CSP450 NAA Project 1b

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Project Overview

This document provides detailed instructions for setting up and implementing DHCP on an Aruba 6300 and HP 2530/2540 Switch. The goal is to establish a local network where two clients can communicate with each other. The project requires deploying two VLANs, each assigned to a client, with DHCP assigning IP addresses from a specified range. Additionally, clients need to connect to the internet and communicate via SSH using key pairs.

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

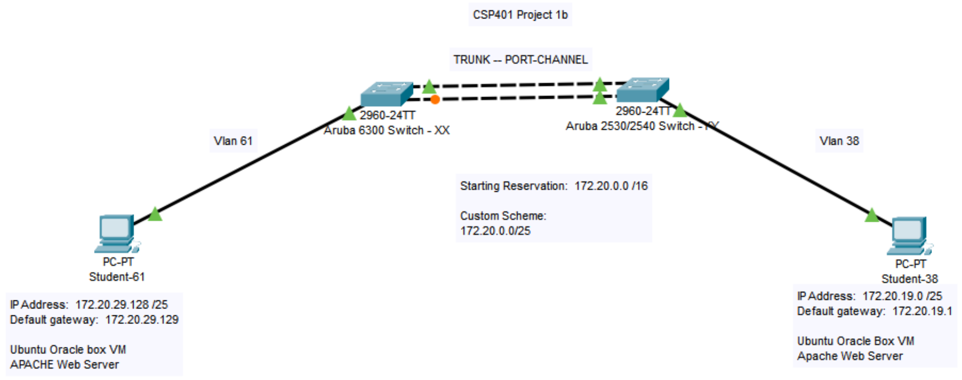
For this project, the subnet was defined as 172.20.X.?/25. X being the unique student ID provided in the course. Determining the subnet is not simple as replacing x with the student ID, rather we must figure out using the subnet mask given to us in the project.

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

If we follow the step of subnetting we get it as 172.20.19.0/25.

So, for my partner's subnet with Student ID 61 is 172.20.29.128/25

Network Topology



Starting Reservation: 172.20.0.0 /16

Custom Scheme:
172.20.0.0/25

IP Address: 172.20.29.128 /25
Default gateway: 172.20.29.129

Ubuntu Oracle box VM
APACHE Web Server

IP Address: 172.20.19.0 /25
Default gateway: 172.20.19.1

Ubuntu Oracle Box VM
Apache Web Server

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. And 2530 switch can be connected via PuTTY.

1. SSH into the Aruba 6300 switch from your Ubuntu VM.
2. Console into the HP 2530/2540 switch using PuTTY.
3. Determine the connected network adapter in the OS network settings.
4. Assign an IPv4 address within the switch's management IP range.
5. Use SSH (e.g., PuTTY) to connect to the switches.

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

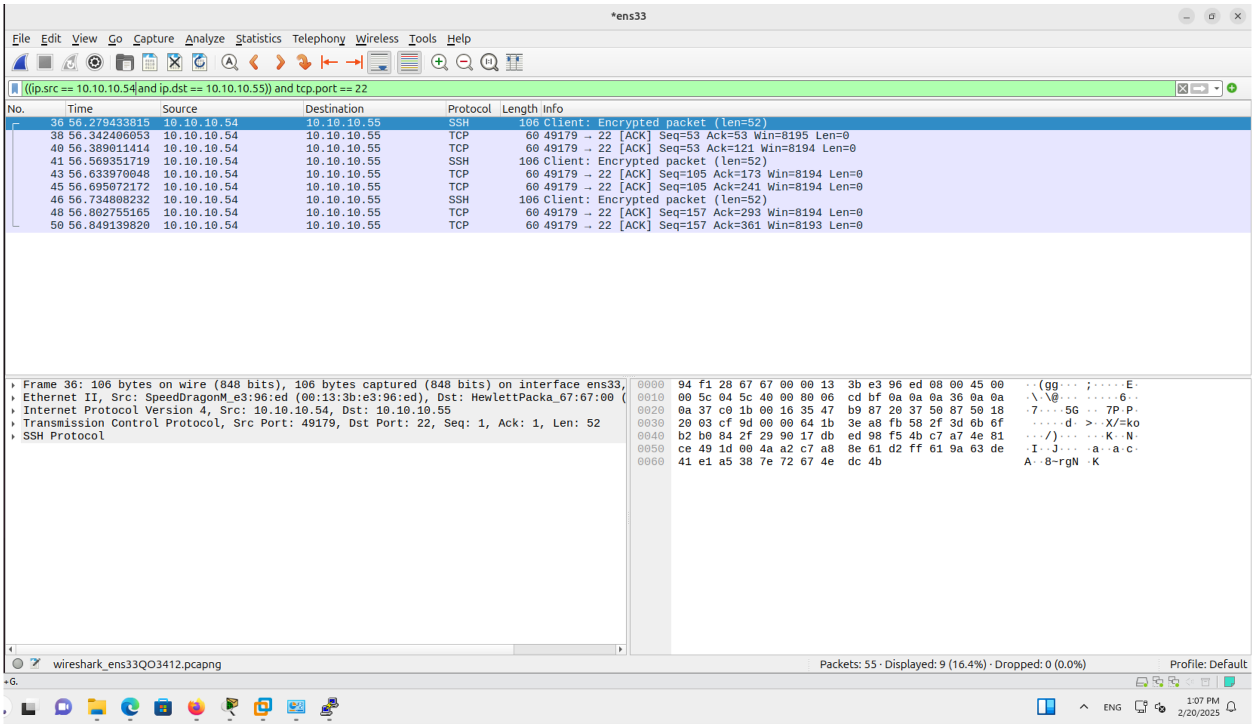
1. Always check the ping first, see if the packet reaches to the other PC. If ping does not work, check the following in order: IP routes, the IP address, switch configuration, hardware connection.
2. If ping is successful, SSH into each other's VM using non admin user account, no password prompt will 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.

4. Check Apache web server connection from the partner's VM.

Appendix A: Wireshark

(Note. *STUDENT_38* IP address: 172.20.19.0 DG:172.20.19.1 , *STUDENT_61* IP address: 172.20.29.128 DG:172.20.29.255)

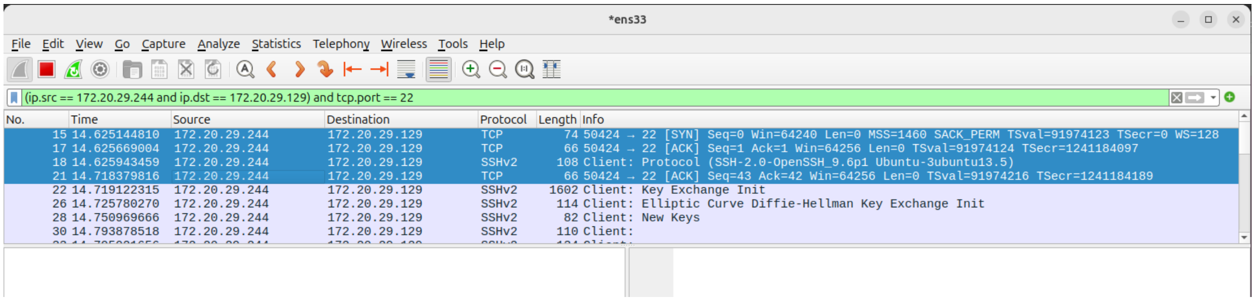
STUDENT_38 **ssh to switch 2530**



*ens33
File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help

```
((ip.src == 10.10.10.54 and ip.dst == 10.10.10.55)) and tcp.port == 22

No.  Time         Source       Destination  Protocol Length Info
  36 56.279433815 10.10.10.54  10.10.10.55  SSH      106 Client: Encrypted packet (len=52)
  38 56.342406053 10.10.10.54  10.10.10.55  TCP       60 49179 → 22 [ACK] Seq=53 Ack=53 Win=8195 Len=0
  40 56.389011414 10.10.10.54  10.10.10.55  TCP       60 49179 → 22 [ACK] Seq=53 Ack=121 Win=8194 Len=0
  41 56.569351719 10.10.10.54  10.10.10.55  SSH      106 Client: Encrypted packet (len=52)
  43 56.633970048 10.10.10.54  10.10.10.55  TCP       60 49179 → 22 [ACK] Seq=105 Ack=173 Win=8194 Len=0
  45 56.695072172 10.10.10.54  10.10.10.55  TCP       60 49179 → 22 [ACK] Seq=105 Ack=241 Win=8194 Len=0
  46 56.734808232 10.10.10.54  10.10.10.55  SSH      106 Client: Encrypted packet (len=52)
  48 56.802755165 10.10.10.54  10.10.10.55  TCP       60 49179 → 22 [ACK] Seq=157 Ack=293 Win=8194 Len=0
  50 56.849139820 10.10.10.54  10.10.10.55  TCP       60 49179 → 22 [ACK] Seq=157 Ack=361 Win=8193 Len=0

Frame 36: 106 bytes on wire (848 bits), 106 bytes captured (848 bits) on interface ens33,
Ethernet II, Src: SpeedDragonM_e3:96:ed (00:13:3b:e3:96:ed), Dst: HewlettPacka_67:67:00 (
Internet Protocol Version 4, Src: 10.10.10.54, Dst: 10.10.10.55
Transmission Control Protocol, Src Port: 49179, Dst Port: 22, Seq: 1, Ack: 1, Len: 52
SSH Protocol

0000  94 f1 28 67 67 00 00 13  3b e3 96 ed 08 00 45 00   ··(gg··· ;·····E·
0010  00 5c 04 5c 40 00 80 06  cd bf 0a 0a 0a 36 0a 0a   ·\·\@··· ·····6··
0020  0a 37 c0 1b 00 16 35 47  b9 87 20 37 50 87 50 18   ·7····5G ·· 7P·P·
0030  20 03 cf 9d 00 00 64 1b  3e a8 fb 58 2f 3d 6b 6f    ·····d· >··X/=ko
0040  b2 b0 84 2f 29 90 17 db  ed 98 f5 4b c7 a7 4e 81   ···/)··· ···K··N·
0050  ce 49 1d 00 4a a2 c7 a8  8e 61 d2 ff 61 9a 63 de   ·I··J··· ·a··a·c·
0060  41 e1 a5 38 7e 72 67 4e  dc 4b                     A··8~rgN ·K

wireshark_ens33QO3412.pcapng    Packets: 55 · Displayed: 9 (16.4%) · Dropped: 0 (0.0%)    Profile: Default
```

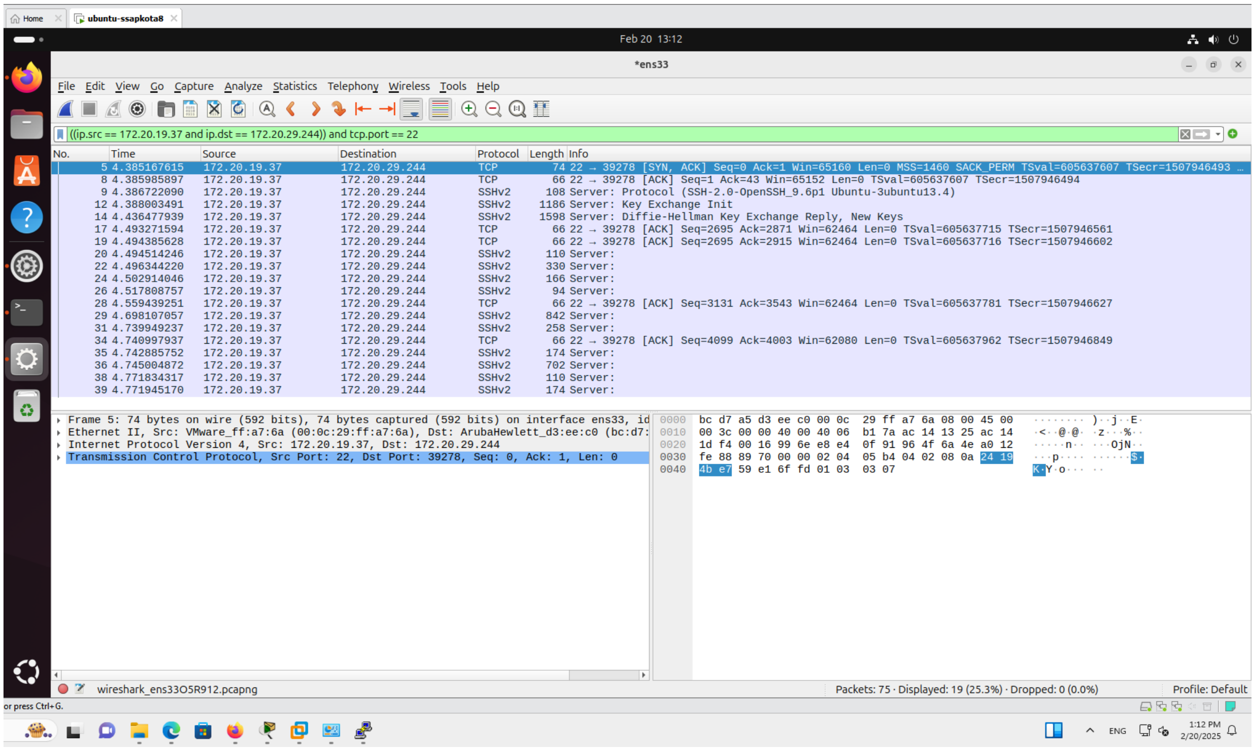
STUDENT_61 **ssh to switch**



*ens33
File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help

```
(ip.src == 172.20.29.244 and ip.dst == 172.20.29.129) and tcp.port == 22

No.  Time         Source         Destination    Protocol Length Info
  15 14.625144810 172.20.29.244  172.20.29.129  TCP        74 50424 → 22 [SYN] Seq=0 Win=64240 Len=0 MSS=1460 SACK_PERM TSval=91974123 TSecr=0 WS=128
  17 14.625669004 172.20.29.244  172.20.29.129  TCP        66 50424 → 22 [ACK] Seq=1 Ack=1 Win=64256 Len=0 TSval=91974124 TSecr=1241184097
  18 14.625943459 172.20.29.244  172.20.29.129  SSHv2     108 Client: Protocol (SSH-2.0-OpenSSH_9.6p1 Ubuntu-3ubuntu13.5)
  21 14.718379816 172.20.29.244  172.20.29.129  TCP        66 50424 → 22 [ACK] Seq=43 Ack=42 Win=64256 Len=0 TSval=91974216 TSecr=1241184189
  22 14.719122315 172.20.29.244  172.20.29.129  SSHv2    1602 Client: Key Exchange Init
  26 14.725780270 172.20.29.244  172.20.29.129  SSHv2     114 Client: Elliptic Curve Diffie-Hellman Key Exchange Init
  28 14.750969666 172.20.29.244  172.20.29.129  SSHv2      82 Client: New Keys
  30 14.793878518 172.20.29.244  172.20.29.129  SSHv2     110 Client:
```

STUDENT_38 VM to *STUDENT_61* VM


Home
ubuntu-ssapkota8
Feb 20 13:12
*ens33
File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help
or press Ctrl+G.
ENG
1:12 PM
2/20/2025

```
((ip.src == 172.20.19.37 and ip.dst == 172.20.29.244)) and tcp.port == 22
```

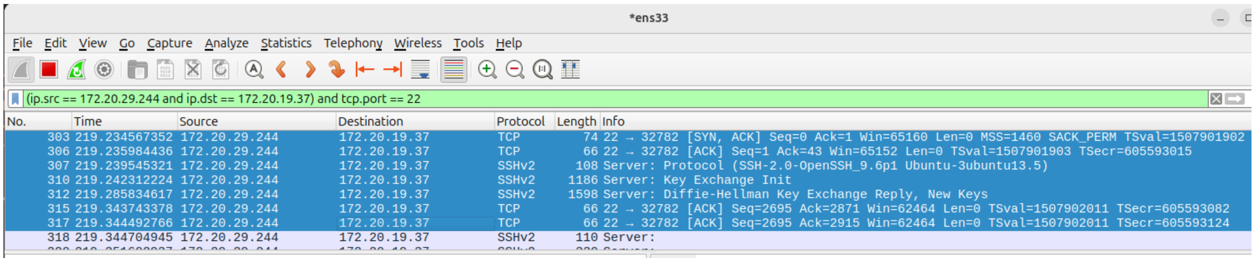
```
No.   Time          Source          Destination      Protocol  Length Info
    5 4.385167615   172.20.19.37    172.20.29.244    TCP         74 22 → 39278 [SYN, ACK] Seq=0 Ack=1 Win=65160 Len=0 MSS=1460 SACK_PERM TSval=605637607 TSecr=1507946493 …
    8 4.385985897   172.20.19.37    172.20.29.244    TCP         66 22 → 39278 [ACK] Seq=1 Ack=43 Win=65152 Len=0 TSval=605637607 TSecr=1507946494
    9 4.386722090   172.20.19.37    172.20.29.244    SSHv2      108 Server: Protocol (SSH-2.0-OpenSSH_9.6p1 Ubuntu-3ubuntu13.4)
   12 4.388003491   172.20.19.37    172.20.29.244    SSHv2     1186 Server: Key Exchange Init
   14 4.436477939   172.20.19.37    172.20.29.244    SSHv2     1598 Server: Diffie-Hellman Key Exchange Reply, New Keys
   17 4.493271594   172.20.19.37    172.20.29.244    TCP         66 22 → 39278 [ACK] Seq=2695 Ack=2871 Win=62464 Len=0 TSval=605637715 TSecr=1507946561
   19 4.494385628   172.20.19.37    172.20.29.244    TCP         66 22 → 39278 [ACK] Seq=2695 Ack=2915 Win=62464 Len=0 TSval=605637716 TSecr=1507946602
   20 4.494514246   172.20.19.37    172.20.29.244    SSHv2      110 Server:
   22 4.496344220   172.20.19.37    172.20.29.244    SSHv2      330 Server:
   24 4.502914046   172.20.19.37    172.20.29.244    SSHv2      166 Server:
   26 4.517808757   172.20.19.37    172.20.29.244    SSHv2       94 Server:
   28 4.559439251   172.20.19.37    172.20.29.244    TCP         66 22 → 39278 [ACK] Seq=3131 Ack=3543 Win=62464 Len=0 TSval=605637781 TSecr=1507946627
   29 4.698107057   172.20.19.37    172.20.29.244    SSHv2      842 Server:
   31 4.739949237   172.20.19.37    172.20.29.244    SSHv2      258 Server:
   34 4.740997937   172.20.19.37    172.20.29.244    TCP         66 22 → 39278 [ACK] Seq=4099 Ack=4003 Win=62080 Len=0 TSval=605637962 TSecr=1507946849
   35 4.742885752   172.20.19.37    172.20.29.244    SSHv2      174 Server:
   36 4.745004872   172.20.19.37    172.20.29.244    SSHv2      702 Server:
   38 4.771834317   172.20.19.37    172.20.29.244    SSHv2      110 Server:
   39 4.771945170   172.20.19.37    172.20.29.244    SSHv2      174 Server:
```

```
› Frame 5: 74 bytes on wire (592 bits), 74 bytes captured (592 bits) on interface ens33, id
› Ethernet II, Src: VMware_ff:a7:6a (00:0c:29:ff:a7:6a), Dst: ArubaHewlett_d3:ee:c0 (bc:d7:
› Internet Protocol Version 4, Src: 172.20.19.37, Dst: 172.20.29.244
› Transmission Control Protocol, Src Port: 22, Dst Port: 39278, Seq: 0, Ack: 1, Len: 0
```

```
0000  bc d7 a5 d3 ee c0 00 0c  29 ff a7 6a 08 00 45 00   ········ )··j··E·
0010  00 3c 00 00 40 00 40 06  b1 7a ac 14 13 25 ac 14   ·<··@·@· ·z···%··
0020  1d f4 00 16 99 6e e8 e4  0f 91 96 4f 6a 4e a0 12   ·····n·· ···OjN··
0030  fe 88 89 70 00 00 02 04  05 b4 04 02 08 0a 24 19   ···p···· ······$·
0040  4b e7 59 e1 6f fd 01 03  03 07                     K·Y·o··· ··
```

```
wireshark_ens33O5R912.pcapng     Packets: 75 · Displayed: 19 (25.3%) · Dropped: 0 (0.0%)     Profile: Default
```

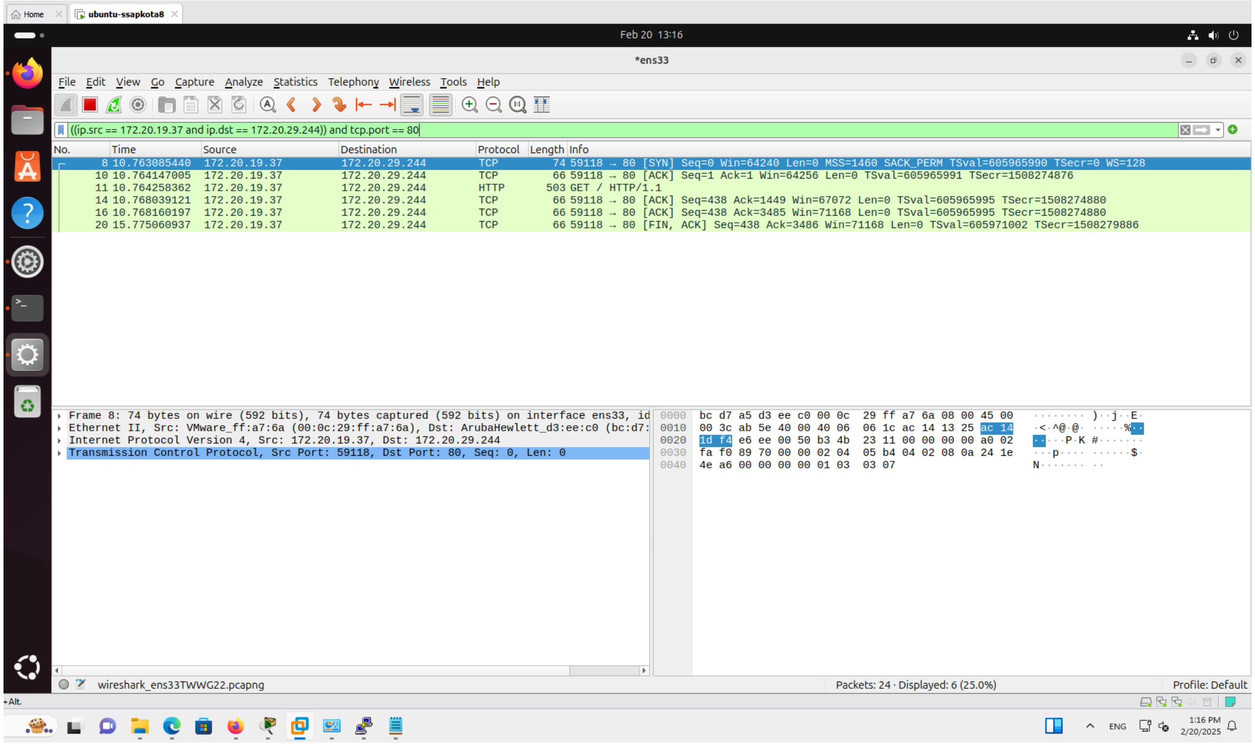
STUDENT_61 VM to *STUDENT_38* VM


*ens33
File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help

```
(ip.src == 172.20.29.244 and ip.dst == 172.20.19.37) and tcp.port == 22
```

```
No.   Time            Source          Destination     Protocol  Length Info
  303 219.234567352   172.20.29.244   172.20.19.37    TCP         74 22 → 32782 [SYN, ACK] Seq=0 Ack=1 Win=65160 Len=0 MSS=1460 SACK_PERM TSval=1507901902
  306 219.235984436   172.20.29.244   172.20.19.37    TCP         66 22 → 32782 [ACK] Seq=1 Ack=43 Win=65152 Len=0 TSval=1507901903 TSecr=605593015
  307 219.239545321   172.20.29.244   172.20.19.37    SSHv2      108 Server: Protocol (SSH-2.0-OpenSSH_9.6p1 Ubuntu-3ubuntu13.5)
  310 219.242312224   172.20.29.244   172.20.19.37    SSHv2     1186 Server: Key Exchange Init
  312 219.285834617   172.20.29.244   172.20.19.37    SSHv2     1598 Server: Diffie-Hellman Key Exchange Reply, New Keys
  315 219.343743378   172.20.29.244   172.20.19.37    TCP         66 22 → 32782 [ACK] Seq=2695 Ack=2871 Win=62464 Len=0 TSval=1507902011 TSecr=605593082
  317 219.344492766   172.20.29.244   172.20.19.37    TCP         66 22 → 32782 [ACK] Seq=2695 Ack=2915 Win=62464 Len=0 TSval=1507902011 TSecr=605593124
  318 219.344704945   172.20.29.244   172.20.19.37    SSHv2      110 Server:
```

HTTP request to Studdent_61 Apache server



Home
ubuntu-ssapkota8
Feb 20 13:16
*ens33
File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help

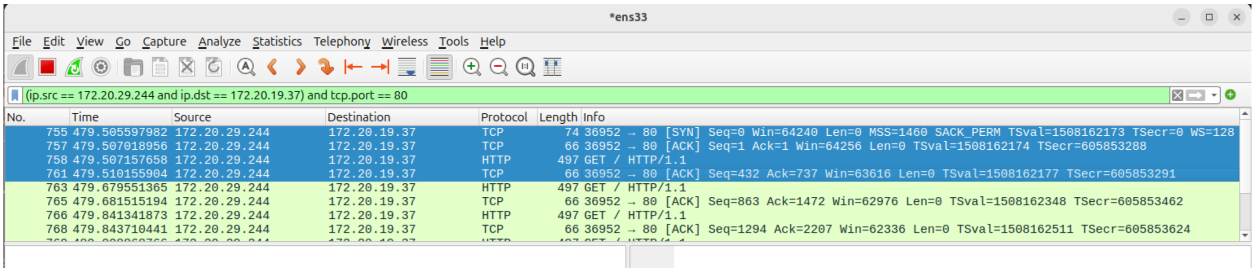
```
((ip.src == 172.20.19.37 and ip.dst == 172.20.29.244)) and tcp.port == 80

No.   Time          Source         Destination     Protocol Length Info
    8 10.763085440  172.20.19.37   172.20.29.244   TCP        74 59118 → 80 [SYN] Seq=0 Win=64240 Len=0 MSS=1460 SACK_PERM TSval=605965990 TSecr=0 WS=128
   10 10.764147005  172.20.19.37   172.20.29.244   TCP        66 59118 → 80 [ACK] Seq=1 Ack=1 Win=64256 Len=0 TSval=605965991 TSecr=1508274876
   11 10.764258362  172.20.19.37   172.20.29.244   HTTP      503 GET / HTTP/1.1
   14 10.768039121  172.20.19.37   172.20.29.244   TCP        66 59118 → 80 [ACK] Seq=438 Ack=1449 Win=67072 Len=0 TSval=605965995 TSecr=1508274880
   16 10.768160197  172.20.19.37   172.20.29.244   TCP        66 59118 → 80 [ACK] Seq=438 Ack=3485 Win=71168 Len=0 TSval=605965995 TSecr=1508274880
   20 15.775060937  172.20.19.37   172.20.29.244   TCP        66 59118 → 80 [FIN, ACK] Seq=438 Ack=3486 Win=71168 Len=0 TSval=605971002 TSecr=1508279886
```

```
› Frame 8: 74 bytes on wire (592 bits), 74 bytes captured (592 bits) on interface ens33, id
› Ethernet II, Src: VMware_ff:a7:6a (00:0c:29:ff:a7:6a), Dst: ArubaHewlett_d3:ee:c0 (bc:d7:
› Internet Protocol Version 4, Src: 172.20.19.37, Dst: 172.20.29.244
› Transmission Control Protocol, Src Port: 59118, Dst Port: 80, Seq: 0, Len: 0
```

```
0000  bc d7 a5 d3 ee c0 00 0c  29 ff a7 6a 08 00 45 00   ········ )··j··E·
0010  00 3c ab 5e 40 00 40 06  06 1c ac 14 13 25 ac 14   ·<·^@·@· ·····%··
0020  1d f4 e6 ee 00 50 b3 4b  23 11 00 00 00 00 a0 02   ·····P·K #·······
0030  fa f0 89 70 00 00 02 04  05 b4 04 02 08 0a 24 1e   ···p···· ······$·
0040  4e a6 00 00 00 00 01 03  03 07                     N······· ··
```

wireshark_ens33TWWG22.pcapng   Packets: 24 · Displayed: 6 (25.0%)   Profile: Default

HTTP request to Studdent_38 Apache server



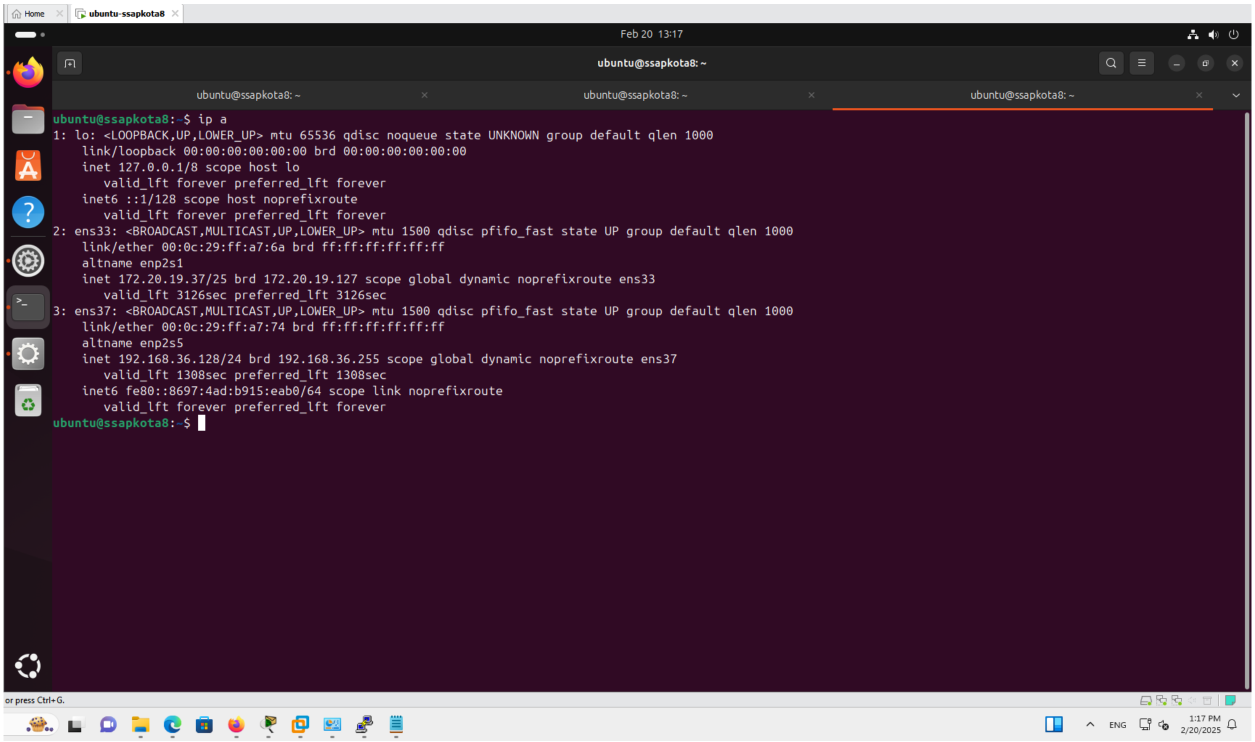
*ens33
File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help

```
(ip.src == 172.20.29.244 and ip.dst == 172.20.19.37) and tcp.port == 80

No.   Time           Source          Destination    Protocol Length Info
  755 479.505597982  172.20.29.244   172.20.19.37   TCP        74 36952 → 80 [SYN] Seq=0 Win=64240 Len=0 MSS=1460 SACK_PERM TSval=1508162173 TSecr=0 WS=128
  757 479.507018956  172.20.29.244   172.20.19.37   TCP        66 36952 → 80 [ACK] Seq=1 Ack=1 Win=64256 Len=0 TSval=1508162174 TSecr=605853288
  758 479.507157658  172.20.29.244   172.20.19.37   HTTP      497 GET / HTTP/1.1
  761 479.510155904  172.20.29.244   172.20.19.37   TCP        66 36952 → 80 [ACK] Seq=432 Ack=737 Win=63616 Len=0 TSval=1508162177 TSecr=605853291
  763 479.679551365  172.20.29.244   172.20.19.37   HTTP      497 GET / HTTP/1.1
  765 479.681515194  172.20.29.244   172.20.19.37   TCP        66 36952 → 80 [ACK] Seq=863 Ack=1472 Win=62976 Len=0 TSval=1508162348 TSecr=605853462
  766 479.841341873  172.20.29.244   172.20.19.37   HTTP      497 GET / HTTP/1.1
  768 479.843710441  172.20.29.244   172.20.19.37   TCP        66 36952 → 80 [ACK] Seq=1294 Ack=2207 Win=62336 Len=0 TSval=1508162511 TSecr=605853624
```

Appendix B: Commands on VM

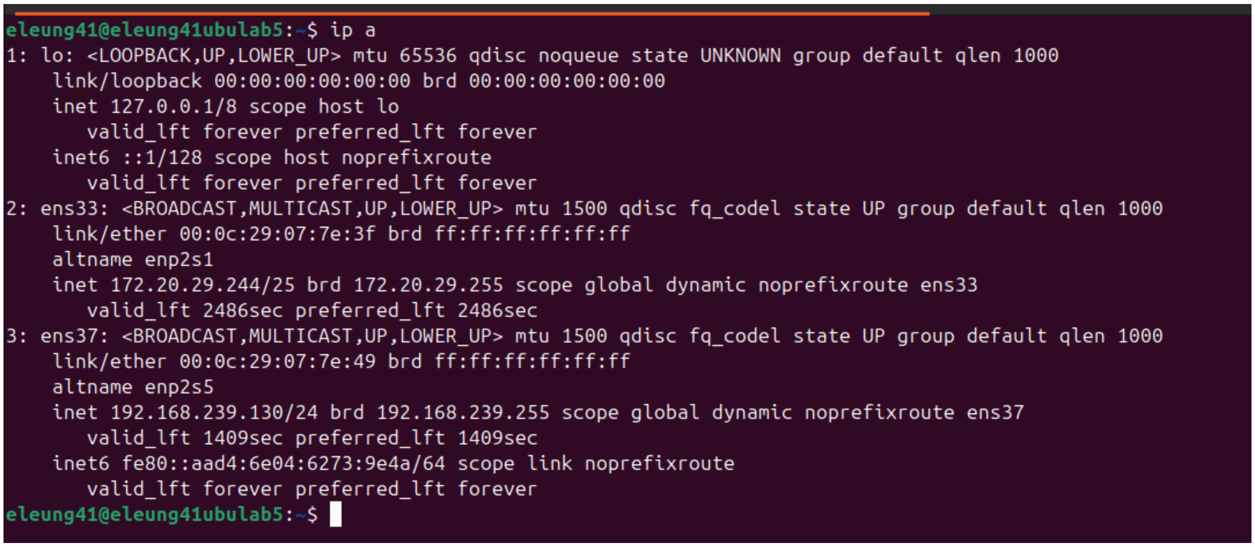
Terminal Command “ip a”

STUDENT_38 VM



```
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 172.20.19.37/25 brd 172.20.19.127 scope global dynamic noprefixroute ens33
       valid_lft 3126sec preferred_lft 3126sec
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 1308sec preferred_lft 1308sec
    inet6 fe80::8697:4ad:b915:eab0/64 scope link noprefixroute
       valid_lft forever preferred_lft forever
ubuntu@ssapkota8:~$
```

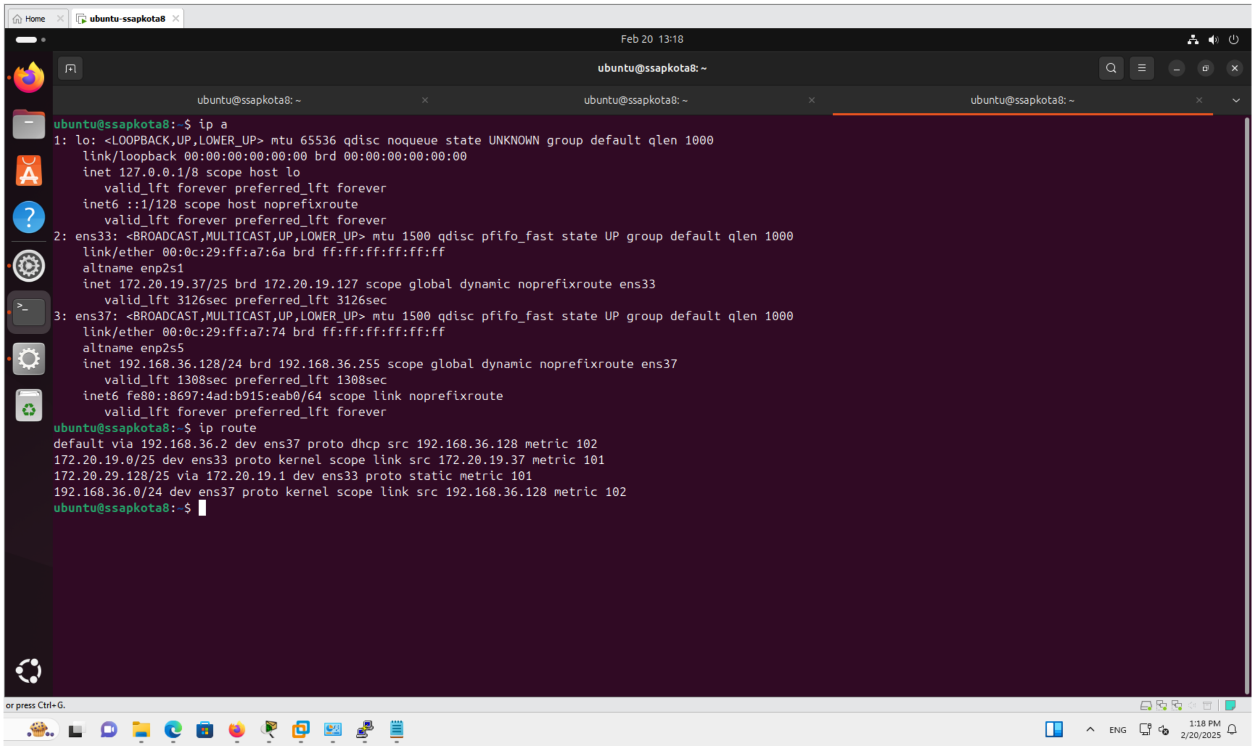
STUDENT_61 VM



```
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 172.20.29.244/25 brd 172.20.29.255 scope global dynamic noprefixroute ens33
       valid_lft 2486sec preferred_lft 2486sec
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 1409sec preferred_lft 1409sec
    inet6 fe80::aad4:6e04:6273:9e4a/64 scope link noprefixroute
       valid_lft forever preferred_lft forever
eleung41@eleung41ubulab5:~$
```

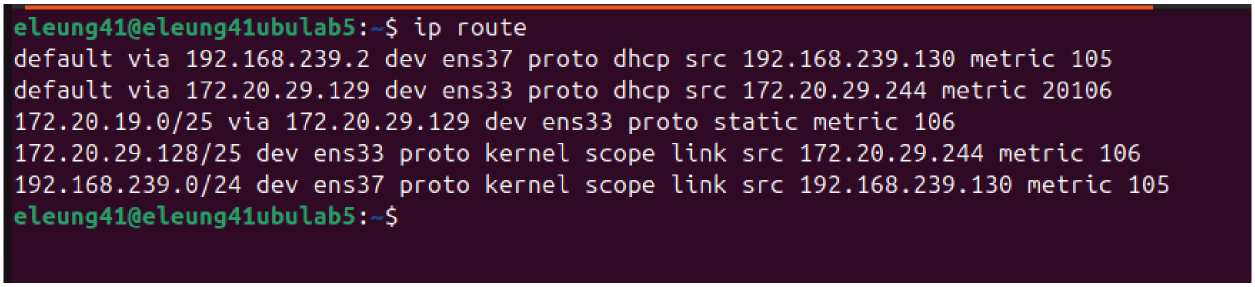
Terminal Command “IP route”

STUDENT_38 VM



```
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 172.20.19.37/25 brd 172.20.19.127 scope global dynamic noprefixroute ens33
       valid_lft 3126sec preferred_lft 3126sec
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 1308sec preferred_lft 1308sec
    inet6 fe80::8697:4ad:b915:eab0/64 scope link noprefixroute
       valid_lft forever preferred_lft forever
ubuntu@ssapkota8:~$ ip route
default via 192.168.36.2 dev ens37 proto dhcp src 192.168.36.128 metric 102
172.20.19.0/25 dev ens33 proto kernel scope link src 172.20.19.37 metric 101
172.20.29.128/25 via 172.20.19.1 dev ens33 proto static metric 101
192.168.36.0/24 dev ens37 proto kernel scope link src 192.168.36.128 metric 102
ubuntu@ssapkota8:~$
```

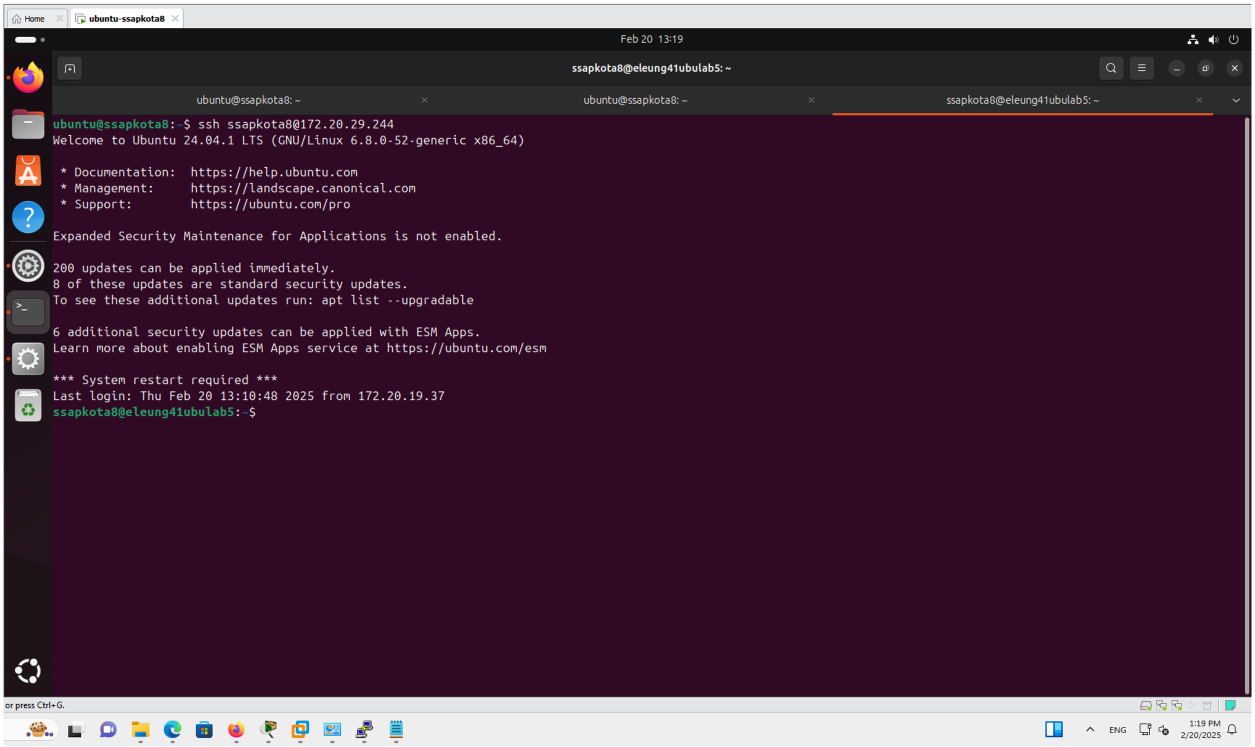
STUDENT_61 VM



```
eleung41@eleung41ubulab5:~$ ip route
default via 192.168.239.2 dev ens37 proto dhcp src 192.168.239.130 metric 105
default via 172.20.29.129 dev ens33 proto dhcp src 172.20.29.244 metric 20106
172.20.19.0/25 via 172.20.29.129 dev ens33 proto static metric 106
172.20.29.128/25 dev ens33 proto kernel scope link src 172.20.29.244 metric 106
192.168.239.0/24 dev ens37 proto kernel scope link src 192.168.239.130 metric 105
eleung41@eleung41ubulab5:~$
```

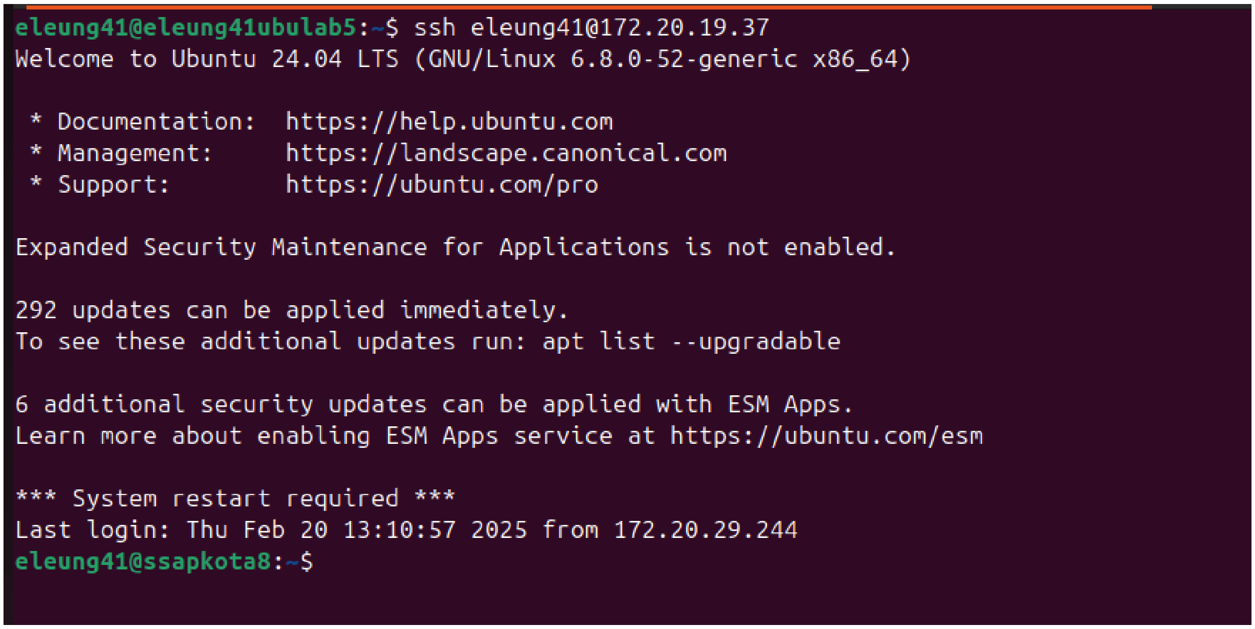
SSH to partners VM

STUDENT_38 VM



```
ubuntu@ssapkota8:~$ ssh ssapkota8@172.20.29.244
Welcome to Ubuntu 24.04.1 LTS (GNU/Linux 6.8.0-52-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.

200 updates can be applied immediately.
8 of these updates are standard security updates.
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 Feb 20 13:10:48 2025 from 172.20.19.37
ssapkota8@eleung41ubulab5:~$
```

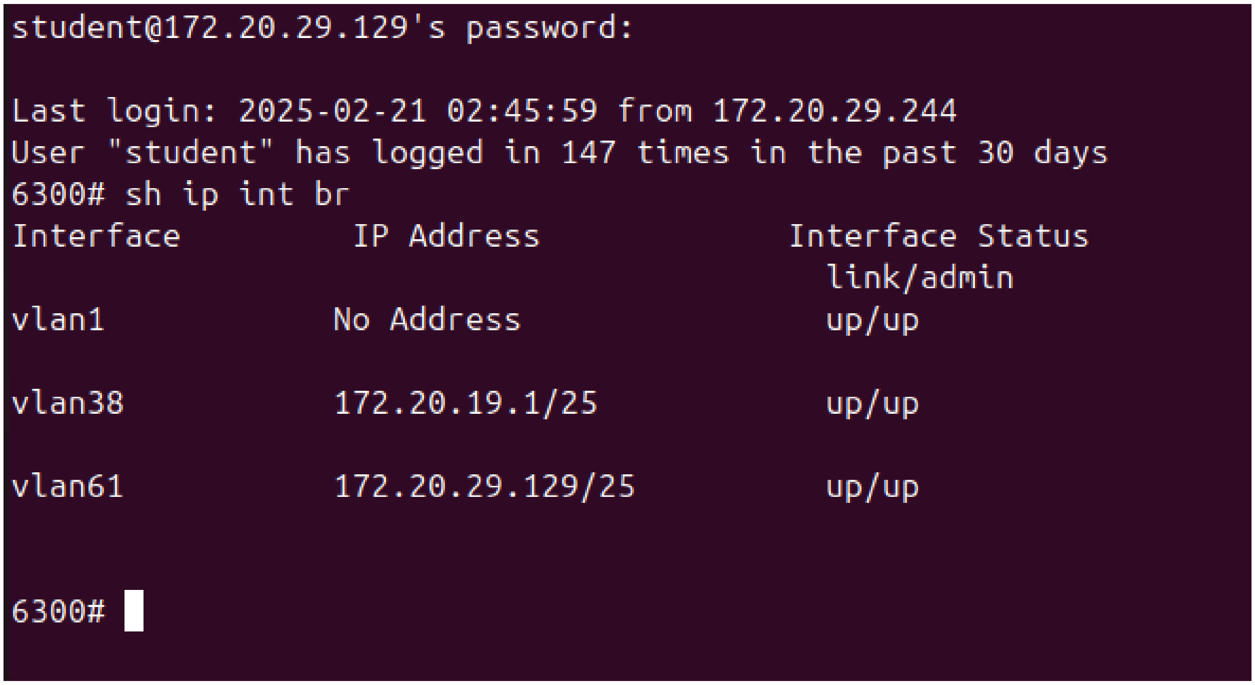
STUDENT_61 VM



```
eleung41@eleung41ubulab5:~$ ssh eleung41@172.20.19.37
Welcome to Ubuntu 24.04 LTS (GNU/Linux 6.8.0-52-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.

292 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 Feb 20 13:10:57 2025 from 172.20.29.244
eleung41@ssapkota8:~$
```

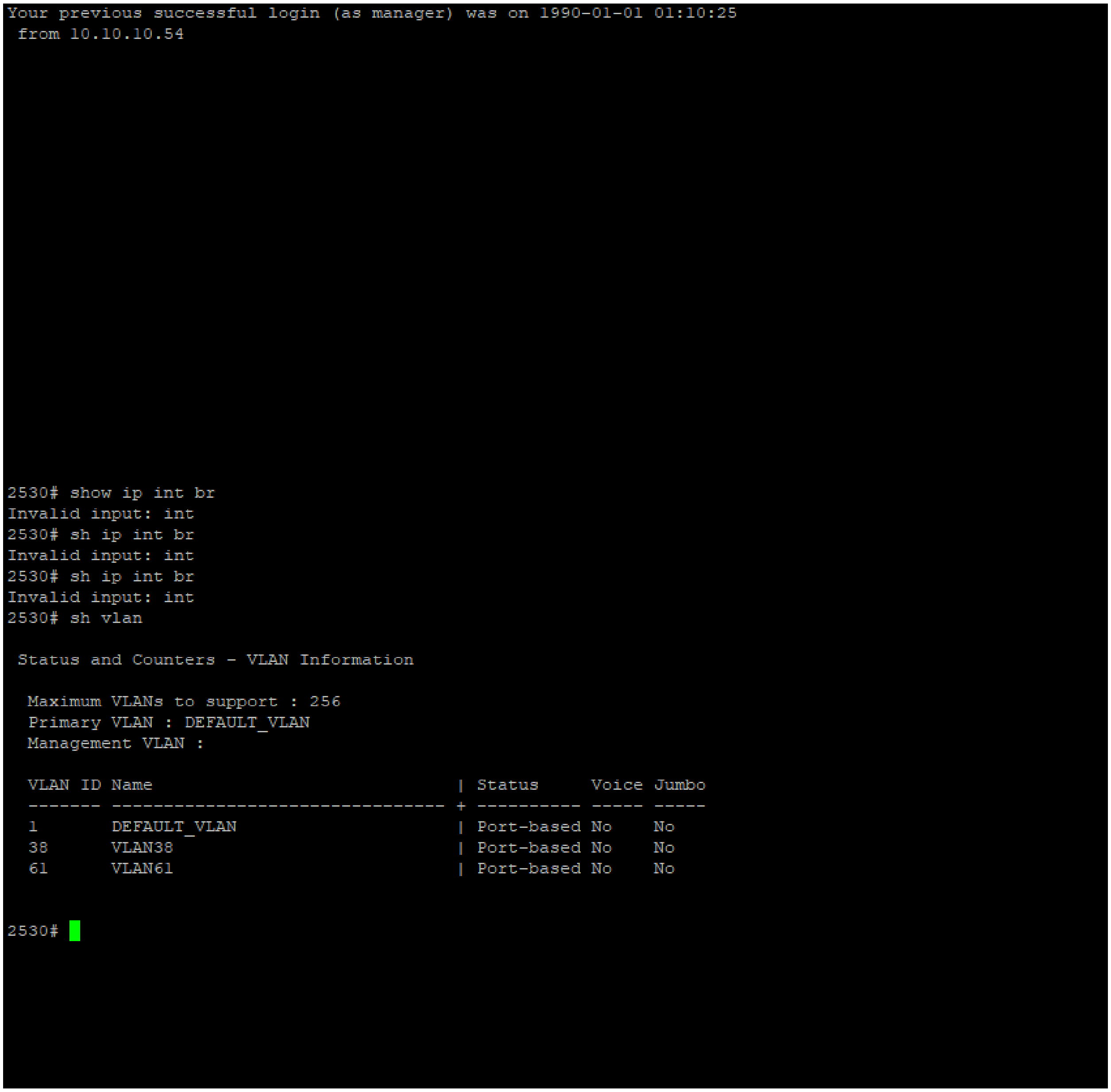
Appendix C: Commands on Switch

Sh ip int br



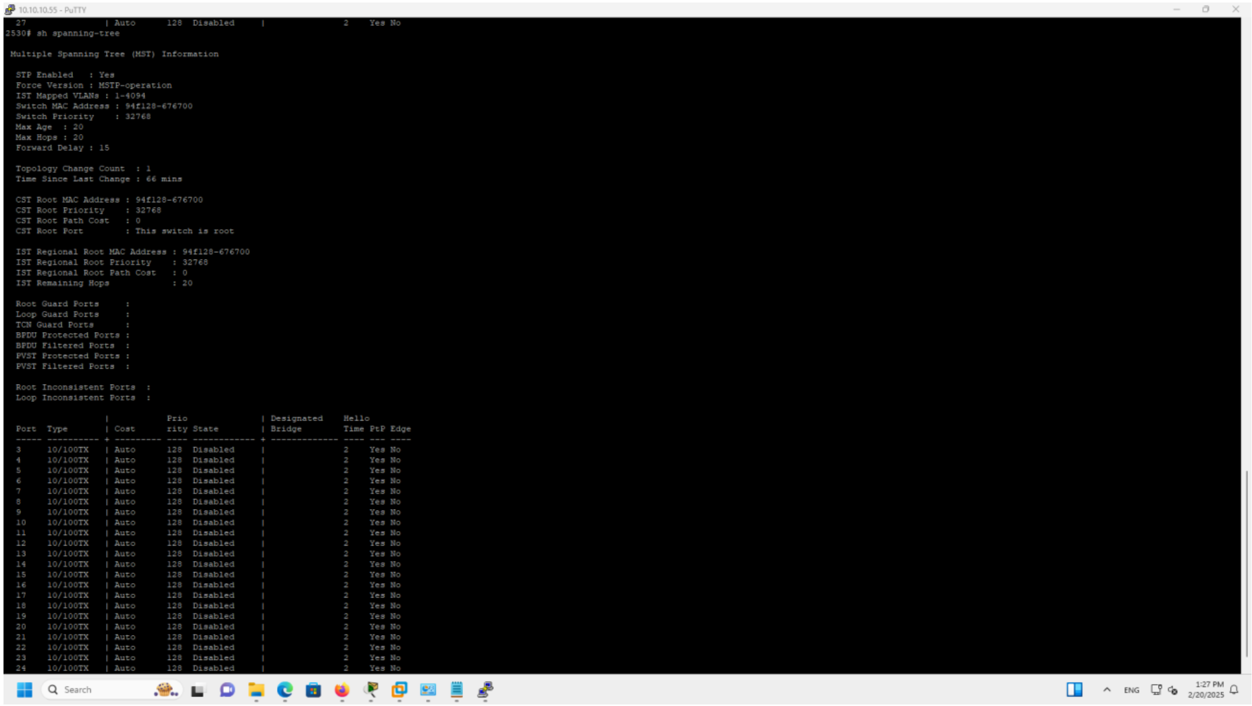
```
student@172.20.29.129's password:

Last login: 2025-02-21 02:45:59 from 172.20.29.244
User "student" has logged in 147 times in the past 30 days
6300# sh ip int br
Interface          IP Address              Interface Status
                                             link/admin
vlan1             No Address                 up/up

vlan38            172.20.19.1/25             up/up

vlan61            172.20.29.129/25           up/up


6300# 
```

Sh vlan

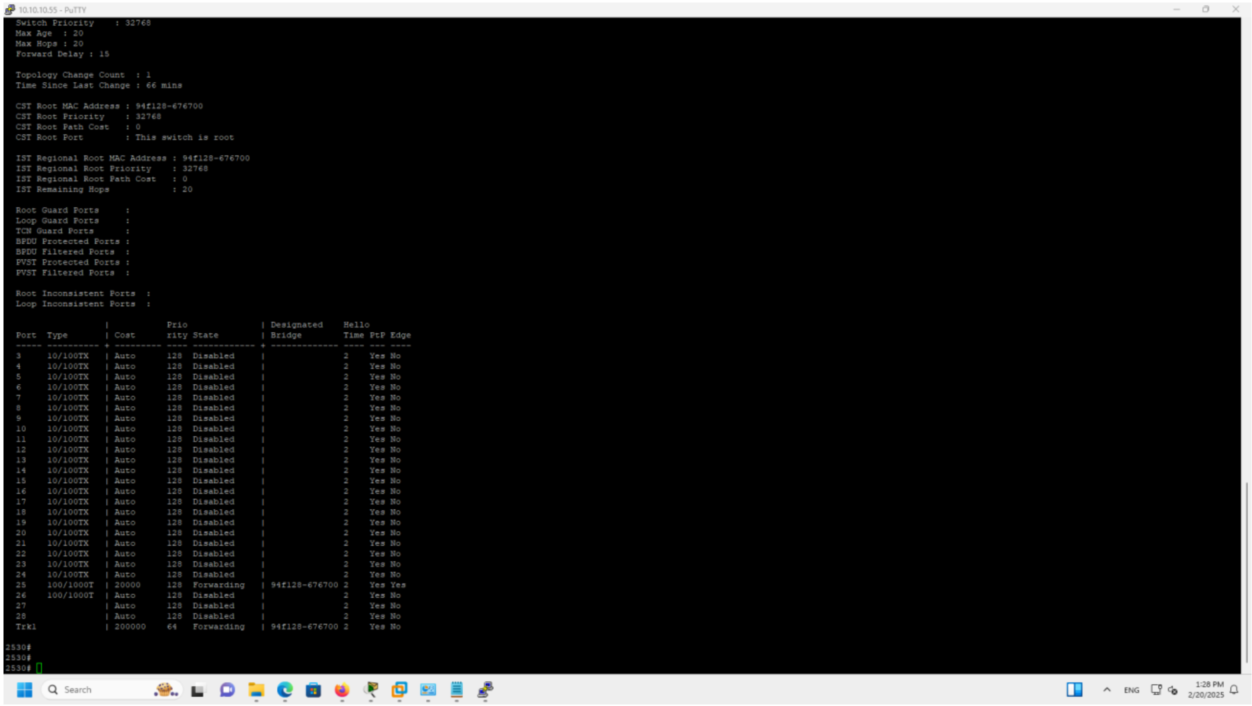


```
Your previous successful login (as manager) was on 1990-01-01 01:10:25
 from 10.10.10.54









































2530# show ip int br
Invalid input: int
2530# sh ip int br
Invalid input: int
2530# sh ip int br
Invalid input: int
2530# sh vlan

 Status and Counters - VLAN Information

  Maximum VLANs to support : 256
  Primary VLAN : DEFAULT_VLAN
  Management VLAN :

  VLAN ID Name                             | Status     Voice Jumbo
  ------- -------------------------------- + ---------- ----- -----
  1       DEFAULT_VLAN                     | Port-based No    No
  38      VLAN38                           | Port-based No    No
  61      VLAN61                           | Port-based No    No


2530#
```

Sh spanning-tree

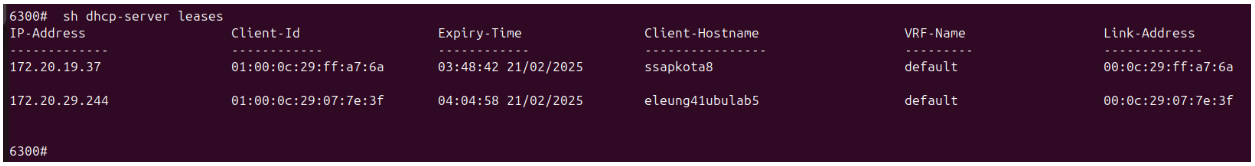


```
  27               | Auto      128  Disabled     |               2    Yes No
2530# sh spanning-tree

 Multiple Spanning Tree (MST) Information

  STP Enabled   : Yes
  Force Version : MSTP-operation
  IST Mapped VLANs : 1-4094
  Switch MAC Address : 94f128-676700
  Switch Priority    : 32768
  Max Age  : 20
  Max Hops : 20
  Forward Delay : 15

  Topology Change Count  : 1
  Time Since Last Change : 66 mins

  CST Root MAC Address : 94f128-676700
  CST Root Priority    : 32768
  CST Root Path Cost   : 0
  CST Root Port        : This switch is root

  IST Regional Root MAC Address : 94f128-676700
  IST Regional Root Priority    : 32768
  IST Regional Root Path Cost   : 0
  IST Remaining Hops            : 20

  Root Guard Ports     :
  Loop Guard Ports     :
  TCN Guard Ports      :
  BPDU Protected Ports :
  BPDU Filtered Ports  :
  PVST Protected Ports :
  PVST Filtered Ports  :

  Root Inconsistent Ports  :
  Loop Inconsistent Ports  :

                   |           Prio              | Designated    Hello
  Port  Type       | Cost      rity State        | Bridge        Time PtP Edge
  ----- ---------- + --------- ---- ------------ + ------------- ---- --- ----
  3     10/100TX   | Auto      128  Disabled     |               2    Yes No
  4     10/100TX   | Auto      128  Disabled     |               2    Yes No
  5     10/100TX   | Auto      128  Disabled     |               2    Yes No
  6     10/100TX   | Auto      128  Disabled     |               2    Yes No
  7     10/100TX   | Auto      128  Disabled     |               2    Yes No
  8     10/100TX   | Auto      128  Disabled     |               2    Yes No
  9     10/100TX   | Auto      128  Disabled     |               2    Yes No
  10    10/100TX   | Auto      128  Disabled     |               2    Yes No
  11    10/100TX   | Auto      128  Disabled     |               2    Yes No
  12    10/100TX   | Auto      128  Disabled     |               2    Yes No
  13    10/100TX   | Auto      128  Disabled     |               2    Yes No
  14    10/100TX   | Auto      128  Disabled     |               2    Yes No
  15    10/100TX   | Auto      128  Disabled     |               2    Yes No
  16    10/100TX   | Auto      128  Disabled     |               2    Yes No
  17    10/100TX   | Auto      128  Disabled     |               2    Yes No
  18    10/100TX   | Auto      128  Disabled     |               2    Yes No
  19    10/100TX   | Auto      128  Disabled     |               2    Yes No
  20    10/100TX   | Auto      128  Disabled     |               2    Yes No
  21    10/100TX   | Auto      128  Disabled     |               2    Yes No
  22    10/100TX   | Auto      128  Disabled     |               2    Yes No
  23    10/100TX   | Auto      128  Disabled     |               2    Yes No
  24    10/100TX   | Auto      128  Disabled     |               2    Yes No
```



```
  Switch Priority    : 32768
  Max Age  : 20
  Max Hops : 20
  Forward Delay : 15

  Topology Change Count  : 1
  Time Since Last Change : 66 mins

  CST Root MAC Address : 94f128-676700
  CST Root Priority    : 32768
  CST Root Path Cost   : 0
  CST Root Port        : This switch is root

  IST Regional Root MAC Address : 94f128-676700
  IST Regional Root Priority    : 32768
  IST Regional Root Path Cost   : 0
  IST Remaining Hops            : 20

  Root Guard Ports     :
  Loop Guard Ports     :
  TCN Guard Ports      :
  BPDU Protected Ports :
  BPDU Filtered Ports  :
  PVST Protected Ports :
  PVST Filtered Ports  :

  Root Inconsistent Ports  :
  Loop Inconsistent Ports  :

                   |           Prio              | Designated    Hello
  Port  Type       | Cost      rity State        | Bridge        Time PtP Edge
  ----- ---------- + --------- ---- ------------ + ------------- ---- --- ----
  3     10/100TX   | Auto      128  Disabled     |               2    Yes No
  4     10/100TX   | Auto      128  Disabled     |               2    Yes No
  5     10/100TX   | Auto      128  Disabled     |               2    Yes No
  6     10/100TX   | Auto      128  Disabled     |               2    Yes No
  7     10/100TX   | Auto      128  Disabled     |               2    Yes No
  8     10/100TX   | Auto      128  Disabled     |               2    Yes No
  9     10/100TX   | Auto      128  Disabled     |               2    Yes No
  10    10/100TX   | Auto      128  Disabled     |               2    Yes No
  11    10/100TX   | Auto      128  Disabled     |               2    Yes No
  12    10/100TX   | Auto      128  Disabled     |               2    Yes No
  13    10/100TX   | Auto      128  Disabled     |               2    Yes No
  14    10/100TX   | Auto      128  Disabled     |               2    Yes No
  15    10/100TX   | Auto      128  Disabled     |               2    Yes No
  16    10/100TX   | Auto      128  Disabled     |               2    Yes No
  17    10/100TX   | Auto      128  Disabled     |               2    Yes No
  18    10/100TX   | Auto      128  Disabled     |               2    Yes No
  19    10/100TX   | Auto      128  Disabled     |               2    Yes No
  20    10/100TX   | Auto      128  Disabled     |               2    Yes No
  21    10/100TX   | Auto      128  Disabled     |               2    Yes No
  22    10/100TX   | Auto      128  Disabled     |               2    Yes No
  23    10/100TX   | Auto      128  Disabled     |               2    Yes No
  24    10/100TX   | Auto      128  Disabled     |               2    Yes No
  25    100/1000T  | 20000     128  Forwarding   | 94f128-676700 2    Yes Yes
  26    100/1000T  | Auto      128  Disabled     |               2    Yes No
  27               | Auto      128  Disabled     |               2    Yes No
  28               | Auto      128  Disabled     |               2    Yes No
  Trk1             | 200000    64   Forwarding   | 94f128-676700 2    Yes No

2530#
2530#
2530#
```

Sh dhcp-server leases



```
6300#  sh dhcp-server leases
IP-Address                   Client-Id                  Expiry-Time                Client-Hostname                   VRF-Name                  Link-Address
-------------                ------------               ------------               ----------------                  ---------                 -------------
172.20.19.37                 01:00:0c:29:ff:a7:6a       03:48:42 21/02/2025        ssapkota8                         default                   00:0c:29:ff:a7:6a

172.20.29.244                01:00:0c:29:07:7e:3f       04:04:58 21/02/2025        eleung41ubulab5                   default                   00:0c:29:07:7e:3f


6300#
```

Appendix D: Switch Script Commands

For 6300 Switch

```
config t
vlan 1,38,61
spanning-tree
interface mgmt
  no shutdown
  ip static 10.10.10.50/28
interface lag 1
  no shutdown
  no routing
  vlan trunk native 1
  vlan trunk allowed all
interface 1/1/1
  no shutdown
  lag 1
interface 1/1/2
  no shutdown
  lag 1
interface 1/1/3
  no shutdown
  no routing
  vlan access 38

interface vlan 38
  ip address 172.20.19.1/25
interface vlan 61
  ip address 172.20.29.129/25

https-server vrf default
https-server vrf mgmt
dhcp-server vrf default
  pool vlan38
    range 172.20.19.2 172.20.19.126 prefix-len 25
    default-router 172.20.19.1
    exit
  pool vlan61
    range 172.20.29.130 172.20.29.254 prefix-len 25
    default-router 172.20.29.129
    exit
  enable
```

<u>Script for switch config 2530</u>

```
# Global Configuration
conf t

# LAG Configuration for ports 1 and 2
trunk 1-2 trk1 lacp

# VLAN 61 Configuration
vlan 61
tagged trk1
no ip address
exit

# VLAN 38 Configuration
vlan 38
untagged 3
tagged trk1
no ip address
exit

# Spanning Tree Configuration
spanning-tree
```