

CSP Project 1c Document

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Project Overview:

This project simulates a multi-VLAN enterprise network environment with routing, switching, firewalls, web/database services, and secure access. Each student is assigned a workstation (PC-PT) and a VM configured with a web server, database, and firewall. The core goal is to demonstrate network configuration, secure communications, and service integration across subnets using industry-standard tools.

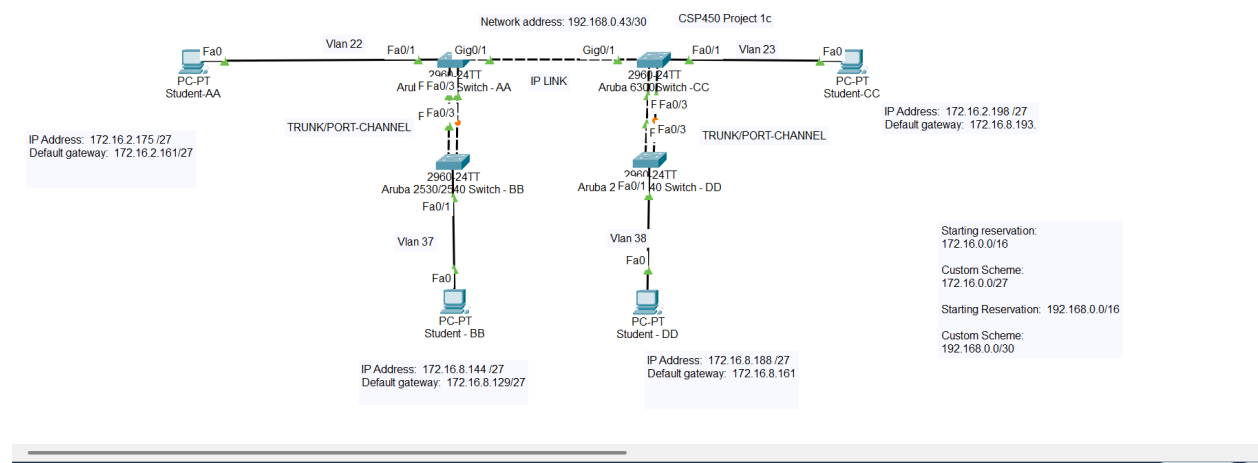
The topology includes:

- 4 students (AA, BB, CC, DD) connected via VLANs (AA, BB, CC, DD)
- Aruba managed switches interconnected via trunk/port-channel links
- Ubuntu VMs running services (Apache, MySQL, Ubuntu Firewall)
- Inter-switch routing via OSPF and a Layer 3 IP link

Project Expectations:

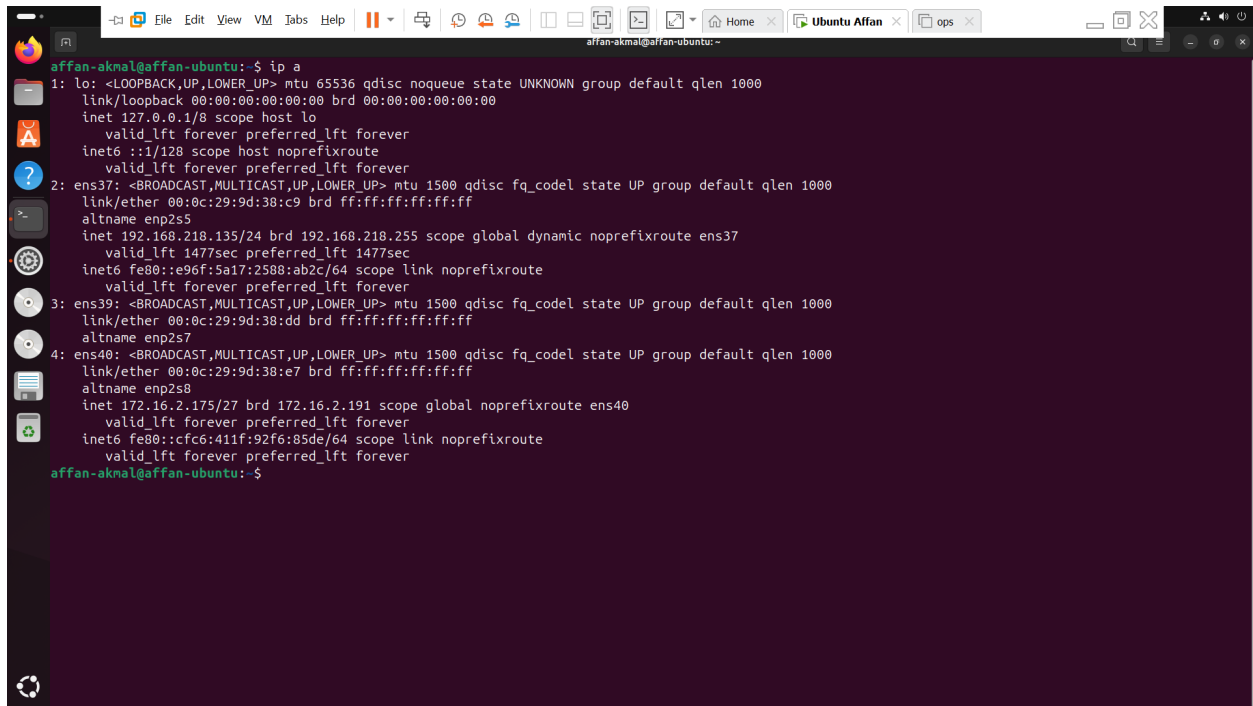
- **Configure VLANs, IPs, and OSPF** on switches with unique hostnames.
- **Set up Ubuntu VMs** with Apache, MariaDB, SSH, and ufw firewall.
- **Establish secure SSH access** to switches and peer VMs using key-pairs.
- **Test connectivity and services:** web (HTTP), database (MariaDB), and routing (OSPF).
- **Capture packets** for SSH, HTTP, MariaDB, and OSPF (2 packets each).
- **Submit outputs:** ip a, ip route, switch show commands, SSH results, and firewall scripts

Network Diagram



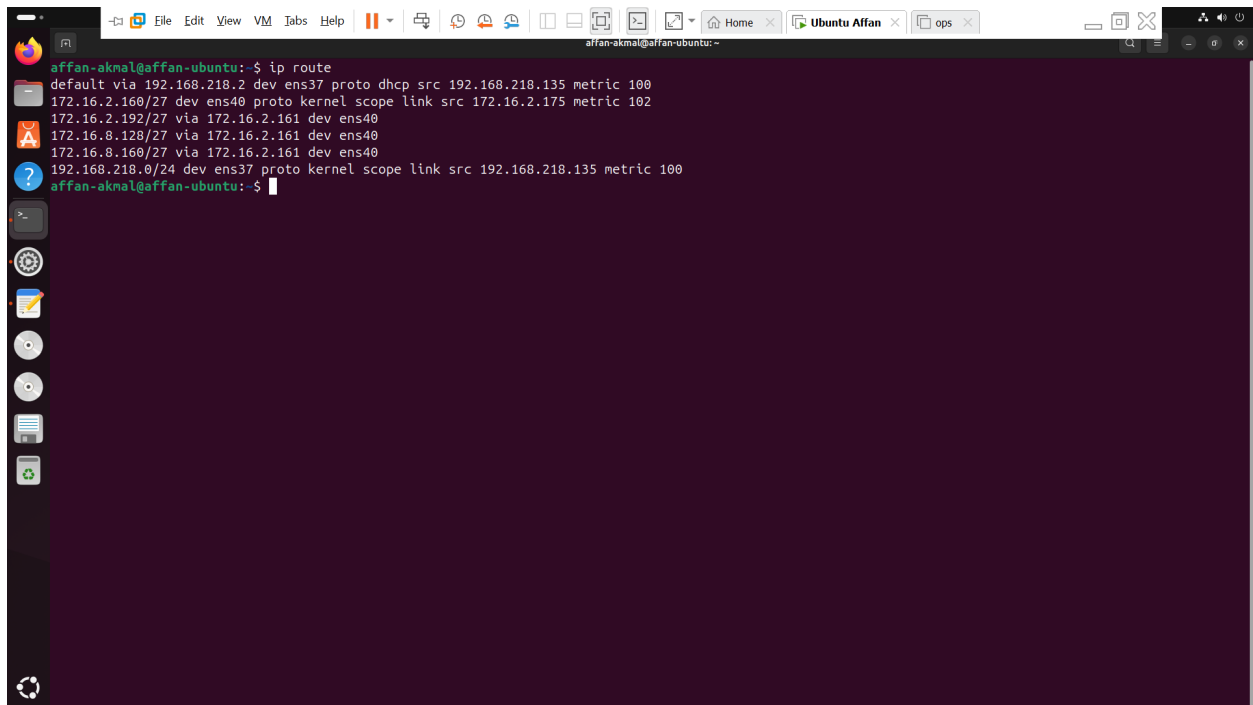
Appendix A From VM

ip a



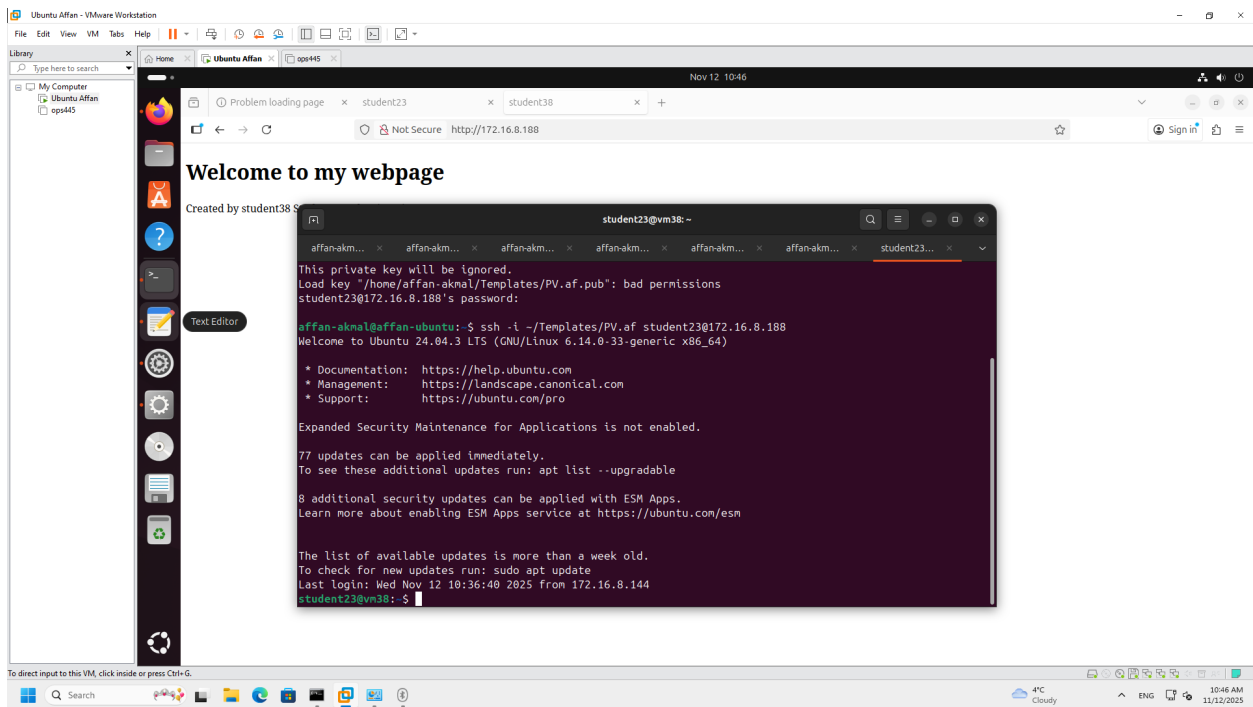
```
affan-akma@affan-ubuntu:~$ ip a
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default qlen 1000
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
    inet 127.0.0.1/8 scope host lo
        valid_lft forever preferred_lft forever
    inet6 ::1/128 scope host noprefixroute
        valid_lft forever preferred_lft forever
2: ens37: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP group default qlen 1000
    link/ether 00:0c:29:9d:38:c9 brd ff:ff:ff:ff:ff:ff
    altname enp2s5
    inet 192.168.218.135/24 brd 192.168.218.255 scope global dynamic noprefixroute ens37
        valid_lft 1477sec preferred_lft 1477sec
    inet6 fe80::e96f:5a17:2588:ab2c/64 scope link noprefixroute
        valid_lft forever preferred_lft forever
3: ens39: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP group default qlen 1000
    link/ether 00:0c:29:9d:38:dd brd ff:ff:ff:ff:ff:ff
    altname enp2s7
4: ens40: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP group default qlen 1000
    link/ether 00:0c:29:9d:38:e7 brd ff:ff:ff:ff:ff:ff
    altname enp2s8
    inet 172.16.2.175/27 brd 172.16.2.191 scope global noprefixroute ens40
        valid_lft forever preferred_lft forever
    inet6 fe80::cfc6:411f:92f6:85de/64 scope link noprefixroute
        valid_lft forever preferred_lft forever
affan-akma@affan-ubuntu:~$
```

ip route

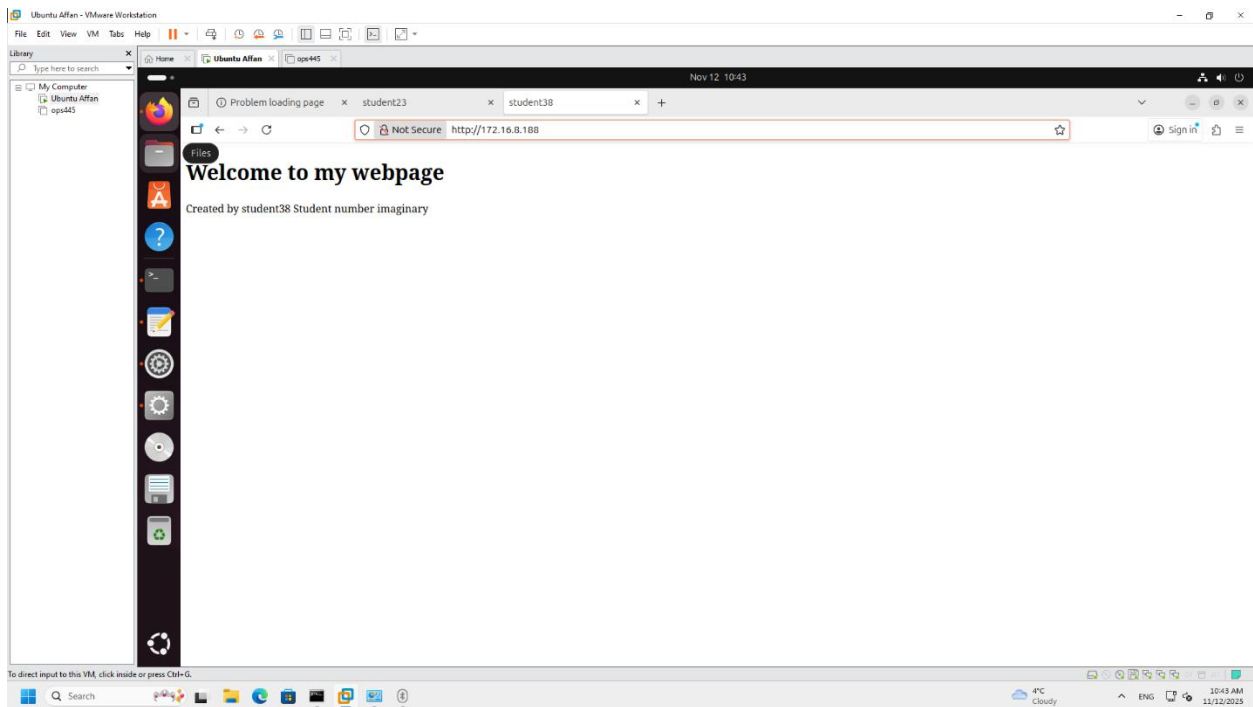


```
affan-akma@affan-ubuntu:~$ ip route
default via 192.168.218.2 dev ens37 proto dhcp src 192.168.218.135 metric 100
172.16.2.160/27 dev ens40 proto kernel scope link src 172.16.2.175 metric 102
172.16.2.192/27 via 172.16.2.161 dev ens40
172.16.8.128/27 via 172.16.2.161 dev ens40
172.16.8.160/27 via 172.16.2.161 dev ens40
192.168.218.0/24 dev ens37 proto kernel scope link src 192.168.218.135 metric 100
affan-akma@affan-ubuntu:~$
```

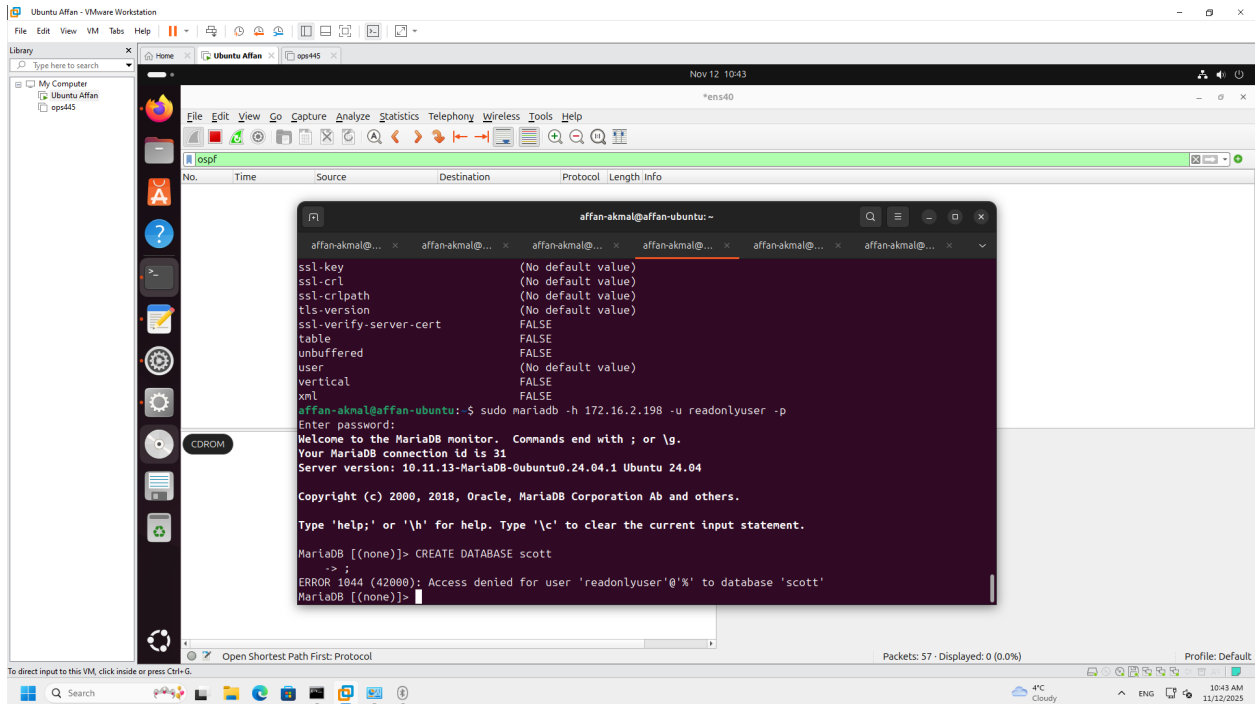
ssh to partner's VM



Partner's Webpage

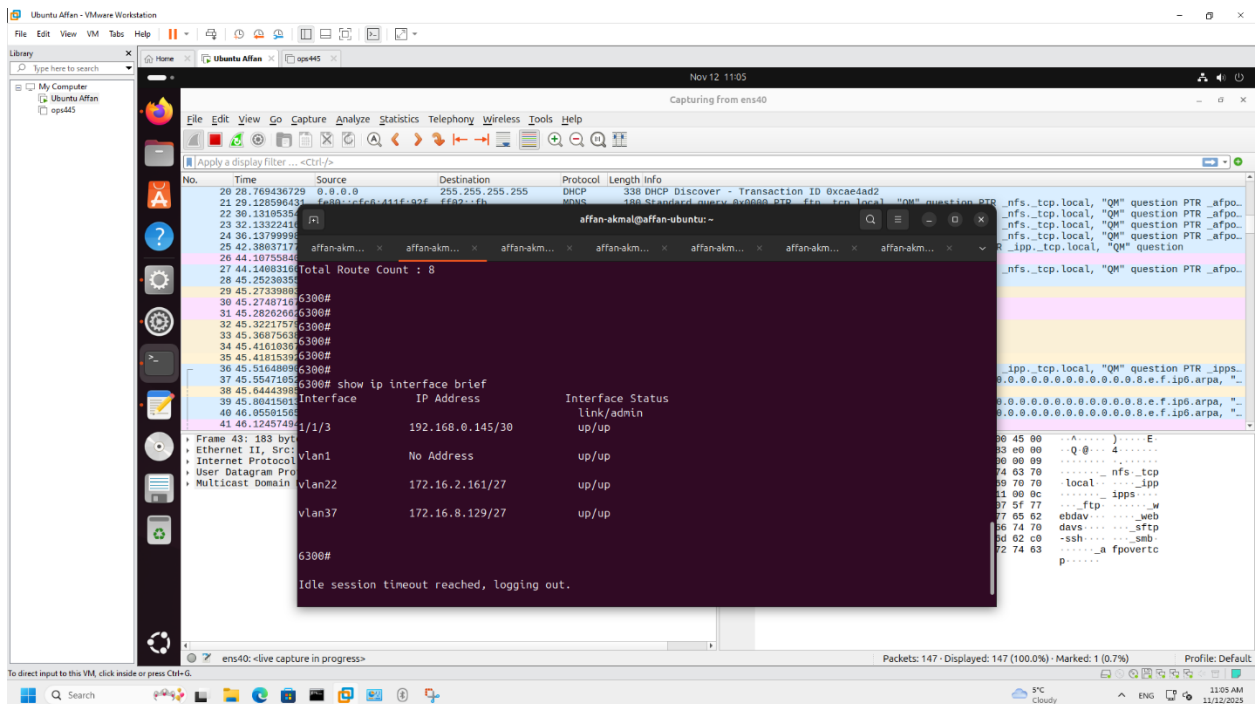


MariDB server

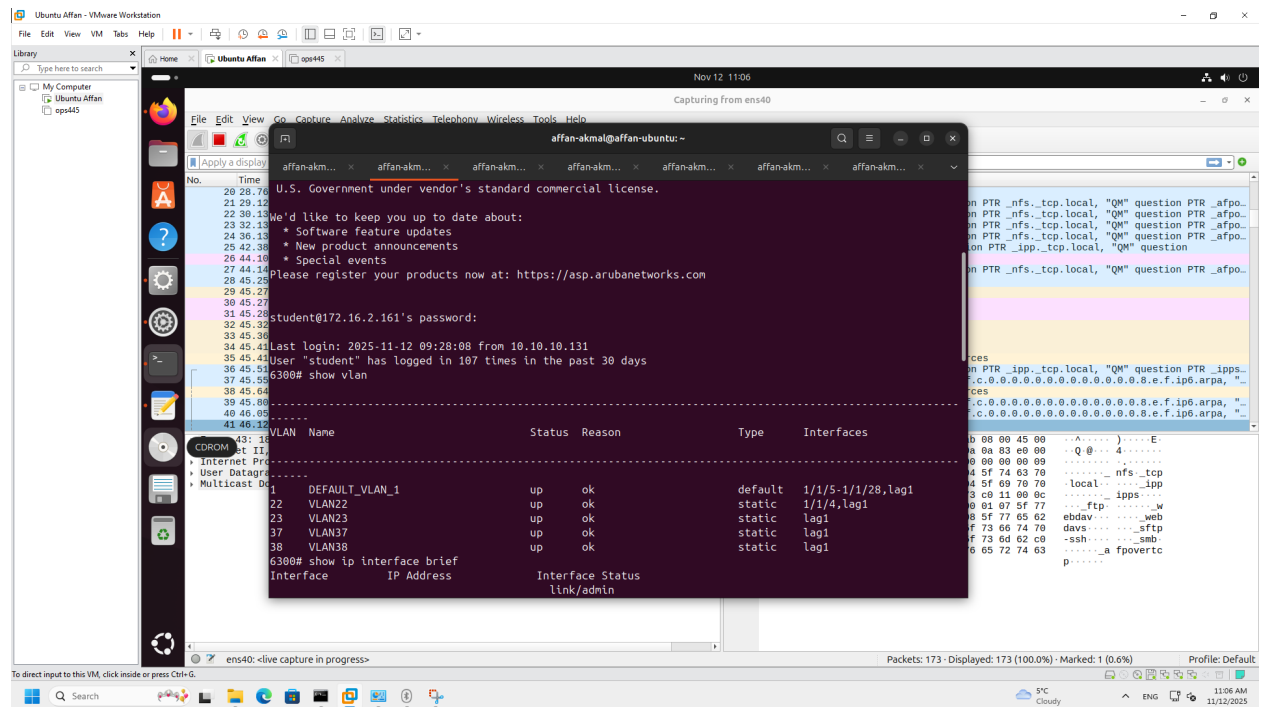


Appendix B Switch commands

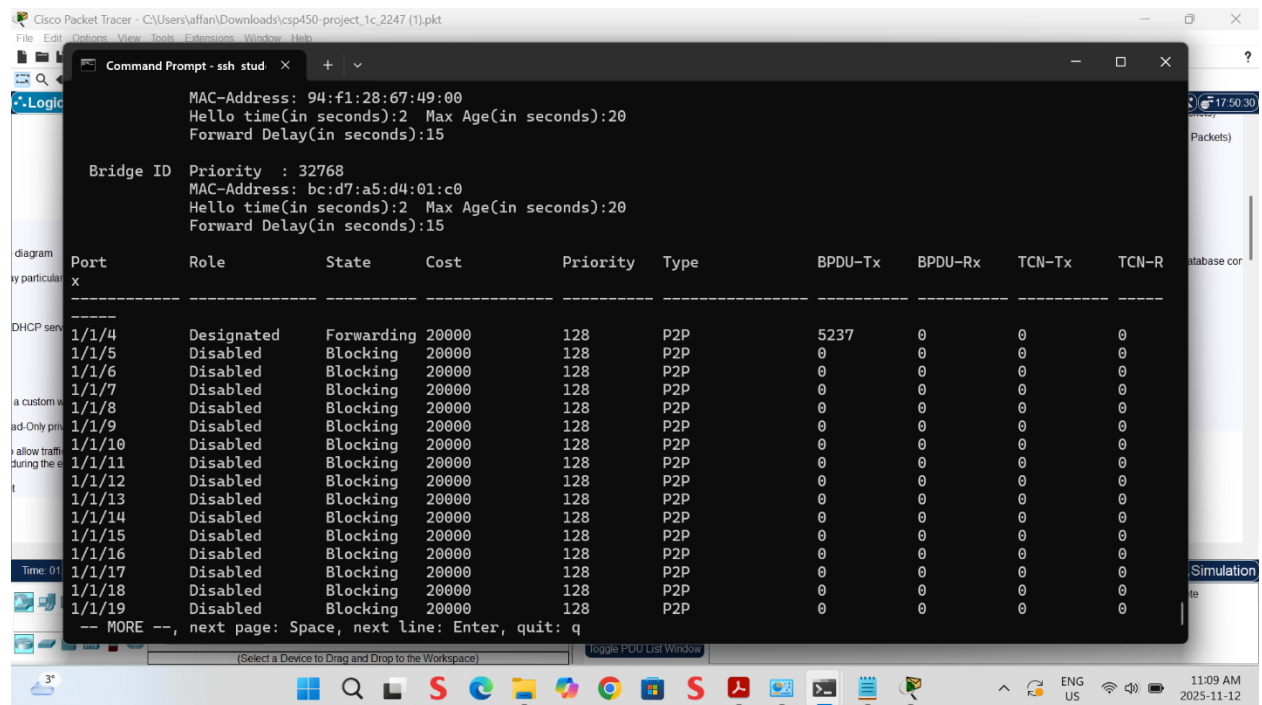
sh ip int br



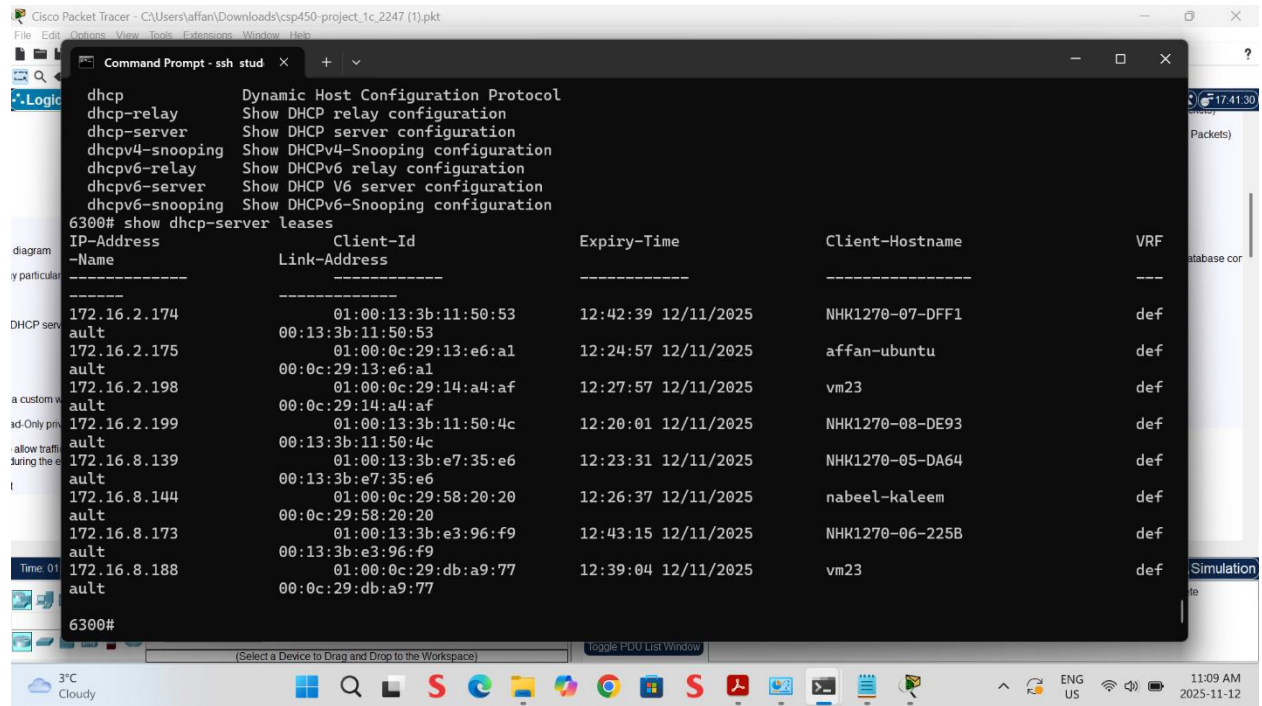
show vlan



sh spanning tree



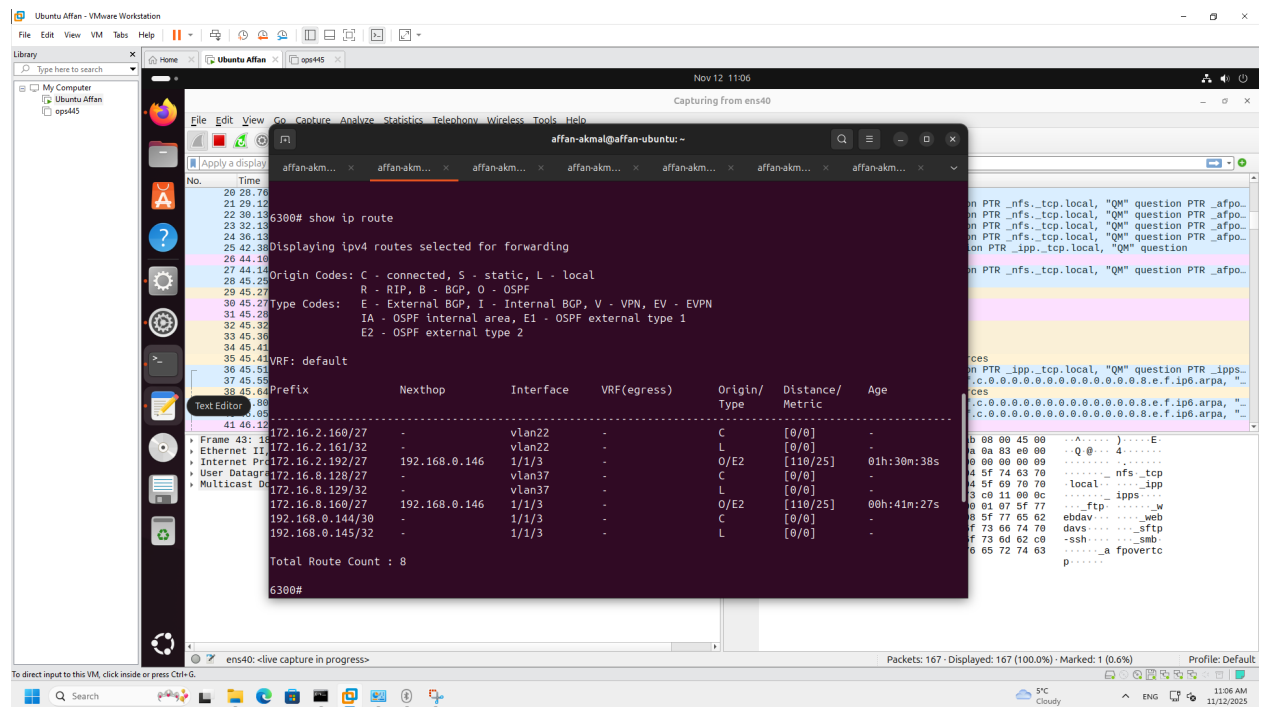
sh dhcp server lease



The screenshot shows a Cisco Packet Tracer interface with a terminal window open. The terminal displays the output of the command `show dhcp-server leases` on a device named 6300. The output is a table with columns: IP-Address, Client-Id, Expiry-Time, Client-Hostname, and VRF. The table lists several active leases for the 172.16.2.0/24 network.

IP-Address	Client-Id	Expiry-Time	Client-Hostname	VRF
172.16.2.174	01:00:13:3b:11:50:53	12:42:39 12/11/2025	NHK1270-07-DFF1	def
172.16.2.175	01:00:0c:29:13:e6:a1	12:24:57 12/11/2025	affan-ubuntu	def
172.16.2.198	01:00:0c:29:13:e6:a1	12:27:57 12/11/2025	vm23	def
172.16.2.199	01:00:13:3b:11:50:4c	12:20:01 12/11/2025	NHK1270-08-DE93	def
172.16.8.139	01:00:13:3b:e7:35:e6	12:23:31 12/11/2025	NHK1270-05-DA64	def
172.16.8.144	01:00:0c:29:58:20:20	12:26:37 12/11/2025	nabeel-kaleem	def
172.16.8.173	01:00:13:3b:e3:96:f9	12:43:15 12/11/2025	NHK1270-06-225B	def
172.16.8.188	01:00:0c:29:db:a9:77	12:39:04 12/11/2025	vm23	def

sh ip route



The screenshot shows a terminal window on a Linux system (Ubuntu) displaying the output of the command `show ip route`. The output shows the IPv4 routing table, including the default route and several static routes.

```
6300# show ip route
Displaying ipv4 routes selected for forwarding
Origin Codes: C - connected, S - static, L - local
R - RIP, B - BGP, O - OSPF
Type Codes: E - External BGP, I - Internal BGP, V - VPN, EV - EVPN
IA - OSPF internal area, E1 - OSPF external type 1
E2 - OSPF external type 2

VRF: default
Prefix          NextHop        Interface      VRF(egress)    Origin/Type    Distance/Metric    Age
-----
172.16.2.168/27 -            vlan22         -               C               [0/0]          -
172.16.2.161/32 -            vlan22         -               L               [0/0]          -
172.16.2.192/27 192.168.0.146 1/1/3          -               O/E2           [110/25]         01h:30m:38s
172.16.8.128/27 -            vlan37         -               C               [0/0]          -
172.16.8.129/32 -            vlan37         -               L               [0/0]          -
172.16.8.168/27 192.168.0.146 1/1/3          -               O/E2           [110/25]         00h:41m:27s
192.168.0.144/30 -            1/1/3          -               C               [0/0]          -
192.168.0.145/32 -            1/1/3          -               L               [0/0]          -

Total Route Count : 8
6300#
```

Appendix C Scripts

Switch AA

config t

interface lag 1

no shutdown

no routing

vlan trunk native 1

vlan trunk allowed all

lACP mode active

lACP rate fast

vlan 22-23,37-38

router ospf 1

router-id 1.1.1.1

redistribute connected

area 0.0.0.0

interface 1/1/1

no shutdown

no routing

lag 1

interface 1/1/2

no shutdown

no routing

lag 1

interface 1/1/3

no shutdown

routing

ip address 192.168.0.145/30

ip ospf 1 area 0.0.0.0

ip ospf network point-to-point

interface 1/1/4

no shutdown

no routing

vlan access 22

interface vlan 22

ip address 172.16.2.161/27

ip ospf 1 area 0.0.0.0

interface vlan 37

ip address 172.16.8.129/27

ip ospf 1 area 0.0.0.0

dhcp-server vrf default

pool vlan22

range 172.16.2.162 172.16.2.190 prefix-len 27

default-router 172.16.2.161

```
dns-server 8.8.8.8
```

```
exit
```

```
pool vlan23
```

```
range 172.16.2.194 172.16.2.222 prefix-len 27
```

```
default-router 172.16.2.193
```

```
dns-server 8.8.8.8
```

```
exit
```

```
pool vlan37
```

```
range 172.16.8.130 172.16.8.158 prefix-len 27
```

```
default-router 172.16.8.129
```

```
dns-server 8.8.8.8
```

```
exit
```

```
pool vlan38
```

```
range 172.16.8.162 172.16.8.190 prefix-len 27
```

```
default-router 172.16.8.161
```

```
dns-server 8.8.8.8
```

```
exit
```

```
enable
```

Switch BB

```
config t
```

```
spanning-tree
```

```
trunk 1-2 trk1 lacp
```

! To configure vlan 37, assign it to port 4 and send traffic to native vlan1 via lacp

```
vlan 37
```

```
name "VLAN37"
```

```
untagged 4
tagged trk1
no ip address
exit
```

Switch CC

```
config t
interface lag 1
    no shutdown
    no routing
    vlan trunk native 1
    vlan trunk allowed all
    lacp mode active
    lacp rate fast
vlan 1,23,38
```

```
router ospf 1
    router-id 2.2.2.2
    redistribute connected
    area 0.0.0.0
interface 1/1/1
    no shutdown
    no routing
    lag 1
```

```
interface 1/1/2
```

no shutdown

no routing

lag 1

interface 1/1/3

no shutdown

routing

ip address 192.168.0.146/30

ip ospf 1 area 0.0.0.0

ip ospf network point-to-point

interface 1/1/4

no shutdown

no routing

vlan access 23

interface vlan 38

ip address 172.16.8.161/27

ip helper-address 192.168.0.145

interface vlan 23

ip address 172.16.2.193/27

ip helper-address 192.168.0.145

Switch DD

config t

spanning-tree

trunk 1-2 trk1 lacp

! To configure vlan 38, assign it to port 4 and send traffic to native vlan1 via lacp

vlan 38

name "VLAN38"

untagged 4

tagged trk1

no ip address

exit