

# 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.

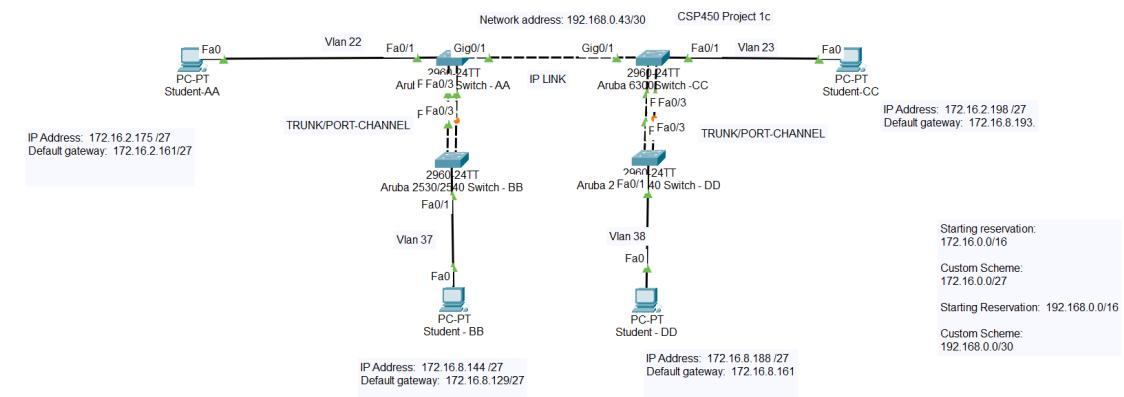
The topology includes:

- 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:

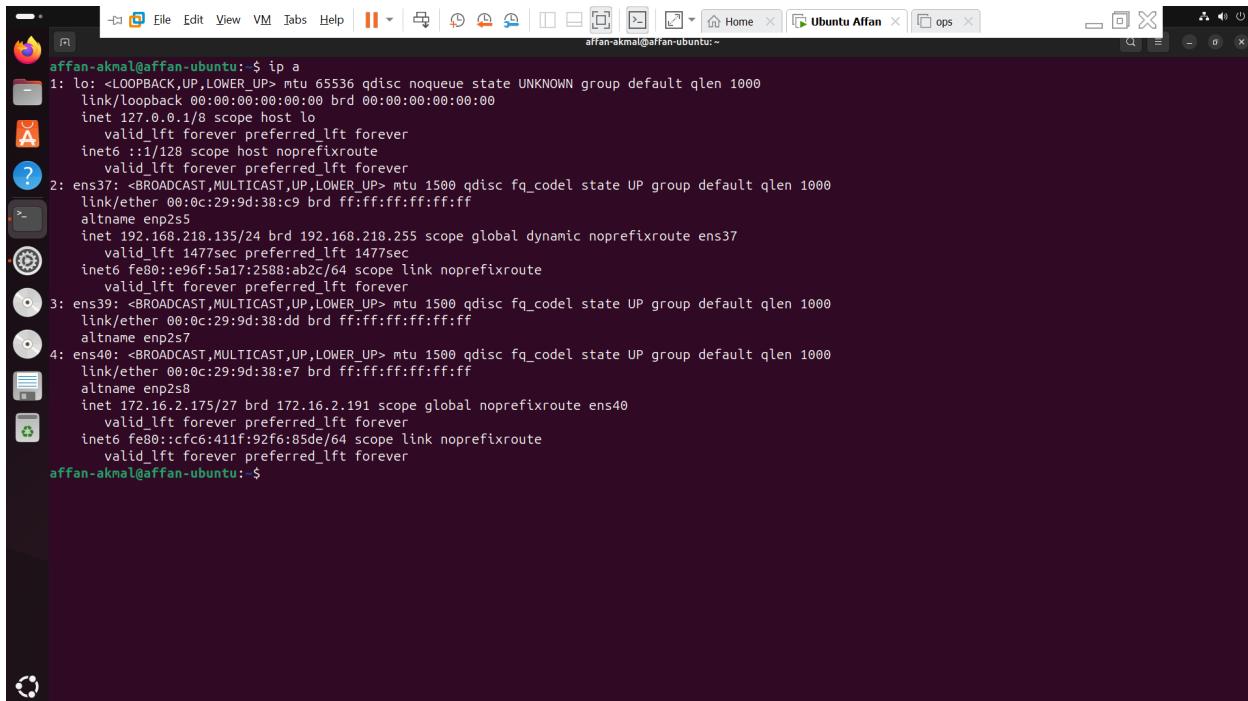
- **Configure VLANs, IPs, and OSPF** on switches with unique hostnames.
- **Set up Ubuntu VMs** with Apache, MariaDB, SSH, and ufw firewall.
- **Establish secure SSH access** to switches and peer VMs using key-pairs.
- **Test connectivity and services**: web (HTTP), database (MariaDB), and routing (OSPF).
- **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



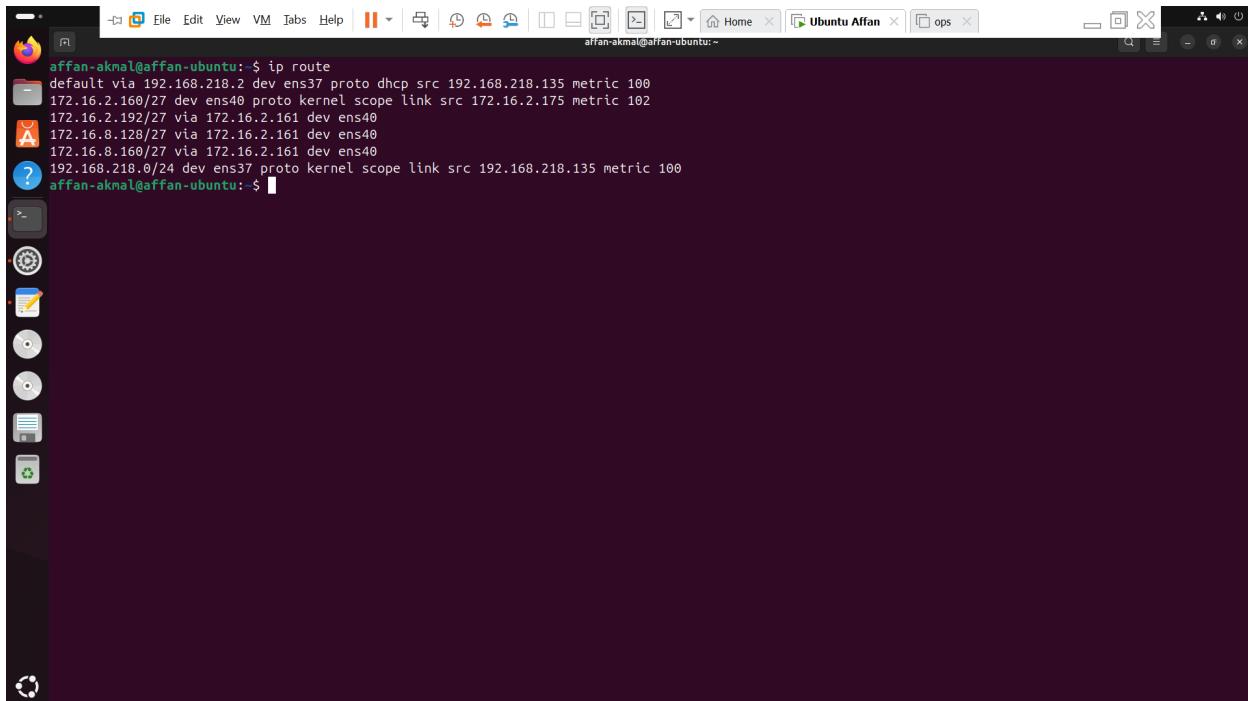
## Appendix A From VM

ip a



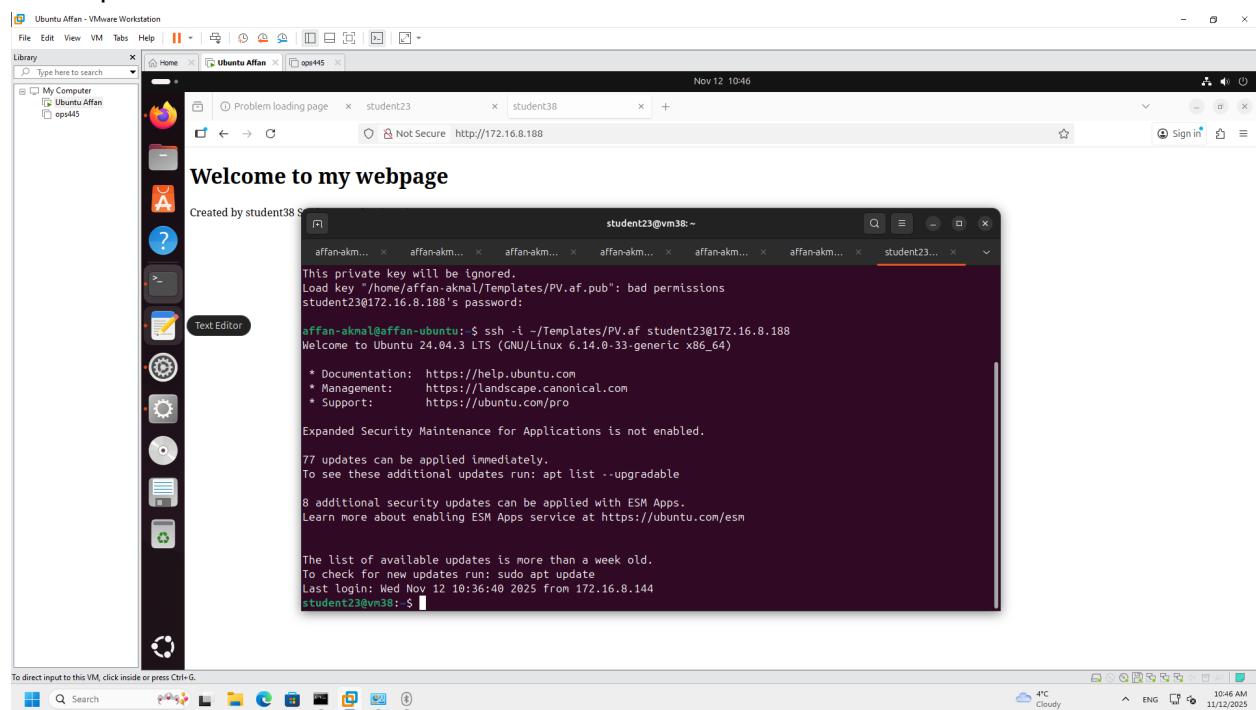
```
affan-akmal@affan-ubuntu: $ ip a
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default qlen 1000
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
        inet 127.0.0.1/8 scope host lo
            valid_lft forever preferred_lft forever
            inet6 ::1/128 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-akmal@affan-ubuntu: $
```

ip route

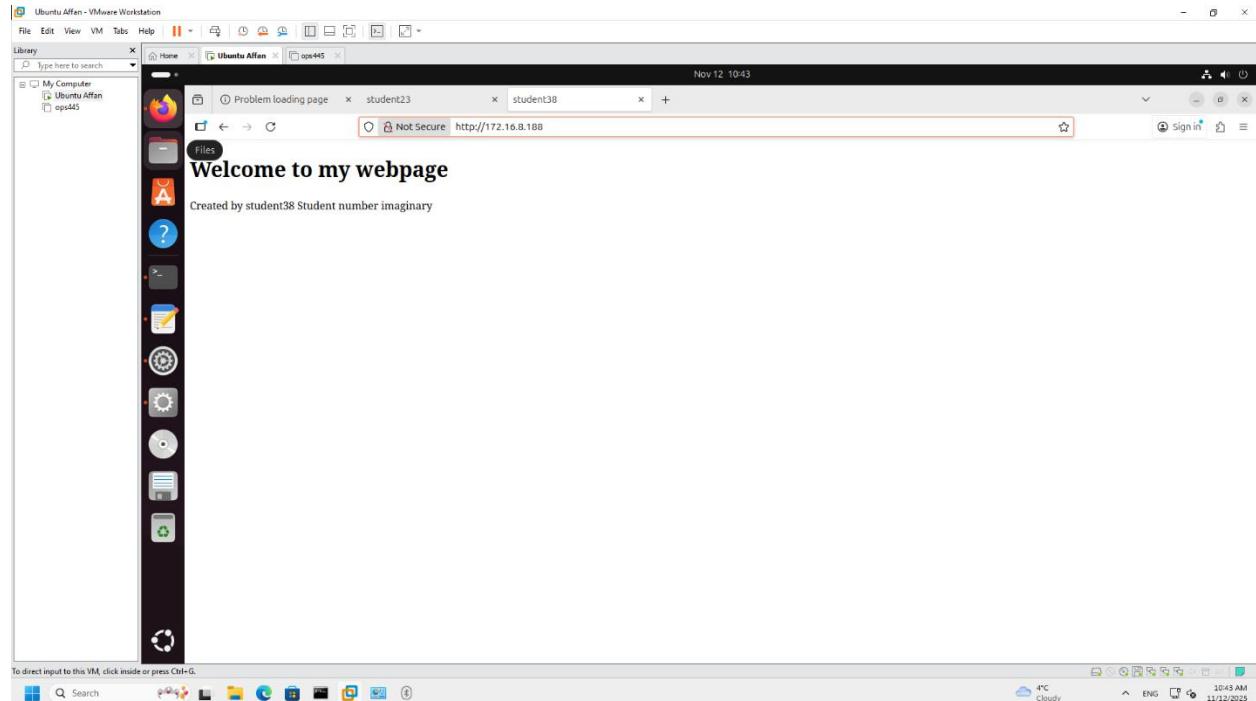


```
affan-akmal@affan-ubuntu: $ ip route
default via 192.168.218.2 dev ens37 proto dhcp src 192.168.218.135 metric 100
    172.16.2.160/27 dev ens40 proto kernel scope link src 172.16.2.175 metric 102
    172.16.2.192/27 via 172.16.2.161 dev ens40
    172.16.8.128/27 via 172.16.2.161 dev ens40
    172.16.8.160/27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

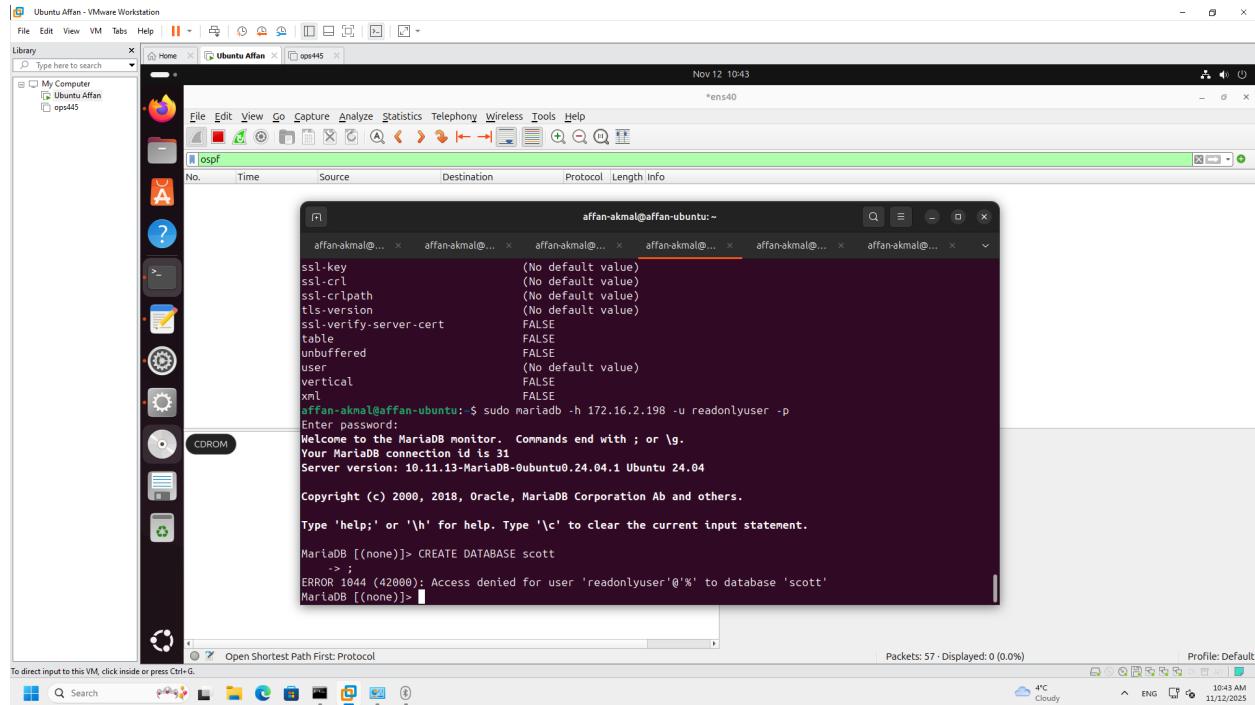
## ssh to partner's VM



## Partner's Webpage

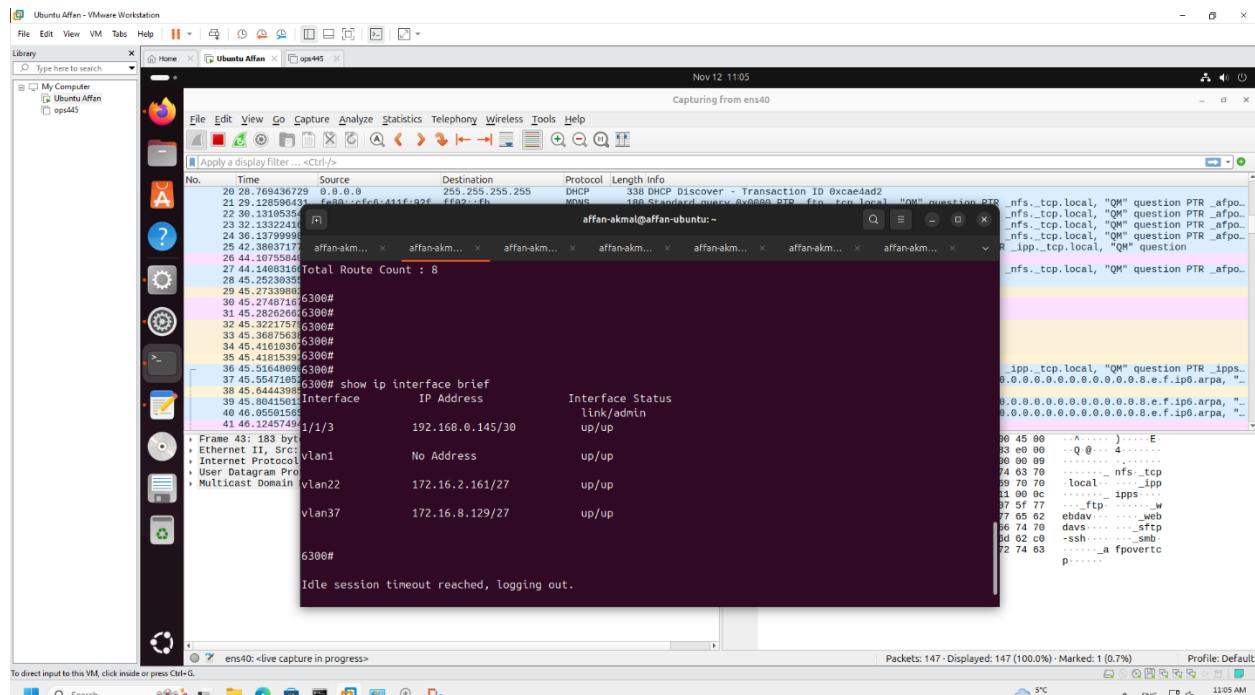


## MariDB server



## Appendix B Switch commands

sh ip int br



## show vlan

```

affan-akmal@affan-ubuntu:~$ show vlan
Time: 20 28 76
21 29 13 We'd like to keep you up to date about:
22 30 13 * Software feature updates
23 32 13 * New product announcements
24 36 13 * Special events
25 40 13
26 44 14 Please register your products now at: https://asp.arubanetworks.com
27 45 27
28 45 27
29 45 27
30 45 27
31 45 27
32 45 32 student@172.16.2.161's password:
33 45 36
34 45 41 Last login: 2025-11-12 09:28:08 from 10.10.10.131
35 45 41 User "student" has logged in 107 times in the past 30 days
36 45 51 6300# show vlan
37 45 51
38 45 54
39 45 56
40 45 58
41 46 12
CDROM 43: 18 VLAN Name Status Reason Type Interfaces
-----+
1 DEFAULT_VLAN_1 up ok default 1/1/5-1/1/28,lag1
22 VLAN22 up ok static 1/1/4,lag1
23 VLAN23 up ok static lag1
37 VLAN37 up ok static lag1
38 VLAN38 up ok static lag1
6300# show ip interface brief
Interface IP Address Interface Status link/admin

```

## sh spanning tree

```

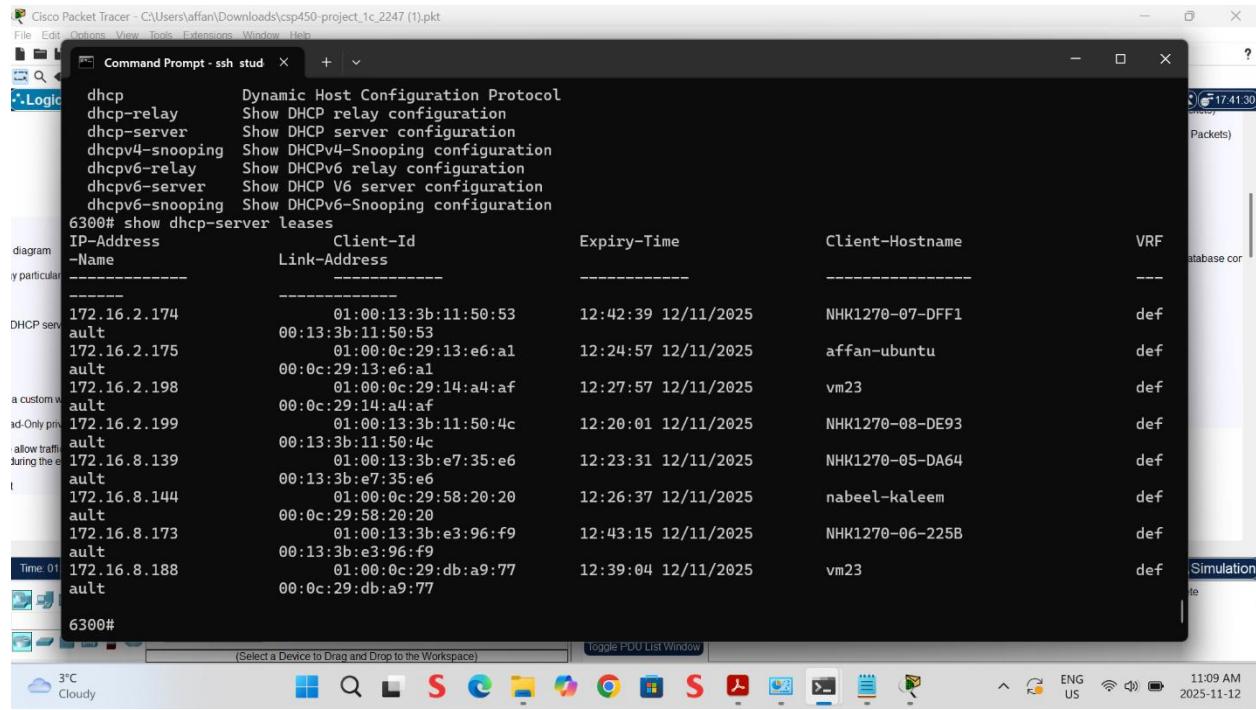
MAC-Address: 94:f1:28:67:49:00
Hello time(in seconds):2 Max Age(in seconds):20
Forward Delay(in seconds):15

Bridge ID Priority : 32768
MAC-Address: bc:d7:a5:d4:01:c0
Hello time(in seconds):2 Max Age(in seconds):20
Forward Delay(in seconds):15

Port      Role     State    Cost   Priority  Type    BPDU-Tx  BPDU-Rx  TCN-Tx  TCN-R
-----+
1/1/4    Designated Forwarding 20000 128    P2P    5237    0        0        0
1/1/5    Disabled   Blocking 20000 128    P2P    0        0        0        0
1/1/6    Disabled   Blocking 20000 128    P2P    0        0        0        0
1/1/7    Disabled   Blocking 20000 128    P2P    0        0        0        0
1/1/8    Disabled   Blocking 20000 128    P2P    0        0        0        0
1/1/9    Disabled   Blocking 20000 128    P2P    0        0        0        0
1/1/10   Disabled   Blocking 20000 128    P2P    0        0        0        0
1/1/11   Disabled   Blocking 20000 128    P2P    0        0        0        0
1/1/12   Disabled   Blocking 20000 128    P2P    0        0        0        0
1/1/13   Disabled   Blocking 20000 128    P2P    0        0        0        0
1/1/14   Disabled   Blocking 20000 128    P2P    0        0        0        0
1/1/15   Disabled   Blocking 20000 128    P2P    0        0        0        0
1/1/16   Disabled   Blocking 20000 128    P2P    0        0        0        0
1/1/17   Disabled   Blocking 20000 128    P2P    0        0        0        0
1/1/18   Disabled   Blocking 20000 128    P2P    0        0        0        0
1/1/19   Disabled   Blocking 20000 128    P2P    0        0        0        0
-- MORE --, next page: Space, next line: Enter, quit: q

```

## sh dhcp server lease

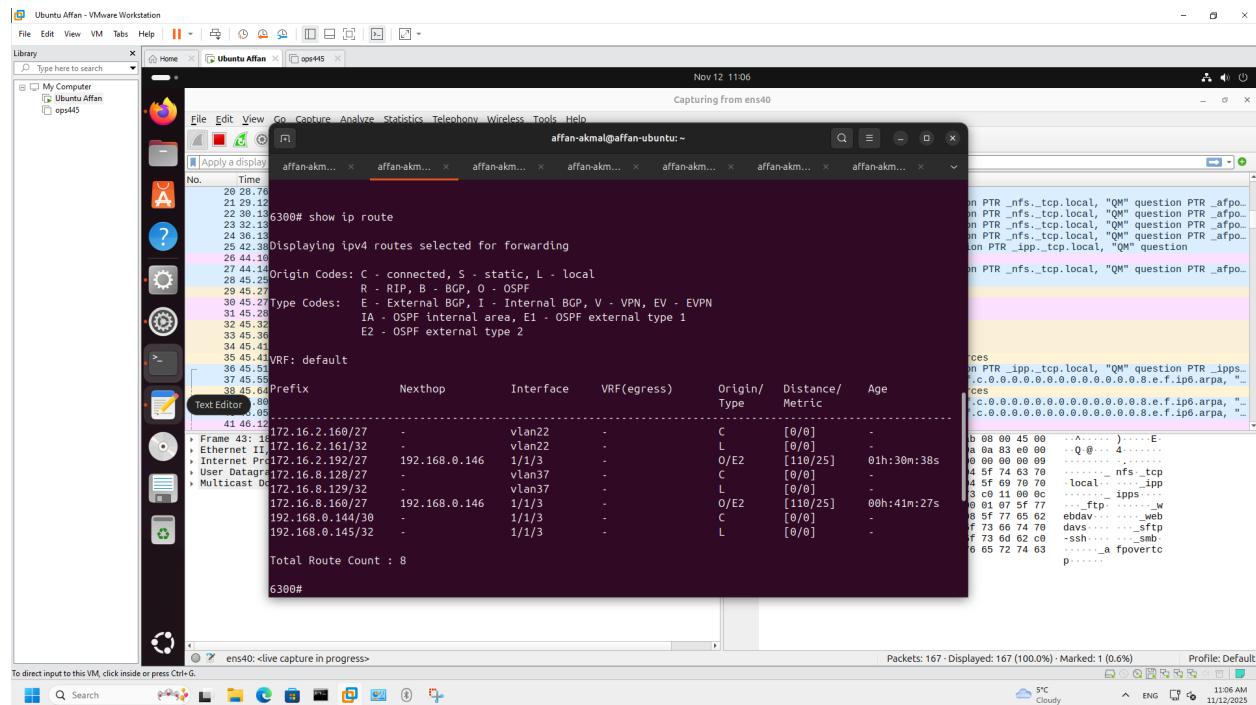


```
Dhcp          Dynamic Host Configuration Protocol
dhcp-relay   Show DHCP relay configuration
dhcp-server  Show DHCP server configuration
dhcpv4-snooping Show DHCPv4-Snooping configuration
dhcpv6-relay  Show DHCPv6 relay configuration
dhcpv6-server Show DHCP V6 server configuration
dhcpv6-snooping Show DHCPv6-Snooping configuration

6300# show dhcp-server leases

IP-Address      Client-Id           Expiry-Time        Client-Hostname      VRF
--Name           Link-Address       -----              -----              -----
----             -----              -----              -----              ----
172.16.2.174    01:00:13:3b:11:50:53 12:42:39 12/11/2025  NHK1270-07-DFF1  def
ault
172.16.2.175    00:13:3b:11:50:53  01:00:0c:29:13:e6:a1 12:24:57 12/11/2025  affan-ubuntu  def
ault
172.16.2.198    00:0c:29:13:e6:a1  01:00:0c:29:14:a4:af 12:27:57 12/11/2025  vm23        def
ault
172.16.2.199    00:0c:29:14:a4:af  01:00:13:3b:11:50:4c 12:20:01 12/11/2025  NHK1270-08-DE93  def
ault
172.16.8.139    00:13:3b:11:50:4c  01:00:13:3b:e7:35:e6 12:23:31 12/11/2025  NHK1270-05-DA64  def
ault
172.16.8.144    00:13:3b:e7:35:e6  01:00:0c:29:58:20:20 12:26:37 12/11/2025  nabeel-kaleem  def
ault
172.16.8.173    00:0c:29:58:20:20  01:00:13:3b:e3:96:f9 12:43:15 12/11/2025  NHK1270-06-225B  def
ault
172.16.8.188    00:0c:29:db:a9:77  01:00:0c:29:db:a9:77 12:39:04 12/11/2025  vm23        def
ault
6300#
```

## sh ip route



```
Ubuntu Akm - VMware Workstation
File Edit View VM Help ||| 
Library Type here to search
Ubuntu Akm | ens45 |
Nov 12 11:06
Capturing from ens40
affan-akmal@affan-ubuntu:~
```

```
File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help
[Apply a display] affan-akm... affan-akm... affan-akm... affan-akm... affan-akm... affan-akm... affan-akm...
No. Time
20 28.76
21 29.12
22 39.13 6300# show ip route
23 32.13
24 33.13
25 44.38 Displaying ipv4 routes selected for forwarding
26 44.19
27 44.14 Origin Codes: C - connected, S - static, L - local
28 44.14
29 45.27 R - RIP, B - BGP, O - OSPF
30 45.27 Type Codes: E - External BGP, I - Internal BGP, V - VPN, EV - EVPN
31 45.28 IA - OSPF internal area, E1 - OSPF external type 1
32 45.32
33 45.32
34 45.41 E2 - OSPF external type 2
35 45.41 VRF: default
36 45.51
37 45.51
38 45.68 Prefix
39 45.68 Text Editor: 88
40 45.68
41 46.12
> Freq: 43: 19172.16.2.168/27
> Ethernet 43: 19172.16.2.161/32
> Internet Prt172.16.2.192/27
> User Datagram172.16.8.128/27
> Multicast D172.16.8.129/32
Total Route Count : 8
6300#
```

To direct input to this VM, click inside or press Ctrl+G.

Packets: 167 - Displayed: 167 (100.0%) - Marked: 1 (0.6%) - Profile: Default

Cloudy ENG US 11:06 AM 11/12/2025

## 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 i 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
```