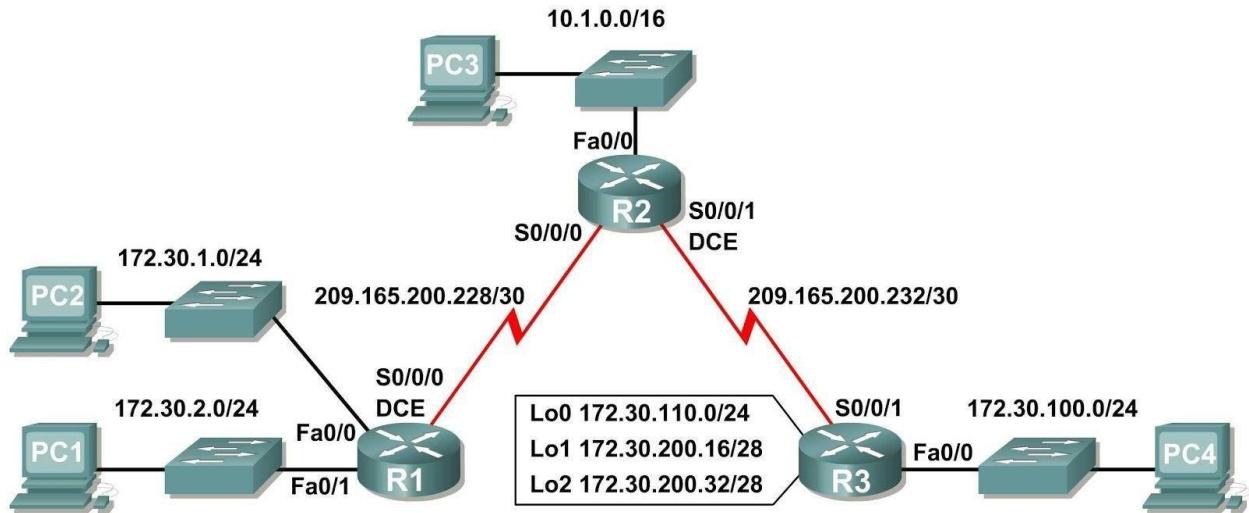


# CEL 51, DCCN, Monsoon 2020

## Lab 7: RIPv2 Router Configuration

### Topology Diagram



**Addressing Table**

Device	Interface	IP Address	Subnet Mask	Default Gateway
R1	<b>Fa0/0</b>	172.30.1.1	255.255.255.0	N/A
	<b>Fa0/1</b>	172.30.2.1	255.255.255.0	N/A
	<b>S0/0/0</b>	209.165.200.230	255.255.255.252	N/A
R2	<b>Fa0/0</b>	10.1.0.1	255.255.0.0	N/A
	<b>S0/0/0</b>	209.165.200.229	255.255.255.252	N/A
	<b>S0/0/1</b>	209.165.200.233	255.255.255.252	N/A
R3	<b>Fa0/0</b>	172.30.100.1	255.255.255.0	N/A
	<b>S0/0/1</b>	209.165.200.234	255.255.255.252	N/A
	<b>Lo0</b>	172.30.110.1	255.255.255.0	N/A
	<b>Lo1</b>	172.30.200.17	255.255.255.240	N/A
	<b>Lo2</b>	172.30.200.33	255.255.255.240	N/A
PC1	NIC	172.30.2.10	255.255.255.0	172.30.2.1

<b>PC2</b>	<b>NIC</b>	172.30.1.10	255.255.255.0	172.30.1.1
<b>PC3</b>	<b>NIC</b>	10.1.0.10	255.255.0.0	10.1.0.1
<b>PC4</b>	<b>NIC</b>	172.30.100.10	255.255.255.0	172.30.100.1

## Learning Objectives

Upon completion of this lab, you will be able to:

- Cable a network according to the Topology Diagram.
- Load provided scripts onto the routers.
- Examine the current status of the network.
- Configure RIPv2 on all routers.
- Examine the automatic summarization of routes.
- Examine routing updates with **debug ip rip**.
- Disable automatic summarization.
- Examine the routing tables.
- Verify network connectivity.
- Document the RIPv2 configuration.

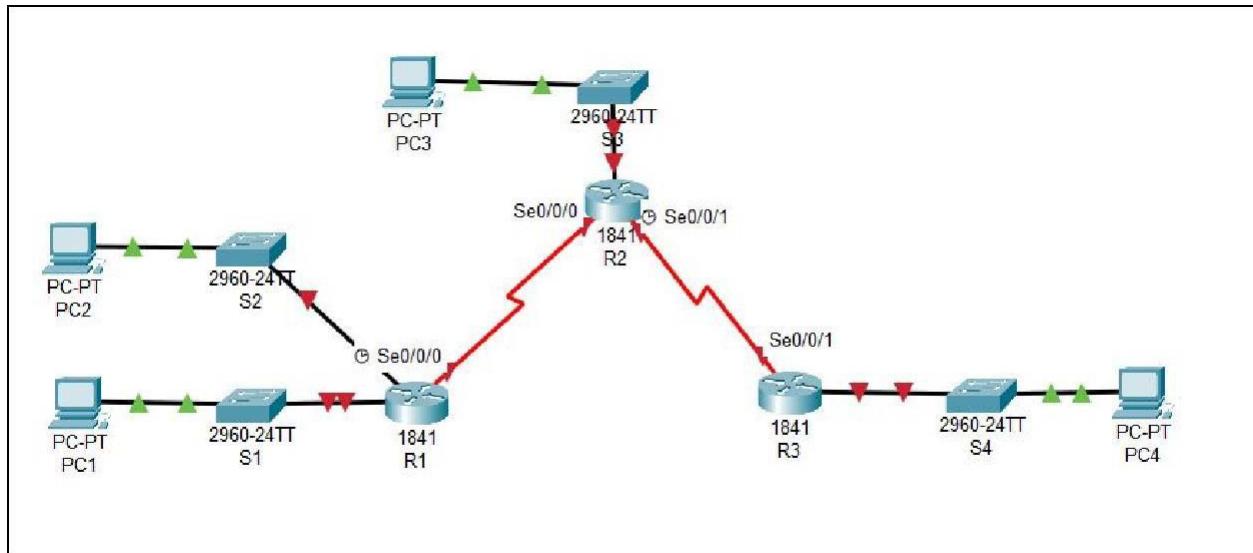
## Scenario

The network shown in the Topology Diagram contains a discontiguous network, 172.30.0.0. This network has been subnetted using VLSM. The 172.30.0.0 subnets are physically and logically divided by at least one other classful or major network, in this case the two serial networks 209.165.200.228/30 and 209.165.200.232/30. This can be an issue when the routing protocol used does not include enough information to distinguish the individual subnets. RIPv2 is a classless routing protocol that can be used to provide subnet mask information in the routing updates. This will allow VLSM subnet information to be propagated throughout the network.

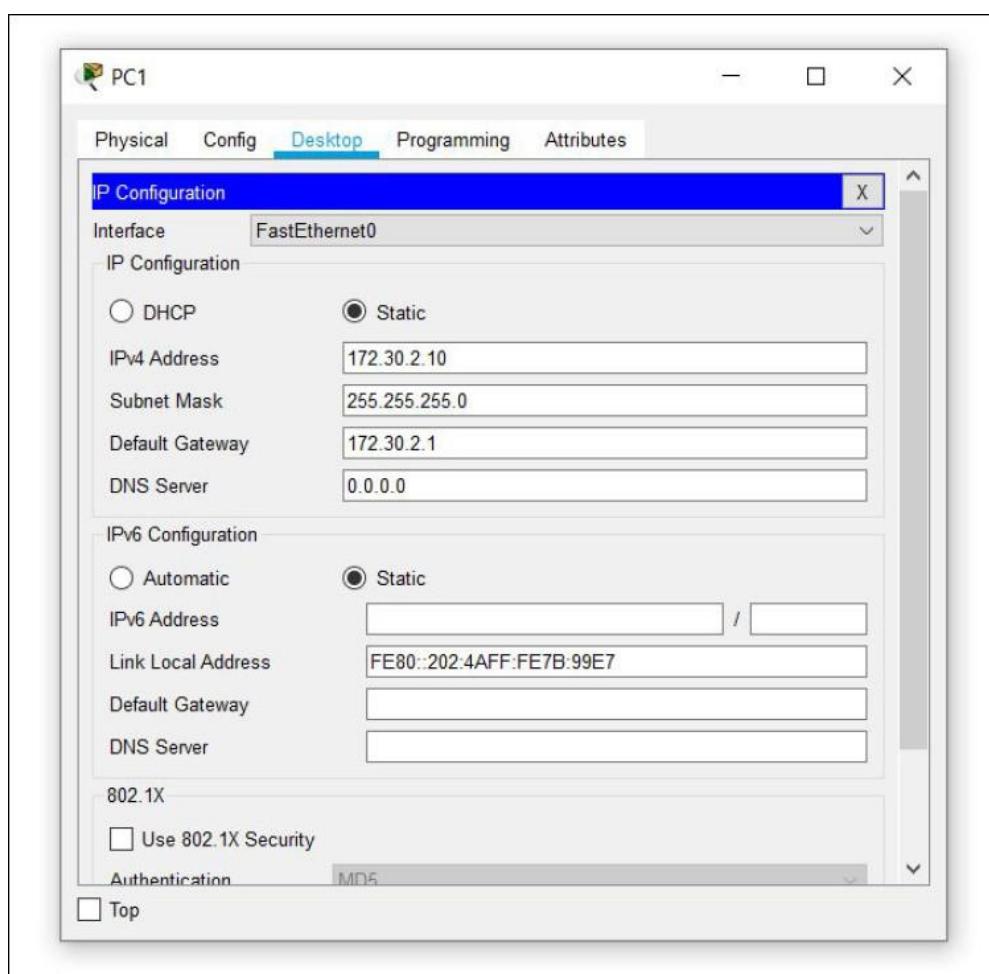
### Task 1: Cable, Erase, and Reload the Routers.

#### Step 1: Cable a network.

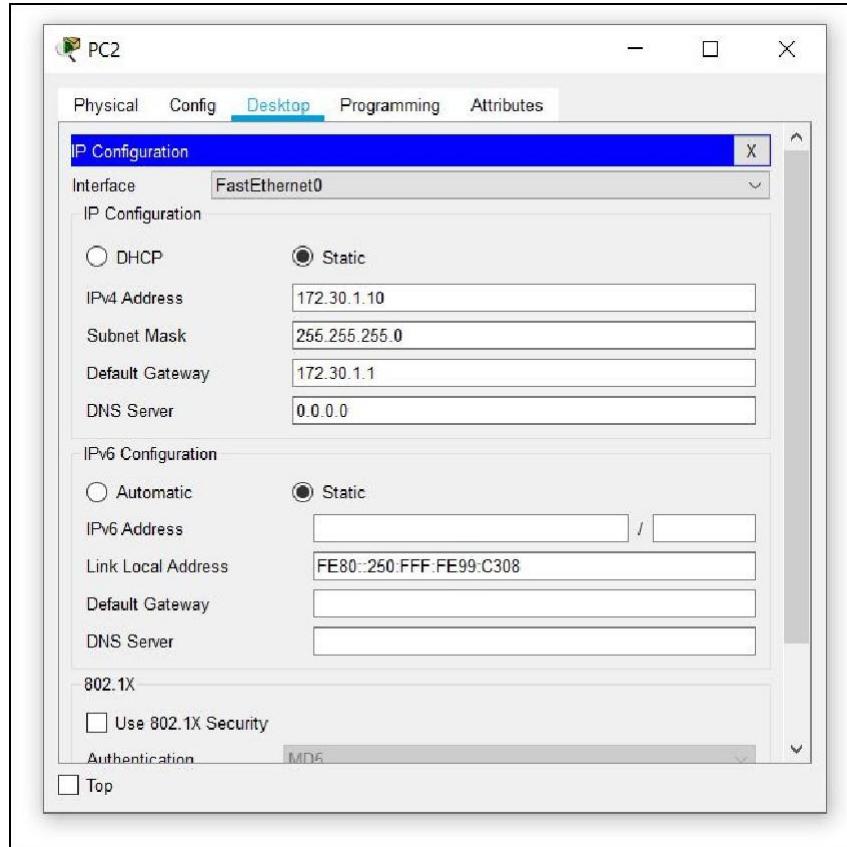
Cable a network that is similar to the one in the Topology Diagram.



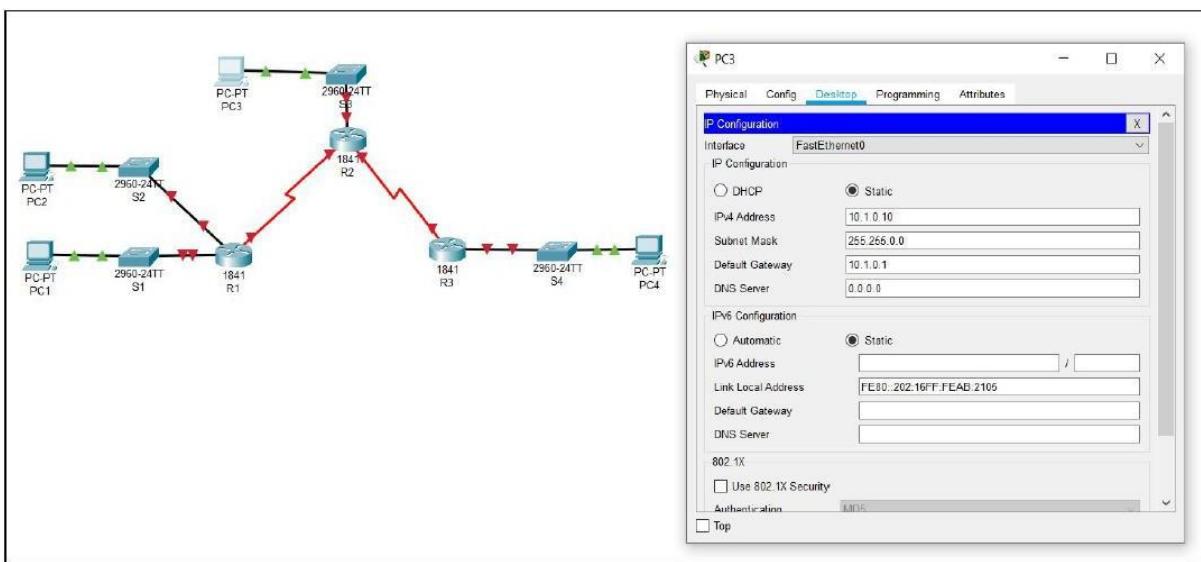
### Configuration of PC1



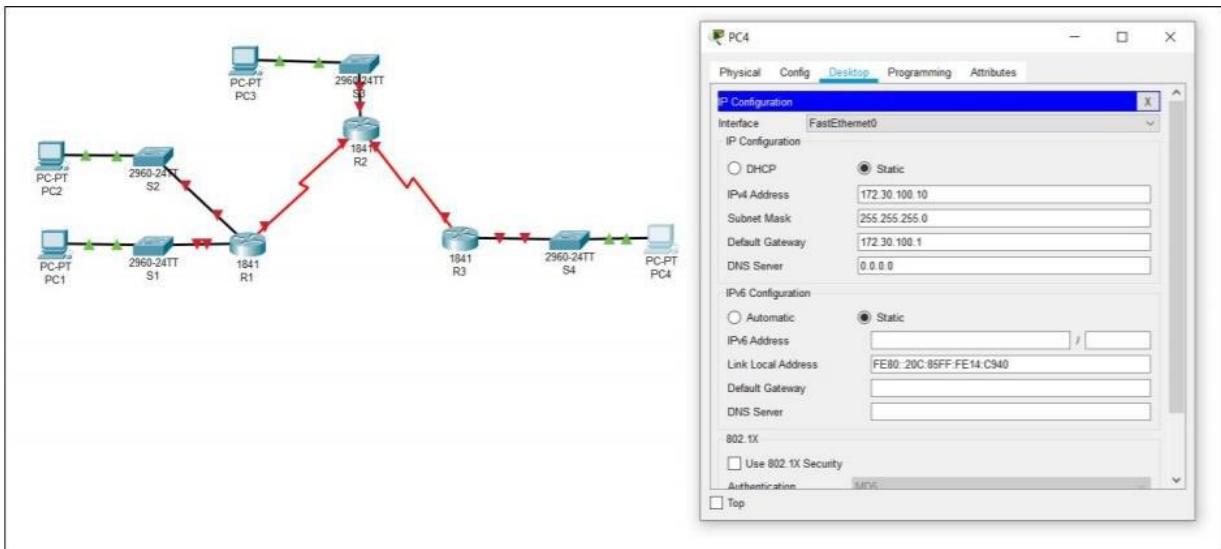
## Configuration of PC2



## Configuration of PC3



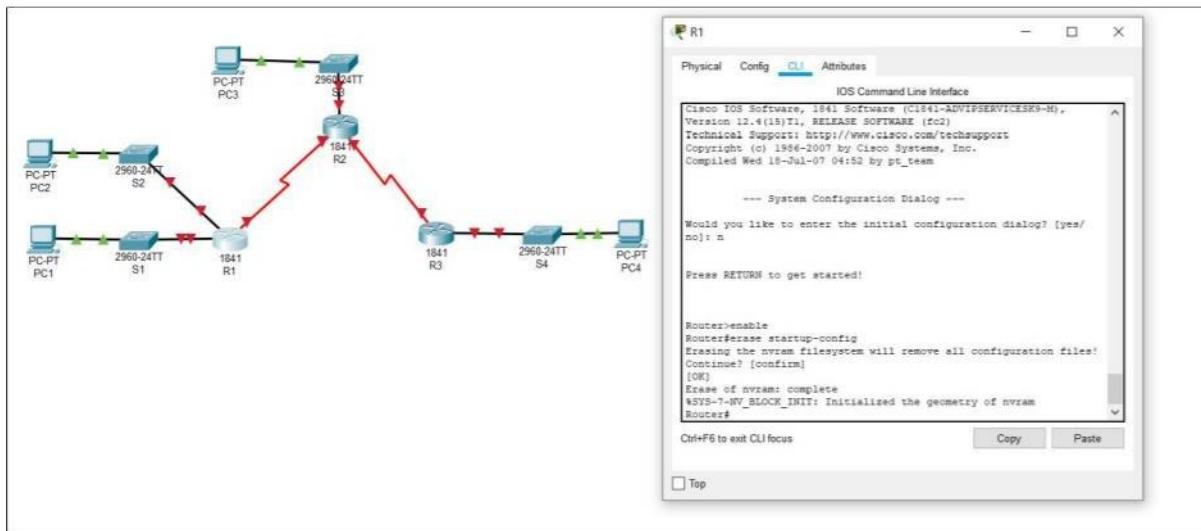
## Configuration of PC4



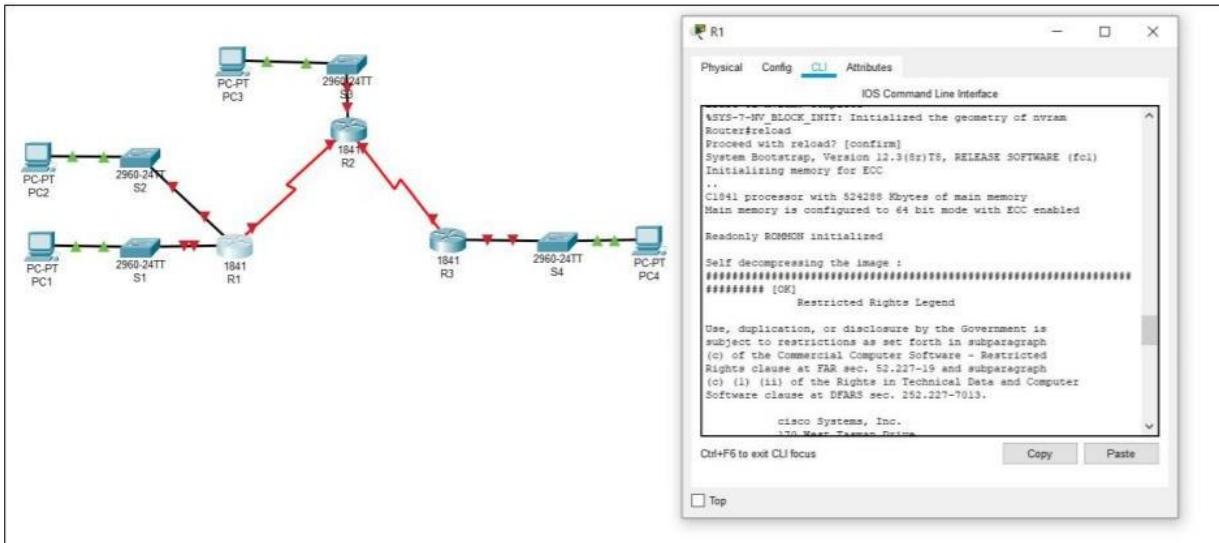
## Step 2: Clear the configuration on each router.

Clear the configuration on each of routers using the **erase startup-config** command and then **reload** the routers. Answer **no** if asked to save changes.

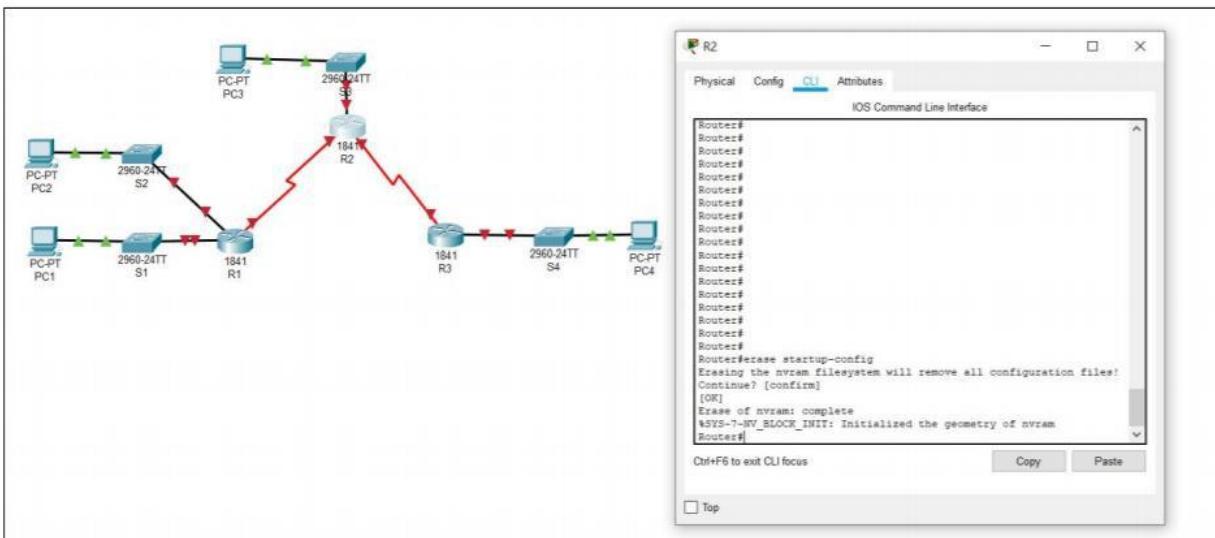
Clearing configuration of R1



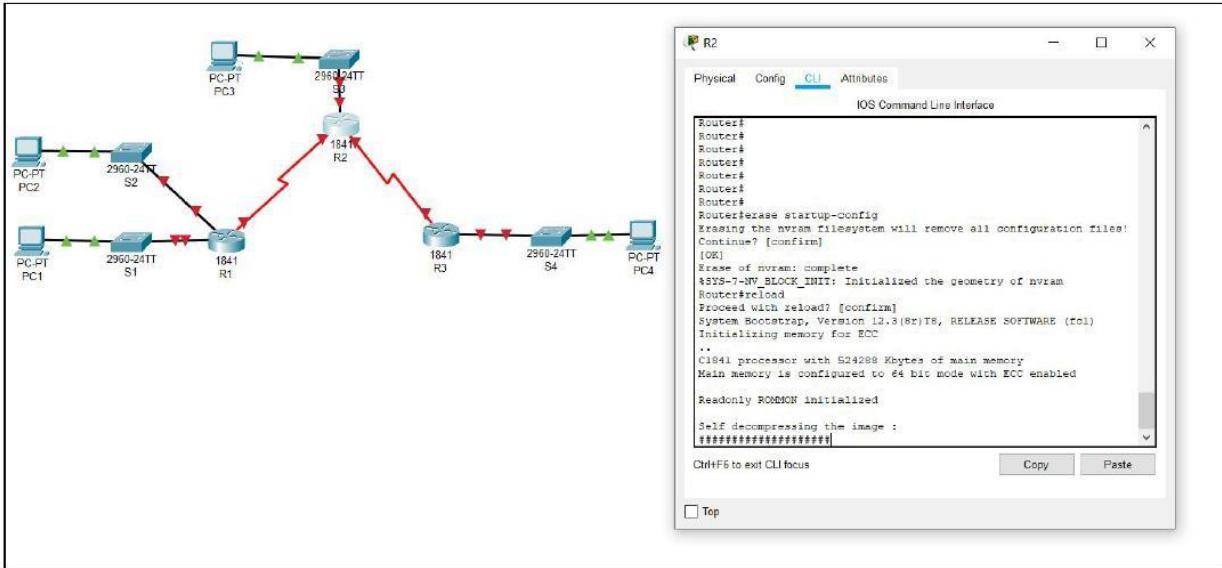
Reloading R1 using reload command



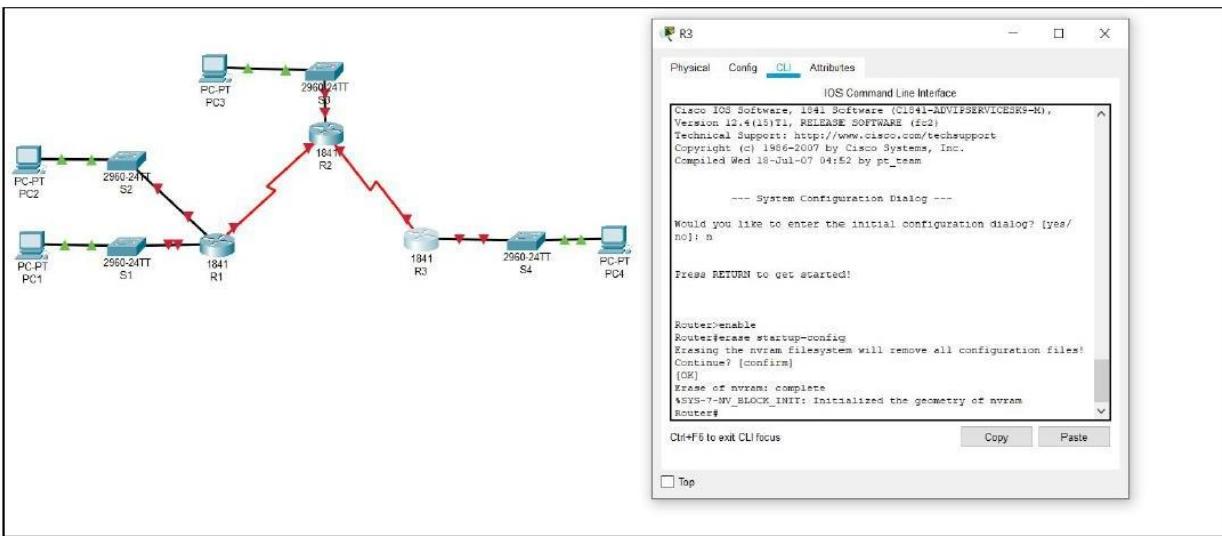
## Clearing configuration of R2



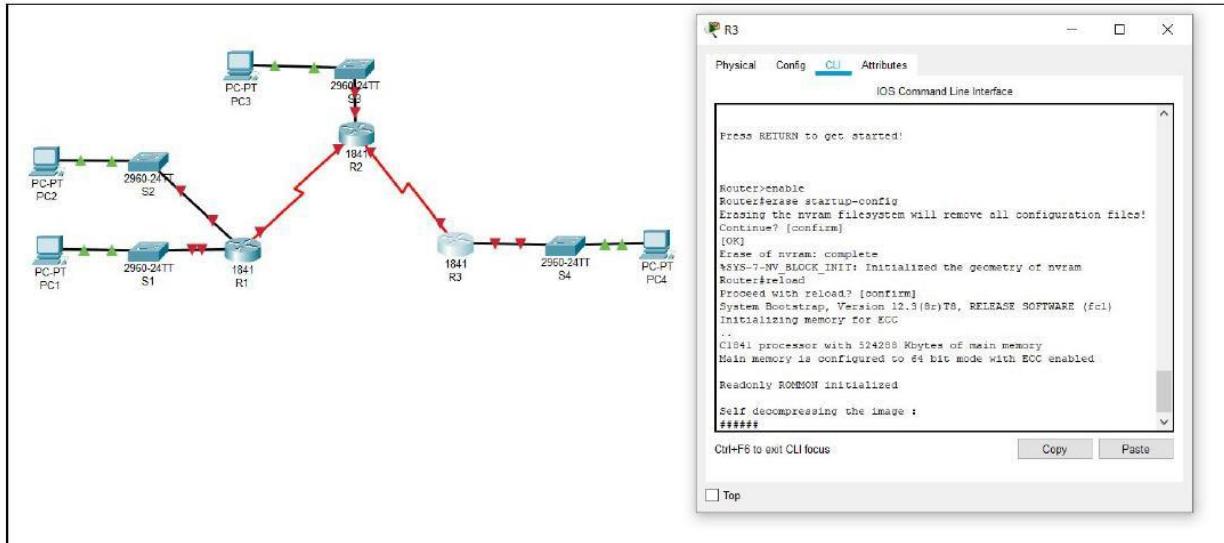
## Reloading R2 using reload command



## Clearing configuration of R3



## Reloading R3



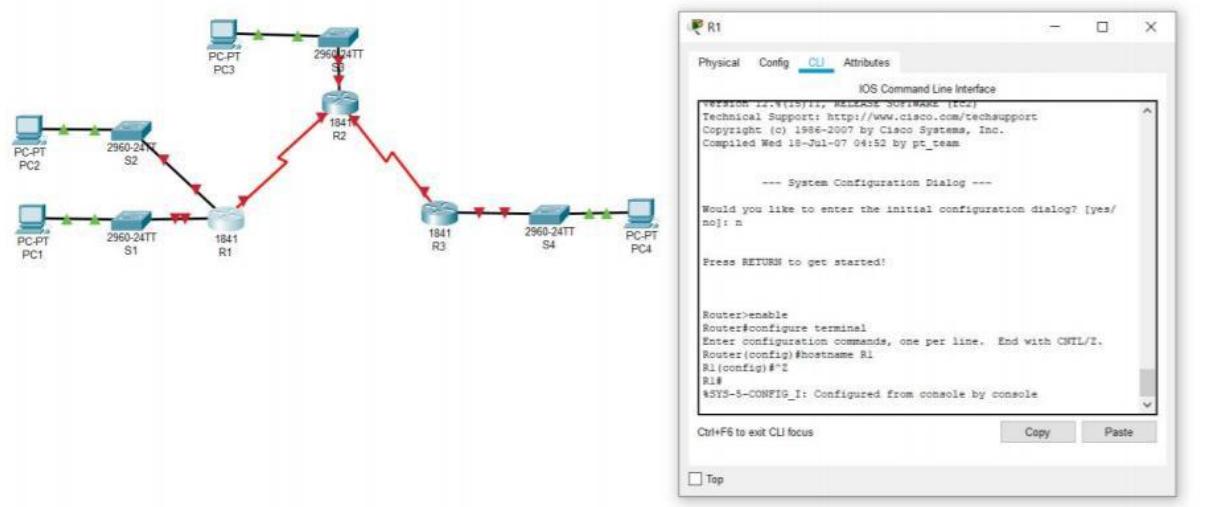
## Task 2: Load Routers with the Supplied Scripts.

### Step 1: Load the following script onto R1.

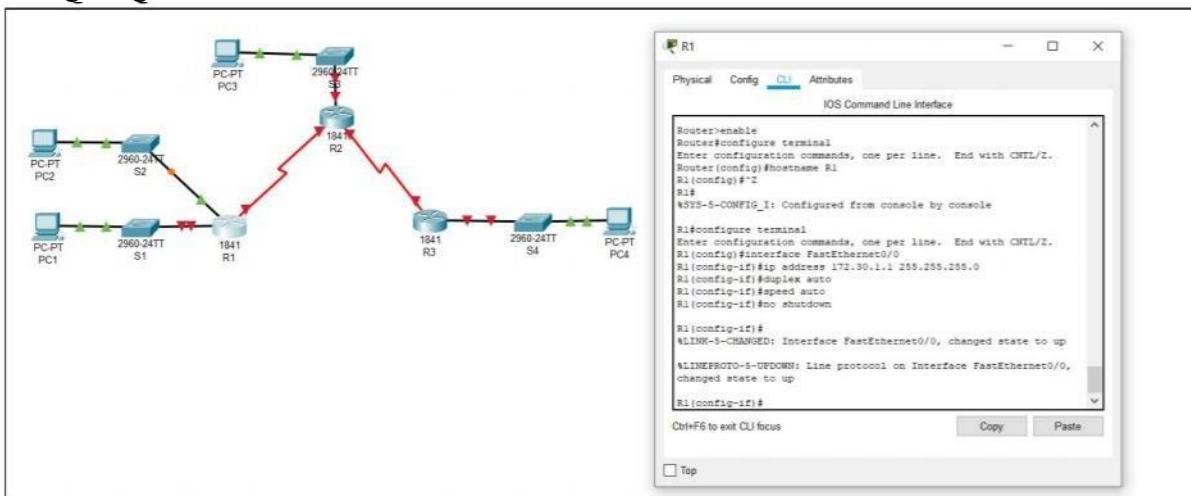
```
!
hostname R1
!
!
!
interface FastEthernet0/0
ip address 172.30.1.1 255.255.255.0
duplex auto
speed auto
no shutdown
!
interface FastEthernet0/1
ip address 172.30.2.1 255.255.255.0
duplex auto
speed auto
no shutdown
!
interface Serial0/0/0
ip address 209.165.200.230 255.255.255.252
clock rate 64000
no shutdown
!
router rip
passive-interface FastEthernet0/0
passive-interface FastEthernet0/1
network 172.30.0.0
network 209.165.200.0
!
```

```
line con 0
line vty 0 4
login
!
end
```

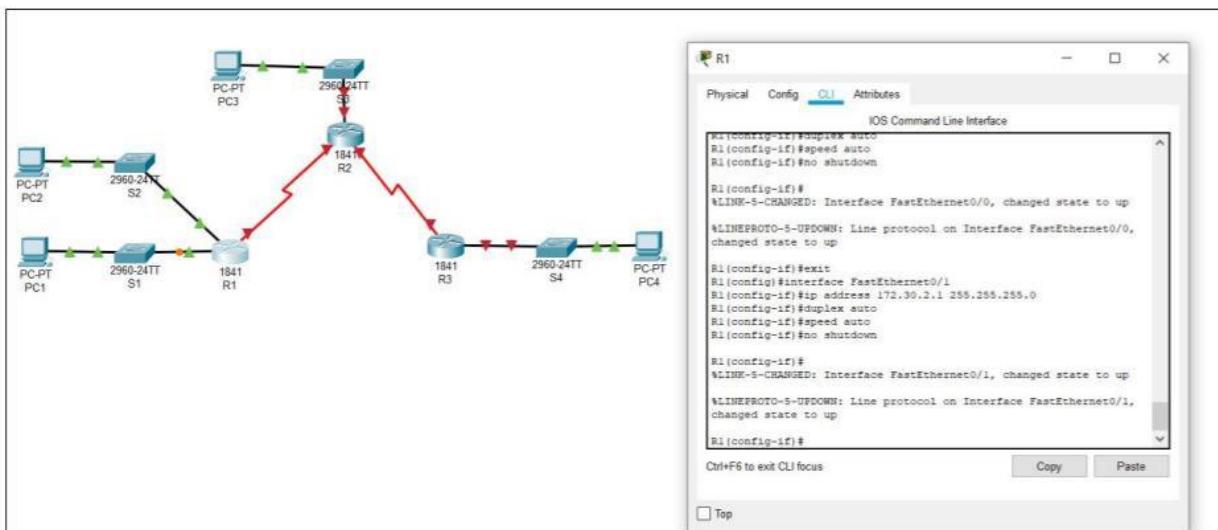
## Assigning hostname as R1



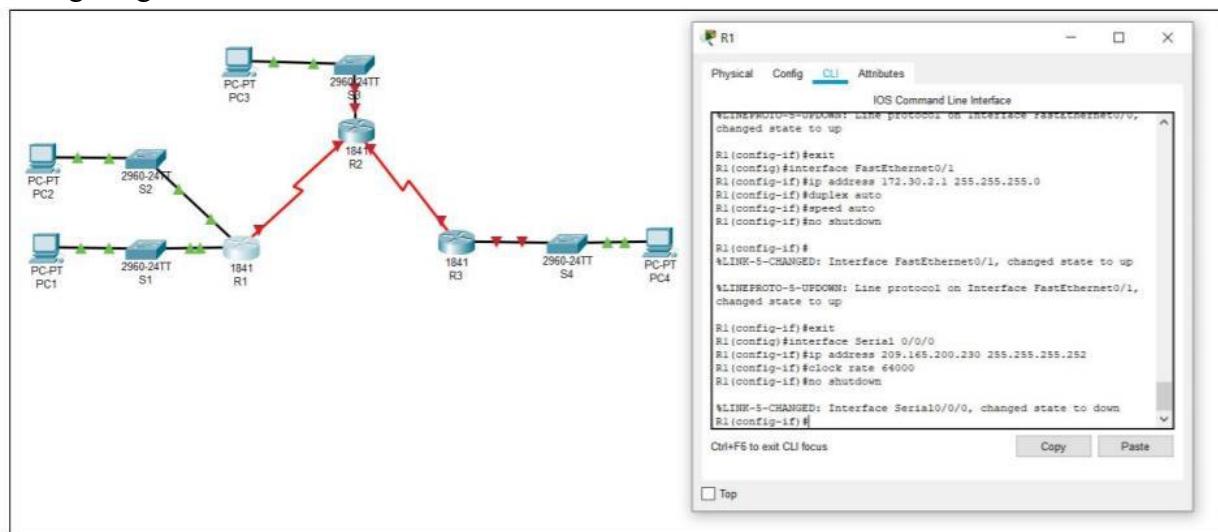
## Configuring FastEthernet0/0



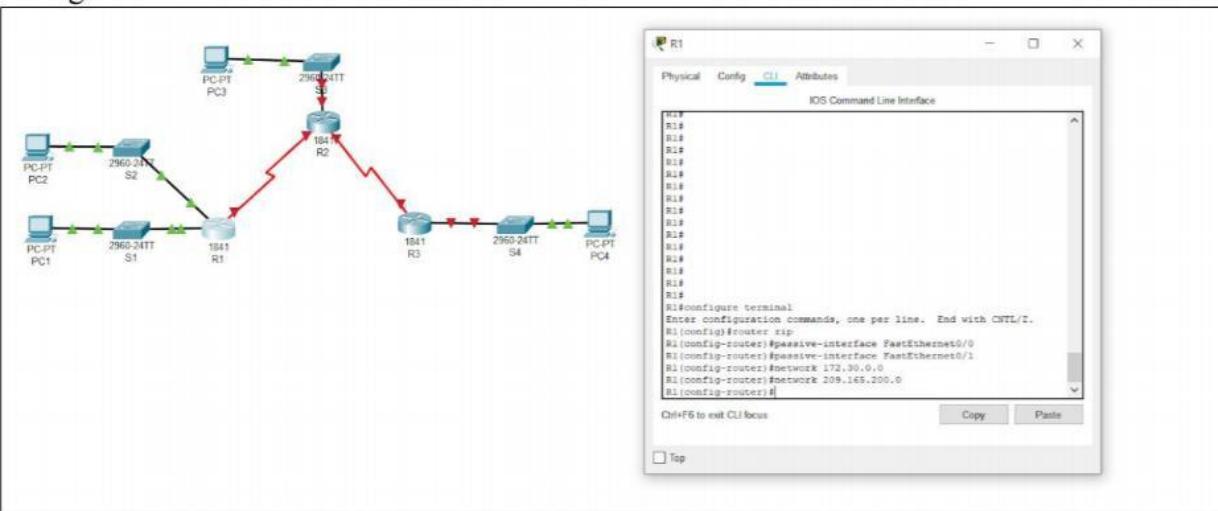
## Configuring FastEthernet0/1



## Configuring Serial0/0/0



## Configuration of RIP



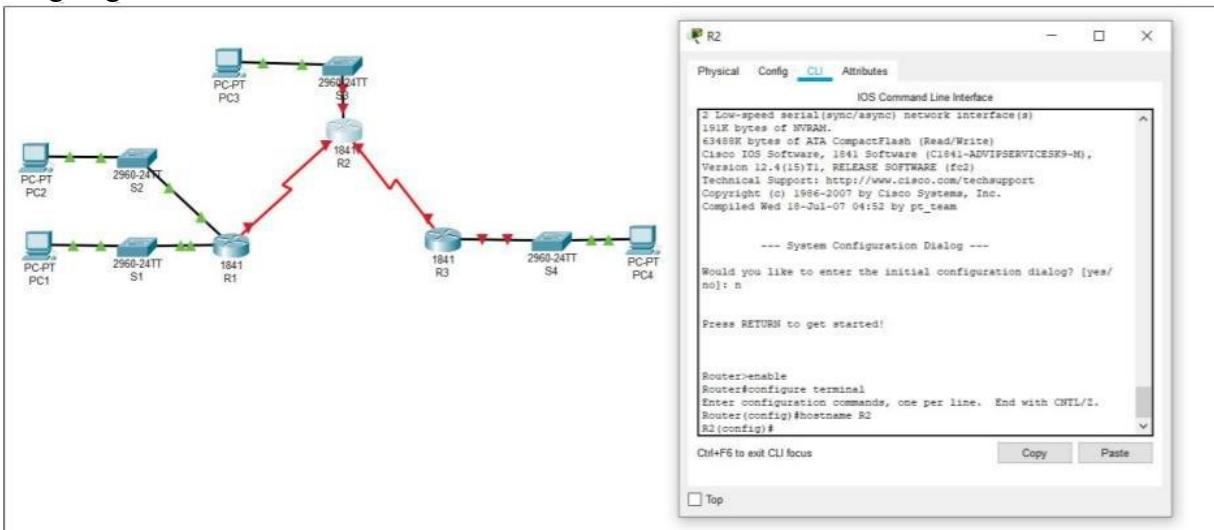
## Running Configuration



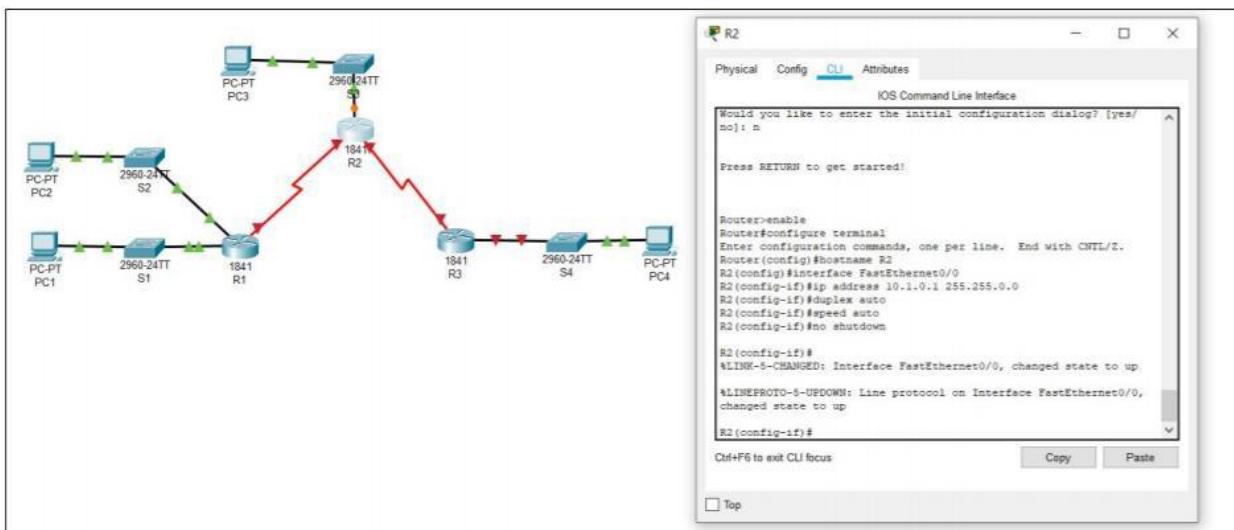
## Step 2: Load the following script onto R2.

```
hostname R2
!
!
!
interface FastEthernet0/0
ip address 10.1.0.1 255.255.0.0
duplex auto
speed auto
no shutdown
!
interface Serial0/0/0
ip address 209.165.200.229 255.255.255.252
no shutdown
!
interface Serial0/0/1
ip address 209.165.200.233 255.255.255.252
clock rate 64000
no shutdown
!
router rip
passive-interface FastEthernet0/0
network 10.0.0.0
network 209.165.200.0
!
line con 0
line vty 0 4
login
!
end
```

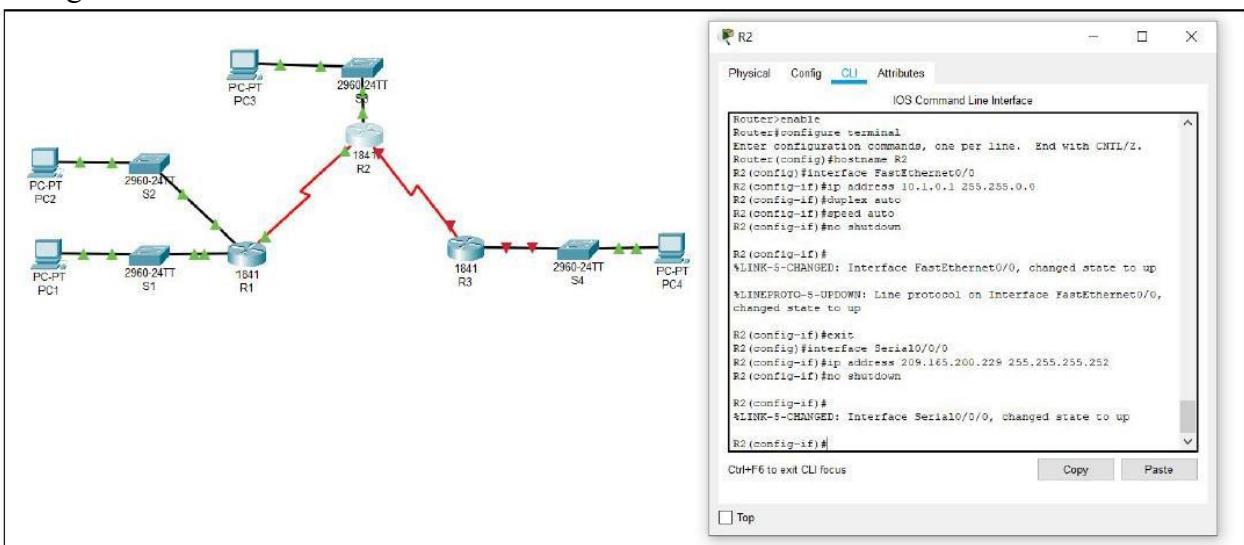
### Assigning hostname as R2



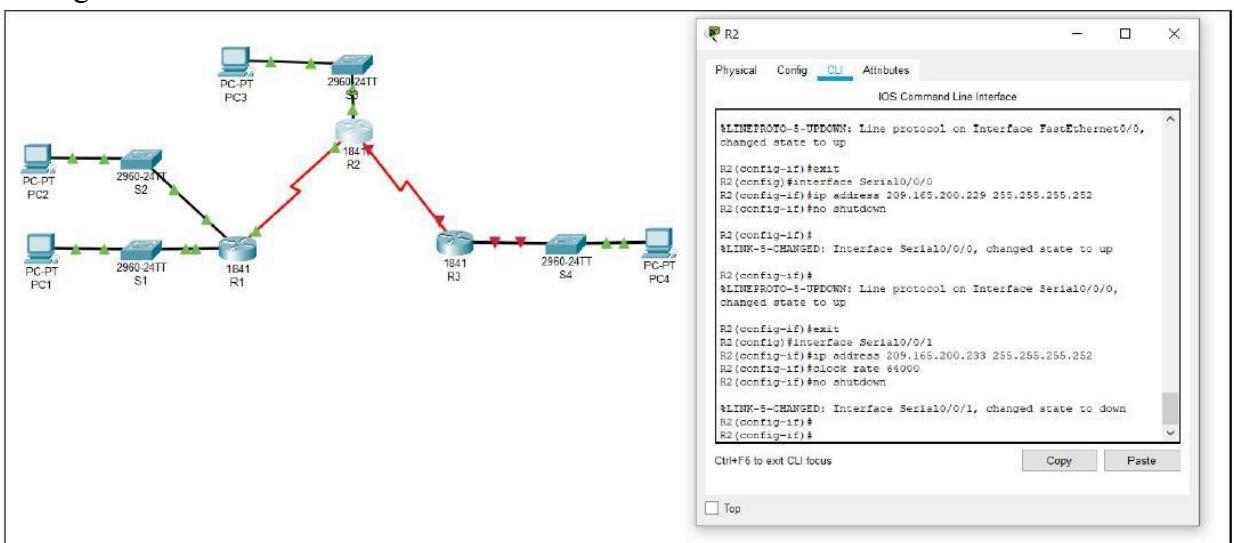
## Configuration of FastEthernet0/0



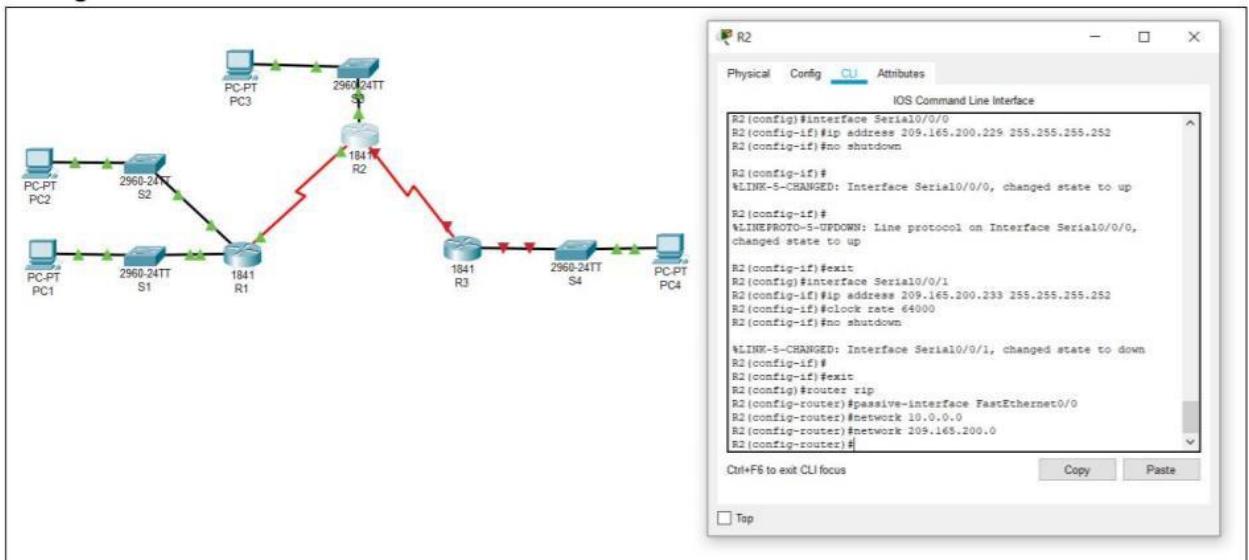
## Configuration of Serial0/0/0



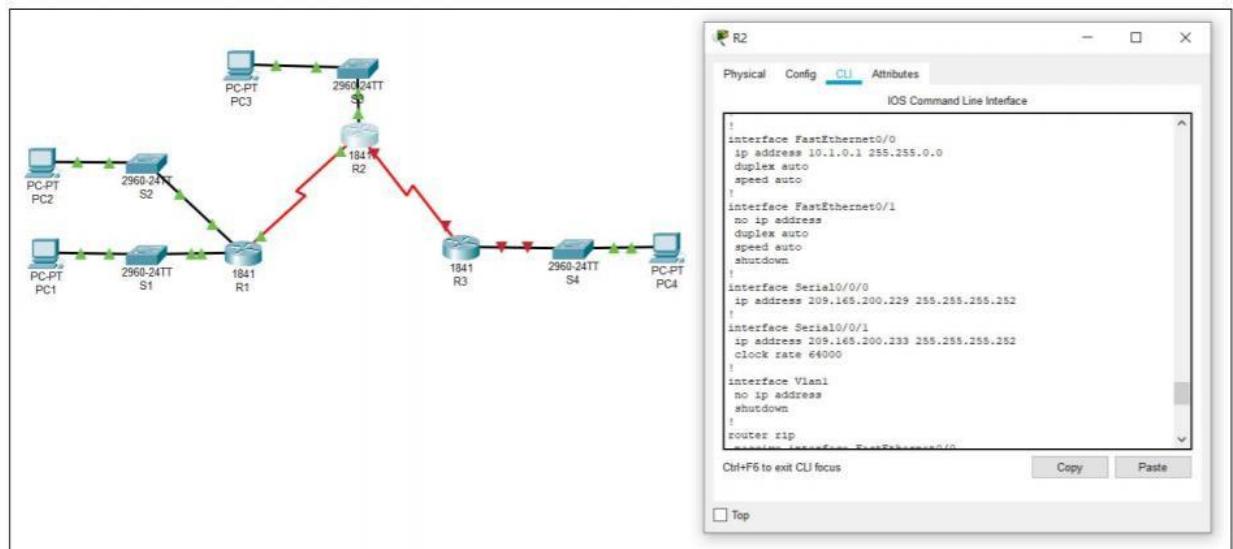
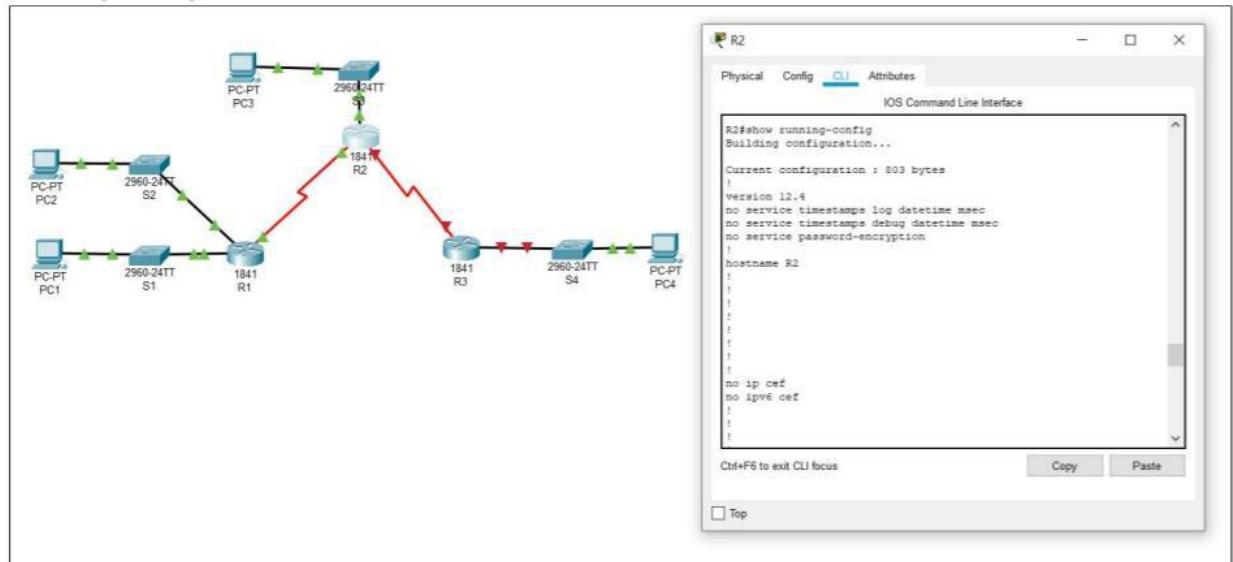
## Configuration of Serial0/0/1

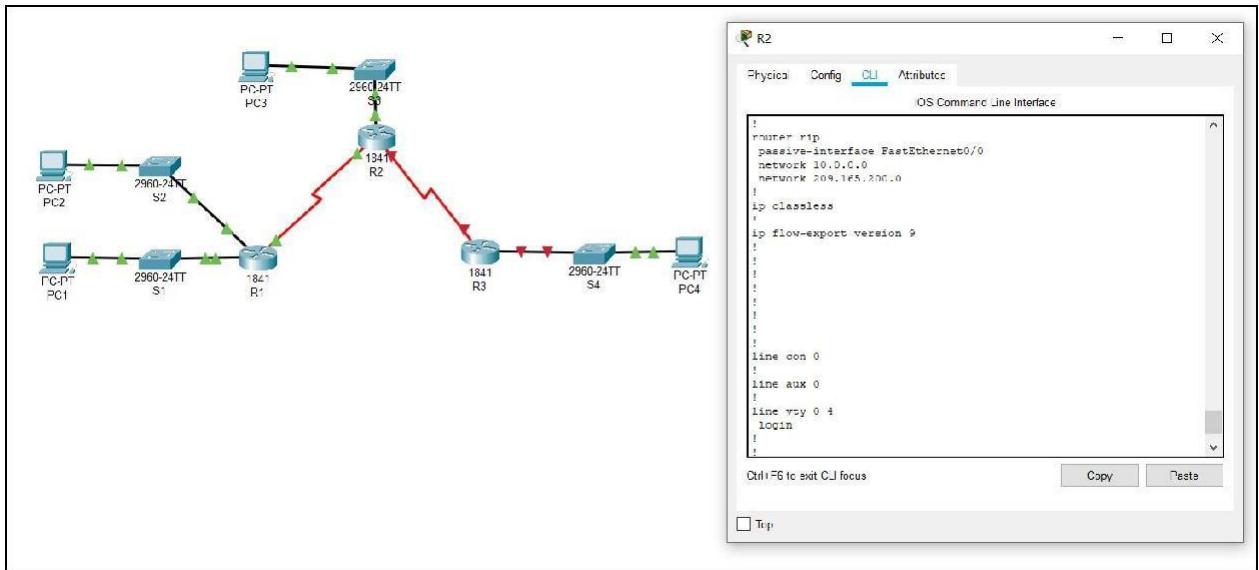


## Configuration of RIP



Running configuration of R2





### Step 3: Load the following script onto R3.

```

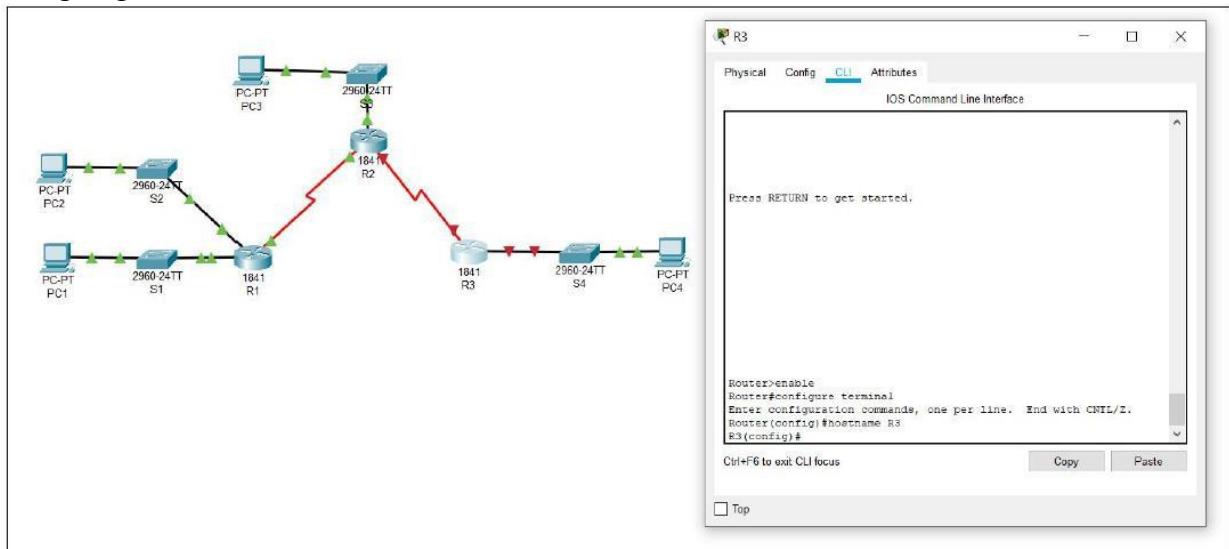
hostname R3
!
!
!
interface FastEthernet0/0
ip address 172.30.100.1 255.255.255.0
duplex auto
speed auto
no shutdown
!
interface Serial0/0/1
ip address 209.165.200.234 255.255.255.252
no shutdown
!
interface Loopback0
ip address 172.30.110.1 255.255.255.0
!
interface Loopback1
ip address 172.30.200.17 255.255.255.240
!
interface Loopback2
ip address 172.30.200.33 255.255.255.240
!
router rip
passive-interface FastEthernet0/0
network 172.30.0.0
network 209.165.200.0
!
line con 0
line vty 0 4

```

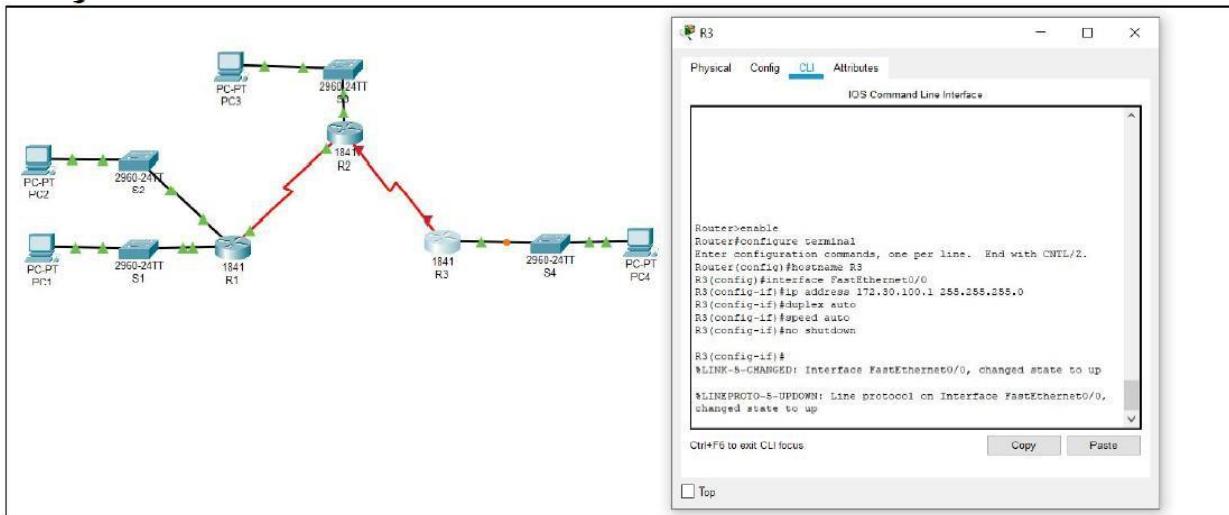
```

login
!
end
Assigning hostname as R3

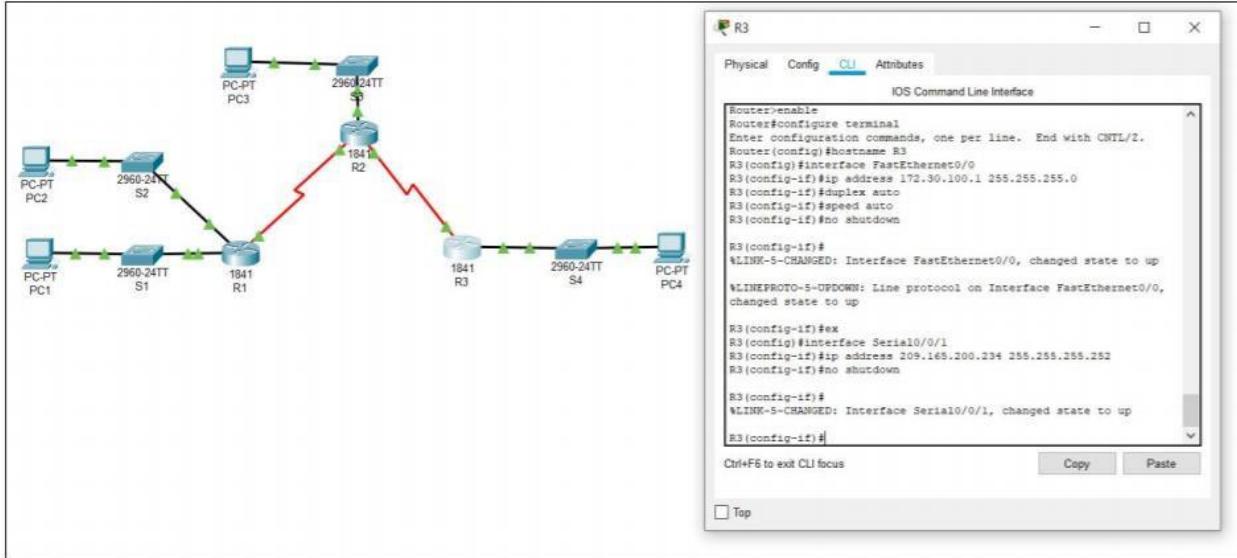
```



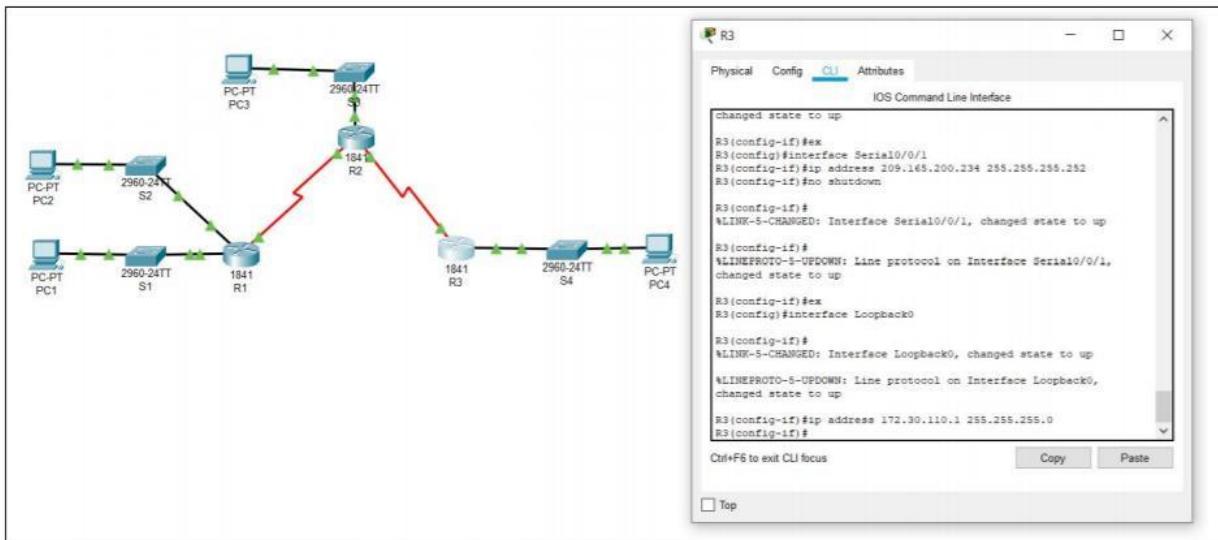
### Configuration of FastEthernet0/0



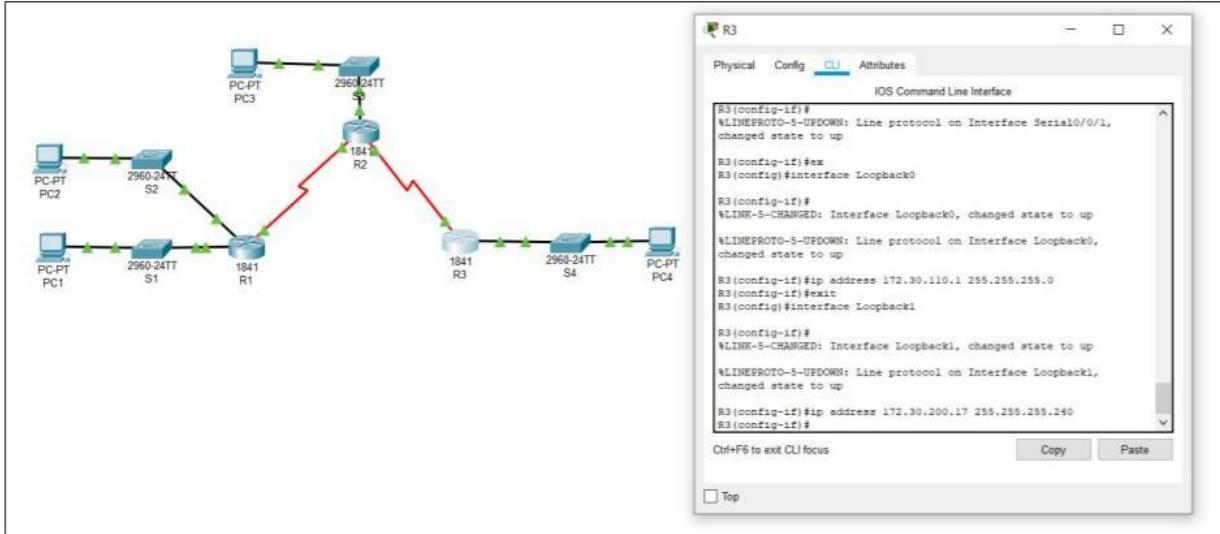
## Configuration of Serial0/0/0



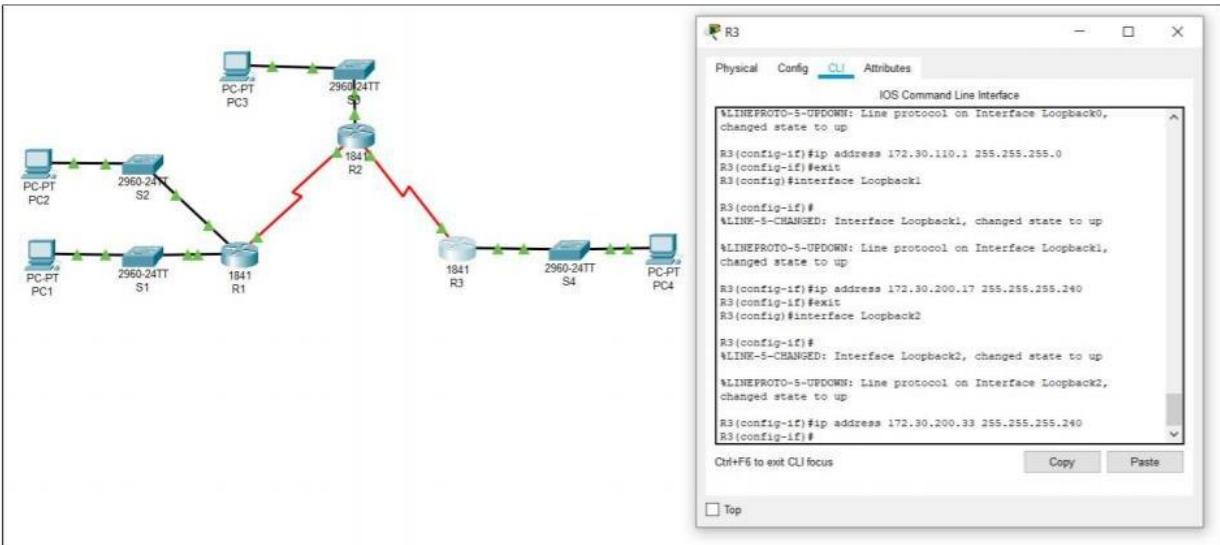
## Configuration of Loopback0



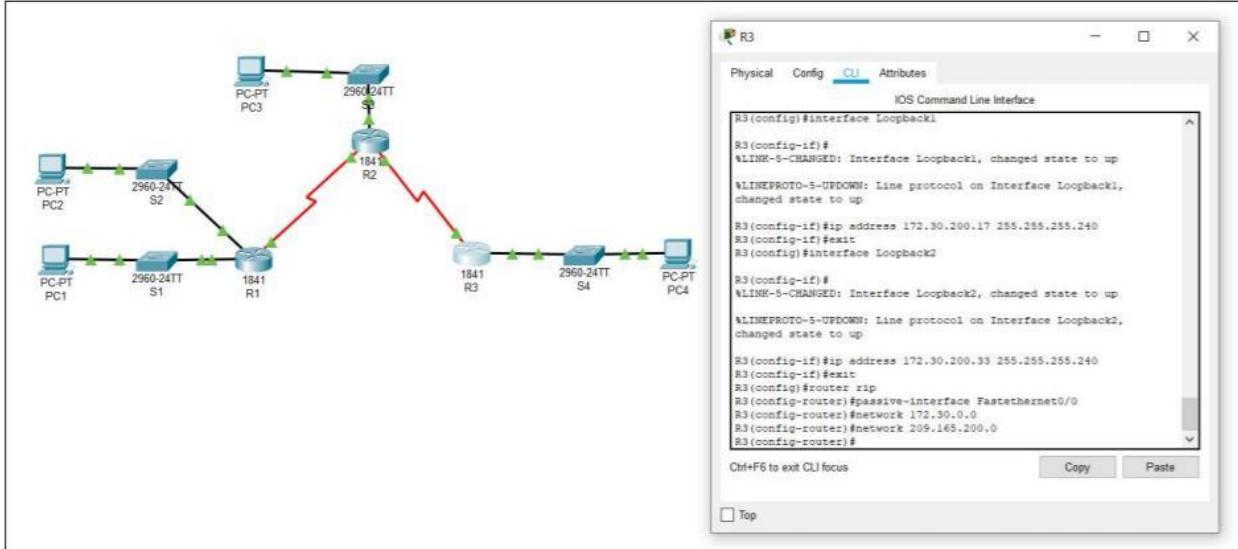
## Configuration of Loopback1



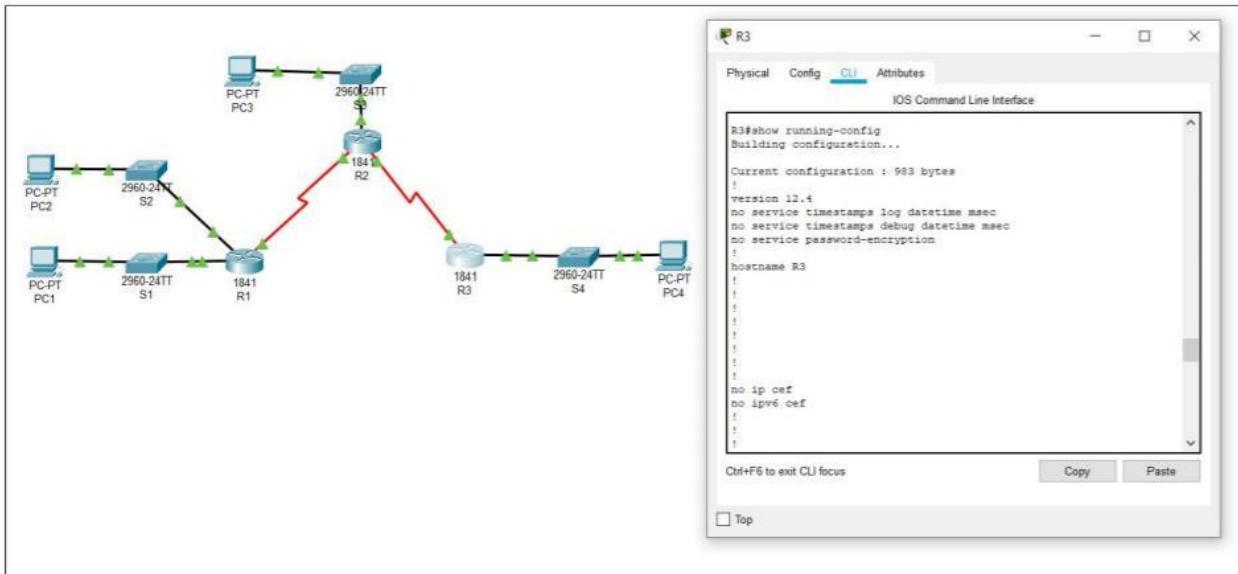
## Configuration of Loopback2

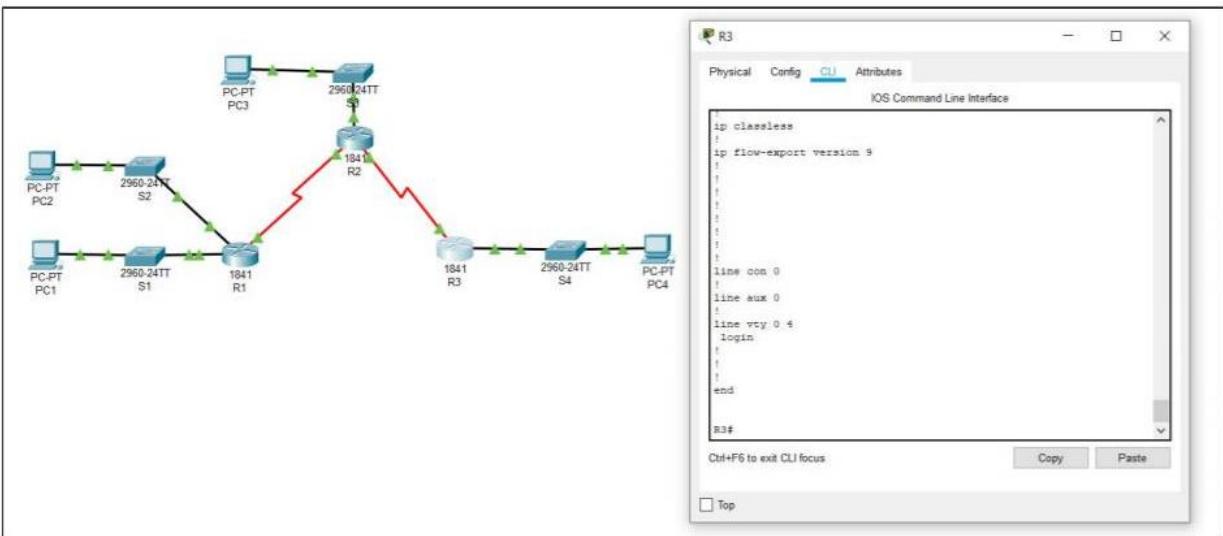
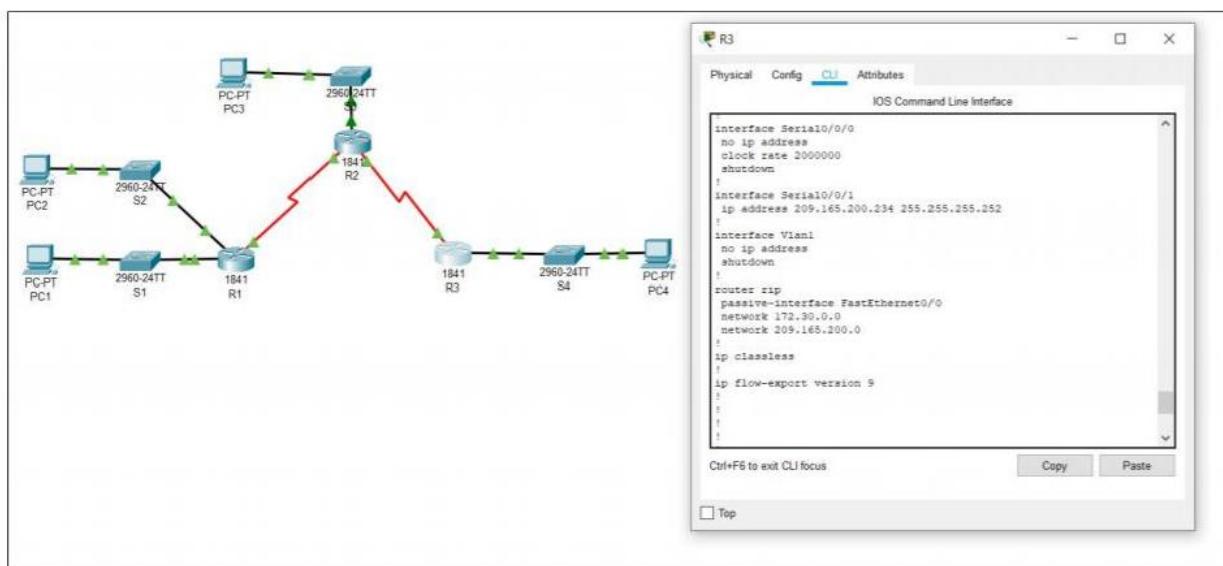
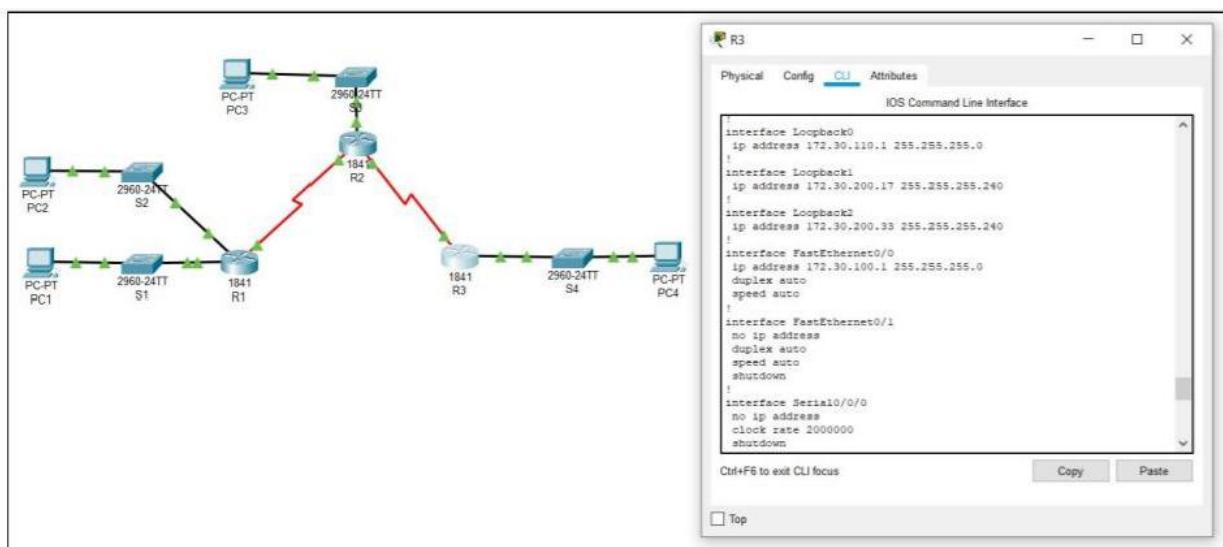


## Configuration of RIP

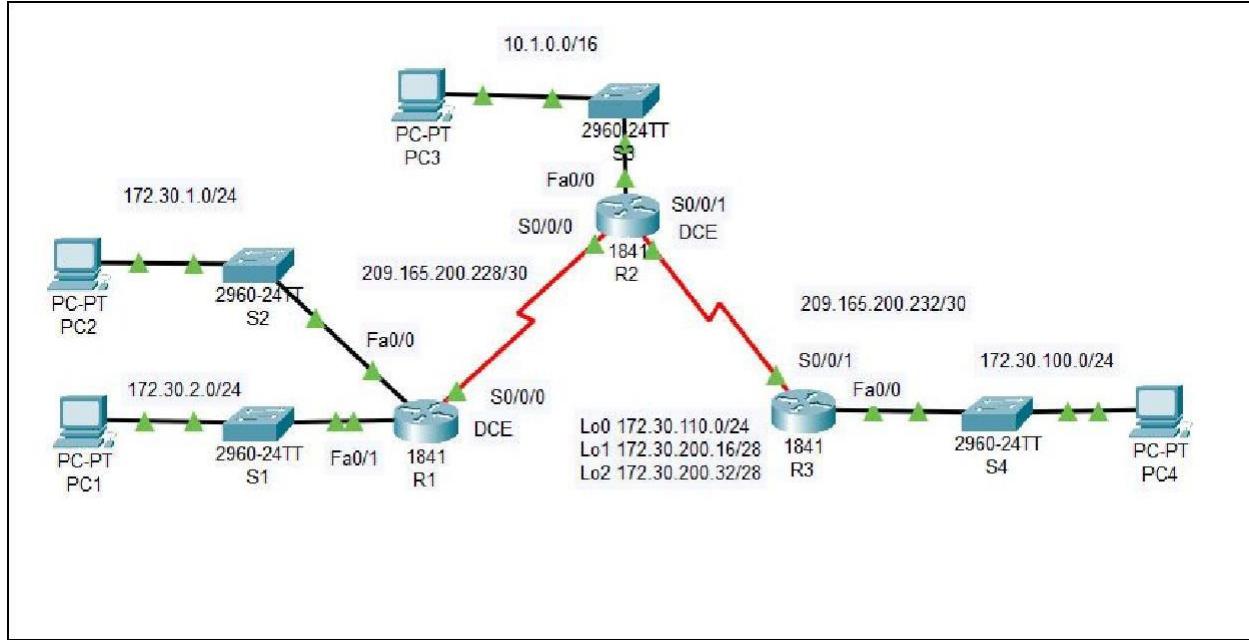


## Running configuration





## Complete Network



### Task 3: Examine the Current Status of the Network.

#### Step 1: Verify that both serial links are up.

The two serial links can quickly be verified using the **show ip interface brief** command on R2.

R2#**show ip interface brief**

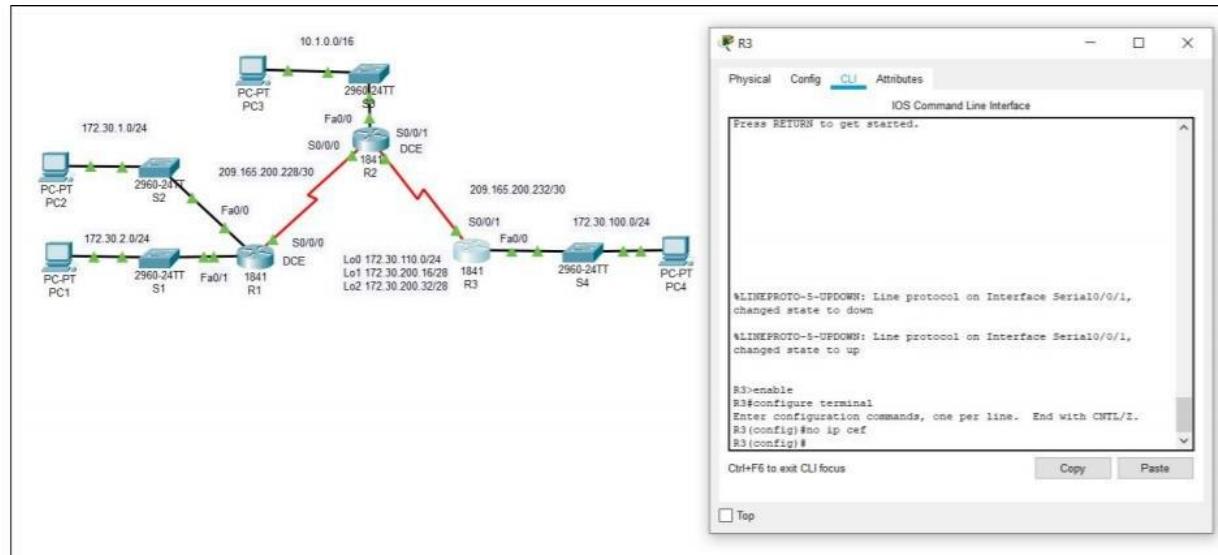
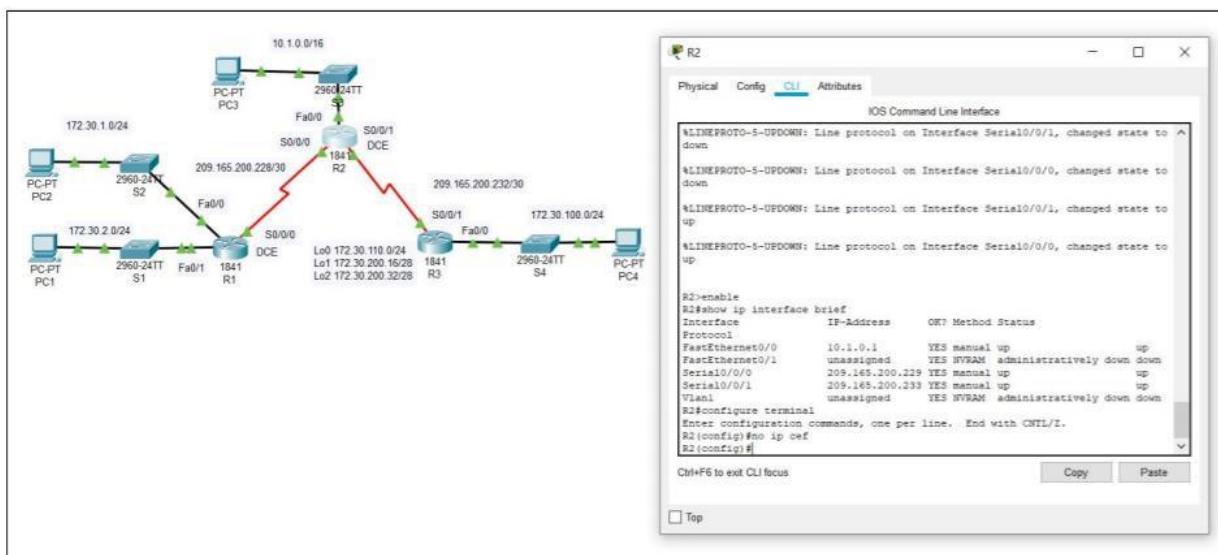
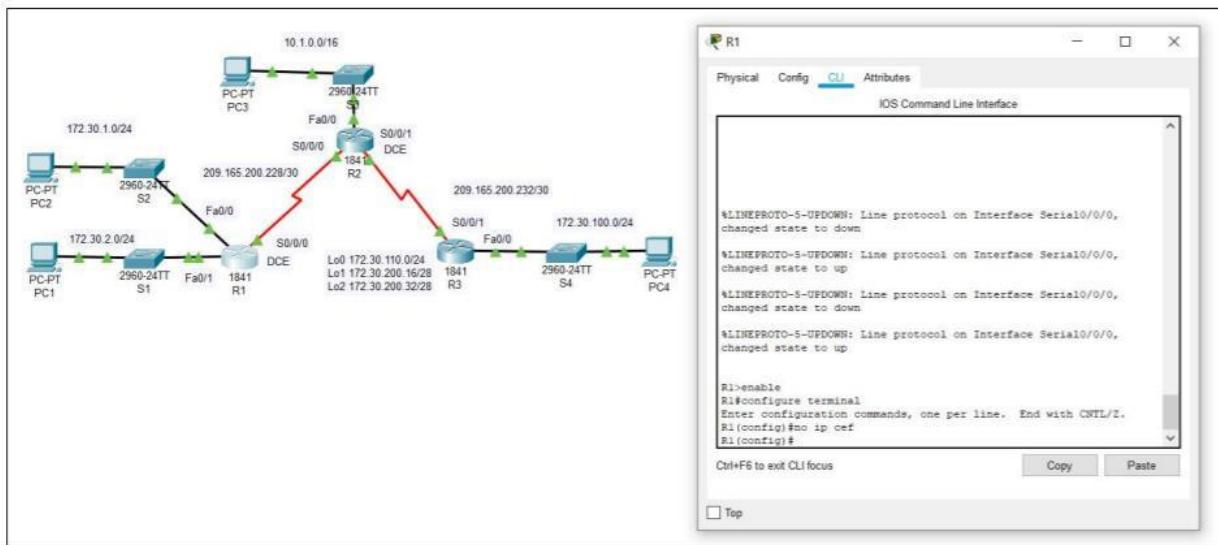
```
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial10/0/0, changed state to down
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial10/0/0, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial10/0/1, changed state to down
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial10/0/0, changed state to down
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial10/0/1, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial10/0/0, changed state to up

R2>enable
R2>show ip interface brief
Interface          IP-Address      MTU    Method Status      Protocol
FastEthernet0/0     10.1.0.1       1500   YES manual up
FastEthernet0/1     unassigned     1500   YES NVRAM administratively down
Serial10/0/0        209.165.200.229 1500   YES manual up
Serial10/0/1        209.165.200.233 1500   YES manual up
Vlan1              unassigned     1500   YES NVRAM administratively down
R2#
```

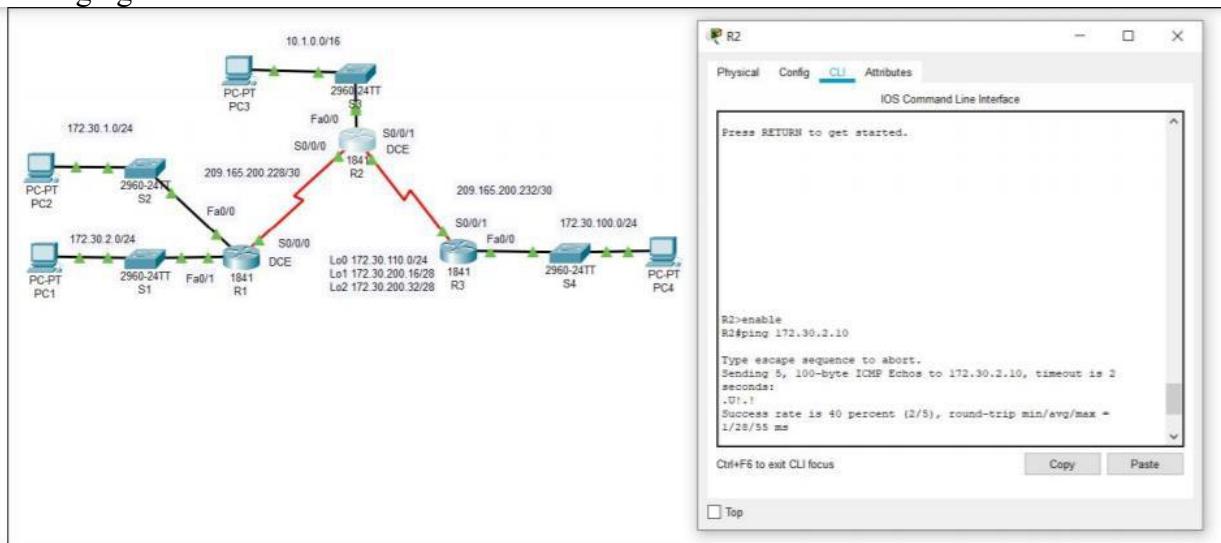
#### Step 2: Check the connectivity from R2 to the hosts on the R1 and R3 LANs.

Note: For the 1841 router, you will need to disable IP CEF to obtain the correct output from the **ping** command. Although a discussion of IP CEF is beyond the scope of this course, you may disable IP CEF by using the following command in global configuration mode:

R2(config)#no ip cef



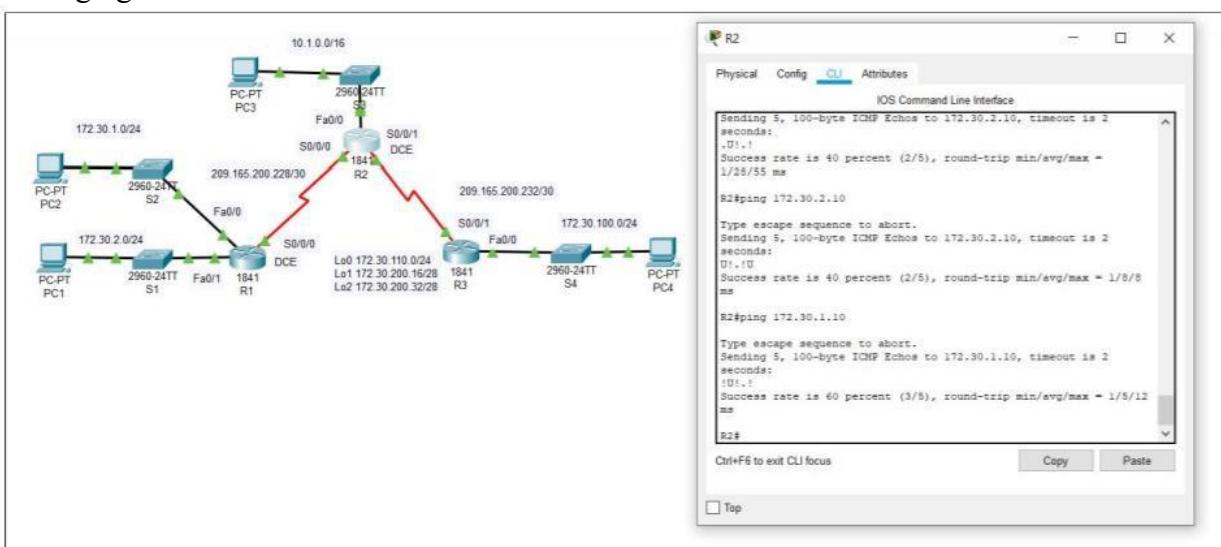
## Pinging PC1 from R2



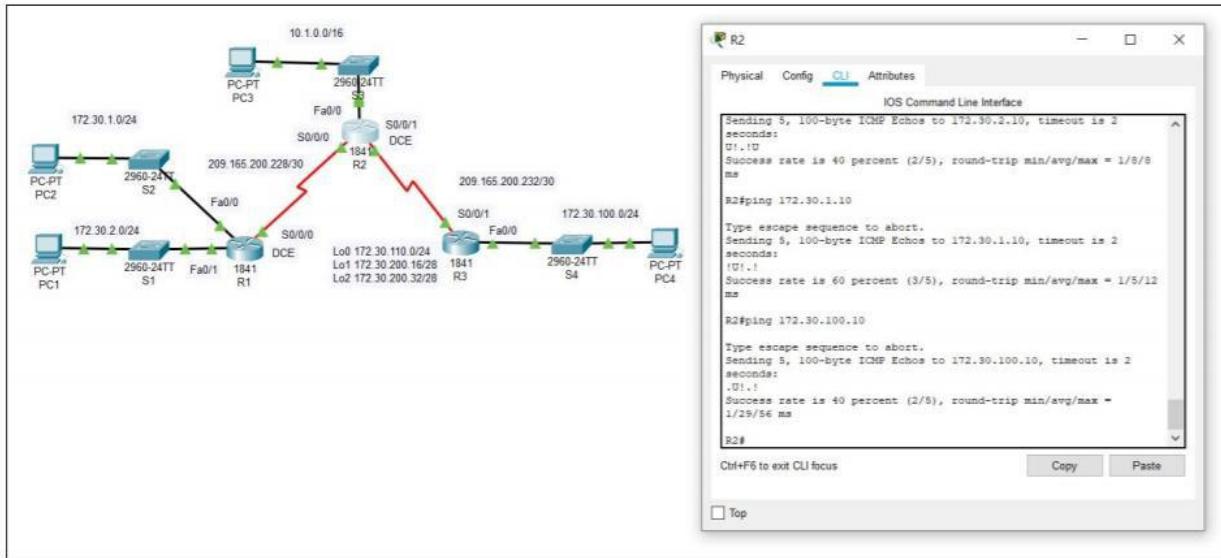
From the R2 router, how many ICMP messages are successful when pinging PC1?

Ans: 2 ICMP messages are successful

## Pinging PC2 from R2



## Pinging PC4 from R2

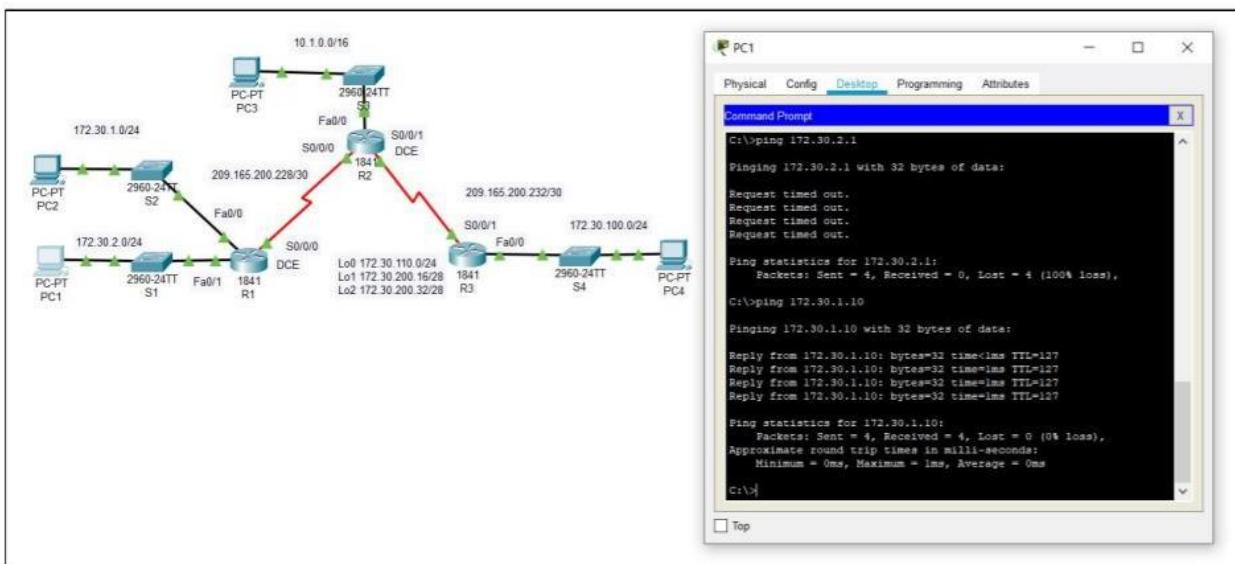


From the R2 router, how many ICMP messages are successful when pinging PC4?

Ans: 2 ICMP messages are successful

## Step 3: Check the connectivity between the PCs.

Pinging PC2 from PC1



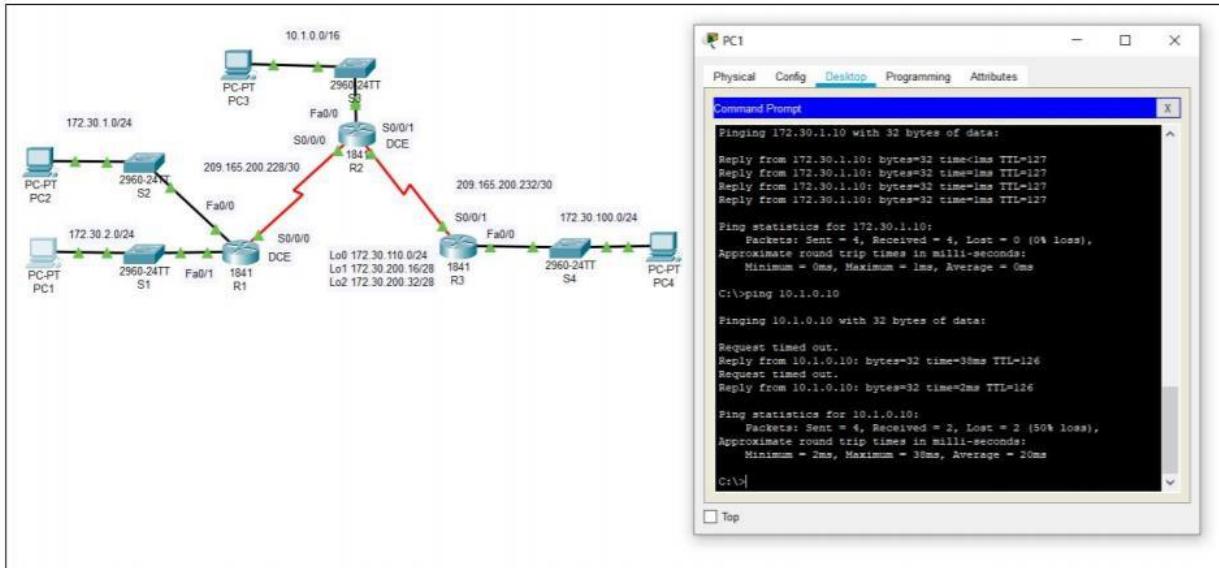
From the PC1, is it possible to ping PC2?

Ans: Yes

What is the success rate?

Ans: 100%

## Pinging PC3 from PC1



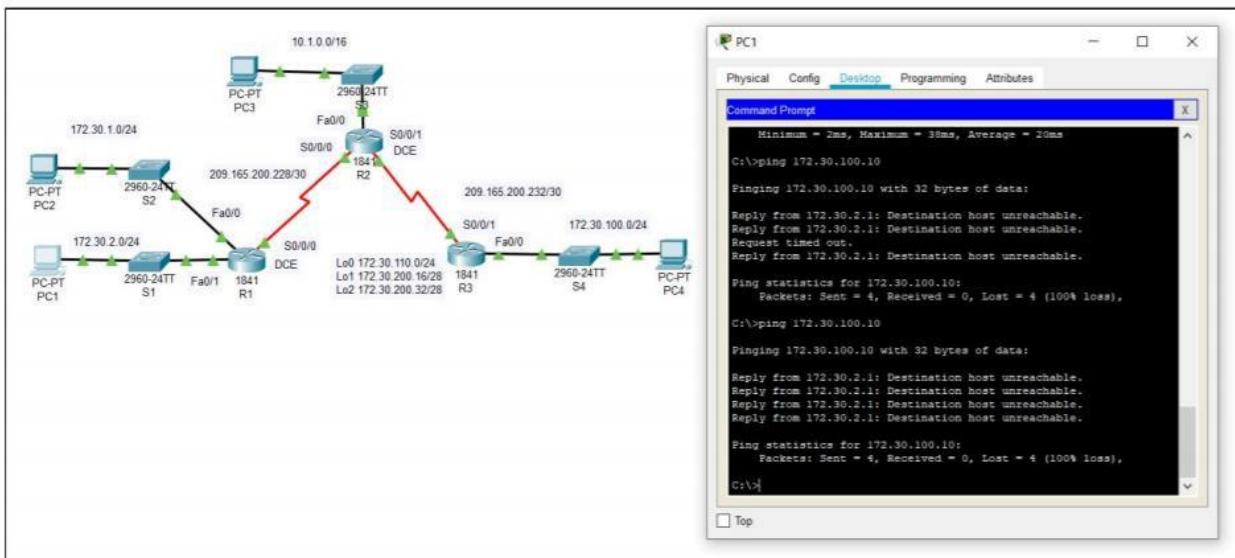
From the PC1, is it possible to ping PC3?

Ans: Yes

What is the success rate?

Ans: 50%

## Pinging PC4 from PC1



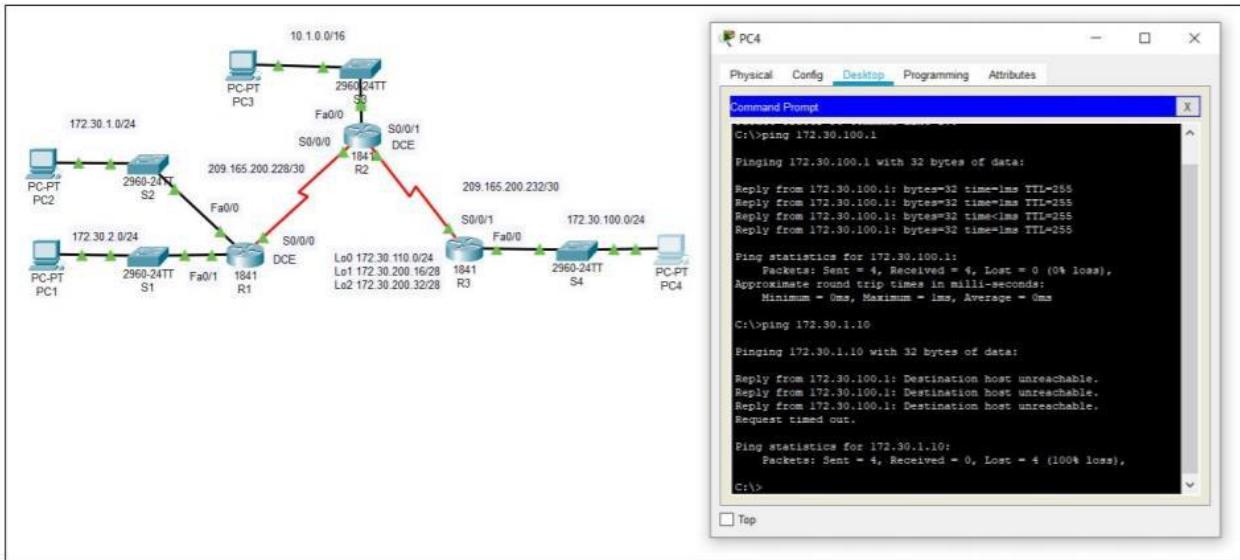
From the PC1, is it possible to ping PC4?

Ans: No

What is the success rate?

Ans: 0%

## Pinging PC2 from PC4



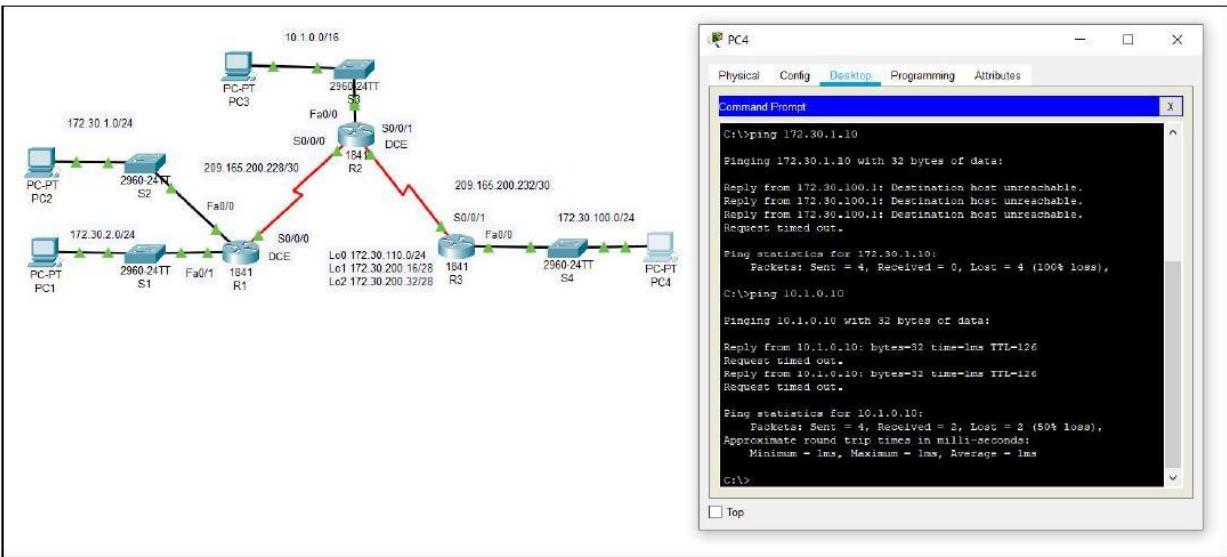
From the PC4, is it possible to ping PC2?

Ans: No

What is the success rate?

Ans: 0%

## Pinging PC3 from PC4



From the PC4, is it possible to ping PC3?

Ans: Yes

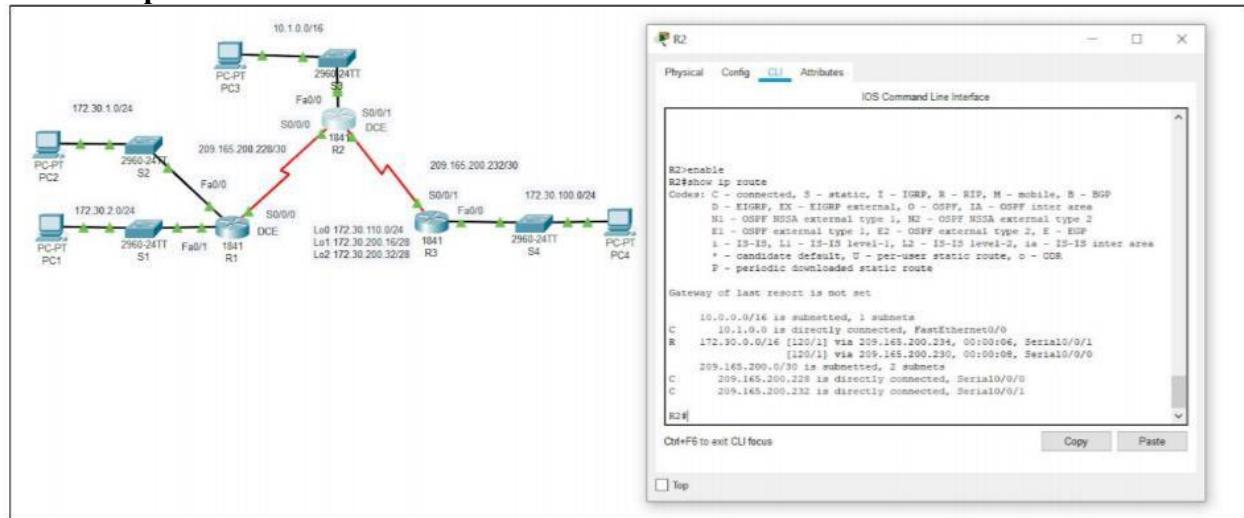
What is the success rate?

Ans: 50%

#### Step 4: View the routing table on R2.

Both the R1 and R3 are advertising routes to the 172.30.0.0/16 network; therefore, there are two entries for this network in the R2 routing table. The R2 routing table only shows the major classful network address of 172.30.0.0—it does not show any of the subnets for this network that are used on the LANs attached to R1 and R3. Because the routing metric is the same for both entries, the router alternates the routes that are used when forwarding packets that are destined for the 172.30.0.0/16 network.

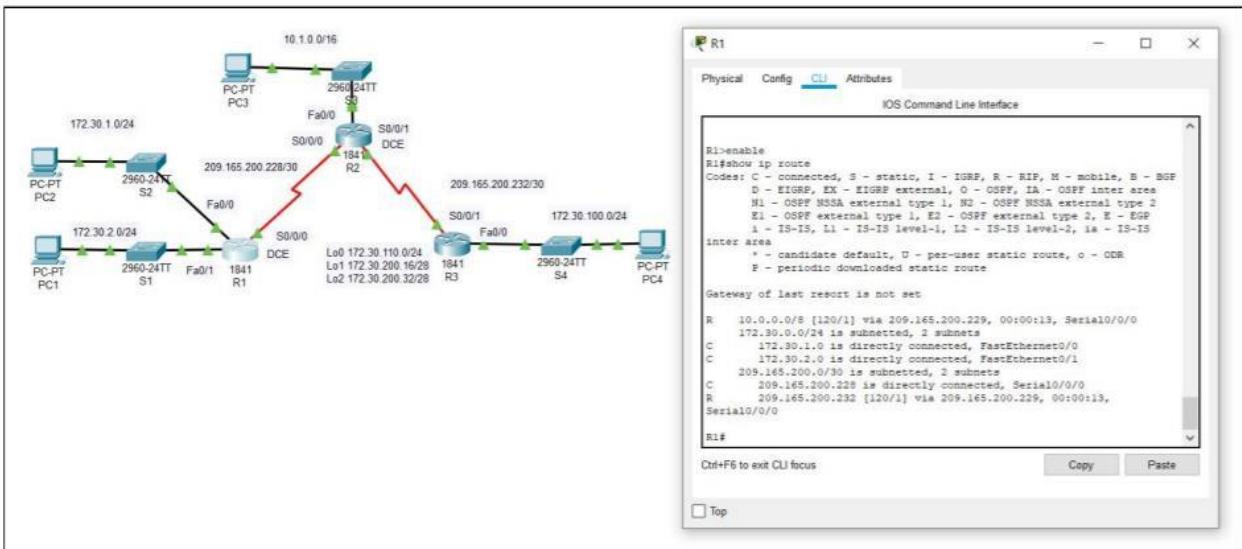
R2#show ip route



#### Step 5: Examine the routing table on the R1 router.

Both R1 and R3 are configured with interfaces on a discontiguous network, 172.30.0.0. The 172.30.0.0 subnets are physically and logically divided by at least one other classful or major network—in this case, the two serial networks 209.165.200.228/30 and 209.165.200.232/30. Classful routing protocols like RIPv1 summarize networks at major network boundaries. Both R1 and R3 will be summarizing 172.30.0.0/24 subnets to 172.30.0.0/16. Because the route to 172.30.0.0/16 is directly connected, and because R1 does not have any specific routes for the 172.30.0.0 subnets on R3, packets destined for the R3 LANs will not be forwarded properly.

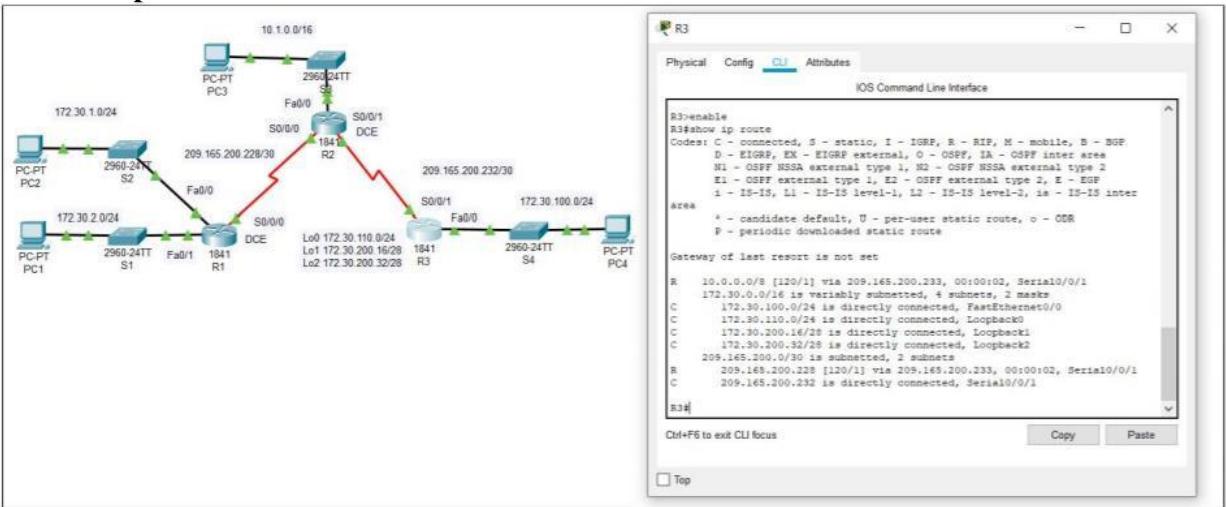
R1#show ip route



## Step 6: Examine the routing table on the R3 router.

R3 only shows its own subnets for 172.30.0.0 network: 172.30.100/24, 172.30.110/24, 172.30.200.16/28, and 172.30.200.32/28. R3 does not have any routes for the 172.30.0.0 subnets on R1.

**R3#show ip route**

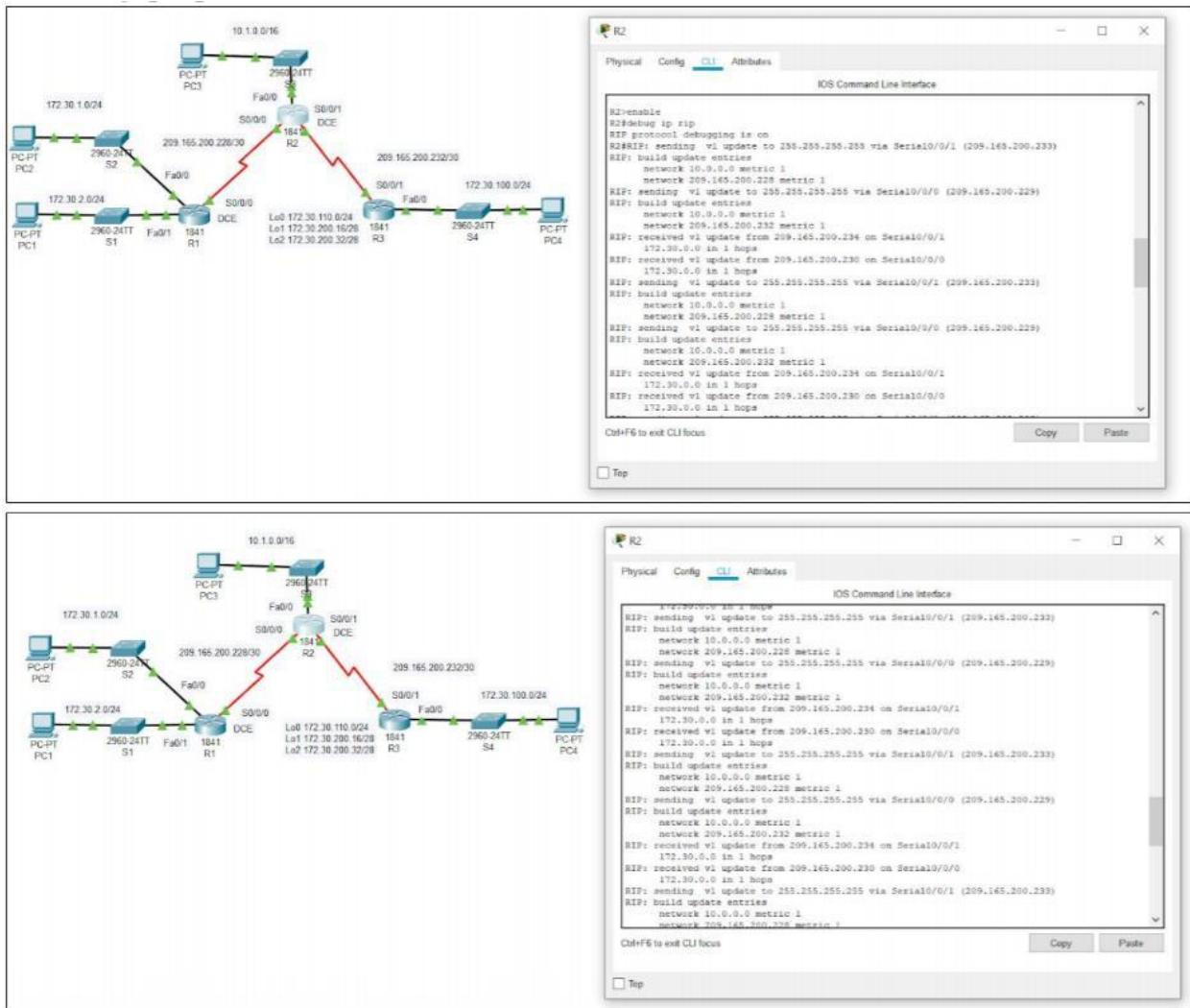


## Step 7: Examine the RIPv1 packets that are being received by R2.

Use the **debug ip rip** command to display RIP routing updates.

R2 is receiving the route 172.30.0.0, with 1 hop, from both R1 and R3. Because these are equal cost metrics, both routes are added to the R2 routing table. Because RIPv1 is a classful routing protocol, no subnet mask information is sent in the update.

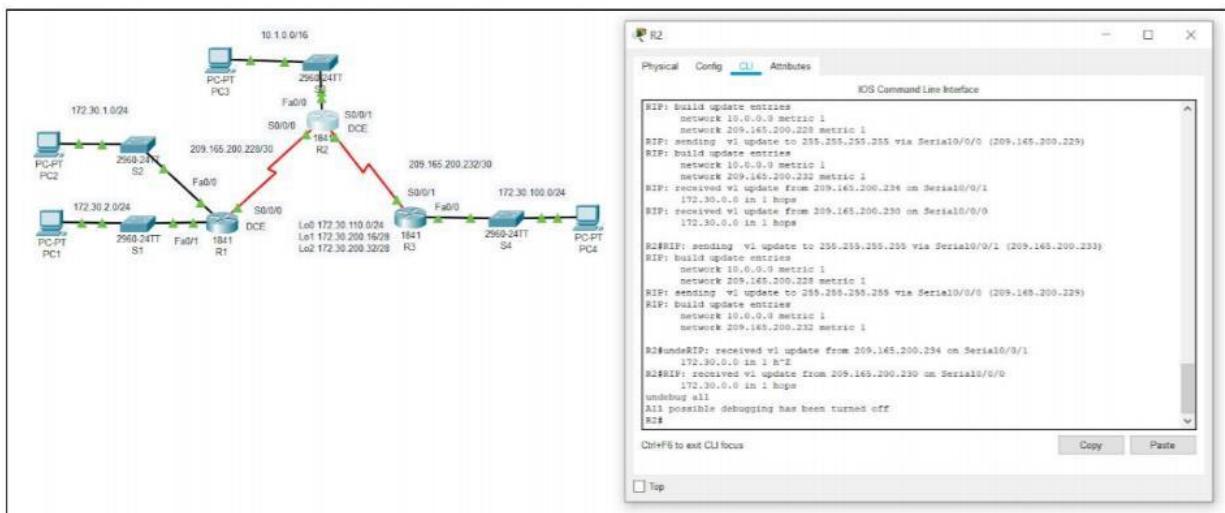
R2#debug ip rip



R2 is sending only the routes for the 10.0.0.0 LAN and the two serial connections to R1 and R3. R1 and R3 are not receiving any information about the 172.30.0.0 subnet routes.

When you are finished, turn off the debugging.

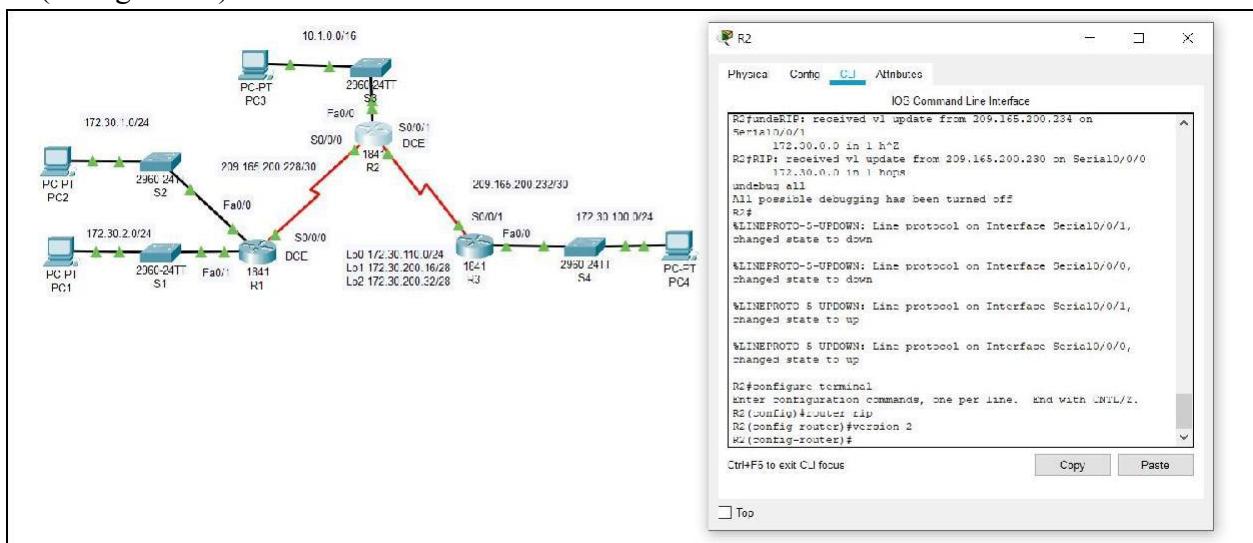
R2#undebbug all

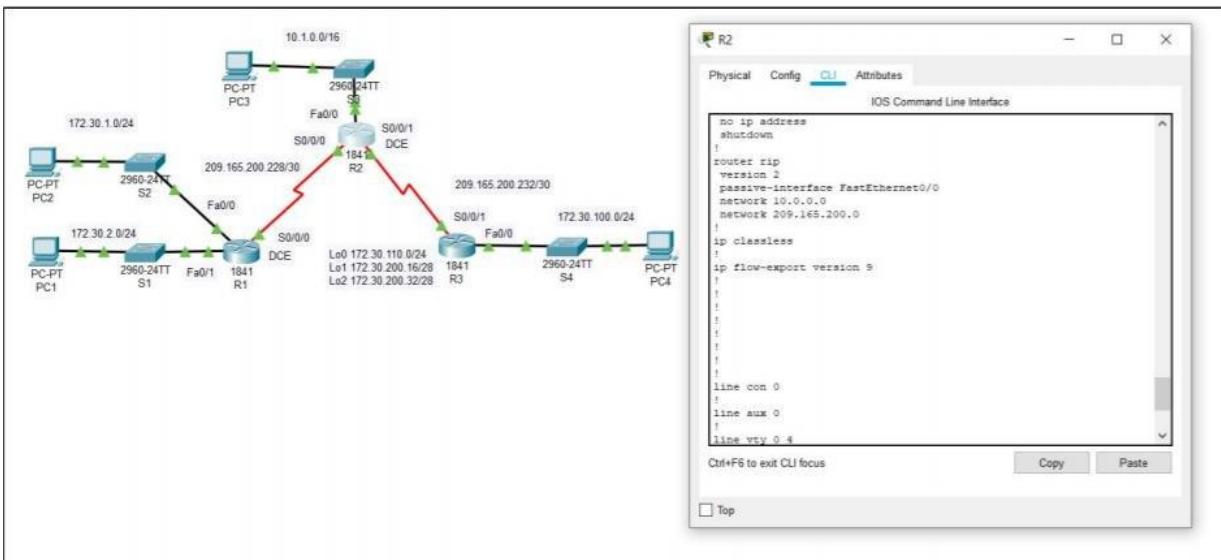


## Task 4: Configure RIP Version 2.

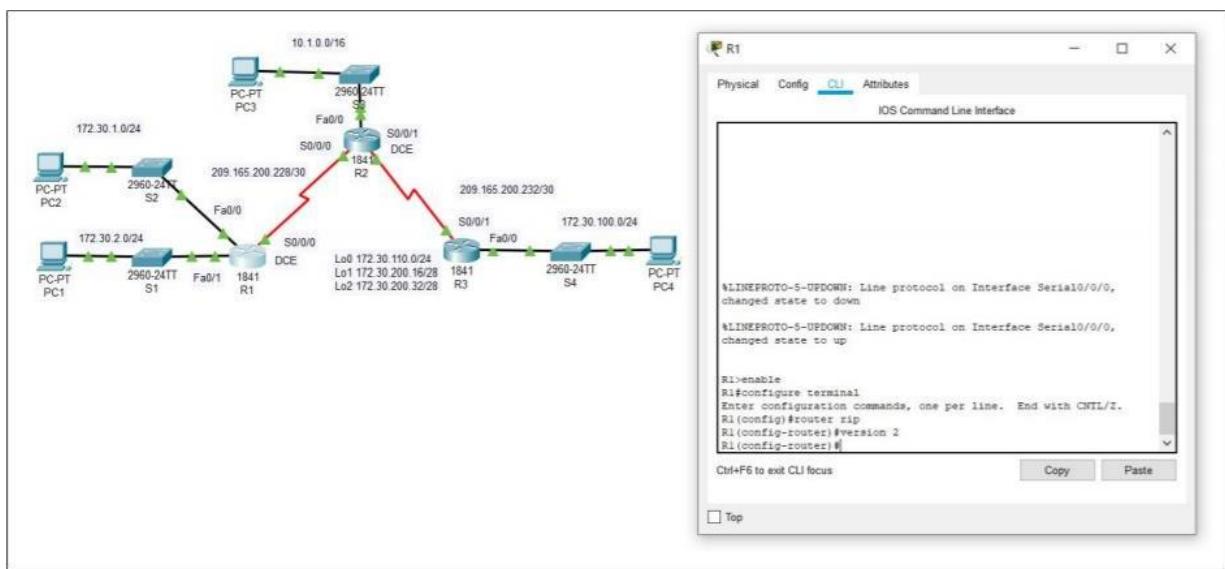
Step 1: Use the **version 2** command to enable RIP version 2 on each of the routers.

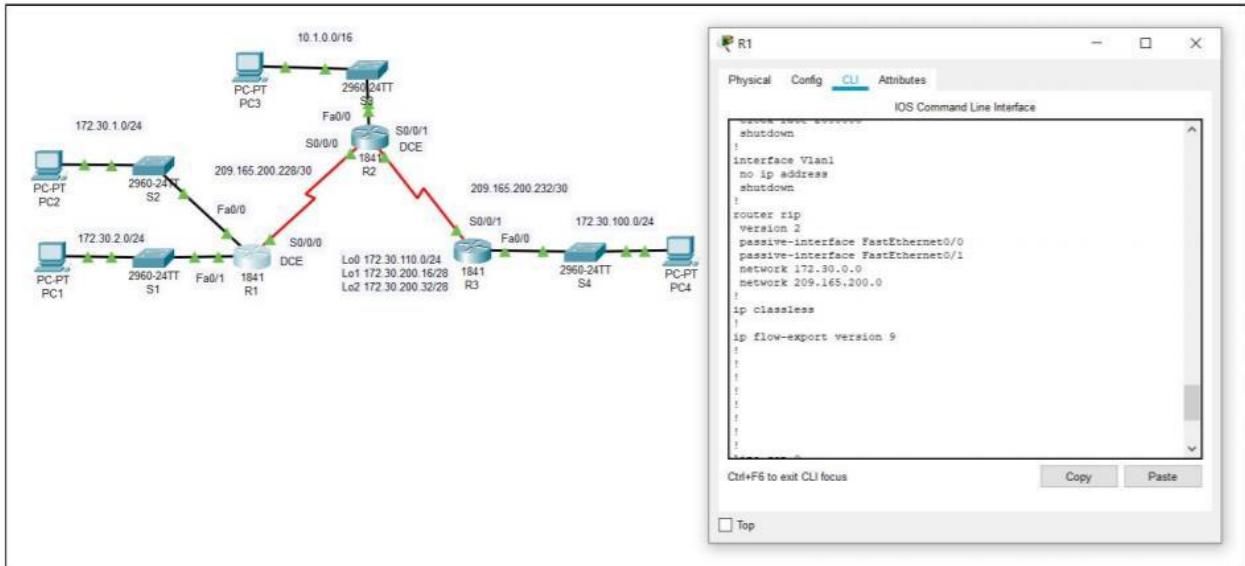
R2(config)#router rip  
R2(config-router)#version 2



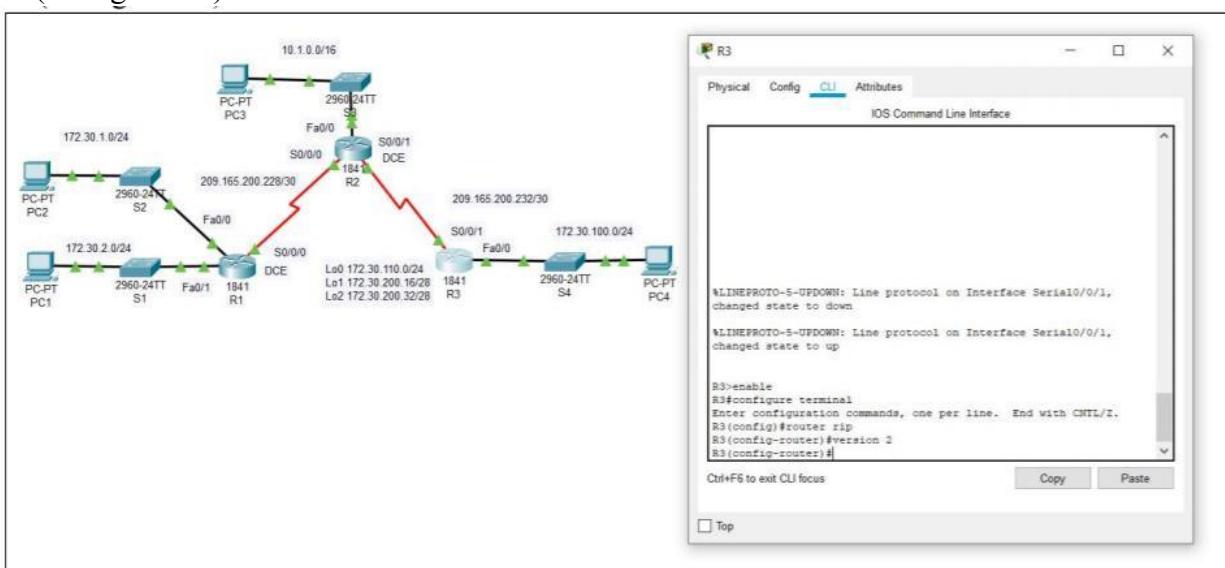


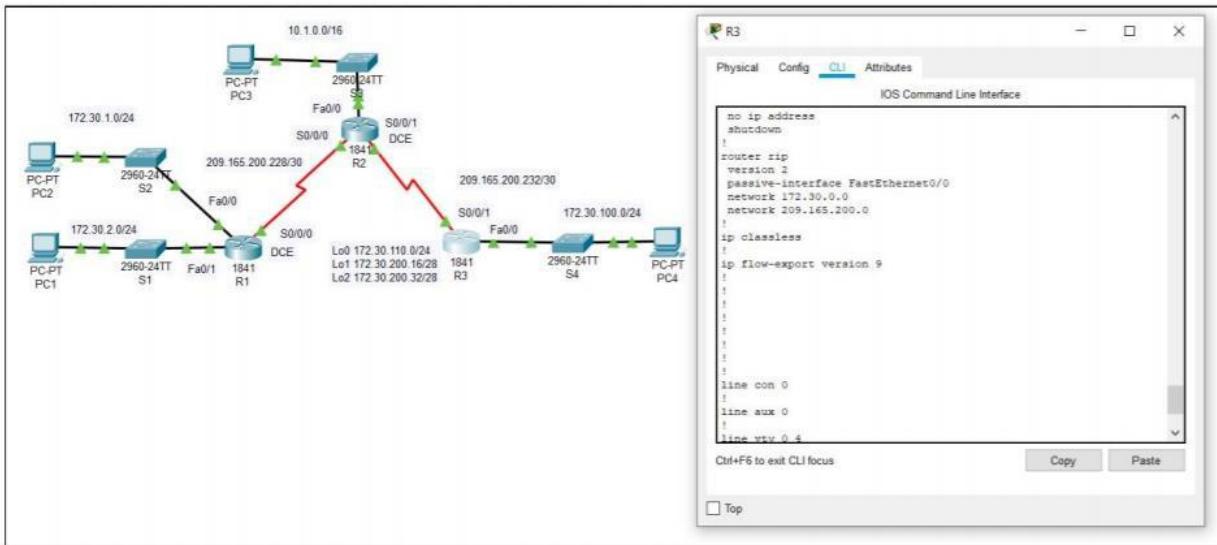
R1(config)#router rip  
R1(config-router)#version 2





```
R3(config)#router rip  
R3(config-router)#version 2
```



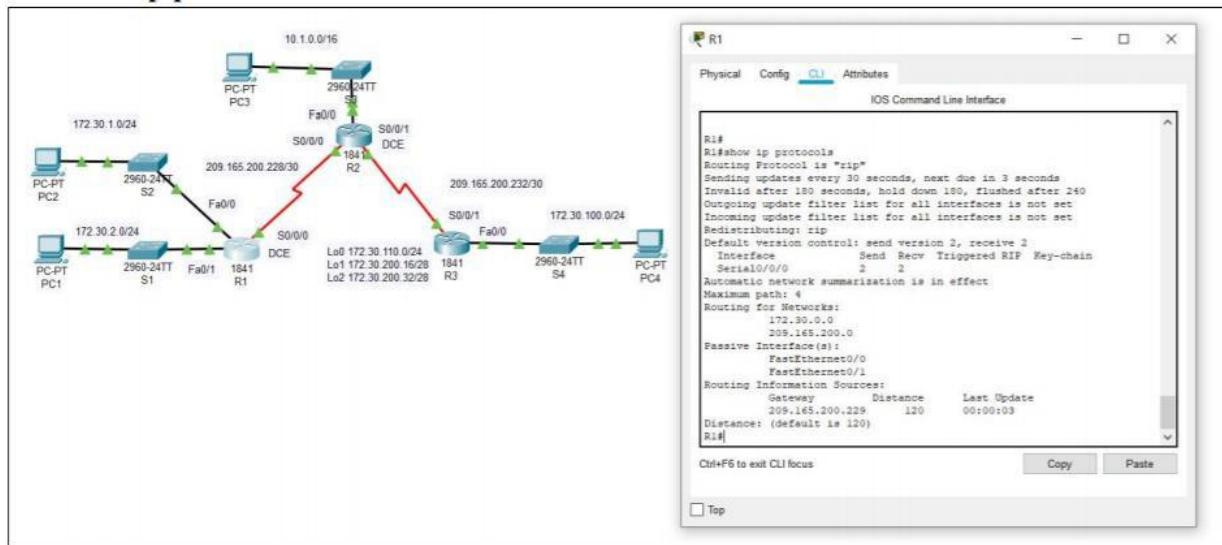


RIPv2 messages include the subnet mask in a field in the routing updates. This allows subnets and their masks to be included in the routing updates. However, by default RIPv2 summarizes networks at major network boundaries, just like RIPv1, except that the subnet mask is included in the update.

### Step 2: Verify that RIPv2 is running on the routers.

The **debug ip rip**, **show ip protocols**, and **show run** commands can all be used to confirm that RIPv2 is running. The output of the **show ip protocols** command for R1 is shown below.

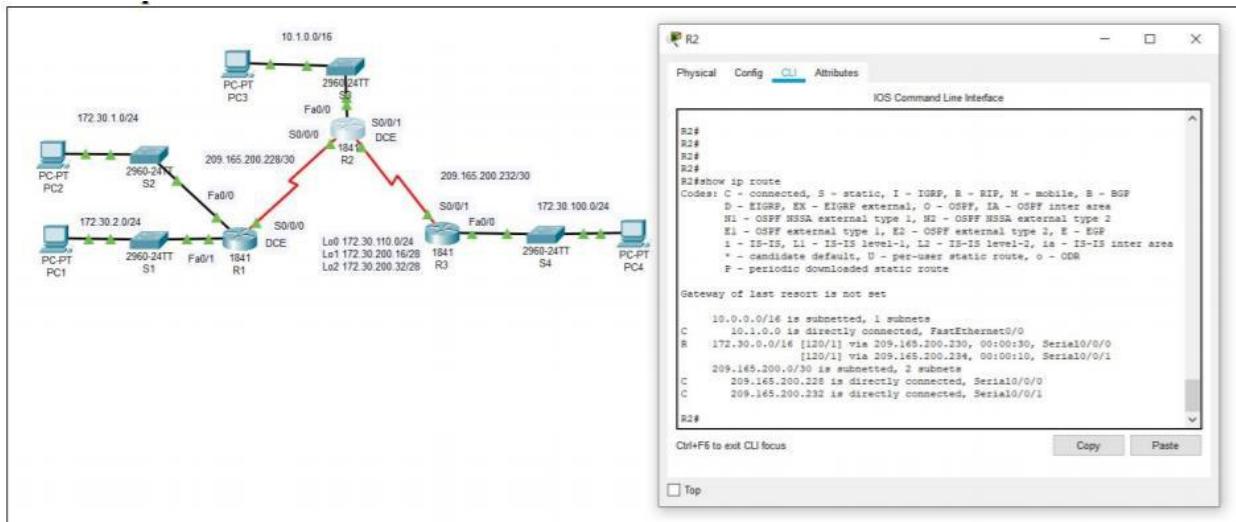
**R1# show ip protocols**



### Task 5: Examine the Automatic Summarization of Routes.

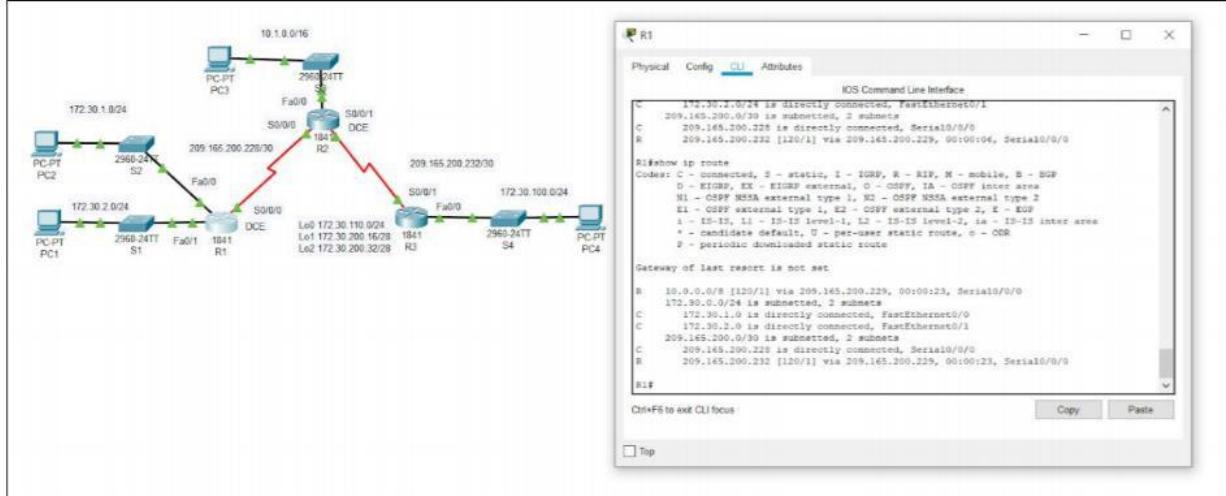
The LANs connected to R1 and R3 are still composed of discontiguous networks. R2 still shows two equal cost paths to the 172.30.0.0/16 network in the routing table. R2 still shows only the major classful network address of 172.30.0.0 and does not show any of the subnets for this network.

R2#show ip route



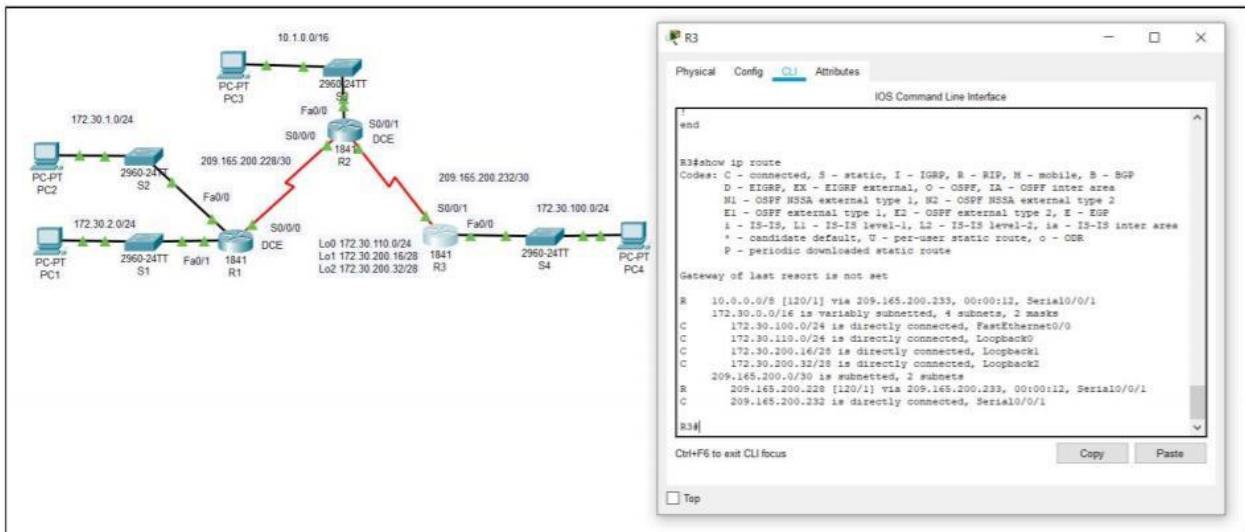
R1 still shows only its own subnets for the 172.30.0.0 network. R1 still does not have any routes for the 172.30.0.0 subnets on R3.

R1#show ip route



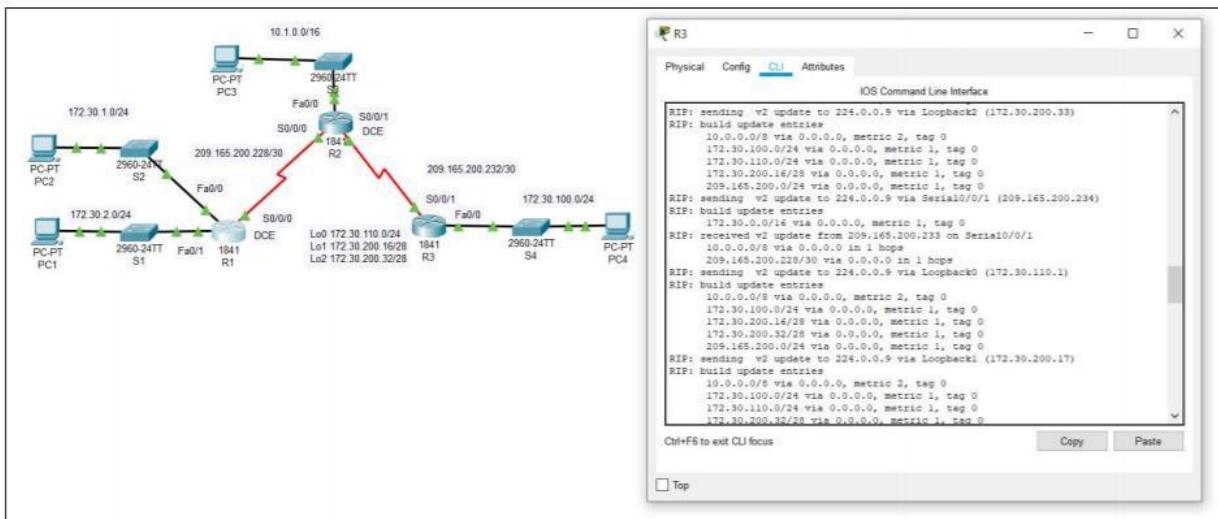
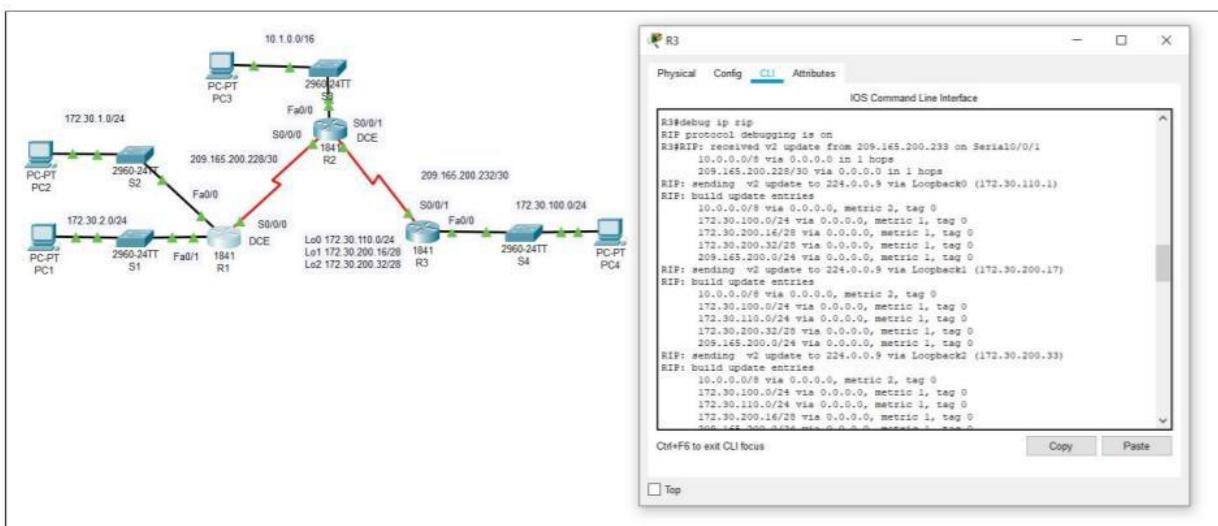
R3 still only shows its own subnets for the 172.30.0.0 network. R3 still does not have any routes for the 172.30.0.0 subnets on R1.

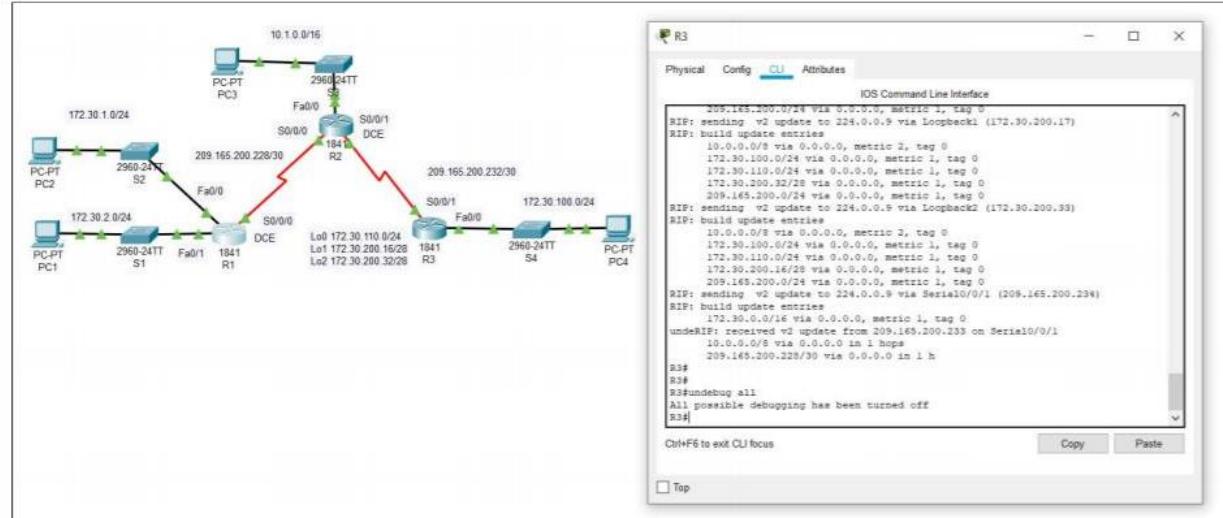
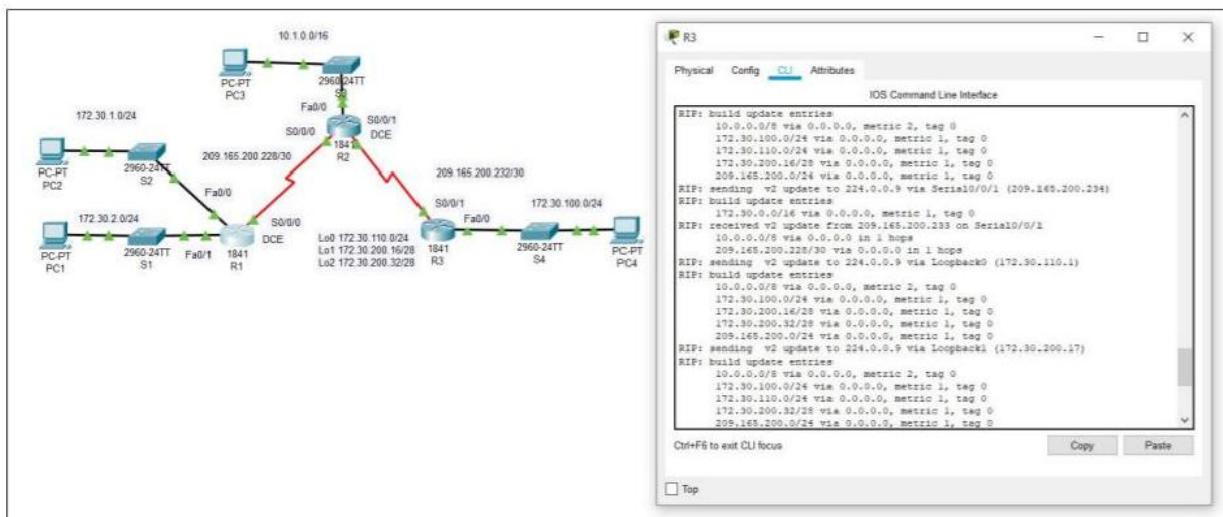
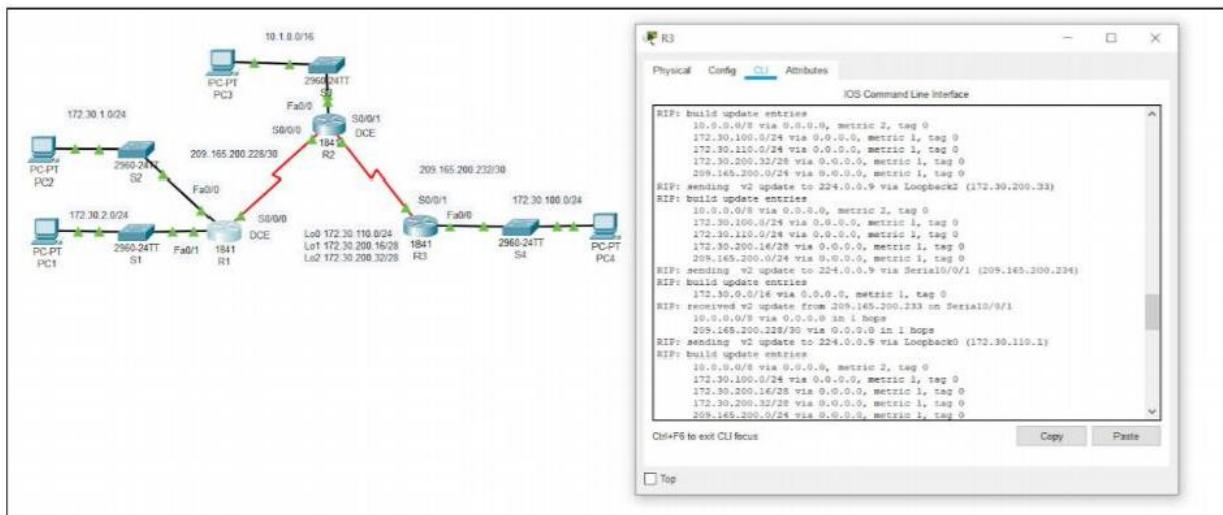
R3#show ip route



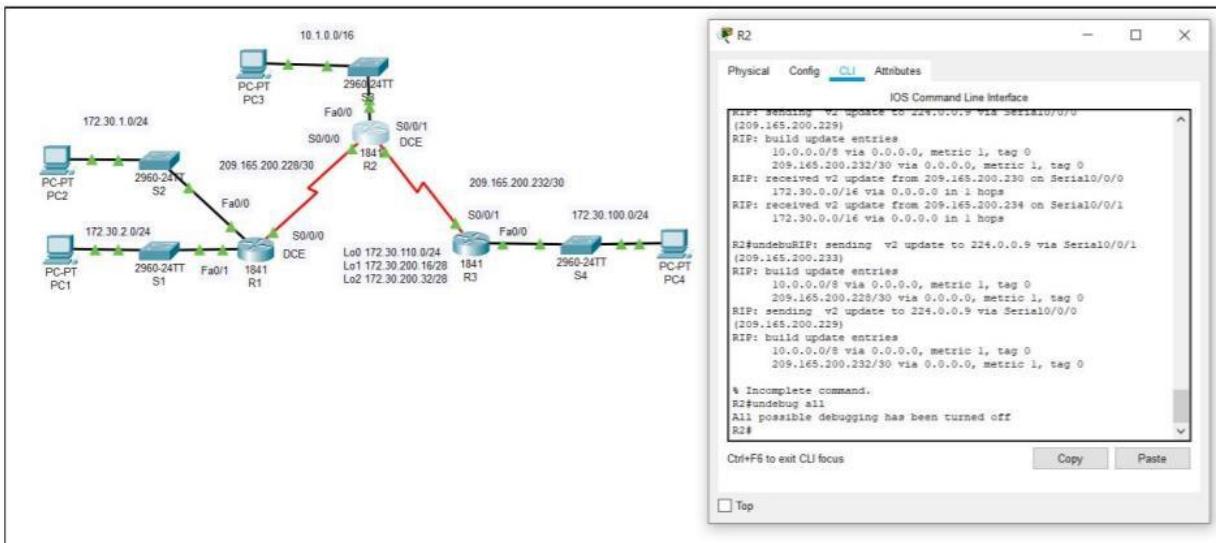
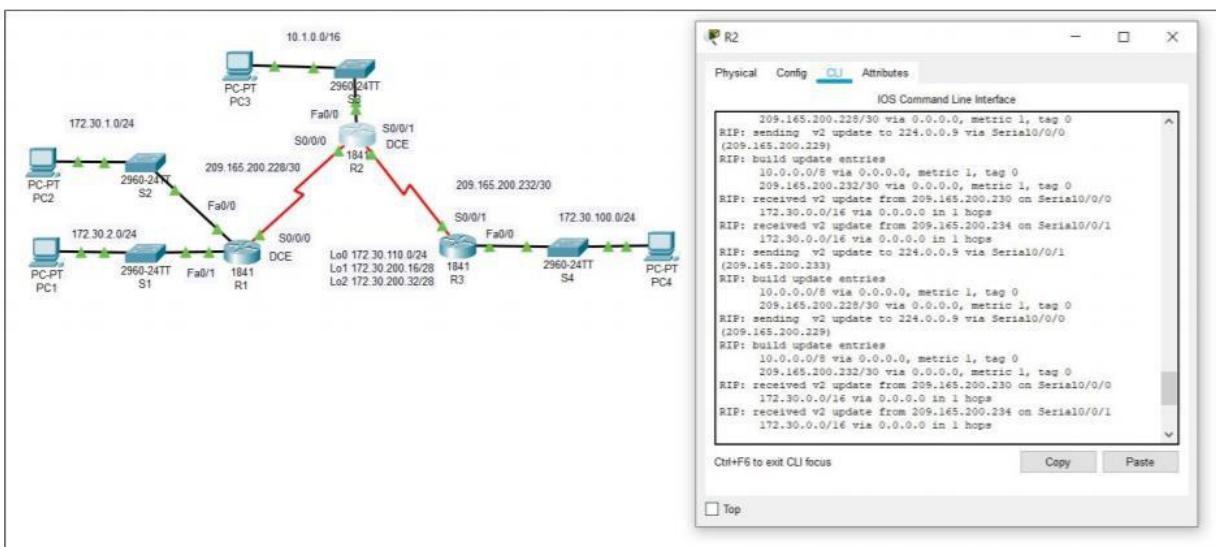
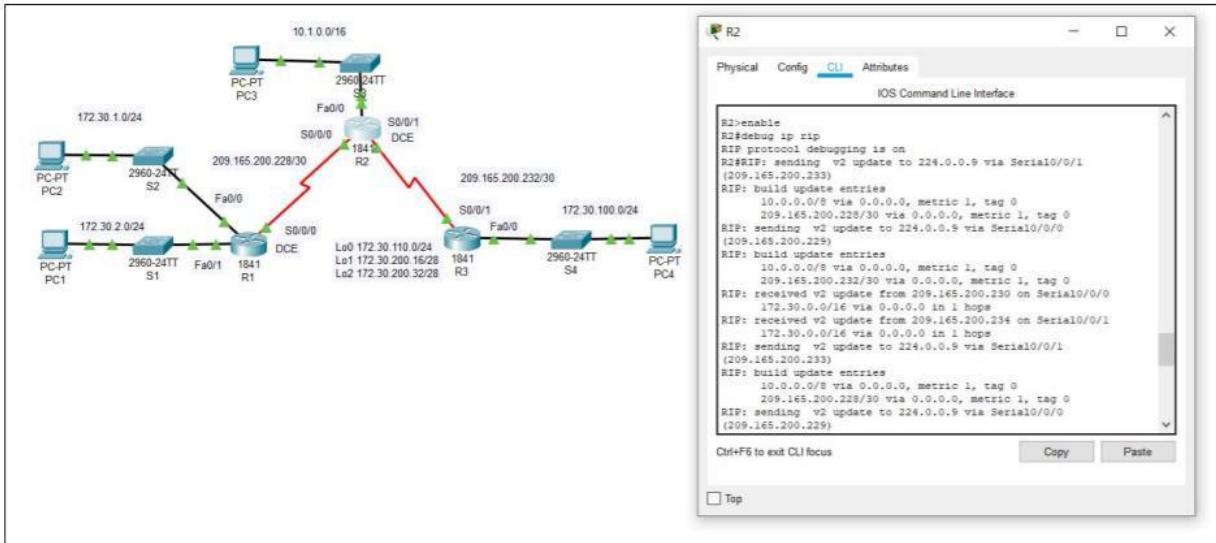
Use the output of the **debug ip rip** command to answer the following questions:

On R3

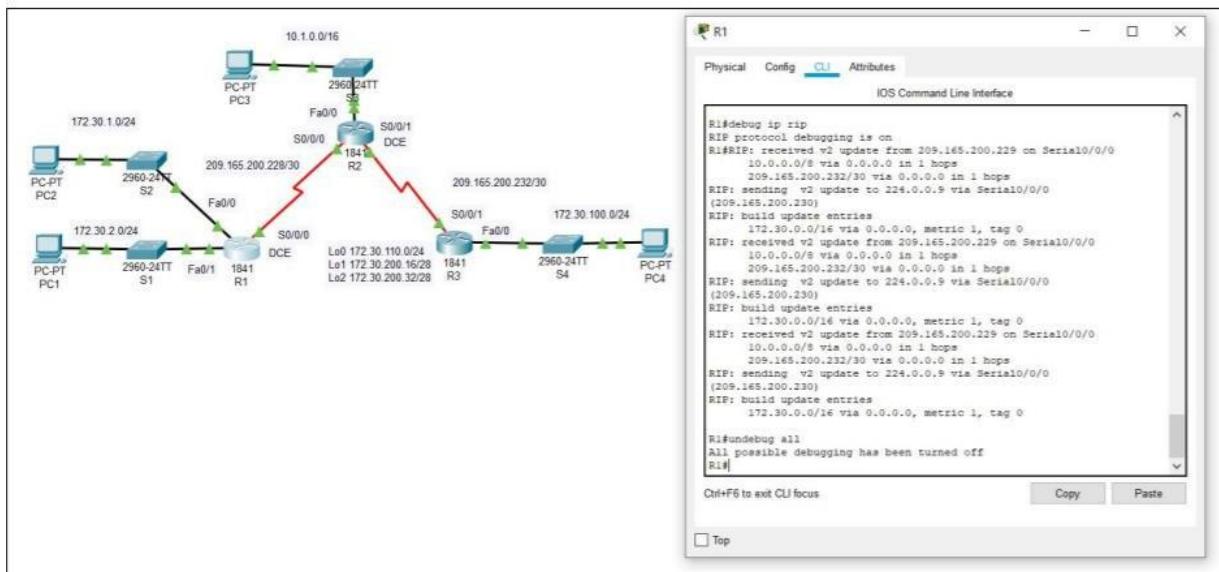




## On R2



## On R1



What entries are included in the RIP updates sent out from R3?

Ans:

1. 10.0.0.0/8
2. 172.30.100.0/24
3. 172.30.110.0/24
4. 172.30.200.16/24
5. 209.165.200.0/24

On R2, what routes are in the RIP updates that are received from R3?

Ans: 172.30.0.0/16

R3 is not sending any of the 172.30.0.0 subnets—only the summarized route of 172.30.0.0/16, including the subnet mask. This is why R2 and R1 are not seeing the 172.30.0.0 subnets on R3.

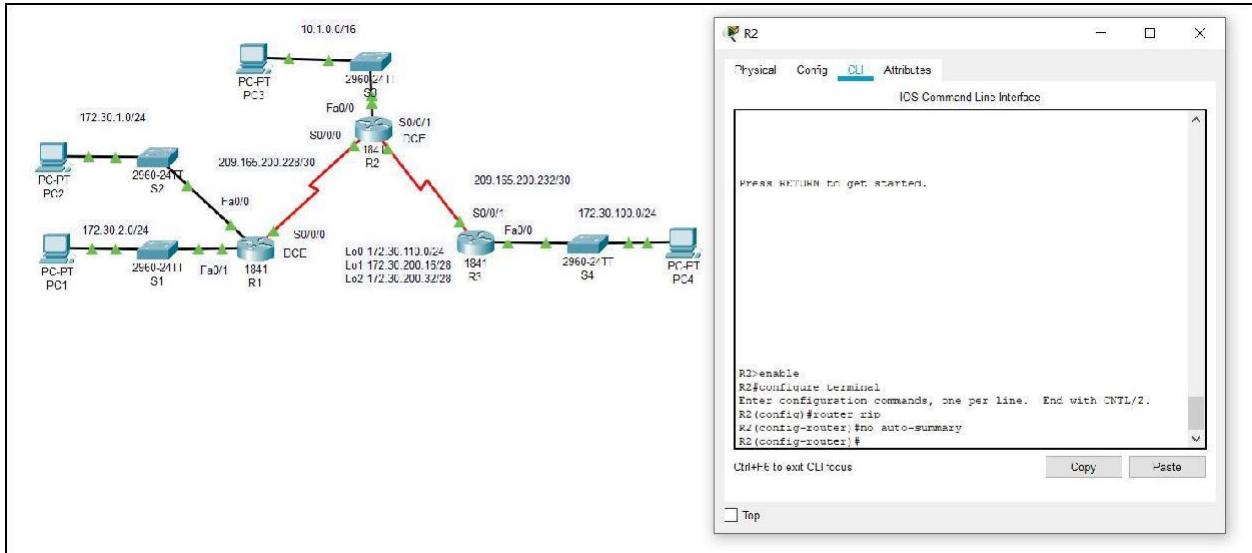
## Task 6: Disable Automatic Summarization.

The **no auto-summary** command is used to turn off automatic summarization in RIPv2. Disable auto summarization on all routers. The routers will no longer summarize routes at major network boundaries.

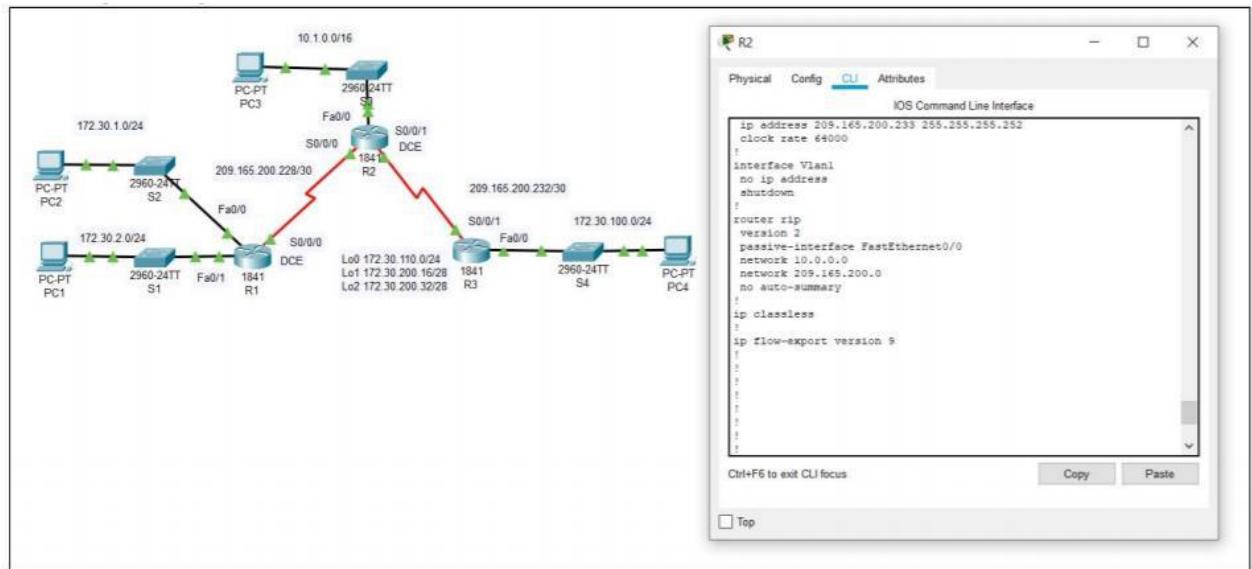
```

R2(config)#router rip
R2(config-router)#no auto-summary

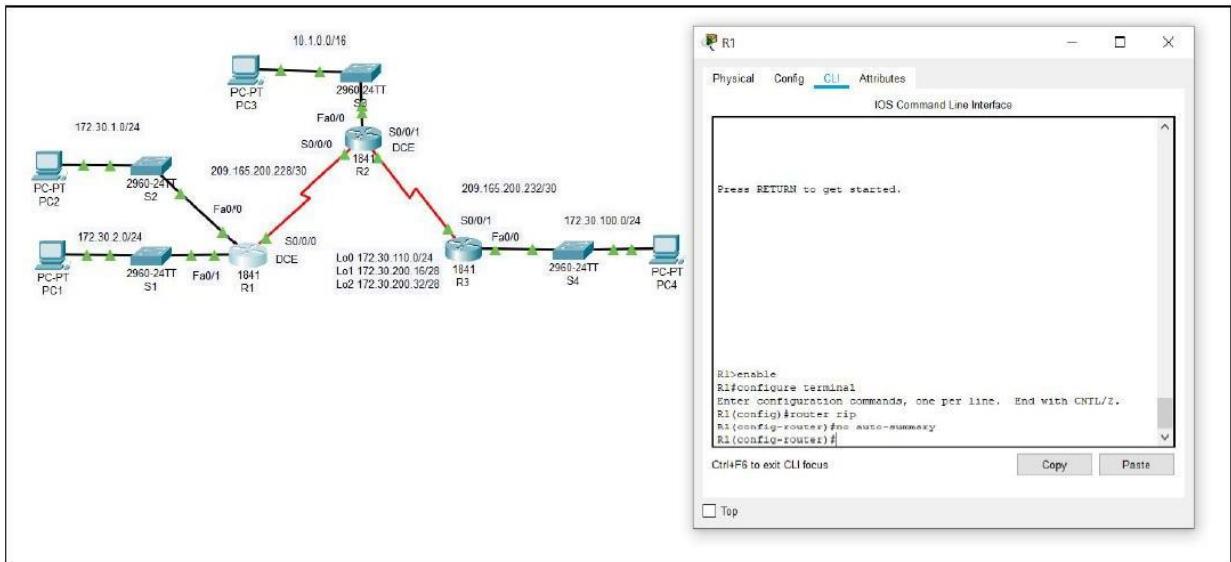
```



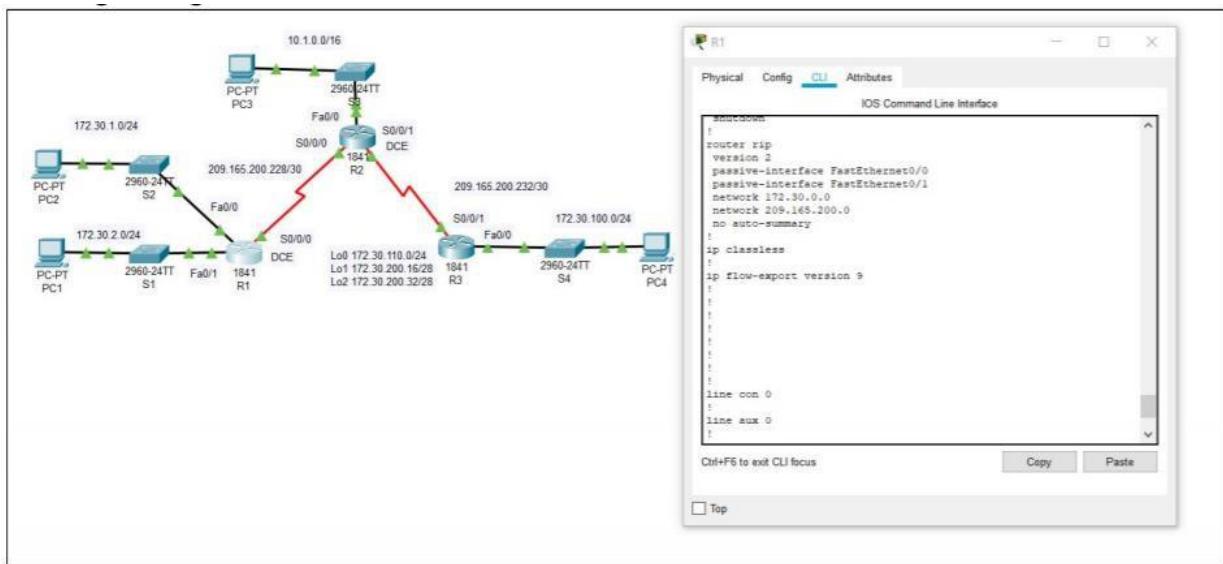
## Running Configuration



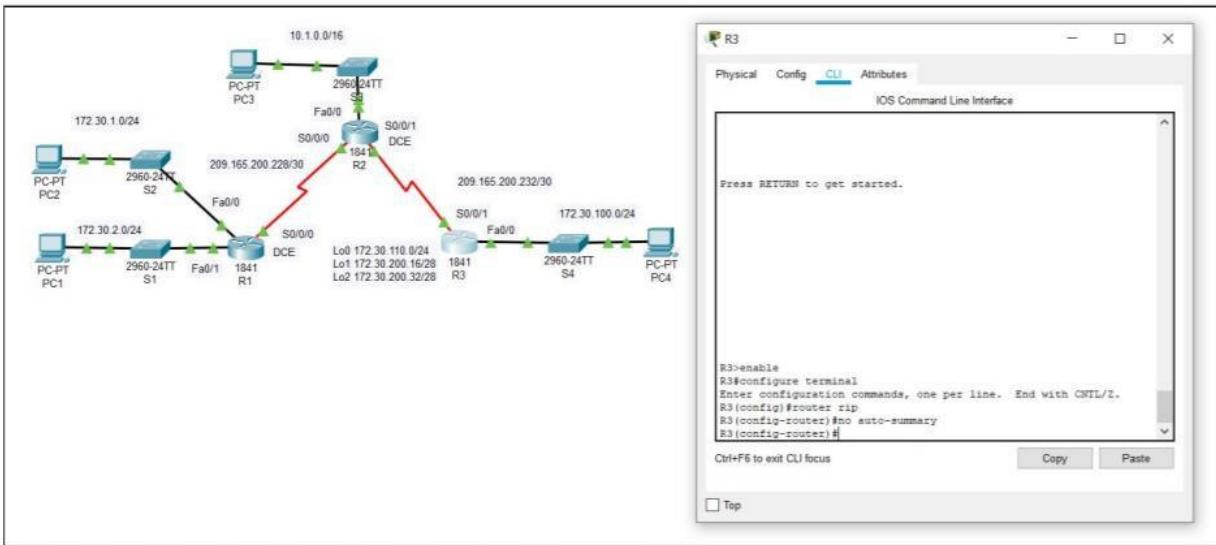
**R1(config)#router rip**  
**R1(config-router)#no auto-summary**



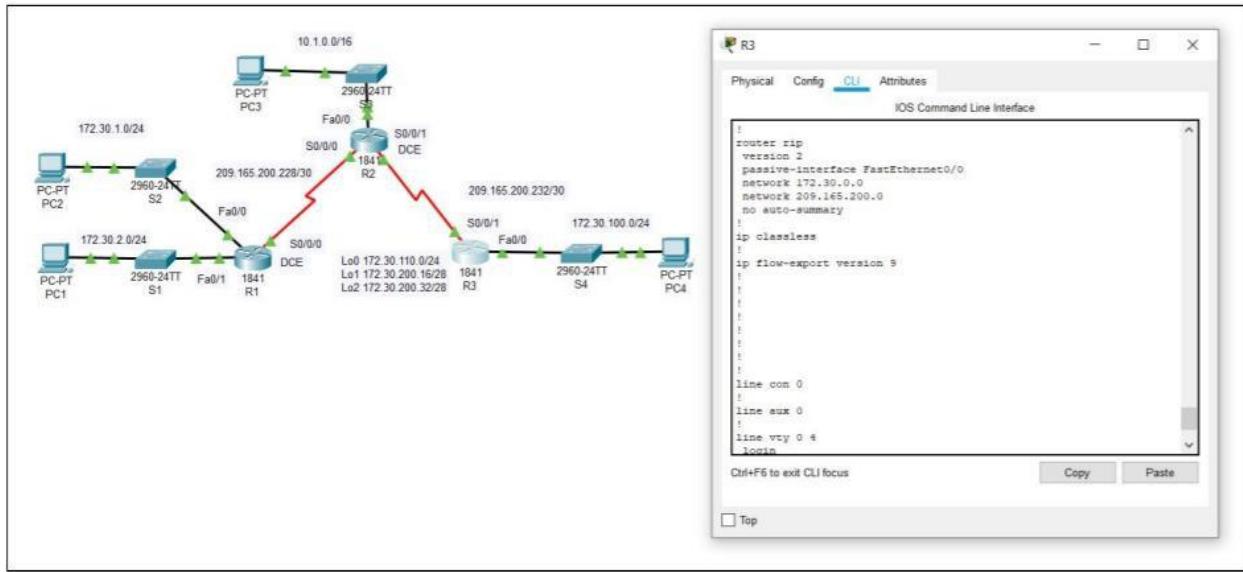
## Running Configuration



R3(config)#**router rip**  
R3(config-router)#**no auto-summary**



## Running Configuration

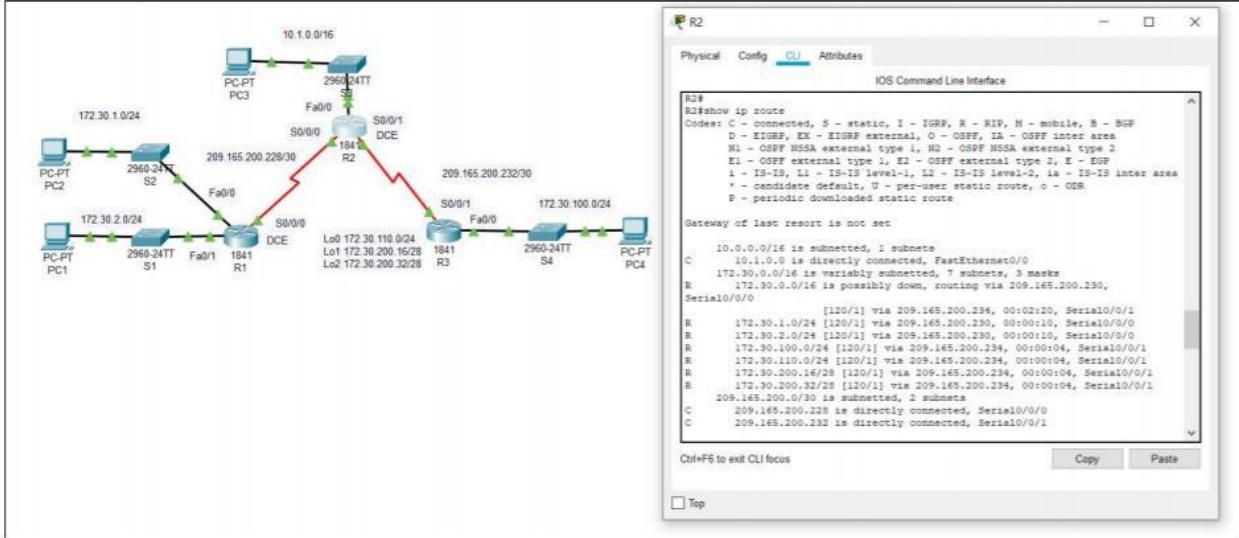


The **show ip route** and **ping** commands can be used to verify that automatic summarization is off.

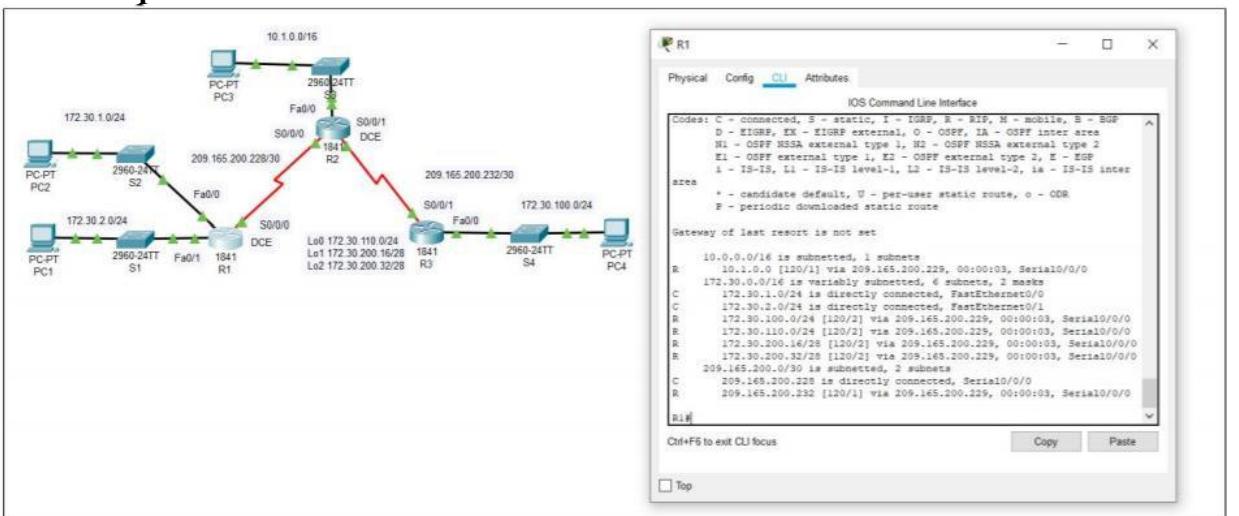
## **Task 7: Examine the Routing Tables.**

The LANs connected to R1 and R3 should now be included in all three routing tables.

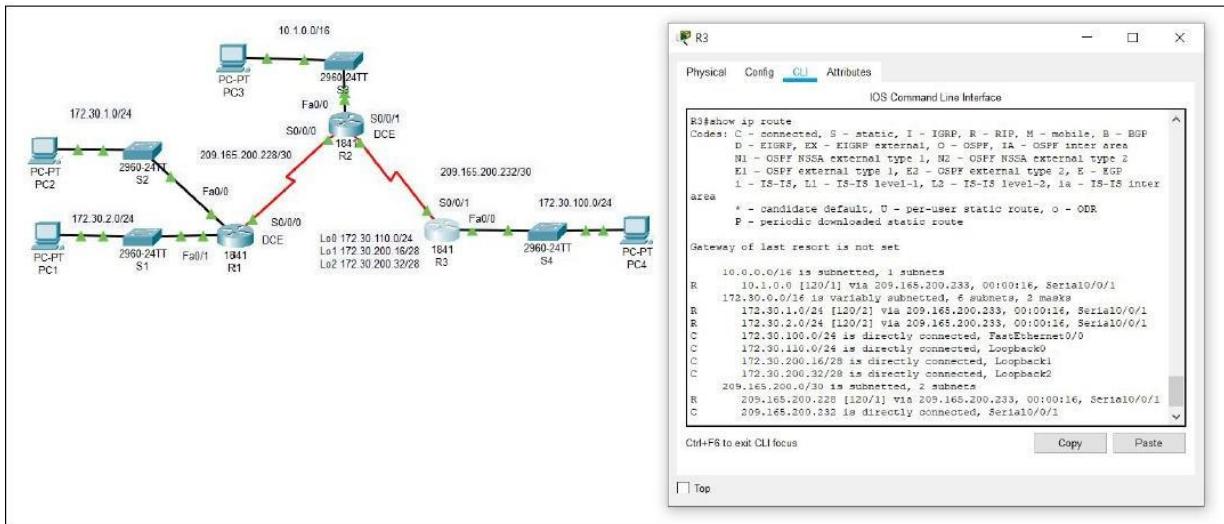
R2#show ip route



R1#show ip route

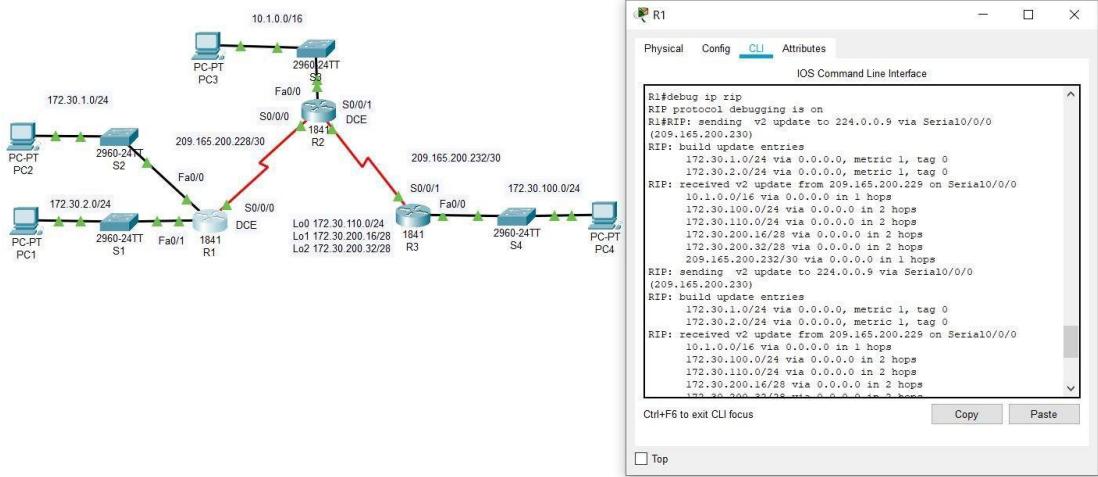


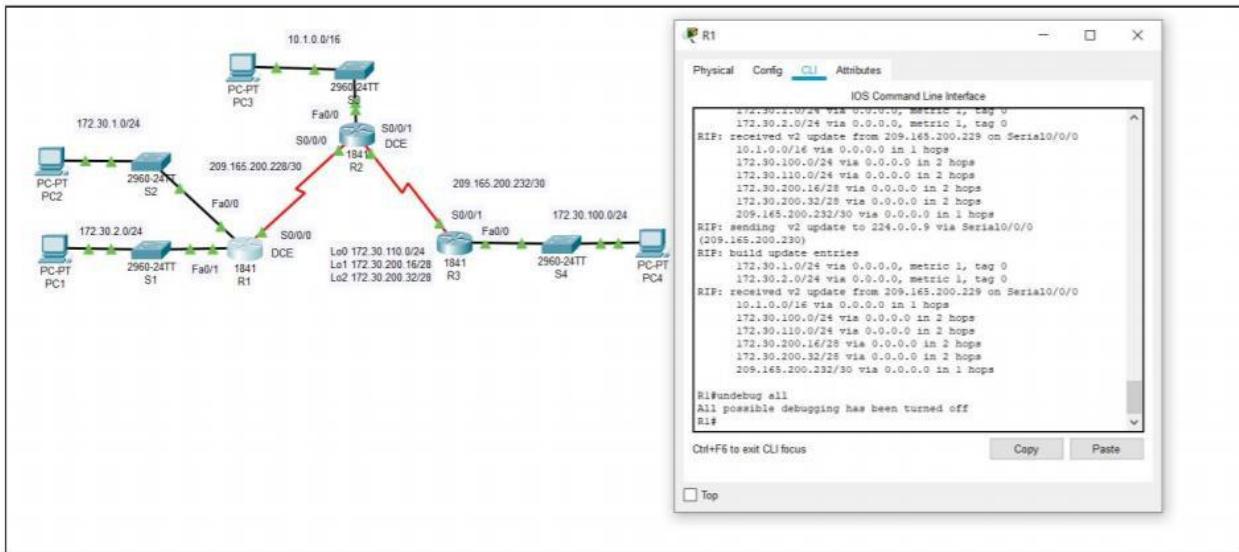
R3#show ip route



Use the output of the **debug ip rip** command to answer the following questions:

On R1



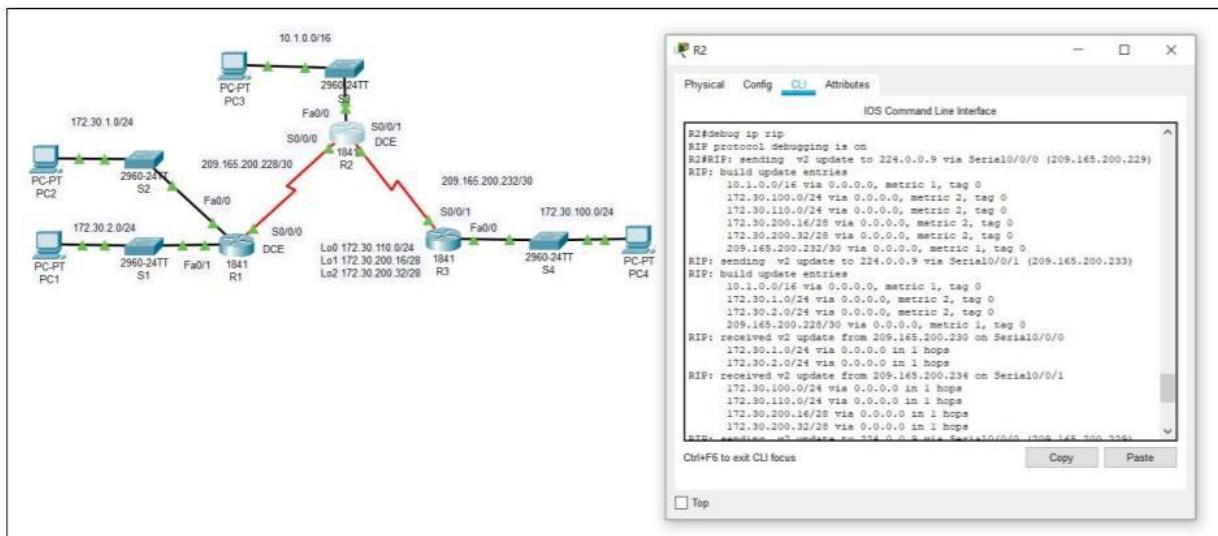


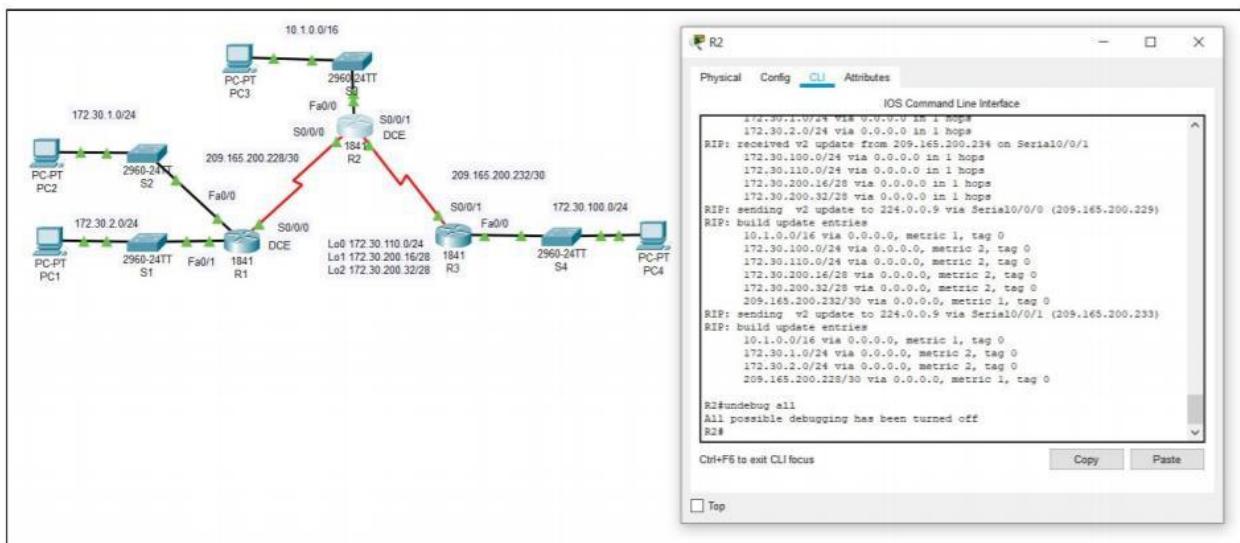
What entries are included in the RIP updates sent out from R1?

Ans:

1. 172.30.1.0/24
2. 172.30.2.0/24

On R2





On R2, what routes are in the RIP updates that are received from R1?

Ans:

1. 172.30.1.0/24
2. 172.30.2.0/24

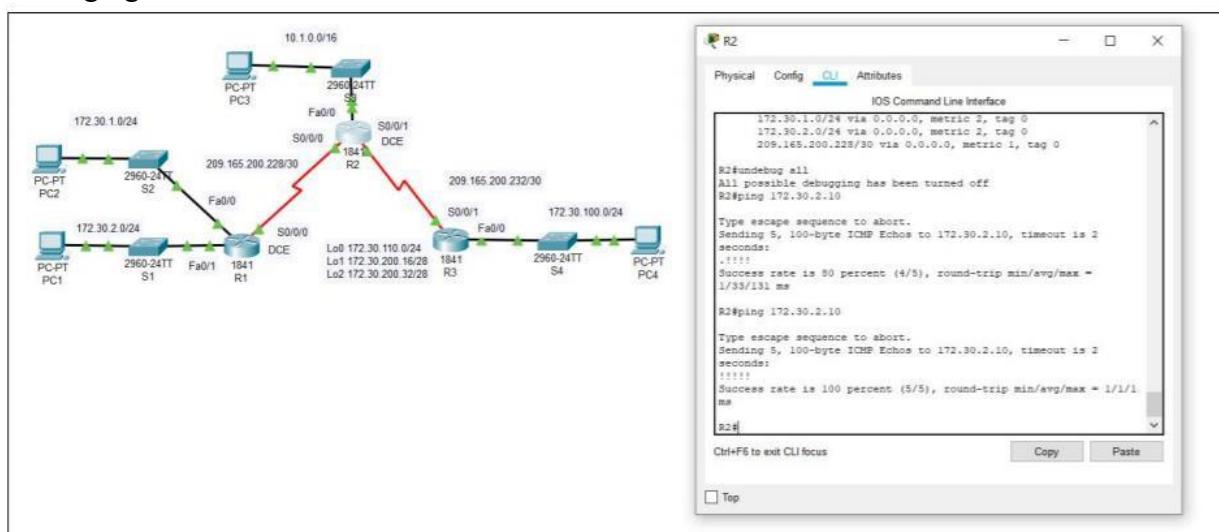
Are the subnet masks now included in the routing updates?

Ans: Yes

### Task 8: Verify Network Connectivity.

#### Step 1: Check connectivity between R2 router and PCs.

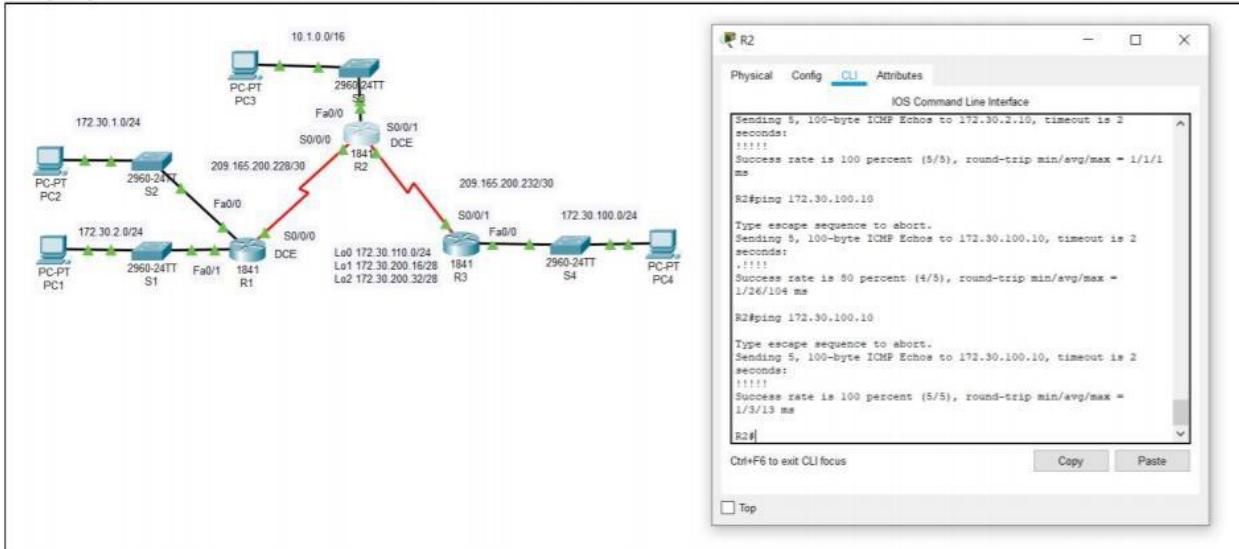
Pinging PC1 from R2



From R2, how many ICMP messages are successful when pinging PC1?

Ans: 5 ICMP messages are successful.

Pinging PC4 from R2

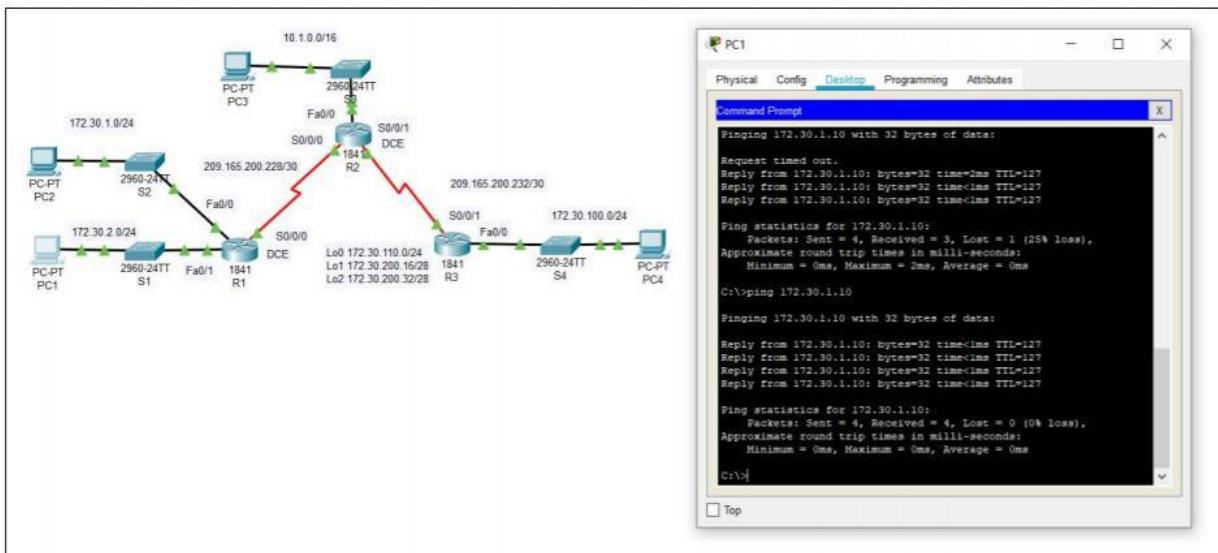


From R2, how many ICMP messages are successful when pinging PC4?

Ans: 5 ICMP messages are successful.

## Step 2: Check the connectivity between the PCs.

Pinging PC2 from PC1



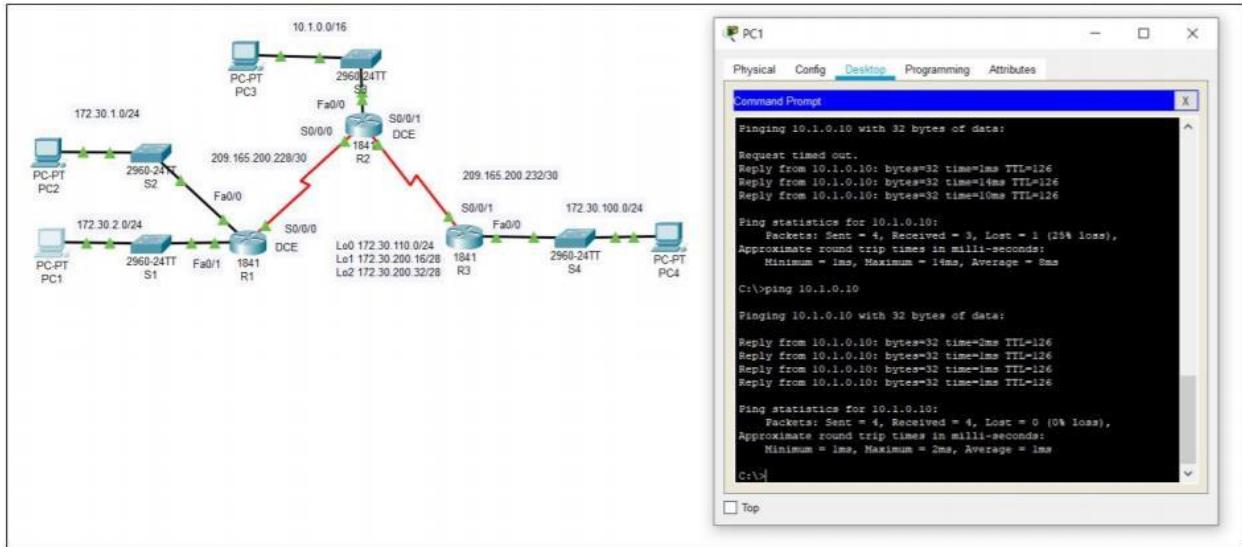
From PC1, is it possible to ping PC2?

Ans: Yes

What is the success rate?

Ans: 100%

Pinging PC3 from PC1



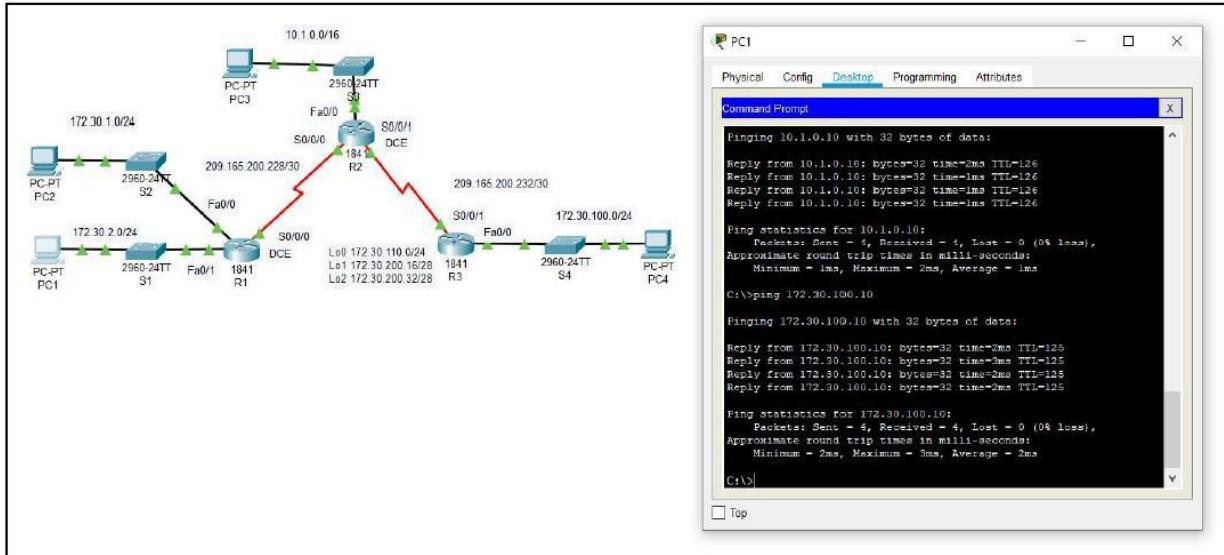
From PC1, is it possible to ping PC3?

Ans: Yes

What is the success rate?

Ans: 100%

Pinging PC4 from PC1



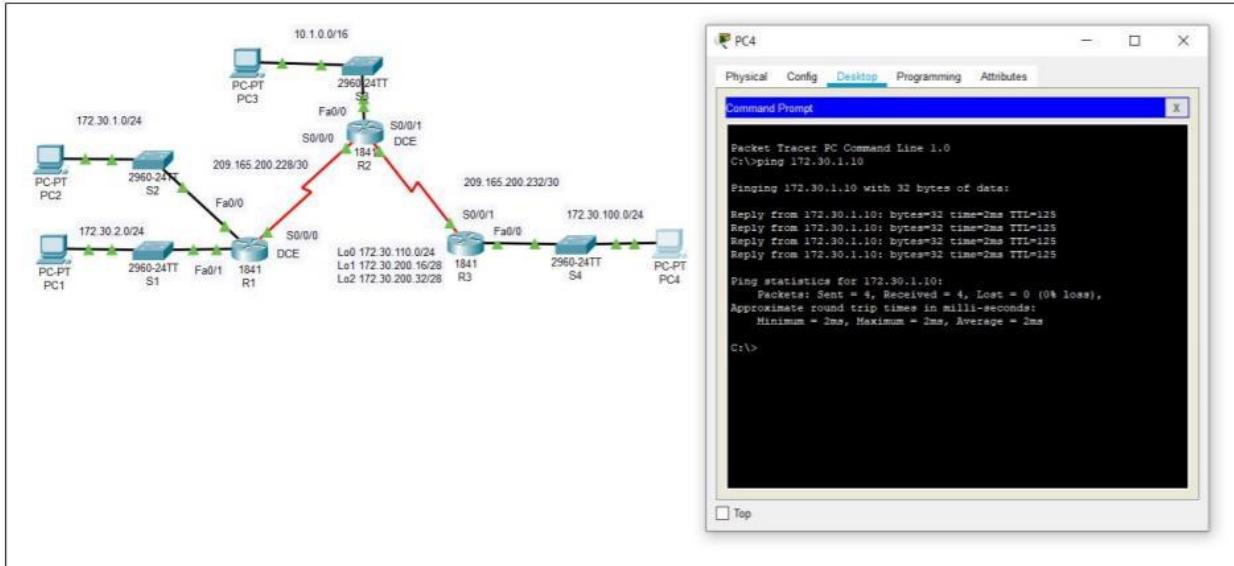
From PC1, is it possible to ping PC4?

Ans: Yes

What is the success rate?

Ans: 100%

Pinging PC2 from PC4



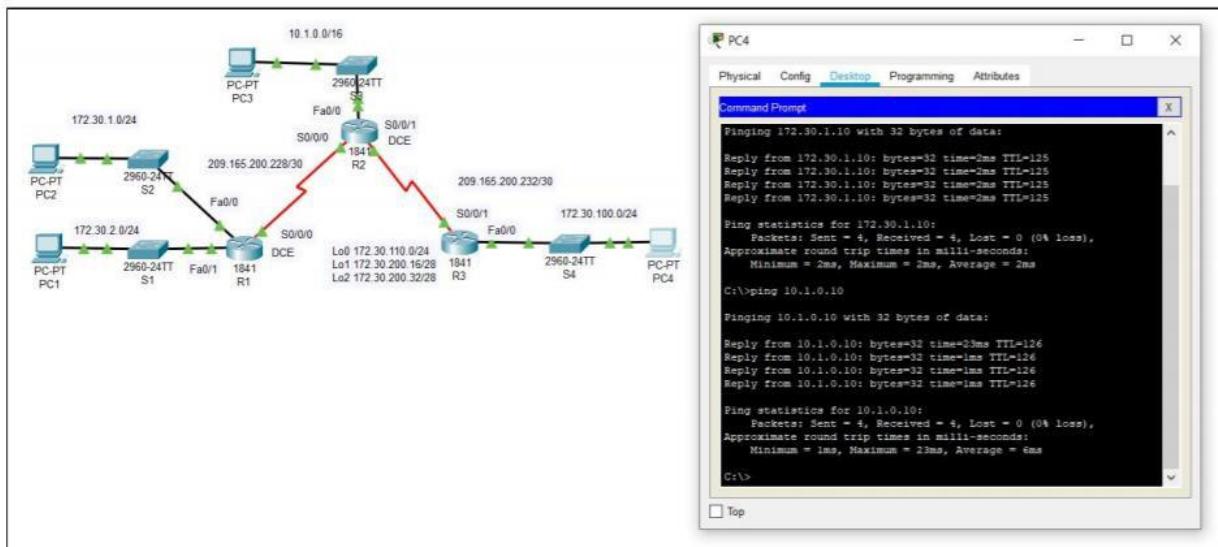
From PC4, is it possible to ping PC2?

Ans: Yes

What is the success rate?

Ans: 100%

Pinging PC3 from PC4



From PC4, is it possible to ping PC3?

Ans: Yes

What is the success rate?

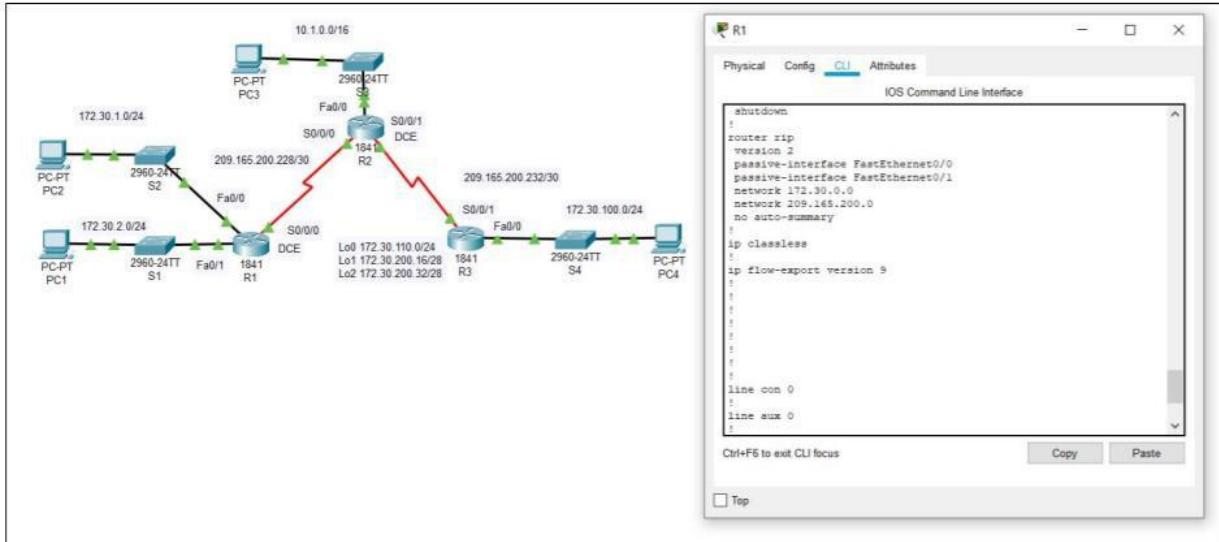
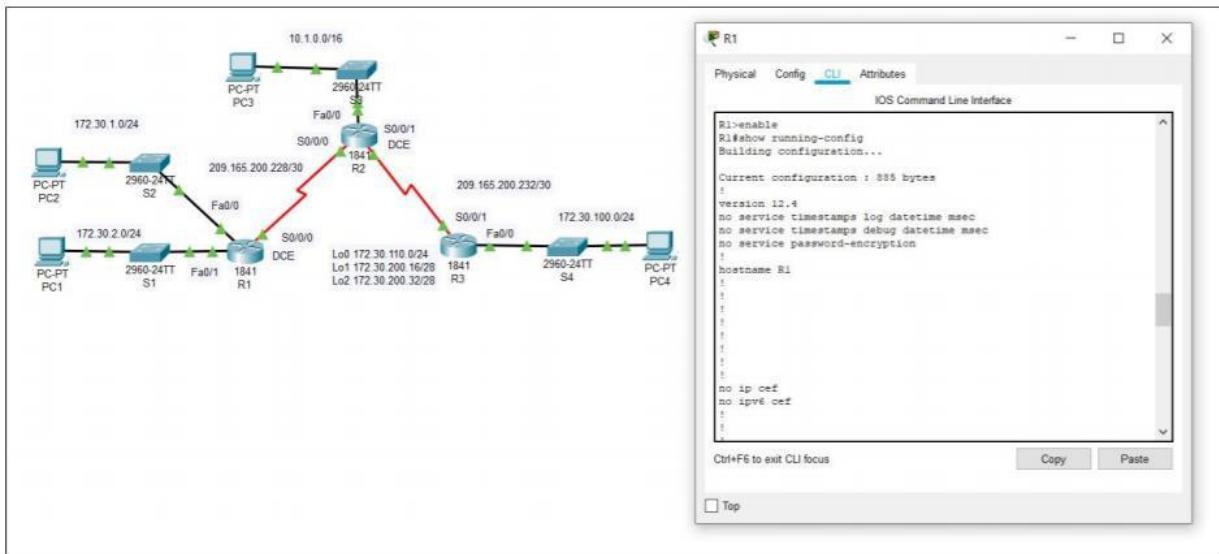
Ans: 100%

## Task 9: Documentation

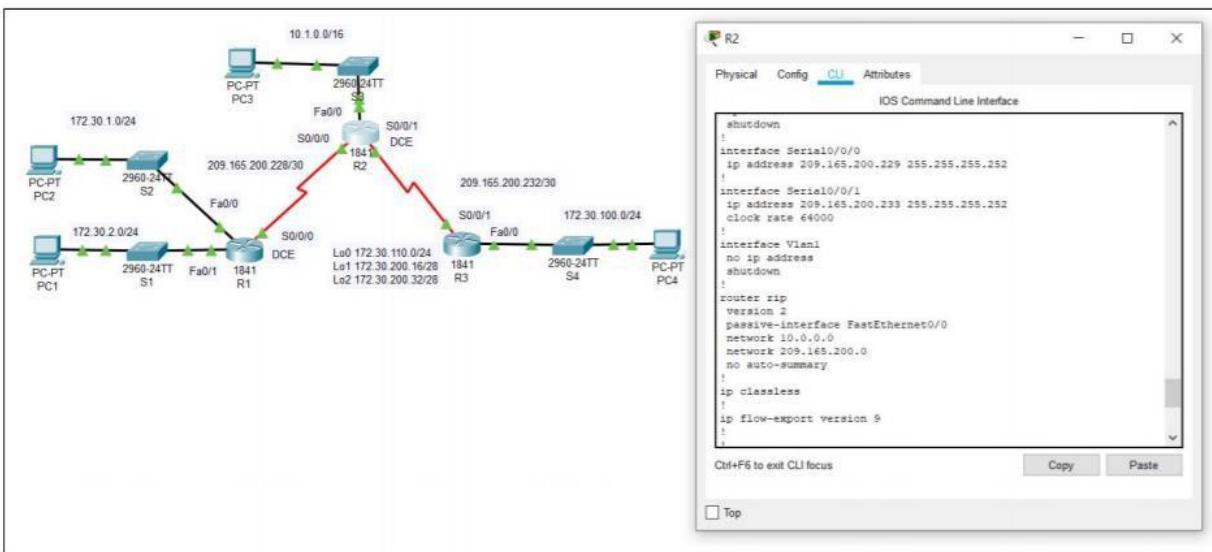
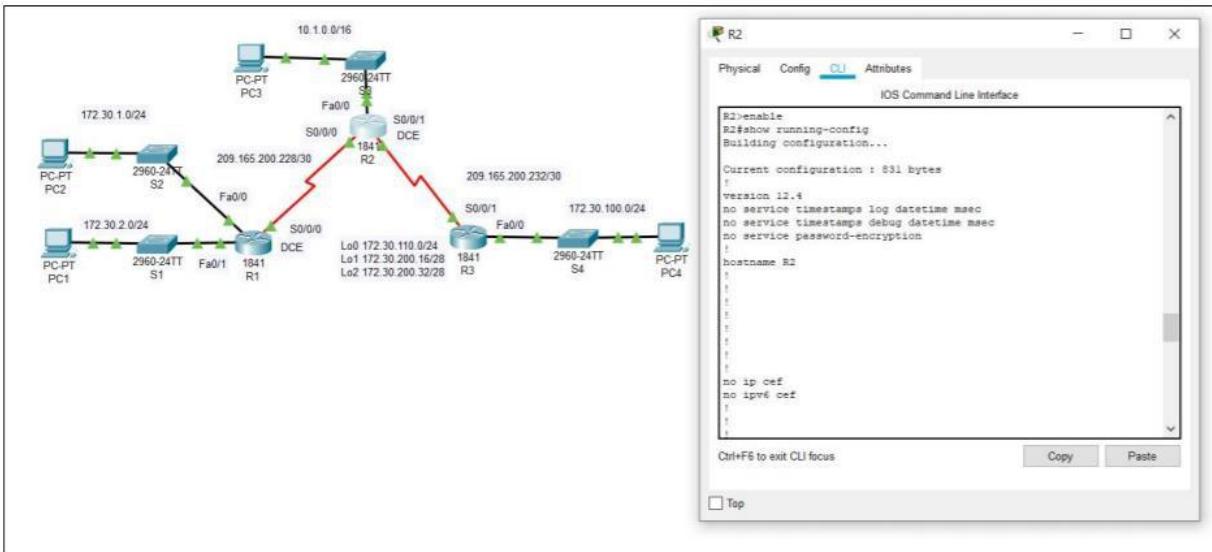
On each router, capture the following command output to a text (.txt) file and save for future reference.

- show running-config

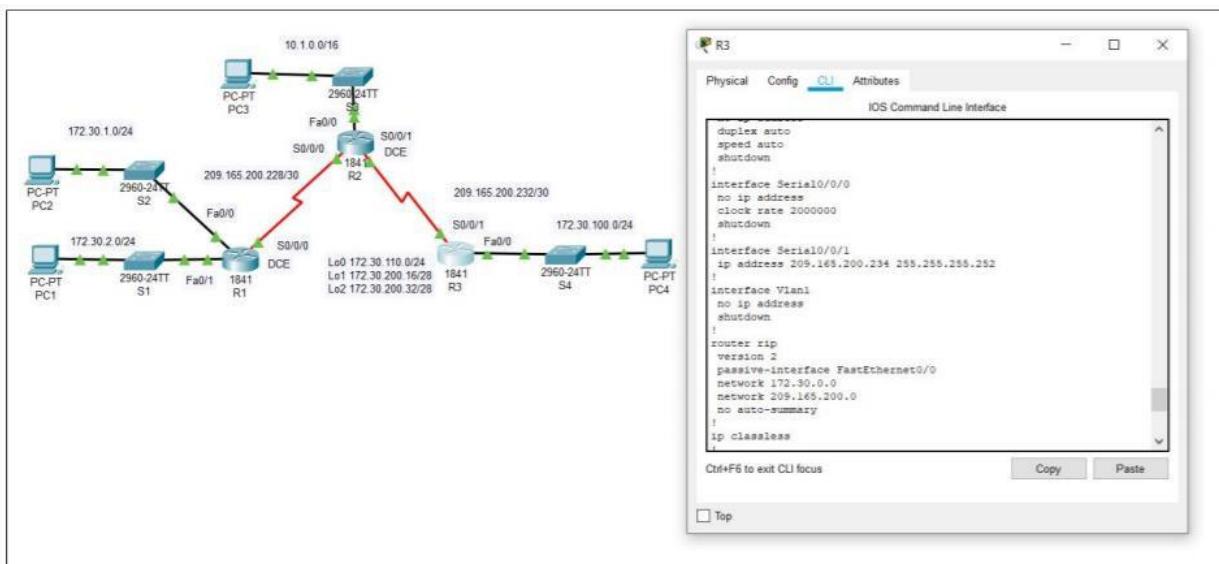
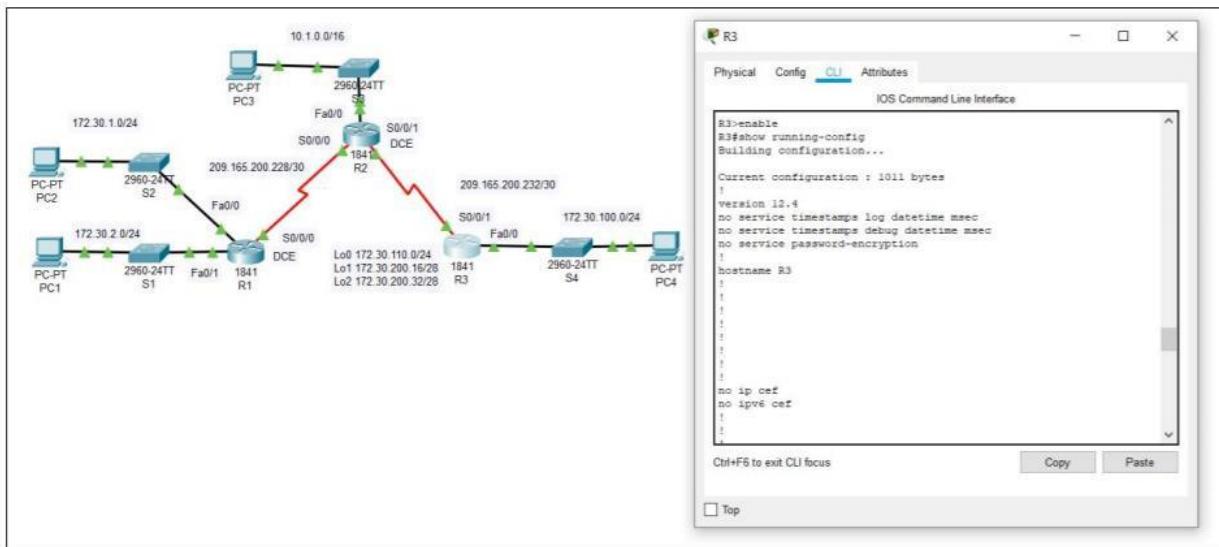
R1



## For R2

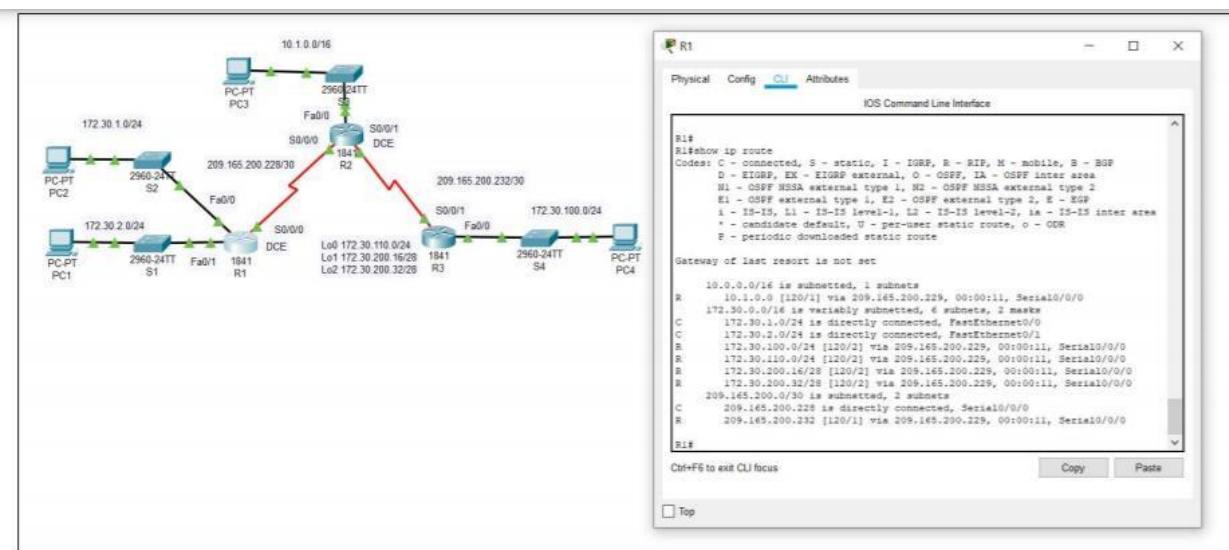


### R3

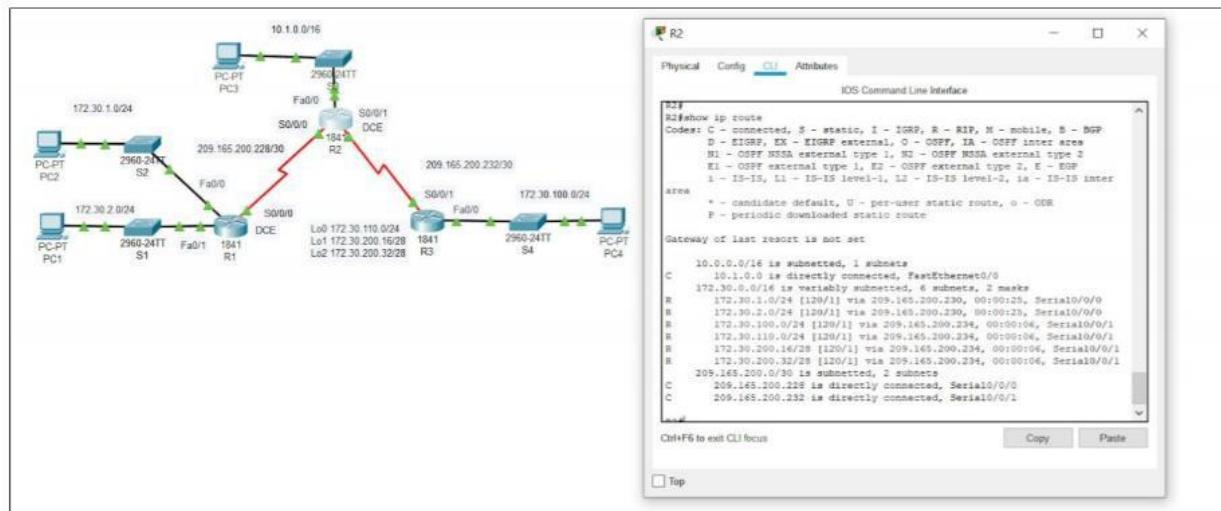


- show ip route

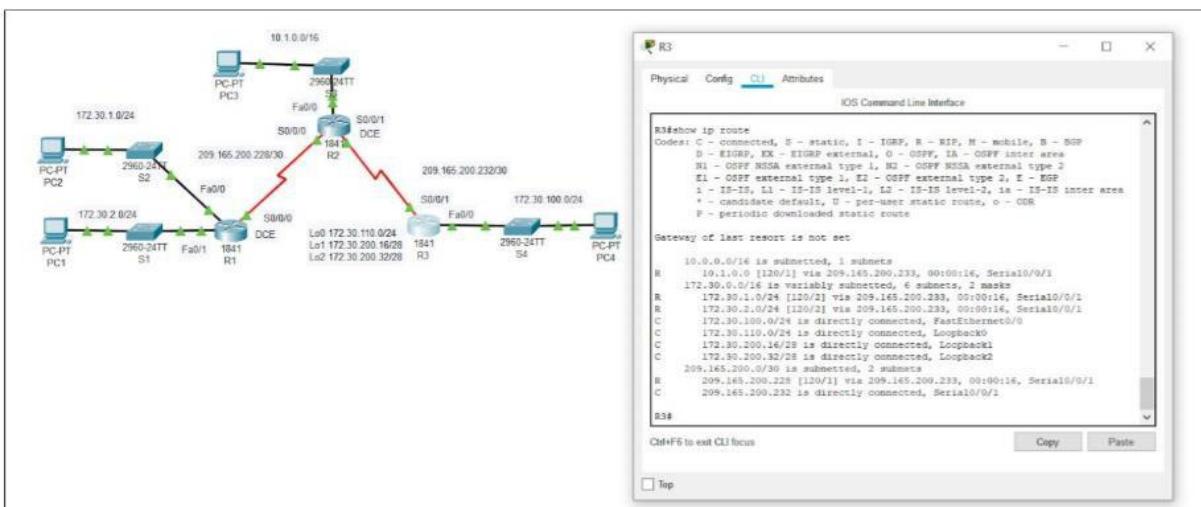
R1



R2

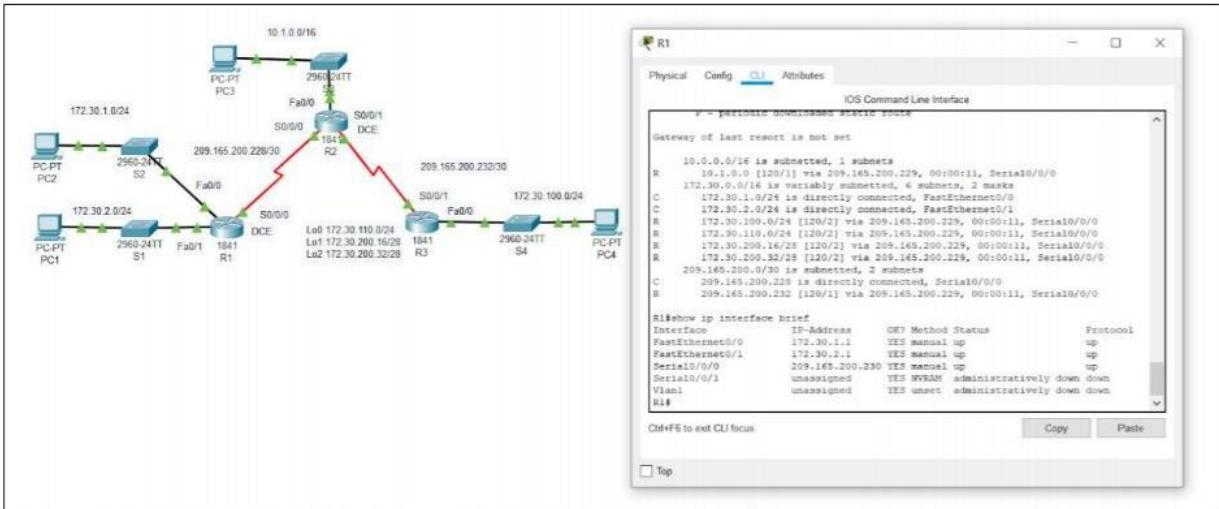


R3

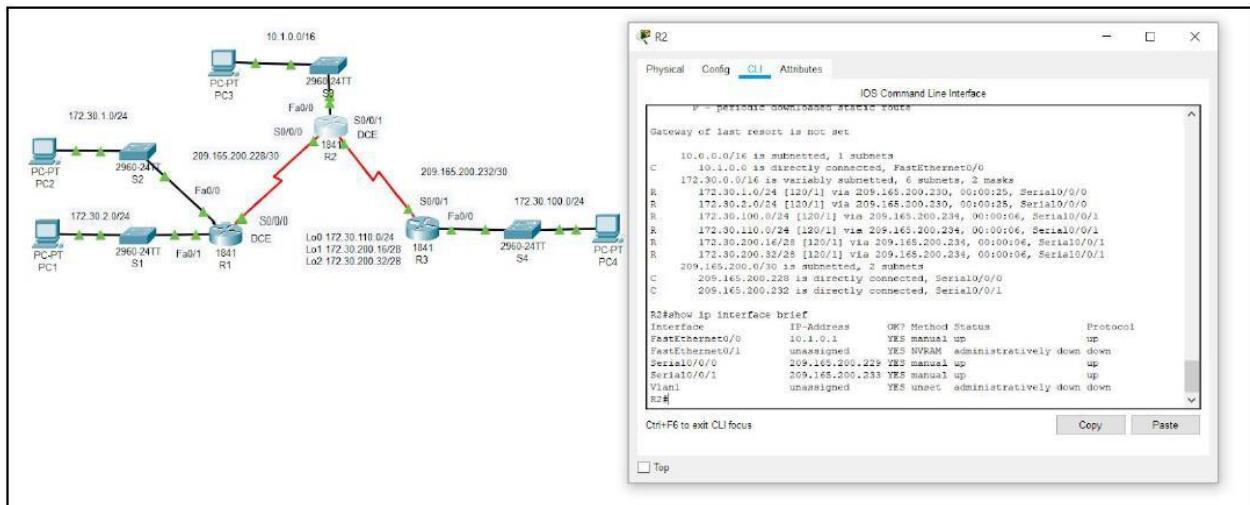


- show ip interface brief

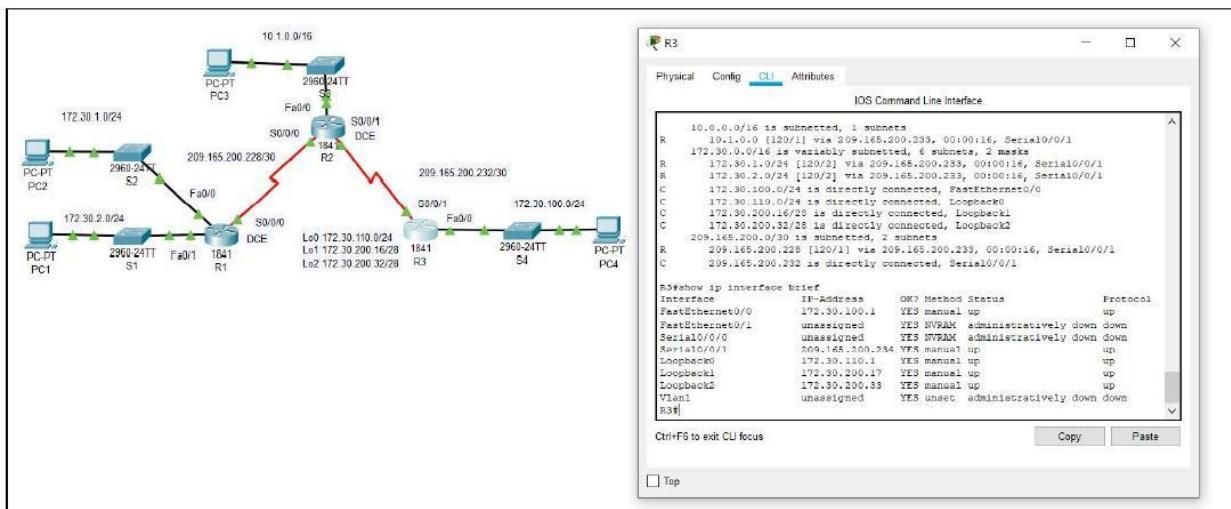
R1



R2

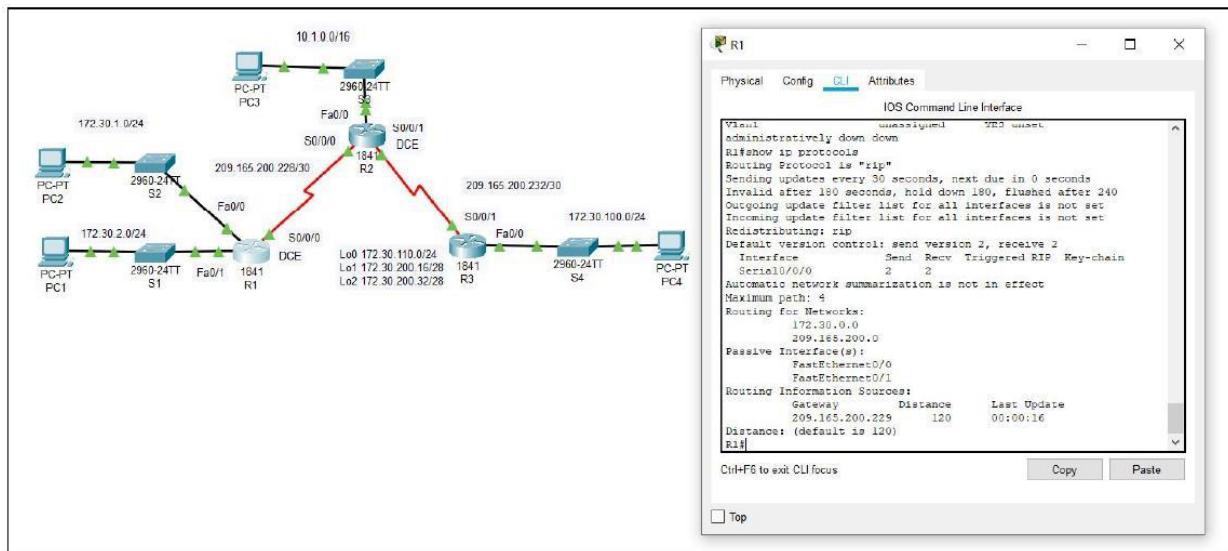


R3

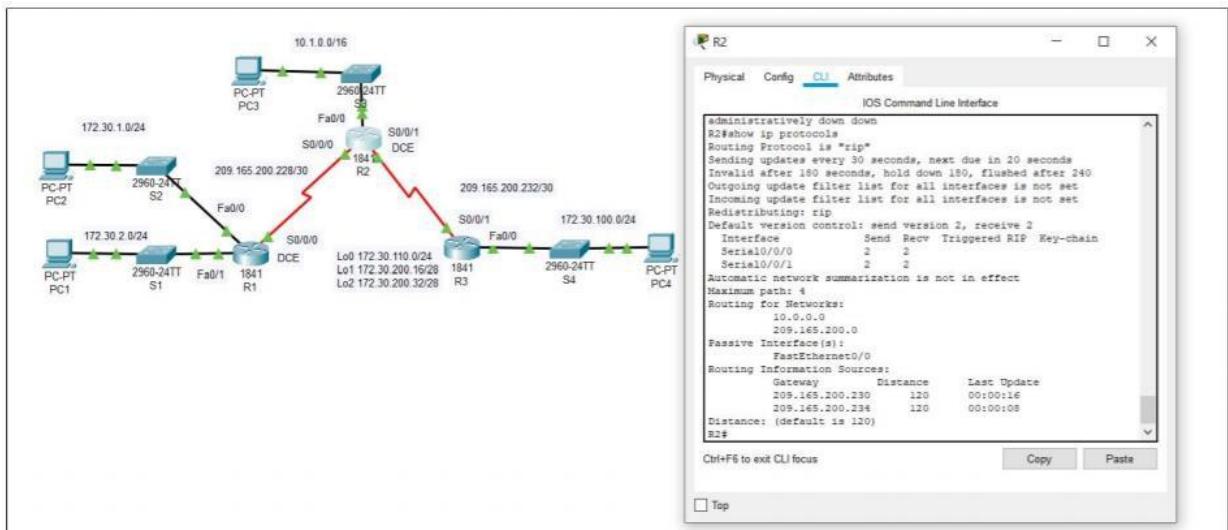


- show ip protocols

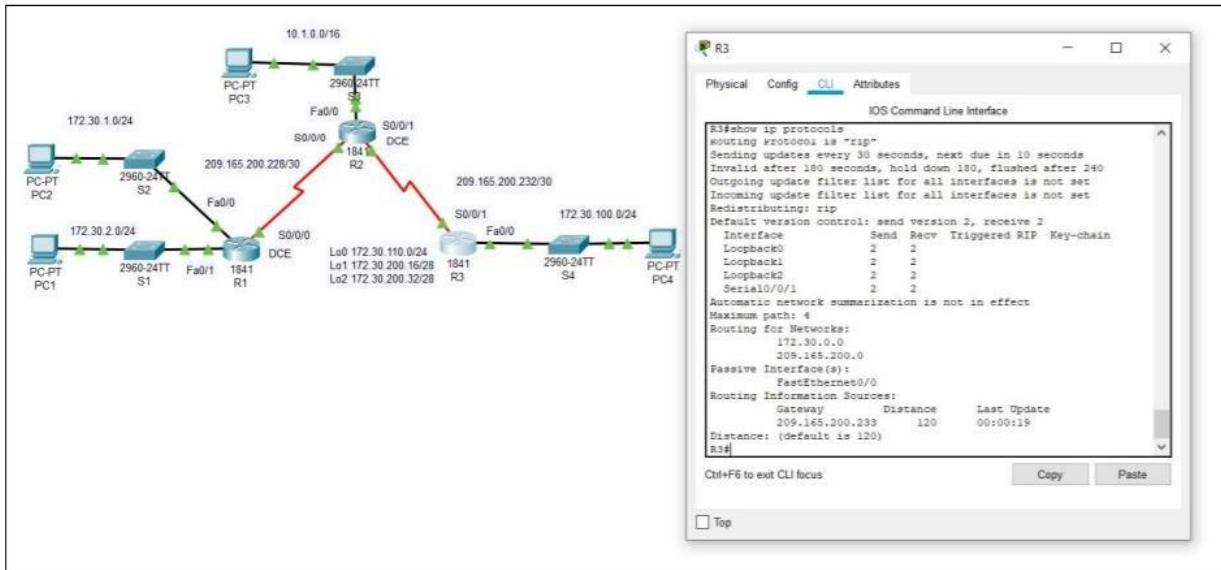
R1



R2



## R3

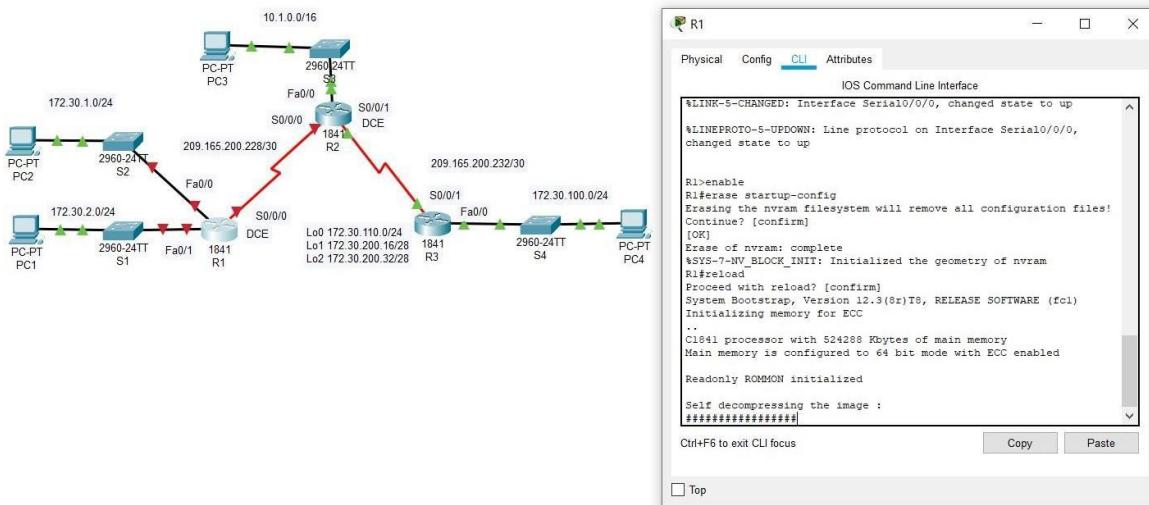


If you need to review the procedures for capturing command output, refer to Lab 1.5.1.

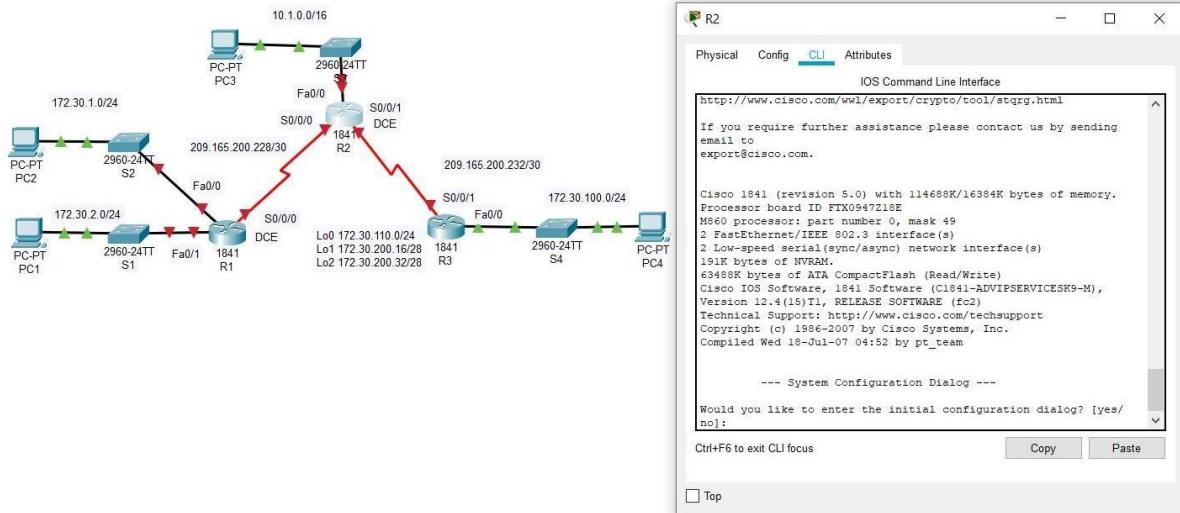
## Task 10: Clean Up

Erase the configurations and reload the routers. Disconnect and store the cabling. For PC hosts that are normally connected to other networks (such as the school LAN or to the Internet), reconnect the appropriate cabling and restore the TCP/IP settings.

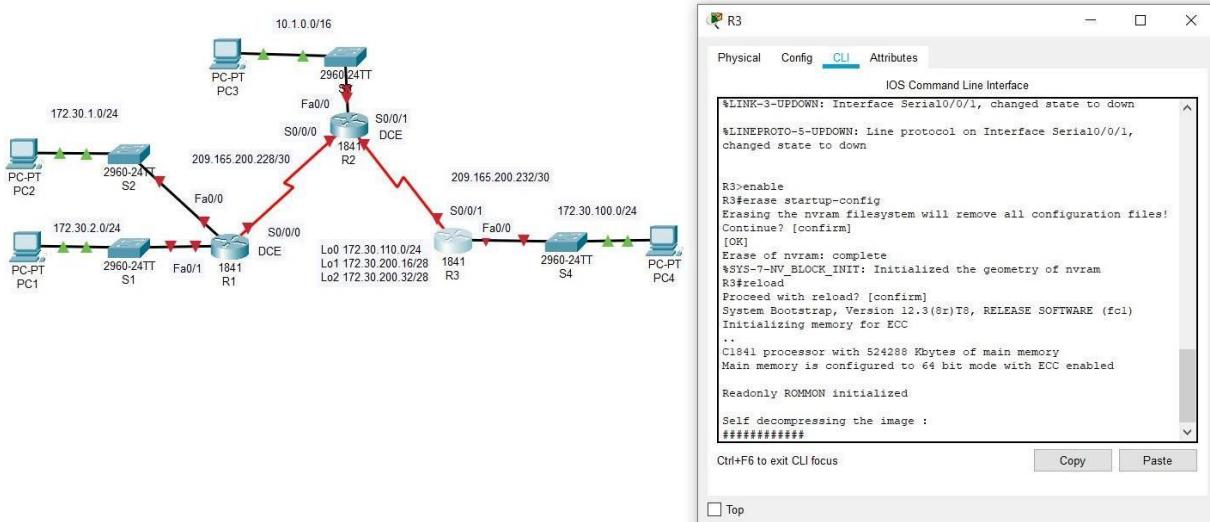
Erasing configuration for R1 and reloading



Erasing configuration for R2 and reloading



### Erasing configuration for R3 and reloading



### Conclusion:

1. In this experiment, I learned about the routing protocols
2. I implemented RIPv2 on the given topology and documented the results.