CEL 51, DCCN, Monsoon 2020

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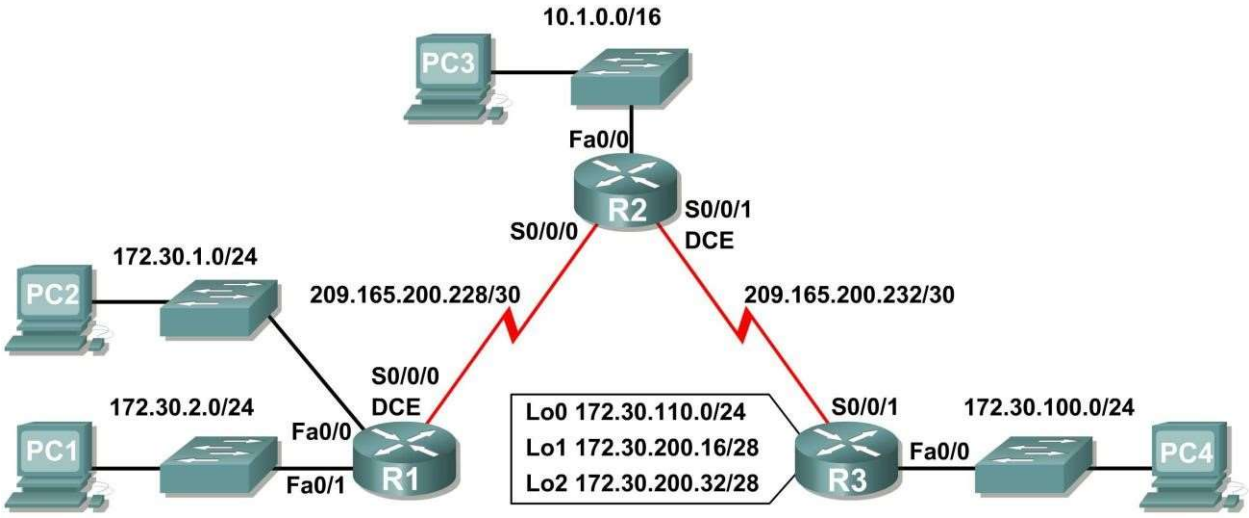
Lab 7: RIPv2 Router Configuration

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	172.30.2.10	255.255.255.0	172.30.2.1

PC2	**NIC**	172.30.[1].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

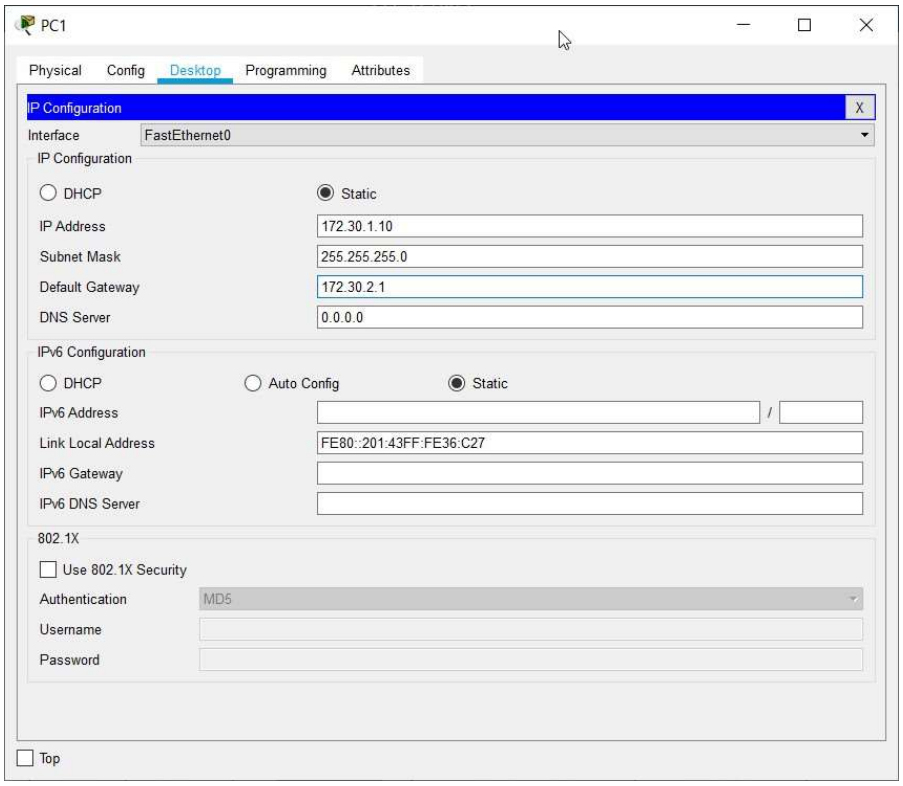
The network shown in the Topology Diagram contains a discontiguous network, 172.30.0.0. This network has been subnetted using VLSM. The 172.30.0.0 subnets are physically and logically divided by at least one other classful or major network, in this case the two serial networks 209.165.200.228/30 and 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.

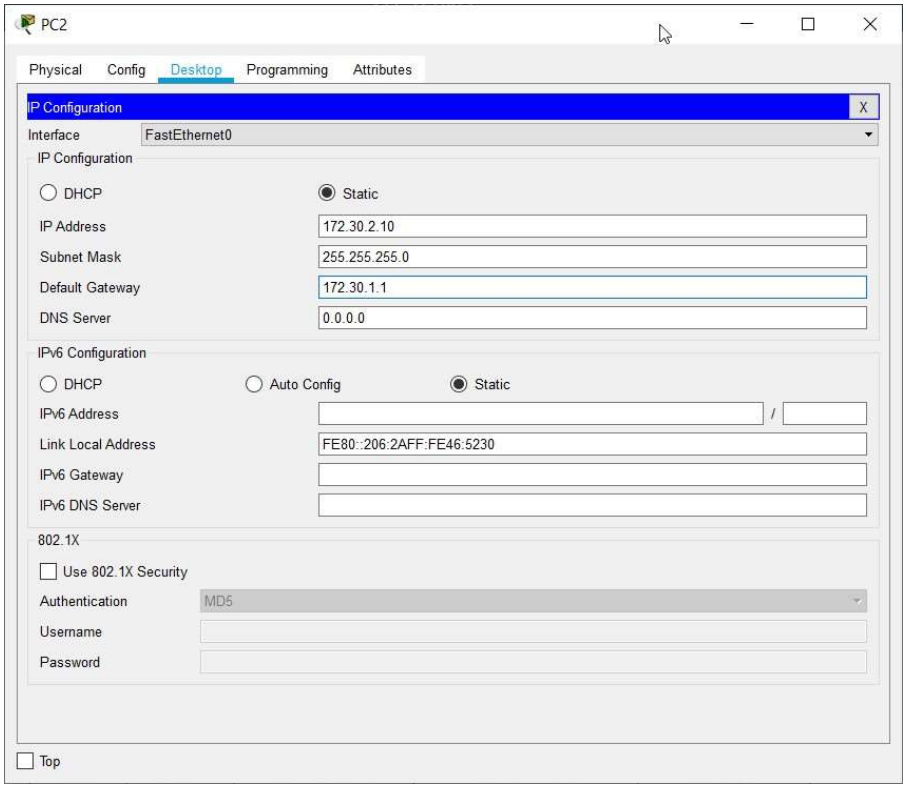
Step 1: Cable a network.

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

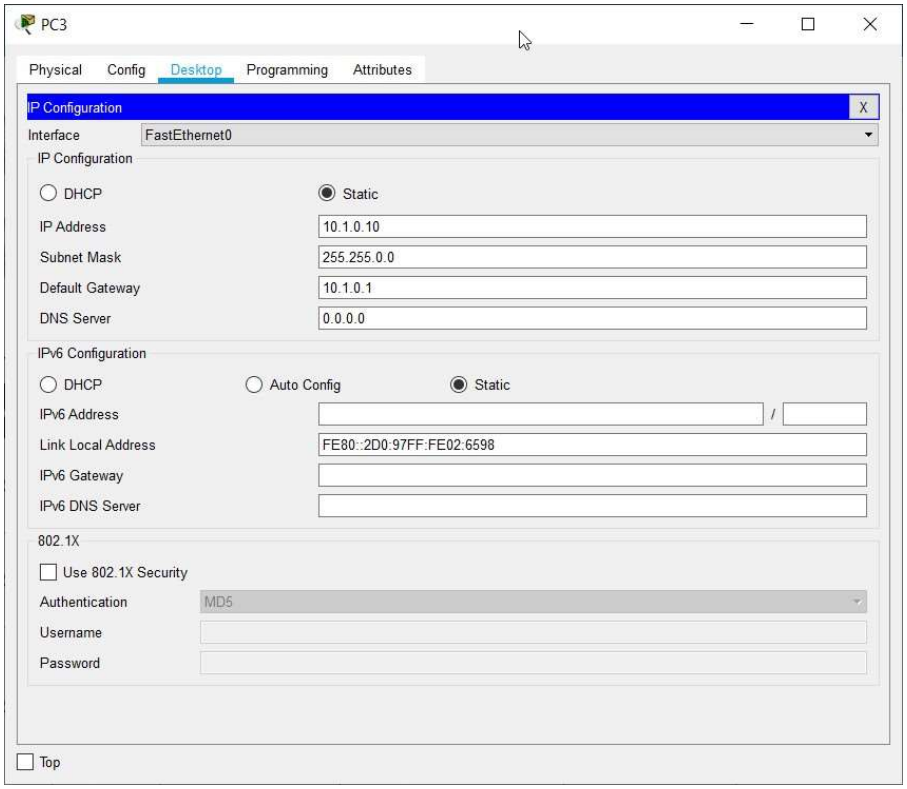
PC1 config



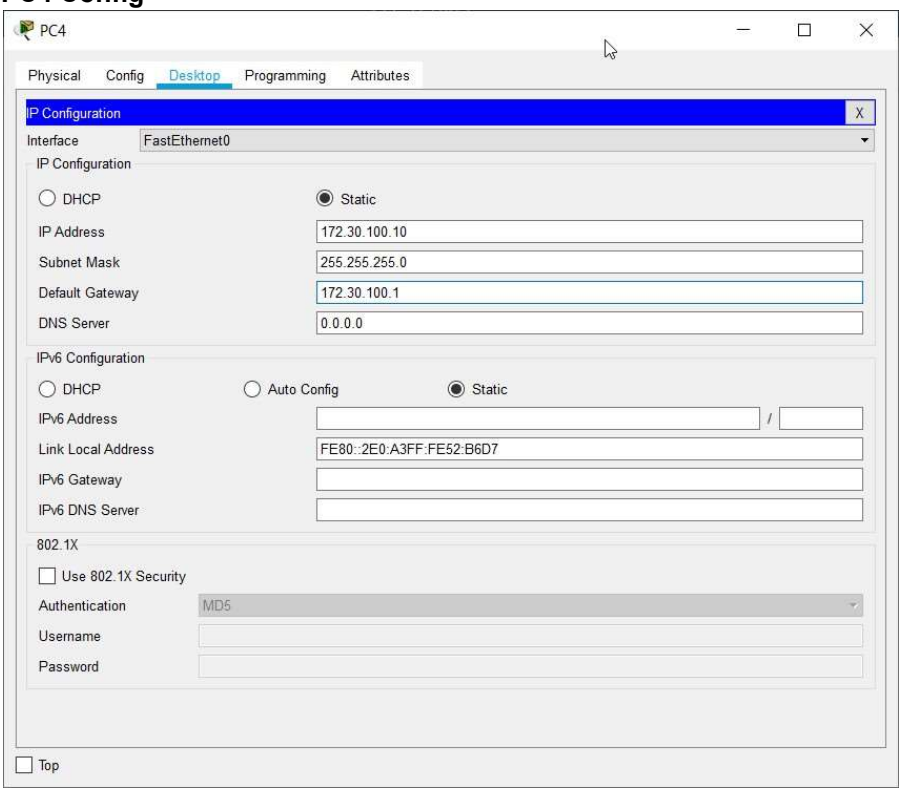
PC2 config

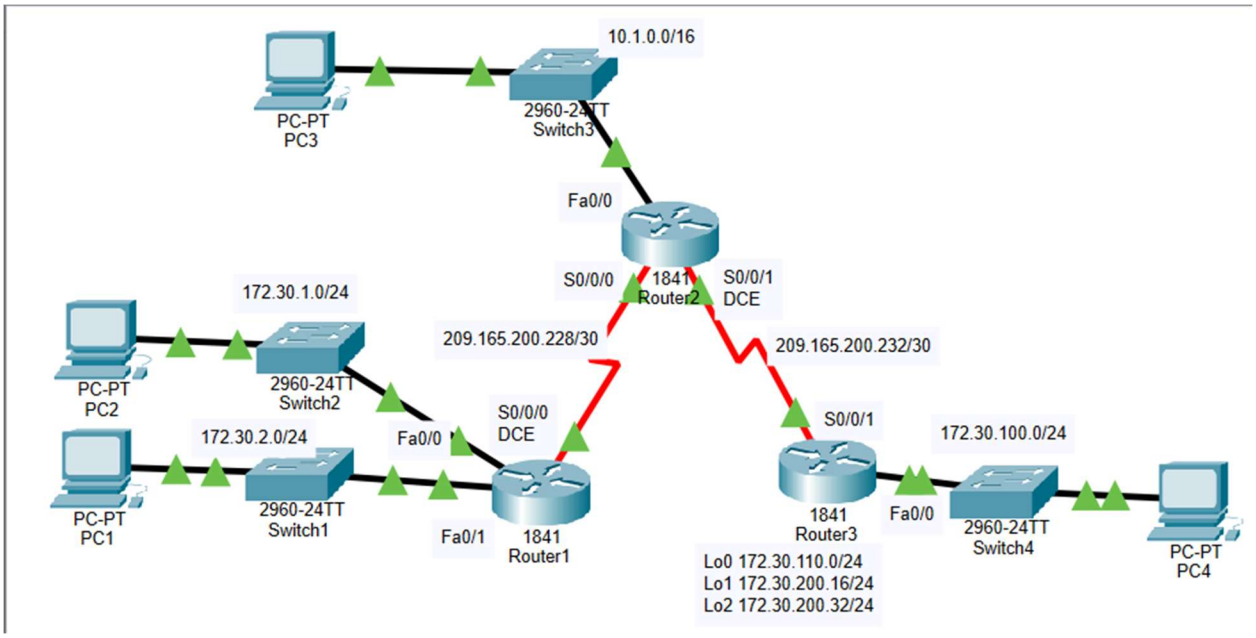


PC3 config


PC3
Physical
Config
Desktop
Programming
Attributes
IP Configuration
X
Interface
FastEthernet0
IP Configuration
DHCP
Static
IP Address
10.1.0.10
Subnet Mask
255.255.0.0
Default Gateway
10.1.0.1
DNS Server
0.0.0.0
IPv6 Configuration
DHCP
Auto Config
Static
IPv6 Address
Link Local Address
FE80::2D0:97FF:FE02:6598
IPv6 Gateway
IPv6 DNS Server
802.1X
Use 802.1X Security
Authentication
MD5
Username
Password
Top

PC4 Config


PC4
Physical
Config
Desktop
Programming
Attributes
IP Configuration
X
Interface
FastEthernet0
IP Configuration
DHCP
Static
IP Address
172.30.100.10
Subnet Mask
255.255.255.0
Default Gateway
172.30.100.1
DNS Server
0.0.0.0
IPv6 Configuration
DHCP
Auto Config
Static
IPv6 Address
Link Local Address
FE80::2E0:A3FF:FE52:B6D7
IPv6 Gateway
IPv6 DNS Server
802.1X
Use 802.1X Security
Authentication
MD5
Username
Password
Top



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.

R1 -

R1

Physical Config CLI Attributes

IOS

```
Router#erase startup-config
Erasing the nvram filesystem will remove all configuration files! Continue? [confirm]
[OK]
Erase of nvram: complete
%SYS-7-NV_BLOCK_INIT: Initialized the geometry of nvram
Router#reload
Proceed with reload? [confirm]
System Bootstrap, Version 12.3(8r)T8, RELEASE SOFTWARE (fc1)
Initializing memory for ECC
..
C1841 processor with 524288 Kbytes of main memory
Main memory is configured to 64 bit mode with ECC enabled

Readonly ROMMON initialized

Self decompressing the image :
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```

Ctrl+F6 to exit CLI focus

R2 -

R2

Physical Config CLI Attributes

IO

```
Router>
Router>enable
Router#erase startup-config
Erasing the nvram filesystem will remove all configuration files! Continue? [confirm]
[OK]
Erase of nvram: complete
%SYS-7-NV_BLOCK_INIT: Initialized the geometry of nvram
Router#
Router#reload
System configuration has been modified. Save? [yes/no]:no
Proceed with reload? [confirm]
System Bootstrap, Version 12.3(8r)T8, RELEASE SOFTWARE (fc1)
Initializing memory for ECC
..
C1841 processor with 524288 Kbytes of main memory
Main memory is configured to 64 bit mode with ECC enabled

Readonly ROMMON initialized

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Ctrl+F6 to exit CLI focus

R3 -

R3

Physical Config CLI Attributes

```
Router>
Router>enable
Router#erase startup-config
Erasing the nvram filesystem will remove all configuration files! Continue? [confirm]
[OK]
Erase of nvram: complete
%SYS-7-NV_BLOCK_INIT: Initialized the geometry of nvram
Router#
Router#reload
System configuration has been modified. Save? [yes/no]:no
Proceed with reload? [confirm]
System Bootstrap, Version 12.3(8r)T8, RELEASE SOFTWARE (fc1)
Initializing memory for ECC
..
C1841 processor with 524288 Kbytes of main memory
Main memory is configured to 64 bit mode with ECC enabled

Readonly ROMMON initialized

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```

Ctrl+F6 to exit CLI focus

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
```

Step 2: Load the following script onto R2.

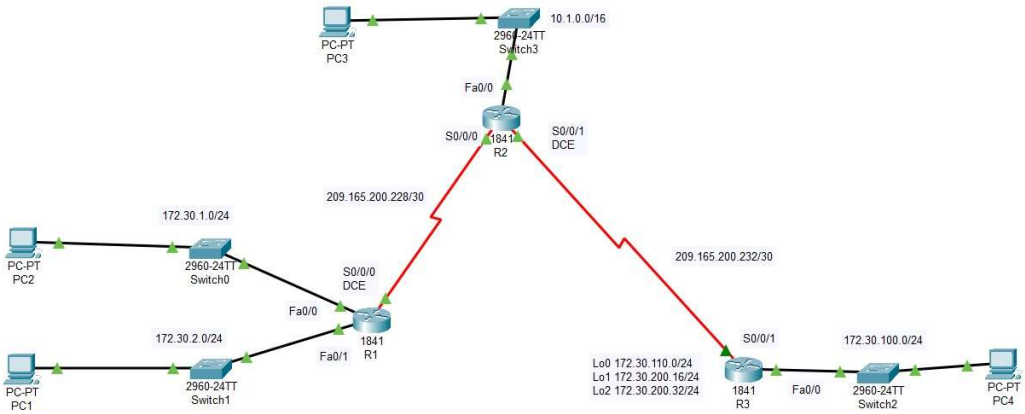
```
 hostname
R2
!
! !
```

```
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
```

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
```

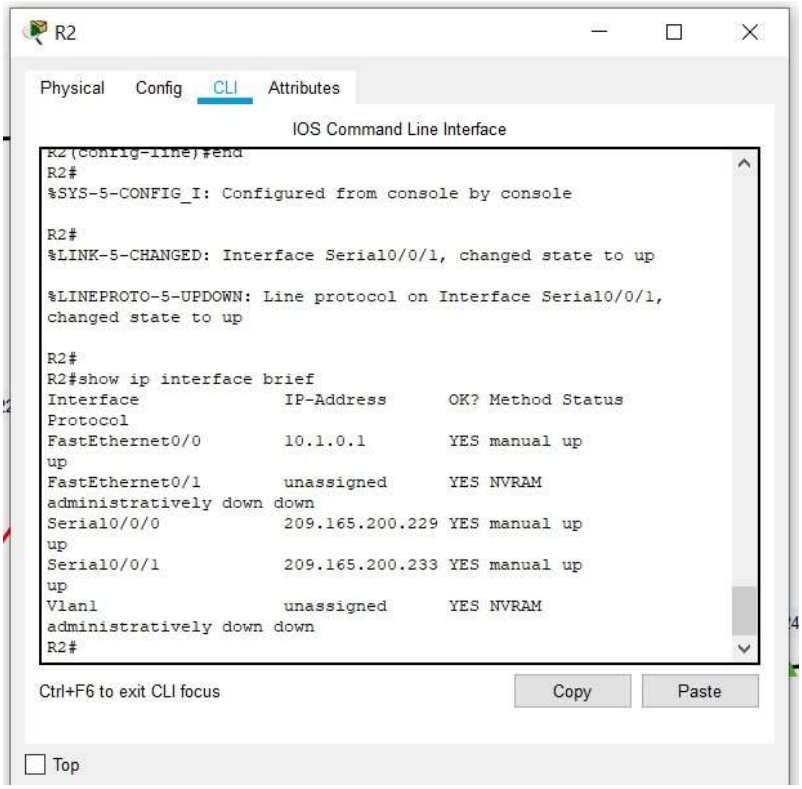


Task 3: Examine the Current Status of the Network.

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.

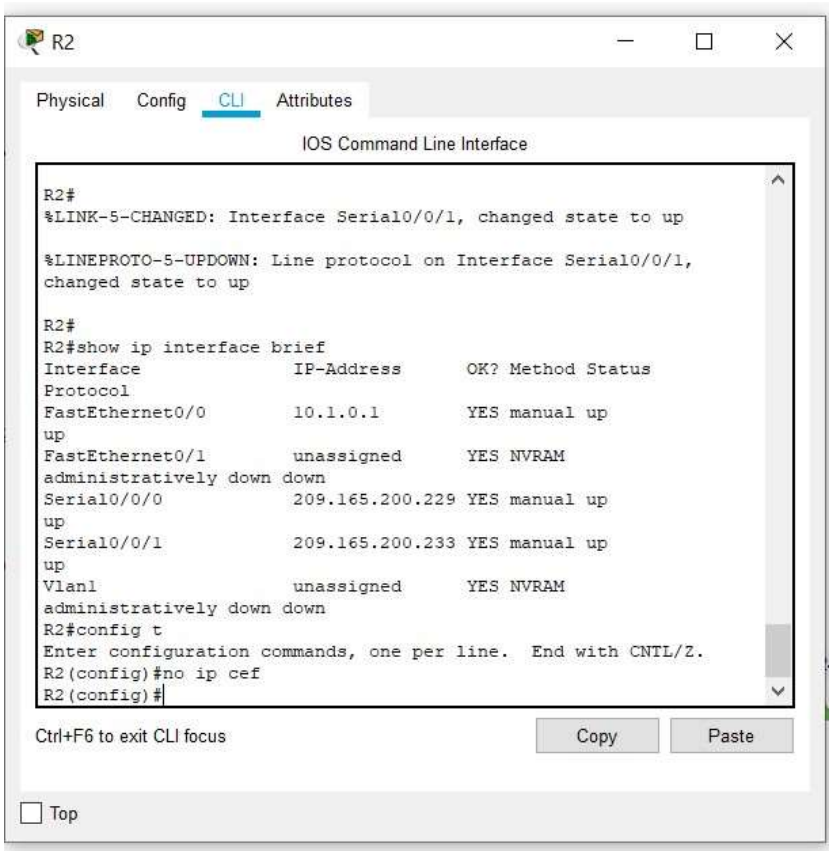
```
R2#show ip interface brief
```



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

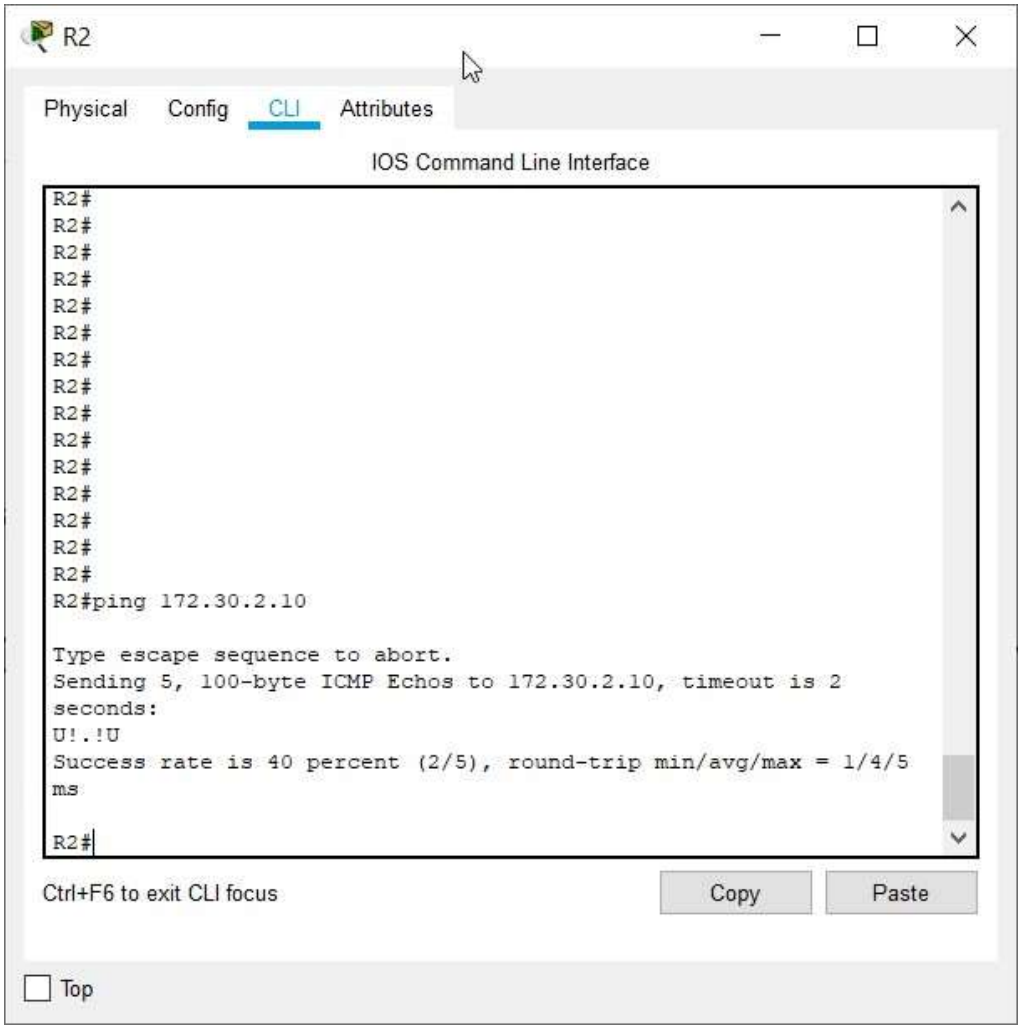
Note: For the 1841 router, you will need to disable IP CEF to obtain the correct output from the **ping** command. Although a discussion of IP CEF is beyond the scope of this course, you may disable IP CEF by using the following command in global configuration mode:

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



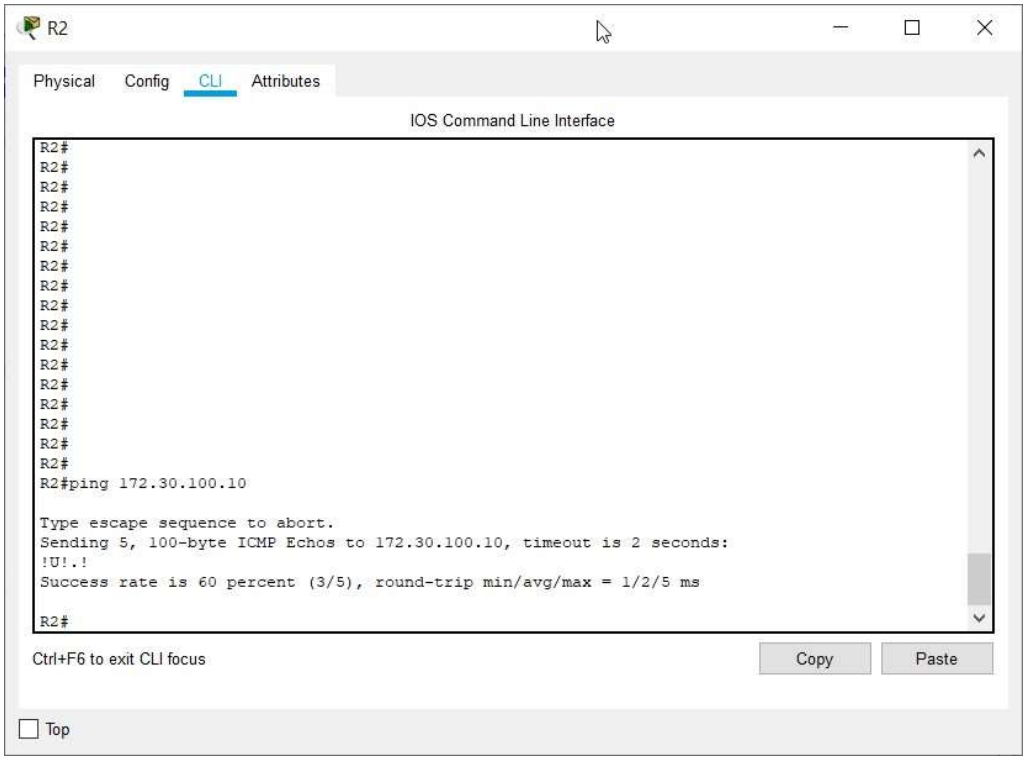
From the R2 router, how many ICMP messages are successful when pinging PC1?

2



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

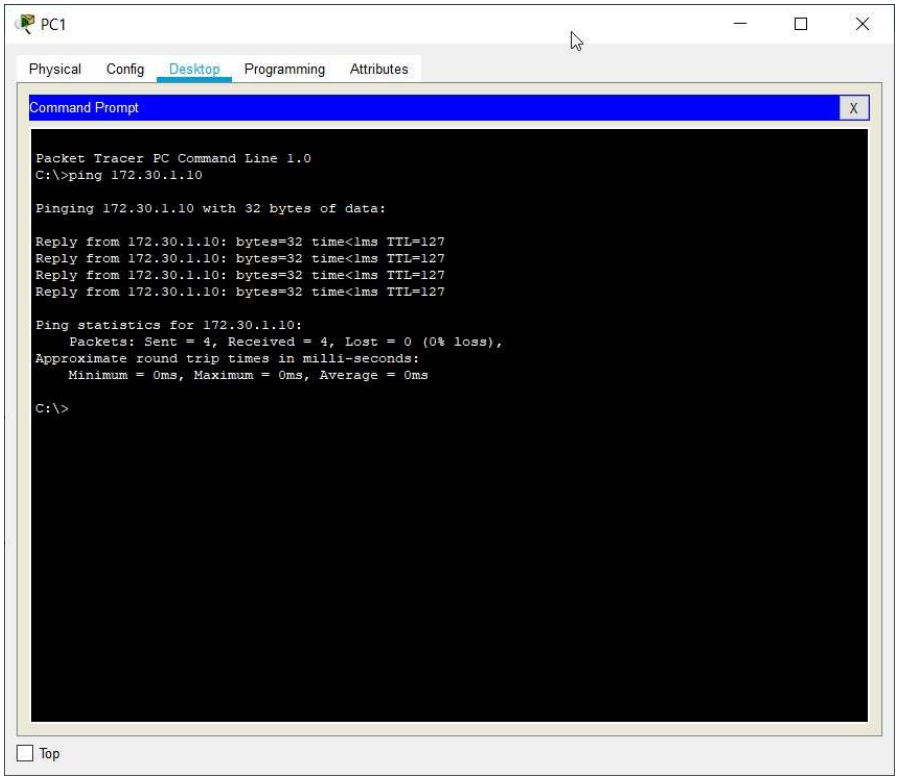
3



Step 3: Check the connectivity between the PCs.

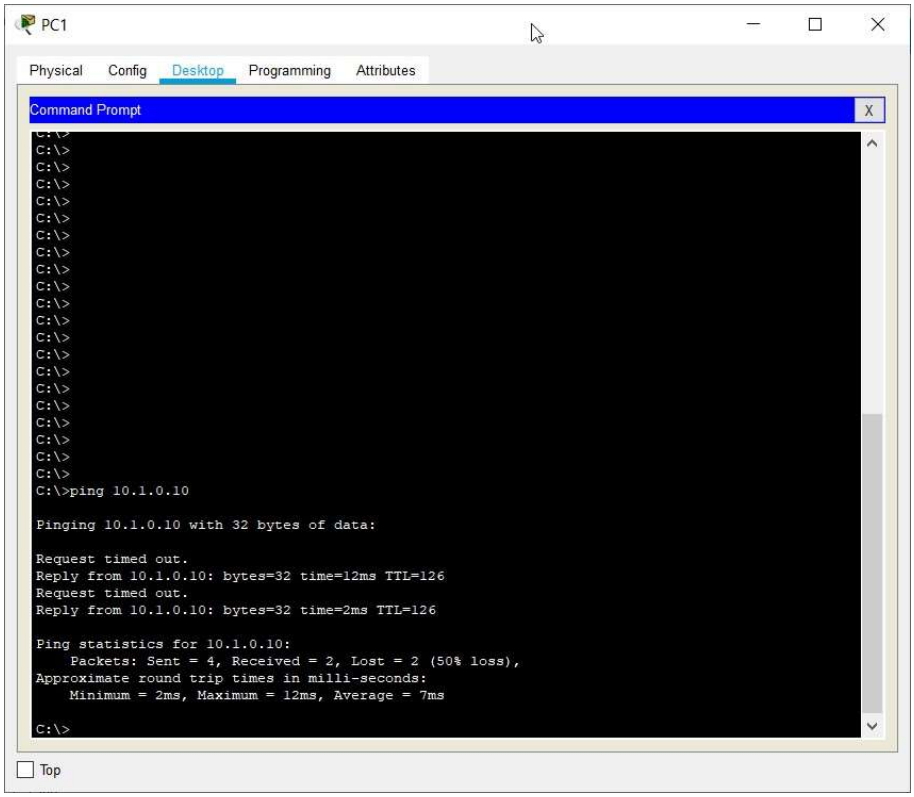
From the PC1, is it possible to ping PC2? Yes

What is the success rate? 100%



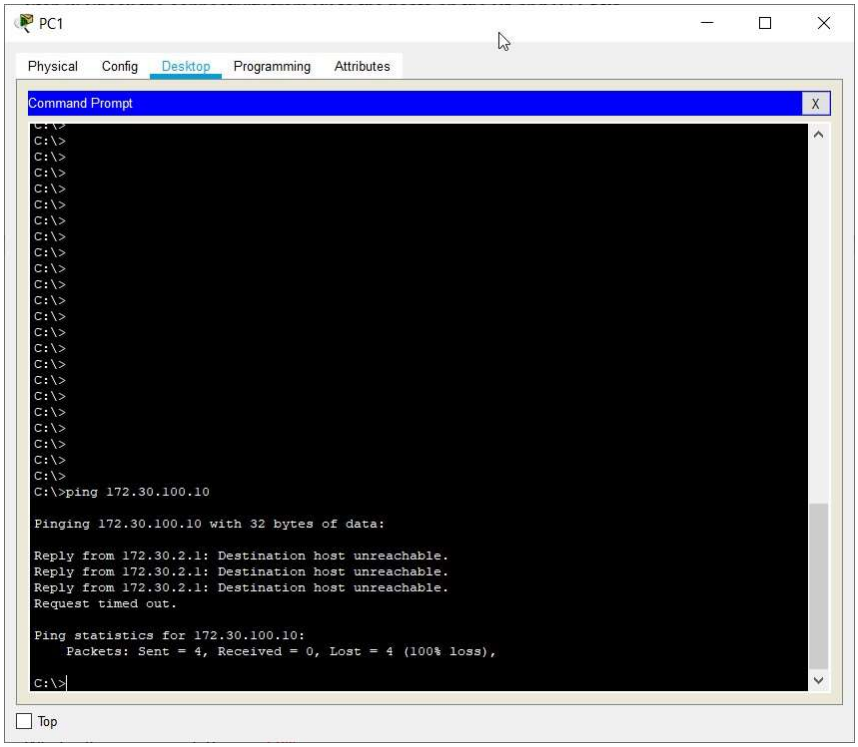
From the PC1, is it possible to ping PC3? Yes

What is the success rate? 50%



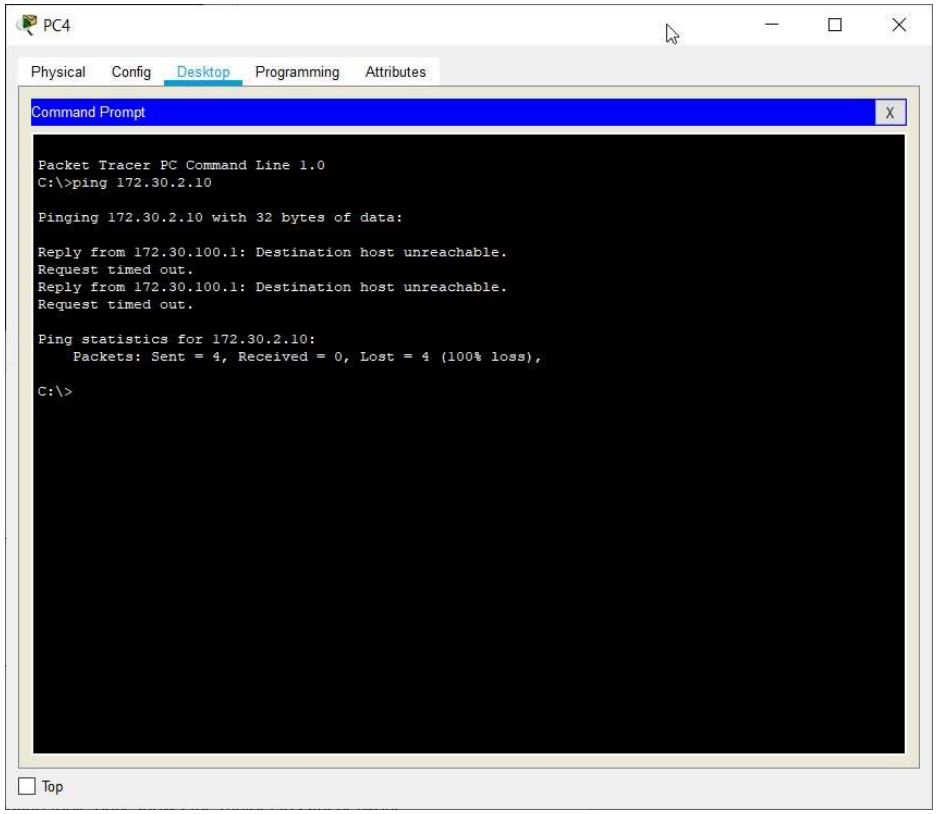
From the PC1, is it possible to ping PC4? No

What is the success rate? 0%



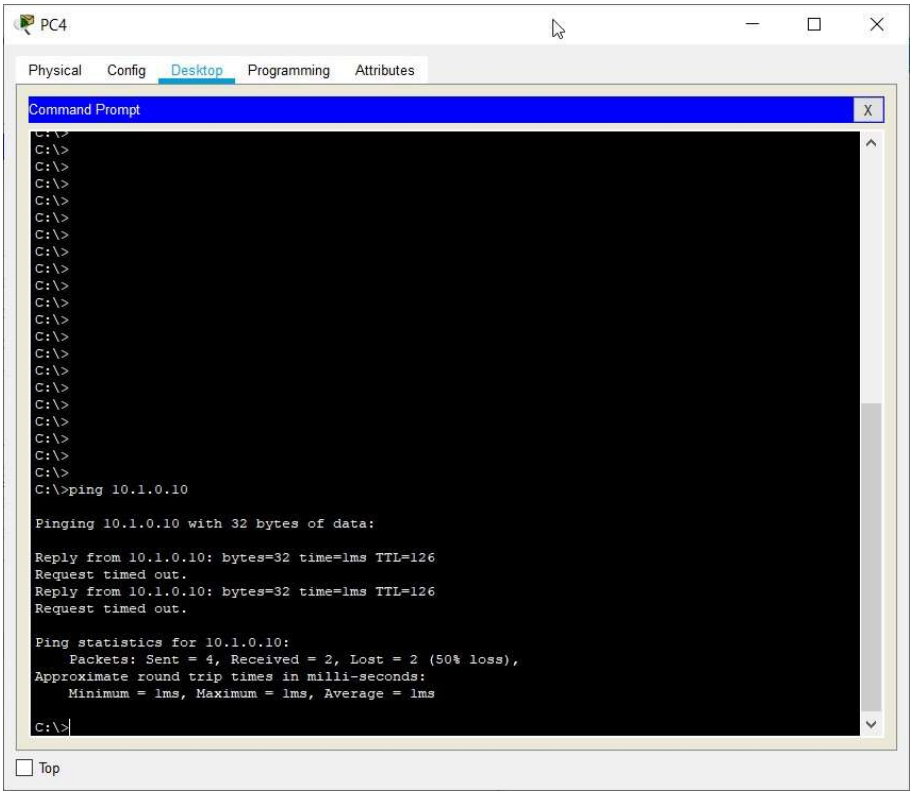
From the PC4, is it possible to ping PC2? No

What is the success rate? 0%


PC4
Physical
Config
Desktop
Programming
Attributes
Command Prompt
X
Packet Tracer PC Command Line 1.0
C:\>ping 172.30.2.10
Pinging 172.30.2.10 with 32 bytes of data:
Reply from 172.30.100.1: Destination host unreachable.
Request timed out.
Reply from 172.30.100.1: Destination host unreachable.
Request timed out.
Ping statistics for 172.30.2.10:
Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),
C:\>
Top

From the PC4, is it possible to ping PC3? Yes

What is the success rate? 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
```

```
R2#
R2#show ip route
Codes: C - connected, S - static, I - IGRP, 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

     10.0.0.0/16 is subnetted, 1 subnets
C       10.1.0.0 is directly connected, FastEthernet0/0
R    172.30.0.0/16 [120/1] via 209.165.200.230, 00:00:24, Serial0/0/0
                   [120/1] via 209.165.200.234, 00:00:01, Serial0/0/1
     209.165.200.0/30 is subnetted, 2 subnets
C       209.165.200.228 is directly connected, Serial0/0/0
C       209.165.200.232 is directly connected, Serial0/0/1

R2#
```

Ctrl+F6 to exit CLI focus

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
```

```
R1>
R1>enable
R1#show ip route
Codes: C - connected, S - static, I - IGRP, 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

R    10.0.0.0/8 [120/1] via 209.165.200.229, 00:00:23, Serial0/0/0
     172.30.0.0/24 is subnetted, 2 subnets
C       172.30.1.0 is directly connected, FastEthernet0/0
C       172.30.2.0 is directly connected, FastEthernet0/1
     209.165.200.0/30 is subnetted, 2 subnets
C       209.165.200.228 is directly connected, Serial0/0/0
R       209.165.200.232 [120/1] via 209.165.200.229, 00:00:23, Serial0/0/0

R1#
```

Ctrl+F6 to exit CLI focus

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
```

```
R3>
R3>enable
R3#
R3#
R3#show ip route
Codes: C - connected, S - static, I - IGRP, 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

R    10.0.0.0/8 [120/1] via 209.165.200.233, 00:00:19, Serial0/0/1
     172.30.0.0/16 is variably subnetted, 4 subnets, 2 masks
C       172.30.100.0/24 is directly connected, FastEthernet0/0
C       172.30.110.0/24 is directly connected, Loopback0
C       172.30.200.16/28 is directly connected, Loopback1
C       172.30.200.32/28 is directly connected, Loopback2
     209.165.200.0/30 is subnetted, 2 subnets
R       209.165.200.228 [120/1] via 209.165.200.233, 00:00:19, Serial0/0/1
C       209.165.200.232 is directly connected, Serial0/0/1

R3#
```

Ctrl+F6 to exit CLI focus

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

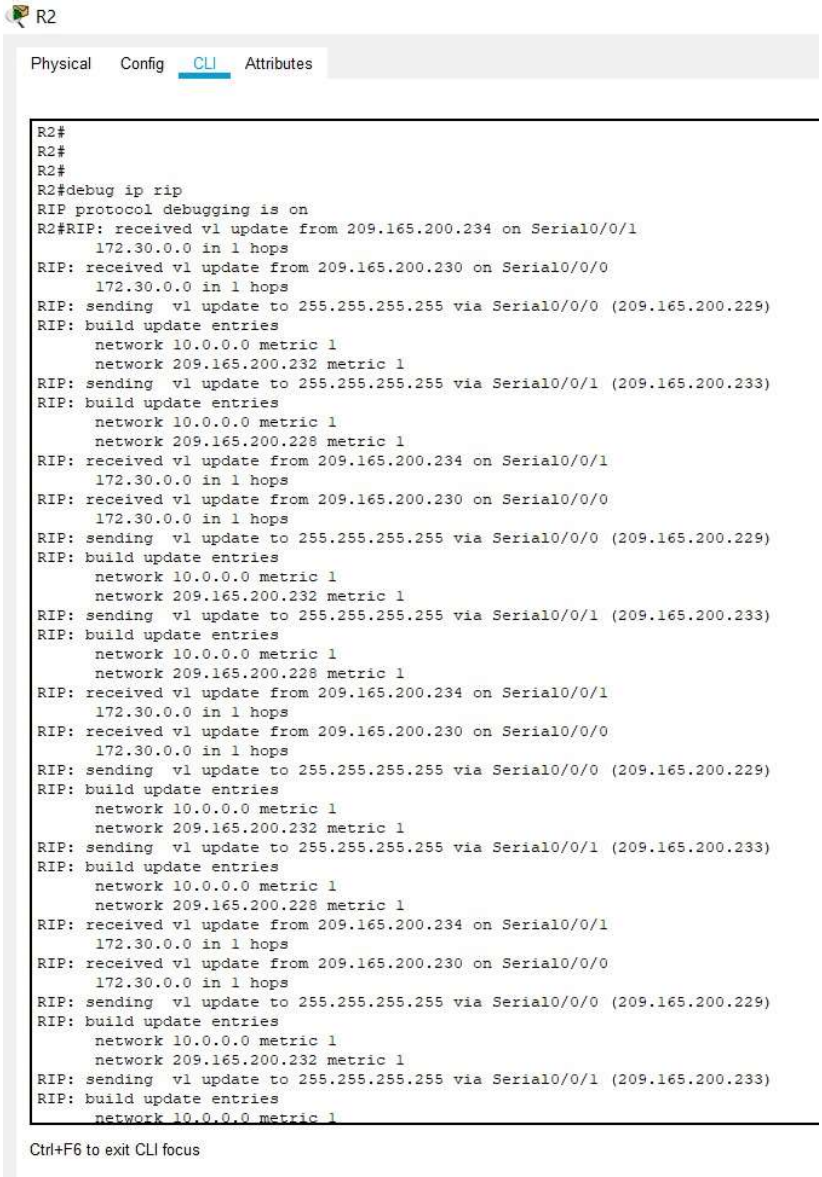
Use the **debug ip rip** command to display RIP routing updates.

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
```

```
R2#undebug all
All possible debugging has been turned off
R2#
```

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
```

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

Ctrl+F6 to exit CLI focus

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

```
R1#config t
Enter configuration commands, one per line.  End with CNTL/Z.
R1(config)#router rip
R1(config-router)#version 2
R1(config-router)#
```

Ctrl+F6 to exit CLI focus

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

```
R3#config t
Enter configuration commands, one per line.  End with CNTL/Z.
R3(config)#router rip
R3(config-router)#version 2
R3(config-router)#
```

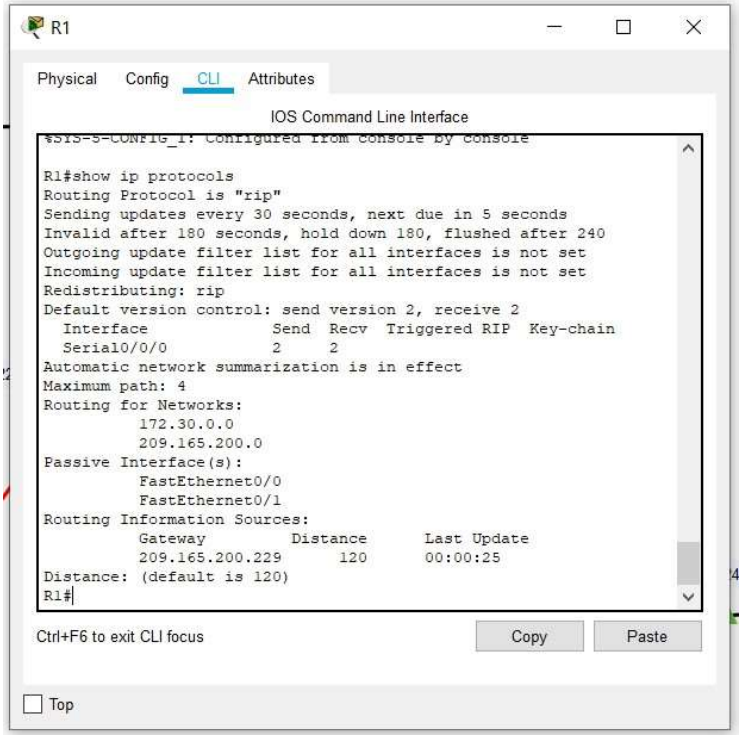
Ctrl+F6 to exit CLI focus

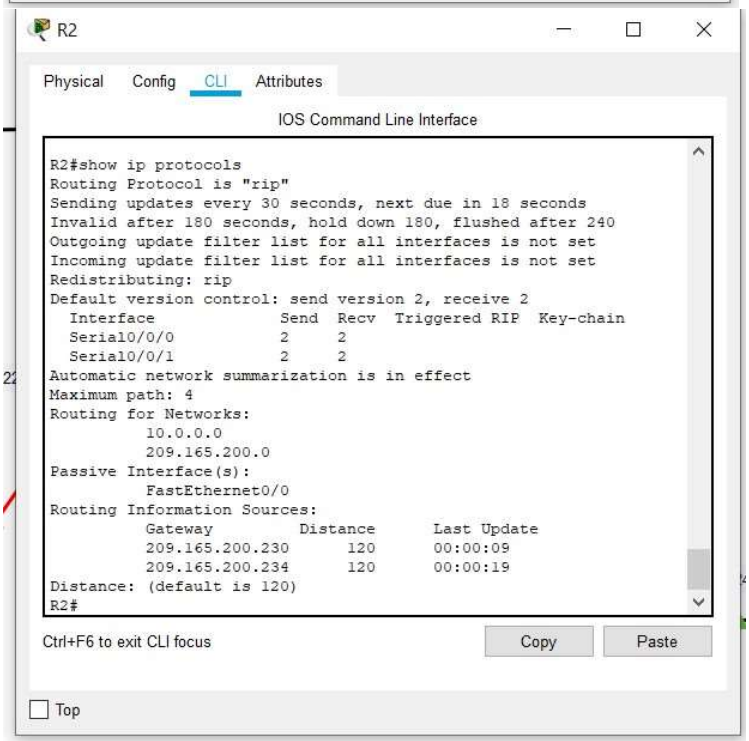
RIPv2 messages include the subnet mask in a field in the routing updates. This allows subnets and their masks to be included in the routing updates. However, by default RIPv2 summarizes networks at major network boundaries, just like RIPv1, except that the subnet mask is included in the update.

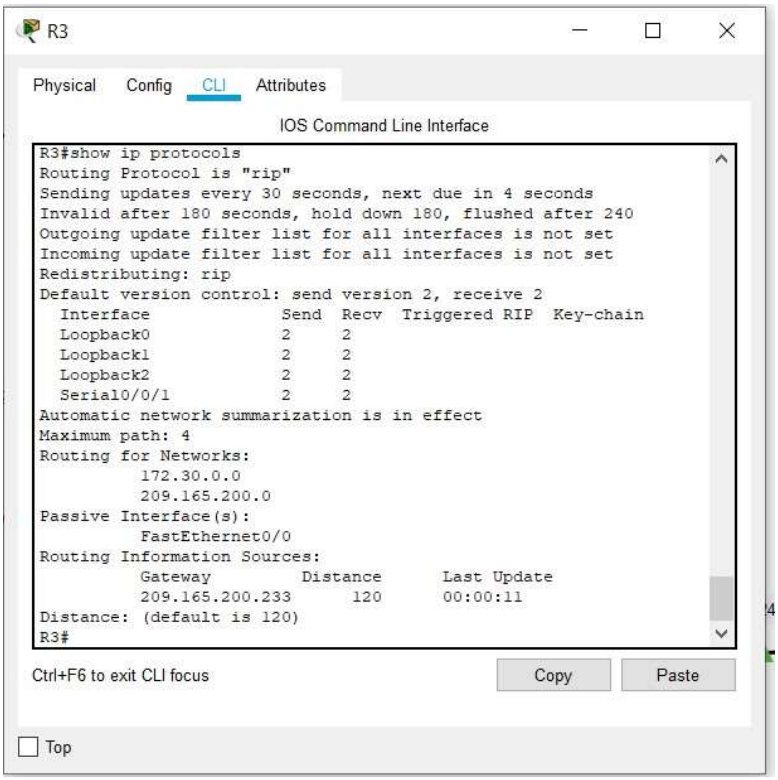
Step 2: Verify that RIPv2 is running on the routers.

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
R2#show ip route
Codes: C - connected, S - static, I - IGRP, 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

     10.0.0.0/16 is subnetted, 1 subnets
C       10.1.0.0 is directly connected, FastEthernet0/0
R    172.30.0.0/16 [120/1] via 209.165.200.230, 00:00:01, Serial0/0/0
                   [120/1] via 209.165.200.234, 00:00:13, Serial0/0/1
     209.165.200.0/30 is subnetted, 2 subnets
C       209.165.200.228 is directly connected, Serial0/0/0
C       209.165.200.232 is directly connected, Serial0/0/1

R2#
```

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**

```
R1#show ip route
Codes: C - connected, S - static, I - IGRP, 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

R    10.0.0.0/8 [120/1] via 209.165.200.229, 00:00:06, Serial0/0/0
     172.30.0.0/24 is subnetted, 2 subnets
C       172.30.1.0 is directly connected, FastEthernet0/0
C       172.30.2.0 is directly connected, FastEthernet0/1
     209.165.200.0/30 is subnetted, 2 subnets
C       209.165.200.228 is directly connected, Serial0/0/0
R       209.165.200.232 [120/1] via 209.165.200.229, 00:00:06, Serial0/0/0

R1#
```

Ctrl+F6 to exit CLI focus

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**

```
R3#
R3#show ip route
Codes: C - connected, S - static, I - IGRP, 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

R    10.0.0.0/8 [120/1] via 209.165.200.233, 00:00:27, Serial0/0/1
     172.30.0.0/16 is variably subnetted, 4 subnets, 2 masks
C       172.30.100.0/24 is directly connected, FastEthernet0/0
C       172.30.110.0/24 is directly connected, Loopback0
C       172.30.200.16/28 is directly connected, Loopback1
C       172.30.200.32/28 is directly connected, Loopback2
     209.165.200.0/30 is subnetted, 2 subnets
R       209.165.200.228 [120/1] via 209.165.200.233, 00:00:27, Serial0/0/1
C       209.165.200.232 is directly connected, Serial0/0/1

R3#
```

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?

```
RIP protocol debugging is on
R3#RIP: received v2 update from 209.165.200.233 on Serial0/0/1
10.0.0.0/8 via 0.0.0.0 in 1 hops
209.165.200.228/30 via 0.0.0.0 in 1 hops
RIP: sending v2 update to 224.0.0.9 via Loopback0 (172.30.110.1)
RIP: build update entries
10.0.0.0/8 via 0.0.0.0, metric 2, tag 0
172.30.100.0/24 via 0.0.0.0, metric 1, tag 0
172.30.200.16/28 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
RIP: sending v2 update to 224.0.0.9 via Loopback1 (172.30.200.17)
RIP: build update entries
10.0.0.0/8 via 0.0.0.0, metric 2, tag 0
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
RIP: sending v2 update to 224.0.0.9 via Serial0/0/1 (209.165.200.234)
RIP: build update entries
172.30.0.0/16 via 0.0.0.0, metric 1, tag 0
RIP: sending v2 update to 224.0.0.9 via Loopback2 (172.30.200.33)
RIP: build update entries
10.0.0.0/8 via 0.0.0.0, metric 2, tag 0
```

```
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
172.30.200.16/28 via 0.0.0.0, metric 1, tag 0
209.165.200.0/24 via 0.0.0.0, metric 1, tag 0
```

10.0.0.0/8 172.30.100.0/24

172.30.110.0/24

172.30.200.16/28

209.165.200.0/24

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

```
RIP protocol debugging is on
R2#RIP: sending v2 update to 224.0.0.9 via Serial0/0/1 (209.165.200.233)
RIP: build update entries
10.0.0.0/8 via 0.0.0.0, metric 1, tag 0
209.165.200.228/30 via 0.0.0.0, metric 1, tag 0
RIP: sending v2 update to 224.0.0.9 via Serial0/0/0 (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
RIP: received v2 update from 209.165.200.230 on Serial0/0/0
172.30.0.0/16 via 0.0.0.0 in 1 hops
RIP: received v2 update from 209.165.200.234 on Serial0/0/1
172.30.0.0/16 via 0.0.0.0 in 1 hops
```

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
```

```
R2#
R2#enable
R2#config t
Enter configuration commands, one per line.  End with CNTL/Z.
R2(config)#router rip
R2(config-router)#no auto-summary
R2(config-router)#
```

Ctrl+F6 to exit CLI focus

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

```
R1#config t
Enter configuration commands, one per line.  End with CNTL/Z.
R1(config)#router rip
R1(config-router)#no auto-summary
R1(config-router)#
```

Ctrl+F6 to exit CLI focus

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

```
R3#config t
Enter configuration commands, one per line.  End with CNTL/Z.
R3(config)#router rip
R3(config-router)#no auto-summary
R3(config-router)#
```

Ctrl+F6 to exit CLI focus

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
```

```
R2#show ip route
Codes: C - connected, S - static, I - IGRP, 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

     10.0.0.0/16 is subnetted, 1 subnets
C       10.1.0.0 is directly connected, FastEthernet0/0
     172.30.0.0/16 is variably subnetted, 7 subnets, 3 masks
R       172.30.0.0/16 [120/1] via 209.165.200.230, 00:01:57, Serial0/0/0
                      is possibly down, routing via 209.165.200.234, Serial0/0/1
R       172.30.1.0/24 [120/1] via 209.165.200.230, 00:00:01, Serial0/0/0
R       172.30.2.0/24 [120/1] via 209.165.200.230, 00:00:01, Serial0/0/0
R       172.30.100.0/24 [120/1] via 209.165.200.234, 00:00:23, Serial0/0/1
R       172.30.110.0/24 [120/1] via 209.165.200.234, 00:00:23, Serial0/0/1
R       172.30.200.16/28 [120/1] via 209.165.200.234, 00:00:23, Serial0/0/1
R       172.30.200.32/28 [120/1] via 209.165.200.234, 00:00:23, Serial0/0/1
     209.165.200.0/30 is subnetted, 2 subnets
 --More--
```

Ctrl+F6 to exit CLI focus

R1#**show ip route**

```
R1#
R1#show ip route
Codes: C - connected, S - static, I - IGRP, 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

     10.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
R       10.0.0.0/8 [120/1] via 209.165.200.229, 00:02:57, Serial0/0/0
R       10.1.0.0/16 [120/1] via 209.165.200.229, 00:00:10, Serial0/0/0
     172.30.0.0/16 is variably subnetted, 7 subnets, 3 masks
R       172.30.0.0/16 [120/2] via 209.165.200.229, 00:02:57, Serial0/0/0
C       172.30.1.0/24 is directly connected, FastEthernet0/0
C       172.30.2.0/24 is directly connected, FastEthernet0/1
R       172.30.100.0/24 [120/2] via 209.165.200.229, 00:00:10, Serial0/0/0
R       172.30.110.0/24 [120/2] via 209.165.200.229, 00:00:10, Serial0/0/0
R       172.30.200.16/28 [120/2] via 209.165.200.229, 00:00:10, Serial0/0/0
R       172.30.200.32/28 [120/2] via 209.165.200.229, 00:00:10, Serial0/0/0
     209.165.200.0/30 is subnetted, 2 subnets
 --More--
```

Ctrl+F6 to exit CLI focus

R3#**show ip route**

```
R3#
R3#show ip route
Codes: C - connected, S - static, I - IGRP, 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

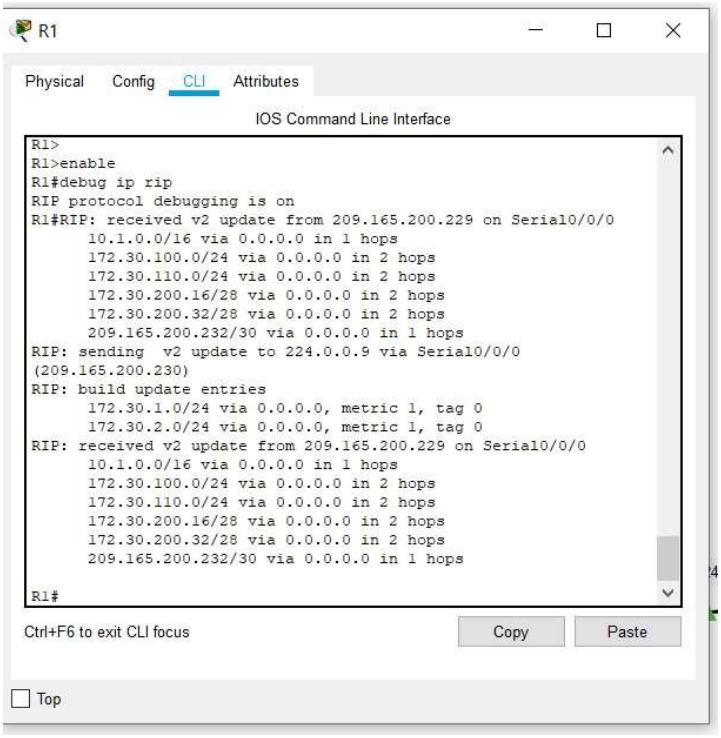
Gateway of last resort is not set

     10.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
R       10.0.0.0/8 is possibly down, routing via 209.165.200.233, Serial0/0/1
R       10.1.0.0/16 [120/1] via 209.165.200.233, 00:00:00, Serial0/0/1
     172.30.0.0/16 is variably subnetted, 6 subnets, 2 masks
R       172.30.1.0/24 [120/2] via 209.165.200.233, 00:00:00, Serial0/0/1
R       172.30.2.0/24 [120/2] via 209.165.200.233, 00:00:00, Serial0/0/1
C       172.30.100.0/24 is directly connected, FastEthernet0/0
C       172.30.110.0/24 is directly connected, Loopback0
C       172.30.200.16/28 is directly connected, Loopback1
C       172.30.200.32/28 is directly connected, Loopback2
     209.165.200.0/30 is subnetted, 2 subnets
R       209.165.200.228 [120/1] via 209.165.200.233, 00:00:00, Serial0/0/1
 --More--
```

Ctrl+F6 to exit CLI focus

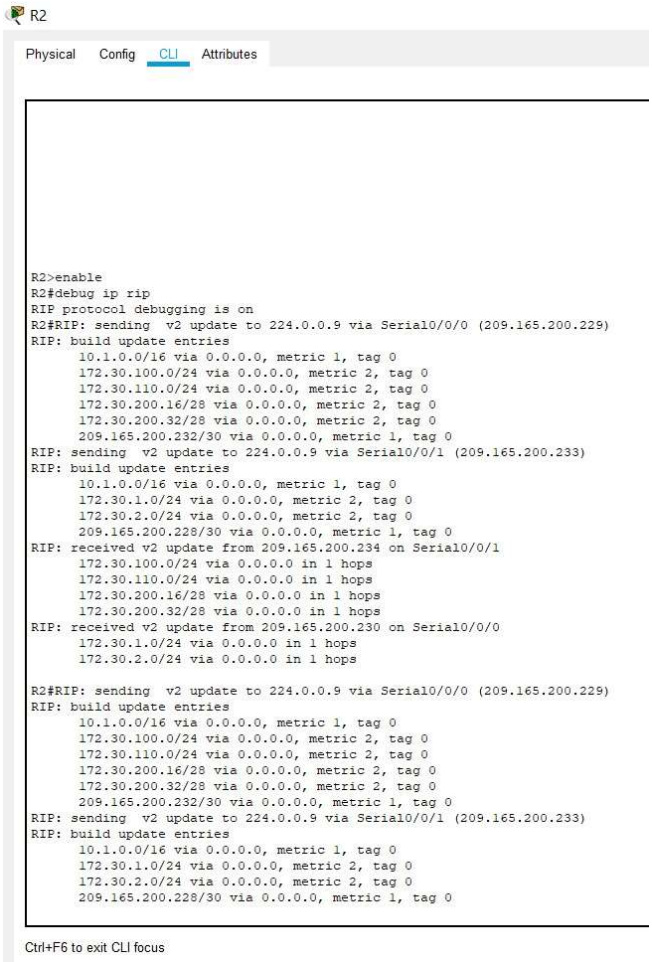
Use the output of the **debug ip rip** command to answer the following questions:

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



172.30.1.0/24
172.30.2.0/24

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



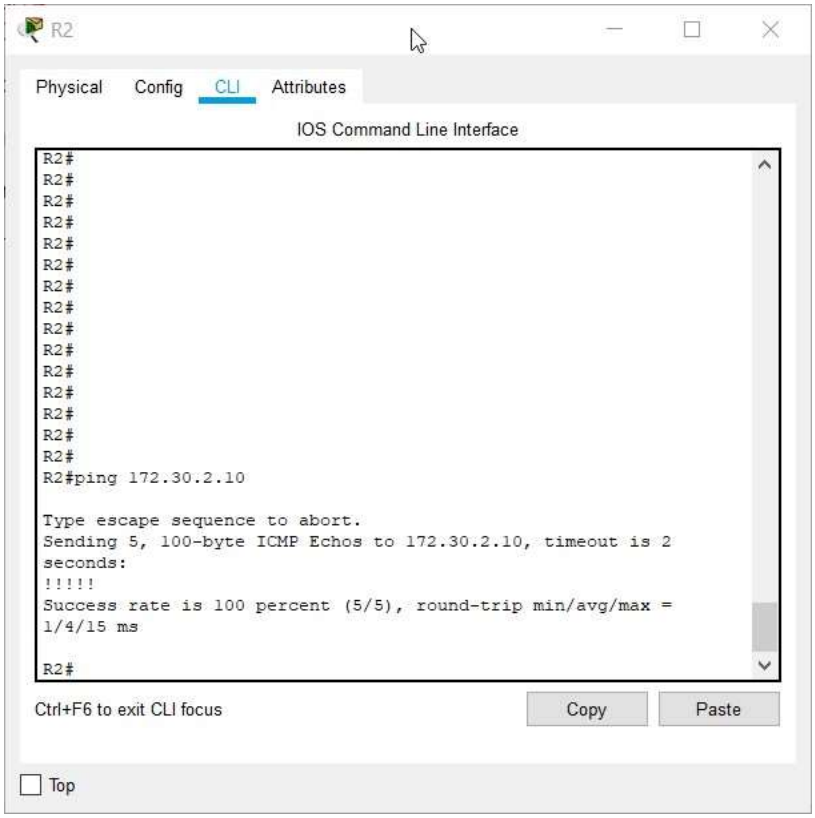
172.30.1.0/24
172.30.2.0/24

Are the subnet masks now included in the routing updates? Yes

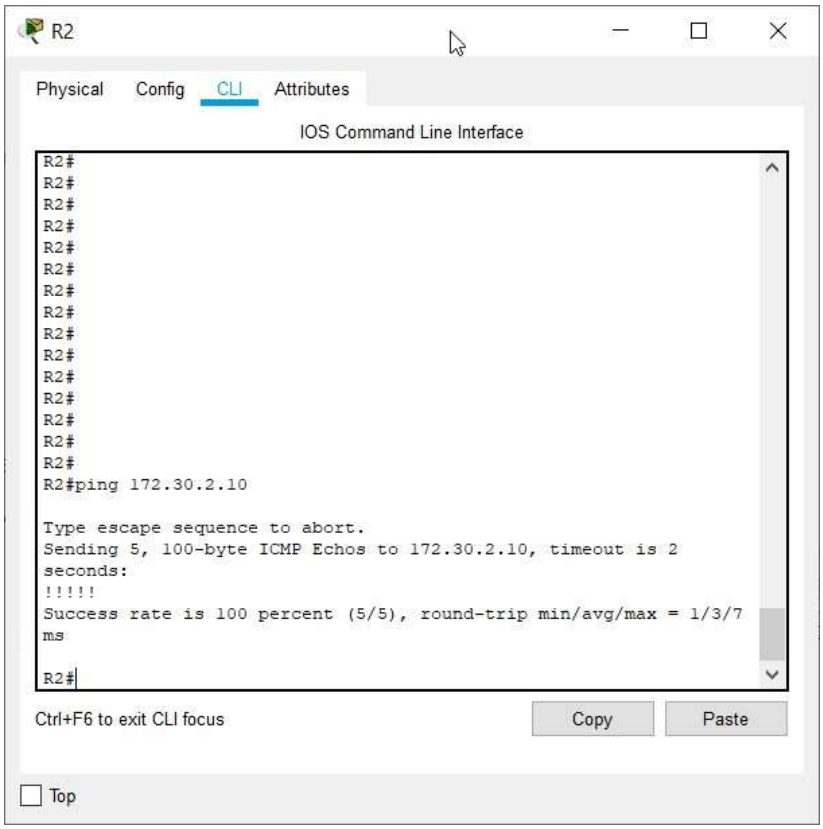
Task 8: Verify Network Connectivity.

Step 1: Check connectivity between R2 router and PCs.

From R2, how many ICMP messages are successful when pinging PC1? **5/5 messages**



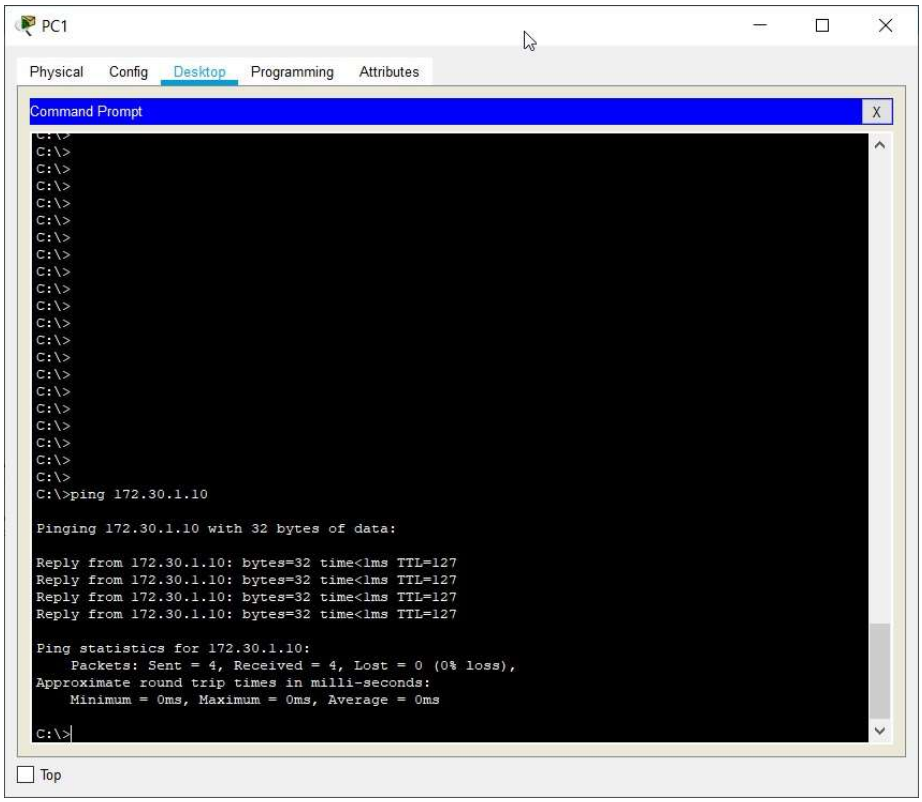
From R2, how many ICMP messages are successful when pinging PC4? **5/5 messages**



Step 2: Check the connectivity between the PCs.

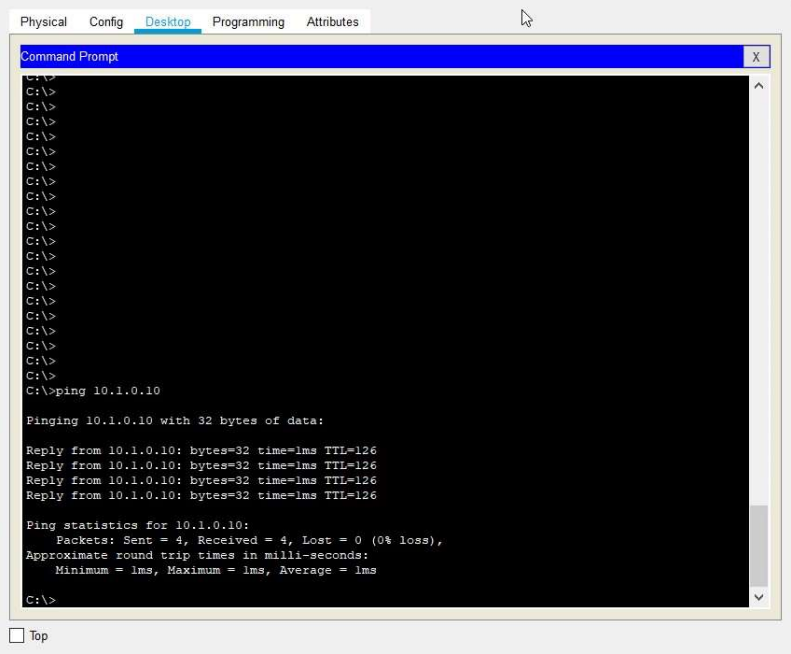
From PC1, is it possible to ping PC2? **yes**

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



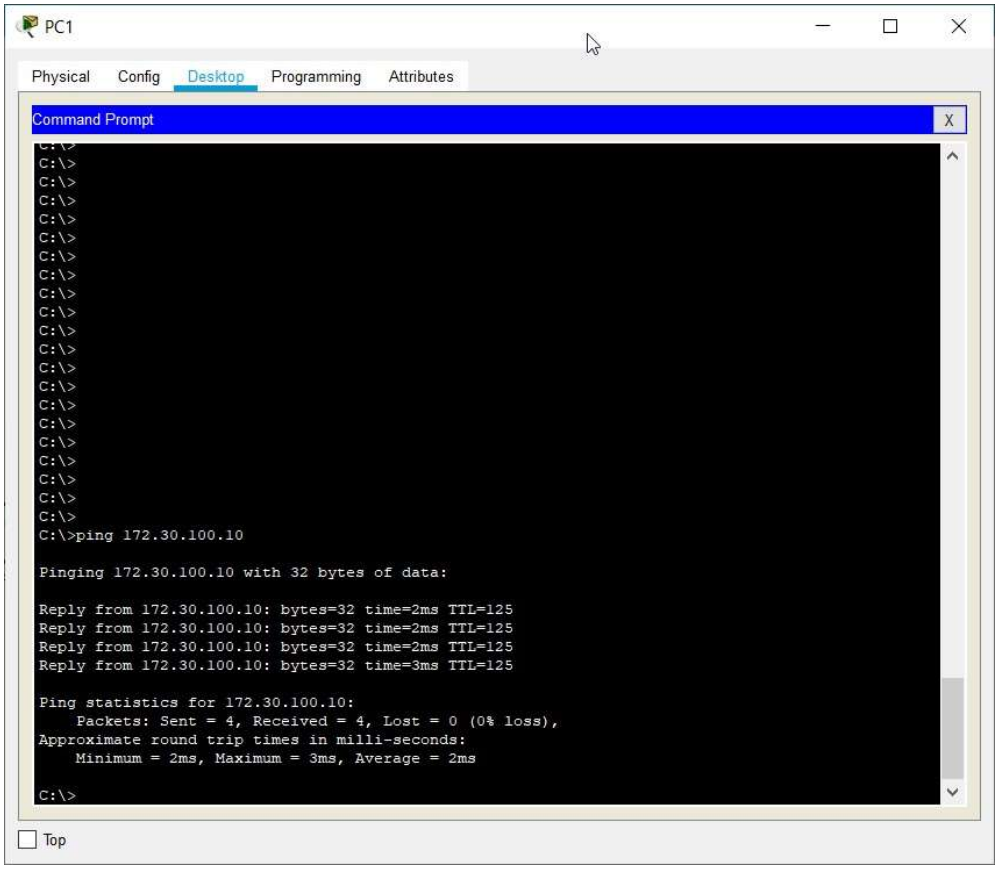
From PC1, is it possible to ping PC3? **yes**

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



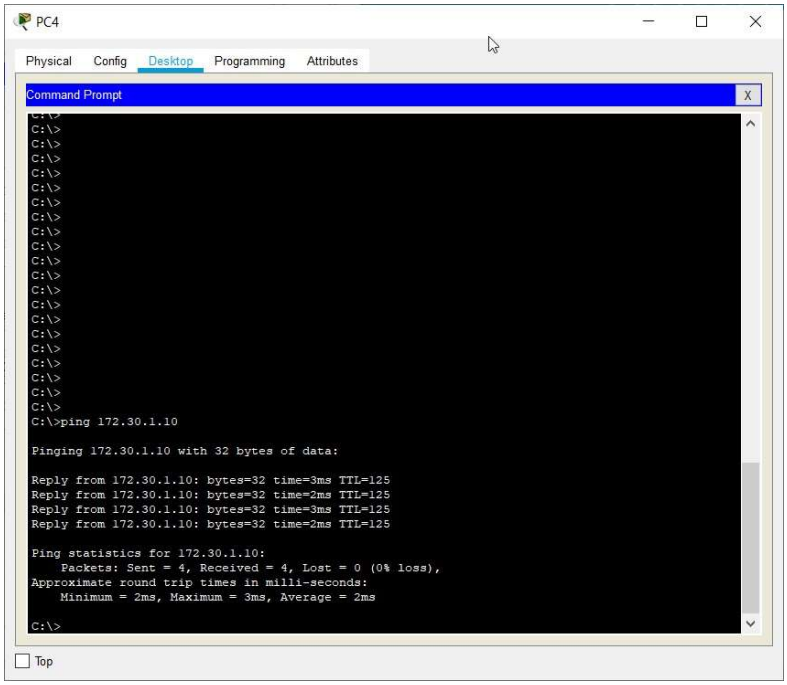
From PC1, is it possible to ping PC4? **yes**

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



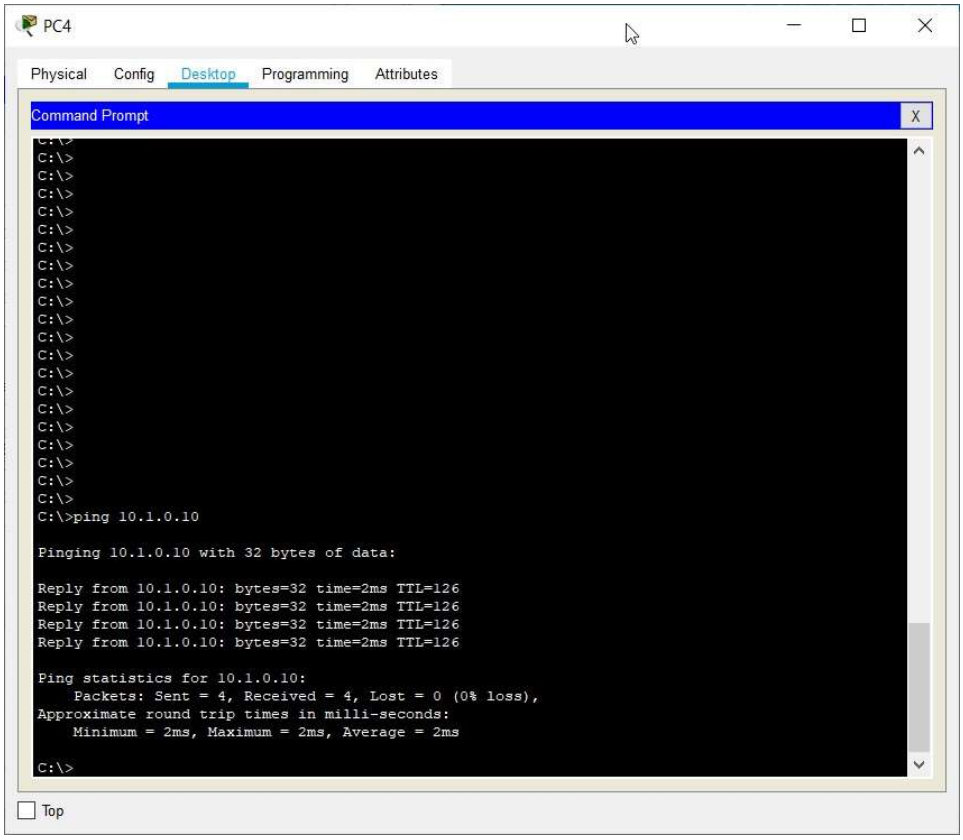
From PC4, is it possible to ping PC2? **yes**

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



From PC4, is it possible to ping PC3? **yes**

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



Task 9: Documentation

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

Router – R1

- **show running-config**

```
R1#sh running-config  Building
configuration...


Current configuration : 883 bytes !
version 12.4
no service timestamps log datetime msec
no service timestamps debug datetime msec
no service password-encryption !
hostname R1 !
!
!
!
!
!
! !
no ip cef no
ipv6 cef !
!
!
!
!
!
!
!
!
!
! !
spanning-tree mode pvst !
!
!
!
! ! interface FastEthernet0/0 ip
address 172.30.1.1 255.255.255.0
duplex auto speed auto !
interface FastEthernet0/1 ip
address 172.30.2.1 255.255.255.0
duplex auto speed auto !
interface Serial0/0/0 ip address
209.165.200.230 255.255.255.252 !
interface Serial0/0/1 no ip address clock
rate 2000000 shutdown !
interface Vlan1 no ip address
shutdown ! router rip version 2
passive-interface FastEthernet0/0
passive-interface FastEthernet0/1
network 172.30.0.0 network
209.165.200.0 no auto-summary !
ip classless !
ip flow-export version 9 !
!
!
!
!
!
! ! line
con 0 !
line aux 0
!
line vty 0 4
password cisco login
!
! !
end
```

- **show ip route**

```
R1#sh ip route
Codes: C - connected, S - static, I - IGRP, 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

10.0.0.0/16 is subnetted, 1 subnets
R 10.1.0.0 [120/1] via 209.165.200.229, 00:00:18, Serial0/0/0
172.30.0.0/16 is variably subnetted, 6 subnets, 2 masks
C 172.30.1.0/24 is directly connected, FastEthernet0/0
C 172.30.2.0/24 is directly connected, FastEthernet0/1
R 172.30.100.0/24 [120/2] via 209.165.200.229, 00:00:18, Serial0/0/0
R 172.30.110.0/24 [120/2] via 209.165.200.229, 00:00:18, Serial0/0/0
R 172.30.200.16/28 [120/2] via 209.165.200.229, 00:00:18, Serial0/0/0
R 172.30.200.32/28 [120/2] via 209.165.200.229, 00:00:18, Serial0/0/0
209.165.200.0/30 is subnetted, 2 subnets
C 209.165.200.228 is directly connected, Serial0/0/0
R 209.165.200.232 [120/1] via 209.165.200.229, 00:00:18, Serial0/0/0
```

- **show ip interface brief**

```
R1#sh ip interface brief
Interface                  IP-Address  OK? Method Status                Protocol
FastEthernet0/0            172.30.1.1  YES manual up                    up
FastEthernet0/1            172.30.2.1  YES manual up                    up
Serial0/0/0              209.165.200.230YES manual up                    up
Serial0/0/1                unassigned  YES NVRAM  administratively down down
```

- Vlan1 unassigned YES unset administratively down down

- **show ip protocols**

```
R1#sh ip protocols
Routing Protocol is "rip"
Sending updates every 30 seconds, next due in 24 seconds
Invalid after 180 seconds, hold down 180, flushed after 240
Outgoing update filter list for all interfaces is not set
Incoming update filter list for all interfaces is not set
Redistributing: rip
Default version control: send version 2, receive 2
Interface Send Recv Triggered RIP Key-chain
Serial0/0/0 2 2
Automatic network summarization is not in effect
Maximum path: 4 Routing
for Networks:
172.30.0.0
209.165.200.0
Passive Interface(s):
FastEthernet0/0
FastEthernet0/1
Routing Information Sources:
Gateway Distance Last Update
209.165.200.229 120 00:00:03
Distance: (default is 120)
```

Router – R2

- **show running-config**

```
R2#sh running-config  Building
configuration...

Current configuration : 867 bytes !
version 12.4
```

```
no service timestamps log datetime msec
no service timestamps debug datetime msec
no service password-encryption !
hostname R2 !
!
!
!
!
!
! ! no ip
cef no ipv6
cef !
!
!
!
!
!
!
!
!
! !
spanning-tree mode pvst !
!
!
!
! ! interface FastEthernet0/0
ip address 10.1.0.1 255.255.0.0
duplex auto speed auto !
interface FastEthernet0/1
no ip address duplex auto
speed auto shutdown !
interface Serial0/0/0 ip address
209.165.200.229 255.255.255.252 clock rate
2000000 !
interface Serial0/0/1 ip address
209.165.200.233 255.255.255.252 clock rate
64000 !
interface Vlan1 no ip address
shutdown ! router rip version 2
passive-interface FastEthernet0/0
network 10.0.0.0 network
209.165.200.0 no auto-summary !
ip classless !
ip flow-export version 9 !
!
!
!
!
!
! ! line
con 0 !
line aux 0
!
line vty 0 4 password
cisco login
! !
end
```

- **show ip route**

```
R2#sh ip route
Codes: C - connected, S - static, I - IGRP, 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
```

```
10.0.0.0/16 is subnetted, 1 subnets
C 10.1.0.0 is directly connected, FastEthernet0/0
172.30.0.0/16 is variably subnetted, 6 subnets, 2 masks
R 172.30.1.0/24 [120/1] via 209.165.200.230, 00:00:10, Serial0/0/0
R 172.30.2.0/24 [120/1] via 209.165.200.230, 00:00:10, Serial0/0/0
R 172.30.100.0/24 [120/1] via 209.165.200.234, 00:00:19, Serial0/0/1
R 172.30.110.0/24 [120/1] via 209.165.200.234, 00:00:19, Serial0/0/1
R 172.30.200.16/28 [120/1] via 209.165.200.234, 00:00:19, Serial0/0/1
R 172.30.200.32/28 [120/1] via 209.165.200.234, 00:00:19, Serial0/0/1
209.165.200.0/30 is subnetted, 2 subnets
C 209.165.200.228 is directly connected, Serial0/0/0 C
209.165.200.232 is directly connected, Serial0/0/1
```

- **show ip interface brief**

```
R2#sh ip int brief
Interface              IP-Address   OK? Method Status                      Protocol
FastEthernet0/0        10.1.0.1        YES manual up                      up
FastEthernet0/1        unassigned   YES NVRAM  administratively down    down
Serial0/0/0            209.165.200.229 YES manual up                      up
Serial0/0/1            209.165.200.233 YES manual up                      up
```

- Vlan1 unassigned YES unset administratively down down

- **show ip protocols**

```
R2#sh ip protocols
Routing Protocol is "rip"
Sending updates every 30 seconds, next due in 18 seconds
Invalid after 180 seconds, hold down 180, flushed after 240
Outgoing update filter list for all interfaces is not set
Incoming update filter list for all interfaces is not set
Redistributing: rip
Default version control: send version 2, receive 2
Interface Send Recv Triggered RIP Key-chain
Serial0/0/0 2 2
Serial0/0/1 2 2
Automatic network summarization is not in effect
Maximum path: 4 Routing
for Networks:
10.0.0.0
209.165.200.0
Passive Interface(s):
FastEthernet0/0
Routing Information Sources:
Gateway Distance Last Update
209.165.200.230 120 00:00:09
209.165.200.234 120 00:00:13
Distance: (default is 120)
```

Router – R3

- **show running-config**

```
R3#sh running-config  Building
configuration...


Current configuration : 1027 bytes !
version 12.4 no service timestamps log
datetime msec no service timestamps debug
datetime msec no service password-
encryption !
hostname R3 !
!
!
!
!
!
! ! no ip
cef no ipv6
cef !
!
!
```

```
!
!
!
!
!
!
!
! !
spanning-tree mode pvst !
!
!
!
! !
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 !
interface FastEthernet0/0 ip address
172.30.100.1 255.255.255.0 duplex auto
speed auto ! interface FastEthernet0/1
no ip address duplex auto speed auto
shutdown ! interface Serial0/0/0 no ip
address clock rate 2000000 shutdown !
interface Serial0/0/1 ip address
209.165.200.234 255.255.255.252 !
interface Vlan1 no ip address
shutdown ! router rip version 2
passive-interface FastEthernet0/0
network 172.30.0.0 network
209.165.200.0 no auto-summary
!
ip classless !
ip flow-export version 9 !
!
!
!
!
!
! !
line con 0 !
line aux 0 !
line vty 0 4
password cisco login
!
! !
end
```

- **show ip route**

```
R3#sh ip route
Codes: C - connected, S - static, I - IGRP, 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

10.0.0.0/16 is subnetted, 1 subnets
R 10.1.0.0 [120/1] via 209.165.200.233, 00:00:04, Serial0/0/1
172.30.0.0/16 is variably subnetted, 6 subnets, 2 masks
R 172.30.1.0/24 [120/2] via 209.165.200.233, 00:00:04, Serial0/0/1
R 172.30.2.0/24 [120/2] via 209.165.200.233, 00:00:04, Serial0/0/1
C 172.30.100.0/24 is directly connected, FastEthernet0/0
C 172.30.110.0/24 is directly connected, Loopback0
C 172.30.200.16/28 is directly connected, Loopback1
C 172.30.200.32/28 is directly connected, Loopback2
209.165.200.0/30 is subnetted, 2 subnets
```

```
R 209.165.200.228 [120/1] via 209.165.200.233, 00:00:04, Serial0/0/1
```

- C 209.165.200.232 is directly connected, Serial0/0/1

- **show ip interface brief**

```
R3#sh ip interface brief
Interface              IP-Address   OK? Method Status                      Protocol
FastEthernet0/0        172.30.100.1    YES manual up                      up
FastEthernet0/1        unassigned   YES NVRAM  administratively down       down
Serial0/0/0            unassigned   YES NVRAM  administratively down       down
Serial0/0/1            209.165.200.234 YES manual up                      up
Loopback0              172.30.110.1   YES manual up                       up
Loopback1              172.30.200.17   YES manual up                      up
Loopback2              172.30.200.33   YES manual up                      up
Vlan1                  unassigned   YES unset  administratively down       down
```

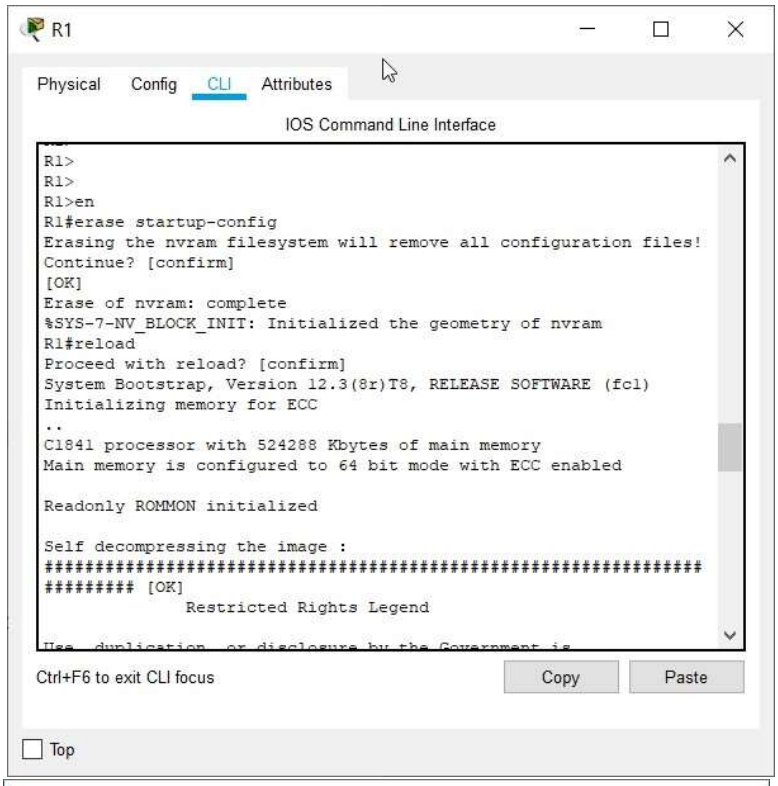
- **show ip protocols**

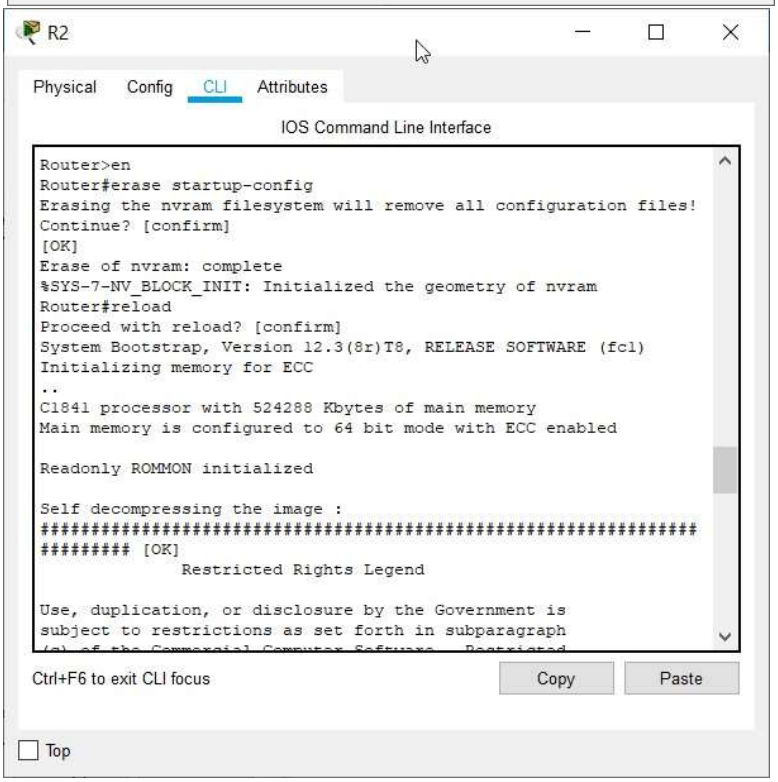
```
R3#sh ip protocols
Routing Protocol is "rip"
Sending updates every 30 seconds, next due in 13 seconds
Invalid after 180 seconds, hold down 180, flushed after 240
Outgoing update filter list for all interfaces is not set Incoming
update filter list for all interfaces is not set
Redistributing: rip
Default version control: send version 2, receive 2
Interface Send Recv Triggered RIP Key-chain Loopback0
2 2
Loopback1 2 2
Loopback2 2 2
Serial0/0/1 2 2
Automatic network summarization is not in effect
Maximum path: 4 Routing
for Networks:
172.30.0.0
209.165.200.0
Passive Interface(s):
FastEthernet0/0
Routing Information Sources:
Gateway Distance Last Update
209.165.200.233 120 00:00:19 Distance:
(default is 120)
```

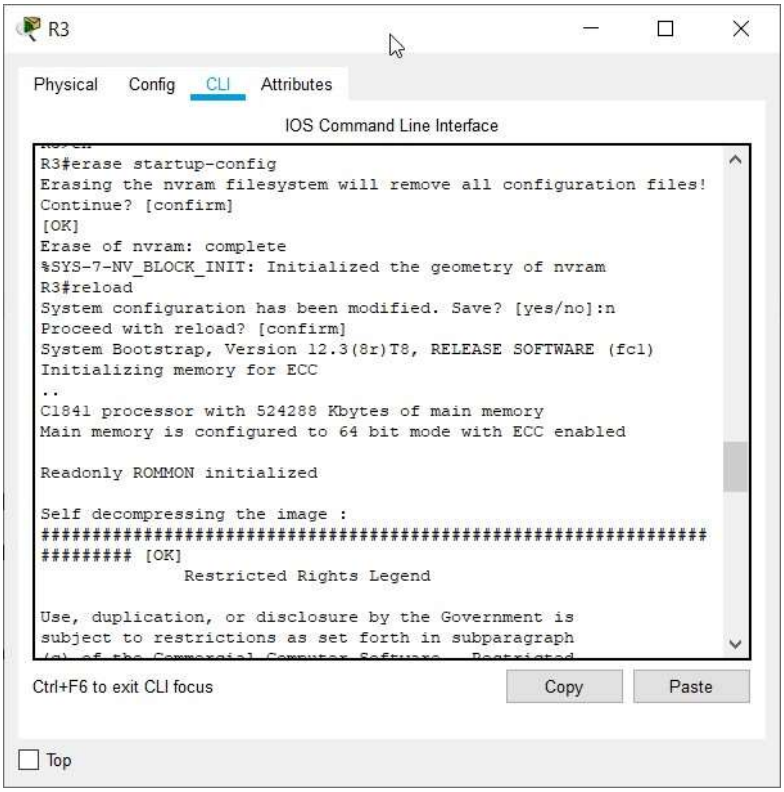
Task 10: Clean Up

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.

Since there is no PC host which are connected to other networks, we disconnect cabling and reload the routers after erasing the configurations


R1
Physical
Config
CLI
Attributes
IOS Command Line Interface
R1>
R1>
R1>en
R1#erase startup-config
Erasing the nvram filesystem will remove all configuration files!
Continue? [confirm]
[OK]
Erase of nvram: complete
%SYS-7-NV_BLOCK_INIT: Initialized the geometry of nvram
R1#reload
Proceed with reload? [confirm]
System Bootstrap, Version 12.3(8r)T8, RELEASE SOFTWARE (fc1)
Initializing memory for ECC
..
C1841 processor with 524288 Kbytes of main memory
Main memory is configured to 64 bit mode with ECC enabled
Readonly ROMMON initialized
Self decompressing the image :
######### [OK]
Restricted Rights Legend
Ctrl+F6 to exit CLI focus
Copy
Paste
Top


R2
Physical
Config
CLI
Attributes
IOS Command Line Interface
Router>en
Router#erase startup-config
Erasing the nvram filesystem will remove all configuration files!
Continue? [confirm]
[OK]
Erase of nvram: complete
%SYS-7-NV_BLOCK_INIT: Initialized the geometry of nvram
Router#reload
Proceed with reload? [confirm]
System Bootstrap, Version 12.3(8r)T8, RELEASE SOFTWARE (fc1)
Initializing memory for ECC
..
C1841 processor with 524288 Kbytes of main memory
Main memory is configured to 64 bit mode with ECC enabled
Readonly ROMMON initialized
Self decompressing the image :
######### [OK]
Restricted Rights Legend
Use, duplication, or disclosure by the Government is
subject to restrictions as set forth in subparagraph
Ctrl+F6 to exit CLI focus
Copy
Paste
Top



Hence, we have Erased all configurations and disconnected and stored the cables.