Networking Academy

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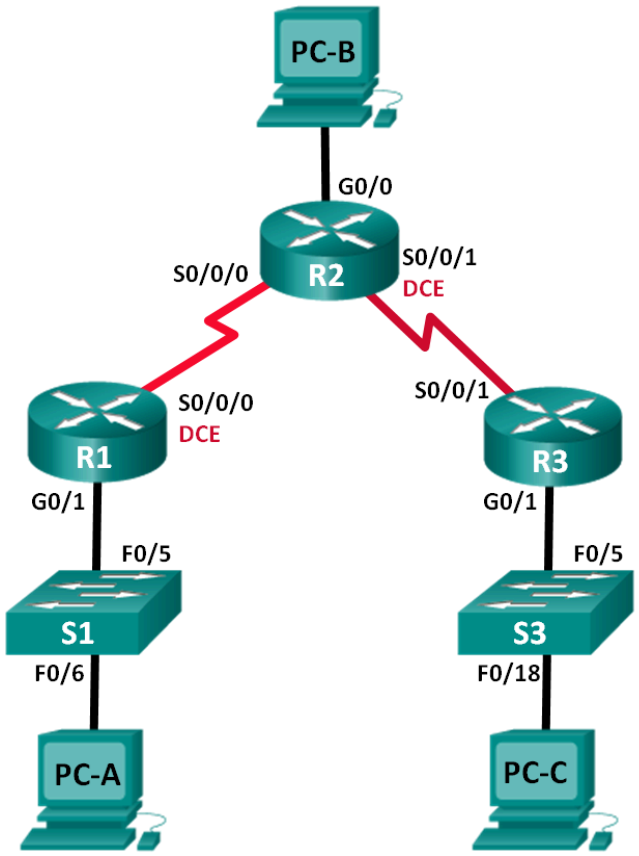
Lab 9.1 – Configuring Basic RIPv2



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	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	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
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 Verify Connectivity

Part 2: Configure and Verify RIPv2 Routing

Part 3: Propagate a Static Default Route using RIPv2

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.

Part 1: Build the Network and Configure Basic Device Settings

In Part 1, you will prepare the network topology and verify basic connectivity.

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

Attach serial interface expansion modules to routers as necessary.

Step 2: Configure device IP settings as indicated in the addressing table.

Step 3: Verify connectivity.

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

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

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

Part 2: Configure Basic 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.

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.

Why would it be good practice to configure a LAN interface such G0/1 of R1 as a passive interface?

This is because sending RIP updates to user LANs wastes bandwidth, wastes resources, and is a security risk.

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

What networks should be advertised on R3?

network 172.30.0.0

network 10.0.0.0

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

What networks should be advertised on R2?

network 10.0.0.0

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: Verify that RIPv2 is running.

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
```

a. Verify that RIPv2 is running on the routers using the **show ip protocols** command. The 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)
```

What information confirms directly connected networks that are being included in the routing updates sent by the router?

Routing for networks: 10.0.0.0 172.30.0.0

b. Ise the **debug ip rip** command on R2, what information is provided that confirms RIPv2 is running?

By sending the v2 update and receiving the v2 update, it is provided to and from a specific interface.

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

Step 2: **Check connectivity between PCs.**

Is PC-A, able to consistently ping PC-C?	Yes
Is PC-C, able to consistently ping PC-A?	Yes

Observe the content of the R1, R2 and R3 routing tables and explain the cause of these results.

Sinec R1 and R3 do not have the path going to the subnet of PC-B, which is 209.165.201.0

Is PC-A, able to consistently ping PC-B?	No
Is PC-C, able to consistently ping PC-B?	No

Observe the content of R1 and R3 routing tables and explain the cause of these results.

Since R1 and R3 do not have the path going to the subnet of PC-B, which is 209.165.201.0

Step 3: Examine the automatic summarization of routes.

The LANs connected to R1 and R3 are composed of discontiguous networks. Furthermore, automatic summarization is in use, causing routers to advertise the subnets combined into a single classful network route

Use the **debug ip rip** command on R2 to determine the routes received in the RIP updates from R1 and R3. List them here.

It receives the 172.30.0.0 from both interfaces.

R1 and R3 are both 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, none of the routers will have specific paths to the individual subnets of 172.16.0.0

Step 4: 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?

network 172.30.30.0 from 10.1.1.2 on S0/0/0

What routes are in the RIP updates that are received from R1?

network 172.30.10.0 from 10.2.2.2 on S0/0/1

Are the subnet masks included in the routing updates?	NO

e. Retest connectivity between PCs.

Is PC-A, able to consistently ping PC-C?	YES
Is PC-C, able to consistently ping PC-A?	YES

Observe the content of the R1, R2 and R3 routing tables and explain the cause of these results.

Since no auto-summary has been configured, the route entry for 172.30.10.0 and 172.30.30.0 is separated and the path to specific subnet will be distinguishable in the topology.

Is PC-A, able to consistently ping PC-B?	NO

Is PC-C, able to consistently ping PC-B?	NO

Observe the content of R1 and R3 routing tables and explain the cause of these results.

There is no route table entry for te subnet of PC-B, which is 209.165.201.0

Part 2: Propagate a Static Default Route Through RIPv2

Routing protocols like RIPv2 may be used to redistribute a default route from a router to the rest of the network through routing updates. This is usually performed on a network edge router which has a static path to an external network which may then be propagated to the rest of the routers in the routing domain.

In part 3, you will configure a static default route on R2 and use RIPv2 to propagate this to R1 and R3..

Step 1: 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

What is the command needed to configure the static default route?

ip route 0.0.0.0 0.0.0.0 209

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
```

This command will advertise the gateway of the last resort by using the RIP protocol.

Step 2: 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?

The destination network is set to 0.0.0.0, It is also used for unknown networks.

b. View the routing table on R2.

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

It is set to static.

Step 3: **Verify connectivity.**

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

Were the pings successful?	YES

Reflection

1. Why is there a need to turn off automatic summarization for RIPv2 if the network uses a discontiguous subnet address allocation scheme?

There is a need for automatic summarization for RIPv2 because this allows the advertisement of more specific routes.

2. What is the advantage of using a routing protocol like RIP to propagate a default route rather than individually configuring a static default route on each router?

Using a routing protocol like RIP to propagate a default route offers significant advantages over manually configuring static default routes on each router. It provides dynamic updates, simplifying network management and reducing the likelihood of errors in large-scale networks. Additionally, RIP enables scalability by automatically propagating routing information, easing the burden of configuration in growing networks. The protocol's flexibility allows for easy adaptation to changes in network topology or policies, ensuring efficient routing. Furthermore, RIP enhances redundancy and resilience by maintaining multiple paths to destinations, while also facilitating load balancing for optimized traffic distribution. Finally, RIP aids in troubleshooting by providing visibility into routing updates, streamlining the identification and resolution of network issues compared to static routing configurations.