



**BIRZEIT UNIVERSITY**

**Department of Electrical and Computer Engineering**

**ENCS3320 - Computer Networks**

**Summer Semester 2023/2024**

**Project#2: Network Design**

**Prepared by:**

Mouath Masalmah - 1220179

Zaid Mousa - 1221833

Bahaa Bani Shamsaa - 1220252

**Instructor:** Dr.Ibrahim Nemers

**Section:** SECTION\_1

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# Task 0:

Subnet	Subnet Mask "/x"	Network IP	Broadcast IP	First IP	Last IP	#hosts
<b>NET 1</b>	255.255.255.224/27	179.01.8.64	179.01.8.95	179.01.8.65	179.01.8.94	30
<b>NET 2</b>	255.255.255.196/26	179.01.8.0	179.01.8.63	179.01.8.1	179.01.8.92	60
<b>NET 3</b>	255.255.255.224/27	179.01.8.96	179.01.8.127	179.01.8.97	179.01.8.12 6	30
<b>NET 4</b>	255.255.255.240/28	179.01.8.128	179.01.8.143	179.01.8.129	179.01.8.14 2	14
<b>R0-R1 LINK</b>	255.255.255.252/30	179.01.8.144	179.01.8.145	179.01.8.146	179.01.8.14 7	2
<b>R0-R3 LINK</b>	255.255.255.252/30	179.01.8.156	179.01.8.157	179.01.8.158	179.01.8.15 9	2
<b>R1-R2 LINK</b>	255.255.255.252/30	179.01.8.148	179.01.8.149	179.01.8.150	179.01.8.15 1	2
<b>R2-R3 LINK</b>	255.255.255.252/30	179.01.8.152	179.01.8.153	179.01.8.154	179.01.8.15 5	2

# **Part1:**

## **1.How we define IP**

- We used the IP of one of the members, which is IP 1220179, where we took the last 2 bits and put them first (ex: 179.01.8.64) and took the 2 before the last and put them in the second (ex: 179.**01**.8.64).

## **2.I Pv4**

- Internet Protocol version 4 ( IPv4 ): is a core system that enables communication between devices on the Internet. It uses 32-bit addresses, allowing for about 4.3 billion unique combinations. These addresses are typically written as four numbers separated by dots, like `179.01.x.x`, where each number can range from 0 to 255.

## **3.The Network Part**

- The **Network Part** of an IP address identifies which network a device is on. Routers use this part to send data to the correct network. For example, in `179.01.8.1` with the subnet mask `255.255.255.0`, the first two numbers `179.01` are the network part.

## **4.The Host Part**

- The **Host Part** pinpoints the specific device within that network. It's unique to each device on the same network. In the same example, `8.1` is the host part, identifying the particular device.

## **Part2:**

### **1. Identify the Required Subnets:**

- Start by identifying the number of subnets required and the number of hosts needed in each subnet. In this case, we have four main subnets (NET 1, NET 2, NET 3, NET 4) and four point-to-point links (R0-R1 LINK, R0-R3 LINK, R1-R2 LINK, R2-R3 LINK).

### **2. Determine the Subnet Mask:**

- Based on the number of hosts required, select the appropriate subnet mask.
- For example:
  - **NET 1:** Requires 30 hosts, so a /27 subnet mask (255.255.255.224) is suitable.
  - **NET 2:** Requires 60 hosts, so a /26 subnet mask (255.255.255.192) is suitable.
  - **Point-to-Point Links:** Require 2 hosts each, so a /30 subnet mask (255.255.255.252) is appropriate.

### **3. Calculate Network, Broadcast, and Usable IP Addresses:**

- Using the subnet mask, calculate the network address, broadcast address, and the range of usable IP addresses for each subnet.
- For example, for **NET 1**:
  - Network IP: 179.01.8.64
  - Broadcast IP: 179.01.8.95
  - Usable IPs: 179.01.8.65 to 179.01.8.94

### **4. Fill in the Table:**

- For each subnet, fill in the table with the calculated values. Ensure the broadcast IP is correct, and the first and last usable IPs are within the correct range.

### **5. Verify IP Allocation:**

- Double-check that no IP addresses overlap between subnets and that all IPs are accounted for.

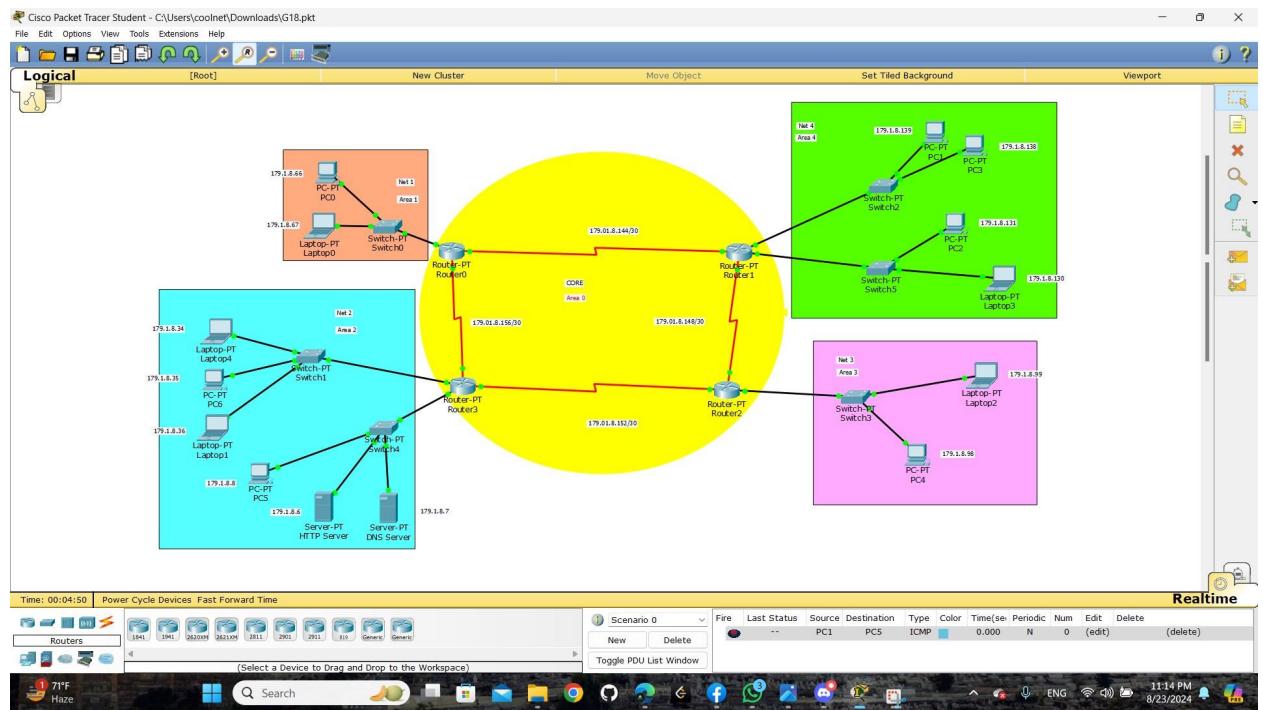


Figure 1: IPs in topology

## Part3:

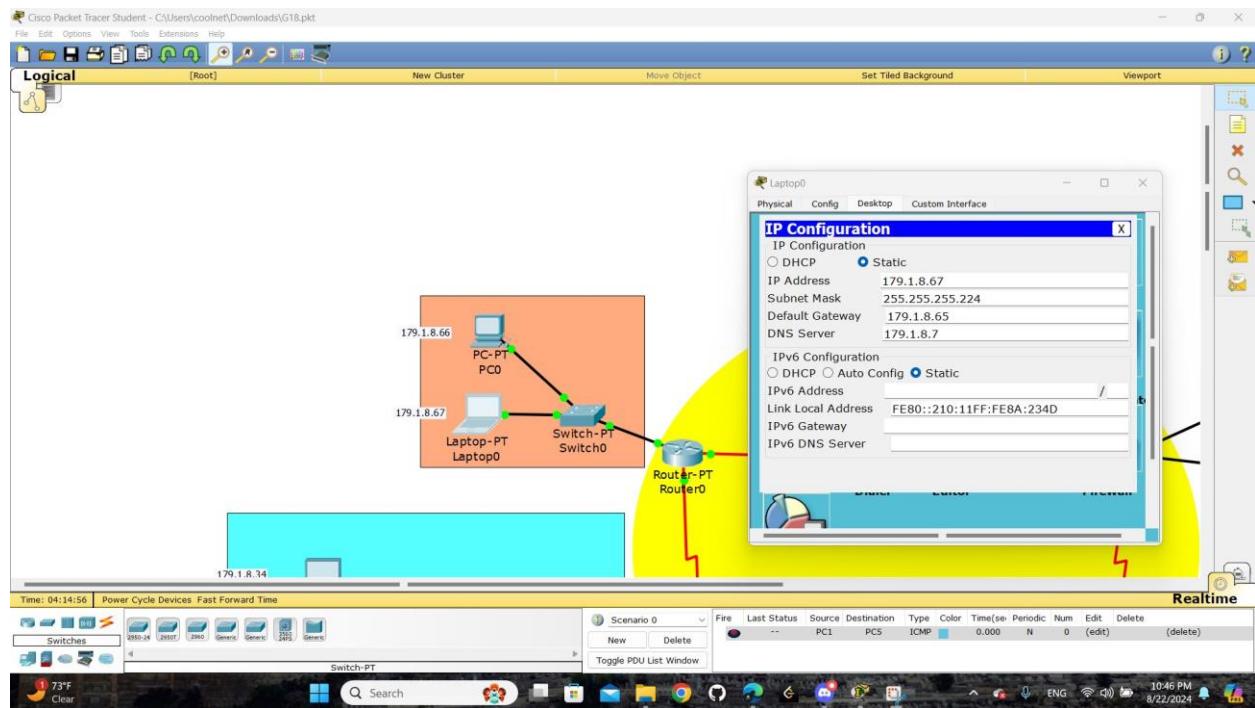


Figure 2: laptop0 IP Configuration

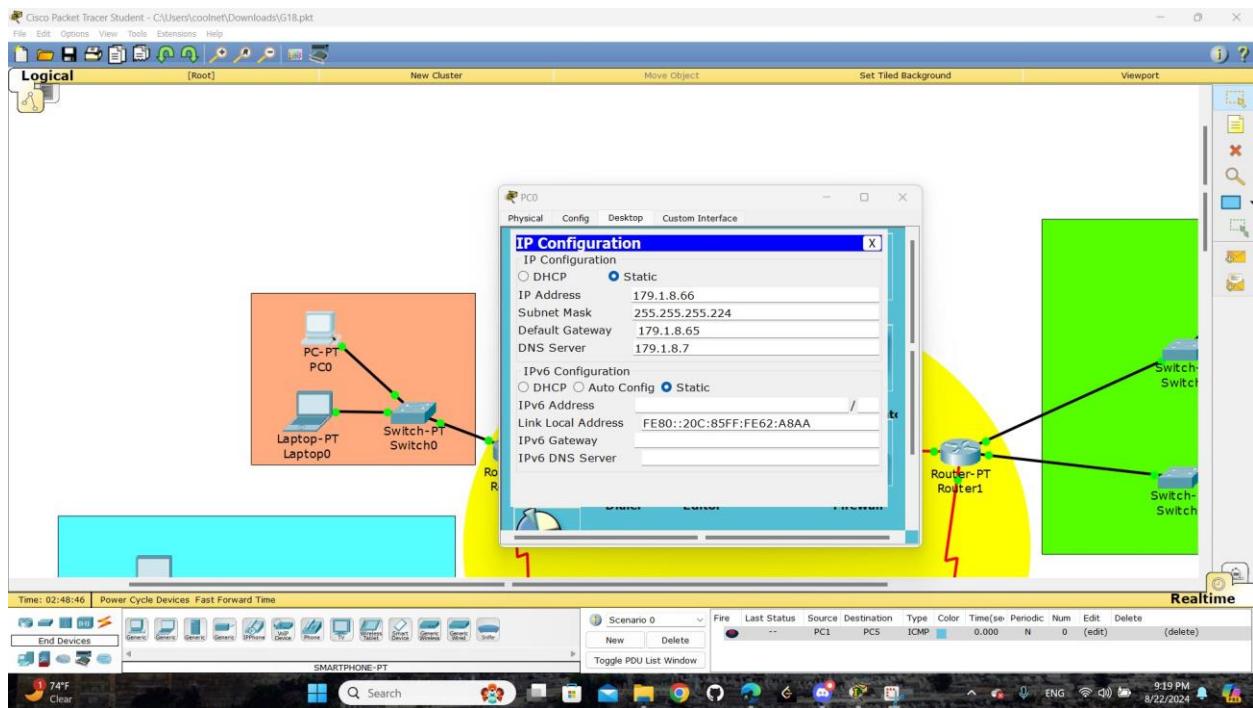


Figure 3: PC0 IP Configuration

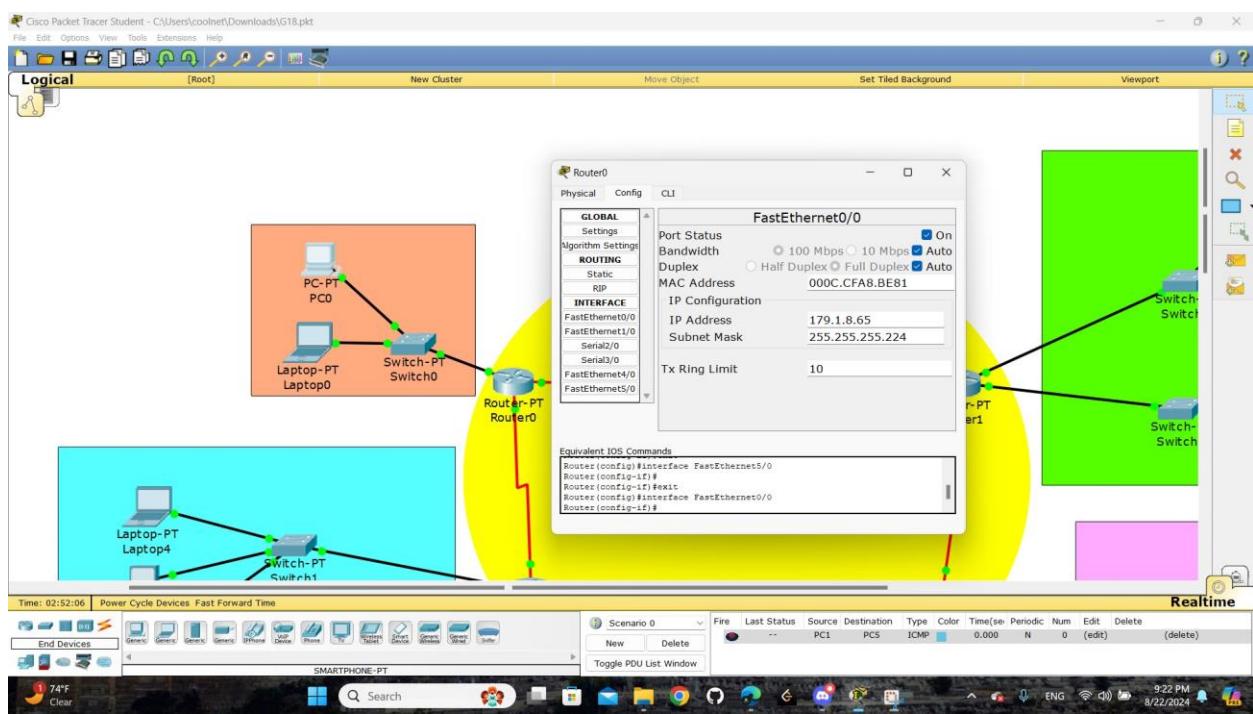


Figure 4: router0 - FastEthernet0/0

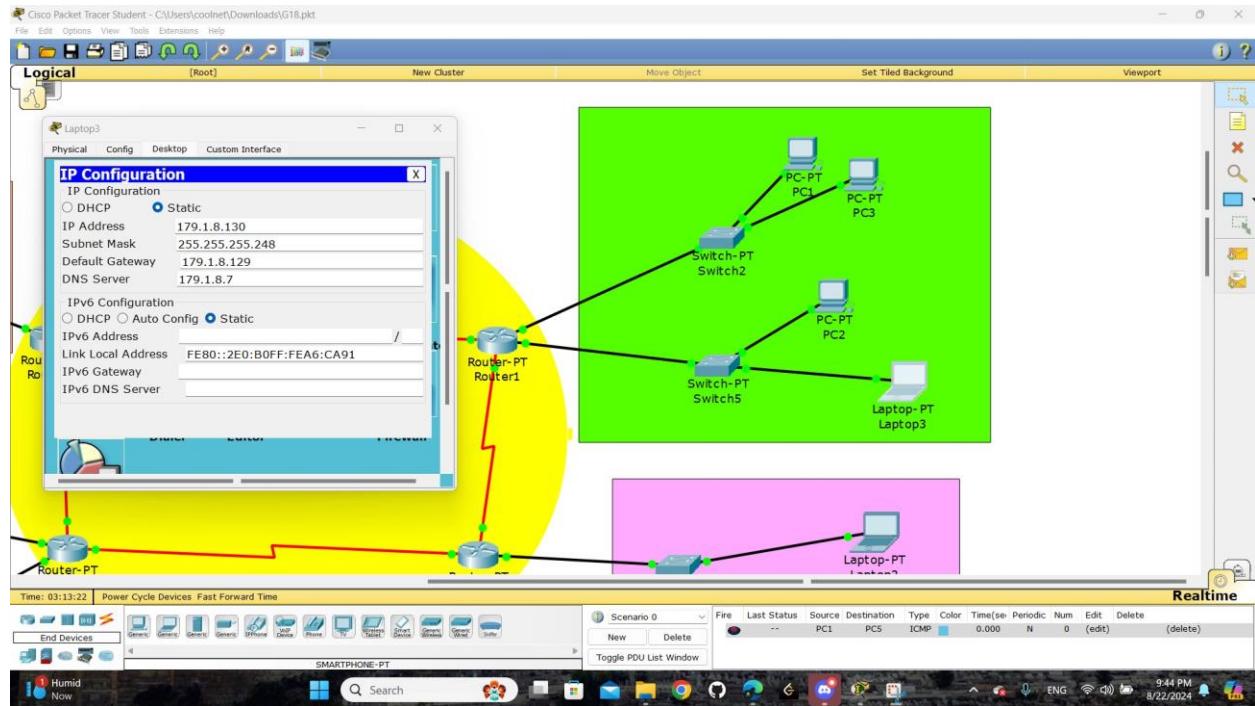


Figure 5: Laptop3 IP Configuration

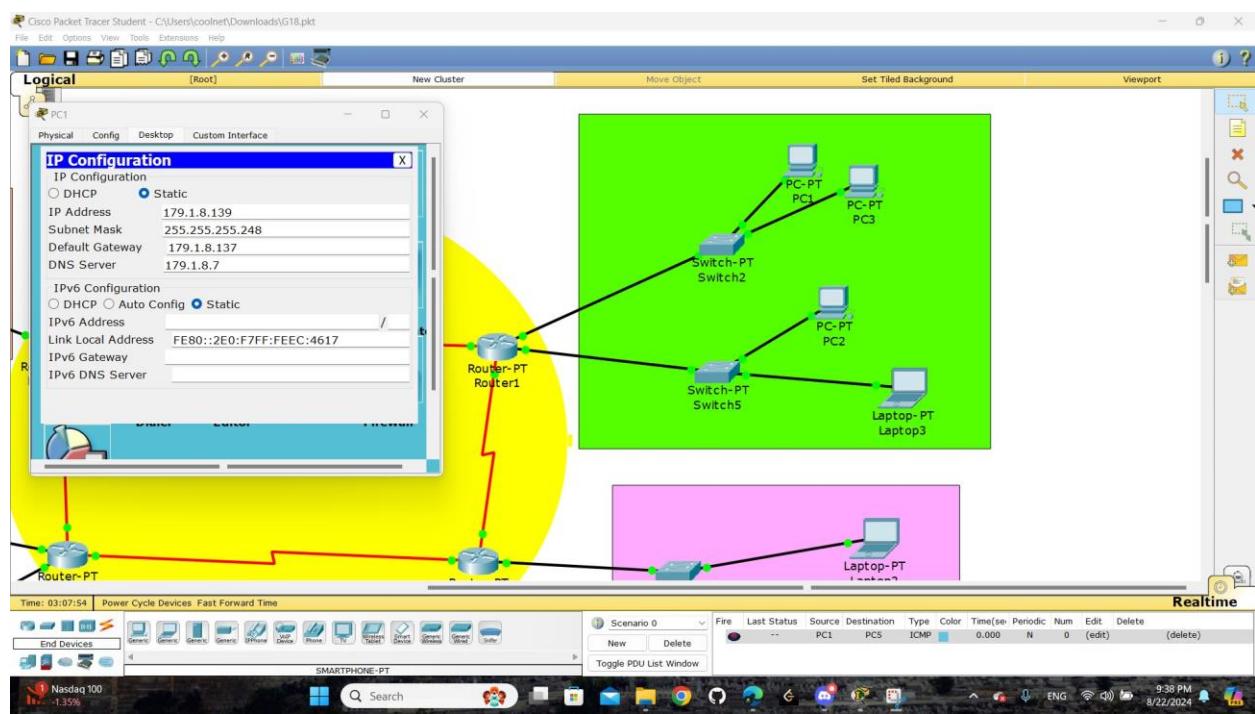


Figure 6: PC1 IP Configuration

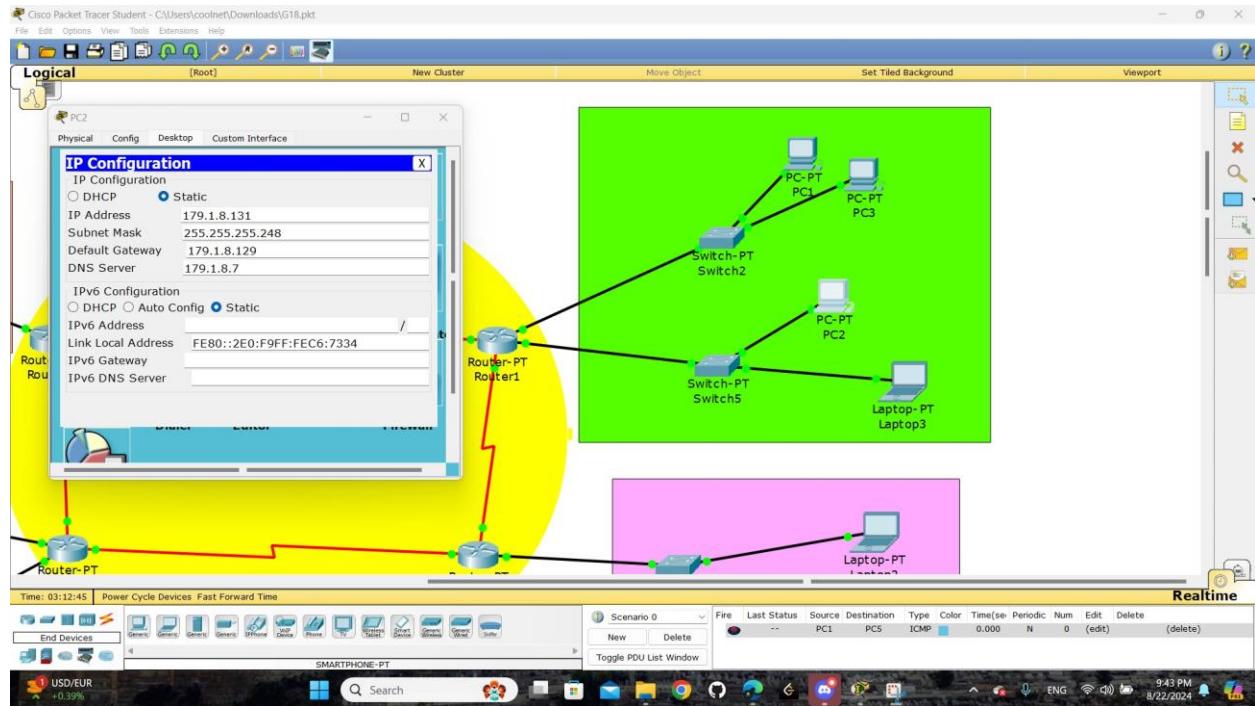


Figure 7: PC2 IP Configuration

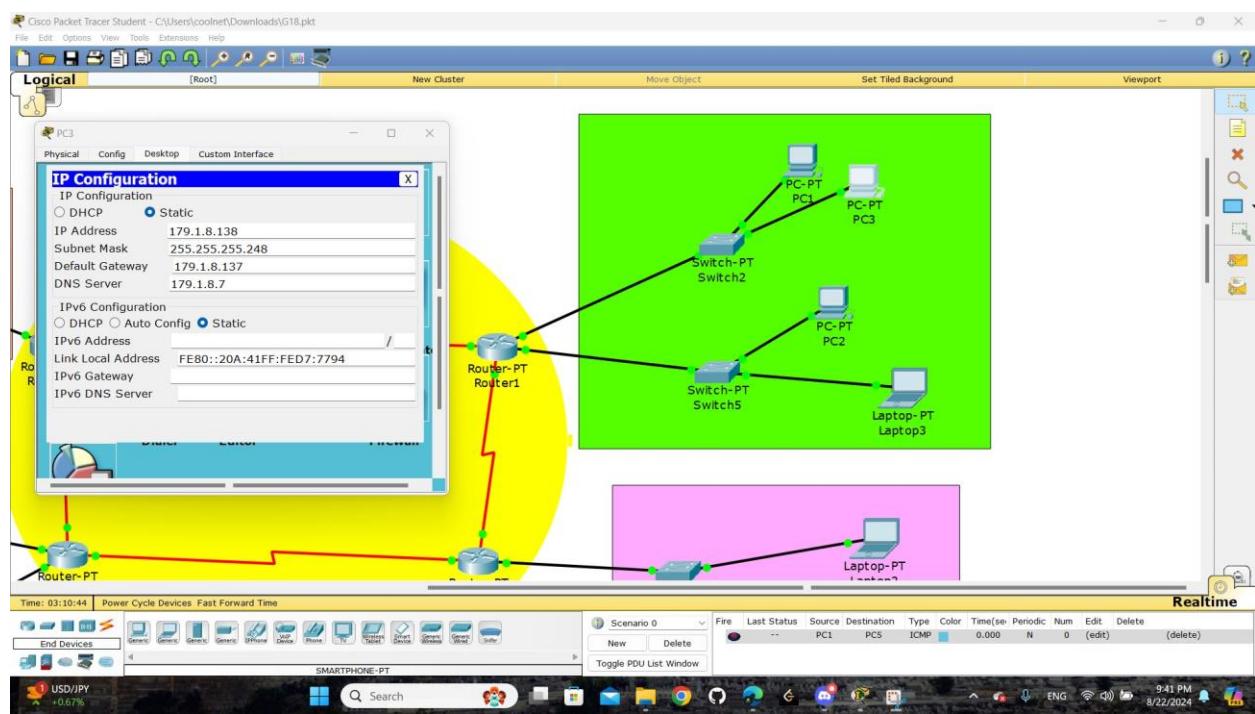


Figure 8: PC3 IP Configuration

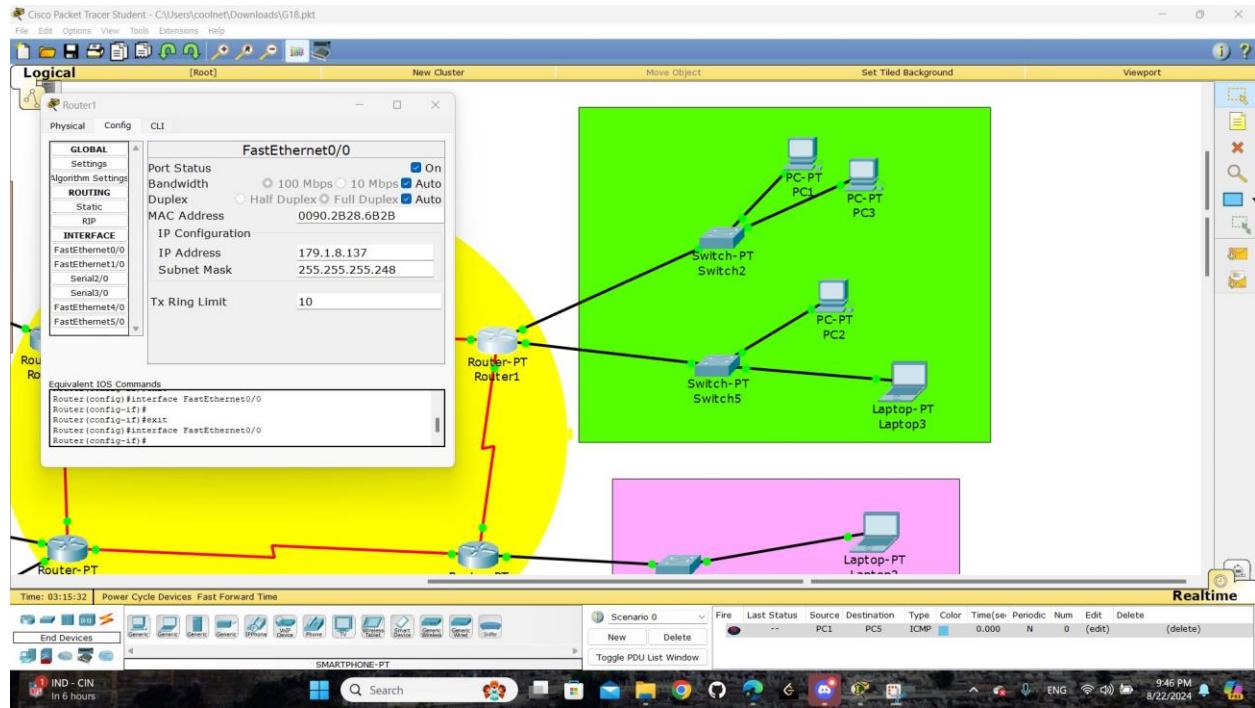


Figure 9: Router1 - FastEthernet0/0

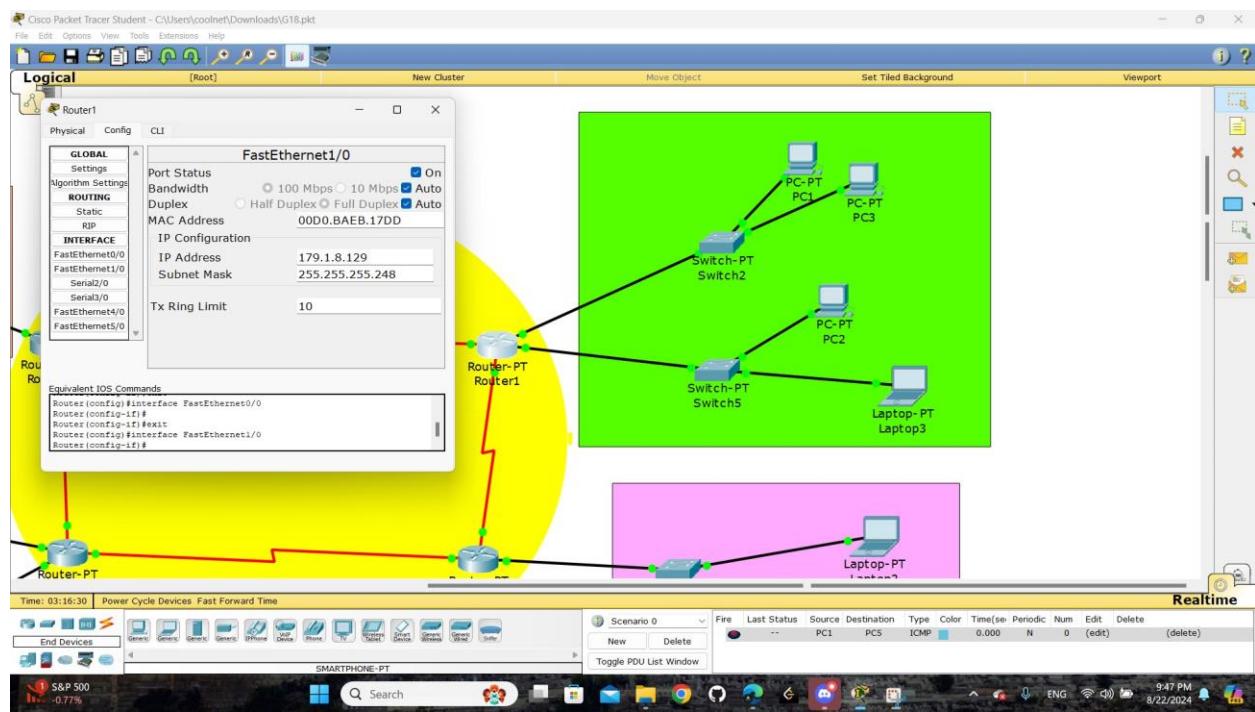


Figure 10: Router1 - FastEthernet1/0

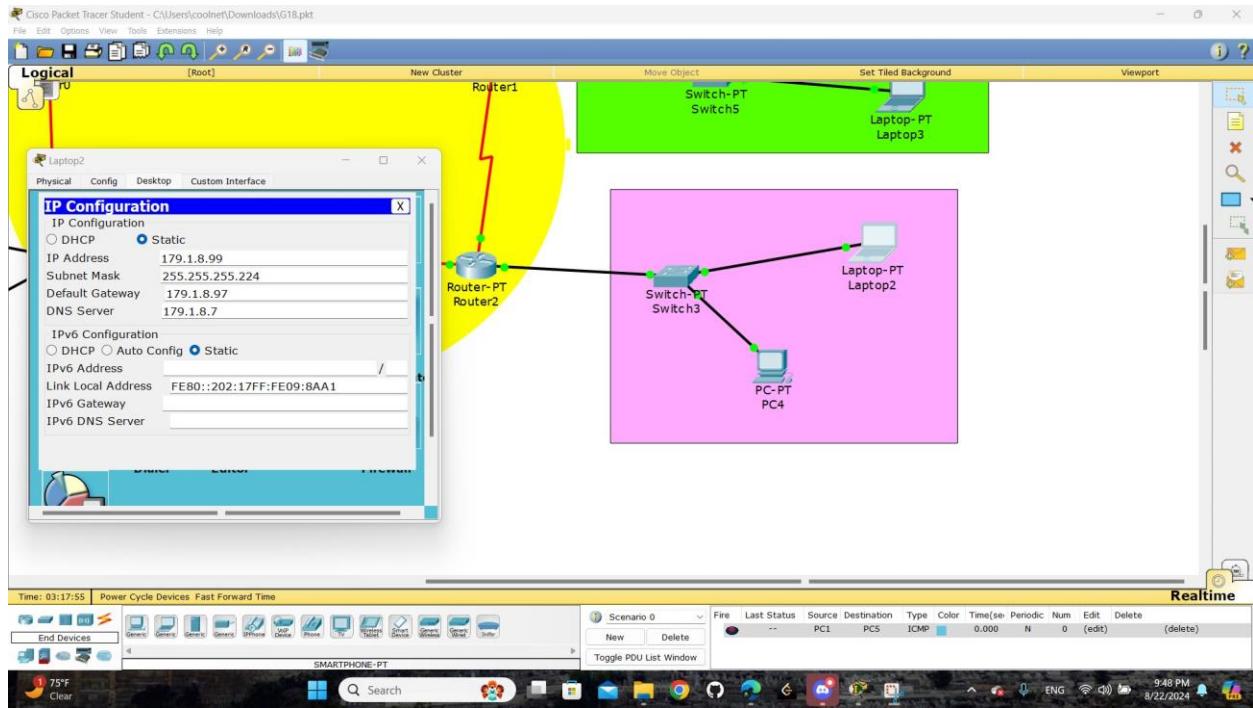


Figure 11: Laptop2 IP Configuration

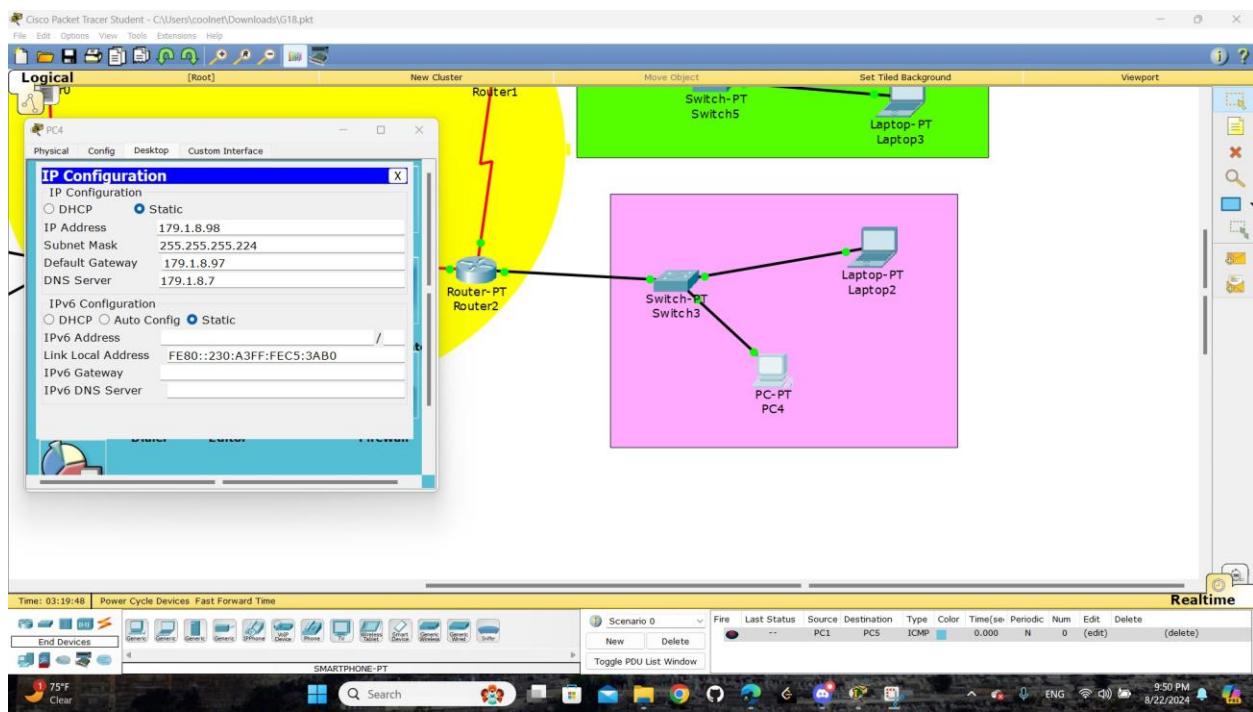


Figure 12: PC4 IP Configuration

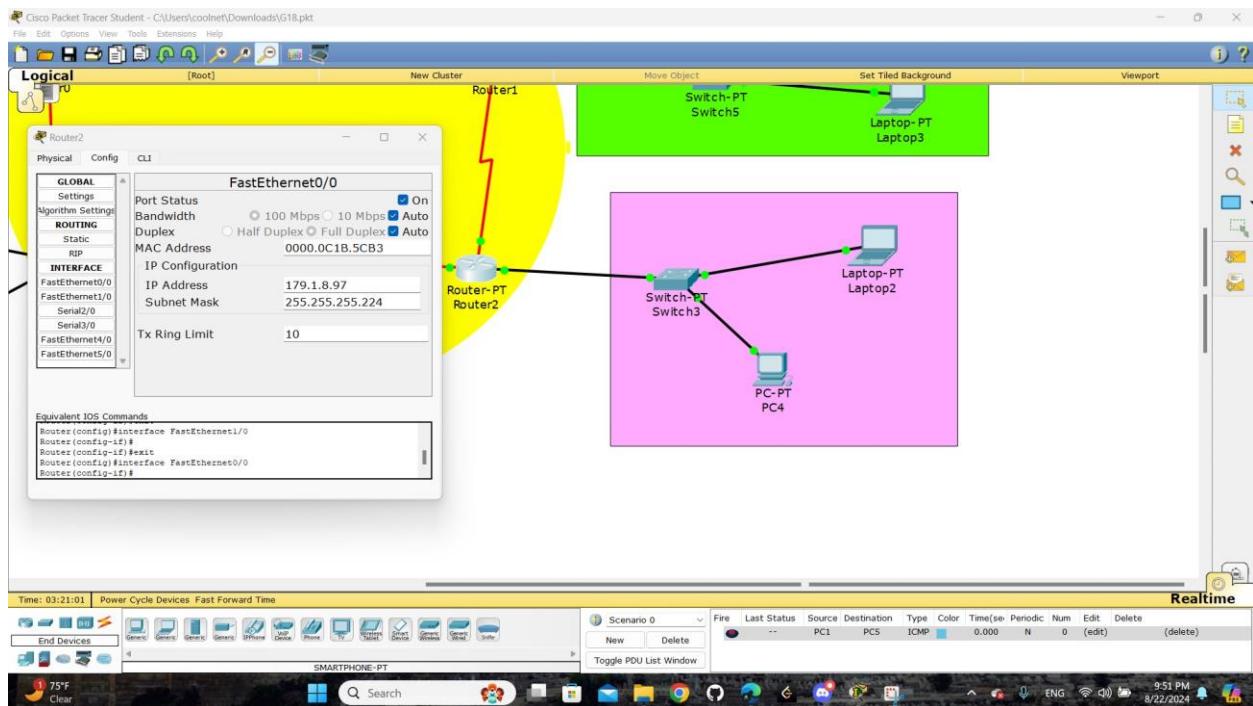


Figure 13: Router2 - FastEthernet0/0

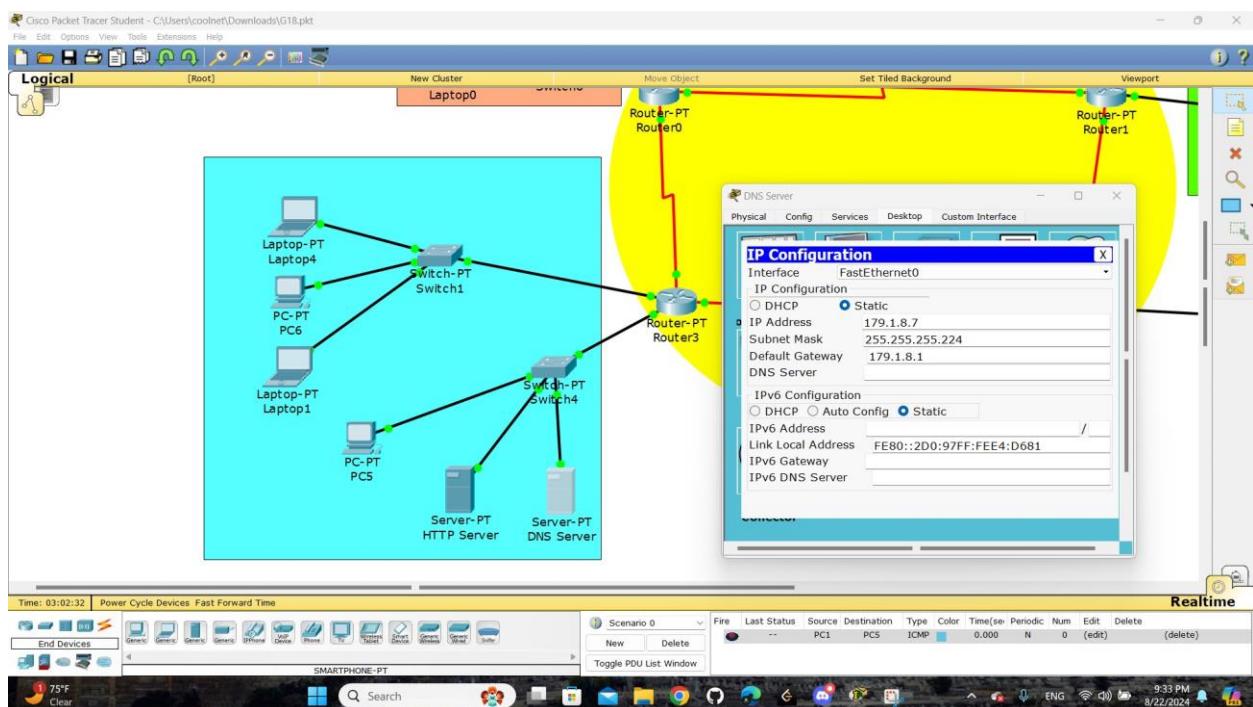


Figure 14: DNS server IP Configuration

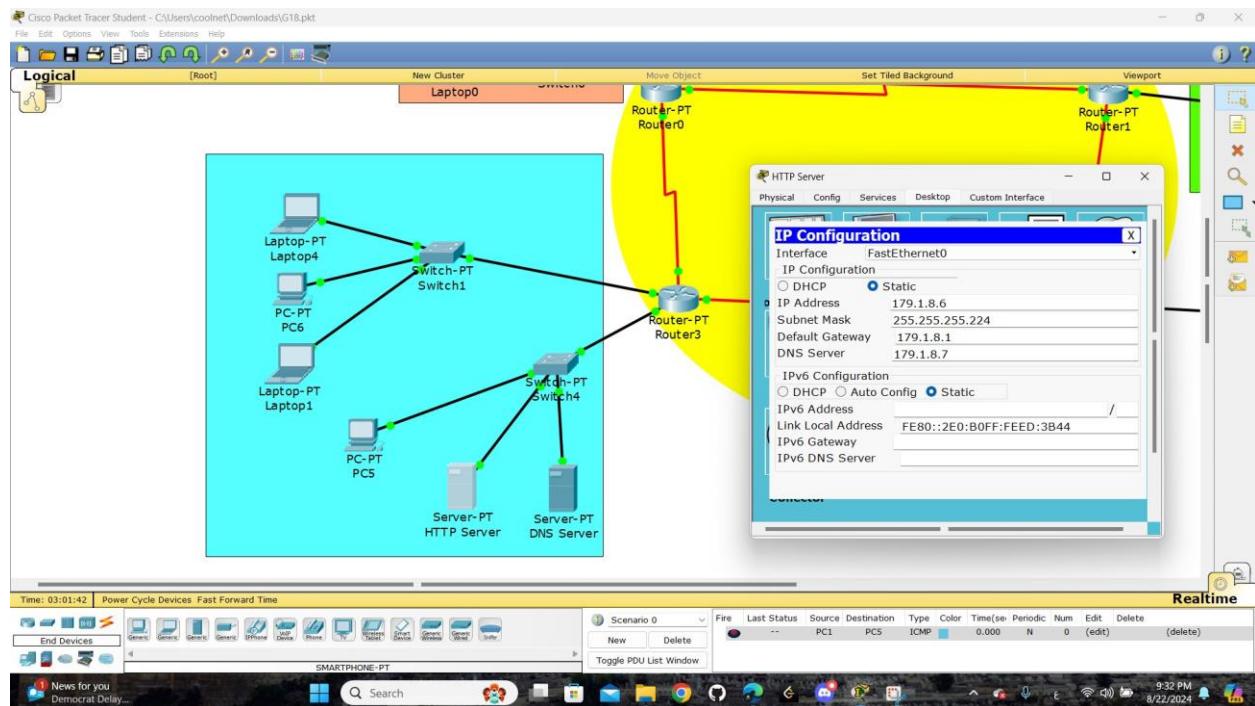


Figure 15: HTTP server IP Configuration

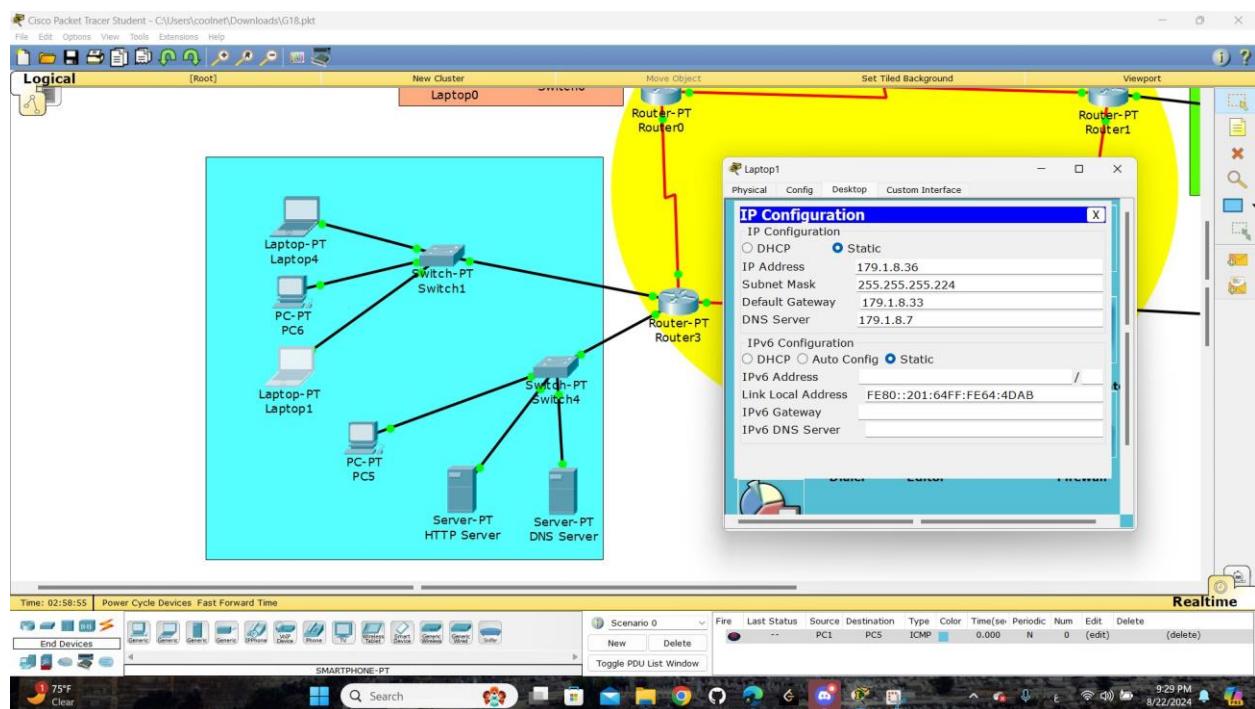


Figure 16: laptop1 IP Configuration

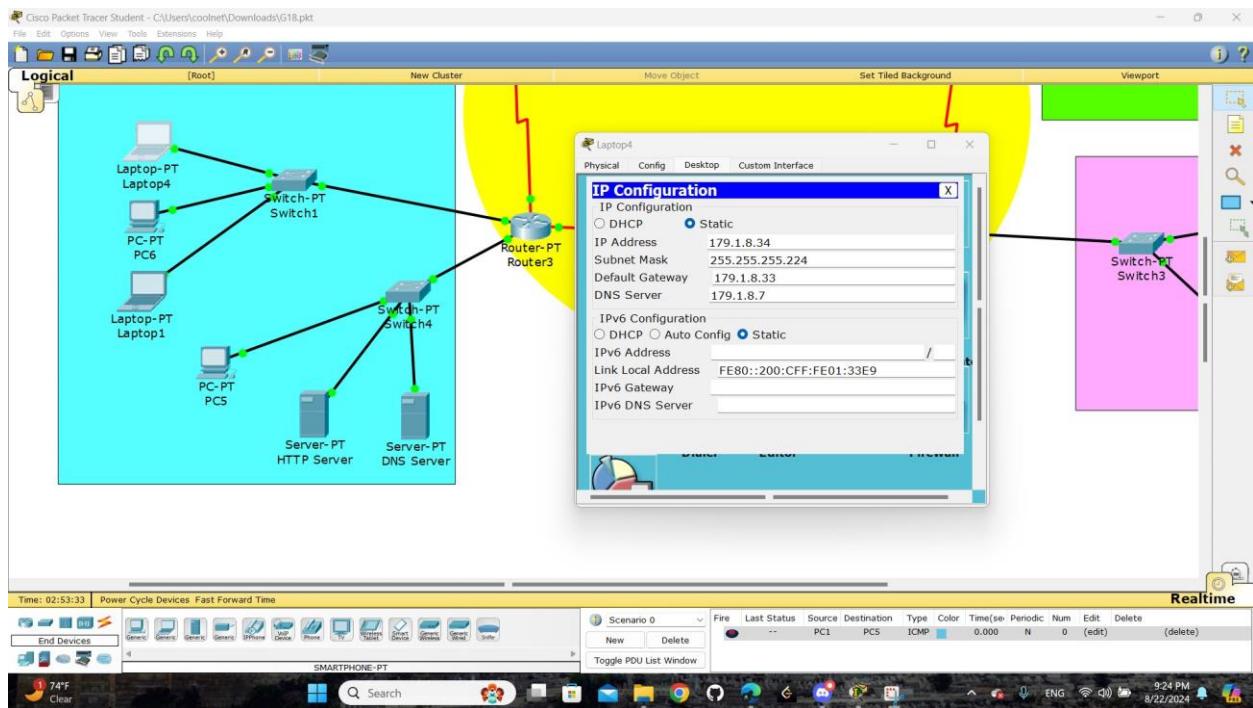


Figure 17: laptop4 IP Configuration

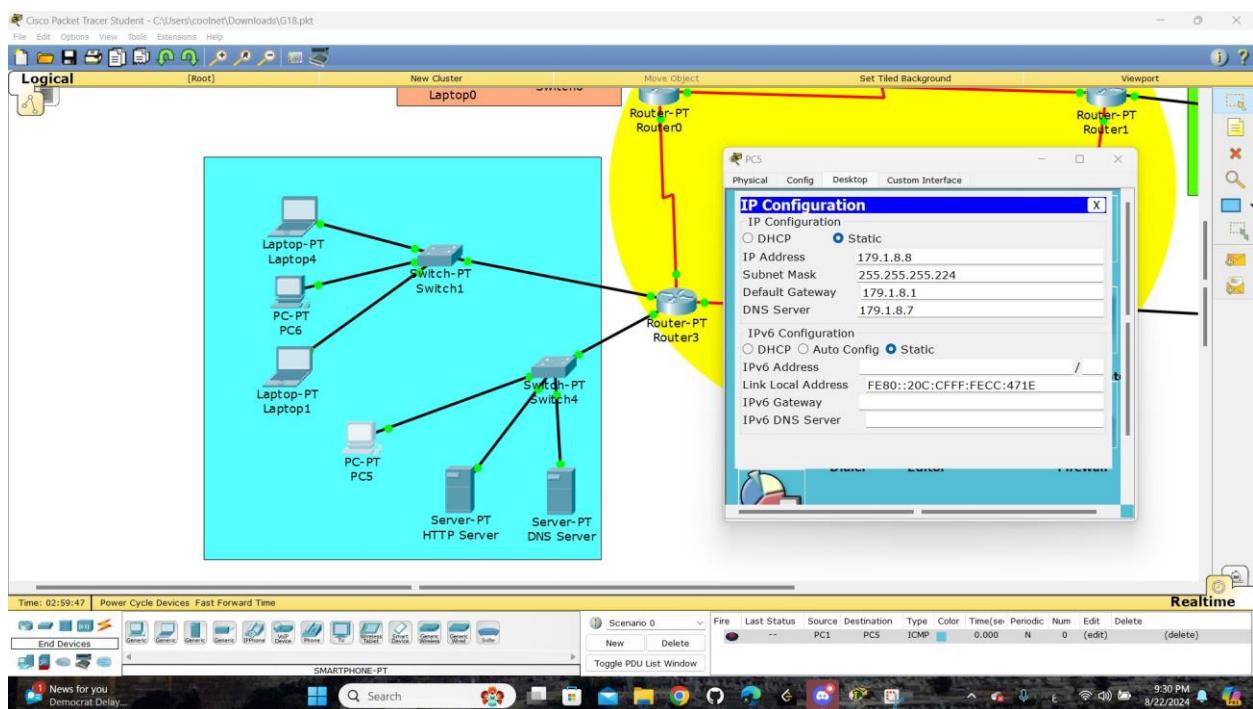


Figure 18: PC5 IP Configuration

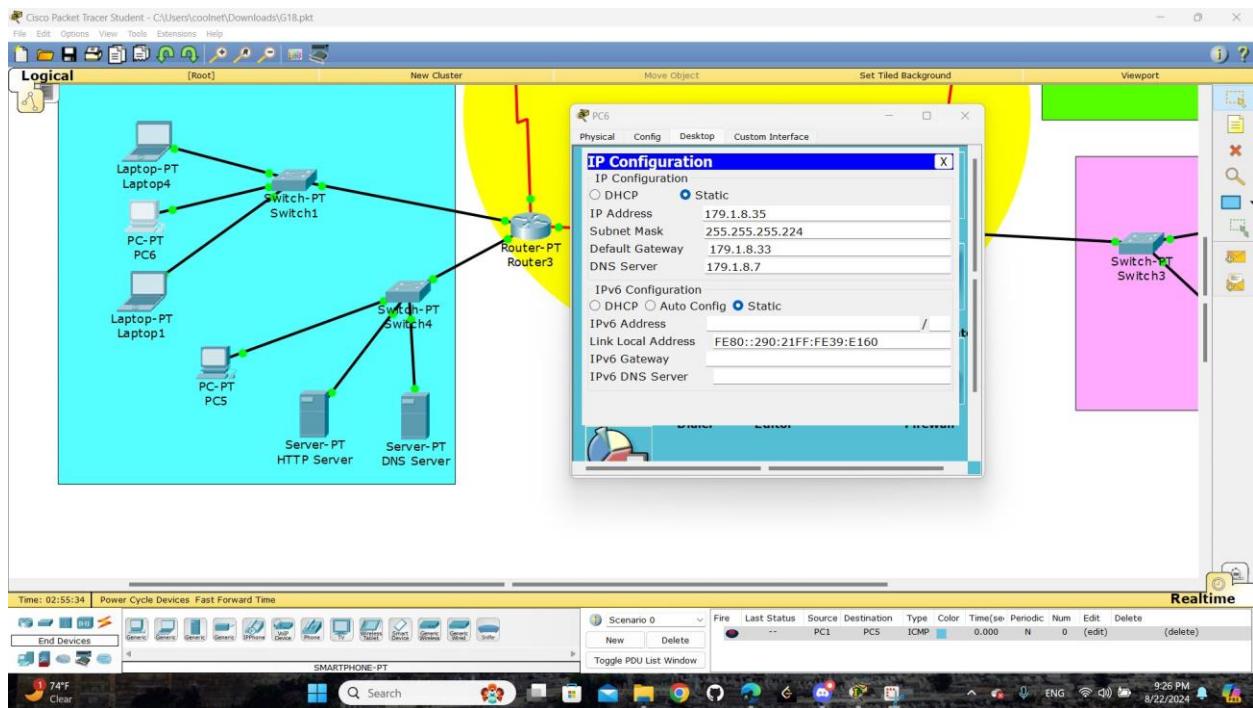


Figure 19: PC6 IP Configuration

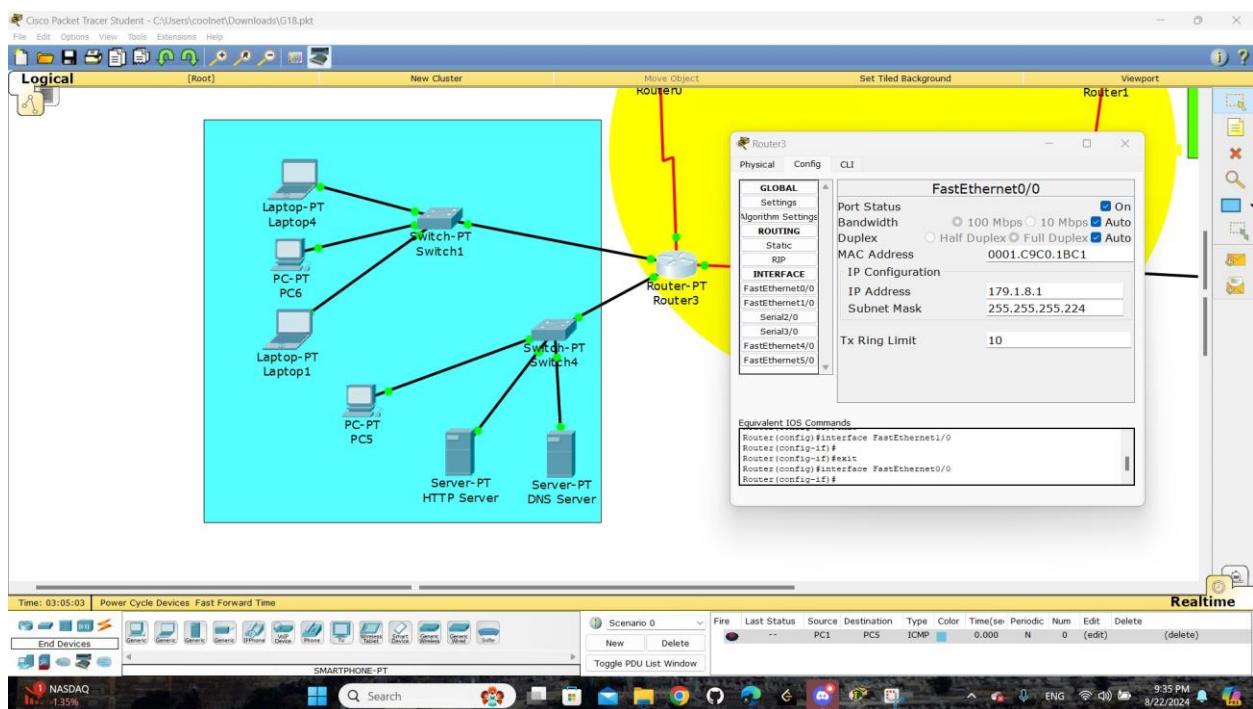


Figure 20: Router3 - FastEthernet0/0

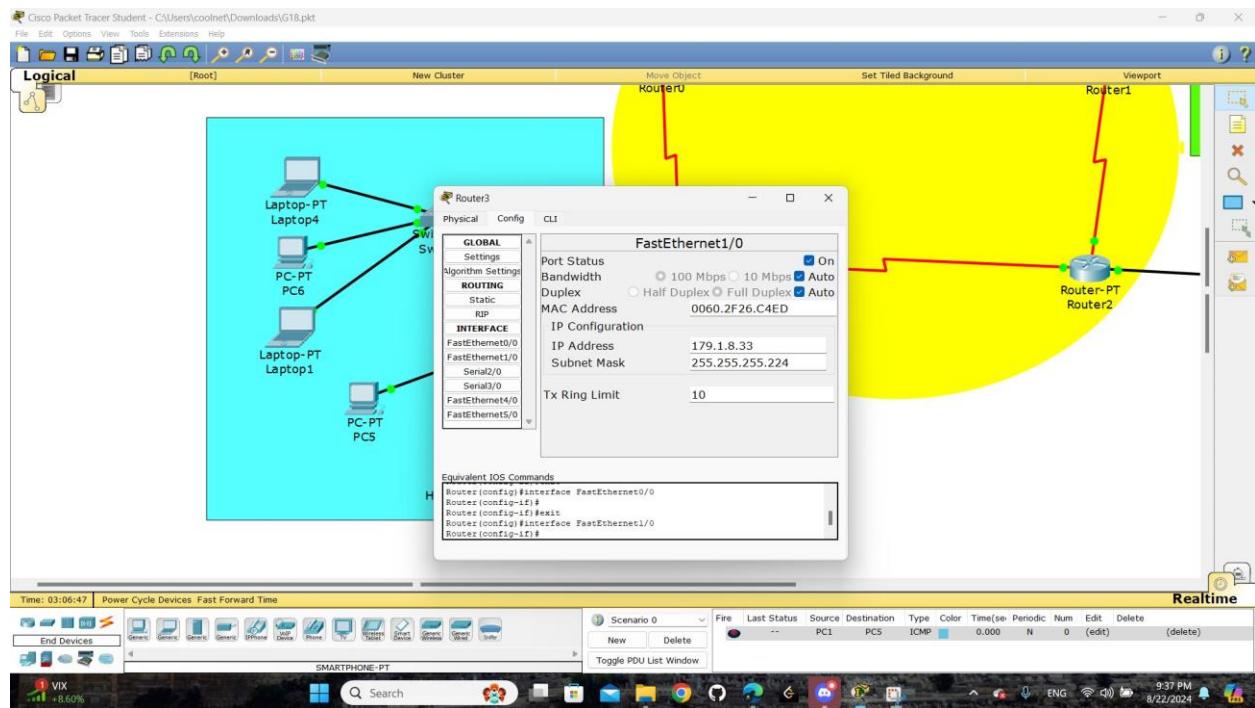


Figure 21: Router3 - FastEthernet1/0

These images are to display the details of each device on the network and these details are “ IP Configuration, IP Address, Subnet Mask, Default Gateway, DNS Server “.

# Task 1:

## Part1:

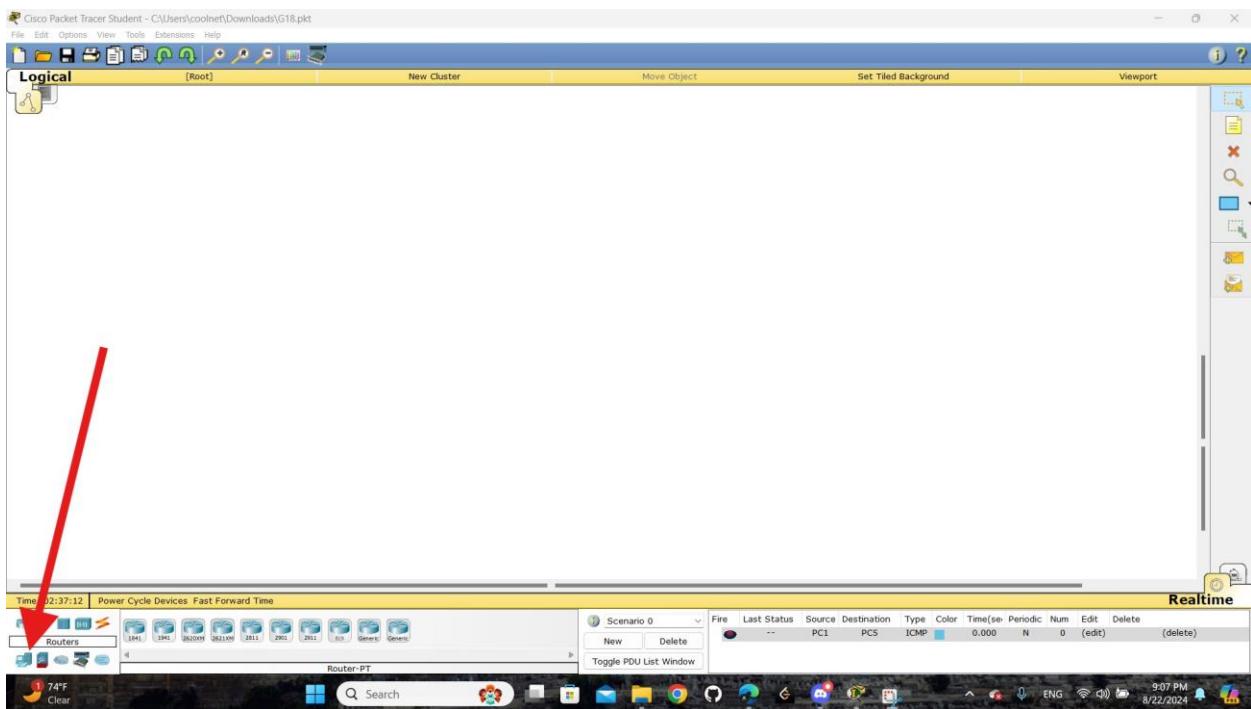


Figure 22: open end device tap

open ( end device ) tap

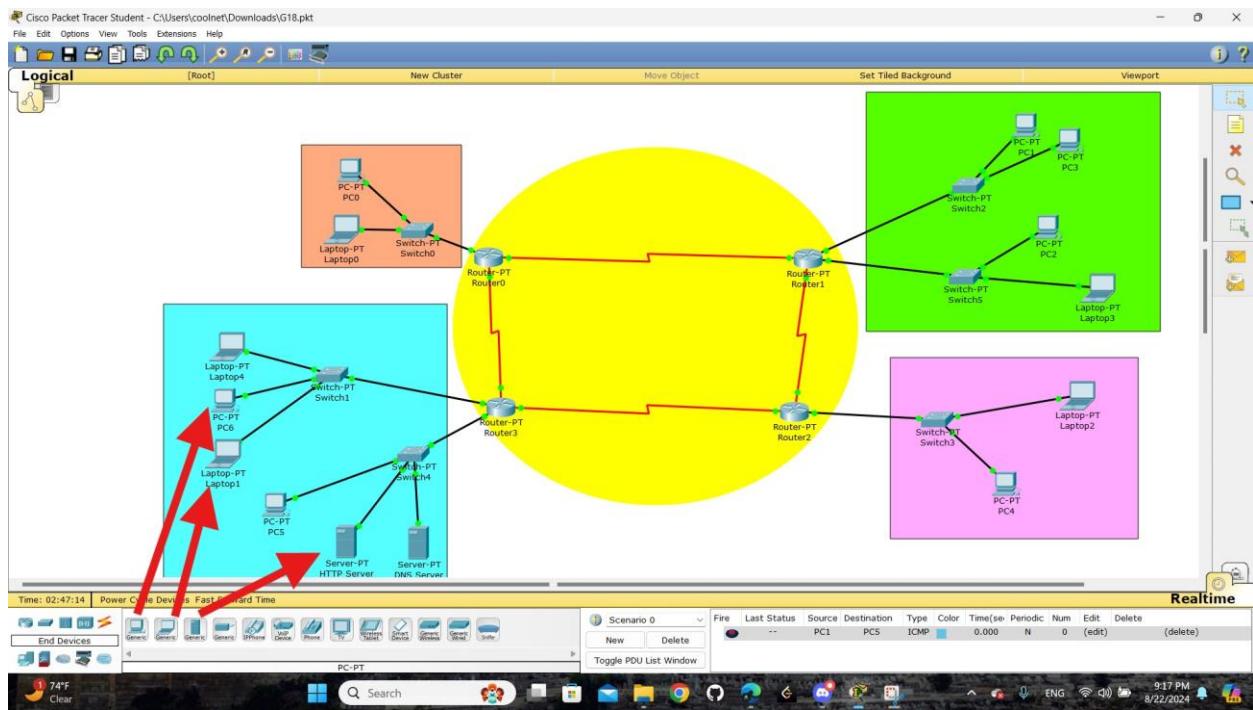


Figure 23: select and insert end device

select any ( end device ) and put it where you want

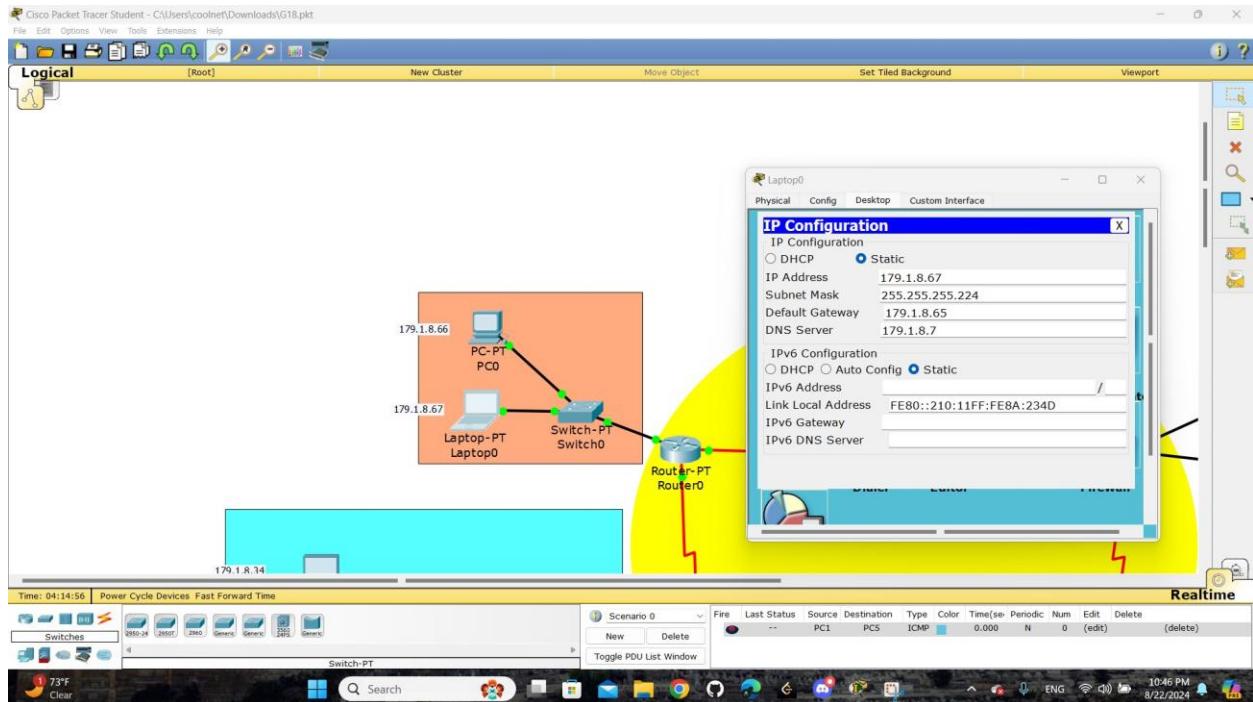


Figure 24: Laptop0 IP Configuration

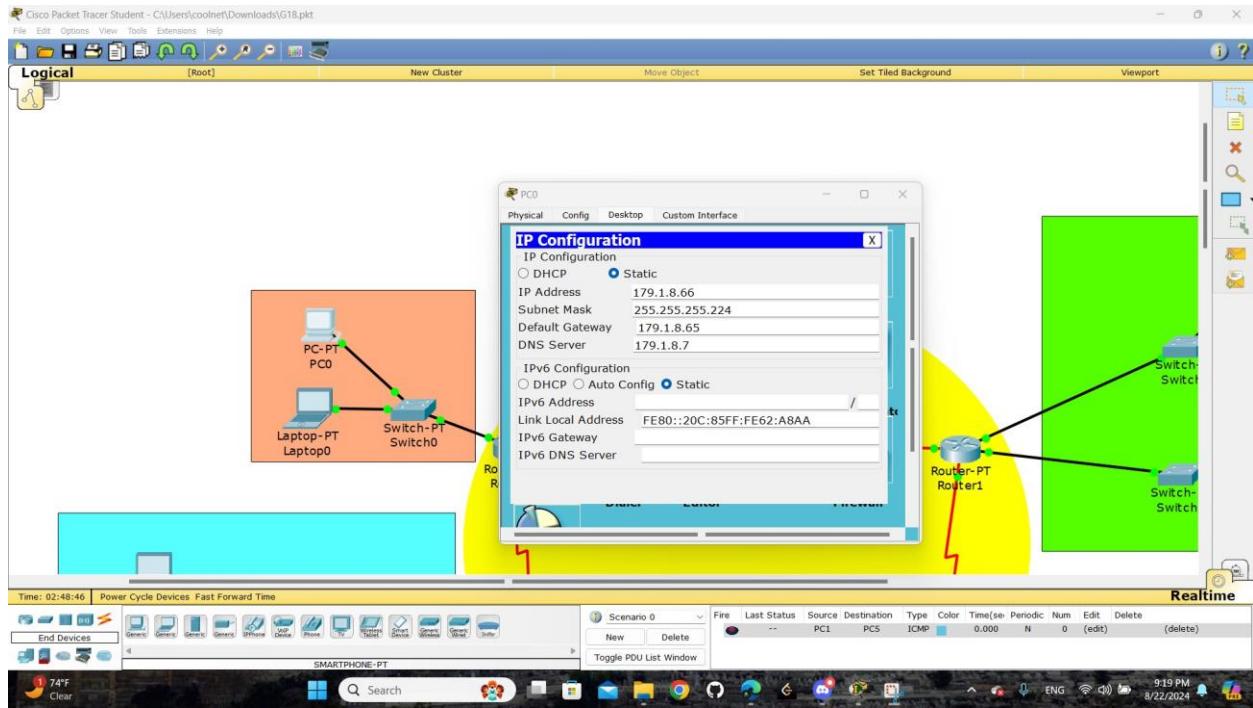


Figure 25: PC0 IP Configuration

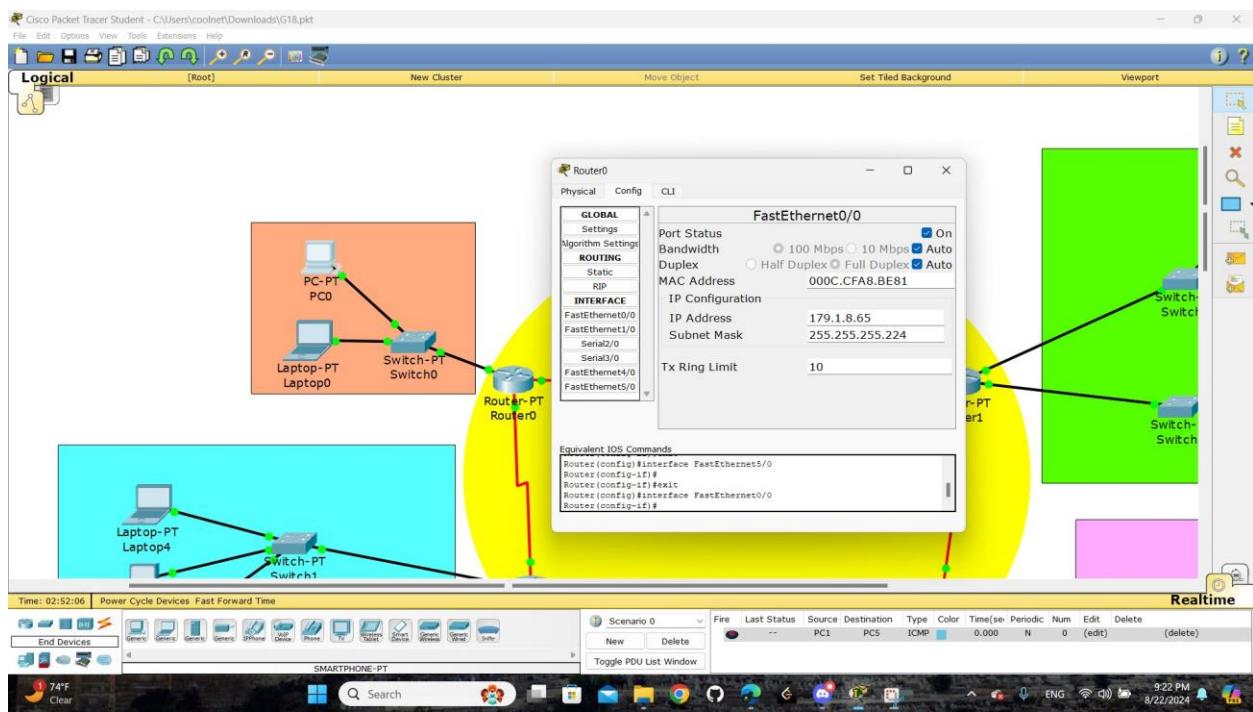


Figure 26: Router0 - FastEthernet0/0

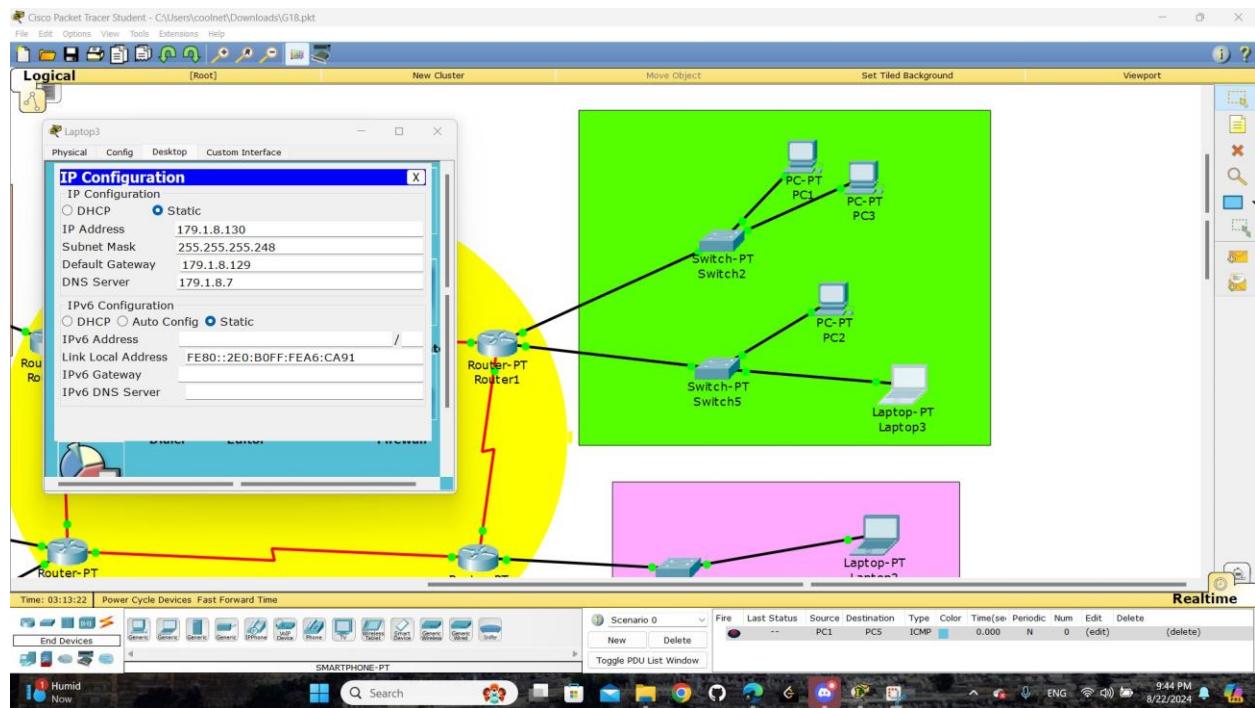


Figure 27: Laptop3 IP Configuration

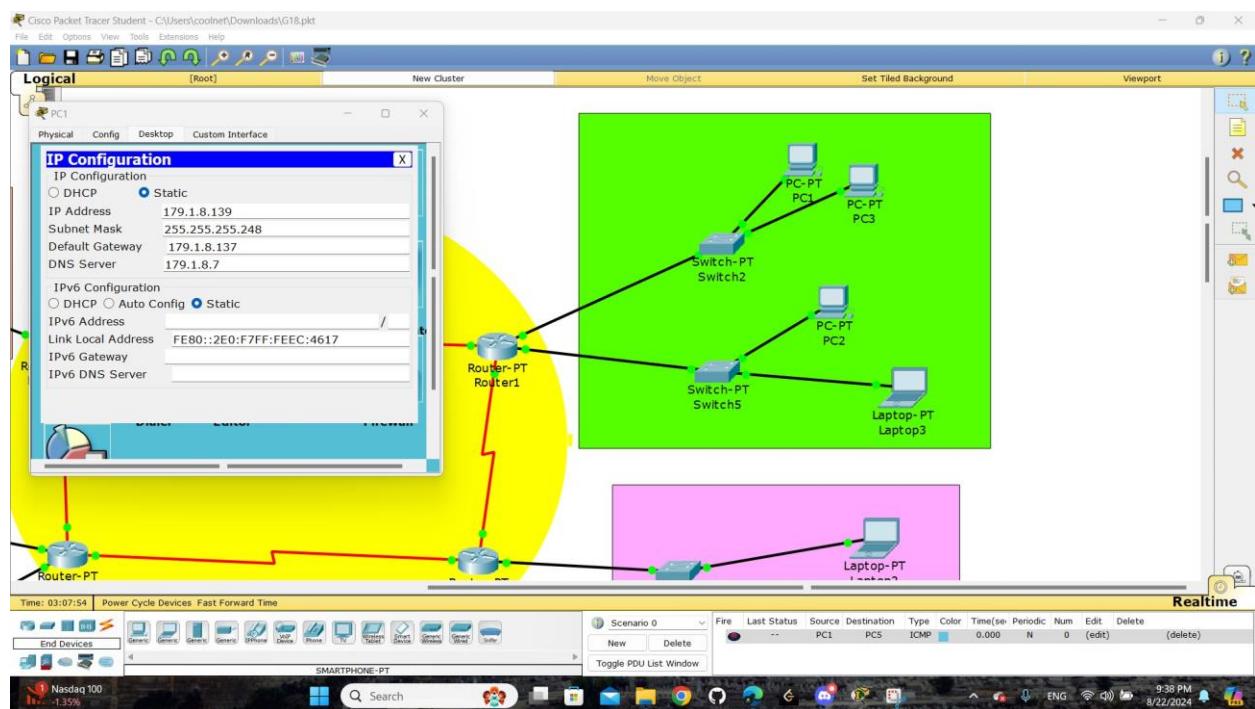


Figure 28: PC1 IP Configuration

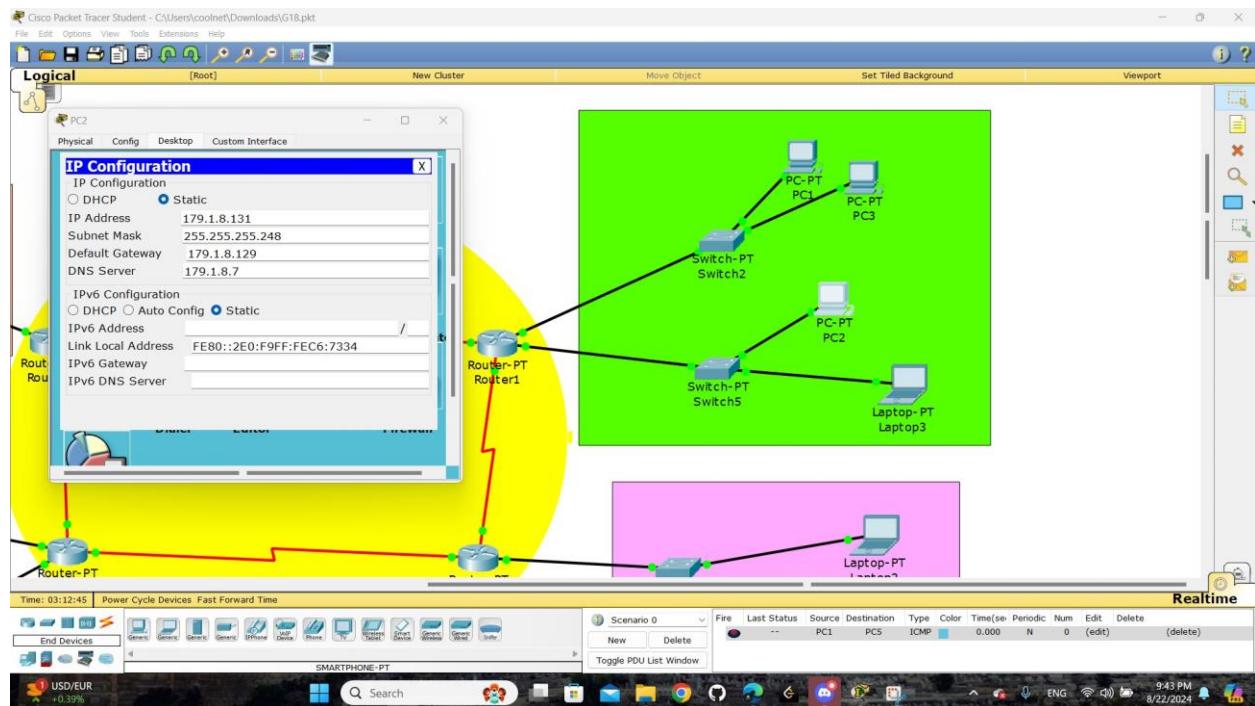


Figure 29: PC2 IP Configuration

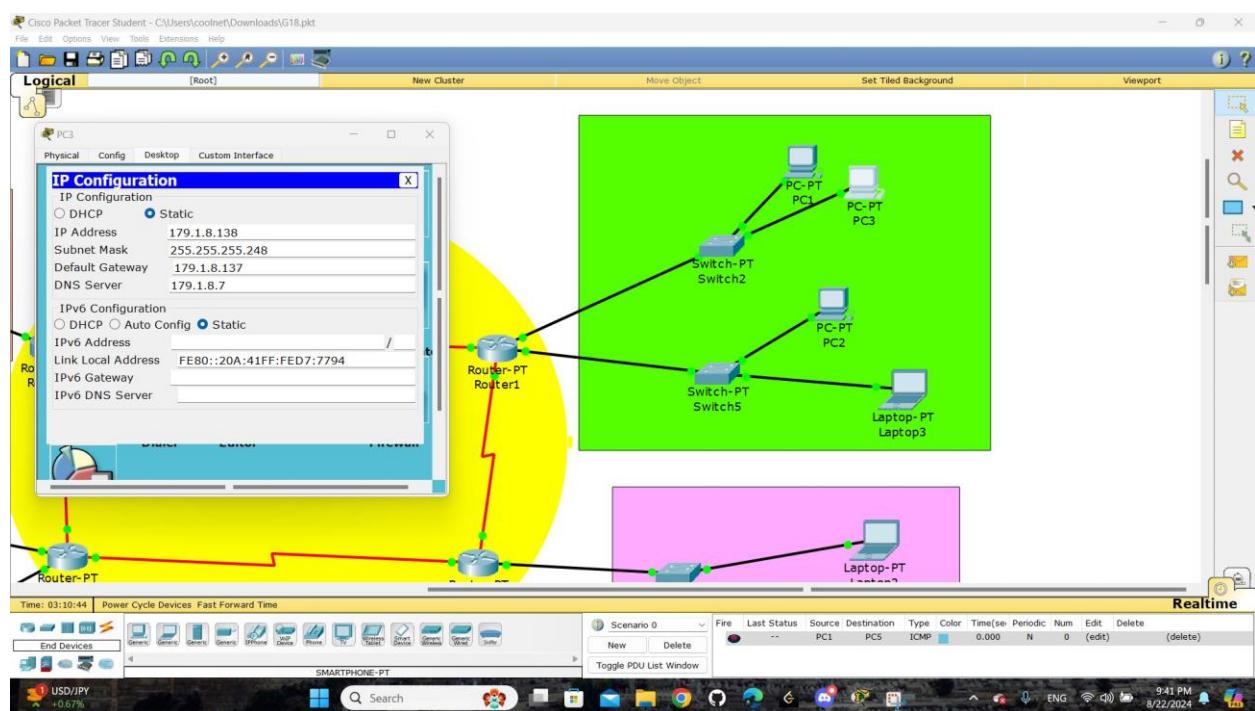


Figure 30: PC3 IP Configuration

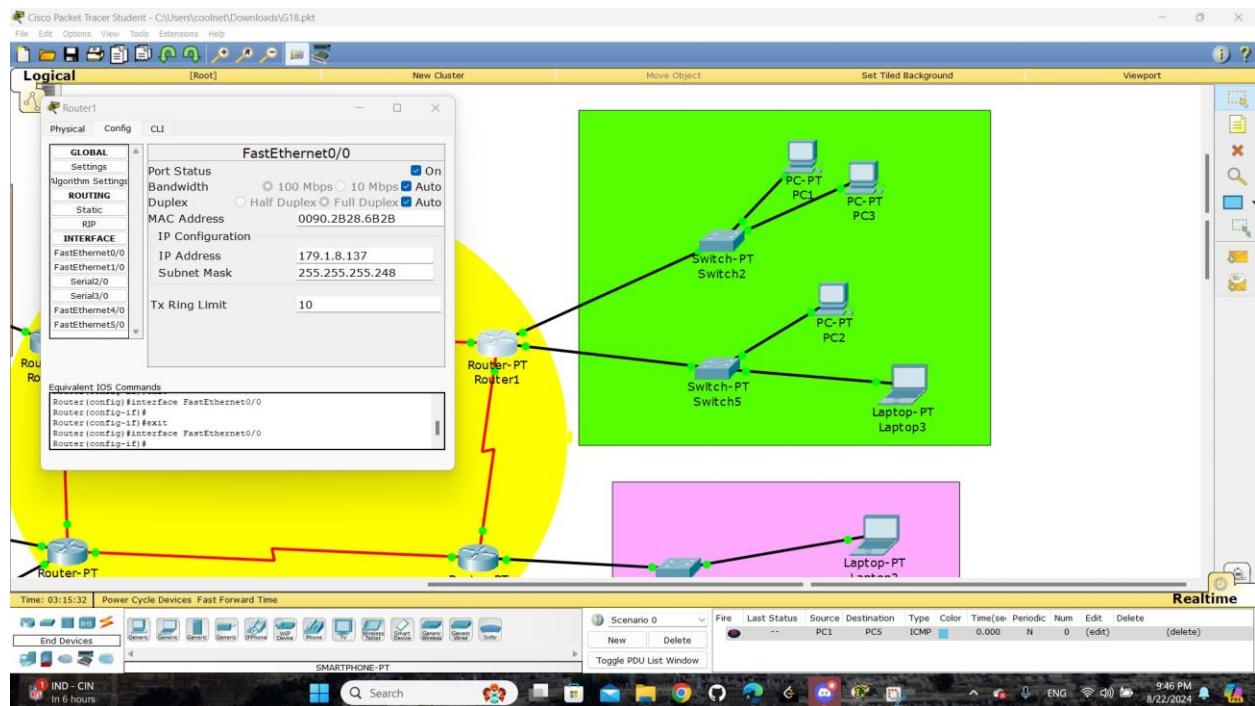


Figure 31: Router1 - FastEthernet0/0

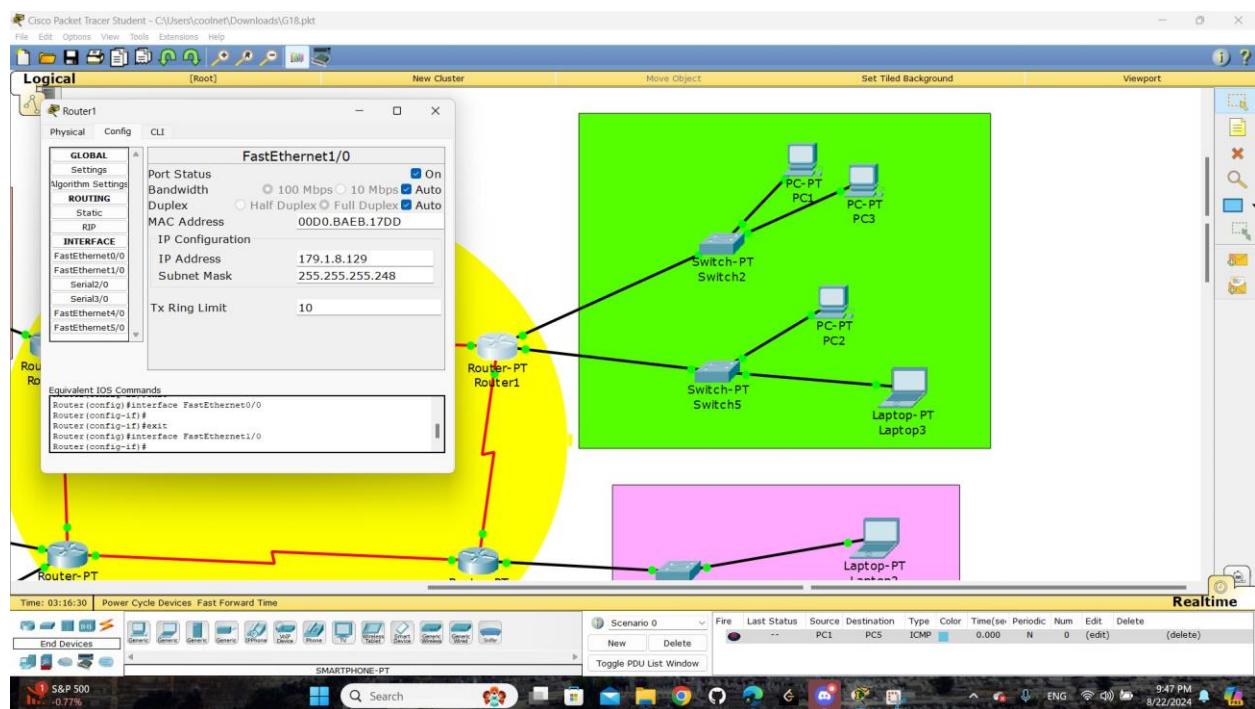


Figure 32: Router1 - FastEthernet1/0

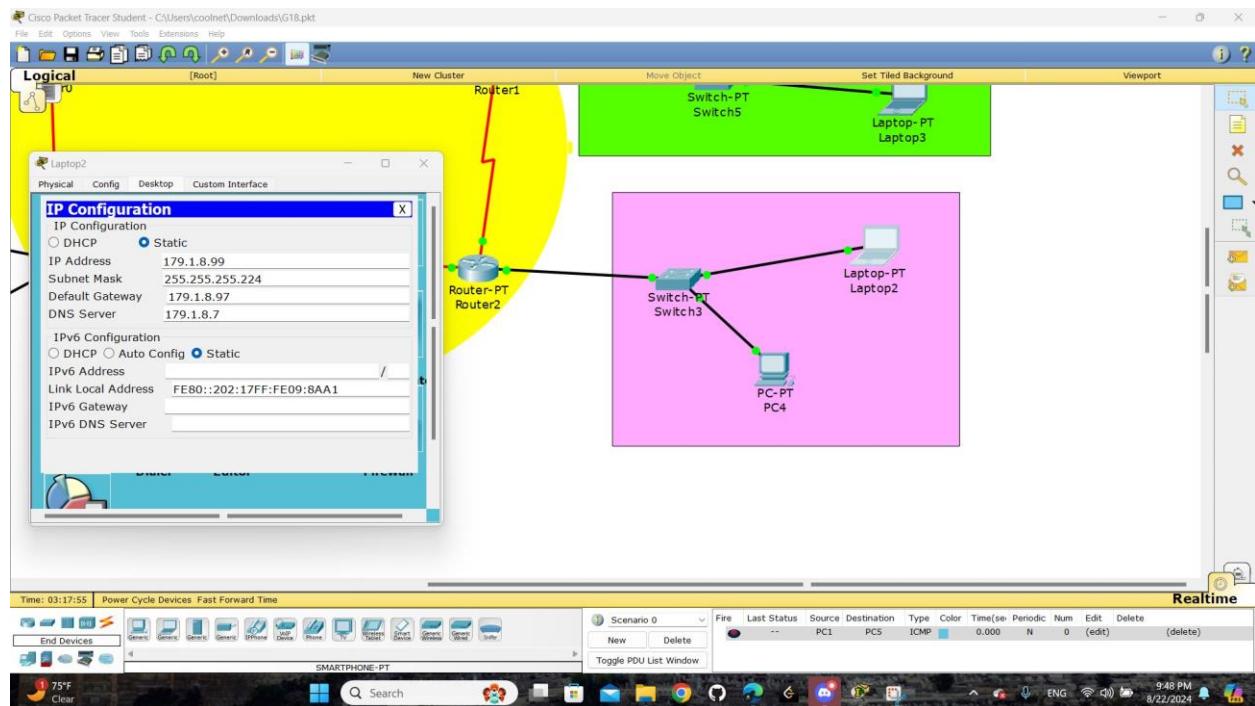


Figure 33: Laptop2 IP Configuration

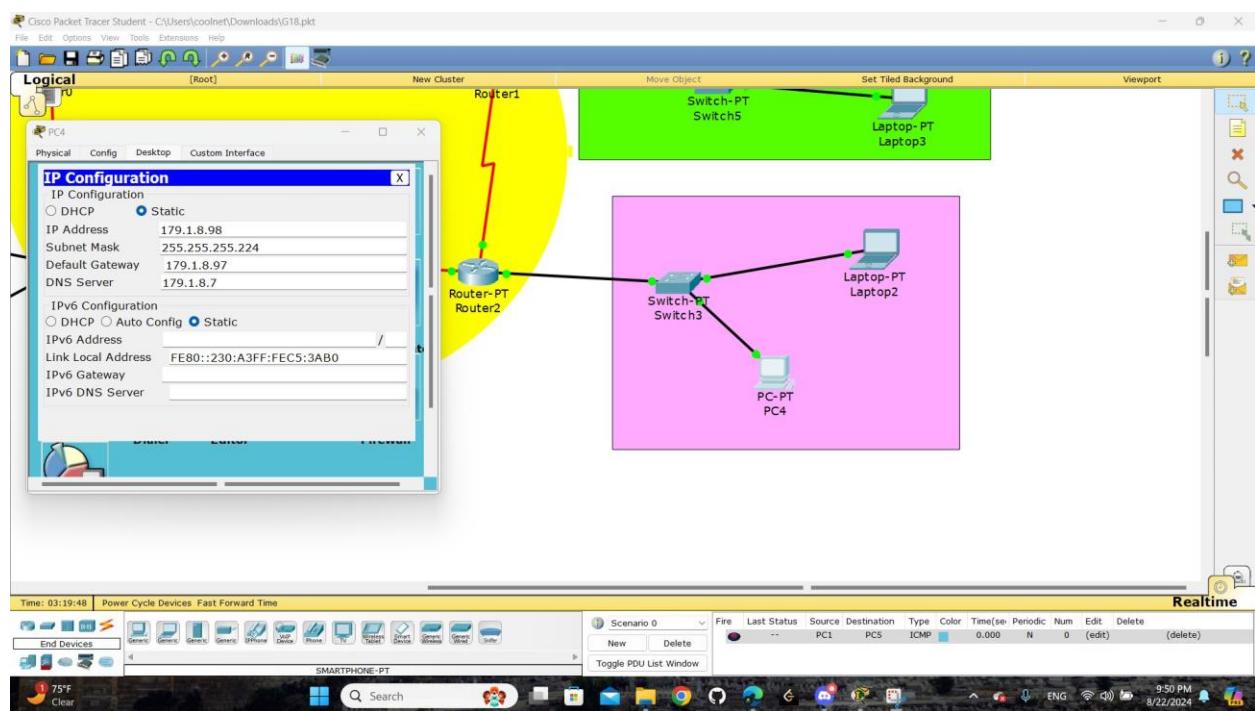


Figure 34: PC4 IP Configuration

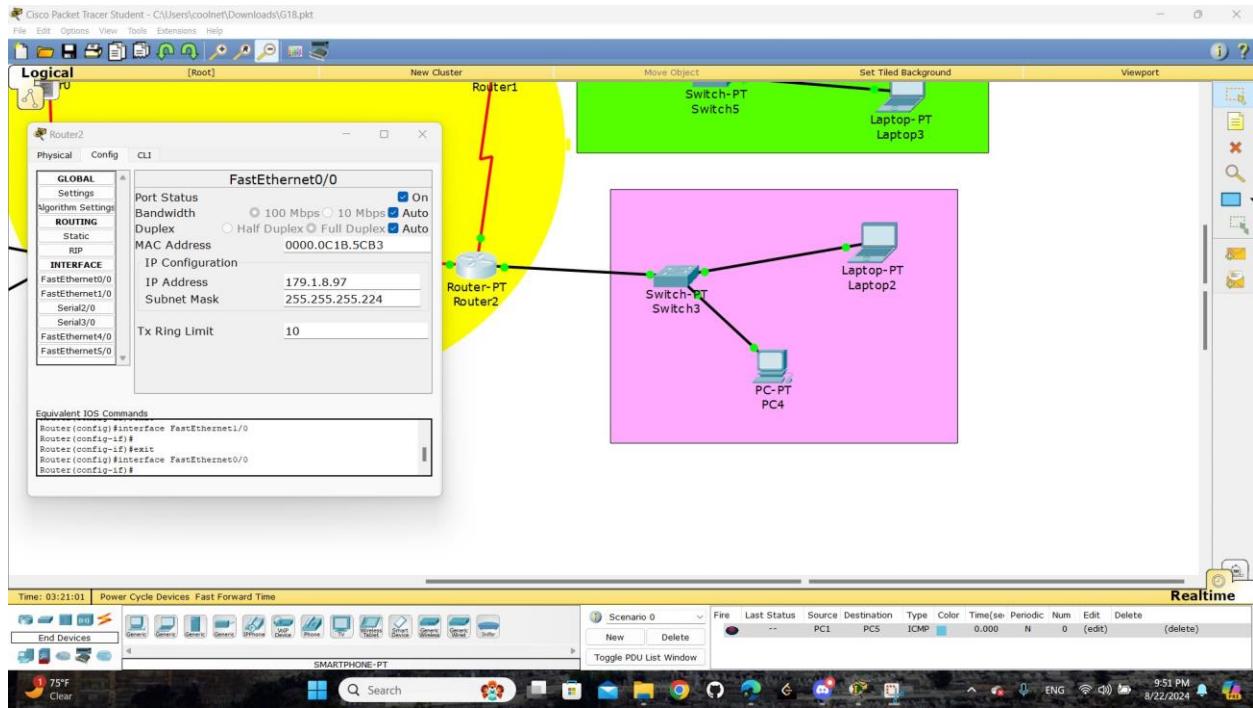


Figure 35: Router - FastEthernet0/0

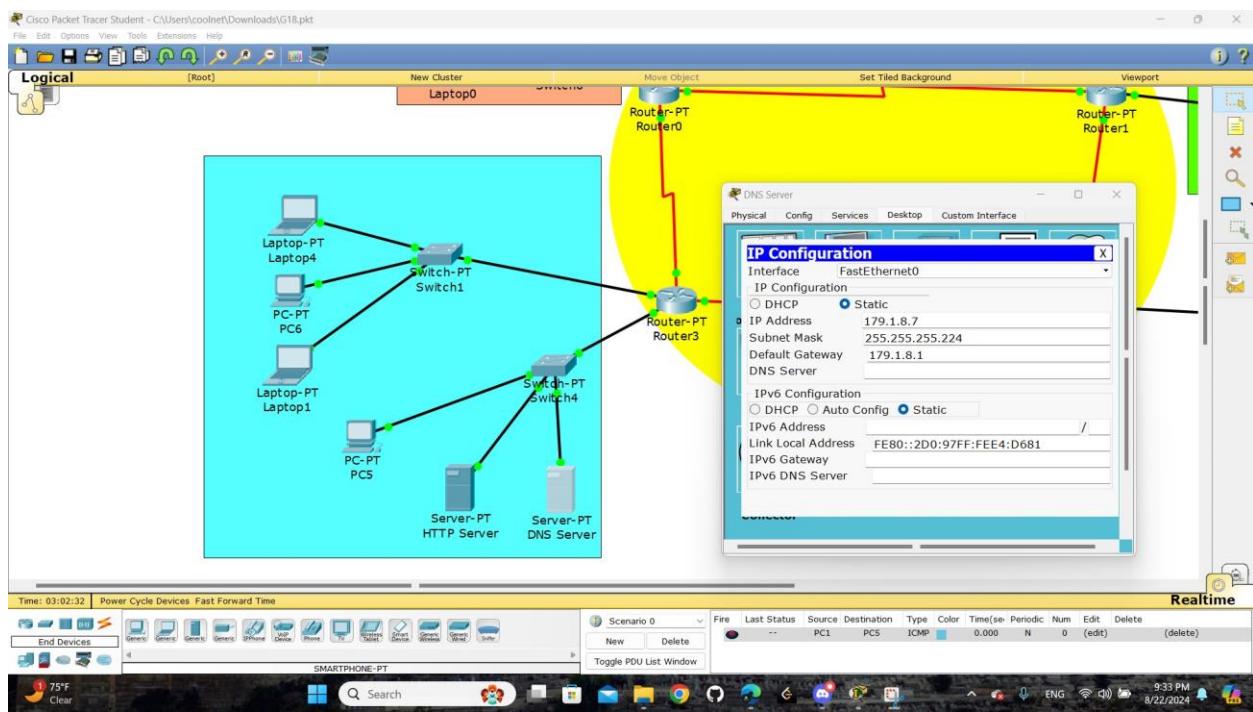


Figure 36: DNS server IP Configuration

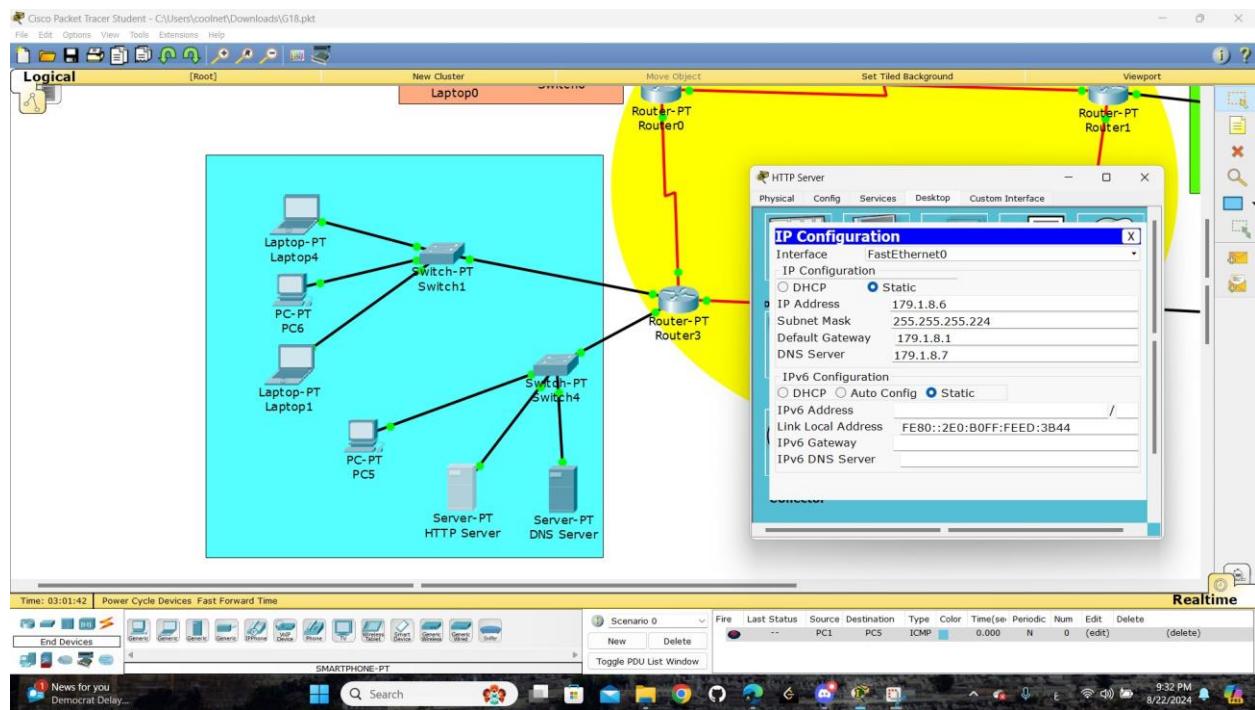


Figure 37: HTTP server IP Configuration

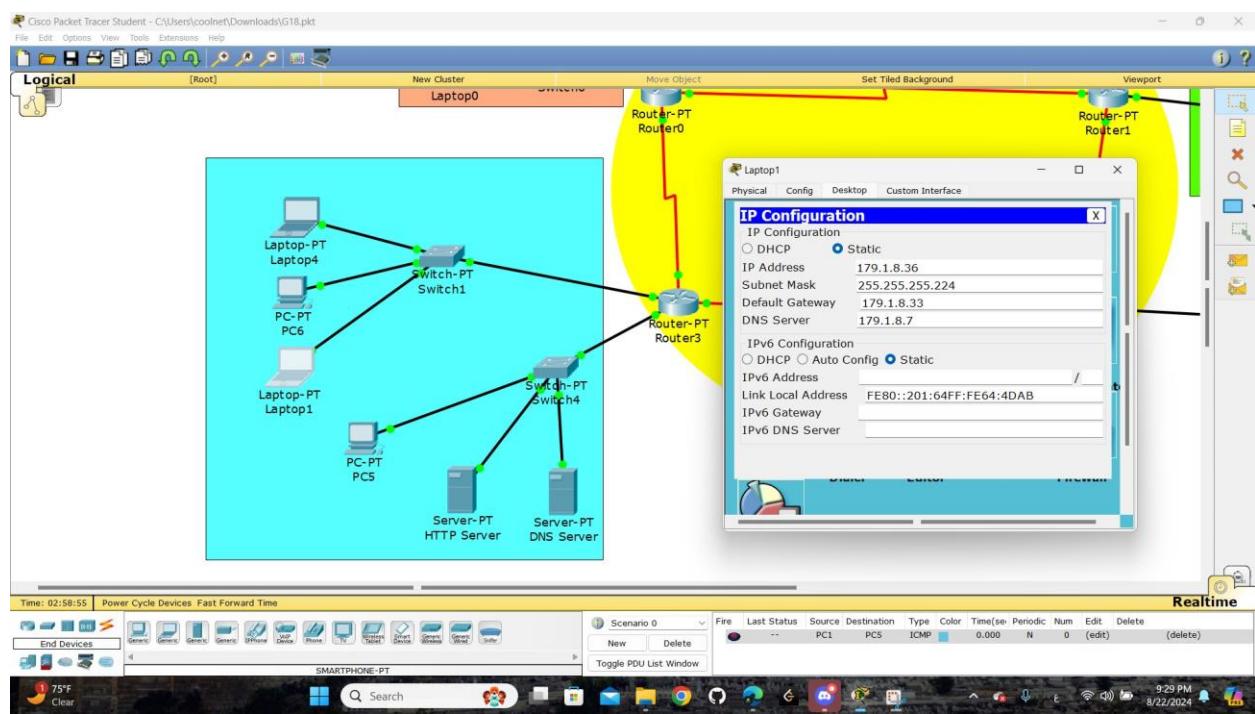


Figure 38: Laptop1 IP Configuration

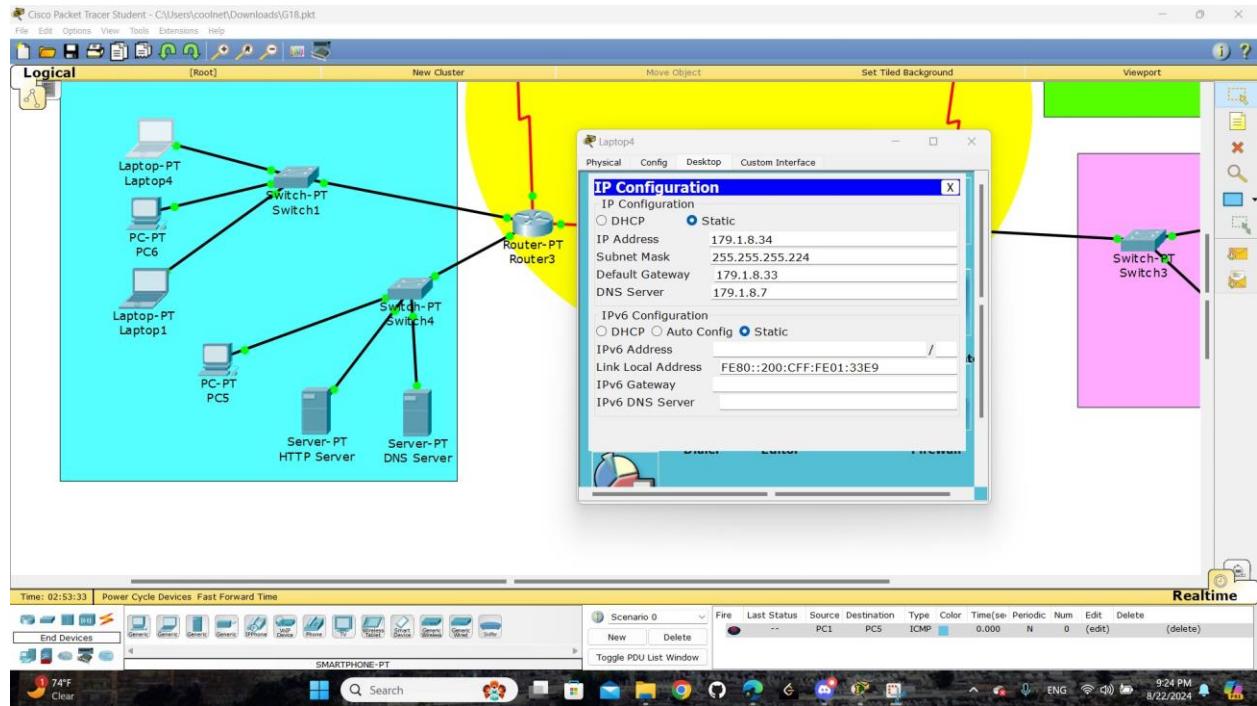


Figure 39: Laptop4 IP Configuration

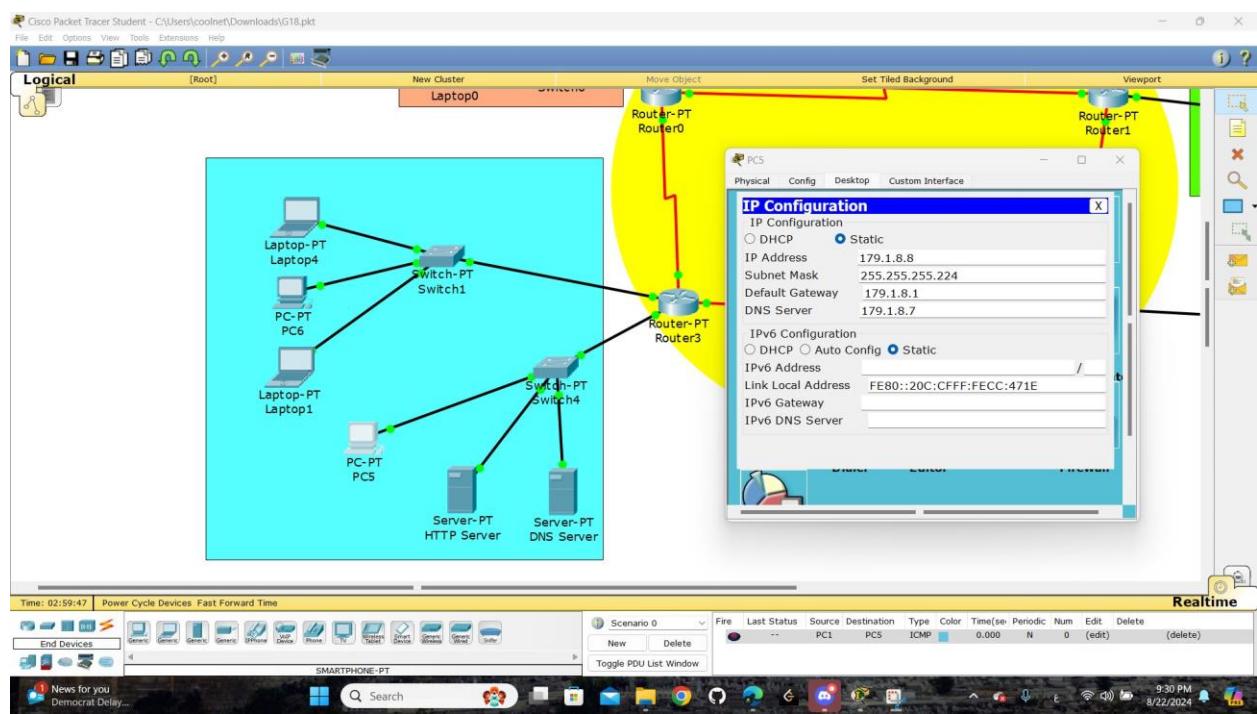


Figure 40: PCS IP Configuration

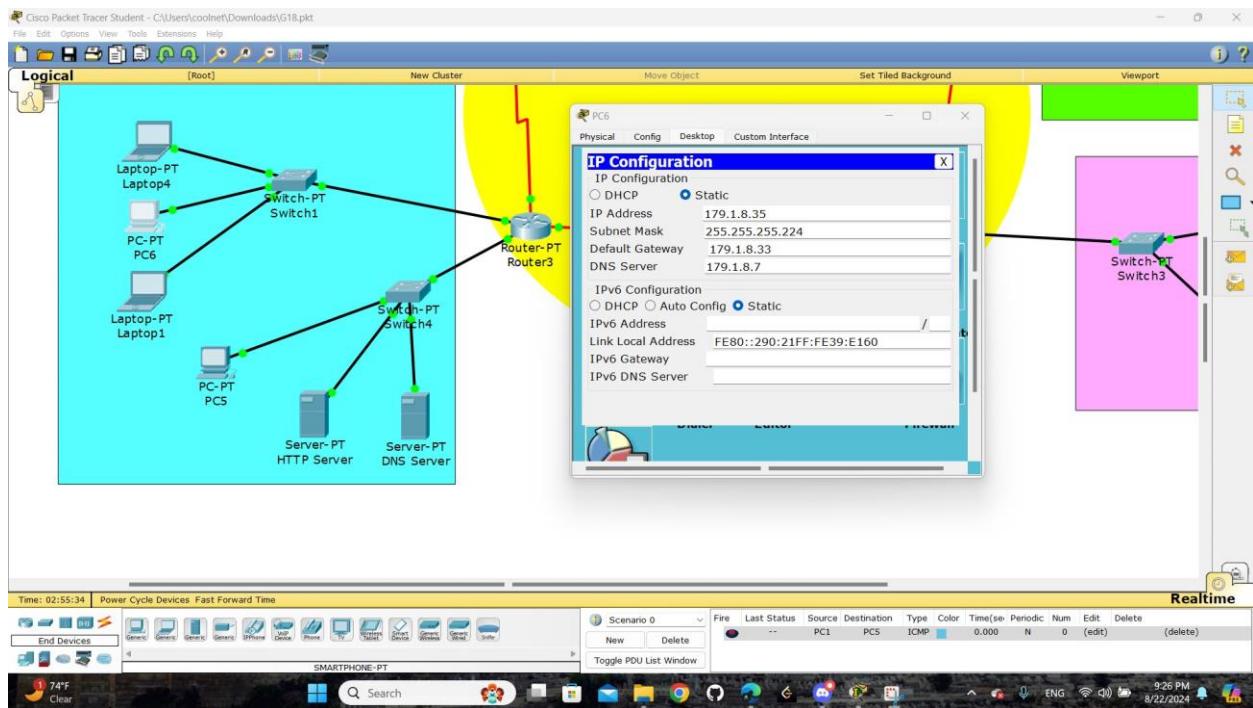


Figure 41: PC6 IP Configuration

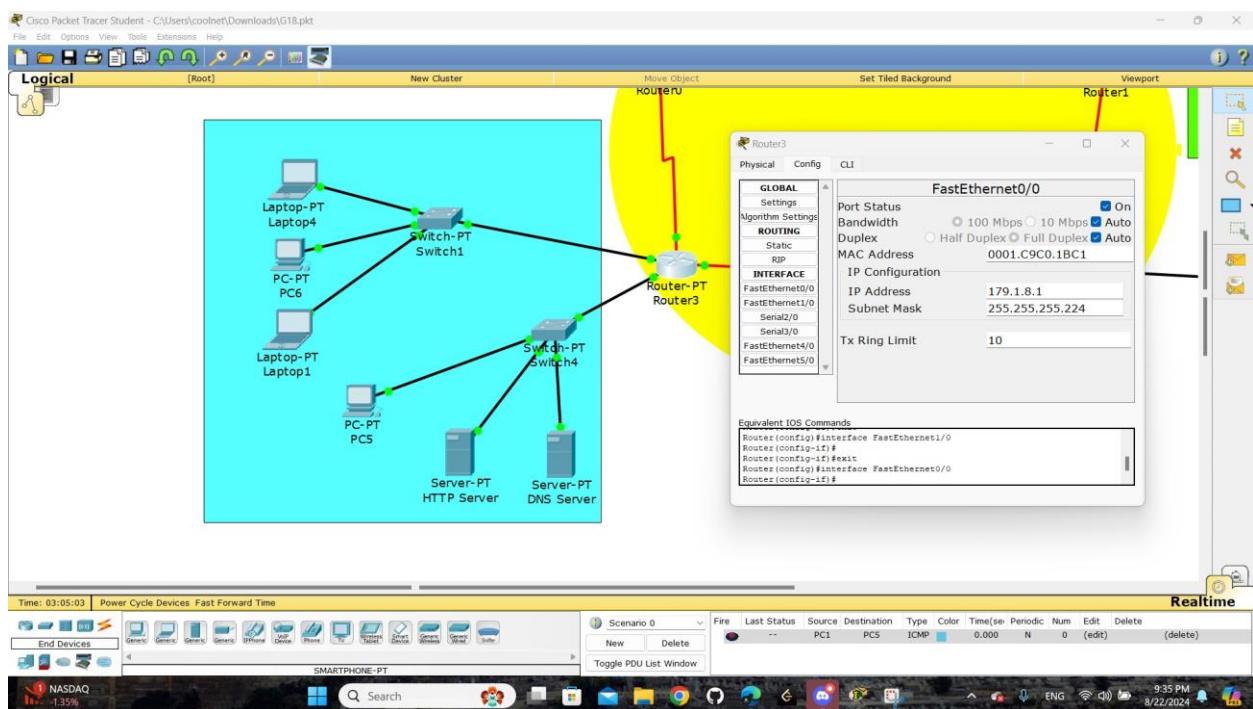


Figure 42: Router3 - FastEthernet0/0

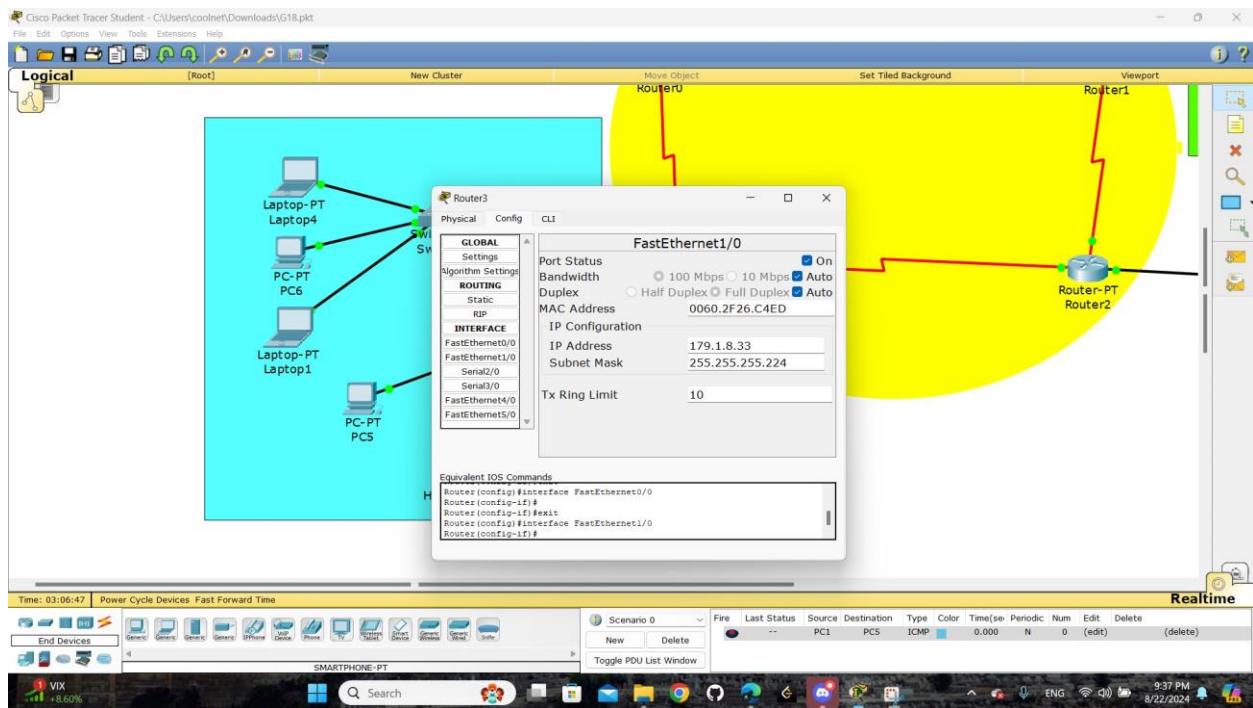


Figure 43: Router3 - FastEthernet1/0

### how we set IP Addresses:

- Click on a device.
- Go to the **Desktop** tab, select **IP Configuration**.
- Enter the IP address, subnet mask, and gateway.

## Part2:

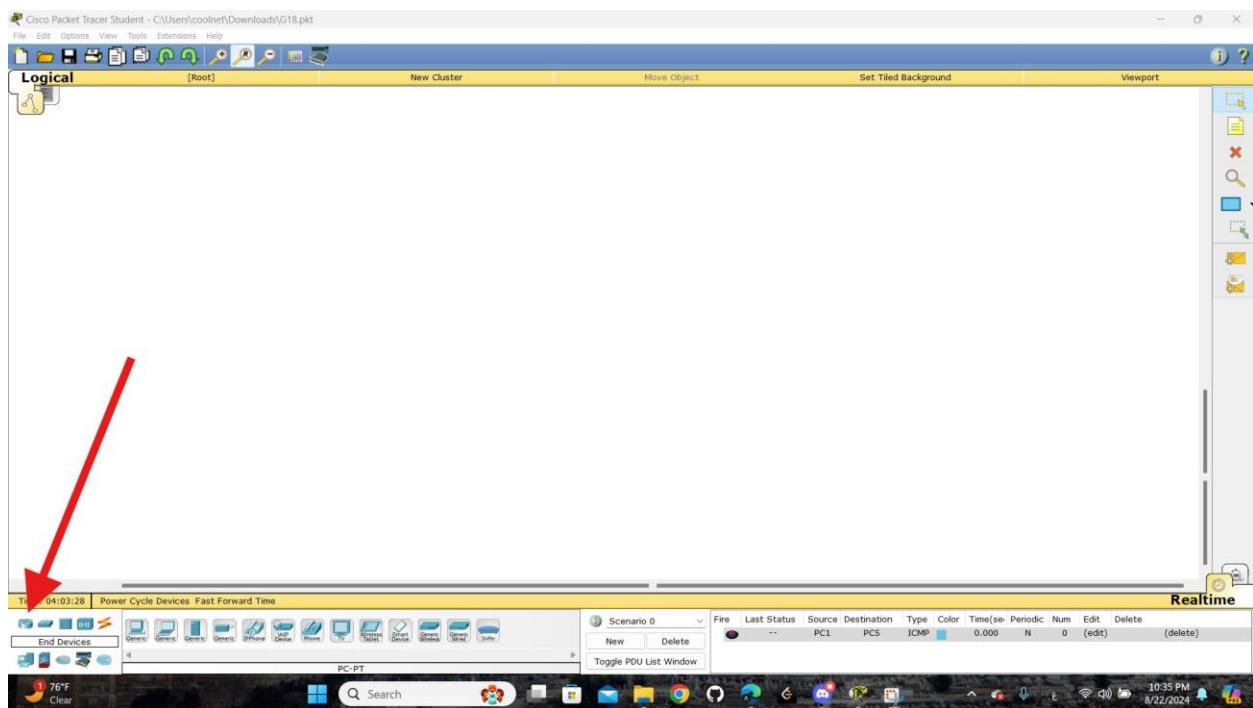


Figure 44: open router tap

open ( router ) tap

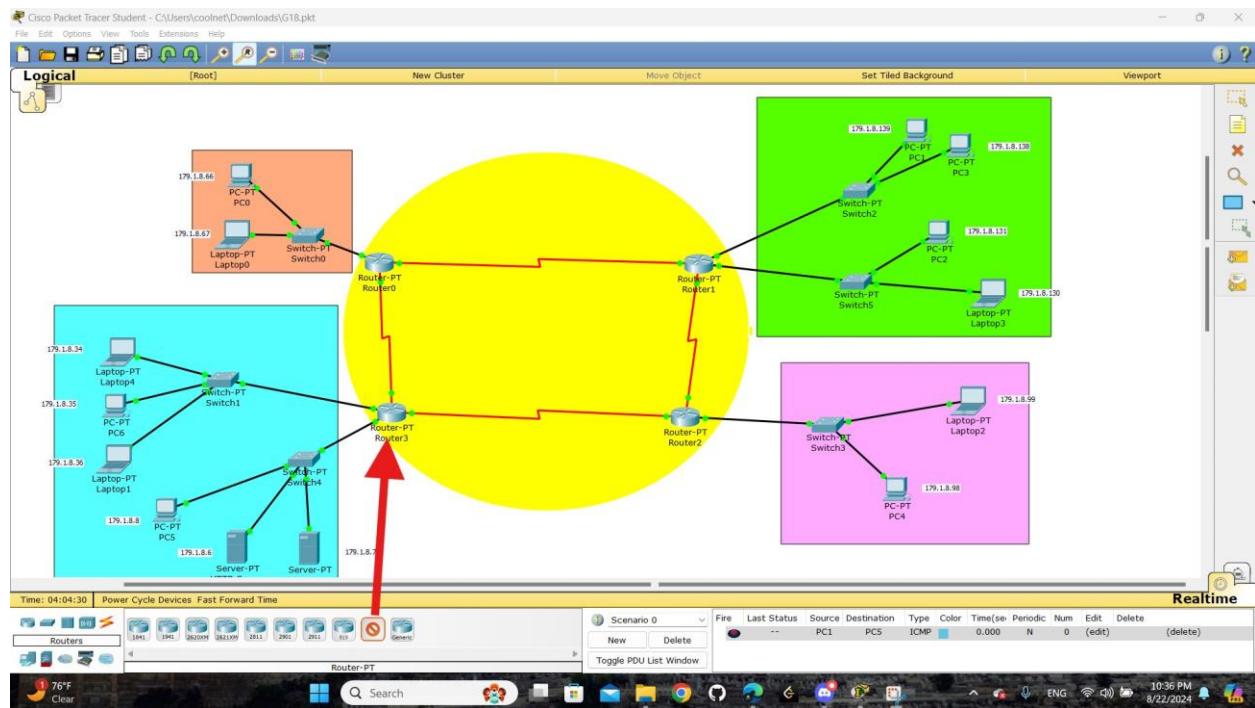


Figure 45: select and insert router

select general ( router ) and put it where are you want

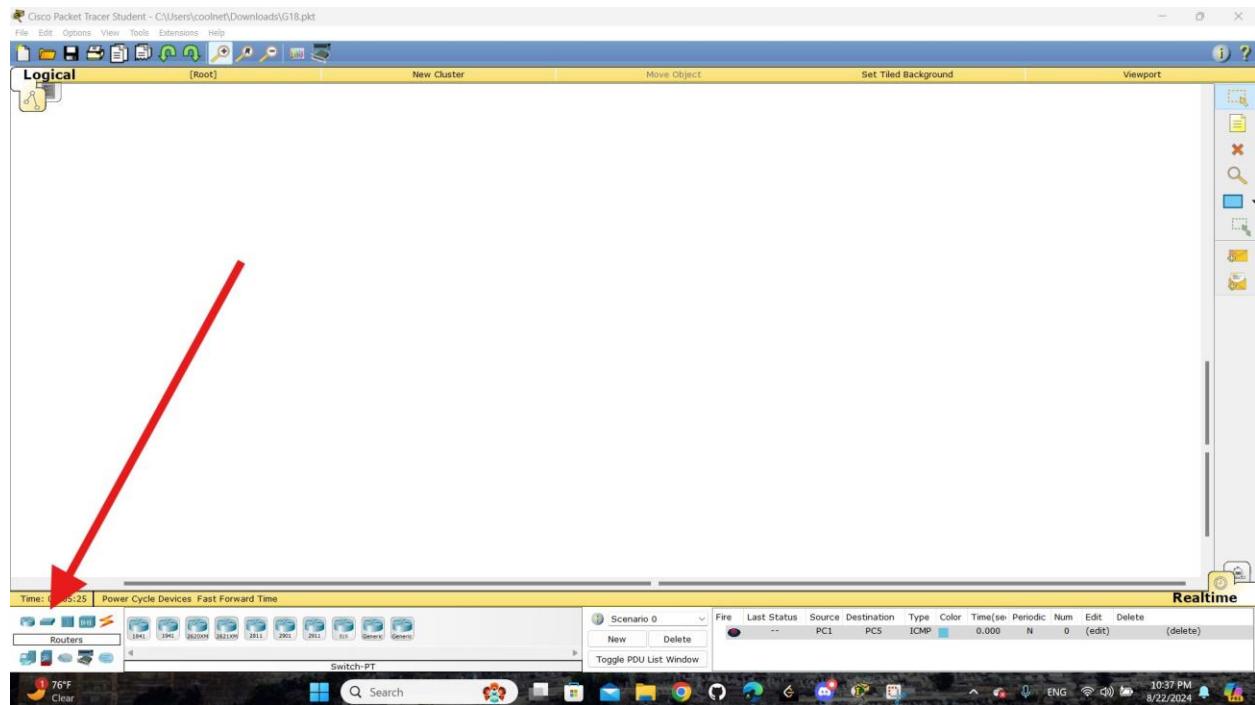


Figure 46: open switch tap

open ( switch) tap

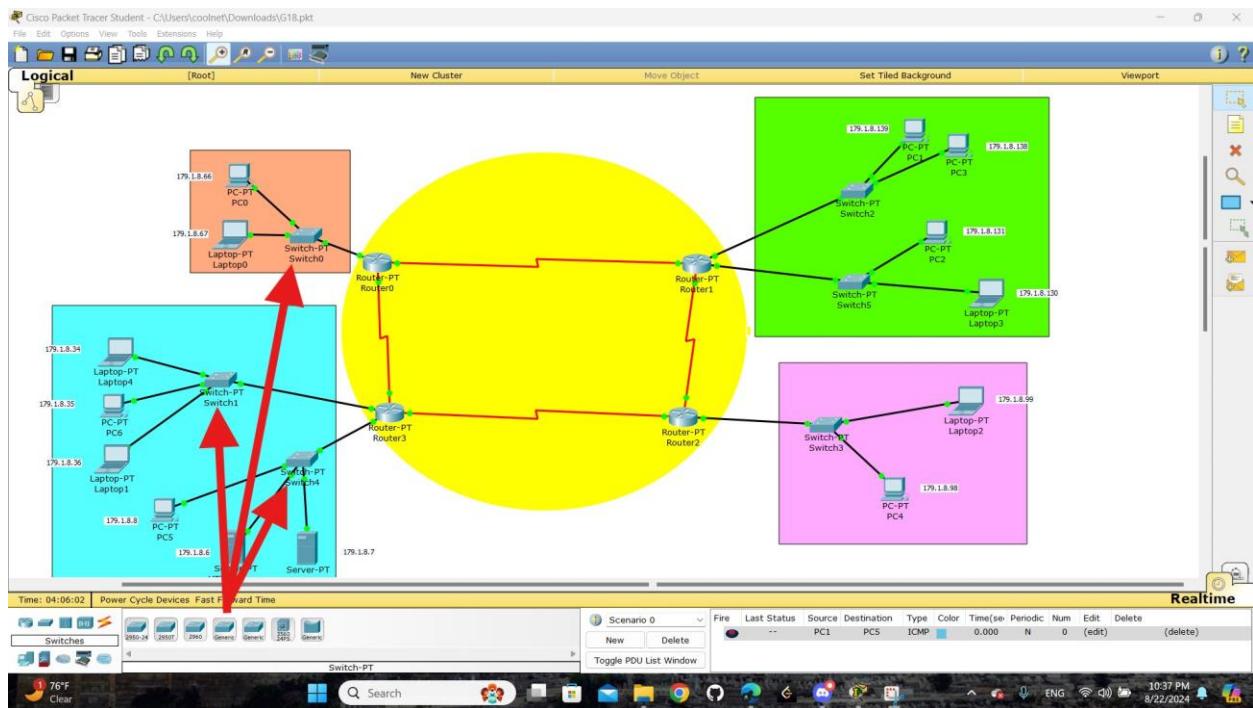


Figure 47: select and insert switch

select general ( switch ) and put it where are you want

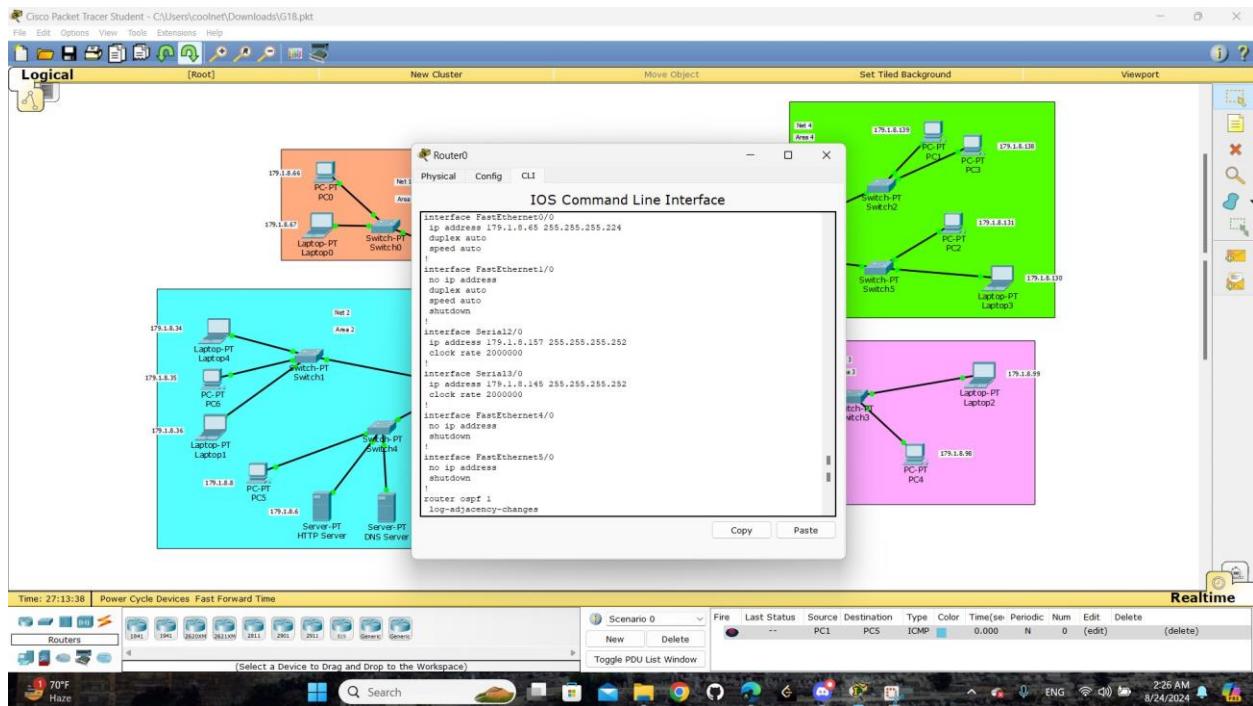


Figure 48: Router0 - IOS Command

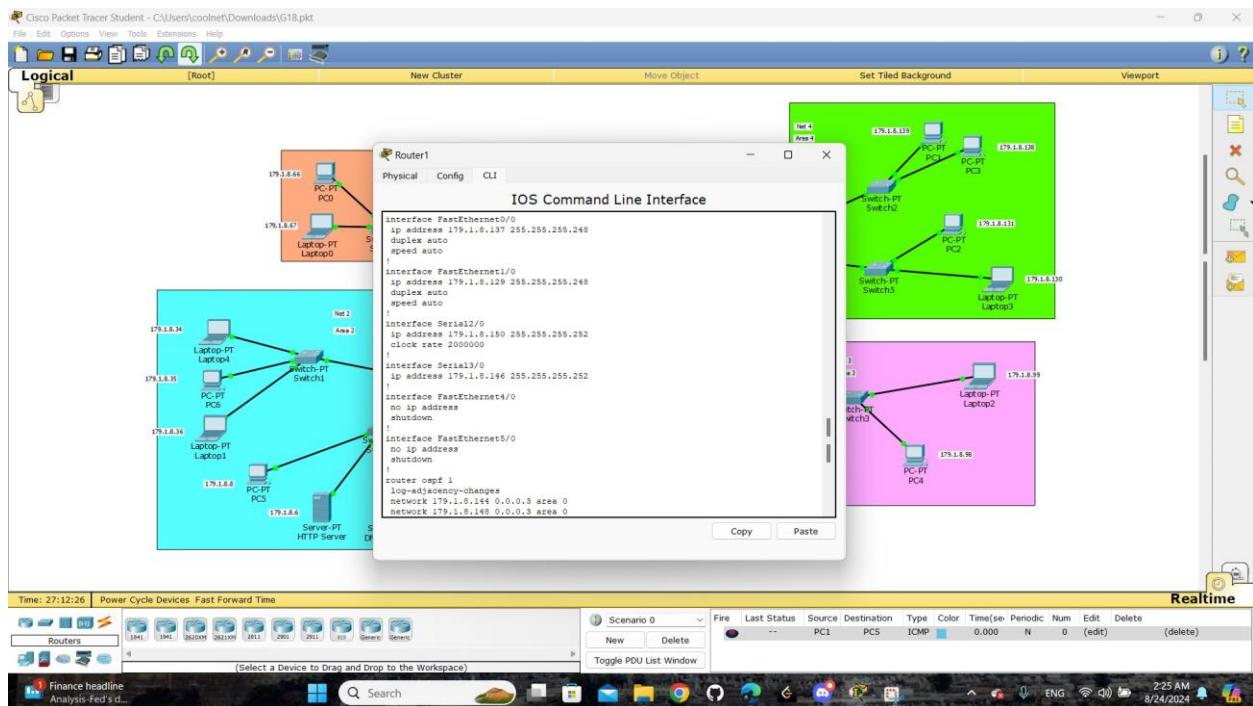


Figure 49: Router1 - IOS Command

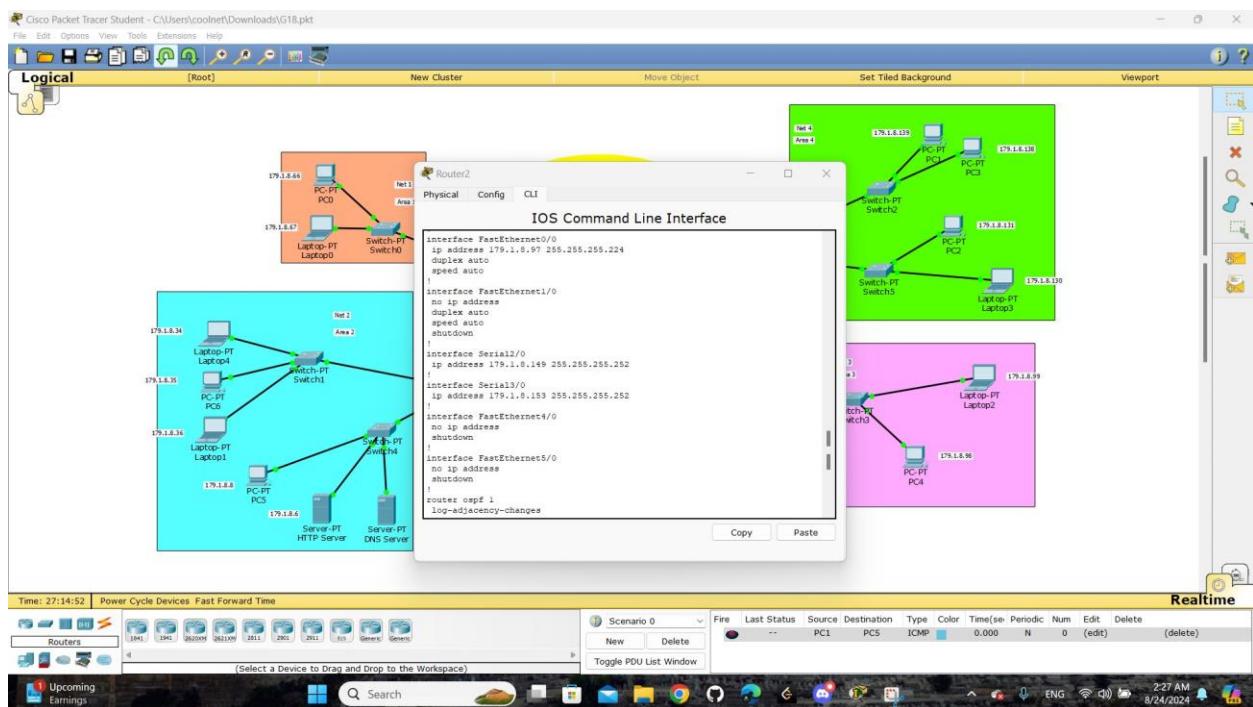


Figure 50: Router2 - IOS Command

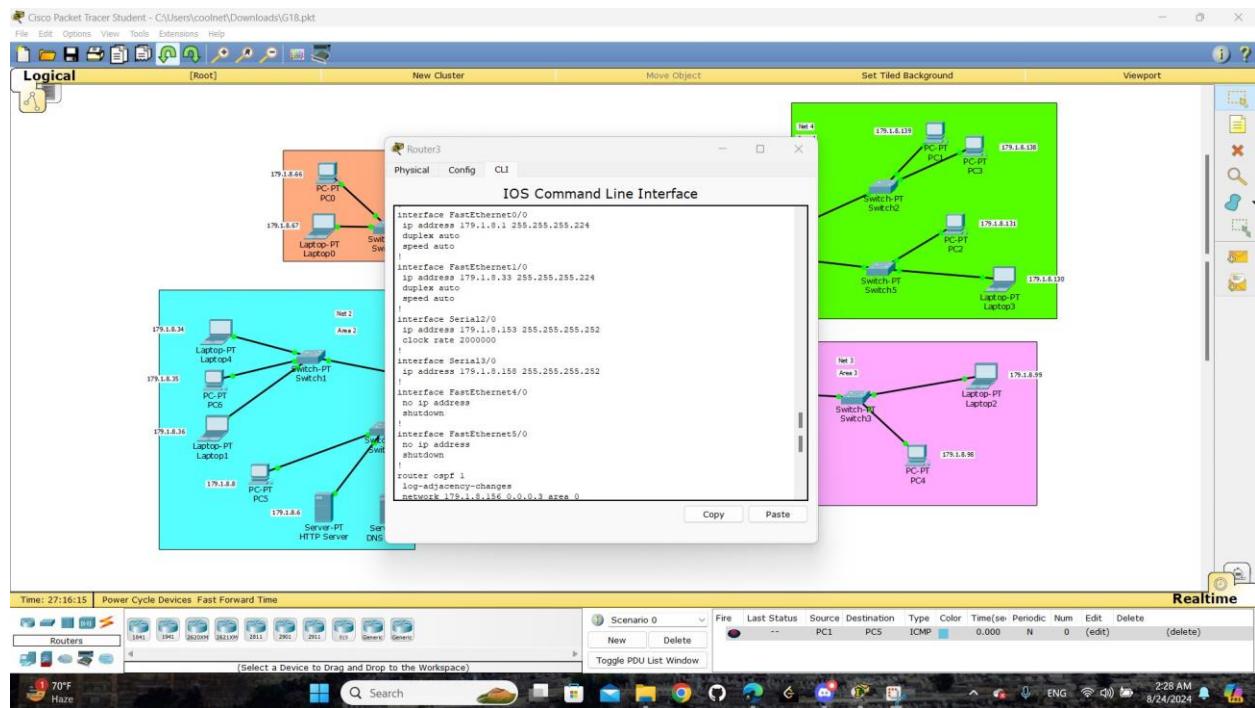


Figure 51: Router3 - IOS Command

The images show the configuration of a router in Packet Tracer. The router's interfaces are set up with specific IP addresses: **ex:** “ `FastEthernet0/0` with `179.1.8.97/27` and `Serial2/0` with `179.1.8.149/30` “. The `no shutdown` command is used to activate them. Additionally, OSPF routing is configured to manage the network, with a command to log changes in OSPF neighbor relationships. This setup connects different network segments, enabling communication across them.

## Part3:

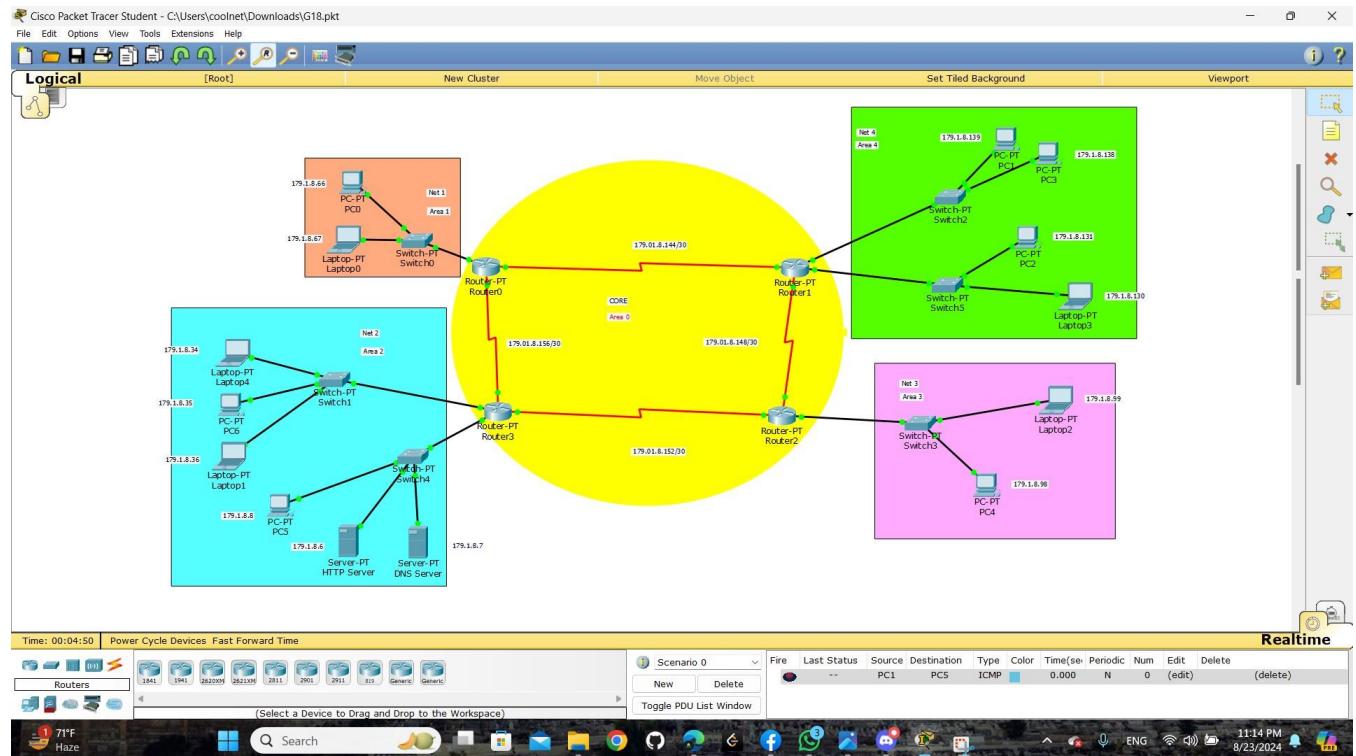


Figure 52: IPs in topology

This is a final image of the IP distribution on the devices.

# Task 2:

## part 1:

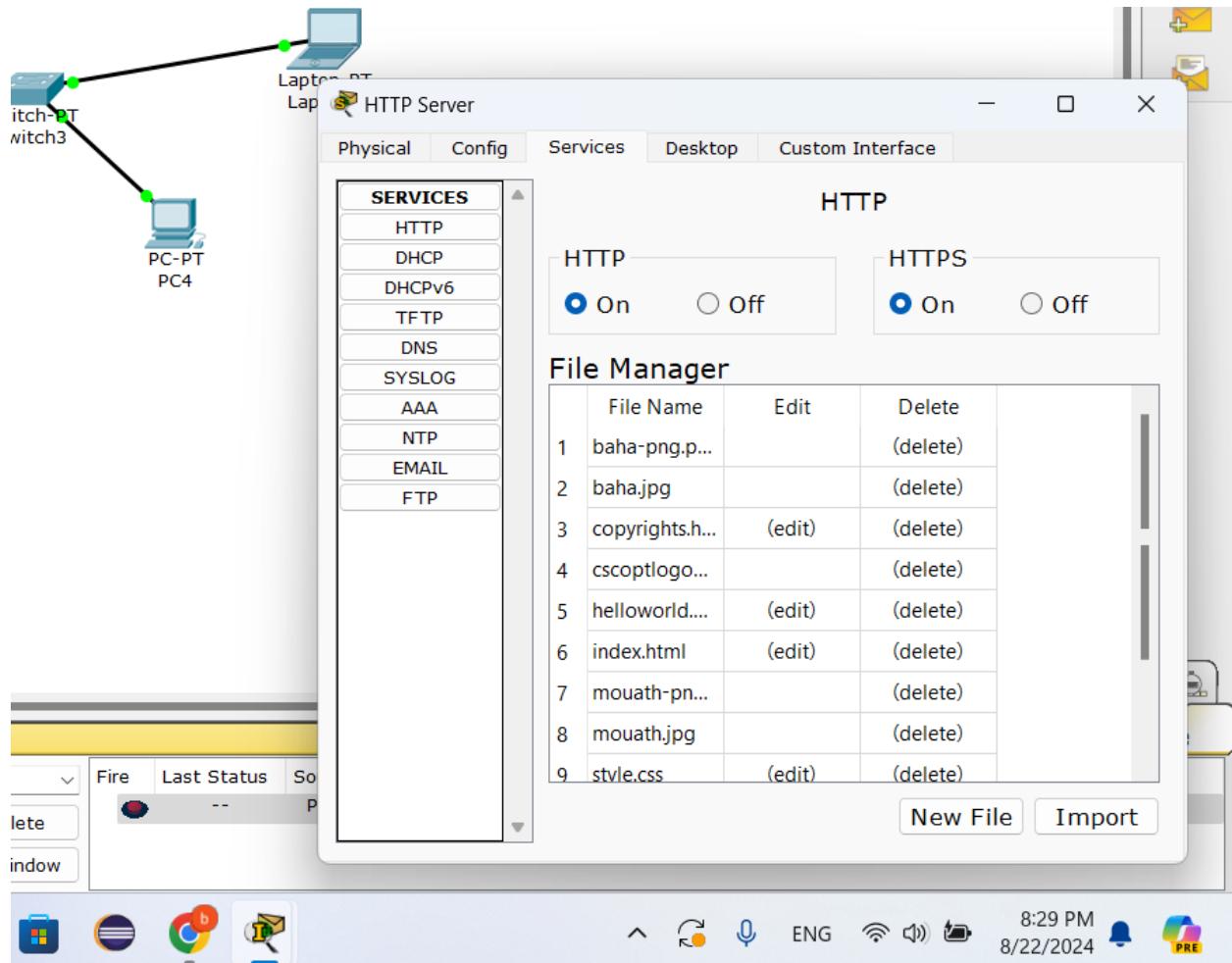


Figure 53: HTTP server – File Manager

Here we have the HTTP server and it is on , and the file manager window shows a list of files and folders

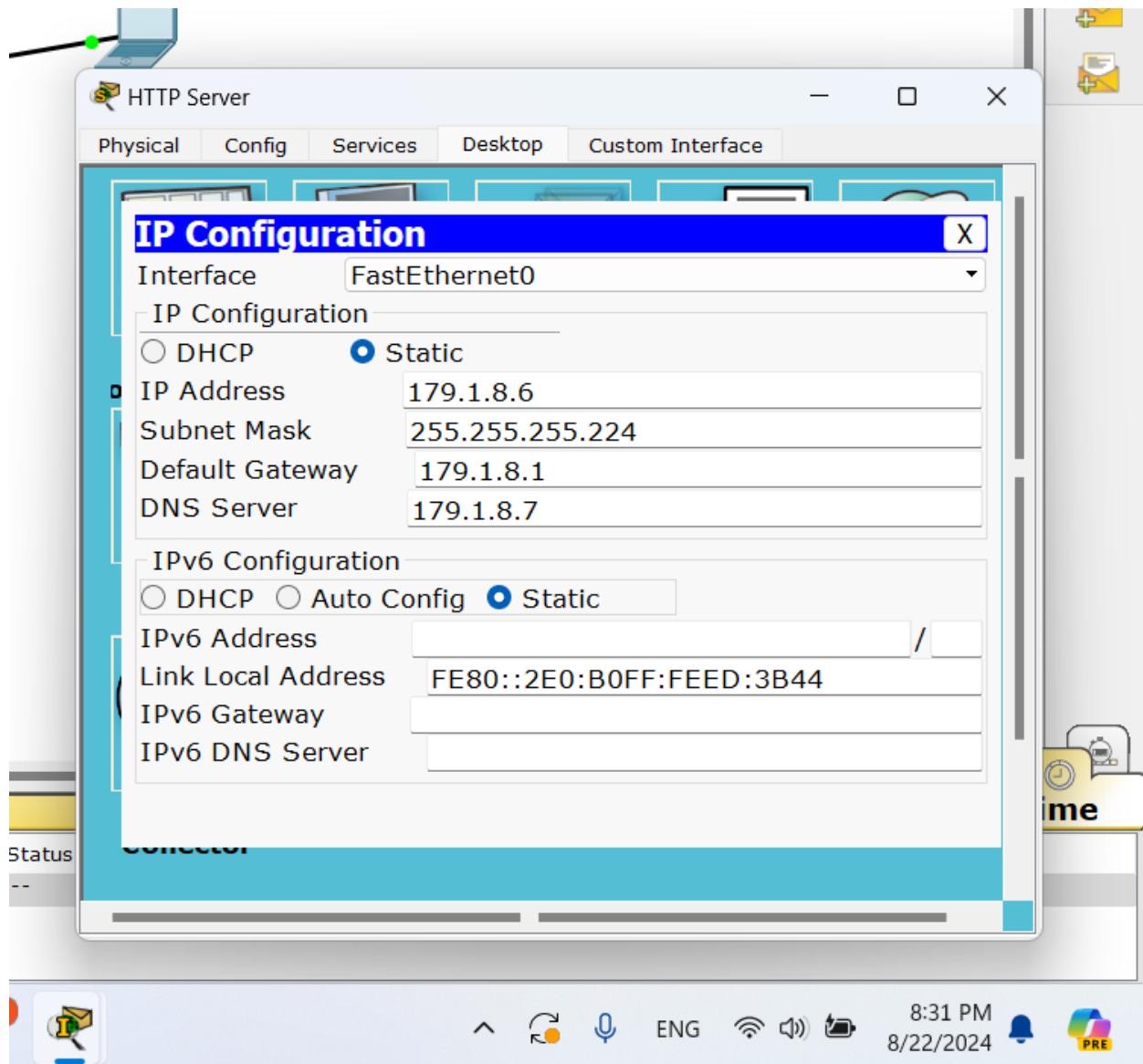


Figure 54: HTTP server IP Configuration

Here we have IP address , Subnet Mask , Default Gateway , DNS Server for HTTP server

## part 2:

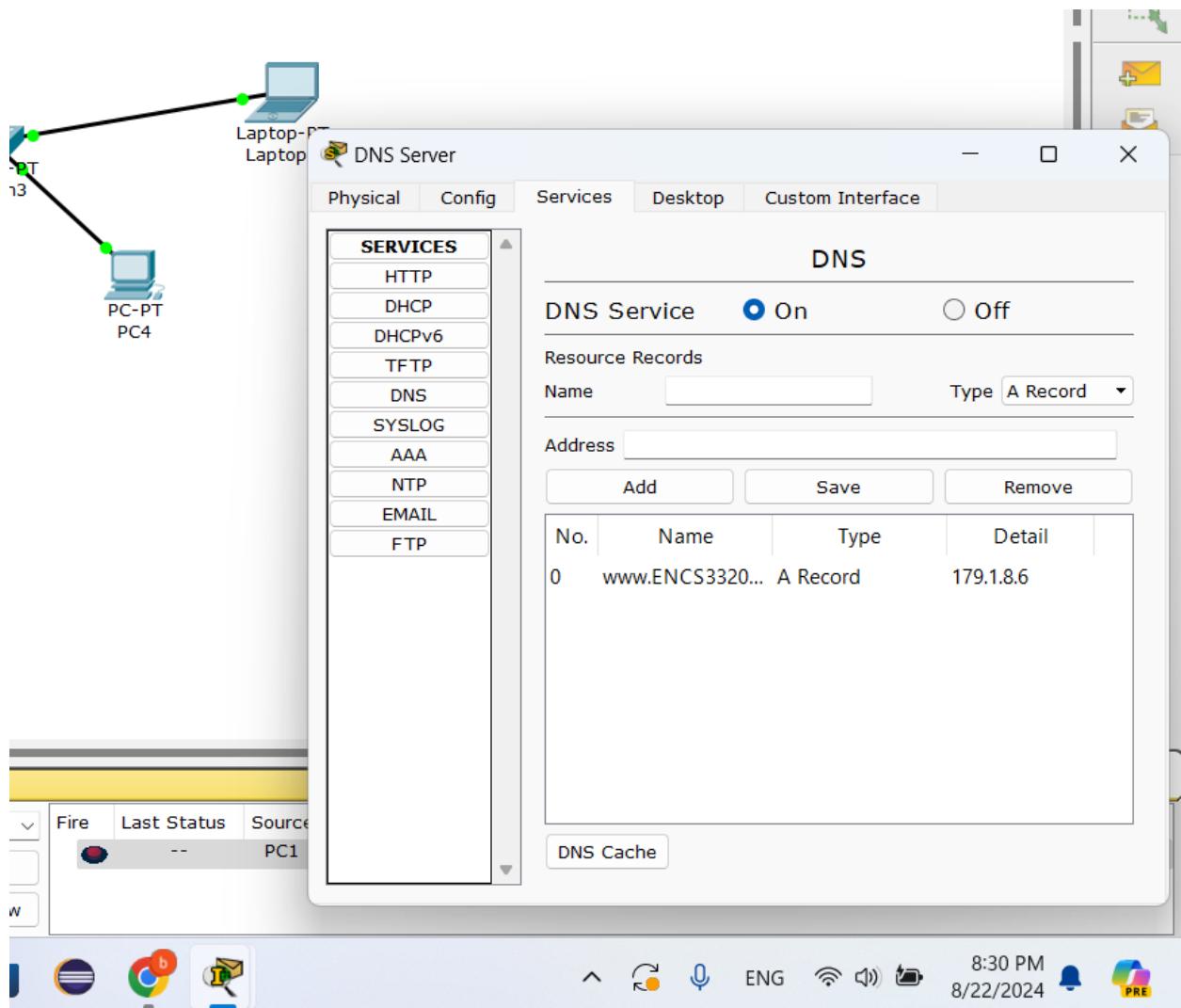


Figure 55: DNS server - File Manager

Here we have the DNS server and it is on , and we have the the domain name www.ENCS3320Summer.com

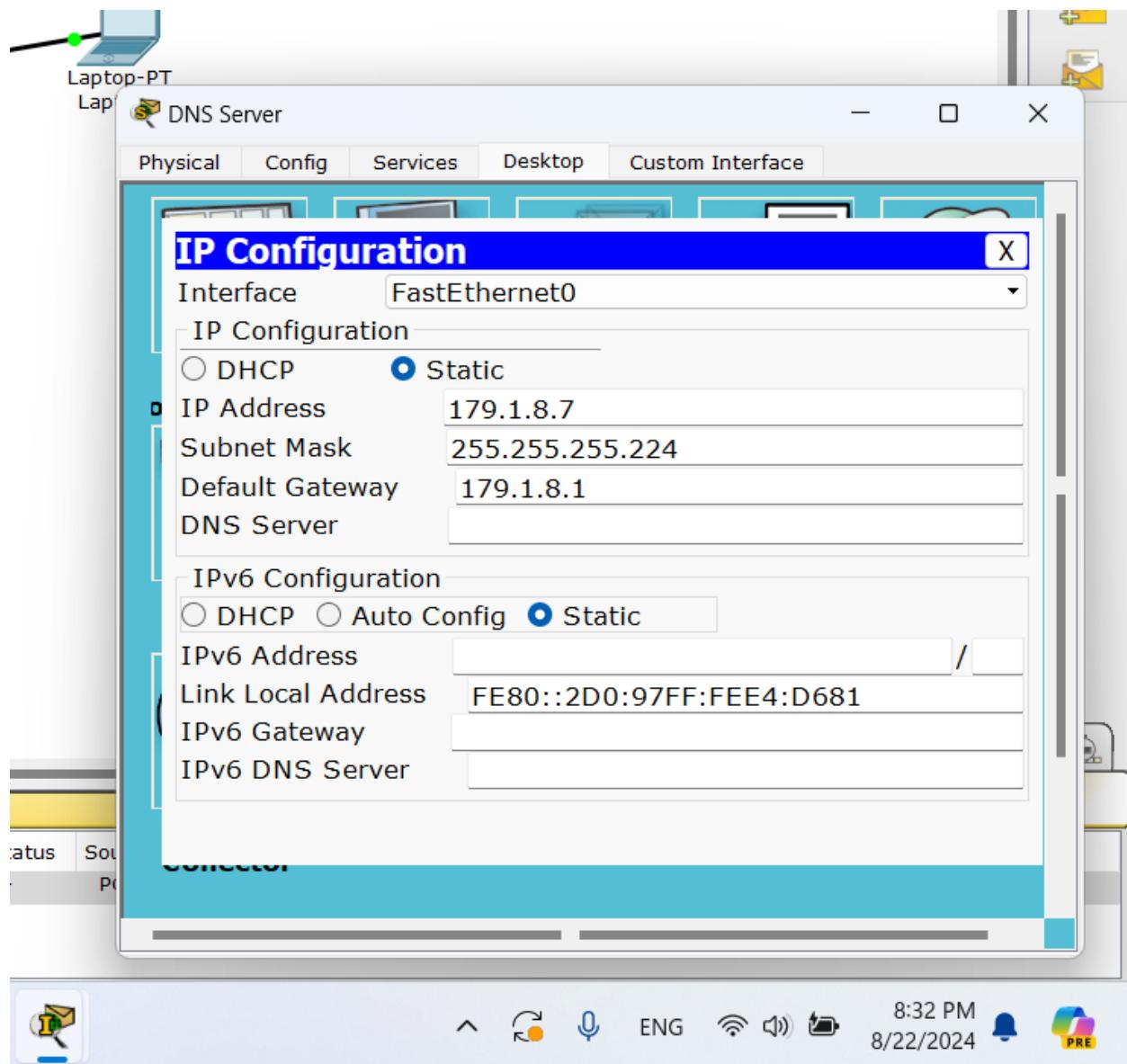


Figure 56: DNS server IP Configuration

Here we have IP Address , Subnet Mask , Default Gateway for DNS server

## Part 3:

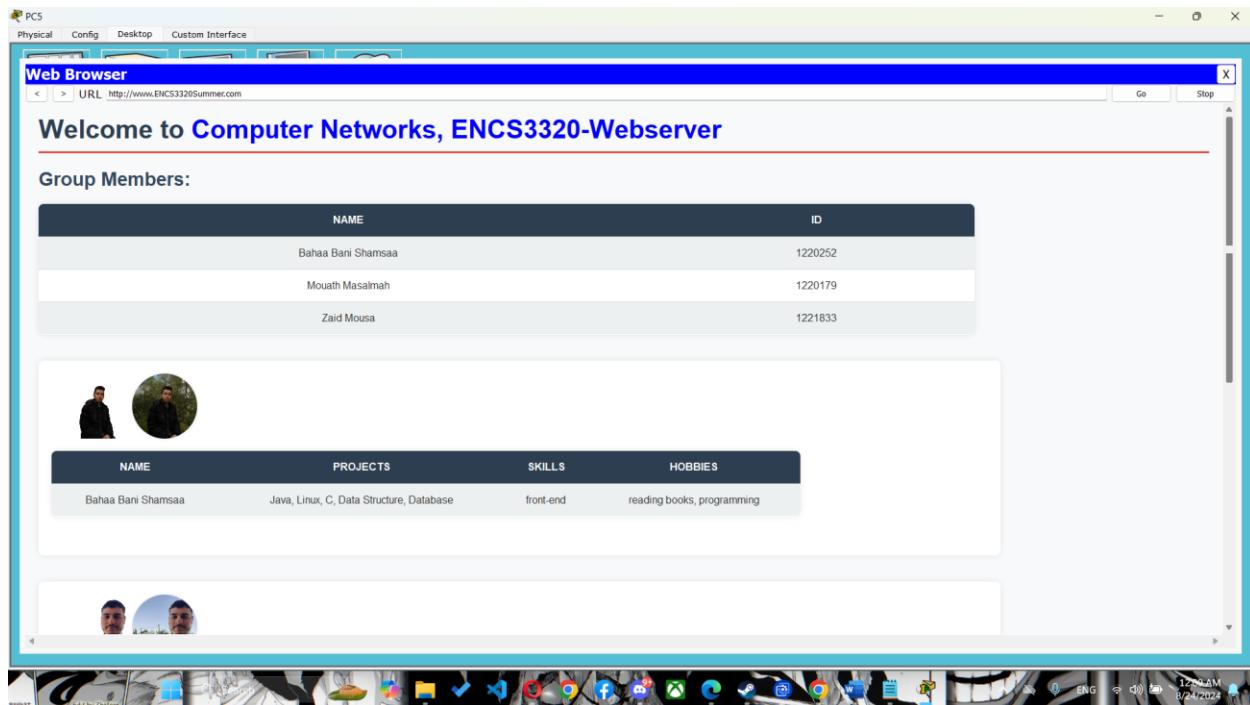


Figure 57: PC5 Web Browser

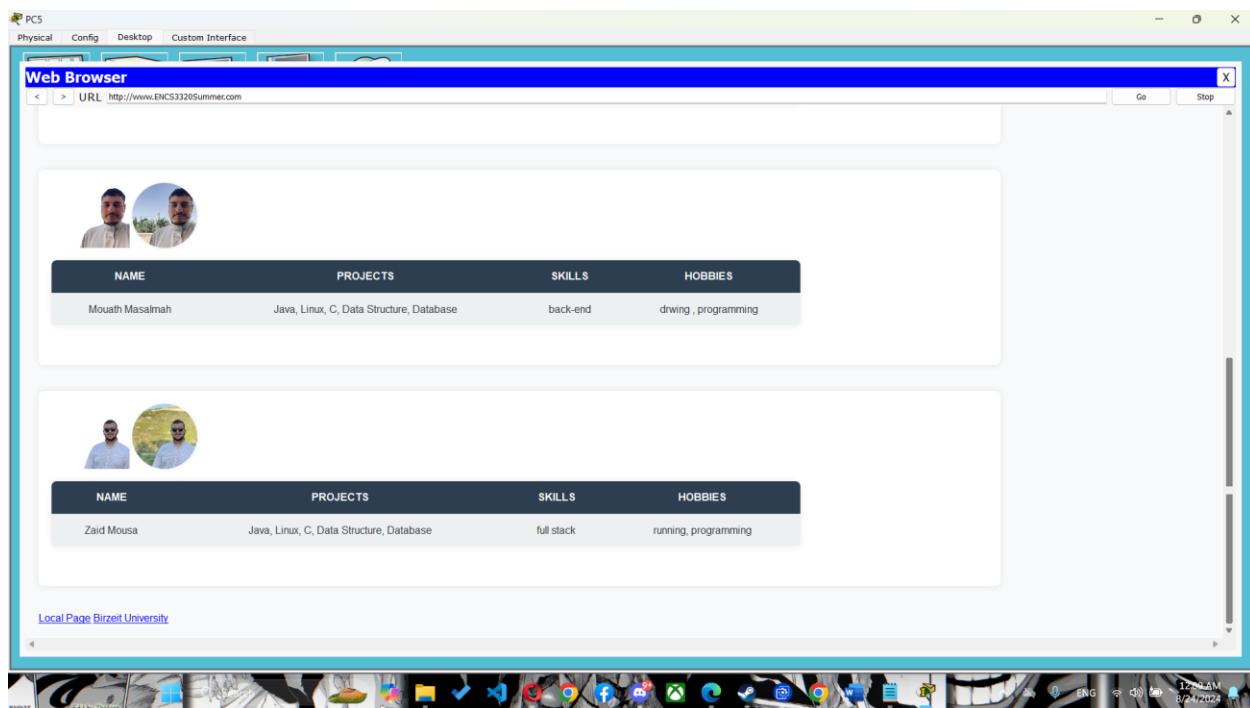


Figure 58: PC5 Web Browser

## Task 3:

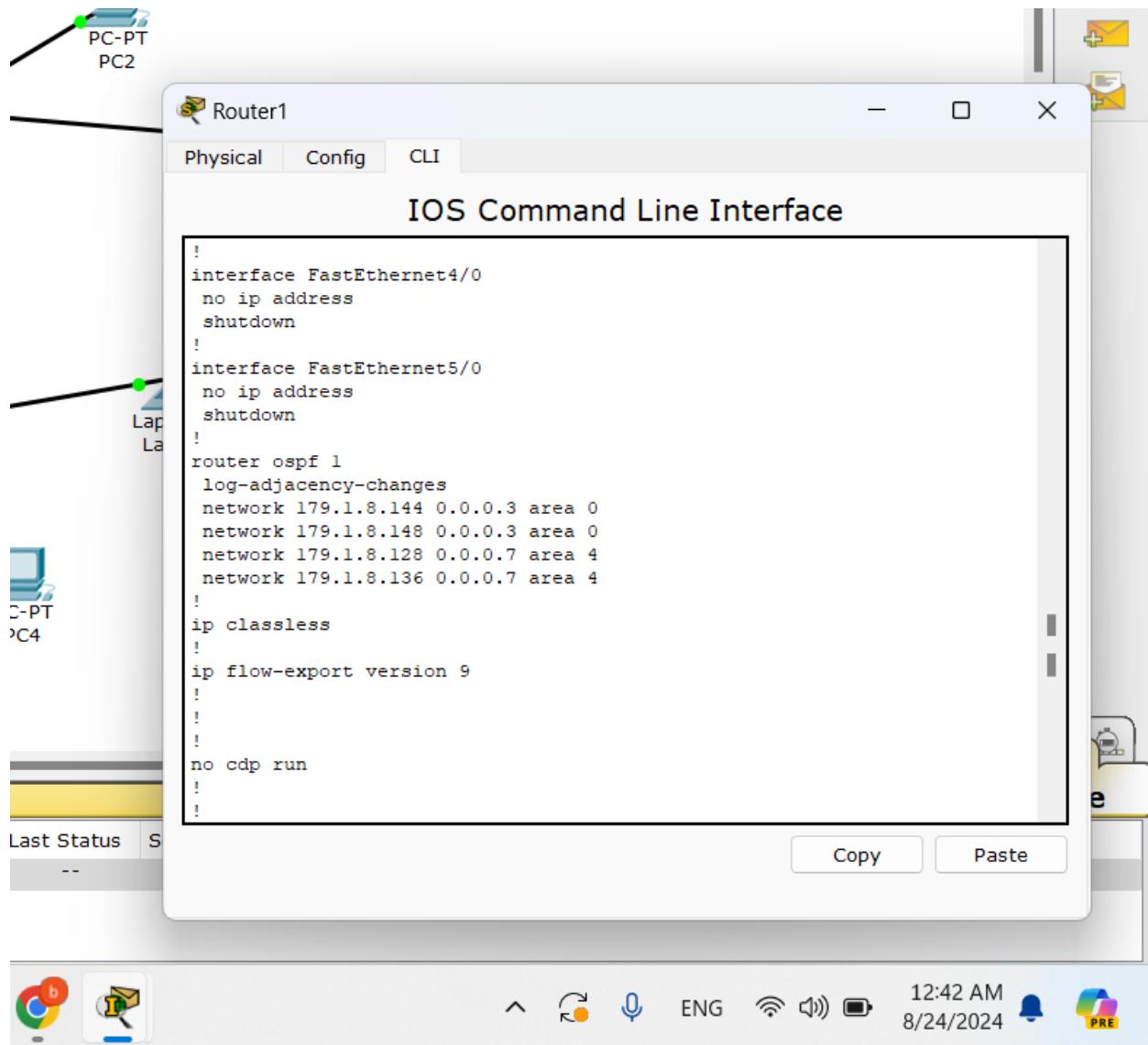


Figure 59: Router1 ospf

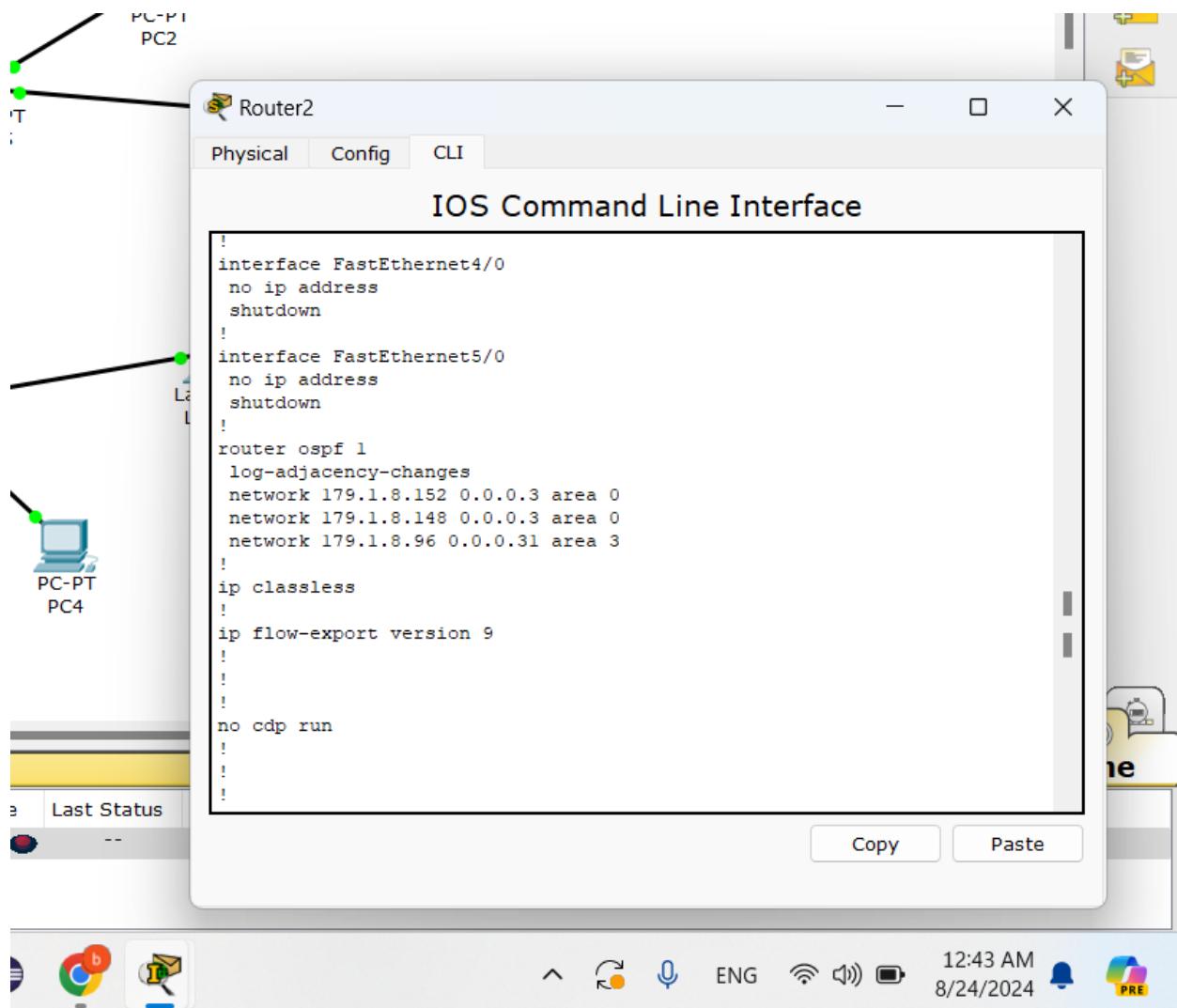


Figure 60: Router2 ospf

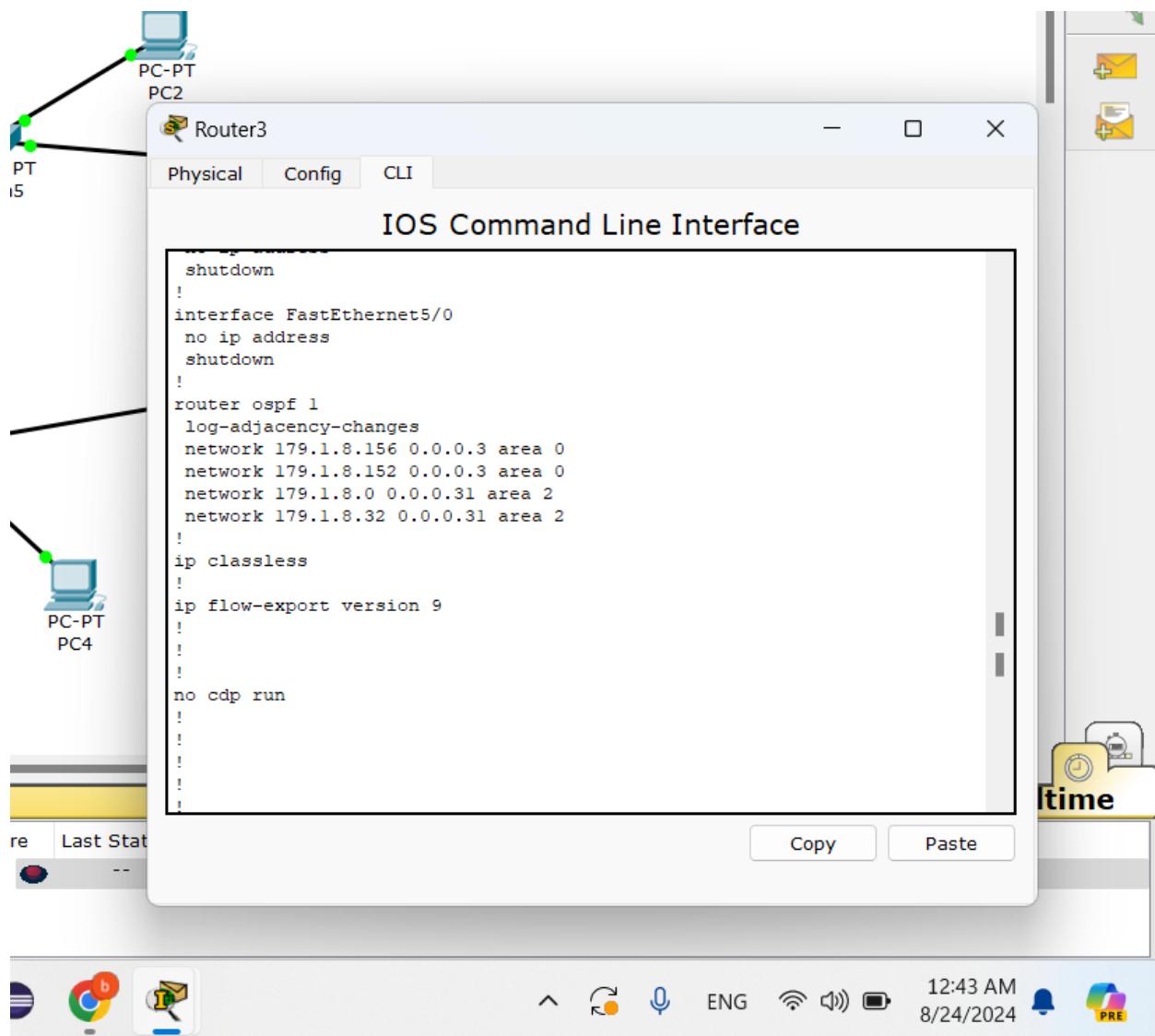


Figure 61: Router3 ospf

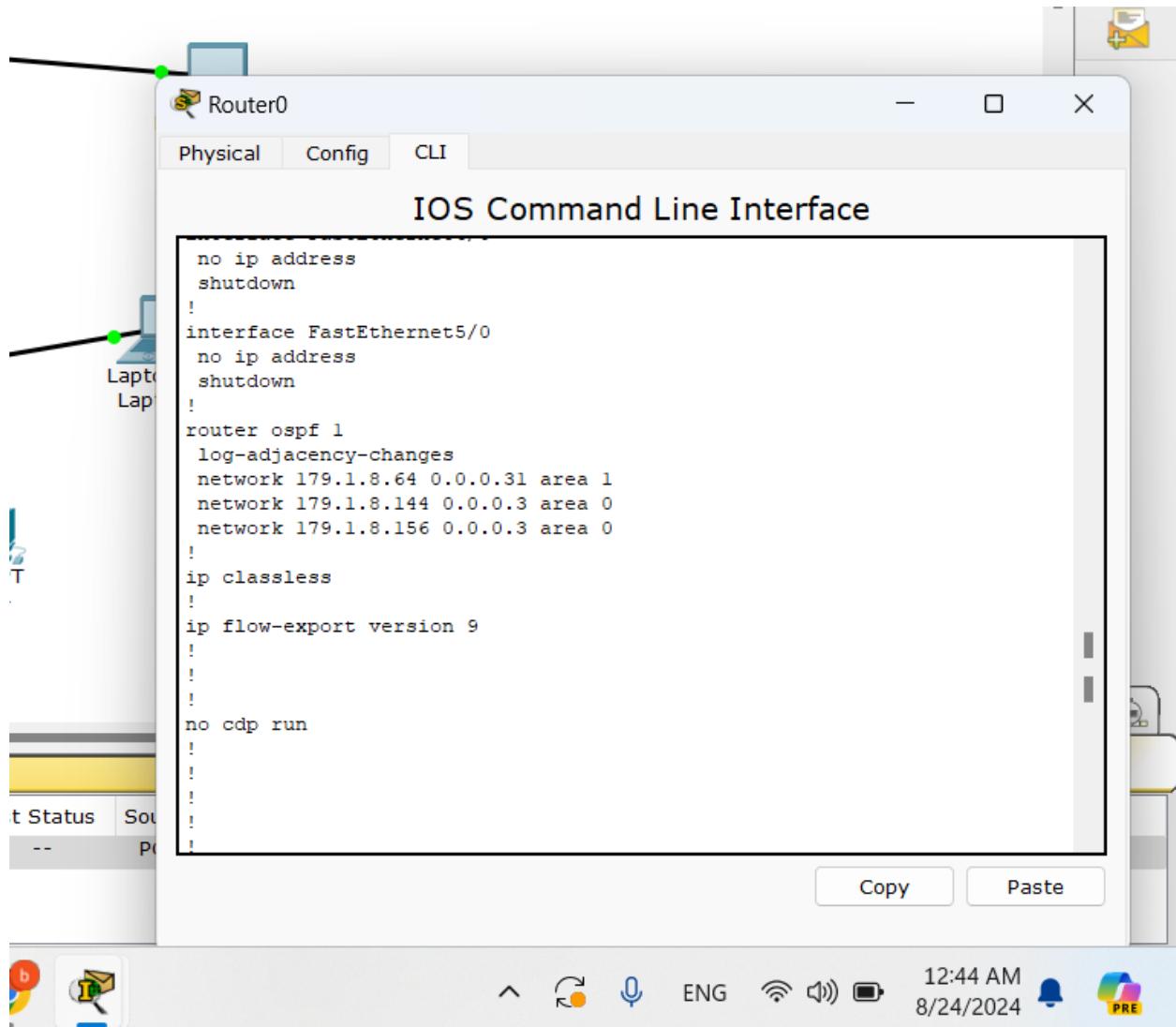


Figure 62: Router0 ospf

Open Shortest Path First (OSPF) is a routing protocol that helps routers find the best path to send data. It's smart, fast, and works well in large networks.

To use OSPF:

**Start OSPF:**

- Go to the router's configuration mode and start OSPF by giving it a number (process ID).

**Add Networks to OSPF:**

- Tell OSPF which networks to manage and in which area they belong.

**(Optional) Set Router ID:**

- Assign a unique ID to your router to identify it in the network.

Commands:

```
router ospf 1
log-adjacency-changes
network 179.1.8.144 0.0.0.3 area 0
network 179.1.8.148 0.0.0.3 area 0
network 179.1.8.128 0.0.0.7 area 4
network 179.1.8.136 0.0.0.7 area 4
```

```
router ospf 1
log-adjacency-changes
network 179.1.8.152 0.0.0.3 area 0
network 179.1.8.148 0.0.0.3 area 0
network 179.1.8.96 0.0.0.31 area 3
```

```
router ospf 1
log-adjacency-changes
network 179.1.8.64 0.0.0.31 area 1
network 179.1.8.144 0.0.0.3 area 0
network 179.1.8.156 0.0.0.3 area 0
```

```
router ospf 1
log-adjacency-changes
network 179.1.8.156 0.0.0.3 area 0
network 179.1.8.152 0.0.0.3 area 0
network 179.1.8.0 0.0.0.31 area 2
network 179.1.8.32 0.0.0.31 area 2
```

# Task 4:

## part 1:

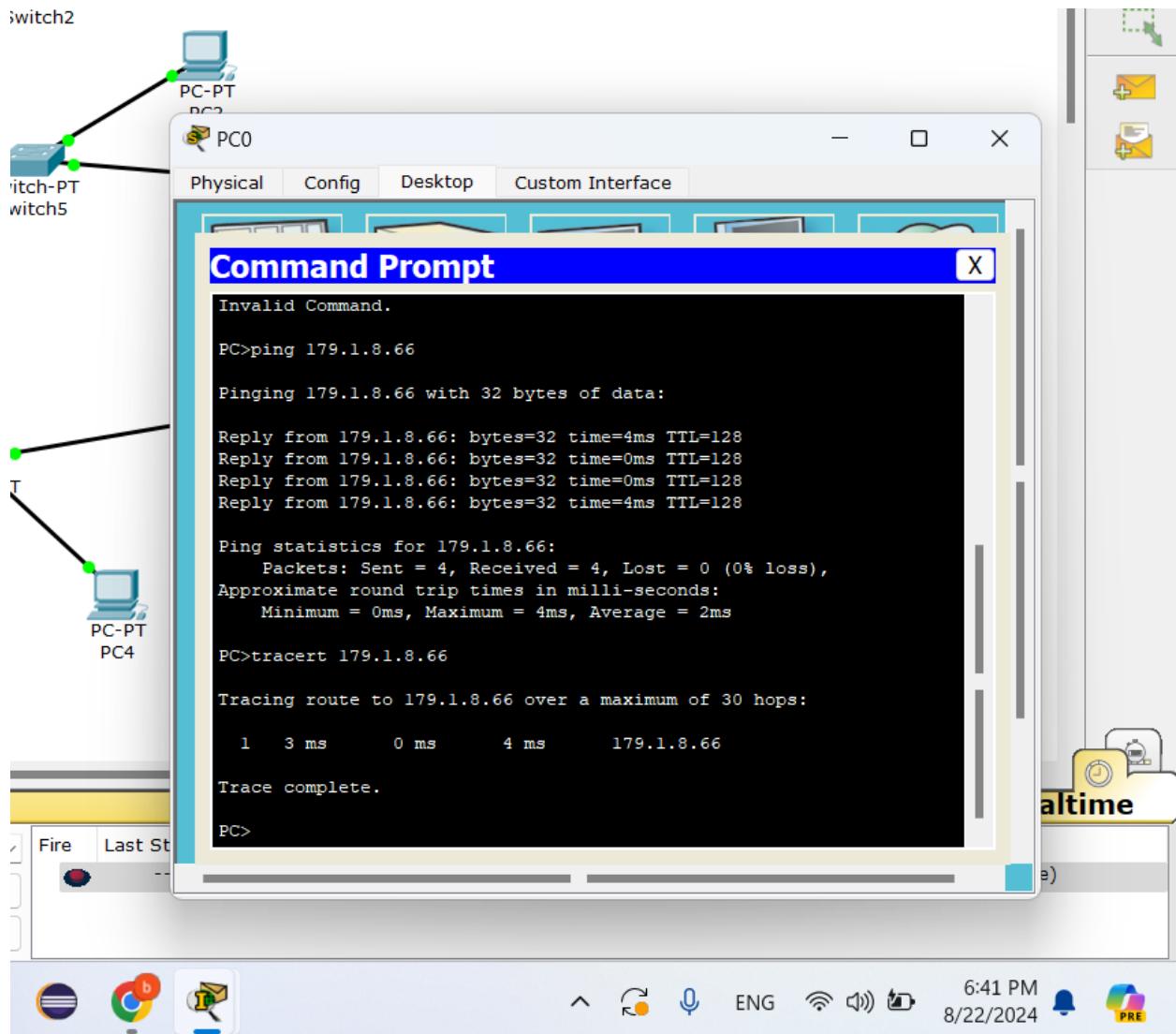


Figure 63: PC0 tracert and ping

Tracert and ping for PC0 with ip 179.1.8.66 and it works as shown in picture

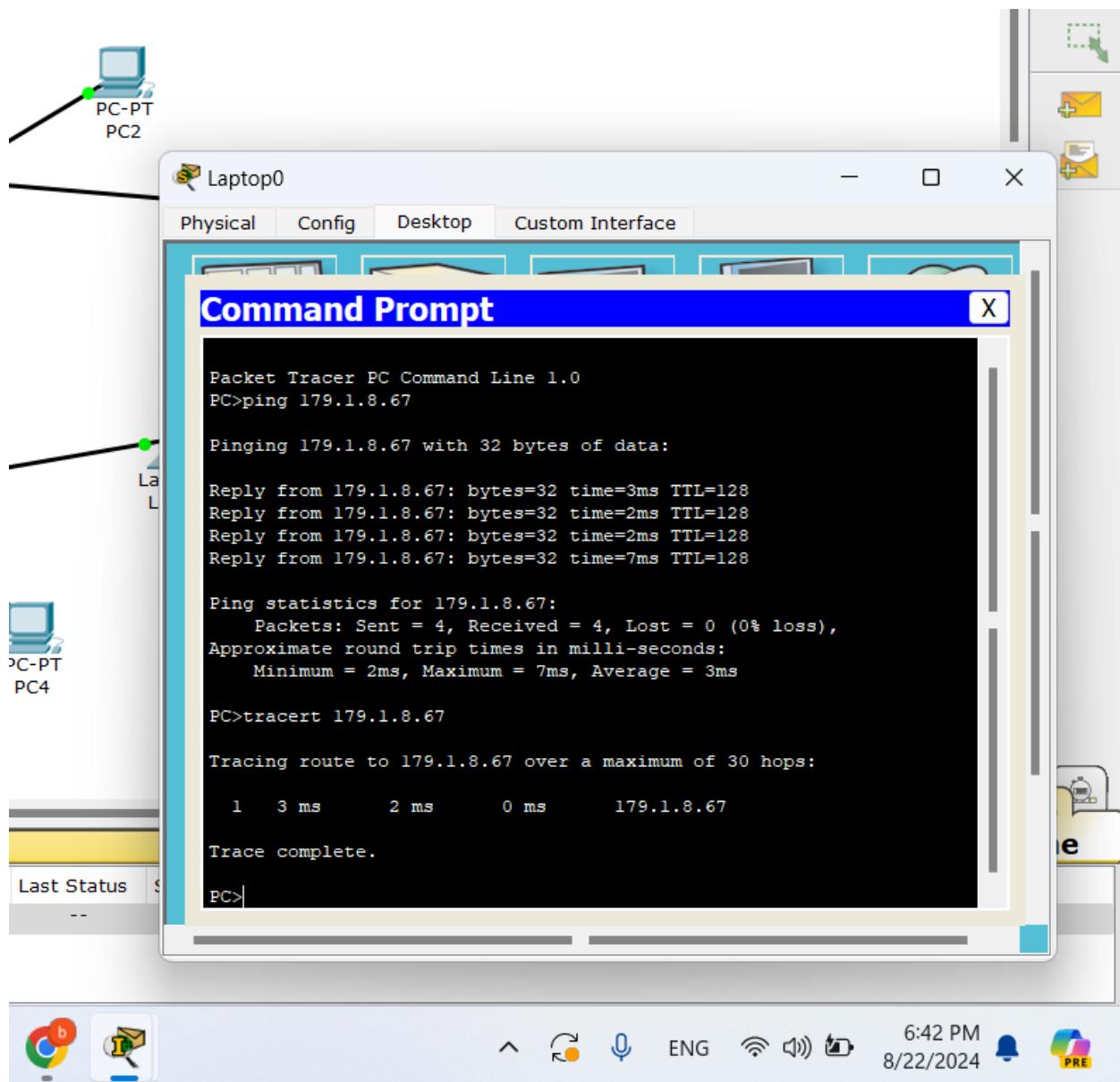


Figure 64: Laptop0 tracert and ping

Tracert and ping for Laptop0 with ip 179.1.8.67 and it works as shown in picture

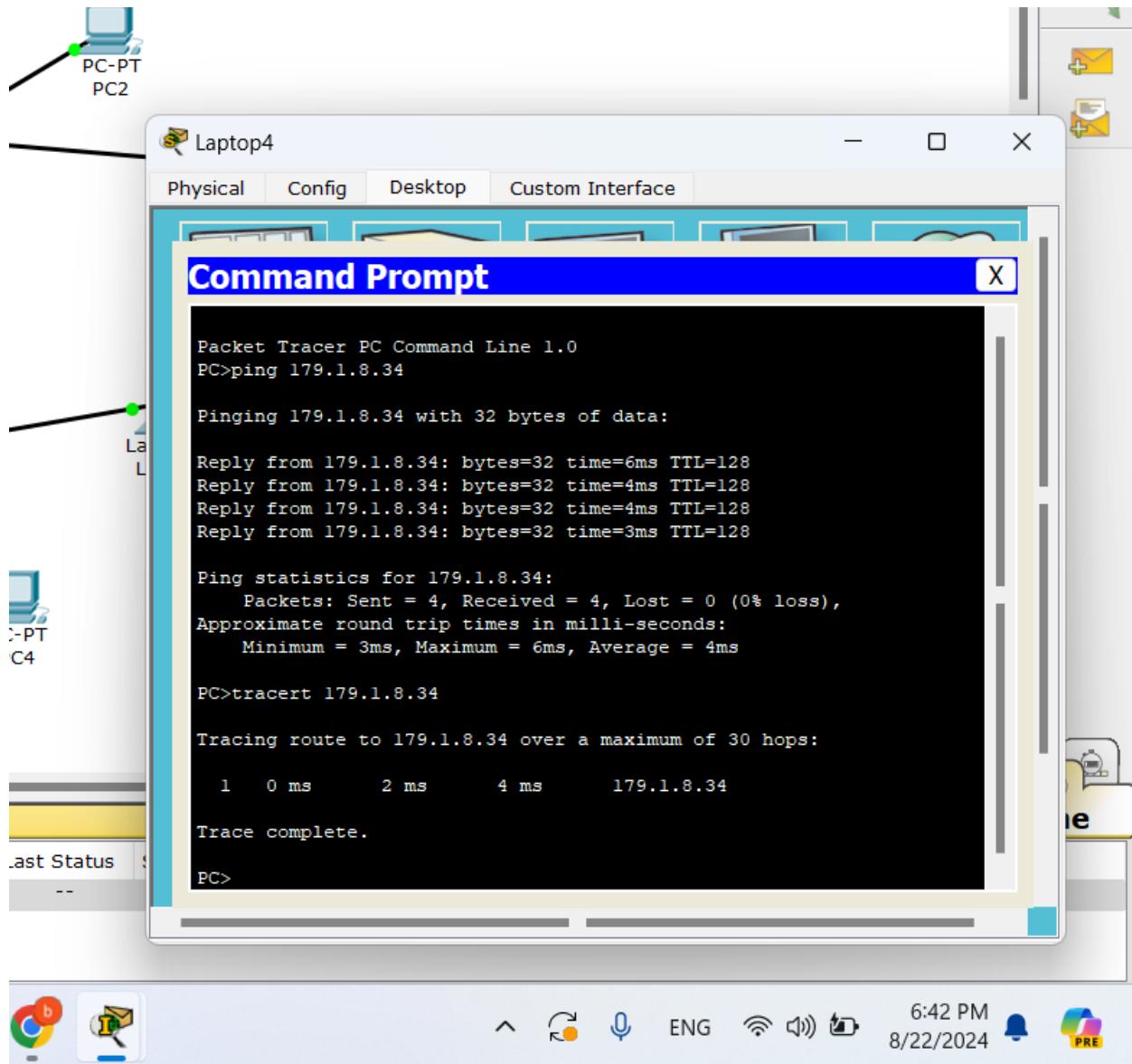


Figure 65: Laptop4 tracert and ping

Tracert and ping for Laptop4 with ip 179.1.8.34 and it works as shown in picture

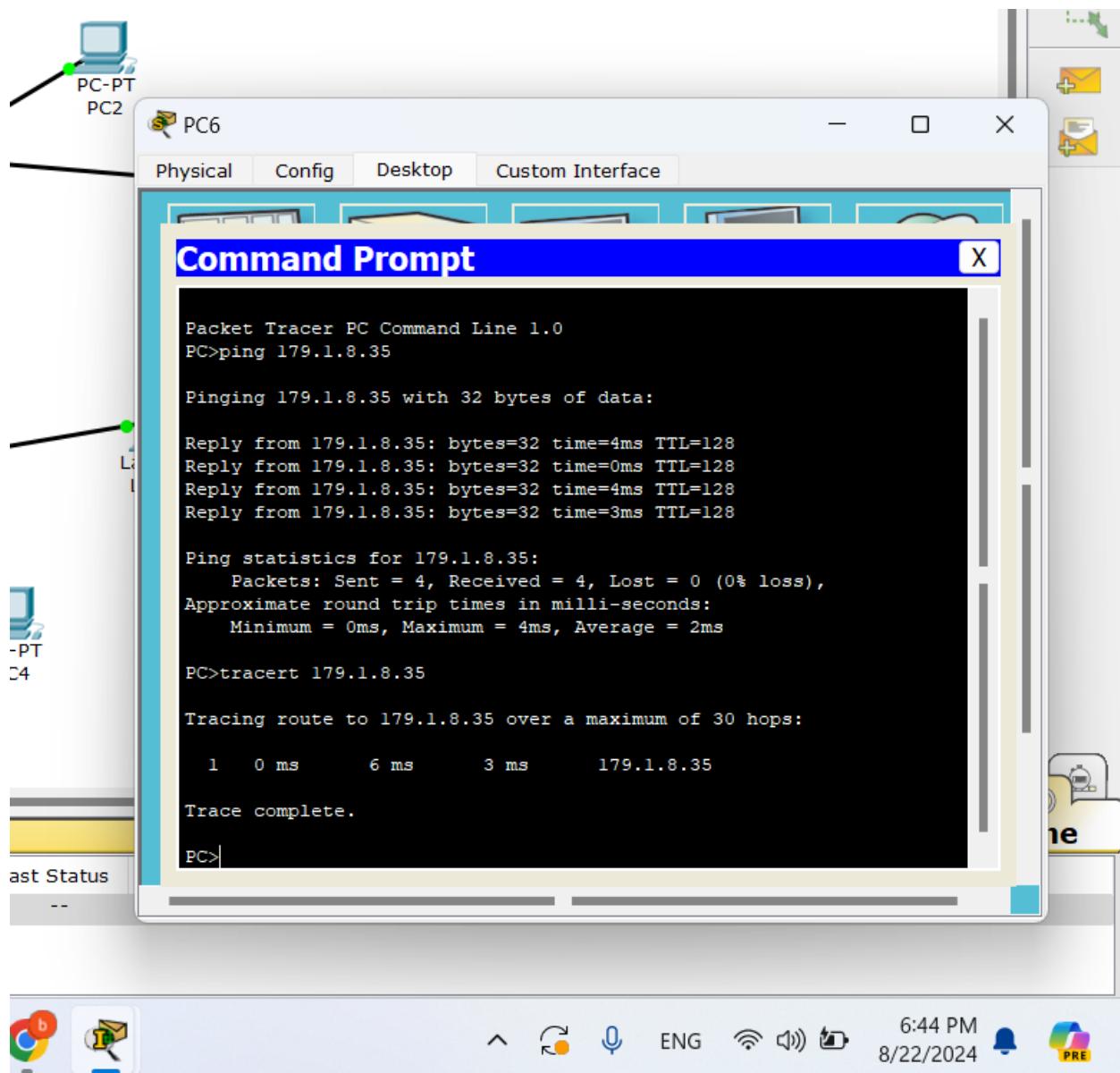


Figure 66: PC6 tracert and ping

Tracert and ping for PC6 with ip 179.1.8.35 and it works as shown in picture

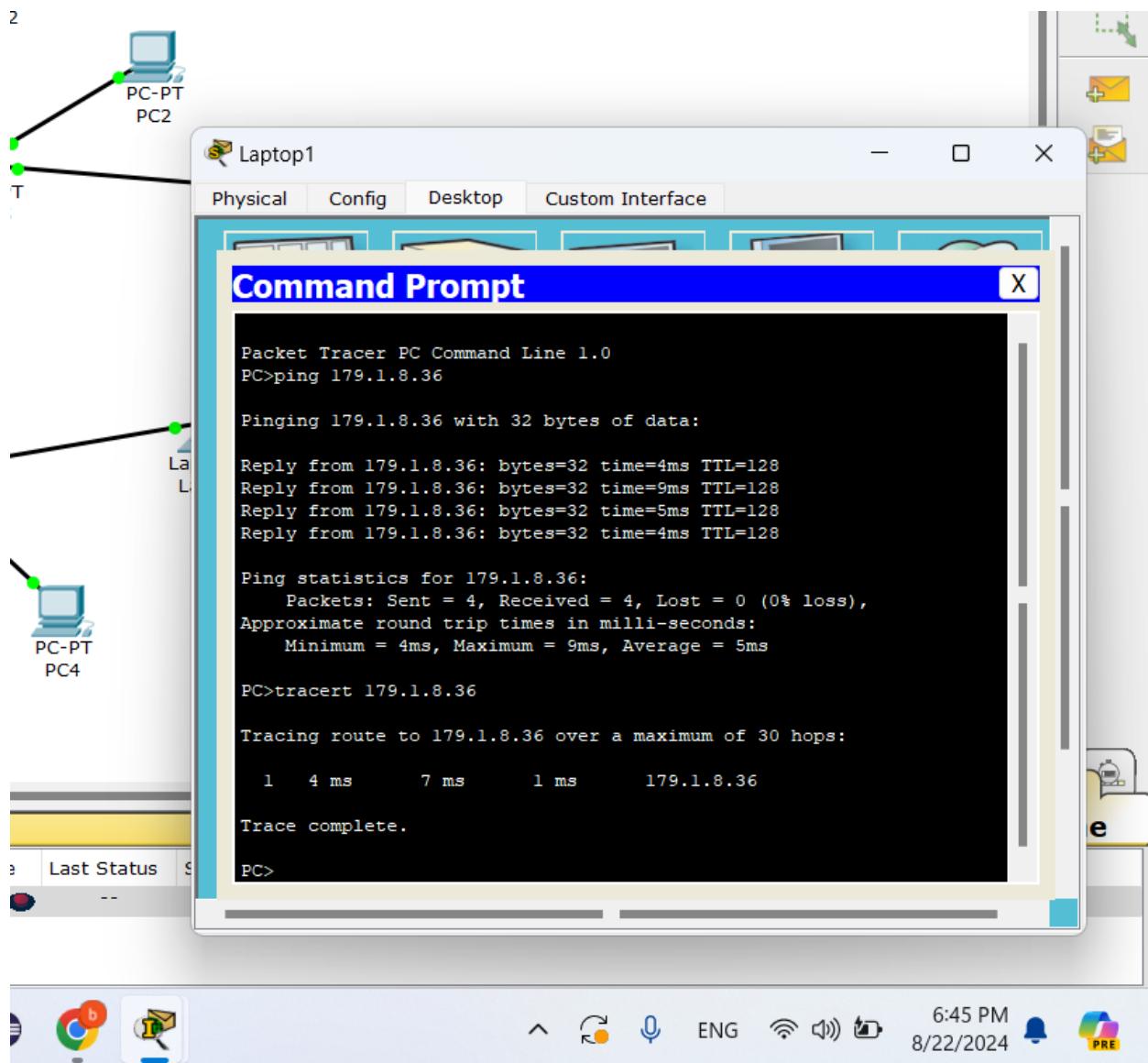


Figure 67: Laptop1 tracert and ping

Tracert and ping for Laptop1 with ip 179.1.8.36 and it works as shown in picture

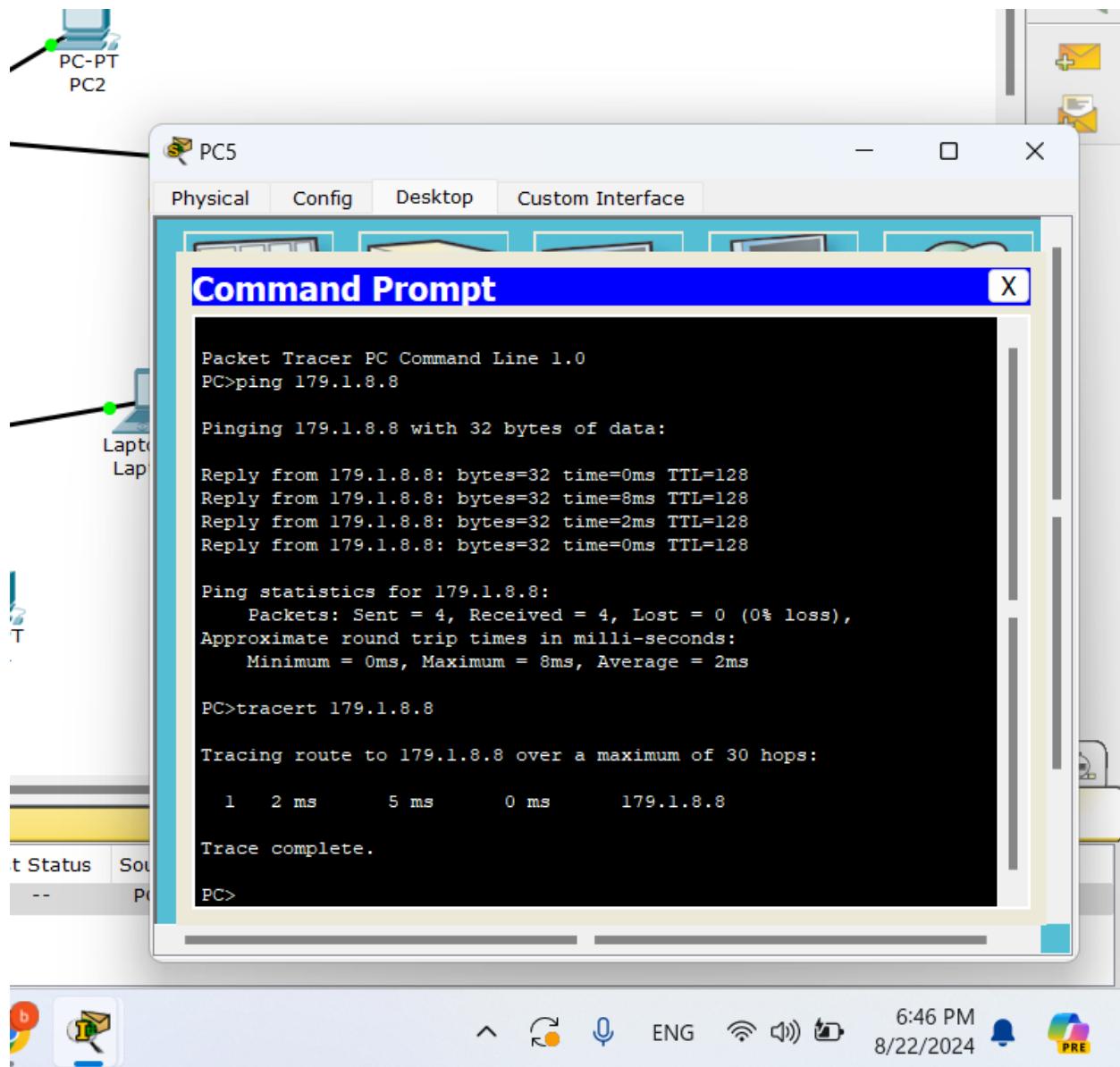


Figure 68: PC5 tracert and ping

Tracert and ping for PC5 with ip 179.1.8.8 and it works as shown in picture

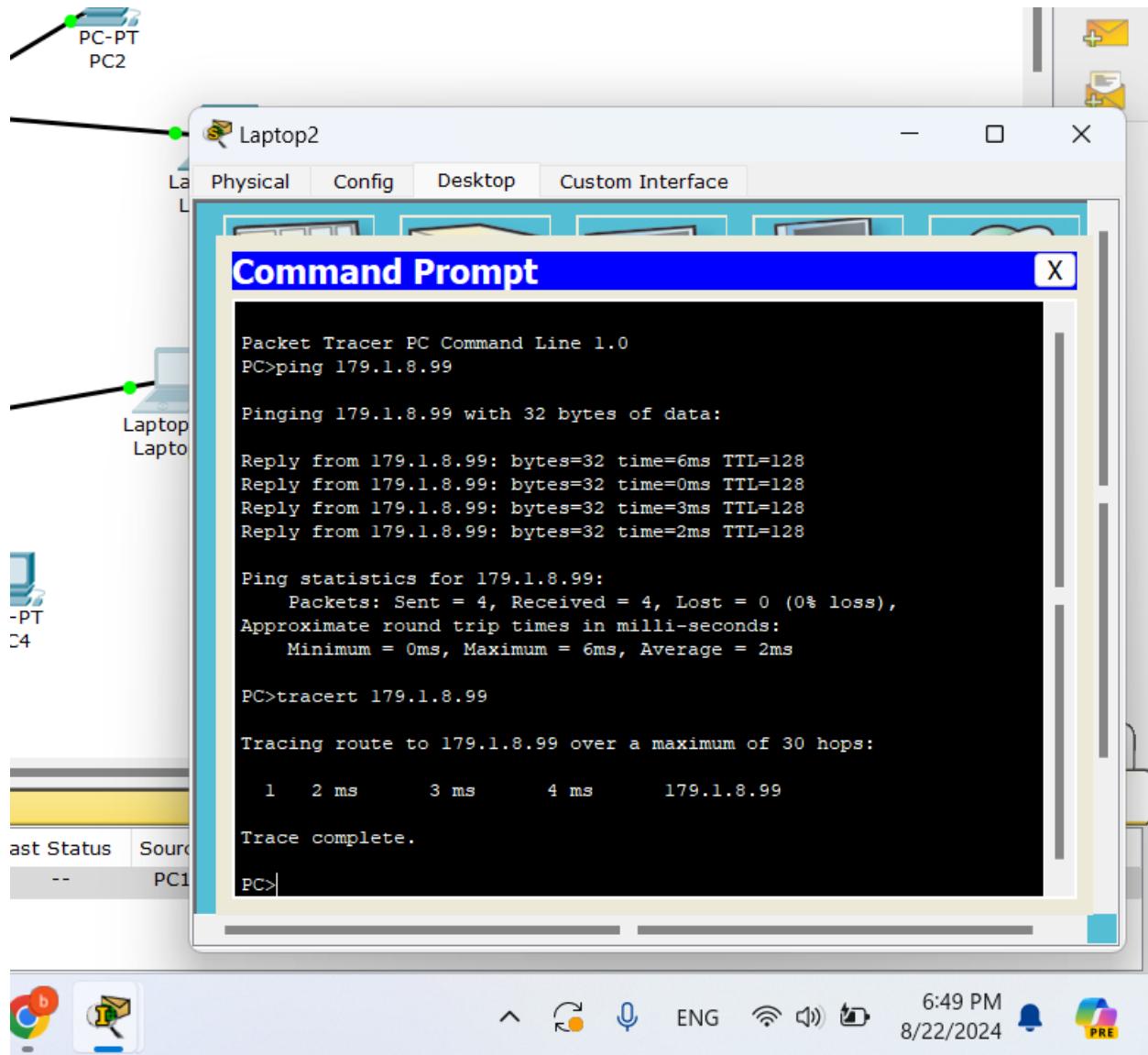


Figure 69: Laptop2 tracert and ping

Tracert and ping for Laptop2 with ip 179.1.8.99 and it works as shown in picture

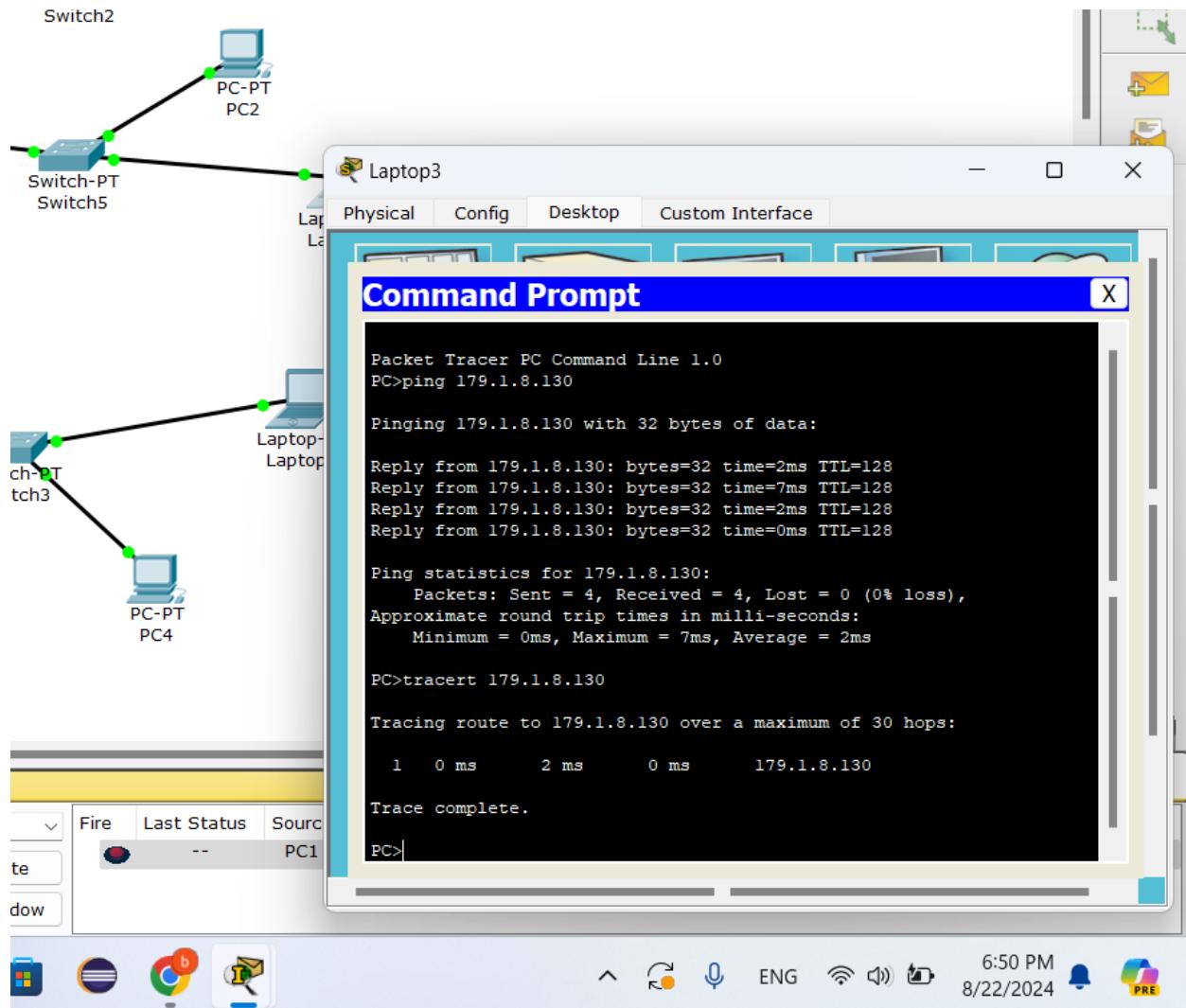


Figure 70: Laptop3 tracert and ping

Tracert and ping for Laptop3 with ip 179.1.8.130 and it works as shown in picture

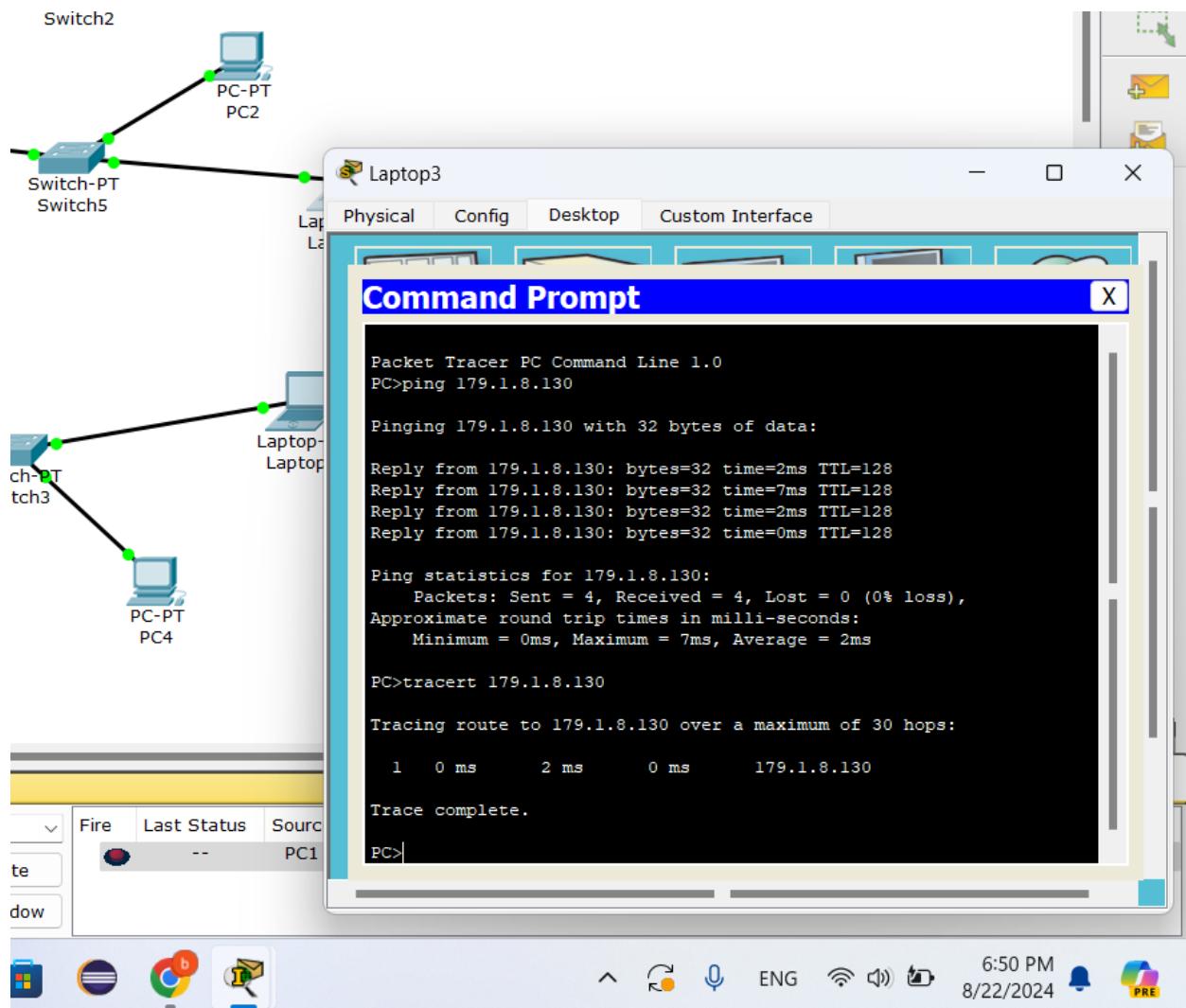


Figure 71: Laptop3 tracert and ping

Tracert and ping for Laptop3 with ip 179.1.8.130 and it works as shown in picture

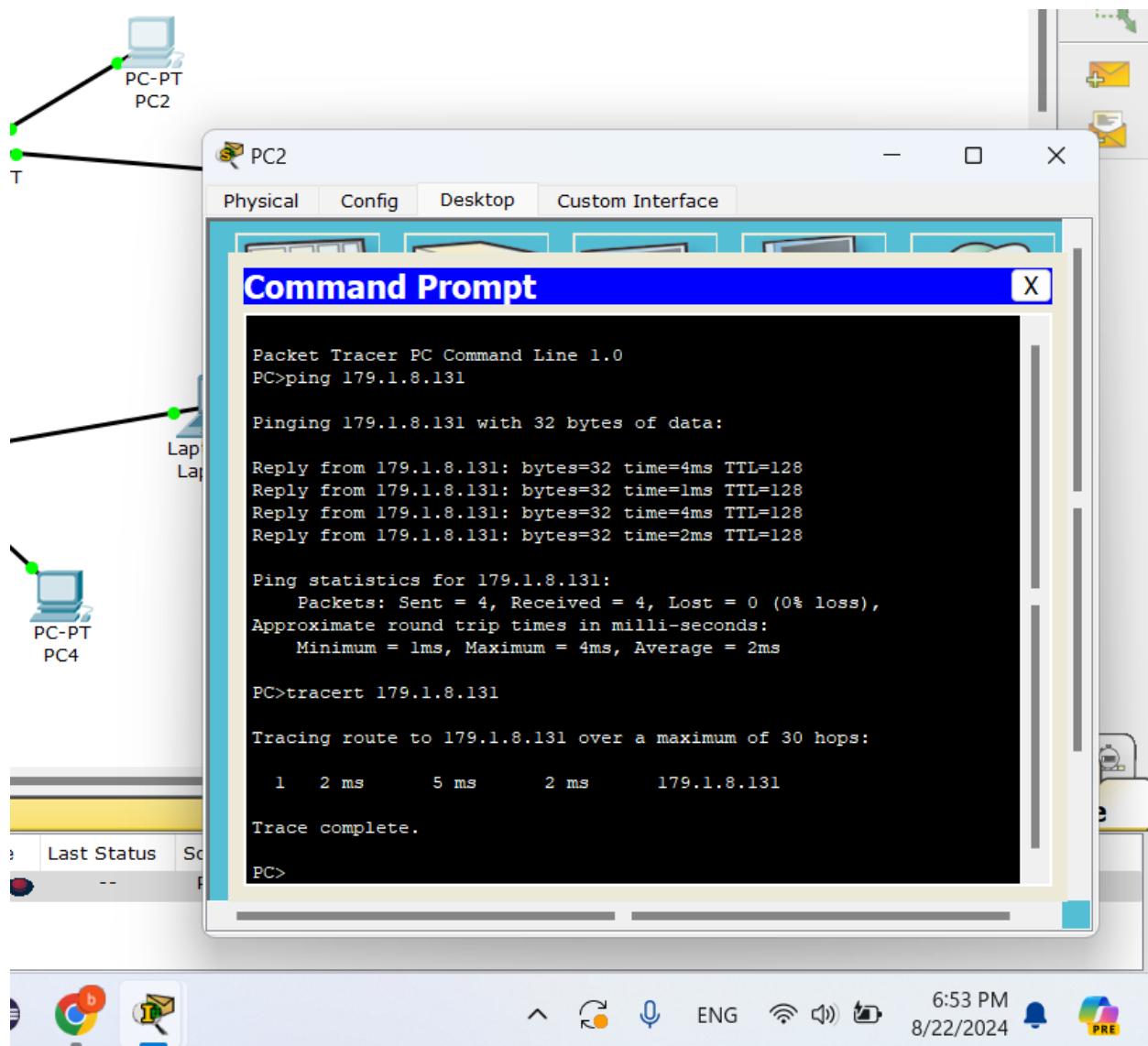


Figure 72: PC2 tracert and ping

Tracert and ping for PC2 with ip 179.1.8.131 and it works as shown in picture

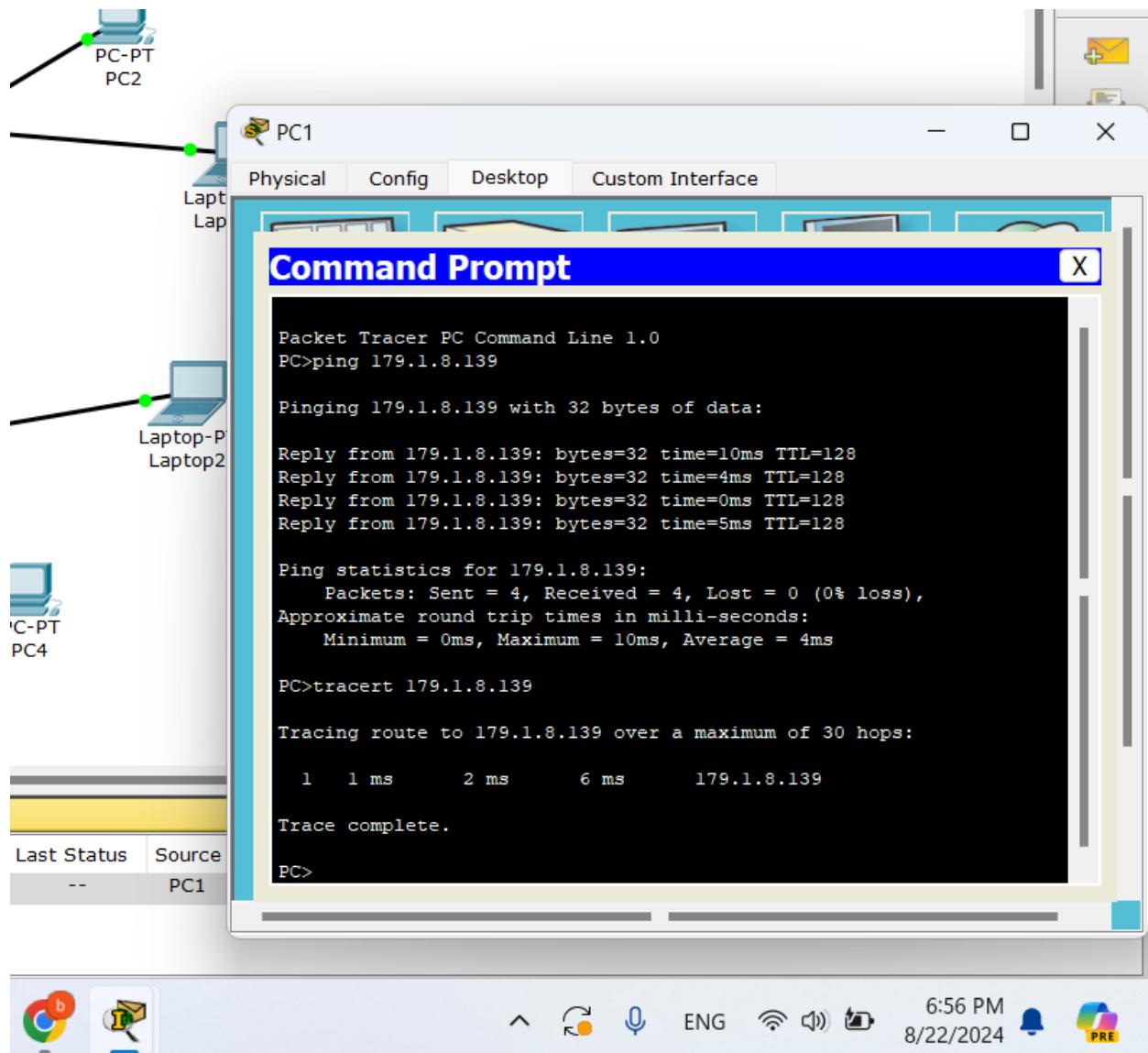


Figure 73: PC1 tracert and ping

Tracert and ping for PC1 with ip 179.1.8.139 and it works as shown in picture

## part 2:

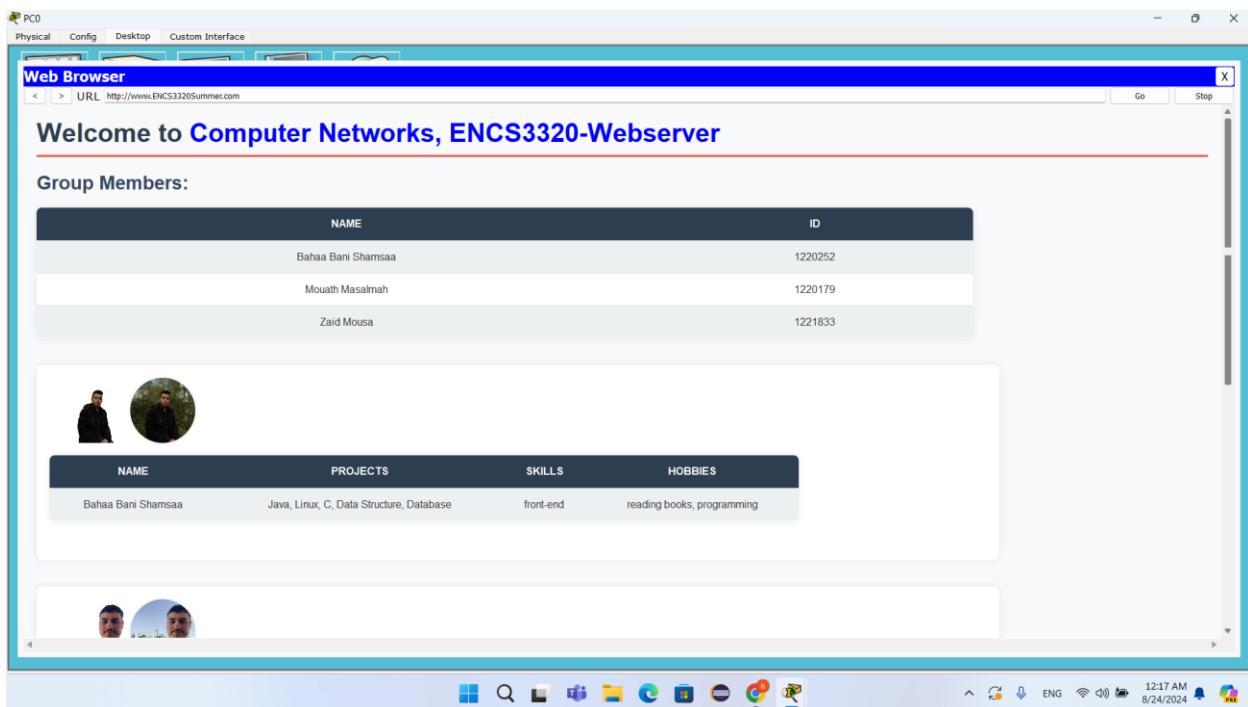


Figure 74: PCO Web Page

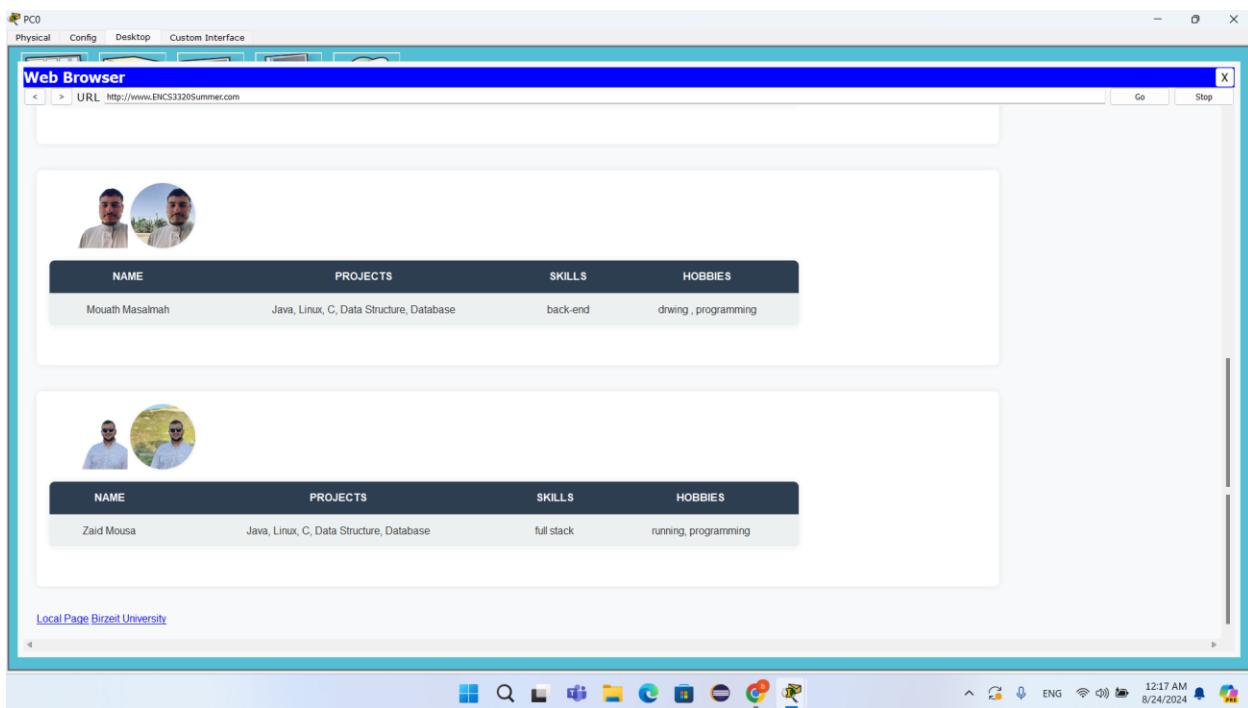


Figure 75: PCO Web Page

web page for PC0

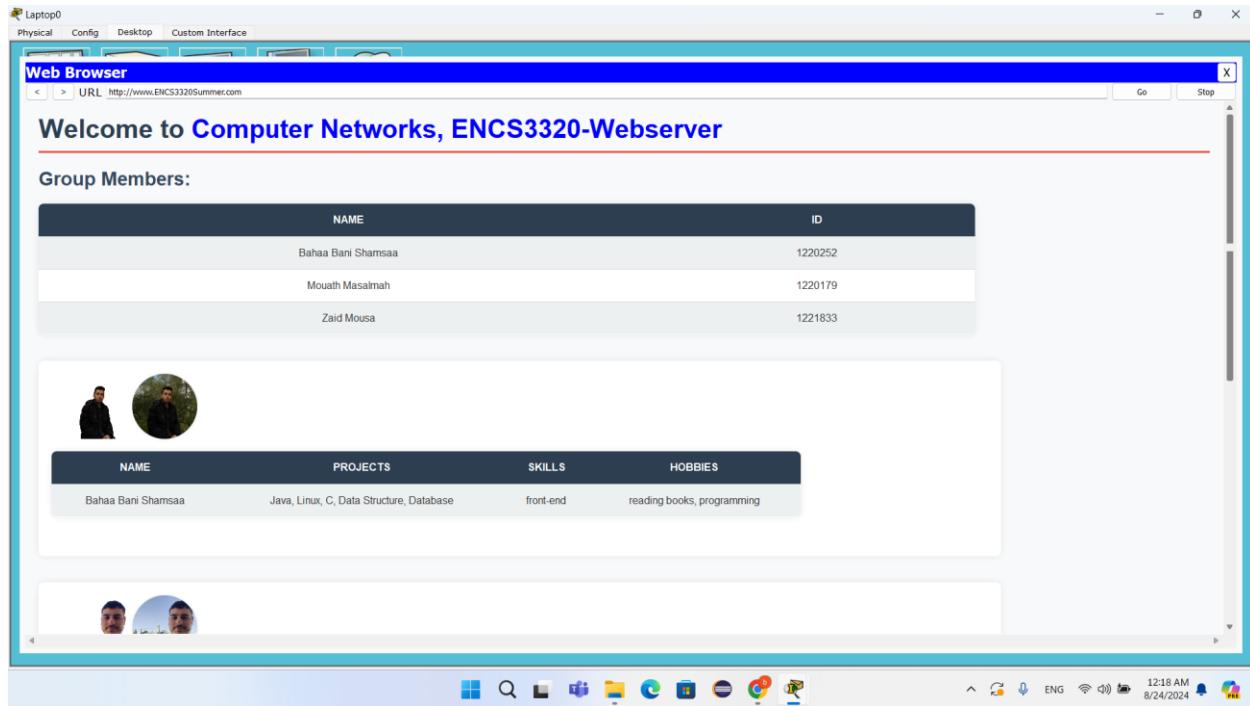


Figure 76: Labtop0 Web Page

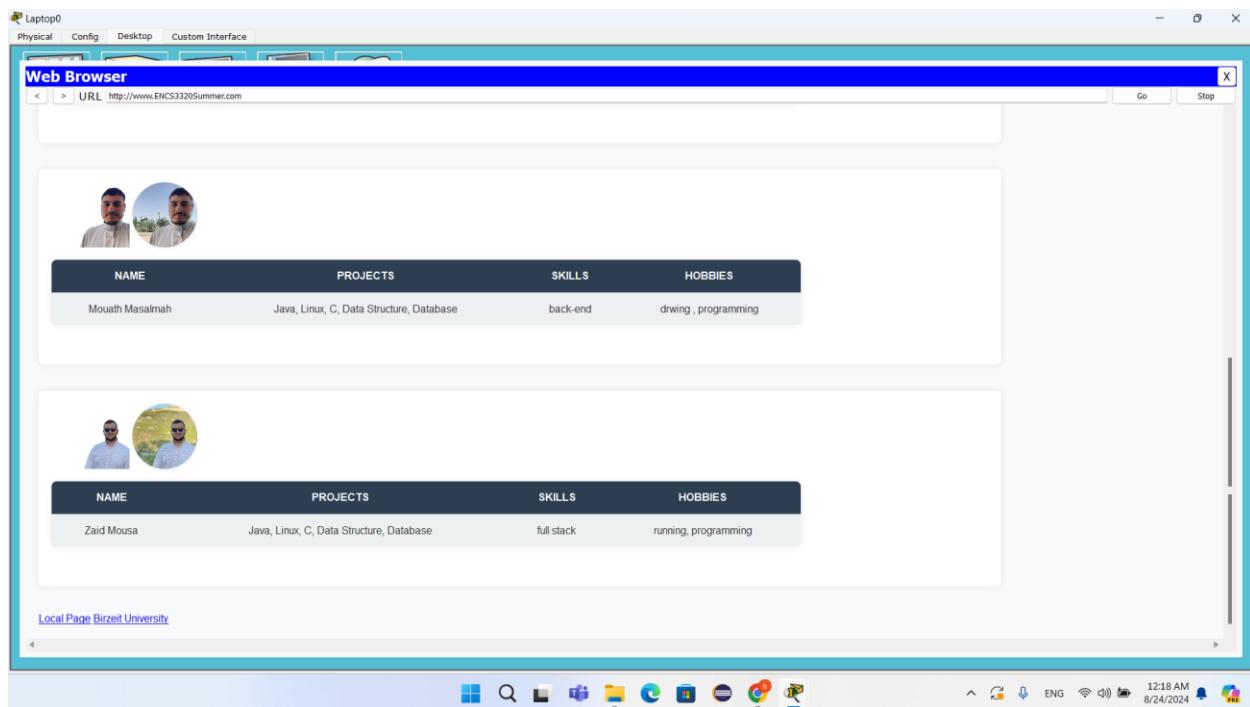


Figure 77: Labtop0 Web Page

web page for Laptop0

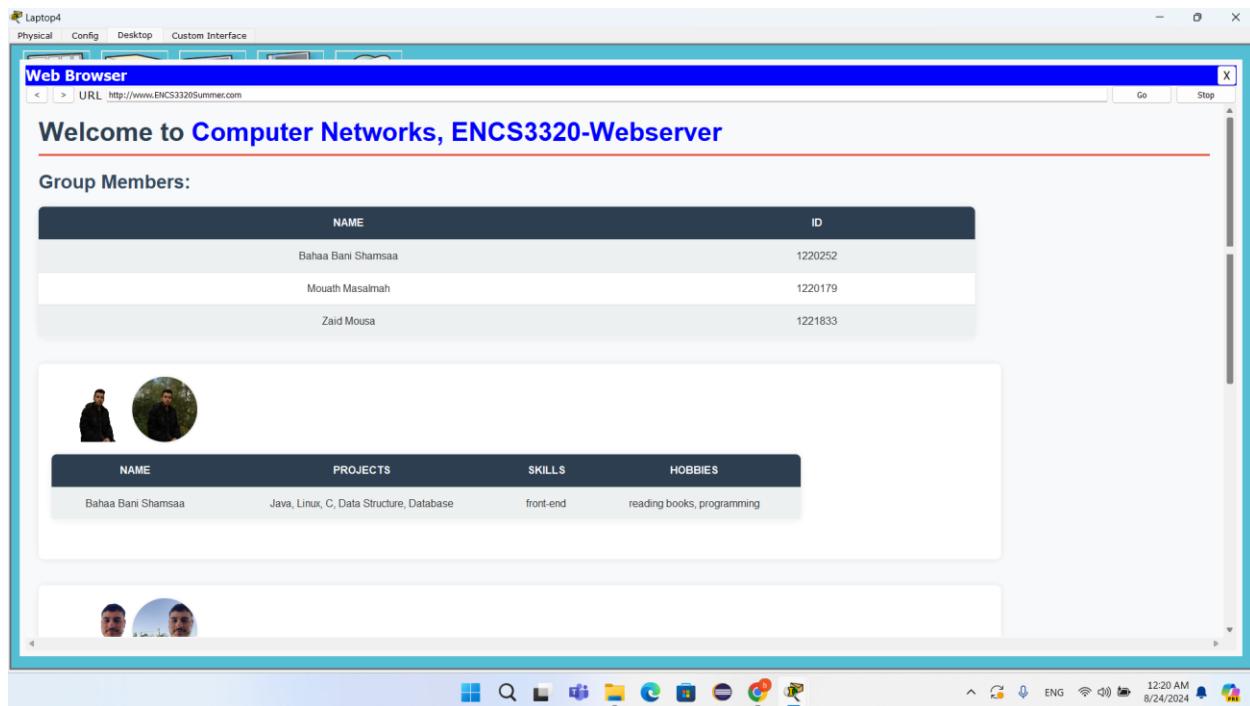


Figure 78: Labtop4 Web Page

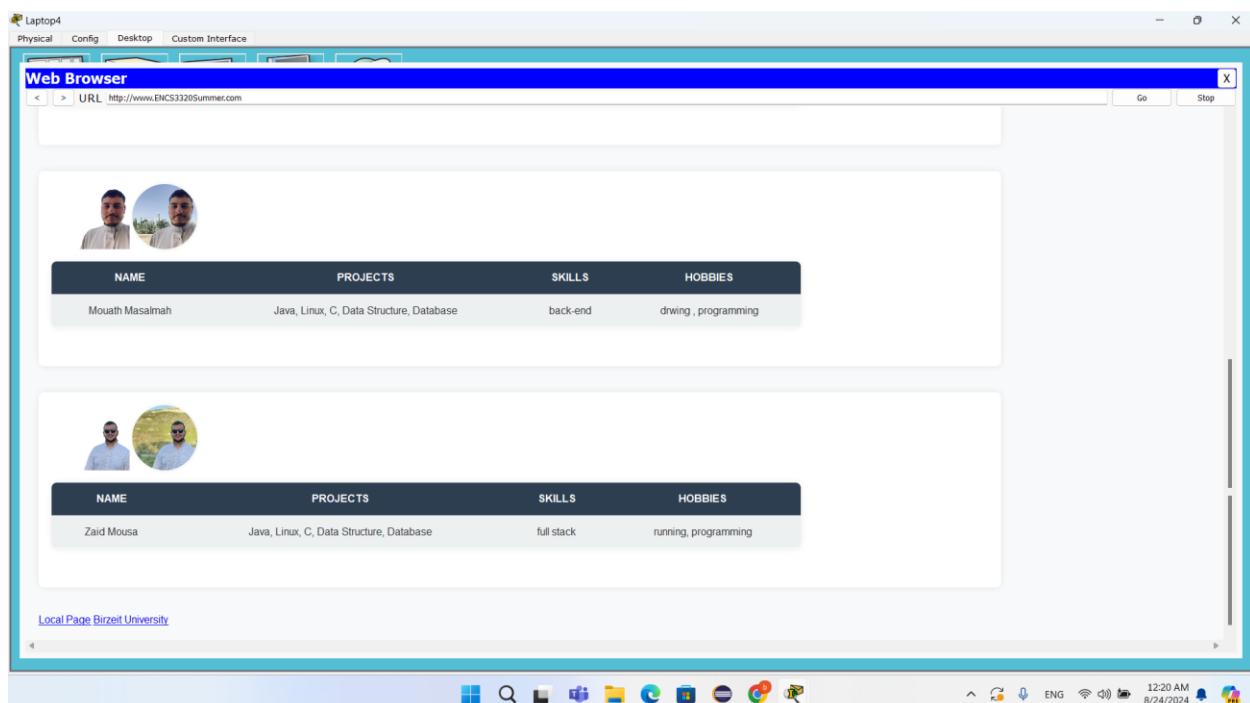


Figure 79: Labtop4 Web Page

web page for Laptop4

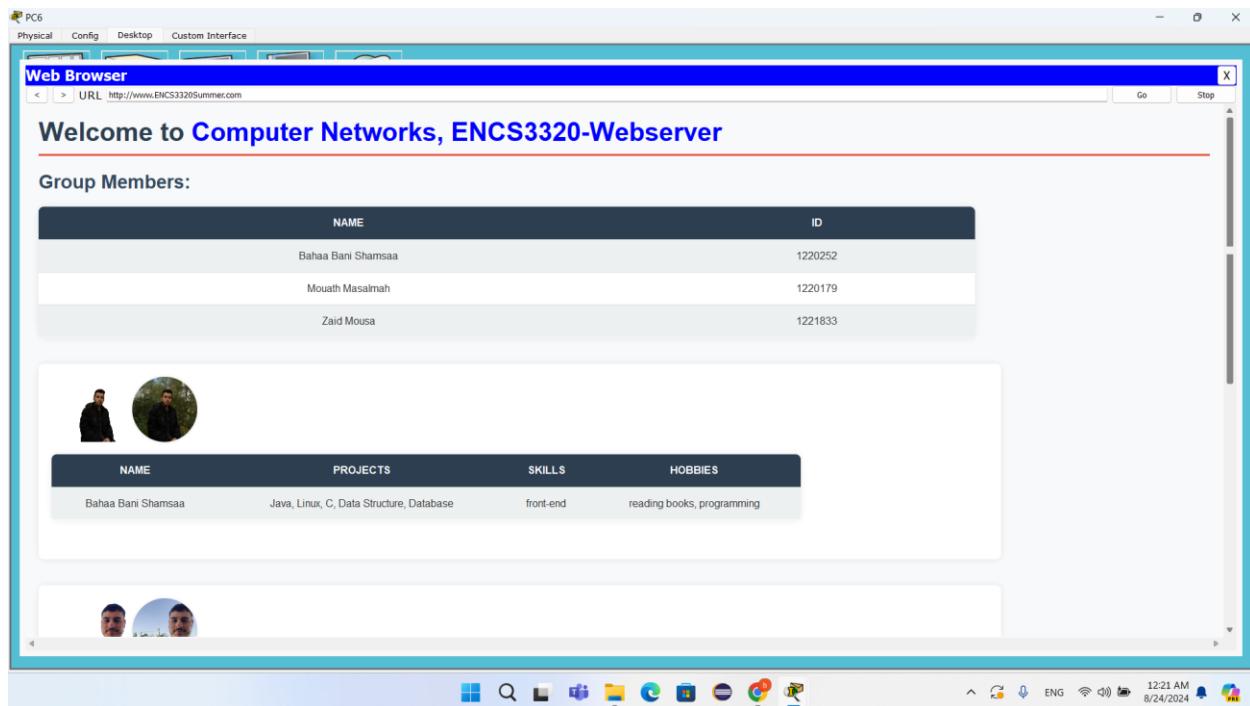


Figure 80: PC6 Web Page

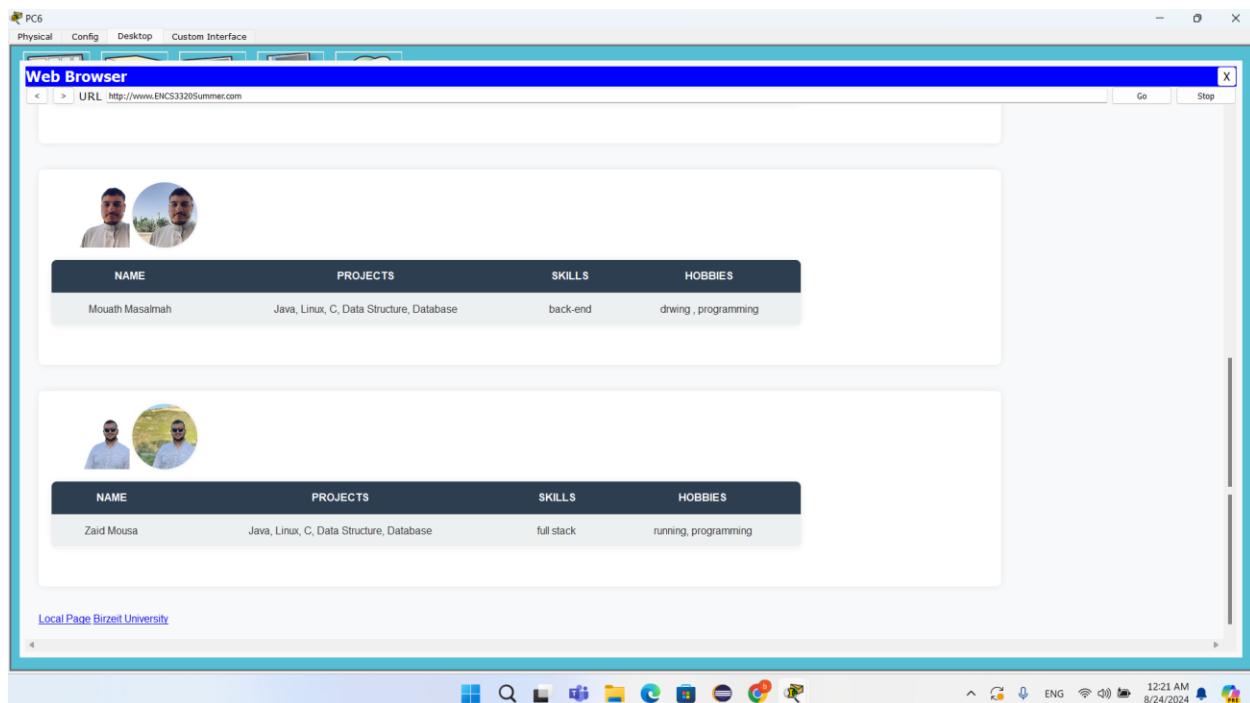


Figure 81: PC6 Web Page

web page for PC6

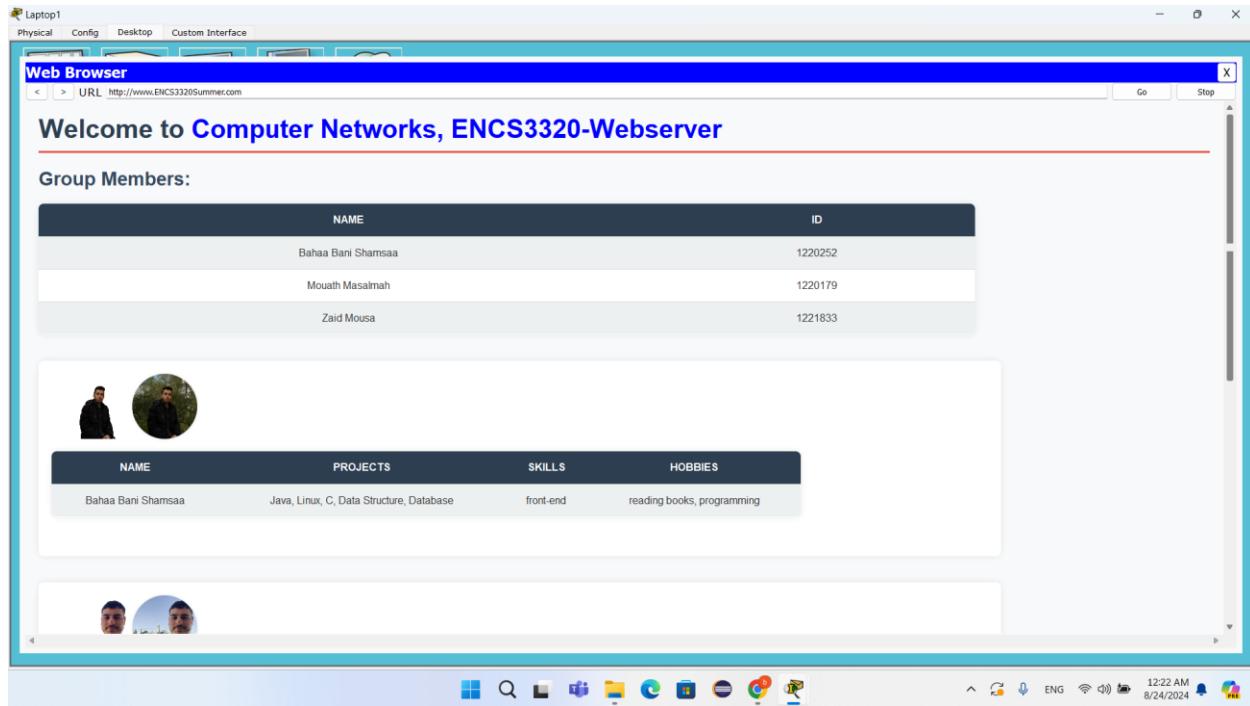


Figure 82: Labtop1 Web Page

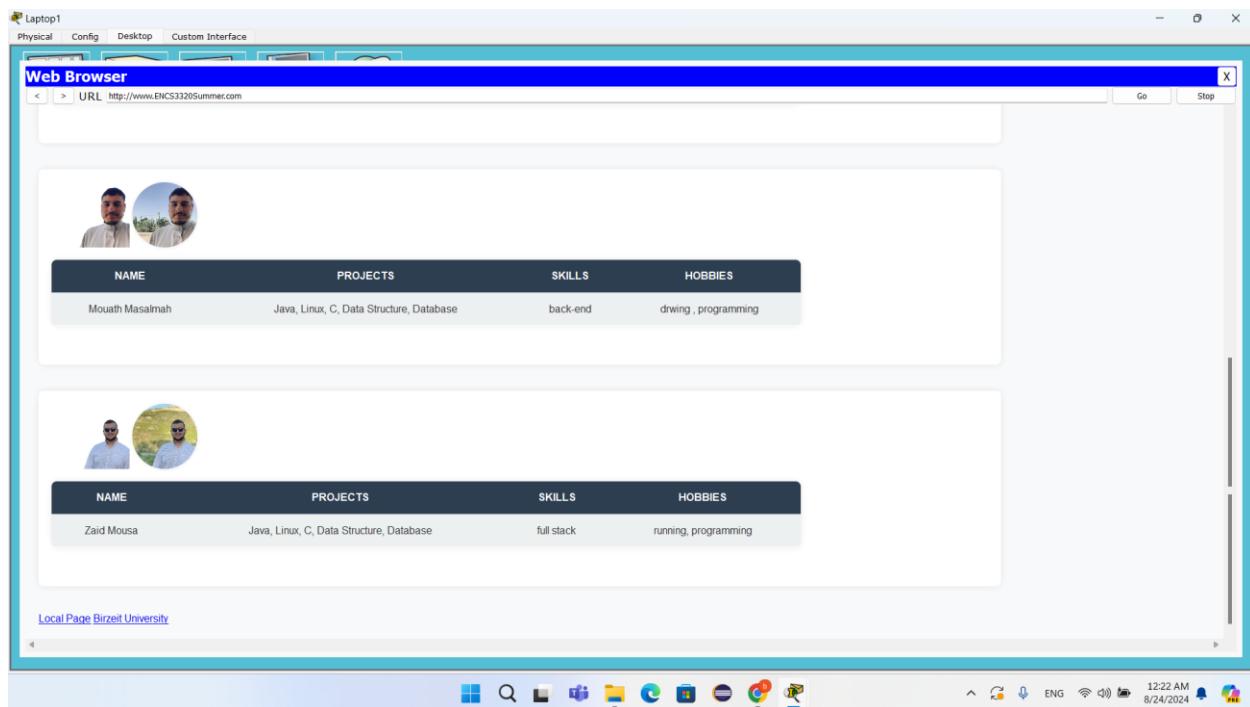


Figure 83: Labtop1 Web Page

web page for Laptop1

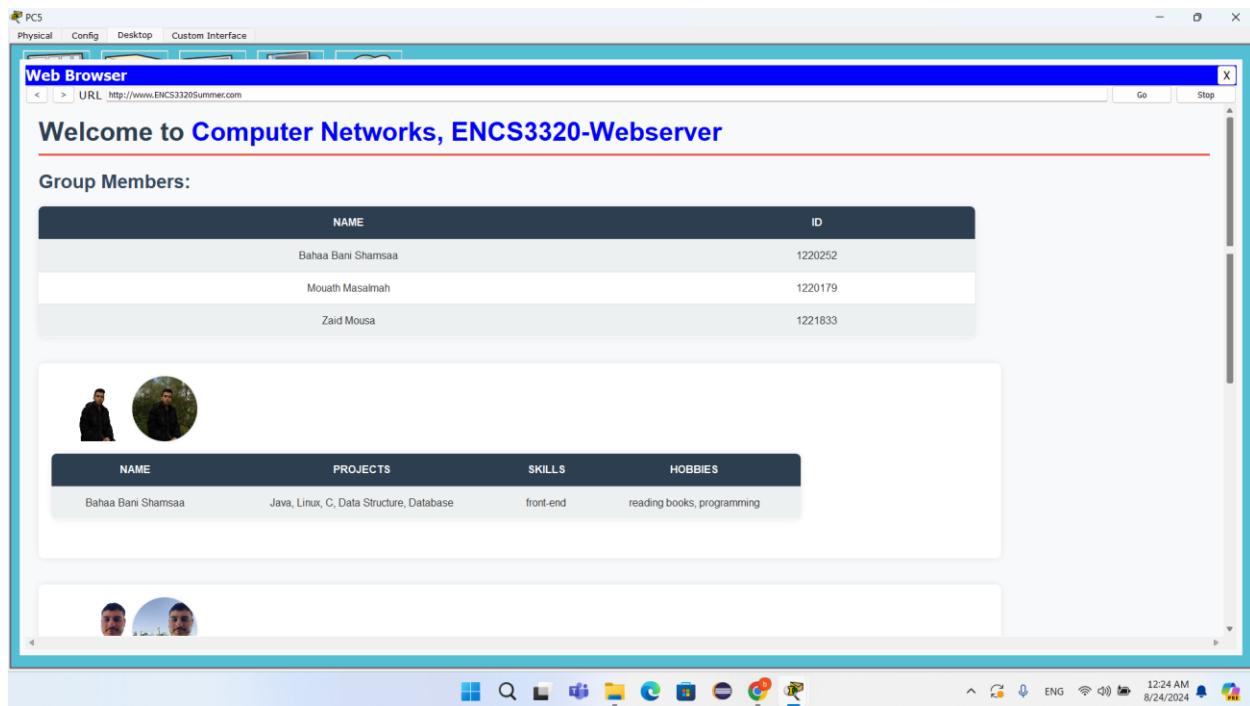


Figure 84: PC5 Web Page

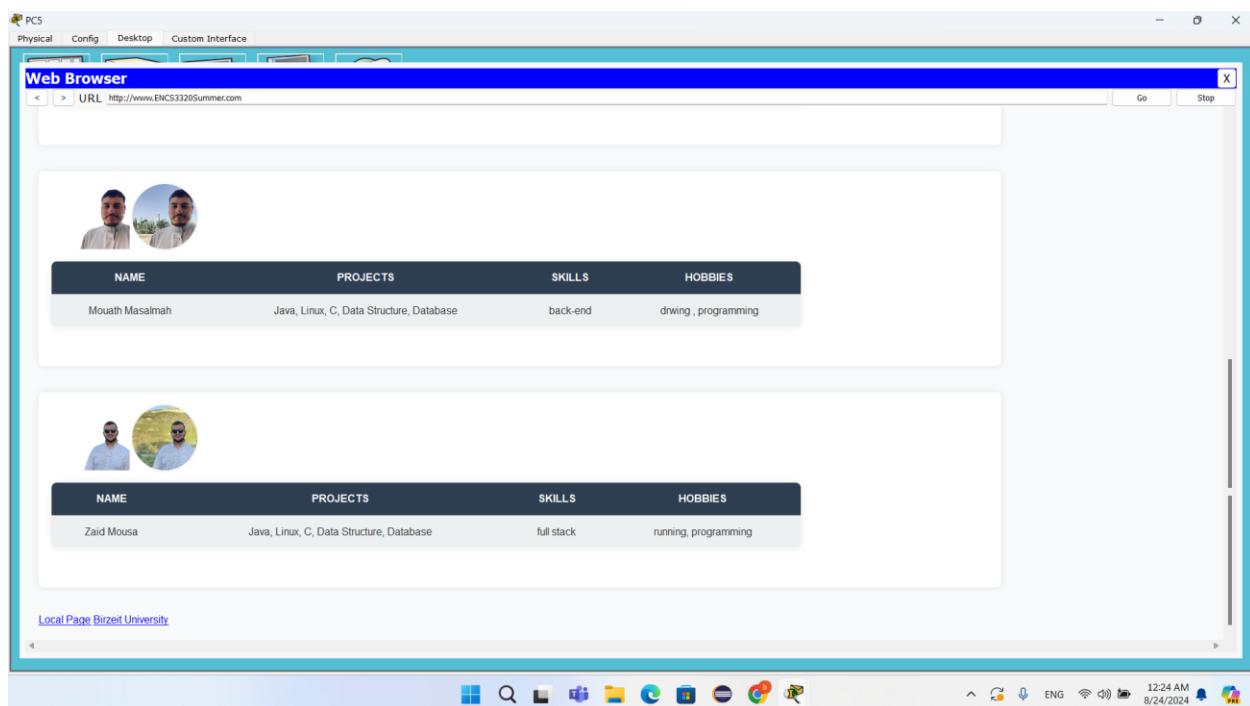


Figure 85: PC5 Web Page

web page for PC5

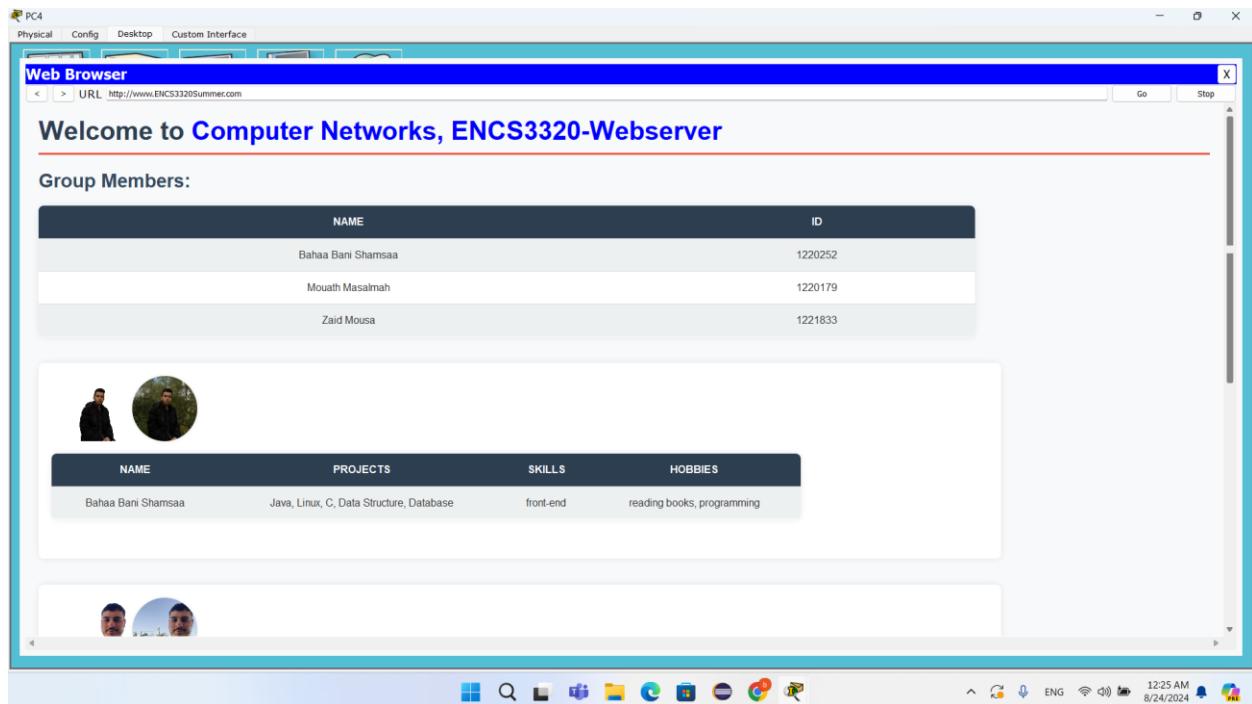


Figure 86: PC4 Web Page

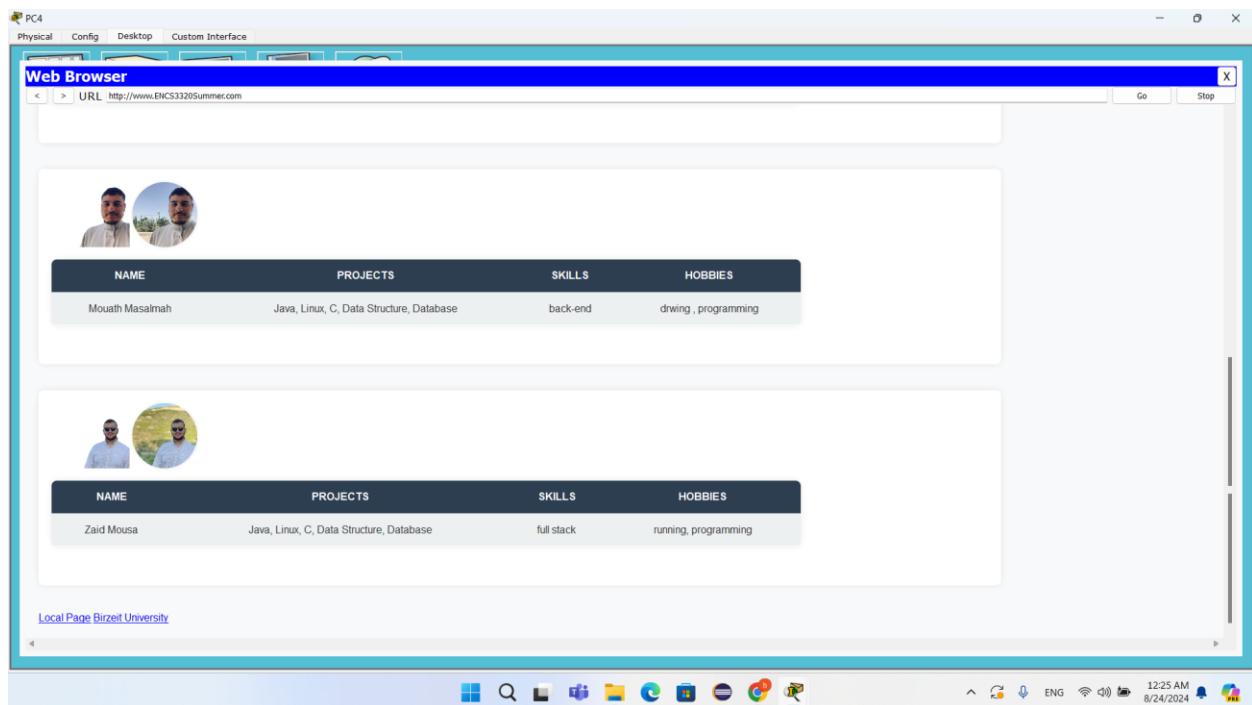


Figure 87: PC4 Web Page

web page for PC4

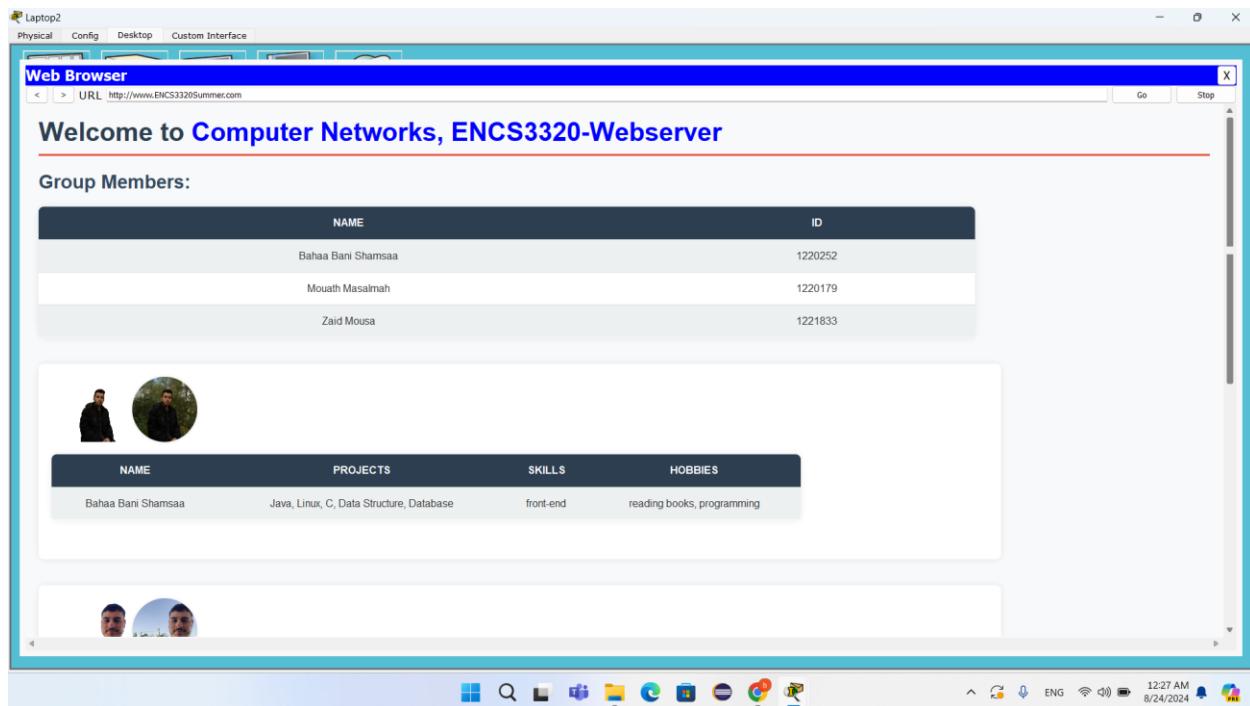


Figure 88: Labtop2 Web Page

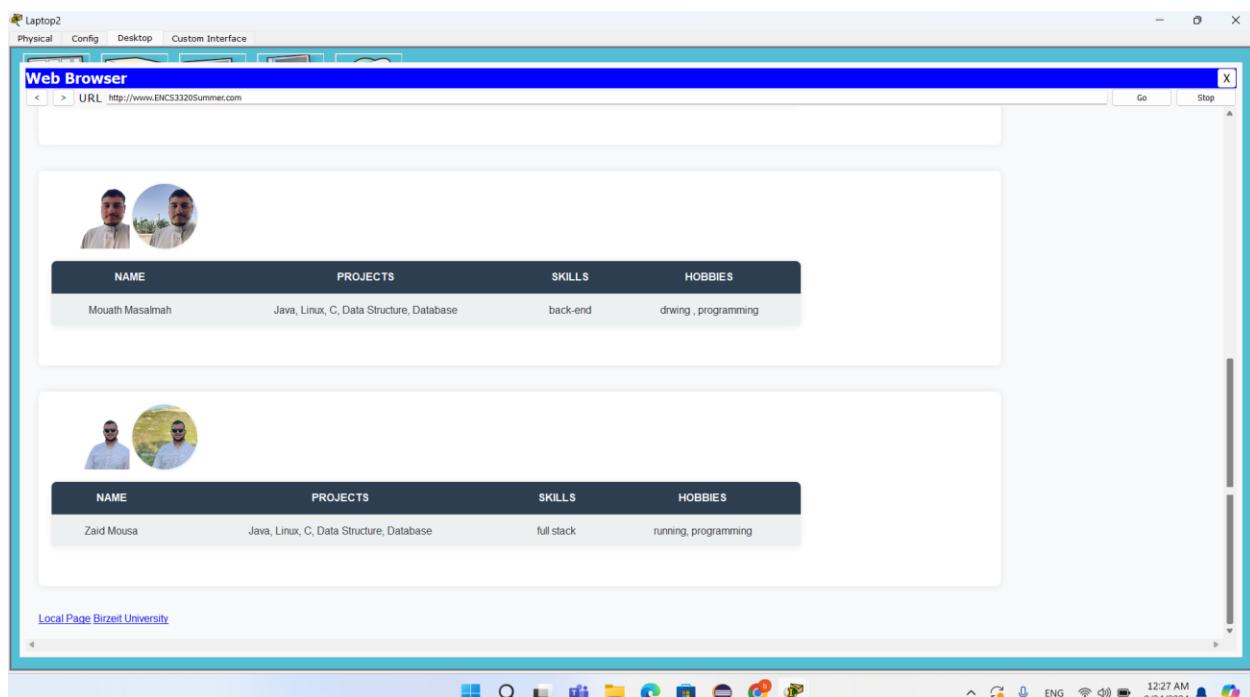


Figure 89: Labtop2 Web Page

web page for Laptop2

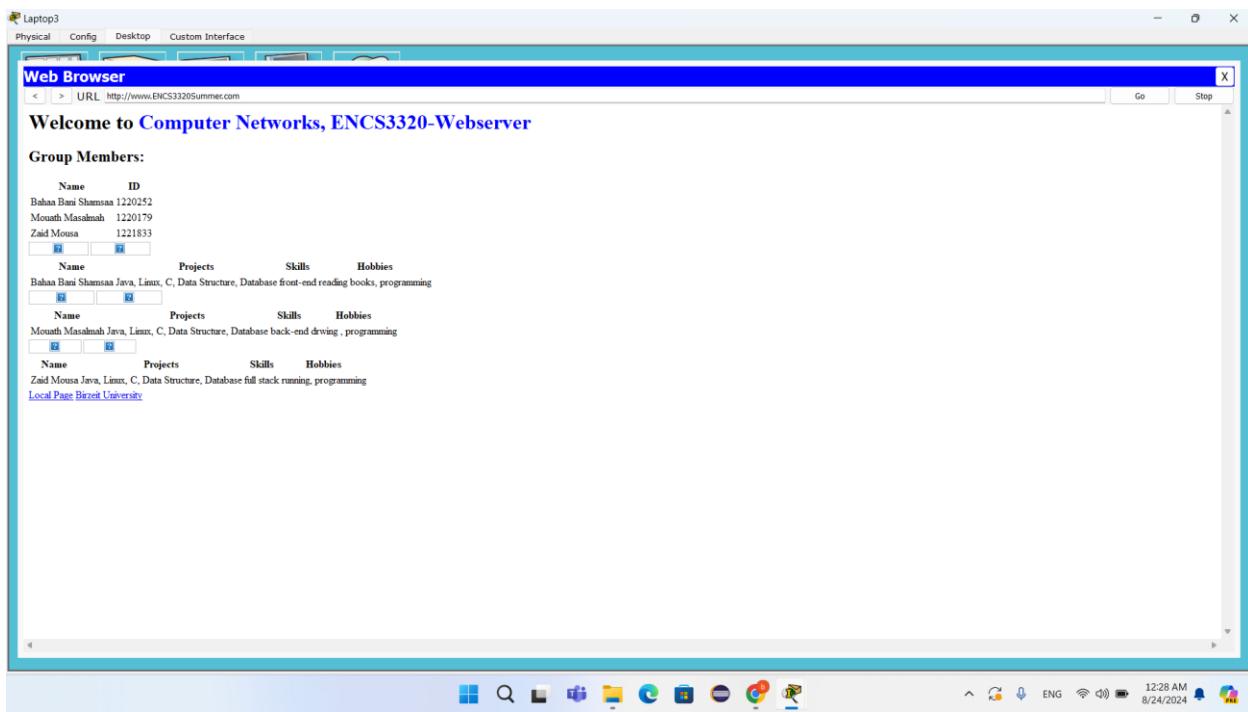


Figure 90: Laptop3 Web Page

web page for Laptop3

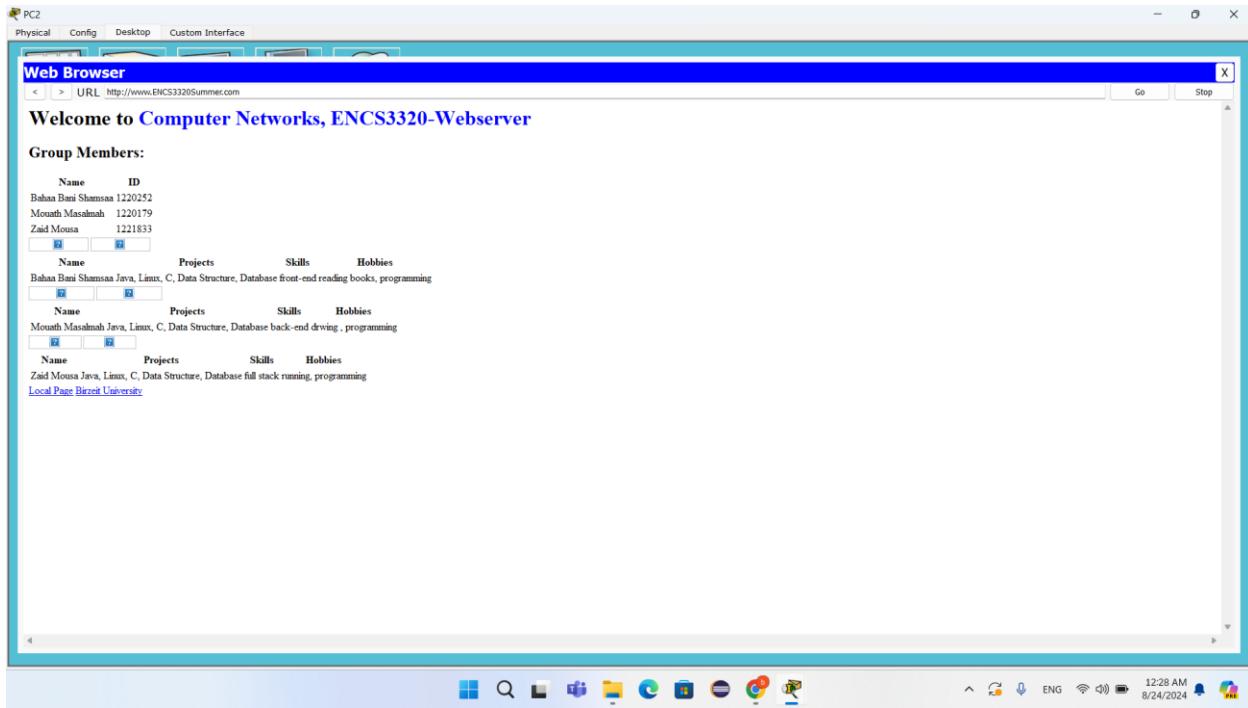


Figure 91: PC2 Web Page

web page for PC2

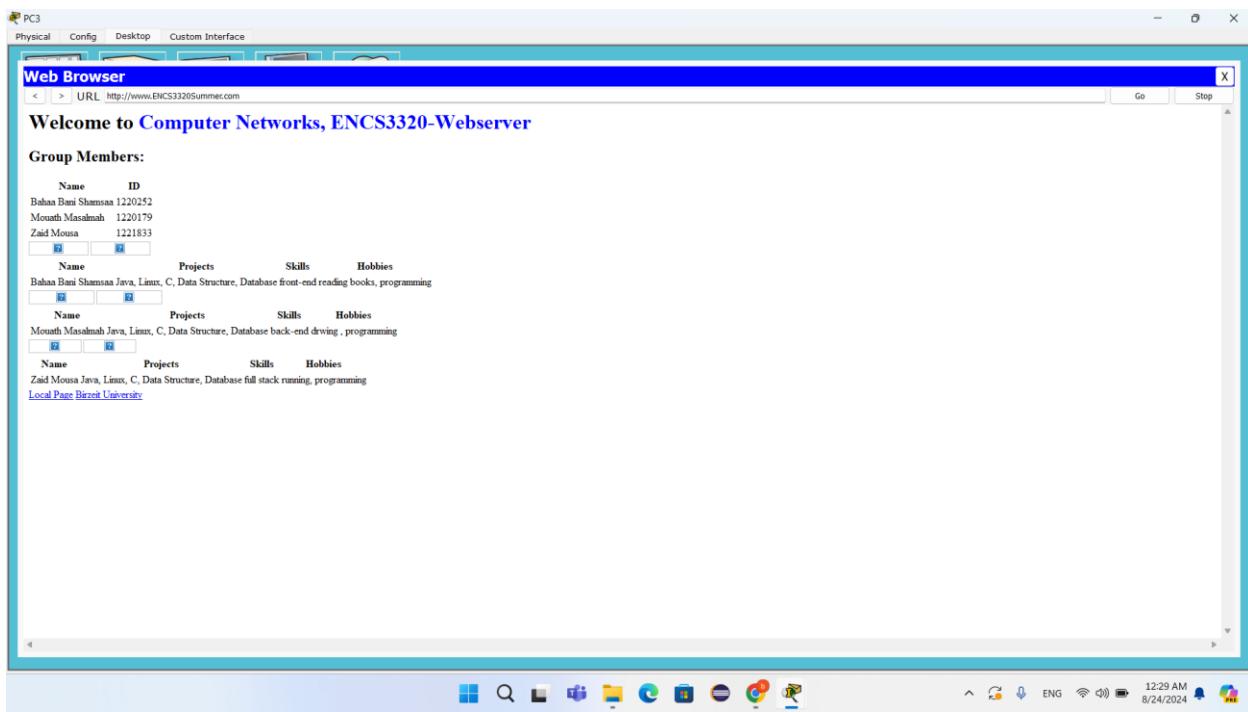


Figure 92: PC3 Web Page

web page for PC3

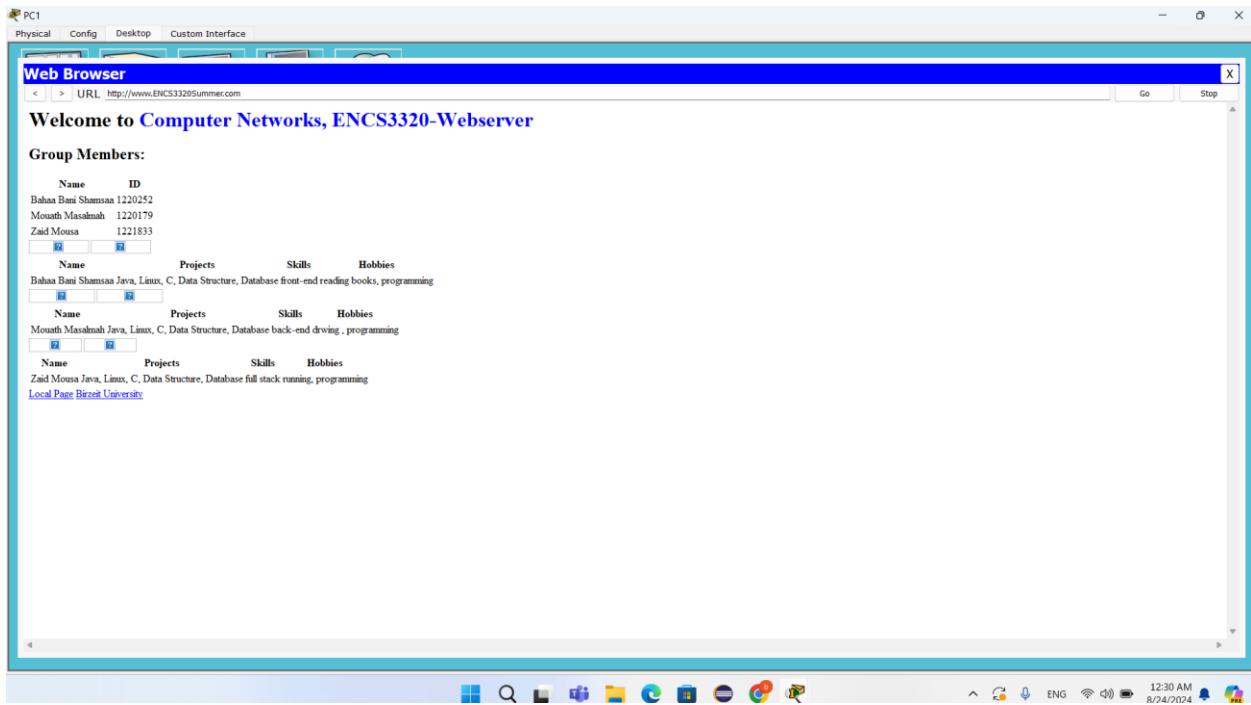


Figure 93: PC1 Web Page

web page for PC1

## Pie Chart:

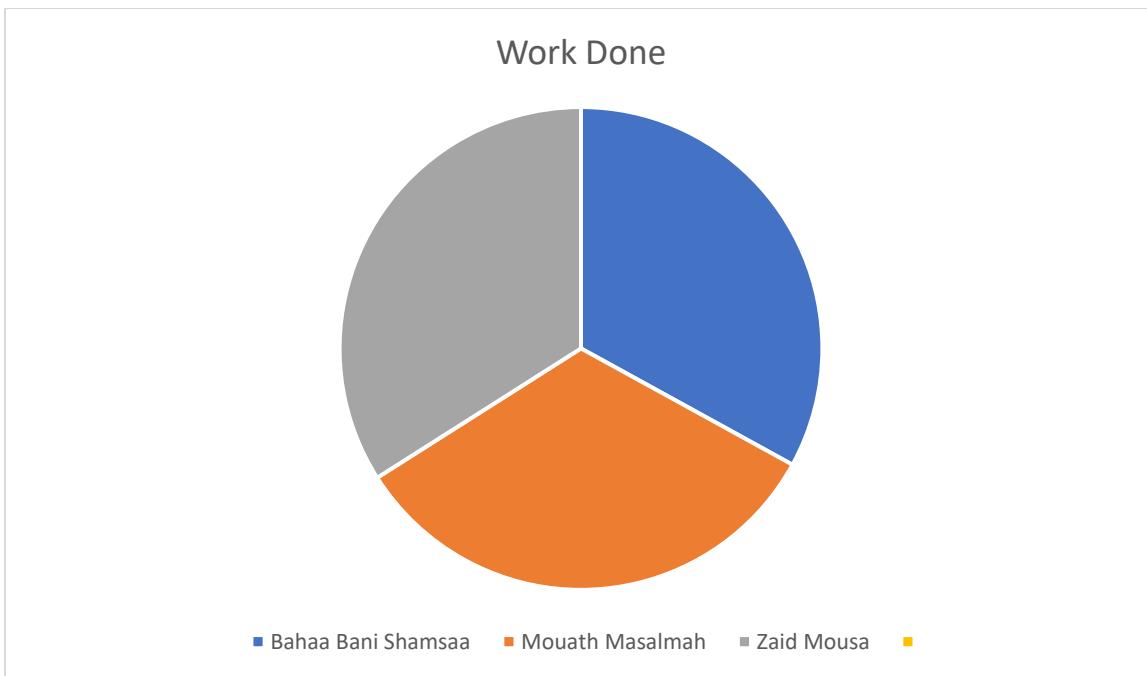


Figure 94: pie chart

## Work and report:

Task 0: Mouath and Zaid

Task 1: Bahaa and Zaid

Task 2: Mouath , Bahaa and Zaid

Task 3: Mouath and Bahaa

Task 4: Mouath , Zaid and Bahaa

# The References:

- [IPv4](#)
- [network Gateway](#)
- [Packet Tracer](#)
- [Subnet Mask](#)
- [Tracert](#)