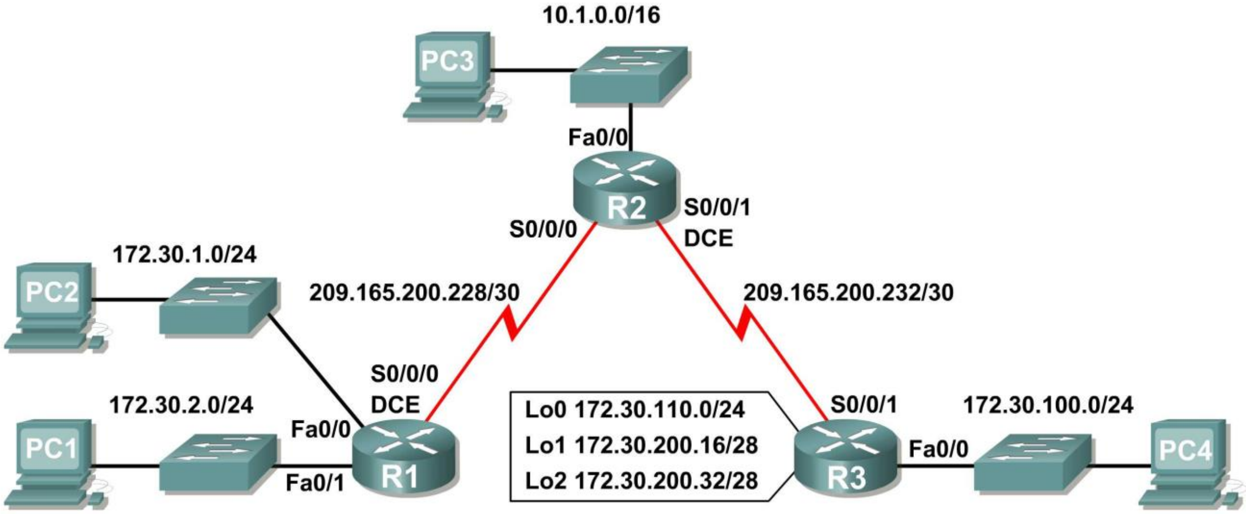
CEL 51, DCCN, Monsoon 2020
Lab 7: RIPv2 Router Configuration

Topology Diagram



Addressing Table

Device	Interface	IP Address	Subnet Mask	Default Gateway
R1	**Fa0/0**	172.30.1.1	255.255.255.0	N/A
	Fa0/1	172.30.2.1	255.255.255.0	N/A
	S0/0/0	209.165.200.230	255.255.255.252	N/A
R2	**Fa0/0**	10.1.0.1	255.255.0.0	N/A
	S0/0/0	209.165.200.229	255.255.255.252	N/A
	S0/0/1	209.165.200.233	255.255.255.252	N/A
R3	**Fa0/0**	172.30.100.1	255.255.255.0	N/A
	S0/0/1	209.165.200.234	255.255.255.252	N/A
	Lo0	172.30.110.1	255.255.255.0	N/A
	Lo1	172.30.200.17	255.255.255.240	N/A
	Lo2	172.30.200.33	255.255.255.240	N/A
PC1	**NIC**	172.30.1.10	255.255.255.0	172.30.2.1
PC2	**NIC**	172.30.2.10	255.255.255.0	172.30.1.1
PC3	**NIC**	10.1.0.10	255.255.0.0	10.1.0.1
PC4	**NIC**	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.

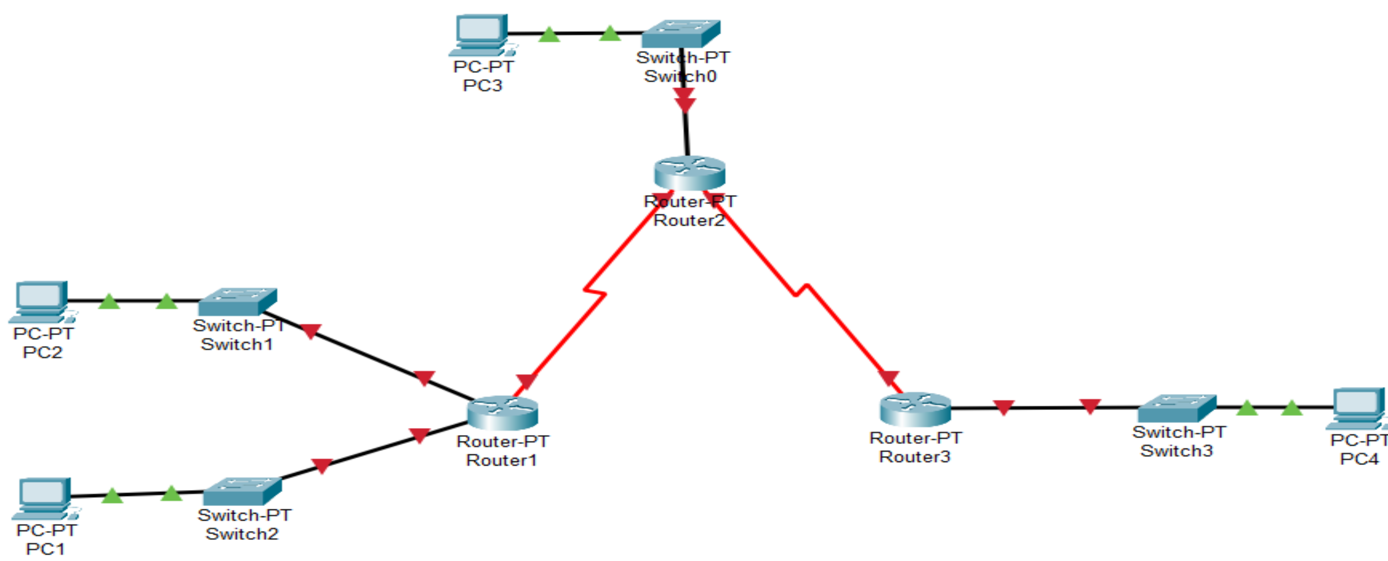
Scenario

The network shown in the Topology Diagram contains a discontinuous network, 172.30.0.0. This network has been sub netted 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.

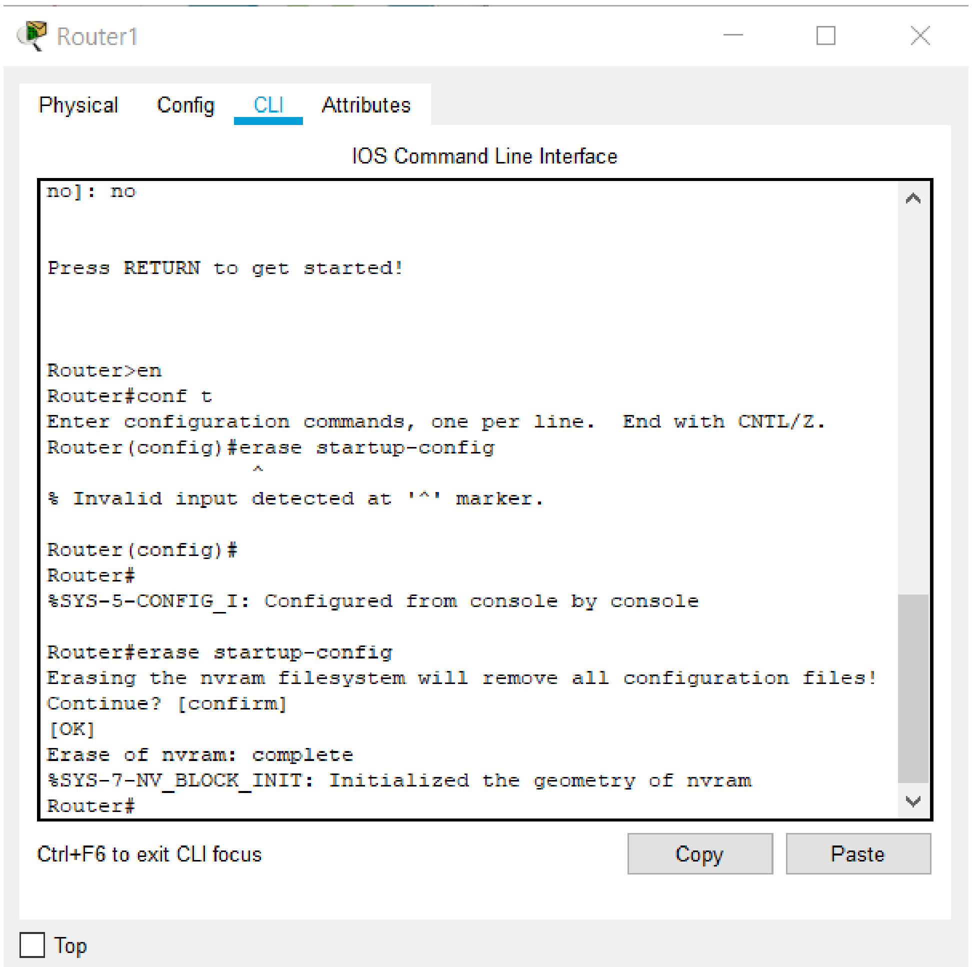
Cable a network that is similar to the one in the Topology Diagram.



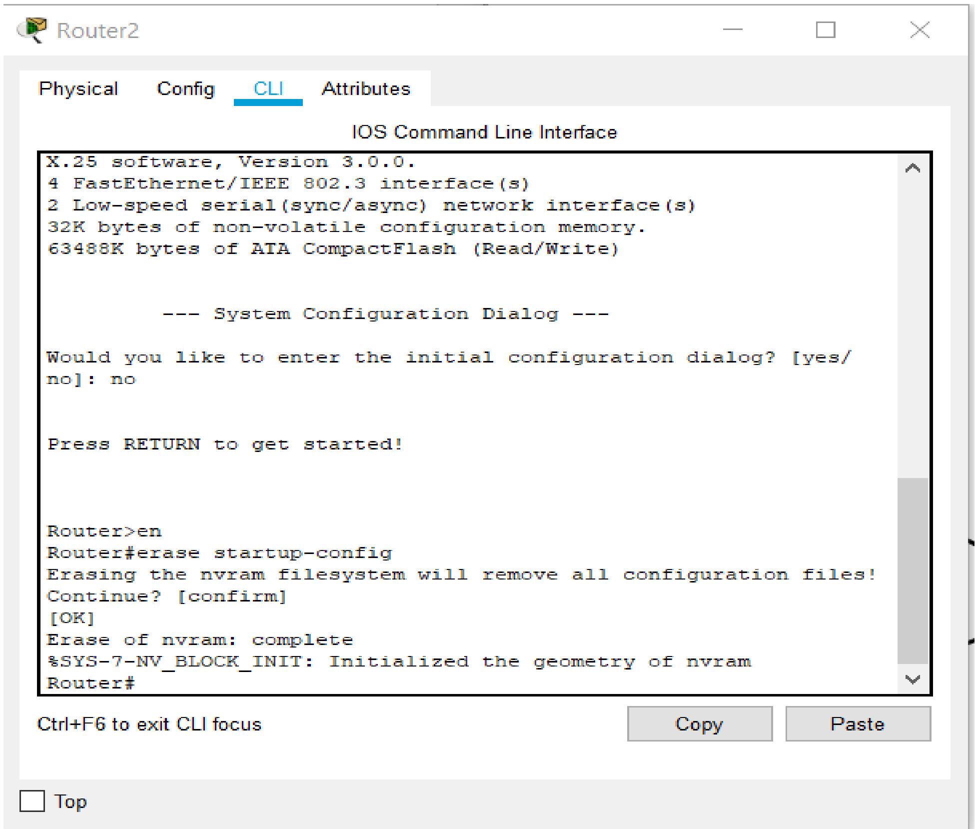
Step 2: Clear the configuration on each router.

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.

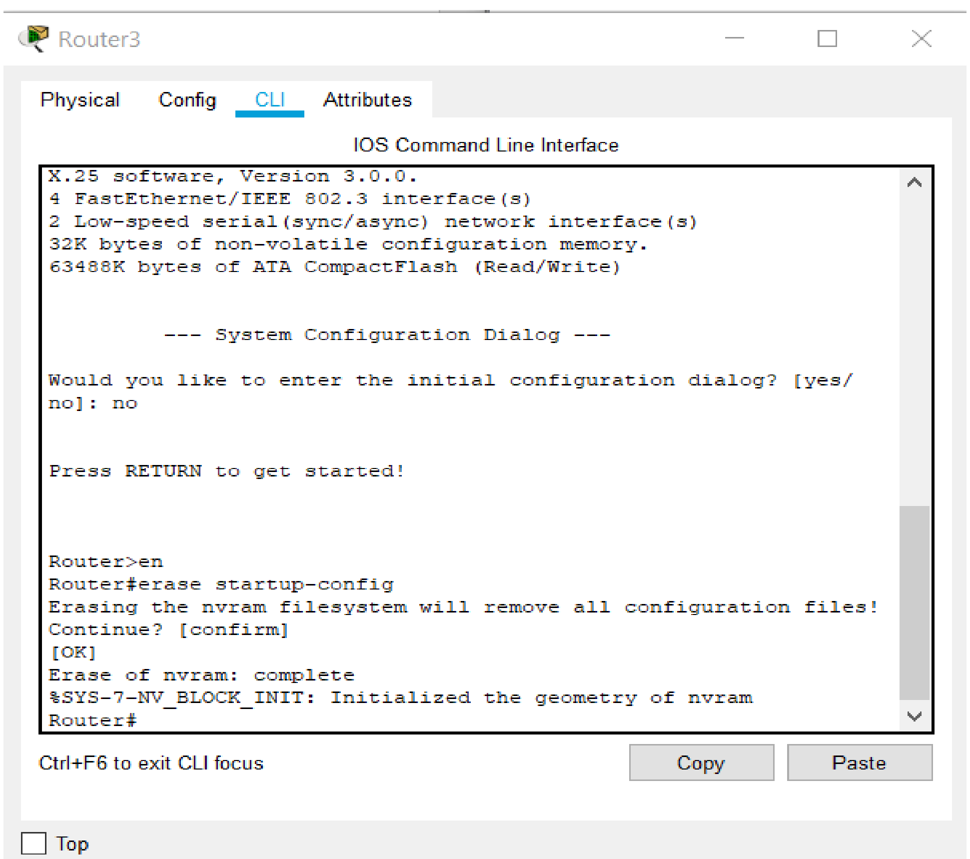
Router 1



Router 2



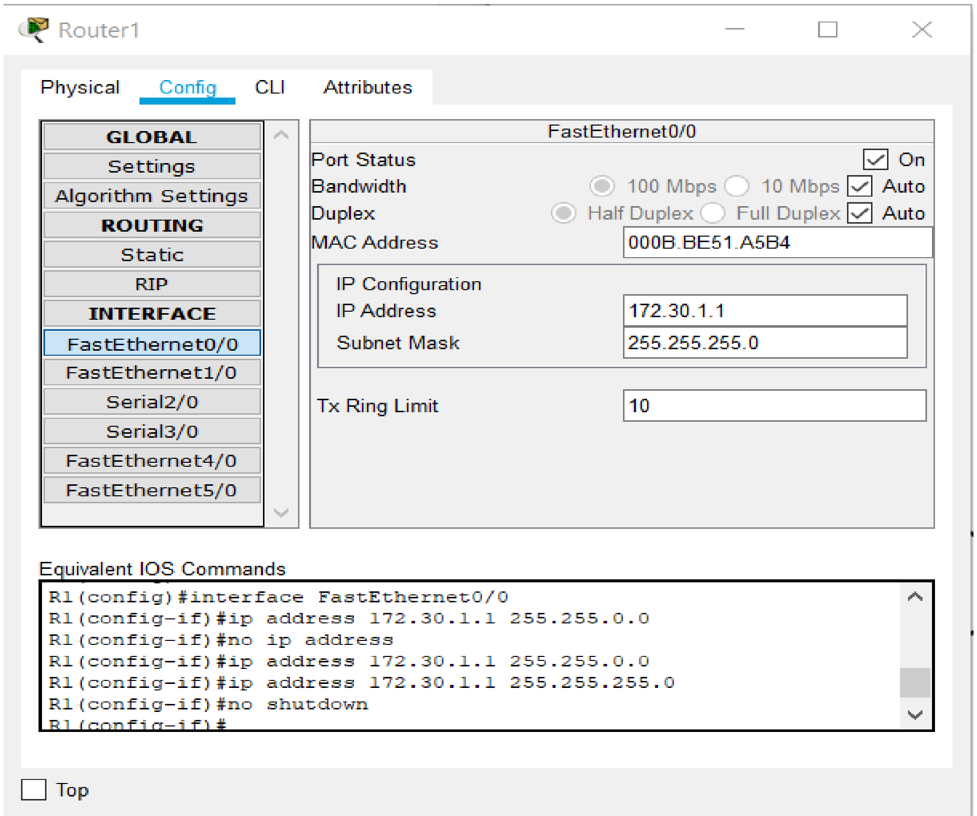
Router 3

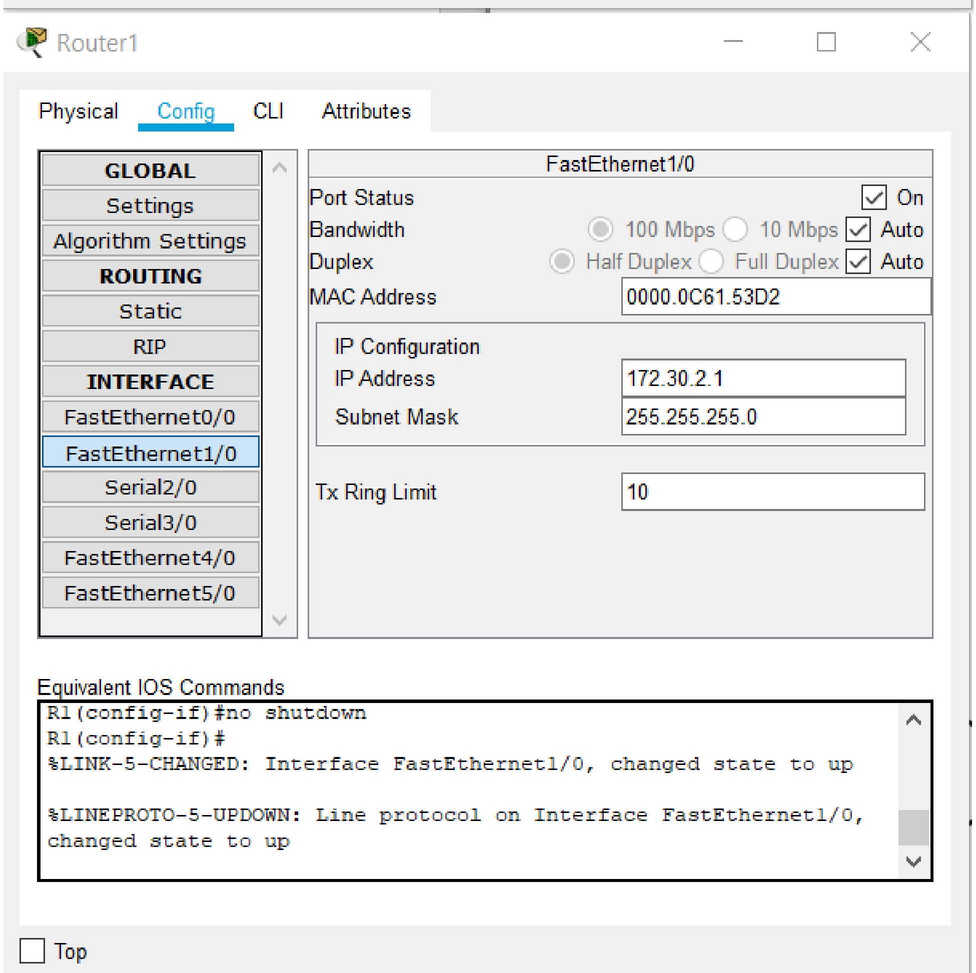


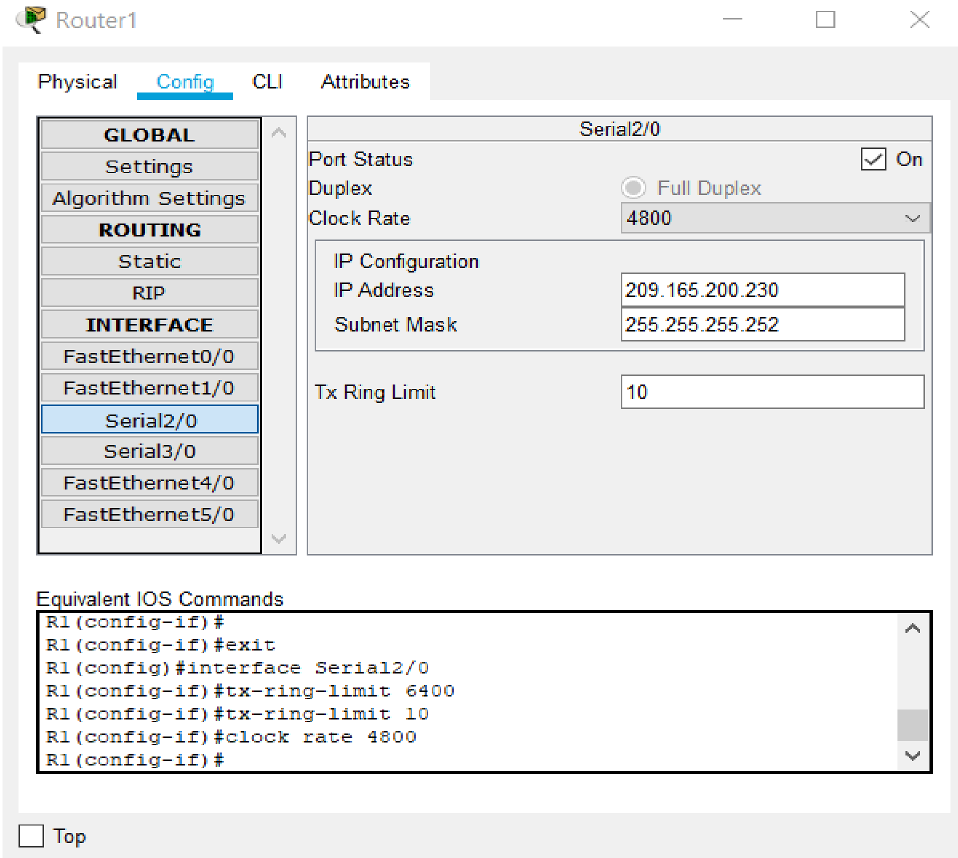
Task 2: Load Routers with the Supplied Scripts.

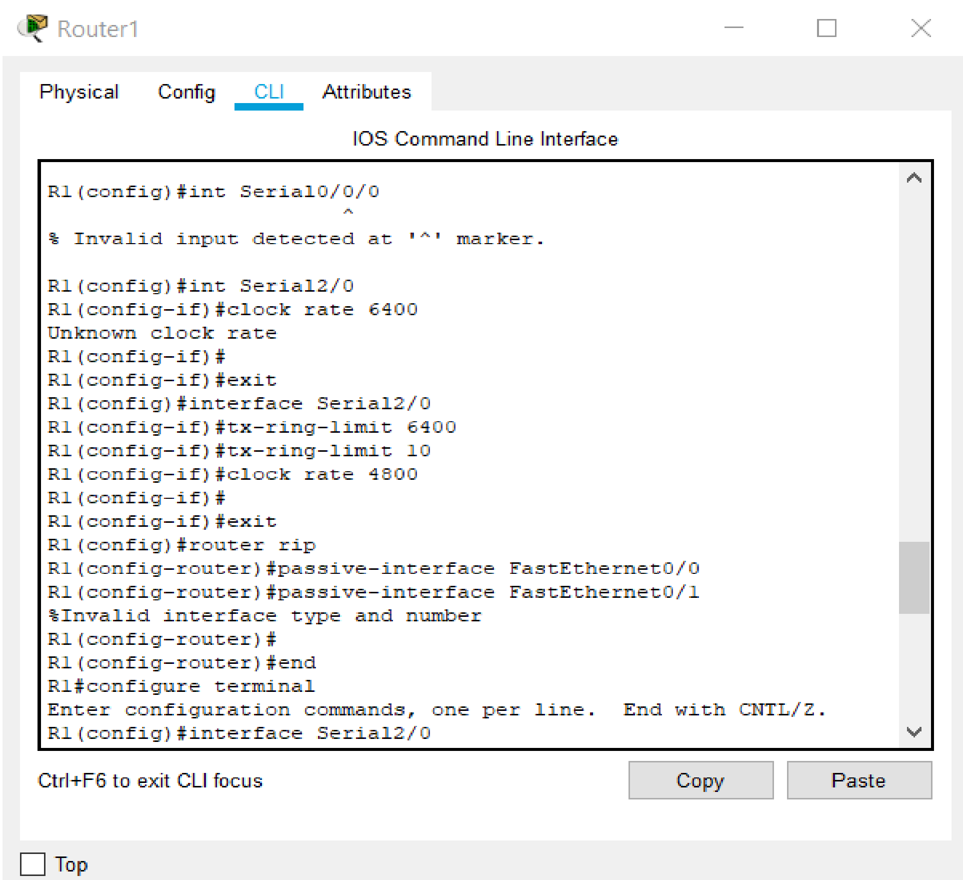
Step 1: Load the following script onto R1.

```
!
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
```


Router1
Physical
Config
CLI
Attributes
GLOBAL
Settings
Algorithm Settings
ROUTING
Static
RIP
INTERFACE
FastEthernet0/0
FastEthernet1/0
Serial2/0
Serial3/0
FastEthernet4/0
FastEthernet5/0
FastEthernet0/0
Port Status
On
Bandwidth
100 Mbps
10 Mbps
Auto
Duplex
Half Duplex
Full Duplex
Auto
MAC Address
000B.BE51.A5B4
IP Configuration
IP Address
172.30.1.1
Subnet Mask
255.255.255.0
Tx Ring Limit
10
Equivalent IOS Commands
R1(config)#interface FastEthernet0/0
R1(config-if)#ip address 172.30.1.1 255.255.0.0
R1(config-if)#no ip address
R1(config-if)#ip address 172.30.1.1 255.255.0.0
R1(config-if)#ip address 172.30.1.1 255.255.255.0
R1(config-if)#no shutdown
Top

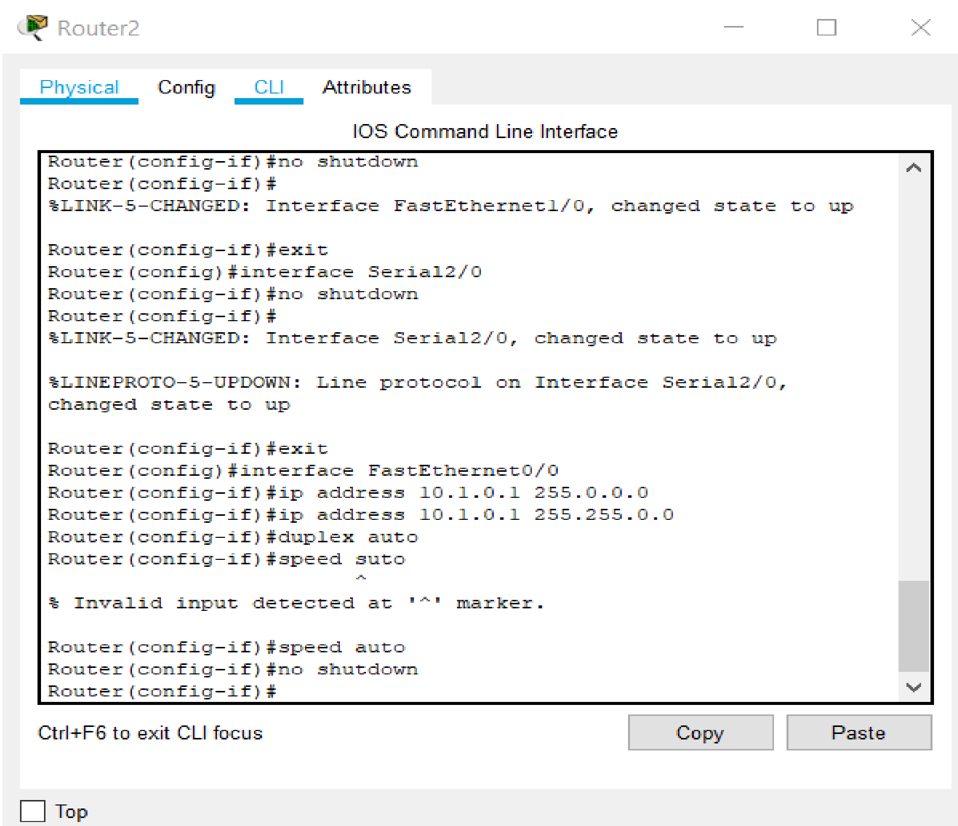

Router1
Physical
Config
CLI
Attributes
GLOBAL
Settings
Algorithm Settings
ROUTING
Static
RIP
INTERFACE
FastEthernet0/0
FastEthernet1/0
Serial2/0
Serial3/0
FastEthernet4/0
FastEthernet5/0
FastEthernet1/0
Port Status
On
Bandwidth
100 Mbps
10 Mbps
Auto
Duplex
Half Duplex
Full Duplex
Auto
MAC Address
0000.0C61.53D2
IP Configuration
IP Address
172.30.2.1
Subnet Mask
255.255.255.0
Tx Ring Limit
10
Equivalent IOS Commands
R1(config-if)#no shutdown
R1(config-if)#
%LINK-5-CHANGED: Interface FastEthernet1/0, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet1/0, changed state to up
Top

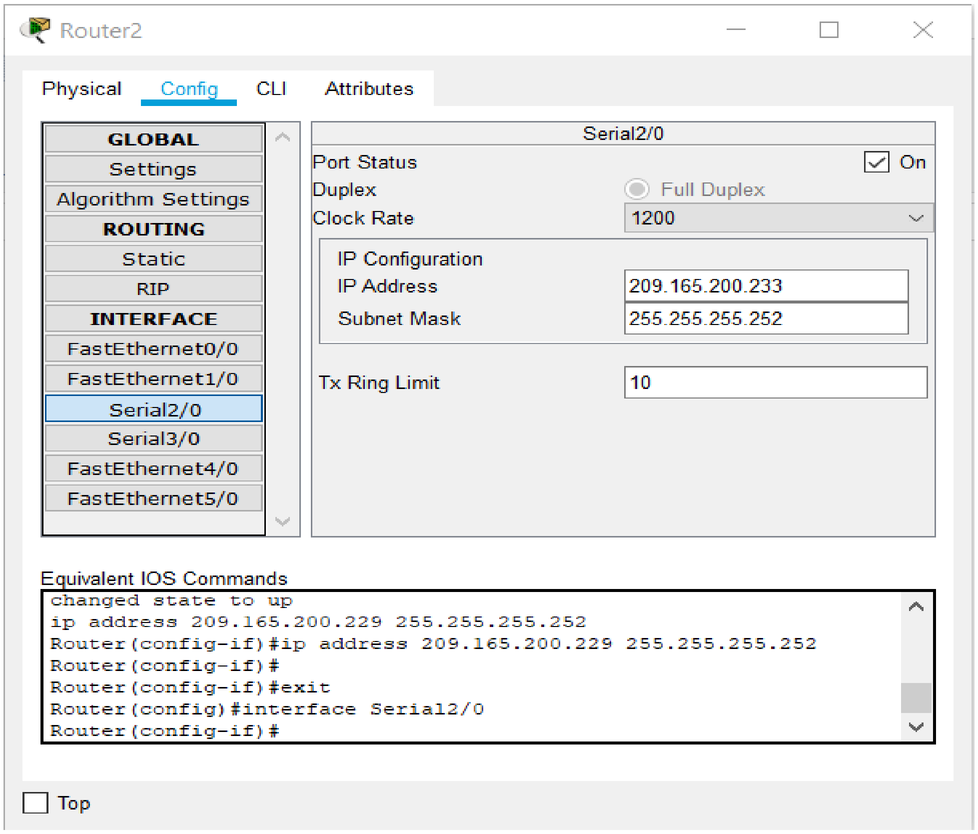

Router1
Physical
Config
CLI
Attributes
GLOBAL
Settings
Algorithm Settings
ROUTING
Static
RIP
INTERFACE
FastEthernet0/0
FastEthernet1/0
Serial2/0
Serial3/0
FastEthernet4/0
FastEthernet5/0
Serial2/0
Port Status
On
Duplex
Full Duplex
Clock Rate
4800
IP Configuration
IP Address
209.165.200.230
Subnet Mask
255.255.255.252
Tx Ring Limit
10
Equivalent IOS Commands
R1(config-if)#
R1(config-if)#exit
R1(config)#interface Serial2/0
R1(config-if)#tx-ring-limit 6400
R1(config-if)#tx-ring-limit 10
R1(config-if)#clock rate 4800
R1(config-if)#
Top

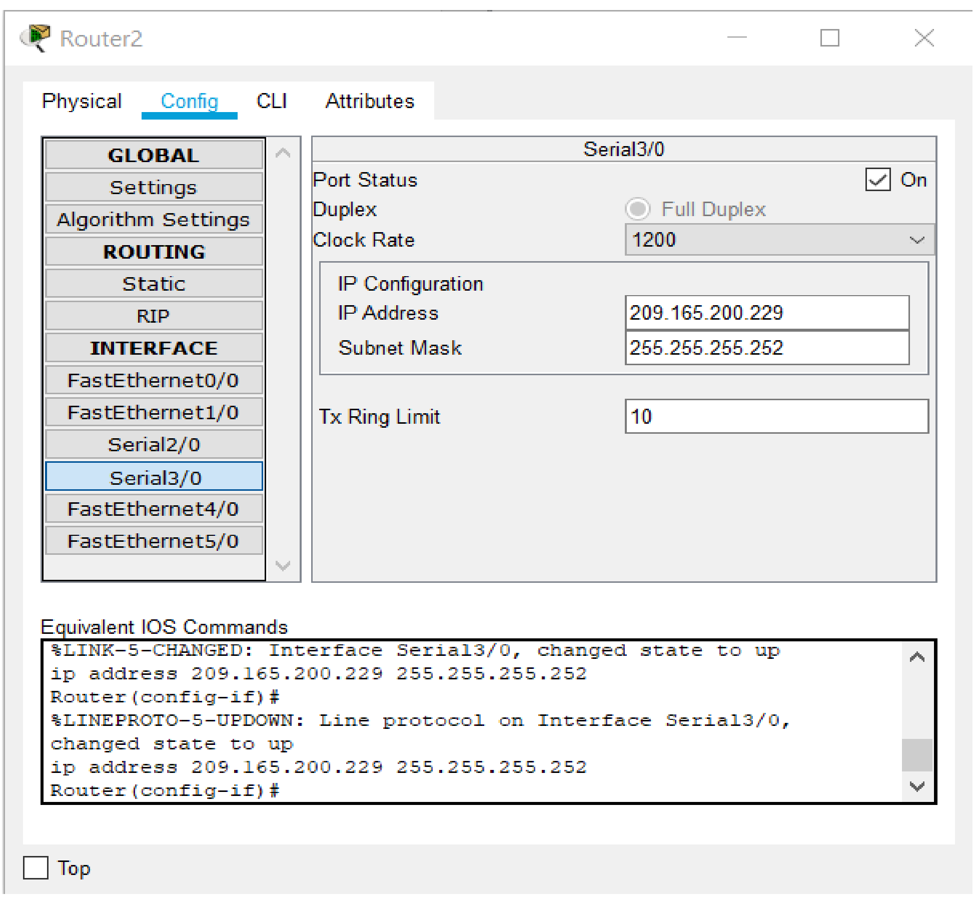

Router1
Physical
Config
CLI
Attributes
IOS Command Line Interface
R1(config)#int Serial0/0/0
^
% Invalid input detected at '^' marker.
R1(config)#int Serial2/0
R1(config-if)#clock rate 6400
Unknown clock rate
R1(config-if)#
R1(config-if)#exit
R1(config)#interface Serial2/0
R1(config-if)#tx-ring-limit 6400
R1(config-if)#tx-ring-limit 10
R1(config-if)#clock rate 4800
R1(config-if)#
R1(config-if)#exit
R1(config)#router rip
R1(config-router)#passive-interface FastEthernet0/0
R1(config-router)#passive-interface FastEthernet0/1
%Invalid interface type and number
R1(config-router)#
R1(config-router)#end
R1#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
R1(config)#interface Serial2/0
Ctrl+F6 to exit CLI focus
Copy
Paste
Top

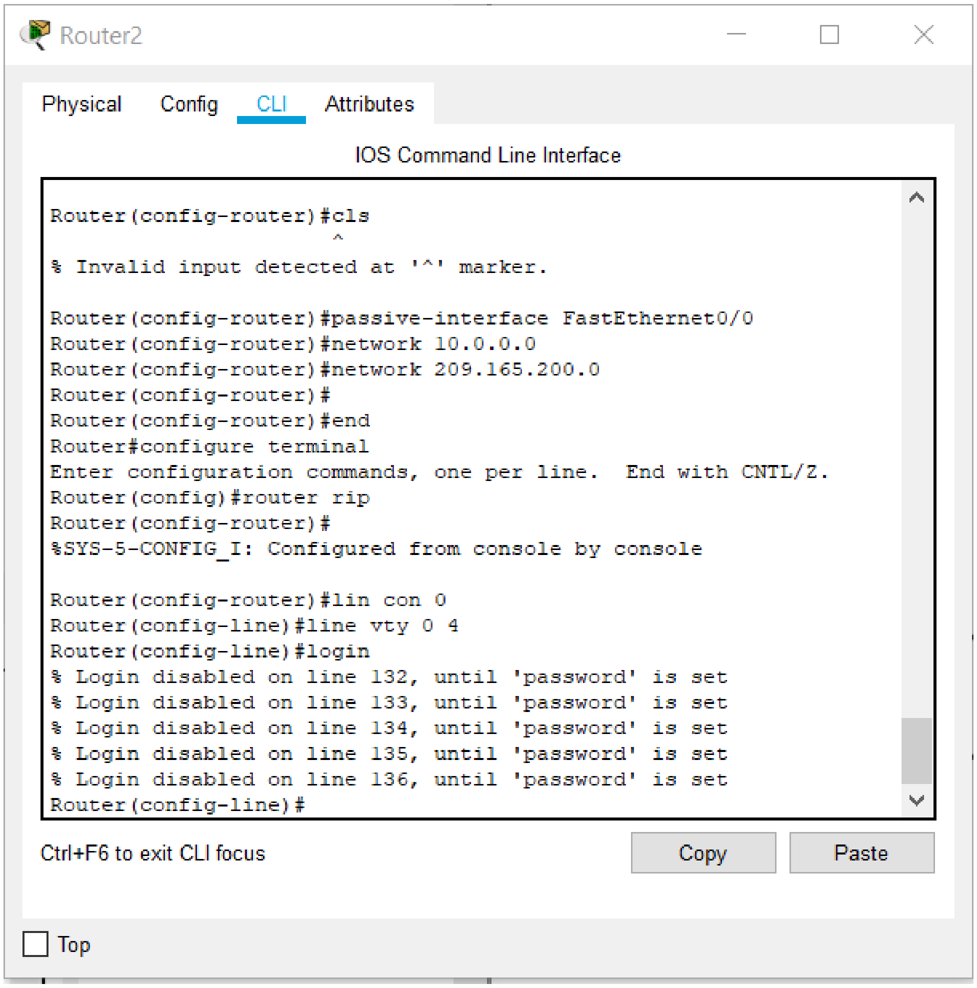
Step 2: Load the following script onto R2.

```
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
```




Router2
Physical
Config
CLI
Attributes
GLOBAL
Settings
Algorithm Settings
ROUTING
Static
RIP
INTERFACE
FastEthernet0/0
FastEthernet1/0
Serial2/0
Serial3/0
FastEthernet4/0
FastEthernet5/0
Serial2/0
Port Status
On
Duplex
Full Duplex
Clock Rate
1200
IP Configuration
IP Address
209.165.200.233
Subnet Mask
255.255.255.252
Tx Ring Limit
10
Equivalent IOS Commands
changed state to up
ip address 209.165.200.229 255.255.255.252
Router(config-if)#ip address 209.165.200.229 255.255.255.252
Router(config-if)#
Router(config-if)#exit
Router(config)#interface Serial2/0
Router(config-if)#
Top

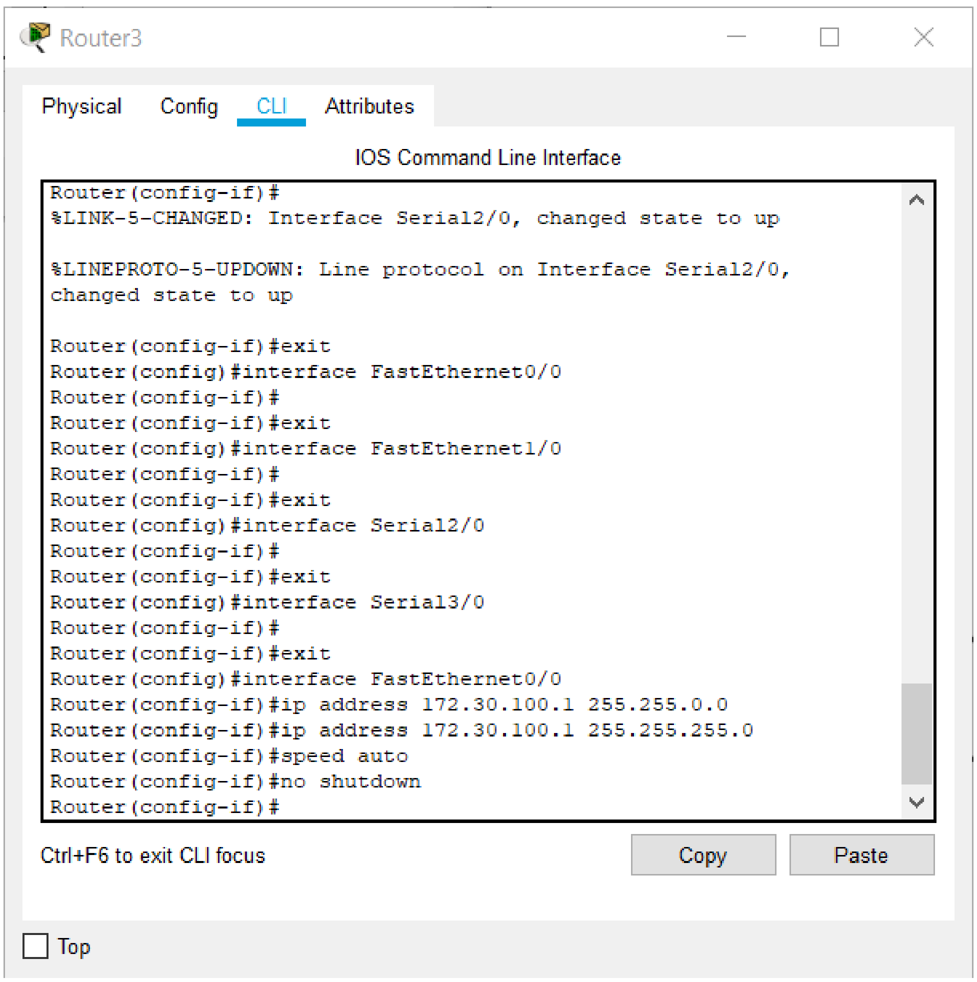

Router2
Physical
Config
CLI
Attributes
GLOBAL
Settings
Algorithm Settings
ROUTING
Static
RIP
INTERFACE
FastEthernet0/0
FastEthernet1/0
Serial2/0
Serial3/0
FastEthernet4/0
FastEthernet5/0
Serial3/0
Port Status
On
Duplex
Full Duplex
Clock Rate
1200
IP Configuration
IP Address
209.165.200.229
Subnet Mask
255.255.255.252
Tx Ring Limit
10
Equivalent IOS Commands
%LINK-5-CHANGED: Interface Serial3/0, changed state to up
ip address 209.165.200.229 255.255.255.252
Router(config-if)#
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial3/0,
changed state to up
ip address 209.165.200.229 255.255.255.252
Router(config-if)#
Top

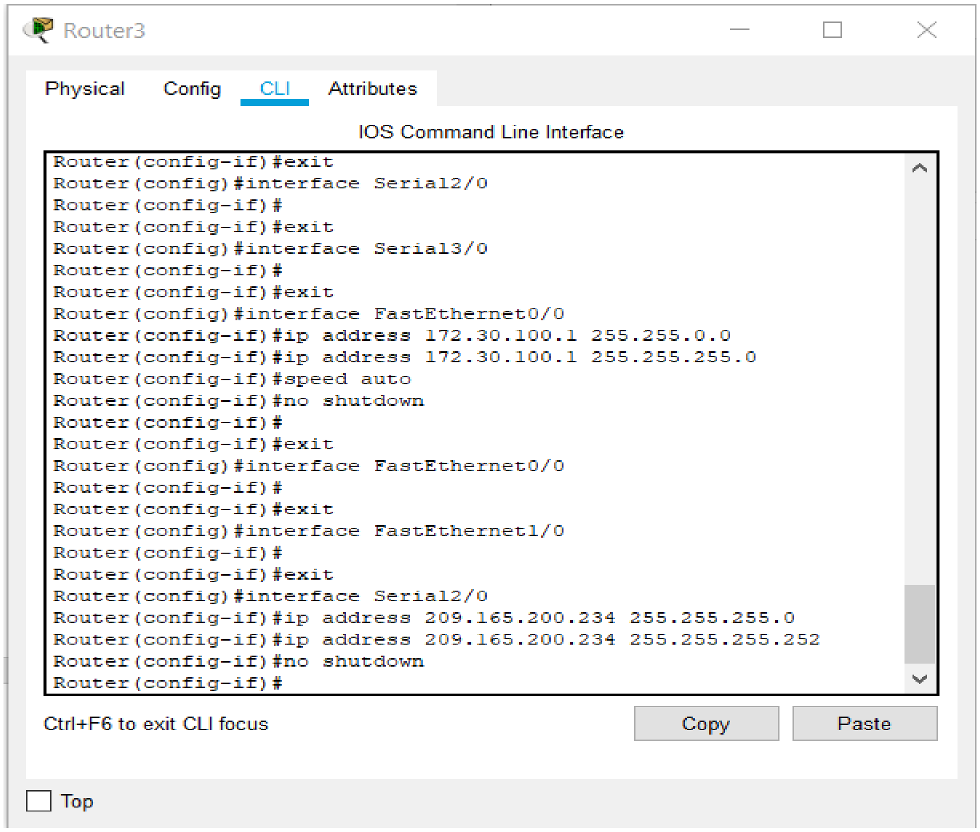


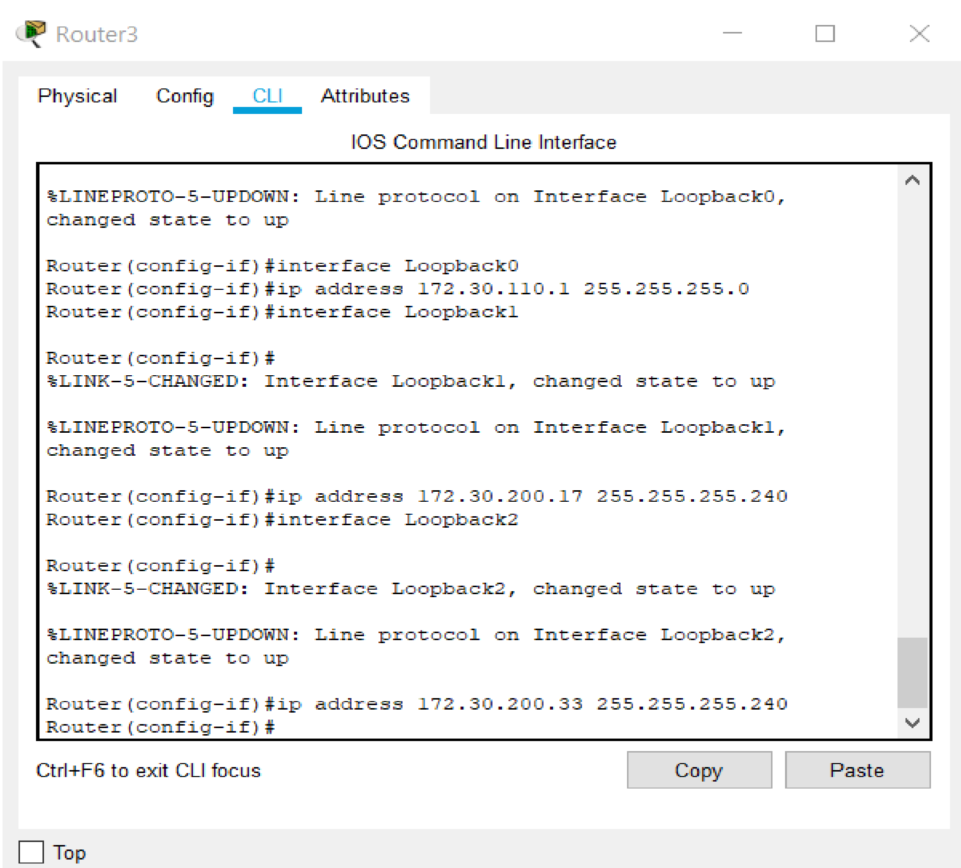
Step 3: Load the following script onto R3.

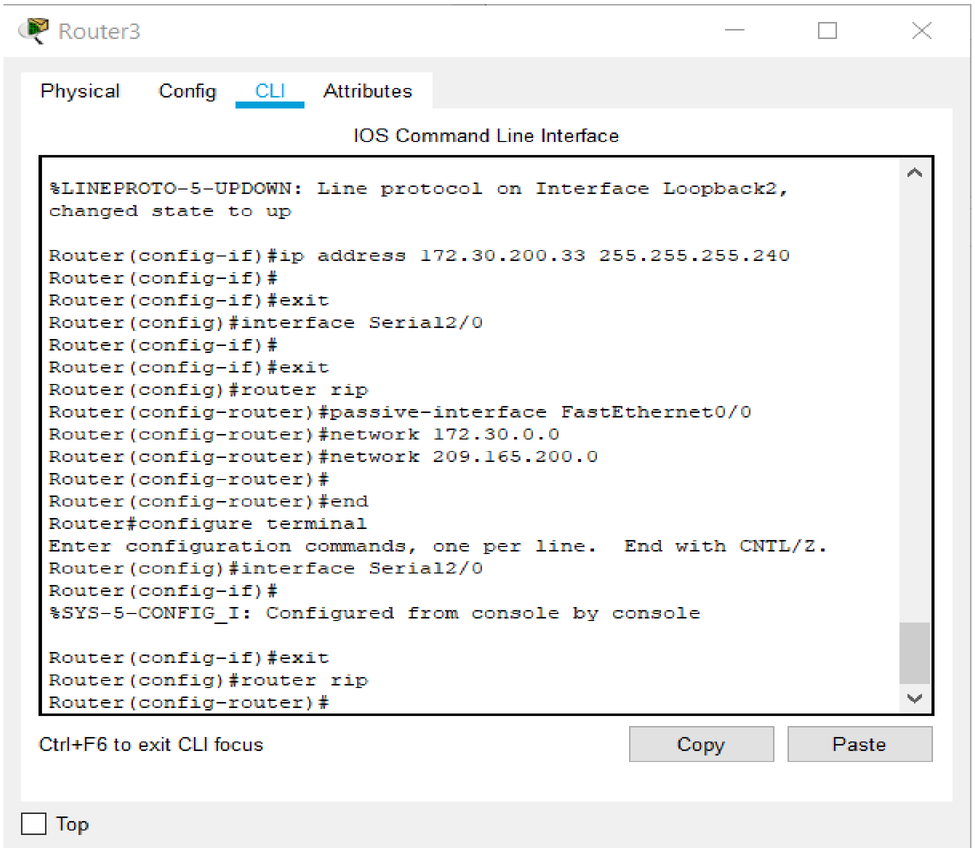
```
hostname R3
!
!
!
interface FastEthernet0/0
 ip address 172.30.100.1 255.255.255.0
 duplex auto
 speed auto
 no shutdown
!
interface Serial0/0/1
 ip address 209.165.200.234 255.255.255.252
 no shutdown
!
interface Loopback0
 ip address 172.30.110.1 255.255.255.0
!
interface Loopback1
 ip address 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
```

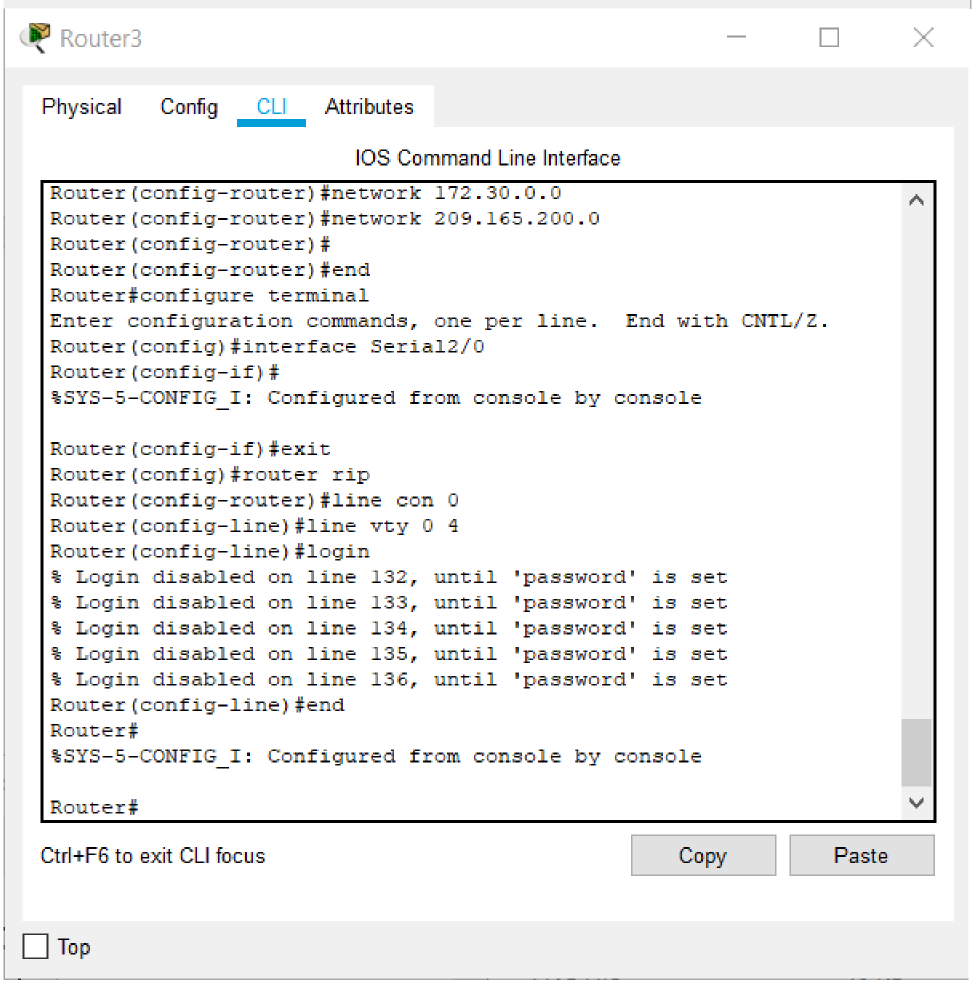



Router3
Physical
Config
CLI
Attributes
IOS Command Line Interface
Router(config-if)#exit
Router(config)#interface Serial2/0
Router(config-if)#
Router(config-if)#exit
Router(config)#interface Serial3/0
Router(config-if)#
Router(config-if)#exit
Router(config)#interface FastEthernet0/0
Router(config-if)#ip address 172.30.100.1 255.255.0.0
Router(config-if)#ip address 172.30.100.1 255.255.255.0
Router(config-if)#speed auto
Router(config-if)#no shutdown
Router(config-if)#
Router(config-if)#exit
Router(config)#interface FastEthernet0/0
Router(config-if)#
Router(config-if)#exit
Router(config)#interface FastEthernet1/0
Router(config-if)#
Router(config-if)#exit
Router(config)#interface Serial2/0
Router(config-if)#ip address 209.165.200.234 255.255.255.0
Router(config-if)#ip address 209.165.200.234 255.255.255.252
Router(config-if)#no shutdown
Router(config-if)#
Ctrl+F6 to exit CLI focus
Copy
Paste
Top


Router3
Physical
Config
CLI
Attributes
IOS Command Line Interface
%LINEPROTO-5-UPDOWN: Line protocol on Interface Loopback0, changed state to up
Router(config-if)#interface Loopback0
Router(config-if)#ip address 172.30.110.1 255.255.255.0
Router(config-if)#interface Loopback1
Router(config-if)#
%LINK-5-CHANGED: Interface Loopback1, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface Loopback1, changed state to up
Router(config-if)#ip address 172.30.200.17 255.255.255.240
Router(config-if)#interface Loopback2
Router(config-if)#
%LINK-5-CHANGED: Interface Loopback2, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface Loopback2, changed state to up
Router(config-if)#ip address 172.30.200.33 255.255.255.240
Router(config-if)#
Ctrl+F6 to exit CLI focus
Copy
Paste
Top



Router3
Physical
Config
CLI
Attributes
IOS Command Line Interface
%LINEPROTO-5-UPDOWN: Line protocol on Interface Loopback2, changed state to up
Router(config-if)#ip address 172.30.200.33 255.255.255.240
Router(config-if)#
Router(config-if)#exit
Router(config)#interface Serial2/0
Router(config-if)#
Router(config-if)#exit
Router(config)#router rip
Router(config-router)#passive-interface FastEthernet0/0
Router(config-router)#network 172.30.0.0
Router(config-router)#network 209.165.200.0
Router(config-router)#
Router(config-router)#end
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#interface Serial2/0
Router(config-if)#
%SYS-5-CONFIG_I: Configured from console by console
Router(config-if)#exit
Router(config)#router rip
Router(config-router)#
Ctrl+F6 to exit CLI focus
Copy
Paste
Top



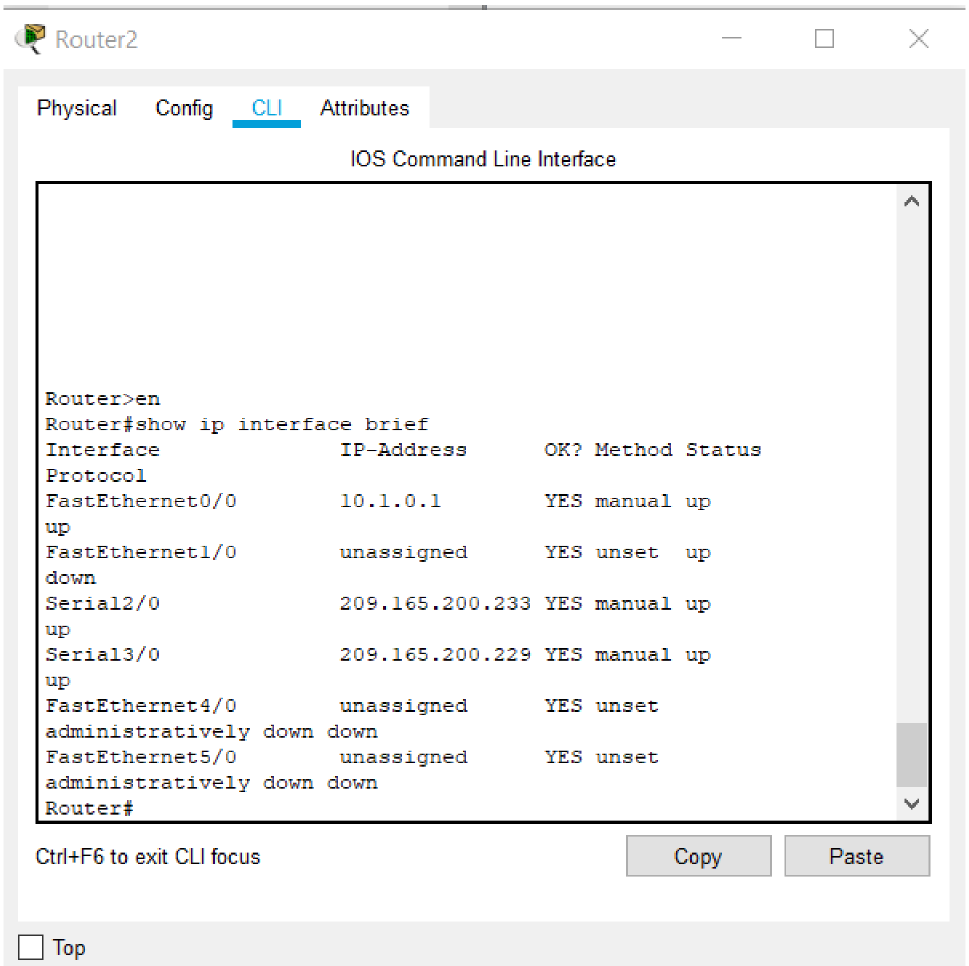
Router3
Physical
Config
CLI
Attributes
IOS Command Line Interface
Router(config-router)#network 172.30.0.0
Router(config-router)#network 209.165.200.0
Router(config-router)#
Router(config-router)#end
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#interface Serial2/0
Router(config-if)#
%SYS-5-CONFIG_I: Configured from console by console
Router(config-if)#exit
Router(config)#router rip
Router(config-router)#line con 0
Router(config-line)#line vty 0 4
Router(config-line)#login
% Login disabled on line 132, until 'password' is set
% Login disabled on line 133, until 'password' is set
% Login disabled on line 134, until 'password' is set
% Login disabled on line 135, until 'password' is set
% Login disabled on line 136, until 'password' is set
Router(config-line)#end
Router#
%SYS-5-CONFIG_I: Configured from console by console
Router#
Ctrl+F6 to exit CLI focus
Copy
Paste
Top

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.

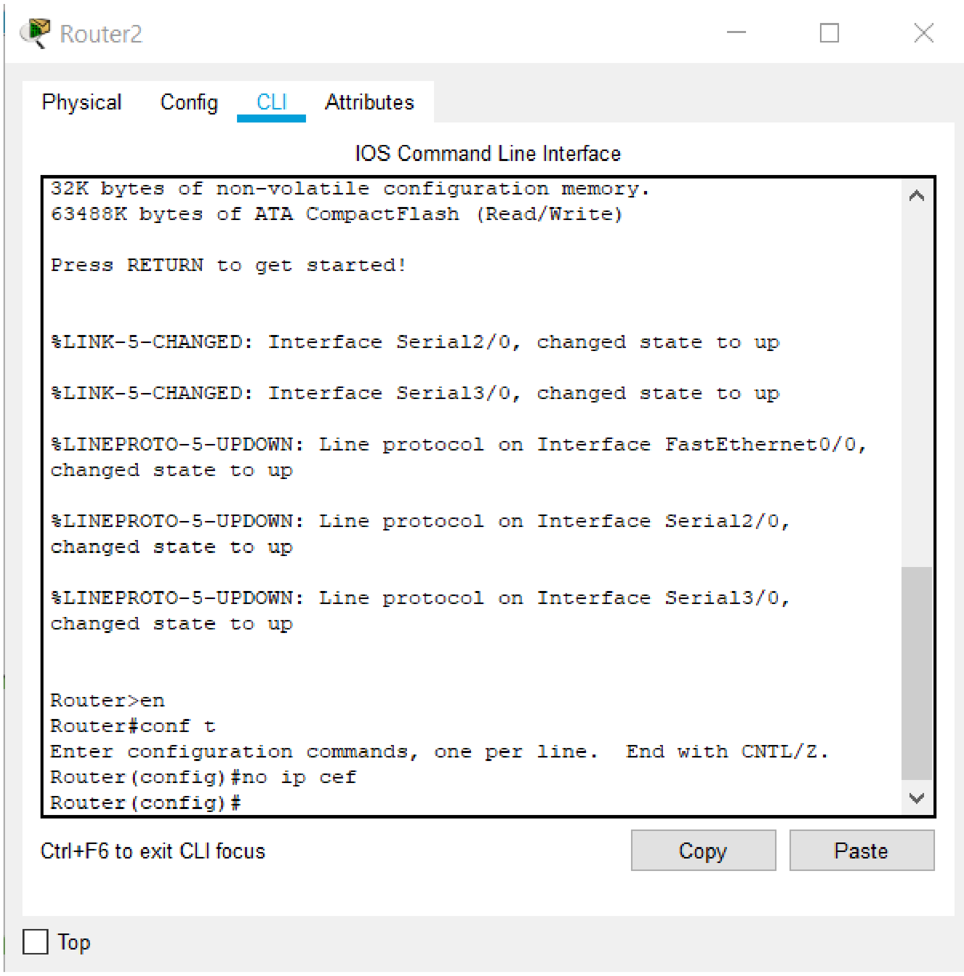
```
R2#show ip interface brief
```



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

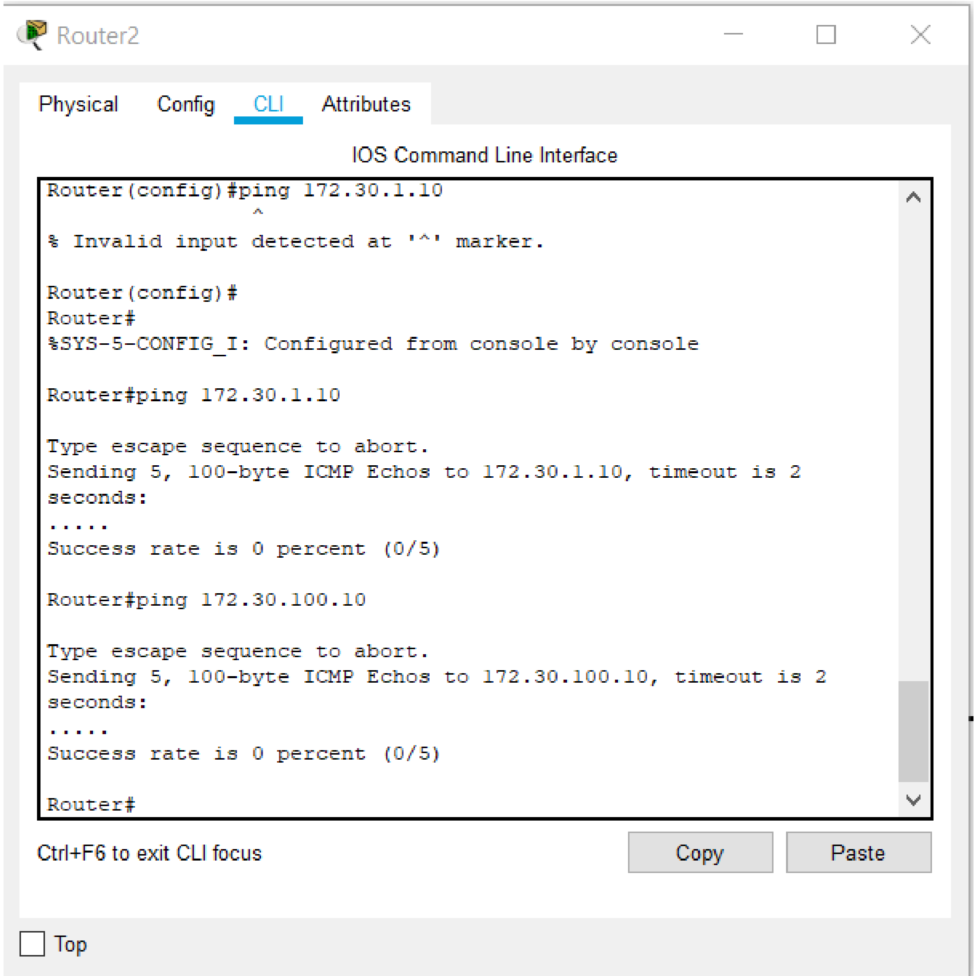
Note: For the 1841 router, you will need to disable IP CEF to obtain the correct output from the **`ping`** command. Although a discussion of IP CEF is beyond the scope of this course, you may disable IP CEF by using the following command in global configuration mode:

```
R2(config)#no ip cef
```



From the R2 router, how many ICMP messages are successful when pinging PC1? **0**

From the R2 router, how many ICMP messages are successful when pinging PC4? **0**



Step 3: Check the connectivity between the PCs.

From the PC1, is it possible to ping PC2? **Yes**

What is the success rate? **3/4**

From the PC1, is it possible to ping PC3? **No**

What is the success rate? **0/4**

From the PC1, is it possible to ping PC4? **No**

What is the success rate? **0/4**

From the PC4, is it possible to ping PC2? **No**

What is the success rate? **0/4**

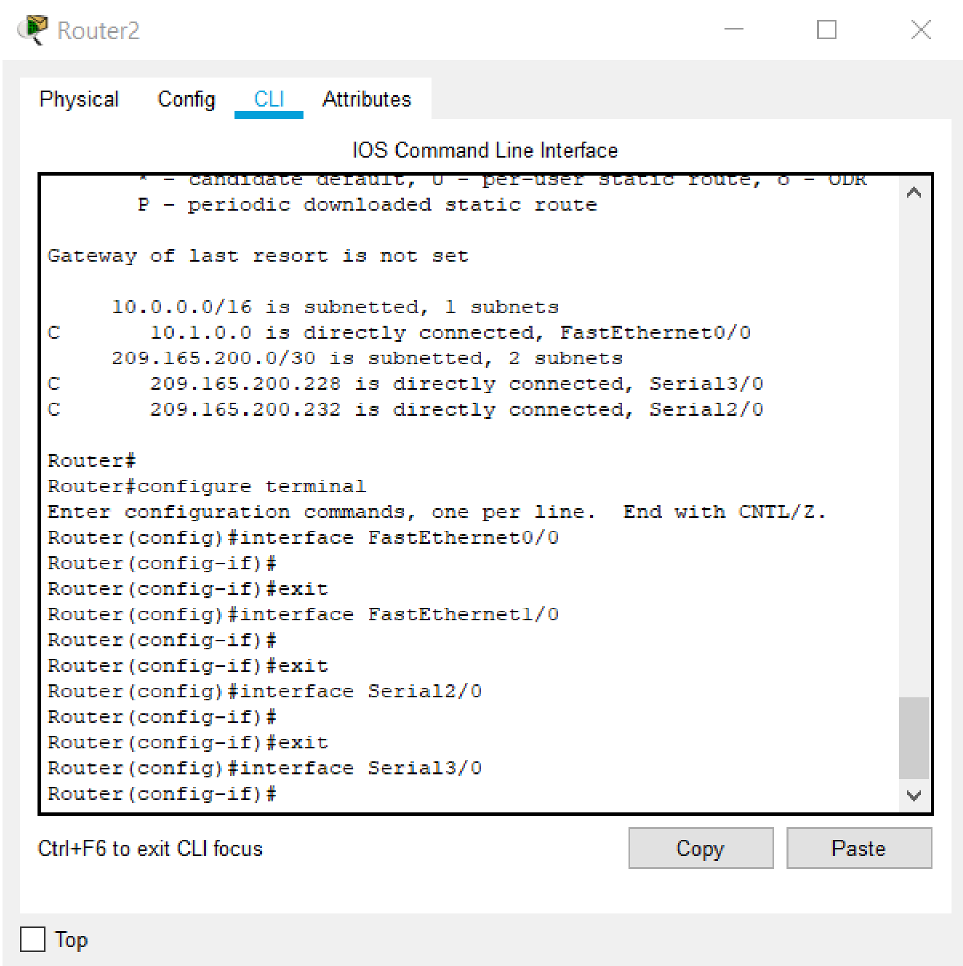
From the PC4, is it possible to ping PC3? **No**

What is the success rate? **0/4**

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.

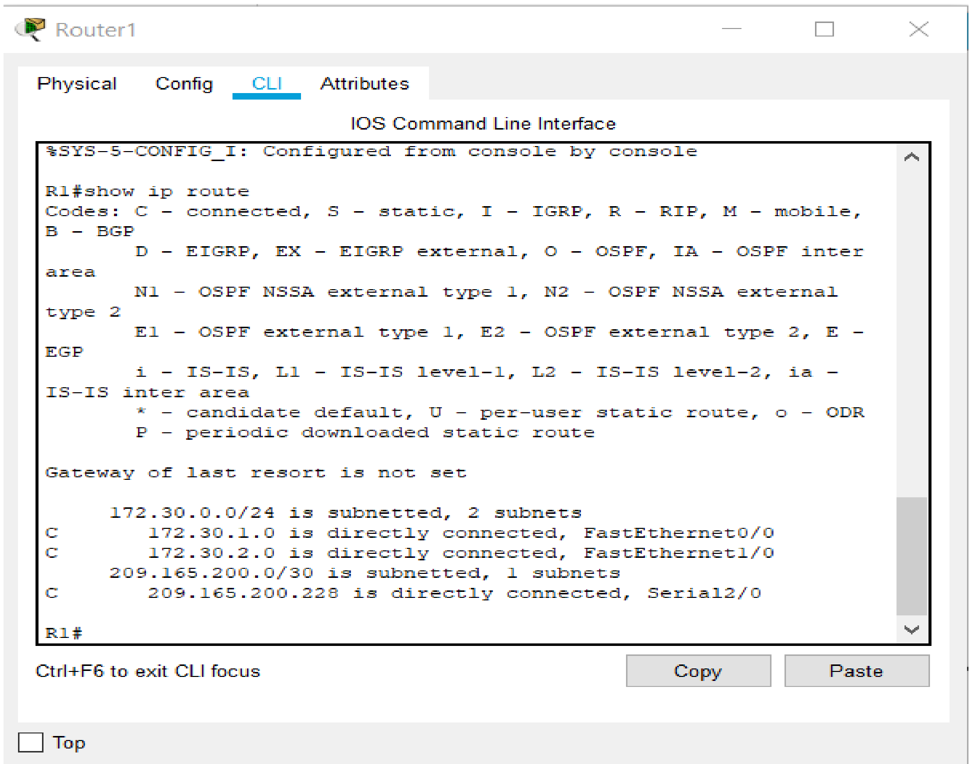
```
R2#show ip route
```



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.

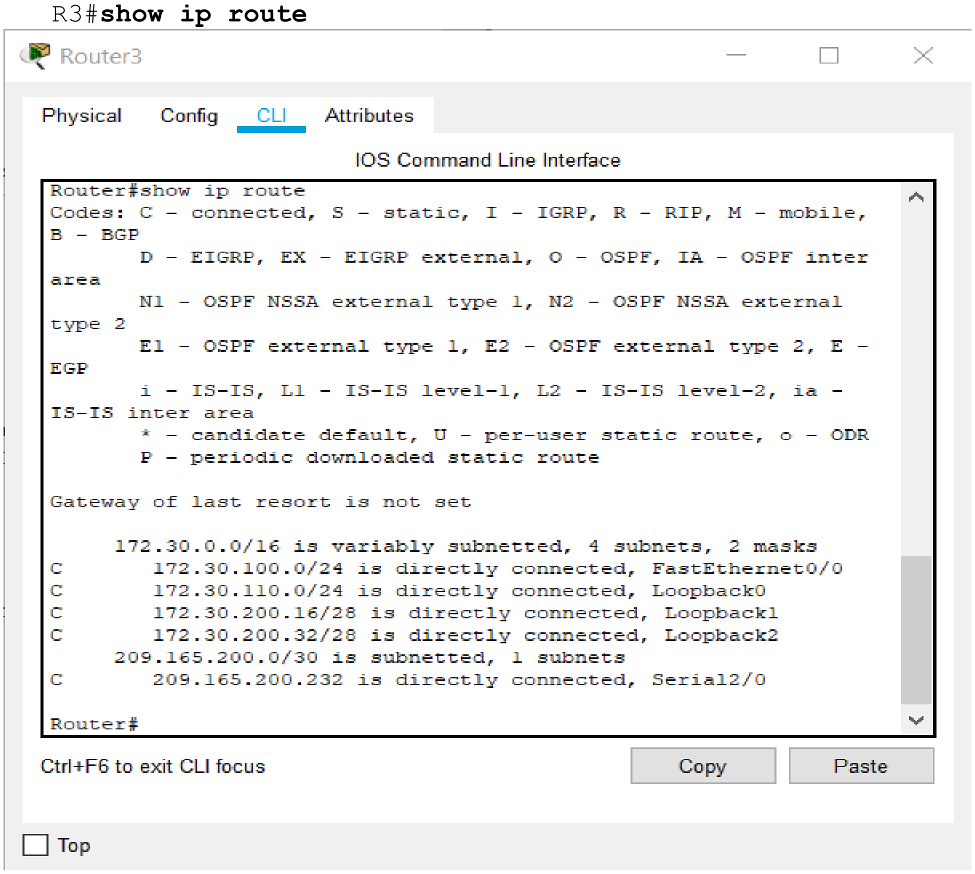
```
R1#show ip route
```



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**

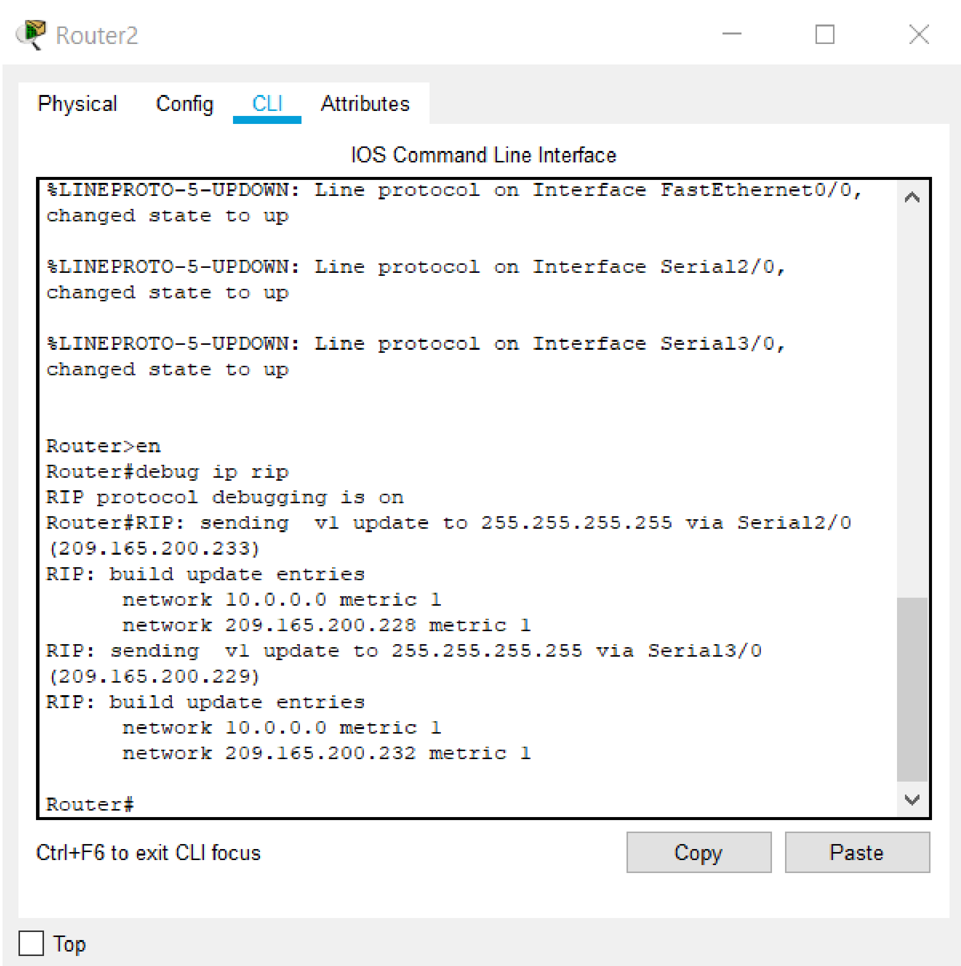


Step 7: Examine the RIPv1 packets that are being received by R2.

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.

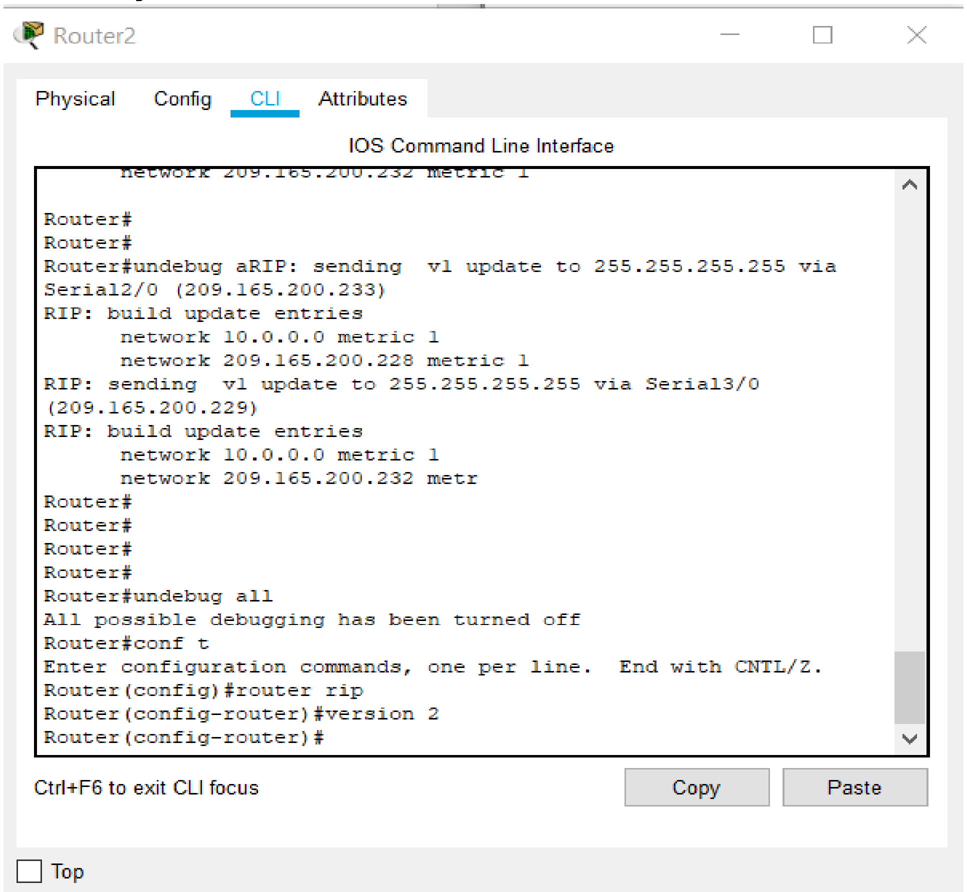
```
R2#undebug all
```

Task 4: Configure RIP Version 2.

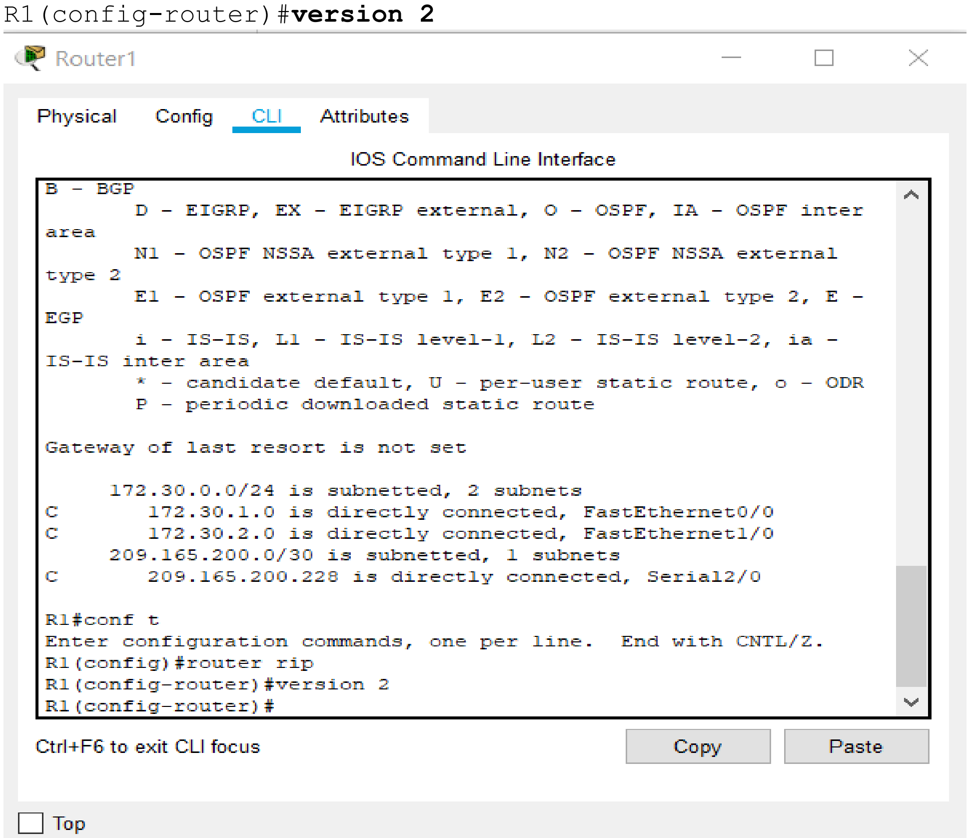
Step 1: Use the `version 2` command to enable RIP version 2 on each of the routers.

```
R2(config)#router rip
```

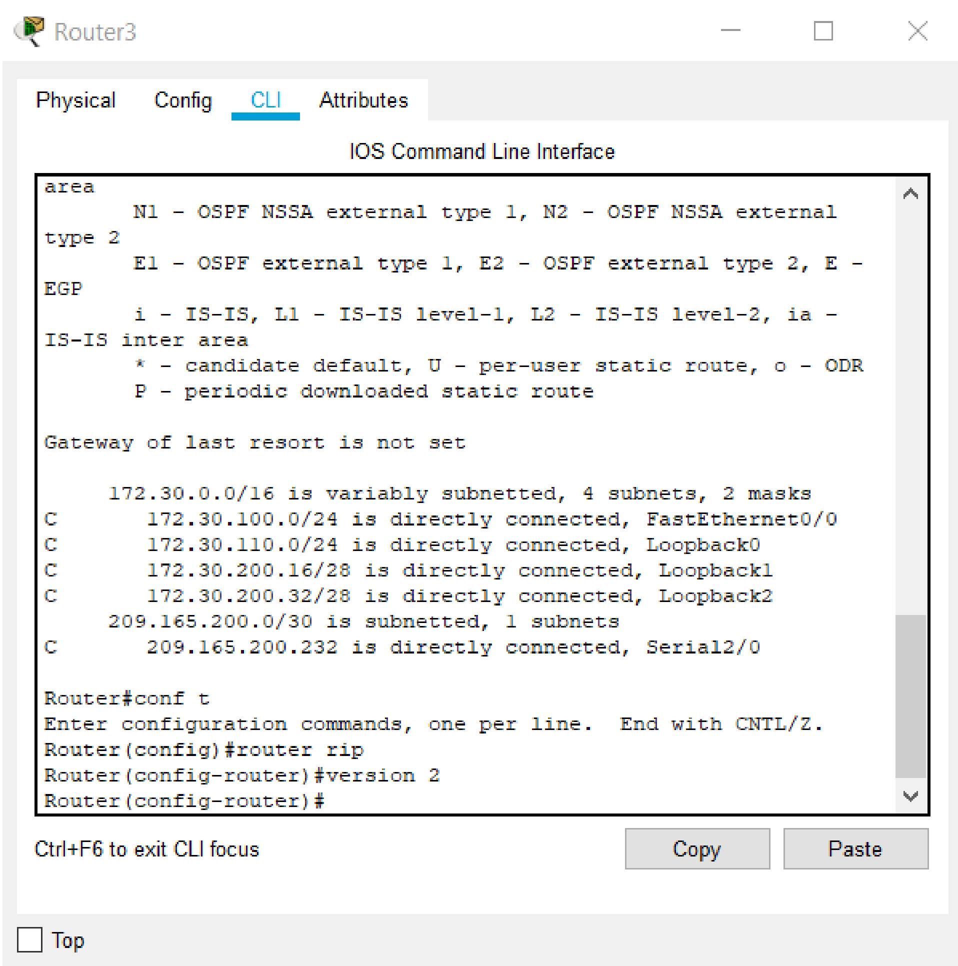
R2(config-router)#**version 2**



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



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

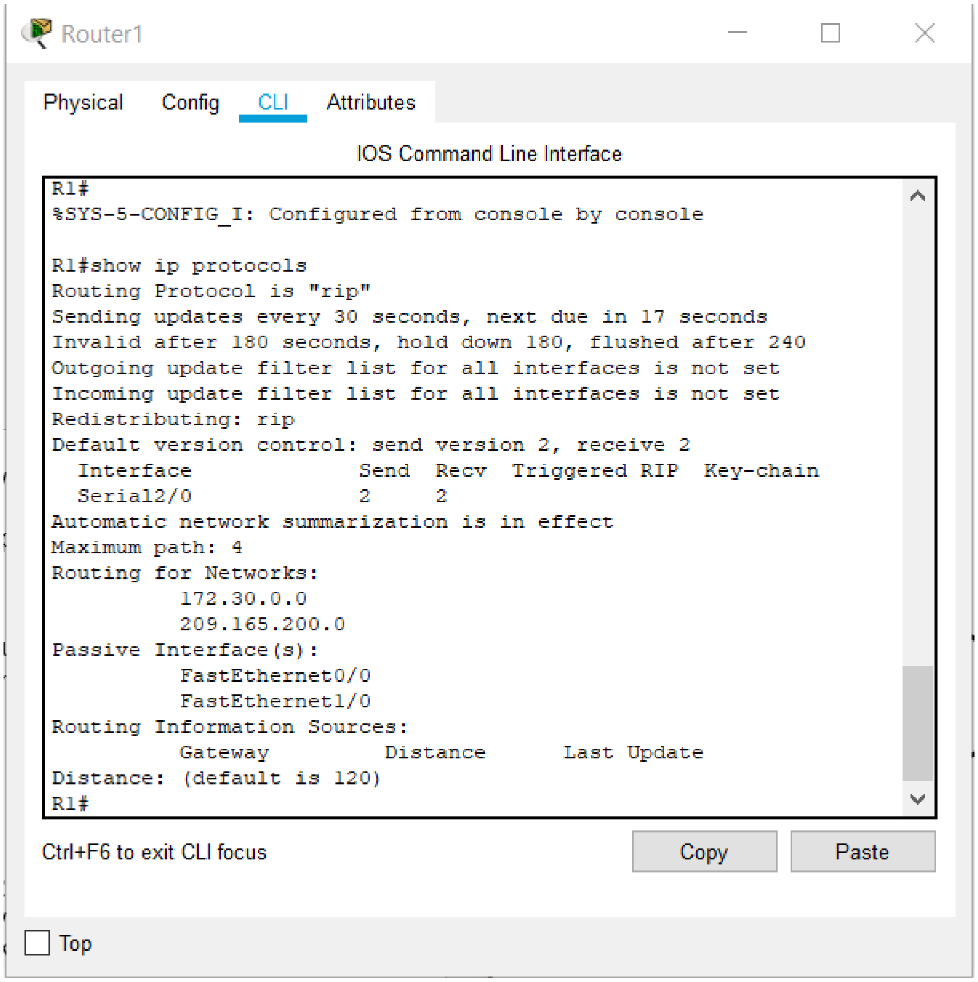


RIPv2 messages include the subnet mask in a field in the routing updates. This allows subnets and their masks to be included in the routing updates. However, by default RIPv2 summarizes networks at major network boundaries, just like RIPv1, except that the subnet mask is included in the update.

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.

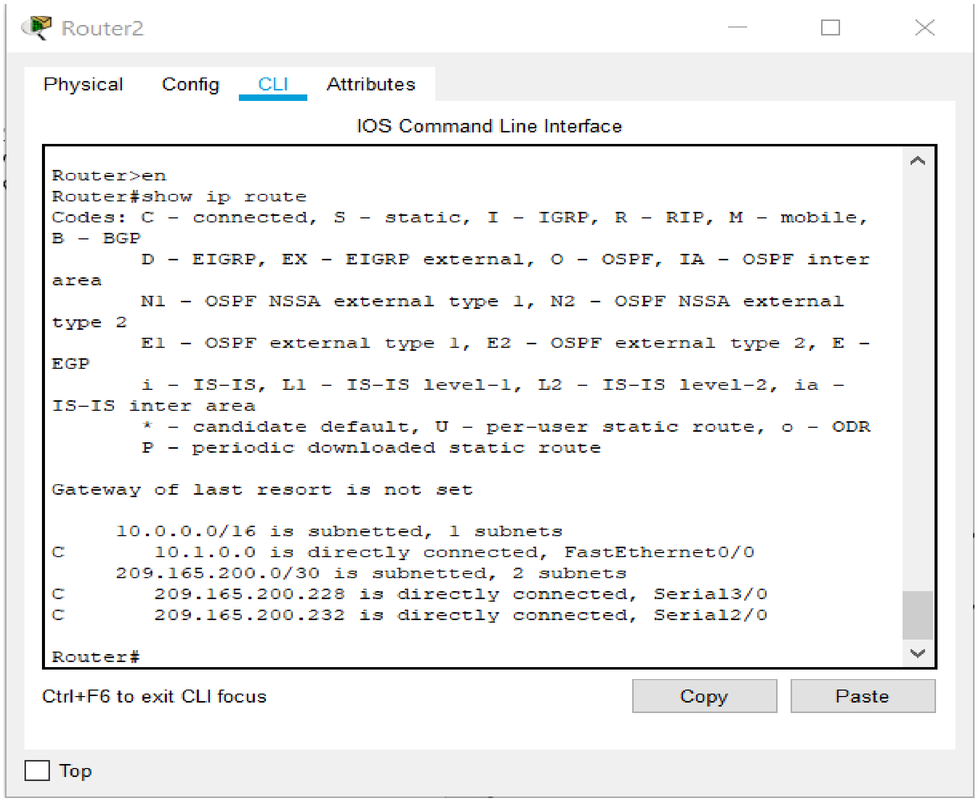
```
R1# show ip protocols
```



Task 5: Examine the Automatic Summarization of Routes.

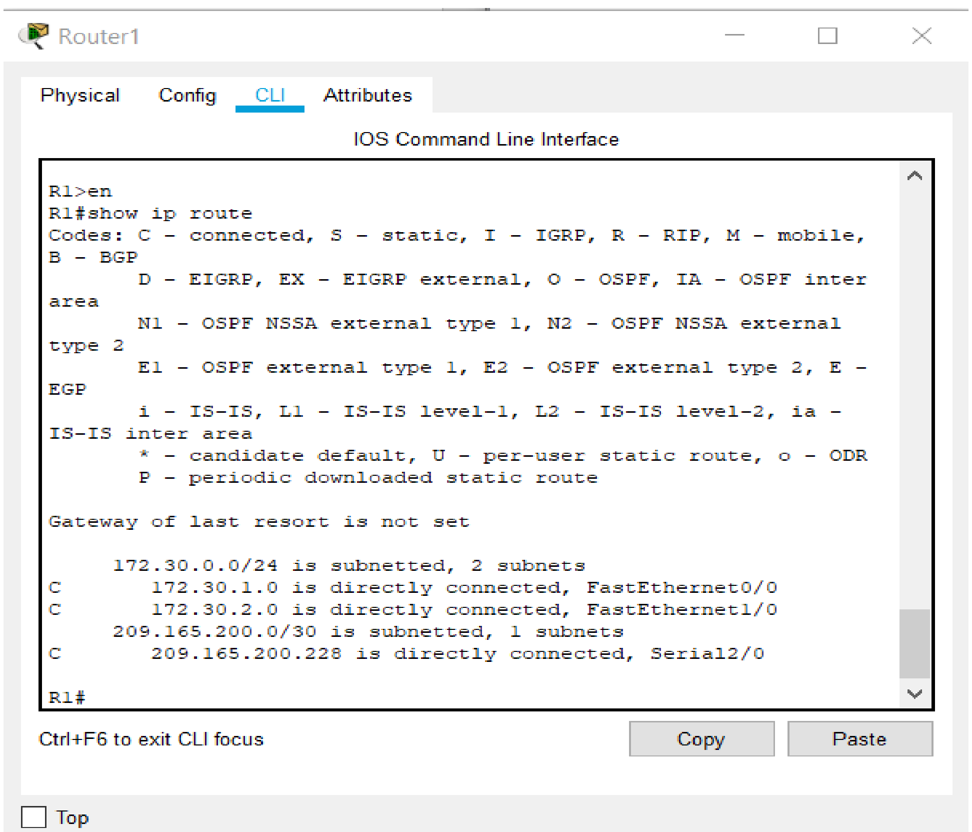
The LANs connected to R1 and R3 are still composed of discontiguous networks. R2 still shows two equal cost paths to the 172.30.0.0/16 network in the routing table. R2 still shows only the major classful network address of 172.30.0.0 and does not show any of the subnets for this network.

R2#**show ip route**



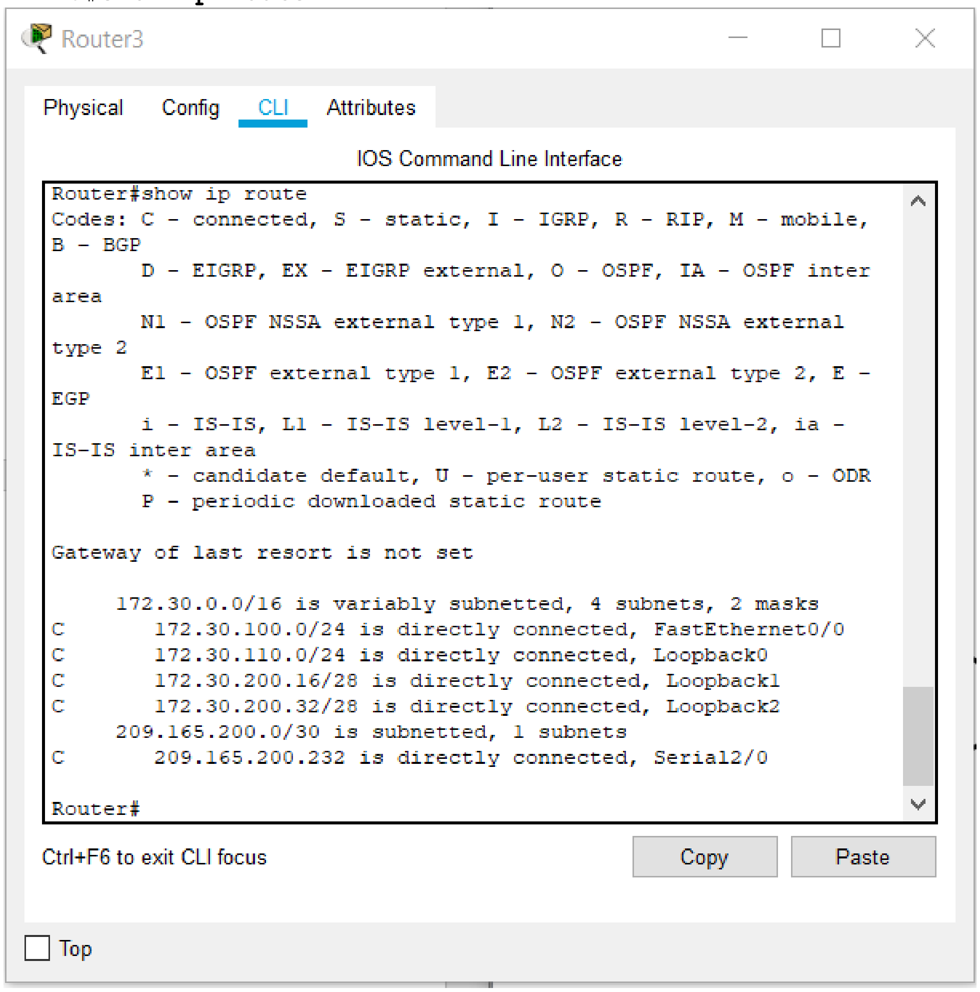
R1 still shows only its own subnets for the 172.30.0.0 network. R1 still does not have any routes for the 172.30.0.0 subnets on R3.

```
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:

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

172.30.100.0/24 via 0.0.0.0, metric 1, tag 0
172.30.110.0/24 via 0.0.0.0, metric 1, tag 0
172.30.200.32/28 via 0.0.0.0, metric 1, tag 0
209.165.200.0/24 via 0.0.0.0, metric 1, tag 0

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

(209.165.200.229)
RIP: build update entries
10.0.0.0/8 via 0.0.0.0, metric 1, tag 0
209.165.200.232/30 via 0.0.0.0, metric 1, tag 0

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.

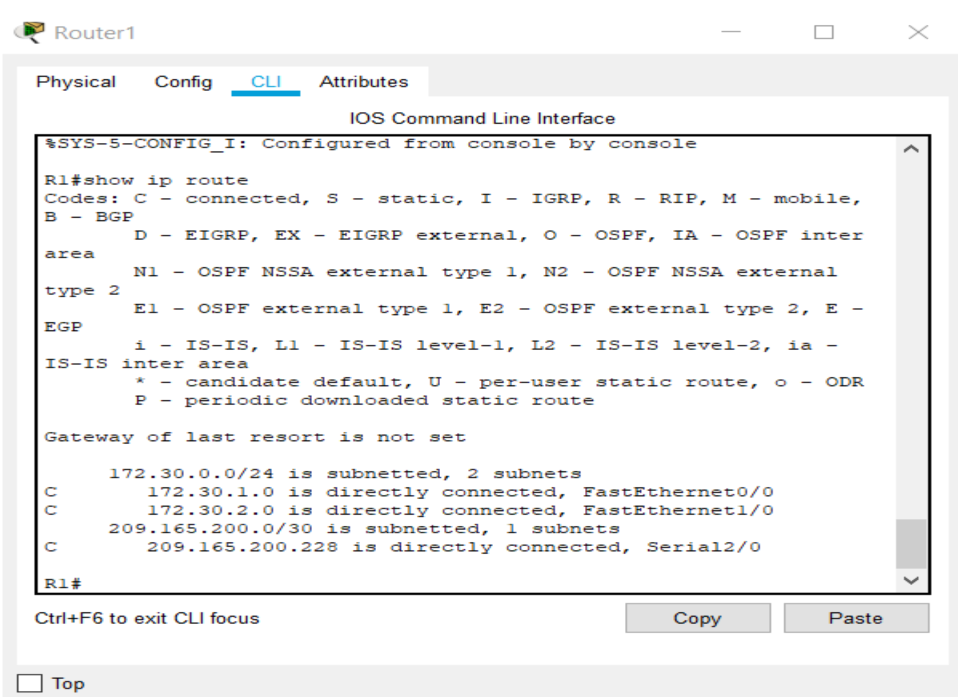
The **no auto-summary** command is used to turn off automatic summarization in RIPv2. Disable auto summarization on all routers. The routers will no longer summarize routes at major network boundaries.

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

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

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

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:

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

(209.165.200.230)
RIP: build update entries
172.30.1.0/24 via 0.0.0.0, metric 1, tag 0
172.30.2.0/24 via 0.0.0.0, metric 1, tag 0
RIP: sending v2 update to 224.0.0.9 via Serial2/0

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

(209.165.200.230)
RIP: build update entries
172.30.1.0/24 via 0.0.0.0, metric 1, tag 0
172.30.2.0/24 via 0.0.0.0, metric 1, tag 0
RIP: sending v2 update to 224.0.0.9 via Serial2/0

Are the subnet masks now included in the routing updates? **No**

Task 8: Verify Network Connectivity.

Step 1: Check connectivity between R2 router and PCs.

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

0/5

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

0/5

Step 2: Check the connectivity between the PCs.

From PC1, is it possible to ping PC2? **Yes**

What is the success rate? **3/4**

From PC1, is it possible to ping PC3? **No**

What is the success rate? **0/4**

From PC1, is it possible to ping PC4? **No**

What is the success rate? **0/4**

From PC4, is it possible to ping PC2? **Yes**

What is the success rate? **4/4**

From PC4, is it possible to ping PC3? **No**

What is the success rate? **0/4**

Task 9: Documentation

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

- **`show running-config`**
- **`show ip route`**
- **`show ip interface brief`**
- **`show ip protocols`**

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.