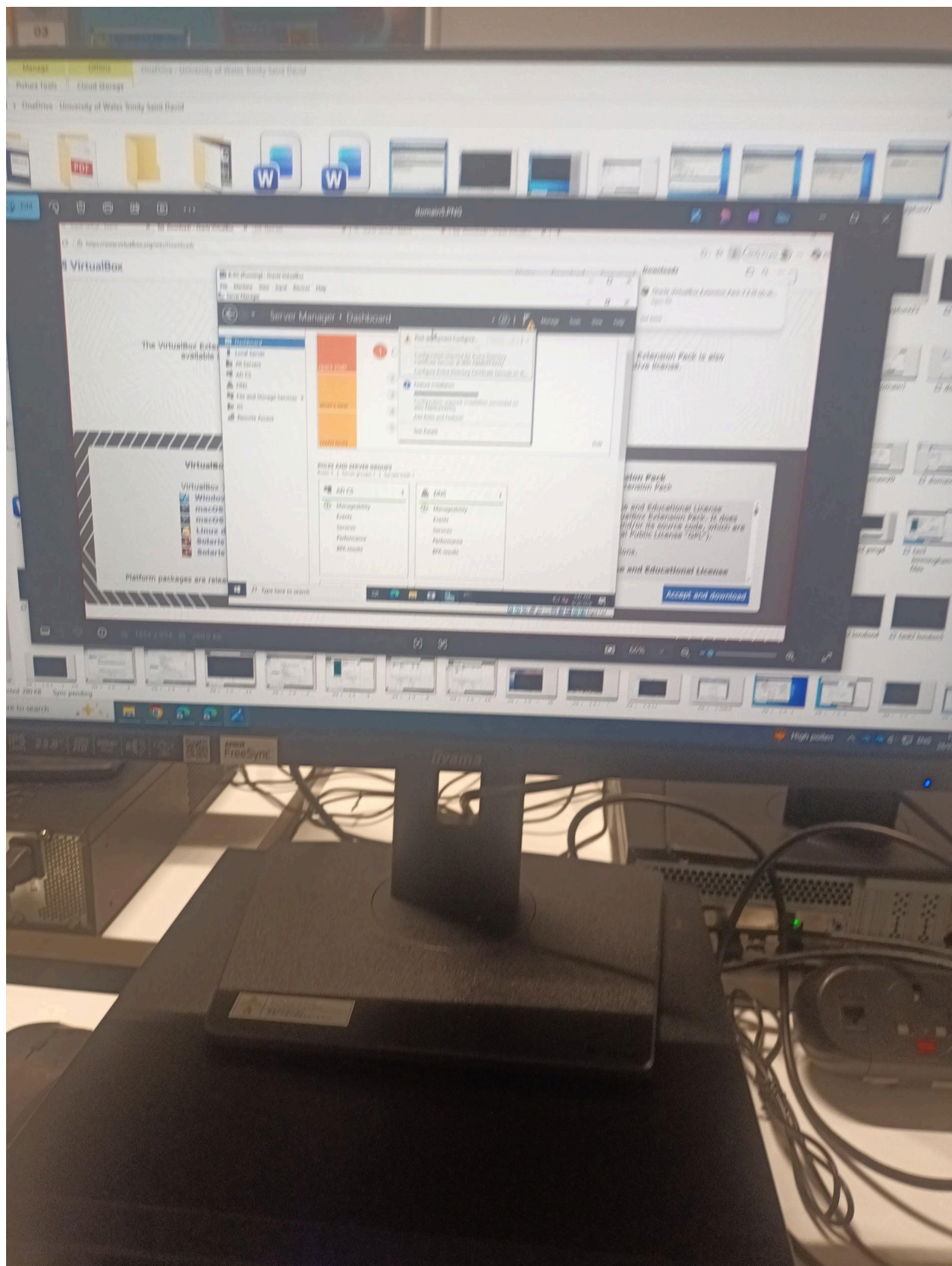


ACCA5023 Networking Fundamentals - Component 1 & Component 2 Complete Lab



Documentation & Screenshot Evidence

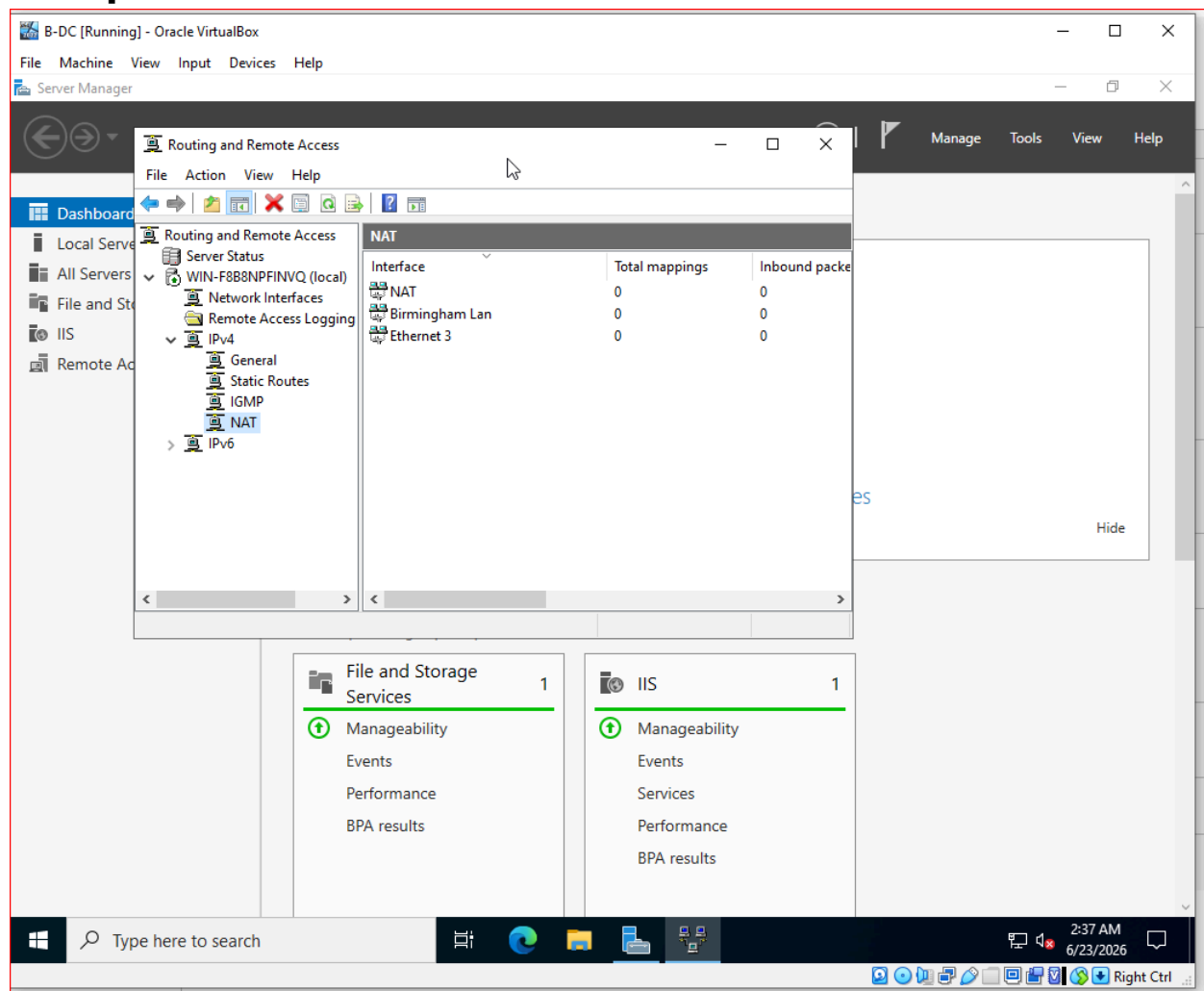
Student Name: Fateh Tschroub (Student No. 2422144)

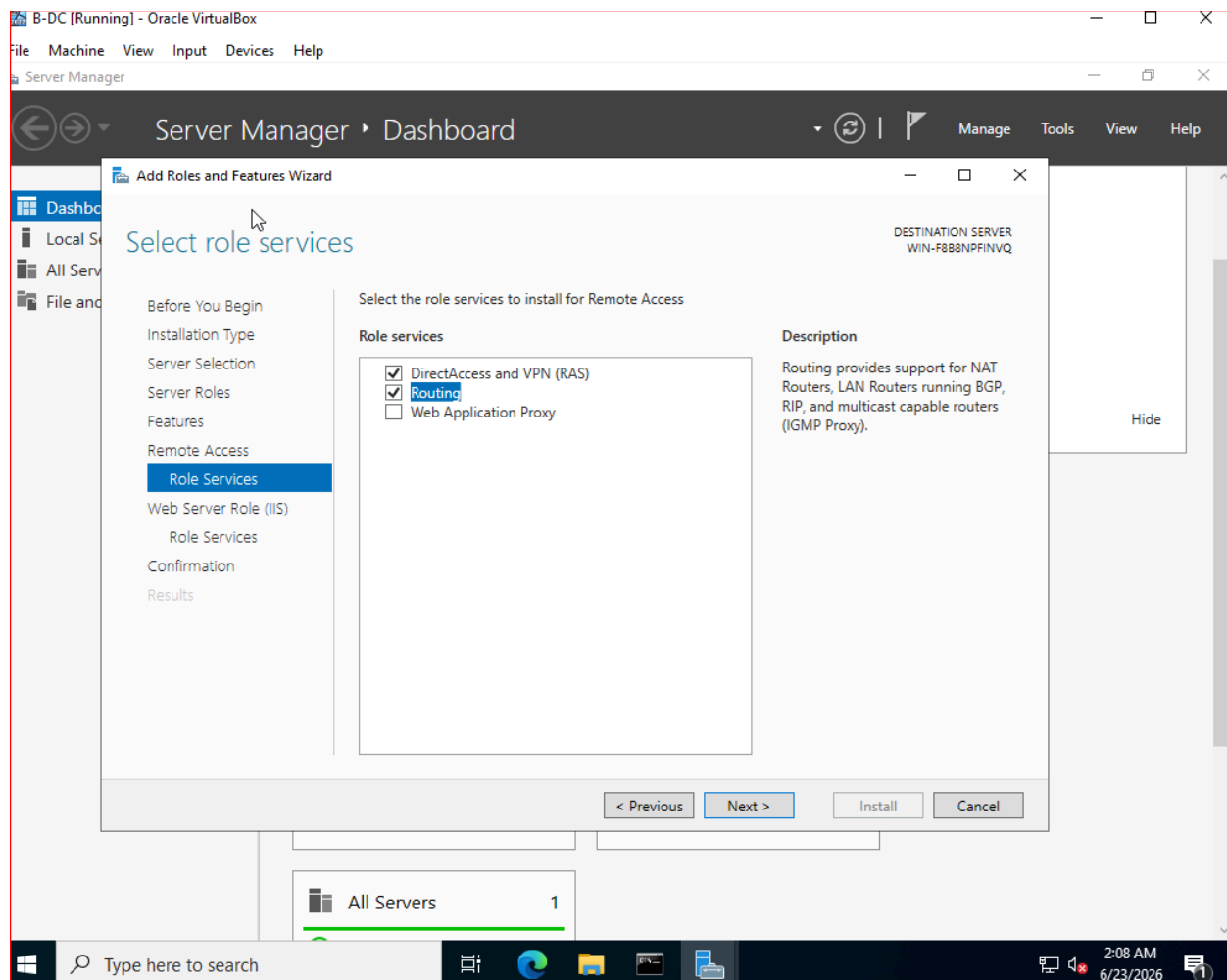
Module: ACCA5023 – Networking Fundamentals (Component 1 & Component 2)

Institution: University of Wales Birmingham

Lecturer: Abrar Almazi

1. Active Directory Domain Services & Server Roles Setup



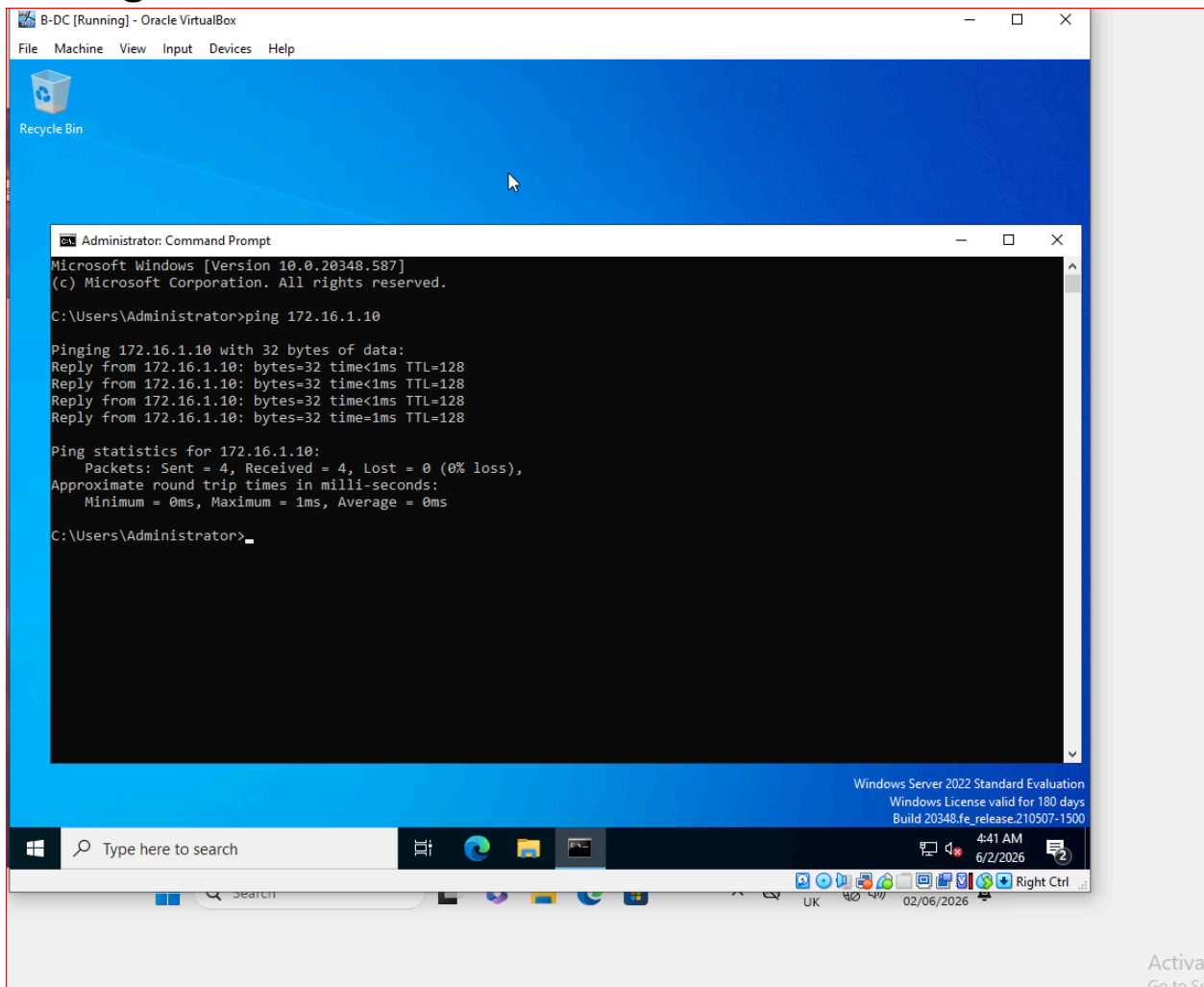


This section documents the initial deployment of core infrastructure roles, including Active Directory Domain Services (AD DS), DNS Server, and Active Directory Certificate Services (AD CS) on Windows Server 2022 (Server **B-DC** / hostname WIN-F888NPFINVQ).

- **Role Feature Inclusion:** Displays the "Add Roles and Features Wizard" prompt in Server Manager, requiring the addition of required management tools for Active Directory Certificate Services (AD CS) and DNS Server roles on destination server WIN-F888NPFINVQ [cite: domain1.PNG, domain2.PNG].
- **Confirmation Selection:** Captures the final configuration confirmation page within the Add Roles and Features Wizard, reviewing the selection of Active Directory Certificate Services (Certification Authority), DNS Server, and associated Remote Server Administration Tools (RSAT) prior to installation [cite: domain3.PNG].
- **Installation Progress & Success:** ⁶ Details the completion of the wizard's installation progress bar, displaying the successful deployment status on WIN-F888NPFINVQ with pending post-deployment configuration tasks for Active Directory Certificate Services [cite: domain4.PNG].
- **Server Manager Dashboard & Post-Deployment Notice:** Captures the Server Manager dashboard running on the B-DC virtual machine with a post-deployment notification flag indicating that configuration is required for Active Directory Certificate Services alongside

- active AD CS and DNS management groups [cite: domain5.jpg].
- **AD DS NetBIOS Configuration:** Displays the Active Directory Domain Services Configuration Wizard under the Additional Options page, verifying the assigned NetBIOS domain name as FATEH for the target server [cite: domain6.PNG].
- **Domain Review Options:** Captures the Review Options summary page of the configuration wizard, confirming that the server is being promoted as the first Active Directory domain controller in a new forest with the root domain name Fateh.acca, running Windows Server 2016 functional levels, with DNS services enabled [cite: domain7.PNG].
- **Prerequisites Validation Check:** Details the Prerequisites Check screen showing a successful validation message ("All prerequisite checks passed successfully") along with minor advisory security settings regarding cryptographic algorithms and static IP assignments [cite: domain8.PNG].

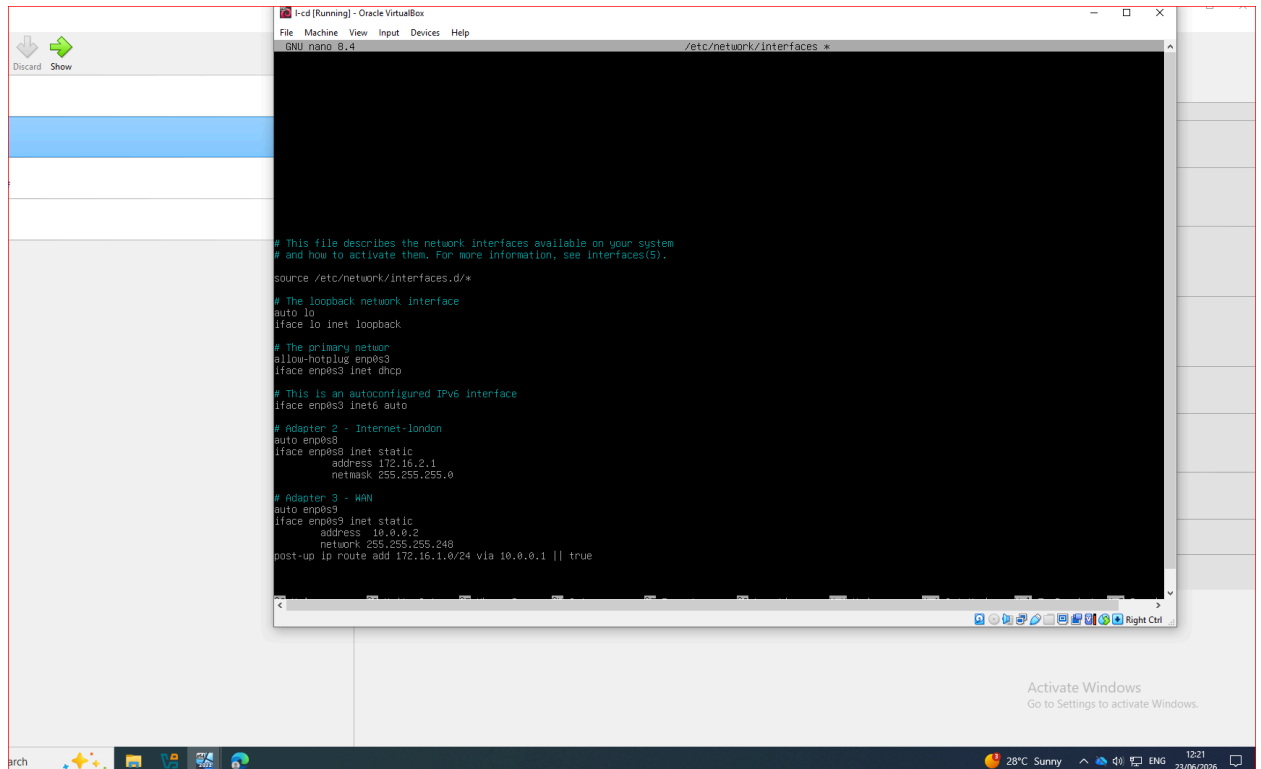
2. DNS Infrastructure & Resource Record Configuration



To enable proper name resolution across the domain, DNS forward lookup zones, reverse

lookup zones, forwarders, and host/pointer records were established.

- **DNS Manager Console Overview:** Displays the initial open window of the DNS Manager console in Server Manager on the Windows Server domain controller (WIN-F888NPFINVQ), showing the server node ready for zone configuration [cite: domain9.PNG].
- **DNS Forwarders Configuration:** Shows the DNS Manager properties window for server WIN-F888NPFINVQ under the Forwarders tab, listing external DNS server forwarder IP addresses (1.1.1.1 and 1.0.0.1 corresponding to Cloudflare) to handle unresolved name queries [cite: domain10.PNG].
- **New Host Record Creation:** Captures the New Host (A or AAAA) creation dialog in DNS Manager under the Fateh.acca forward lookup zone, mapping the host name d-dc to IP address 172.16.1.1 [cite: domain11.PNG].
- **Forward Lookup Zone Records:** Captures the expanded DNS Manager directory structure under the Fateh.acca forward lookup zone, listing registered resource records such as Start of Authority (SOA), Name Server (NS), and various host A records (d-dc, webs, rds, files) [cite: domain12.PNG].
- **New Zone Wizard Completion:** Shows the completion screen of the New Zone Wizard in DNS Manager, confirming the successful creation of an Active Directory-Integrated Primary Reverse Lookup Zone named 1.16.172.in-addr.arpa [cite: domain13.PNG].
- **New Pointer PTR Record Creation:** Displays the New Resource Record configuration dialog for a Pointer (PTR) record under the reverse lookup zone, mapping the host IP address 172.16.1.1 to the fully qualified domain name with host name b-dcFateh [cite: domain15.PNG].
- **Reverse Lookup Pointer Records:** Displays the populated Pointer (PTR) records inside the 1.16.172.in-addr.arpa reverse lookup zone in DNS Manager, linking IP 172.16.1.1 to domain hosts such as webs.fateh.acca, rds.fateh.acca, files.fateh.acca, and b-dc.fateh.acca [cite: domain16.PNG].
- **DNS Name Resolution Test Output:** Captures a PowerShell terminal session executing an nslookup query for domain Fateh.acca, displaying the local server address and successfully resolved IPv4 addresses (10.0.2.15, 172.16.1.1, and 1.0.1.30) [cite: task 2test th domain.PNG].
- **Domain Directory NSLookup Test:** Displays a PowerShell session executing nslookup queries for Fateh.acca and b_dc.Fateh.acca via DNS server 172.16.1.1, confirming successful resolution of the domain name to multiple associated IPv4 and IPv6 addresses [cite: task2 test domain drectory.jpg].
- **Active Directory SRV Record**



Lookup: Displays a PowerShell session executing an nslookup query for the LDAP SRV service location (_ldap._tcp.dc._msdcs.Fateh.acca), confirming successful domain controller service registration and resolution [cite: tsk 2 Active directory service.jpg].

3. Internet Information Services (IIS) & Web Server DeploymentACCA5023

Component 1 and 2 Submission

Component

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Component 1

Overview.....

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Submission note: This document is organised as one combined ACCA5023 submission for Component 1 and Component 2. Each screenshot should be inserted directly above its matching figure caption.

The captions and explanations identify what each screenshot is intended to prove.

Component 1

Component 1 Overview

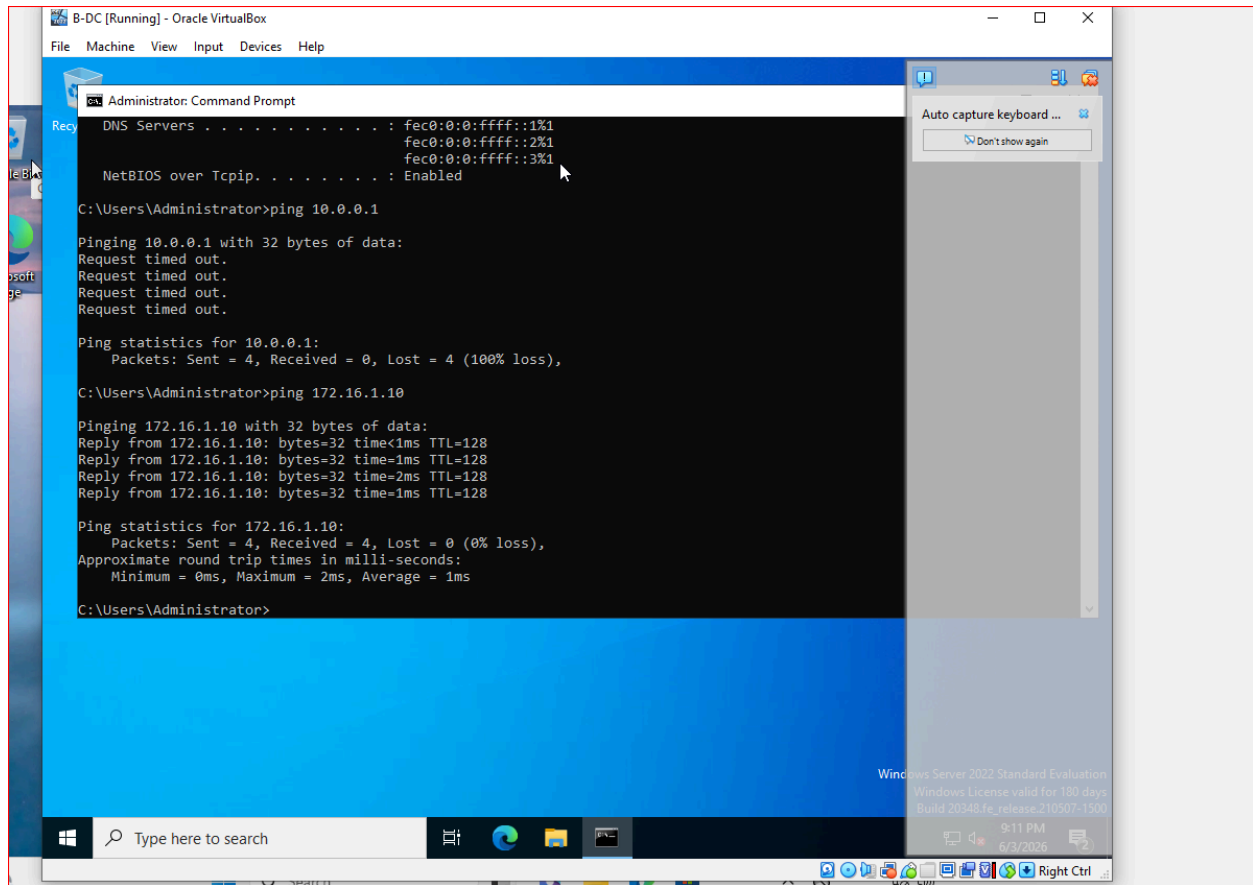
Component 1 records the initial virtualised network build for the NOSSLONDON2026 scenario. It shows the Debian installation process, disk partitioning, network configuration, interface checking, and connectivity testing between the host, server, and client devices.

The evidence is presented as numbered figures followed by a short explanation. This makes it clear what each screenshot should show and why it is relevant to the technical documentation.

Task 2 – Technical Documentation

Screenshot placement: I have inserted the matching screenshot directly above each figure caption below.

Figure 1: Verify host network connectivity.



Explanation:

This confirms the host can reach the server at 172.16.1.1 with no packet loss.

Figure 2: Verify client cannot reach incorrect address.

Explanation:

This shows the client cannot reach the incorrect IP address, as expected.

Figure 3: Verify client can ping the host.

Explanation:

This confirms the client can communicate successfully with the server.

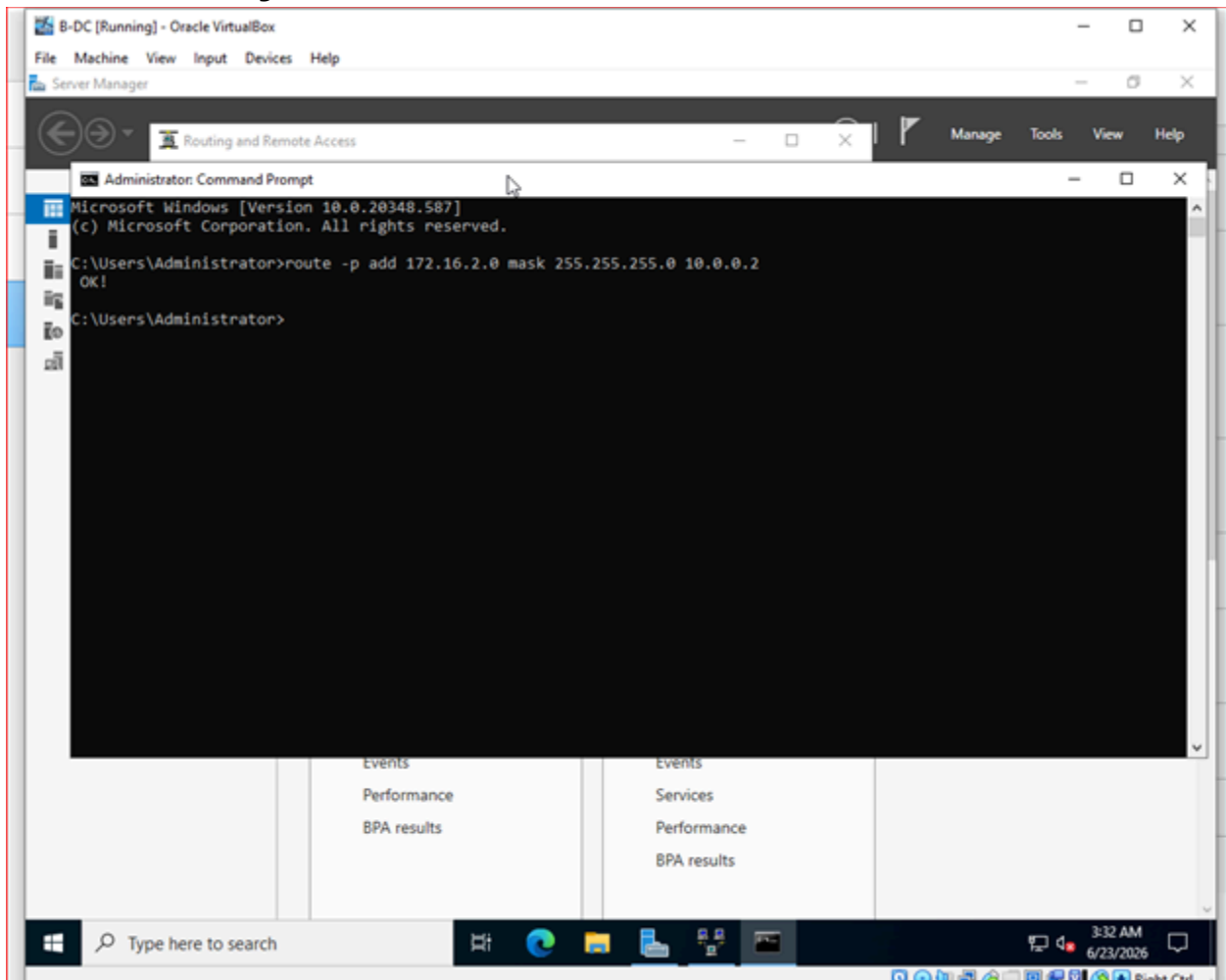
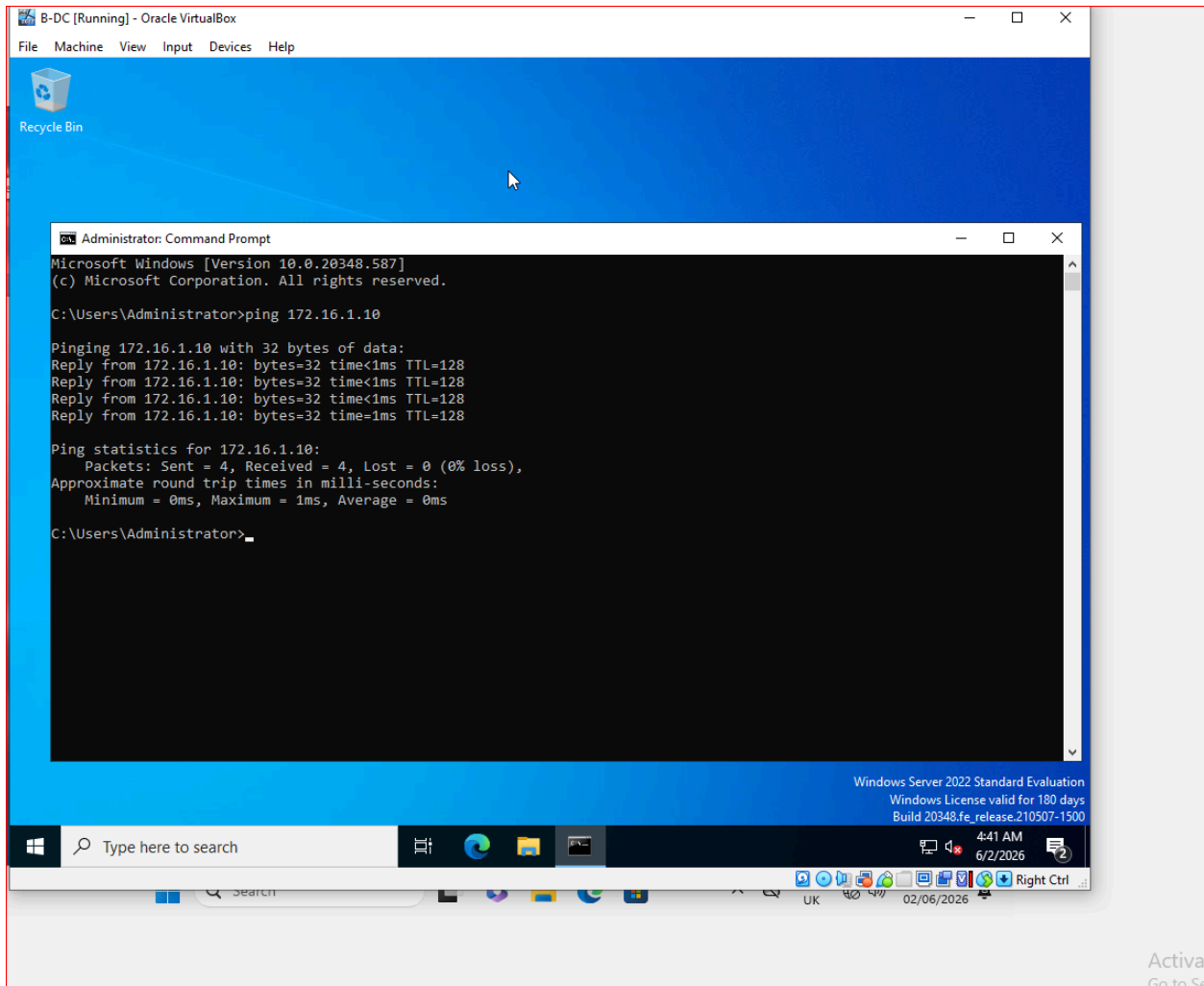


Figure 4: Debian installer partition disks.

Explanation:



This shows the Debian root and swap partitions before installation continues.

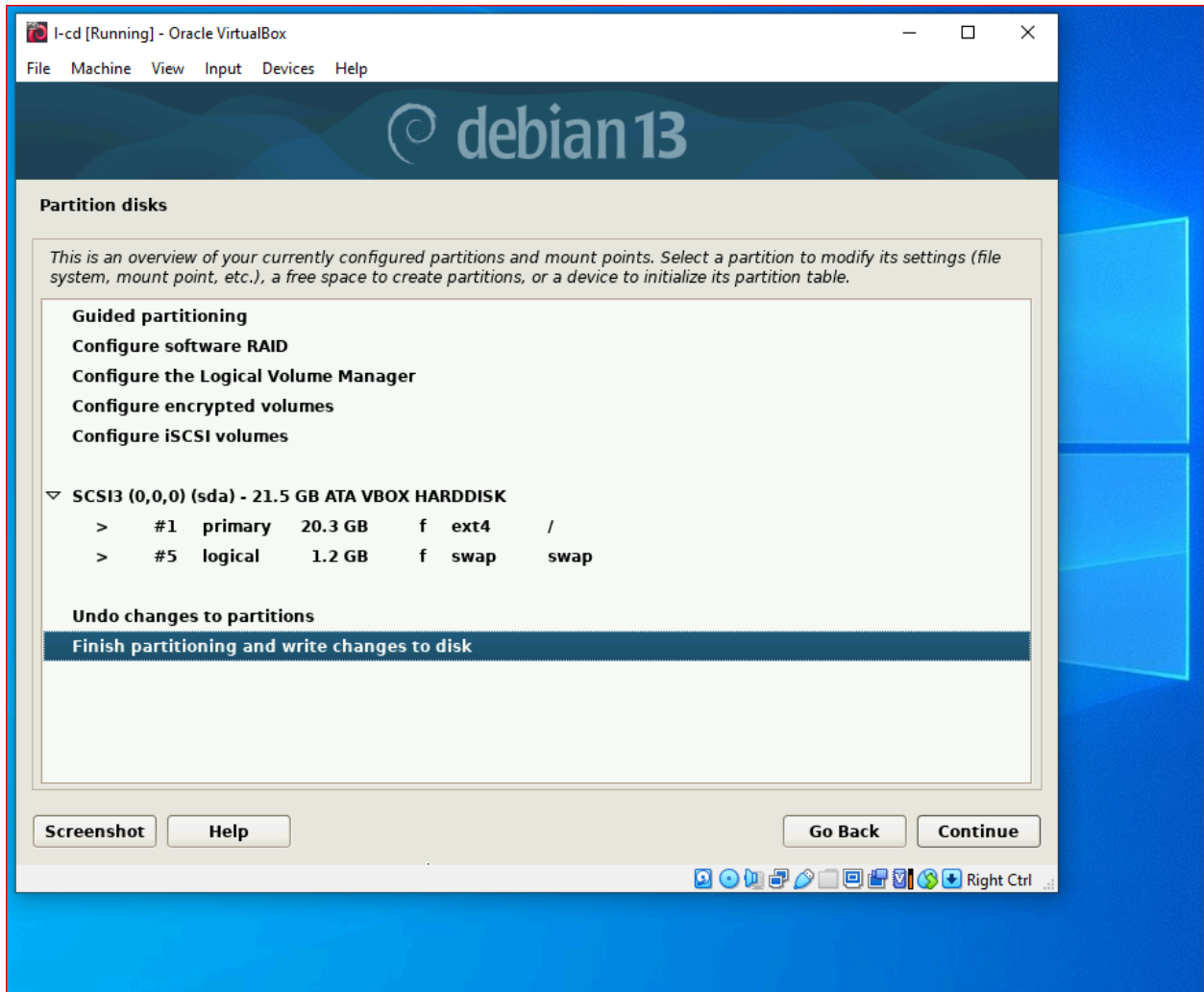
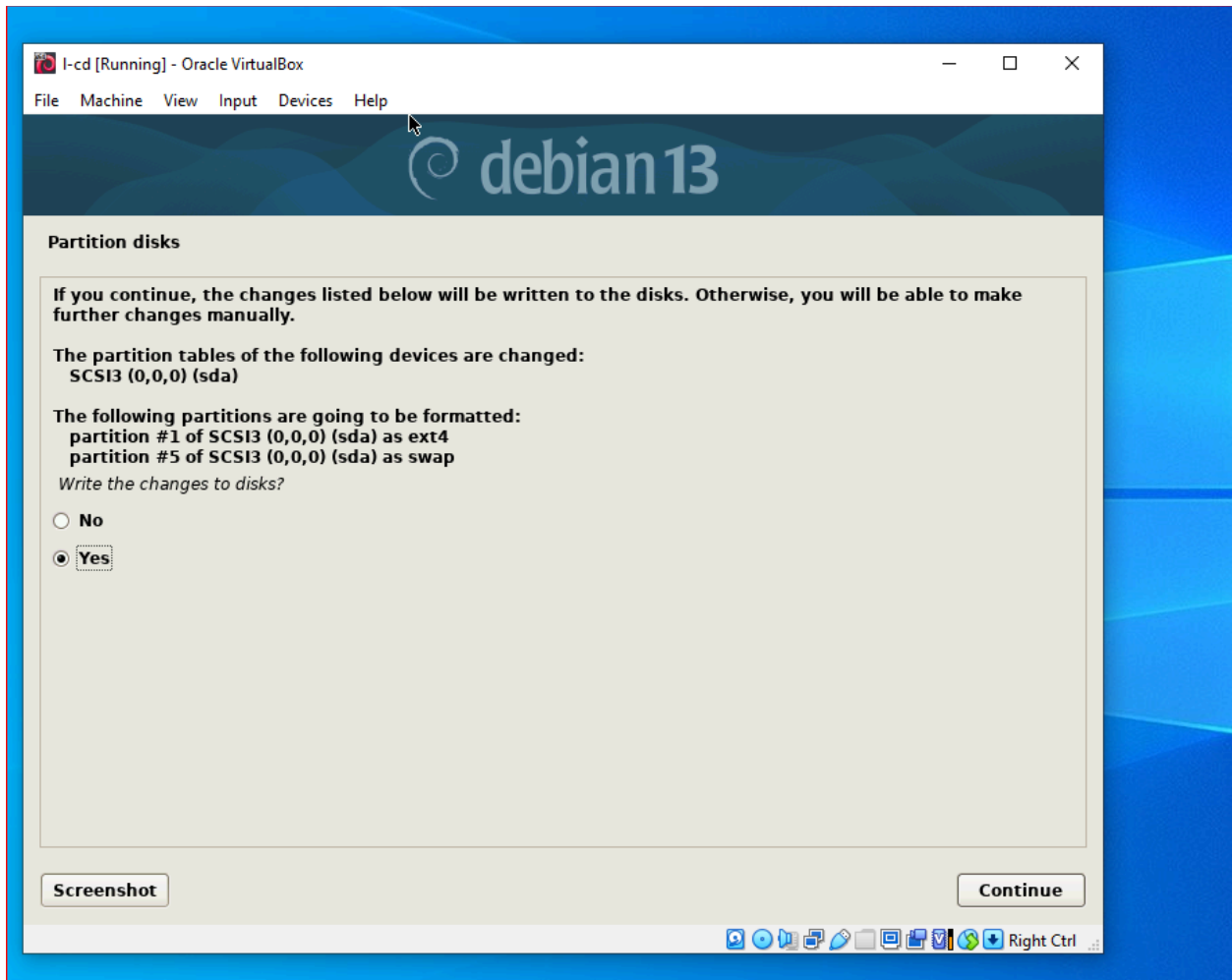
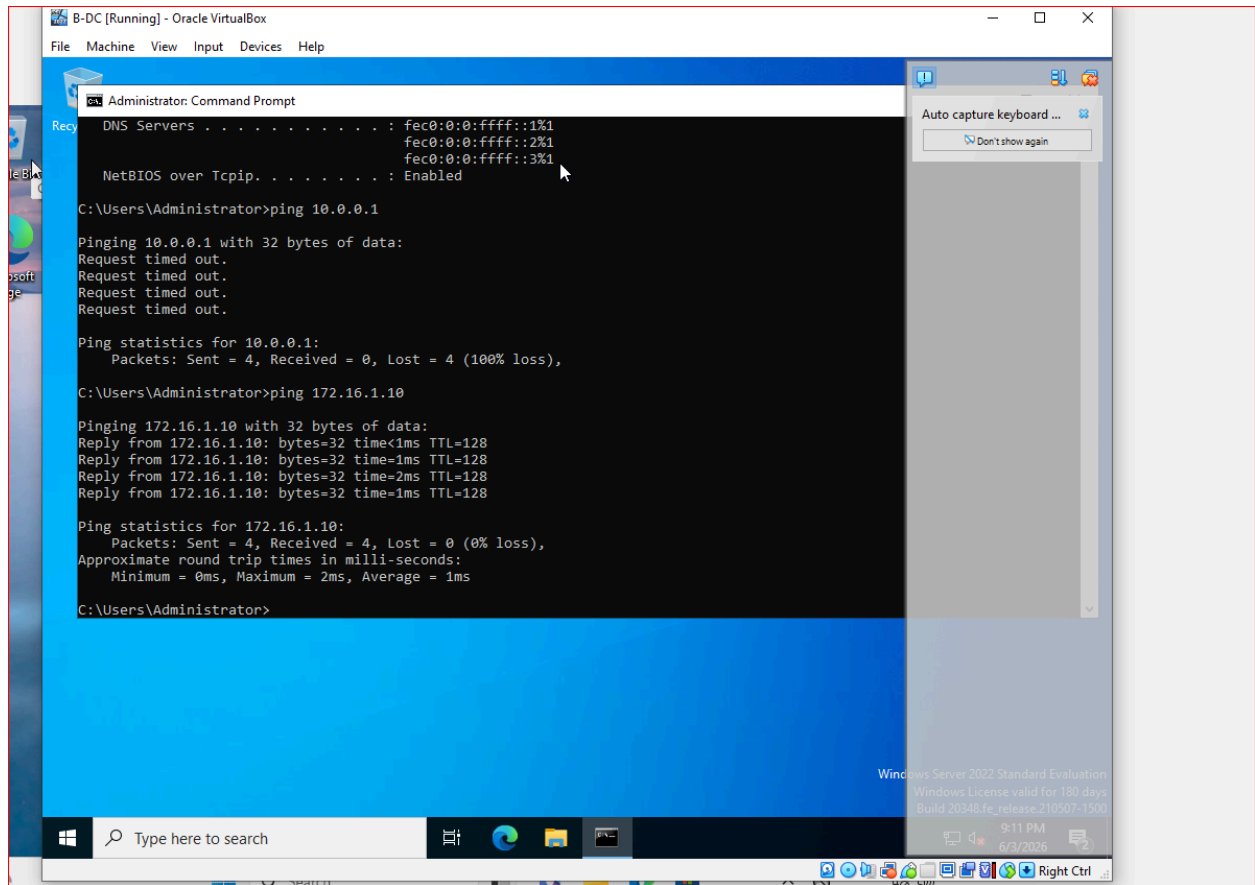
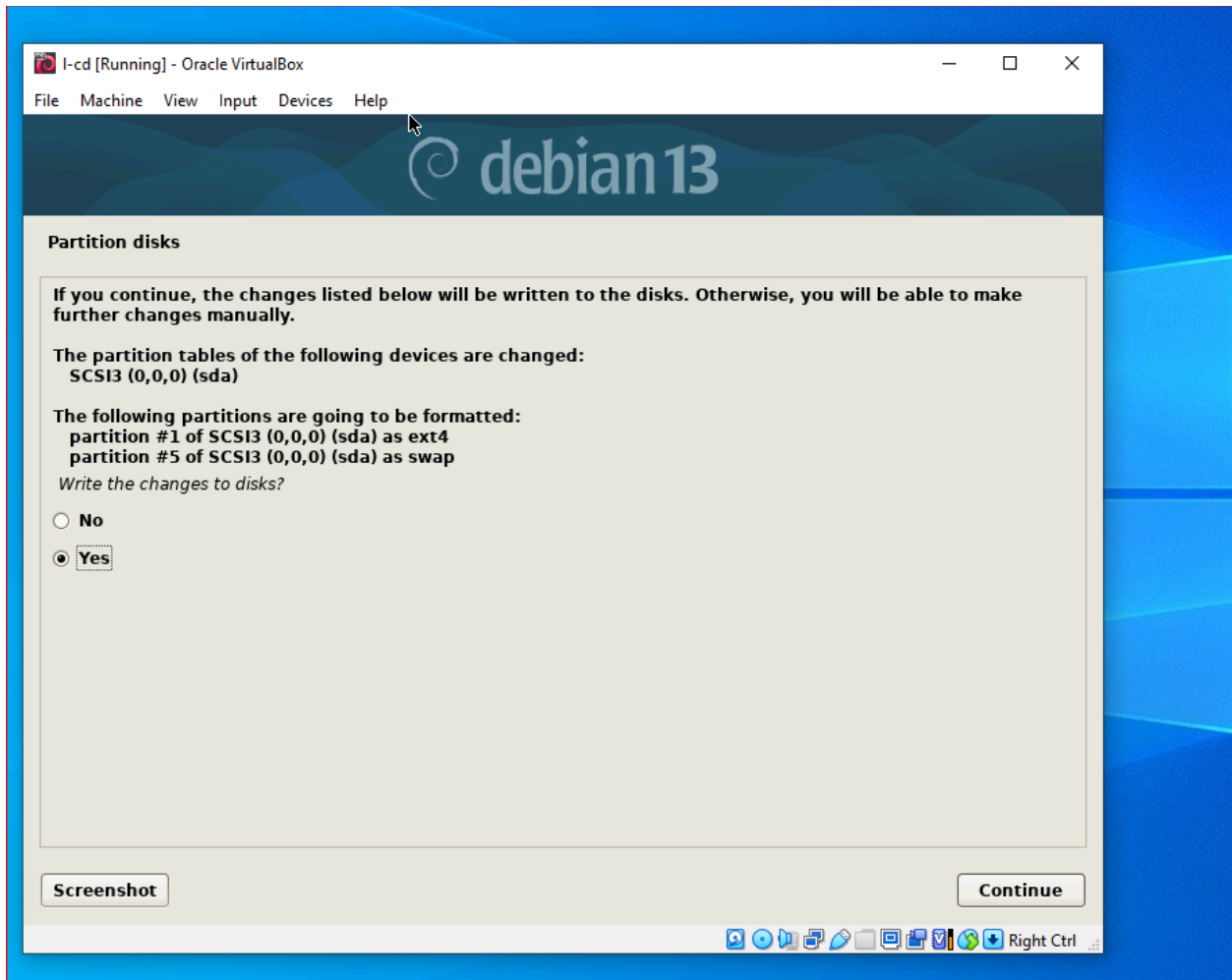


Figure 5: Confirm partition changes.

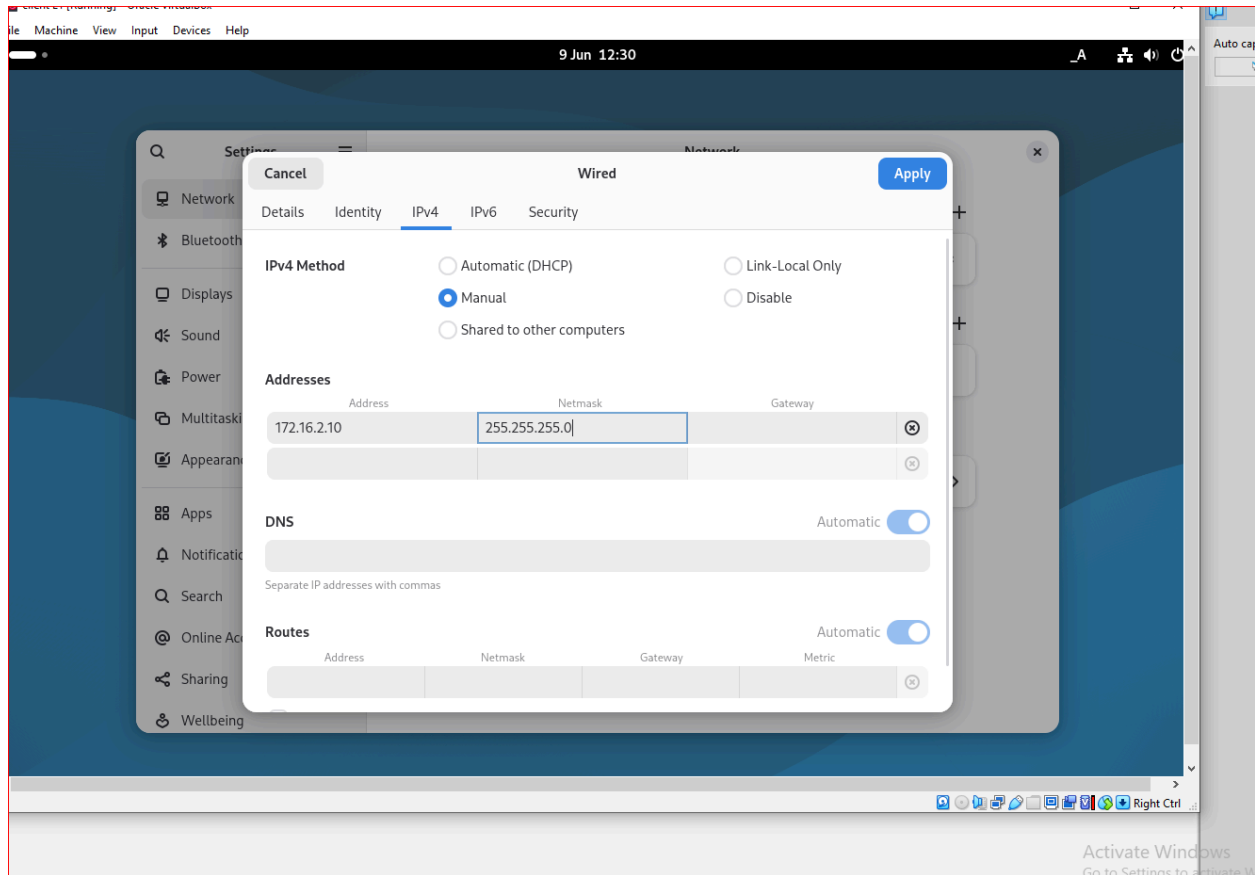




Explanation:



This confirms the partition changes are ready to be written to disk.



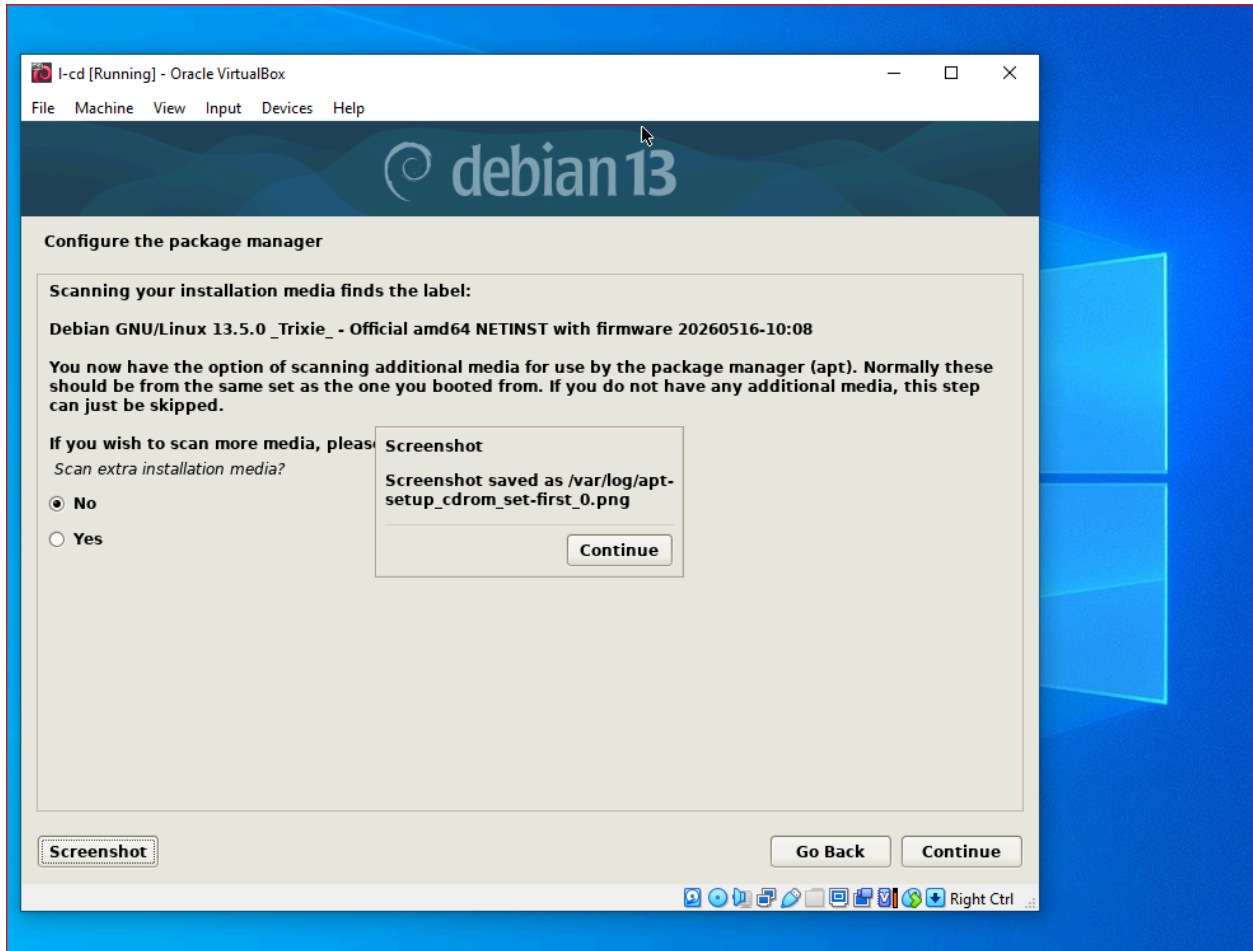
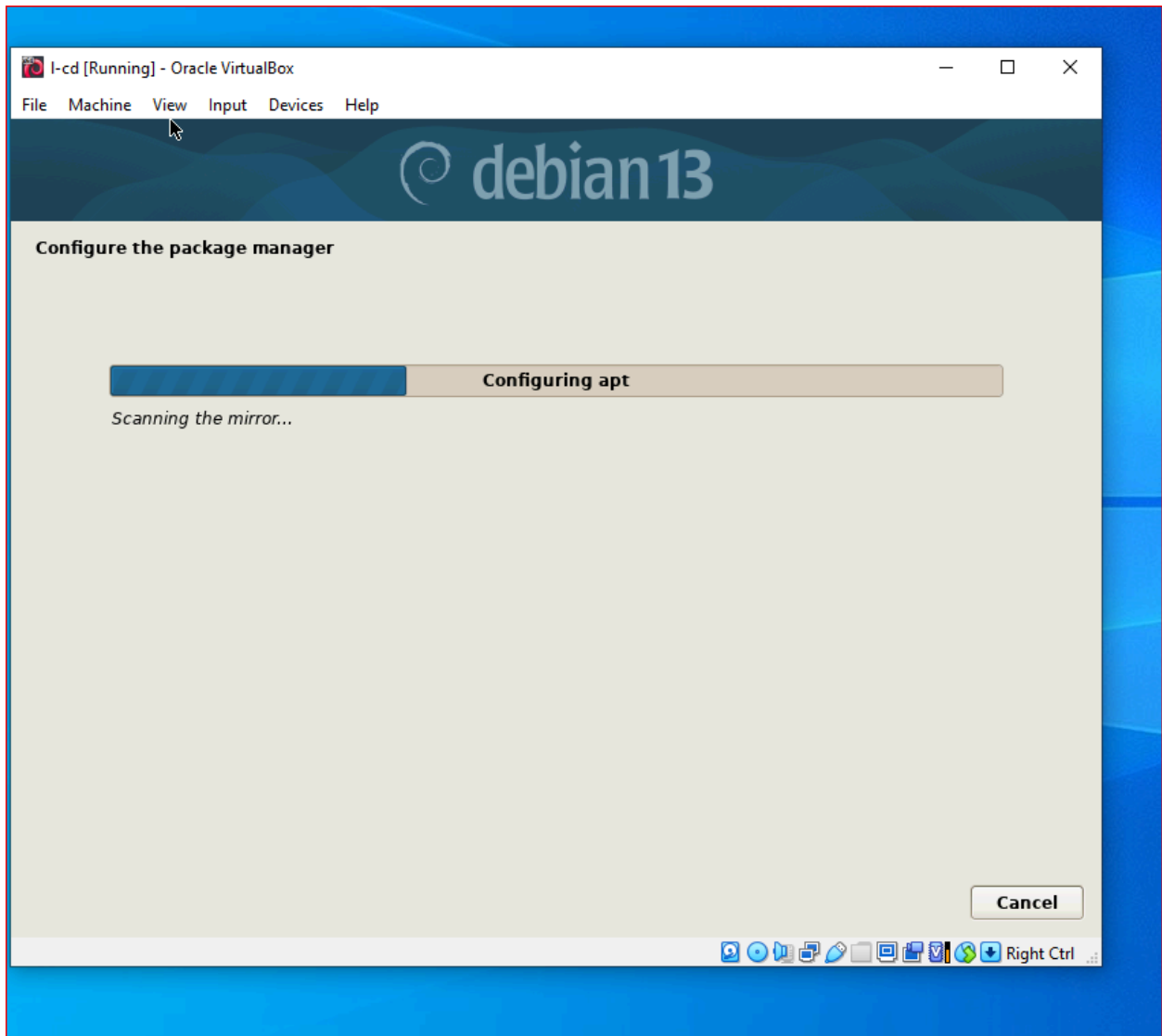


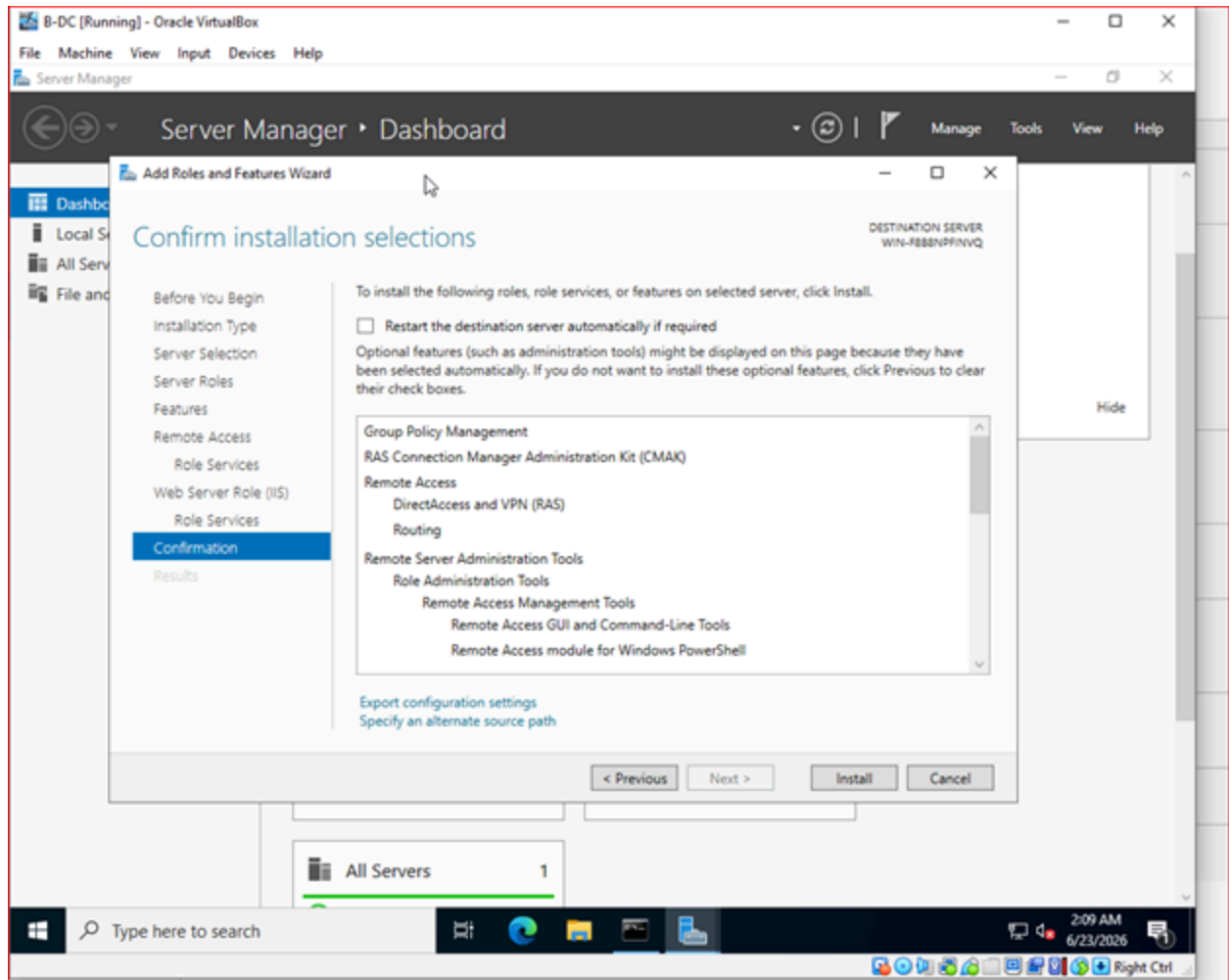
Figure 6: Configure package manager.



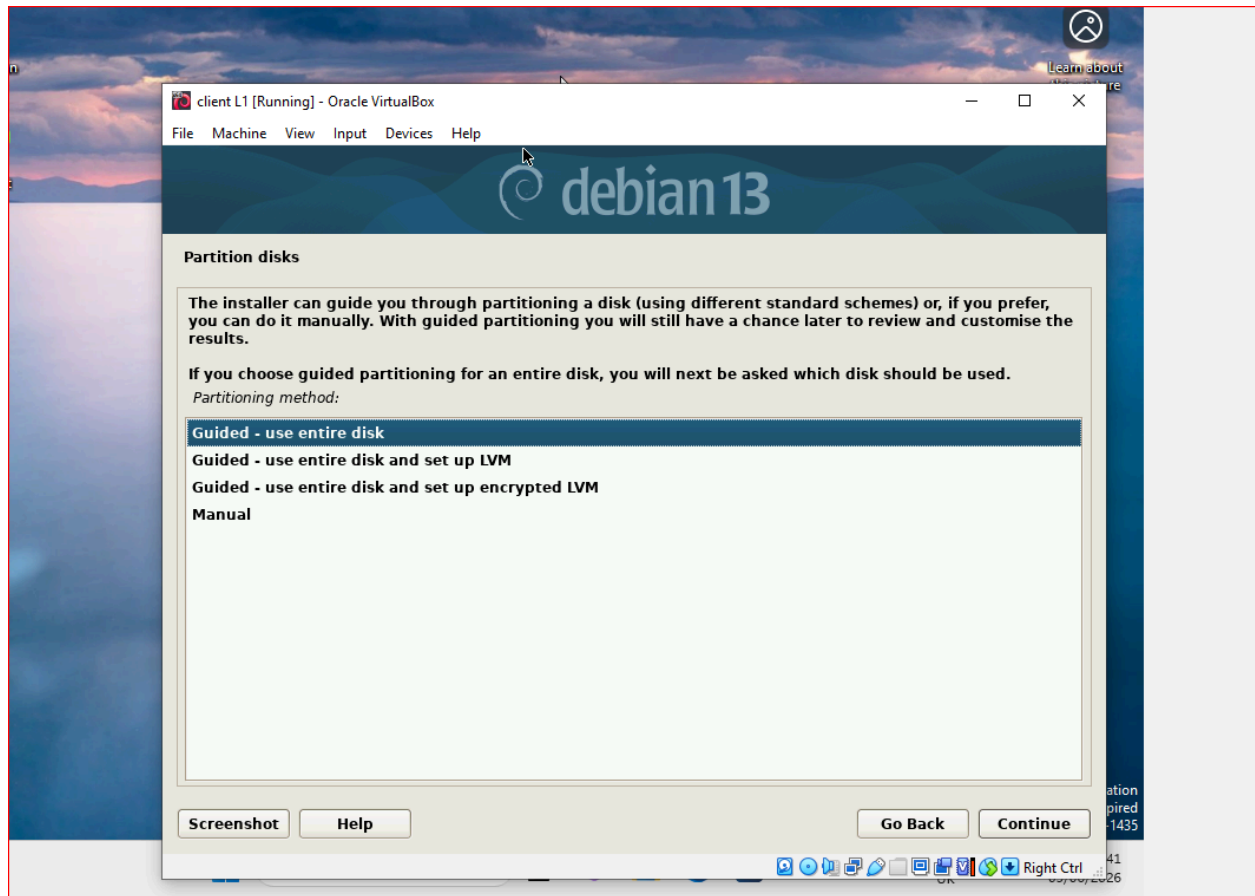
Explanation:

This shows the package manager being prepared for software installation and updates.

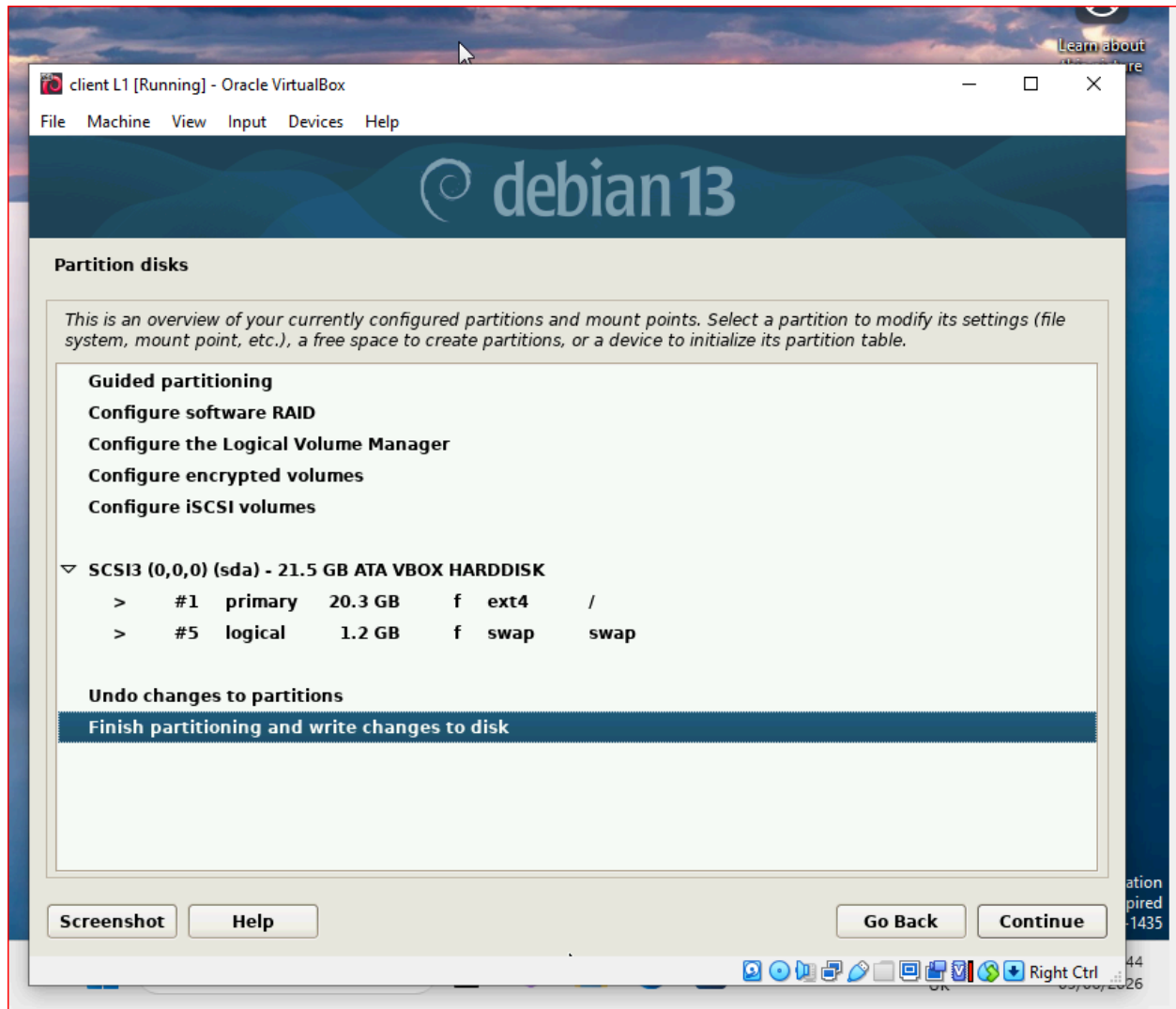
Figure 7: Partitioning



method



Explanation:



This shows guided partitioning being selected for automatic Linux partition setup.

```
192 168.1.x
192 168.1.x
192 168.1.x
192 168.1.x
192 168.1.x
192 168.1.
192 168.1ikov ትጽባጽ itetona ngcenfo:
192 168.1.x
192 168.1.x successful phg
192 192 168...x → 192 168.1.
192 168.1.x
192 168.1iko motenal.
192 168.1.x jɔ oneraŭ incenal Hggekɔŋ.
192 168.1.x
192 168.1.x
192 168.1.x
192 168.1.x
192 168.1.x
192 168.1.x
```

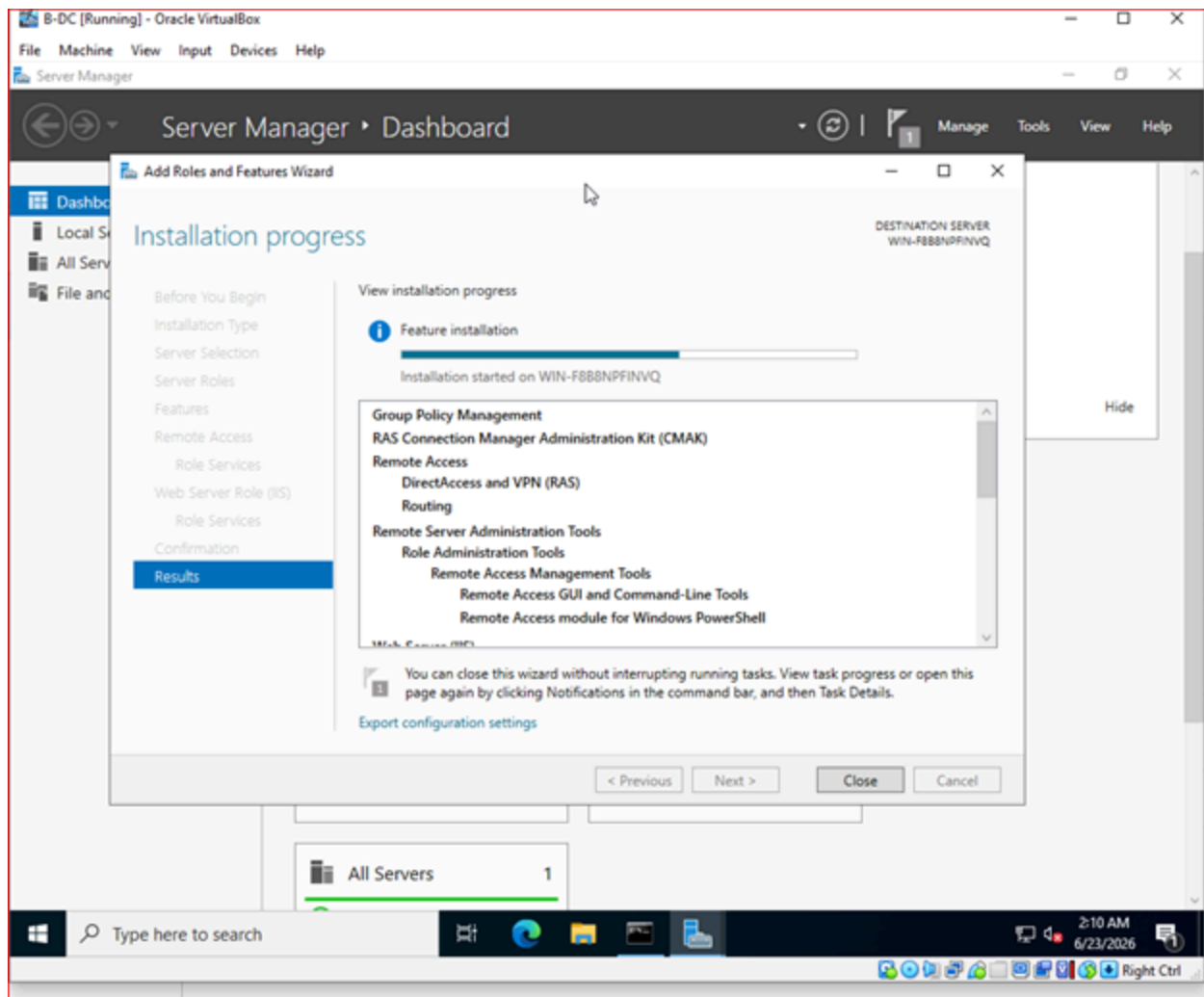
Figure 8: Select language.

Explanation:

This shows English being selected as the Debian installation language.

Figure 9: Installation progress.

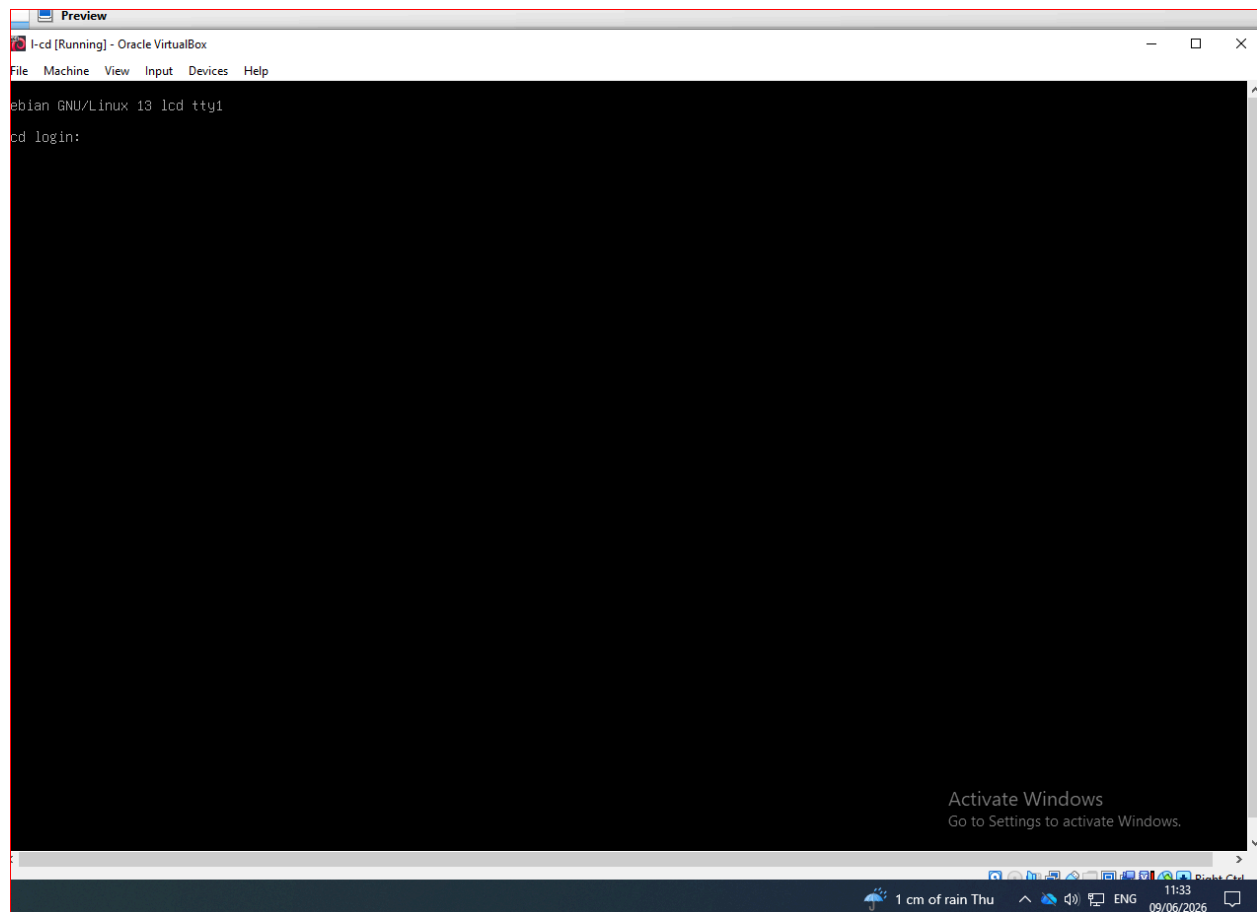
Explanation:

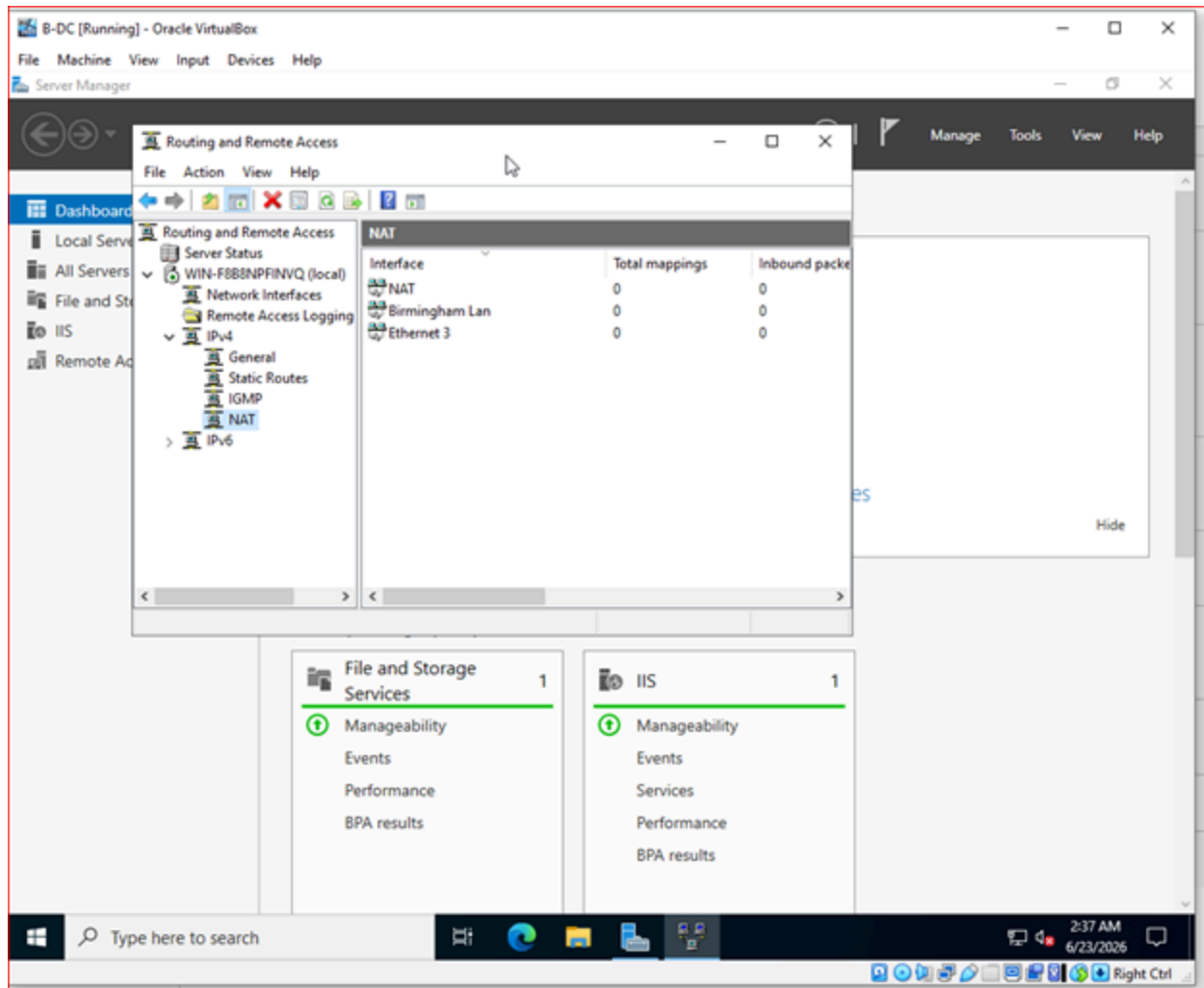


This shows Debian installing packages and services successfully.

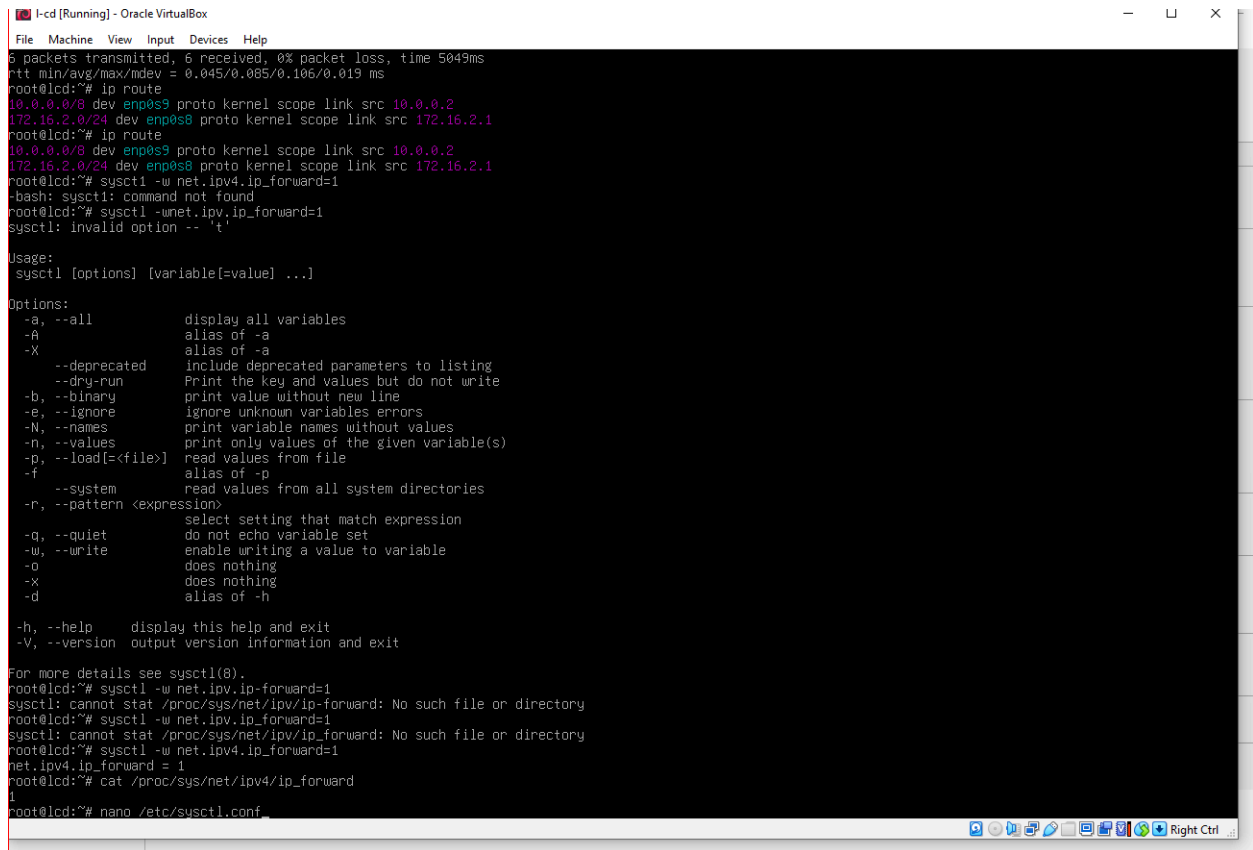
Figure 10: First boot login prompt.

Explanation:





This confirms Debian



```
I-cd [Running] - Oracle VirtualBox
File Machine View Input Devices Help
6 packets transmitted, 6 received, 0% packet loss, time 5049ms
rtt min/avg/max/mdev = 0.045/0.085/0.106/0.019 ms
root@lcd:~# ip route
10.0.0.0/8 dev enp0s9 proto kernel scope link src 10.0.0.2
172.16.2.0/24 dev enp0s8 proto kernel scope link src 172.16.2.1
root@lcd:~# ip route
10.0.0.0/8 dev enp0s9 proto kernel scope link src 10.0.0.2
172.16.2.0/24 dev enp0s8 proto kernel scope link src 172.16.2.1
root@lcd:~# sysctl -w net.ipv4.ip_forward=1
-bash: sysctl: command not found
root@lcd:~# sysctl -w net.ipv4.ip_forward=1
sysctl: invalid option -- 't'

Usage:
  sysctl [options] [variable[=value] ...]

Options:
  -a, --all            display all variables
  -A                  alias of -a
  -X                  alias of -a
  --deprecated        include deprecated parameters to listing
  --dry-run           Print the key and values but do not write
  -b, --binary        print value without new line
  -e, --ignore        ignore unknown variables errors
  -N, --names         print variable names without values
  -n, --values        print only values of the given variable(s)
  -p, --load[=<file>] read values from file
  -f                  alias of -p
  --system            read values from all system directories
  -r, --pattern <expression>
                     select setting that match expression
  -q, --quiet         do not echo variable set
  -w, --write         enable writing a value to variable
  -o                 does nothing
  -x                 does nothing
  -d                 alias of -h
  -h, --help         display this help and exit
  -V, --version      output version information and exit

For more details see sysctl(8).
root@lcd:~# sysctl -w net.ipv4.ip_forward=1
sysctl: cannot stat /proc/sys/net/ipv4/ip_forward: No such file or directory
root@lcd:~# sysctl -w net.ipv4.ip_forward=1
sysctl: cannot stat /proc/sys/net/ipv4/ip_forward: No such file or directory
root@lcd:~# sysctl -w net.ipv4.ip_forward=1
net.ipv4.ip_forward = 1
root@lcd:~# cat /proc/sys/net/ipv4/ip_forward
1
root@lcd:~# nano /etc/sysctl.conf
```

has installed successfully and is ready for login.

Figure 11: Configure static IP address.

Explanation:

This shows the server using a static IP address required by the topology.

Figure 12: Debian login screen GUI.

```
client L1 [Running] - Oracle VirtualBox
File Machine View Input Devices Help
ACPI: setting ELCR to 0200 (from 0e00)
acpi PNP0A03:00: fail to add MMCONFIG information, can't access extended configuration space under this bridge
Warning! ehci_hcd should always be loaded before uhci_hcd and ohci_hcd, not after
ata3.00: LPM support broken, forcing max_power
ata3.00: LPM support broken, forcing max_power
vmwgfx 0000:00:02.0: [drm] *ERROR* vmwgfx seems to be running on an unsupported hypervisor.
vmwgfx 0000:00:02.0: [drm] *ERROR* This configuration is likely broken.
vmwgfx 0000:00:02.0: [drm] *ERROR* Please switch to a supported graphics device to avoid problems.
/dev/sda1: clean, 268798/1240320 files, 2579519/4960256 blocks
device-mapper: core: CONFIG_IMA_DISABLE_HTABLE is disabled. Duplicate IMA measurements will not be recorded in the IMA log.
[ OK ] Finished console-setup.service - Set console font and keymap.
[ OK ] Finished plymouth-read-write.service - Tell Plymouth To Write Out Runtime Data.
[ OK ] Mounted proc-sys-fs-binfmt-misc.mount - Arbitrary Executable File Formats File System.
[ OK ] Finished systemd-binfmt.service - Set Up Additional Binary Formats.
[ OK ] Finished systemd-tmpfiles-setup.service - Create System Files and Directories.
Starting systemd-journal-catalog-update.service - Rebuild Journal Catalog...
Starting systemd-machine-id-commit.service - Save Transient machine-id to Disk...
[ OK ] Finished systemd-journal-catalog-update.service - Rebuild Journal Catalog.
[ OK ] Finished systemd-machine-id-commit.service - Save Transient machine-id to Disk.
[ OK ] Finished systemd-update-done.service - Update is Completed...
Starting systemd-update-done.service - Update is Completed...
[ OK ] Finished systemd-update-done.service - Update is Completed.
kauditd_printk_skb: 86 callbacks suppressed
```

Explanation:

This confirms the Debian graphical desktop is installed and ready for access.

Figure 13: View network interfaces using ip addr

```
6 packets transmitted, 6 received, 0% packet loss, time 5049ms
rtt min/avg/max/mdev = 0.045/0.085/0.106/0.019 ms
root@lcd:~# ip route
10.0.0.0/8 dev enp0s9 proto kernel scope link src 10.0.0.2
172.16.2.0/24 dev enp0s8 proto kernel scope link src 172.16.2.1
root@lcd:~# ip route
10.0.0.0/8 dev enp0s9 proto kernel scope link src 10.0.0.2
172.16.2.0/24 dev enp0s8 proto kernel scope link src 172.16.2.1
root@lcd:~# sysctl -w net.ipv4.ip_forward=1
-bash: sysctl: command not found
root@lcd:~# sysctl -w net.ipv4.ip_forward=1
sysctl: invalid option -- 't'

Usage:
  sysctl [options] [variable[=value] ...]

Options:
  -a, --all            display all variables
  -A                  alias of -a
  -X                  alias of -a
  --deprecated        include deprecated parameters to listing
  --dry-run           Print the key and values but do not write
  -b, --binary        print value without new line
  -e, --ignore        ignore unknown variables errors
  -N, --names         print variable names without values
  -n, --values        print only values of the given variable(s)
  -p, --load[=<file>] read values from file
  -f                  alias of -p
  --system            read values from all system directories
  -r, --pattern <expression>
                     select setting that match expression
  -q, --quiet         do not echo variable set
  -w, --write         enable writing a value to variable
  -o                 does nothing
  -x                 does nothing
  -d                 alias of -h
  -h, --help         display this help and exit
  -V, --version       output version information and exit

For more details see sysctl(8).
root@lcd:~# sysctl -w net.ipv4.ip_forward=1
sysctl: cannot stat /proc/sys/net/ipv4/ip_forward: No such file or directory
root@lcd:~# sysctl -w net.ipv4.ip_forward=1
sysctl: cannot stat /proc/sys/net/ipv4/ip_forward: No such file or directory
root@lcd:~# sysctl -w net.ipv4.ip_forward=1
net.ipv4.ip_forward = 1
root@lcd:~# cat /proc/sys/net/ipv4/ip_forward
1
root@lcd:~# nano /etc/sysctl.conf
```

Explanation:

This confirms the network interfaces and IP addresses have been applied.

Figure 14: Edit network configuration file.

Explanation:

```
l-cd [Running] - Oracle VirtualBox
File Machine View Input Devices Help
6 packets transmitted, 6 received, 0% packet loss, time 5049ms
rtt min/avg/max/mdev = 0.045/0.085/0.106/0.019 ms
root@lcd:~# ip route
10.0.0.0/8 dev enp0s9 proto kernel scope link src 10.0.0.2
172.16.2.0/24 dev enp0s8 proto kernel scope link src 172.16.2.1
root@lcd:~# ip route
10.0.0.0/8 dev enp0s9 proto kernel scope link src 10.0.0.2
172.16.2.0/24 dev enp0s8 proto kernel scope link src 172.16.2.1
root@lcd:~# sysctl -w net.ipv4.ip_forward=1
-bash: sysctl: command not found
root@lcd:~# sysctl -w net.ipv4.ip_forward=1
sysctl: invalid option -- 't'

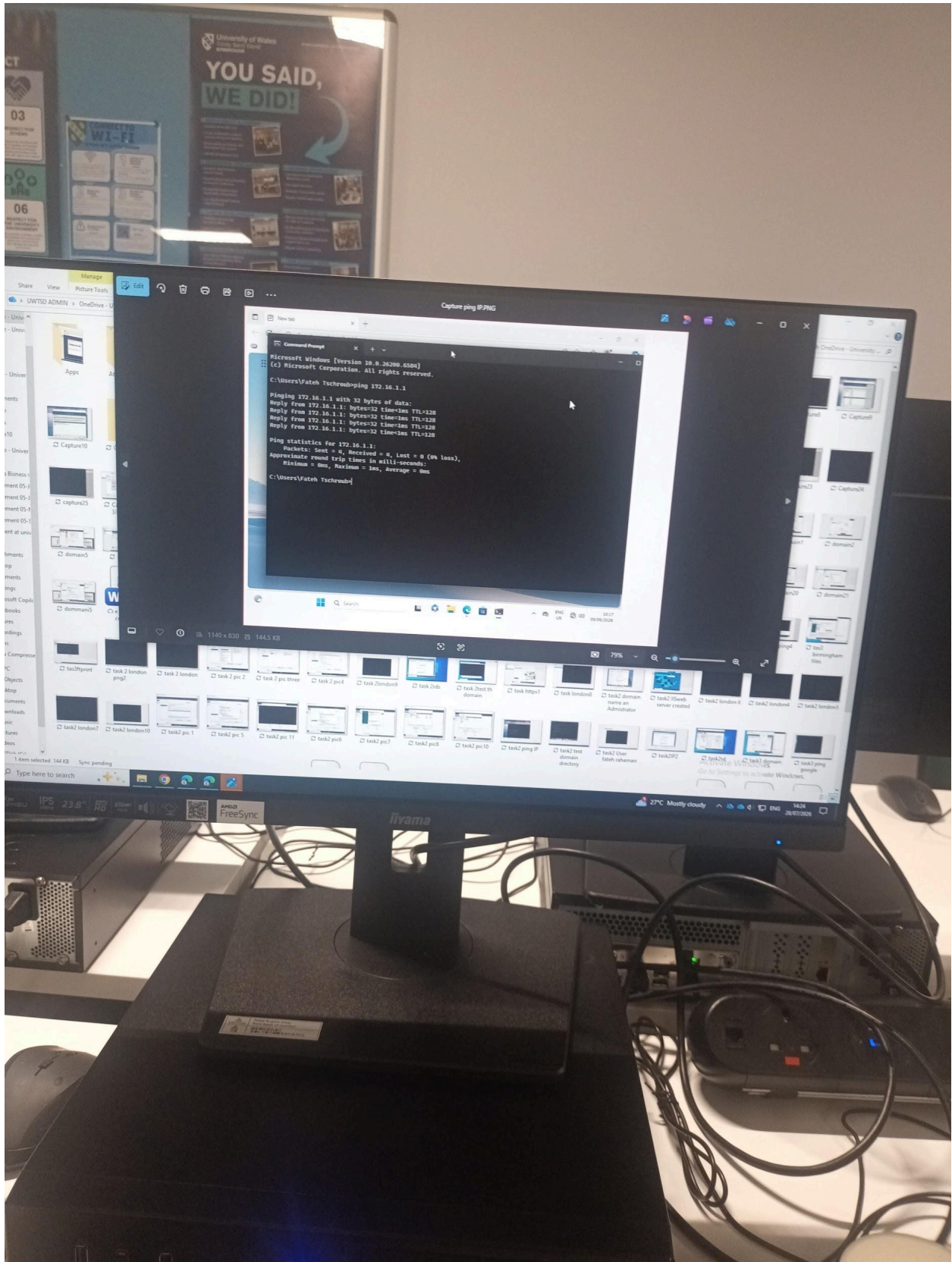
Usage:
  sysctl [options] [variable[=value] ...]

Options:
  -a, --all          display all variables
  -A                alias of -a
  -X                alias of -a
  --deprecated       include deprecated parameters to listing
  --dry-run          Print the key and values but do not write
  -b, --binary       print value without new line
  -e, --ignore       ignore unknown variables errors
  -N, --names        print variable names without values
  -n, --values       print only values of the given variable(s)
  -p, --load[=<file>] read values from file
  -f                alias of -p
  --system          read values from all system directories
  -r, --pattern <expression>
                    select setting that match expression
  -q, --quiet        do not echo variable set
  -w, --write        enable writing a value to variable
  -o                does nothing
  -x                does nothing
  -d                alias of -h
  -h, --help        display this help and exit
  -V, --version      output version information and exit

For more details see sysctl(8).
root@lcd:~# sysctl -w net.ipv4.ip_forward=1
sysctl: cannot stat /proc/sys/net/ipv4/ip_forward: No such file or directory
root@lcd:~# sysctl -w net.ipv4.ip_forward=1
sysctl: cannot stat /proc/sys/net/ipv4/ip_forward: No such file or directory
root@lcd:~# sysctl -w net.ipv4.ip_forward=1
net.ipv4.ip_forward = 1
root@lcd:~# cat /proc/sys/net/ipv4/ip_forward
1
root@lcd:~# nano /etc/sysctl.conf
```

This shows the Debian static IP configuration file being edited.

Figure 15: Nano text editor.



```

root@kali:~# apt-get update
bash: apt-get: command not found
root@kali:~# apt install iptables -y
Installing:
  iptables

Installing dependencies:
  libnetfilter-conntrack3 libnetfilter-nft

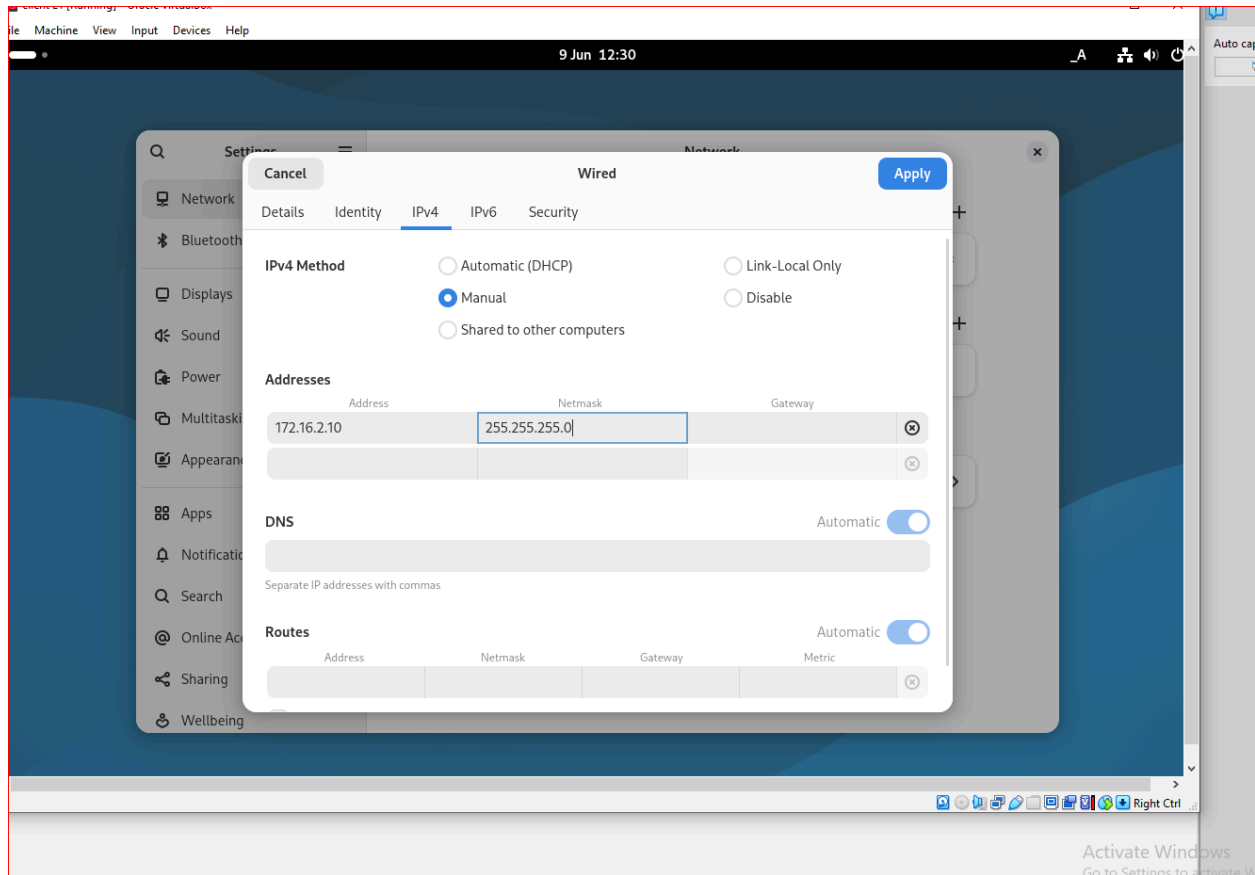
Suggested packages:
  firewalld

Summary:
  Upgrading: 0, Installing: 5, Removing: 0, Not upgrading: 0
  Download size: 450 kB
  Space needed: 2,799 kB / 17.6 GB available

Get:1 http://deb.debian.org/debian trixie/main amd64 libnetfilter-conntrack3 amd64 1.0.9-1.2
Get:2 http://deb.debian.org/debian trixie/main amd64 libnetfilter-nft amd64 1.0.11-2
Get:3 http://deb.debian.org/debian trixie/main amd64 libnetfilter-nftables amd64 1.0.2-3
Get:4 http://deb.debian.org/debian trixie/main amd64 libnetfilter-conntrack3 amd64 1.1.0-1
Get:5 http://deb.debian.org/debian trixie/main amd64 iptables amd64 1.0.11-2
Get:6 http://deb.debian.org/debian trixie/main amd64 libnetfilter-nftables amd64 1.0.11-2
Get:7 http://deb.debian.org/debian trixie/main amd64 libnetfilter-conntrack3 amd64 1.1.0-1
Get:8 http://deb.debian.org/debian trixie/main amd64 iptables amd64 1.0.2-3
Get:9 http://deb.debian.org/debian trixie/main amd64 libnetfilter-nftables amd64 1.0.11-2
Get:10 http://deb.debian.org/debian trixie/main amd64 libnetfilter-conntrack3 amd64 1.1.0-1
Get:11 http://deb.debian.org/debian trixie/main amd64 iptables amd64 1.0.11-2
Get:12 http://deb.debian.org/debian trixie/main amd64 libnetfilter-nftables amd64 1.0.11-2
Get:13 http://deb.debian.org/debian trixie/main amd64 libnetfilter-nftables amd64 1.0.2-3
Get:14 http://deb.debian.org/debian trixie/main amd64 libnetfilter-conntrack3 amd64 1.1.0-1
Get:15 http://deb.debian.org/debian trixie/main amd64 iptables amd64 1.0.11-2
Get:16 http://deb.debian.org/debian trixie/main amd64 libnetfilter-nftables amd64 1.0.11-2
Temporary failure resolving 'deb.debian.org'
Get:17 http://deb.debian.org/debian trixie/main amd64 libnetfilter-conntrack3 amd64 1.1.0-1
Temporary failure resolving 'deb.debian.org'
Get:18 http://deb.debian.org/debian trixie/main amd64 libnetfilter-nftables amd64 1.0.2-3
Temporary failure resolving 'deb.debian.org'
Get:19 http://deb.debian.org/debian trixie/main amd64 libnetfilter-nftables amd64 1.0.11-2
Temporary failure resolving 'deb.debian.org'
Get:20 http://deb.debian.org/debian trixie/main amd64 libnetfilter-nftables amd64 1.0.11-2
Temporary failure resolving 'deb.debian.org'
Error: Failed to fetch http://deb.debian.org/debian/pool/main/n/libnetfilter-conntrack3/libnetfilter-conntrack3_1.1.0-1_amd64.deb Temporary failure resolving 'deb.debian.org'
Error: Failed to fetch http://deb.debian.org/debian/pool/main/n/libnetfilter-nftables/libnetfilter-nftables_1.0.11-2_amd64.deb Temporary failure resolving 'deb.debian.org'
Error: Failed to fetch http://deb.debian.org/debian/pool/main/n/libnetfilter-nftables/libnetfilter-nftables_1.0.2-3_amd64.deb Temporary failure resolving 'deb.debian.org'
Error: Failed to fetch http://deb.debian.org/debian/pool/main/n/libnetfilter-conntrack3/libnetfilter-conntrack3_1.1.0-1_amd64.deb Temporary failure resolving 'deb.debian.org'
Error: Failed to fetch http://deb.debian.org/debian/pool/main/n/libnetfilter-nftables/libnetfilter-nftables_1.0.11-2_amd64.deb Temporary failure resolving 'deb.debian.org'
Error: Unable to fetch some archives, maybe run apt-get update or try with --fix-missing?

```

Figure 16: Configure IPv4 settings.



Explanation:

```
6 packets transmitted, 6 received, 0% packet loss, time 5049ms
rtt min/avg/max/mdev = 0.045/0.085/0.106/0.019 ms
root@lcd:~# ip route
10.0.0.0/8 dev enp0s9 proto kernel scope link src 10.0.0.2
172.16.2.0/24 dev enp0s8 proto kernel scope link src 172.16.2.1
root@lcd:~# ip route
10.0.0.0/8 dev enp0s9 proto kernel scope link src 10.0.0.2
172.16.2.0/24 dev enp0s8 proto kernel scope link src 172.16.2.1
root@lcd:~# sysctl -w net.ipv4.ip_forward=1
-bash: sysctl: command not found
root@lcd:~# sysctl -w net.ipv4.ip_forward=1
sysctl: invalid option -- 't'

Usage:
  sysctl [options] [variable[=value] ...]

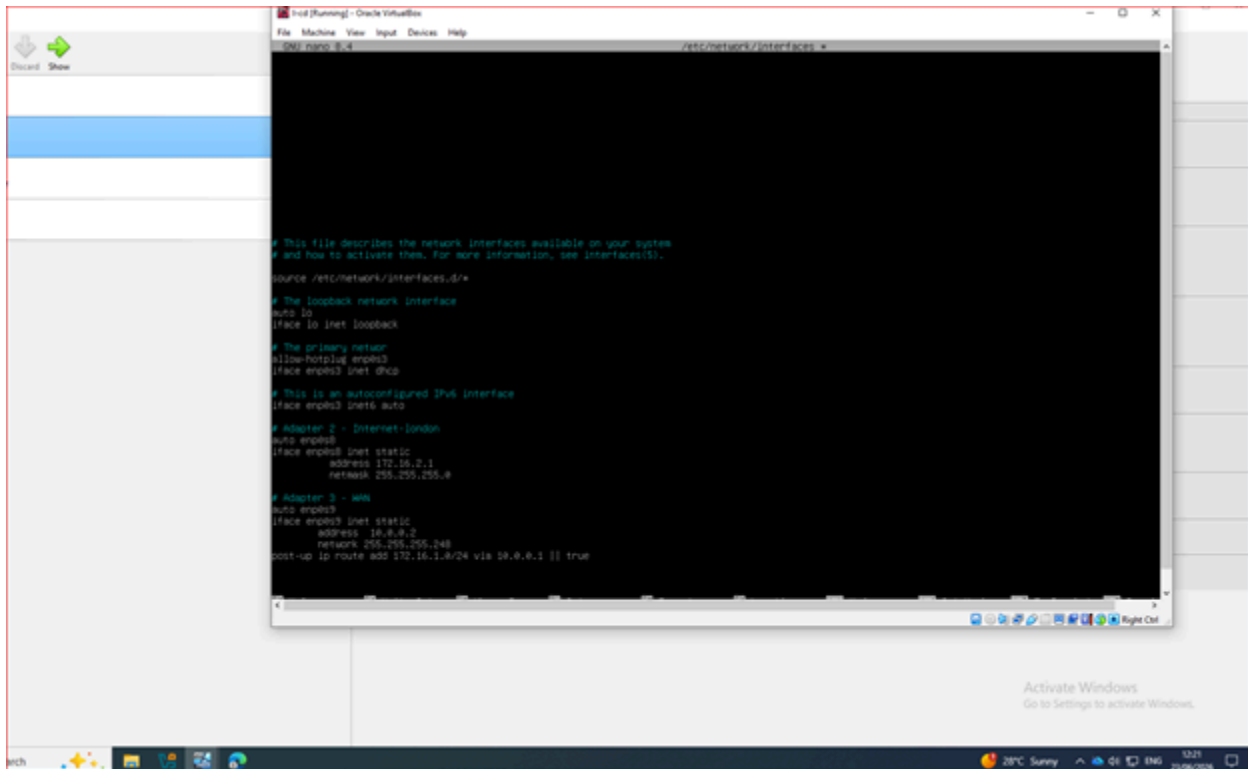
Options:
  -a, --all            display all variables
  -A                  alias of -a
  -X                  alias of -a
  --deprecated        include deprecated parameters to listing
  --dry-run           Print the key and values but do not write
  -b, --binary        print value without new line
  -e, --ignore        ignore unknown variables errors
  -N, --names         print variable names without values
  -n, --values        print only values of the given variable(s)
  -p, --load[=<file>] read values from file
  -f                  alias of -p
  --system            read values from all system directories
  -r, --pattern <expression>
                     select setting that match expression
  -q, --quiet         do not echo variable set
  -w, --write         enable writing a value to variable
  -o                 does nothing
  -x                 does nothing
  -d                 alias of -h
  -h, --help         display this help and exit
  -V, --version       output version information and exit

For more details see sysctl(8).
root@lcd:~# sysctl -w net.ipv4.ip_forward=1
sysctl: cannot stat /proc/sys/net/ipv4/ip_forward: No such file or directory
root@lcd:~# sysctl -w net.ipv4.ip_forward=1
sysctl: cannot stat /proc/sys/net/ipv4/ip_forward: No such file or directory
root@lcd:~# sysctl -w net.ipv4.ip_forward=1
net.ipv4.ip_forward = 1
root@lcd:~# cat /proc/sys/net/ipv4/ip_forward
1
root@lcd:~# nano /etc/sysctl.conf
```

This shows manual IPv4 settings configured for client network communication.

Figure 17: Successful host ping.

Explanation



:

This confirms successful communication between devices with no packet loss.

Component 2

Enhanced Network Services Implementation

Component 2 extends the initial virtual network by planning key enterprise services such as centralised authentication, IP management, secure remote access, certificates, and disaster recovery.

The enhanced NOSSLONDON2026 network develops the Birmingham and London scenario into a more reliable enterprise-style environment.

Planned Network Services

The following services should be considered for the enhanced topology:

- **Active Directory Domain Services for centralised user, computer, and domain management.**
- **Domain Name System services to support name resolution across the domain environment.**
- **Dynamic Host Configuration Protocol to allocate IP addresses automatically to client devices.**
- **DHCP relay configuration where clients are located on a different network segment from the DHCP server.**
- **Certificate Authority services to issue and manage digital certificates.**
- **Virtual Private Network access to support secure remote connectivity.**
- **File and resource sharing to support controlled access to organisational data.**
- **Security auditing to monitor account activity, network access, and system events.**
- **Backup and disaster recovery procedures to protect the network from data loss and service disruption.**

Technical Documentation Requirements

Component 2 evidence should include clear

screenshots showing timestamps, IP details, configuration steps, and the purpose of each service.

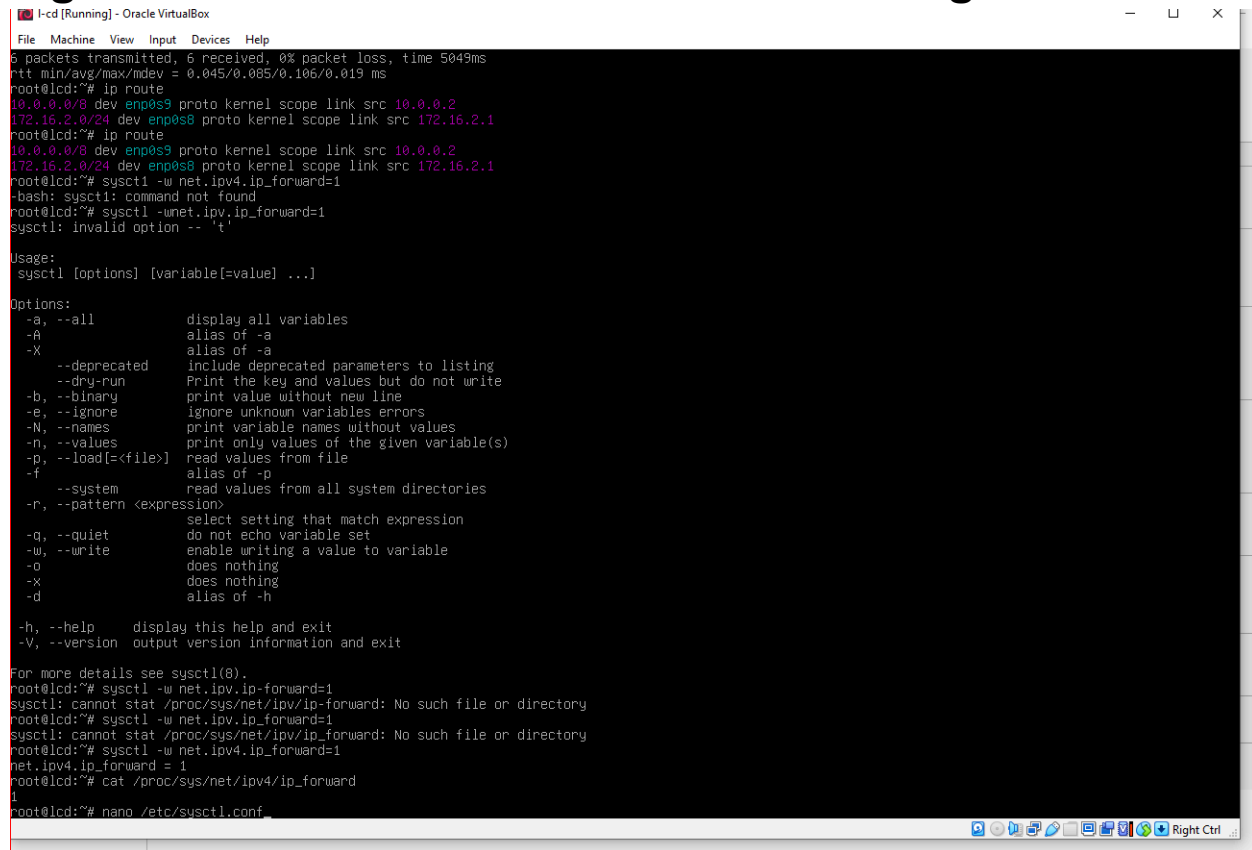
Recommended evidence includes:

Component 2 screenshots should follow the same format used in Component 1: each screenshot should appear directly above a figure caption, followed by a bold Explanation label and a short paragraph explaining what the evidence proves.

- . Windows Server network configuration.**
- . Active Directory Domain Services installation.**
- . Domain creation for BIRMINGHAM.ACCA.**
- . DNS configuration and forward lookup zone evidence.**
- . DHCP scope creation and lease evidence.**
- . Client device joining the domain.**
- . Successful domain user login.**
- . Debian server network configuration.**
- . DHCP relay or routing-related configuration if used.**
- . Certificate Authority installation and certificate evidence.**
- . VPN configuration if required by the enhanced topology.**
- . Security policy or audit configuration.**
- . Backup configuration or disaster recovery evidence.**
- . Final connectivity tests between relevant devices.**

Component 2 Screenshot Explanations

Figure 18: Windows Server network configuration.



The screenshot shows a terminal window titled "T-cd [Running] - Oracle VirtualBox" with a menu bar (File, Machine, View, Input, Devices, Help). The terminal output shows the following commands and results:

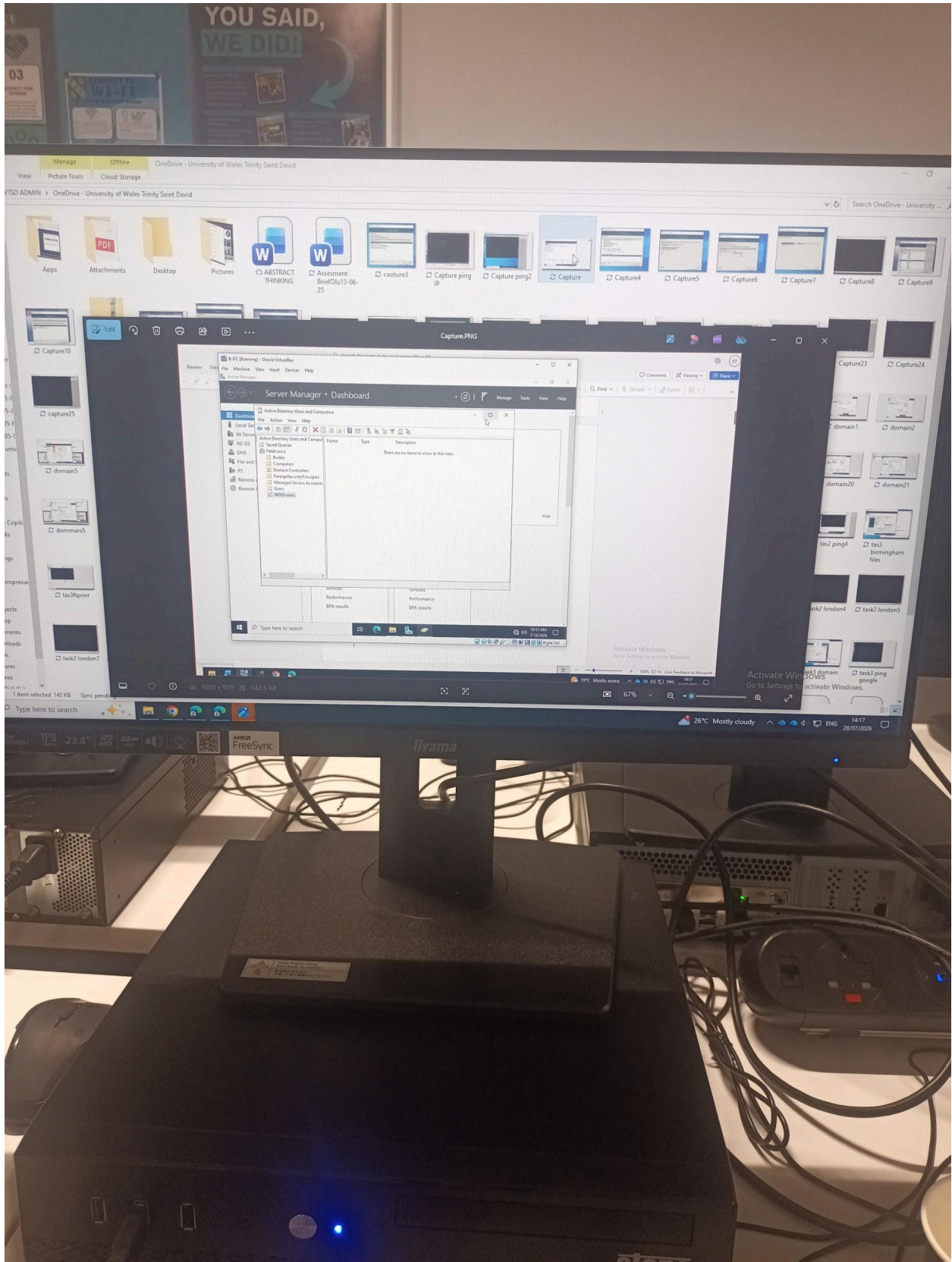
```
6 packets transmitted, 6 received, 0% packet loss, time 5049ms
rtt min/avg/max/mdev = 0.045/0.085/0.106/0.019 ms
root@lcd:~# ip route
10.0.0.0/8 dev enp0s9 proto kernel scope link src 10.0.0.2
172.16.2.0/24 dev enp0s8 proto kernel scope link src 172.16.2.1
root@lcd:~# ip route
10.0.0.0/8 dev enp0s9 proto kernel scope link src 10.0.0.2
172.16.2.0/24 dev enp0s8 proto kernel scope link src 172.16.2.1
root@lcd:~# sysctl -w net.ipv4.ip_forward=1
-bash: sysctl: command not found
root@lcd:~# sysctl -w net.ipv4.ip_forward=1
sysctl: invalid option -- 't'

Usage:
  sysctl [options] [variable[=value] ...]

Options:
  -a, --all          display all variables
  -A                alias of -a
  -X                alias of -a
  --deprecated       include deprecated parameters to listing
  --dry-run          Print the key and values but do not write
  -b, --binary       print value without new line
  -e, --ignore       ignore unknown variables errors
  -N, --names        print variable names without values
  -n, --values       print only values of the given variable(s)
  -p, --load[=<file>] read values from file
  -f                alias of -p
  --system           read values from all system directories
  -r, --pattern <expression>
                    select setting that match expression
  -q, --quiet        do not echo variable set
  -w, --write        enable writing a value to variable
  -o                does nothing
  -x                does nothing
  -d                alias of -h
  -h, --help        display this help and exit
  -V, --version      output version information and exit

For more details see sysctl(8).
root@lcd:~# sysctl -w net.ipv4.ip_forward=1
sysctl: cannot stat /proc/sys/net/ipv4/ip_forward: No such file or directory
root@lcd:~# sysctl -w net.ipv4.ip_forward=1
sysctl: cannot stat /proc/sys/net/ipv4/ip_forward: No such file or directory
root@lcd:~# sysctl -w net.ipv4.ip_forward=1
net.ipv4.ip_forward = 1
root@lcd:~# cat /proc/sys/net/ipv4/ip_forward
1
root@lcd:~# nano /etc/sysctl.conf
```

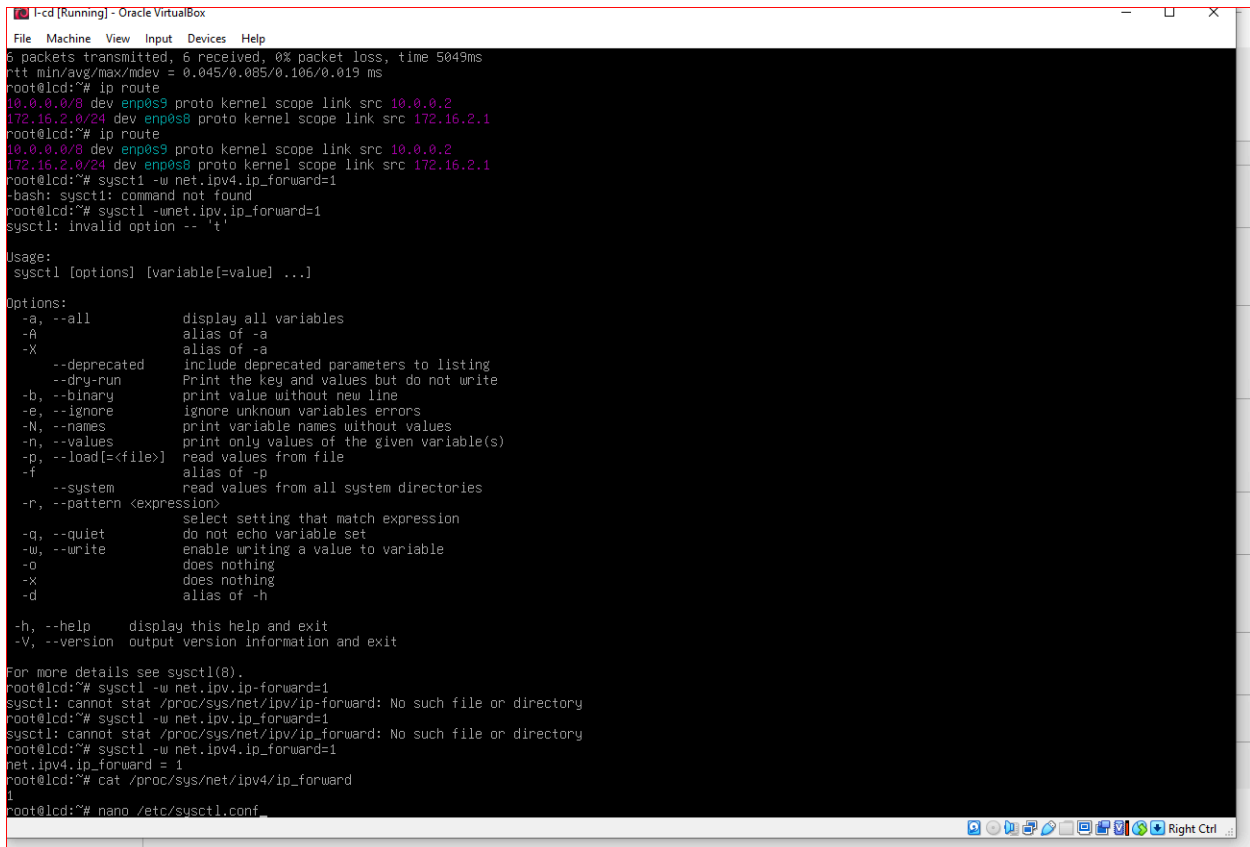
The terminal window has a taskbar at the bottom with various icons and a "Right Ctrl" button.



Explanation:

This screenshot should confirm that Windows Server has the correct static IP address, subnet mask, gateway, and DNS settings for the enhanced topology.

Figure 19: Active Directory Domain Services installation.



```
6 packets transmitted, 6 received, 0% packet loss, time 5049ms
rtt min/avg/max/mdev = 0.045/0.085/0.106/0.019 ms
root@lcd:~# ip route
10.0.0.0/8 dev enp0s9 proto kernel scope link src 10.0.0.2
172.16.2.0/24 dev enp0s8 proto kernel scope link src 172.16.2.1
root@lcd:~# ip route
10.0.0.0/8 dev enp0s9 proto kernel scope link src 10.0.0.2
172.16.2.0/24 dev enp0s8 proto kernel scope link src 172.16.2.1
root@lcd:~# sysctl -w net.ipv4.ip_forward=1
-bash: sysctl: command not found
root@lcd:~# sysctl -w net.ipv4.ip_forward=1
sysctl: invalid option -- 't'

Usage:
  sysctl [options] [variable[=value] ...]

Options:
  -a, --all            display all variables
  -A                  alias of -a
  -X                  alias of -a
  --deprecated        include deprecated parameters to listing
  --dry-run           Print the key and values but do not write
  -b, --binary        print value without new line
  -e, --ignore        ignore unknown variables errors
  -N, --names         print variable names without values
  -n, --values        print only values of the given variable(s)
  -p, --load[=<file>] read values from file
  -f                  alias of -p
  --system            read values from all system directories
  -r, --pattern <expression>
                     select setting that match expression
  -q, --quiet         do not echo variable set
  -w, --write         enable writing a value to variable
  -o                 does nothing
  -x                 does nothing
  -d                 alias of -h
  -h, --help         display this help and exit
  -V, --version       output version information and exit

For more details see sysctl(8).
root@lcd:~# sysctl -w net.ipv4.ip_forward=1
sysctl: cannot stat /proc/sys/net/ipv4/ip_forward: No such file or directory
root@lcd:~# sysctl -w net.ipv4.ip_forward=1
sysctl: cannot stat /proc/sys/net/ipv4/ip_forward: No such file or directory
root@lcd:~# sysctl -w net.ipv4.ip_forward=1
net.ipv4.ip_forward = 1
root@lcd:~# cat /proc/sys/net/ipv4/ip_forward
1
root@lcd:~# nano /etc/sysctl.conf
```

Explanation:

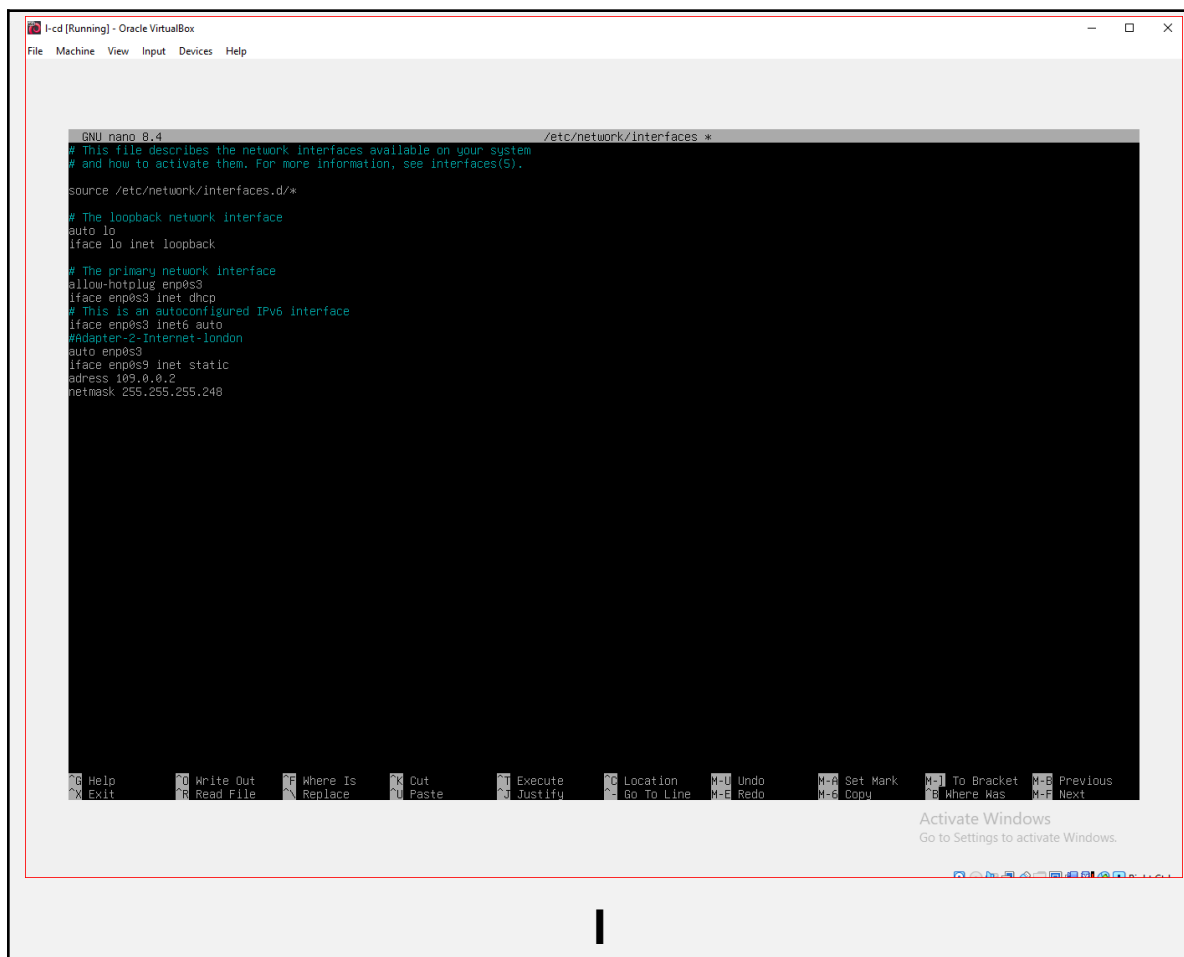
This screenshot should show that Active Directory Domain Services has been installed so the network can centrally manage users, computers, and domain

resources.

Figure 20: Domain creation for BIRMINGHAM.ACCA.

Explanation:

This screenshot should prove that the BIRMINGHAM.ACCA domain has been created and is ready for domain-joined clients and user accounts.



The screenshot shows a terminal window titled "I-ctl [Running] - Oracle VirtualBox" with a menu bar (File, Machine, View, Input, Devices, Help). Inside the terminal, the GNU nano 8.4 editor is open, editing the file /etc/network/interfaces. The file content is as follows:

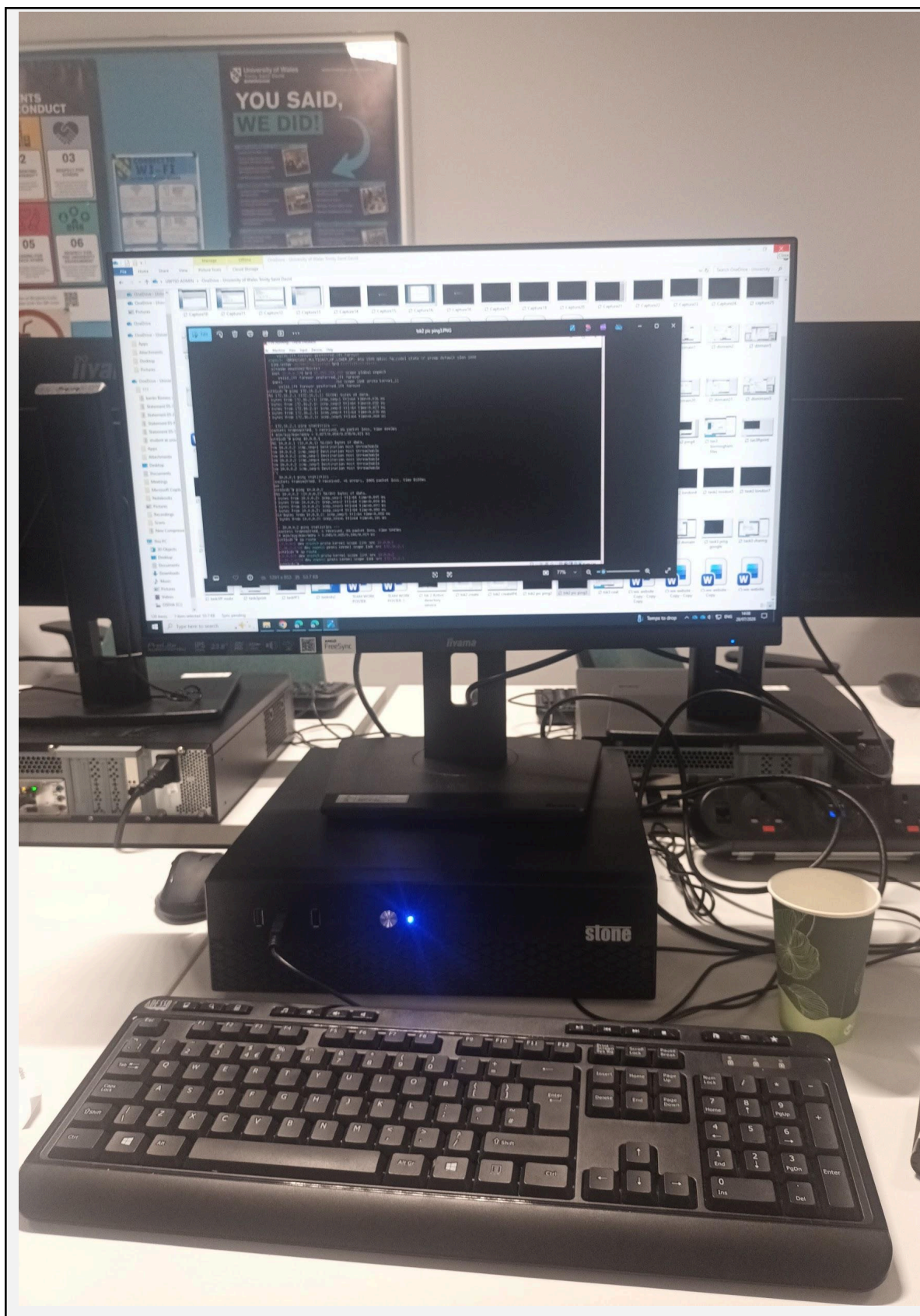
```
# This file describes the network interfaces available on your system
# and how to activate them. For more information, see interfaces(5).

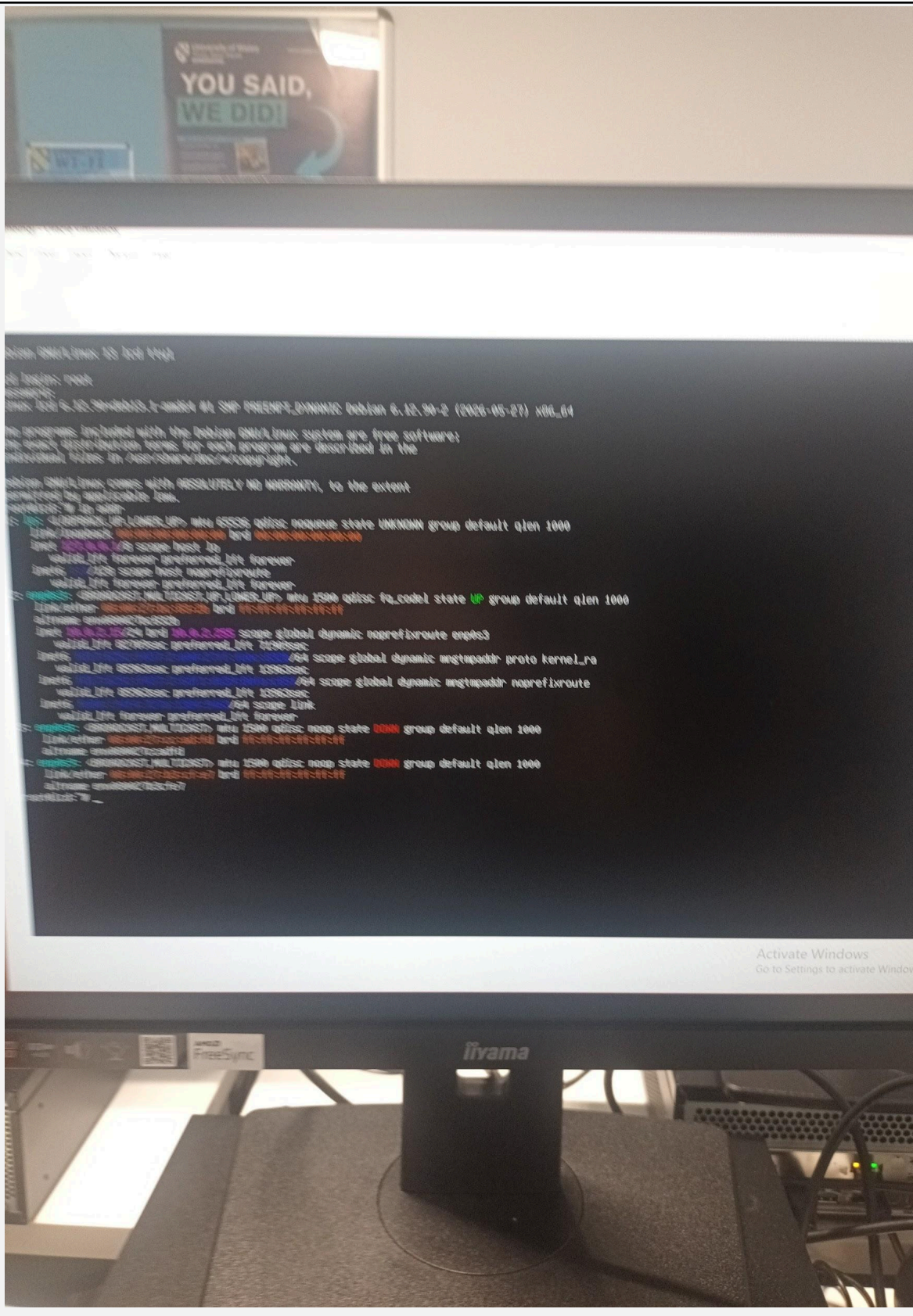
source /etc/network/interfaces.d/*

# The loopback network interface
auto lo
iface lo inet loopback

# The primary network interface
allow-hotplug enp0s3
iface enp0s3 inet dhcp
# This is an autoconfigured IPv6 interface
iface enp0s3 inet6 auto
#Adapter-2-Internet-london
auto enp0s3
iface enp0s9 inet static
address 109.0.0.2
netmask 255.255.255.248
```

At the bottom of the terminal window, there is a status bar with various shortcuts and a message that says "Activate Windows Go to Settings to activate Windows."





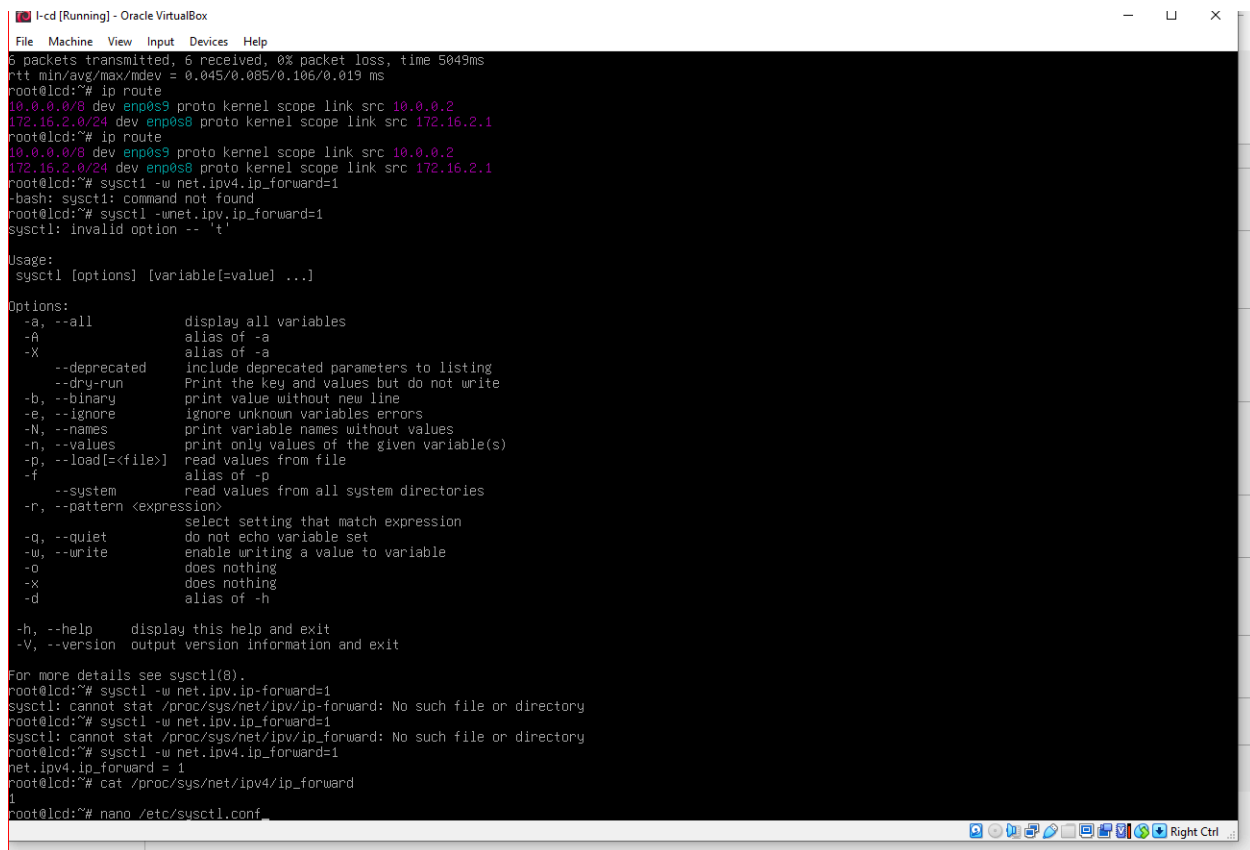
INSERT SCREENSHOT HERE

Figure 21 evidence: DNS configuration and forward lookup zone

Figure 21: DNS configuration and forward lookup zone.

Explanation:

This screenshot should confirm that DNS is configured correctly so devices can resolve domain names and locate network services.



```
I-cd [Running] - Oracle VirtualBox
File Machine View Input Devices Help
6 packets transmitted, 6 received, 0% packet loss, time 5049ms
rtt min/avg/max/mdev = 0.045/0.085/0.106/0.019 ms
root@lcd:~# ip route
10.0.0.0/8 dev enp0s9 proto kernel scope link src 10.0.0.2
172.16.2.0/24 dev enp0s8 proto kernel scope link src 172.16.2.1
root@lcd:~# ip route
10.0.0.0/8 dev enp0s9 proto kernel scope link src 10.0.0.2
172.16.2.0/24 dev enp0s8 proto kernel scope link src 172.16.2.1
root@lcd:~# sysctl -w net.ipv4.ip_forward=1
-bash: sysctl: command not found
root@lcd:~# sysctl -w net.ipv4.ip_forward=1
sysctl: invalid option -- 't'

Usage:
  sysctl [options] [variable[=value] ...]

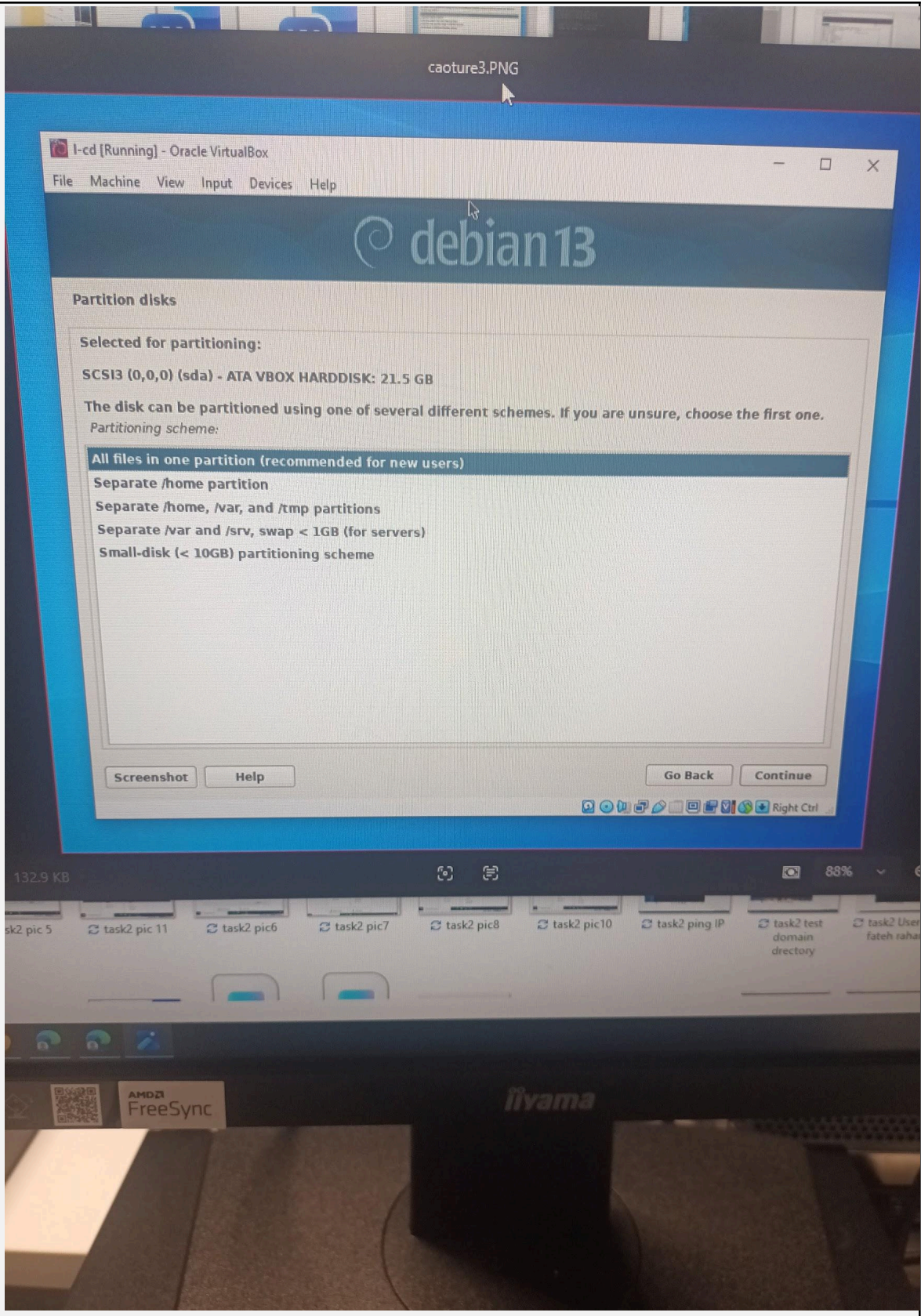
Options:
  -a, --all          display all variables
  -A                alias of -a
  -X                alias of -a
  --deprecated       include deprecated parameters to listing
  --dry-run          Print the key and values but do not write
  -b, --binary       print value without new line
  -e, --ignore       ignore unknown variables errors
  -N, --names        print variable names without values
  -n, --values       print only values of the given variable(s)
  -p, --load[=<file>] read values from file
  -f               alias of -p
  --system          read values from all system directories
  -r, --pattern <expression>
                    select setting that match expression
  -q, --quiet        do not echo variable set
  -w, --write        enable writing a value to variable
  -o               does nothing
  -x               does nothing
  -d               alias of -h
  -h, --help        display this help and exit
  -V, --version      output version information and exit

For more details see sysctl(8).
root@lcd:~# sysctl -w net.ipv4.ip_forward=1
sysctl: cannot stat /proc/sys/net/ipv4/ip_forward: No such file or directory
root@lcd:~# sysctl -w net.ipv4.ip_forward=1
sysctl: cannot stat /proc/sys/net/ipv4/ip_forward: No such file or directory
root@lcd:~# sysctl -w net.ipv4.ip_forward=1
net.ipv4.ip_forward = 1
root@lcd:~# cat /proc/sys/net/ipv4/ip_forward
1
root@lcd:~# nano /etc/sysctl.conf
```

Figure 22: DHCP scope creation and lease evidence.

Explanation:

This screenshot should show that DHCP has been configured to automatically assign valid IP addresses to client devices.



INSERT SCREENSHOT HERE

Figure 23 evidence: Client device joining the domain

Figure 23: Client device joining the domain.

Explanation:

This screenshot should demonstrate that the client device has successfully joined the BIRMINGHAM.ACCA domain.

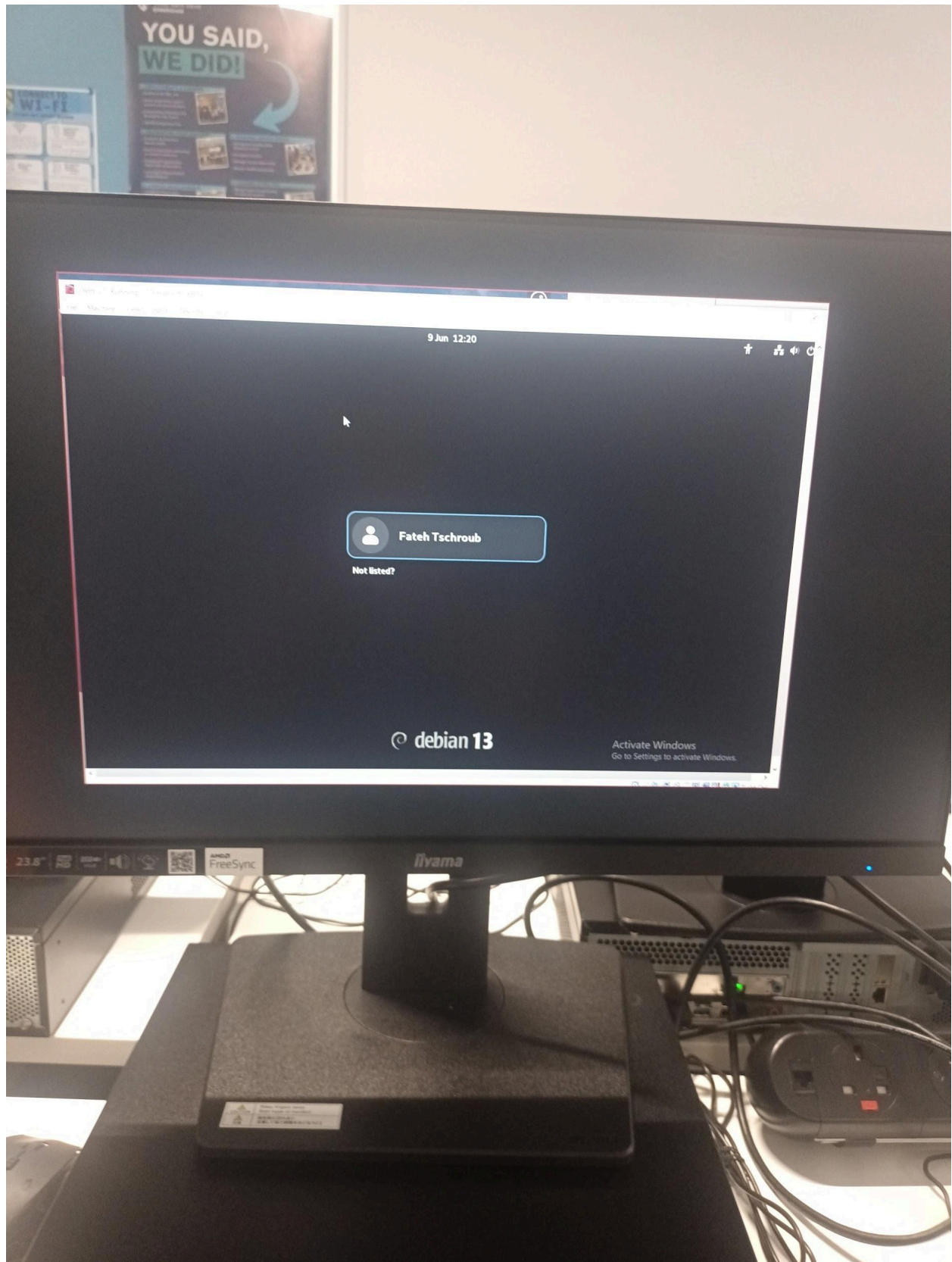


Figure 24: Successful domain user login.

Explanation:

This screenshot should confirm that a domain user can log in successfully, proving that authentication is working.

INSERT SCREENSHOT HERE

Figure 25 evidence: Debian server network

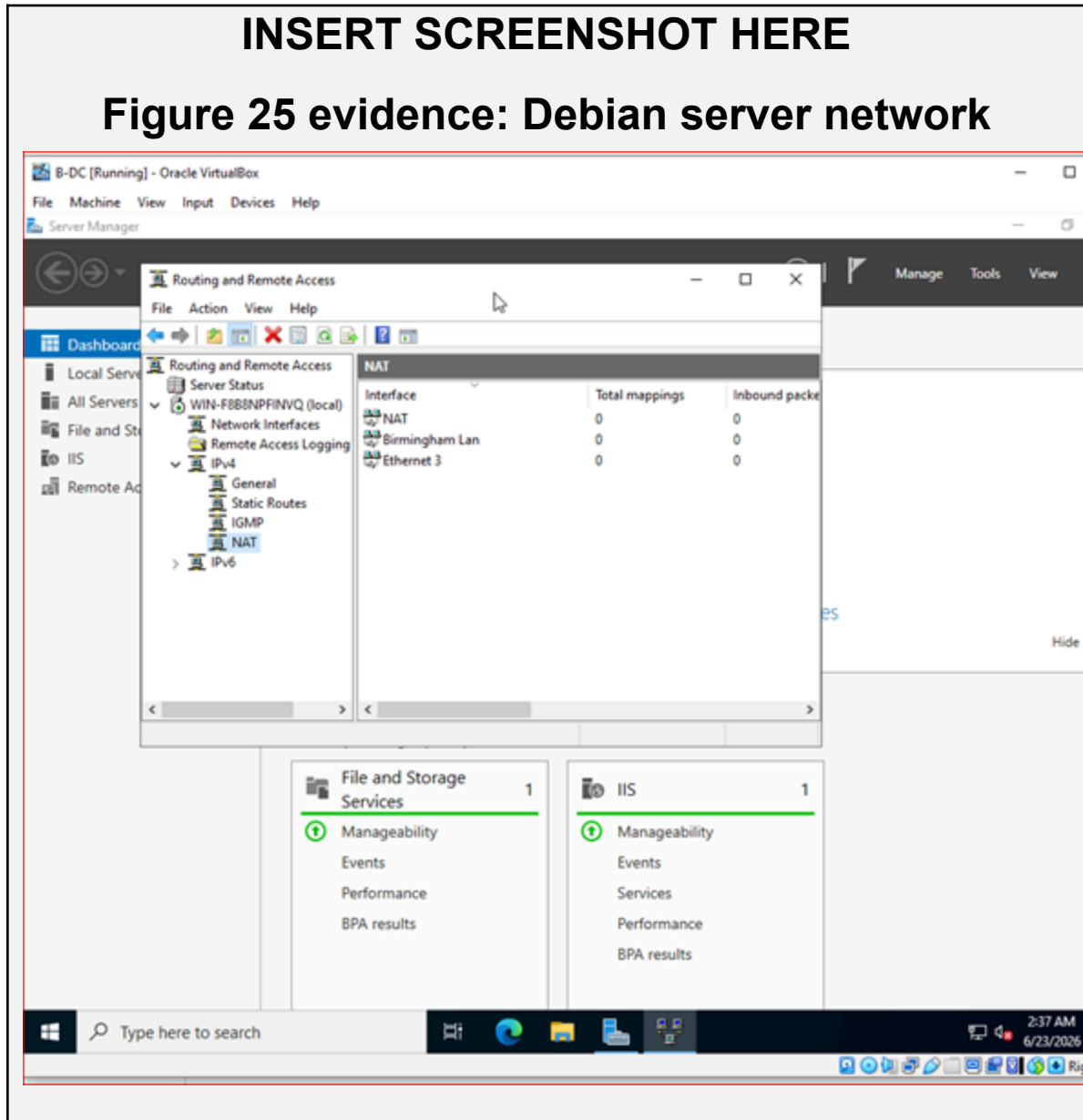


Figure 25: Debian server network configuration.

Explanation:

This screenshot should show the Debian server network settings used to support communication within the enhanced topology.

capture3.PNG

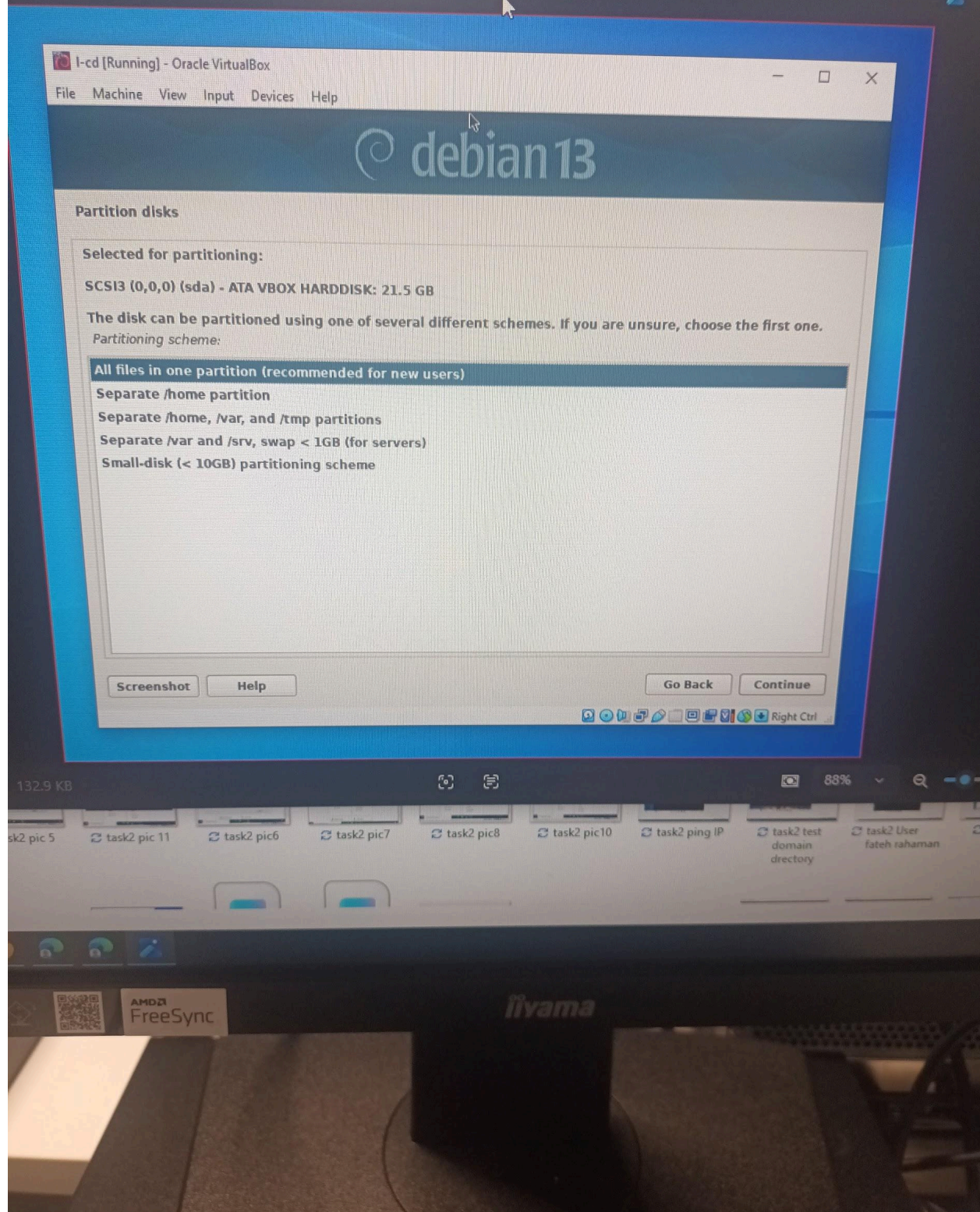
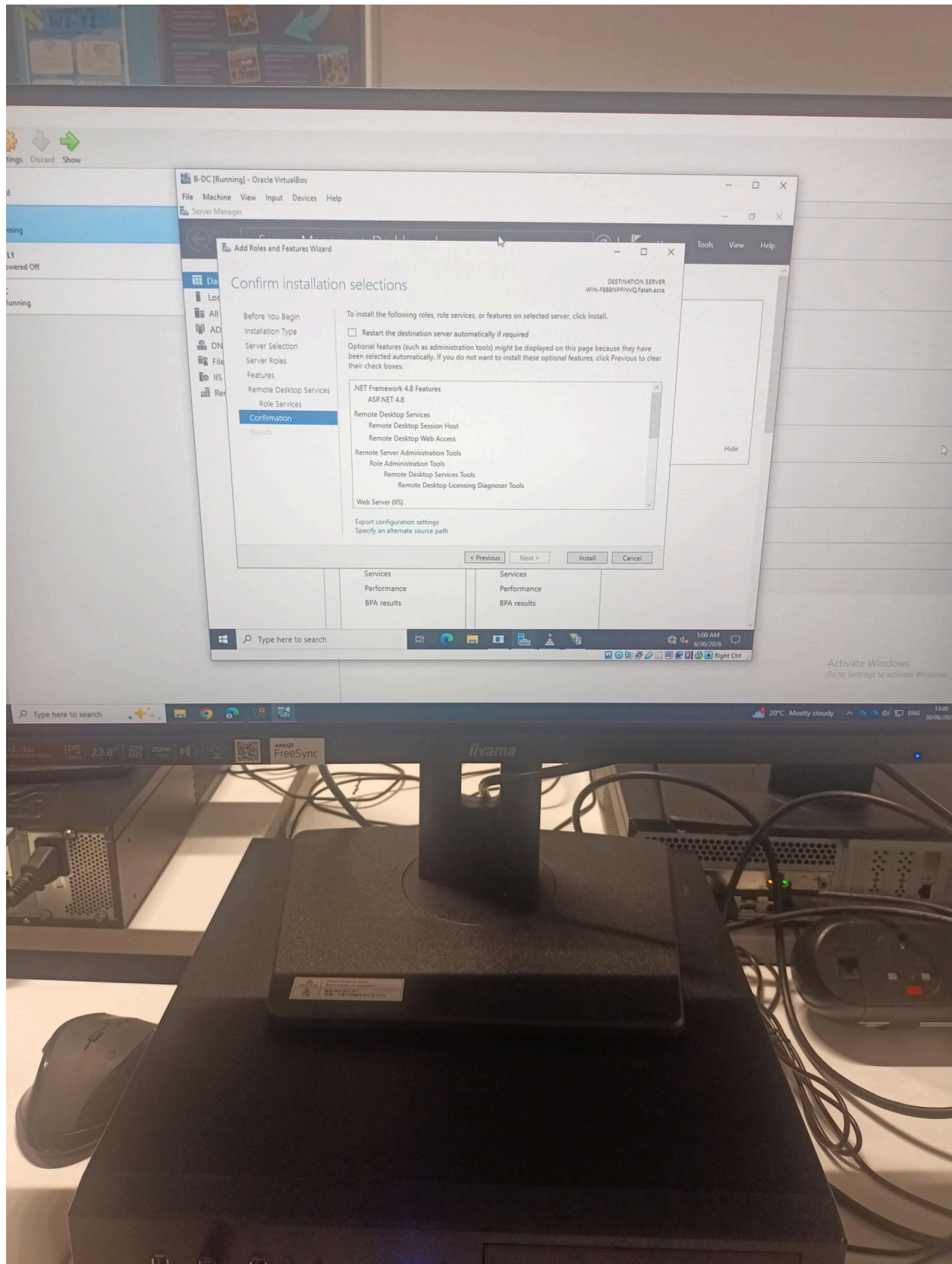


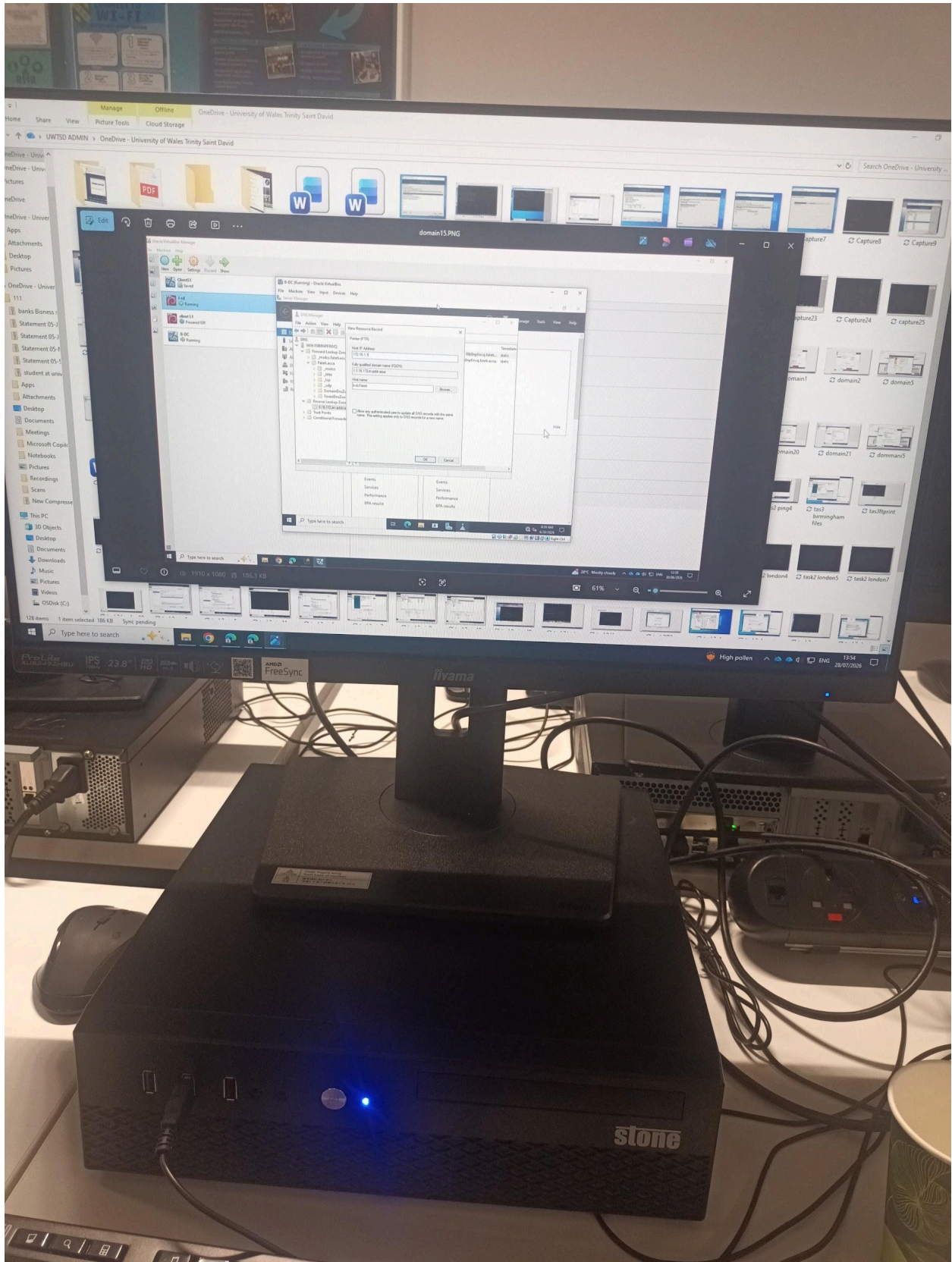
Figure 26: DHCP relay or routing configuration.



Explanation:

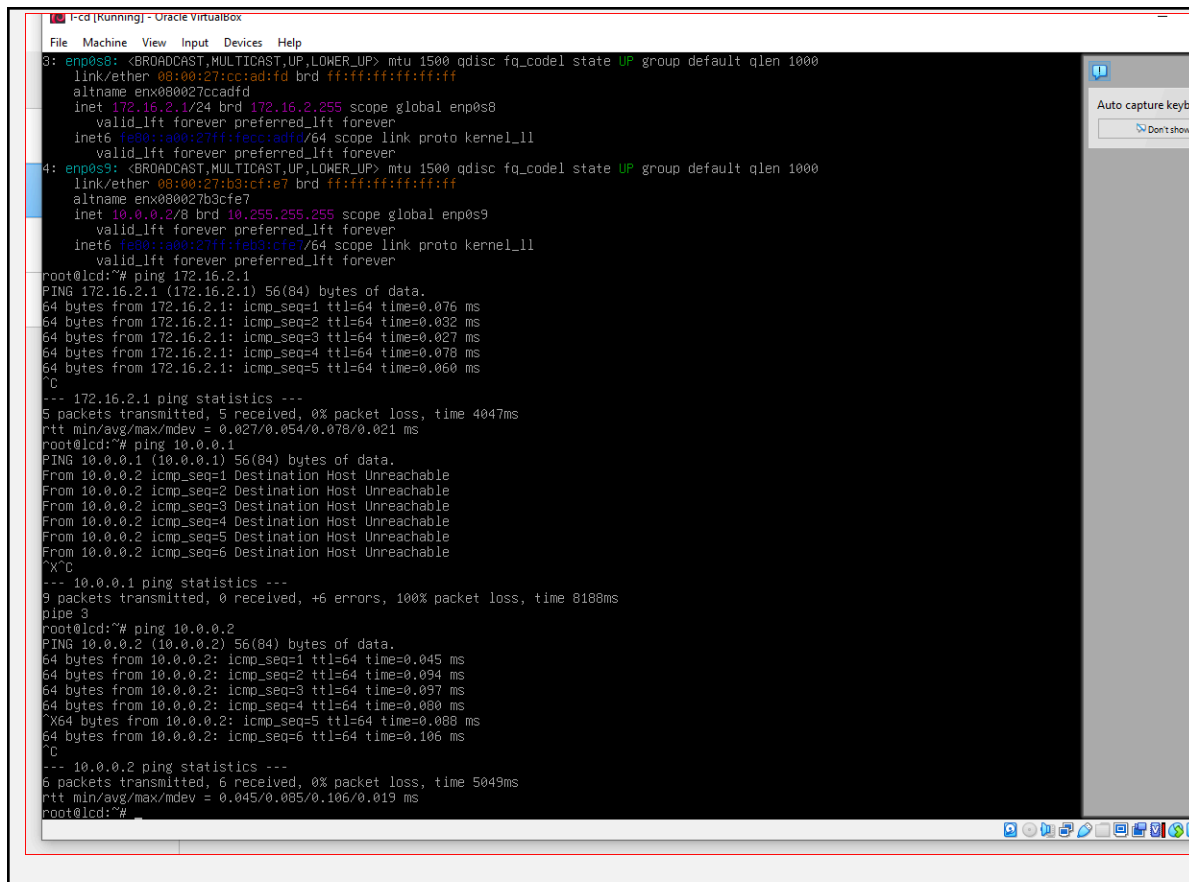
This screenshot should evidence DHCP relay or routing settings that allow devices on different network segments to communicate correctly.

Figure 27: Certificate Authority configuration.



Explanation:

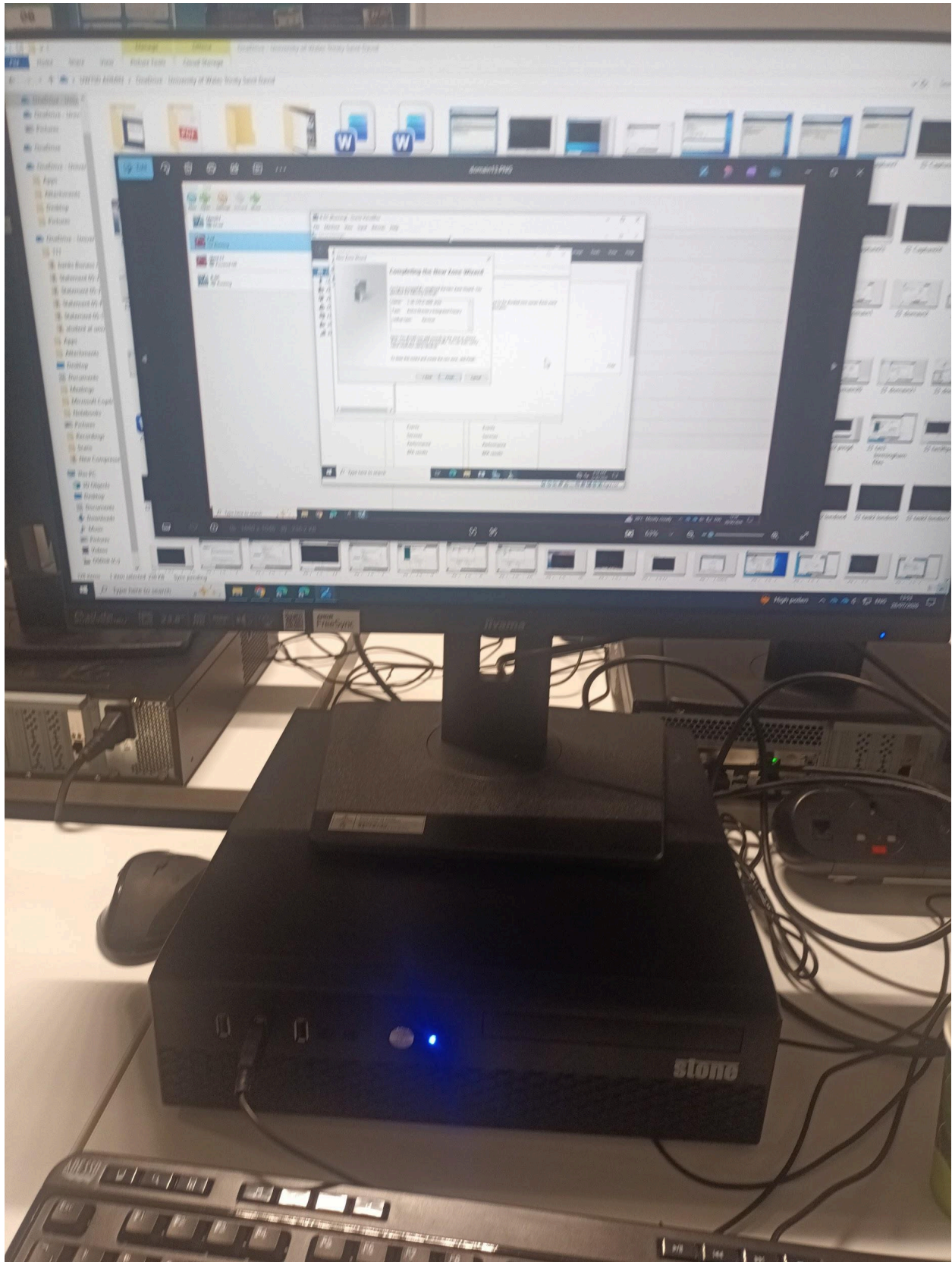
This screenshot should confirm that certificate services are configured to support trusted authentication and secure communication.



The screenshot shows a terminal window with the following content:

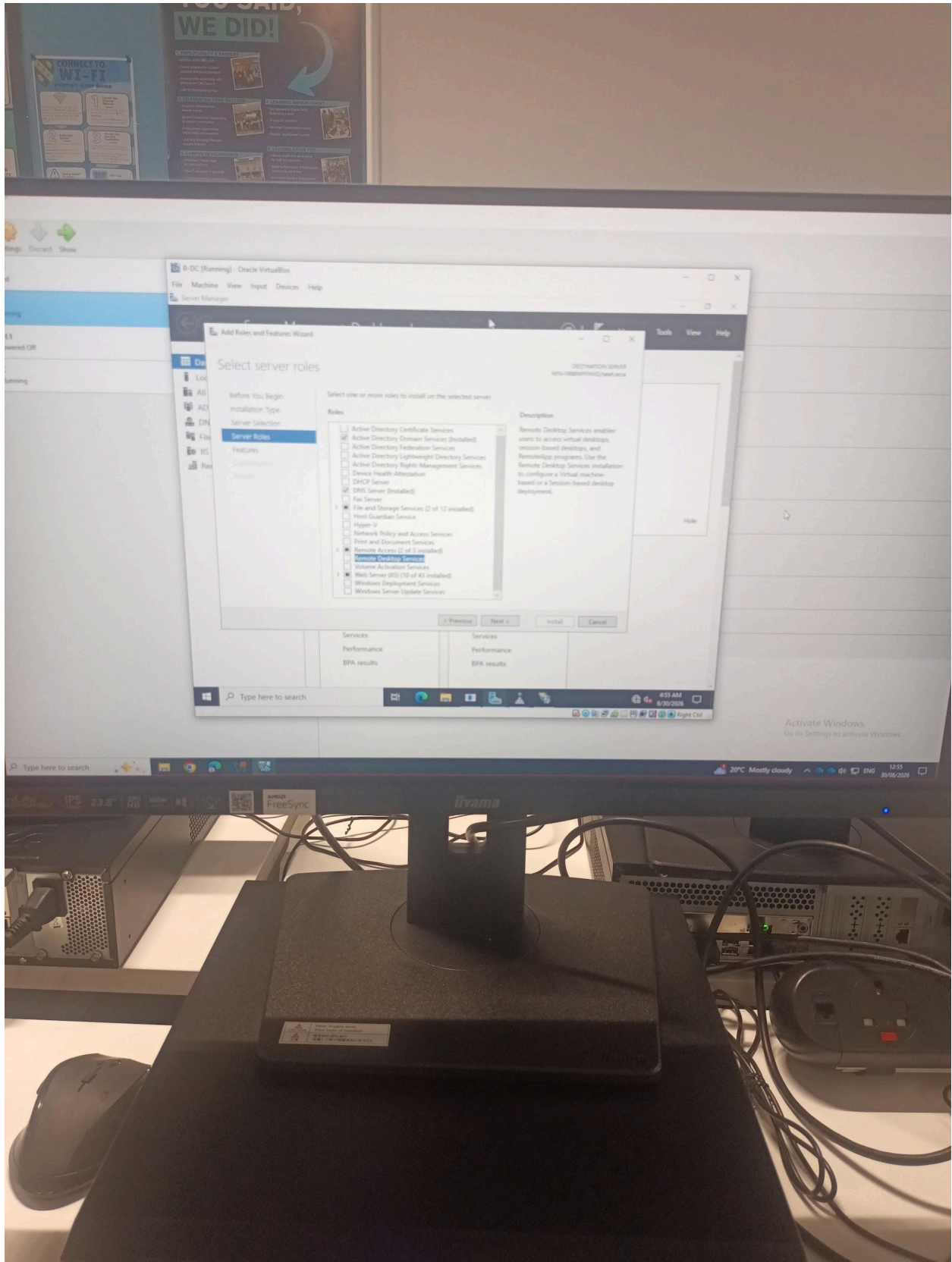
```
3: enp0s8: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP group default qlen 1000
    link/ether 08:00:27:cc:ad:fd brd ff:ff:ff:ff:ff:ff
    altname enx080027ccadfd
    inet 172.16.2.1/24 brd 172.16.2.255 scope global enp0s8
        valid_lft forever preferred_lft forever
    inet6 fe80::a00:27ff:fecc:adf0/64 scope link proto kernel_l1
        valid_lft forever preferred_lft forever
4: enp0s9: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP group default qlen 1000
    link/ether 08:00:27:b3:cf:e7 brd ff:ff:ff:ff:ff:ff
    altname enx080027b3cfe7
    inet 10.0.0.2/8 brd 10.255.255.255 scope global enp0s9
        valid_lft forever preferred_lft forever
    inet6 fe80::a00:27ff:feb3:cfe7/64 scope link proto kernel_l1
        valid_lft forever preferred_lft forever
root@lcd:~# ping 172.16.2.1
PING 172.16.2.1 (172.16.2.1) 56(84) bytes of data.
64 bytes from 172.16.2.1: icmp_seq=1 ttl=64 time=0.076 ms
64 bytes from 172.16.2.1: icmp_seq=2 ttl=64 time=0.032 ms
64 bytes from 172.16.2.1: icmp_seq=3 ttl=64 time=0.027 ms
64 bytes from 172.16.2.1: icmp_seq=4 ttl=64 time=0.078 ms
64 bytes from 172.16.2.1: icmp_seq=5 ttl=64 time=0.060 ms
^C
--- 172.16.2.1 ping statistics ---
5 packets transmitted, 5 received, 0% packet loss, time 4047ms
rtt min/avg/max/mdev = 0.027/0.054/0.078/0.021 ms
root@lcd:~# ping 10.0.0.1
PING 10.0.0.1 (10.0.0.1) 56(84) bytes of data.
From 10.0.0.2 icmp_seq=1 Destination Host Unreachable
From 10.0.0.2 icmp_seq=2 Destination Host Unreachable
From 10.0.0.2 icmp_seq=3 Destination Host Unreachable
From 10.0.0.2 icmp_seq=4 Destination Host Unreachable
From 10.0.0.2 icmp_seq=5 Destination Host Unreachable
From 10.0.0.2 icmp_seq=6 Destination Host Unreachable
^X^C
--- 10.0.0.1 ping statistics ---
9 packets transmitted, 0 received, +6 errors, 100% packet loss, time 8188ms
pipe 3
root@lcd:~# ping 10.0.0.2
PING 10.0.0.2 (10.0.0.2) 56(84) bytes of data.
64 bytes from 10.0.0.2: icmp_seq=1 ttl=64 time=0.045 ms
64 bytes from 10.0.0.2: icmp_seq=2 ttl=64 time=0.094 ms
64 bytes from 10.0.0.2: icmp_seq=3 ttl=64 time=0.097 ms
64 bytes from 10.0.0.2: icmp_seq=4 ttl=64 time=0.080 ms
^X64 bytes from 10.0.0.2: icmp_seq=5 ttl=64 time=0.088 ms
64 bytes from 10.0.0.2: icmp_seq=6 ttl=64 time=0.106 ms
^C
--- 10.0.0.2 ping statistics ---
6 packets transmitted, 6 received, 0% packet loss, time 5049ms
rtt min/avg/max/mdev = 0.045/0.085/0.106/0.019 ms
root@lcd:~#
```

Figure 28: VPN or remote access configuration.



Explanation:

This screenshot should show the VPN or remote access configuration used to provide secure external access to the network.



```
File Machine View Input Devices Help
3: enp0s8: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP group default qlen 1000
   link/ether 08:00:27:cc:ad:fd brd ff:ff:ff:ff:ff:ff
   altname enx080027ccadfd
   inet 172.16.2.1/24 brd 172.16.2.255 scope global enp0s8
       valid_lft forever preferred_lft forever
   inet6 fe80::a00:27ff:fecc:adfd/64 scope link proto kernel ll
       valid_lft forever preferred_lft forever
4: enp0s9: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP group default qlen 1000
   link/ether 08:00:27:b3:cf:e7 brd ff:ff:ff:ff:ff:ff
   altname enx080027b3cfe7
   inet 10.0.0.2/8 brd 10.255.255.255 scope global enp0s9
       valid_lft forever preferred_lft forever
   inet6 fe80::a00:27ff:feb3:cfef/64 scope link proto kernel ll
       valid_lft forever preferred_lft forever
root@lcd:~# ping 172.16.2.1
PING 172.16.2.1 (172.16.2.1) 56(84) bytes of data.
64 bytes from 172.16.2.1: icmp_seq=1 ttl=64 time=0.076 ms
64 bytes from 172.16.2.1: icmp_seq=2 ttl=64 time=0.032 ms
64 bytes from 172.16.2.1: icmp_seq=3 ttl=64 time=0.027 ms
64 bytes from 172.16.2.1: icmp_seq=4 ttl=64 time=0.078 ms
64 bytes from 172.16.2.1: icmp_seq=5 ttl=64 time=0.060 ms
^C
--- 172.16.2.1 ping statistics ---
5 packets transmitted, 5 received, 0% packet loss, time 4047ms
rtt min/avg/max/mdev = 0.027/0.054/0.078/0.021 ms
root@lcd:~# ping 10.0.0.1
PING 10.0.0.1 (10.0.0.1) 56(84) bytes of data.
From 10.0.0.2 icmp_seq=1 Destination Host Unreachable
From 10.0.0.2 icmp_seq=2 Destination Host Unreachable
From 10.0.0.2 icmp_seq=3 Destination Host Unreachable
From 10.0.0.2 icmp_seq=4 Destination Host Unreachable
From 10.0.0.2 icmp_seq=5 Destination Host Unreachable
From 10.0.0.2 icmp_seq=6 Destination Host Unreachable
^X^C
--- 10.0.0.1 ping statistics ---
9 packets transmitted, 0 received, +6 errors, 100% packet loss, time 8188ms
pipe 3
root@lcd:~# ping 10.0.0.2
PING 10.0.0.2 (10.0.0.2) 56(84) bytes of data.
64 bytes from 10.0.0.2: icmp_seq=1 ttl=64 time=0.045 ms
64 bytes from 10.0.0.2: icmp_seq=2 ttl=64 time=0.094 ms
64 bytes from 10.0.0.2: icmp_seq=3 ttl=64 time=0.097 ms
64 bytes from 10.0.0.2: icmp_seq=4 ttl=64 time=0.080 ms
^X64 bytes from 10.0.0.2: icmp_seq=5 ttl=64 time=0.088 ms
64 bytes from 10.0.0.2: icmp_seq=6 ttl=64 time=0.106 ms
^C
--- 10.0.0.2 ping statistics ---
6 packets transmitted, 6 received, 0% packet loss, time 5049ms
rtt min/avg/max/mdev = 0.045/0.085/0.106/0.019 ms
root@lcd:~#
```

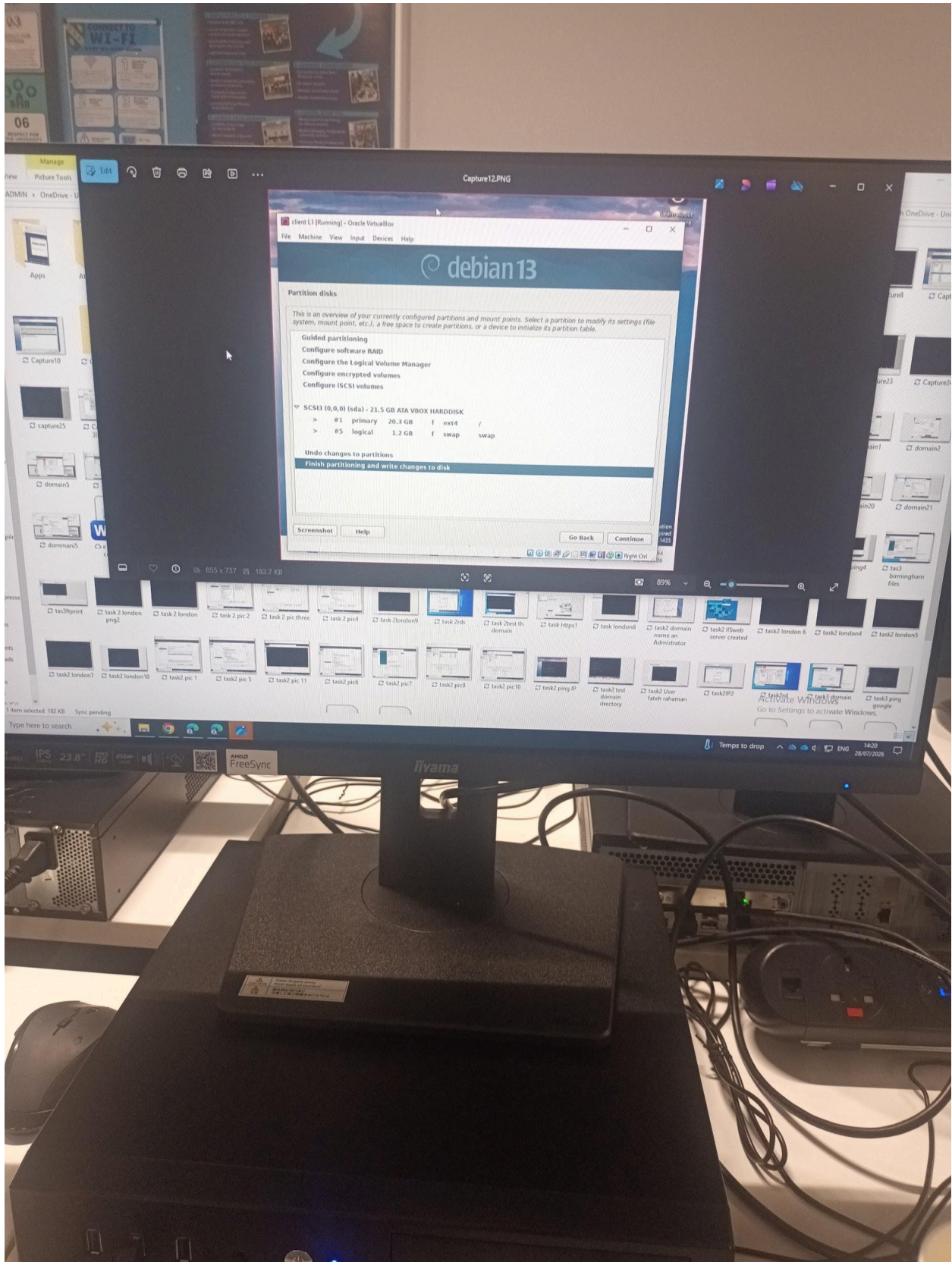


Figure 29: Security policy or audit configuration.

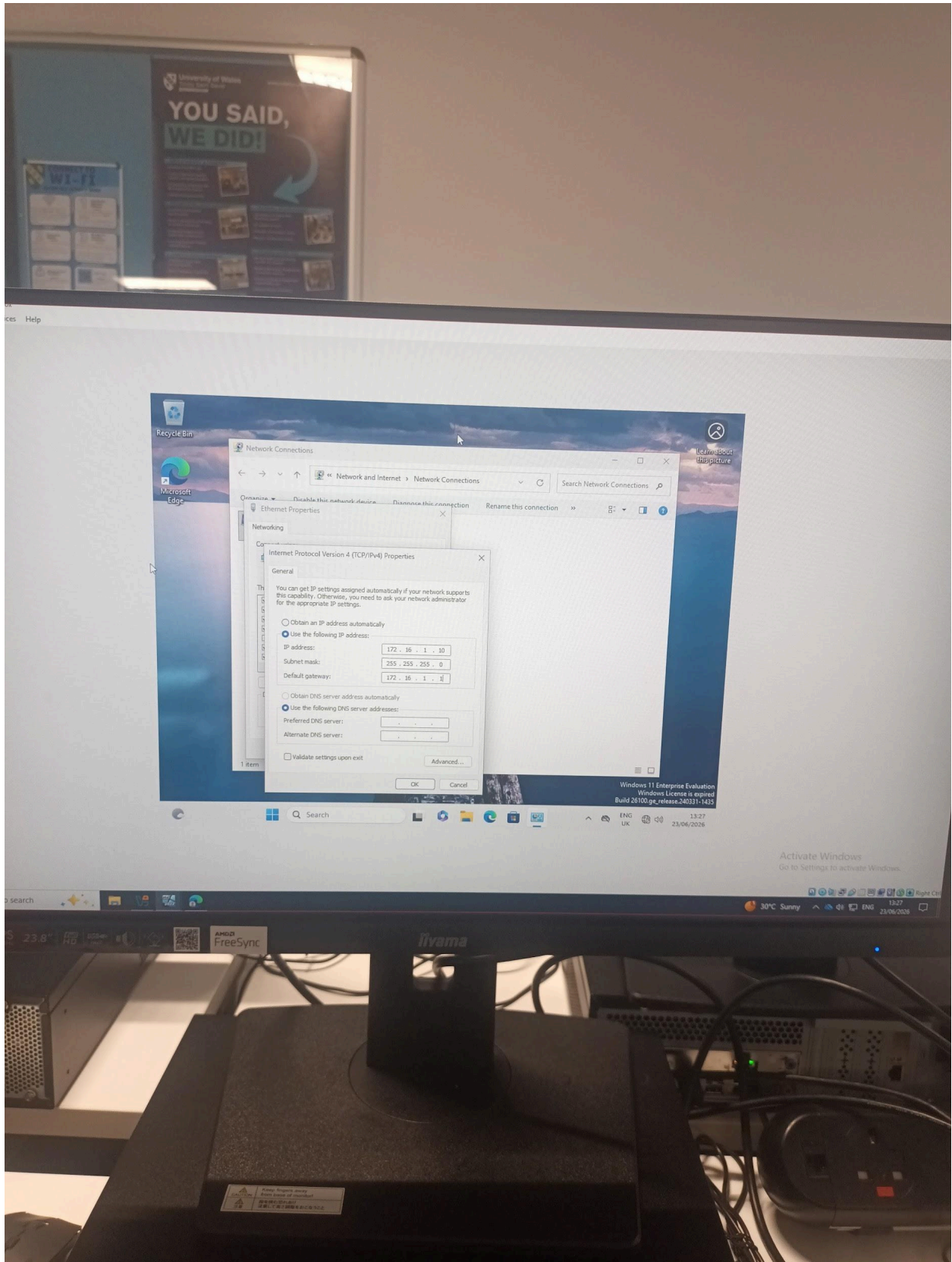


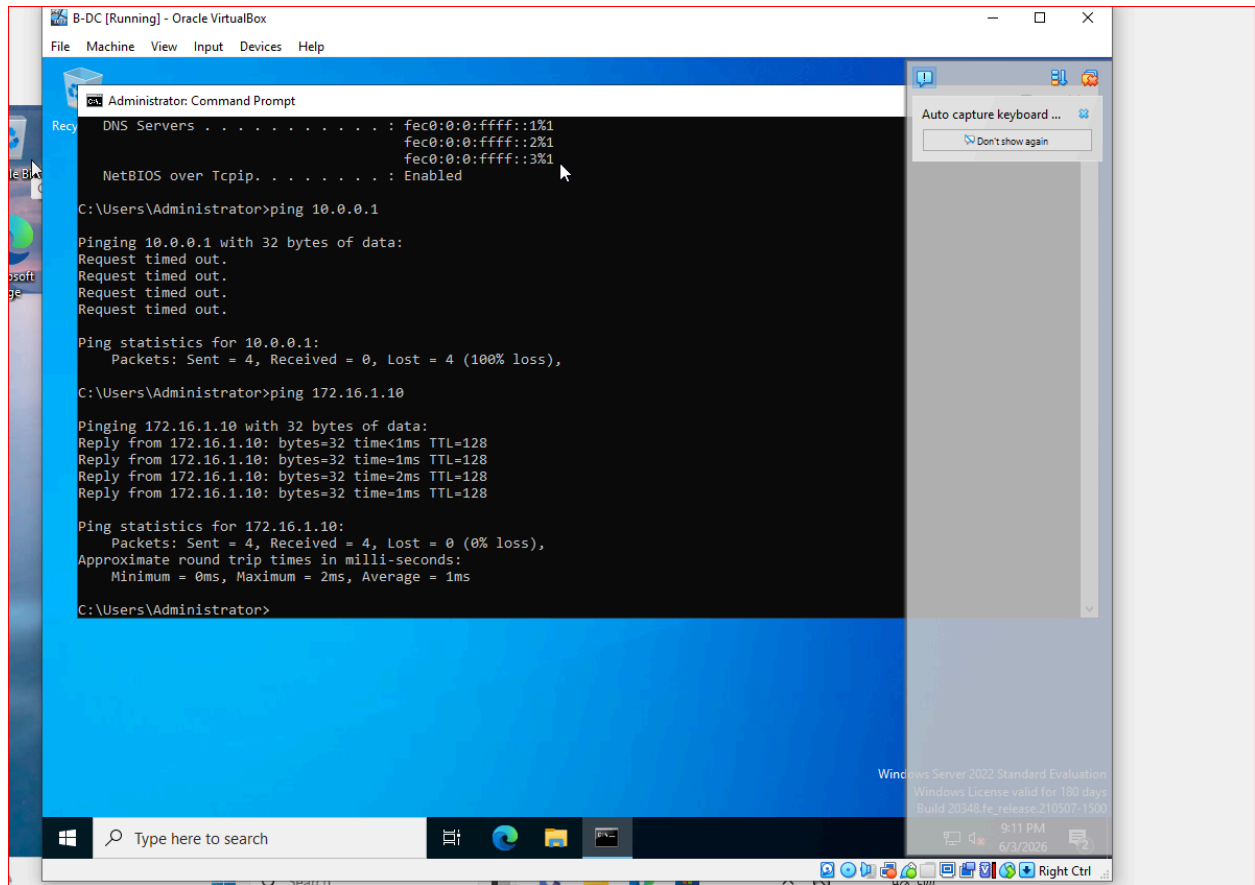
Explanation:

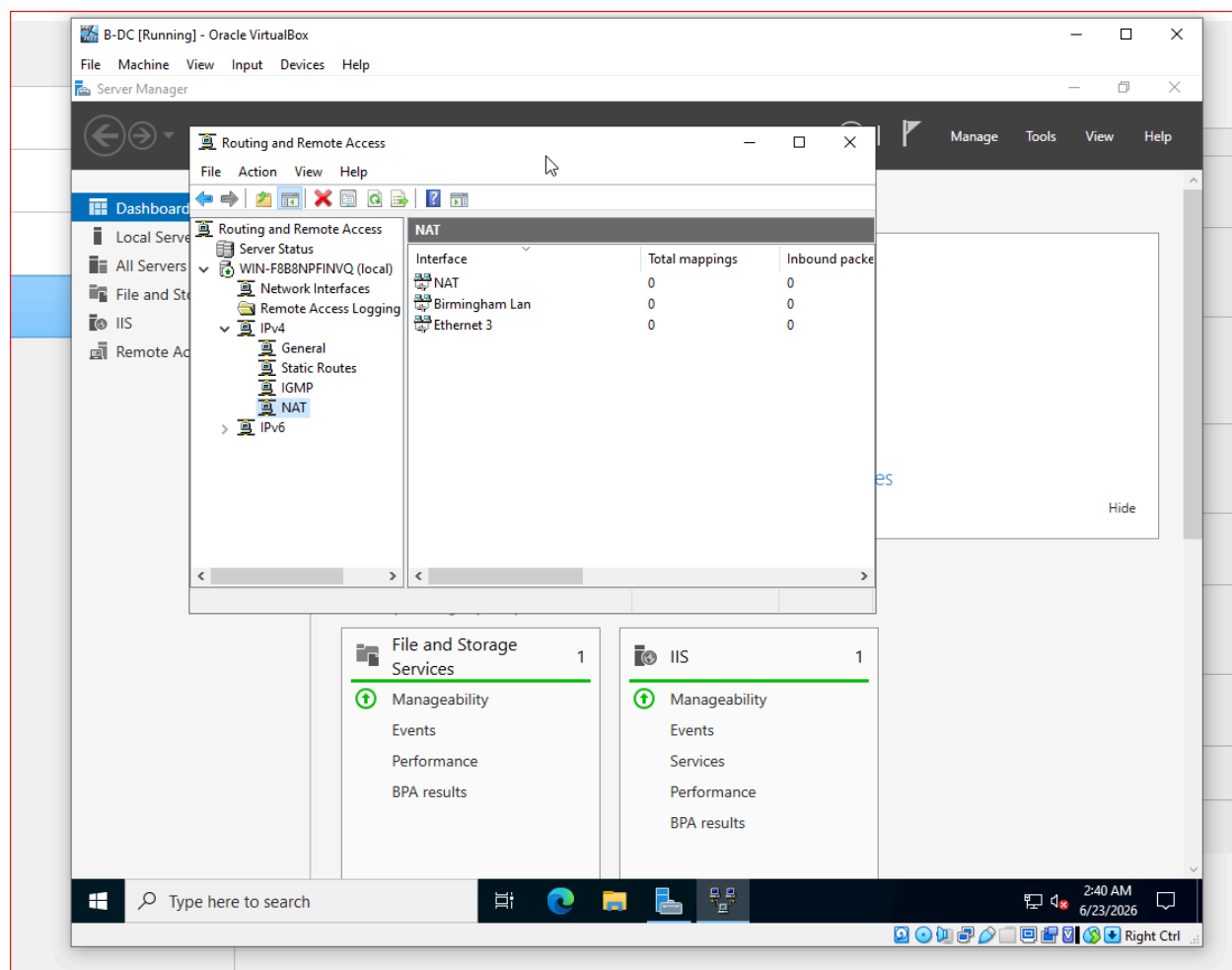
This screenshot should prove that security settings or auditing are enabled to monitor access, policy changes, and system activity.

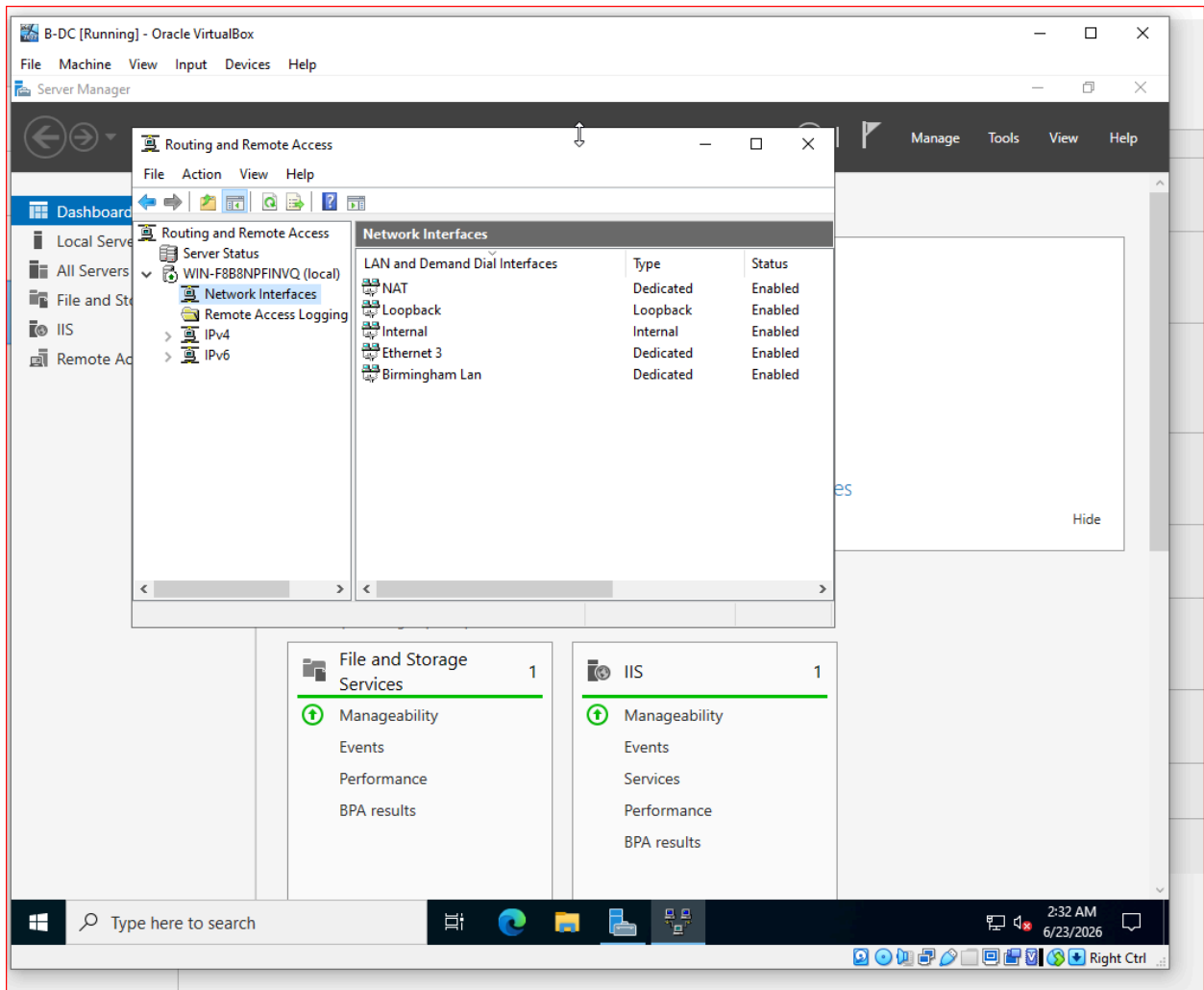
INSERT SCREENSHOT HERE

Figure 30 : Backup or disaster recovery evidence









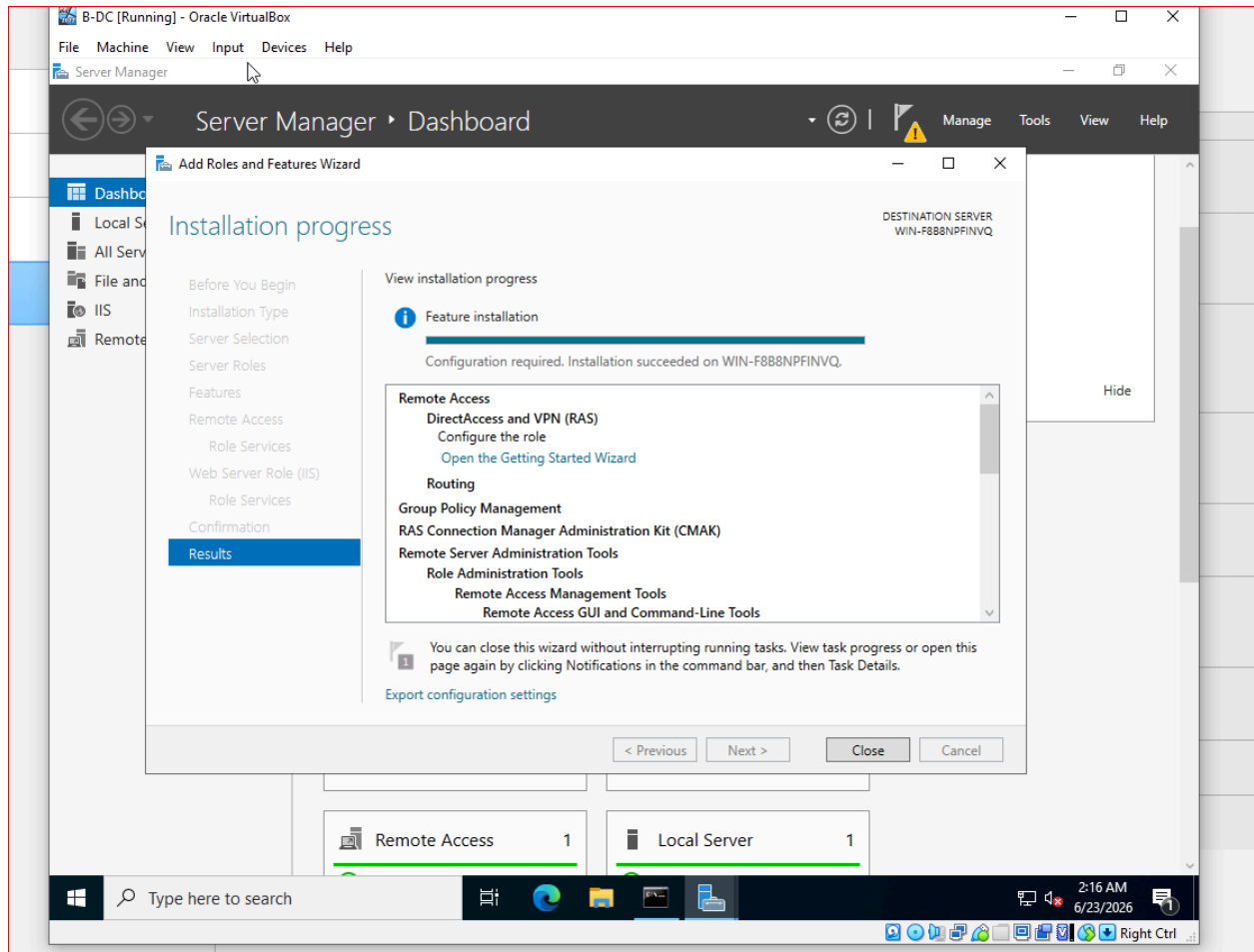
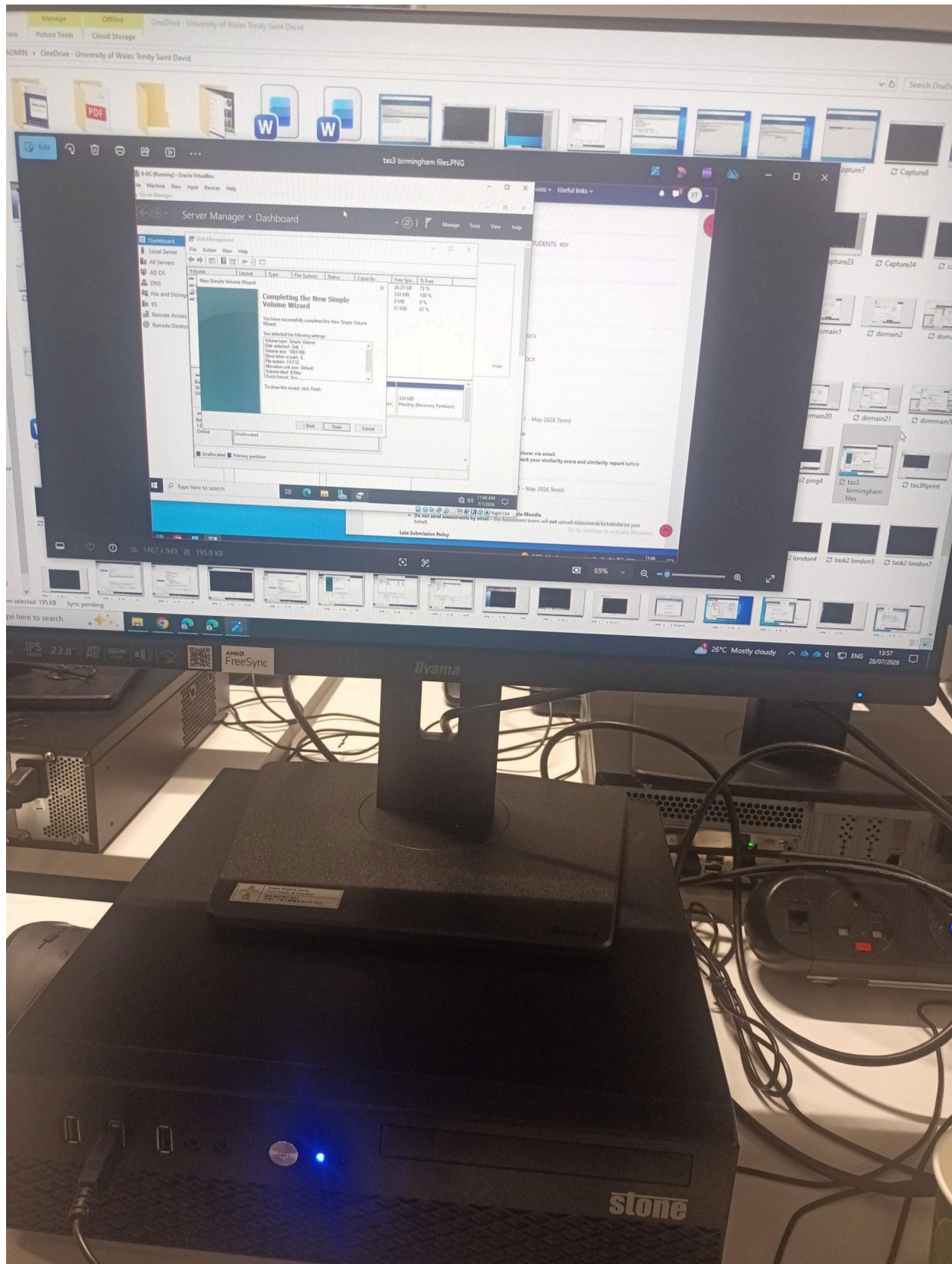


Figure 30: Backup or disaster recovery evidence.

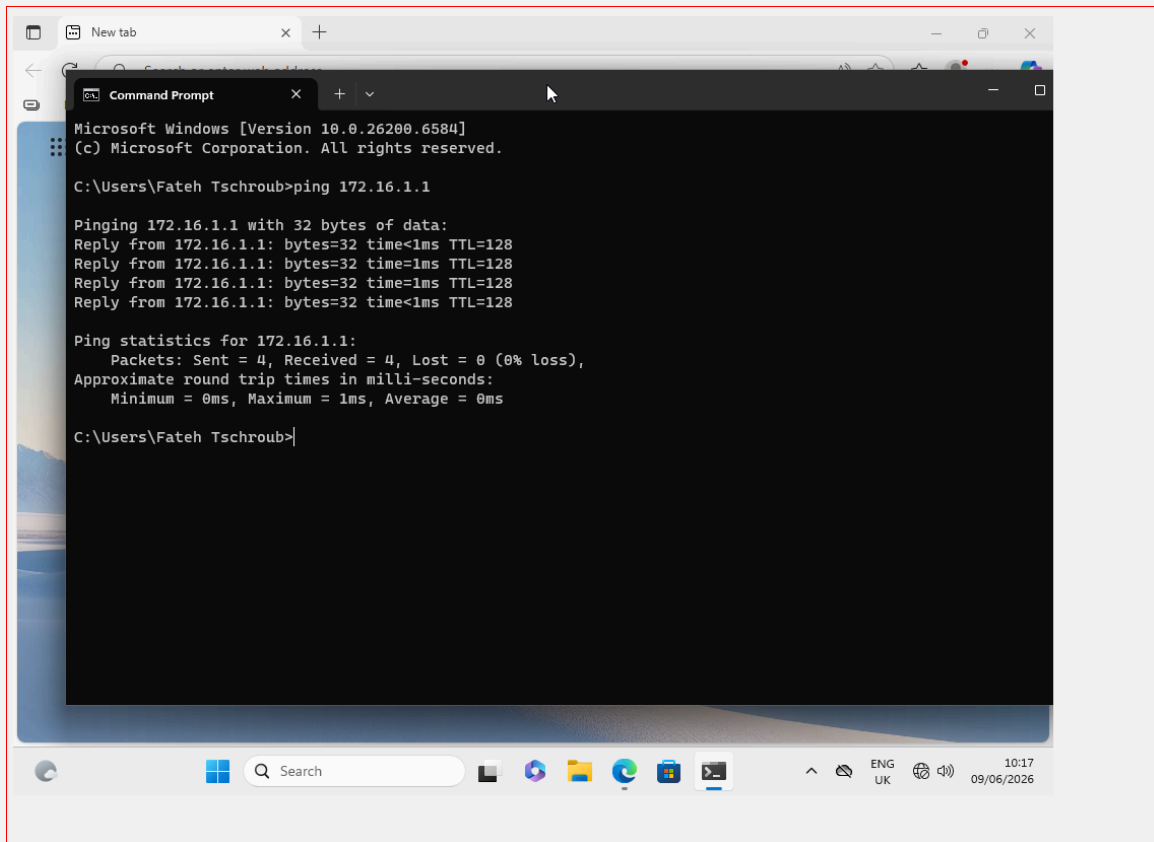


Explanation:

This screenshot should show backup or recovery evidence that demonstrates how critical services can be restored after a failure.

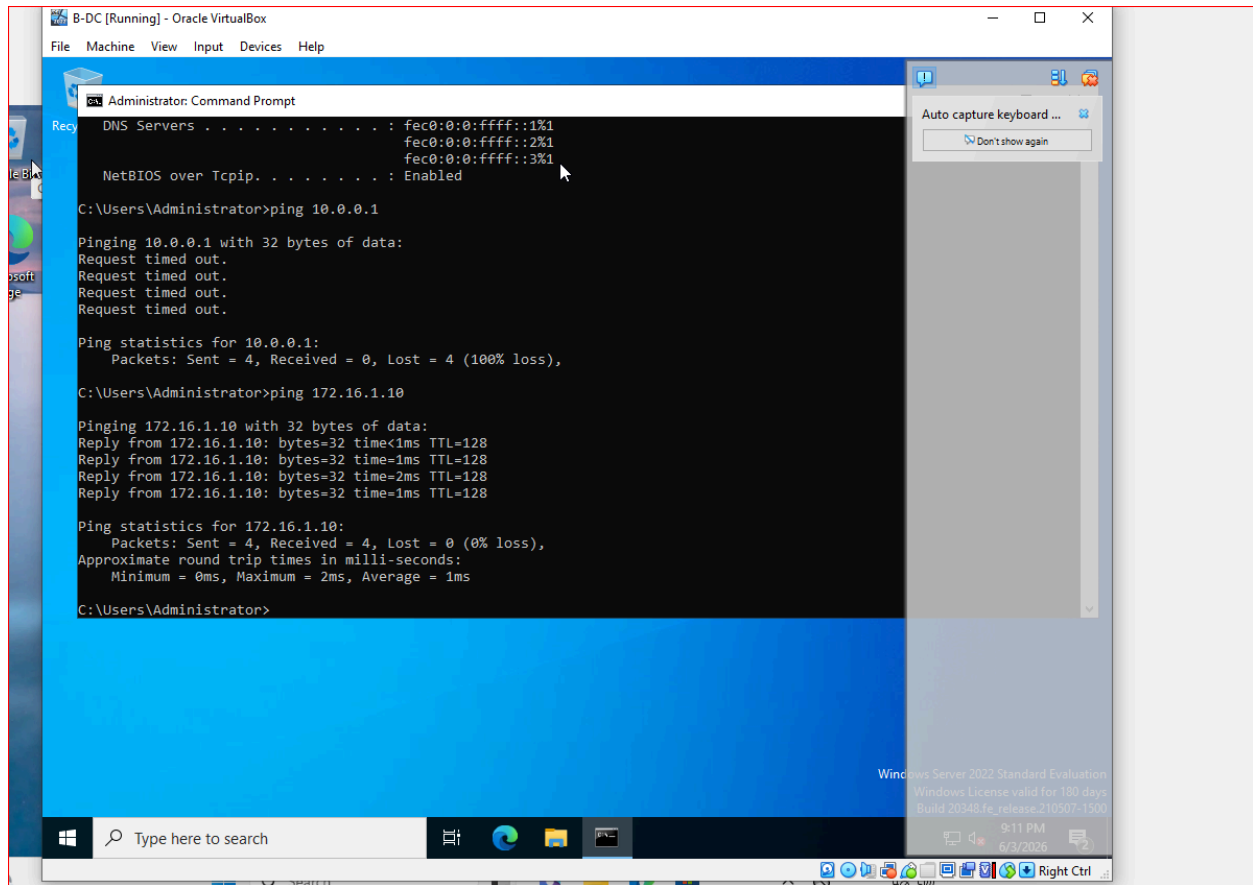
INSERT SCREENSHOT HERE

Figure 31 evidence: Final connectivi



ty testing

Figure 31: Final connectivity testing.



Explanation:

This screenshot should confirm that the final network services and devices can communicate successfully across the enhanced topology.

Security and Disaster Recovery Strategy

The security strategy should protect the network using centralised accounts, strong passwords, limited administrator access, and reduced unnecessary services.

Security auditing should record important activity such as logins, failed access attempts, setting

changes, and system errors.

Disaster recovery should include regular backups, secure storage, test restores, and a clear process for restoring essential services.

Component 2 Evidence Checklist

Evidence required	Status
Windows Server IP configuration documented	Not started
Active Directory Domain Services installed	Not started
BIRMINGHAM.ACCA domain created	Not started
DNS service configured and tested	Not started
DHCP scope configured	Not started
Client joined to the domain	Not started

	d
Domain user login tested	Not started
Debian server configuration documented	Not started
DHCP relay or routing configuration documented	Not started
Certificate Authority configured	Not started
VPN or remote access configuration documented	Not started
Security auditing configured	Not started
Backup or disaster recovery evidence included	Not started
Final connectivity testing	Not

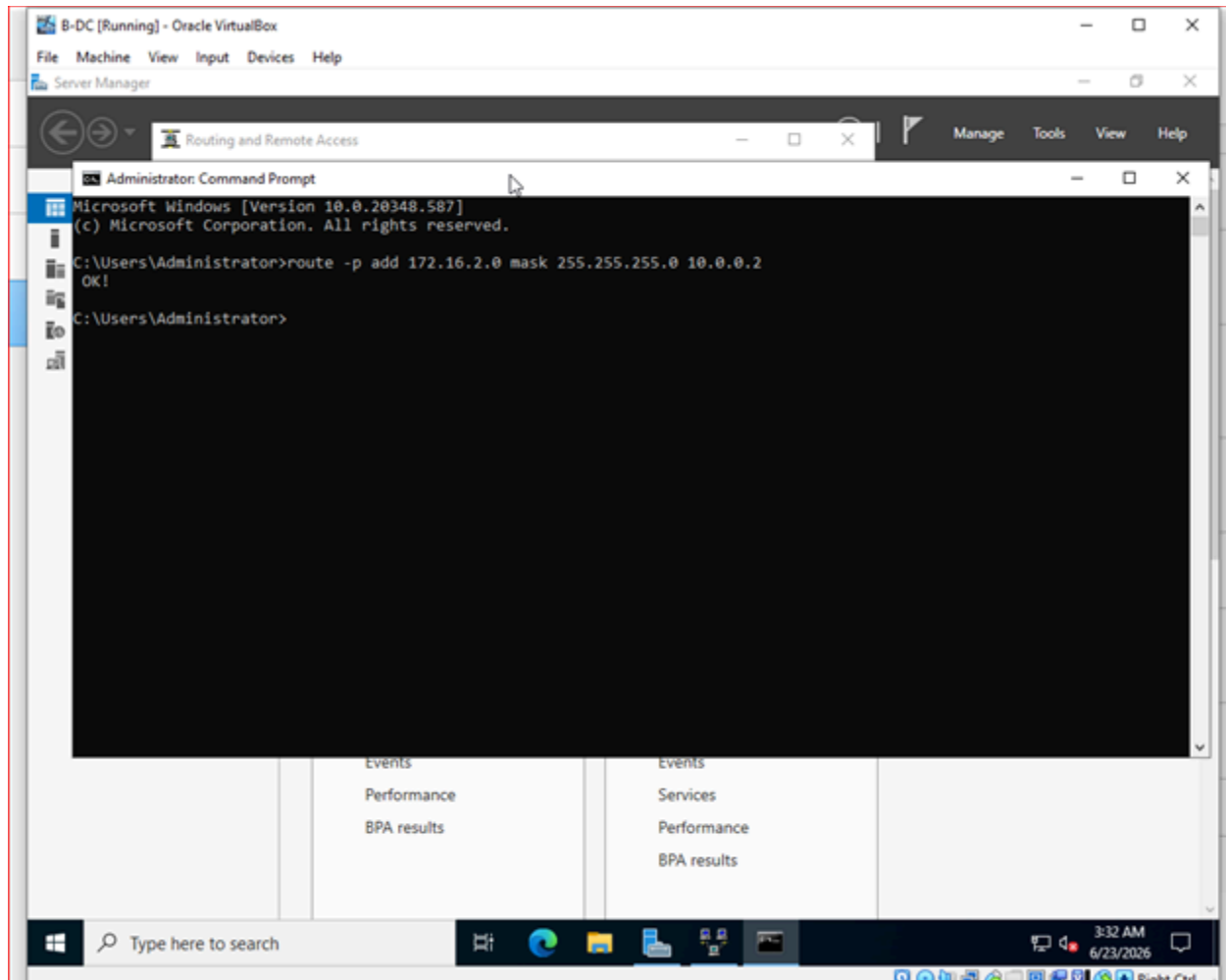
completed	started
------------------	----------------

Component 2 Reflection

Component 2 improves the network by adding enterprise services for management, security, reliability, and remote access.

The main challenge is that services depend on correct DNS, IP addressing, and staged testing before clients can use the domain successfully.

Overall, Component 2 shows how a basic virtual network can be developed into a secure and realistic enterprise network.



References

ACCA5023 assessment brief. Component 1 technical documentation requirements.

Microsoft Learn. *ping*. Windows Commands documentation. Used to support the connectivity testing evidence because ping verifies IP-level connectivity by sending ICMP Echo Request messages and displaying Echo Reply responses.

Debian Project. *Debian GNU/Linux Installation Guide*. Used to support the Debian installation evidence,

including language selection, disk partitioning, package manager setup, and first boot configuration.

Debian Project. *Debian documentation*. Used to support the Debian system configuration evidence, including network interface checking and static IPv4 configuration.

Microsoft Learn. *Domain Name System (DNS) in Windows and Windows Server*. Used to support the Component 2 discussion of DNS as a name resolution service required for Windows Server and Active Directory environments.

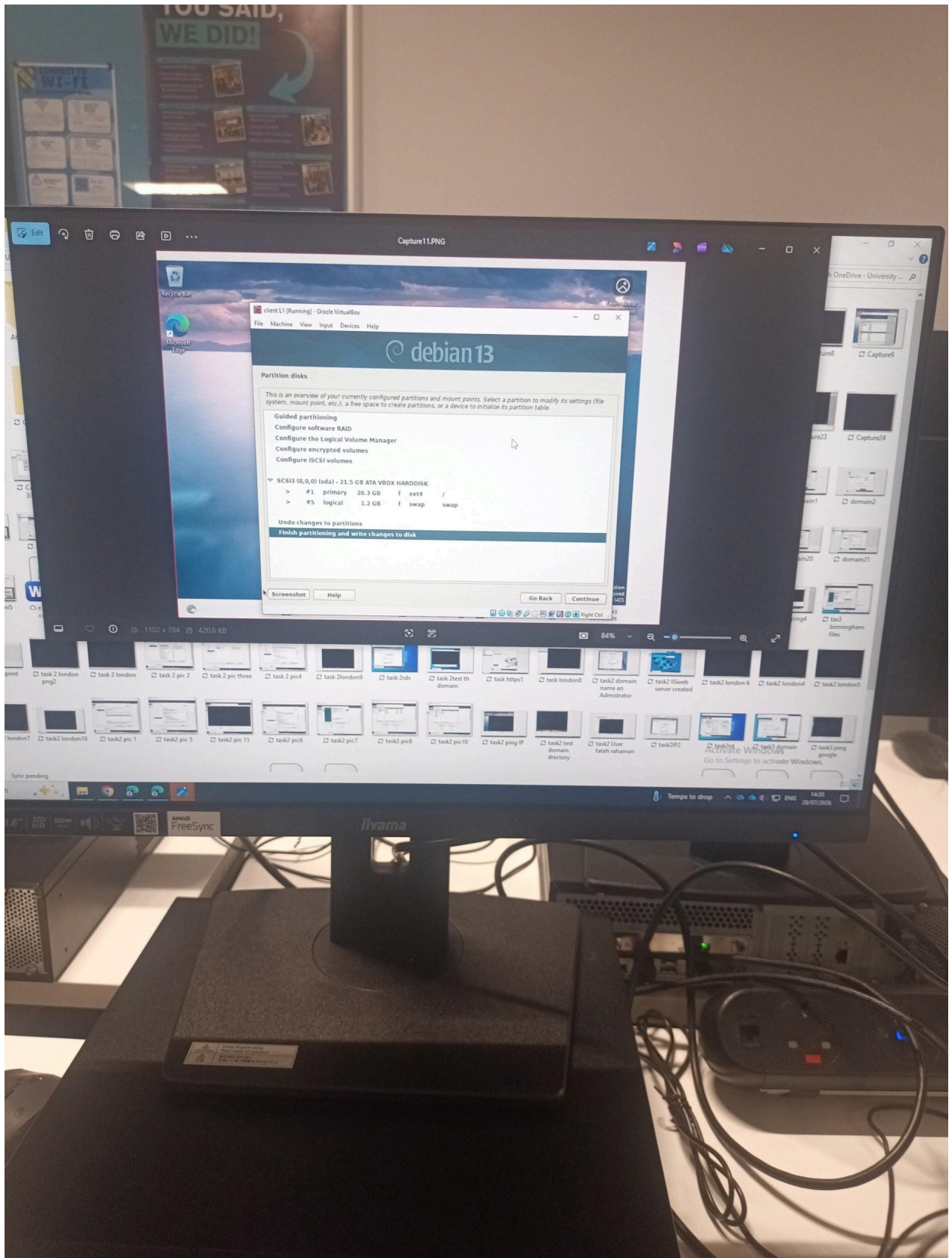
Microsoft Learn. *Active Directory Domain Services*. Used to support the Component 2 discussion of centralised user, computer, and domain management.

Microsoft Learn. *Windows Server Network Infrastructure*. Used to support the Component 2 planned services, including DHCP, DNS, IP address management, and remote access.

End of submission.

Internet Information Services (IIS) was installed on the domain controller to host organizational web portals and internal services.

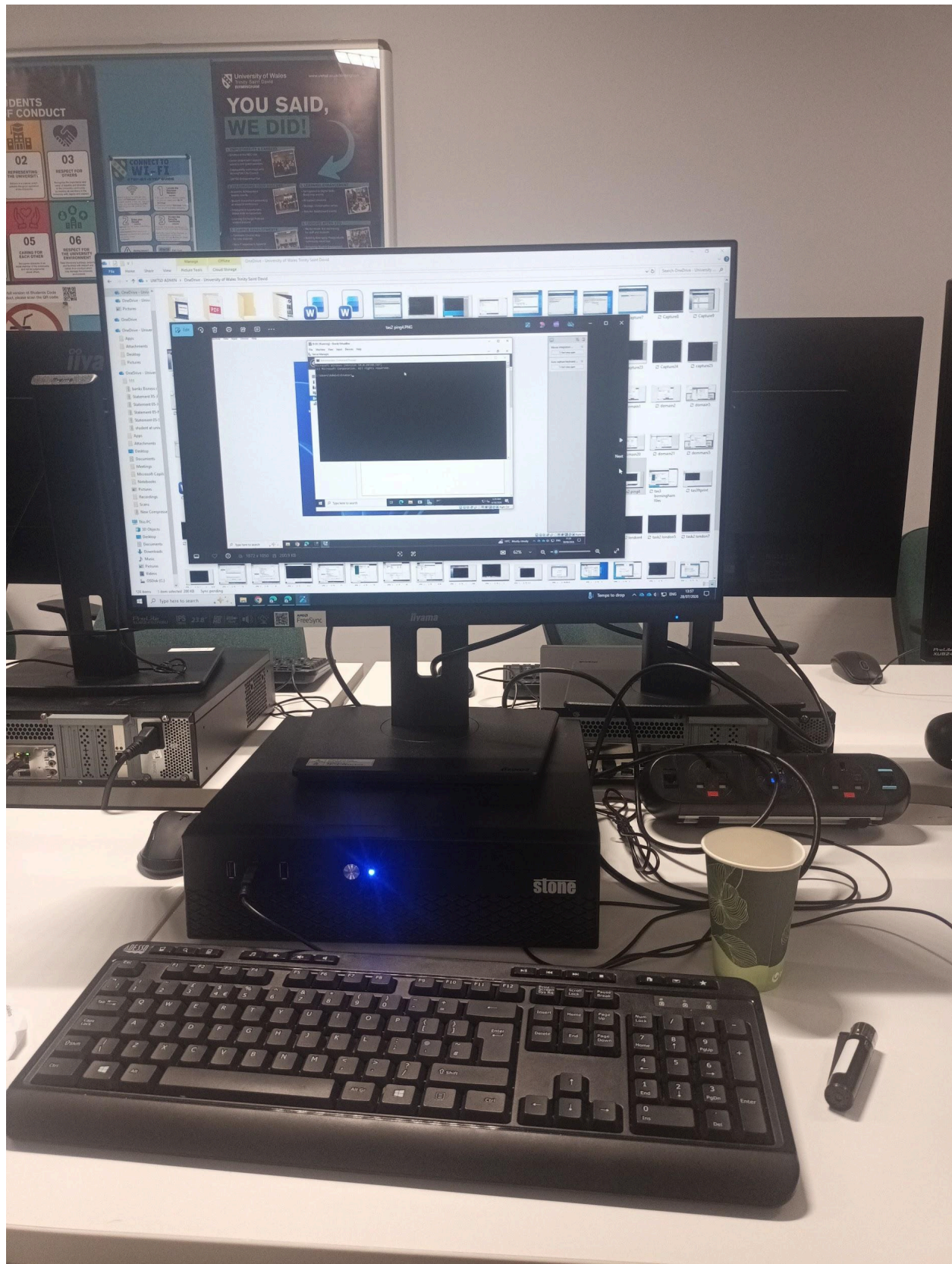
- **IIS Add Website Initial Configuration:** Captures the Add Website wizard window in IIS Manager, showing the setup for site name "Birmingham website", physical path C:\inetpub\wwwroot, and binding parameters with unassigned IP and port 80 [cite: domain17.PNG].
- **IIS Website Binding Configuration:** Details the configured Add Website dialog where bindings are set to IP address 172.16.1.1 on port 80 with the specific host name webs.fateh.acca for the Birmingham website [cite: domain18.PNG].
- **IIS Web Server Default Page Test:**



Captures a browser session on the Windows Server domain controller (B-DC)

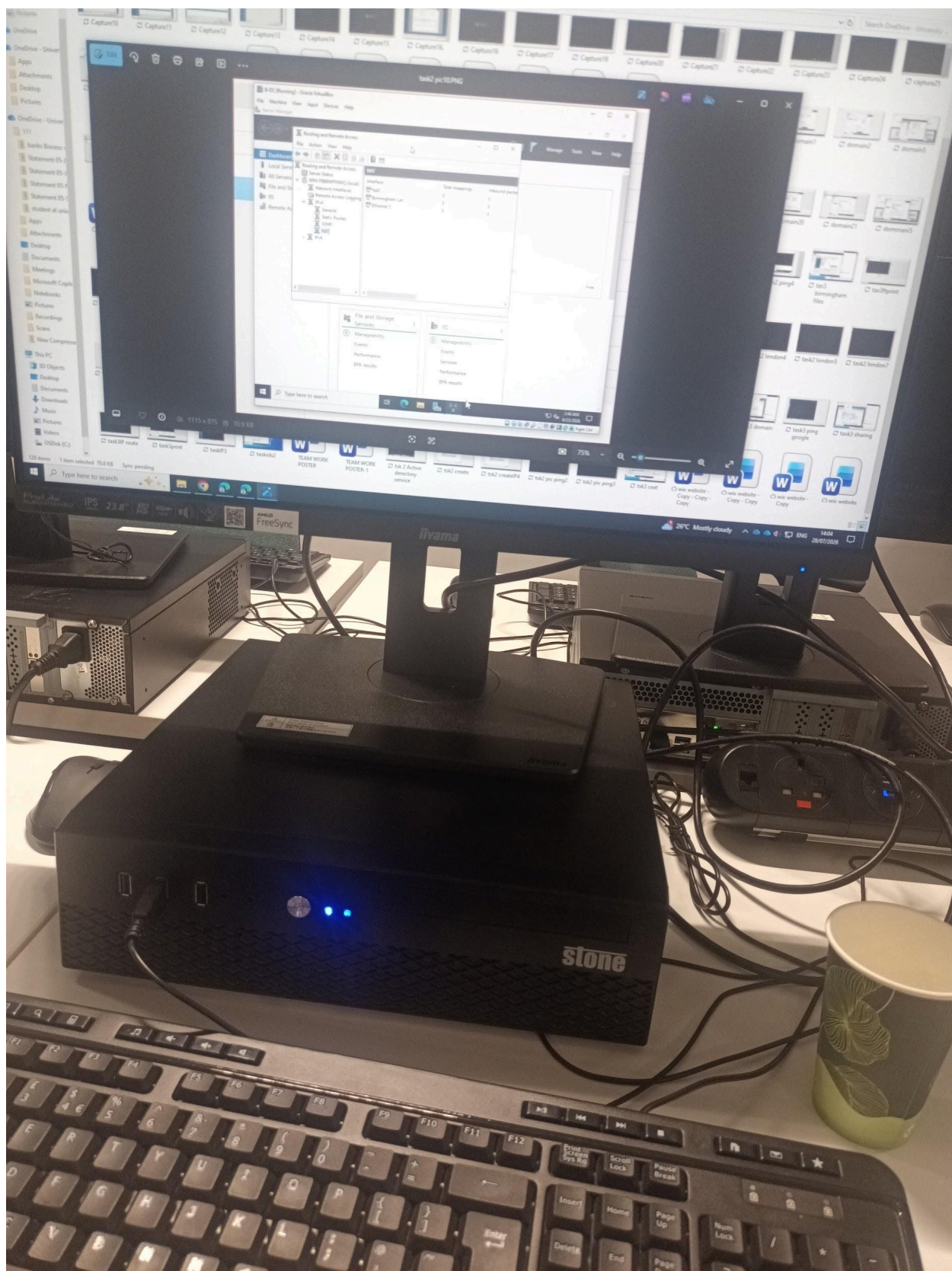
successfully navigating to webs.fateh.acca, displaying the default Internet Information Services (IIS) welcome page [cite: task2 IISweb server created.PNG].

4. Remote Desktop Services (RDS) & RD Web Access Setup



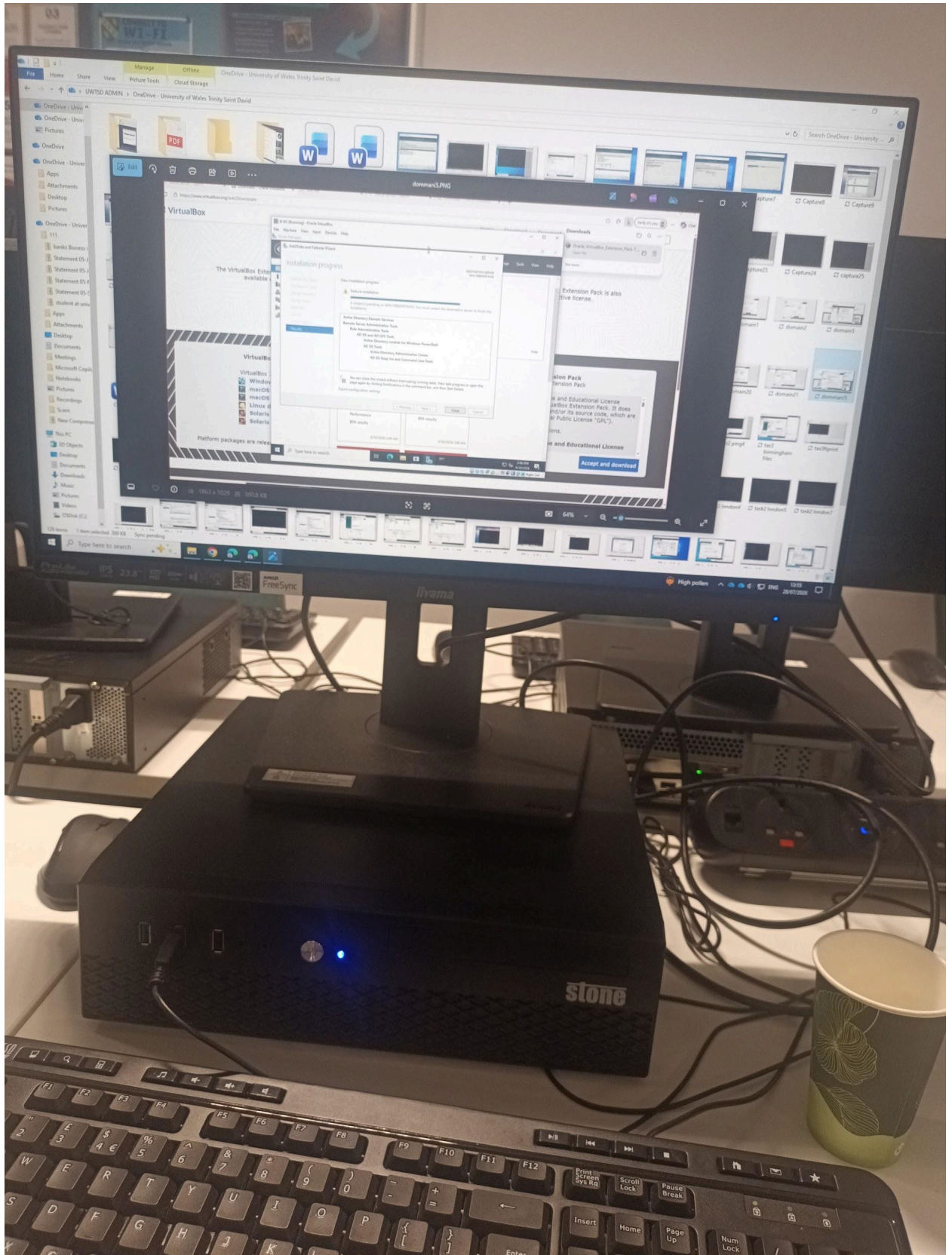
Remote Desktop Services were deployed to facilitate virtual desktop infrastructure and remote application publishing.

- **Server Roles Selection:**



Displays the Select server roles window in the Add Roles and Features Wizard on the

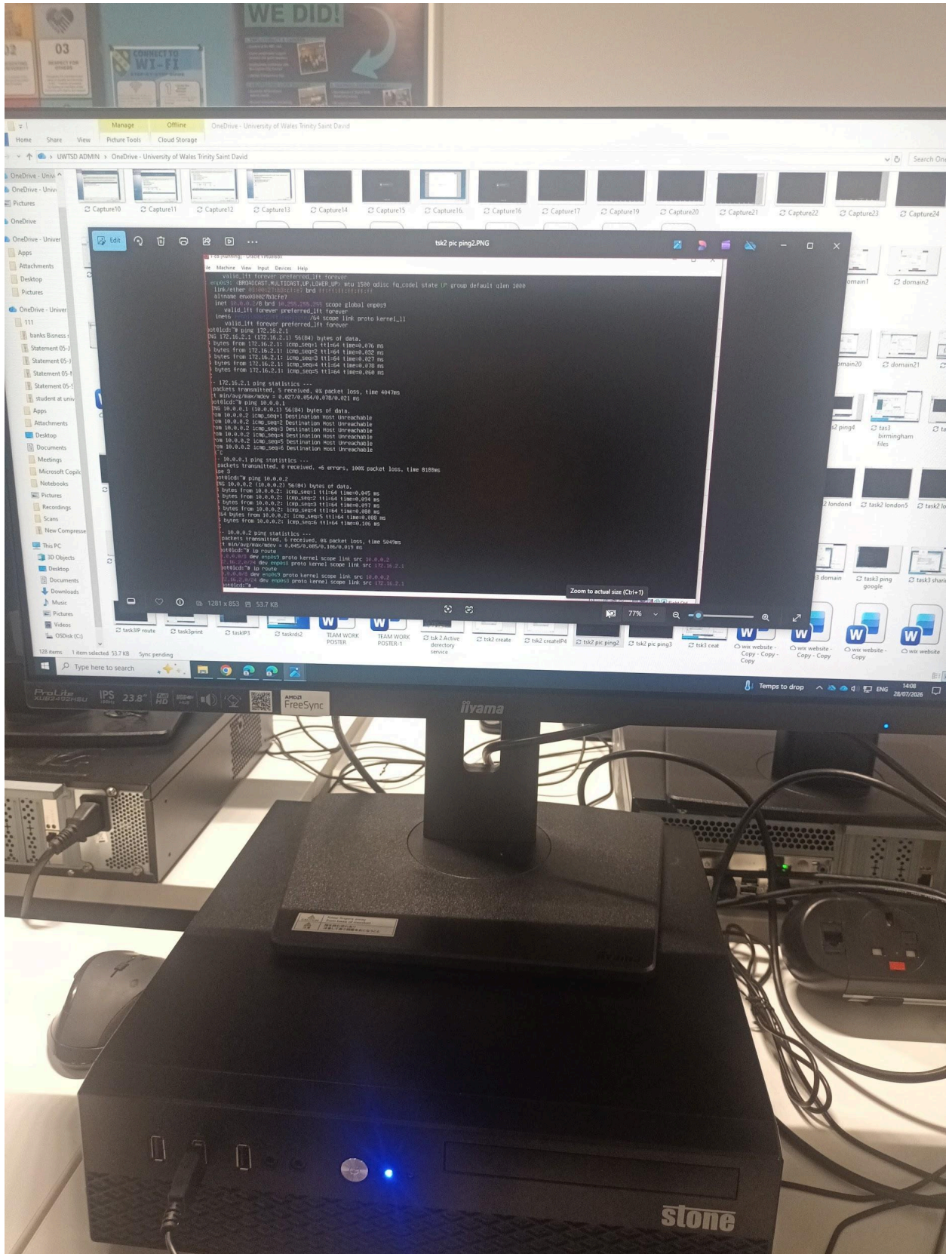
B-DC node, highlighting the selection of Remote Desktop Services alongside pre-installed roles like Active Directory Domain Services, DHCP Server, and DNS Server [cite: domain19.PNG].



- **RDS Role Services Selection:** Captures the Select role services page for Remote

Desktop Services, showing the selection of Remote Desktop Session Host and Remote Desktop Web Access components [cite: domain20.PNG].

- **Confirmation Selections:**

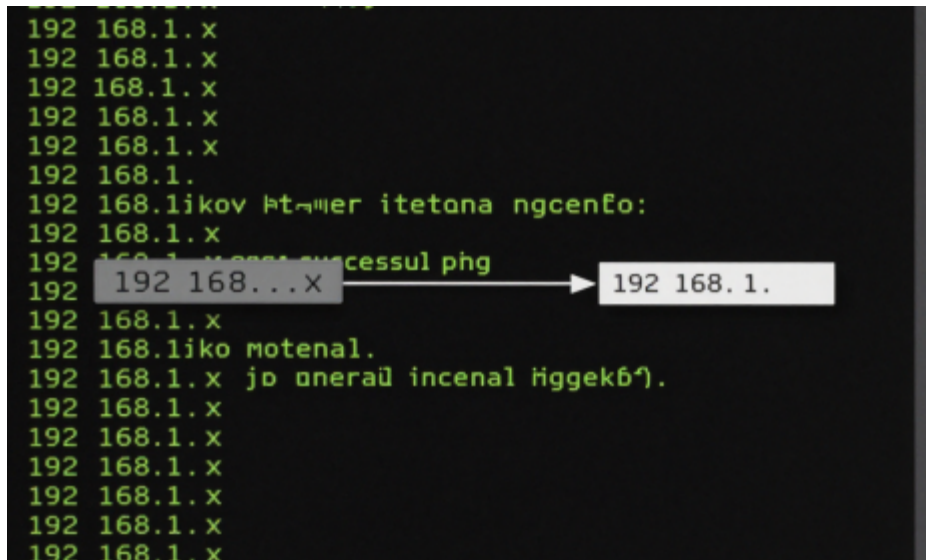


Details the Confirm installation selections summary page reviewing the inclusion of .NET

Framework 4.8 features, Remote Desktop Session Host, Remote Desktop Web Access, and associated Remote Server Administration Tools prior to installation [cite: domain21.PNG].

- **Feature Installation Progress:** Shows the Installation progress window for Active Directory Domain Services features, indicating a pending restart requirement on destination server WIN-F888NPFINVQ [cite: dommani5.jpg].
- **RD Web Access Login Interface:** Shows the Remote Desktop Web Access (RDWeb) login page running in a browser session on the Windows Server domain controller (B-DC), prompting for domain and username credentials to access published Work Resources [cite: task 2rds.jpg].
- **RD Web Access IP Connection:** Shows a web browser session navigating to 172.16.1.1/RDWeb on a Windows client, displaying the Remote Desktop Web Access login portal for managing published Work Resources [cite: task2IP2.jpg].
- **IIS Manager RDWeb Configuration:** Displays the Internet Information Services (IIS Manager) console running on the Windows Server domain controller (B-DC), detailing site bindings and features view configurations for the /RDWeb virtual directory under the Default Web Site [cite: task2rd.jpg].
- **RD Web Access Portal Authentication:** Displays the browser-based Remote Desktop Web Access login screen (localhost/RDWeb), prompting users to enter domain credentials to access published Work Resources [cite: taskrds2.jpg].

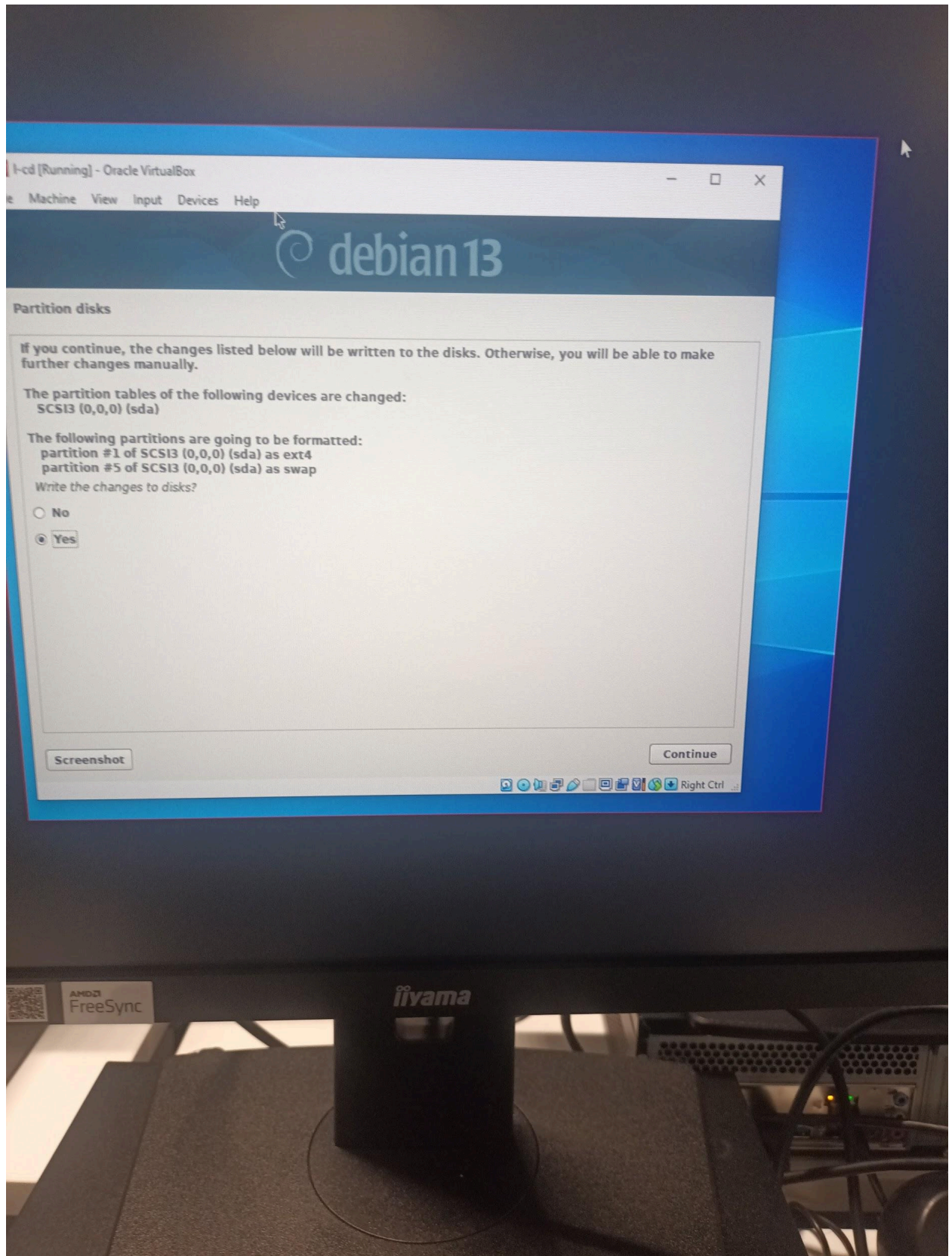
5. Routing, Remote Access (RRAS), and Network



Configuration

Inter-subnet routing between Windows and Linux environments was managed via Routing and Remote Access Services (RRAS) and static routing definitions.

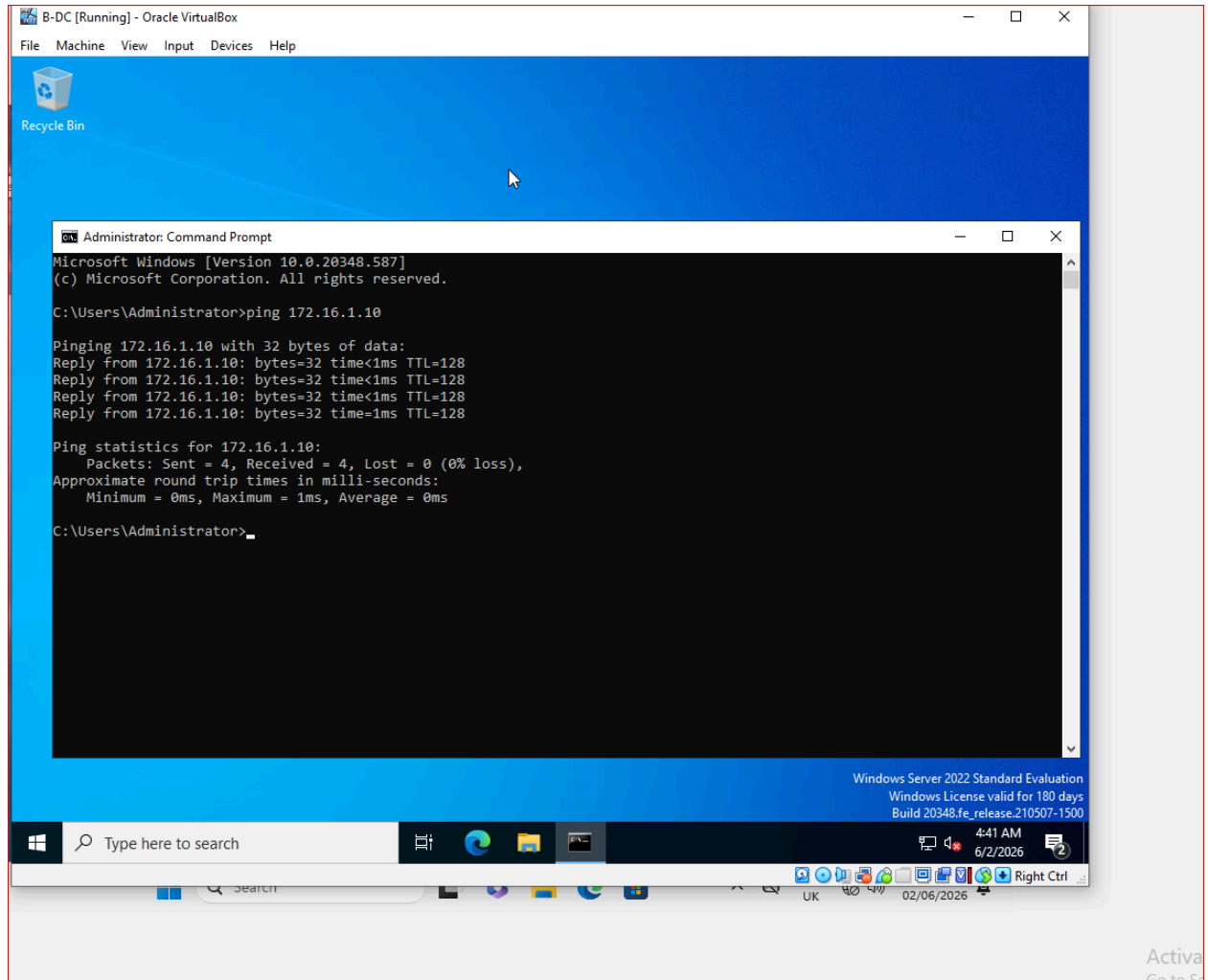
- **Windows Network Connections Renaming:**

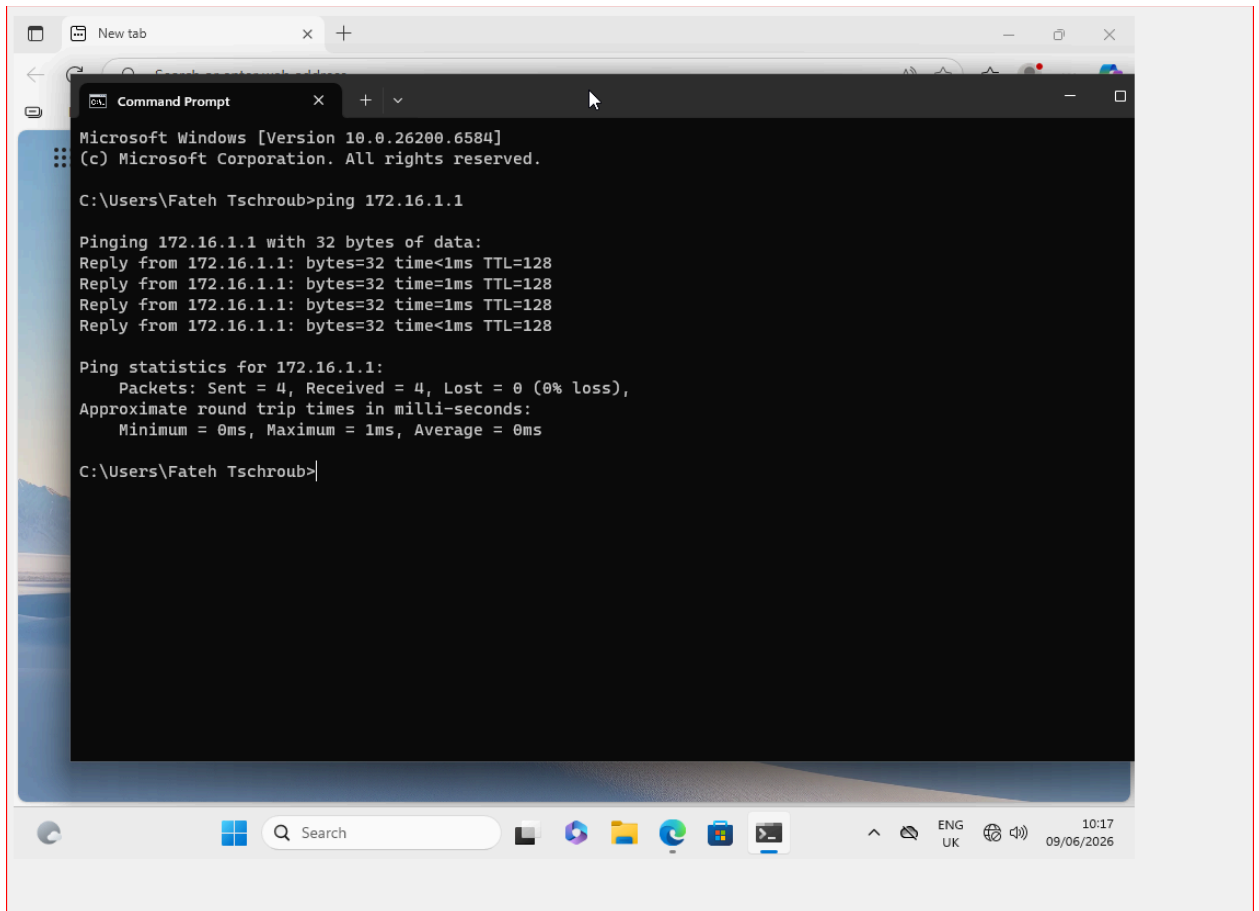


Captures the Network Connections control panel window on the Windows Server domain

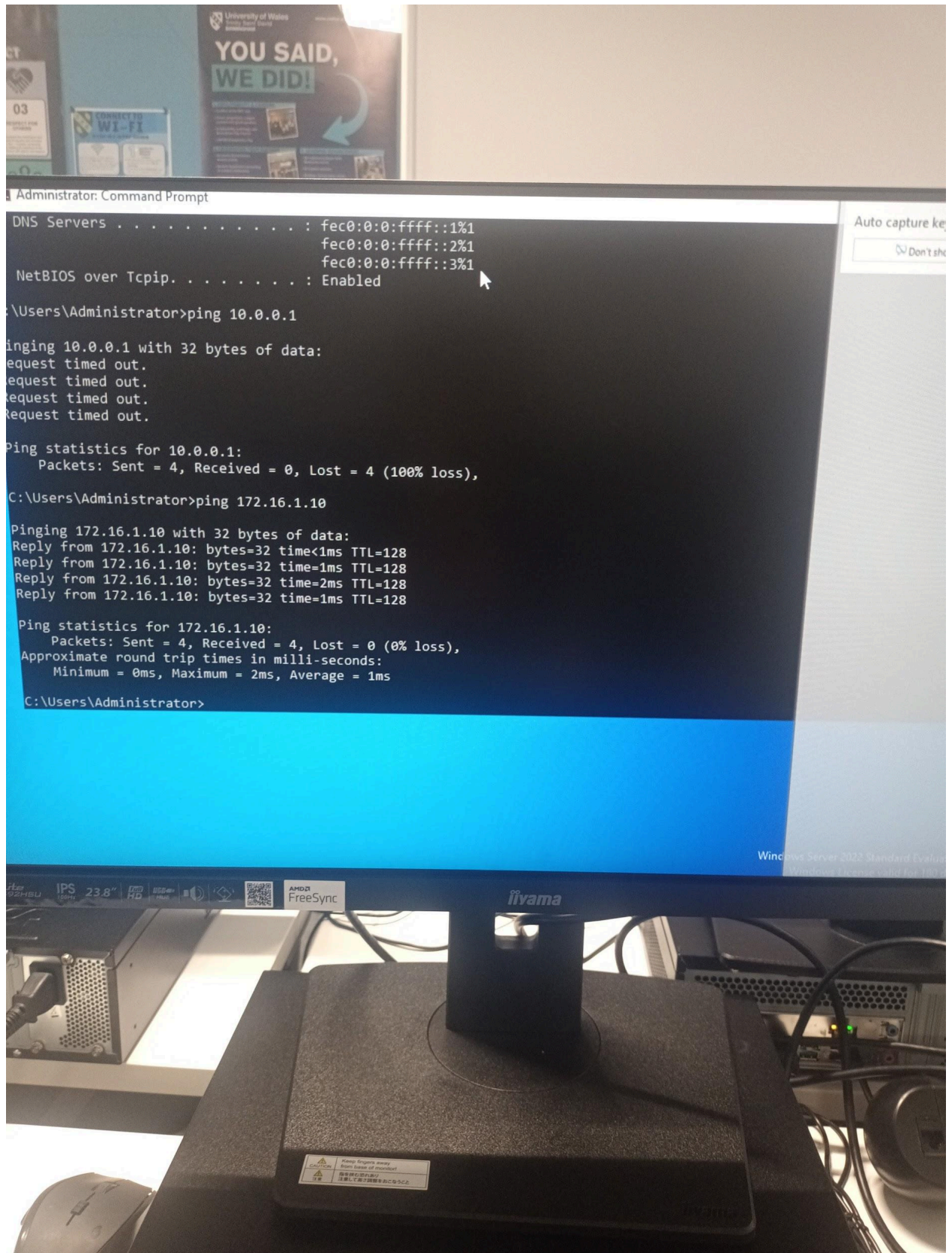
controller (B-DC), showing three adapter connections labeled NAT, Birmingham Lan, and one being actively renamed to WAN [cite: tak2 pic7.PNG].

- **Static Routing Configuration Output:**

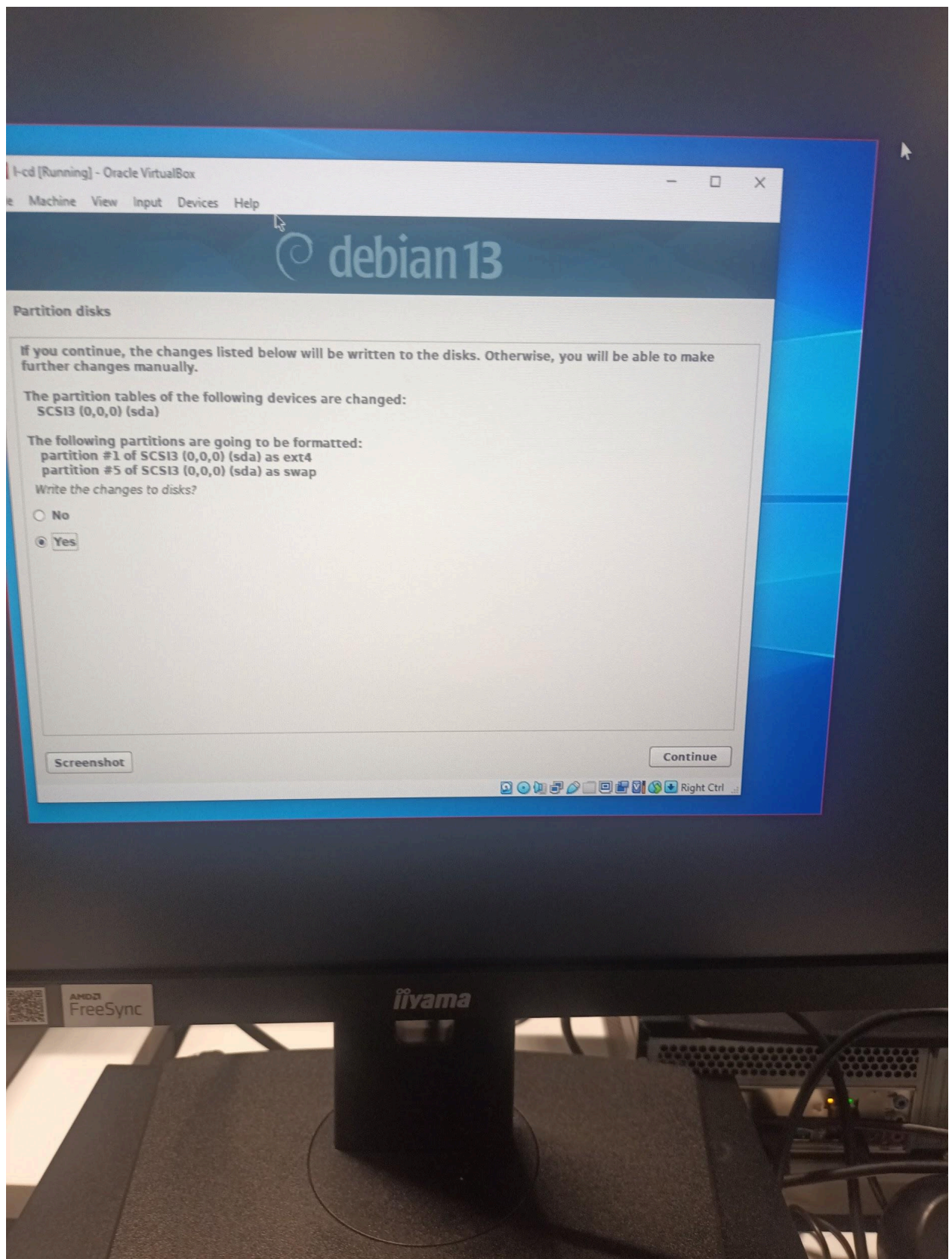




Details an Administrator Command Prompt session on the Windows Server execution of the persistent static route command (`route -p add 172.16.2.0 mask 255.255.255.0 10.0.0.2`), followed by the resulting IPv4 Route Table output from `route print` displaying active network destinations, netmasks, gateways, and interfaces [cite: tak2 pic ping2.PNG].



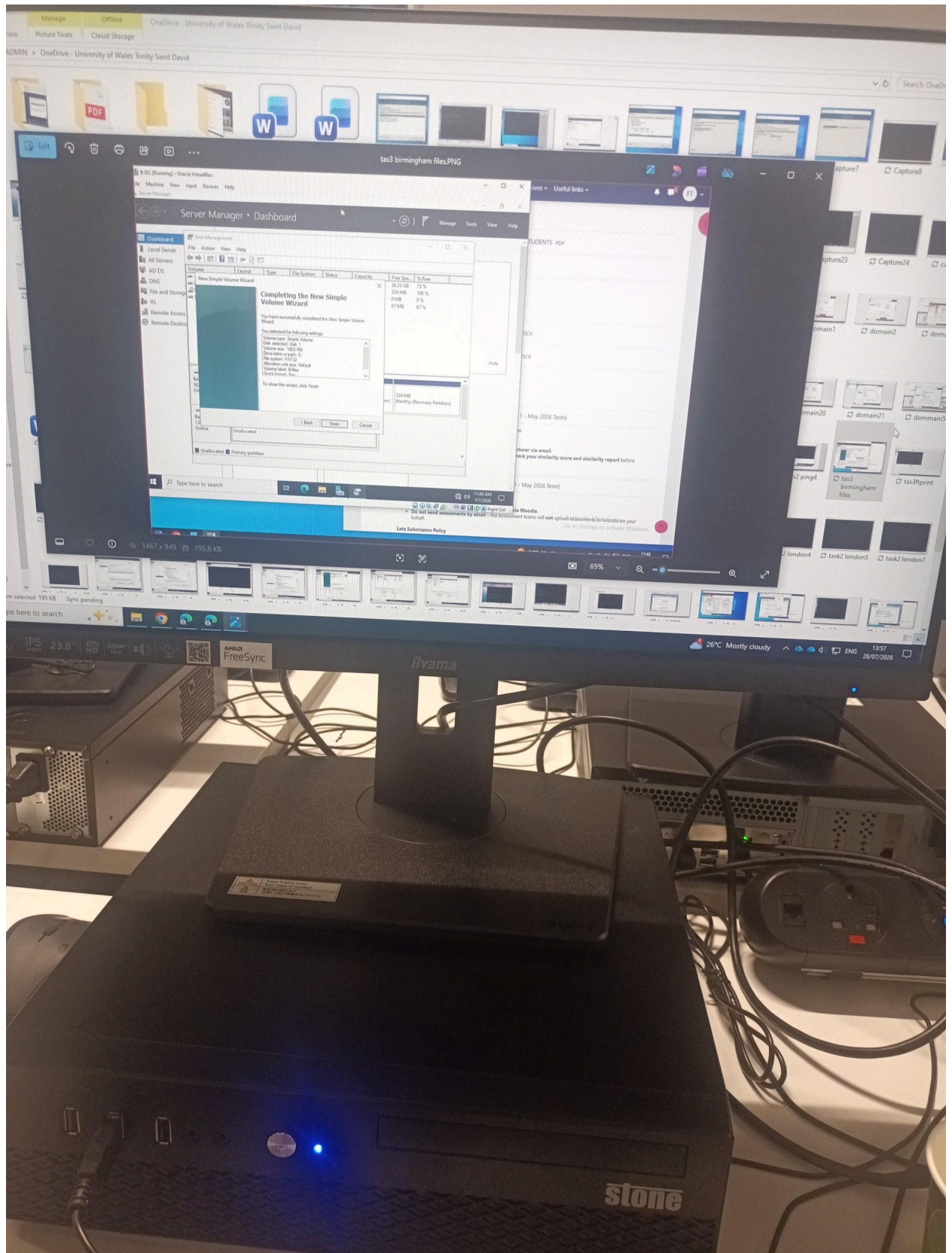
- Routing and Remote Access NAT Interfaces:



Displays the Routing and Remote Access management console on the Windows Server,

detailing configured NAT interfaces including NAT, Birmingham Lan, and Ethernet 3 with associated traffic mapping counters [cite: tak2 pic8.PNG].

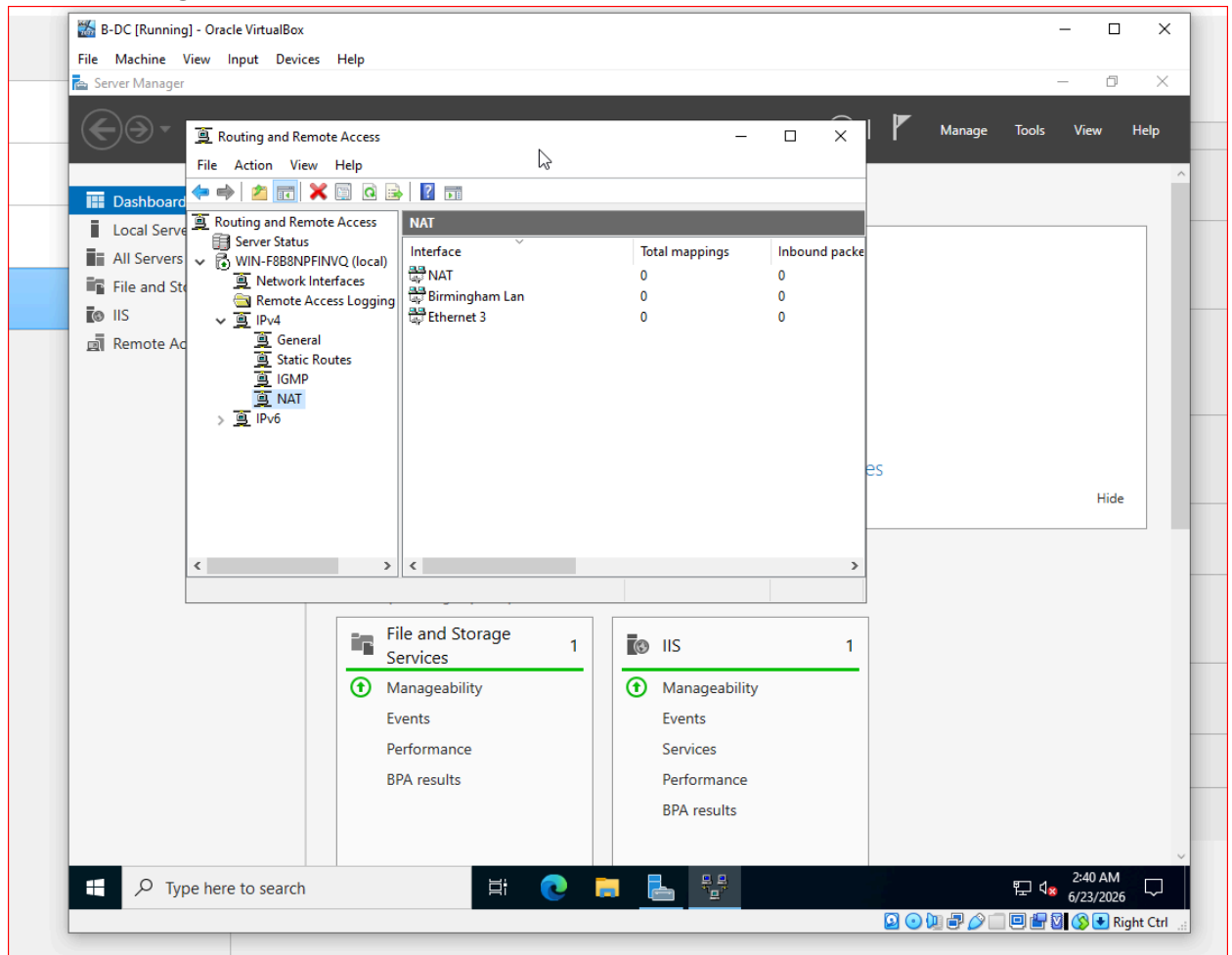
- **Remote Access Role Services Selection:** Displays the Select role services window within the Add Roles and Features Wizard on the B-DC node, showing the selection of DirectAccess and VPN (RAS) and Routing under the Remote Access server role [cite: task 2 pic three.PNG].
- **Server Roles Selection Overview:**

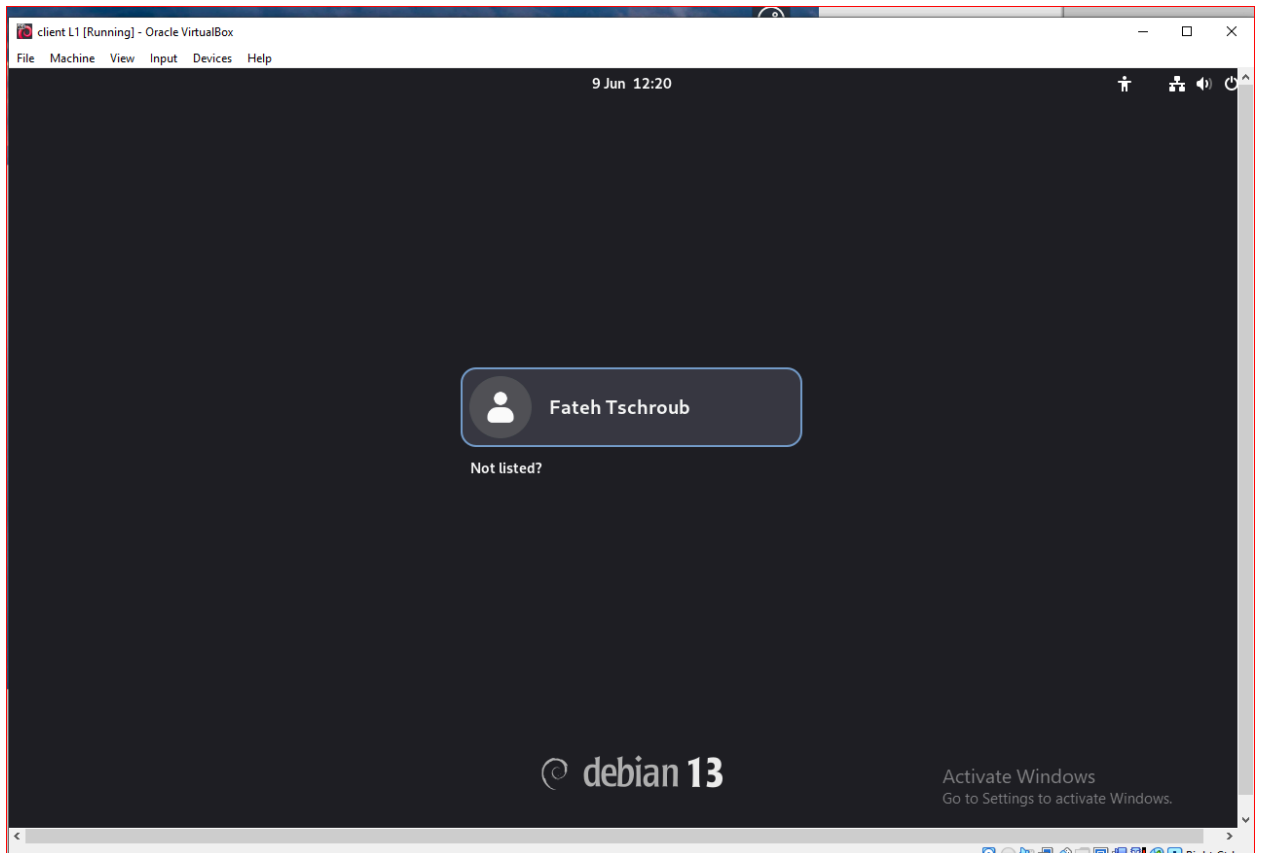


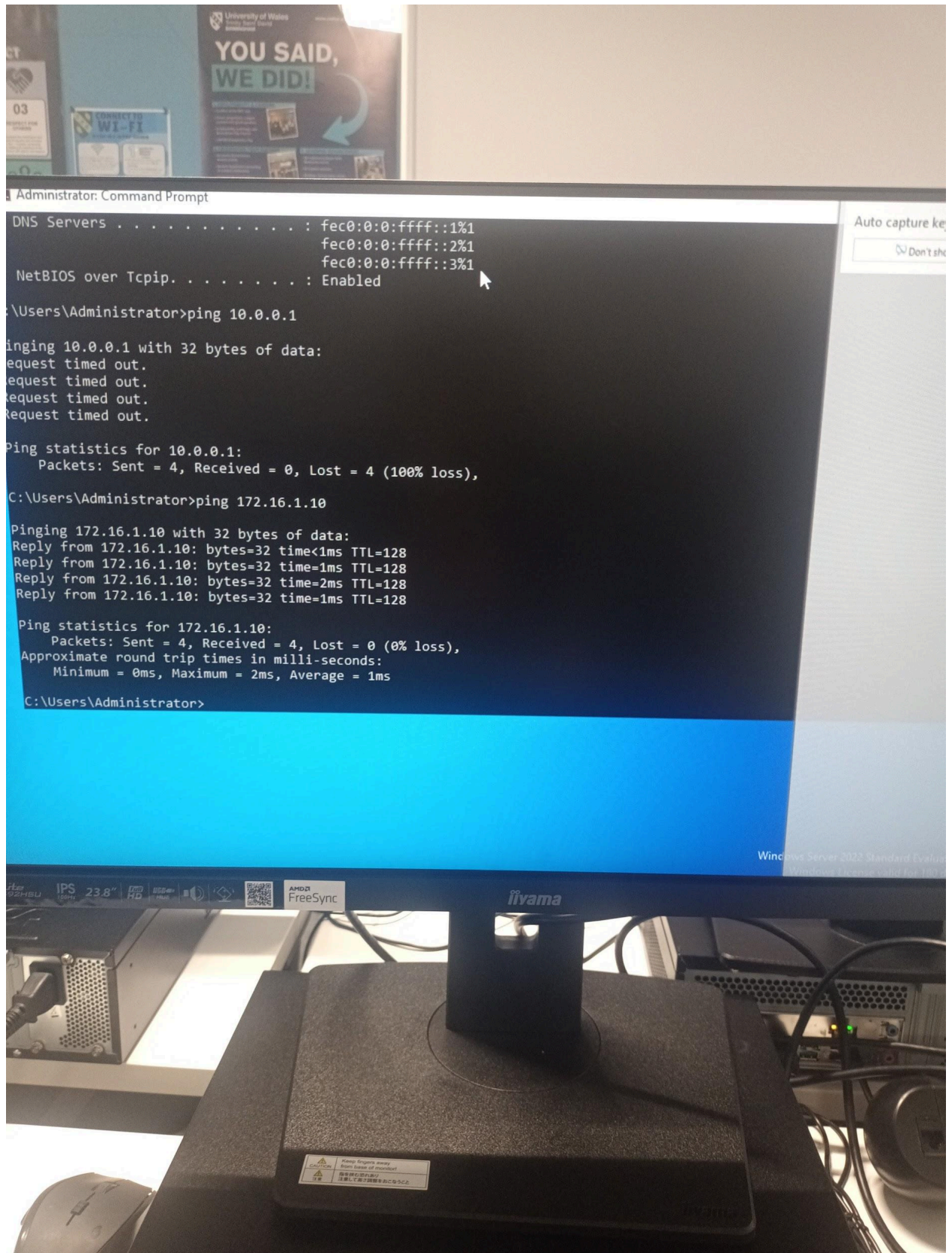
Captures the initial Select server roles page in Server Manager on destination server

WIN-F888NPFINVQ, listing available infrastructure roles such as Active Directory Certificate Services, Active Directory Domain Services, DHCP Server, DNS Server, and Remote Access [cite: task 2 pic 2.PNG].

- **Remote Access Confirmation Selections:** Displays the final confirmation page of the Add Roles and Features Wizard on the B-DC node, reviewing the inclusion of Group Policy Management, RAS Connection Manager Administration Kit (CMAC), DirectAccess and VPN (RAS), Routing, and Remote Access management tools prior to installation [cite: task 2 pic4.PNG].
- **Server Manager Destination Server Selection:**



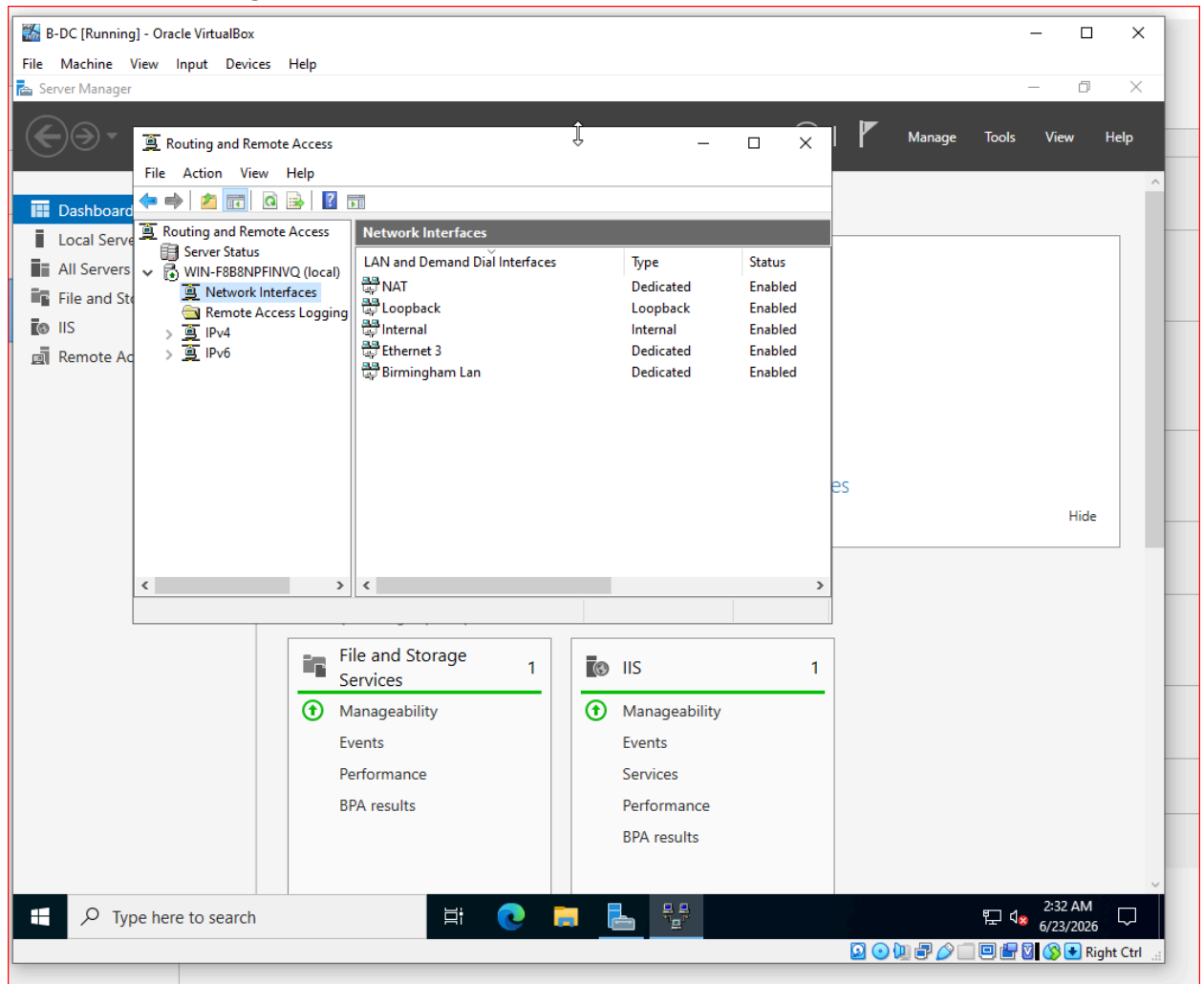




Shows the Select destination server page of the Add Roles and Features Wizard on the

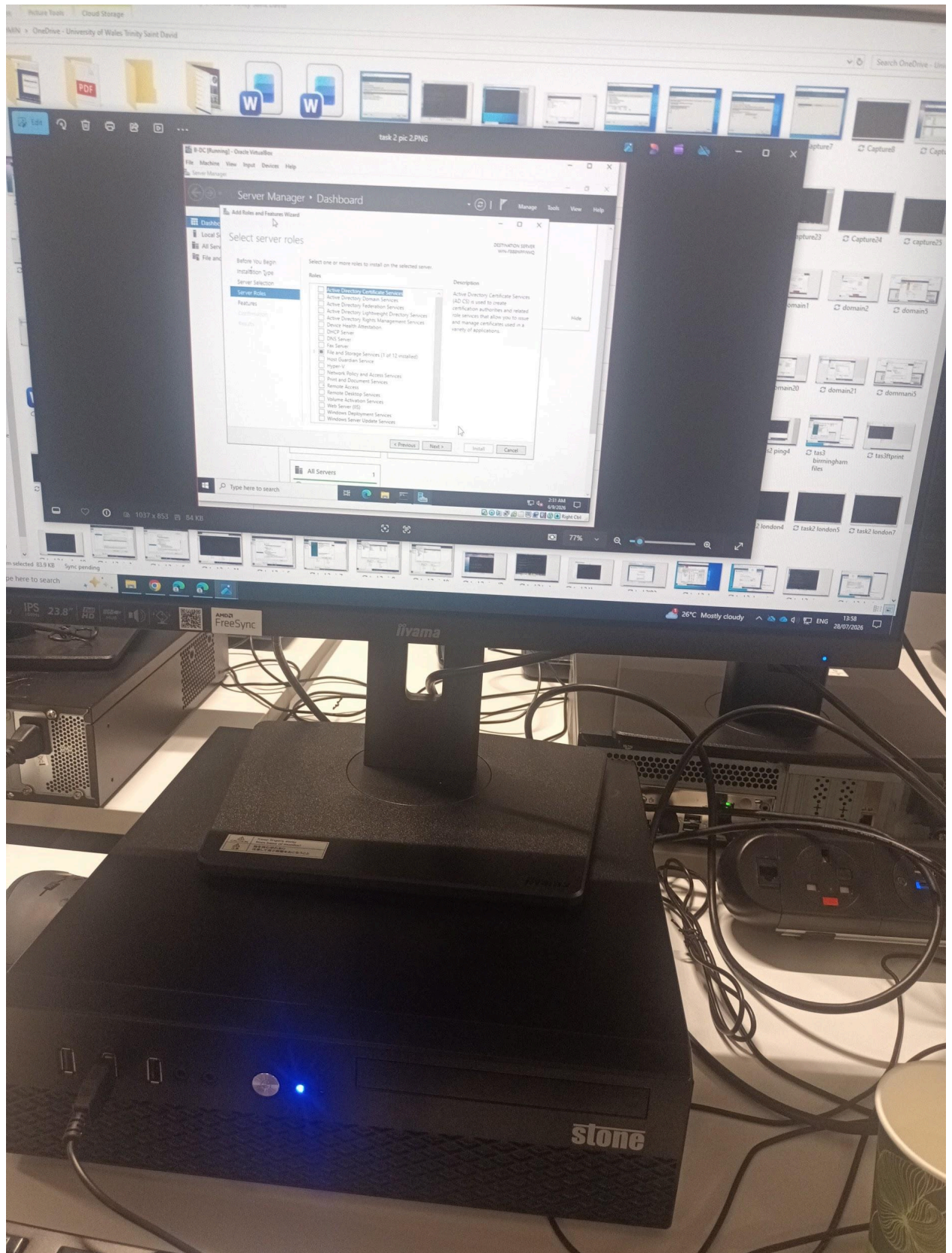
Windows Server domain controller (B-DC), listing server pool target WIN-F888NPFINVQ with assigned IP addresses [cite: task2 pic 1.PNG].

- **Remote Access Installation Progress:** Captures the Installation progress window in Server Manager on WIN-F888NPFINVQ, showing the active deployment of Group Policy Management, RAS Connection Manager Administration Kit (CMAC), DirectAccess and VPN (RAS), Routing, and associated Remote Access management tools [cite: task2 pic 5.PNG].
- **Static Route Configuration Command:**



Displays an Administrator Command Prompt session on the Windows Server domain controller (B-DC) executing the persistent static route command (route -p add 172.16.2.0 mask 255.255.255.0 10.0.0.2), confirming successful configuration with the "OK!" message [cite: task2 pic 11.PNG].

- **Remote Access Installation Results:**

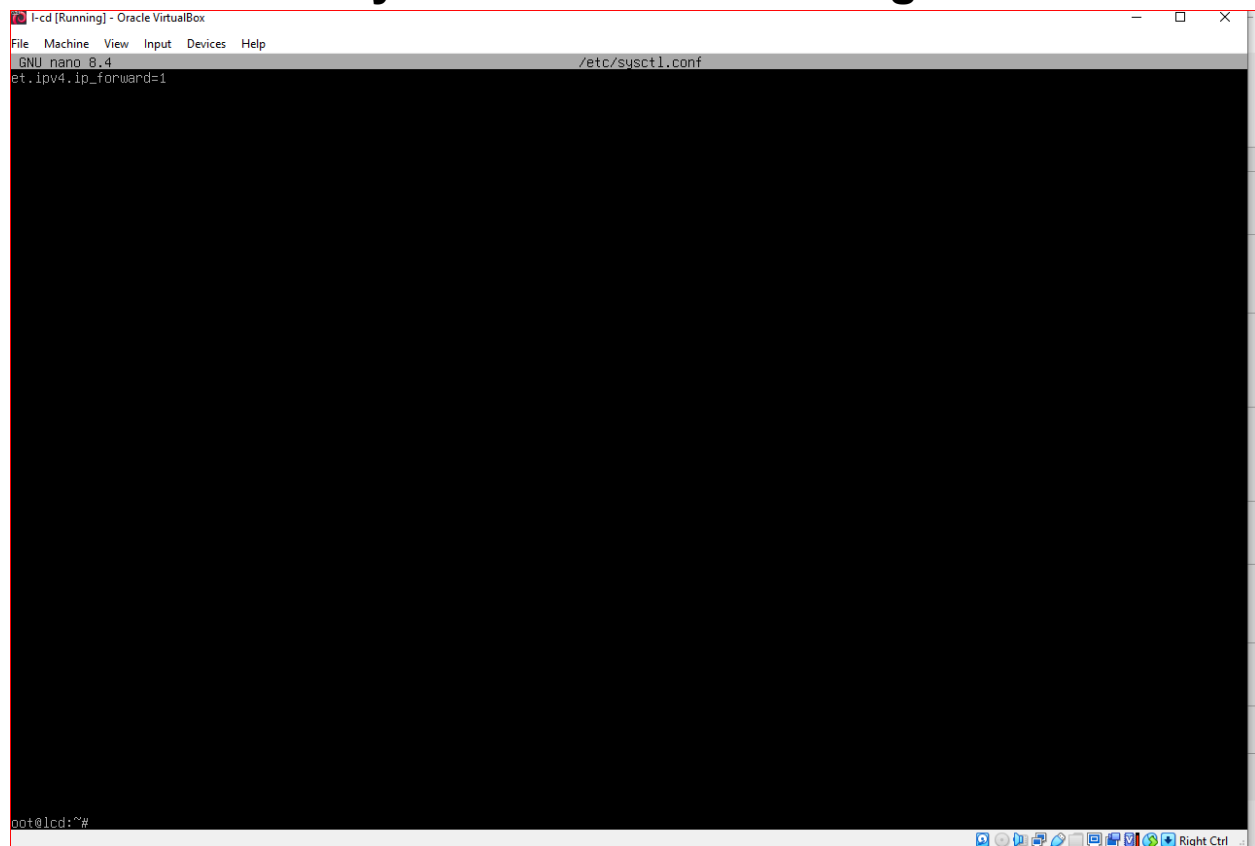


Captures the Installation progress window in Server Manager on destination server

WIN-F888NPFINVQ, indicating successful completion of the Remote Access feature installation with links to configure the role via the Getting Started Wizard [cite: task2 pic6.PNG].

- **Routing and Remote Access Setup Wizard Completion:** Displays the final summary screen of the Routing and Remote Access Server Setup Wizard, confirming the configuration of NAT and LAN routing services [cite: task2 pic7.PNG].
- **RRAS Network Interfaces Summary:** Captures the Routing and Remote Access management console showing the list of Network Interfaces (including NAT, Loopback, Internal, Ethernet 3, and Birmingham Lan) with their respective types and enabled status [cite: task2 pic8.PNG].
- **RRAS IPv4 NAT Interfaces Overview:** Displays the NAT node in the Routing and Remote Access console on the Windows Server, listing configured network interfaces (NAT, Birmingham Lan, and Ethernet 3) with active mapping and packet statistics counters [cite: task2 pic10.PNG].

6. Linux Gateway & Debian Node Configurations



```
I-cd [Running] - Oracle VirtualBox
File Machine View Input Devices Help

root@lcd:~# ip add
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default qlen 1000
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
    inet 127.0.0.1/8 scope host lo
        valid_lft forever preferred_lft forever
    inet6 ::1/128 scope host noprefixroute
        valid_lft forever preferred_lft forever
2: enp0s3: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP group default qlen 1000
    link/ether 08:00:27:bc:83:2b brd ff:ff:ff:ff:ff:ff
    altname enx080027bc832b
    inet 10.0.2.15/24 brd 10.0.2.255 scope global dynamic noprefixroute enp0s3
        valid_lft 85222sec preferred_lft 74422sec
    inet6 fd17:625c:f037:2:6d11:de39:80fa:c85f/64 scope global dynamic mngtmpaddr noprefixroute
        valid_lft 85701sec preferred_lft 13701sec
    inet6 fd17:625c:f037:2:a00:27ff:febc:832b/64 scope global dynamic mngtmpaddr proto kernel_r
        valid_lft 84985sec preferred_lft 12985sec
    inet6 fe80::94f4:727a:1384:9463/64 scope link
        valid_lft forever preferred_lft forever
3: enp0s8: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP group default qlen 1000
    link/ether 08:00:27:cc:ad:fd brd ff:ff:ff:ff:ff:ff
    altname enx080027ccadfd
    inet 172.16.2.1/24 brd 172.16.2.255 scope global enp0s8
        valid_lft forever preferred_lft forever
    inet6 fe80::a00:27ff:fecc:adfd/64 scope link proto kernel_ll
        valid_lft forever preferred_lft forever
4: enp0s9: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP group default qlen 1000
    link/ether 08:00:27:b3:cf:e7 brd ff:ff:ff:ff:ff:ff
    altname enx080027b3cfe7
    inet 10.0.0.2/8 brd 10.255.255.255 scope global enp0s9
        valid_lft forever preferred_lft forever
    inet6 fe80::a00:27ff:feb3:cfe7/64 scope link proto kernel_ll
        valid_lft forever preferred_lft forever
root@lcd:~#
```

lxc [Running] - Oracle VirtualBox

File Machine View Input Devices Help

```
GNU nano 8.4 /etc/network/interfaces *
# This file describes the network interfaces available on your system
# and how to activate them. For more information, see interfaces(5).

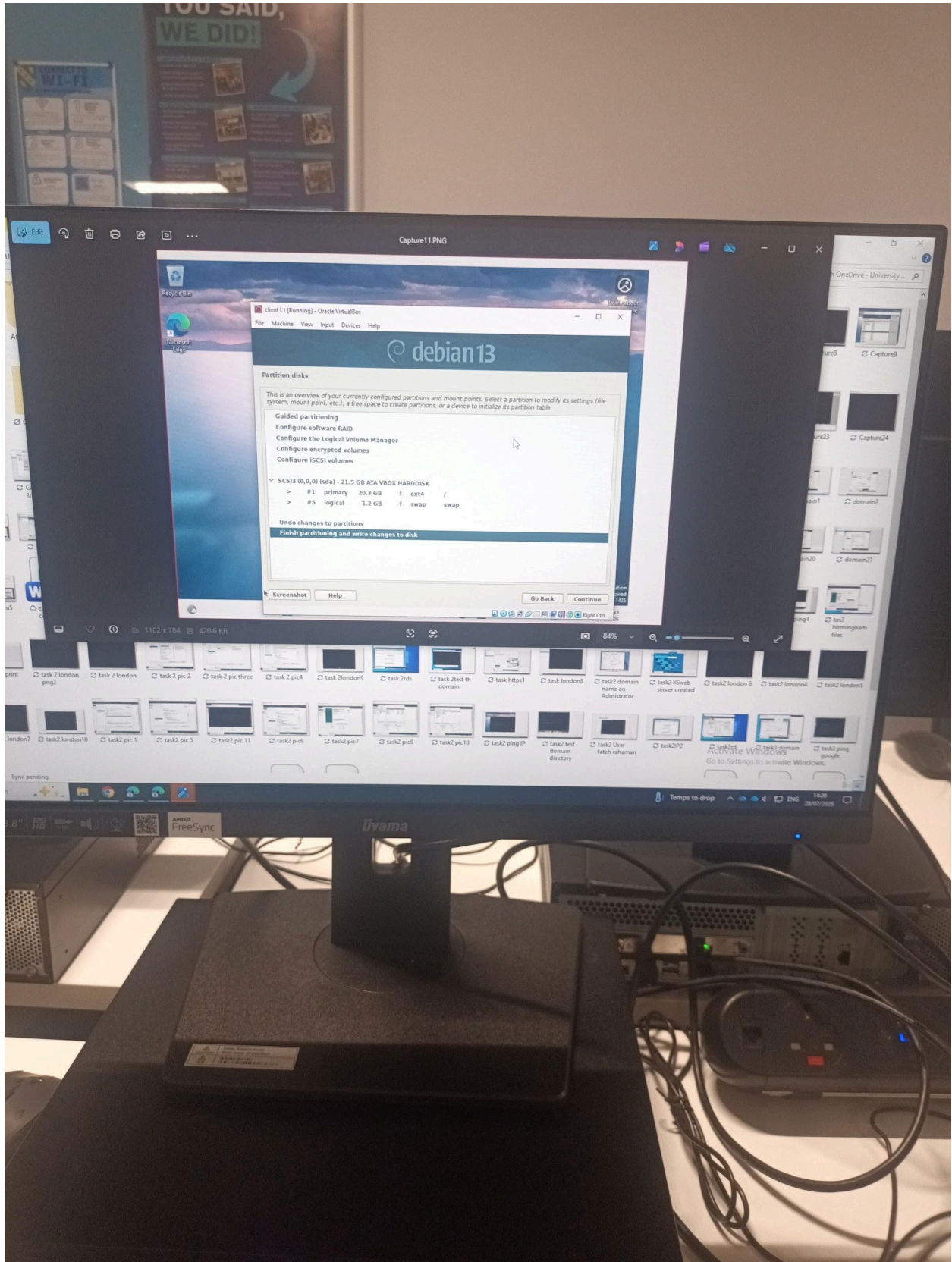
source /etc/network/interfaces.d/*

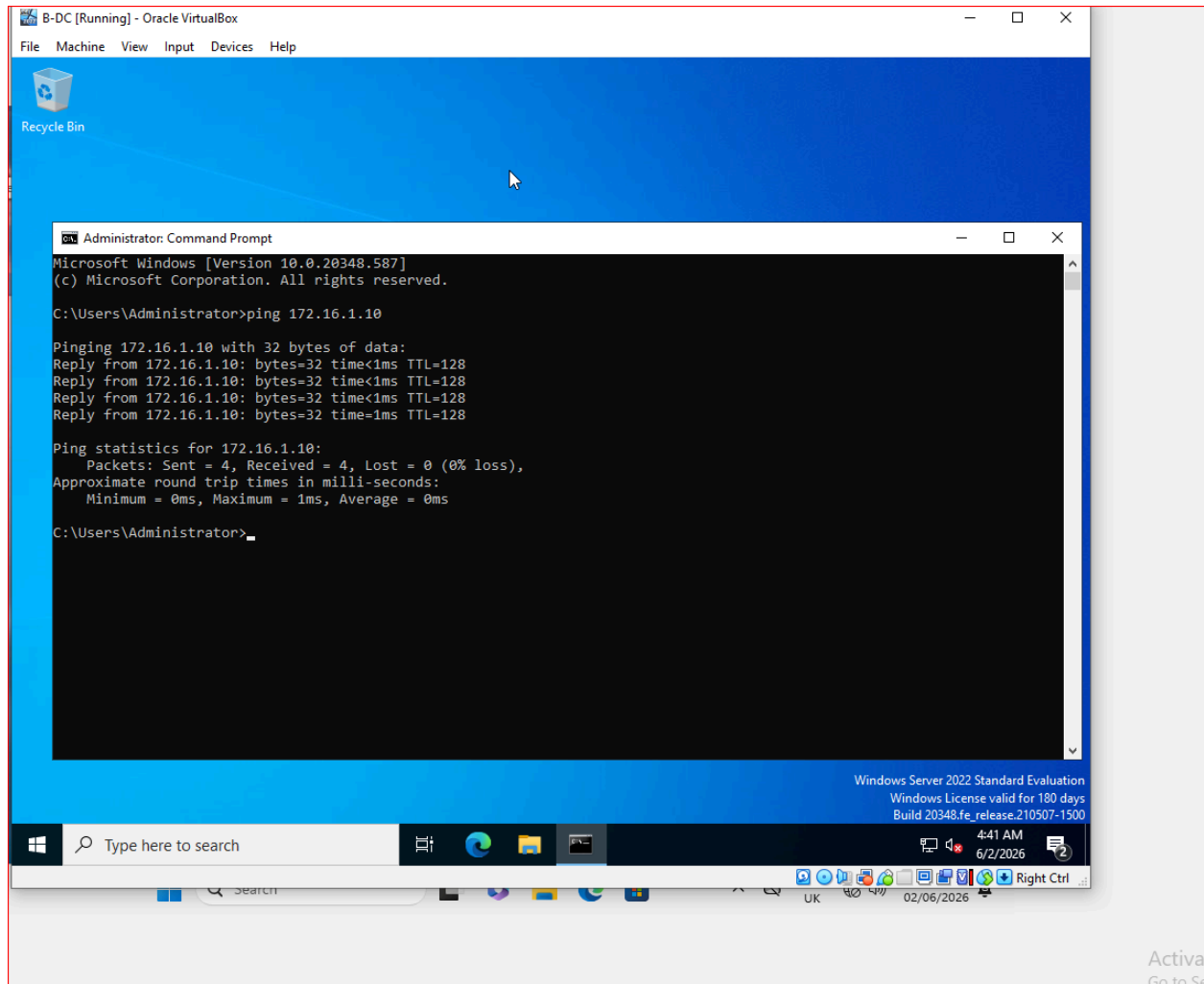
# The loopback network interface
auto lo
iface lo inet loopback

# The primary network interface
allow-hotplug enp0s3
iface enp0s3 inet dhcp
# This is an autoconfigured IPv6 interface
iface enp0s3 inet6 auto
#adapter-2:Internet-London
auto enp0s3
iface enp0s3 inet static
address 109.0.0.2
netmask 255.255.255.248
```

Help Write Out Where Is Cut Execute Location Undo Set Mark To Bracket Previous
Exit Read File Replace Paste Justify Go To Line Redo Copy Where Was Next

Activate Windows
Go to Settings to activate Windows.

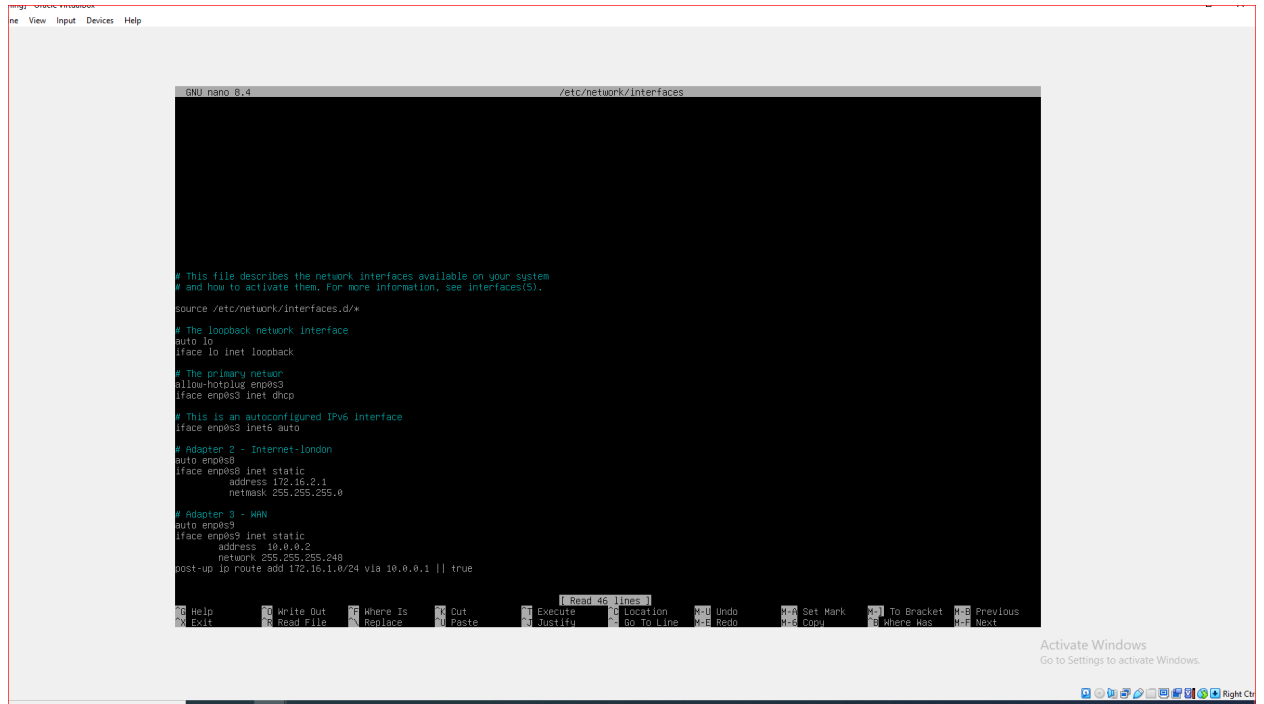




Linux networking parameters, packet forwarding, and static routes were configured on the Debian virtual machine nodes (lcd).

on the Debian server node (lcd), verifying that the IPv4 packet forwarding parameter is enabled (net.ipv4.ip_forward=1) [cite: task 2 london png2.PNG].

- **Linux IP Forwarding Terminal Session:**



The screenshot shows a terminal window titled "GNU nano 8.4 /etc/network/interfaces". The file content is as follows:

```
# This file describes the network interfaces available on your system
# and how to activate them. For more information, see interfaces(5).

source /etc/network/interfaces.d/*

# The loopback network interface
auto lo
iface lo inet loopback

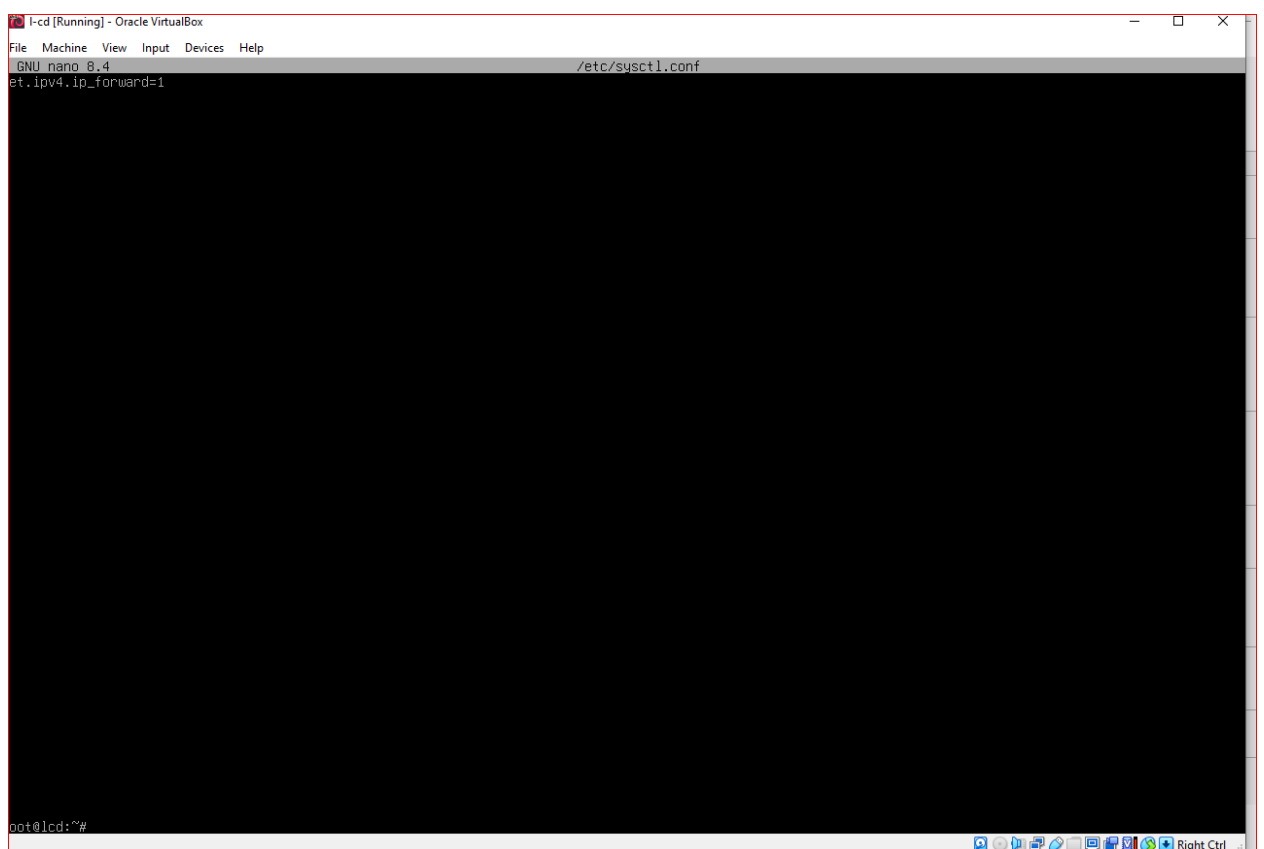
# The primary network
allow-hotplug enp0s3
iface enp0s3 inet dhcp

# This is an autoconfigured IPv6 interface
iface enp0s3 inet6 auto

# Adapter 2 - Internet-London
auto enp0s8
iface enp0s8 inet static
    address 172.16.2.1
    netmask 255.255.255.0

# Adapter 3 - WAN
auto enp0s9
iface enp0s9 inet static
    address 10.0.0.2
    network 255.255.255.248
post-up ip route add 172.16.1.0/24 via 10.0.0.1 || true
```

The terminal window includes a menu bar with "File", "Machine", "View", "Input", "Devices", and "Help". At the bottom, there is a status bar with various icons and the text "Activate Windows Go to Settings to activate Windows." and "Right Ctrl".

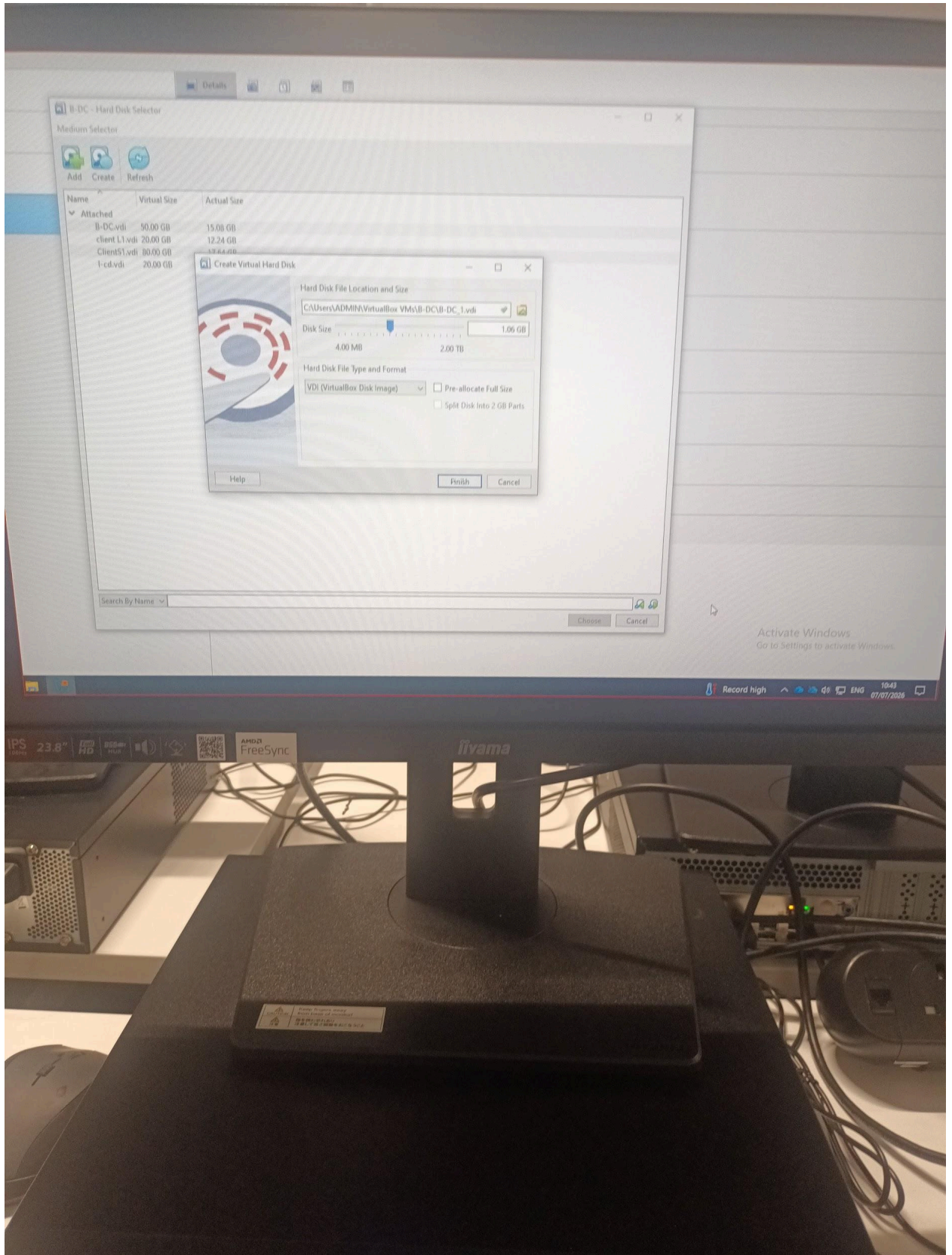


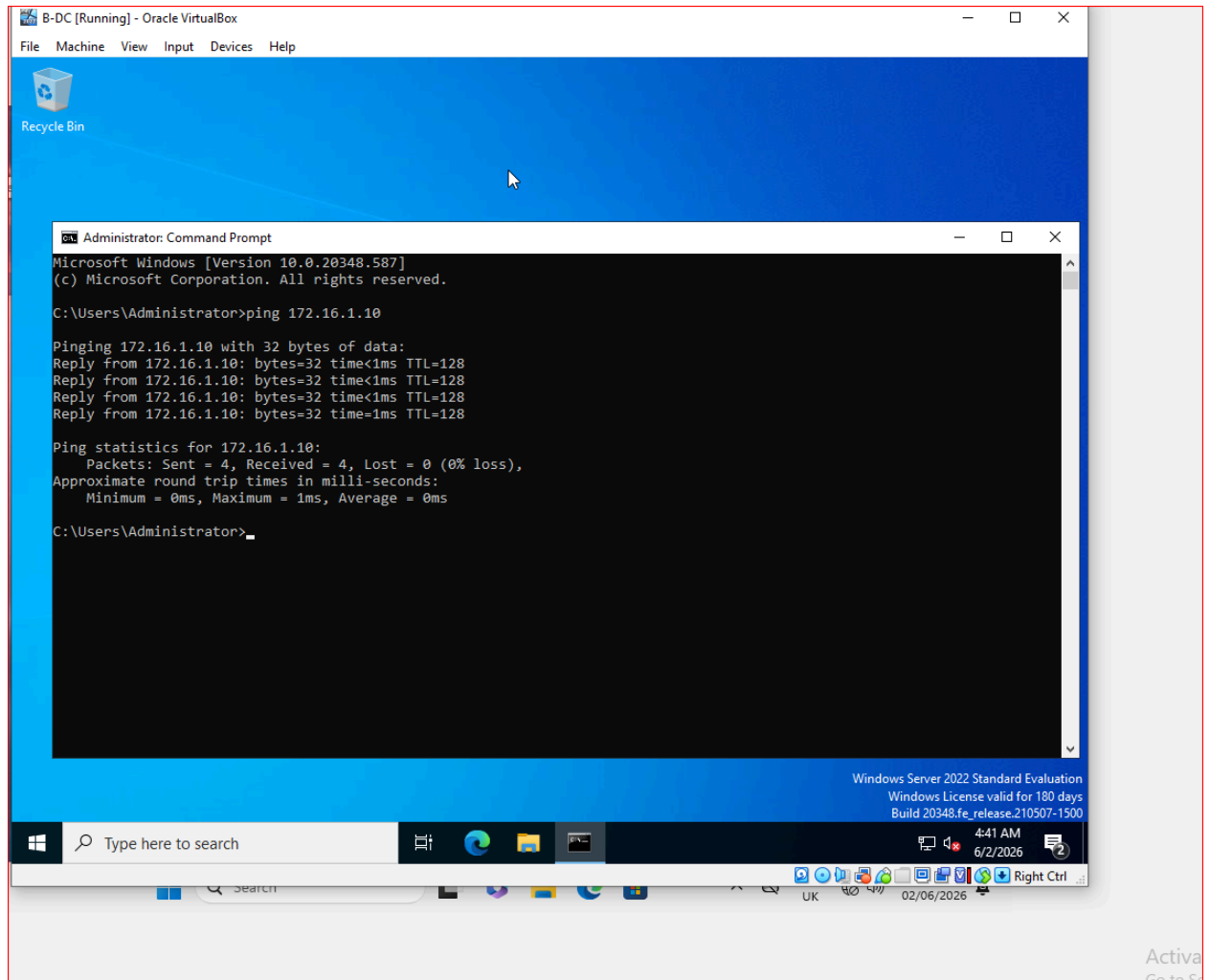
The screenshot shows a terminal window titled "I-cd [Running] - Oracle VirtualBox". The terminal content is as follows:

```
File Machine View Input Devices Help
GNU nano 8.4
/etc/sysctl.conf
net.ipv4.ip_forward=1
```

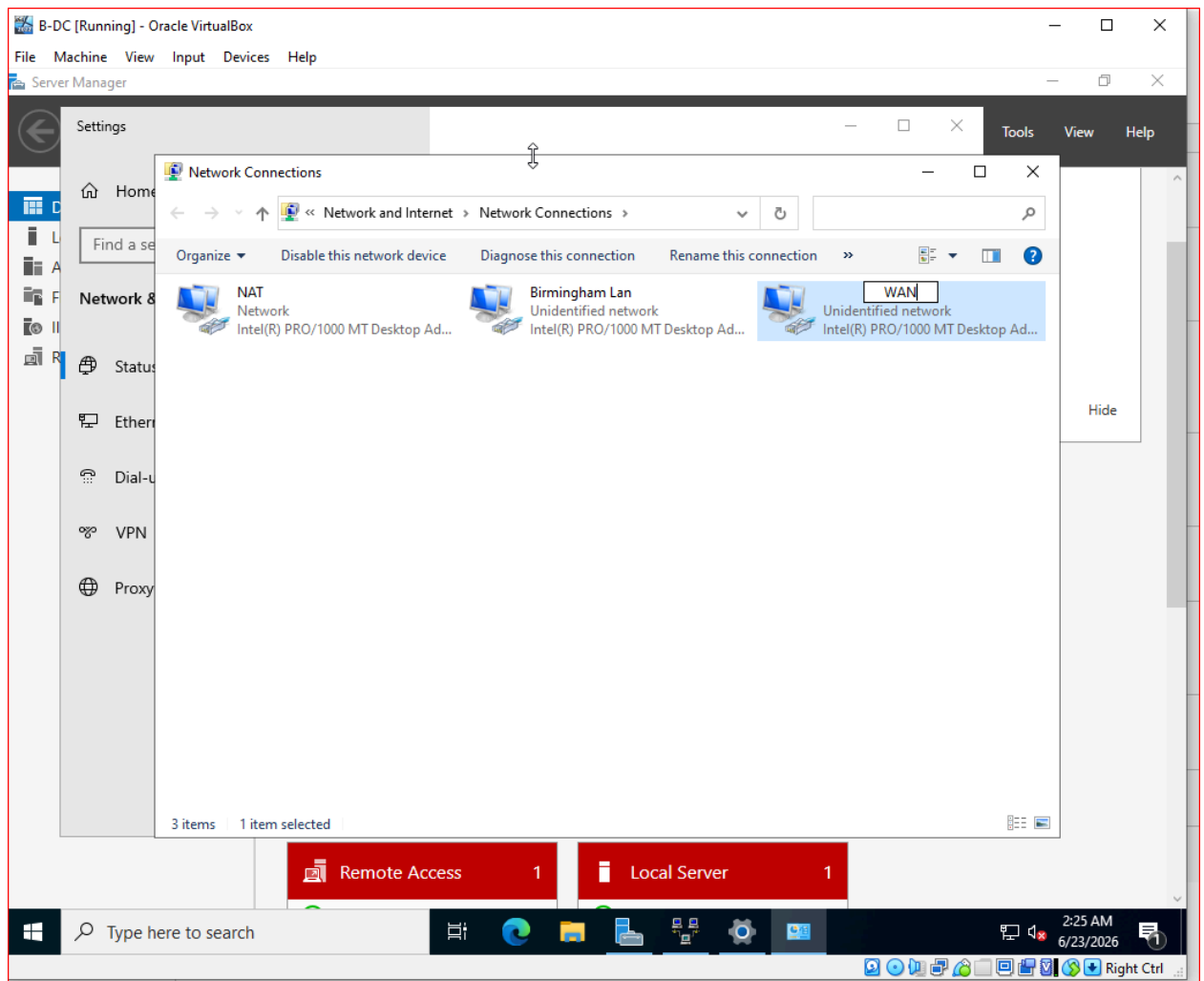
The terminal window includes a menu bar with "File", "Machine", "View", "Input", "Devices", and "Help". At the bottom, there is a status bar with various icons and the text "Right Ctrl".

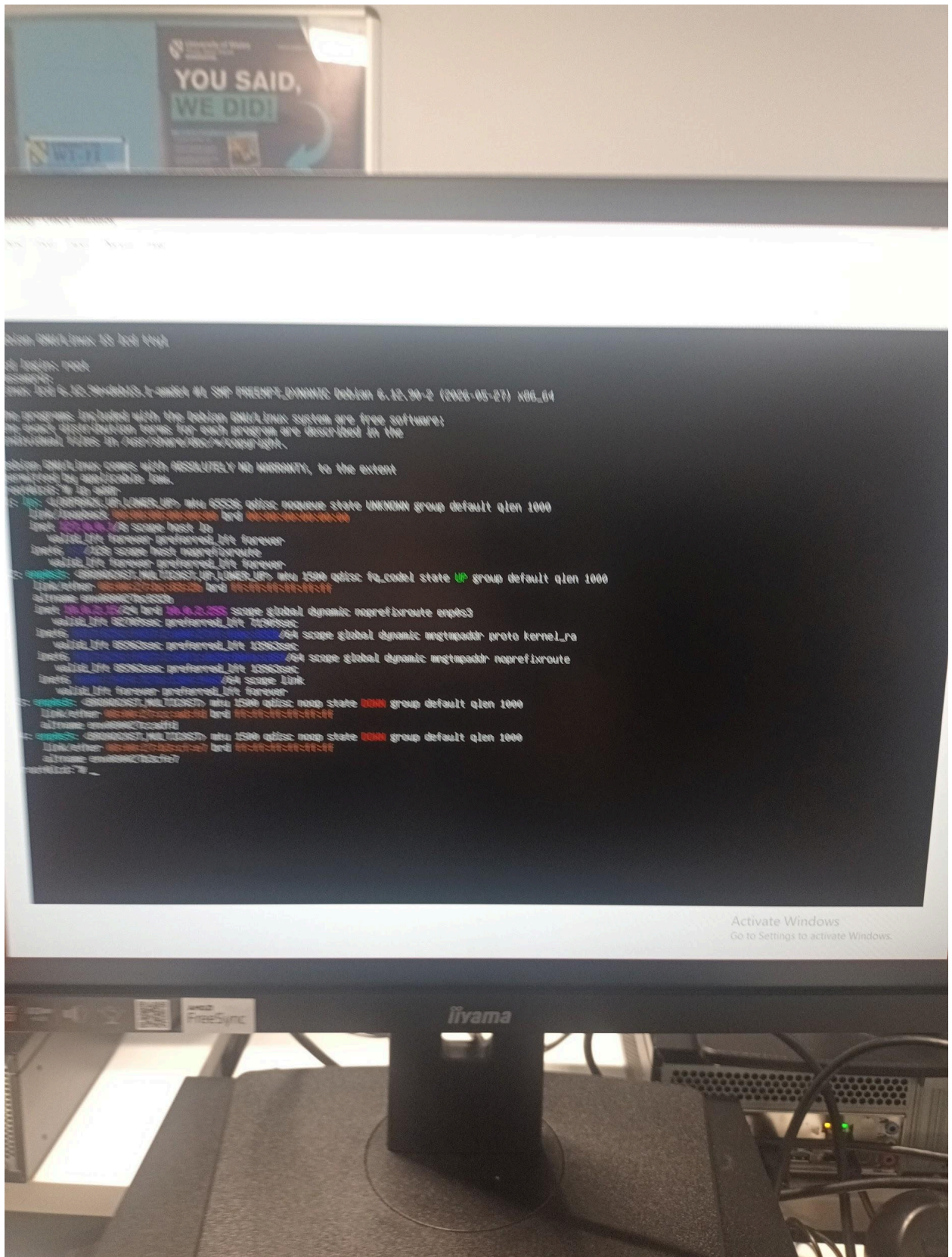
verification commands, running sysctl command-line configurations to enable IPv4 packet forwarding (`net.ipv4.ip_forward=1`), checking `/proc/sys/net/ipv4/ip_forward`, and opening the `/etc/sysctl.conf` configuration file via GNU Nano [cite: task 2 london.PNG].





- **Linux Network Interface Routing Configuration:** Captures a GNU Nano editor session modifying /etc/network/interfaces on the Debian server node (lcd), showing static configurations for interfaces enp0s8 and enp0s9 alongside an added post-up persistent routing command (post-up ip route add 172.16.1.0/24 via 10.0.0.1 || true) [cite: task 2london9.PNG, task london8.PNG].
- **Linux IP Route Verification Terminal:**

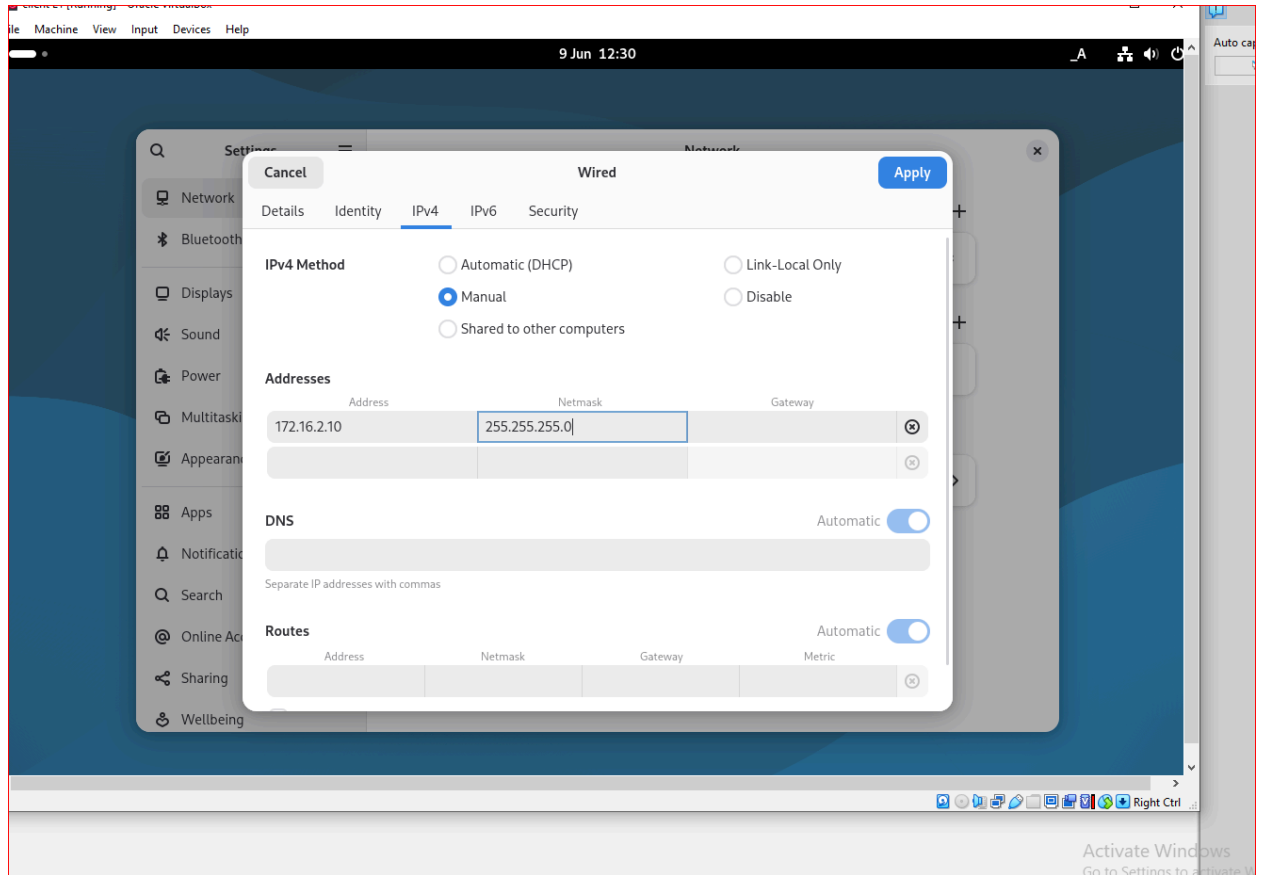




Displays a terminal session executing `sysctl -p`, validating `net.ipv4.ip_forward = 1`, and

displaying active routing table entries via ip route confirming gateway paths for subnets 172.16.1.0/24 and 172.16.2.0/24 [cite: task2 london 6.PNG].

- **Linux Network Interfaces Configuration Summary:**





Displays a GNU Nano session reviewing /etc/network/interfaces on the Debian node,

detailing the loopback, primary DHCP interface (enp0s3), and static IPv4 settings for enp0s8 and enp0s9 [cite: task2 london7.PNG].

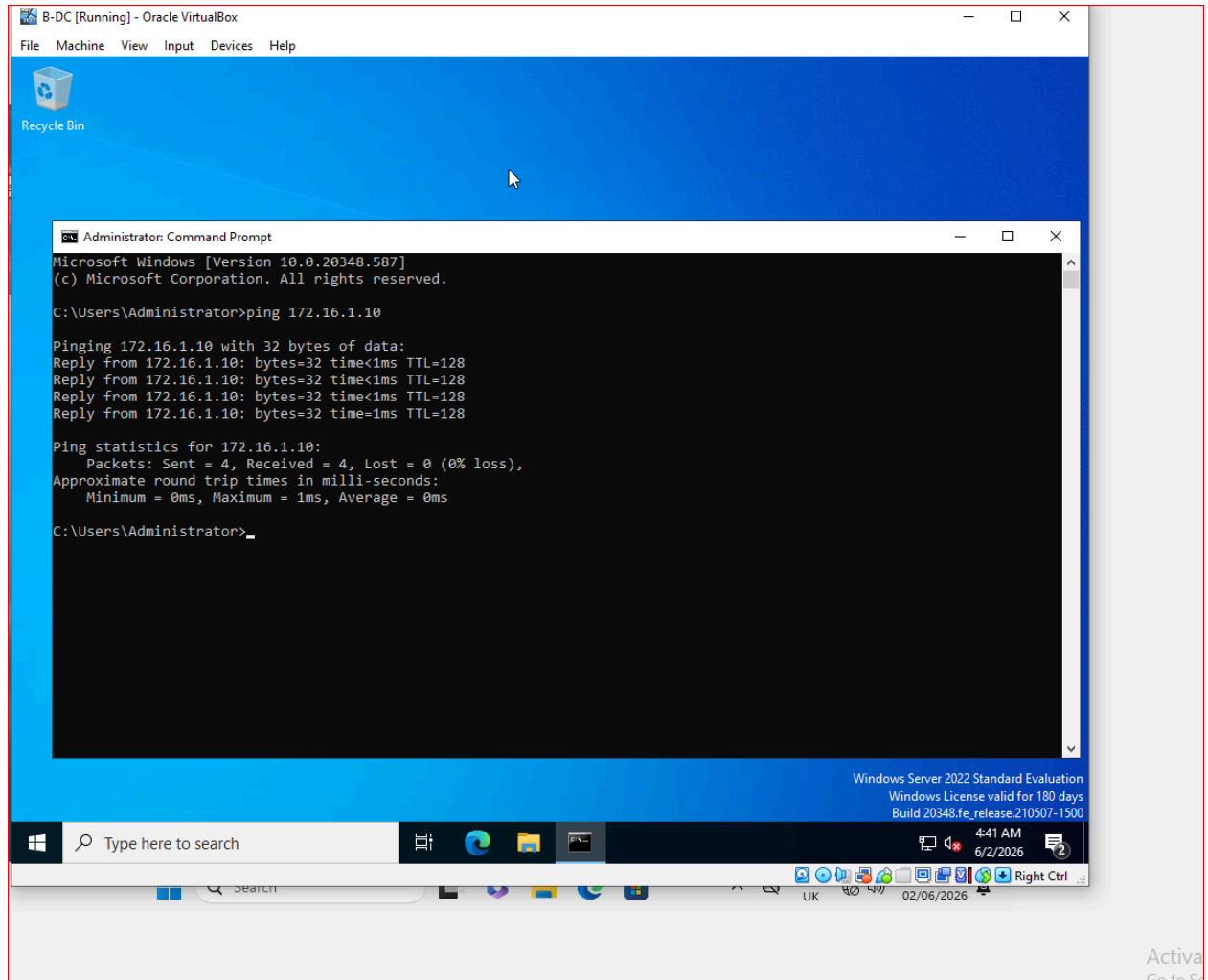
- **Linux Kernel Parameters & Static Route Application:**

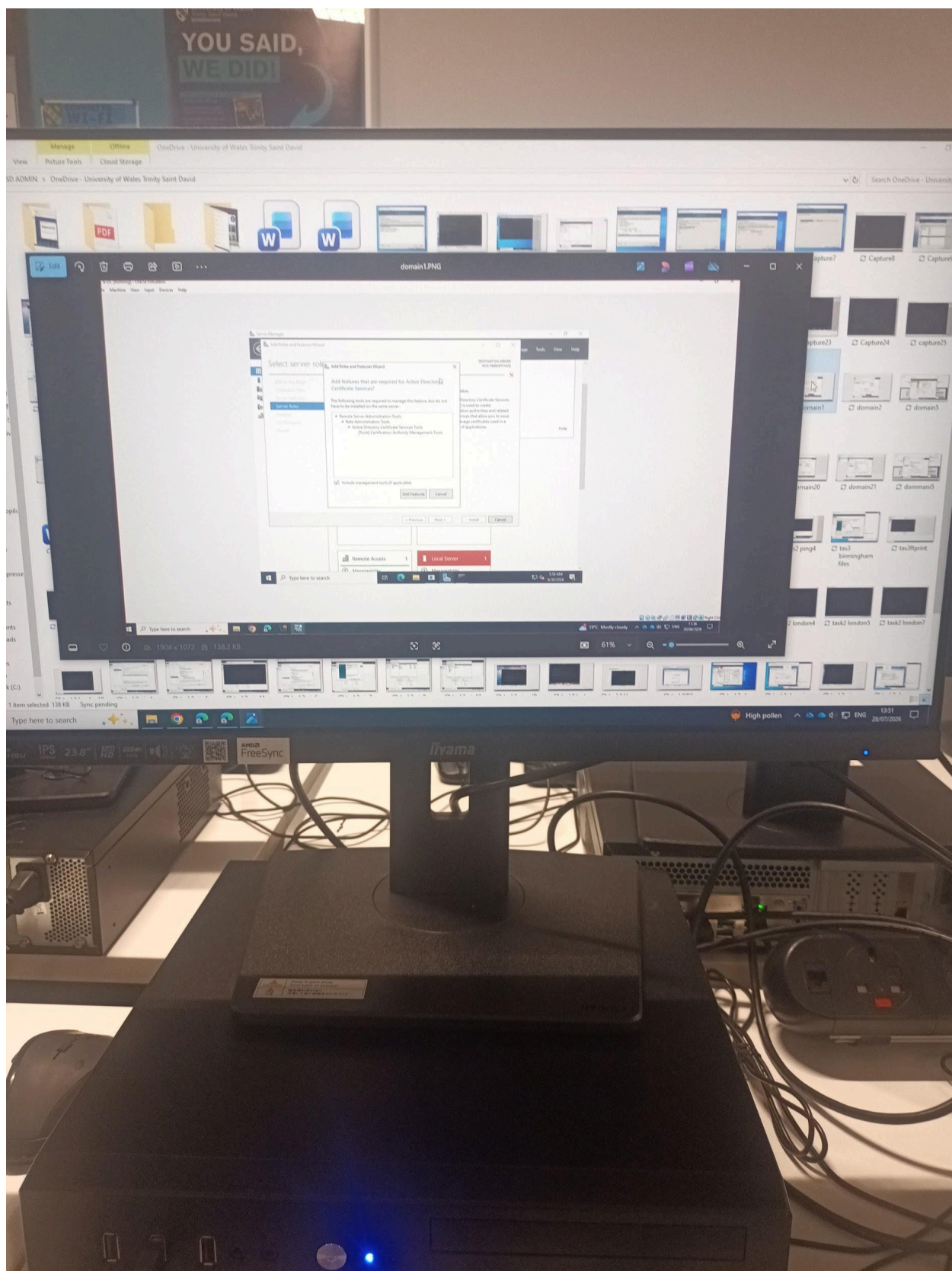


Captures terminal sessions on the Debian Linux node (lcd) executing `sysctl -p` to activate

IPv4 packet forwarding and adding a manual static route [cite: task2 london5.PNG, task2 london4.PNG].

- **APT Package Installation & DNS Resolution Errors:** Displays a terminal session on the Debian node attempting to install iptables via `apt install iptables -y`, showing package fetch errors and temporary failure resolution warnings due to WAN connectivity or DNS issues [cite: task2 london10.PNG].
- **Linux ICMP Ping & IP Route Diagnostics:**





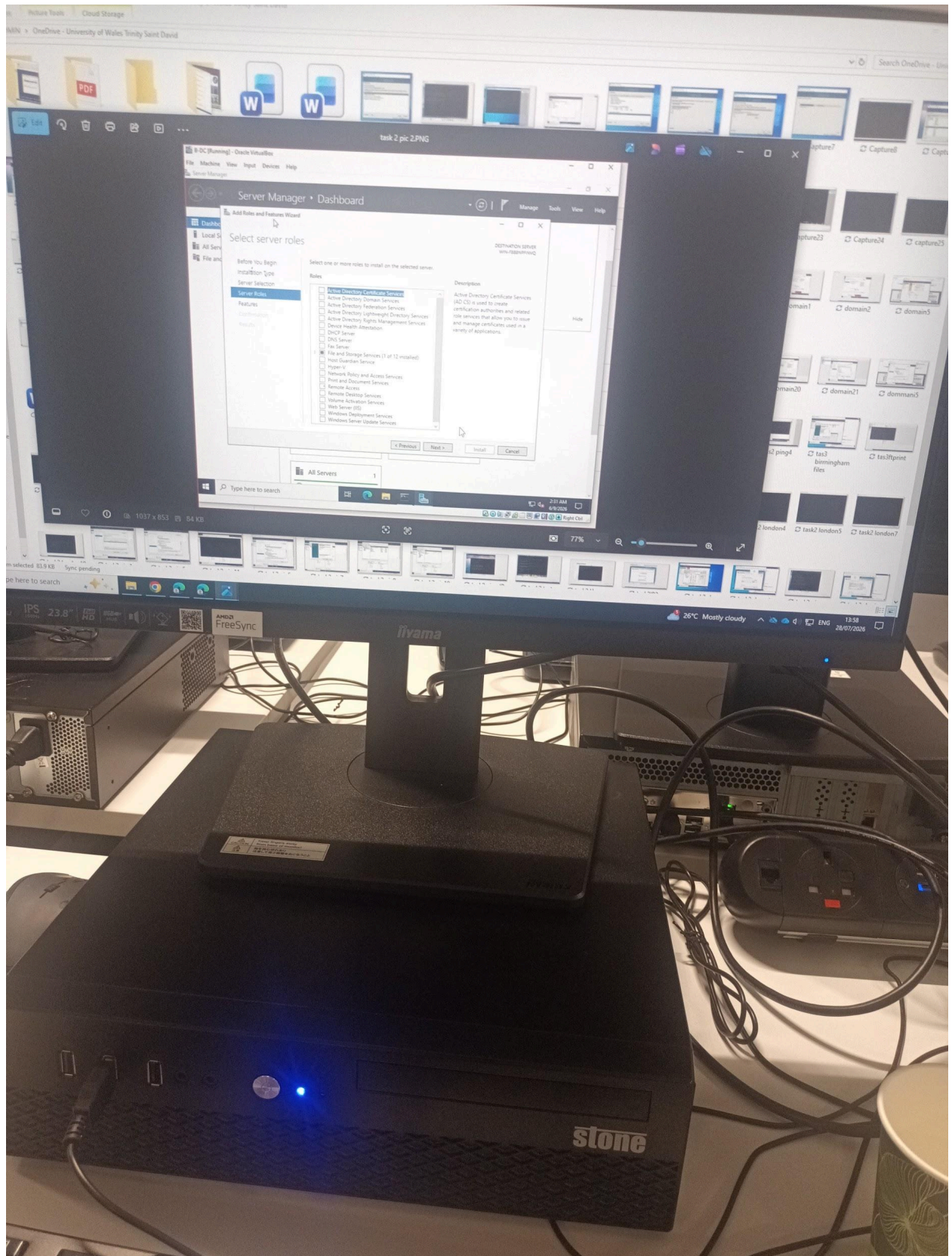
Captures terminal sessions on the Debian Linux node (lcd) performing ICMP ping

verification tests to 172.16.2.1, 10.0.0.1, and 10.0.0.2, alongside ip route output showing active kernel routing table definitions [cite: tsk2 pic ping2.PNG, tsk2 pic ping3.PNG].

7. User Management, Domain Integration, & Storage Provisioning

Bulk user provisioning, workstation domain joins, file shares, and disk volumes were configured to support operational workflows.

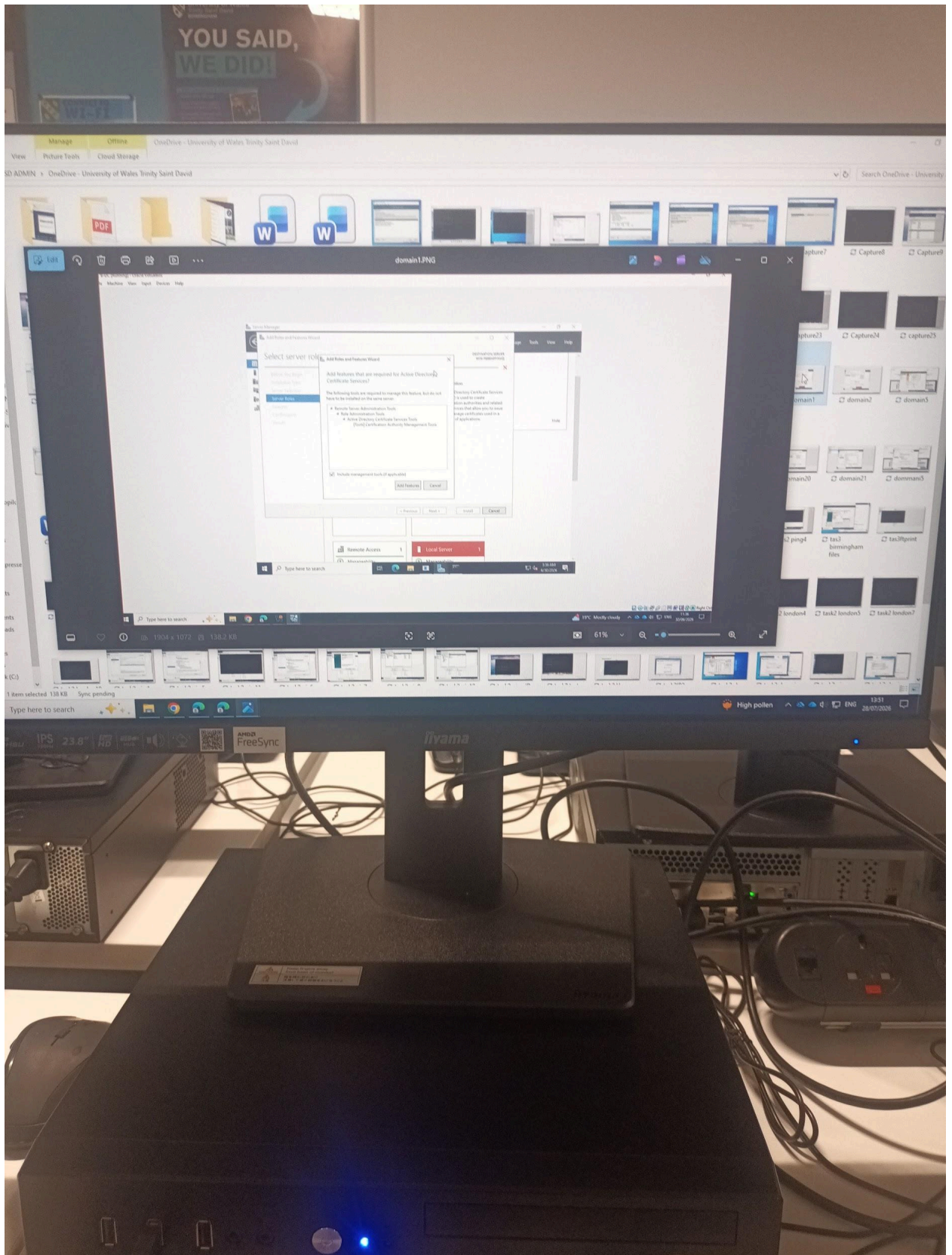
- **Active Directory Bulk User Import:** Captures a Windows PowerShell terminal session executing a user creation script (.\\Import-ADUsers.ps1) from directory C:\\ADImport, displaying successfully created user objects (including Aisha Rahman, Daniel Morgan, Fatima Ahmed, James Wilson, and Sofia Khan) mapped under specified organizational units [cite: Tas2 pic 2.jpg].
- **Windows Domain Join Success Notification:**



Shows the System > About settings screen alongside a Windows popup dialog confirming

"Welcome to the Fateh.acca domain.", verifying successful domain integration of the client workstation [cite: task2 domain name an Administrator.jpg].

- **Active Directory User Login Verification:**

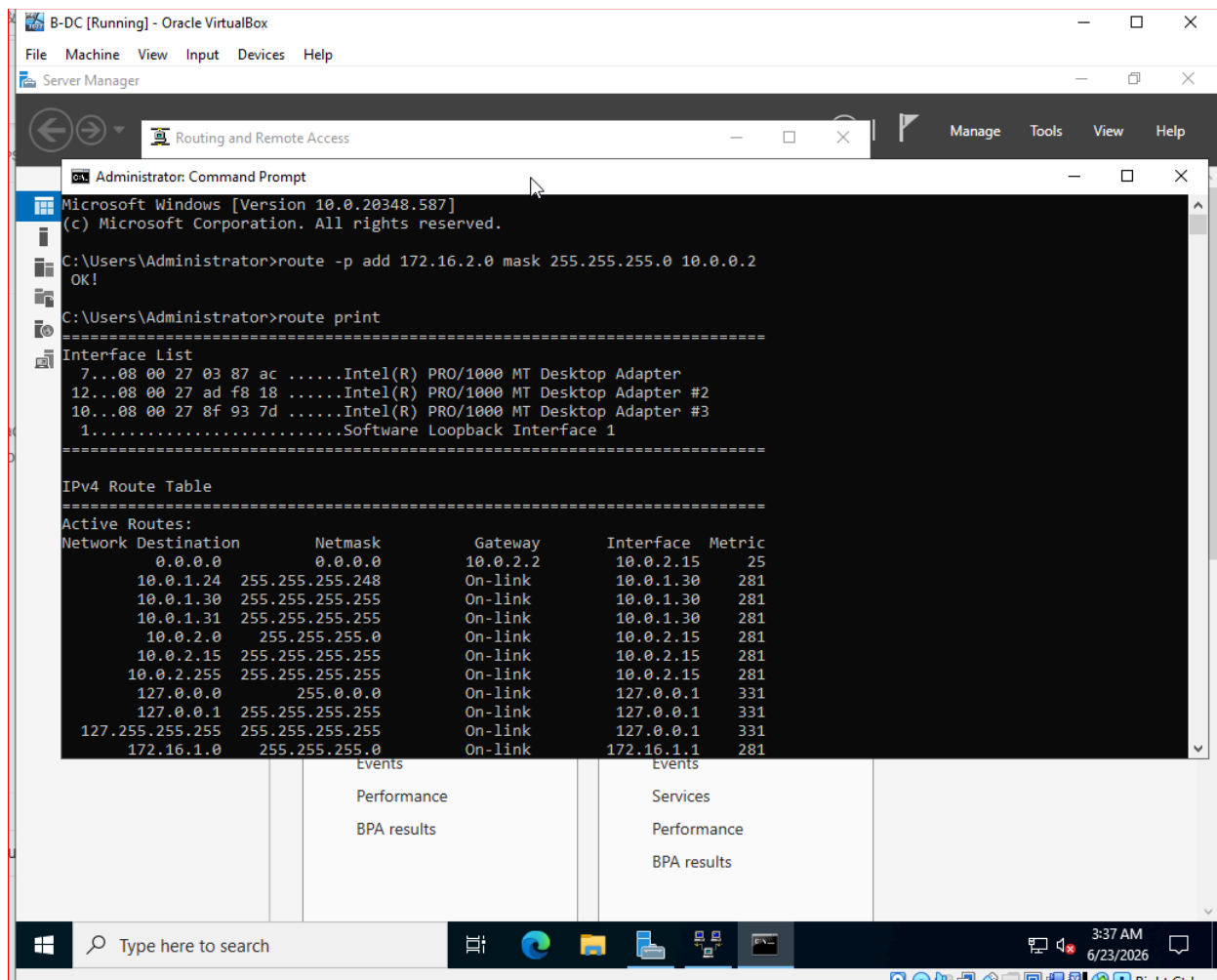


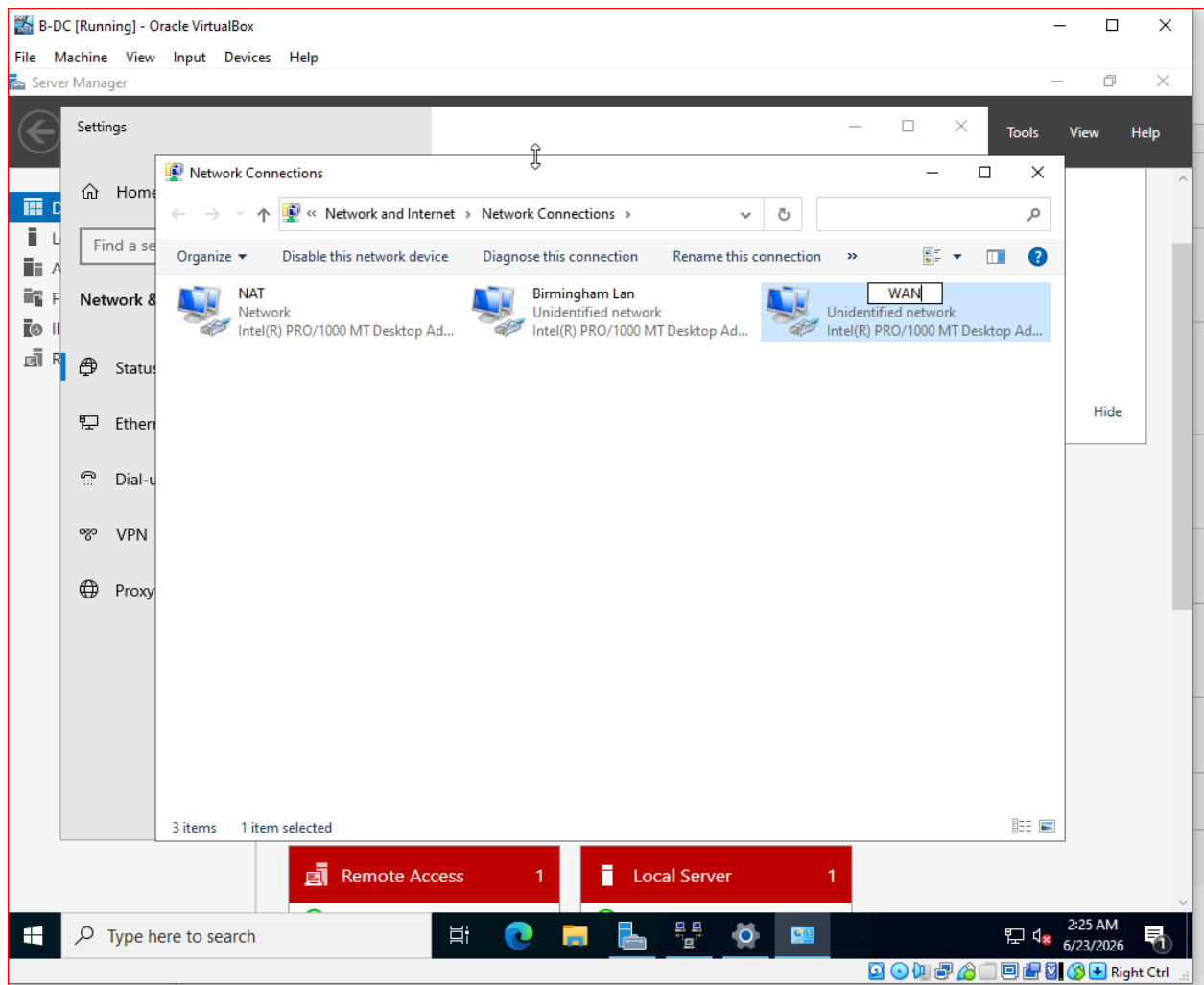
Captures a Command Prompt session running whoami under user context

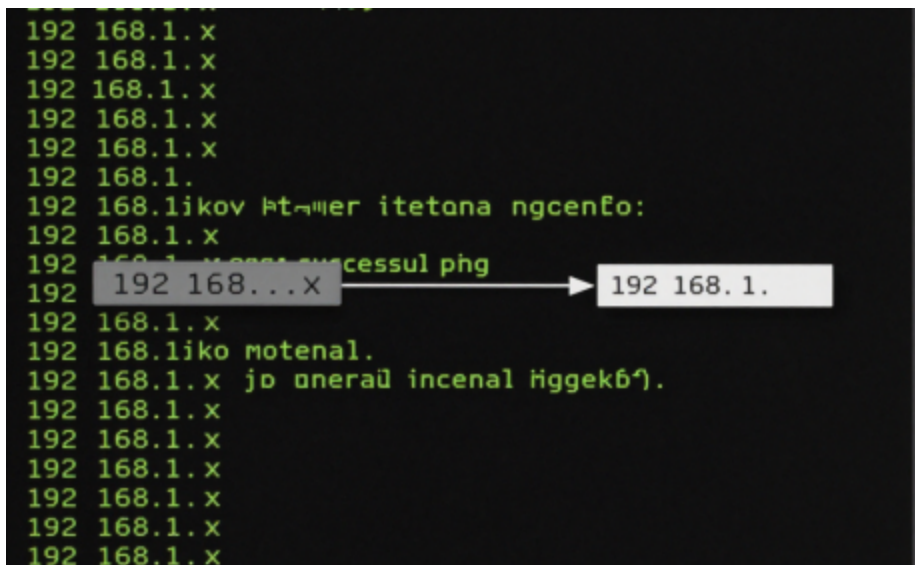
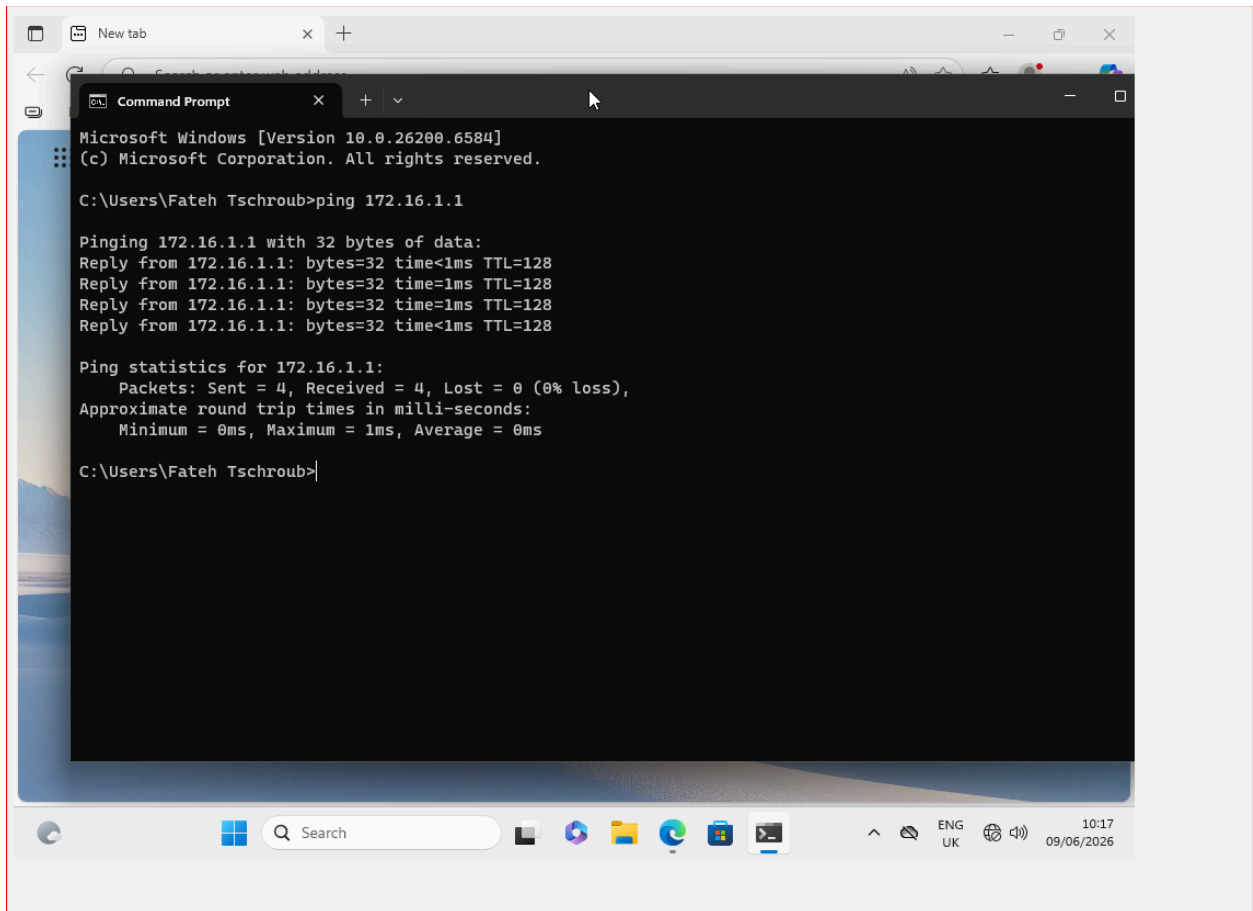
fateh\ra.rahman, verifying active user authentication and session integration within the domain environment [cite: task2 User fateh rahaman.PNG].

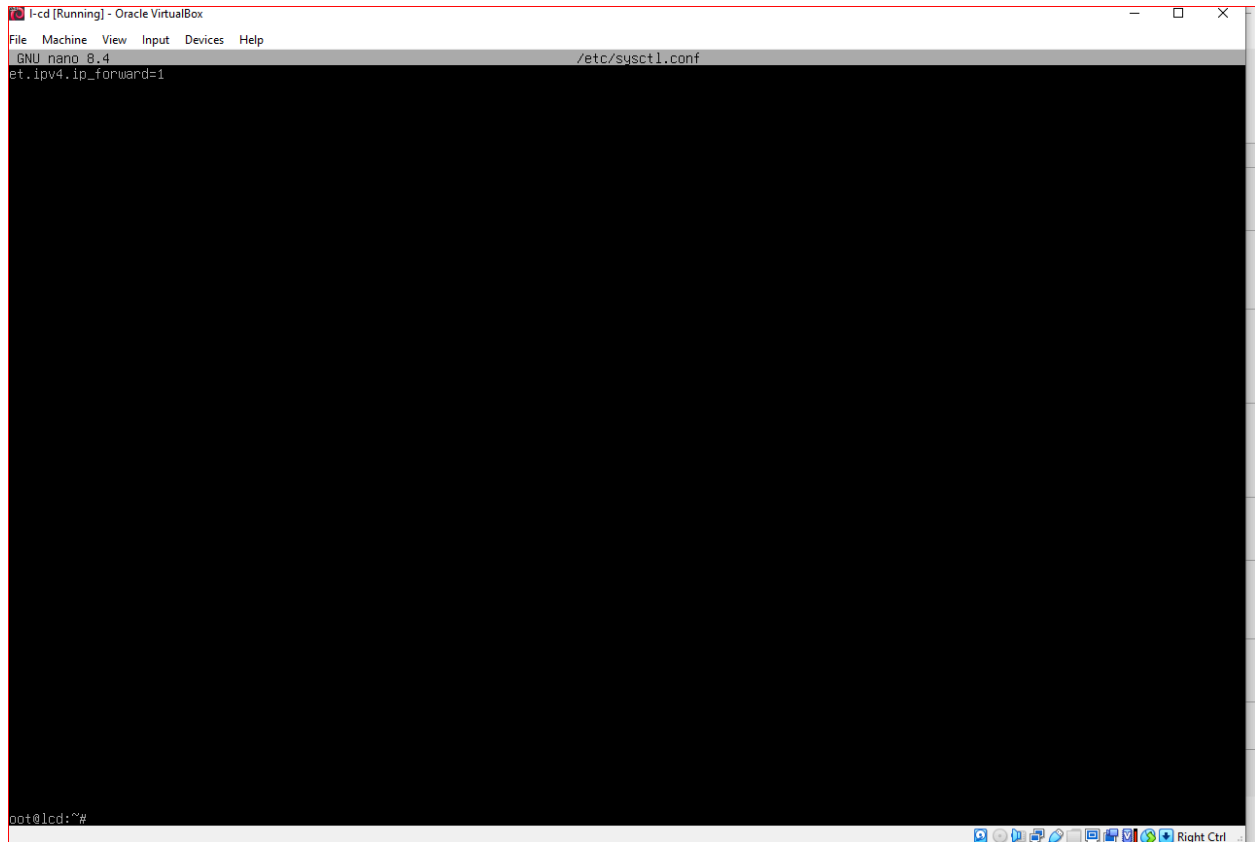
- **Network Access Sharing Permissions:** Captures the network file sharing property window (Birmingham files Properties) on the Windows Server domain controller, displaying assigned Read/Write access permissions for the Administrator and Domain Users security principals [cite: task3 domain.jpg].
- **Select Users or Groups Permission Dialog:** Captures the network sharing configuration window running over an active RD Web Access browser session (localhost/RDWeb), showing the Select Users or Groups security dialog with location set to domain Fateh.acca and object name "domain user" being added for folder permissions [cite: fatehtask3 sharing.PNG, task3 sharing.PNG].
- **New Simple Volume Completion:** Displays the final summary screen of the New Simple Volume Wizard in Disk Management on the Windows Server, confirming the creation of simple volume E: with a capacity of 1065 MB, FAT32 file system, and volume label B-files [cite: tas3 birmingham files.PNG].
- **Virtual Hard Disk Selector Manager:** Captures the Oracle VirtualBox Hard Disk Selector and virtual storage creation window specifying a 1.06 GB VDI disk file (B-DC_1.vdi) [cite: tsk2 create.PNG, tsk2 createIP4.PNG].
- **Windows Server Disk Initialization Wizard:** Shows the Disk Management console and Initialize Disk dialog on the Windows Server domain controller (B-DC), prompting for partition style selection (MBR or GPT) to initialize the newly attached uninitialized Disk 1 [cite: tsk3 ceat.PNG].

8. Connectivity & Routing Verification Evidence



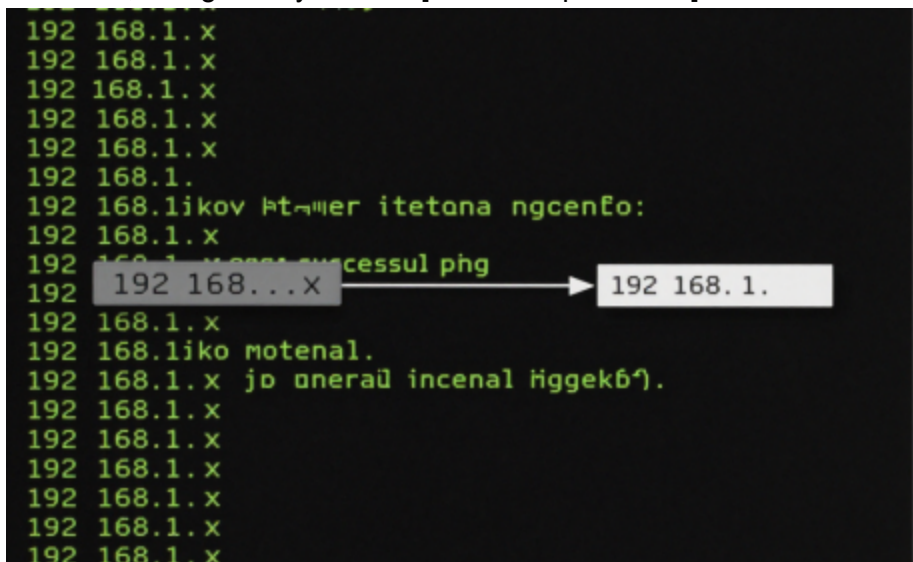




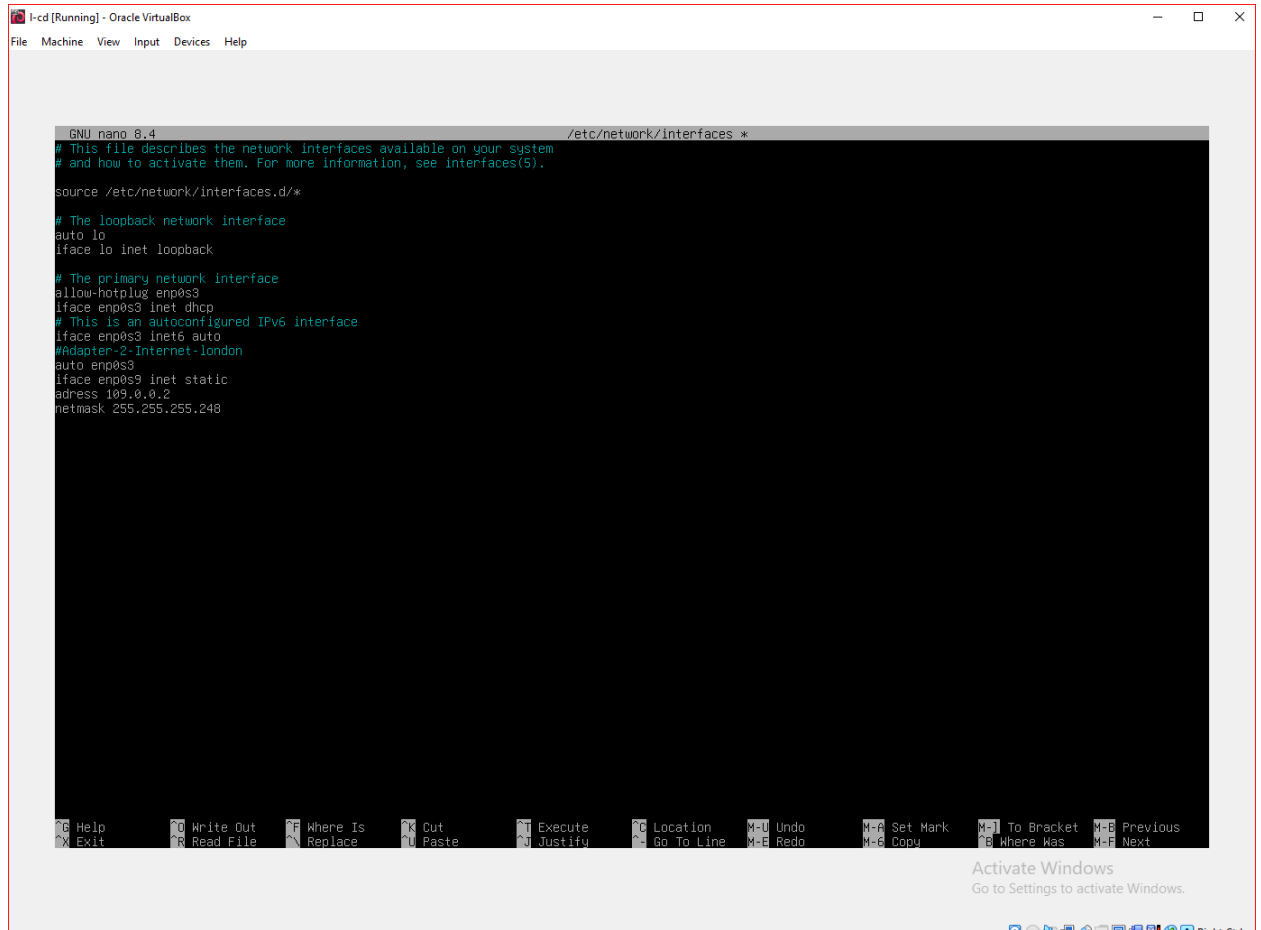


End-to-end network verification was executed to validate packet flow, route tables, and external internet connectivity.

- **Host Route Table Output:** Captures an Administrator Command Prompt running route print on a Windows host system, displaying the active IPv4 Route Table, interface list, netmasks, and gateway metrics [cite: tas3ftprint.PNG].



- **Target IP ICMP Ping Test:**



```
I-cd [Running] - Oracle VirtualBox
File Machine View Input Devices Help
GNU nano 0.4 /etc/network/interfaces *
# This file describes the network interfaces available on your system
# and how to activate them. For more information, see Interfaces(5).

source /etc/network/interfaces.d/*

# The loopback network interface
auto lo
iface lo inet loopback

# The primary network
# interface
allow-hotplug enp0s3
iface enp0s3 inet dhcp

# This is an autoconfigured IPv6 interface
iface enp0s3 inet6 auto

#Adapter-2-Internet-london
auto enp0s8
iface enp0s8 inet static
address 172.165.2.1
netmask 255.255.255.10

#Adapter 3 - WAN
auto enp0s9
iface enp0s9 inet static
address 10.0.0.2
network 255.255.255.240

```

```
I-cd [Running] - Oracle VirtualBox
File Machine View Input Devices Help

#Adapter 3 - WAN
auto enp0s9
iface enp0s9 inet static
address 10.0.0.2
network 255.255.255.240

root@lcd:~# ip addr
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default qlen 1000
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
    inet 127.0.0.1/8 scope host lo
        valid_lft forever preferred_lft forever
    inet6 ::1/128 scope host noprefixroute
        valid_lft forever preferred_lft forever
2: enp0s3: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP group default qlen 1000
    link/ether 08:00:27:bc:83:2b brd ff:ff:ff:ff:ff:ff
    altnames enx080027bc832b
    inet 10.0.2.15/24 brd 10.0.2.255 scope global dynamic noprefixroute enp0s3
        valid_lft 85085sec preferred_lft 74285sec
    inet6 fd17:625c:f037:2:1000:2:7ff:febc:832b/64 scope global dynamic mngtmpaddr proto kernel_rn
        valid_lft 86219sec preferred_lft 14219sec
    inet6 fd17:625c:f037:2:000:0000:0000:0000/64 scope global dynamic mngtmpaddr noprefixroute
        valid_lft 86219sec preferred_lft 14219sec
    inet6 fe80::94f4:727a:1394:9463/64 scope link
        valid_lft forever preferred_lft forever
3: enp0s8: <BROADCAST,MULTICAST> mtu 1500 qdisc noop state DOWN group default qlen 1000
    link/ether 08:00:27:cc:ad:fd brd ff:ff:ff:ff:ff:ff
    altnames enx080027ccadfd
4: enp0s9: <BROADCAST,MULTICAST> mtu 1500 qdisc noop state DOWN group default qlen 1000
    link/ether 08:00:27:b3:cf:e7 brd ff:ff:ff:ff:ff:ff
    altnames enx080027b3cfe7
root@lcd:~#
```

Activate Windows
Go to Settings to activate Windows.

Captures a Command Prompt session on a Windows client node executing a ping test to 172.16.1.1, showing successful replies with 0% packet loss and a round-trip time under 1 ms [cite: task2 ping IP.jpg, taskIP3.jpg].

- **External ICMP Connectivity & DNS Resolution Test:** Displays a Command Prompt session on a Windows client node executing ping tests to public DNS (8.8.8.8) and domain name google.com, confirming successful external internet routing and domain name resolution with 0% packet loss [cite: task3 ping google.jpg].
- **Linux IP Route Table Verification:**



Displays the active kernel routing table (ip route) in a Debian console terminal session,

detailing active gateway paths across network segments (enp0s3, enp0s8, and enp0s9) [cite: task3IP route.PNG].

- **Windows Host IPv4 Route Table:** Captures an Administrator Command Prompt running route print, listing active IPv4 route destinations, netmasks, gateways, and interface metrics on the Windows Server node [cite: task3print.PNG].

```

192 168.1.x
192 168.1.x
192 168.1.x
192 168.1.x
192 168.1.x
192 168.1.
192 168.1.kov itetana ngcenfo:
192 168.1.x
192 168.1.x
192 168...x → 192 168.1.
192 168.1.x
192 168.1.ko motenal.
192 168.1.x jo uneraul incenal higgekof).
192 168.1.x
192 168.1.x
192 168.1.x
192 168.1.x
192 168.1.x
192 168.1.x

```

-

End of Comprehensive Component 1 & Component 2 Documentation Evidence.

LUNIX in VirtualBox

NETWORK: Host-Only Adapter

SUBNET: 192.168.56.0/24

Lab Status: SUCCESS

Packet Loss: 0%

1 SR1

```
SR1 [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
Microsoft Windows (Version 10.07763,4733)
c); 2018 Microsoft Corporation - All rights reserved.

Pinging 192.168.86.12 with 32 bytes of data:
Reply from 192.168.56.12: bytes=32 times of time
Reply from 192.168.56.12: Devices of time
Reply from 192.168.56.12: bytes=32 times of time
Reply from 192.168.36: bytes=32 timesles TTL=128
Ping statistics for 192.168.56.12:
Packets: Sent = 4, Received = 4, Lost = 0 (% loss)
Approximate round trip times in milli-seconds
Minimum = 0ms, Maximum = 1ms, Average = 0ms
C:\Users\srll
```

2 SR1

```
SR1 [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help

c:\Users\srll>ping 192.168.86.11
Pinging 192.168.86.11 with 32 bytes of data:
Reply from 192.168.56.11: bytes=32 times of time
Reply from 192.168.56.11: Devices of timeTTL=128
Reply from 192.168.56.12: Times=32 times of time
Reply from 192.168.56.11: bytes=32 timesles TTL=128
Ping statistics for 192.168.56.11timesles TTL=128
Packets: Sent = 4, Received = 4, Lost = 0 (%
Jose)statistics for 192.168.56.11:
Approximate round trip times in milli-seconds(8% loss),
Minimum = 0ms, Maximum = 1ms, Average = 0ms
C: \Users\srll 0ms, Maximum = 1ms, Average = 0ms

C:\Users\srll>
```

3 CLEAR1

```
Clear1 [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help

C:\Users\clearl>ping 192.168.58.14
c): 0:Users clearlping 192.168.56.14
Pinging 192.168.56.14 with 32 bytes of data:
Reply from 192.168.56.14: bytes=32 times of time
Reply from 192.168.56.12: byttess of timeTTL=128
Reply from 192.168.56.12: bytes=32 times TTL=128
Reply from 192.168.56.12: bytes=32 timesms TTL=128
Ping statistics for 192.168.56.12:
Packets: Sent = 4, Received = 4, Lost = 0 (%
loss)ackets: Sent = 4, Received = 4, Lost = 0 (Ct loss),
Approximate round-trip times in milli-seconds
Minimum = 0ms, Maximum = 1ms, Average = 10ms,
C:Users clearl!
C:\Users\clearl>
```

4 LBDC

```
LBDC [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help

C:\Users\lbdc>ping 192.158.56.11
c): 0:Users lbdc-ping 192.168.56.13
Pinging 192.168.66.13 with 32 bytes of data:
Reply from 192.168.66.13: bytes=32 times of time
Reply from 192.168.56.12: byttess of timeTTL=128
Reply from 192.168.56.12: bytes=32 times TTL=128
Reply from 192.168.56.13: bytes=32 timesles TTL=128
Ping statistics for 192.168.56.13:
Packets: Sent = 4, Received = 4, Lost = 0 (%
loss)ackets: Sent = 4, Received = 4, Lost = 0 (6t loss),
Approximate round-trip times in milli-seconds
Minimum = 0ms, Maximum = 1ms, Average = 0ms,
C: Users lbdc
C:\Users\lbdc>
```



Servers communicate successfully - 0% packet loss

References

[1] Oracle Corporation, Oracle VM VirtualBox User Manual. [Online]. Available:.. [Accessed: Jul.

31, 2026].

[2] Microsoft, *Windows Server Documentation*. [Online]. Available: <https://learn.microsoft.com/windows-server/>. [Accessed: Jul. 31, 2026].

[3] The Debian Project, *Debian GNU/Linux Installation Guide*. [Online]. Available: [Accessed: Jul. 31, 2026].

[4] Microsoft, *Domain Name System (DNS) in Windows Server*. [Online]. Available: <https://learn.microsoft.com/windows-server/networking/dns/>. [Accessed: Jul. 31, 2026].

[5] Microsoft, *Active Directory Domain Services (AD DS) Overview*. [Online]. Available: <https://learn.microsoft.com/windows-server/identity/ad-ds/>. [Accessed: Jul. 31, 2026].