

# CEIS 191

---

Fundamentals of Information Technology and Networking



# Introduction

---

- This course introduces the underlying technology of local area networks (LANs), wide area networks (WANs) and the Internet. Topics include the Open Systems Interconnection (OSI) model, Internet Protocol (IP) addressing, Transmission media, Transmission Control Protocol/Internet Protocol (TCP/IP) suite, an overview of routing and switching, network troubleshooting, and network security.

# Challenges

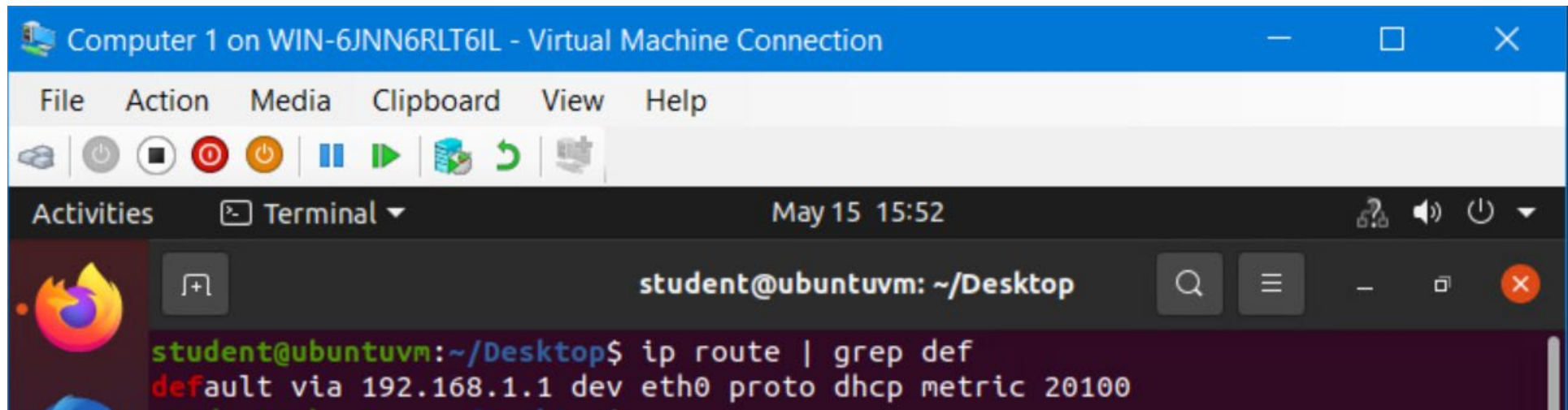
- While taking this class I oversaw a large automation project in the Austin Chalk Basin of Central Texas after changing to a new company. I was working very long hours, so besides the live lectures I was not able to join any homework huddles. There was numerous times where I had to re-try network configurations to make sure everything was working properly

# IPv4 Addressing

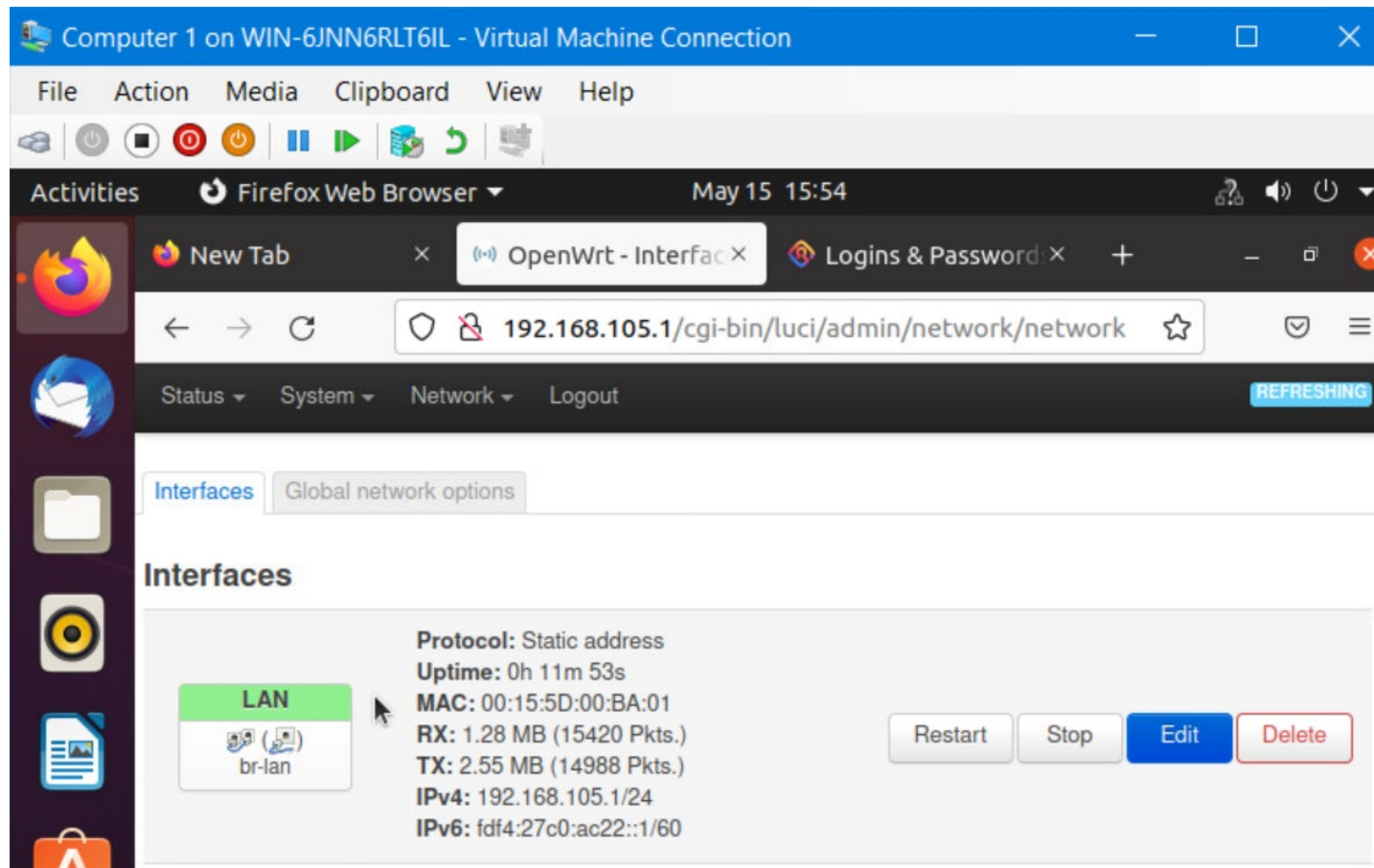
---

# Preparation

Screenshot shown includes the terminal window that shows the default gateway IP address.



# IPv4 Address Assignment

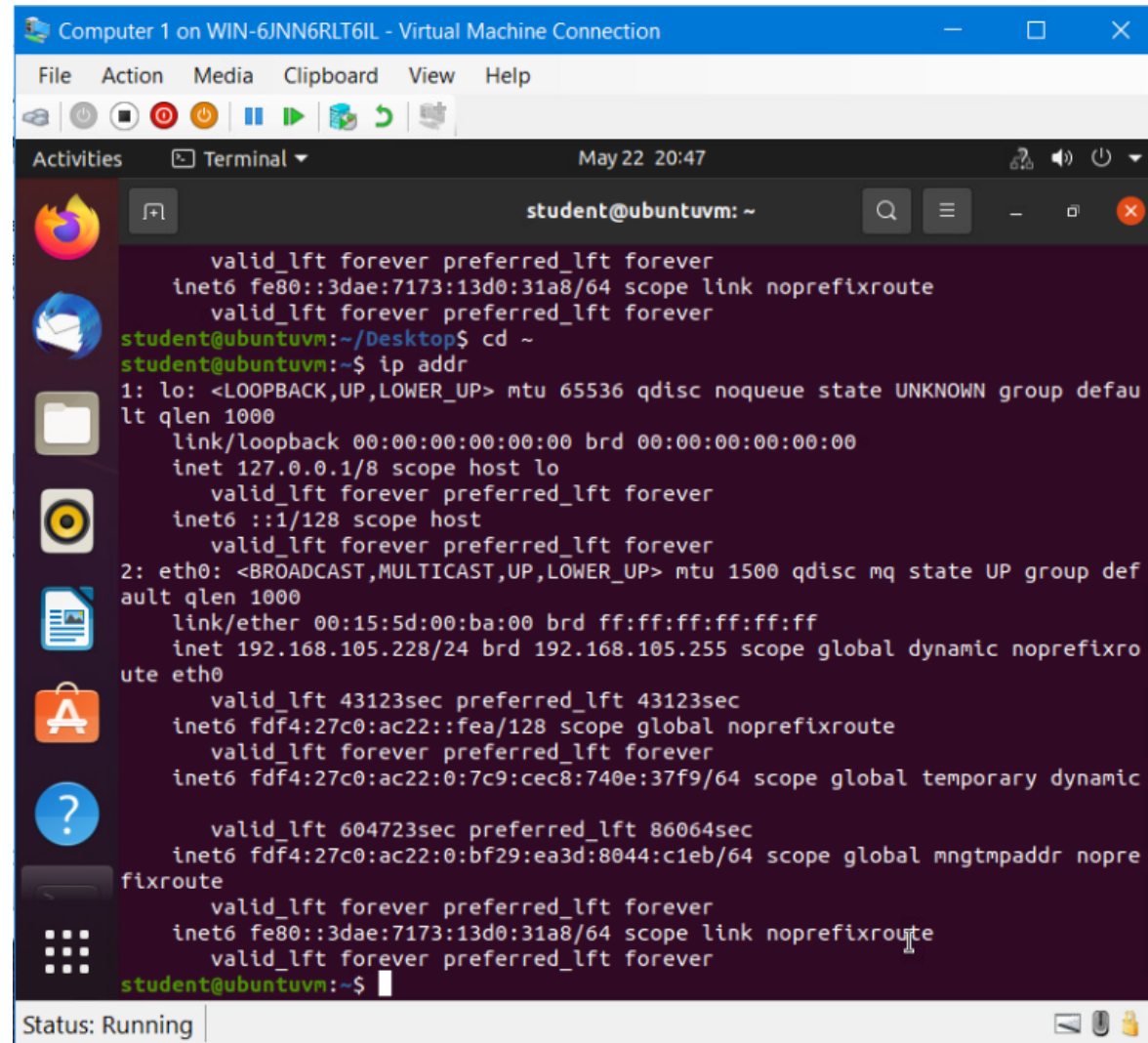


# Connectivity Test



# Dynamic IP Address Assignment

Shown is the IPv4  
address of the  
*Computer 1* VM.



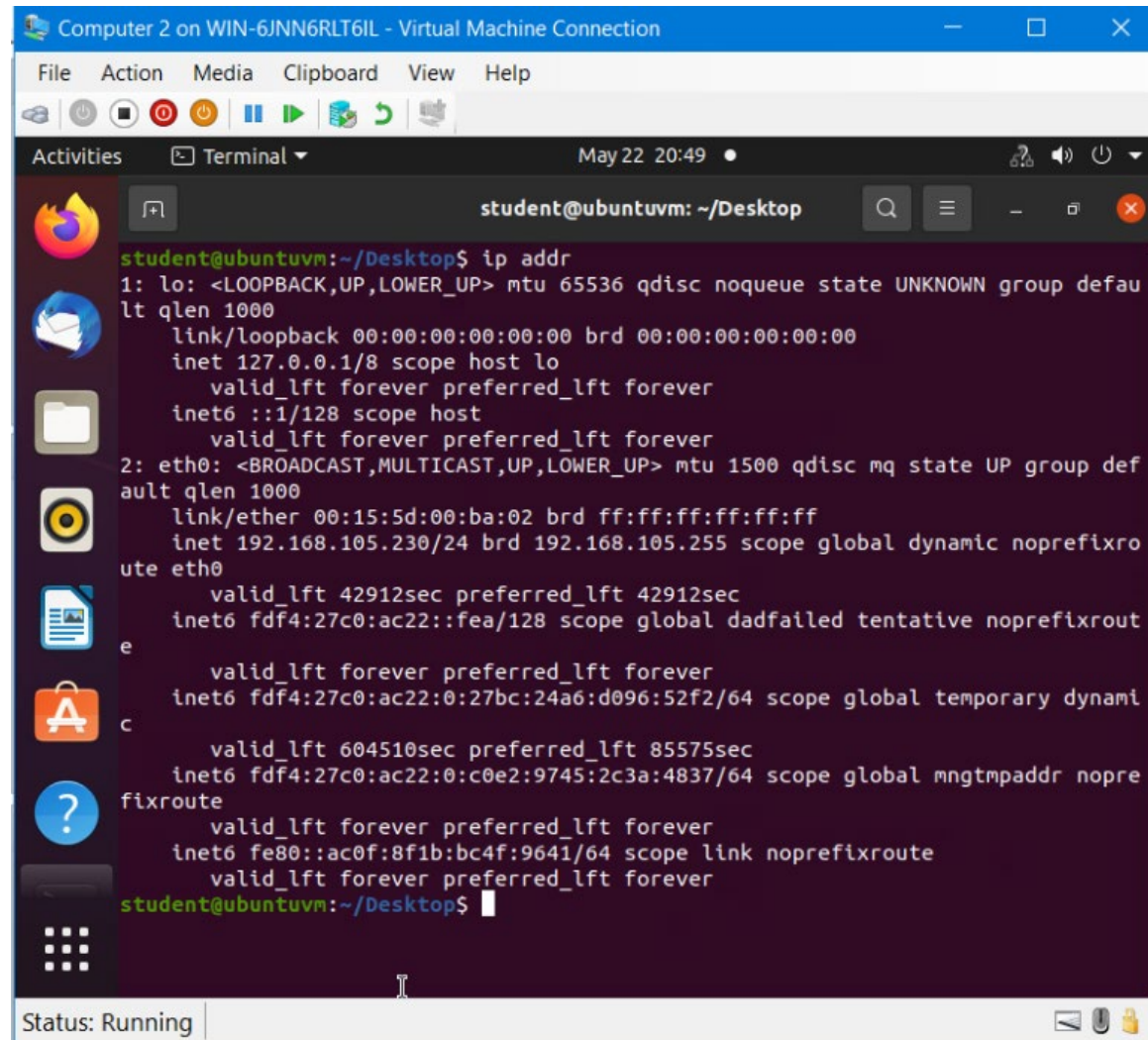
The screenshot shows a terminal window titled "Computer 1 on WIN-6JNN6RLT6IL - Virtual Machine Connection". The terminal displays the output of the `ip addr` command, showing the IPv4 address `192.168.105.228` assigned to the `eth0` interface. The terminal also shows the user `student` at the `ubuntuvvm` prompt. The status bar at the bottom indicates "Status: Running".

```
valid_lft forever preferred_lft forever
inet6 fe80::3dae:7173:13d0:31a8/64 scope link noprefixroute
valid_lft forever preferred_lft forever
student@ubuntuvvm:~/Desktop$ cd ~
student@ubuntuvvm:~$ ip addr
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group defau
lt 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
        valid_lft forever preferred_lft forever
2: eth0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc mq state UP group def
ault qlen 1000
    link/ether 00:15:5d:00:ba:00 brd ff:ff:ff:ff:ff:ff
    inet 192.168.105.228/24 brd 192.168.105.255 scope global dynamic noprefixro
ute eth0
        valid_lft 43123sec preferred_lft 43123sec
    inet6 fdf4:27c0:ac22::fea/128 scope global noprefixroute
        valid_lft forever preferred_lft forever
    inet6 fdf4:27c0:ac22:0:7c9:cec8:740e:37f9/64 scope global temporary dynamic
        valid_lft 604723sec preferred_lft 86064sec
    inet6 fdf4:27c0:ac22:0:bf29:ea3d:8044:c1eb/64 scope global mngtmpaddr nopre
fixroute
    valid_lft forever preferred_lft forever
    inet6 fe80::3dae:7173:13d0:31a8/64 scope link noprefixroute
    valid_lft forever preferred_lft forever
student@ubuntuvvm:~$
```



# Dynamic IP Address Assignment

Shown is the IPv4  
address of the  
*Computer 2* VM.

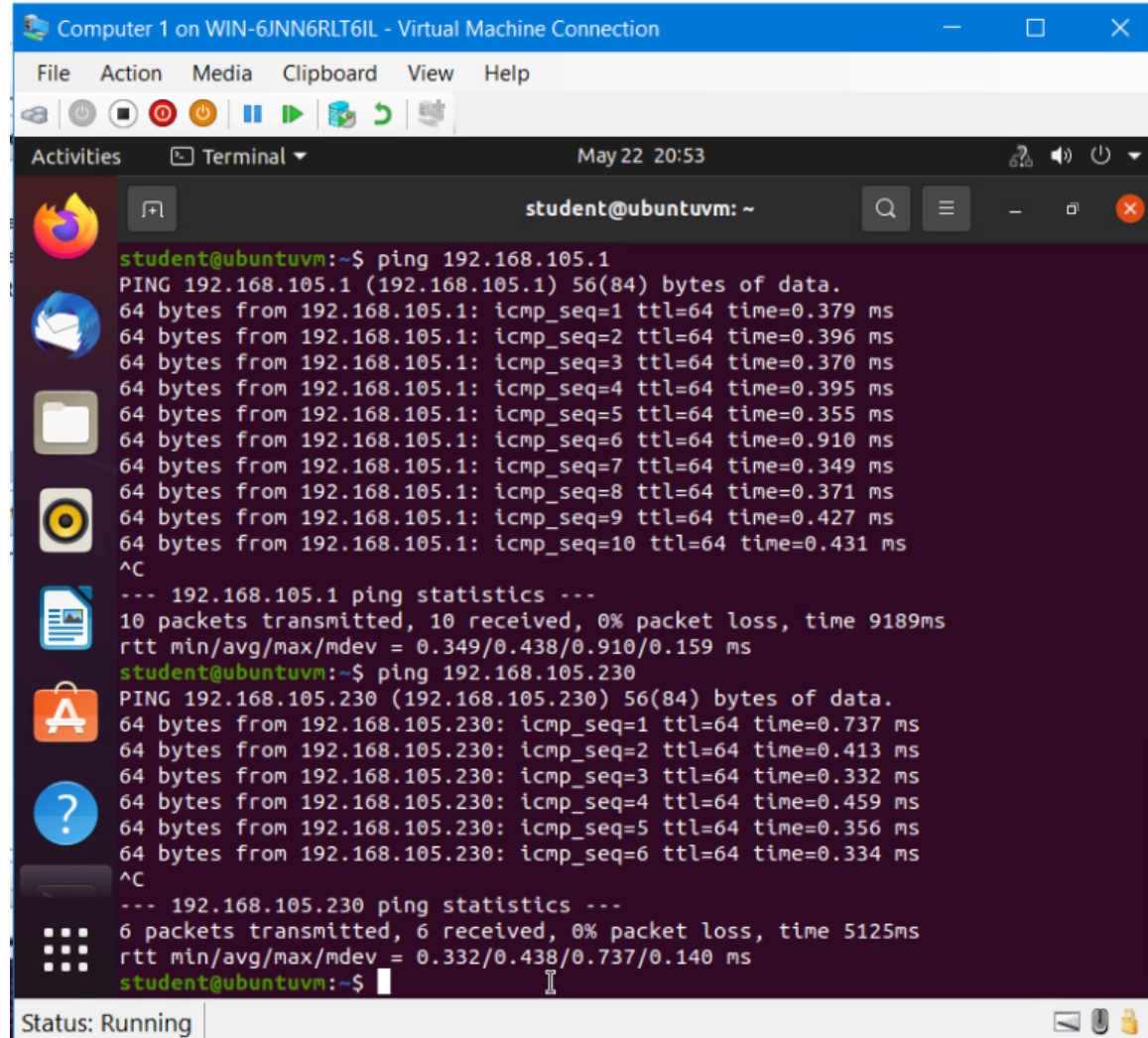


The screenshot shows a terminal window titled "Computer 2 on WIN-6JNN6RLT6IL - Virtual Machine Connection". The terminal displays the output of the command `ip addr`. The output shows the configuration for the loopback interface `lo` and the Ethernet interface `eth0`. The IPv4 address for `eth0` is `192.168.105.230`.

```
student@ubuntuvm: ~/Desktop
student@ubuntuvm:~/Desktop$ ip addr
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group defau
lt 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
        valid_lft forever preferred_lft forever
2: eth0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc mq state UP group def
ault qlen 1000
    link/ether 00:15:5d:00:ba:02 brd ff:ff:ff:ff:ff:ff
    inet 192.168.105.230/24 brd 192.168.105.255 scope global dynamic noprefixro
ute eth0
        valid_lft 42912sec preferred_lft 42912sec
    inet6 fdf4:27c0:ac22::fea/128 scope global dadfailed tentative noprefixrout
e
        valid_lft forever preferred_lft forever
    inet6 fdf4:27c0:ac22:0:27bc:24a6:d096:52f2/64 scope global temporary dynami
c
        valid_lft 604510sec preferred_lft 85575sec
    inet6 fdf4:27c0:ac22:0:c0e2:9745:2c3a:4837/64 scope global mngtmpaddr nopre
fixroute
        valid_lft forever preferred_lft forever
    inet6 fe80::ac0f:8f1b:bc4f:9641/64 scope link noprefixroute
        valid_lft forever preferred_lft forever
student@ubuntuvm:~/Desktop$
```

# Connectivity Test

Shown is the connectivity tests between the *Computer 1* VM and the other two devices (i.e., the *SOHO Router* VM and *Computer 2* VM).



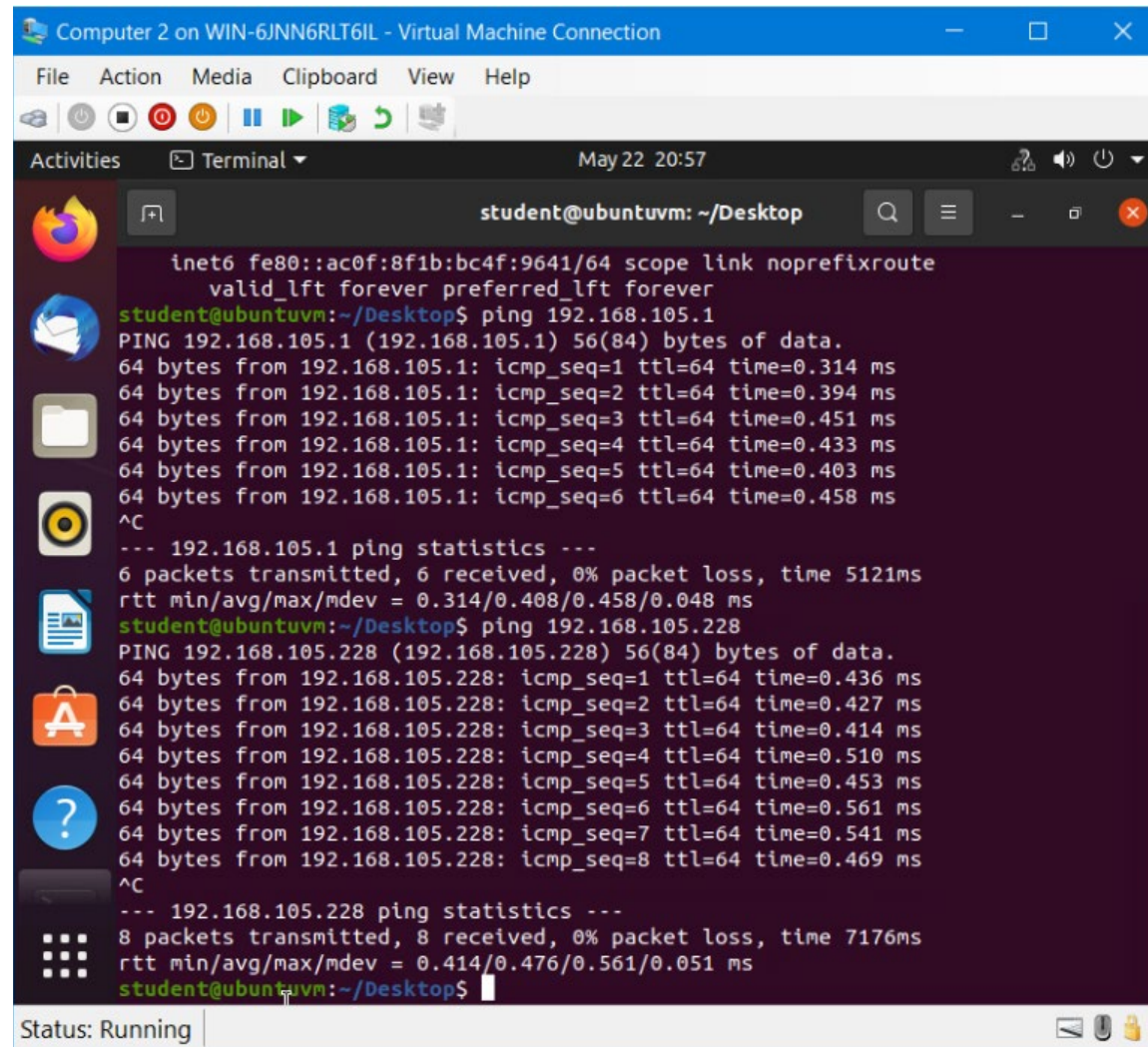
The screenshot shows a terminal window titled "Computer 1 on WIN-6JNN6RLT6IL - Virtual Machine Connection". The terminal displays the results of two ping tests performed by a user named "student" on a machine named "ubuntuvvm".

```
student@ubuntuvm:~$ ping 192.168.105.1
PING 192.168.105.1 (192.168.105.1) 56(84) bytes of data.
64 bytes from 192.168.105.1: icmp_seq=1 ttl=64 time=0.379 ms
64 bytes from 192.168.105.1: icmp_seq=2 ttl=64 time=0.396 ms
64 bytes from 192.168.105.1: icmp_seq=3 ttl=64 time=0.370 ms
64 bytes from 192.168.105.1: icmp_seq=4 ttl=64 time=0.395 ms
64 bytes from 192.168.105.1: icmp_seq=5 ttl=64 time=0.355 ms
64 bytes from 192.168.105.1: icmp_seq=6 ttl=64 time=0.910 ms
64 bytes from 192.168.105.1: icmp_seq=7 ttl=64 time=0.349 ms
64 bytes from 192.168.105.1: icmp_seq=8 ttl=64 time=0.371 ms
64 bytes from 192.168.105.1: icmp_seq=9 ttl=64 time=0.427 ms
64 bytes from 192.168.105.1: icmp_seq=10 ttl=64 time=0.431 ms
^C
--- 192.168.105.1 ping statistics ---
10 packets transmitted, 10 received, 0% packet loss, time 9189ms
rtt min/avg/max/mdev = 0.349/0.438/0.910/0.159 ms
student@ubuntuvm:~$ ping 192.168.105.230
PING 192.168.105.230 (192.168.105.230) 56(84) bytes of data.
64 bytes from 192.168.105.230: icmp_seq=1 ttl=64 time=0.737 ms
64 bytes from 192.168.105.230: icmp_seq=2 ttl=64 time=0.413 ms
64 bytes from 192.168.105.230: icmp_seq=3 ttl=64 time=0.332 ms
64 bytes from 192.168.105.230: icmp_seq=4 ttl=64 time=0.459 ms
64 bytes from 192.168.105.230: icmp_seq=5 ttl=64 time=0.356 ms
64 bytes from 192.168.105.230: icmp_seq=6 ttl=64 time=0.334 ms
^C
--- 192.168.105.230 ping statistics ---
6 packets transmitted, 6 received, 0% packet loss, time 5125ms
rtt min/avg/max/mdev = 0.332/0.438/0.737/0.140 ms
student@ubuntuvm:~$
```

The terminal window includes a menu bar (File, Action, Media, Clipboard, View, Help), a toolbar with various icons, and a sidebar with application icons. The status bar at the bottom indicates "Status: Running".

# Connectivity Test

Shown is the connectivity tests between the *Computer 2* VM and the other two devices (i.e., the *SOHO Router* VM and *Computer 1* VM).



```
Computer 2 on WIN-6JNN6RLT6IL - Virtual Machine Connection
File Action Media Clipboard View Help
Activities Terminal May 22 20:57
student@ubuntuvvm: ~/Desktop
inet6 fe80::ac0f:8f1b:bc4f:9641/64 scope link noprefixroute
valid_lft forever preferred_lft forever
student@ubuntuvvm:~/Desktop$ ping 192.168.105.1
PING 192.168.105.1 (192.168.105.1) 56(84) bytes of data.
64 bytes from 192.168.105.1: icmp_seq=1 ttl=64 time=0.314 ms
64 bytes from 192.168.105.1: icmp_seq=2 ttl=64 time=0.394 ms
64 bytes from 192.168.105.1: icmp_seq=3 ttl=64 time=0.451 ms
64 bytes from 192.168.105.1: icmp_seq=4 ttl=64 time=0.433 ms
64 bytes from 192.168.105.1: icmp_seq=5 ttl=64 time=0.403 ms
64 bytes from 192.168.105.1: icmp_seq=6 ttl=64 time=0.458 ms
^C
--- 192.168.105.1 ping statistics ---
6 packets transmitted, 6 received, 0% packet loss, time 5121ms
rtt min/avg/max/mdev = 0.314/0.408/0.458/0.048 ms
student@ubuntuvvm:~/Desktop$ ping 192.168.105.228
PING 192.168.105.228 (192.168.105.228) 56(84) bytes of data.
64 bytes from 192.168.105.228: icmp_seq=1 ttl=64 time=0.436 ms
64 bytes from 192.168.105.228: icmp_seq=2 ttl=64 time=0.427 ms
64 bytes from 192.168.105.228: icmp_seq=3 ttl=64 time=0.414 ms
64 bytes from 192.168.105.228: icmp_seq=4 ttl=64 time=0.510 ms
64 bytes from 192.168.105.228: icmp_seq=5 ttl=64 time=0.453 ms
64 bytes from 192.168.105.228: icmp_seq=6 ttl=64 time=0.561 ms
64 bytes from 192.168.105.228: icmp_seq=7 ttl=64 time=0.541 ms
64 bytes from 192.168.105.228: icmp_seq=8 ttl=64 time=0.469 ms
^C
--- 192.168.105.228 ping statistics ---
8 packets transmitted, 8 received, 0% packet loss, time 7176ms
rtt min/avg/max/mdev = 0.414/0.476/0.561/0.051 ms
student@ubuntuvvm:~/Desktop$
```

Status: Running

# IP Subnetting and Loopback Interfaces

---

## Subnetting Table

Subnet	Subnet Notation	Network Address	First Usable Host Address	Last Useable Host Address	Broadcast Address
The First Subnet	<b>192.168.5.0/25</b>	Challenge Question 2	Challenge Question 4	<b>192.168.5.126</b>	Challenge Question 6
The Second Subnet	Challenge Question 1	Challenge Question 3	<b>192.168.5.129</b>	Challenge Question 5	<b>192.168.5.255</b>

Challenge Question 1: 192.168.5.128/25

Challenge Question 2: 192.168.5.0

Challenge Question 3: 192.168.5.128

Challenge Question 4: 192.168.5.1

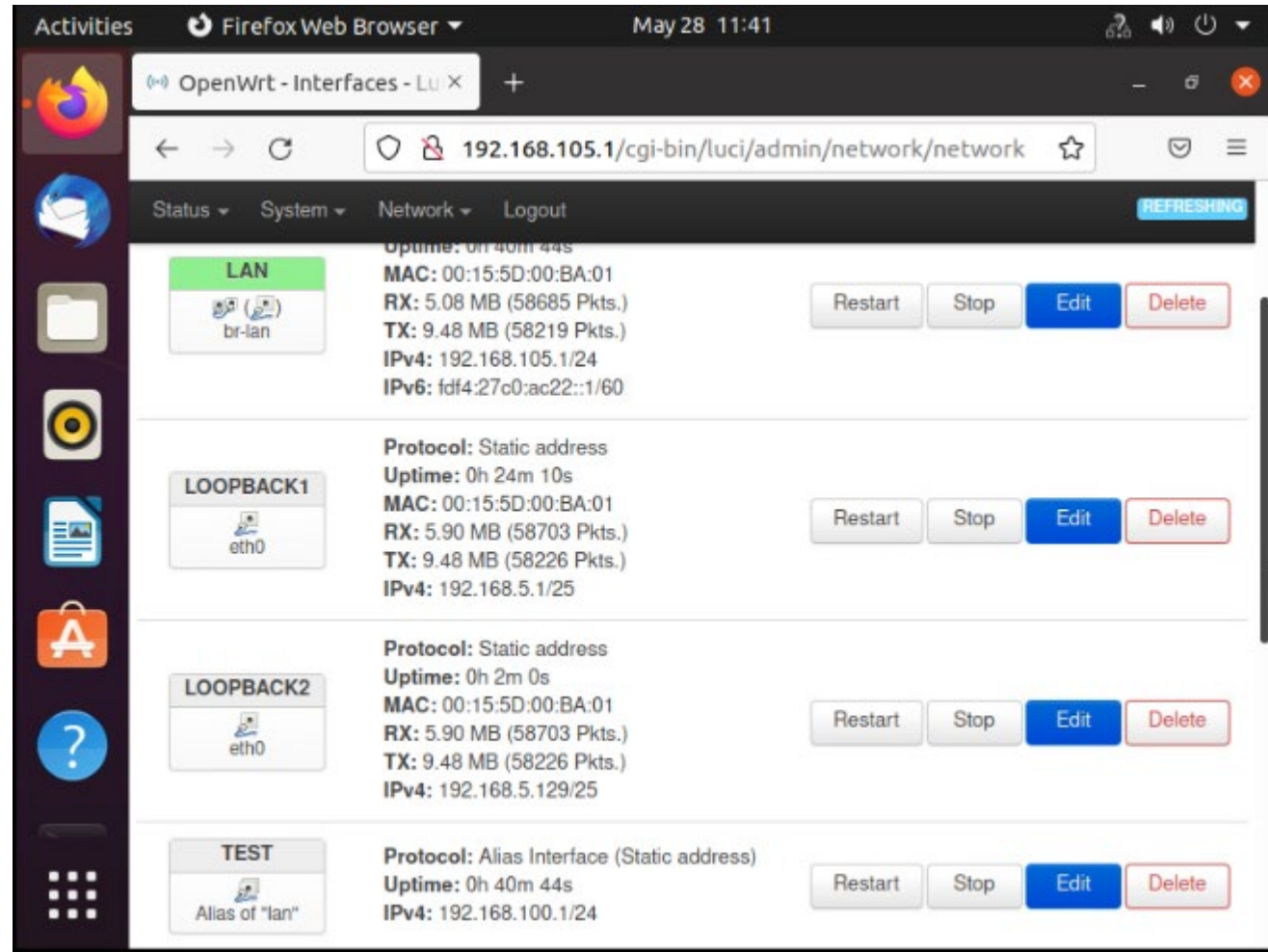
Challenge Question 5: 192.168.5.254

Challenge Question 6: 192.168.5.127



# Loopback Interfaces

Shown is the both Loopback1 and Loopback2 interfaces and their correct IPv4 addresses.

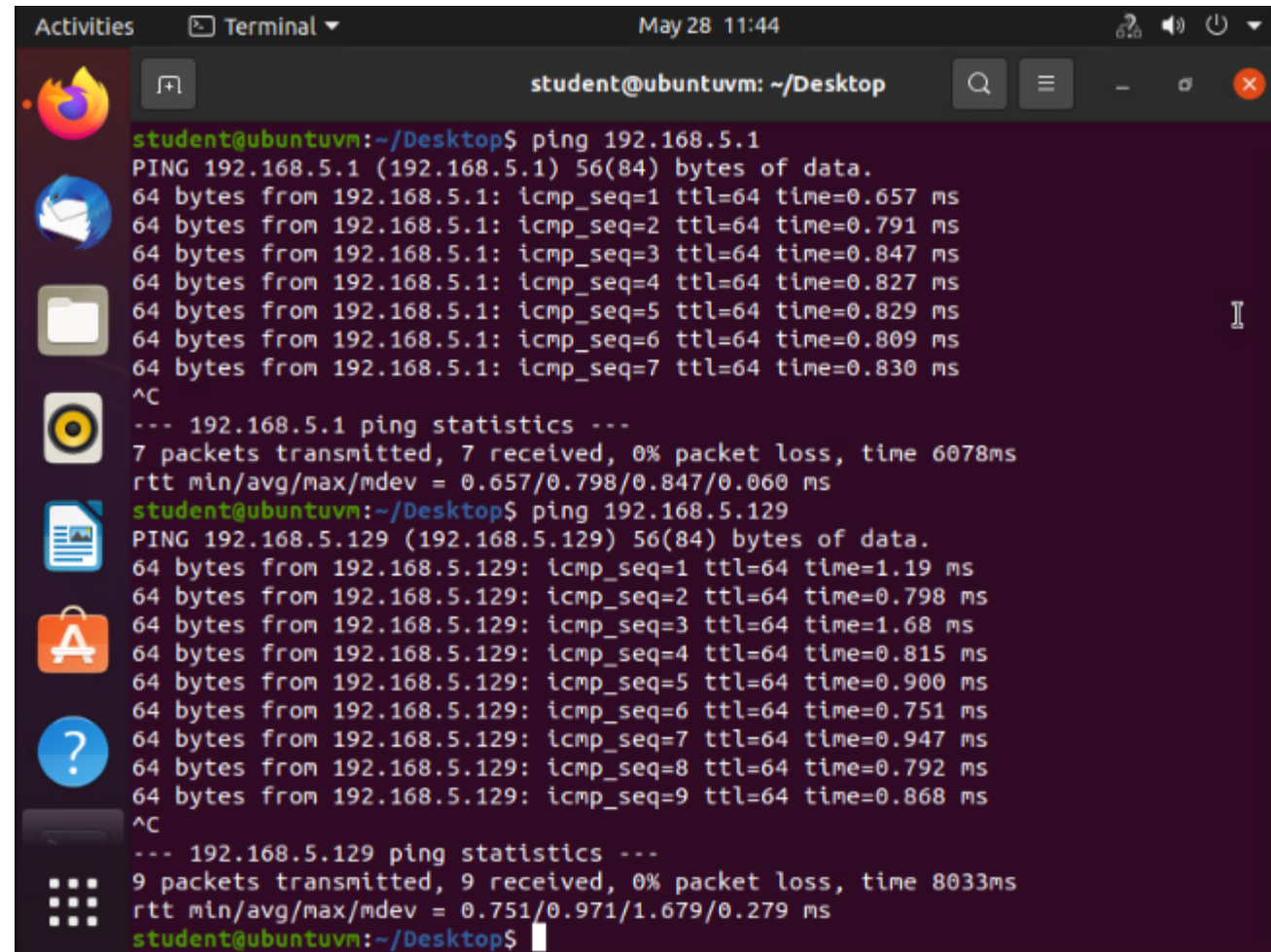


The screenshot shows the OpenWrt LuCI web interface in a Firefox browser window. The browser's address bar displays the URL `192.168.105.1/cgi-bin/luci/admin/network/network`. The interface has a top navigation bar with tabs for Status, System, Network, and Logout. A 'REFRESHING' button is visible in the top right corner. The main content area lists four network interfaces: LAN, LOOPBACK1, LOOPBACK2, and TEST. Each interface entry includes its name, icon, protocol, uptime, MAC address, RX/TX statistics, and IPv4/IPv6 addresses. The LOOPBACK1 and LOOPBACK2 interfaces are highlighted with a light blue background. The TEST interface is an alias for the LAN interface.

Interface	Protocol	Uptime	MAC	RX	TX	IPv4	IPv6
LAN		0h 40m 44s	00:15:5D:00:BA:01	5.08 MB (58685 Pkts.)	9.48 MB (58219 Pkts.)	192.168.105.1/24	fd4:27c0:ac22::1/60
LOOPBACK1	Static address	0h 24m 10s	00:15:5D:00:BA:01	5.90 MB (58703 Pkts.)	9.48 MB (58226 Pkts.)	192.168.5.1/25	
LOOPBACK2	Static address	0h 2m 0s	00:15:5D:00:BA:01	5.90 MB (58703 Pkts.)	9.48 MB (58226 Pkts.)	192.168.5.129/25	
TEST	Alias Interface (Static address)	0h 40m 44s				192.168.100.1/24	

# Connectivity Tests

Shown is the two successful ping tests from the *Computer 1* VM to the *Loopback 1* and *Loopback 2* interfaces.



```
Activities Terminal May 28 11:44
student@ubuntuvm: ~/Desktop

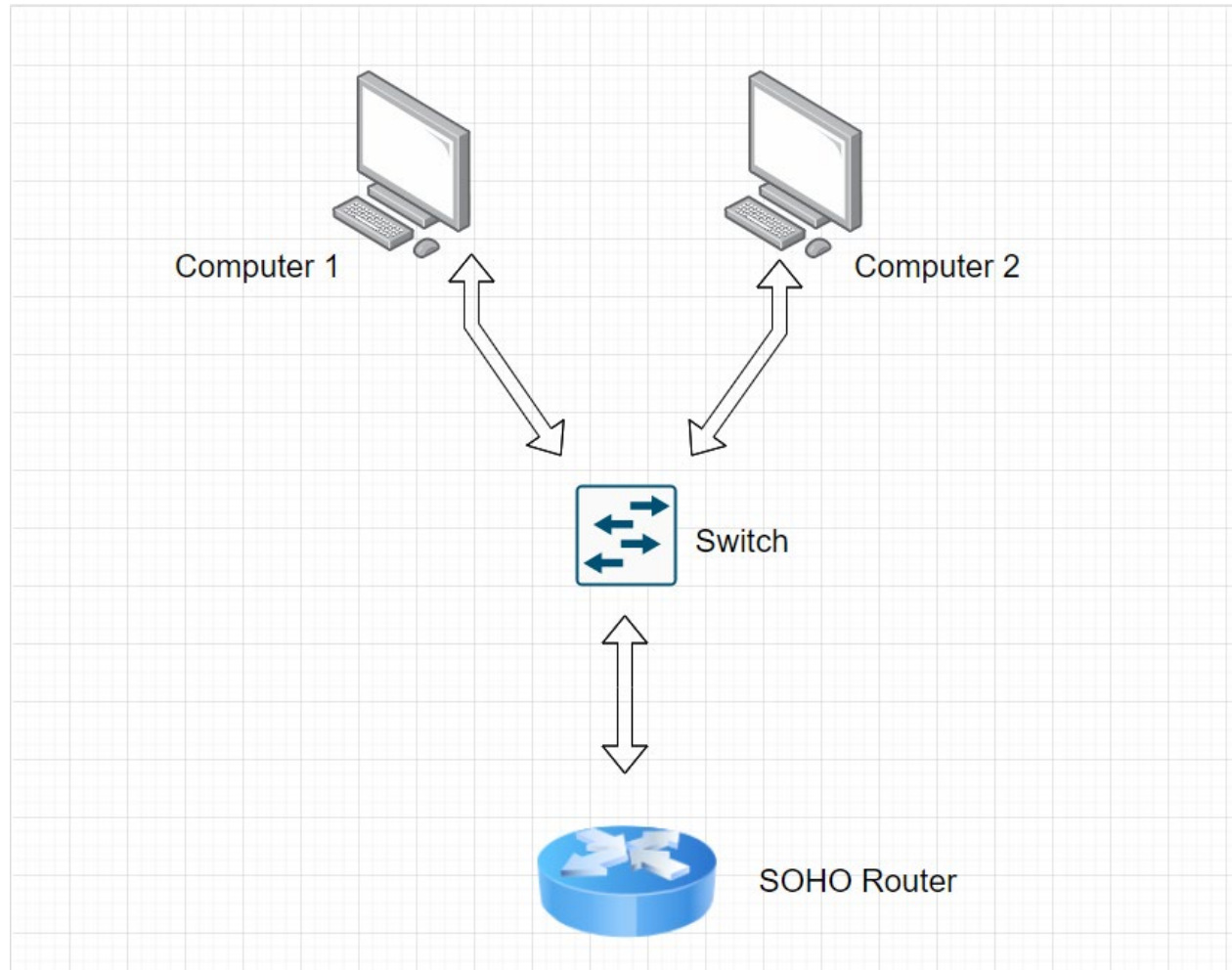
student@ubuntuvm:~/Desktop$ ping 192.168.5.1
PING 192.168.5.1 (192.168.5.1) 56(84) bytes of data.
64 bytes from 192.168.5.1: icmp_seq=1 ttl=64 time=0.657 ms
64 bytes from 192.168.5.1: icmp_seq=2 ttl=64 time=0.791 ms
64 bytes from 192.168.5.1: icmp_seq=3 ttl=64 time=0.847 ms
64 bytes from 192.168.5.1: icmp_seq=4 ttl=64 time=0.827 ms
64 bytes from 192.168.5.1: icmp_seq=5 ttl=64 time=0.829 ms
64 bytes from 192.168.5.1: icmp_seq=6 ttl=64 time=0.809 ms
64 bytes from 192.168.5.1: icmp_seq=7 ttl=64 time=0.830 ms
^C
--- 192.168.5.1 ping statistics ---
7 packets transmitted, 7 received, 0% packet loss, time 6078ms
rtt min/avg/max/mdev = 0.657/0.798/0.847/0.060 ms
student@ubuntuvm:~/Desktop$ ping 192.168.5.129
PING 192.168.5.129 (192.168.5.129) 56(84) bytes of data.
64 bytes from 192.168.5.129: icmp_seq=1 ttl=64 time=1.19 ms
64 bytes from 192.168.5.129: icmp_seq=2 ttl=64 time=0.798 ms
64 bytes from 192.168.5.129: icmp_seq=3 ttl=64 time=1.68 ms
64 bytes from 192.168.5.129: icmp_seq=4 ttl=64 time=0.815 ms
64 bytes from 192.168.5.129: icmp_seq=5 ttl=64 time=0.900 ms
64 bytes from 192.168.5.129: icmp_seq=6 ttl=64 time=0.751 ms
64 bytes from 192.168.5.129: icmp_seq=7 ttl=64 time=0.947 ms
64 bytes from 192.168.5.129: icmp_seq=8 ttl=64 time=0.792 ms
64 bytes from 192.168.5.129: icmp_seq=9 ttl=64 time=0.868 ms
^C
--- 192.168.5.129 ping statistics ---
9 packets transmitted, 9 received, 0% packet loss, time 8033ms
rtt min/avg/max/mdev = 0.751/0.971/1.679/0.279 ms
student@ubuntuvm:~/Desktop$
```

# Network Diagram

---



Network Diagram  
made on  
[app.diagram.net](http://app.diagram.net)



# SOHO Wireless Network Security



# SOHO Wireless Network Security

1. What are the factory default username and password of a TP-Link router? Why is it important to change the default username and password of a SOHO router?

**Answer:** admin / admin

It is important to change the default password because many of these routers are sold across the world and many people have access to the same default password

2. To protect a SOHO wireless network with a small number of devices, which address management method provides more control, configuring the device IP addresses manually (static IP) or using a DHCP server (dynamic IP)? Why?

**Answer:** Static IP gives you more control over what your IP will be changed to. As you will manually change the IP. A Dynamic IP using a DHCP server doesn't give you as

much control

3. What does MAC filtering do? If needed, when would you use deny filtering rules and when would you use allow filtering rules? What happens to devices that want to connect, if the "Allow the stations specified by any enabled entries in the list to access" function is enabled but there are no entries in the list?

**Answer:** MAC filtering allows an individual to control which machine accesses the network through filtering out the specific MAC address of the machine. If the function is enabled but there are no MAC addresses entered then it wouldn't know which address to filter out and deny all of them

# SOHO Wireless Network Security

1. What wireless security settings are displayed on the Wireless Security page? Which one is recommended by the vendor? Why?

**Answer:** WPA/WPA2- Personal is recommended. This is because Enterprise and TKIP encryption is not available with WPS enabled for Network Security

2. Among the configurations you explored in this module, which one is a true security function? Why?

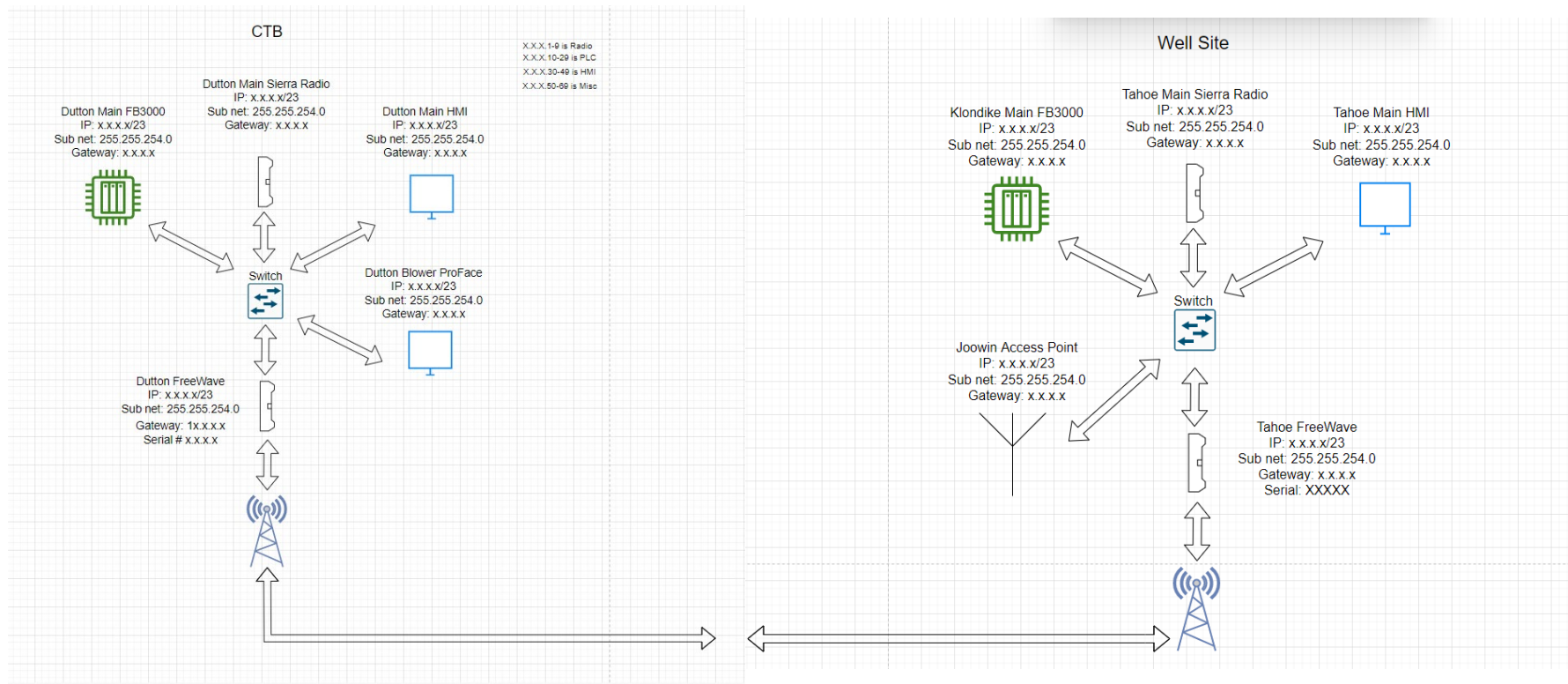
**Answer:** I think using a DHCP server and making your IP dynamic along with using a mac filter system is great protection, but the wireless network encryption is the best because it offers the base level of security for the network

3. What would you do to protect your wireless network at home? Why?

**Answer:** A strong password including special characters and number, nothing with common phrases or names. Also a dynamic IP address.

# Career Skills

- I added a lot of knowledge to my understanding of networks. I used the apps.diagrams.net website to help build out a wireless ethernet network for a client (shown below).



# Conclusion

---

- I really enjoyed using Infosec Learning to continue networking. It is very user friendly and intuitive. I hope to carry over the knowledge I have learned into my career and further my understanding of networking.