# Department of Computer Science and Engineering

## Islamic University of Technology (IUT)

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# Laboratory Report

## CSE 4512: Computer Networks Lab


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**Title:** Configuring and Verifying RIP in a network topology

## **Objective**:

1. Describe the concept of dynamic routing
2. Explain disadvantages of RIPv1 and improvement in RIPv2
3. Configure Routing Information Protocol (RIP) in a network topology following given specifications

## **Devices/ software Used**:

1. Device: Windows PC
2. Software: Cisco Packet Tracer 7.3.0

## **Theory:**

**Distance Vector (DV) Routing:** A unicast intradomain routing method which uses Bellman-Ford algorithm to find the shortest path between any two nodes/routers in a network if the distance/cost between the nodes/routers are provided.

**Count to Infinity problem in DV routing :** A decrease in cost will be propagated quickly but an increase in cost will be propagated slowly. When a link between two nodes is broken then the other routers are to be notified instantly. But in distance vector routing, an unreachable router is given the cost of infinity. The other routers keep advertising a better path than infinity and eventually after several updates, the broken link will be recorded.

**Two node Loop problem in DV routing:** An example of the count to infinity problem. Here, one of two connected routers gets disconnected. As the router advertises the cost to the disconnected router as infinite, other routers advertise a better cost which eventually takes several updates till the value reaches to infinity.

**Split Horizon (one solution to instability):** Not allowing a router to advertise new information to the router from which it got its information.

**Poison Reverse:** The router can't tell if the entry is unreachable due to timer being expired or split horizon. In Poison Reverse, the router sends a negative advertisement saying that the distance to the unreachable node is infinite. This negative advertisement will make the source router send a better advertisement if the node is still reachable or acknowledge that the node is actually unreachable.

**Routing Information Protocol (RIP):** A unicast intradomain routing protocol based on Distance Vector Routing. Currently, two versions of RIP are available: RIP version 1 and RIP version 2.

**Forwarding Table used in RIP:** A table maintained by every router in RIP. This table consists of destination address, hop count or cost, and next hop address.

**Hop Count as cost:** A metric used as the cost between two nodes. Defined as the number of nodes to be passed to reach the destination.

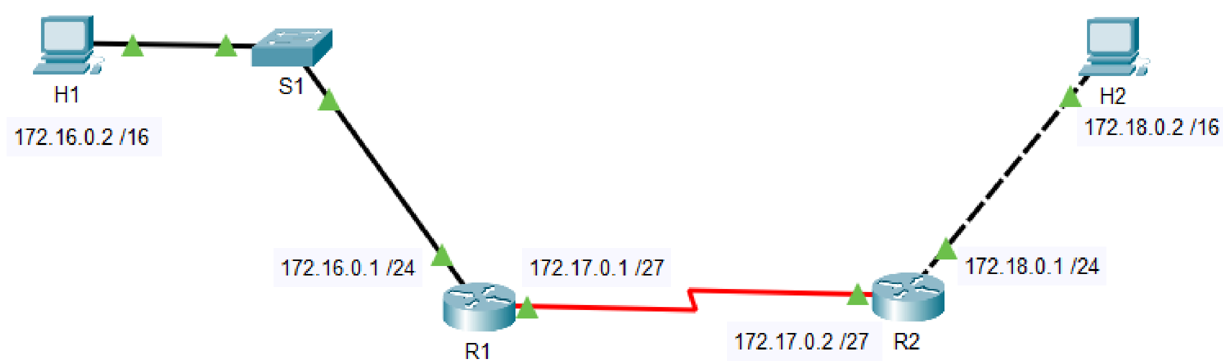
**Timers in RIP:** RIP has 3 timers:

i) **Periodic Timer:** Controls advertising of regular update messages. Uses a random number set between 25 to 35. Counts down, sends an update message when it hits zero and sets the timer randomly again.

ii) **Expiration Timer:** Tells the router how long the information received is valid. The value is set to 180 s for a particular route.

iii) **Garbage Collection Timer**: The time required to remove information when it becomes invalid. It is set to 120s and when it reaches zero, the information is removed from the routing table.

## Diagram of the experiment:



# Working Procedure:

## Step 1: Build the network and configure the routers

a. We build the network as shown in the topology diagram

b. In global configuration mode, we configure the host names and interfaces according to chart

## Step 2: Configure the hosts

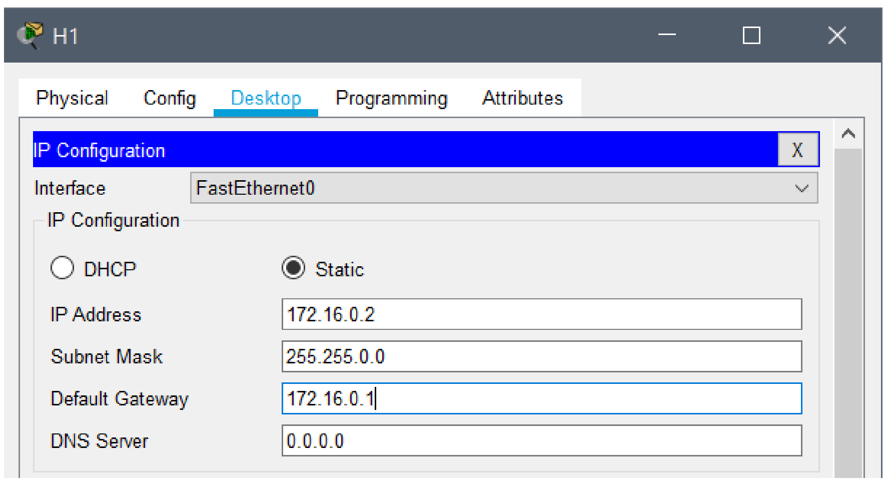
a. We configure host H1 attached to R1 with an IP address, subnet mask, and default gateway that is compatible with the IP address of the R1 Fast Ethernet interface (172.16.0.1/24)

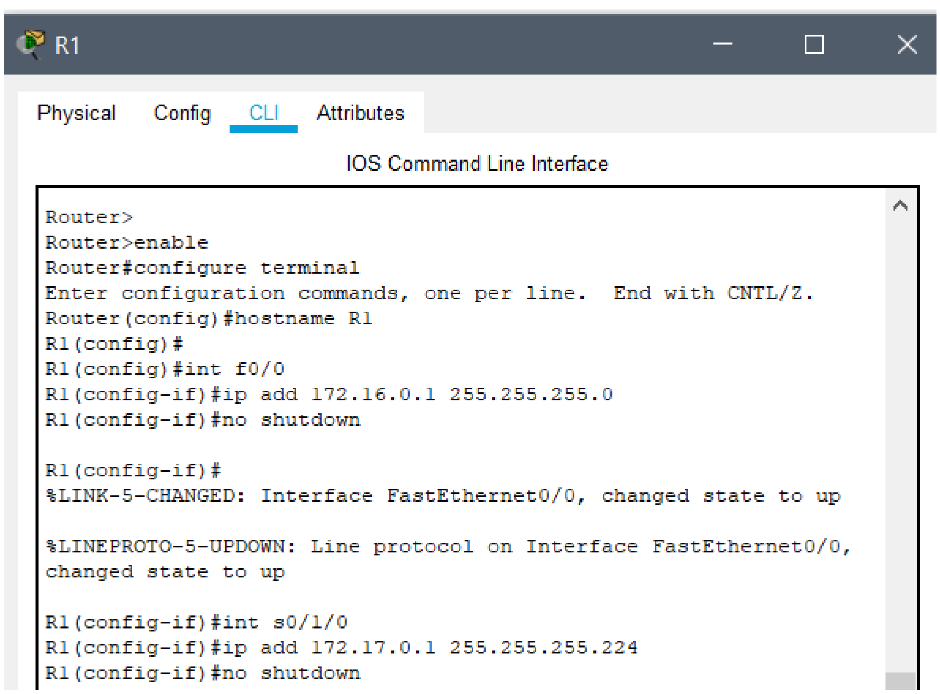
Host H1 IP configuration:

IP address: 172.16.0.2

Subnet mask: 255.255.0.0

Default gateway: 172.16.0.1



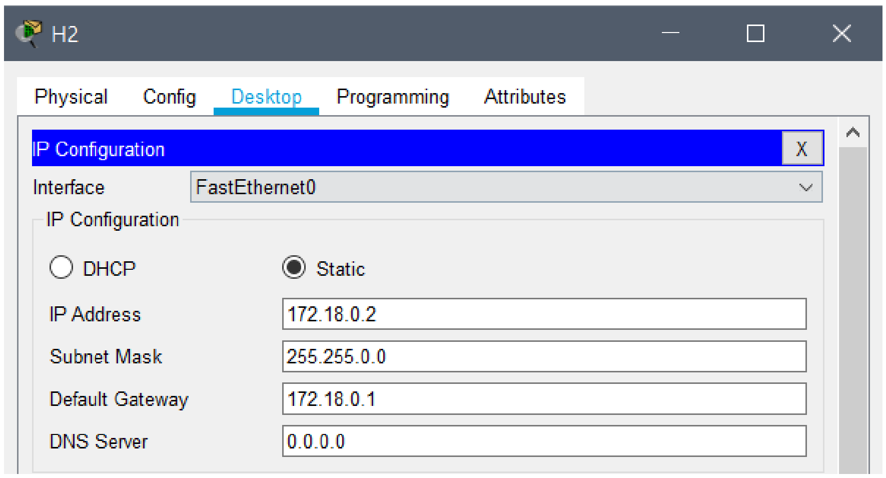
b. We configure host H2 attached to R2 with an IP address, subnet mask, and default gateway that is compatible with the IP address of the R2 Fast Ethernet interface (172.18.0.1/24).

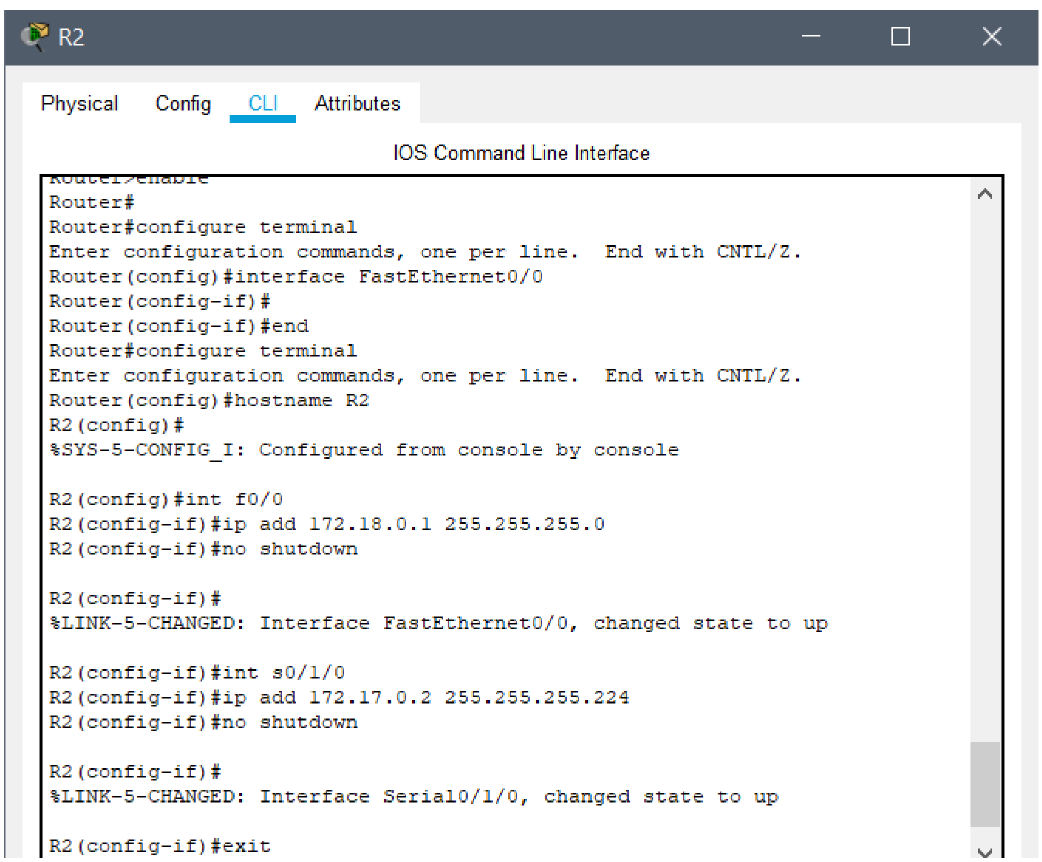
Host H2 IP configuration:

IP address: 172.18.0.2

Subnet mask: 255.255.0.0

Default gateway: 172.18.0.1



## Step 3: Check the R1 routing table

We view the IP routing table for R1 using the show ip route command.

```
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

     172.16.0.0/24 is subnetted, 1 subnets
C       172.16.0.0 is directly connected, FastEthernet0/0
     172.17.0.0/27 is subnetted, 1 subnets
C       172.17.0.0 is directly connected, Serial0/1/0

R1#
```

## Step 4: Test end-to-end connectivity

a. From R1, we ping the R2 router Fast Ethernet interface

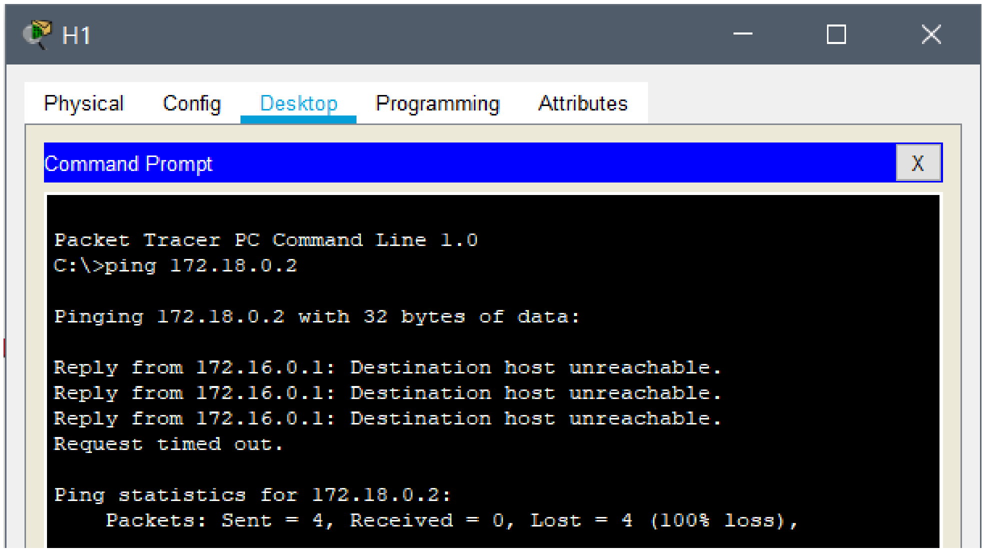
```
R1#ping 172.18.0.1
```

```
R1#ping 172.18.0.1

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 172.18.0.1, timeout is 2
seconds:
.....
Success rate is 0 percent (0/5)
```

b. From host H1, we ping host H2 (from network 172.16.0.2 to network 172.18.0.2)

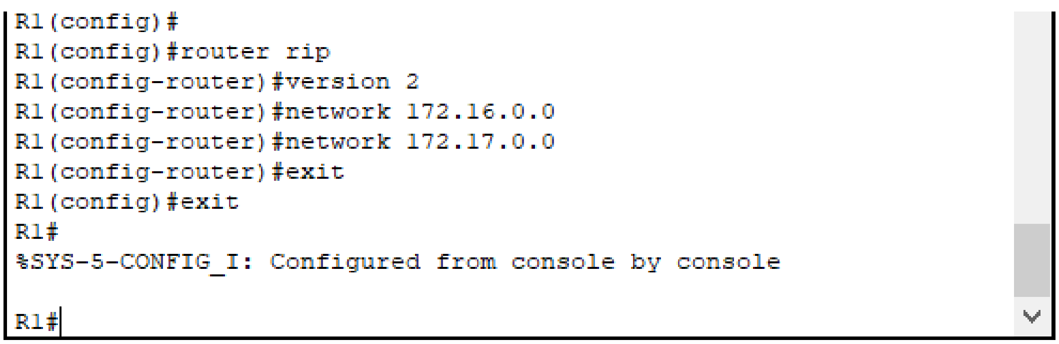
```
C:\>ping 172.18.0.2
```




## Step 5: Configure the routing protocol of the routers

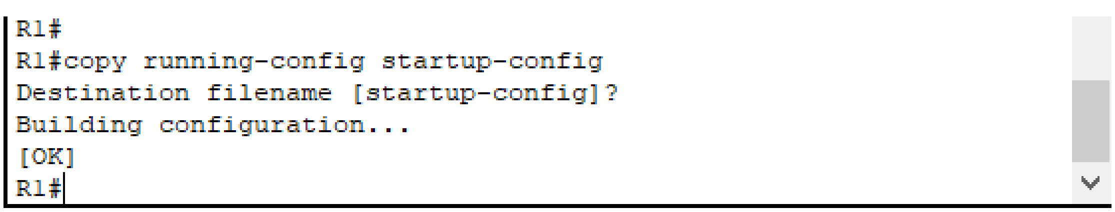
a. In global configuration mode, we enter the following on R1

```
R1(config)#router rip R1(config-router)#version 2
R1(config-router)#network 172.16.0.0
R1(config-router)#network 172.17.0.0
R1(config-router)#exit
R1(config)#exit
```




b. We save the R1 router configuration

```
R1#copy running-config startup-config
```



c. In global configuration mode, we enter the following on R2

```
R2(config)#router rip
R2(config-router)#version 2
R2(config-router)#network 172.17.0.0
R2(config-router)#network 172.18.0.0
R2(config-router)#exit
R2(config)#exit
```

```
R2>en
R2#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
R2(config)#router rip
R2(config-router)#version 2
R2(config-router)#network 172.17.0.0
R2(config-router)#network 172.18.0.0
R2(config-router)#exit
R2(config)#exit
```

d. We save the R2 router configuration

```
R2#copy running-config startup-config
```

```
R2#copy running-config startup-config
Destination filename [startup-config]?
Building configuration...
[OK]
R2#
```

## Step 6: View the routing tables for each router

a. In enable or privileged EXEC mode, we examine the routing table entries using the show ip route command on router 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

     172.16.0.0/24 is subnetted, 1 subnets
C       172.16.0.0 is directly connected, FastEthernet0/0
     172.17.0.0/27 is subnetted, 1 subnets
C       172.17.0.0 is directly connected, Serial0/1/0
R    172.18.0.0/16 [120/1] via 172.17.0.2, 00:00:25, Serial0/1/0
```

b. We examine the routing table entries on router 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

R    172.16.0.0/16 [120/1] via 172.17.0.1, 00:00:22, Serial0/1/0
     172.17.0.0/27 is subnetted, 1 subnets
C       172.17.0.0 is directly connected, Serial0/1/0
     172.18.0.0/24 is subnetted, 1 subnets
C       172.18.0.0 is directly connected, FastEthernet0/0

R2>
```

## Step 7: Test end-to-end connectivity.

a. From R1, we ping the R2 router Fast Ethernet interface

```
R1#ping 172.18.0.1
```

```
R1#ping 172.18.0.1

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 172.18.0.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 4/8/16 ms

R1#
```

b. From the host H1 command prompt, ping H2 (from network 172.16.0.2 to network 172.18.0.2)

```
C:\>ping 172.18.0.2
```

```
C:\>ping 172.18.0.2

Pinging 172.18.0.2 with 32 bytes of data:

Reply from 172.18.0.2: bytes=32 time=2ms TTL=126
Reply from 172.18.0.2: bytes=32 time=1ms TTL=126
Reply from 172.18.0.2: bytes=32 time=1ms TTL=126
Reply from 172.18.0.2: bytes=32 time=4ms TTL=126

Ping statistics for 172.18.0.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 1ms, Maximum = 4ms, Average = 2ms

C:\>
```

### Step 8: Use debug to observe RIP communications

a. Using the debug ip rip command, we can see real-time communication and updates passing between routers that are running RIP

```
R1#debug ip rip
RIP protocol debugging is on
R1#RIP: received v2 update from 172.17.0.2 on Serial0/1/0
      172.18.0.0/16 via 0.0.0.0 in 1 hops

R1#RIP: sending  v2 update to 224.0.0.9 via FastEthernet0/0 (172.16.0.1)
RIP: build update entries
      172.17.0.0/16 via 0.0.0.0, metric 1, tag 0
      172.18.0.0/16 via 0.0.0.0, metric 2, tag 0
RIP: sending  v2 update to 224.0.0.9 via Serial0/1/0 (172.17.0.1)
RIP: build update entries
      172.16.0.0/16 via 0.0.0.0, metric 1, tag 0
RIP: received v2 update from 172.17.0.2 on Serial0/1/0
      172.18.0.0/16 via 0.0.0.0 in 1 hops
RIP: sending  v2 update to 224.0.0.9 via FastEthernet0/0 (172.16.0.1)
RIP: build update entries
      172.17.0.0/16 via 0.0.0.0, metric 1, tag 0
      172.18.0.0/16 via 0.0.0.0, metric 2, tag 0
RIP: sending  v2 update to 224.0.0.9 via Serial0/1/0 (172.17.0.1)
RIP: build update entries
      172.16.0.0/16 via 0.0.0.0, metric 1, tag 0

R1#
```

b. We enter the command undebug all to stop all debugging activity

```
R1#undebug all
All possible debugging has been turned off
R1#
```

Ctrl+F6 to exit CLI focus    Copy    Paste

## **Observation**:

### Step 3: Check the R1 routing table

b.What is the significance of the “C” to the left of the 172.16.0.0 and 172.17.0.0 network entries in the routing table?

**Ans:** The “C” means connected.

c. Is there a route in the R1 routing table to the R2 Ethernet network 172.18.0.0? Why?
**Ans:** No, there is no such route. Because we did not configure the routing yet, and it can be done either manually or dynamically.

### Step 4: Test end-to-end connectivity

a.Are the pings successful?
**Ans:** No

b.Are the pings successful?
**Ans:** No

c.Why are the pings not successful?
**Ans:** Because the routing was not configured. A packet has no routing protocol to follow and is therefore unable to reach the destination.

### Step 6: View the routing tables for each router

b. Which networks are shown in the R1 routing table?
**Ans:** 172.16.0.0/24
172.17.0.0/27
172.18.0.0/16

c. What is the significance of the “R” to the left of the 172.18.0.0 network entry in the routing table?
**Ans:** The “R” means RIP. It means the routing protocol that will be used to dynamically update the routing table and ensure that the packet reaches the destination is RIP.

d. What does “via 172.17.0.2” mean for this network route?
**Ans:** It means that when the packet will reach its destination it will go through this network and this network will act as an intermediary router.

e. What does “Serial0/1/0” mean for this network route?
**Ans:** It is router R1’s interface which is used to communicate serially with R2.

g. Which networks are shown in the R2 routing table?

**Ans:** 172.16.0.0/16
172.17.0.0/27
172.18.0.0/24

### Step 7: Test end-to-end connectivity

a. Are the pings successful?
**Ans:** Yes

c. Are the pings successful?
**Ans:** Yes

d. Why are the pings successful this time?
**Ans:** This time the routing was configured using RIP. The router can now dynamically update its routing table and forward the packet to its proper destination.

### Step 8: Use debug to observe RIP communications

c. What interface does router R1 send and receive updates through?
**Ans:** Serial 0/1/0

d. Why does the route to 172.17.0.0 have a metric of 1, and the route to 172.18.0.0 have a metric of 2?
**Ans:** The metric indicates the hop count which means the number of hops a packet needs to travel to reach its destination. 172.17.0.0 is directly connected to the other network, needs to pass through 1 router only and hence, the metric is 1. But 172.18.0.0 has one intermediary router and needs to go to 2 routers to reach its destination. That's why the metric is 2.

### Step 9: Reflection

a. What would happen to the routing table on router R1 if the Ethernet network on router R2 went down?
**Ans:** R1 would dynamically update its routing table and remove the entries on R2 after a certain period of time

b. What would happen if router R1 was configured to run RIPv1, and R2 was configured to run RIPv2?
**Ans:** Since RIPv2 is backwards compatible, R2 will receive updates from R1 which uses RIPv1.

## Challenges:

- I faced no major challenges in this lab apart from finding the answers to some of the questions in the observation section.