

# Fundamentals of Information Technology and Networking (NETW191)

Final Project  
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Oct. 2024

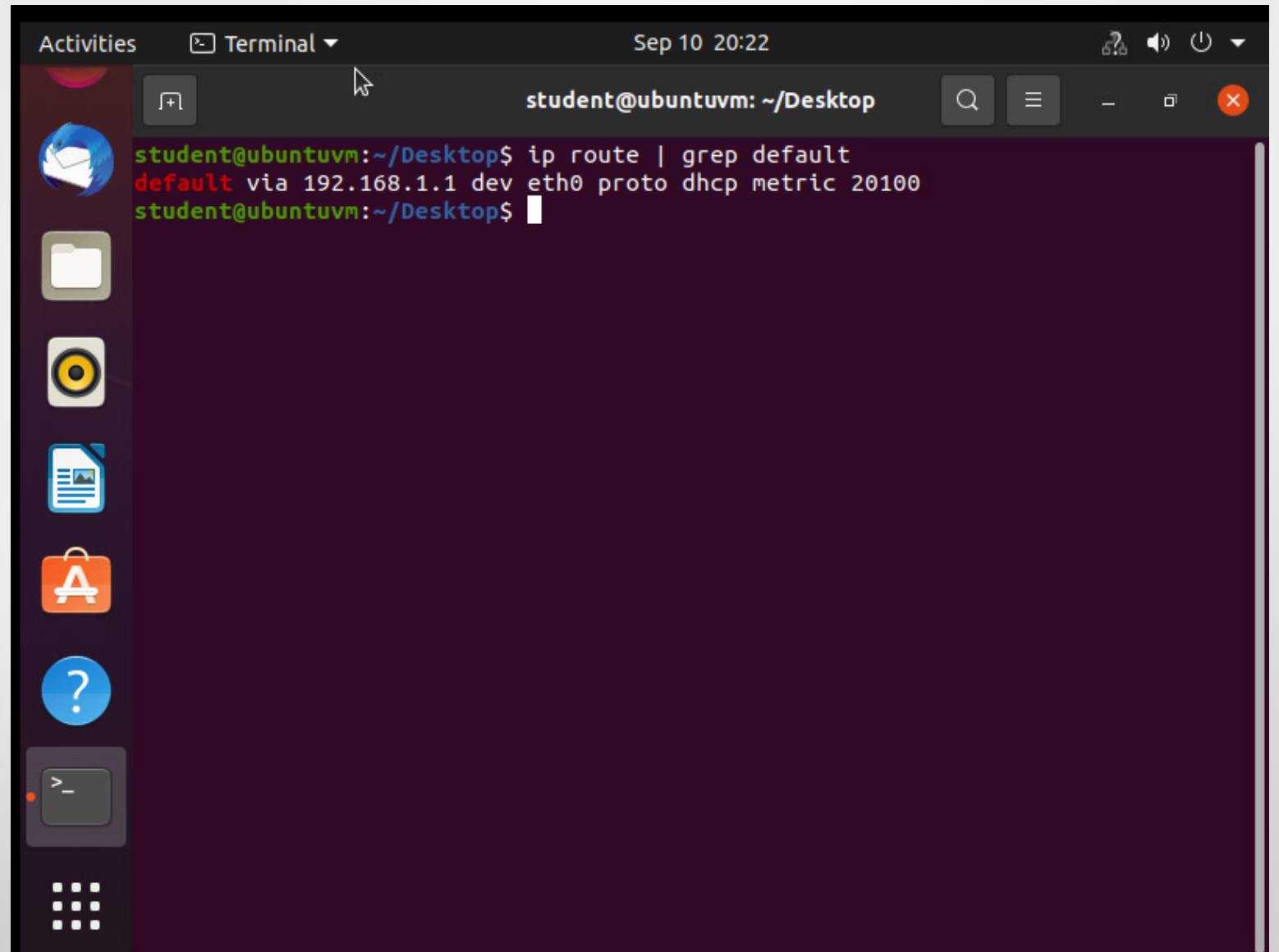
# Introduction

- This presentation covers my five-part project completed while taking Fundamentals of Information Technology and Networking (NETW191)
- It includes examples of IPv4 Addressing, Connectivity Testing, IP Subnetting and Loopback Interfaces, VISIO Network Diagram, and SOHO Wireless Network Security
- The objective of this presentation is to give the viewers a better understanding of network design, function, and security

# IPv4 Addressing

- In this project I will use a SOHO router virtual machine to change the root password
- Use of a browser to access SOHO router virtual machine management interface to change the IPV4 address

# Preparation



The screenshot shows a terminal window titled "Terminal" with a timestamp of "Sep 10 20:22". The window's title bar also includes "Activities", "Terminal", and system icons. The terminal's address bar shows "student@ubuntuvm: ~/Desktop". The terminal content displays the command `ip route | grep default` and its output: `default via 192.168.1.1 dev eth0 proto dhcp metric 20100`. The prompt `student@ubuntuvm:~/Desktop$` is visible at the end of the line.

```
student@ubuntuvm:~/Desktop$ ip route | grep default
default via 192.168.1.1 dev eth0 proto dhcp metric 20100
student@ubuntuvm:~/Desktop$
```

# IPv4 Address Assignment

Activities Firefox Web Browser Sep 10 20:32

OpenWrt - Interfaces - Lu X OpenWrt - Interfaces - Lu X

192.168.105.1/cgi-bin/luci/admin/network/network

Status System Network Logout REFRESHING

Interfaces Global network options

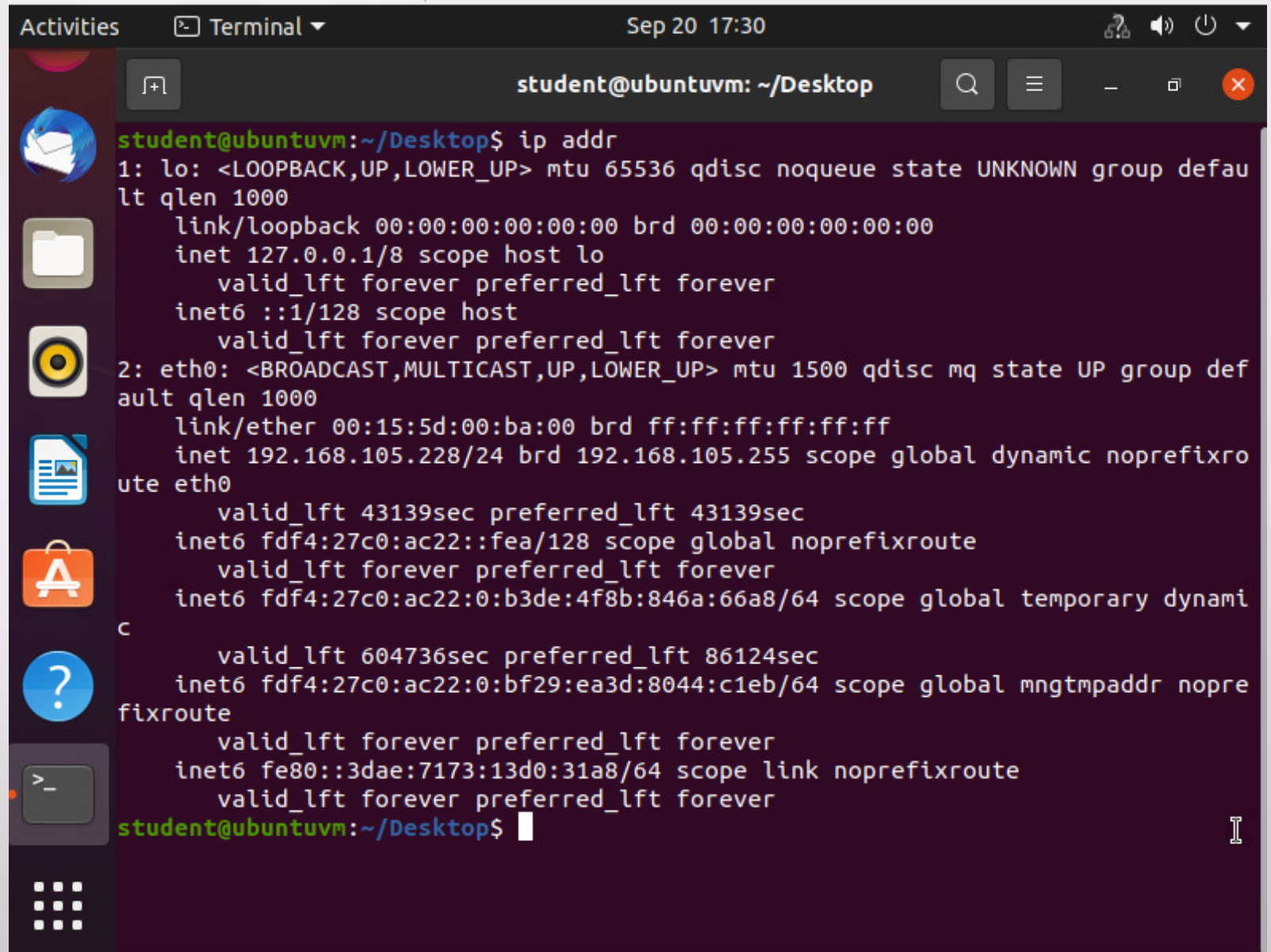
### Interfaces

<b>LAN</b> br-lan	<b>Protocol:</b> Static address <b>Uptime:</b> 0h 3m 38s <b>MAC:</b> 00:15:5D:00:BA:01 <b>RX:</b> 492.89 KB (5937 Pkts.) <b>TX:</b> 1.01 MB (5547 Pkts.) <b>IPv4:</b> 192.168.105.1/24 <b>IPv6:</b> fdf4:27c0:ac22::1/60	Restart Stop Edit Delete
<b>TEST</b> Alias of "lan"	<b>Protocol:</b> Alias Interface (Static address) <b>Uptime:</b> 0h 3m 38s <b>IPv4:</b> 192.168.100.1/24	Restart Stop Edit Delete
<b>WAN</b> eth1	<b>Protocol:</b> DHCP client <b>RX:</b> 0 B (0 Pkts.) <b>TX:</b> 0 B (0 Pkts.) <b>Error:</b> Network device is not present	Restart Stop Edit Delete
<b>WAN6</b>	<b>Protocol:</b> DHCPv6 client	

# Connectivity Testing

- In this project we check the connection between two computers and a router

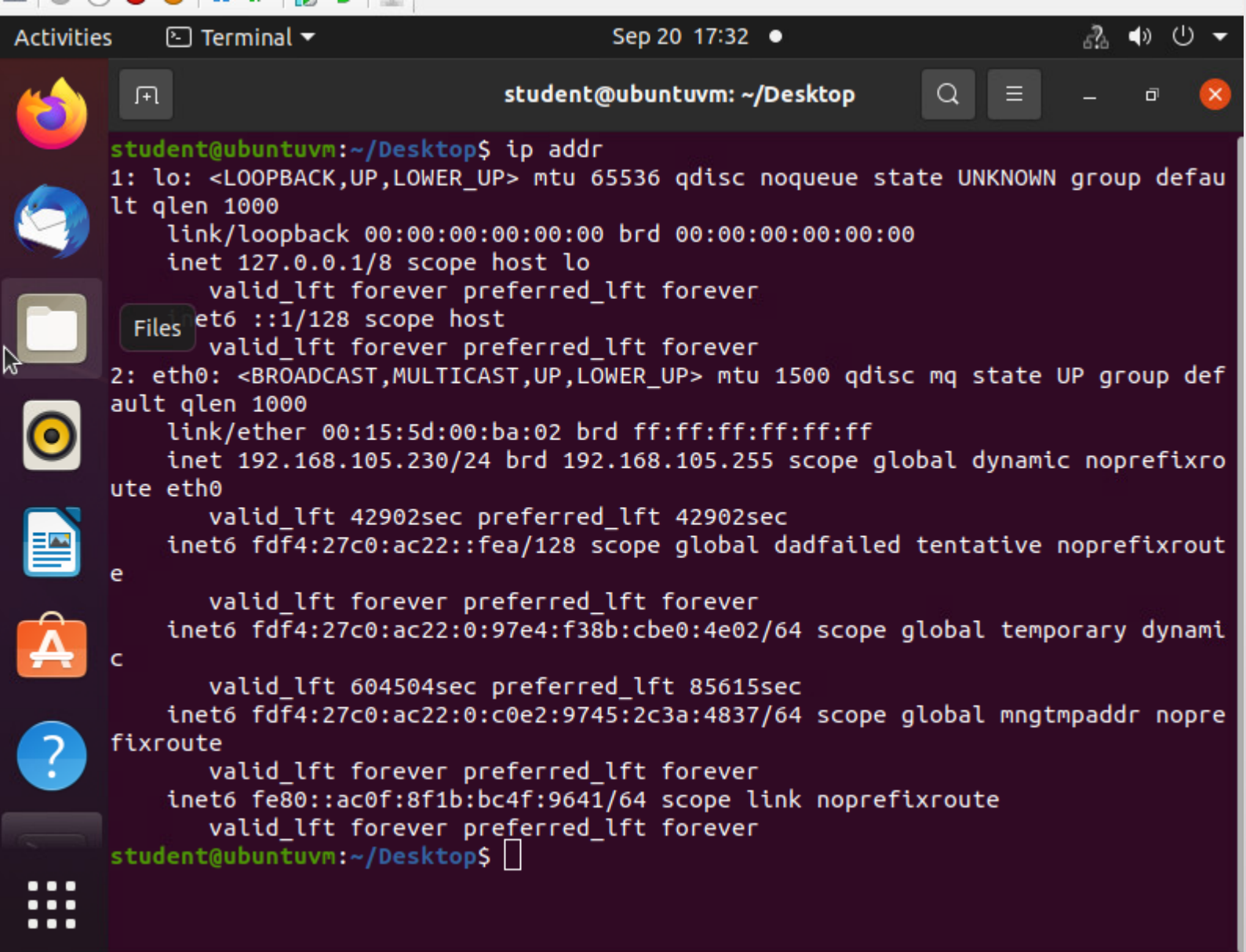
# Dynamic IP Address Assignment 1



A terminal window titled 'student@ubuntuvvm: ~/Desktop' showing the output of the 'ip addr' command. The window has a dark theme and a sidebar with application icons. The output shows details for the loopback interface 'lo' and the ethernet interface 'eth0'.

```
student@ubuntuvvm:~/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: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 43139sec preferred_lft 43139sec
    inet6 fdf4:27c0:ac22::fea/128 scope global noprefixroute
        valid_lft forever preferred_lft forever
    inet6 fdf4:27c0:ac22:0:b3de:4f8b:846a:66a8/64 scope global temporary dynami
c
        valid_lft 604736sec preferred_lft 86124sec
    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:~/Desktop$
```

# Dynamic IP Address Assignment 2

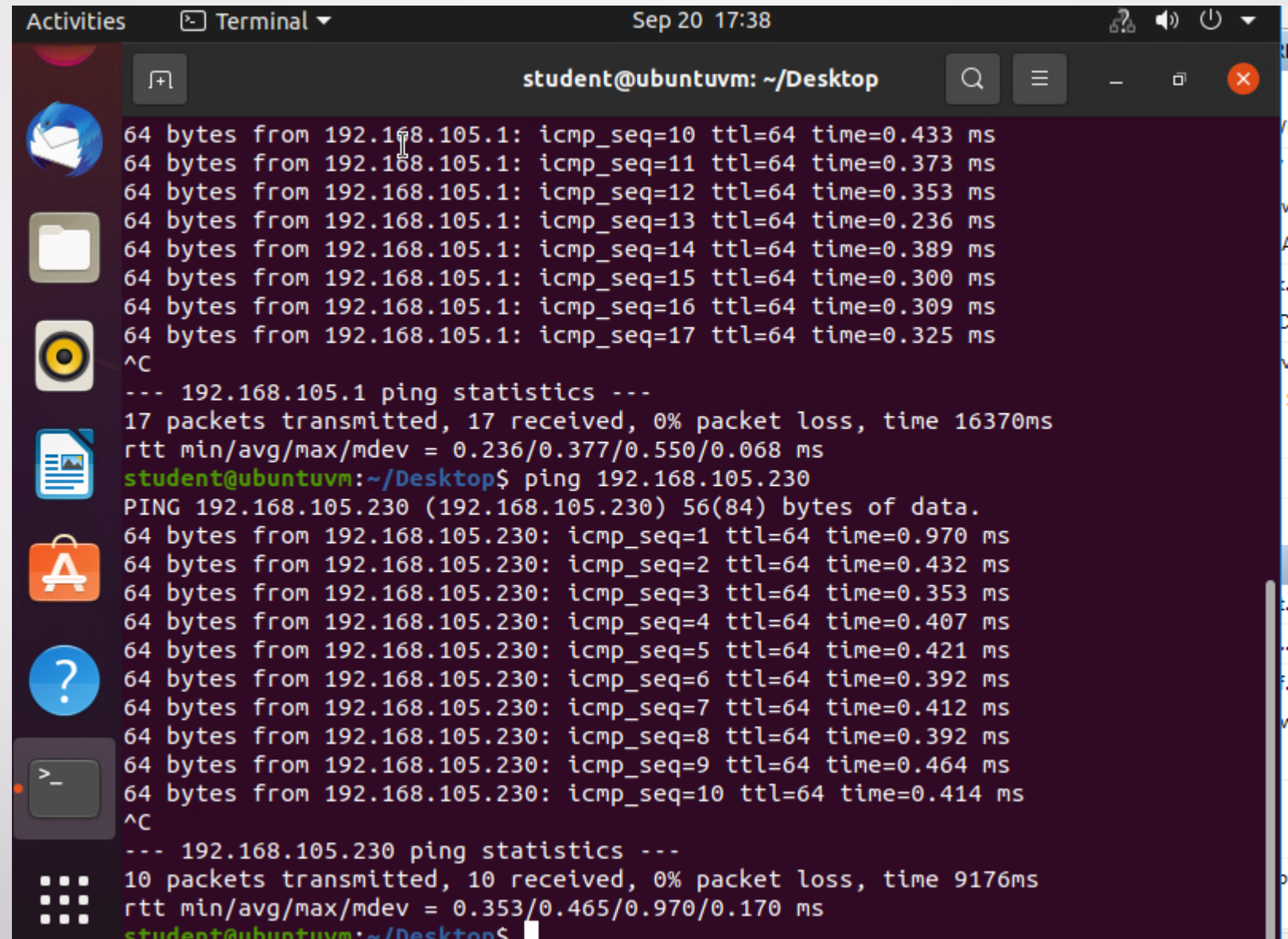


A terminal window titled 'student@ubuntuvvm: ~/Desktop' showing the output of the 'ip addr' command. The window has a dark theme and a sidebar on the left with application icons. The output shows details for the loopback interface 'lo' and the ethernet interface 'eth0'.

```
student@ubuntuvvm:~/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
    et6 ::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 42902sec preferred_lft 42902sec
    inet6 fdf4:27c0:ac22::fea/128 scope global dadfailed tentative noprefixrout
e
        valid_lft forever preferred_lft forever
    inet6 fdf4:27c0:ac22:0:97e4:f38b:cbe0:4e02/64 scope global temporary dynami
c
        valid_lft 604504sec preferred_lft 85615sec
    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@ubuntuvvm:~/Desktop$
```



# Connectivity Test 1



The image shows a terminal window titled "student@ubuntuvvm: ~/Desktop" with a dark background. The window displays the results of two ping tests. The first test is for 192.168.105.1, showing 17 successful pings with a 0% packet loss and a total time of 16370ms. The second test is for 192.168.105.230, showing 10 successful pings with a 0% packet loss and a total time of 9176ms. The terminal output is as follows:

```
student@ubuntuvvm: ~/Desktop
64 bytes from 192.168.105.1: icmp_seq=10 ttl=64 time=0.433 ms
64 bytes from 192.168.105.1: icmp_seq=11 ttl=64 time=0.373 ms
64 bytes from 192.168.105.1: icmp_seq=12 ttl=64 time=0.353 ms
64 bytes from 192.168.105.1: icmp_seq=13 ttl=64 time=0.236 ms
64 bytes from 192.168.105.1: icmp_seq=14 ttl=64 time=0.389 ms
64 bytes from 192.168.105.1: icmp_seq=15 ttl=64 time=0.300 ms
64 bytes from 192.168.105.1: icmp_seq=16 ttl=64 time=0.309 ms
64 bytes from 192.168.105.1: icmp_seq=17 ttl=64 time=0.325 ms
^C
--- 192.168.105.1 ping statistics ---
17 packets transmitted, 17 received, 0% packet loss, time 16370ms
rtt min/avg/max/mdev = 0.236/0.377/0.550/0.068 ms
student@ubuntuvvm:~/Desktop$ 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=0.970 ms
64 bytes from 192.168.105.230: icmp_seq=2 ttl=64 time=0.432 ms
64 bytes from 192.168.105.230: icmp_seq=3 ttl=64 time=0.353 ms
64 bytes from 192.168.105.230: icmp_seq=4 ttl=64 time=0.407 ms
64 bytes from 192.168.105.230: icmp_seq=5 ttl=64 time=0.421 ms
64 bytes from 192.168.105.230: icmp_seq=6 ttl=64 time=0.392 ms
64 bytes from 192.168.105.230: icmp_seq=7 ttl=64 time=0.412 ms
64 bytes from 192.168.105.230: icmp_seq=8 ttl=64 time=0.392 ms
64 bytes from 192.168.105.230: icmp_seq=9 ttl=64 time=0.464 ms
64 bytes from 192.168.105.230: icmp_seq=10 ttl=64 time=0.414 ms
^C
--- 192.168.105.230 ping statistics ---
10 packets transmitted, 10 received, 0% packet loss, time 9176ms
rtt min/avg/max/mdev = 0.353/0.465/0.970/0.170 ms
student@ubuntuvvm:~/Desktop$
```

# Connectivity Test 2

```
Activities Terminal Sep 20 17:40 student@ubuntuvm: ~/Desktop

c
    valid_lft 604504sec preferred_lft 85615sec
    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$ 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=0.421 ms
64 bytes from 192.168.105.1: icmp_seq=2 ttl=64 time=0.375 ms
64 bytes from 192.168.105.1: icmp_seq=3 ttl=64 time=0.424 ms
64 bytes from 192.168.105.1: icmp_seq=4 ttl=64 time=0.461 ms
64 bytes from 192.168.105.1: icmp_seq=5 ttl=64 time=0.430 ms
^C
--- 192.168.105.1 ping statistics ---
5 packets transmitted, 5 received, 0% packet loss, time 4088ms
rtt min/avg/max/mdev = 0.375/0.422/0.461/0.027 ms
student@ubuntuvm:~/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=0.358 ms
64 bytes from 192.168.105.228: icmp_seq=2 ttl=64 time=0.437 ms
64 bytes from 192.168.105.228: icmp_seq=3 ttl=64 time=0.421 ms
64 bytes from 192.168.105.228: icmp_seq=4 ttl=64 time=0.459 ms
^C
--- 192.168.105.228 ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3051ms
rtt min/avg/max/mdev = 0.358/0.418/0.459/0.037 ms
student@ubuntuvm:~/Desktop$
```



# IP Subnetting Loopback Interfaces

In this project we will be IP subnetting and creating 2 new loopback interfaces called Loopback1 and Loopback2 as well as testing the connection to them.

# IP Subnetting

Subnet ID	Network Mask (/prefix)	Network Mask (Dotted decimal)	Network Address	First Usable Host Address	Last Usable Host Address	Broadcast Address
0	/25	255.255.255.128	192.168.5.0	192.168.5.1	192.168.5.126	192.168.5.127
1	/25	255.255.255.128	196.168.5.128	192.168.5.129	192.168.5.254	192.168.5.255

This table should include **two /25 subnets**, listing

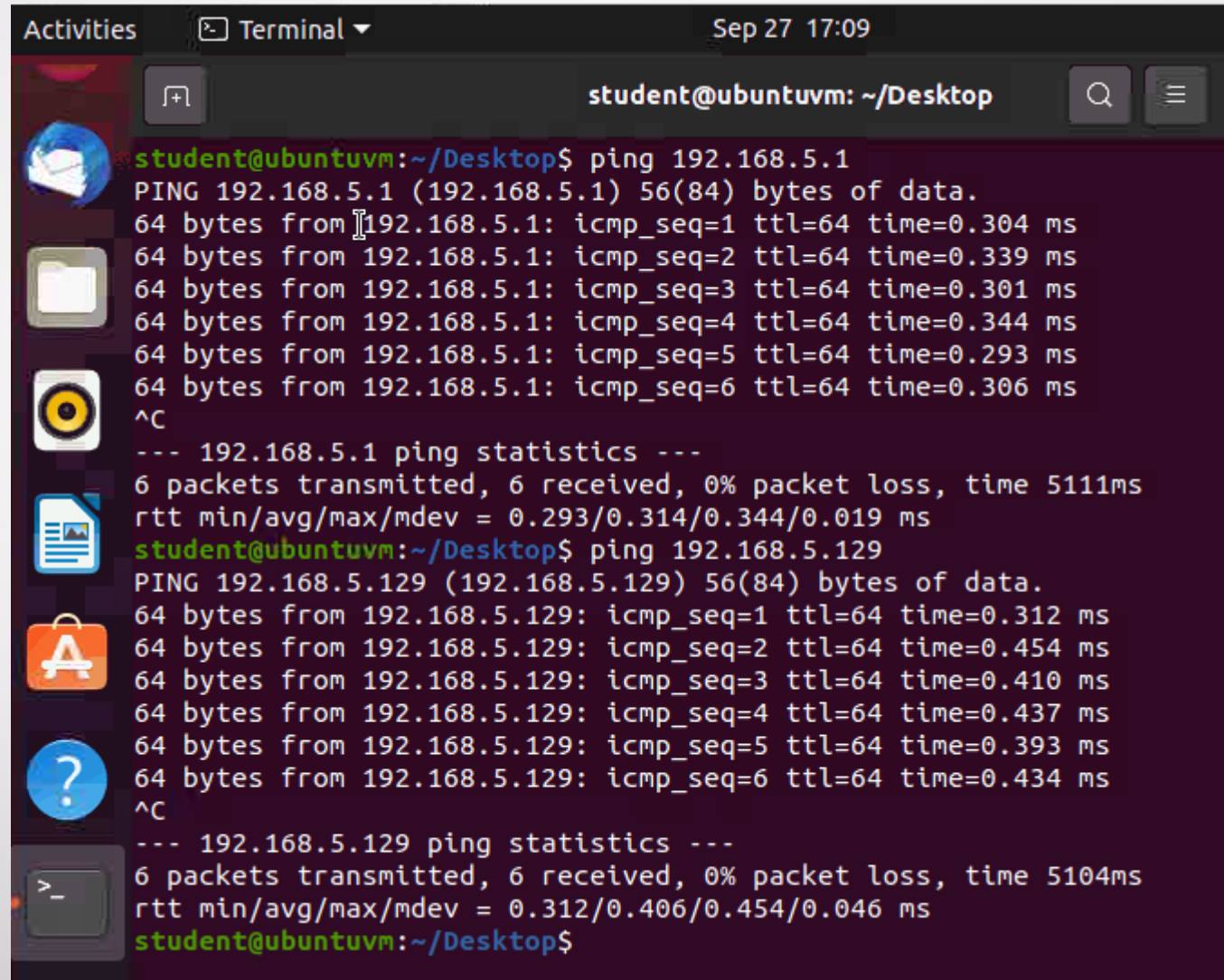
- Subnet notation
- Network address
- First usable host address
- Last usable host address
- Broadcast address

# Loopback Interfaces

The screenshot shows the OpenWrt LuCI web interface in a Firefox browser. The address bar displays `192.168.105.1/cgi-bin/luci/admin/network/network`. The navigation bar includes links for Status, System, Network, and Logout, along with a REFRESHING button. The main content area is titled "Interfaces" and shows two configured interfaces:

Interface	Protocol	Uptime	MAC	RX	TX	IPv4	Actions
LOOPBACK1 eth0	Static address	0h 5m 34s	00:15:5D:00:BA:01	2.32 MB (23453 Pkts.)	3.27 MB (23182 Pkts.)	192.168.5.1/25	Restart Stop Edit Delete
LOOPBACK2 eth0	Static address	0h 0m 14s	00:15:5D:00:BA:01	2.32 MB (23453 Pkts.)	3.27 MB (23182 Pkts.)	192.168.5.129/25	Restart Stop Edit Delete

# Connectivity Tests



A terminal window titled "Terminal" with a date and time of "Sep 27 17:09". The window shows a user named "student@ubuntuvvm" in the directory "~/Desktop". The user has executed two ping commands. The first command is "ping 192.168.5.1", which shows six successful pings with varying response times (0.293 to 0.344 ms) and a summary showing 0% packet loss and a total time of 511ms. The second command is "ping 192.168.5.129", which also shows six successful pings with varying response times (0.312 to 0.454 ms) and a summary showing 0% packet loss and a total time of 510ms. The terminal window has a sidebar with icons for Activities, Terminal, and various application icons.

```
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=0.304 ms
64 bytes from 192.168.5.1: icmp_seq=2 ttl=64 time=0.339 ms
64 bytes from 192.168.5.1: icmp_seq=3 ttl=64 time=0.301 ms
64 bytes from 192.168.5.1: icmp_seq=4 ttl=64 time=0.344 ms
64 bytes from 192.168.5.1: icmp_seq=5 ttl=64 time=0.293 ms
64 bytes from 192.168.5.1: icmp_seq=6 ttl=64 time=0.306 ms
^C
--- 192.168.5.1 ping statistics ---
6 packets transmitted, 6 received, 0% packet loss, time 511ms
rtt min/avg/max/mdev = 0.293/0.314/0.344/0.019 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=0.312 ms
64 bytes from 192.168.5.129: icmp_seq=2 ttl=64 time=0.454 ms
64 bytes from 192.168.5.129: icmp_seq=3 ttl=64 time=0.410 ms
64 bytes from 192.168.5.129: icmp_seq=4 ttl=64 time=0.437 ms
64 bytes from 192.168.5.129: icmp_seq=5 ttl=64 time=0.393 ms
64 bytes from 192.168.5.129: icmp_seq=6 ttl=64 time=0.434 ms
^C
--- 192.168.5.129 ping statistics ---
6 packets transmitted, 6 received, 0% packet loss, time 510ms
rtt min/avg/max/mdev = 0.312/0.406/0.454/0.046 ms
student@ubuntuvm:~/Desktop$
```

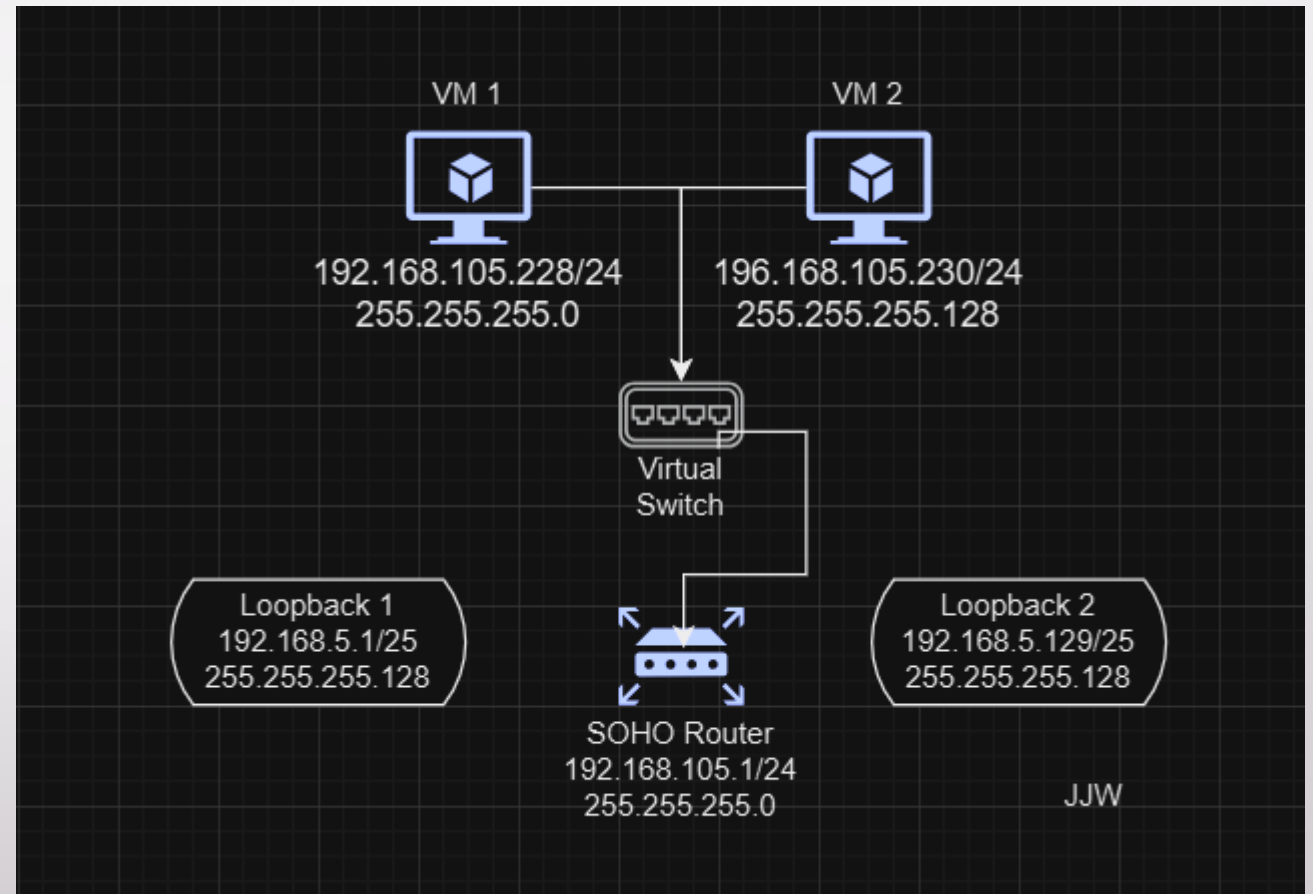




# Visio Network Diagram

In this project I used Visio to design and visually show the connections between the SOHO Router, Virtual Switch, Virtual Machine 1, Virtual Machine 2, and Loopback connections.

# Microsoft Visio Network Diagram







# SOHO Wireless Network Security

In this project we will discuss SOHO wireless network security and the importance of securing your network.

# SOHO Wireless Network Security 1 of 3

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:

default username/password - admin/admin

It is important to change this, because if you don't anyone can easily access your router and then get into your computers from there.

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 addresses provide more control, because it uses the same IP address for each device allowing consistent access to printers, servers, or NAS. This also allows IT professionals to easily troubleshoot devices and it provides the option of limiting the number of devices, which makes everything easier to monitor and control.

# SOHO Wireless Network Security 2 of 3

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 uses the unique MAC addresses of devices to control their access to the network. Deny Filtering would be used when you want to block a device from accessing the network while allow filtering grants network access permission to the specified devices. If you do not submit any entries to the “Allow the stations specified by any enabled entries in the list to access” function then no devices will be able to access the network.

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

Answer:

The security settings displayed are Disable Wireless Security, WPA/WPA2 - Personal, WPA/WPA2 - Enterprise, and WEP. The vendor recommends to enable wireless security and select WPA2-PSK AES encryption, because of stronger encryption, better security than older protocols, it's compatible with almost all modern wireless devices, and AES provides better performance while maintaining security.

# SOHO Wireless Network Security 3 of 3

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

Answer:

WPA2-PSK AES encryption is a true security function, because it ensures data sent over the network is encrypted, prevents unauthorized devices from connecting by requiring a PSK (Pre-Shared Key), checks for tampering during transmission, and meets industry standards and regulatory requirements for data security.

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

Answer:

I personally try to use a very unguessable password, always change your default network name and password, disable SSID broadcasting, enable MAC filtering, make sure to stay updated, disable remote management, and enable firewalls. I also recommend using a guest network for visitors and regularly check connected devices.



# Challenges

- Challenges I faced while doing these projects was mainly navigation. I had to learn to navigate multiple interfaces and websites as well as learning to locate different information.
- I easily overcame these challenges by taking the time to re-read all of my lessons as well as reading everything written on the different interfaces and websites.



# Career Skills

- Understand the concept of network addressing and network protocols
- Explain data transmission concepts and characteristics of different transmission media
- Segment a network into multiple LANs or multiple VLANs
- Understand networking fundamentals, including network types, hardware devices, topologies, the OSI model, structured cabling, and documentation
- Implement security into the design of a network
- Produce a network to a specification



# Conclusion

This class provided a great teaching on the fundamentals of information technology and networking. With these teachings I can now design, setup, troubleshoot, manage, and secure a network. I also achieved the skills to monitor network performance, manage projects, identify security threats and secure them. I am excited to continue learning more about network security and hone my skills to advance me in my career path. Learning the basics of network security will allow me to better understand advanced security techniques providing a better service to future customers.

# References

- Live Lessons. Professor Marzouk, Hassan and Khan Nabeel, Ronald Darnell, Rexford Okrah, Kevin Greshock, Peter Bieniek, Alex Leung, Burton Piper, Farooq Afzal. NETW191, 2024
- West, Jill. *CompTIA Network+ Guide to Networks*. 2021.
- *Network+ Guide to Networks, Loose-Leaf Version*. Cengage Learning, 2018.
- Project Guides