Department of Computer Science and Engineering

Islamic University of Technology (IUT)

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Laboratory Report

CSE 4412 : Data Communication and Networking Lab

Name	**: Mirza Mohammad Azwad**
Student ID	**: 200042121**
Section	**: BSc in SWE(Group A)**
Semester	**: 4th Semester**
Academic Year	**: 2022-23**
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Lab No	**: 06**

Title: Configuration of RIP in a network topology.

Objective:

1. Understand distance vector routing
2. Understand RIP
3. Understand the necessity of dynamic routing

Devices/ software Used:

1. Switch-2960
2. Router-PT
3. PC-PT
4. DCE/DTE Cables(Serial Connector)
5. Copper Straight Through Cables(Ethernet Connector)
6. IP Configuration
7. Command Prompt
8. Router Config

Theory:

Distance Vector (DV) Routing

Distance Vector Routing (DVR) is another type of routing protocol that uses a distance-vector algorithm to determine the best route for data packets based on distance. Each router maintains a table that lists the distance to each destination network in the internetwork, as well as the next hop router to reach that destination. The router updates its table periodically or when it detects a change in the network topology. The primary advantage of DVR is its simplicity, but it is also prone to routing loops and slow convergence times.

Count to Infinity problem in DV routing

The **Count to Infinity problem** is an issue in distance-vector routing protocols, where routers may get stuck in a loop and keep increasing the metric to a destination router indefinitely, resulting in an inaccurate and unstable network. To prevent this, techniques like split horizon, poison reverse, hold-down timers, route poisoning, and triggered updates can be used to limit the scope of route advertisements and prevent routing loops.

Two node Loop problem in DV routing

The **Two Node Loop problem** is a common issue in distance-vector routing protocols, where two routers are connected to each other via two different links with the same metric. This can create a routing loop, where each router thinks it has the shortest path to the other, and keeps forwarding packets back and forth between them indefinitely, causing network congestion and instability. To prevent this problem, techniques such as route poisoning or using a higher metric for one of the links can be employed to break the loop and ensure proper routing.

Split Horizon (one solution to instability)

Split Horizon is a technique used in RIP to prevent routing loops. It specifies that a router should not advertise a route back to the neighbor from which it was learned. For example, if router A learns a route to network X from router B, it should not advertise that route back to router B. This is done to prevent routing loops, where two routers keep advertising the same route to each other, causing a loop. Split Horizon helps to ensure that each router has accurate and up-to-date routing information.

Poison Reverse

Poisson Reverse is a technique used in RIP to prevent routing loops caused by delayed updates. It specifies that if a router receives an update about a route that it has advertised, it should not advertise this route to any of its neighbors for a period of time. This period of time is known as the **hold-down timer** and is typically set to 180 seconds in RIP.

The hold-down timer starts when a router receives an update about a route that it has advertised. During this time, the router does not advertise this route to any of its neighbors, even if it receives additional updates about the same route. This helps to prevent routing loops caused by delayed updates, where a router receives an update about a route from a neighbor after it has already advertised the route to other neighbors.

After the hold-down timer expires, the router can advertise the updated route to its neighbors. This helps to ensure that all routers in the network have consistent routing information and reduces the likelihood of routing loops.

Poisson Reverse is one of the techniques used in RIP to improve the stability and efficiency of the protocol, especially in large networks or networks with complex topologies.

However, Split Horizon can also cause some inefficiencies, particularly in large networks or networks with complex topologies. To address this, another technique called Split Horizon with Poison Reverse is used, which specifies that if a router receives an update about a route that it has advertised, it should not advertise this route to any of its neighbors for a period of time. This period of time is known as the hold-down timer and is typically set to 180 seconds in RIP.

Routing Information Protocol (RIP)

Routing Information Protocol (RIP) is one of the oldest and most basic distance vector routing protocols. It works by broadcasting its entire routing table to all of its neighbors every 30 seconds. Each router then uses this information to update its own routing table. However, this can lead to routing loops and slow convergence times.
RIP v1 is one of the oldest and most basic distance vector routing protocols. It works by broadcasting its entire routing table to all of its neighbors every 30 seconds. Each router then uses this information to update its own routing table. However, RIP v1 has its limitations, such as not supporting Variable Length Subnet Mask (VLSM), and only using classful IP addresses.

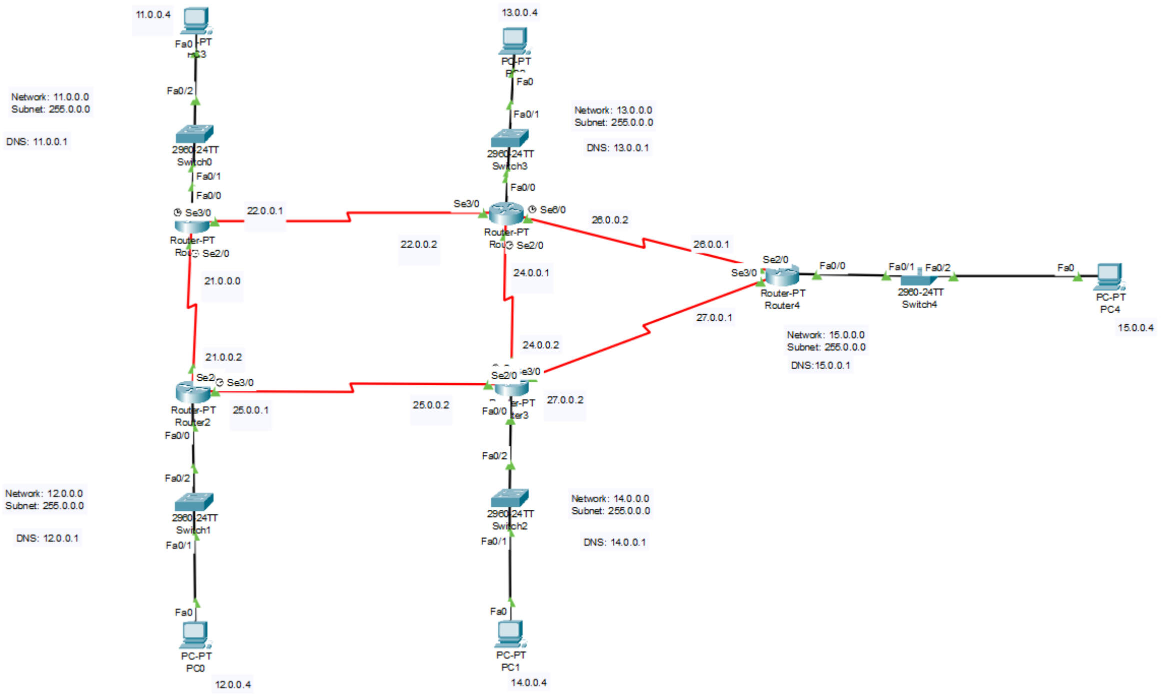
RIP v2, on the other hand, is an improved version of RIP that supports VLSM and multicasting. With multicasting, a group message is sent, essentially a group of IP addresses, and the end system or PC has to subscribe to a particular broadcast IP address.

RIPng is an extension of RIP that supports IPv6. It is similar to RIP v2 in terms of functionality, but with support for IPv6 address space.

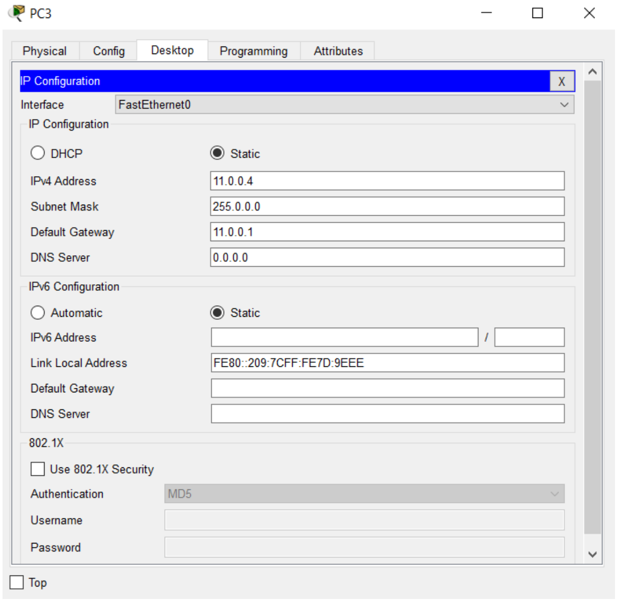
Overall, RIP is a simple and easy-to-use routing protocol. However, it is also prone to routing loops and slow convergence times. As such, it is generally not recommended for large networks or networks with complex topologies.

Diagram of the experiment:

Router Configuration for the experiment showing all the addresses and interfaces



Configuration for one **PC-PT PC3**



IP Configuration

Interface: FastEthernet0

IP Configuration

○ DHCP ● Static

IPv4 Address: 11.0.0.4

Subnet Mask: 255.0.0.0

Default Gateway: 11.0.0.1

DNS Server: 0.0.0.0

IPv6 Configuration

○ Automatic ● Static

IPv6 Address: /

Link Local Address: FE80::209:7CFF:FE7D:9EEE

Default Gateway:

DNS Server:

802.1X

☐ Use 802.1X Security

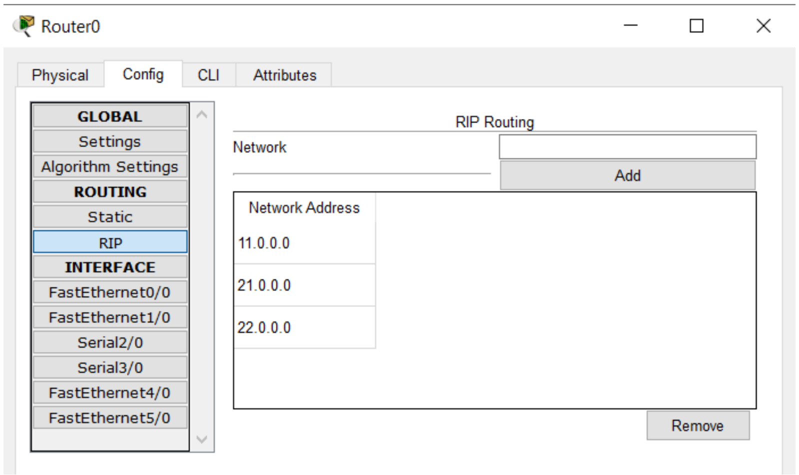
Authentication: MD5

Username:

Password:

☐ Top

Configuration for RIP for **Router-PT Router0**

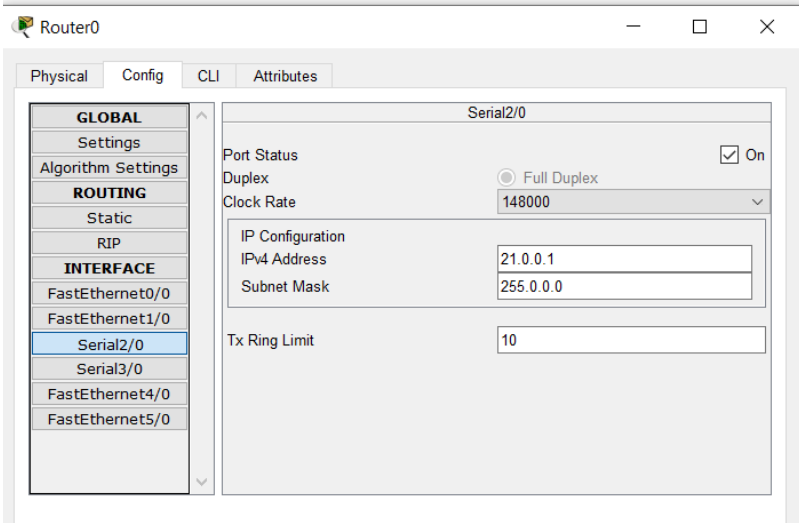


RIP Routing

Network

Network Address
11.0.0.0
21.0.0.0
22.0.0.0

Configuration for **Serial2/0(DCE)**



Serial2/0

Port Status ☑ On

Duplex ○ Full Duplex

Clock Rate 148000

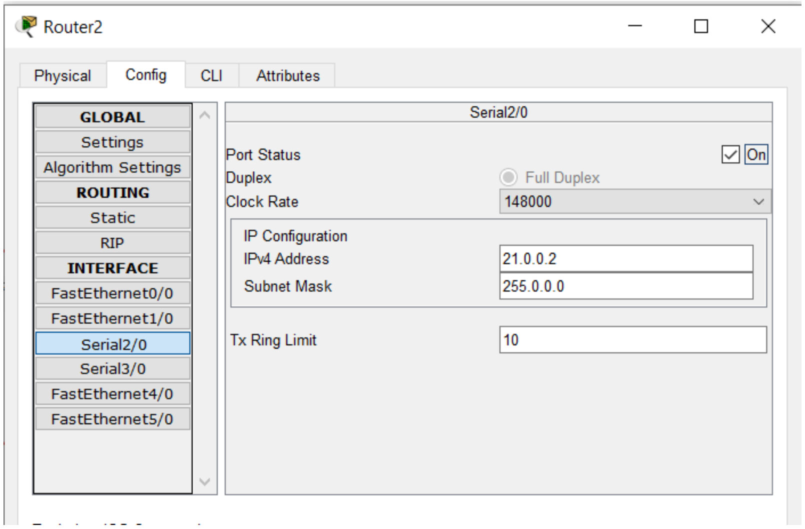
IP Configuration

IPv4 Address 21.0.0.1

Subnet Mask 255.0.0.0

Tx Ring Limit 10

Configuration for Serial2/0(DTE) in Router2



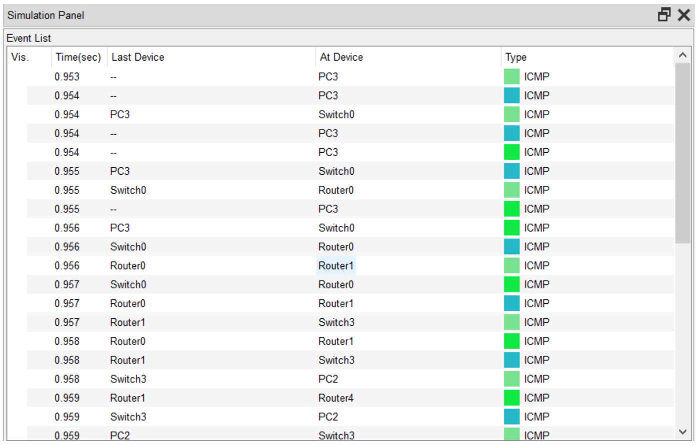
Serial2/0

Port Status ☑ On
Duplex ○ Full Duplex
Clock Rate 148000

IP Configuration
IPv4 Address 21.0.0.2
Subnet Mask 255.0.0.0

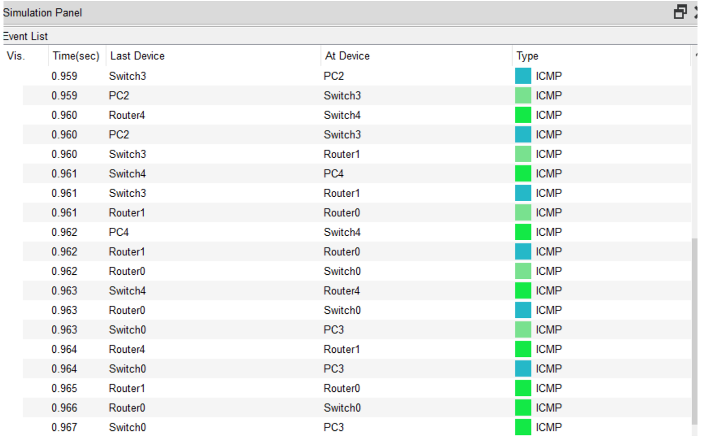
Tx Ring Limit 10

Packets being sent from PC3 to PC4(Event list for single packet)


Simulation Panel

Event List

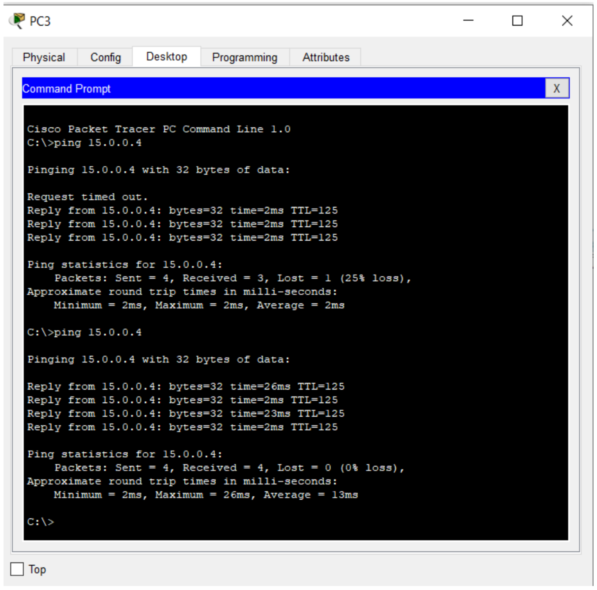
Vis.	Time(sec)	Last Device	At Device	Type
	0.953	--	PC3	ICMP
	0.954	--	PC3	ICMP
	0.954	PC3	Switch0	ICMP
	0.954	--	PC3	ICMP
	0.954	--	PC3	ICMP
	0.955	PC3	Switch0	ICMP
	0.955	Switch0	Router0	ICMP
	0.955	--	PC3	ICMP
	0.956	PC3	Switch0	ICMP
	0.956	Switch0	Router0	ICMP
	0.956	Router0	Router1	ICMP
	0.957	Switch0	Router0	ICMP
	0.957	Router0	Router1	ICMP
	0.957	Router1	Switch3	ICMP
	0.958	Router0	Router1	ICMP
	0.958	Router1	Switch3	ICMP
	0.958	Switch3	PC2	ICMP
	0.959	Router1	Router4	ICMP
	0.959	Switch3	PC2	ICMP
	0.959	PC2	Switch3	ICMP


Simulation Panel

Event List

Vis.	Time(sec)	Last Device	At Device	Type
	0.959	Switch3	PC2	ICMP
	0.959	PC2	Switch3	ICMP
	0.960	Router4	Switch4	ICMP
	0.960	PC2	Switch3	ICMP
	0.960	Switch3	Router1	ICMP
	0.961	Switch4	PC4	ICMP
	0.961	Switch3	Router1	ICMP
	0.961	Router1	Router0	ICMP
	0.962	PC4	Switch4	ICMP
	0.962	Router1	Router0	ICMP
	0.962	Router0	Switch0	ICMP
	0.963	Switch4	Router4	ICMP
	0.963	Router0	Switch0	ICMP
	0.963	Switch0	PC3	ICMP
	0.964	Router4	Router1	ICMP
	0.964	Switch0	PC3	ICMP
	0.965	Router1	Router0	ICMP
	0.966	Router0	Switch0	ICMP
	0.967	Switch0	PC3	ICMP

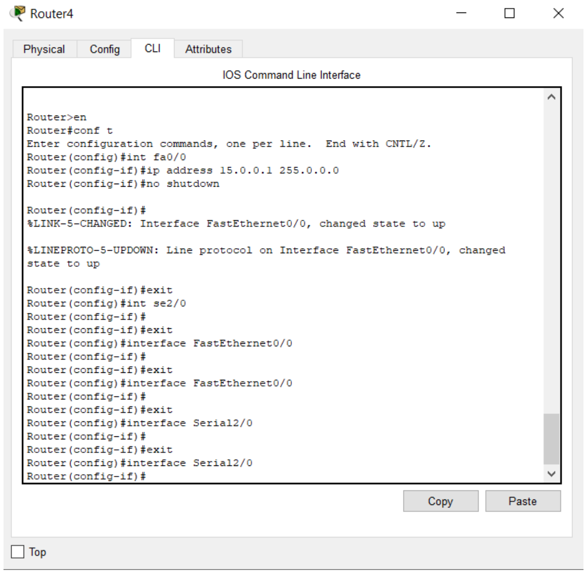
The command line messages showing the packets are delivered successfully from PC3 to PC4 across two hops



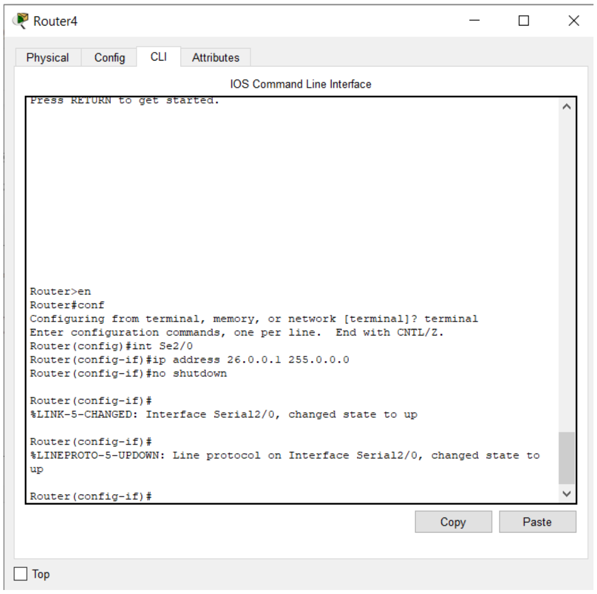
```
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 15.0.0.4

Pinging 15.0.0.4 with 32 bytes of data:

Request timed out.
Reply from 15.0.0.4: bytes=32 time=2ms TTL=125
Reply from 15.0.0.4: bytes=32 time=2ms TTL=125
Reply from 15.0.0.4: bytes=32 time=2ms TTL=125

Ping statistics for 15.0.0.4:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
Approximate round trip times in milli-seconds:
    Minimum = 2ms, Maximum = 2ms, Average = 2ms

C:\>ping 15.0.0.4

Pinging 15.0.0.4 with 32 bytes of data:

Reply from 15.0.0.4: bytes=32 time=26ms TTL=125
Reply from 15.0.0.4: bytes=32 time=2ms TTL=125
Reply from 15.0.0.4: bytes=32 time=23ms TTL=125
Reply from 15.0.0.4: bytes=32 time=2ms TTL=125

Ping statistics for 15.0.0.4:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 2ms, Maximum = 26ms, Average = 13ms

C:\>
```

Configuration of Routers:

Commands for configuring RIP for one PC(PC4) is shown below

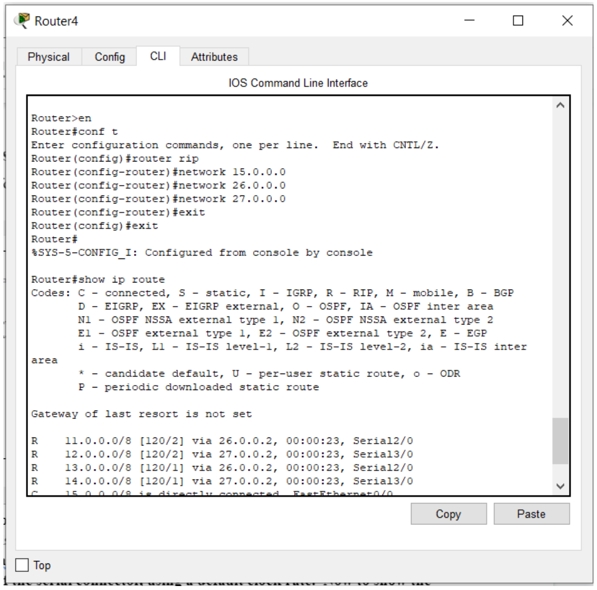


```
Router>en
Router#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#int fa0/0
Router(config-if)#ip address 15.0.0.1 255.0.0.0
Router(config-if)#no shutdown

Router(config-if)#
%LINK-5-CHANGED: Interface FastEthernet0/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed
state to up

Router(config-if)#exit
Router(config)#int se2/0
Router(config-if)#
Router(config-if)#exit
Router(config)#interface FastEthernet0/0
Router(config-if)#
Router(config-if)#exit
Router(config)#interface FastEthernet0/0
Router(config-if)#
Router(config-if)#exit
Router(config)#interface Serial2/0
Router(config-if)#
Router(config-if)#exit
Router(config)#interface Serial2/0
Router(config-if)#
```

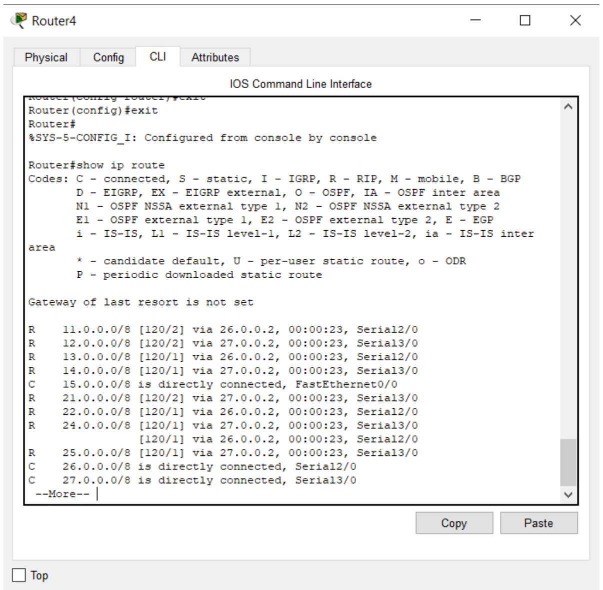


```
Press RETURN to get started.









Router>en
Router#conf
Configuring from terminal, memory, or network [terminal]? terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#int Se2/0
Router(config-if)#ip address 26.0.0.1 255.0.0.0
Router(config-if)#no shutdown

Router(config-if)#
%LINK-5-CHANGED: Interface Serial2/0, changed state to up

Router(config-if)#
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial2/0, changed state to
up

Router(config-if)#
```

Similar to the second image above, the Se3/0 is configured as 27.0.0.1 keeping in mind that the DTE end for Se3/0 on the other end is also configured with the same network ID as being a 27.0.0.2 IP address. The same applied to the the DTE end for the one I showed, I demonstrated configuring the DCE end in the second image of the serial connector, using a default clock rate. Now to show the RIP commands.



```
Router>en
Router#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#router rip
Router(config-router)#network 15.0.0.0
Router(config-router)#network 26.0.0.0
Router(config-router)#network 27.0.0.0
Router(config-router)#exit
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console

Router#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    11.0.0.0/8 [120/2] via 26.0.0.2, 00:00:23, Serial2/0
R    12.0.0.0/8 [120/2] via 27.0.0.2, 00:00:23, Serial3/0
R    13.0.0.0/8 [120/1] via 26.0.0.2, 00:00:23, Serial2/0
R    14.0.0.0/8 [120/1] via 27.0.0.2, 00:00:23, Serial3/0
C    15.0.0.0/8 is directly connected, FastEthernet0/0
```



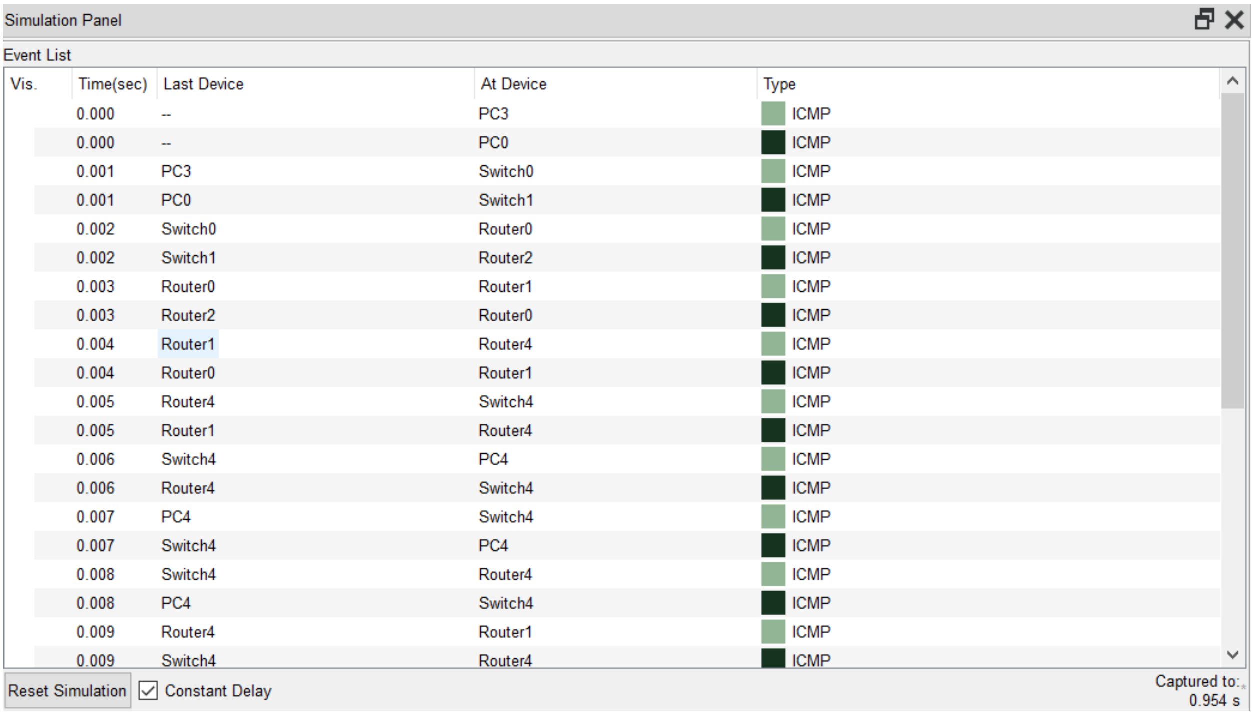
```
Router(config-router)#exit
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console

Router#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    11.0.0.0/8 [120/2] via 26.0.0.2, 00:00:23, Serial2/0
R    12.0.0.0/8 [120/2] via 27.0.0.2, 00:00:23, Serial3/0
R    13.0.0.0/8 [120/1] via 26.0.0.2, 00:00:23, Serial2/0
R    14.0.0.0/8 [120/1] via 27.0.0.2, 00:00:23, Serial3/0
C    15.0.0.0/8 is directly connected, FastEthernet0/0
R    21.0.0.0/8 [120/2] via 27.0.0.2, 00:00:23, Serial3/0
R    22.0.0.0/8 [120/1] via 26.0.0.2, 00:00:23, Serial2/0
R    24.0.0.0/8 [120/1] via 27.0.0.2, 00:00:23, Serial3/0
                [120/1] via 26.0.0.2, 00:00:23, Serial2/0
R    25.0.0.0/8 [120/1] via 27.0.0.2, 00:00:23, Serial3/0
C    26.0.0.0/8 is directly connected, Serial2/0
C    27.0.0.0/8 is directly connected, Serial3/0
 --More--
```

the serial connection using a default clock rate. Now to show the

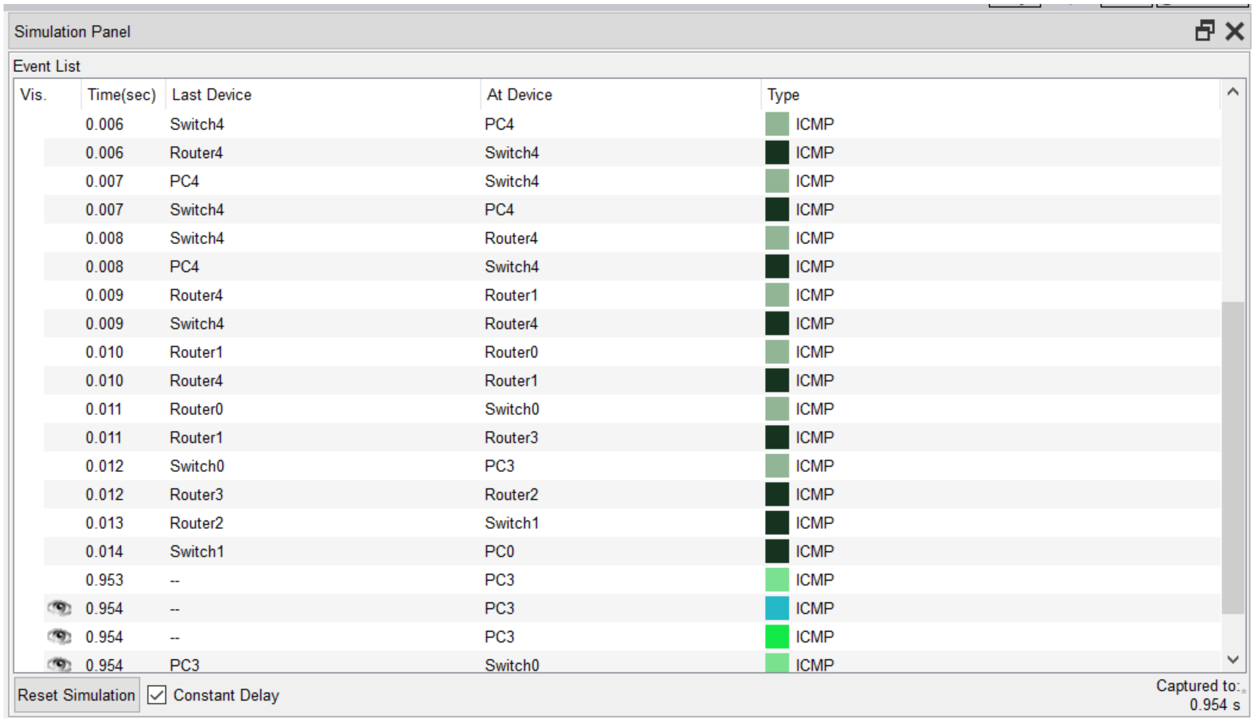
This configures the Router-4 via the rip command and then making it able to receive packets from other routers connected from further hops.

Observation:

After setting up the RIP routing algorithm if Serial port Se3/0 of Router 4 is switched off then what are the changes occurred in Routing information of the routers.



Vis.	Time(sec)	Last Device	At Device	Type
	0.000	--	PC3	🟩 ICMP
	0.000	--	PC0	⬛ ICMP
	0.001	PC3	Switch0	🟩 ICMP
	0.001	PC0	Switch1	⬛ ICMP
	0.002	Switch0	Router0	🟩 ICMP
	0.002	Switch1	Router2	⬛ ICMP
	0.003	Router0	Router1	🟩 ICMP
	0.003	Router2	Router0	⬛ ICMP
	0.004	Router1	Router4	🟩 ICMP
	0.004	Router0	Router1	⬛ ICMP
	0.005	Router4	Switch4	🟩 ICMP
	0.005	Router1	Router4	⬛ ICMP
	0.006	Switch4	PC4	🟩 ICMP
	0.006	Router4	Switch4	⬛ ICMP
	0.007	PC4	Switch4	🟩 ICMP
	0.007	Switch4	PC4	⬛ ICMP
	0.008	Switch4	Router4	🟩 ICMP
	0.008	PC4	Switch4	⬛ ICMP
	0.009	Router4	Router1	🟩 ICMP
	0.009	Switch4	Router4	⬛ ICMP



Vis.	Time(sec)	Last Device	At Device	Type
	0.006	Switch4	PC4	ICMP
	0.006	Router4	Switch4	ICMP
	0.007	PC4	Switch4	ICMP
	0.007	Switch4	PC4	ICMP
	0.008	Switch4	Router4	ICMP
	0.008	PC4	Switch4	ICMP
	0.009	Router4	Router1	ICMP
	0.009	Switch4	Router4	ICMP
	0.010	Router1	Router0	ICMP
	0.010	Router4	Router1	ICMP
	0.011	Router0	Switch0	ICMP
	0.011	Router1	Router3	ICMP
	0.012	Switch0	PC3	ICMP
	0.012	Router3	Router2	ICMP
	0.013	Router2	Switch1	ICMP
	0.014	Switch1	PC0	ICMP
	0.953	--	PC3	ICMP
👁	0.954	--	PC3	ICMP
👁	0.954	--	PC3	ICMP
👁	0.954	PC3	Switch0	ICMP

When Seial port 3/0 is turned off the most crucial observation is how packets are dispatched from PC0 to PC4. The direct route via Router3 to Router 4 is no longer available but since the the path from Router1 to Router4 is still active we can observe that the packet is dispatched from PC0 to Router2 and then it travels to Router0 since it knows that direct route from Router2 to Router3 to Router4 is no longer available. It then travels from Router0 to Router1 and then it moves to Router4 using the alternate path that takes a greater number of hops. The routing table automatically configured the next best path since the current best path was no longer feasible.

Challenges:

The biggest challenge for me was figuring out that the IP addresses assigned to the serial ports had to be consistent and I kept on getting errors since they weren't. An example of this issue was for instance I was trying to configure the DCE end of router4 as 26.0.0.1 and router3 was 24.0.0.2. This caused unusual errors as the packets weren't reaching the destination and then I realized that for rip the network ID is taken to route the packets from one router to the next so for 26.0.0.1 and 26.0.0.2 was needed instead with the network ID configured using the rip command being 26.0.0.0. This caused the simulation to work as the packets were routed as per the broadcast address for 26.0.0.0 before the routing algorithm runs and creates the best possible path using the dynamic routing approach. The other challenge was that I couldn't initially figure out why the connection between some routers and switches weren't working initially and then I figured out that in the pkt file we were provided some of the router switch connections weren't turned on when I turned them on the packets were being properly dispatched between the source and the destination. I still struggle with figuring out how the best path is determined as sometimes paths with the same hop count seem to be treated differently, I assume that this may be due to network congestion issues.