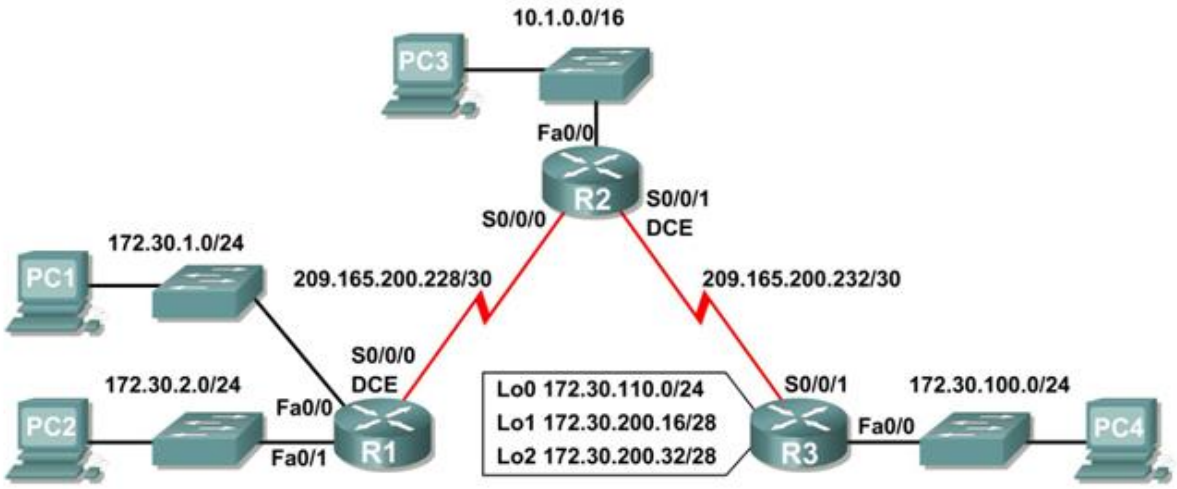
Lab 7.5.1: RIPv2 Basic Configuration Lab

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	172.30.1.1
PC2	NIC	172.30.2.10	255.255.255.0	172.30.2.1
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.

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.

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
Interface              IP-Address      OK? Method Status                Protocol
FastEthernet0/0        10.1.0.1        YES manual up                    up
FastEthernet0/1        unassigned      YES manual 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 manual administratively down down
```

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?

3

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%

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

Output omitted

     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, 00:00:15, 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
```

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
```



```
Output omitted


R    10.0.0.0/8 [120/1] via 209.165.200.229, 00:00:02, 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, 00:00:02, Serial0/0/0
```

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

Output omitted

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
```

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
RIP protocol debugging is on
RIP: received v1 update from 209.165.200.234 on Serial0/0/1
      172.30.0.0 in 1 hops
RIP: received v1 update from 209.165.200.230 on Serial0/0/0
      172.30.0.0 in 1 hops
```

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.

```
RIP: sending  v1 update to 255.255.255.255 via Serial0/0/1
(209.165.200.233)
RIP: build update entries
      network 10.0.0.0 metric 1
      network 209.165.200.228 metric 1
RIP: sending  v1 update to 255.255.255.255 via Serial0/0/0
(209.165.200.229)
```



```
RIP: build update entries
      network 10.0.0.0 metric 1
      network 209.165.200.232 metric 1
```

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
Routing Protocol is "rip"
Sending updates every 30 seconds, next due in 7 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
  FastEthernet0/0       2     2
  FastEthernet0/1       2     2
  Serial0/0/0           2     2
Automatic network summarization is 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
Distance: (default is 120)
```


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

Output omitted

     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, 00:00:07, Serial0/0/0
                   [120/1] via 209.165.200.234, 00:00:08, 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
```

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

Output omitted

R    10.0.0.0/8 [120/1] via 209.165.200.229, 00:00:09, 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, 00:00:09, Serial0/0/0
```

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

Output omitted

R    10.0.0.0/8 [120/1] via 209.165.200.233, 00:00:16, 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, 00:00:16, Serial0/0/1
C       209.165.200.232 is directly connected, Serial0/0/1
```


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?

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?

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

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

Output omitted

     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, 00:01:28, Serial0/0/0
                      [120/1] via 209.165.200.234, 00:01:56, Serial0/0/1
R       172.30.1.0/24 [120/1] via 209.165.200.230, 00:00:08, Serial0/0/0
```



```
R        172.30.2.0/24 [120/1] via 209.165.200.230, 00:00:08, Serial0/0/0
R        172.30.100.0/24 [120/1] via 209.165.200.234, 00:00:08, Serial0/0/1
R        172.30.110.0/24 [120/1] via 209.165.200.234, 00:00:08, Serial0/0/1
R        172.30.200.16/28 [120/1] via 209.165.200.234, 00:00:08, Serial0/0/1
R        172.30.200.32/28 [120/1] via 209.165.200.234, 00:00:08, 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

R1#show ip route

Output omitted

     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, 00:02:13, Serial0/0/0
R       10.1.0.0/16 [120/1] via 209.165.200.229, 00:00:21, 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, 00:00:21, Serial0/0/0
R       172.30.110.0/24 [120/2] via 209.165.200.229, 00:00:21, Serial0/0/0
R       172.30.200.16/28 [120/2] via 209.165.200.229, 00:00:21, Serial0/0/0
R       172.30.200.32/28 [120/2] via 209.165.200.229, 00:00:21, 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, 00:00:21, Serial0/0/0

R3#show ip route

Output omitted

     10.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
R       10.0.0.0/8 [120/1] via 209.165.200.233, 00:02:28, Serial0/0/1
R       10.1.0.0/16 [120/1] via 209.165.200.233, 00:00:08, 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, 00:00:08, Serial0/0/1
R       172.30.2.0/24 [120/2] via 209.165.200.233, 00:00:08, 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, 00:00:08, Serial0/0/1
C       209.165.200.232 is directly connected, Serial0/0/1
```

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

172.30.1.0/24

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

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

5

Step 2: Check the connectivity between the PCs.

From PC1, is it possible to ping PC2? yes

What is the success rate? 100%

From PC1, is it possible to ping PC3? yes

What is the success rate? 100%

From PC1, is it possible to ping PC4? yes

What is the success rate? 100%

From PC4, is it possible to ping PC2? yes

What is the success rate? 100%

From PC4, is it possible to ping PC3? yes

What is the success rate? 100%

Task 9: Documentation

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

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

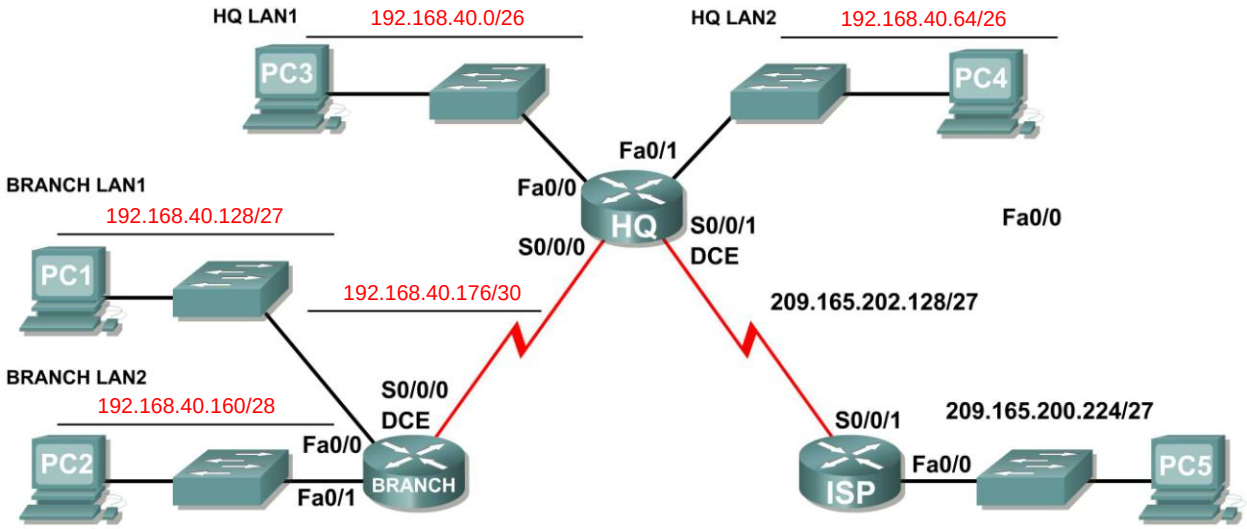
If you need to review the procedures for capturing command output, refer to Lab 1.5.1.

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.

Lab 7.5.2: RIPv2 Challenge Configuration Lab

Topology Diagram



Addressing Table

Device	Interface	IP Address	Subnet Mask	Default Gateway
BRANCH	Fa0/0	192.168.40.129	255.255.255.224	N/A
	Fa0/1	192.168.40.161	255.255.255.240	N/A
	S0/0/0	192.168.40.178	255.255.255.252	N/A
HQ	Fa0/0	192.168.40.1	255.255.255.192	N/A
	Fa0/1	192.168.40.65	255.255.255.192	N/A
	S0/0/0	192.168.40.177	255.255.255.252	N/A
	S0/0/1	209.165.202.158	255.255.255.224	N/A
ISP	Fa0/0	209.165.200.225	255.255.255.224	N/A
	S0/0/1	209.165.202.129	255.255.255.224	N/A
PC1	NIC	192.168.40.158	255.255.255.224	192.168.40.129
PC2	NIC	192.168.40.174	255.255.255.240	192.168.40.161
PC3	NIC	192.168.40.62	255.255.255.192	192.168.40.1
PC4	NIC	192.168.40.126	255.255.255.192	192.168.40.65
PC5	NIC	209.165.200.254	255.255.255.224	209.165.200.225

Learning Objectives

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

- Create an efficient VLSM design given the requirements.
- Assign appropriate addresses to interfaces and document the addresses.
- Cable a network according to the Topology Diagram.
- Erase the startup configuration and reload a router to the default state.
- Configure routers including RIP version 2.
- Configure and propagate a static default route.
- Verify RIP version 2 operation.
- Test and verify full connectivity.
- Reflect upon and document the network implementation.

Scenario

In this lab activity, you will be given a network address that must be subnetted using VLSM to complete the addressing of the network shown in the Topology Diagram. A combination of RIP version 2 and static routing will be required so that hosts on networks that are not directly connected will be able to communicate with each other.

Task 1: Subnet the Address Space.

Step 1: Examine the network requirements.

The addressing for the network has the following requirements:

- The ISP LAN will use the 209.165.200.224/27 network.
- The link between ISP and HQ will use the 209.165.202.128/27 network.
- The 192.168.40.0/24 network must be subnetted using VLSM for all other addresses in the network.
  - The HQ LAN1 will require 50 host IP addresses.
  - The HQ LAN2 will require 50 host IP addresses.
  - The BRANCH LAN1 will require 30 host IP addresses.
  - The BRANCH LAN2 will require 12 host IP addresses.
  - The link between HQ and BRANCH will require an IP address at each end.

  (**Note:** Remember that the interfaces of network devices are also host IP addresses and are included in the above addressing requirements.)

Step 2: Consider the following questions when creating your network design:

How many subnets need to be created from the 192.168.40.0/24 network? 5

How many total IP addresses are required from the 192.168.40.0/24 network? 144

What subnet mask will be used for the HQ LAN1 subnet? 255.255.255.192

What is the maximum number of host addresses that could be used on this subnet? 62

What subnet mask will be used for the HQ LAN2 subnet? 255.255.255.192

What is the maximum number of host addresses that could be used on this subnet? 62

What subnet mask will be used for the BRANCH LAN1 subnet? 255.255.255.244

What is the maximum number of host addresses that could be used on this subnet? 30

What subnet mask will be used for the BRANCH LAN2 subnet? 255.255.255.240

What is the maximum number of host addresses that could be used on this subnet? 14

What subnet mask will be used for the link between the HQ and BRANCH routers? 255.255.255.252

What is the maximum number of host addresses that could be used on this subnet? 2

Step 3: Assign subnetwork addresses to the Topology Diagram.

1. Assign subnet 0 of the 192.168.40.0 network to the HQ LAN1 subnet.
   What is the network address of this subnet? 192.168.40.0/26
2. Assign subnet 1 of the 192.168.40.0 network to the HQ LAN2 subnet.
   What is the network address of this subnet? 192.168.40.64/26
3. Assign subnet 2 of the 192.168.40.0 network to the BRANCH LAN1 subnet.
   What is the network address of this subnet? 192.168.40.128 /27
4. Assign subnet 3 of the 192.168.40.0 network to the BRANCH LAN2 subnet.
   What is the network address of this subnet? 192.168.40.160 /28
5. Assign subnet 4 of the 192.168.40.0 network to the link between the HQ and BRANCH routers.
   What is the network address of this subnet? 192.168.40.176 /30

Task 2: Determine Interface Addresses.

Step 1: Assign appropriate addresses to the device interfaces.

1. Assign the first valid host address in the 209.165.200.224/27 network to the LAN interface on the ISP router.
2. Assign the last valid host address in 209.165.200.224/27 network to PC5.
3. Assign the first valid host address in the 209.165.202.128/27 network to the WAN interface of ISP.
4. Assign the last valid host address in the 209.165.202.128/27 network to the Serial 0/0/1 interface of HQ.
5. Assign the first valid host address in the HQ LAN1 network to the LAN1 interface of HQ.
6. Assign the last valid host address in the HQ LAN1 network to PC 3.
7. Assign the first valid host address in the HQ LAN2 network to the LAN2 interface of HQ.
8. Assign the last valid host address in the HQ LAN2 network to PC 4.
9. Assign the first valid host address in the HQ/BRANCH WAN link to the Serial 0/0/0 interface of HQ.
10. Assign the last valid host address in the HQ/BRANCH WAN link to the Serial 0/0/0 interface of BRANCH.
11. Assign the first valid host address in the BRANCH LAN1 network to the LAN1 interface of BRANCH.
12. Assign the last valid host address in the BRANCH LAN1 network to PC 1.
13. Assign the first valid host address in the BRANCH LAN2 network to the LAN2 interface of BRANCH.
14. Assign the last valid host address in the BRANCH LAN2 network to PC 2.

Step 2: Document the addresses to be used in the table provided under the Topology Diagram.

Task 3: Prepare the Network.

Step 1: Cable a network that is similar to the one in the Topology Diagram.

You can use any current router in your lab as long as it has the required interfaces as shown in the topology.

Note: If you use 1700, 2500, or 2600 routers, the router outputs and interface descriptions will appear different.

Step 2: Clear any existing configurations on the routers.

Task 4: Perform Basic Router Configurations.

Perform basic configuration of the BRANCH, HQ, and ISP routers according to the following guidelines:

1. Configure the router hostname.
2. Disable DNS lookup.
3. Configure an EXEC mode password.
4. Configure a message-of-the-day banner.
5. Configure a password for console connections.
6. Configure a password for VTY connections.
7. Synchronize unsolicited messages and debug output with solicited output and prompts for the console and virtual terminal lines.
8. Configure an EXEC timeout of 15 minutes.

Task 5: Configure and Activate Serial and Ethernet Addresses

Step 1: Configure the BRANCH, HQ, and ISP routers.

Configure the interfaces on BRANCH, HQ, and ISP with the IP addresses from the Addressing Table provided under the Topology Diagram.

When you have finished, be sure to save the running configuration to the NVRAM of the router.

Step 2: Configure the Ethernet interfaces of PC1, PC2, PC3, PC4, and PC5.

Configure the Ethernet interfaces of PC1, PC2, PC3, PC4, and PC5 with the IP addresses from the Addressing Table provided under the Topology Diagram.

Task 6: Verify Connectivity to Next-Hop Device.

You should *not* have connectivity between end devices yet. However, you can test connectivity between two routers and between an end device and its default gateway.

Step 1: Verify BRANCH connectivity.

Verify that BRANCH can ping across the WAN link to HQ and that HQ can ping across the WAN link it shares with ISP.

Step 2: Verify that PC1, PC2, PC3, PC4, and PC5 can ping their respective default gateways.

Task 7: Configure RIPv2 Routing on the BRANCH Router.

Consider the networks that need to be included in the RIP updates that are sent out by BRANCH.

What networks are present in the BRANCH routing table? List the networks with slash notation.

192.168.40.128/27

192.168.40.160/28

192.168.40.176/30

What commands are required to enable RIP version 2 and include the connected networks in the routing updates?

```
router rip
version 2
network 192.168.40.0
```

Are there any router interfaces that do not need to have RIP updates sent out? yes

What command is used to disable RIP updates on these interfaces?

```
passive-interface FastEthernet0/0
passive-interface FastEthernet0/1
```

Task 8: Configure RIPv2 and Static Routing on HQ.

Consider the type of static routing that is needed on HQ.

What networks are present in the HQ routing table? List the networks with slash notation.

192.168.1.0/26

209.165.200.0/27

A static default route will need to be configured to send all packets with destination addresses that are not in the routing table to ISP. What command is needed to accomplish this? Use the appropriate exit interface on HQ in the command.

```
ip route 0.0.0.0 0.0.0.0 Serial0/0/1
```


What commands are required to enable RIP version 2 and include the LAN1 and LAN2 networks as well as the link between HQ and BRANCH in the routing updates?

```
router rip
version 2
network 192.168.40.0
```

Are there any router interfaces that do not need to have RIP updates sent out? yes

What command is used to disable RIP updates on these interfaces?

```
passive-interface FastEthernet0/0
passive-interface FastEthernet0/1
```

HQ needs to send the default route information to BRANCH in the RIP updates. What command is used to configure this?

```
default-information originate
```

Task 9: Configure Static Routing on the ISP Router.

Note: In a real-world implementation of this topology, you would not be configuring the ISP router. However, your service provider is an active partner in solving your connectivity needs. Service provider administrators are human, too, and make mistakes. Therefore, it is important that you understand the types of errors an ISP could make that would cause your networks to lose connectivity.

Static routes will need to be configured on ISP for all traffic that is destined for the RFC 1918 addresses that are used on the BRANCH LANs, HQ LANs, and the link between the BRANCH and HQ routers.

What are the commands that will need to be configured on the ISP router to accomplish this?

```
ip route 192.168.40.0 255.255.255.0 Serial0/0/1
```

Task 10: Verify the Configurations.

Answer the following questions to verify that the network is operating as expected:

From PC1, is it possible to ping PC3? yes

From PC1, is it possible to ping the PC5? yes

From PC4, is it possible to ping the PC5? yes

The answer to the above questions should be **yes**. If any of the above pings failed, check your physical connections and configurations. Refer to your basic troubleshooting techniques used in the Chapter 1 labs.

What routes are present in the routing table of the BRANCH router?

192.168.40.0/26

192.168.40.64/26

192.168.40.128/27

192.168.40.160/28

192.168.40.176/30

0.0.0.0/0

What is the gateway of last resort in the routing table of BRANCH?

192.168.40.177

What routes are present in the routing table of the HQ router?

192.168.40.0/26

192.168.40.64/26

192.168.40.128/27

192.168.40.160/28

192.168.40.176/30

209.165.202.0/27

0.0.0.0/0

What networks are present in the routing table of ISP?

192.168.40.0/24

209.165.200.0/27

209.165.202.0/27

What networks are present in the RIP updates sent from HQ?

0.0.0.0/0

192.168.40.0/26

192.168.40.64/26

What networks are present in the RIP updates sent from BRANCH?

192.168.40.128/27

192.168.40.160/28

Task 11: Reflection

Why is it necessary to use RIPv2 instead of RIPv1 with this network design?

version 1 does not support VLSM

Task 12: Document the Router Configurations

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

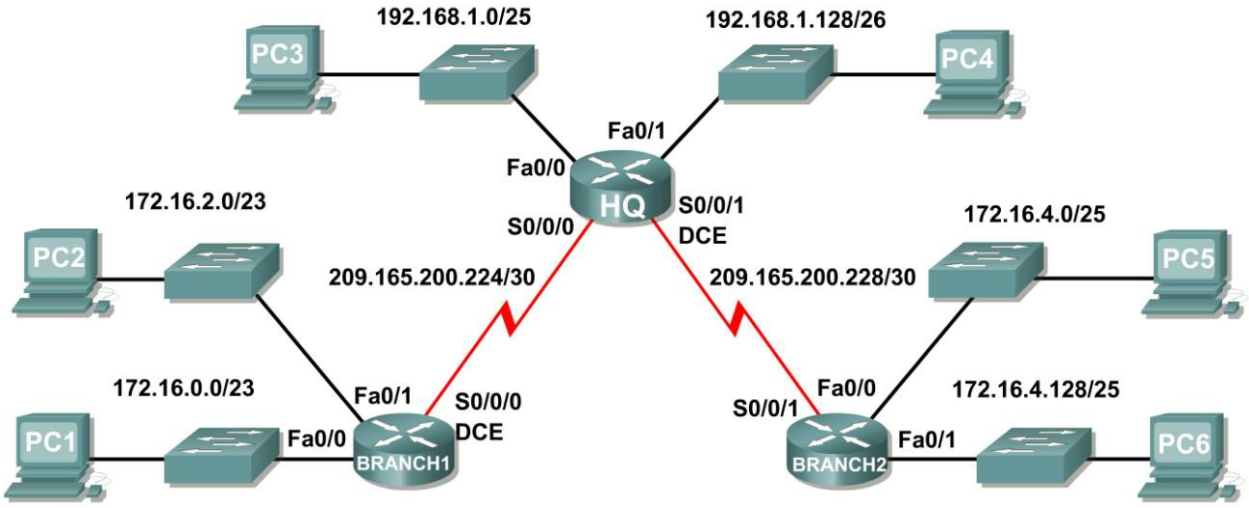
- Running configuration
- Routing table
- Interface summarization

Task 13: 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.

Lab 7.5.3: RIPv2 Troubleshooting Lab

Topology Diagram



Addressing Table

Device	Interface	IP Address	Subnet Mask	Default Gateway
HQ	Fa0/0	192.168.1.1	255.255.255.128	N/A
	Fa0/1	192.168.1.129	255.255.255.192	N/A
	S0/0/0	209.165.200.225	255.255.255.252	N/A
	S0/0/1	209.165.200.229	255.255.255.252	N/A
BRANCH1	Fa0/0	172.16.0.1	255.255.254.0	N/A
	Fa0/1	172.16.2.1	255.255.254.0	N/A
	S0/0/0	209.165.200.226	255.255.255.252	N/A
BRANCH2	Fa0/0	172.16.4.1	255.255.255.128	N/A
	Fa0/1	172.16.4.129	255.255.255.128	N/A
	S0/0/1	209.165.200.230	255.255.255.252	N/A
PC1	NIC	172.16.0.10	255.255.254.0	172.16.0.1
PC2	NIC	172.16.2.10	255.255.254.0	172.16.2.1
PC3	NIC	192.168.1.10	255.255.255.128	192.168.1.1
PC4	NIC	192.168.1.138	255.255.255.192	192.168.1.129
PC5	NIC	172.16.4.10	255.255.255.128	172.16.4.1
PC6	NIC	172.16.4.138	255.255.255.128	172.16.4.129

Learning Objectives

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

- Cable a network according to the Topology Diagram.
- Erase the startup configuration and reload a router to the default state.
- Load the routers with supplied scripts.
- Gather information about the non-converged portion of the network along with any other errors.
- Analyze information to determine why convergence is not complete.
- Propose solutions to network errors.
- Implement solutions to network errors.
- Document the corrected network.

Scenario

In this lab, you will begin by loading configuration scripts on each of the routers. These scripts contain errors that will prevent end-to-end communication across the network. You will need to troubleshoot each router to determine the configuration errors, and then use the appropriate commands to correct the configurations. When you have corrected all of the configuration errors, all of the hosts on the network should be able to communicate with each other.

The network should also have the following requirements met:.

- RIPv2 routing is configured on the BRANCH1 router.
- RIPv2 routing is configured on the BRANCH2 router.
- RIPv2 routing is configured on the HQ router.
- RIP updates must be disabled on the BRANCH1, BRANCH2, and HQ LAN interfaces.

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 the routers using the e**rase startup-config** command and then **reload** the routers. Answer **no** if asked to save changes.

Task 2: Load Routers with the Supplied Scripts

Step 1: Load the following script onto the BRANCH1 router:

```
hostname BRANCH1
!
interface FastEthernet0/0
 ip address 172.16.0.1 255.255.254.0
 duplex auto
 speed auto
 no shutdown
!
interface FastEthernet0/1
 ip address 172.16.2.1 255.255.254.0
 duplex auto
```



```
 speed auto
 no shutdown
!
interface Serial0/0/0
 ip address 209.165.200.226 255.255.255.252
 clock rate 64000
 no shutdown
!
router rip
passive-interface FastEthernet0/0
 passive-interface FastEthernet0/1
 network 172.16.0.0
 network 209.165.200.0
!
ip classless
!
line con 0
line vty 0 4
 login
!
end
```

Step 2: Load the following script onto the BRANCH2 router.

```
hostname BRANCH2
!
interface FastEthernet0/0
 ip address 172.16.4.129 255.255.255.128
 duplex auto
 speed auto
 no shutdown
!
interface FastEthernet0/1
 ip address 172.16.4.1 255.255.255.128
 duplex auto
 speed auto
 no shutdown
!
interface Serial0/0/1
 ip address 209.165.200.230 255.255.255.252
 no shutdown
!
router rip
 version 2
 passive-interface FastEthernet0/0
 passive-interface FastEthernet0/1
 network 209.165.200.0
!
ip classless
!
line con 0
line vty 0 4
 login
!
end
```


Step 3: Load the following script onto the HQ router.

```
hostname HQ
!
interface FastEthernet0/0
 ip address 192.168.1.1 255.255.255.128
 duplex auto
 speed auto
 no shutdown
!
interface FastEthernet0/1
 ip address 192.168.1.129 255.255.255.192
 duplex auto
 speed auto
 no shutdown
!
interface Serial0/0/0
 ip address 209.165.200.225 255.255.255.252
 no shutdown
!
interface Serial0/0/1
 ip address 209.165.200.229 255.255.255.252
 no shutdown
!
router rip
 version 2
 passive-interface FastEthernet0/0
 passive-interface FastEthernet0/1
 network 192.168.1.0
 network 209.165.200.0
!
ip classless
!
line con 0
line vty 0 4
 login
!
end
```

Task 3: Troubleshoot the BRANCH1 Router

Step 1: Begin troubleshooting at the Host connected to BRANCH1.

From the host PC1, is it possible to ping PC2? yes

From the host PC1, is it possible to ping PC3? no

From the host PC1, is it possible to ping PC5? no

From the host PC1, is it possible to ping the default gateway? yes

Step 2: Examine BRANCH1 to find possible configuration errors.

Begin by viewing the summary of status information for each interface on the router.

Are there any problems with the configuration of the interfaces?

no

If there are any problems with the configuration of the interfaces, record any commands that will be necessary to correct the configuration errors.

Step 3: If you have recorded any commands above, apply them to the router configuration now.

Step 4: View summary of the status information.

If any changes were made to the configuration in the previous step, view the summary of the status information for the router interfaces again.

Does the information in the interface status summary indicate any configuration errors? no

If the answer is **yes**, troubleshoot the interface status of the interfaces again.

Step 5: Troubleshoot the routing configuration on BRANCH1.

What networks and routes are shown in the routing table?

172.16.0.0/23

172.16.0.0 is directly connected

172.16.2.0 is directly connected

192.168.1.0/24 [120/1] via 209.165.200.225

209.165.200.0/30

209.165.200.224 is directly connected

Are there any problems with the routing table?

no

If there are any problems with the routing configuration, record any commands that will be necessary to correct the configuration errors.

Are there any problems with the routing table that could be due to errors on other parts of the network?

no branch 2 routing table

What networks are included in the RIP updates being sent from BRANCH1?

172.16.0.0/23

172.16.2.0/23

Are there any problems with the RIP updates that are being sent out from the router?

it is using RIP v1

If there are any additional problems with the RIP configuration, record any commands that will be necessary to correct the configuration errors.

configure terminal

router rip

version 2

Step 6: If you have recorded any commands above; apply them to the router configuration now.

Step 7: View the routing information.

If any changes were made to the configuration in the previous steps, view the routing information again.

Does the information in routing table indicate any configuration errors? no

Does the information included in the RIP updates that are sent out indicate any configuration errors? no

If the answer to either of these questions is **yes**, troubleshoot the routing configuration again.

What networks and routes are shown in the routing table?

172.16.0.0/23

172.16.0.0 is directly connected

172.16.2.0 is directly connected

192.168.1.0/24 [120/1] via 209.165.200.225

209.165.200.0/30

209.165.200.224 is directly connected

Step 8: Attempt to ping between the hosts again.

From the host PC1, is it possible to ping PC3? yes

From the host PC1, is it possible to ping PC4? yes

From the host PC1, is it possible to ping the Serial 0/0/1 interface of the HQ router? no

Task 4: Troubleshoot HQ

Step 1: Begin troubleshooting at the host PC3.

From the host PC3, is it possible to ping PC1? yes

From the host PC3, is it possible to ping PC5? no

From the host PC3, is it possible to ping the default gateway? yes

Step 2: Examine the HQ router to find possible configuration errors.

Begin by viewing the summary of status information for each interface on the router.

Are there any problems with the configuration of the interfaces?

down protocol on s0/0/1

If there are any problems with the configuration of the interfaces, record any commands that will be necessary to correct the configuration errors.

configure terminal

interface serial 0/0/1

clock rate 64000

Step 3: If you have recorded any commands above, apply them to the router configuration now.

Step 4: Troubleshoot the routing configuration on HQ.

What networks and routes are shown in the routing table?

172.16.0.0/16 [120/1] via 209.165.200.226

192.168.1.0/24

192.168.1.0/25 is directly connected

192.168.1.128/25 is directly connected

209.165.200.0/30

209.165.200.224 is directly connected

209.165.200.228 is directly connected

Are there any problems with the routing table?

no branch2 routes

If there are any problems with the routing table, record any commands that will be necessary to correct the configuration errors.

What networks are included in the RIP updates?

172.16.0.0/16

192.168.1.0/24

209.165.200.224/30

Are there any problems with the RIP updates that are being sent out from HQ?

no

If there are any problems with the RIP configuration, record any commands that will be necessary to correct the configuration errors.

Step 5: If you have recorded any commands above, apply them to the router configuration now.

Step 6: View the routing information.

If any changes were made to the configuration in the previous steps, view the routing information again.

Does the information in routing table indicate any configuration errors on HQ? no

Does the information included in the RIP updates that are sent out indicate any configuration errors on HQ? no

If the answer to either of these questions is **yes**, troubleshoot the routing configuration again.

Step 7: Attempt to ping between the hosts again.

From the host PC3, is it possible to ping PC1? yes

From the host PC3, is it possible to ping PC5? no

From the host PC3, is it possible to ping the default gateway? yes

Task 5: Troubleshoot BRANCH2

Step 1: Begin troubleshooting at the Host PC5.

From the host PC5, is it possible to ping PC6? no

From the host PC5, is it possible to ping PC1? no

From the host PC3, is it possible to ping the default gateway? no

Step 2: Examine BRANCH2 to find possible configuration errors.

Begin by viewing the summary of status information for each interface on the router.

Are there any problems with the configuration of the interfaces?

wrong ip for fa0// and fa0/1

If there are any problems with the configuration of the interfaces, record any commands that will be necessary to correct the configuration errors.

configure terminal

interface FastEthernet0/0

no ip address

interface FastEthernet0/1

no ip address

interface FastEthernet0/0

ip address 172.16.4.1 255.255.255.128

no shutdown

interface FastEthernet0/1

ip address 172.16.4.129 255.255.255.128

no shutdown

Step 3: If you have recorded any commands above, apply them to the router configuration now.

Step 4: View the summary of the status information.

If any changes were made to the configuration in the previous step, view the summary of the status information for the router interfaces again.

Does the information in the interface status summary indicate any configuration errors? no

If the answer is **yes**, troubleshoot the interface status of the interfaces again.

Step 5: Troubleshoot the routing configuration on BRANCH2.

Begin by viewing the routing table.

What networks and routes are shown in the routing table?

172.16.0.0/16

172.16.0.0/16 [120/2] via 209.165.200.229

172.16.4.0/25 is directly connected

172.16.4.128/25 is directly connected

192.168.1.0/24 [120/1] via 209.165.200.229

209.165.200.0/30

209.165.200.224 [120/1] via 209.165.200.229

209.165.200.228 is directly connected

Step 6: Examine the routes that are being sent out in the routing updates from BRANCH2.

Are there any problems with these routing updates?

no routing table for branch 2

If there are any problems with the routing configuration, record any commands that will be necessary to correct the configuration errors.

configure terminal

router rip

network 172.16.0.0

Step 7: If you have recorded any commands above, apply them to the router configuration now.

Step 8: Attempt to ping the hosts again.

From the host PC5, is it possible to ping PC6? yes

From the host PC5, is it possible to ping PC1? yes

From the host PC3, is it possible to ping the default gateway? yes

From the HQ router, is it possible to ping PC1? yes

From the HQ router, is it possible to ping PC5? yes

Step 9: Examine the routing updates that are being received on BRANCH2.

What networks are being received in the RIP updates?

172.16.0.0/16

192.168.1.0/24

209.165.200.224/30

Are there any problems with these routing updates?

branch 1 summarization

If there are any problems with the routing configuration, record any commands that will be necessary to correct the configuration errors.

configure terminal

router rip

no auto-summary

Do these commands need to be applied only to BRANCH2, or do they also need to be applied to any other routers in the network?

no auto-summary

Step 10: If you have recorded any commands above, apply them to the router configuration now.

Step 11: View the routing information.

If any changes were made to the configuration in the previous step, view the routing table again.

Does the information in routing table or routing updates indicate any configuration errors? no

If the answer is **yes**, troubleshoot the routing configuration again.

Step 12: Attempt to ping between the hosts again.

From the host PC5, is it possible to ping PC6? yes

From the host PC5, is it possible to ping PC1? yes

From the host PC5, is it possible to ping PC3? yes

From the host PC1, is it possible to ping PC3? yes

From the HQ router, is it possible to ping PC1? yes

From the HQ router, is it possible to ping PC5? yes

Task 6: Reflection

There were a number of configuration errors in the scripts that were provided for this lab. Use the space below to write a brief description of the errors that you found.

Task 7: 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 8: 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.

