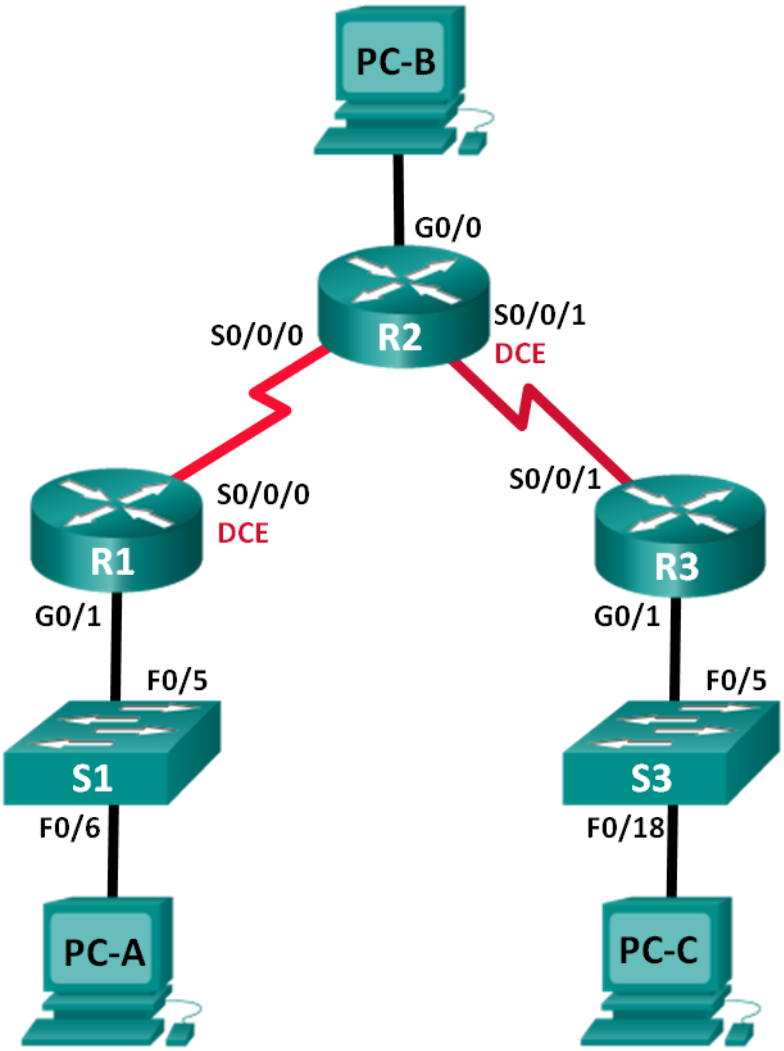
Lab – Configuring Basic RIPv2

Topology



Addressing Table

Device	Interface	IP Address	Subnet Mask	Default Gateway
R1	G0/1	172.30.10.1	255.255.255.0	N/A
	S0/0/0 (DCE)	10.1.1.1	255.255.255.252	N/A
R2	G0/0	209.165.201.1	255.255.255.0	N/A
	S0/0/0	10.1.1.2	255.255.255.252	N/A
	S0/0/1 (DCE)	10.2.2.2	255.255.255.252	N/A
R3	G0/1	172.30.30.1	255.255.255.0	N/A
	S0/0/1	10.2.2.1	255.255.255.252	N/A
S1	N/A	VLAN 1	N/A	N/A
S3	N/A	VLAN 1	N/A	N/A
PC-A	NIC	172.30.10.3	255.255.255.0	172.30.10.1
PC-B	NIC	209.165.201.2	255.255.255.0	209.165.201.1
PC-C	NIC	172.30.30.3	255.255.255.0	172.30.30.1

Objectives

Part 1: Build the Network and Configure Basic Device Settings

Part 2: Configure and Verify RIPv2 Routing

- Configure RIPv2 on the routers and verify that it is running.
- Configure a passive interface.
- Examine routing tables.
- Disable automatic summarization.
- Configure a default route.
- Verify end-to-end connectivity.

Background / Scenario

RIP version 2 (RIPv2) is used for routing of IPv4 addresses in small networks. RIPv2 is a classless, distance-vector routing protocol, as defined by RFC 1723. Because RIPv2 is a classless routing protocol, subnet masks are included in the routing updates. By default, RIPv2 automatically summarizes networks at major network boundaries. When automatic summarization has been disabled, RIPv2 no longer summarizes networks to their classful address at boundary routers.

In this lab, you will configure the network topology with RIPv2 routing, disable automatic summarization, propagate a default route, and use CLI commands to display and verify RIP routing information.

Note: The routers used with CCNA hands-on labs are Cisco 1941 Integrated Services Routers (ISRs) with Cisco IOS Release 15.2(4)M3 (universalk9 image). The switches used are Cisco Catalyst 2960s with Cisco IOS Release 15.0(2) (lanbasek9 image). Other routers, switches, and Cisco IOS versions can be used. Depending on the model and Cisco IOS version, the commands available and output produced might vary from what is shown in this lab. Refer to the Router Interface Summary Table at the end of the lab for the correct interface identifiers.

Note: Make sure that the routers and switches have been erased and have no startup configurations. If you are unsure, contact your instructor.

Required Resources

- 3 Routers (Cisco 1941 with Cisco IOS Release 15.2(4)M3 universal image or comparable)
- 2 Switches (Cisco 2960 with Cisco IOS Release 15.0(2) lanbasek9 image or comparable)
- 3 PCs (Windows 7, Vista, or XP with terminal emulation program, such as Tera Term)
- Console cables to configure the Cisco IOS devices via the console ports
- Ethernet and Serial cables as shown in the topology

Part 1: Build the Network and Configure Basic Device Settings

In Part 1, you will set up the network topology and configure basic settings.

Step 1: Cable the network as shown in the topology.

Step 2: Initialize and reload the router and switch.

Step 3: Configure basic settings for each router and switch.

Refer Building a Switch and Router Network doc

a. Disable DNS lookup.

b. Configure device names as shown in the topology.

c. Configure password encryption.

d. Assign **class** as the privileged EXEC password.

e. Assign **cisco** as the console and vty passwords.

f. Configure a MOTD banner to warn users that unauthorized access is prohibited.

g. Configure **logging synchronous** for the console line.

Catalyst 3560 Software Configuration Guide, Release 12.2(52)SE - Configuring System Message Logging [Cisco Catalyst 3560 Series Switches] - Cisco

R1(config)#line console 0

R1(config-line)# logging synchronous

R1(config-line)#end

```
R1#
```

h. Configure the IP addresses listed in the Addressing Table for all interfaces.

```
R1(config)#interface gigabitEthernet 0/1
R1(config-if)#ip address 192.168.0.1 255.255.255.0
R1(config-if)#no shutdown
R1(config-if)#description LAN-A

R1(config)#interface serial 0/0/0
R1(config-if)#ip address 10.1.1.1 255.255.255.252
R1(config-if)#no shutdown
```

i. Configure a description for each interface with an IP address.

j. Configure the clock rate, if applicable, to the DCE serial interface.

Serial interface no shutdown make the link up when both the ends are up!

```
Router(config)#int s0/0/1
Router(config-if)#ip add
Router(config-if)#ip address 10.2.2.1 255.255.255.252
Router(config-if)#no shut

Router(config-if)#
%LINK-5-CHANGED: Interface Serial0/0/1, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/1, changed state to up


Router(config)#hostname R3
R3(config)#int g0/1
R3(config-if)#ip add
R3(config-if)#ip address 172.30.30.1 255.255.255.0
R3(config-if)#no shut
```

k. Copy the running-configuration to the startup-configuration.

Step 4: Configure PC IP Addressing.

Refer to the Addressing Table for IP address information of the PCs.

Step 5: Test connectivity.

At this point, the PCs are unable to ping each other.

Ping pc B from pc A!

```
C:\>ping 209.165.201.2(ip of PC-B)

Pinging 209.165.201.2 with 32 bytes of data:

Reply from 172.30.10.1: Destination host unreachable.
Reply from 172.30.10.1: Destination host unreachable.
Reply from 172.30.10.1: Destination host unreachable.
Request timed out.
```

Ping statistics for 209.165.201.2:
Packets: Sent = 4, Received = 0, Lost = 4 (100% loss)

a. Each workstation should be able to ping the attached router. Verify and troubleshoot if necessary.

Pind R1 from PC-A: possible!

C:\>ping 172.30.10.1

Pinging 172.30.10.1 with 32 bytes of data:

Reply from 172.30.10.1: bytes=32 time<1ms TTL=255
Reply from 172.30.10.1: bytes=32 time<1ms TTL=255
Reply from 172.30.10.1: bytes=32 time<1ms TTL=255
Reply from 172.30.10.1: bytes=32 time<1ms TTL=255

Ping statistics for 172.30.10.1:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round-trip times in milli-seconds:
Minimum = 0ms, Maximum = 0ms, Average = 0ms

b. The routers should be able to ping one another. Verify and troubleshoot if necessary.

ping the connected serial interface(s0/0/0 of R2) from R1

R1>ping 10.1.1.2

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.1.1.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/7/13 m
R1>

Part 2: Configure and Verify RIPv2 Routing

In Part 2, you will configure RIPv2 routing on all routers in the network and then verify that the routing tables are updated correctly. After RIPv2 has been verified, you will disable automatic summarization, configure a default route, and verify end-to-end connectivity.

Step 1: Configure RIPv2 routing.

a. Configure RIPv2 on R1as the routing protocol and advertise the appropriate connected networks.

R1# **config t**
R1(config)# **router rip**
R1(config-router)# **version 2**
R1(config-router)# **passive-interface g0/1**
R1(config-router)# **network 172.30.0.0**
R1(config-router)# **network 10.0.0.0**

The **passive-interface** command stops routing updates out the specified interface. This process prevents unnecessary routing traffic on the LAN. However, the network that the specified interface belongs to is still advertised in routing updates that are sent out across other interfaces.

b. Configure RIPv2 on R3 and use the **network** statement to add the appropriate connected networks and prevent routing updates on the LAN interface.

c. Configure RIPv2 on R2 and use the network statements to add the appropriate connected networks. Do not advertise the 209.165.201.0 network.

Not to advertise **do not give the command** R2(config-router)#network x.x.x.x

Note: It is not necessary to make the G0/0 interface passive on R2 because the network associated with this interface is not being advertised.

Step 2: Examine the current state of the network.

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

R2# **show ip interface brief**

Interface	IP-Address	OK?	Method	Status	Protocol
Embedded-Service-Engine0/0	unassigned	YES	unset	administratively down	down
GigabitEthernet0/0	209.165.201.1	YES	manual	up	up
GigabitEthernet0/1	unassigned	YES	unset	administratively down	down
Serial0/0/0	10.1.1.2	YES	manual	up	up
Serial0/0/1	10.2.2.2	YES	manual	up	up

b. Check connectivity between PCs.

From PC-A, is it possible to ping PC-B? _____ Why?

Cannot ping; the network associated with PC-B is not advertised when configuring RIP on R2.

C:\>ping 209.165.201.2

Pinging 209.165.201.2 with 32 bytes of data:

Reply from 172.30.10.1: Destination host unreachable.

Request timed out.

Reply from 172.30.10.1: Destination host unreachable.

Reply from 172.30.10.1: Destination host unreachable.

Ping statistics for 209.165.201.2:

Packets: Sent = 4, Received = 0, Lost = 4 (100% loss)

From PC-A, is it possible to ping PC-C? _____ Why? Cannot ping;

R1 displays only its own subnet for the 172.30.10.0/24 network. R1 does not have a route for the 172.30.30.0/24 subnet on R3.

C:\>ping 172.30.30.3

Pinging 172.30.30.3 with 32 bytes of data:

Reply from 172.30.10.1: Destination host unreachable.
Reply from 172.30.10.1: Destination host unreachable.
Reply from 172.30.10.1: Destination host unreachable.
Reply from 172.30.10.1: Destination host unreachable.

Ping statistics for 172.30.30.3:
Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),

C:\>

From PC-C, is it possible to ping PC-B? _____ Why?

Cannot ping; the network associated with PC-B is not advertised when configuring RIP on R2.

C:\>ping 209.165.201.2

Pinging 209.165.201.2 with 32 bytes of data:

Reply from 172.30.30.1: Destination host unreachable.
Reply from 172.30.30.1: Destination host unreachable.
Reply from 172.30.30.1: Destination host unreachable.
Request timed out.

Ping statistics for 209.165.201.2:
Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),

C:\>

From PC-C, is it possible to ping PC-A? _____ Why? Cannot ping;

R3 only displays its own subnet for the 172.30.30.0/24 network. R3 does not have a route for the 172.30.10.0/24 subnets on R1.

C:\>ping 172.30.10.3

Pinging 172.30.10.3 with 32 bytes of data:

Reply from 172.30.30.1: Destination host unreachable.
Reply from 172.30.30.1: Destination host unreachable.
Reply from 172.30.30.1: Destination host unreachable.
Reply from 172.30.30.1: Destination host unreachable.

Ping statistics for 172.30.10.3:
Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),

C:\>

c. Verify that RIPv2 is running on the routers.

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

R1# **show ip protocols**
Routing Protocol is "rip"
Outgoing update filter list for all interfaces is not set
Incoming update filter list for all interfaces is not set
Sending updates every 30 seconds, next due in 7 seconds
Invalid after 180 seconds, hold down 180, flushed after 240
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 in effect
Maximum path: 4
Routing for Networks:
10.0.0.0
172.30.0.0
Passive Interface(s):
GigabitEthernet0/1
Routing Information Sources:

Gateway	Distance	Last Update
10.1.1.2	120	

Distance: (default is 120)

When issuing the **debug ip rip** command on R2, what information is provided that confirms RIPv2 is running?

R1#debug ip rip

RIP protocol debugging is on

R1#RIP: sending v2 update to 224.0.0.9 via Serial0/0/0 (10.1.1.1)

RIP: build update entries

172.30.0.0/16 via 0.0.0.0, metric 1, tag 0

R1#RIP: received v2 update from 10.1.1.2 on Serial0/0/0

10.2.2.0/30 via 0.0.0.0 in 1 hops

R1#RIP: sending v2 update to 224.0.0.9 via Serial0/0/0 (10.1.1.1)

RIP: build update entries

172.30.0.0/16 via 0.0.0.0, metric 1, tag 0

R1#RIP: received v2 update from 10.1.1.2 on Serial0/0/0

10.2.2.0/30 via 0.0.0.0 in 1 hops

When you are finished observing the debugging outputs, issue the **undebug all** command at the privileged EXEC prompt.

R1#undebug all

All possible debugging has been turned off

R1#

When issuing the **show run** command on R3, what information is provided that confirms RIPv2 is running?

router rip

version 2

passive-interface GigabitEthernet0/1

network 10.0.0.0

network 172.30.0.0

d. Examine the automatic summarization of routes.

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

R2# **show ip route**

<Output omitted>

```
      10.0.0.0/8 is variably subnetted, 4 subnets, 2 masks
C        10.1.1.0/30 is directly connected, Serial0/0/0
L        10.1.1.2/32 is directly connected, Serial0/0/0
C        10.2.2.0/30 is directly connected, Serial0/0/1
L        10.2.2.2/32 is directly connected, Serial0/0/1
R     172.30.0.0/16 [120/1] via 10.2.2.1, 00:00:23, Serial0/0/1
                    [120/1] via 10.1.1.1, 00:00:09, Serial0/0/0
      209.165.201.0/24 is variably subnetted, 2 subnets, 2 masks
C        209.165.201.0/24 is directly connected, GigabitEthernet0/0
L        209.165.201.1/32 is directly connected, GigabitEthernet0/0
```

R1 displays only its own subnet for the 172.30.10.0/24 network. R1 does not have a route for the 172.30.30.0/24 subnet on R3.

R1# **show ip route**

<Output omitted>

```
      10.0.0.0/8 is variably subnetted, 3 subnets, 2 masks
C        10.1.1.0/30 is directly connected, Serial0/0/0
L        10.1.1.1/32 is directly connected, Serial0/0/0
R        10.2.2.0/30 [120/1] via 10.1.1.2, 00:00:21, Serial0/0/0
      172.30.0.0/16 is variably subnetted, 2 subnets, 2 masks
C        172.30.10.0/24 is directly connected, GigabitEthernet0/1
L        172.30.10.1/32 is directly connected, GigabitEthernet0/1
```

R3 only displays its own subnet for the 172.30.30.0/24 network. R3 does not have a route for the 172.30.10.0/24 subnets on R1.

R3# **show ip route**

<Output omitted>

```
      10.0.0.0/8 is variably subnetted, 3 subnets, 2 masks
C        10.2.2.0/30 is directly connected, Serial0/0/1
L        10.2.2.1/32 is directly connected, Serial0/0/1
R        10.1.1.0/30 [120/1] via 10.2.2.2, 00:00:23, Serial0/0/1
      172.30.0.0/16 is variably subnetted, 2 subnets, 2 masks
C        172.30.30.0/24 is directly connected, GigabitEthernet0/1
L        172.30.30.1/32 is directly connected, GigabitEthernet0/1
```

Use the **debug ip rip** command on R2 to determine the routes received in the RIP updates from R3 and list them here.

```
R2#RIP: received v2 update from 10.1.1.1 on Serial0/0/0
     172.30.0.0/16 via 0.0.0.0 in 1 hops
RIP: sending  v2 update to 224.0.0.9 via Serial0/0/0 (10.1.1.2)
RIP: build update entries
     10.2.2.0/30 via 0.0.0.0, metric 1, tag 0
RIP: sending  v2 update to 224.0.0.9 via Serial0/0/1 (10.2.2.2)
RIP: build update entries
     10.1.1.0/30 via 0.0.0.0, metric 1, tag 0
RIP: received v2 update from 10.2.2.1 on Serial0/0/1
     172.30.0.0/16 via 0.0.0.0 in 1 hops
```

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. Therefore, the routing tables on R1 and R2 do not display the 172.30.0.0 subnets on R3.

Step 3: Disable automatic summarization.

a. 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 classful network boundaries. R1 is shown here as an example.

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

b. Issue the **clear ip route *** command to clear the routing table.

```
R1(config-router)# end
R1# clear ip route *
```

c. Examine the routing tables. Remember that it will take some time to converge the routing tables after clearing them.

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

```
R2# show ip route
<Output omitted>
Gateway of last resort is not set

      10.0.0.0/8 is variably subnetted, 4 subnets, 2 masks
C        10.1.1.0/30 is directly connected, Serial0/0/0
L        10.1.1.2/32 is directly connected, Serial0/0/0
C        10.2.2.0/30 is directly connected, Serial0/0/1
L        10.2.2.2/32 is directly connected, Serial0/0/1
      172.30.0.0/16 is variably subnetted, 3 subnets, 2 masks
R        172.30.0.0/16 [120/1] via 10.2.2.1, 00:01:01, Serial0/0/1
                       [120/1] via 10.1.1.1, 00:01:15, Serial0/0/0
R        172.30.10.0/24 [120/1] via 10.1.1.1, 00:00:21, Serial0/0/0
R        172.30.30.0/24 [120/1] via 10.2.2.1, 00:00:04, Serial0/0/1
      209.165.201.0/24 is variably subnetted, 2 subnets, 2 masks
C        209.165.201.0/24 is directly connected, GigabitEthernet0/0
L        209.165.201.1/32 is directly connected, GigabitEthernet0/0
R1# show ip route
<Output omitted>
Gateway of last resort is not set

      10.0.0.0/8 is variably subnetted, 3 subnets, 2 masks
C        10.1.1.0/30 is directly connected, Serial0/0/0
L        10.1.1.1/32 is directly connected, Serial0/0/0
R        10.2.2.0/30 [120/1] via 10.1.1.2, 00:00:12, Serial0/0/0
      172.30.0.0/16 is variably subnetted, 3 subnets, 2 masks
C        172.30.10.0/24 is directly connected, GigabitEthernet0/1
L        172.30.10.1/32 is directly connected, GigabitEthernet0/1
R        172.30.30.0/24 [120/2] via 10.1.1.2, 00:00:12, Serial0/0/0
```

R3# **show ip route**

<Output omitted>

10.0.0.0/8 is variably subnetted, 3 subnets, 2 masks

C 10.2.2.0/30 is directly connected, Serial0/0/1

L 10.2.2.1/32 is directly connected, Serial0/0/1

R 10.1.1.0/30 [120/1] via 10.2.2.2, 00:00:23, Serial0/0/1

172.30.0.0/16 is variably subnetted, 2 subnets, 2 masks

C 172.30.30.0/24 is directly connected, GigabitEthernet0/1

L 172.30.30.1/32 is directly connected, GigabitEthernet0/1

R 172.30.10.0 [120/2] via 10.2.2.2, 00:00:16, Serial0/0/1

d. Use the **debug ip rip** command on R2 to examine the RIP updates.

R2# debug ip rip

After 60 seconds, issue the **no debug ip rip** command.

What routes are in the RIP updates that are received from R3?

R2#RIP: received v2 update from 10.1.1.1 on Serial0/0/0

172.30.10.0/24 via 0.0.0.0 in 1 hops

RIP: sending v2 update to 224.0.0.9 via Serial0/0/0 (10.1.1.2)

RIP: build update entries

10.2.2.0/30 via 0.0.0.0, metric 1, tag 0

172.30.30.0/24 via 0.0.0.0, metric 2, tag 0

RIP: sending v2 update to 224.0.0.9 via Serial0/0/1 (10.2.2.2)

RIP: build update entries

10.1.1.0/30 via 0.0.0.0, metric 1, tag 0

172.30.10.0/24 via 0.0.0.0, metric 2, tag 0

RIP: received v2 update from 10.2.2.1 on Serial0/0/1

172.30.30.0/24 via 0.0.0.0 in 1 hops

Are the subnet masks included in the routing updates? Yes. Subnet masks are included in routing update

Step 4: Configure and redistribute a default route for Internet access.

a. From R2, create a static route to network 0.0.0.0 0.0.0.0, using the **ip route** command. This forwards any traffic with an unknown destination address to PC-B at 209.165.201.2, simulating the Internet by setting a Gateway of Last Resort on router R2.

R2(config)# **ip route 0.0.0.0 0.0.0.0 209.165.201.2**

b. R2 will advertise a route to the other routers if the **default-information originate** command is added to its RIP configuration.

R2(config)# **router rip**

R2(config-router)# **default-information originate**

Step 5: Verify the routing configuration.

a. View the routing table on R1.

R1# **show ip route**
<Output omitted>
Gateway of last resort is 10.1.1.2 to network 0.0.0.0

R* 0.0.0.0/0 [120/1] via 10.1.1.2, 00:00:13, Serial0/0/0
10.0.0.0/8 is variably subnetted, 3 subnets, 2 masks
C 10.1.1.0/30 is directly connected, Serial0/0/0
L 10.1.1.1/32 is directly connected, Serial0/0/0
R 10.2.2.0/30 [120/1] via 10.1.1.2, 00:00:13, Serial0/0/0
172.30.0.0/16 is variably subnetted, 3 subnets, 2 masks
C 172.30.10.0/24 is directly connected, GigabitEthernet0/1
L 172.30.10.1/32 is directly connected, GigabitEthernet0/1
R 172.30.30.0/24 [120/2] via 10.1.1.2, 00:00:13, Serial0/0/0

How can you tell from the routing table that the subnetted network shared by R1 and R3 has a pathway for Internet traffic?

_____
_____

_____
_____

b. View the routing table on R2.

How is the pathway for Internet traffic provided in its routing table?

_____
_____

_____
_____

Step 6: Verify connectivity.

a. Simulate sending traffic to the Internet by pinging from PC-A and PC-C to 209.165.201.2.

Were the pings successful? Yes

b. Verify that hosts within the subnetted network can reach each other by pinging between PC-A and PC-C.

Were the pings successful? Yes

Note: It may be necessary to disable the PCs firewall.

Reflection

1. Why would you turn off automatic summarization for RIPv2?

   Otherwise, routers will send only the summarized route and the subnet mask, and they will not send the subnets that were summarized. Due to this those networks will not be there in the other router's routing tables. And those routers will not learn any route to those summarized subnets.

2. How did R1 and R3 learn the pathway to the Internet?

   R2 advertises the route to the other routers as we added the **default-information originate** command to its RIP configuration.

Router Interface Summary Table

Router Interface Summary				
Router Model	**Ethernet Interface #1**	**Ethernet Interface #2**	**Serial Interface #1**	**Serial Interface #2**
1800	Fast Ethernet 0/0 (F0/0)	Fast Ethernet 0/1 (F0/1)	Serial 0/0/0 (S0/0/0)	Serial 0/0/1 (S0/0/1)
1900	Gigabit Ethernet 0/0 (G0/0)	Gigabit Ethernet 0/1 (G0/1)	Serial 0/0/0 (S0/0/0)	Serial 0/0/1 (S0/0/1)
2801	Fast Ethernet 0/0 (F0/0)	Fast Ethernet 0/1 (F0/1)	Serial 0/1/0 (S0/1/0)	Serial 0/1/1 (S0/1/1)
2811	Fast Ethernet 0/0 (F0/0)	Fast Ethernet 0/1 (F0/1)	Serial 0/0/0 (S0/0/0)	Serial 0/0/1 (S0/0/1)
2900	Gigabit Ethernet 0/0 (G0/0)	Gigabit Ethernet 0/1 (G0/1)	Serial 0/0/0 (S0/0/0)	Serial 0/0/1 (S0/0/1)

Note: To find out how the router is configured, look at the interfaces to identify the type of router and how many interfaces the router has. There is no way to effectively list all the combinations of configurations for each router class. This table includes identifiers for the possible combinations of Ethernet and Serial interfaces in the device. The table does not include any other type of interface, even though a specific router may contain one. An example of this might be an ISDN BRI interface. The string in parenthesis is the legal abbreviation that can be used in Cisco IOS commands to represent the interface.