

CSP450 NAA Project 1a

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Project Overview

This document will provide detailed instructions for setting up and implementing a DHCP on an Aruba- 6300 Switch. This is to establish a local network for two clients to be able to communicate with each other. The Project requires deploying two VLANs, each assigned to a client, also DHCP assigning IP addresses to clients that are from pool of specific range of IP addresses. Furthermore, these clients require to be connected to the internet and communicate with the other client through the switch. Clients communicate with each other by using ssh using a key pair.

Key word definitions for this project

VLANs: Virtual Local Area Network(s) are used to create virtual segments within a physical network topology, allowing them to function as separate networks. In this project, VLANs are utilized to differentiate between the two networks.

DHCP: The Dynamic Host Configuration Protocol (DHCP) is used to automatically assign IP addresses to clients. When a client connects to the DHCP server, it receives an IP address from the available pool of addresses. For this project, we set the IP address pools for each VLANs.

IP Routes: IP routes are defined paths that directs network traffic to specified direction. Static routes are defined on each client to help direct the flow of network traffic that is outside of the respective network.

SSH: Secure Shell (SSH) enables clients to remotely log into connected machines and execute commands as if they were physically logged into the machine.

Determining Subnet for this project

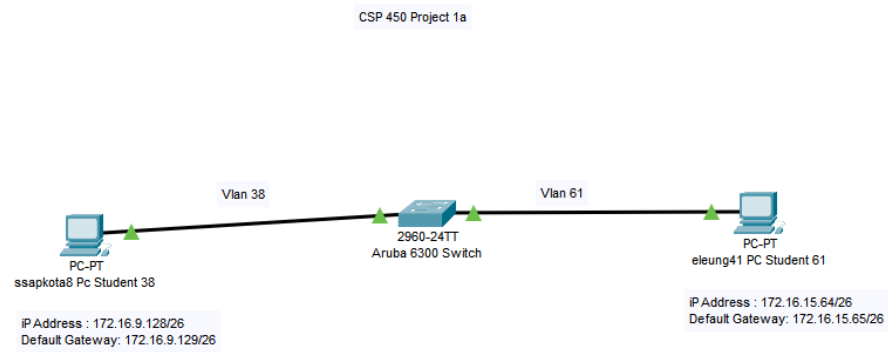
For this project, the subnet was defined as 172.16.X.*/26. X being the unique student ID provided in the course. Determining the subnet is not simple as replacing x with the student ID, rather we must figure out using the subnet mask given to us in the project.

So, we use unique student ID of my as 38.

If we follow the step of subnetting we get it as 172.16.9.128/26.

So, for my partner's subnet with Student ID 61 is 172.16.15.64/26

Network Topology



Implementation

Step 1 Accessing the Switch

Aruba 6300 Switch has two methods of connecting, this documentation will spell out how to connect using SSH established through ethernet connection to the MGMT port.

1. Connect the ethernet cable from the PC to the management port on Aruba 6300 switch. Making sure the port number is same in the lab pc and in the back server room.
2. Open Network configuration and determine which adaptor is connected to the switch
3. Configure IPv4 of the network adaptor in use to be one of the management interface IP address range given.
4. Connect using SSH by entering the IP address of the switch. This can be done through Putty or other methods.

Step 2 VLAN configurations

The project requires two PC to be given different subset of IP addresses from DHCP. For us to set this up, we need to first create a VLAN for the two PCs

1. Create two VLANS using any two number between 1 to 1024 on the switch
2. Give VLANs respective default gateway
3. Assign each VLAN to a distinct interface as an access port.

Step 3 DHCP configurations

DHCP is used to auto assign IP address to devices from a give pool of addresses. We need to create a pool for each VLAN, and in process we need to define the subnet and the range of IP addresses we are going to lease out.

1. Create a virtual routing instance (dhcp-server vrf default)
2. Define DHCP pools in each VLAN, here we need to define the range of IP addresses to lease out and specify the default routing IP address

Step 4 Confirmation on Clients

We need to confirm that DHCP is working properly and check the devices are assigned correct IP address we have set up. Furthermore, we need to make sure we still have internet connection

1. Configure the VM network adaptors as one bridged adaptor to the switch and other as NAT connected to the internet
2. Make sure the network adaptors are all enabled in the Ubuntu VM

3. In the network setting of the adaptor that does not have internet connection, change the IPv4 setting to “Obtain an IP address automatically”
4. We can use the command `ip a` in the terminal to check that ip address is correctly assigned to the VM

Step 5 IP routes and SSH set up

Currently the pings to other VM will not work as there is not IP routes set up for the other network. We need to define these routes to be directed to the switch so that the switch can redirect the packets to the correct port/PC

1. Set up IP routes by defining range of IP addresses that will be directed to the default gateway (ie. IP address of the switch in that VLAN)
2. Install SSH client, used OpenSSH-server for our case.
3. Create a new user that will be used to ssh into the machine, making sure the user created does not have admin access.
4. Create a key-pair on each of the client on the new user and install the public key on the user. We can install the public key by issuing the following command: `ssh-copy-id -I [location of public key] [username]@[ip address]`
5. We also need to disable root access, we can do this by editing `sshd_config` file. Go to `/etc/ssh/sshd_config` file and edit `PermitRootLogin` from yes to no. Save the edit and restart ssh service

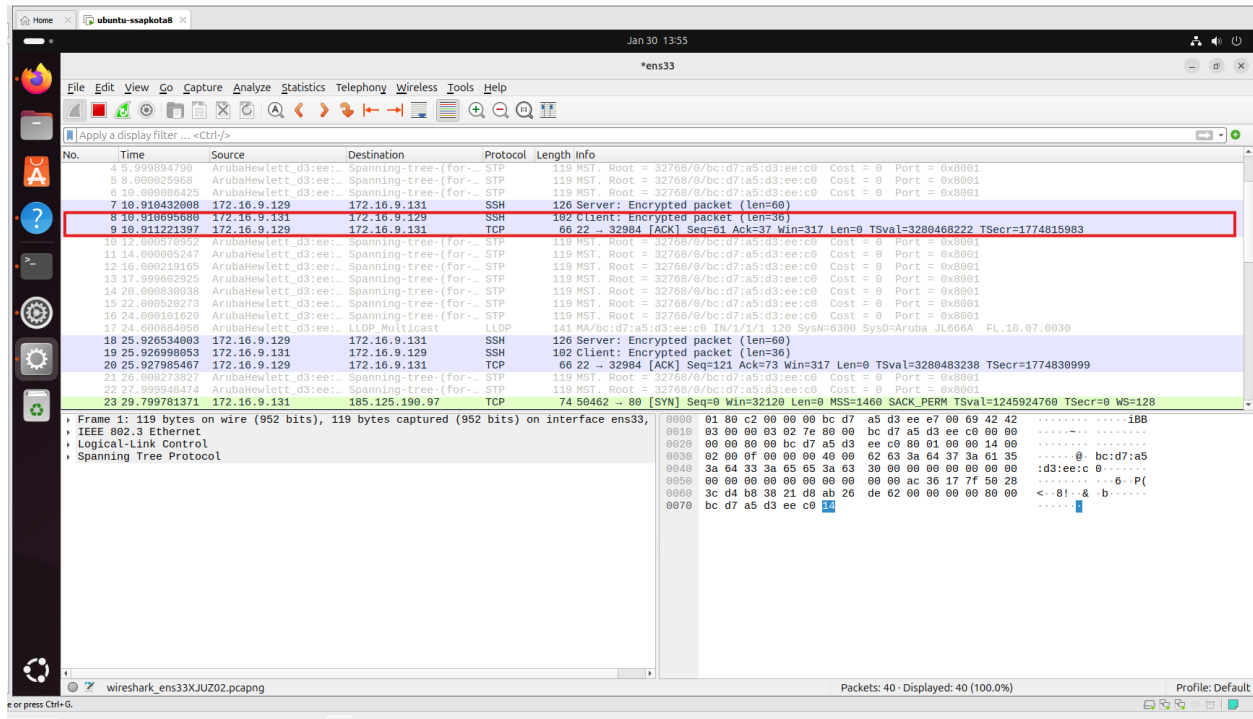
Step 6 Testing the network configuration

1. Always check the ping first, see if the packet reaches to the other PC. If ping does not work, check the following in order: IP routes, the IP address, switch configuration, hardware connection.
2. If ping is successful, SSH into each other's VM using non admin user account, no password prompt will be needed as we have installed the public key installed. If successful, everything is configured correctly. If unsuccessful, check the above steps again.
3. Try SSH into each other's VM using root account, we should be denied without a password prompt. If you are able to login, or password is prompted, check the `sshd_config` file again and make sure it is saved, and you have restarted the ssh service.

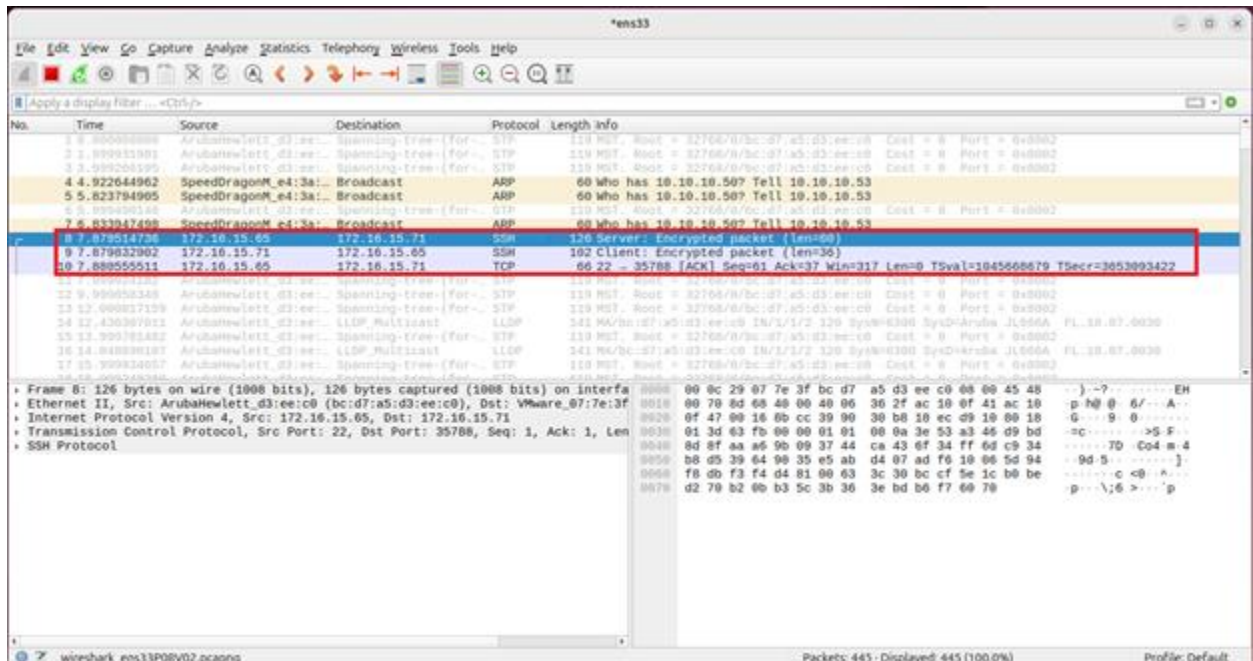
Appendix A: Wireshark

(Note. *STUDENT_A* IP address: 172.16.9.128 DG:172.16.9.129 , *STUDENT_B* IP address: 172.16.15.64 DG:172.16.15.65)

STUDENT_A VM to switch



STUDENT_B VM to switch



STUDENT_A VM to STUDENT_B VM

Jan 30 13:58
*ens33

File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help

Apply a display filter ... <Ctrl>/>

No.	Time	Source	Destination	Protocol	Length	Info
443	149.555898013	172.16.9.131	172.16.15.71	SSHv2	214	Client: 166 Server: 382
444	149.558730403	172.16.9.131	172.16.15.71	SSHv2	166	Client: 166 Server: 382
445	149.560318927	172.16.9.131	172.16.15.71	SSHv2	166	Client: 166 Server: 382
446	149.569409455	172.16.15.71	172.16.9.131	SSHv2	94	Server: 178 Client: 842
447	149.569808889	172.16.9.131	172.16.15.71	SSHv2	178	Client: 842 Server: 250
448	149.606796293	172.16.15.71	172.16.9.131	SSHv2	842	Server: 250 Client: 66
449	149.647367055	172.16.9.131	172.16.15.71	TCP	66	55858 -> 22 [ACK] Seq=3557 Ack=3907 Win=31872 Len=0 TSval=1892274725 TSecr=1662349079
450	149.648671512	172.16.15.71	172.16.9.131	SSHv2	250	Server: 526 Client: 174
451	149.648759345	172.16.9.131	172.16.15.71	TCP	66	55858 -> 22 [ACK] Seq=3557 Ack=4099 Win=31872 Len=0 TSval=1892274726 TSecr=1662349121
452	149.649074476	172.16.9.131	172.16.15.71	SSHv2	526	Client: 174 Server: 782
453	149.652999084	172.16.15.71	172.16.9.131	SSHv2	174	Server: 782 Client: 66
454	149.653188905	172.16.15.71	172.16.9.131	SSHv2	782	Server: 66 Client: 66
455	149.653570843	172.16.9.131	172.16.15.71	TCP	66	55858 -> 22 [ACK] Seq=4017 Ack=4843 Win=31872 Len=0 TSval=1892274731 TSecr=1662349125
456	149.675445828	172.16.15.71	172.16.9.131	SSHv2	198	Server: 66 Client: 66
457	149.716338463	172.16.9.131	172.16.15.71	TCP	66	55858 -> 22 [ACK] Seq=4017 Ack=4975 Win=31872 Len=0 TSval=1892274794 TSecr=1662349148

Frame 456: 198 bytes on wire (1584 bits), 198 bytes captured (1584 bits) on interface ens33
 Ethernet II, Src: ArubaHewlett_d3:ee:c0 (bc:d7:a5:d3:ee:c0), Dst: VMware_ff:a7:6a (00:0c:29:ff:a7:6a)
 Internet Protocol Version 4, Src: 172.16.15.71, Dst: 172.16.9.131
 ... 0101 = Version: 4
 ... 0101 = Header Length: 20 bytes (5)
 ... 0101 = Differentiated Services Field: 0x10 (DSCP: Unknown, ECT: Not-ECT)
 Total Length: 184
 Identification: 0x0bbe (3066)
 ... 0101 = Flags: 0x2, Don't fragment
 ... 0000 0000 0000 = Fragment Offset: 0
 Time to Live: 63
 Protocol: TCP (6)
 Header Checksum: 0xbe87 [validation disabled]
 [Header checksum status: Unverified]
 Source Address: 172.16.15.71
 Destination Address: 172.16.9.131
 Transmission Control Protocol, Src Port: 22, Dst Port: 55858, Seq: 4843, Ack: 4017, Len: 198
 SSH Protocol

wireshark_ens33XJU02.pcapng

Packets: 471 - Displayed: 471 (100.0%) - Dropped: 0 (0.0%) Profile: Default

STUDENT_B VM to STUDENT_A VM

Capturing from ens33

File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help

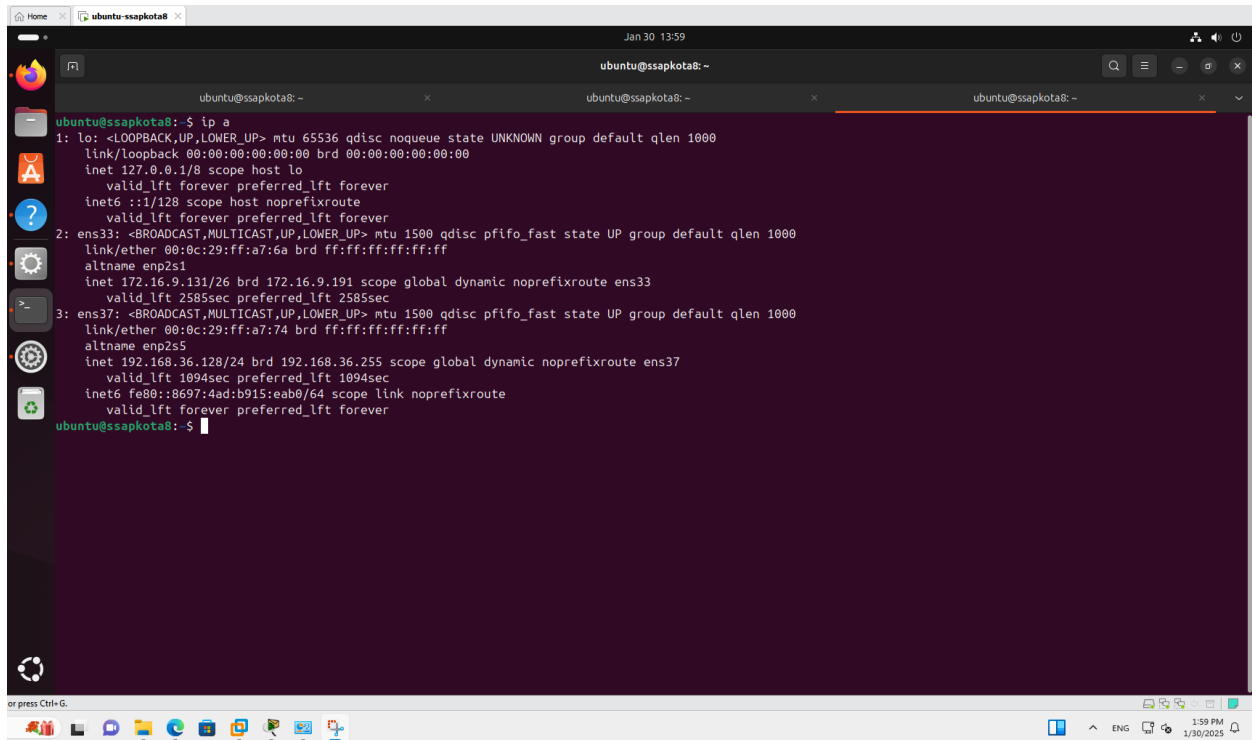
tcp.flags.syn

No.	Time	Source	Destination	Protocol	Length	Info
143	132.027741808	ArubaHewlett_d3:ee:c0	Spanning-tree (for-...	STP	218	MST: Root = 32768/0/bc:d7:a5:d3:ee:c0 Cost = 0 Port = 0x8001
144	132.030057402	ArubaHewlett_d3:ee:c0	Spanning-tree (for-...	STP	218	MST: Root = 32768/0/bc:d7:a5:d3:ee:c0 Cost = 0 Port = 0x8002
145	132.032200141	ArubaHewlett_d3:ee:c0	Spanning-tree (for-...	STP	218	MST: Root = 32768/0/bc:d7:a5:d3:ee:c0 Cost = 0 Port = 0x8003
146	132.034358258	ArubaHewlett_d3:ee:c0	Spanning-tree (for-...	STP	218	MST: Root = 32768/0/bc:d7:a5:d3:ee:c0 Cost = 0 Port = 0x8004
147	132.037535876	ArubaHewlett_d3:ee:c0	Spanning-tree (for-...	STP	218	MST: Root = 32768/0/bc:d7:a5:d3:ee:c0 Cost = 0 Port = 0x8005
148	140.037670870	ArubaHewlett_d3:ee:c0	Spanning-tree (for-...	STP	218	MST: Root = 32768/0/bc:d7:a5:d3:ee:c0 Cost = 0 Port = 0x8006
149	141.708722549	172.16.15.71	172.16.9.131	TCP	74	60496 -> 22 [SYN] Seq=0 Win=64240 Len=0 MSS=1460 SACK_PERM TSval=1862081202 TSecr=0 WS=128
150	141.775012989	172.16.9.131	172.16.15.71	TCP	74	23 -> 60496 [RST] Seq=0 Win=0 Len=0 MSS=1460 SACK_PERM TSval=1862081202 TSecr=1862081202
151	141.775023930	172.16.15.71	172.16.9.131	TCP	66	60496 -> 22 [ACK] Seq=1 Ack=1 Win=64240 Len=0 TSval=1862081206 TSecr=1862081206
152	141.775023932	172.16.15.71	172.16.9.131	SSHv2	188	Client: Protocol (SSHv2.0-OpenSSH.9.6p1 Ubuntu-Jubuntu13.0)
153	141.774889868	172.16.9.131	172.16.15.71	TCP	66	22 -> 60496 [ACK] Seq=1 Ack=42 Win=31872 Len=0 TSval=1862081206 TSecr=1862081206
154	141.774889868	172.16.9.131	172.16.15.71	SSHv2	188	Server: Protocol (SSHv2.0-OpenSSH.9.6p1 Ubuntu-Jubuntu13.0)
155	141.775012989	172.16.15.71	172.16.9.131	TCP	66	60496 -> 22 [ACK] Seq=1 Ack=1579 Win=31872 Len=0 TSval=1862081207 TSecr=1862081207
156	141.775013887	172.16.15.71	172.16.9.131	SSHv2	188	Client: Key Exchange Init
157	141.775013887	172.16.9.131	172.16.15.71	TCP	66	22 -> 60496 [ACK] Seq=1 Ack=1579 Win=31872 Len=0 TSval=1862081207 TSecr=1862081207
158	141.775013887	172.16.9.131	172.16.15.71	SSHv2	188	Server: Key Exchange Init
159	141.809295078	172.16.15.71	172.16.9.131	SSHv2	1274	Client: Diffie-Hellman Key Exchange Init
160	141.817290961	172.16.9.131	172.16.15.71	SSHv2	1598	Server: Diffie-Hellman Key Exchange Reply, New Keys
161	141.817290961	172.16.15.71	172.16.9.131	TCP	66	60496 -> 22 [ACK] Seq=2787 Ack=2693 Win=64648 Len=0 TSval=1862081250 TSecr=1892066857
162	141.833983279	172.16.15.71	172.16.9.131	SSHv2	158	Client: New Keys

Appendix B: Commands on VM

Terminal Command “ip a”

STUDENT_A VM



The screenshot shows a terminal window titled 'ubuntu@ssapkota8: ~' with the command 'ip a' executed. The output displays network interface details for three interfaces: 'lo' (loopback), 'ens33' (ethernet), and 'ens37' (ethernet). The 'lo' interface has IP 127.0.0.1. The 'ens33' interface has IP 172.16.9.131. The 'ens37' interface has IP 192.168.36.128. The terminal window is part of a desktop environment with a taskbar at the bottom showing various application icons and system status indicators.

```
ubuntu@ssapkota8:~$ 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: ens33: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc pfifo_fast state UP group default qlen 1000
    link/ether 00:0c:29:ff:a7:6a brd ff:ff:ff:ff:ff:ff
    altname enp2s1
    inet 172.16.9.131/26 brd 172.16.9.191 scope global dynamic noprefixroute ens33
        valid_lft 2585sec preferred_lft 2585sec
3: ens37: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc pfifo_fast state UP group default qlen 1000
    link/ether 00:0c:29:ff:a7:74 brd ff:ff:ff:ff:ff:ff
    altname enp2s5
    inet 192.168.36.128/24 brd 192.168.36.255 scope global dynamic noprefixroute ens37
        valid_lft 1094sec preferred_lft 1094sec
    inet6 fe80::8697:4ad:b915:eab0/64 scope link noprefixroute
        valid_lft forever preferred_lft forever
ubuntu@ssapkota8:~$
```

STUDENT_B VM

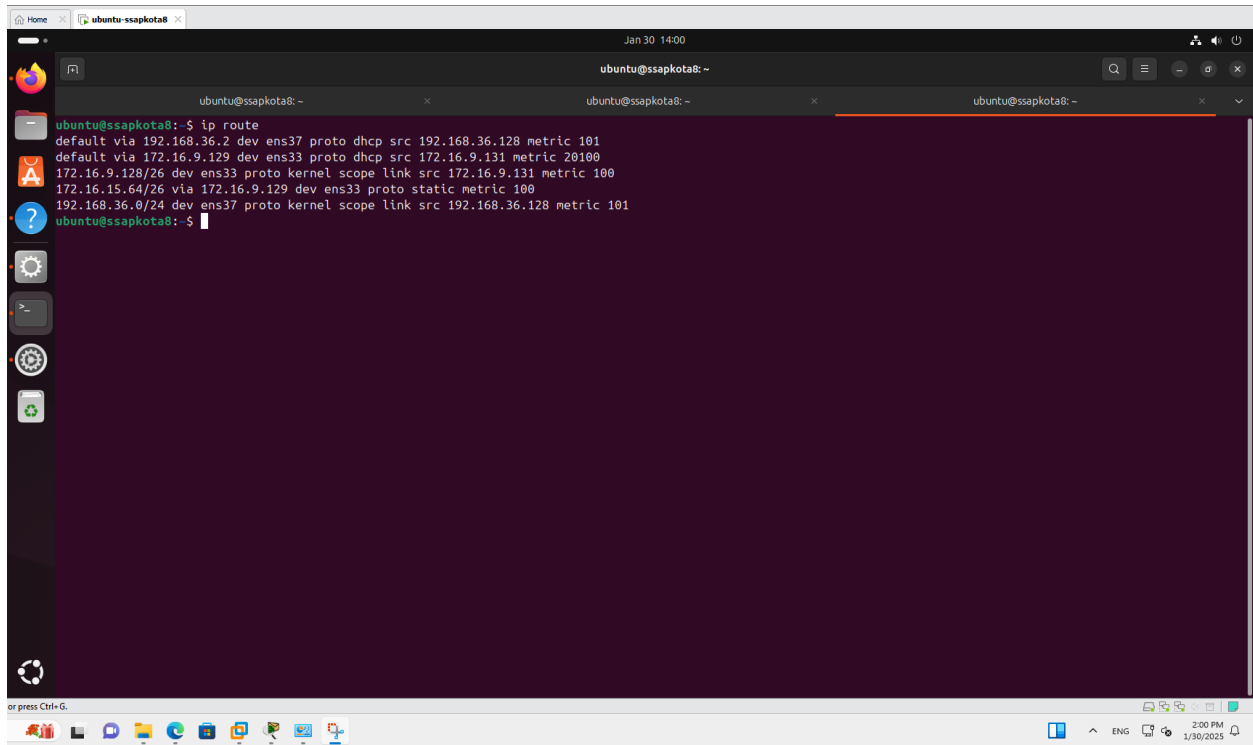


The screenshot shows a terminal window titled 'eleung41@eleung41ubulab5: ~' with the command 'ip a' executed. The output displays network interface details for three interfaces: 'lo' (loopback), 'ens33' (ethernet), and 'ens37' (ethernet). The 'lo' interface has IP 127.0.0.1. The 'ens33' interface has IP 172.16.15.71. The 'ens37' interface has IP 192.168.239.130. The terminal window is part of a desktop environment with a taskbar at the bottom showing various application icons and system status indicators.

```
eleung41@eleung41ubulab5:~$ 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: ens33: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP group default qlen 1000
    link/ether 00:0c:29:07:7e:3f brd ff:ff:ff:ff:ff:ff
    altname enp2s1
    inet 172.16.15.71/26 brd 172.16.15.127 scope global dynamic noprefixroute ens33
        valid_lft 1904sec preferred_lft 1904sec
3: ens37: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP group default qlen 1000
    link/ether 00:0c:29:07:7e:49 brd ff:ff:ff:ff:ff:ff
    altname enp2s5
    inet 192.168.239.130/24 brd 192.168.239.255 scope global dynamic noprefixroute ens37
        valid_lft 1441sec preferred_lft 1441sec
    inet6 fe80::aad4:6e04:6273:9e4a/64 scope link noprefixroute
        valid_lft forever preferred_lft forever
eleung41@eleung41ubulab5:~$
```

Terminal Command “IP route”

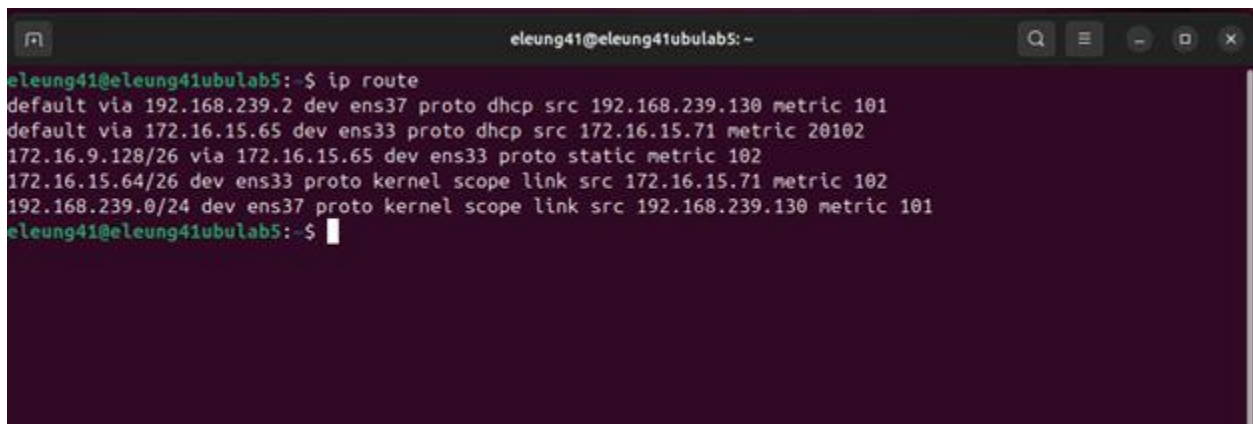
STUDENT_A VM



The screenshot shows a terminal window titled 'ubuntu@ssapkota8: ~' with a dark purple background. The terminal displays the output of the 'ip route' command, which lists the system's routing table. The output includes default routes for ens37 and ens33, and specific routes for 172.16.9.128/26 and 192.168.36.0/24. The terminal window is part of a desktop environment with a taskbar at the bottom and a sidebar on the left.

```
ubuntu@ssapkota8:~$ ip route
default via 192.168.36.2 dev ens37 proto dhcp src 192.168.36.128 metric 101
default via 172.16.9.129 dev ens33 proto dhcp src 172.16.9.131 metric 20100
172.16.9.128/26 dev ens33 proto kernel scope link src 172.16.9.131 metric 100
172.16.15.64/26 via 172.16.9.129 dev ens33 proto static metric 100
192.168.36.0/24 dev ens37 proto kernel scope link src 192.168.36.128 metric 101
ubuntu@ssapkota8:~$
```

STUDENT_B VM

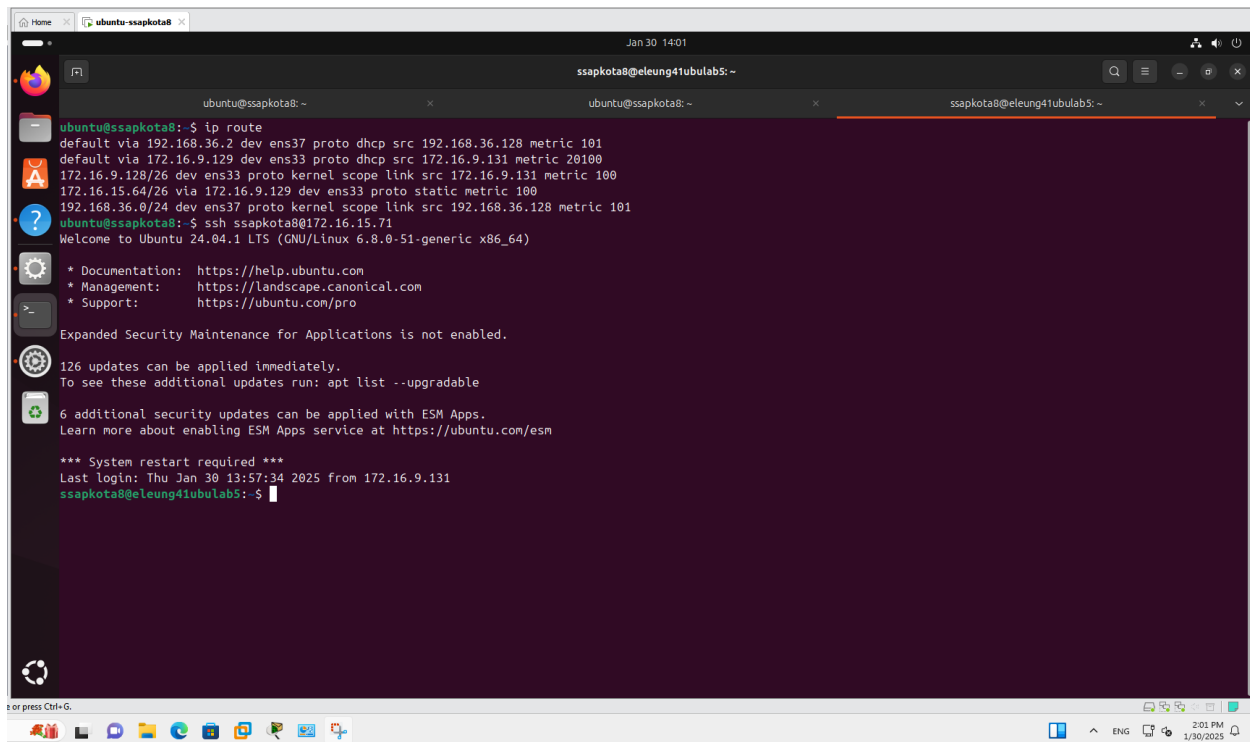


The screenshot shows a terminal window titled 'eleung41@eleung41ubulab5: ~' with a dark purple background. The terminal displays the output of the 'ip route' command, which lists the system's routing table. The output includes default routes for ens37 and ens33, and specific routes for 172.16.15.65 and 192.168.239.0/24. The terminal window is part of a desktop environment with a taskbar at the bottom and a sidebar on the left.

```
eleung41@eleung41ubulab5:~$ ip route
default via 192.168.239.2 dev ens37 proto dhcp src 192.168.239.130 metric 101
default via 172.16.15.65 dev ens33 proto dhcp src 172.16.15.71 metric 20102
172.16.9.128/26 via 172.16.15.65 dev ens33 proto static metric 102
172.16.15.64/26 dev ens33 proto kernel scope link src 172.16.15.71 metric 102
192.168.239.0/24 dev ens37 proto kernel scope link src 192.168.239.130 metric 101
eleung41@eleung41ubulab5:~$
```

SSH to partners VM

STUDENT_A VM



The screenshot shows a terminal window titled 'ssapkota8@eleung41ubulab5: ~'. The user 'ubuntu@ssapkota8' has executed the following commands and received the following output:

```
ubuntu@ssapkota8:~$ ip route
default via 192.168.36.2 dev ens37 proto dhcp src 192.168.36.128 metric 101
default via 172.16.9.129 dev ens33 proto dhcp src 172.16.9.131 metric 20100
172.16.9.128/26 via 172.16.9.129 dev ens33 proto kernel scope link src 172.16.9.131 metric 100
172.16.15.64/26 via 172.16.9.129 dev ens33 proto static metric 100
192.168.36.0/24 dev ens37 proto kernel scope link src 192.168.36.128 metric 101
ubuntu@ssapkota8:~$ ssh ssapkota8@172.16.15.71
Welcome to Ubuntu 24.04.1 LTS (GNU/Linux 6.8.0-51-generic x86_64)

 * Documentation:  https://help.ubuntu.com
 * Management:    https://landscape.canonical.com
 * Support:       https://ubuntu.com/pro

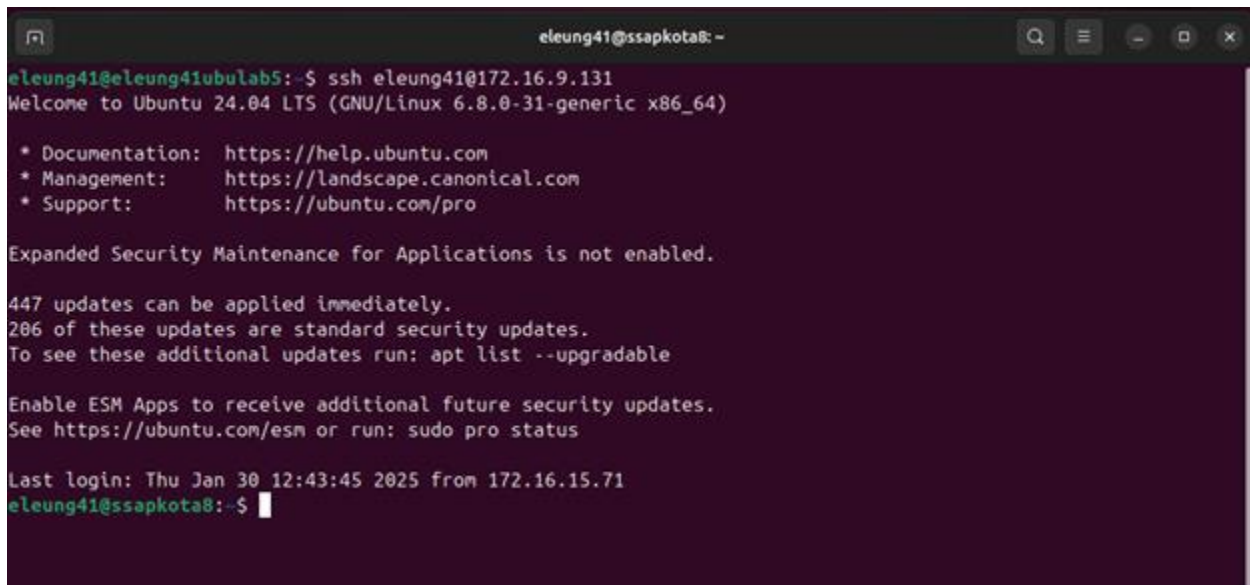
Expanded Security Maintenance for Applications is not enabled.

126 updates can be applied immediately.
To see these additional updates run: apt list --upgradable

6 additional security updates can be applied with ESM Apps.
Learn more about enabling ESM Apps service at https://ubuntu.com/esm

*** System restart required ***
Last login: Thu Jan 30 13:57:34 2025 from 172.16.9.131
ssapkota8@eleung41ubulab5:~$
```

STUDENT_B VM



The screenshot shows a terminal window titled 'eleung41@ssapkota8: ~'. The user 'eleung41@eleung41ubulab5' has executed the following commands and received the following output:

```
eleung41@eleung41ubulab5:~$ ssh eleung41@172.16.9.131
Welcome to Ubuntu 24.04 LTS (GNU/Linux 6.8.0-31-generic x86_64)

 * Documentation:  https://help.ubuntu.com
 * Management:    https://landscape.canonical.com
 * Support:       https://ubuntu.com/pro

Expanded Security Maintenance for Applications is not enabled.

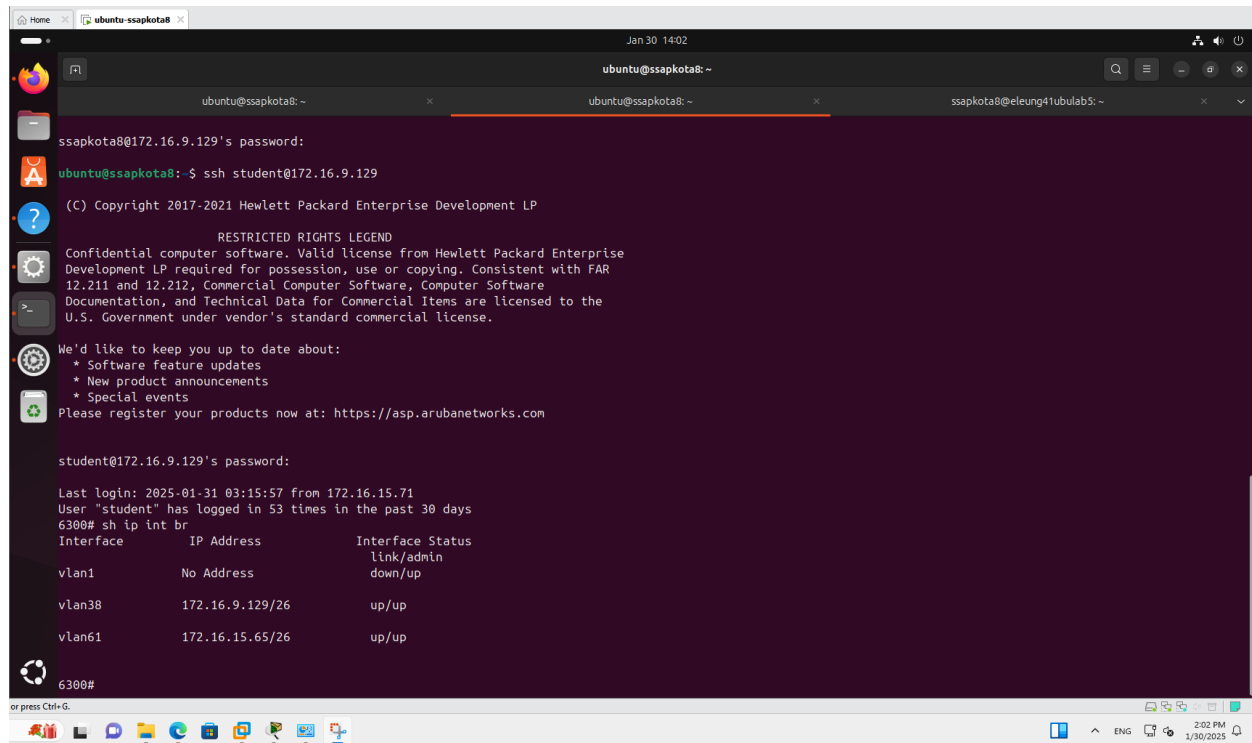
447 updates can be applied immediately.
206 of these updates are standard security updates.
To see these additional updates run: apt list --upgradable

Enable ESM Apps to receive additional future security updates.
See https://ubuntu.com/esm or run: sudo pro status

Last login: Thu Jan 30 12:43:45 2025 from 172.16.15.71
eleung41@ssapkota8:~$
```

Appendix C: Commands on Switch

Sh ip int br



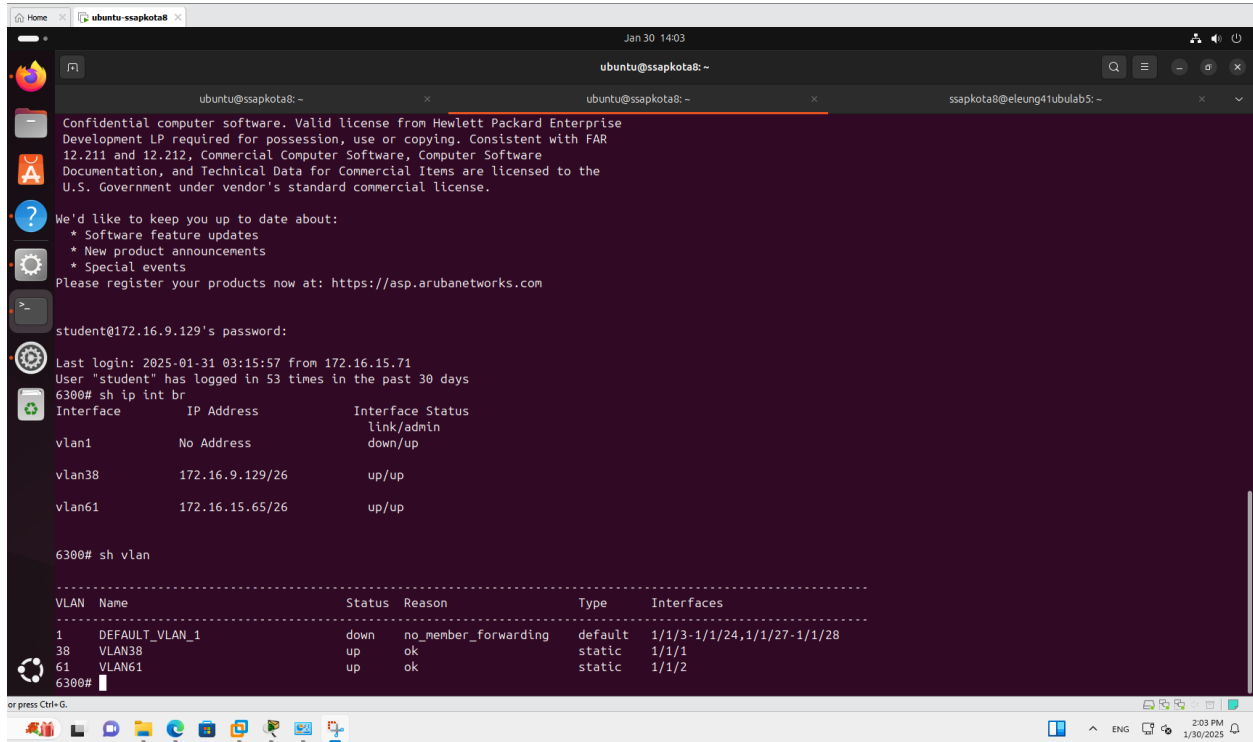
The screenshot shows a terminal window with the following content:

```
ssapkota8@172.16.9.129's password:
ubuntu@ssapkota8:~$ ssh student@172.16.9.129
(C) Copyright 2017-2021 Hewlett Packard Enterprise Development LP
RESTRICTED RIGHTS LEGEND
Confidential computer software. Valid license from Hewlett Packard Enterprise
Development LP required for possession, use or copying. Consistent with FAR
12.211 and 12.212, Commercial Computer Software, Computer Software
Documentation, and Technical Data for Commercial Items are licensed to the
U.S. Government under vendor's standard commercial license.
We'd like to keep you up to date about:
* Software feature updates
* New product announcements
* Special events
Please register your products now at: https://asp.arubanetworks.com

student@172.16.9.129's password:
Last login: 2025-01-31 03:15:57 from 172.16.15.71
User "student" has logged in 53 times in the past 30 days
6300# sh ip int br
Interface      IP Address      Interface Status
              link/admin
vlan1          No Address      down/up
vlan38         172.16.9.129/26 up/up
vlan61         172.16.15.65/26 up/up
6300#
```

The terminal window is titled "ubuntu@ssapkota8: ~" and shows the user "student" logging in from "172.16.15.71". The command "sh ip int br" is executed, displaying the IP addresses and status of the switch interfaces.

Sh vlan



The screenshot shows a terminal window with the following content:

```
Confidential computer software. Valid license from Hewlett Packard Enterprise
Development LP required for possession, use or copying. Consistent with FAR
12.211 and 12.212, Commercial Computer Software, Computer Software
Documentation, and Technical Data for Commercial Items are licensed to the
U.S. Government under vendor's standard commercial license.

We'd like to keep you up to date about:
* Software feature updates
* New product announcements
* Special events
Please register your products now at: https://asp.arubanetworks.com

student@172.16.9.129's password:

Last login: 2025-01-31 03:15:57 from 172.16.15.71
User "student" has logged in 53 times in the past 30 days
6300# sh ip int br

```

Interface	IP Address	Interface Status
vlan1	No Address	link/admin down/up
vlan38	172.16.9.129/26	up/up
vlan61	172.16.15.65/26	up/up

```
6300# sh vlan

```

VLAN	Name	Status	Reason	Type	Interfaces
1	DEFAULT_VLAN_1	down	no_member_forwarding	default	1/1/3-1/1/24,1/1/27-1/1/28
38	VLAN38	up	ok	static	1/1/1
61	VLAN61	up	ok	static	1/1/2

6300#

Sh spanning-tree

```
ubuntu@ssapkota8: ~  
38 VLAN38 up ok static 1/1/1  
61 VLAN61 up ok static 1/1/2  
6300# sh spanning-tree  
Spanning tree status : Enabled Protocol: MSTP  
MST0  
Root ID Priority : 32768  
MAC-Address: bc:d7:a5:d3:ee:c0  
This bridge is the root  
Hello time(in seconds):2 Max Age(in seconds):20  
Forward Delay(in seconds):15  
Bridge ID Priority : 32768  
MAC-Address: bc:d7:a5:d3:ee: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-Rx  
-----  
1/1/1 Designated Forwarding 20000 128 P2P 1697 0 2 0  
1/1/2 Designated Forwarding 20000 128 P2P 3590 0 0 0  
1/1/3 Disabled Blocking 20000 128 P2P 0 0 0 0  
1/1/4 Disabled Blocking 20000 128 P2P 0 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
```

```
ubuntu@ssapkota8: ~  
Spanning tree status : Enabled Protocol: MSTP  
MST0  
Root ID Priority : 32768  
MAC-Address: bc:d7:a5:d3:ee:c0  
This bridge is the root  
Hello time(in seconds):2 Max Age(in seconds):20  
Forward Delay(in seconds):15  
Bridge ID Priority : 32768  
MAC-Address: bc:d7:a5:d3:ee: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-Rx  
-----  
1/1/1 Designated Forwarding 20000 128 P2P 1697 0 2 0  
1/1/2 Designated Forwarding 20000 128 P2P 3590 0 0 0  
1/1/3 Disabled Blocking 20000 128 P2P 0 0 0 0  
1/1/4 Disabled Blocking 20000 128 P2P 0 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  
6300#
```

Sh dhcp-server leases

```
Jan 30 14:06
ubuntu@ssapkota8: ~
MAC-Address: bc:d7:a5:d3:ee: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-Rx
-----
1/1/1     Designated Forwarding 20000     128       P2P       1697       0          2          0
1/1/2     Designated Forwarding 20000     128       P2P       3590       0          0          0
1/1/3     Disabled  Blocking 20000     128       P2P       0          0          0          0
1/1/4     Disabled  Blocking 20000     128       P2P       0          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

6300# sh dhcp-server leases
IP-Address      Client-Id      Expiry-Time    Client-Hostname  VRF-Name      Link-Address
-----
172.16.9.131    01:00:0c:29:ff:a7:6a 04:21:13 31/01/2025 ssapkota8        default        00:0c:29:ff:a7:6a
172.16.9.150    01:00:13:3b:e3:96:ec 04:26:15 31/01/2025 NHK1270-25-2350 default        00:13:3b:e3:96:ec
172.16.15.71    01:00:0c:29:07:7e:3f 04:17:47 31/01/2025 eleung41ubulab5 default        00:0c:29:07:7e:3f

6300#
```

Appendix D: Switch Script Commands

```
conf t
vlan 1,38, 61
spanning-tree
interface 1/1/1
    no shutdown
    no routing
    vlan access 38
interface 1/1/2
    no shutdown
    no routing
    vlan access 61
interface vlan 1
    ip dhcp
interface vlan 38
    ip address 172.16.9.129/26
interface vlan 61
    ip address 172.16.15.65/26
dhcp-server vrf default
    pool 38
        range 172.16.9.130 172.16.9.190 prefix-len 26
        default-router 172.16.9.129
    exit
    pool 61
        range 172.16.15.66 172.16.15.126 prefix-len 26
        default-router 172.16.15.65
    exit
enable
```