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Course & Section: BSCpE III - GF Score:_____

Static Routing

Objectives

Upon completion of this laboratory exercise, the student will be able to

- Cable a network according to the Topology Diagram.
- Configure and activate Serial and Ethernet interfaces.
- Configure a static route using an intermediate address.
- Test Connectivity between the PC's

Equipment

PC
Packet Tracer

Introduction

Static routing is the most secure way of routing. It reduces overhead from network resources. In this type of routing we manually add routes in routing table. It is useful where numbers of route are limited. In this article we will explain static routing with examples. Like other routing methods static routing also has its pros and cons.

Advantage of static routing

- It is easy to implement.
- It is most secure way of routing, since no information is shared with other routers.
- It puts no overhead on resources such as CPU or memory.

Disadvantage of static routing

- It is suitable only for small network.
- If a link fails it cannot reroute the traffic.

Configuring Static Routes

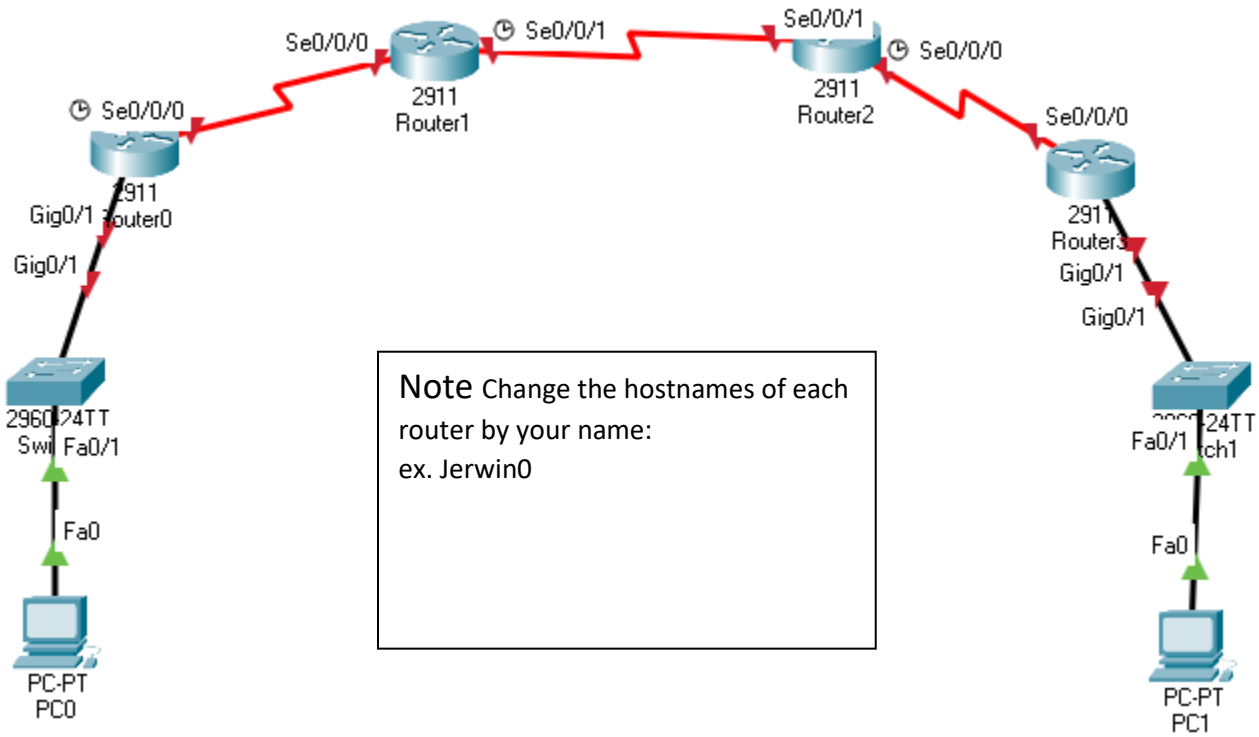
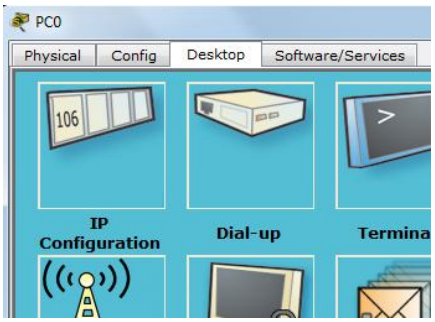
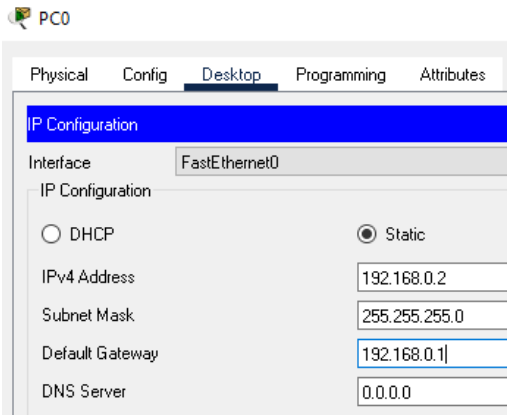


Figure 1. Topology for Activity #4

Table 1. Addressing table for the topology

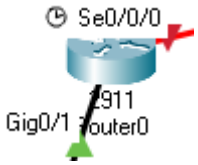
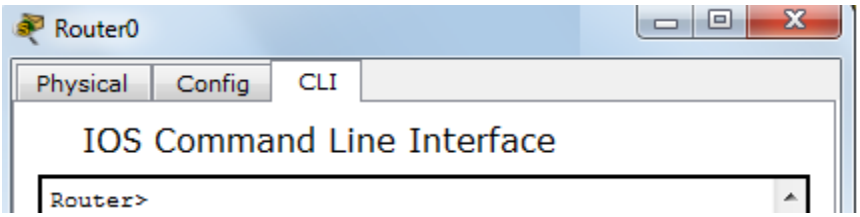
DEVICE	CONNECTED FROM	CONNECTED TO	IP ADDRESS	SUBNET MASK
PC0	FastEthernet0	Switch0's FastEthernet0/1	192.168.0.2	255.255.255.0
SWITCH0	FastEthernet0/1	PC0's FastEthernet0	-	-
SWITCH0	GigabitEthernet0/1	Router0's GigabitEthernet0/1	-	-
ROUTER0	GigabitEthernet0/1	Swith0's GigabitEthernet0/1	192.168.0.1	255.255.255.0
ROUTER0	Serial 0/0/0	Router1's Serial 0/0/0	200.0.0.1	255.255.255.0
ROUTER1	Serial 0/0/0	Router0's Serial 0/0/0	200.0.0.2	255.255.255.0
ROUTER1	Serial 0/0/1	Router2's Serial 0/0/1	200.0.1.1	255.255.255.0
ROUTER2	Serial 0/0/1	Router1's Serial 0/0/1	200.0.1.2	255.255.255.0
ROUTER2	Serial 0/0/0	Router3's Serial 0/0/0	200.0.2.1	255.255.255.0
ROUTER3	Serial 0/0/0	Router2's Serial 0/0/0	200.0.2.2	255.255.255.0
ROUTER3	GigabitEthernet0/1	Switch1's GigabitEthernet0/1	192.168.1.1	255.255.255.0
SWITCH1	GigabitEthernet0/1	Router3's GigabitEthernet0/1	-	
SWITCH1	FastEthernet0/1	PC0's FastEthernet0	-	
PC1	FastEthernet0	Switch1's FastEthernet0	192.168.1.2	255.255.255.0

Assign IP address on a PC

	Image	Direction
Step 1		Double Click the PC
Step 2		Select the Desktop Tab and Click the IP Configuration
Step 3		Assign the IP address, Subnet Mask and Default Gateway of the PC0, based on Table 1. **PC0** IPv4 address: 192.168.0.2 Subnet Mast: 255.255.255.0 Default Gateway: 192.168.0.1 **PC1** IPv4 address: 192.168.1.2 Subnet Mast: 255.255.255.0 Default Gateway: 192.168.1.1
Step 4		Repeat Steps 1-3 for PC1

Assign IP address to interfaces of routers

Router 0

	Image	Direction/Description
Step 1		Double Click the Router
Step 2		Click the tab CLI and enter the User Exec Mode
Step 3	`Router>enable` `Router#configure terminal`	Type the following Commands to enter Global Configuration Mode

Step 4	`Router(config)#interface gigabitEthernet 0/1`
	`Router(config-if)#ip address 192.168.0.1 255.255.255.0`
	`Router(config-if)#no shutdown`
	`Router(config-if)#exit`
	
	NOTE:
	If ever you wrongly configured something wrong just put add **no** at the command
	Ex. no ip address 192.168.0.1 255.255.255.0
		Type the following Commands to Assign IP address.
		
		interface fastEthernet 0/0 command is used to enter in interface mode.
		ip address 10.0.0.1 255.0.0.0 command will assign IP address to interface.
		no shutdown command will bring the interface up.
		exit command is used to return in global configuration mode.

Step 5	`Router#configure terminal`
	`Router(config)#interface serial 0/0/0`
	`Router(config-if)#ip address 200.0.0.1 255.255.255.0`
	`Router(config-if)#clock rate 64000`
	`Router(config-if)#no shutdown`
	`Router(config-if)#exit`
		Router#configure terminal Command is used to enter in global configuration mode.
		Router(config)#interface serial 0/0/0 Command is used to enter in interface mode.
		Router(config-if)#ip address 192.168.0.253

	Note: Only on DCE Serial Interface we assign a clock rate. We don't assign clock rate on DTE.
	`Router1#show controller se0/0/1`
	`Interface Serial0/0/1`
	`Hardware is PowerQUICC MPC860`
	`DCE V.35, clock rate 2000000`
	
	Note: You can use **show controller command** to check if the interface is DCE or DTE
		255.255.255.252 Command assigns IP address to interface. ***Router(config-if)#clock rate 64000*** In real life environment these parameters control the data flow between serial links and need to be set at service providers end. **Router(config-if)#no shutdown** Command brings interface up. **Router(config-if)#exit** Command is used to return in global configuration mode.

Router 1

	Image	Direction/Description

Step 1	`Router>enable`
	`Router#configure terminal`
	`Router(config)#interface serial 0/0/1`
	`Router(config-if)#ip address 200.0.1.1 255.255.255.0`
	`Router(config-if)#no shutdown`
	`Router(config-if)#exit`
	`Router(config)#interface serial 0/0/1`
	`Router(config-if)#ip address 200.0.1.1 255.255.255.0`
	`Router(config-if)#clock rate 64000`
	`Router(config-if)#no shutdown`
	`Router(config-if)#exit`
		Follow the steps 1 & 2, on Assigning IP address in Router 0, and perform the following commands on the left.

Router 2

	Image	Direction/Description

Step 1	`Router>enable`
	`Router#configure terminal`
	`Router(config)#interface serial 0/0/1`
	`Router(config-if)#ip address 200.0.1.2 255.255.255.0`
		Follow the steps 1 & 2, on Assigning IP address in Router 0, and perform the following commands on the left.

	Router(config-if)#no shutdown Router(config-if)#exit Router(config)#interface serial 0/0/0 Router(config-if)#ip address 200.0.2.1 255.255.255.252 Router(config-if)#clock rate 64000 Router(config-if)#no shutdown Router(config-if)#exit	

Router 3

	Image	**Direction/Description**
Step 1	Router>enable Router#configure terminal Router(config)#interface serial 0/0/0 Router(config-if)#ip address 200.0.2.2 255.255.255.0 Router(config-if)#no shutdown Router(config-if)#exit Router(config)#interface gigabitEthernet 0/1 Router(config-if)#ip address 192.168.1.1 255.255.255.0 Router(config-if)#no shutdown Router(config-if)#exit	Follow the steps 1 & 2, on Assigning IP address in Router 0, and perform the following commands on the left.

Checking the status of the routers interface

After assigning all the ip address to the interfaces. The next step is to check the status of the interfaces on each router with the command **show ip interface brief**.

As you can on the output below, the Status and Protocol of interface FastEthernet0/0 and Serial 0/0/0 are “up” this means the interface are working properly.

Do this to all routers and make sure the interfaces are “up”.

```
Router0#
Router0#show ip int brief
Interface              IP-Address      OK? Method Status                Protocol
GigabitEthernet0/0     unassigned      YES unset  administratively down down
GigabitEthernet0/1     192.168.0.1     YES manual up                    up
GigabitEthernet0/2     unassigned      YES unset  administratively down down
Serial0/0/0            200.0.0.1       YES manual up                    up
```

```
Router1#
Router1#show ip int brief
Interface              IP-Address      OK? Method Status                Protocol
GigabitEthernet0/0     unassigned      YES unset  administratively down down
GigabitEthernet0/1     unassigned      YES unset  administratively down down
GigabitEthernet0/2     unassigned      YES unset  administratively down down
Serial0/0/0            200.0.0.2       YES manual up                    up
Serial0/0/1            200.0.1.1       YES manual up                    up

Router2#
Router2#show ip int brief
Interface              IP-Address      OK? Method Status                Protocol
GigabitEthernet0/0     unassigned      YES unset  administratively down down
GigabitEthernet0/1     unassigned      YES unset  administratively down down
GigabitEthernet0/2     unassigned      YES unset  administratively down down
Serial0/0/0            200.0.2.1       YES manual up                    up
Serial0/0/1            200.0.1.2       YES manual up                    up

Router3#
Router3#show ip int brief
Interface              IP-Address      OK? Method Status                Protocol
GigabitEthernet0/0     unassigned      YES unset  administratively down down
GigabitEthernet0/1     192.168.1.1     YES manual up                    up
GigabitEthernet0/2     unassigned      YES unset  administratively down down
Serial0/0/0            200.0.2.2       YES manual up                    up
Serial0/0/1            unassigned      YES unset  administratively down down
```

Configuring Static Route

To configure static routes with a next-hop specified, use the following syntax:

```
Router(config)# ip route network-address subnet-mask ip-address
```

network-address:—Destination network address of the remote network to be added to the routing table.

subnet-mask—Subnet mask of the remote network to be added to the routing table. The subnet mask can be modified to summarize a group of networks.

ip-address—Commonly referred to as the next-hop router's IP address.

Router0

On the R0 router, configure a static route to the 192.168.1.0 network using the Serial 0/0/0 interface of R1 as the next-hop address.

```
Router(config)#ip route 192.168.1.0 255.255.255.0 200.0.0.2
```

This command instructs router that when you receive a packet for 192.168.1.0 network give it to 200.0.0.2. Network 192.168.0.0 is directly connected so we do not need to configure it here.

Router1

On the R1 router, configure a static route to the 192.168.0.0 network using the Serial 0/0/0 interface of R0 as the next-hop address. We also need to configure a static route to the 192.168..0.1.0 network using the Serial 0/0/1 interface of R2 as the next-hop address.

```
Router(config)#ip route 192.168.0.0 255.255.255.0 200.0.0.1
Router(config)#ip route 192.168.1.0 255.255.255.0 200.0.1.2
```

On this router both networks are reachable via other routers so we need to configure route for both networks 192.168.0.0 and 192.168.1.0

Router2

On the R2 router, configure a static route to the 192.168.0.0 network using the Serial 0/0/1 interface of R1 as the next-hop address. We also need to configure a static route to the 192.168.1.0 network using the Serial 0/0/0 interface of R3 as the next-hop address.

```
Router(config)#ip route 192.168.0.0 255.255.255.0 200.0.1.1
Router(config)#ip route 192.168.1.0 255.255.255.0 200.0.2.2
```

Same as Router1 again we need configure route for both networks on this router.

Router3

On the R3 router, configure a static route to the 192.168.0.0 network using the Serial 0/0/0 interface of R2 as the next-hop address.

```
Router(config)#ip route 192.168.0.0 255.255.255.0 200.0.2.1
```

Network 192.168.1.0 is directly connected so we only need to configure network 10.0.0.0 on this router.

NOTE:

If ever you wrongly configured something wrong just put add **no** at the command

Ex. no ip route 192.168.0.0 255.255.255.0 200.0.0.1

Checking static routers

After configuring all the static routes on the router. The next step is to check if the static routes are configured you can use the command **show ip route.**

C-stands for connected networks to the router.

L-stands for local interfaces in the network

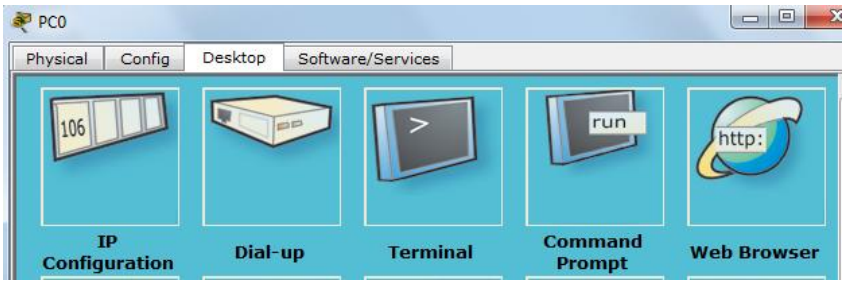
S-stand for statically configured routes

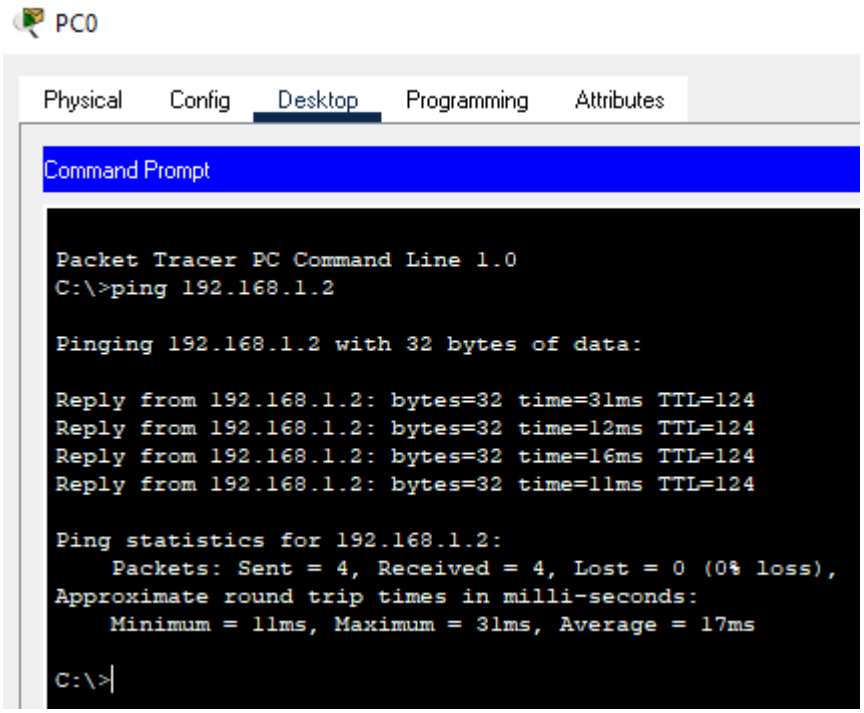
```
Router0#show ip route
Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
       i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
       * - candidate default, U - per-user static route, o - ODR
       P - periodic downloaded static route

Gateway of last resort is not set

     192.168.0.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.0.0/24 is directly connected, GigabitEthernet0/1
L       192.168.0.1/32 is directly connected, GigabitEthernet0/1
S    192.168.1.0/24 [1/0] via 200.0.0.2
     200.0.0.0/24 is variably subnetted, 2 subnets, 2 masks
C       200.0.0.0/24 is directly connected, Serial0/0/0
L       200.0.0.1/32 is directly connected, Serial0/0/0

Router1#show ip route
Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
       i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
       * - candidate default, U - per-user static route, o - ODR
       P - periodic downloaded static route

Gateway of last resort is not set

S    192.168.0.0/24 [1/0] via 200.0.0.1
S    192.168.1.0/24 [1/0] via 200.0.1.2
     200.0.0.0/24 is variably subnetted, 2 subnets, 2 masks
C       200.0.0.0/24 is directly connected, Serial0/0/0
L       200.0.0.2/32 is directly connected, Serial0/0/0
     200.0.1.0/24 is variably subnetted, 2 subnets, 2 masks
C       200.0.1.0/24 is directly connected, Serial0/0/1
L       200.0.1.1/32 is directly connected, Serial0/0/1

Router2#show ip route
Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
       i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
       * - candidate default, U - per-user static route, o - ODR
       P - periodic downloaded static route

Gateway of last resort is not set

S    192.168.0.0/24 [1/0] via 200.0.1.1
S    192.168.1.0/24 [1/0] via 200.0.2.2
     200.0.1.0/24 is variably subnetted, 2 subnets, 2 masks
C       200.0.1.0/24 is directly connected, Serial0/0/1
L       200.0.1.2/32 is directly connected, Serial0/0/1
     200.0.2.0/24 is variably subnetted, 2 subnets, 2 masks
C       200.0.2.0/24 is directly connected, Serial0/0/0
L       200.0.2.1/32 is directly connected, Serial0/0/0
```

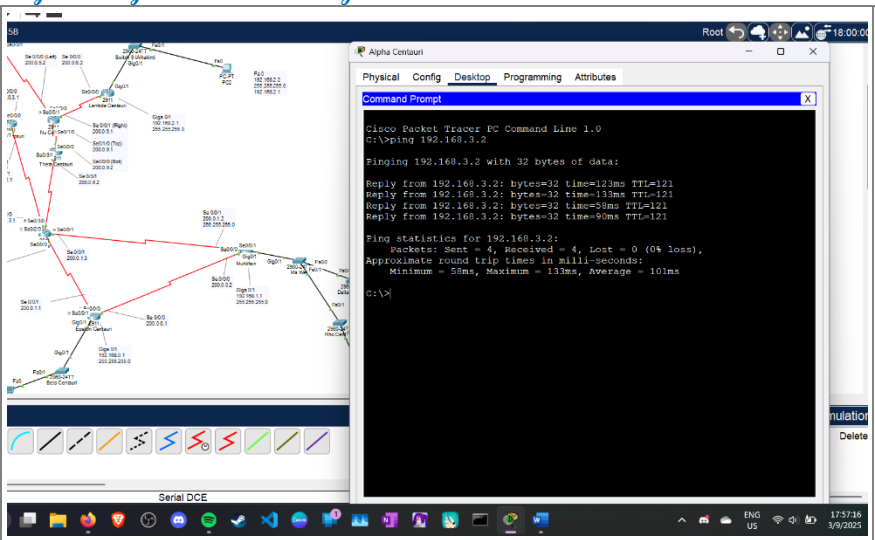
```
Router3#show ip route
Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
       i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
       * - candidate default, U - per-user static route, o - ODR
       P - periodic downloaded static route

Gateway of last resort is not set

S    192.168.0.0/24 [1/0] via 200.0.2.1
     192.168.1.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.1.0/24 is directly connected, GigabitEthernet0/1
L       192.168.1.1/32 is directly connected, GigabitEthernet0/1
     200.0.2.0/24 is variably subnetted, 2 subnets, 2 masks
C       200.0.2.0/24 is directly connected, Serial0/0/0
L       200.0.2.2/32 is directly connected, Serial0/0/0
```

Verifying Connections

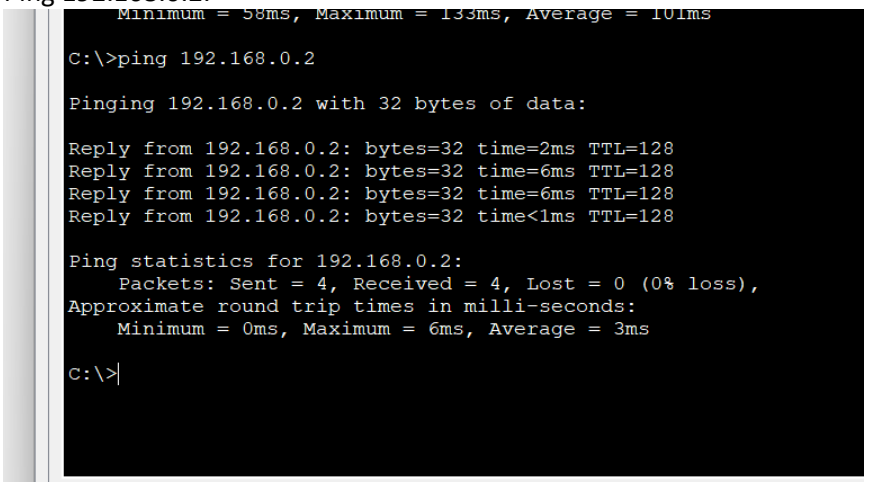
To verify the result we can use *ping* command. Access the command prompt of PC0 and use *ping* command to test the connectivity from PC1.

	Image	Direction
Step 1		Double Click the PC
Step 2		Select the Desktop Tab and Click the Command Prompt
Step 3		Type ping 192.168.1.2

		
Step 4		Repeat Steps 1-3 for PC1 and use the address 192.168.0.2



Ping 192.168.0.2:



Default Static Route

A default static route is a route that matches all packets. A default route identifies the gateway IP address to which the router sends all IP packets that it does not have a learned or static route for. A default static route is simply a static route with 0.0.0.0/0 as the destination IPv4 address. Configuring a default static route creates a Gateway of Last Resort.

Default static routes are used:

- When no other routes in the routing table match the packet destination IP address. In other words, when a more specific match does not exist. A common use is when connecting a company's edge router to the ISP network.
- When a router has only one other router to which it is connected. This condition is known as a stub router.

Configuring Default Static Route

Since R0 and R3 are considered to be stub router, we can configure a default static route for all packets leaving the router.

To configure default static routes with a next-hop specified, use the following syntax:

```
Router(config)# ip route 0.0.0.0 0.0.0.0 ip-address
```

network-address(0.0.0.0) and subnet-mask(0.0.0.0): if both network address and subnet mask are both 0.0.0.0 it means that "packets from any IP address with any subnet mask are sent the next hop addres"

ip-address—Commonly referred to as the next-hop router's IP address

Router0

On the R0 router, configure a default static route with network address of 0.0.0.0 and subnet mask of 0.0.0.0 using the Serial 0/0/0 interface of R1 as the next-hop address.

```
Router(config)#ip route 0.0.0.0 0.0.0.0 200.0.0.2
```

Router3

On the R3 router, configure a default static route with network address of 0.0.0.0 and subnet mask of 0.0.0.0 using the Serial 0/0/0 interface of R2 as the next-hop address.

```
Router(config)#ip route 0.0.0.0 0.0.0.0 200.0.2.1
```

Checking default static routers

After configuring all the static routes on the router. The next step is to check if the static routes are configured you can use the command **show ip route.**

***S**-stand for default statically configured routes

```
Router(config)#do show ip route
Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
       i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
       * - candidate default, U - per-user static route, o - ODR
       P - periodic downloaded static route

Gateway of last resort is 200.0.0.2 to network 0.0.0.0

     192.168.0.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.0.0/24 is directly connected, GigabitEthernet0/1
L       192.168.0.1/32 is directly connected, GigabitEthernet0/1
S    192.168.1.0/24 [1/0] via 200.0.0.2
     200.0.0.0/24 is variably subnetted, 2 subnets, 2 masks
C       200.0.0.0/24 is directly connected, Serial0/0/0
L       200.0.0.1/32 is directly connected, Serial0/0/0
S*   0.0.0.0/0 [1/0] via 200.0.0.2
```

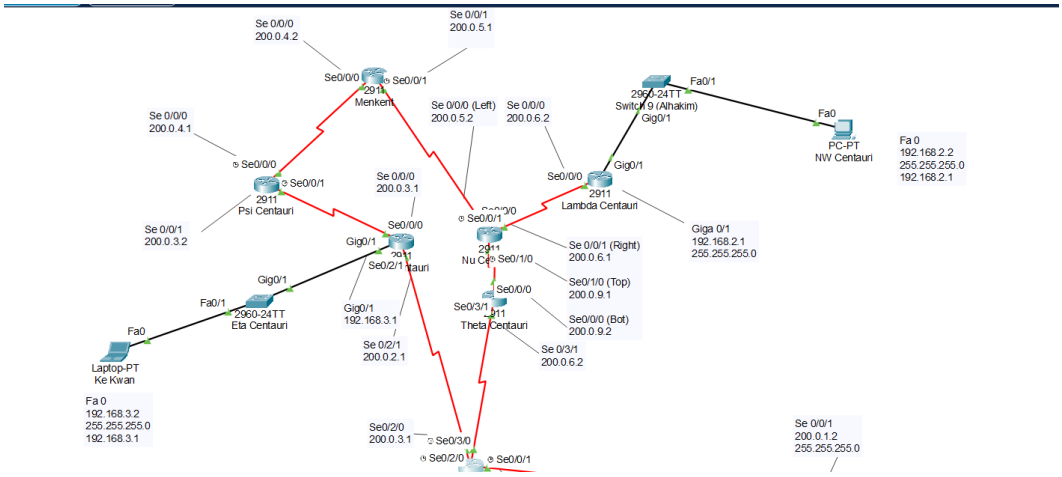
Conclusion: (discuss what you learn in this activity)

During this lab, I built a network topology inspired by the Centaurus constellation and learned how to cable devices according to a specified diagram. Although it was challenging at first, I enjoyed the hands-on experience of configuring and activating both Serial and Ethernet interfaces on multiple routers. By using intermediate addresses to set up static routes, I came to appreciate how each router needs proper path information to forward packets successfully. Finally, testing connectivity between PCs with tools like ping helped verify that my configuration was correct and that end-to-end communication worked as intended.

Overall, this exercise reinforced the importance of systematic planning, accurate IP addressing, and clear routing instructions. I also gained confidence in troubleshooting issues such as missing routes or misconfigured interfaces that can disrupt network communication. By walking through each objective step by step, I now have a stronger foundation in router setup, static routing, and basic network verification techniques, all of which are crucial for designing and maintaining reliable networks.

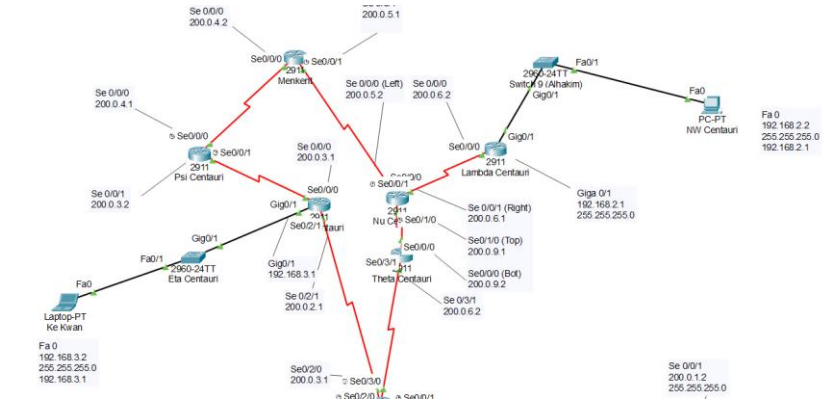
Additional Activity

1. Modify the network by adding a new network (router, PC and switch) on Router.



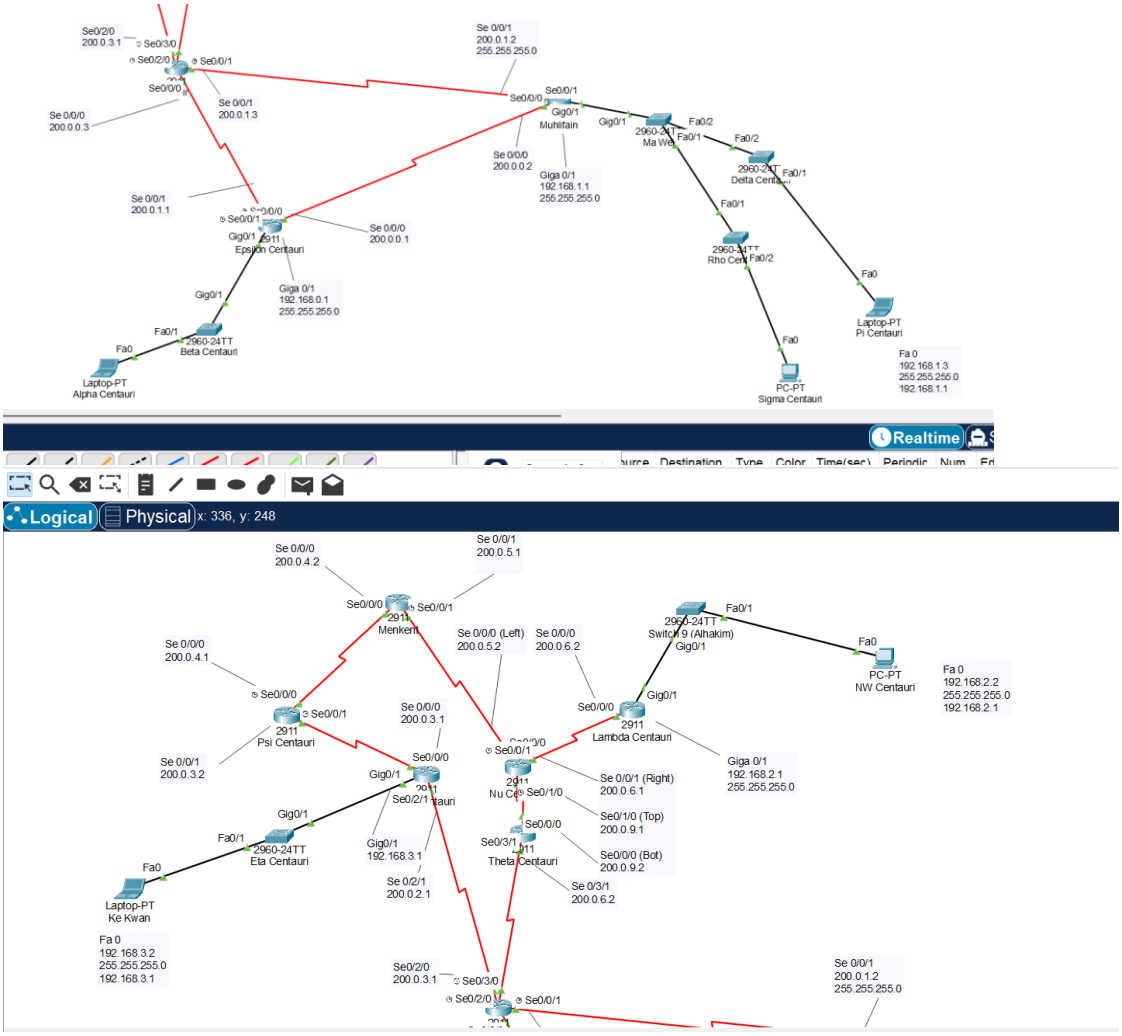
2. Add an edge network and configure Default Static Route.

   Edge network are: **Alpha Centauri (Laptop-PT)**, **Pi Centauri (Laptop-PT)**, **Sigma Centauri (PC-PT), Ke Kwan (Laptop-PT), & NW Centauri (PC-PT)**



3. Add a backup static route.

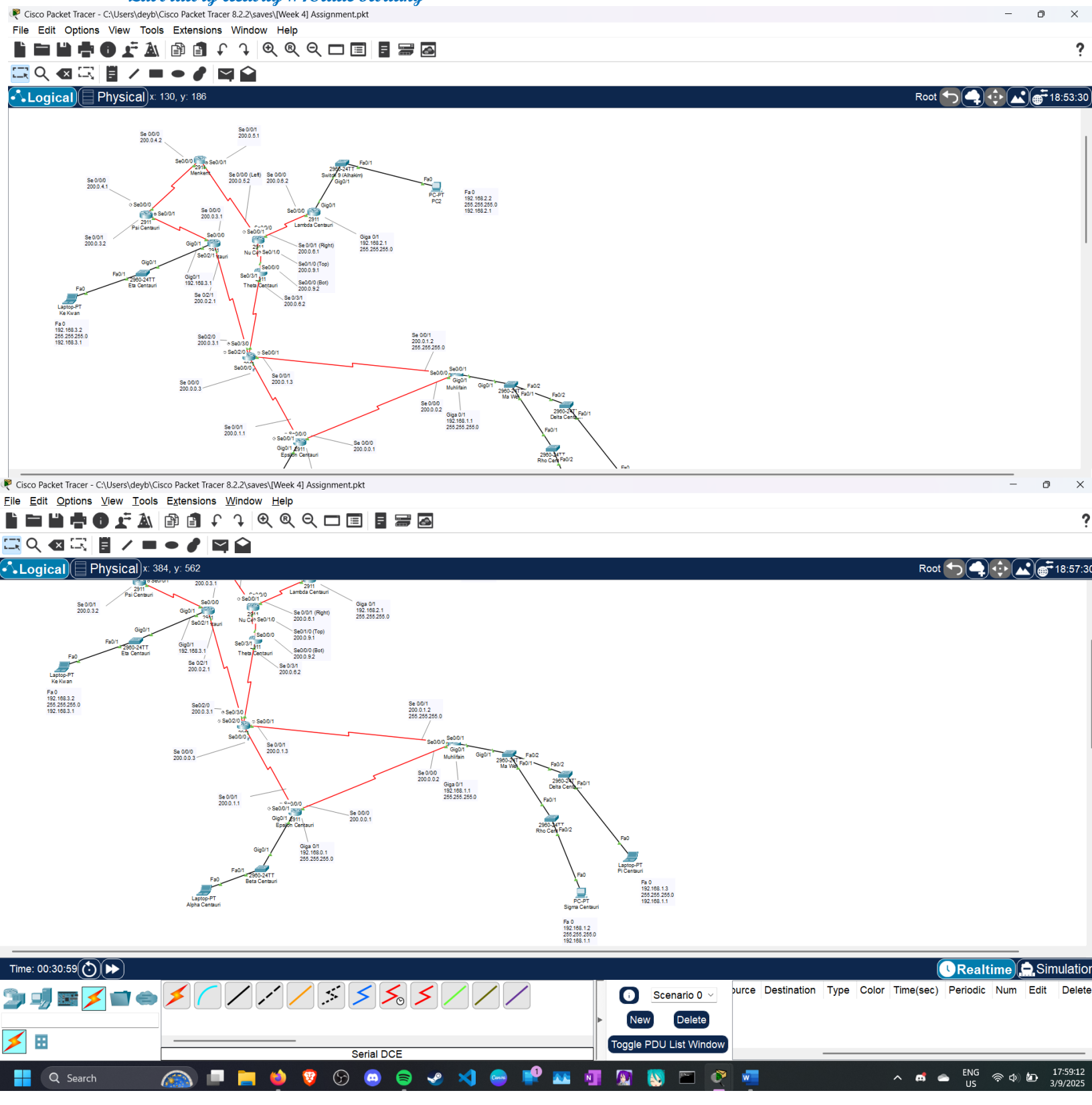
- Backup Static routes are Epsilon Centauri, Muhlifain Centauri, Alnair Centauri, Theta Centauri, Nu Centauri, Psi and Menkent Centauri.



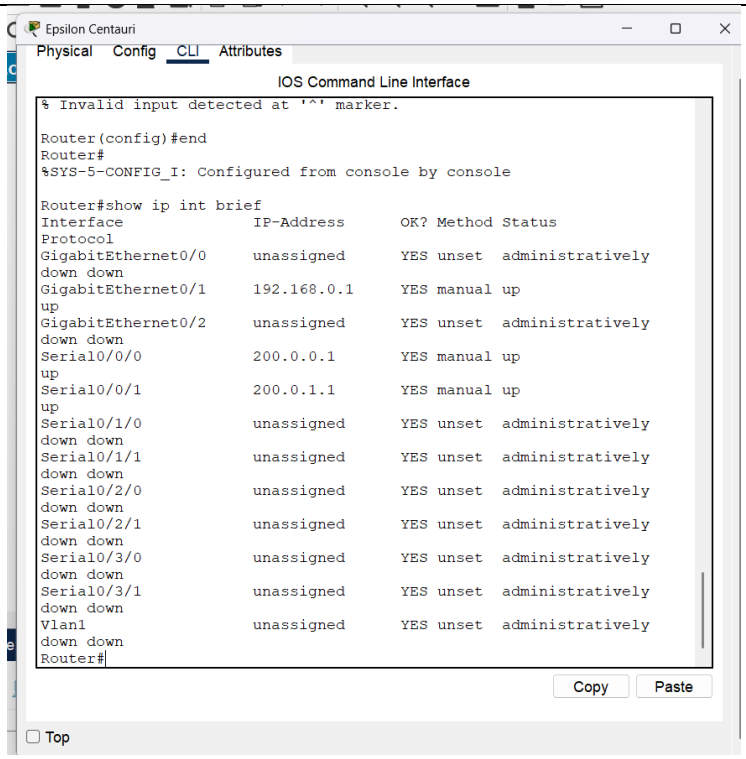
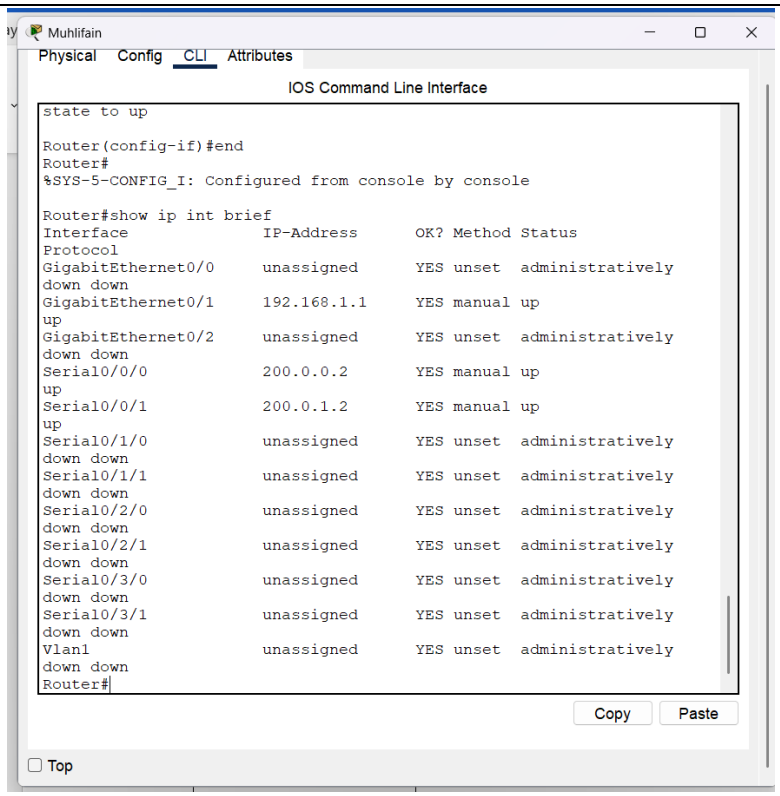
Screenshot

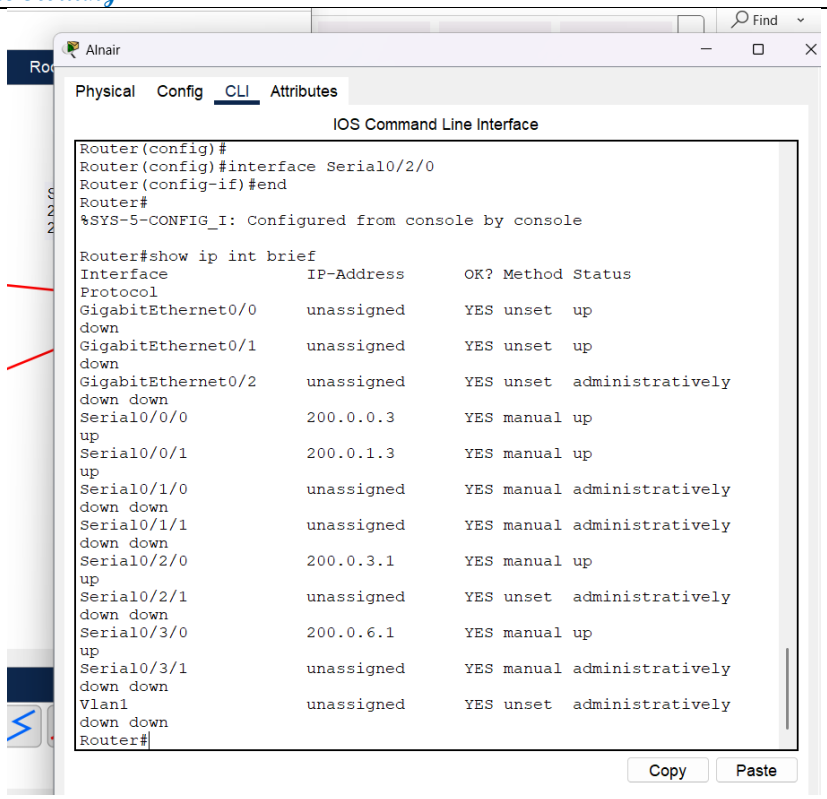
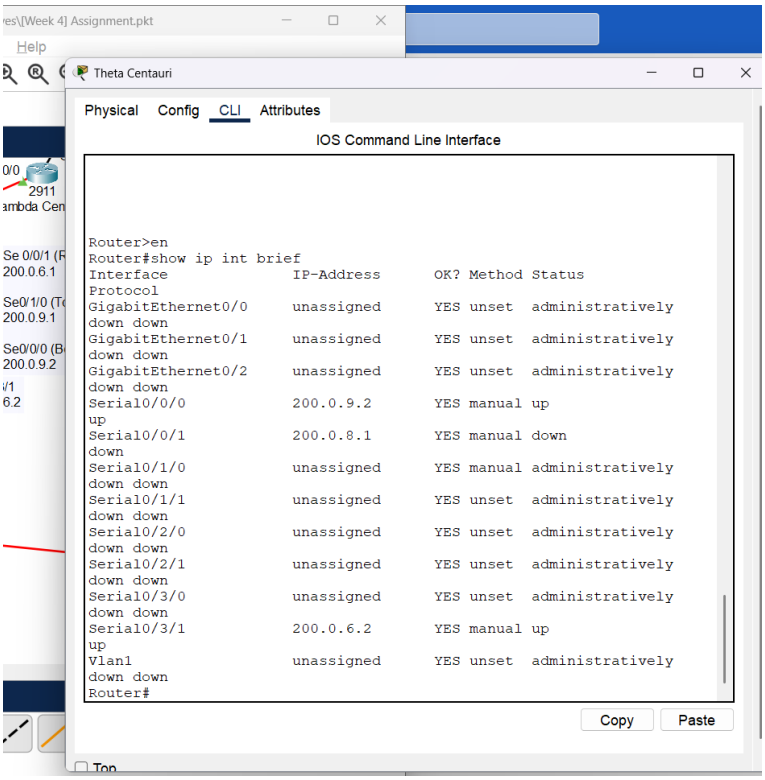
Insert Screenshot of the following in the modified network

a. Network Setup

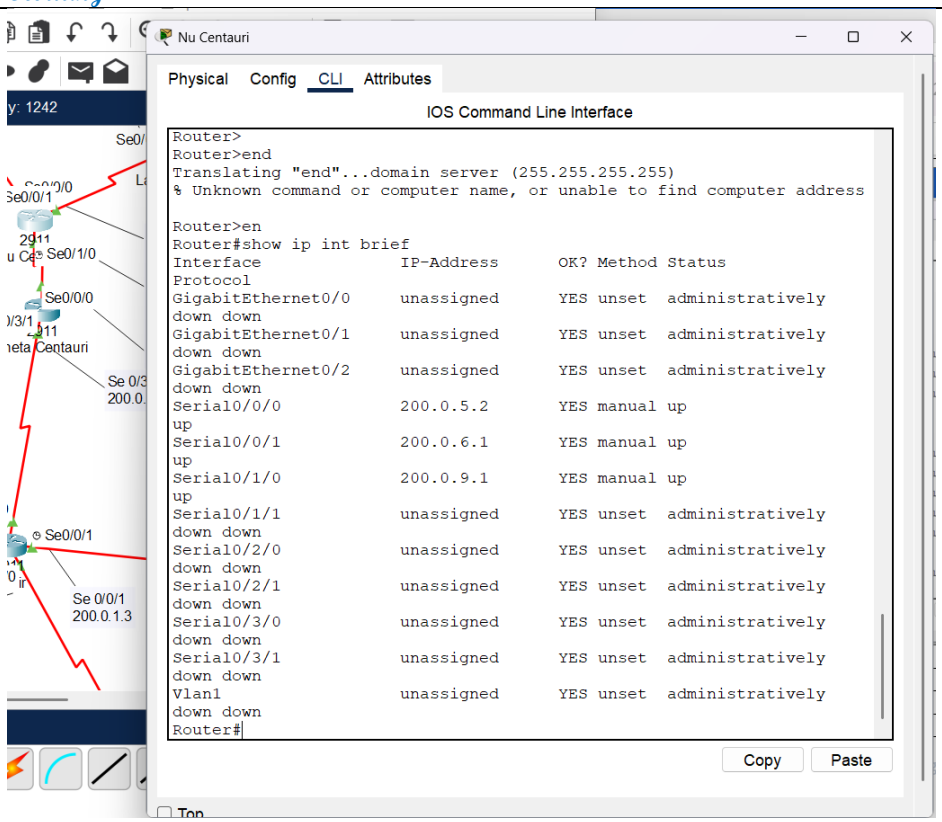


b. IP address configuration of each in interface (use show ip int brief) on each router

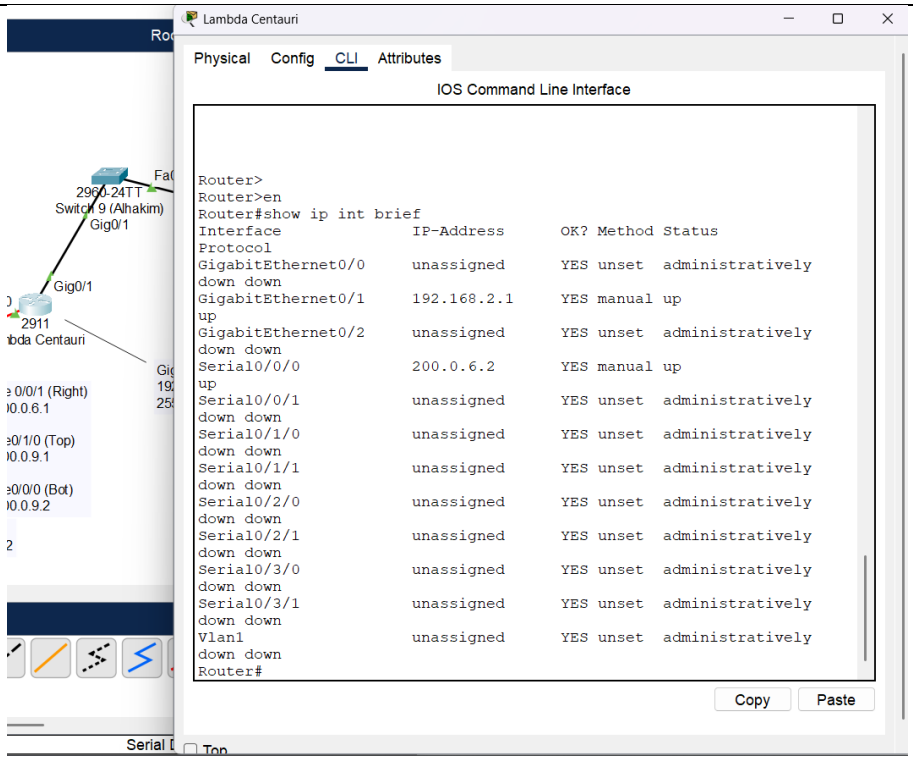
Epison Centauri	
Muhlifain Centauri	

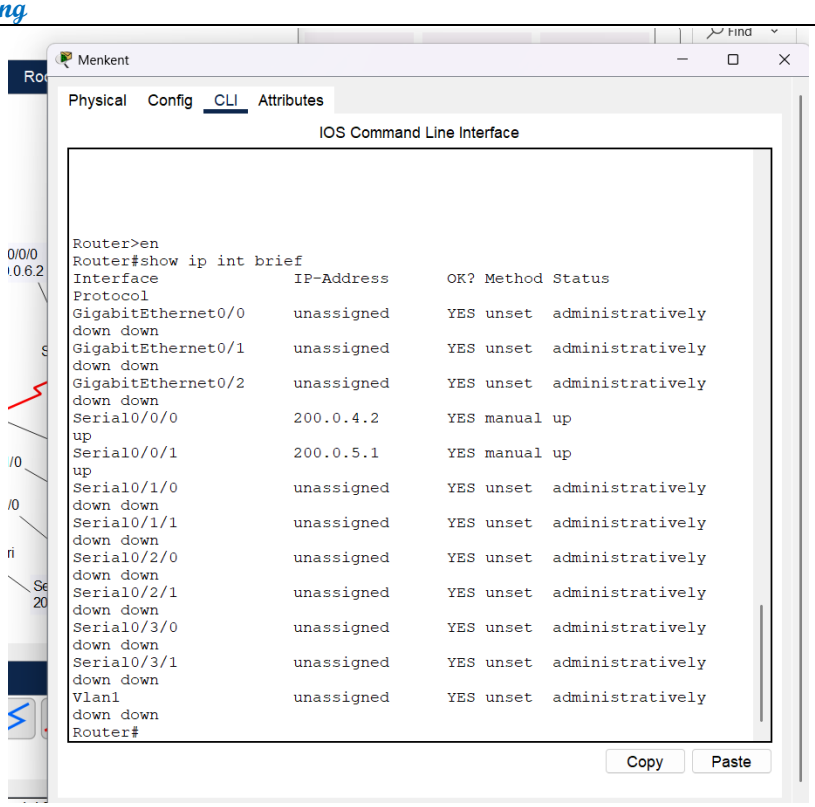
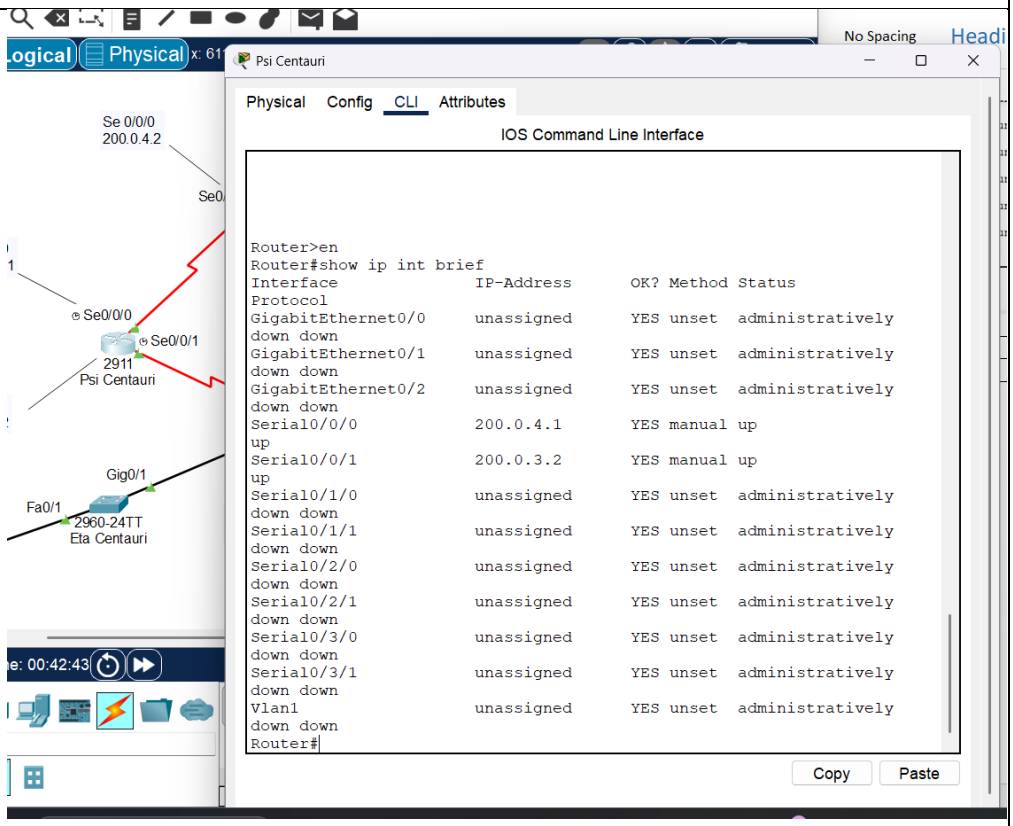
Alnair Centauri	
Theta Centauri	

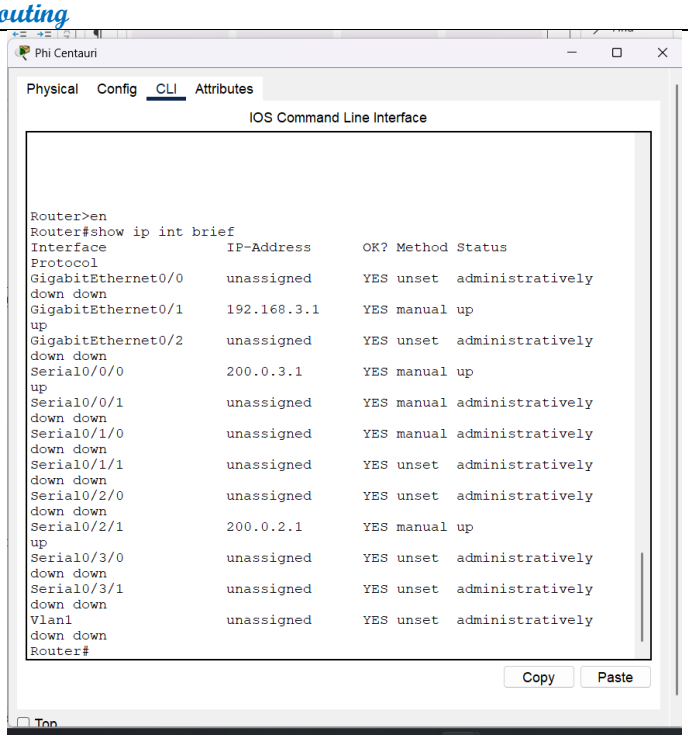
Nu Centauri



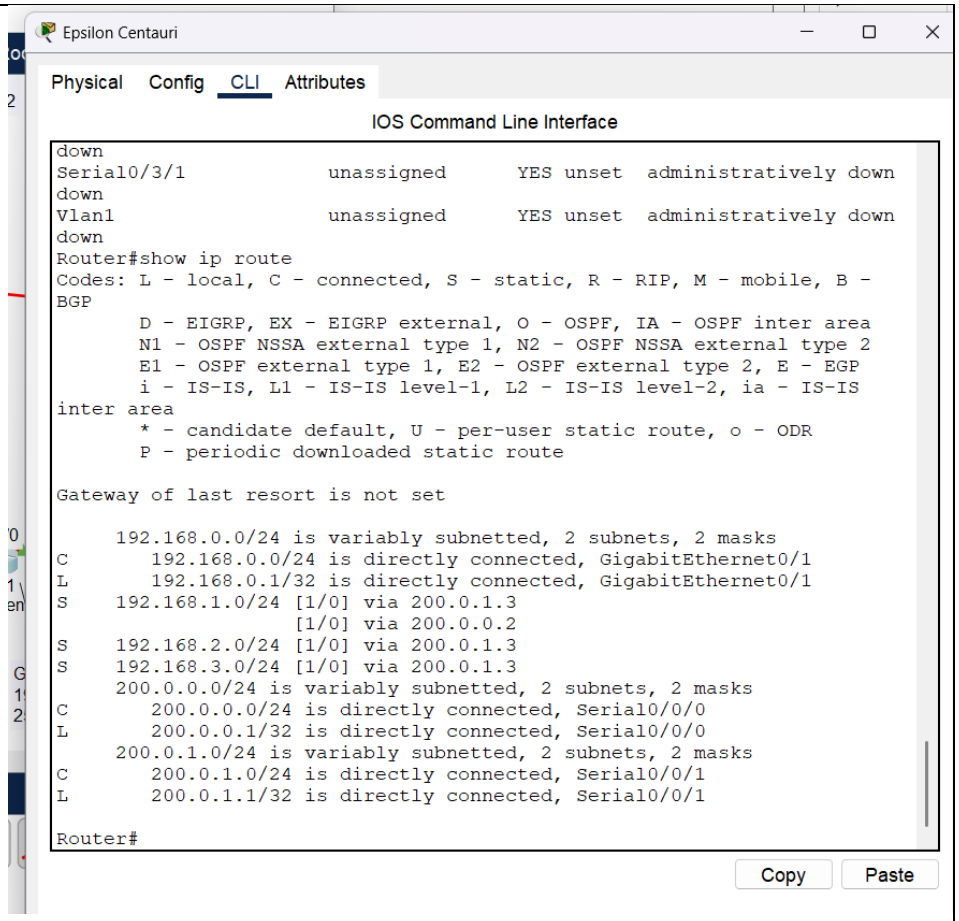
Lambda Centauri

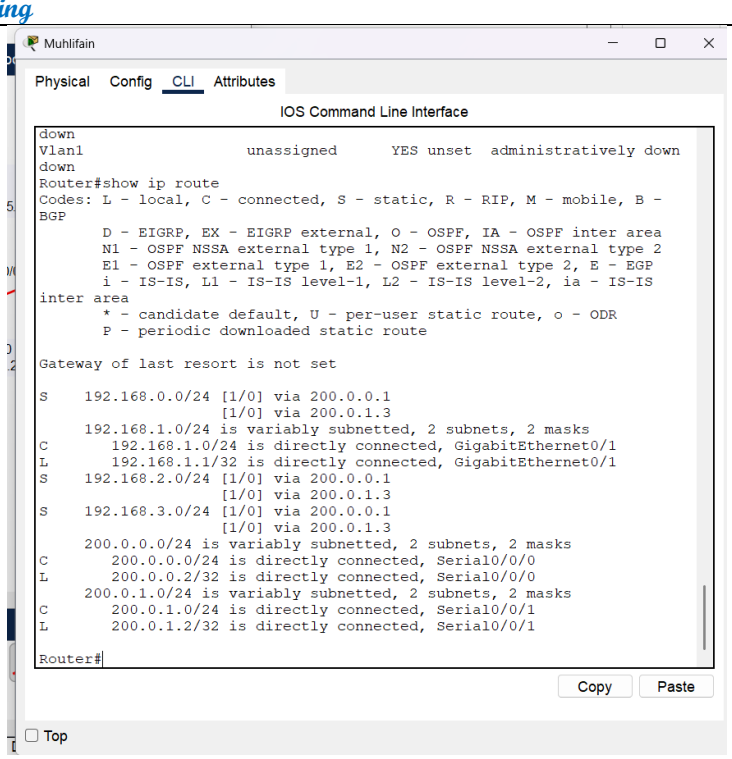
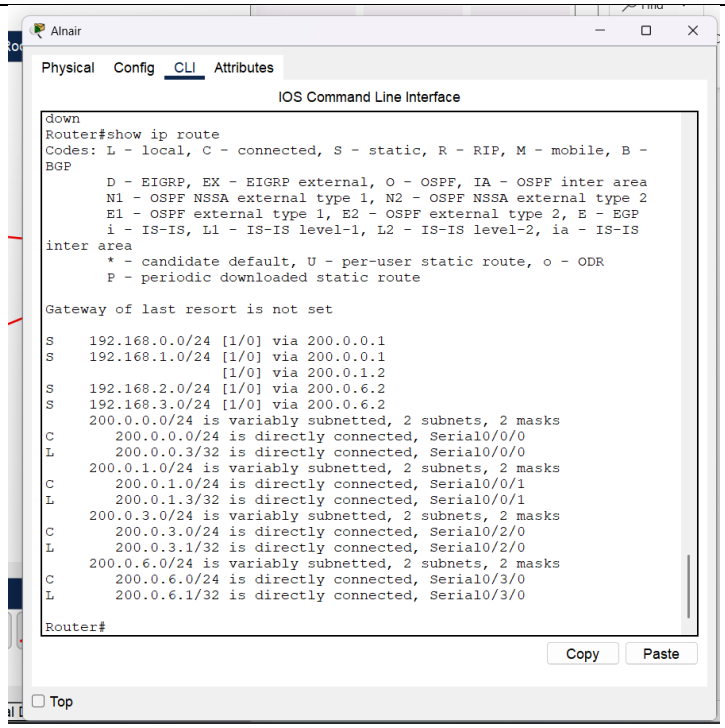


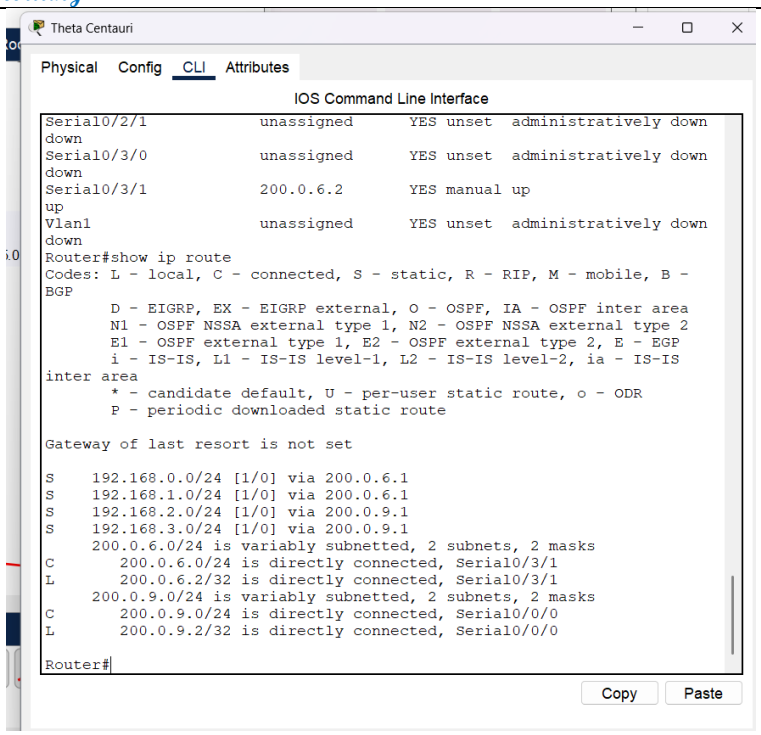
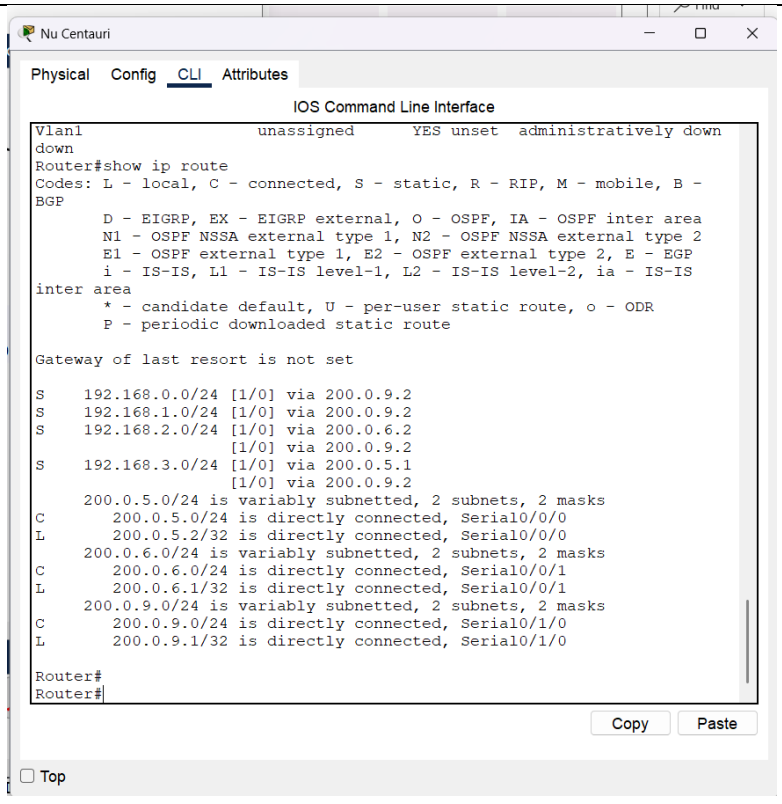
Menkent Centauri	
Psi Centauri	

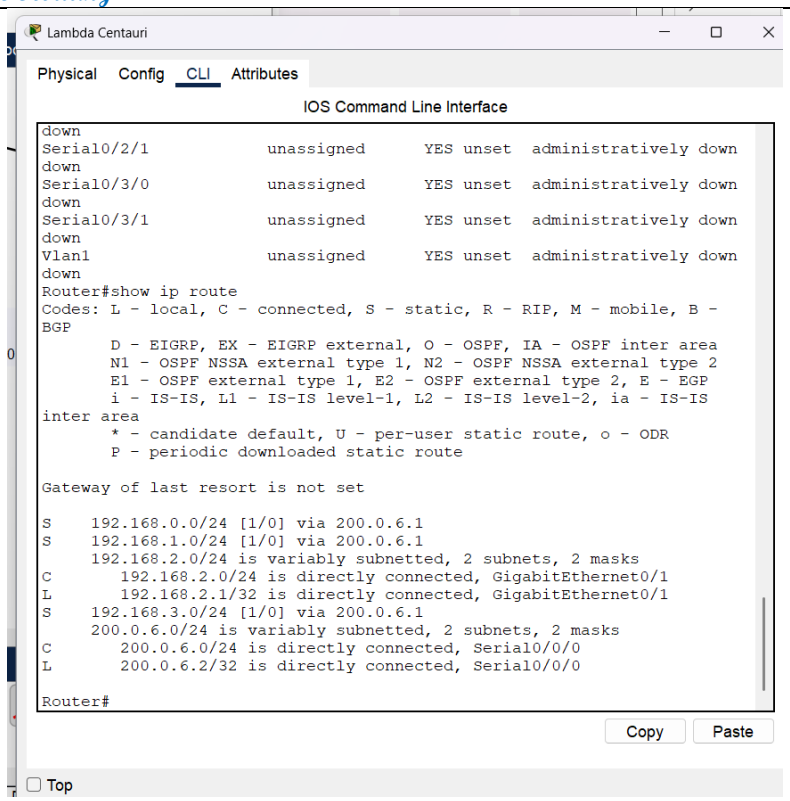
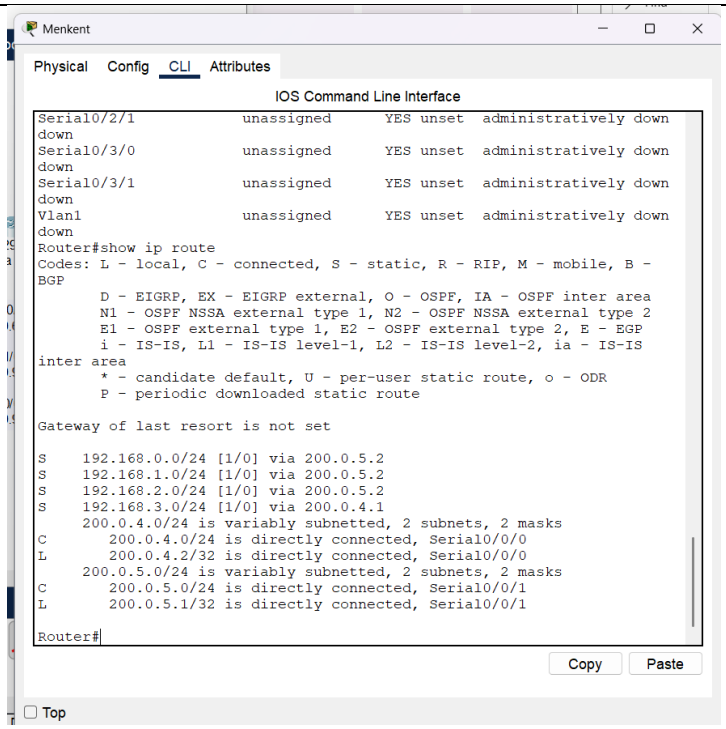
Phi Centauri	

c. Show each static routing configuration (use show ip route) on each router

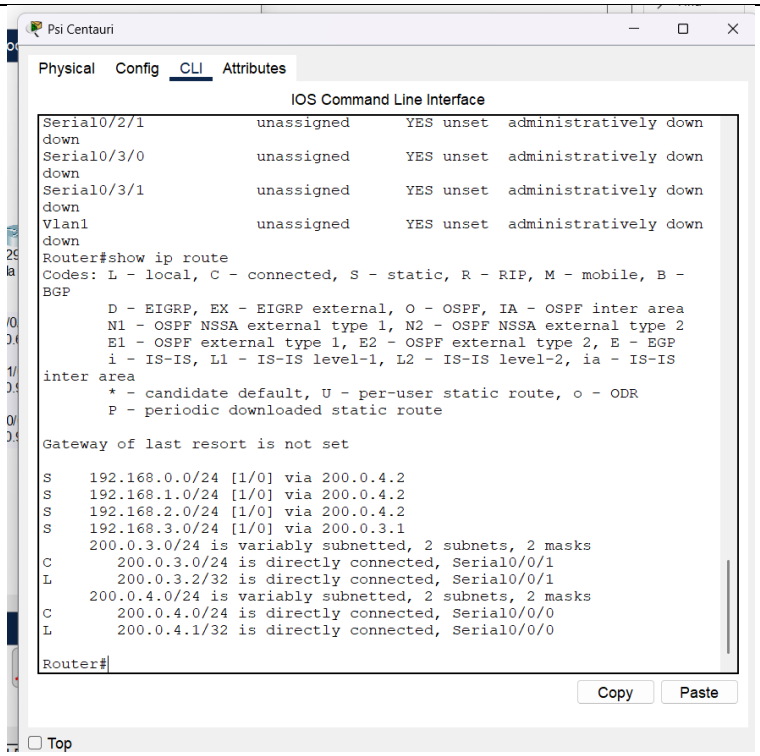
Epison Centauri	

Muhlifain Centauri	
Alnair Centauri	

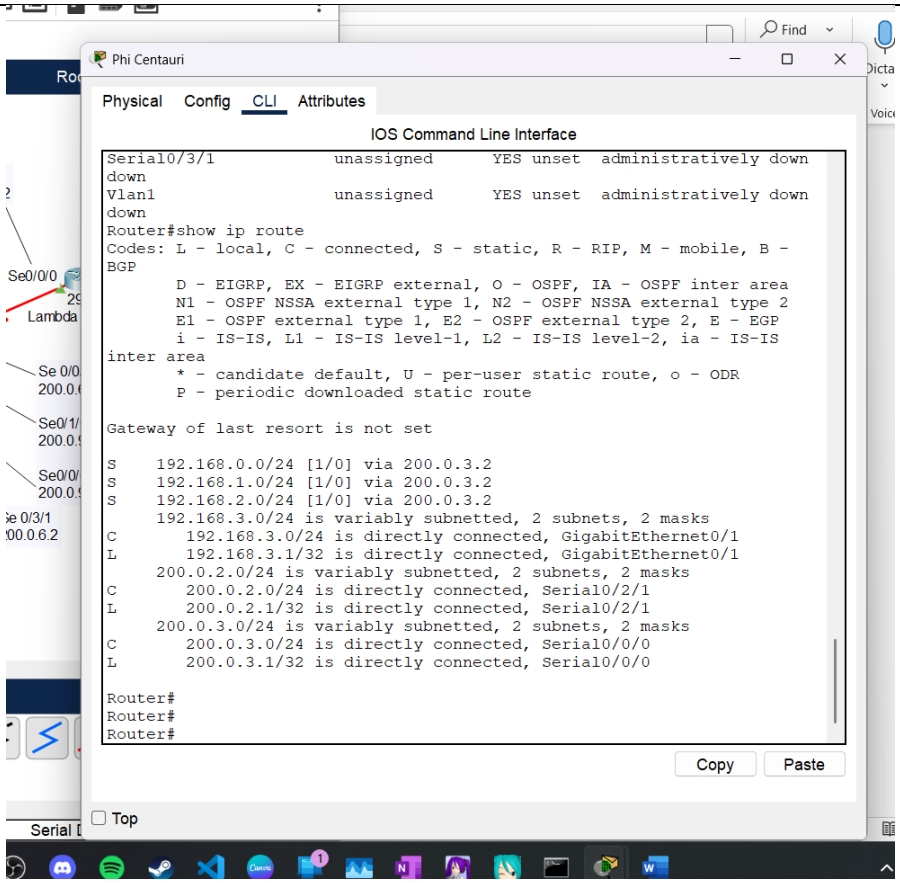
Theta Centauri	
Nu Centauri	

Lambda Centauri	
Menkent Centauri	

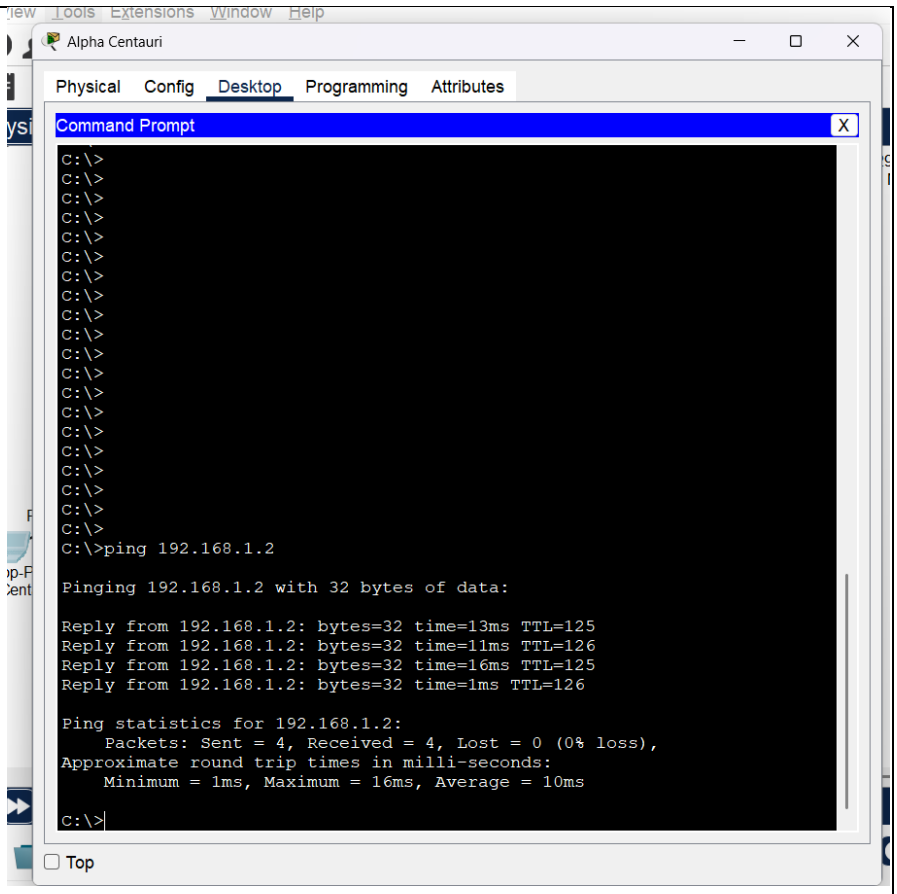
Psi Centauri

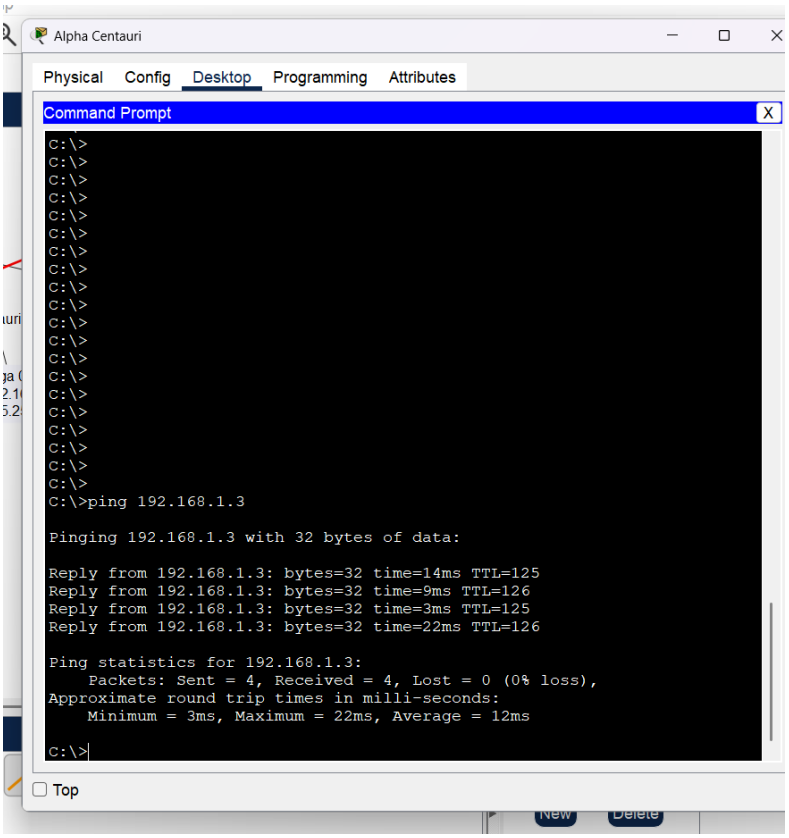
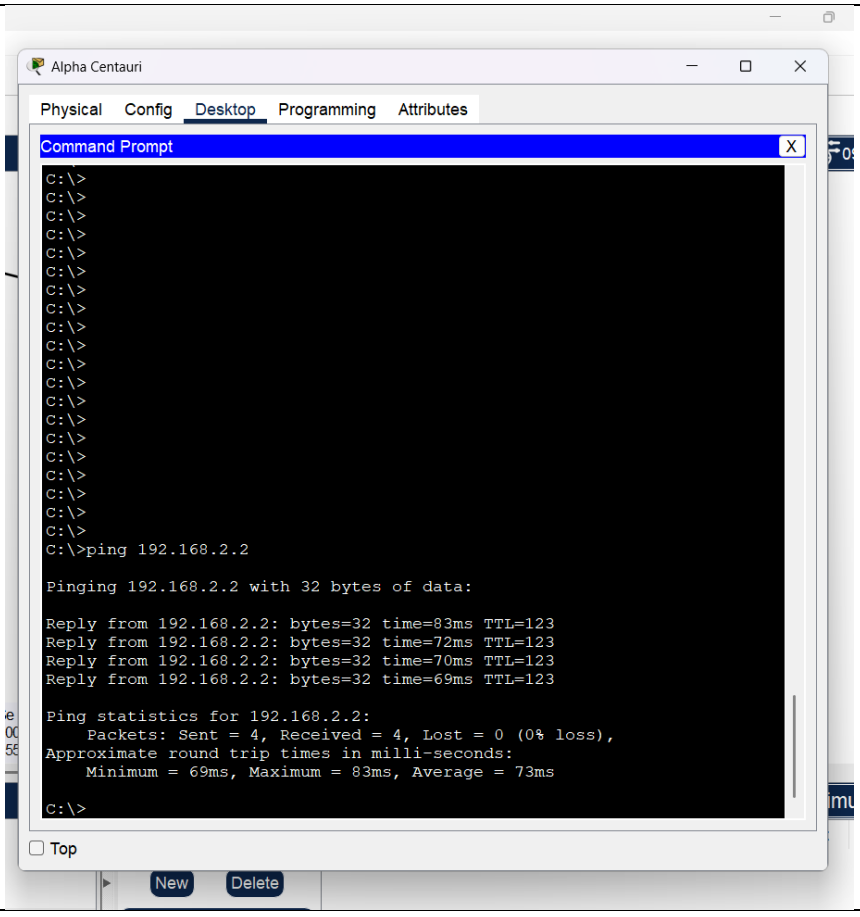
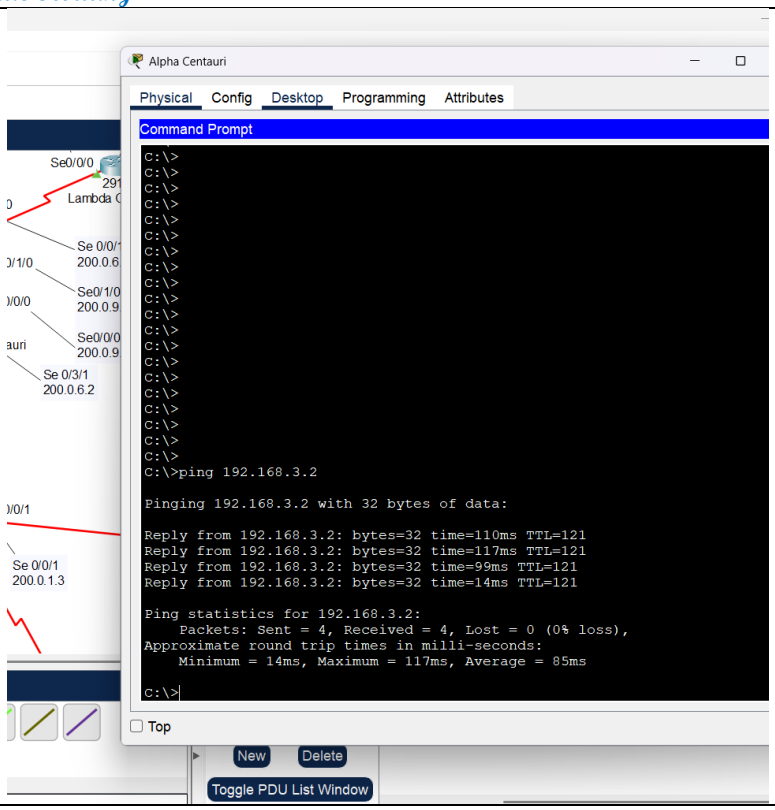


Phi Centauri



d. Show the ping / "success" connection between PC's

Laptop-PT (Alpha Centauri) **&** PC-PT (Sigma Centauri)	

Laptop-PT (Alpha Centauri) **&** Laptop-PT (Pi Centauri)	
Laptop-PT (Alpha Centauri) **&** PC-PT (NW Centauri)	

Laptop-PT (Alpha Centauri) **&** Laptop-PT (Ke Kwan)