

Network Operating Systems and Services

Coursework 2

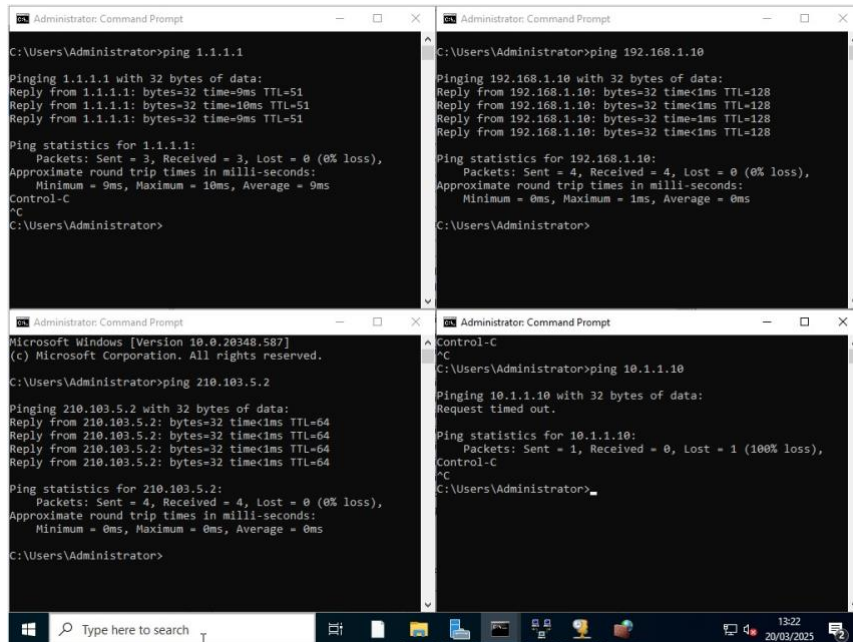
Rim Al Mutwaly



Prifysgol Cymru
Y Drindod Dewi Sant
University of Wales
Trinity Saint David

I. Swansea

Before starting the second coursework's manipulations, I wanted to make sure that all the virtual machines were pinging correctly with each other. I found out that everything was pinging following the topology and that there were no issues.



```
C:\Users\Administrator>ping 1.1.1.1
Pinging 1.1.1.1 with 32 bytes of data:
Reply from 1.1.1.1: bytes=32 time=9ms TTL=51
Reply from 1.1.1.1: bytes=32 time=10ms TTL=51
Reply from 1.1.1.1: bytes=32 time=9ms TTL=51

Ping statistics for 1.1.1.1:
    Packets: Sent = 3, Received = 3, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 9ms, Maximum = 10ms, Average = 9ms
^C
C:\Users\Administrator>

C:\Users\Administrator>ping 192.168.1.10
Pinging 192.168.1.10 with 32 bytes of data:
Reply from 192.168.1.10: bytes=32 time<1ms TTL=128
Reply from 192.168.1.10: bytes=32 time<1ms TTL=128
Reply from 192.168.1.10: bytes=32 time<1ms TTL=128
Reply from 192.168.1.10: bytes=32 time<1ms TTL=128

Ping statistics for 192.168.1.10:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 1ms, Average = 0ms
^C
C:\Users\Administrator>

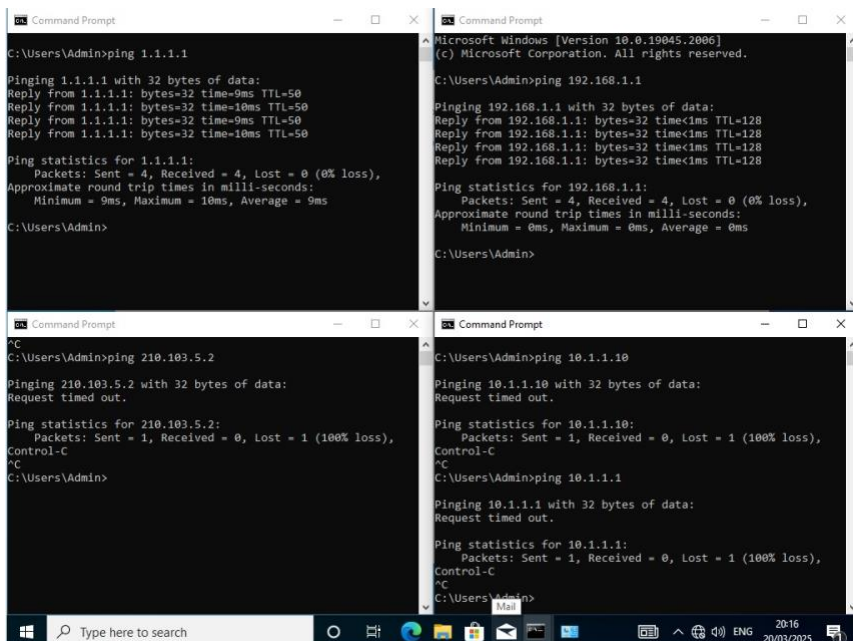
C:\Users\Administrator>ping 210.103.5.2
Pinging 210.103.5.2 with 32 bytes of data:
Reply from 210.103.5.2: bytes=32 time<1ms TTL=64
Reply from 210.103.5.2: bytes=32 time<1ms TTL=64
Reply from 210.103.5.2: bytes=32 time<1ms TTL=64
Reply from 210.103.5.2: bytes=32 time<1ms TTL=64

Ping statistics for 210.103.5.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms
^C
C:\Users\Administrator>

C:\Users\Administrator>ping 10.1.1.10
Request timed out.

Ping statistics for 10.1.1.10:
    Packets: Sent = 1, Received = 0, Lost = 1 (100% loss),
^C
C:\Users\Administrator>
```

Figure 1: Ping Windows server



```
C:\Users\Admin>ping 1.1.1.1
Pinging 1.1.1.1 with 32 bytes of data:
Reply from 1.1.1.1: bytes=32 time=9ms TTL=50
Reply from 1.1.1.1: bytes=32 time=10ms TTL=50
Reply from 1.1.1.1: bytes=32 time=9ms TTL=50
Reply from 1.1.1.1: bytes=32 time=10ms TTL=50

Ping statistics for 1.1.1.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 9ms, Maximum = 10ms, Average = 9ms
^C
C:\Users\Admin>

C:\Users\Admin>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
C:\Users\Admin>

C:\Users\Admin>ping 210.103.5.2
Request timed out.

Ping statistics for 210.103.5.2:
    Packets: Sent = 1, Received = 0, Lost = 1 (100% loss),
^C
C:\Users\Admin>

C:\Users\Admin>ping 10.1.1.10
Request timed out.

Ping statistics for 10.1.1.10:
    Packets: Sent = 1, Received = 0, Lost = 1 (100% loss),
^C
C:\Users\Admin>ping 10.1.1.1
Request timed out.

Ping statistics for 10.1.1.1:
    Packets: Sent = 1, Received = 0, Lost = 1 (100% loss),
^C
C:\Users\Admin>
```

Figure 2: Ping Windows client

The first step is to install Routing and Remote Access Service, which is as Window server service that allows to set up routing, VPN, and NAT functionally.

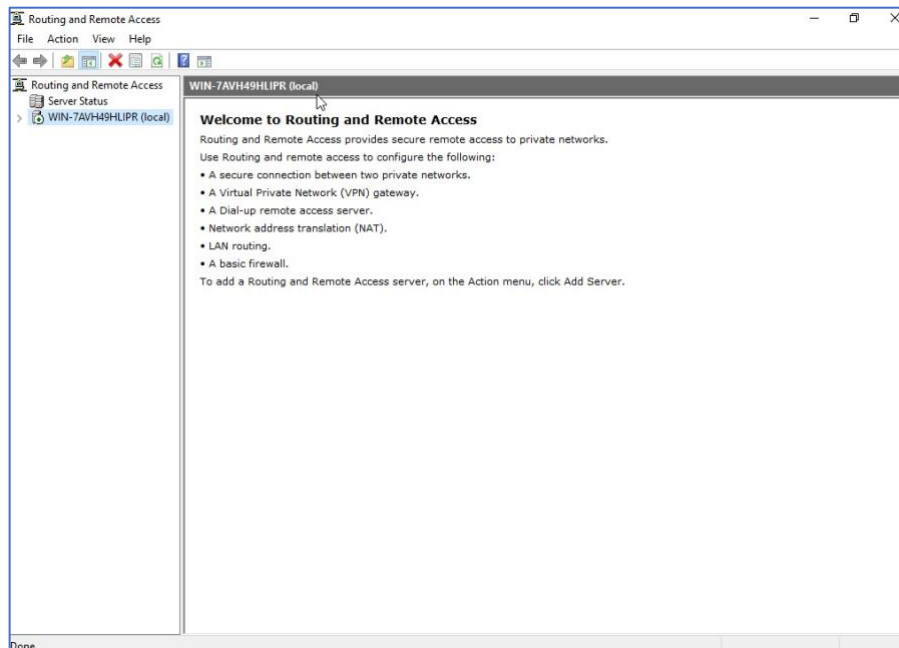


Figure 3: Installing Routing and Remote Access

Then, always on Window server, we modify firewall rules to allow ICMP traffic on Window server to check the connectivity between the Virtual Machines, to report errors when packets can't reach their destination and support tools to track the path a packet takes. We created a new inbound rule to allow ICMPv4 traffic, for LAN traffic so only for local services and we put a range of IP addresses from 0 to 255.

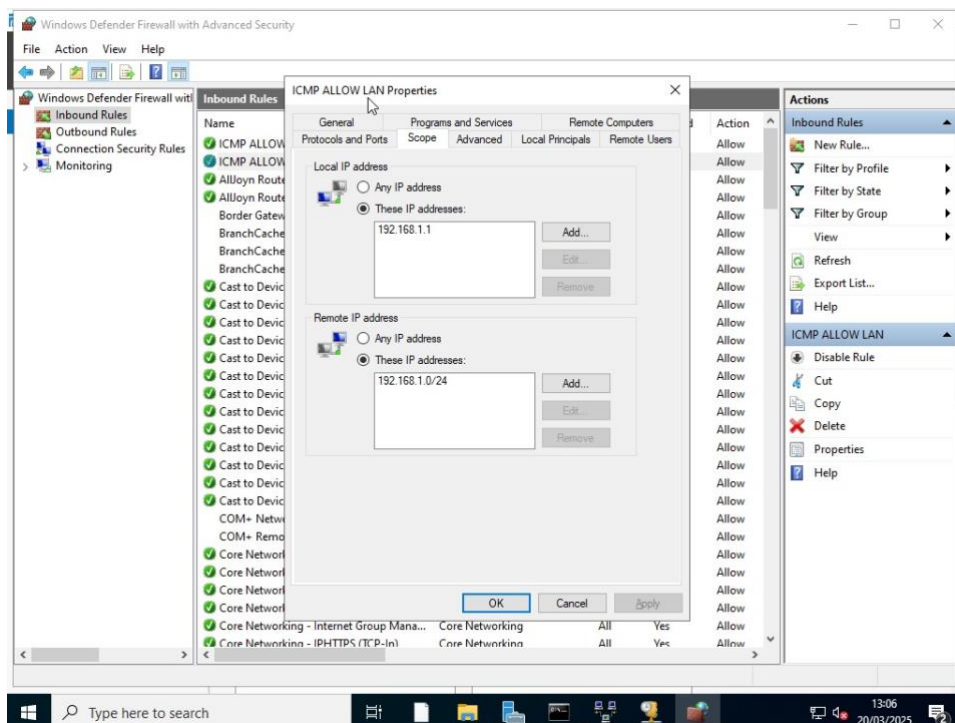


Figure 4: Allow ICMP for LAN traffic

Then, we created another ICMP rule to allow ICMP for WAN traffic for external services and we put a small range of IP addresses.

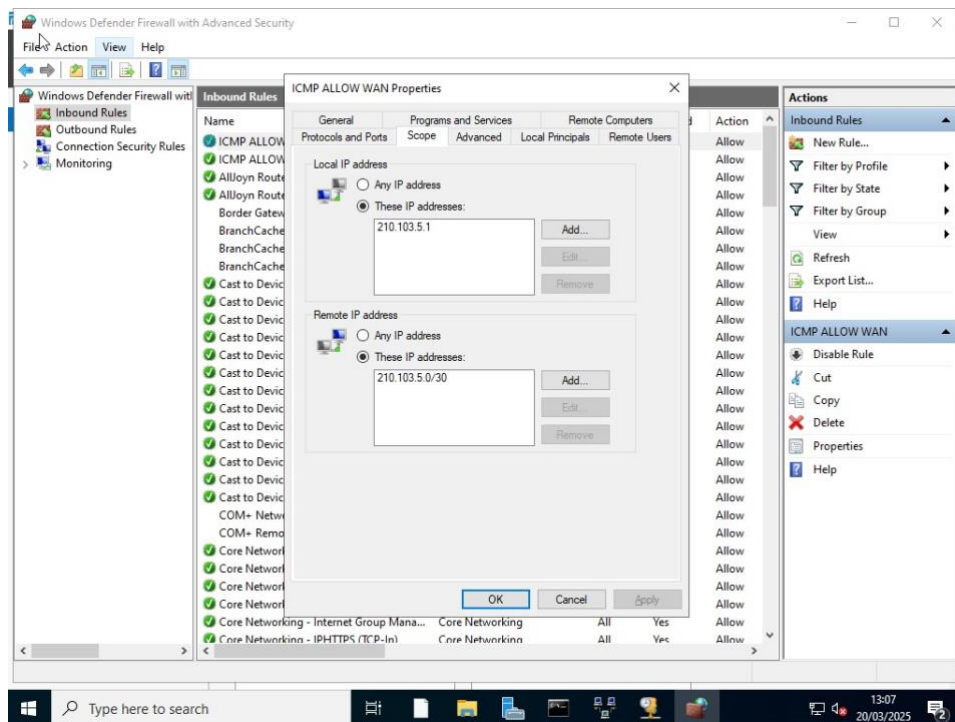


Figure 5: Allow ICMP for WAN traffic

After that, we must install the DNS that will turn out domains name into IP addresses.

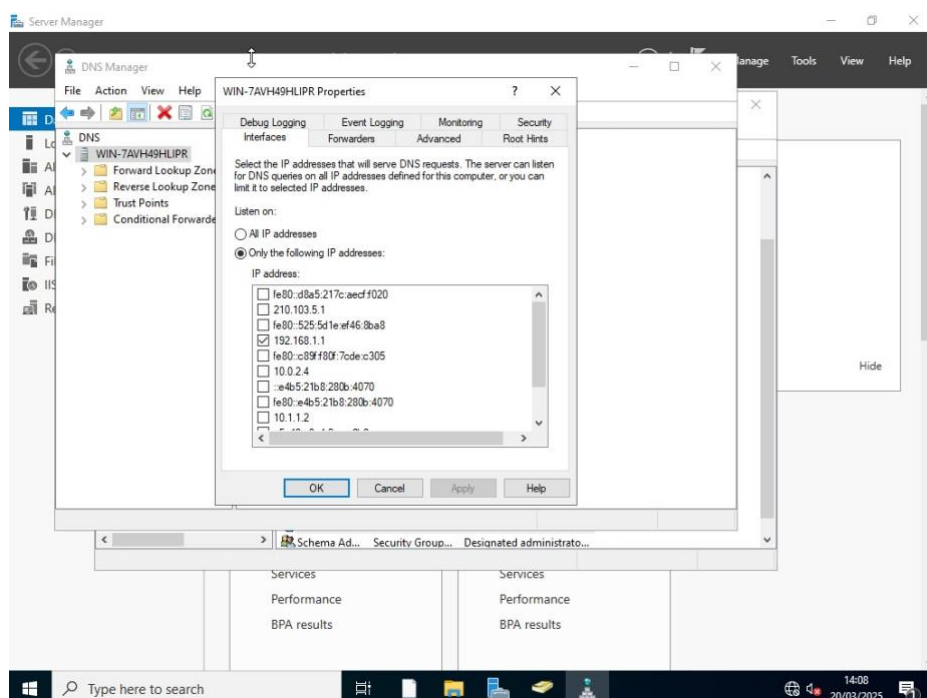


Figure 6: DNS server interfaces

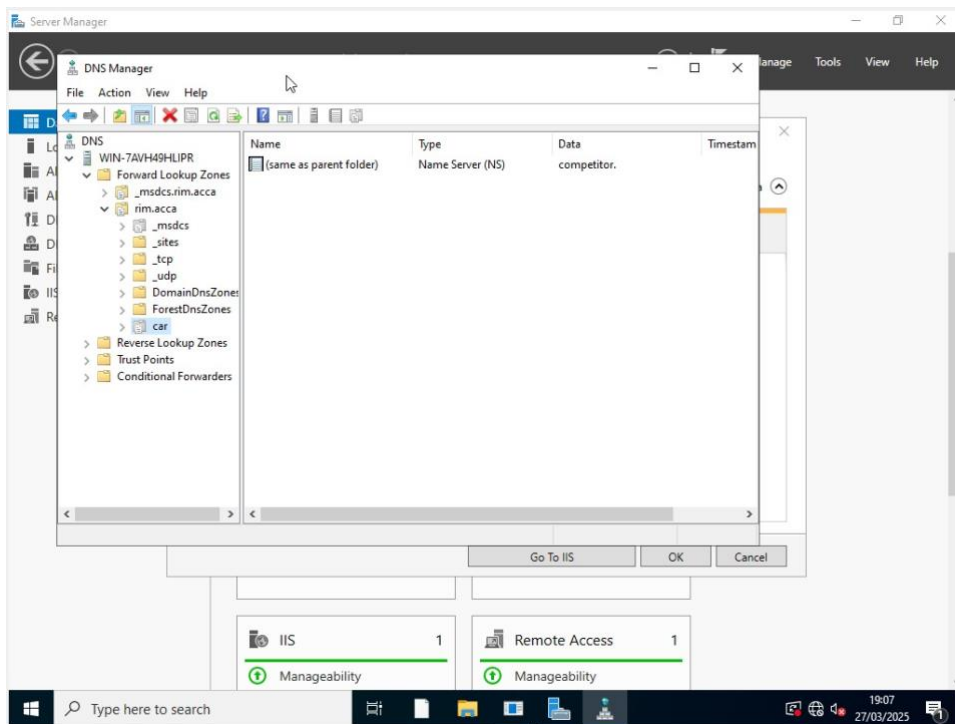


Figure 7: DNS

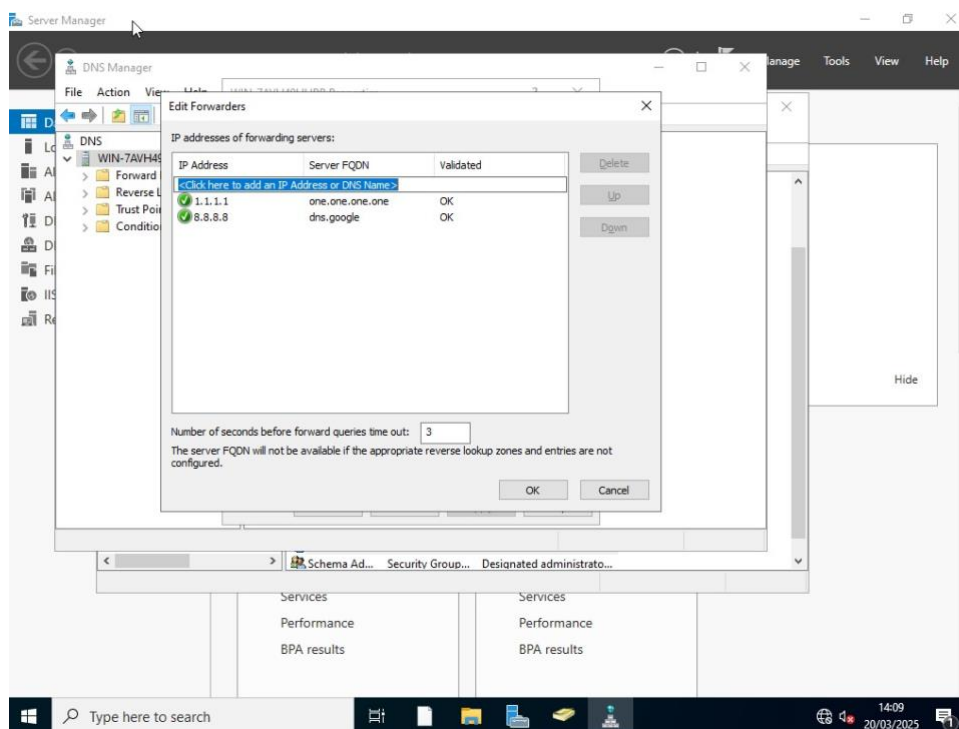


Figure 8: Forwarder DNS server

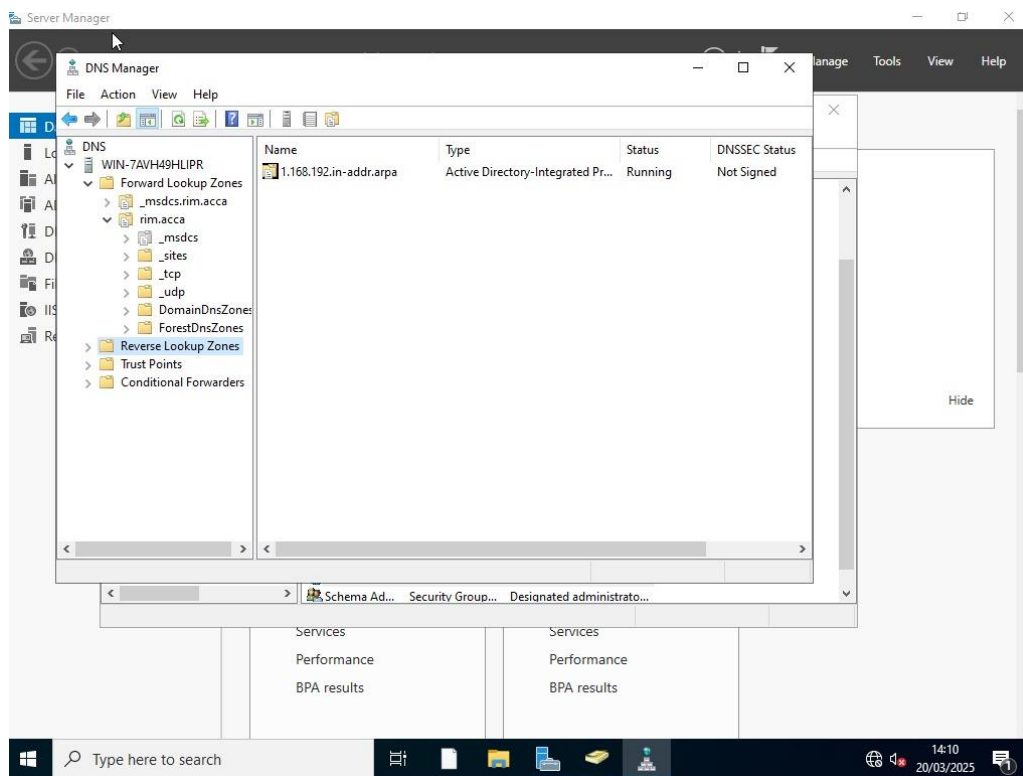


Figure 9: DNS Reverse lookupzone

Then, we install DHCP :

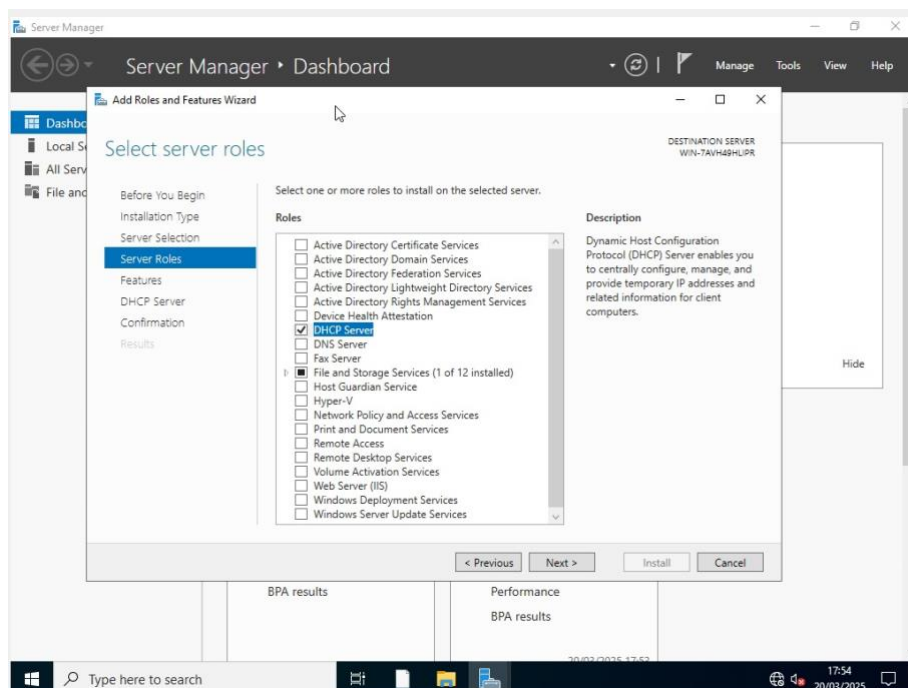


Figure 10: Installing DHCP

And the last installation is for AD DS:

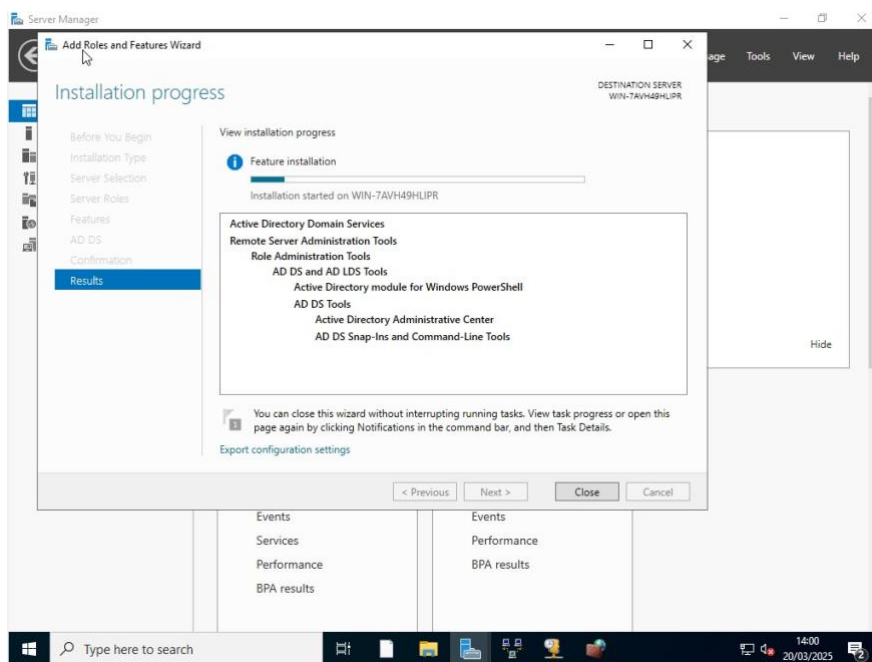


Figure 11: Installing AD DS

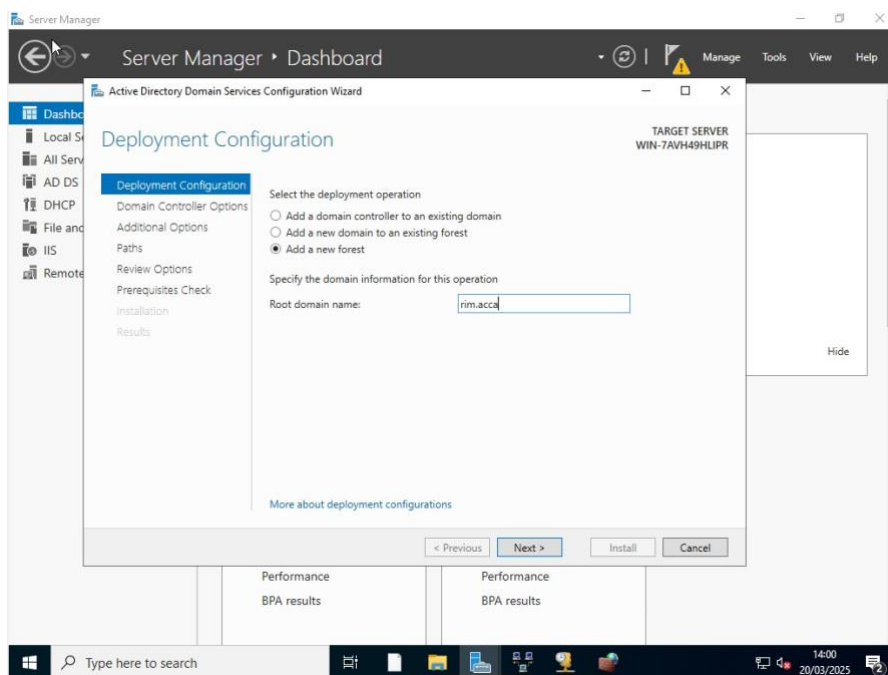


Figure 12: Creation of a forest

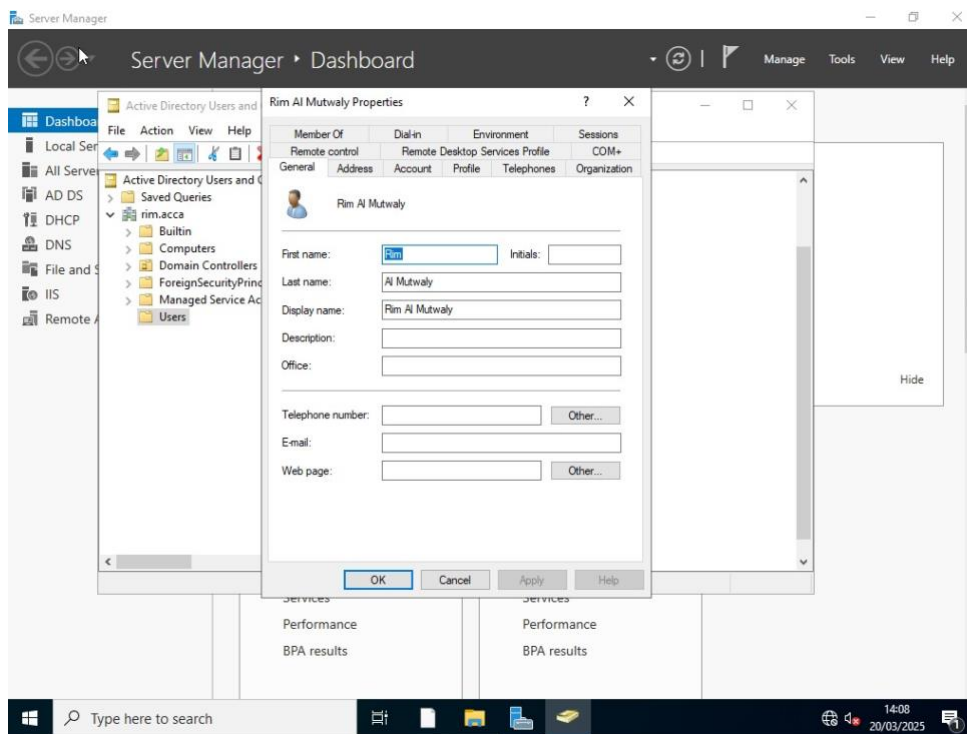


Figure 13: Creating my user

Now, we can configure site-to-site VPN to Cardiff network. To do so, we have to choose which type of VPN connection do we want to create and in our case, we choose a Point-to-Point Tunneling Protocol (PPTP) because it is easier and faster to configure.

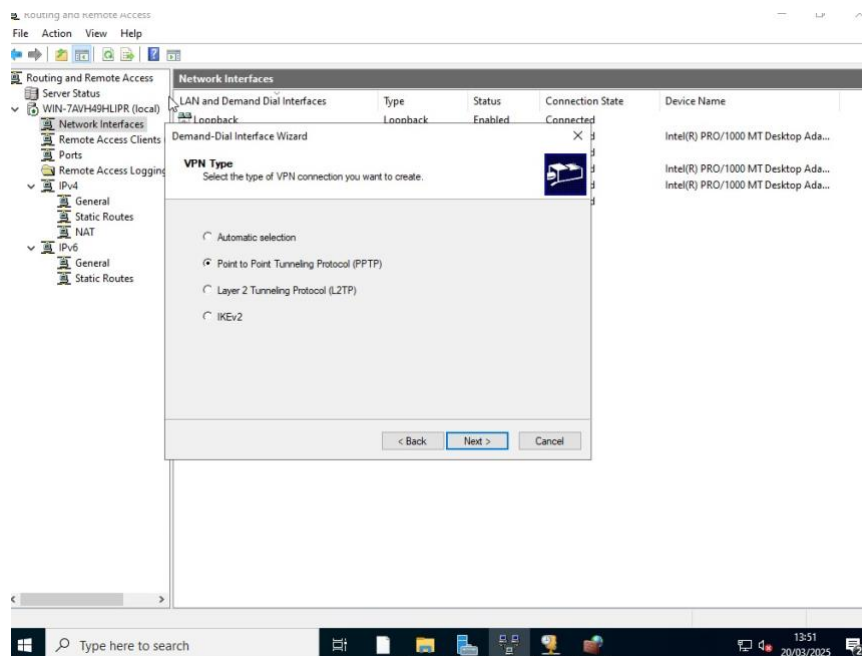


Figure 14: VPN Point-to-Point Tunneling Protocol

Then we must check the connection type “persistent connection”, so the VPN between Swansea and Cardiff will always stays active and will not need to manually reconnect or re-authenticate every time the system restarts or loose connection temporarily. The VPN between Swansea and Cardiff will be permanently established, making both sides work as if they’re part of the same internal network.

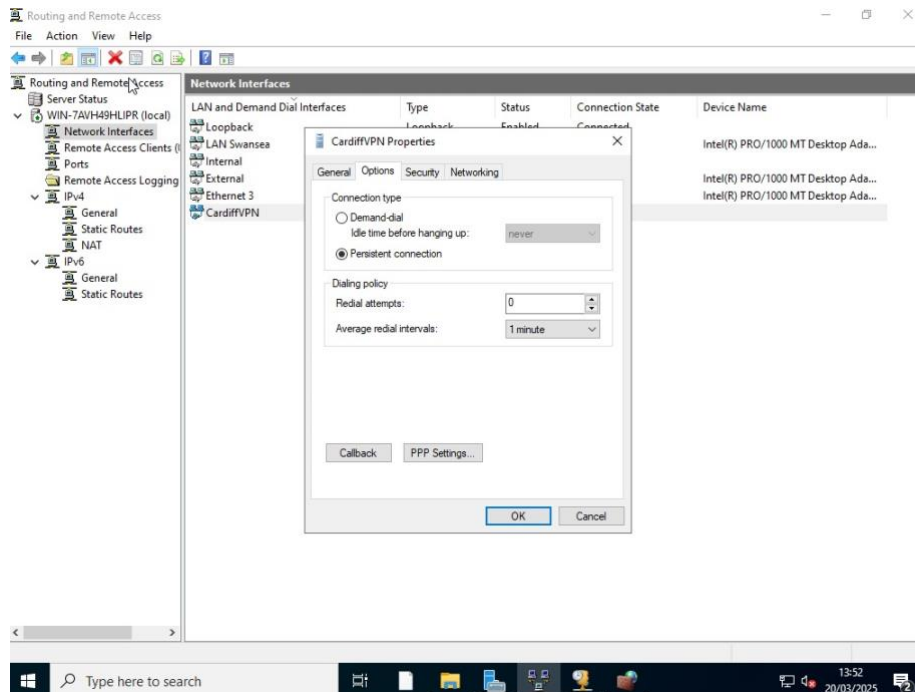


Figure 15: VPN persistent connection

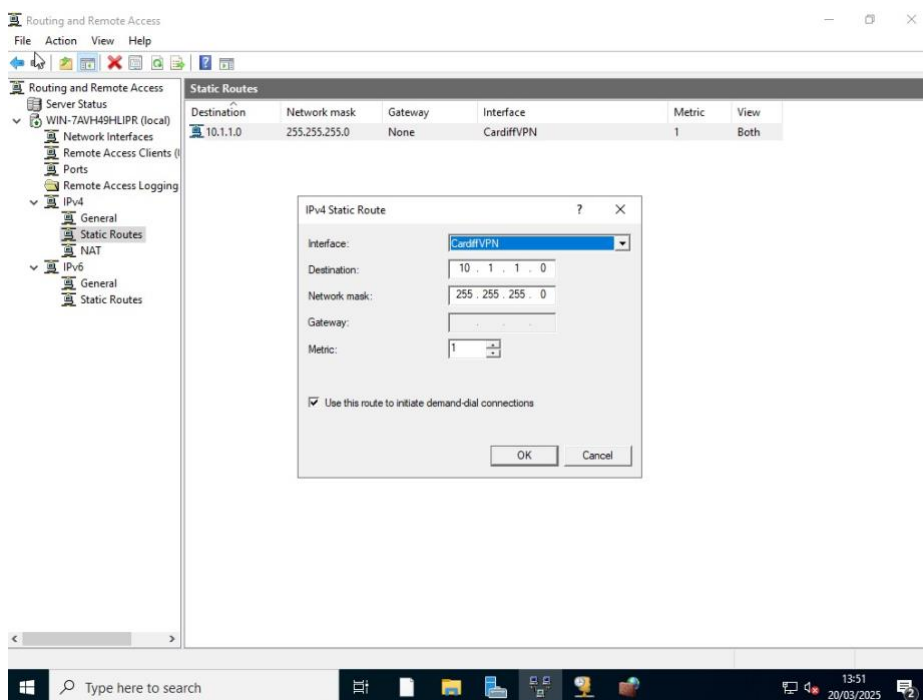


Figure 16: New static route to Cardiff LAN



On Windows server:



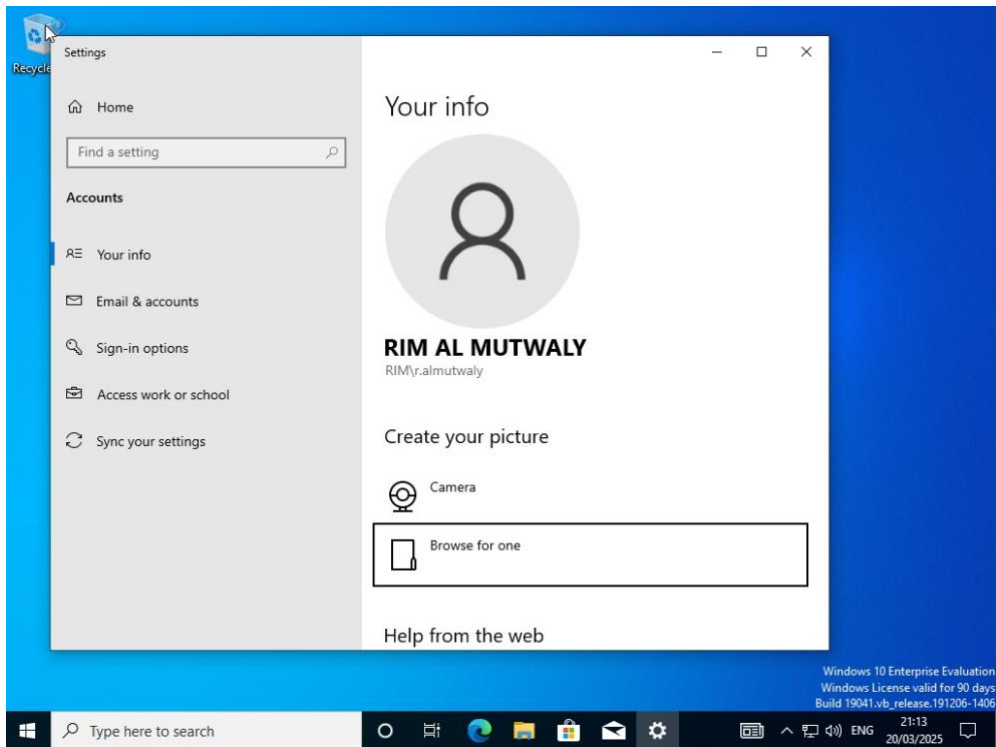


Figure 19: Success connecting user in client

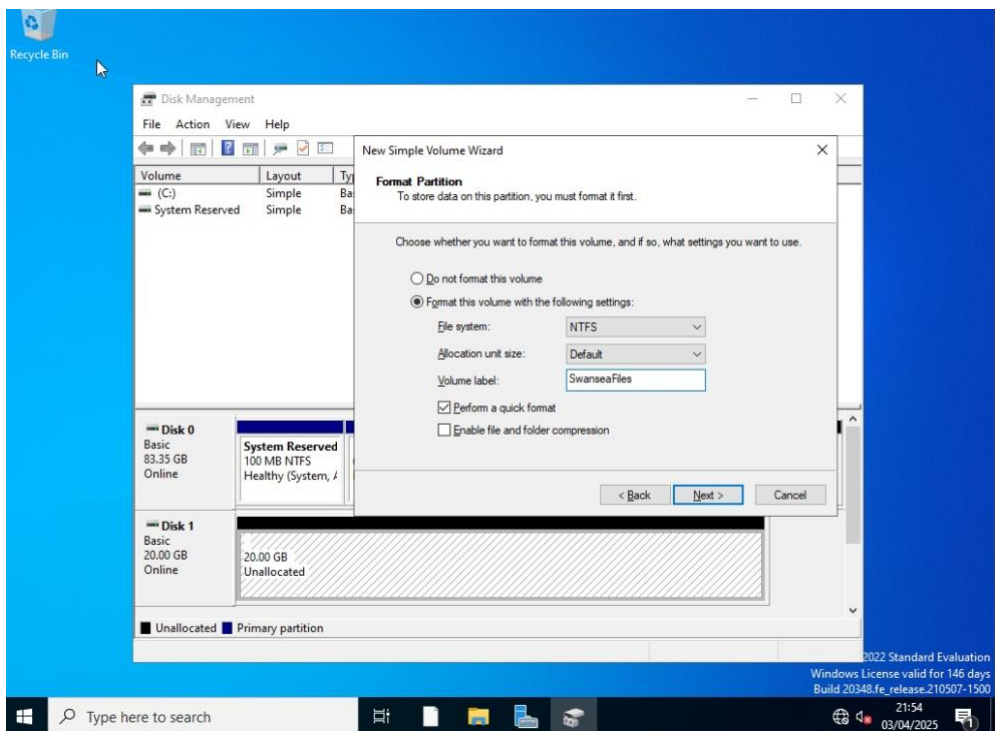


Figure 20: Partition disk on DC

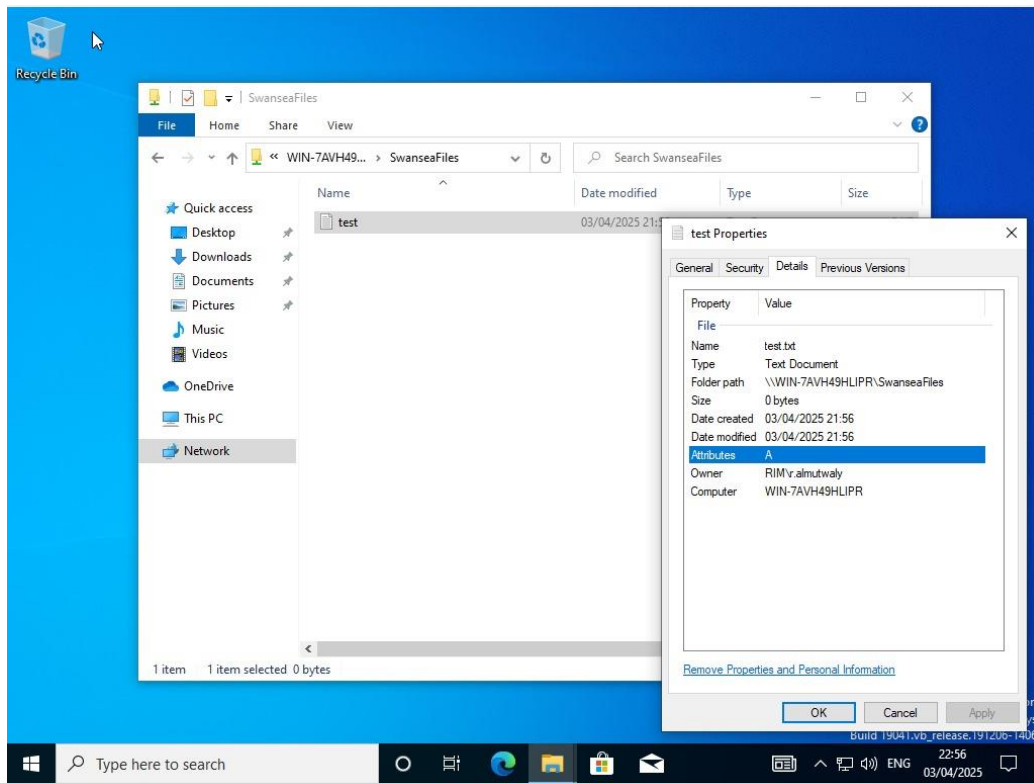


Figure 21: Success file creation in Swansea client

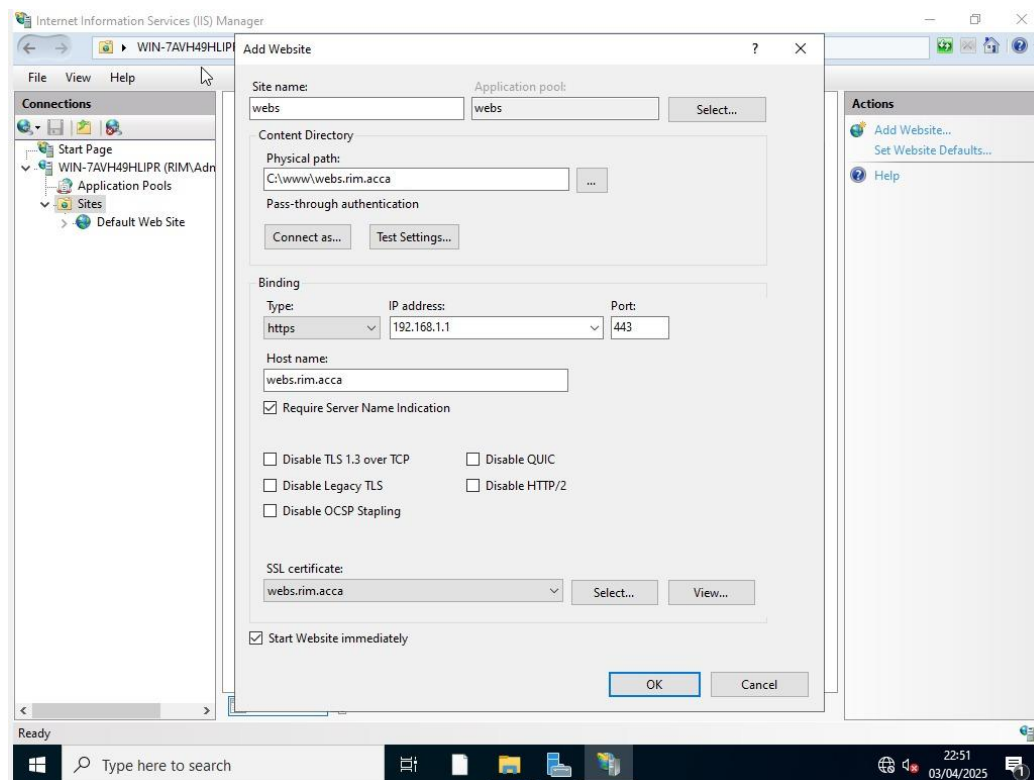


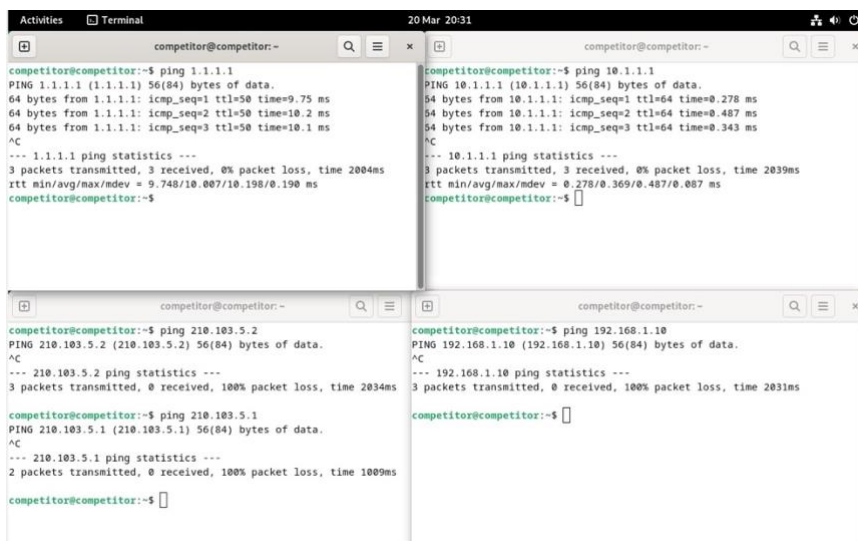
Figure 22: Webs creation

II. Cardiff

Like for Swansea, we check the pinging for Cardiff and everything was pinging successfully.

```
competitor@competitor:~$ ping 1.1.1.1
PING 1.1.1.1 (1.1.1.1) 56(84) bytes of data:
64 bytes from 1.1.1.1: icmp_seq=1 ttl=51 time=9.97 ms
64 bytes from 1.1.1.1: icmp_seq=2 ttl=51 time=9.65 ms
64 bytes from 1.1.1.1: icmp_seq=3 ttl=51 time=9.66 ms
^C
--- 1.1.1.1 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2005ms
rtt min/avg/max/mdev = 9.658/9.768/9.972/0.149 ms
competitor@competitor:~$ ping 10.1.1.10
PING 10.1.1.10 (10.1.1.10) 56(84) bytes of data:
64 bytes from 10.1.1.10: icmp_seq=1 ttl=64 time=0.671 ms
64 bytes from 10.1.1.10: icmp_seq=2 ttl=64 time=0.568 ms
64 bytes from 10.1.1.10: icmp_seq=3 ttl=64 time=0.539 ms
^C
--- 10.1.1.10 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2045ms
rtt min/avg/max/mdev = 0.539/0.598/0.671/0.057 ms
competitor@competitor:~$ ping 210.103.5.1
PING 210.103.5.1 (210.103.5.1) 56(84) bytes of data:
64 bytes from 210.103.5.1: icmp_seq=1 ttl=120 time=0.351 ms
64 bytes from 210.103.5.1: icmp_seq=2 ttl=120 time=0.319 ms
64 bytes from 210.103.5.1: icmp_seq=3 ttl=120 time=0.620 ms
^C
--- 210.103.5.1 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2033ms
rtt min/avg/max/mdev = 0.319/0.432/0.620/0.130 ms
competitor@competitor:~$ ping 192.168.1.10
PING 192.168.1.10 (192.168.1.10) 56(84) bytes of data:
^C
--- 192.168.1.10 ping statistics ---
0 packets transmitted, 0 received, 100% packet loss, time 3049ms
competitor@competitor:~$ ping 192.168.1.1
PING 192.168.1.1 (192.168.1.1) 56(84) bytes of data:
^C
--- 192.168.1.1 ping statistics ---
0 packets transmitted, 0 received, 100% packet loss, time 2025ms
competitor@competitor:~$ date
Thu 20 Mar 2025:04 GMT 2025
competitor@competitor:~$
```

Figure 23: Ping Debian server



```
competitor@competitor:~$ ping 1.1.1.1
PING 1.1.1.1 (1.1.1.1) 56(84) bytes of data:
64 bytes from 1.1.1.1: icmp_seq=1 ttl=50 time=9.75 ms
64 bytes from 1.1.1.1: icmp_seq=2 ttl=50 time=10.2 ms
64 bytes from 1.1.1.1: icmp_seq=3 ttl=50 time=10.1 ms
^C
--- 1.1.1.1 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2004ms
rtt min/avg/max/mdev = 9.748/10.007/10.198/0.190 ms
competitor@competitor:~$

competitor@competitor:~$ ping 10.1.1.1
PING 10.1.1.1 (10.1.1.1) 56(84) bytes of data:
64 bytes from 10.1.1.1: icmp_seq=1 ttl=64 time=0.278 ms
64 bytes from 10.1.1.1: icmp_seq=2 ttl=64 time=0.487 ms
64 bytes from 10.1.1.1: icmp_seq=3 ttl=64 time=0.343 ms
^C
--- 10.1.1.1 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2039ms
rtt min/avg/max/mdev = 0.278/0.369/0.487/0.087 ms
competitor@competitor:~$

competitor@competitor:~$ ping 210.103.5.2
PING 210.103.5.2 (210.103.5.2) 56(84) bytes of data:
^C
--- 210.103.5.2 ping statistics ---
0 packets transmitted, 0 received, 100% packet loss, time 2034ms
competitor@competitor:~$

competitor@competitor:~$ ping 210.103.5.1
PING 210.103.5.1 (210.103.5.1) 56(84) bytes of data:
^C
--- 210.103.5.1 ping statistics ---
0 packets transmitted, 0 received, 100% packet loss, time 1009ms
competitor@competitor:~$

competitor@competitor:~$ ping 192.168.1.10
PING 192.168.1.10 (192.168.1.10) 56(84) bytes of data:
^C
--- 192.168.1.10 ping statistics ---
0 packets transmitted, 0 received, 100% packet loss, time 2031ms
competitor@competitor:~$
```

Figure 24: Ping Debian client

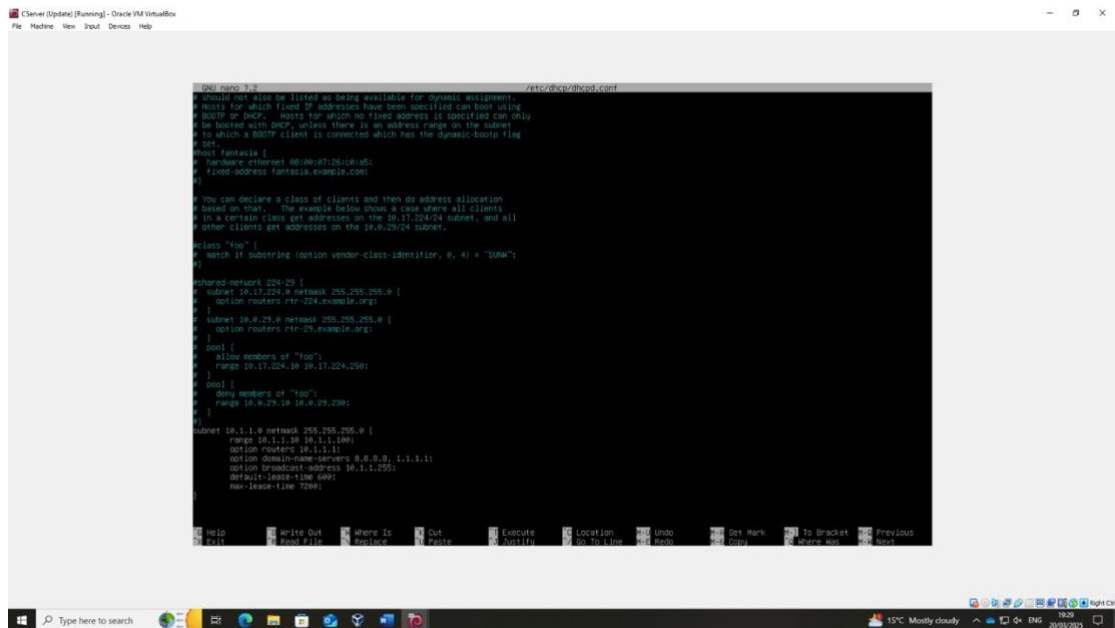


Figure 25: Installing DHCP

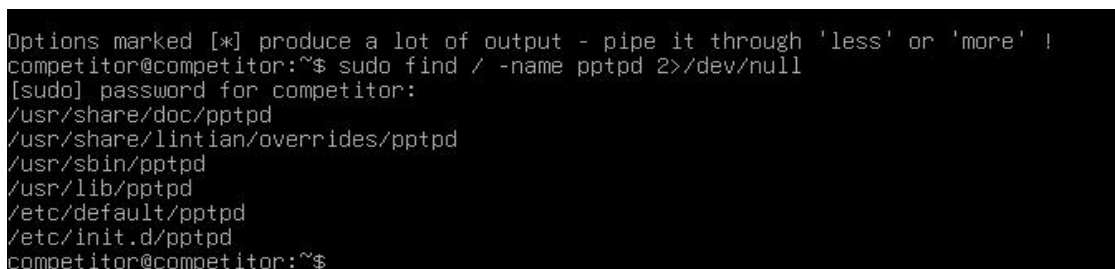


Figure 26: Installing VPN

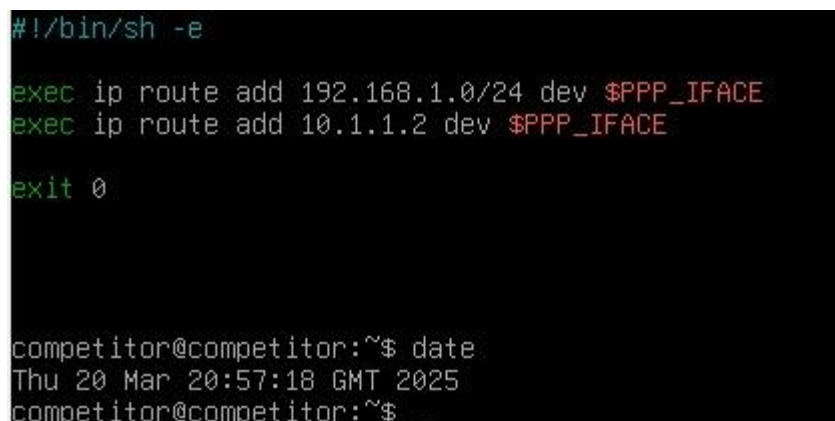


Figure 27: Static route

```
#remoteip 192.168.1.234-238,192.168.1.245
localip 10.1.1.1
remoteip 10.1.1.2-3

competitor@competitor:~$ date
Thu 20 Mar 20:56:25 GMT 2025
competitor@competitor:~$
```

Figure 28: VPN Point-to-Point Tunelling Protocol

```
competitor@competitor:~$ sudo sysctl -p
net.ipv4.conf.all.proxy_arp = 1
net.ipv4.ip_forward = 1
competitor@competitor:~$ date
Thu 20 Mar 20:54:23 GMT 2025
competitor@competitor:~$
```

Figure 29: IP forward and arp proxy

```
GNU nano 7.2
# Secrets for authentication using CHAP
# client      server  secret          IP addresses
Cardiff * rim *
```

Figure 30: CHAP secrets

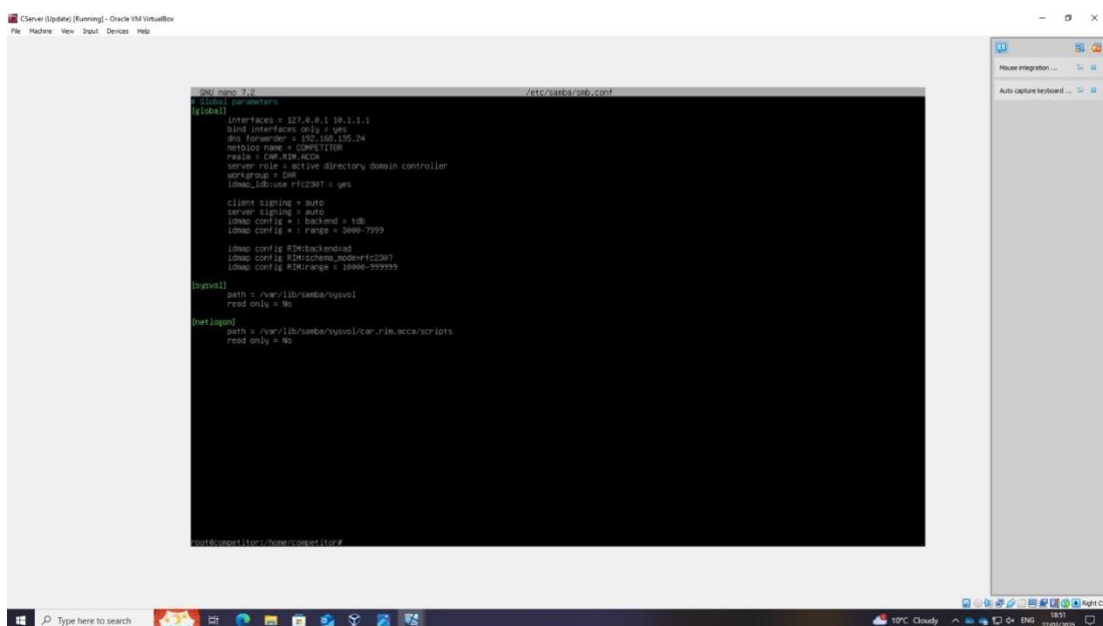


Figure 31: Debian settings

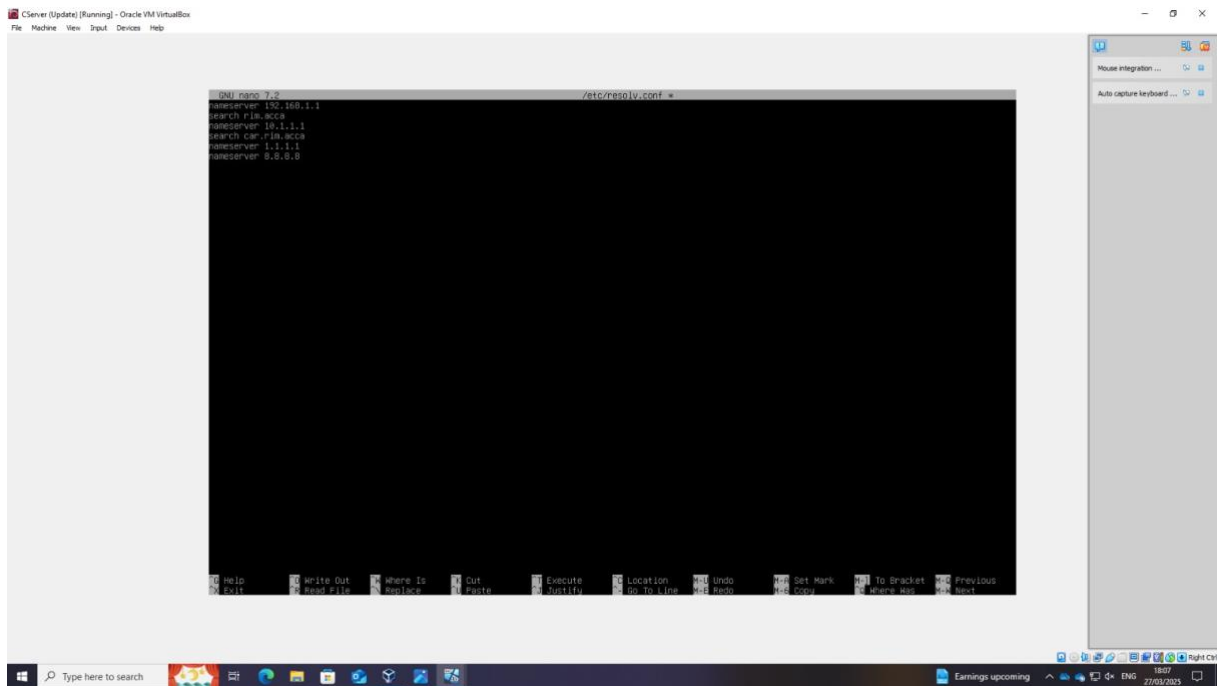


Figure 32: Resolve.conf

```

samba-tool domain passwordsettings set: error: ambiguous option: --min-pwd (--min-pwd-age, --min-pwd-length?)
root@competitor:/home/competitor# samba-tool domain passwordsettings set --min-pwd-length=0
Minimum password length changed!
All changes applied successfully!
root@competitor:/home/competitor# samba-tool domain passwordsettings set --complexity=off
Password complexity deactivated!
All changes applied successfully!
root@competitor:/home/competitor# samba-tool user create r.almutwaly 'rim' --given-name='Rim' --surname='Al Mutwaly'
User 'r.almutwaly' added successfully
root@competitor:/home/competitor# date
Thu 3 Apr 20:59:30 BST 2025
root@competitor:/home/competitor#

```

Figure 33: Cardiff user creation

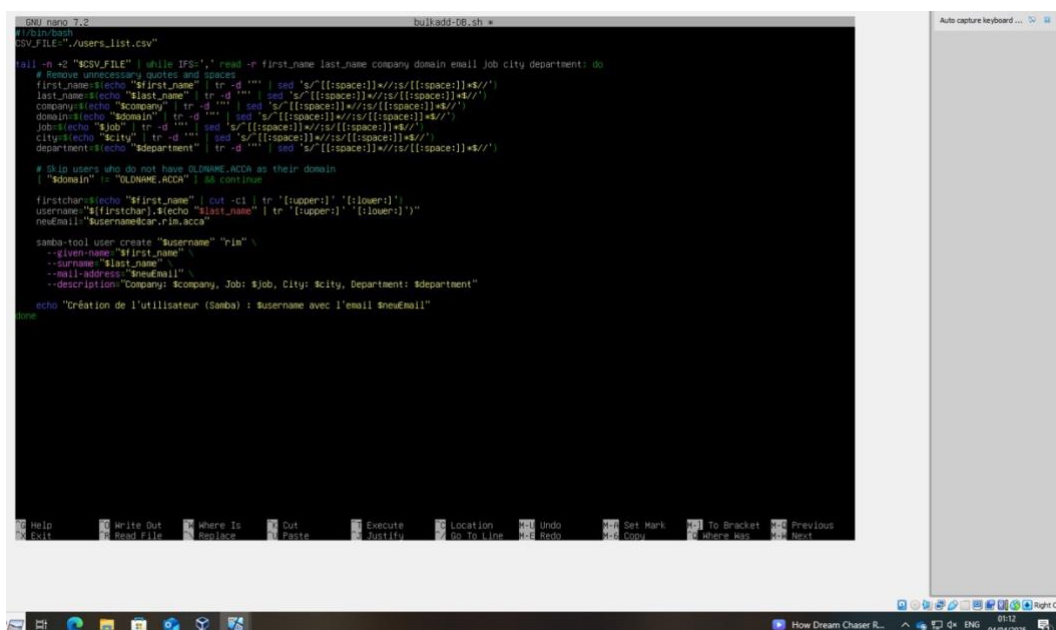


Figure 34: User script

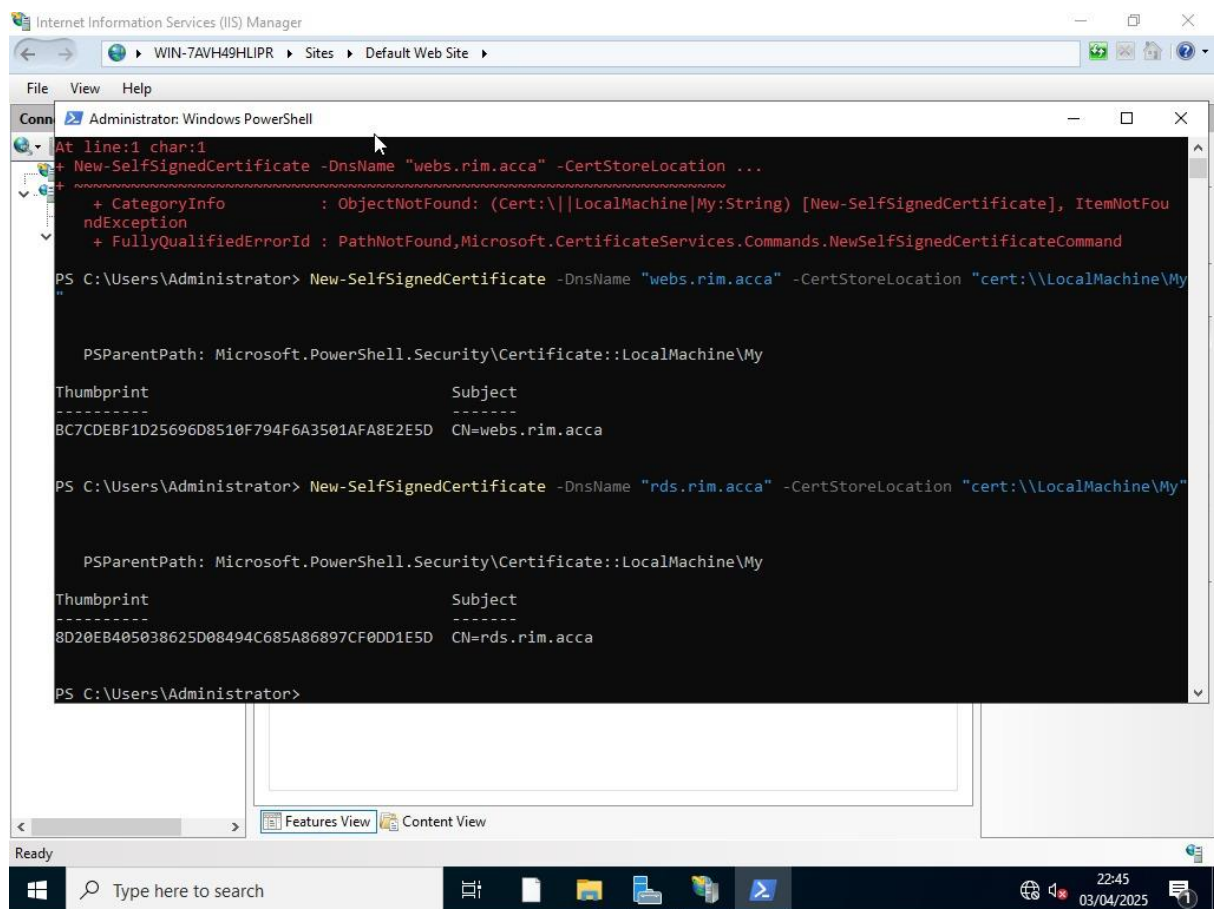


Figure 35: Certificate for rds

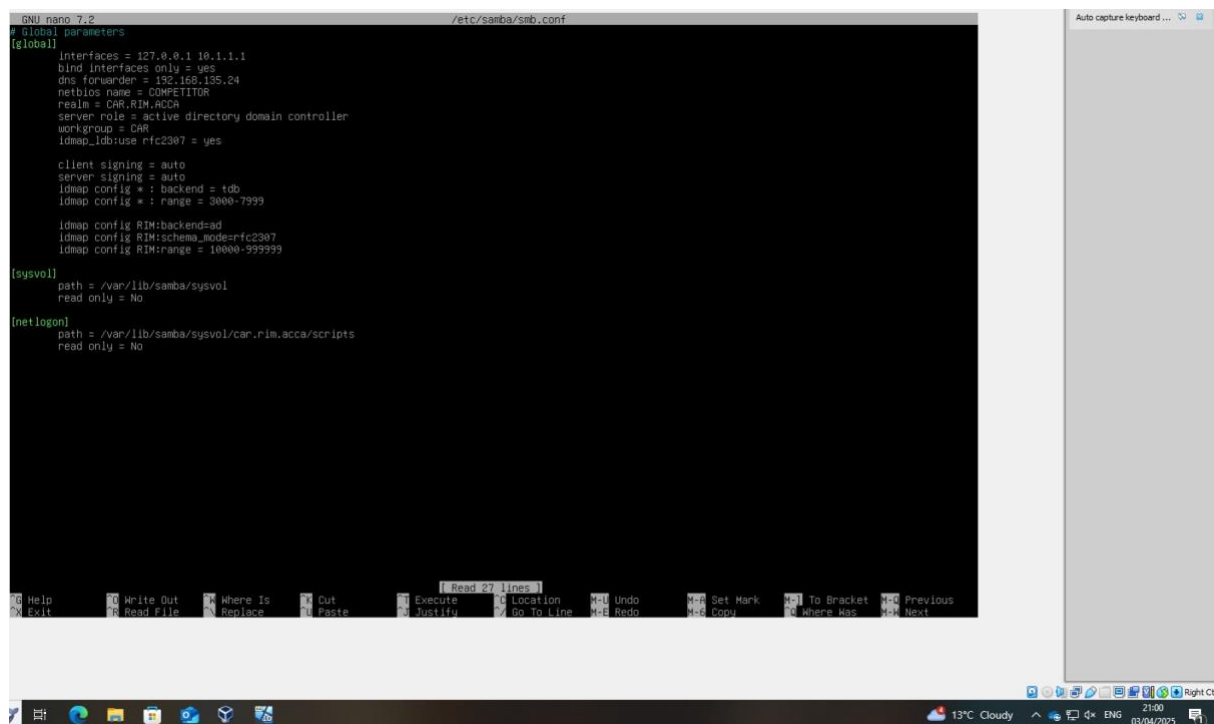


Figure 36: Active Directory configuration

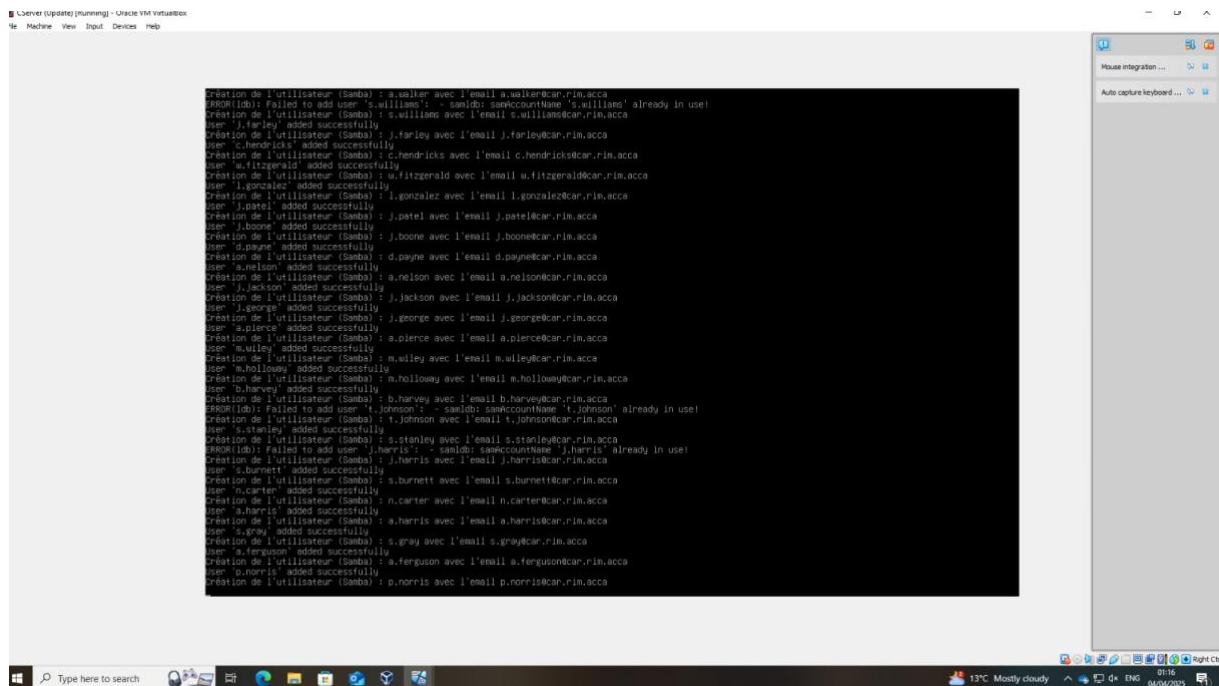


Figure 37: Creating users

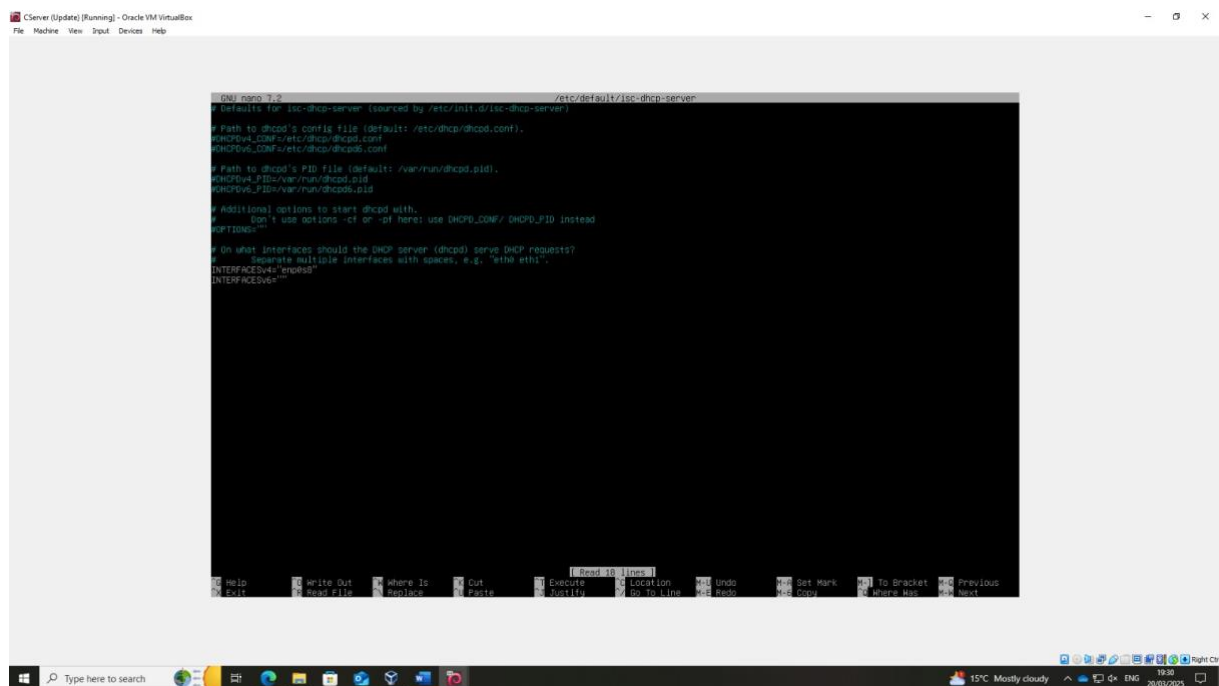
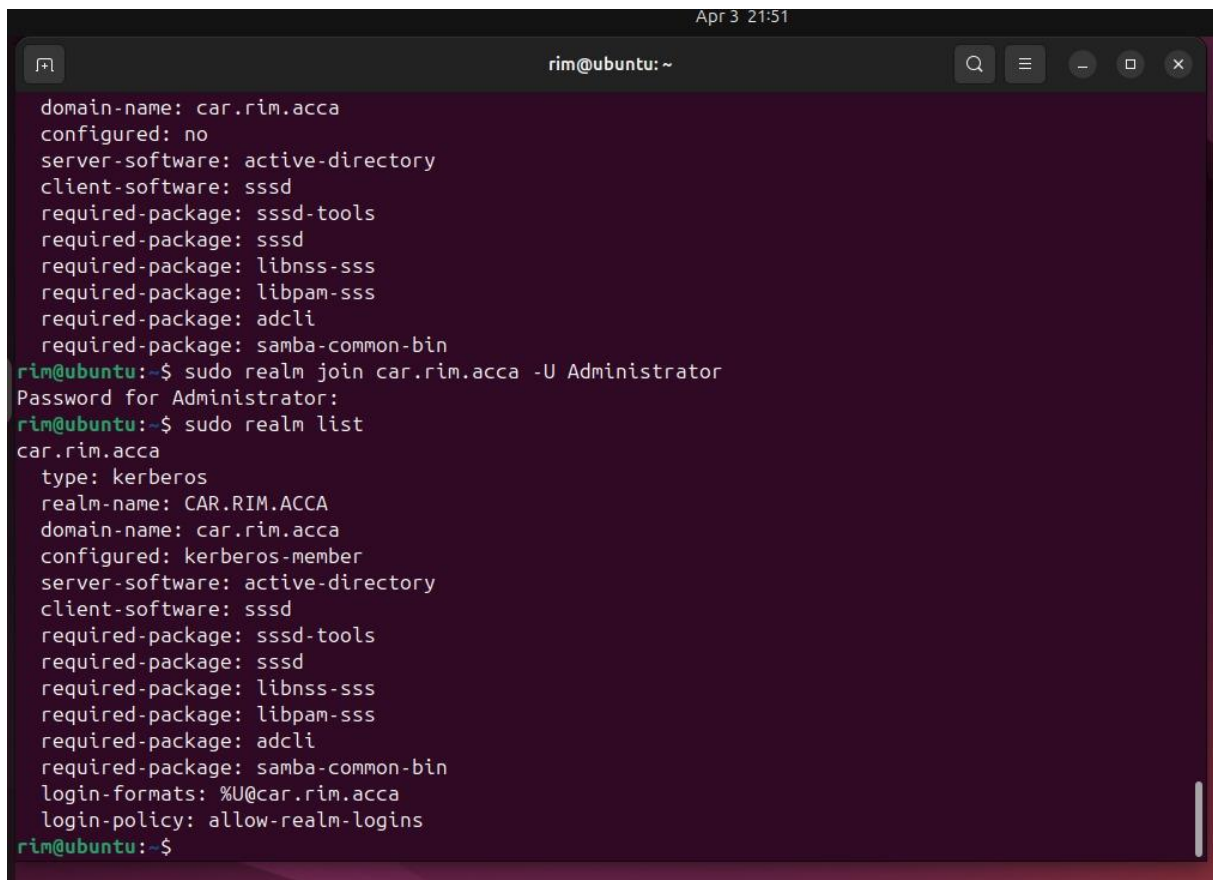


Figure 38: Debian interfaces

In Ubuntu :



```

Apr 3 21:51
rim@ubuntu: ~
domain-name: car.rim.acca
configured: no
server-software: active-directory
client-software: sssd
required-package: sssd-tools
required-package: sssd
required-package: libnss-sss
required-package: libpam-sss
required-package: adcli
required-package: samba-common-bin
rim@ubuntu:~$ sudo realm join car.rim.acca -U Administrator
Password for Administrator:
rim@ubuntu:~$ sudo realm list
car.rim.acca
  type: kerberos
  realm-name: CAR.RIM.ACCA
  domain-name: car.rim.acca
  configured: kerberos-member
  server-software: active-directory
  client-software: sssd
  required-package: sssd-tools
  required-package: sssd
  required-package: libnss-sss
  required-package: libpam-sss
  required-package: adcli
  required-package: samba-common-bin
  login-formats: %U@car.rim.acca
  login-policy: allow-realm-logins
rim@ubuntu:~$
```

Figure 39: Joining Ubuntu to domain

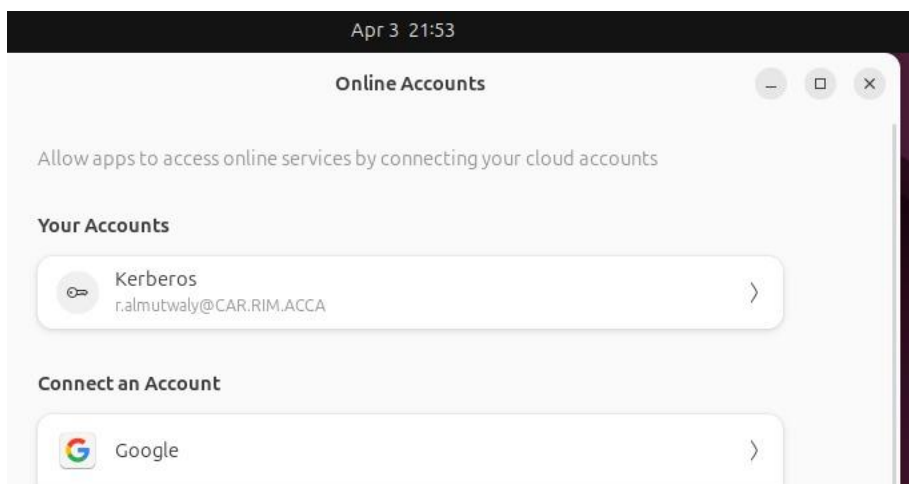


Figure 40: Success joining account