



# Configuration of Dynamic Routing using RIP and OSPF

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# 1 Objectives

- Familiarization with dynamic routing.
- Configuring dynamic routing using RIP and OSPF.
- Observe how dynamic routing can address changing network topology automatically.

## 2 Required Tools

### 2.1 Cisco Packet Tracer

Cisco Packet Tracer is a visual simulation software developed and distributed by Cisco Systems. Packet Tracer is a cross platform tool that allows simulated environment for modern computer network and network topologies.

## 3 Simulation Activities

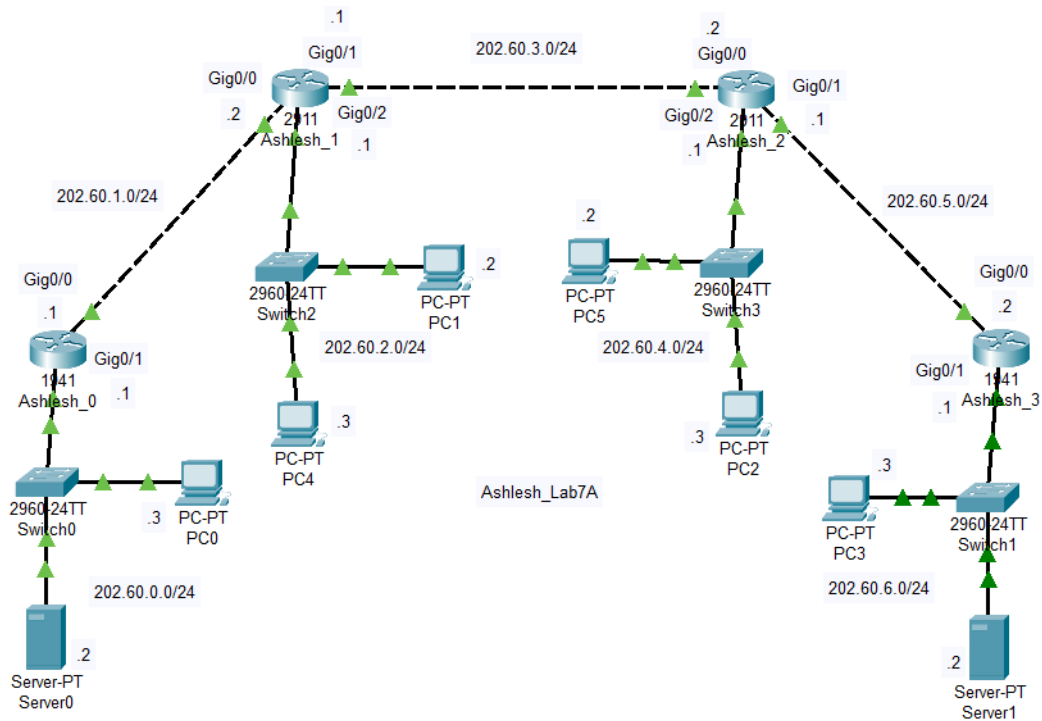


Figure 1: Simulated network for Activity A

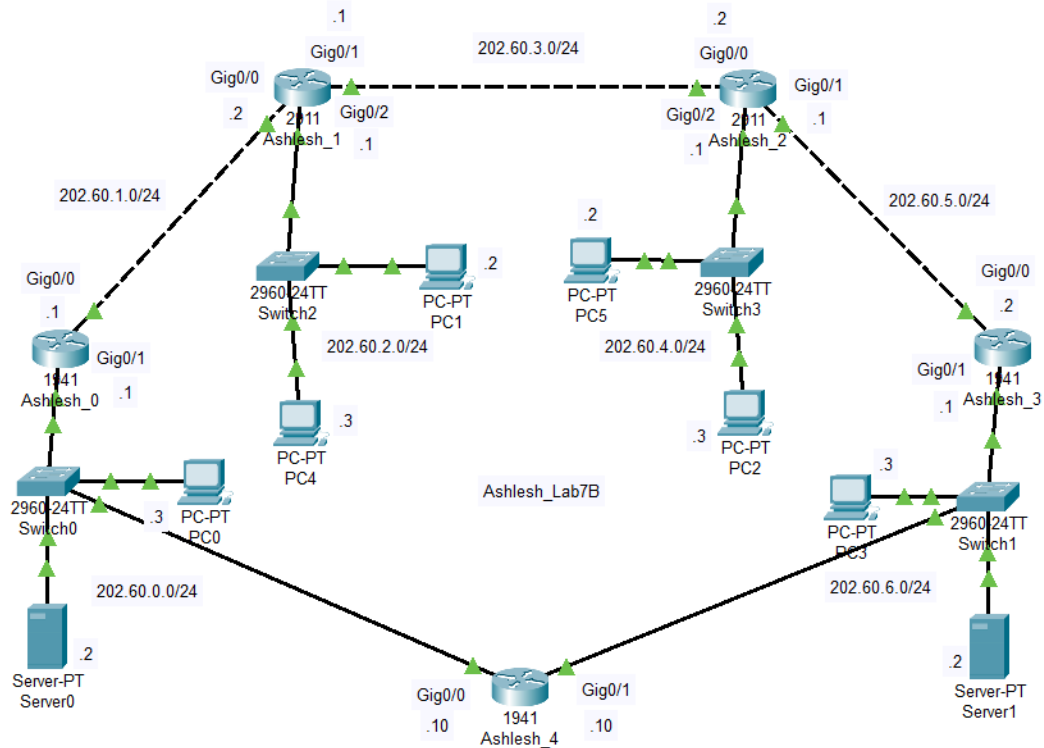


Figure 2: Simulated network for Activity B

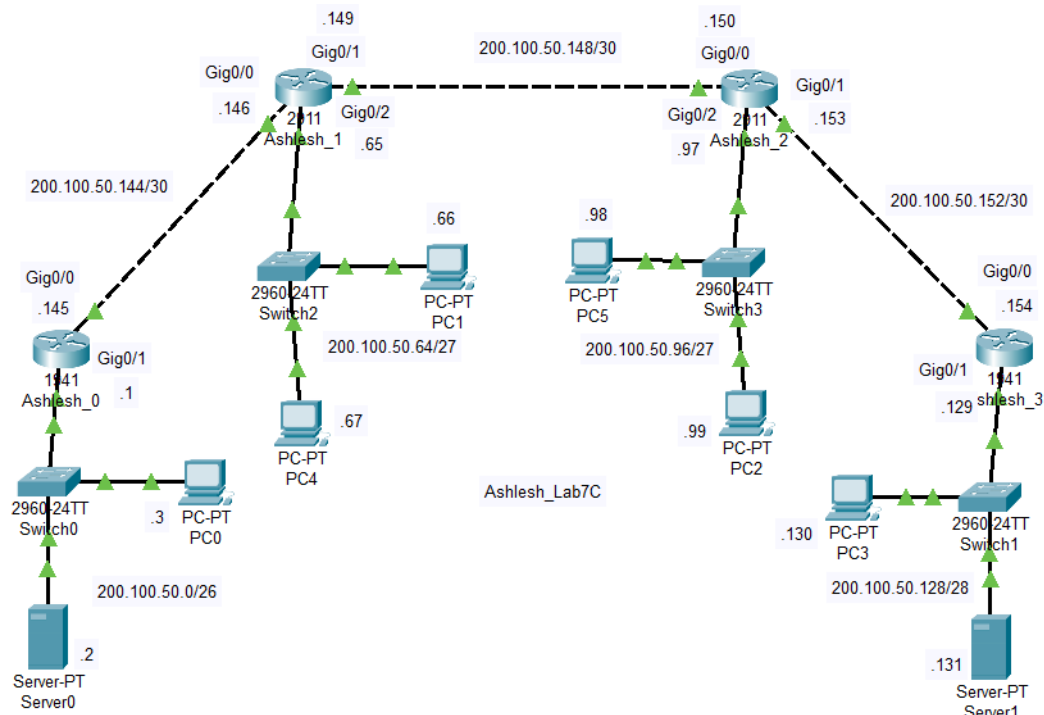


Figure 3: Simulated network for Activity C

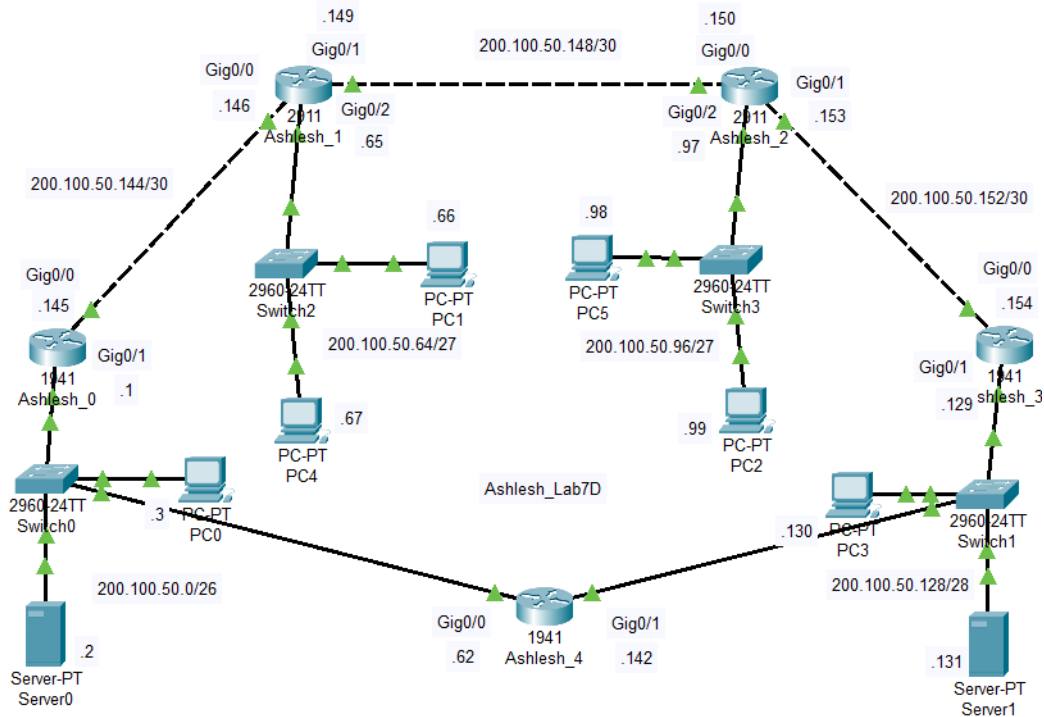


Figure 4: Simulated network for Activity D

## 4 Exercises

### Problem 1

**What is dynamic routing? How it differs with static routing? Explain briefly.**

Dynamic routing is a networking technique used for managing routing tables where updates in the network topologies are reflected in the routing table automatically. This is possible with the routing information being shared between adjacent routers such that any changes to the network are advertized according to the different protocols and are responsible for routing table updates.

It is different than static routing methods based on the following points,

Category	Static Routing	Dynamic Routing
Protocols used	May not follow any protocol.	Follows protocols such as OSPF, RIP, BGP etc.
Adaptability	Routes are user defined, so don't adapt to network changes.	Routes adapt as per the changes in the network.
Security	Highly secure.	Less secure.
Applications	Smaller networks with less routes to be defined by the administrator.	Larger networks with frequently changing links.
Resources	No additional resources needed for application.	Memory, bandwidth and other resources consumed during application.
Shortest path algorithm	Not applied.	Different algorithms based on protocols are applied for shortest route detection.

Table 1: Difference between Static Routing and Dynamic Routing

### Problem 2

List out the dynamic routing configuration commands (used during the lab experiment) of router with their syntax and examples.

#### RIP Configuration

```
Router(config)# router rip
Router(config-router)# network network-identifier
```

Example:

```
Router(config)# router rip
Router(config-router)# network 202.60.0.0
Router(config-router)# network 202.60.1.0
```

Listing 1: Syntax for configuring RIP

#### OSPF Configuration

```
Router(config)# router ospf process-id
Router(config-router)# network network-identifier wildcard-mask area area-id
```

Example:

```
Router(config)# router ospf 1
Router(config-router)# network 200.100.50.0 0.0.0.63 area 0
Router(config-router)# network 200.100.50.144 0.0.0.3 area 0
```

Listing 2: Syntax for configuring OSPF

### Problem 3

Note down the observations of each steps with necessary commands specified in the activities mentioned in the lab sheet and comment on the result by explaining the reason in detail.

To avoid repeated lines on the observations for *show ip route* command, the codes for different kinds of routes are mentioned as,

```
Codes: L - local, C - connected, S - static, 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
```

Listing 3: Codes for different types of route included in show ip route

### a. Activity A

#### Sub activity 1

Router	hostname	console password	enable password	vtty password
0	Ashlesh_0	ashlesh	407	pandey
1	Ashlesh_1			
2	Ashlesh_2			
3	Ashlesh_3			

Table 2: Configuration parameters for routers

#### Sub activity 2

Gigabitethernet interfaces	IP address	Subnet mask
Router 0: 0/0	202.60.1.1	255.255.255.0
Router 0: 0/1	202.60.0.1	255.255.255.0
Router 1: 0/0	202.60.1.2	255.255.255.0
Router 1: 0/1	202.60.3.1	255.255.255.0
Router 1: 0/2	202.60.2.1	255.255.255.0
Router 2: 0/0	202.60.3.2	255.255.255.0
Router 2: 0/1	202.60.5.1	255.255.255.0
Router 2: 0/2	202.60.4.1	255.255.255.0
Router 3: 0/0	202.60.5.2	255.255.255.0
Router 3: 0/1	202.60.6.1	255.255.255.0

Note: The interfaces are marked on Figure 1.

Table 3: IP address and subnet masks for the gigabitethernet interfaces on the routers

#### Sub activity 3

Device	IP address	Subnet mask
PC0	202.60.0.3	255.255.255.0
PC1	202.60.2.2	255.255.255.0
PC2	202.60.4.3	255.255.255.0
PC3	202.60.6.3	255.255.255.0
PC4	202.60.2.3	255.255.255.0
PC5	202.60.4.2	255.255.255.0
Server0	202.60.0.2	255.255.255.0
Server1	202.60.6.2	255.255.255.0

Note: The ip addressess and subnet masks are set using the IP configuration application. The default gateways for the PCs and servers were also set as, PC0 and Server0: 202.60.0.1, PC1 and PC4: 202.60.2.1, PC2 and PC5: 202.60.4.1, PC3 and Server1: 202.60.6.1

Table 4: IP address and subnet masks for the PCs and servers in the network

#### Sub activity 4

Telnet was enabled in sub activity 1 while configuring the vty terminal password.

#### Sub activity 5

```
Ashlesh_0#show ip route
Gateway of last resort is not set

    202.60.0.0/24 is variably subnetted, 2 subnets, 2 masks
C       202.60.0.0/24 is directly connected, GigabitEthernet0/1
L       202.60.0.1/32 is directly connected, GigabitEthernet0/1
    202.60.1.0/24 is variably subnetted, 2 subnets, 2 masks
C       202.60.1.0/24 is directly connected, GigabitEthernet0/0
L       202.60.1.1/32 is directly connected, GigabitEthernet0/0
```

Listing 4: Observation for show ip route on Router 0

```
Ashlesh_1#show ip route
Gateway of last resort is not set

    202.60.1.0/24 is variably subnetted, 2 subnets, 2 masks
C       202.60.1.0/24 is directly connected, GigabitEthernet0/0
L       202.60.1.2/32 is directly connected, GigabitEthernet0/0
    202.60.2.0/24 is variably subnetted, 2 subnets, 2 masks
C       202.60.2.0/24 is directly connected, GigabitEthernet0/2
L       202.60.2.1/32 is directly connected, GigabitEthernet0/2
    202.60.3.0/24 is variably subnetted, 2 subnets, 2 masks
C       202.60.3.0/24 is directly connected, GigabitEthernet0/1
L       202.60.3.1/32 is directly connected, GigabitEthernet0/1
```

Listing 5: Observation for show ip route on Router 1

```
Ashlesh_2#show ip route
Gateway of last resort is not set

    202.60.3.0/24 is variably subnetted, 2 subnets, 2 masks
C       202.60.3.0/24 is directly connected, GigabitEthernet0/0
L       202.60.3.2/32 is directly connected, GigabitEthernet0/0
    202.60.4.0/24 is variably subnetted, 2 subnets, 2 masks
C       202.60.4.0/24 is directly connected, GigabitEthernet0/2
L       202.60.4.1/32 is directly connected, GigabitEthernet0/2
    202.60.5.0/24 is variably subnetted, 2 subnets, 2 masks
C       202.60.5.0/24 is directly connected, GigabitEthernet0/1
L       202.60.5.1/32 is directly connected, GigabitEthernet0/1
```

Listing 6: Observation for show ip route on Router 2

```
Ashlesh_3#show ip route
Gateway of last resort is not set

    202.60.5.0/24 is variably subnetted, 2 subnets, 2 masks
C       202.60.5.0/24 is directly connected, GigabitEthernet0/0
L       202.60.5.2/32 is directly connected, GigabitEthernet0/0
    202.60.6.0/24 is variably subnetted, 2 subnets, 2 masks
C       202.60.6.0/24 is directly connected, GigabitEthernet0/1
L       202.60.6.1/32 is directly connected, GigabitEthernet0/1
```

Listing 7: Observation for show ip route on Router 3

### Sub activity 6

Sending Host	Destination	Ping status
PC0	PC0 Server0	Successful
	PC1 PC4 PC2 PC5 PC3 Server1	Destination host unreachable
	Router0: 0/0 Router0: 0/1	Successful
	Router1: 0/0	Request timed out
	Router1: 0/1 Router1: 0/2 Router2: 0/0 Router2: 0/1 Router2: 0/2 Router3: 0/0 Router3: 0/1	Destination host unreachable

Table 5: Observation for ping tests from PC0 to other PCs, servers and router interfaces



**Sub activity 7**

Sending Host	Destination	Ping status
PC1	PC0 Server0	Destination host unreachable
	PC1 PC4	Successful
	PC2 PC5 PC3 Server1	Destination host unreachable
	Router0: 0/0	Request timed out
	Router0: 0/1	Destination host unreachable
	Router1: 0/0 Router1: 0/1 Router1: 0/2	Successful
	Router2: 0/0	Request timed out
	Router2: 0/1 Router2: 0/2 Router3: 0/0 Router3: 0/1	Destination host unreachable

Table 6: Observation for ping tests from PC1 to other PCs, servers and router interfaces

**Sub activity 8**

Sending Host	Destination	Ping status
PC2	PC0 Server0 PC1 PC4	Destination host unreachable
	PC2 PC5	Successful
	PC3 Server1 Router0: 0/0 Router0: 0/1 Router1: 0/0	Destination host unreachable
	Router1: 0/1	Request timed out
	Router1: 0/2	Destination host unreachable
	Router2: 0/0 Router2: 0/1 Router2: 0/2	Successful
	Router3: 0/0	Request timed out
	Router3: 0/1	Destination host unreachable

Table 7: Observation for ping tests from PC2 to other PCs, servers and router interfaces

Sending Host	Destination	Ping status
PC3	PC0	Destination host unreachable
	Server0	
	PC1	
	PC4	
	PC2	
	PC5	
	PC3	Successful
	Server1	
	Router0: 0/0 Router0: 0/1 Router1: 0/0 Router1: 0/1 Router1: 0/2 Router2: 0/0	Destination host unreachable
	Router2: 0/1	
	Router2: 0/2	
	Router3: 0/0 Router3: 0/1	Successful

Table 8: Observation for ping tests from PC3 to other PCs, servers and router interfaces

Sending Host	Destination	Ping status
Router 0	PC0	Successful
	Server0	
	PC1	Failed
	PC4	
	PC2	
	PC5	
	PC3	
	Server1	
	Router1: 0/0	Successful
	Router1: 0/1 Router1: 0/2 Router2: 0/0 Router2: 0/1 Router2: 0/2 Router3: 0/0 Router3: 0/1	Failed

Table 9: Observation for ping tests from Router 0 to other PCs, servers and router interfaces

Sending Host	Destination	Ping status
Router 1	PC0 Server0	Failed
	PC1 PC4	Successful
	PC2 PC5 PC3 Server1	Failed
	Router0: 0/0	Successful
	Router0: 0/1	Failed
	Router2: 0/0	Successful
	Router2: 0/1 Router2: 0/2 Router3: 0/0 Router3: 0/1	Failed

Table 10: Observation for ping tests from Router 1 to other PCs, servers and router interfaces

Sending Host	Destination	Ping status
Router 2	PC0 Server0 PC1 PC4	Failed
	PC2 PC5	Successful
	PC3 Server1	Failed
	Router0: 0/0 Router0: 0/1 Router1: 0/0	Failed
	Router1: 0/1	Successful
	Router1: 0/2	Failed
	Router3: 0/0	Successful
	Router3: 0/1	Failed

Table 11: Observation for ping tests from Router 2 to other PCs, servers and router interfaces

Sending Host	Destination	Ping status
Router 3	PC0	Failed
	Server0	
	PC1	
	PC4	
	PC2	
	PC5	
	PC3	Successful
	Server1	
	Router0: 0/0	Failed
	Router0: 0/1	
	Router1: 0/0	
	Router1: 0/1	
	Router1: 0/2	
	Router2: 0/0	
	Router2: 0/1	Successful
	Router2: 0/2	Failed

Table 12: Observation for ping tests from Router 3 to other PCs, servers and router interfaces

### Sub activity 9

```
C:\>telnet 202.60.0.1
Trying 202.60.0.1 ...Open

User Access Verification

Password:
Ashlesh_0>enable
Password:
Ashlesh_0#config terminal
Ashlesh_0(config)#router rip
Ashlesh_0(config-router)#network 202.60.0.0
Ashlesh_0(config-router)#network 202.60.1.0
Ashlesh_0(config-router)#exit
Ashlesh_0(config)#exit
Ashlesh_0#
```

Listing 8: Configuring RIP on Router 0 using telnet from PC0

### Sub activity 10

```
Ashlesh_0#telnet 202.60.1.2
Trying 202.60.1.2 ...Open
```

```
User Access Verification

Password:
Ashlesh_1>enable
Password:
Ashlesh_1#config terminal
Ashlesh_1(config)#router rip
Ashlesh_1(config-router)#network 202.60.1.0
Ashlesh_1(config-router)#network 202.60.2.0
Ashlesh_1(config-router)#network 202.60.3.0
Ashlesh_1(config-router)#exit
Ashlesh_1(config)#exit
Ashlesh_1#
```

Listing 9: Configuring RIP on Router 1 using telnet from Router 0

### Sub activity 11

```
Ashlesh_1#telnet 202.60.3.2
Trying 202.60.3.2 ...Open

User Access Verification

Password:
Ashlesh_2>enable
Password:
Ashlesh_2#config terminal
Ashlesh_2(config)#router rip
Ashlesh_2(config-router)#network 202.60.3.0
Ashlesh_2(config-router)#network 202.60.4.0
Ashlesh_2(config-router)#network 202.60.5.0
Ashlesh_2(config-router)#exit
Ashlesh_2(config)#exit
Ashlesh_2#
```

Listing 10: Configuring RIP on Router 2 using telnet from Router 1

```
Ashlesh_2#telnet 202.60.5.2
Trying 202.60.5.2 ...Open

User Access Verification

Password:
Ashlesh_3>enable
Password:
Ashlesh_3#config terminal
```

```
Ashlesh_3(config)#router rip
Ashlesh_3(config-router)#network 202.60.5.0
Ashlesh_3(config-router)#network 202.60.6.0
Ashlesh_3(config-router)#exit
Ashlesh_3(config)#exit
Ashlesh_3#exit

[Connection to 202.60.5.2 closed by foreign host]
Ashlesh_2#exit

[Connection to 202.60.3.2 closed by foreign host]
Ashlesh_1#exit

[Connection to 202.60.1.2 closed by foreign host]
Ashlesh_0#exit

[Connection to 202.60.0.1 closed by foreign host]
C:\>
```

Listing 11: Configuring RIP on Router 3 using telnet from Router 2

### Sub activity 12

```
Ashlesh_0#show ip route
Gateway of last resort is not set

    202.60.0.0/24 is variably subnetted, 2 subnets, 2 masks
C       202.60.0.0/24 is directly connected, GigabitEthernet0/1
L       202.60.0.1/32 is directly connected, GigabitEthernet0/1
    202.60.1.0/24 is variably subnetted, 2 subnets, 2 masks
C       202.60.1.0/24 is directly connected, GigabitEthernet0/0
L       202.60.1.1/32 is directly connected, GigabitEthernet0/0
R       202.60.2.0/24 [120/1] via 202.60.1.2, 00:00:14, GigabitEthernet0/0
R       202.60.3.0/24 [120/1] via 202.60.1.2, 00:00:14, GigabitEthernet0/0
R       202.60.4.0/24 [120/2] via 202.60.1.2, 00:00:14, GigabitEthernet0/0
R       202.60.5.0/24 [120/2] via 202.60.1.2, 00:00:14, GigabitEthernet0/0
R       202.60.6.0/24 [120/3] via 202.60.1.2, 00:00:14, GigabitEthernet0/0
```

Listing 12: Observation for show ip route on Router 0

```
Ashlesh_1#show ip route
Gateway of last resort is not set

R       202.60.0.0/24 [120/1] via 202.60.1.1, 00:00:15, GigabitEthernet0/0
    202.60.1.0/24 is variably subnetted, 2 subnets, 2 masks
C       202.60.1.0/24 is directly connected, GigabitEthernet0/0
L       202.60.1.2/32 is directly connected, GigabitEthernet0/0
    202.60.2.0/24 is variably subnetted, 2 subnets, 2 masks
```

```

C      202.60.2.0/24 is directly connected, GigabitEthernet0/2
L      202.60.2.1/32 is directly connected, GigabitEthernet0/2
      202.60.3.0/24 is variably subnetted, 2 subnets, 2 masks
C      202.60.3.0/24 is directly connected, GigabitEthernet0/1
L      202.60.3.1/32 is directly connected, GigabitEthernet0/1
R      202.60.4.0/24 [120/1] via 202.60.3.2, 00:00:03, GigabitEthernet0/1
R      202.60.5.0/24 [120/1] via 202.60.3.2, 00:00:03, GigabitEthernet0/1
R      202.60.6.0/24 [120/2] via 202.60.3.2, 00:00:03, GigabitEthernet0/1

```

Listing 13: Observation for show ip route on Router 1

```

Ashlesh_2#show ip route
Gateway of last resort is not set

R      202.60.0.0/24 [120/2] via 202.60.3.1, 00:00:03, GigabitEthernet0/0
R      202.60.1.0/24 [120/1] via 202.60.3.1, 00:00:03, GigabitEthernet0/0
R      202.60.2.0/24 [120/1] via 202.60.3.1, 00:00:03, GigabitEthernet0/0
      202.60.3.0/24 is variably subnetted, 2 subnets, 2 masks
C      202.60.3.0/24 is directly connected, GigabitEthernet0/0
L      202.60.3.2/32 is directly connected, GigabitEthernet0/0
      202.60.4.0/24 is variably subnetted, 2 subnets, 2 masks
C      202.60.4.0/24 is directly connected, GigabitEthernet0/2
L      202.60.4.1/32 is directly connected, GigabitEthernet0/2
      202.60.5.0/24 is variably subnetted, 2 subnets, 2 masks
C      202.60.5.0/24 is directly connected, GigabitEthernet0/1
L      202.60.5.1/32 is directly connected, GigabitEthernet0/1
R      202.60.6.0/24 [120/1] via 202.60.5.2, 00:00:02, GigabitEthernet0/1

```

Listing 14: Observation for show ip route on Router 2

```

Ashlesh_3#show ip route
Gateway of last resort is not set

R      202.60.0.0/24 [120/3] via 202.60.5.1, 00:00:26, GigabitEthernet0/0
R      202.60.1.0/24 [120/2] via 202.60.5.1, 00:00:26, GigabitEthernet0/0
R      202.60.2.0/24 [120/2] via 202.60.5.1, 00:00:26, GigabitEthernet0/0
R      202.60.3.0/24 [120/1] via 202.60.5.1, 00:00:26, GigabitEthernet0/0
R      202.60.4.0/24 [120/1] via 202.60.5.1, 00:00:26, GigabitEthernet0/0
      202.60.5.0/24 is variably subnetted, 2 subnets, 2 masks
C      202.60.5.0/24 is directly connected, GigabitEthernet0/0
L      202.60.5.2/32 is directly connected, GigabitEthernet0/0
      202.60.6.0/24 is variably subnetted, 2 subnets, 2 masks
C      202.60.6.0/24 is directly connected, GigabitEthernet0/1
L      202.60.6.1/32 is directly connected, GigabitEthernet0/1

```

Listing 15: Observation for show ip route on Router 3

The routing tables shown in Listings 12 to 15 are different than that in Listings 4 to 7. There are additional routes rather than just the local and connected ones. The routes configured using RIP are denoted with R

in the table. Although only the adjacent networks were explicitly included during the RIP configuration, other networks are also learnt by individual routers with properly via links to these networks based on the neighbouring router's routing information. For instance, there are routes configured/learnt with RIP for all networks in Router 0 with the routes going through 202.60.1.2.

```
C:\>ping 202.60.2.2

Pinging 202.60.2.2 with 32 bytes of data:

Reply from 202.60.2.2: bytes=32 time=1ms TTL=126
Reply from 202.60.2.2: bytes=32 time<1ms TTL=126
Reply from 202.60.2.2: bytes=32 time<1ms TTL=126
Reply from 202.60.2.2: bytes=32 time<1ms TTL=126

Ping statistics for 202.60.2.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 1ms, Average = 0ms
```

Listing 16: Observation for ping test from PC0 to PC1

```
C:\>ping 202.60.4.3

Pinging 202.60.4.3 with 32 bytes of data:

Reply from 202.60.4.3: bytes=32 time<1ms TTL=125
Reply from 202.60.4.3: bytes=32 time=2ms TTL=125
Reply from 202.60.4.3: bytes=32 time<1ms TTL=125
Reply from 202.60.4.3: bytes=32 time<1ms TTL=125

Ping statistics for 202.60.4.3:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 2ms, Average = 0ms
```

Listing 17: Observation for ping test from PC0 to PC2

```
C:\>ping 202.60.4.3

Pinging 202.60.4.3 with 32 bytes of data:

Reply from 202.60.4.3: bytes=32 time<1ms TTL=126
Reply from 202.60.4.3: bytes=32 time<1ms TTL=126
Reply from 202.60.4.3: bytes=32 time<1ms TTL=126
Reply from 202.60.4.3: bytes=32 time<1ms TTL=126

Ping statistics for 202.60.4.3:
```



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

Listing 18: Observation for ping test from PC1 to PC2

```
C:\>ping 202.60.6.3

Pinging 202.60.6.3 with 32 bytes of data:

Reply from 202.60.6.3: bytes=32 time<1ms TTL=125
Reply from 202.60.6.3: bytes=32 time<1ms TTL=125
Reply from 202.60.6.3: bytes=32 time<1ms TTL=125
Reply from 202.60.6.3: bytes=32 time<1ms TTL=125

Ping statistics for 202.60.6.3:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms
```

Listing 19: Observation for ping test from PC1 to PC3

```
C:\>ping 202.60.6.3

Pinging 202.60.6.3 with 32 bytes of data:

Reply from 202.60.6.3: bytes=32 time=1ms TTL=126
Reply from 202.60.6.3: bytes=32 time<1ms TTL=126
Reply from 202.60.6.3: bytes=32 time<1ms TTL=126
Reply from 202.60.6.3: bytes=32 time<1ms TTL=126

Ping statistics for 202.60.6.3:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 1ms, Average = 0ms
```

Listing 20: Observation for ping test from PC2 to PC3

```
C:\>ping 202.60.0.3

Pinging 202.60.0.3 with 32 bytes of data:

Reply from 202.60.0.3: bytes=32 time=1ms TTL=124
Reply from 202.60.0.3: bytes=32 time<1ms TTL=124
Reply from 202.60.0.3: bytes=32 time<1ms TTL=124
Reply from 202.60.0.3: bytes=32 time<1ms TTL=124
```

```
Ping statistics for 202.60.0.3:
  Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
  Minimum = 0ms, Maximum = 1ms, Average = 0ms
```

Listing 21: Observation for ping test from PC3 to PC0

Sending Host	Destination	Ping status
PC0 or PC1 or PC2 or PC3	PC0	Successful
	Server0	
	PC1	
	PC4	
	PC2	
	PC5	
	PC3	
	Server1	
	Router0: 0/0	
	Router0: 0/1	
	Router1: 0/0	
	Router1: 0/1	
	Router1: 0/2	
	Router2: 0/0	
	Router2: 0/1	
	Router2: 0/2	
	Router3: 0/0	
	Router3: 0/1	

Table 13: Observation for ping tests from PC0, PC1, PC2 and PC3 to other PCs, servers and router interfaces

Sending Host	Destination	Ping status
Router 0	PC0	Successful
	Server0	
	PC1	
	PC4	
	PC2	
	PC5	
	PC3	
	Server1	
	Router1: 0/0	
	Router1: 0/1	
	Router1: 0/2	
	Router2: 0/0	
	Router2: 0/1	
	Router2: 0/2	
	Router3: 0/0	
	Router3: 0/1	

Table 14: Observation for ping tests from Router 0 to other PCs, servers and router interfaces

Sending Host	Destination	Ping status
Router 1	PC0	Successful
	Server0	
	PC1	
	PC4	
	PC2	
	PC5	
	PC3	
	Server1	
	Router0: 0/0	
	Router0: 0/1	
	Router2: 0/0	
	Router2: 0/1	
	Router2: 0/2	
	Router3: 0/0	
	Router3: 0/1	

Table 15: Observation for ping tests from Router 1 to other PCs, servers and router interfaces

Sending Host	Destination	Ping status
Router 2	PC0	Successful
	Server0	
	PC1	
	PC4	
	PC2	
	PC5	
	PC3	
	Server1	
	Router0: 0/0	
	Router0: 0/1	
	Router1: 0/0	
	Router1: 0/1	
	Router1: 0/2	
	Router3: 0/0	
	Router3: 0/1	

Table 16: Observation for ping tests from Router 2 to other PCs, servers and router interfaces

Sending Host	Destination	Ping status
Router 3	PC0	Successful
	Server0	
	PC1	
	PC4	
	PC2	
	PC5	
	PC3	
	Server1	
	Router0: 0/0	
	Router0: 0/1	
	Router1: 0/0	
	Router1: 0/1	
	Router1: 0/2	
	Router2: 0/0	
	Router2: 0/1	
	Router2: 0/2	

Table 17: Observation for ping tests from Router 3 to other PCs, servers and router interfaces

### Sub activity 13

```
C:\>tracert 202.60.2.2

Tracing route to 202.60.2.2 over a maximum of 30 hops:

  1    1 ms      0 ms      0 ms      202.60.0.1
  2    0 ms      0 ms      0 ms      202.60.1.2
  3    0 ms      0 ms      0 ms      202.60.2.2

Trace complete.
```

Listing 22: Observation for tracert from PC0 to PC1

```
C:\>tracert 202.60.4.3

Tracing route to 202.60.4.3 over a maximum of 30 hops:

  1    0 ms      0 ms      0 ms      202.60.0.1
  2    0 ms      0 ms      0 ms      202.60.1.2
  3    1 ms      0 ms      0 ms      202.60.3.2
  4    0 ms      0 ms      0 ms      202.60.4.3

Trace complete.
```

Listing 23: Observation for tracert from PC0 to PC2

```
C:\>tracert 202.60.6.3

Tracing route to 202.60.6.3 over a maximum of 30 hops:

  1    0 ms      0 ms      0 ms      202.60.0.1
  2    0 ms      0 ms      0 ms      202.60.1.2
  3    0 ms      0 ms      0 ms      202.60.3.2
  4    0 ms      0 ms      0 ms      202.60.5.2
  5    0 ms      0 ms      0 ms      202.60.6.3

Trace complete.
```

Listing 24: Observation for tracert from PC0 to PC3

```
C:\>tracert 202.60.0.3

Tracing route to 202.60.0.3 over a maximum of 30 hops:

  1    1 ms      0 ms      0 ms      202.60.2.1
  2    0 ms      0 ms      0 ms      202.60.1.1
  3    2 ms      0 ms      0 ms      202.60.0.3

Trace complete.
```

Listing 25: Observation for tracert from PC1 to PC0

```
C:\>tracert 202.60.4.3

Tracing route to 202.60.4.3 over a maximum of 30 hops:

  1    1 ms      0 ms      0 ms      202.60.2.1
  2    0 ms      0 ms      0 ms      202.60.3.2
  3    0 ms      0 ms      0 ms      202.60.4.3

Trace complete.
```

Listing 26: Observation for tracert from PC1 to PC2

```
C:\>tracert 202.60.6.3

Tracing route to 202.60.6.3 over a maximum of 30 hops:

  1    0 ms      0 ms      0 ms      202.60.2.1
  2    0 ms      0 ms      0 ms      202.60.3.2
  3    0 ms      0 ms      0 ms      202.60.5.2
  4    0 ms      0 ms      0 ms      202.60.6.3
```

```
Trace complete.
```

Listing 27: Observation for tracert from PC1 to PC3

```
C:\>tracert 202.60.0.3

Tracing route to 202.60.0.3 over a maximum of 30 hops:

  1    0 ms      0 ms      0 ms      202.60.4.1
  2    0 ms      0 ms      0 ms      202.60.3.1
  3    0 ms      0 ms      0 ms      202.60.1.1
  4    0 ms      0 ms      0 ms      202.60.0.3

Trace complete.
```

Listing 28: Observation for tracert from PC2 to PC0

```
C:\>tracert 202.60.2.2

Tracing route to 202.60.2.2 over a maximum of 30 hops:

  1    0 ms      0 ms      1 ms      202.60.4.1
  2    0 ms      0 ms      0 ms      202.60.3.1
  3    0 ms      0 ms      0 ms      202.60.2.2

Trace complete.
```

Listing 29: Observation for tracert from PC2 to PC1

```
C:\>tracert 202.60.6.3

Tracing route to 202.60.6.3 over a maximum of 30 hops:

  1    0 ms      0 ms      0 ms      202.60.4.1
  2    2 ms      0 ms      0 ms      202.60.5.2
  3    0 ms      0 ms      0 ms      202.60.6.3

Trace complete.
```

Listing 30: Observation for tracert from PC2 to PC3

```
C:\>tracert 202.60.0.3

Tracing route to 202.60.0.3 over a maximum of 30 hops:
```

```

1    0 ms      0 ms      0 ms      202.60.6.1
2    1 ms      0 ms      0 ms      202.60.5.1
3    0 ms      0 ms      0 ms      202.60.3.1
4    0 ms      0 ms      0 ms      202.60.1.1
5    1 ms      1 ms      0 ms      202.60.0.3

Trace complete.

```

Listing 31: Observation for tracert from PC3 to PC0

```

C:\>tracert 202.60.2.2

Tracing route to 202.60.2.2 over a maximum of 30 hops:

 1    0 ms      0 ms      1 ms      202.60.6.1
 2    0 ms      0 ms      0 ms      202.60.5.1
 3    0 ms      0 ms      0 ms      202.60.3.1
 4    0 ms      1 ms      0 ms      202.60.2.2

Trace complete.

```

Listing 32: Observation for tracert from PC3 to PC1

```

C:\>tracert 202.60.4.3

Tracing route to 202.60.4.3 over a maximum of 30 hops:

 1    0 ms      0 ms      0 ms      202.60.6.1
 2    0 ms      0 ms      0 ms      202.60.5.1
 3    0 ms      0 ms      0 ms      202.60.4.3

Trace complete.

```

Listing 33: Observation for tracert from PC3 to PC2

## b. Activity B

A new router, Router 4 is added between Switch 0 and Switch 1 to increase reliability. The interfaces were configured as mentioned in Figure 2.

```

Ashlesh_4>enable
Ashlesh_4#config terminal
Ashlesh_4(config)#router rip
Ashlesh_4(config-router)#network 202.60.0.0
Ashlesh_4(config-router)#network 202.60.6.0
Ashlesh_4(config-router)#exit
Ashlesh_4(config)#exit

```

Ashlesh\_4#

Listing 34: Configuring RIP on Router 4 using CLI

### Sub activity 1

```
Ashlesh_0#show ip route
Gateway of last resort is not set

    202.60.0.0/24 is variably subnetted, 2 subnets, 2 masks
C       202.60.0.0/24 is directly connected, GigabitEthernet0/1
L       202.60.0.1/32 is directly connected, GigabitEthernet0/1
    202.60.1.0/24 is variably subnetted, 2 subnets, 2 masks
C       202.60.1.0/24 is directly connected, GigabitEthernet0/0
L       202.60.1.1/32 is directly connected, GigabitEthernet0/0
R       202.60.2.0/24 [120/1] via 202.60.1.2, 00:00:04, GigabitEthernet0/0
R       202.60.3.0/24 [120/1] via 202.60.1.2, 00:00:04, GigabitEthernet0/0
R       202.60.4.0/24 [120/2] via 202.60.1.2, 00:00:04, GigabitEthernet0/0
R       202.60.5.0/24 [120/2] via 202.60.1.2, 00:00:04, GigabitEthernet0/0
        [120/2] via 202.60.0.10,00:00:27, GigabitEthernet0/1
R       202.60.6.0/24 [120/1] via 202.60.0.10,00:00:27, GigabitEthernet0/1
```

Listing 35: Observation for show ip route on Router 0

```
Ashlesh_1#show ip route
Gateway of last resort is not set

R       202.60.0.0/24 [120/1] via 202.60.1.1, 00:00:28, GigabitEthernet0/0
    202.60.1.0/24 is variably subnetted, 2 subnets, 2 masks
C       202.60.1.0/24 is directly connected, GigabitEthernet0/0
L       202.60.1.2/32 is directly connected, GigabitEthernet0/0
    202.60.2.0/24 is variably subnetted, 2 subnets, 2 masks
C       202.60.2.0/24 is directly connected, GigabitEthernet0/2
L       202.60.2.1/32 is directly connected, GigabitEthernet0/2
    202.60.3.0/24 is variably subnetted, 2 subnets, 2 masks
C       202.60.3.0/24 is directly connected, GigabitEthernet0/1
L       202.60.3.1/32 is directly connected, GigabitEthernet0/1
R       202.60.4.0/24 [120/1] via 202.60.3.2, 00:00:25, GigabitEthernet0/1
R       202.60.5.0/24 [120/1] via 202.60.3.2, 00:00:25, GigabitEthernet0/1
R       202.60.6.0/24 [120/2] via 202.60.3.2, 00:00:25, GigabitEthernet0/1
        [120/2] via 202.60.1.1, 00:00:28, GigabitEthernet0/0
```

Listing 36: Observation for show ip route on Router 1

```
Ashlesh_2#show ip route
Gateway of last resort is not set
```



```
R    202.60.0.0/24 [120/2] via 202.60.3.1, 00:00:10, GigabitEthernet0/0
      [120/2] via 202.60.5.2, 00:00:02, GigabitEthernet0/1
R    202.60.1.0/24 [120/1] via 202.60.3.1, 00:00:10, GigabitEthernet0/0
R    202.60.2.0/24 [120/1] via 202.60.3.1, 00:00:10, GigabitEthernet0/0
      202.60.3.0/24 is variably subnetted, 2 subnets, 2 masks
C    202.60.3.0/24 is directly connected, GigabitEthernet0/0
L    202.60.3.2/32 is directly connected, GigabitEthernet0/0
      202.60.4.0/24 is variably subnetted, 2 subnets, 2 masks
C    202.60.4.0/24 is directly connected, GigabitEthernet0/2
L    202.60.4.1/32 is directly connected, GigabitEthernet0/2
      202.60.5.0/24 is variably subnetted, 2 subnets, 2 masks
C    202.60.5.0/24 is directly connected, GigabitEthernet0/1
L    202.60.5.1/32 is directly connected, GigabitEthernet0/1
R    202.60.6.0/24 [120/1] via 202.60.5.2, 00:00:02, GigabitEthernet0/1
```

Listing 37: Observation for show ip route on Router 2

```
Ashlesh_3#show ip route
Gateway of last resort is not set

R    202.60.0.0/24 [120/1] via 202.60.6.10,00:00:06, GigabitEthernet0/1
R    202.60.1.0/24 [120/2] via 202.60.5.1, 00:00:09, GigabitEthernet0/0
      [120/2] via 202.60.6.10,00:00:06, GigabitEthernet0/1
R    202.60.2.0/24 [120/2] via 202.60.5.1, 00:00:09, GigabitEthernet0/0
R    202.60.3.0/24 [120/1] via 202.60.5.1, 00:00:09, GigabitEthernet0/0
R    202.60.4.0/24 [120/1] via 202.60.5.1, 00:00:09, GigabitEthernet0/0
      202.60.5.0/24 is variably subnetted, 2 subnets, 2 masks
C    202.60.5.0/24 is directly connected, GigabitEthernet0/0
L    202.60.5.2/32 is directly connected, GigabitEthernet0/0
      202.60.6.0/24 is variably subnetted, 2 subnets, 2 masks
C    202.60.6.0/24 is directly connected, GigabitEthernet0/1
L    202.60.6.1/32 is directly connected, GigabitEthernet0/1
```

Listing 38: Observation for show ip route on Router 3

The routing tables shown in Listings 35 to 38 are different than that in Listings 12 to 15. There are additional routes for networks that go through the newly added router. For instance, there are two possible routes to the network 202.60.5.0/24 from Router 0, one through 202.60.1.2 and other through 202.60.0.10. This is due to the fact that both the routes have two hops in between the source and destination. In cases where one route has lesser hops than the other, only one of the routes is included. For instance, there is a route in Router 0's routing table to reach the network 202.60.6.0/24 that goes through 202.60.0.10. Although there is a possible lengthier route, it is removed once a route with lesser hops is detected.

## Sub activity 2

```
C:\>tracert 202.60.2.2

Tracing route to 202.60.2.2 over a maximum of 30 hops:
```

```

1    0 ms      0 ms      0 ms      202.60.0.1
2    0 ms      0 ms      3 ms      202.60.1.2
3   11 ms      0 ms     11 ms      202.60.2.2

Trace complete.

```

Listing 39: Observation for tracert from PC0 to PC1

```

C:\>tracert 202.60.4.3

Tracing route to 202.60.4.3 over a maximum of 30 hops:

 1    0 ms      0 ms      0 ms      202.60.0.1
 2    3 ms      0 ms     10 ms      202.60.1.2
 3   13 ms      0 ms      0 ms      202.60.5.1
 4    0 ms      0 ms     13 ms      202.60.4.3

Trace complete.

```

Listing 40: Observation for tracert from PC0 to PC2

```

C:\>tracert 202.60.6.3

Tracing route to 202.60.6.3 over a maximum of 30 hops:

 1    0 ms      0 ms      0 ms      202.60.0.1
 2    0 ms      0 ms      0 ms      202.60.0.10
 3   12 ms     12 ms     12 ms      202.60.6.3

Trace complete.

```

Listing 41: Observation for tracert from PC0 to PC3

```

C:\>tracert 202.60.0.3

Tracing route to 202.60.0.3 over a maximum of 30 hops:

 1    0 ms      0 ms      0 ms      202.60.2.1
 2    0 ms      0 ms      0 ms      202.60.1.1
 3   12 ms     10 ms     10 ms      202.60.0.3

Trace complete.

```

Listing 42: Observation for tracert from PC1 to PC0

```
C:\>tracert 202.60.4.3

Tracing route to 202.60.4.3 over a maximum of 30 hops:

  1    0 ms      0 ms      0 ms      202.60.2.1
  2    3 ms      5 ms      0 ms      202.60.3.2
  3    3 ms     12 ms     13 ms     202.60.4.3

Trace complete.
```

Listing 43: Observation for tracert from PC1 to PC2

```
C:\>tracert 202.60.6.3

Tracing route to 202.60.6.3 over a maximum of 30 hops:

  1    0 ms      0 ms      0 ms      202.60.2.1
  2    0 ms      0 ms      0 ms      202.60.3.2
  3   13 ms     14 ms      0 ms     202.60.0.10
  4   12 ms     12 ms      0 ms     202.60.6.3

Trace complete.
```

Listing 44: Observation for tracert from PC1 to PC3

```
C:\>tracert 202.60.0.3

Tracing route to 202.60.0.3 over a maximum of 30 hops:

  1    0 ms      0 ms      0 ms      202.60.4.1
  2    0 ms      0 ms      0 ms      202.60.5.2
  3   11 ms     13 ms     13 ms     202.60.1.1
  4   11 ms     18 ms     14 ms     202.60.0.3

Trace complete.
```

Listing 45: Observation for tracert from PC2 to PC0

```
C:\>tracert 202.60.2.2

Tracing route to 202.60.2.2 over a maximum of 30 hops:

  1    0 ms      0 ms      0 ms      202.60.4.1
  2    0 ms      0 ms      0 ms      202.60.3.1
  3    0 ms      0 ms      0 ms      202.60.2.2
```

```
Trace complete.
```

Listing 46: Observation for tracert from PC2 to PC1

```
C:\>tracert 202.60.6.3

Tracing route to 202.60.6.3 over a maximum of 30 hops:

  1    0 ms      0 ms      0 ms      202.60.4.1
  2    0 ms      0 ms      0 ms      202.60.5.2
  3    0 ms      0 ms      0 ms      202.60.6.3

Trace complete.
```

Listing 47: Observation for tracert from PC2 to PC3

```
C:\>tracert 202.60.0.3

Tracing route to 202.60.0.3 over a maximum of 30 hops:

  1    0 ms      0 ms      0 ms      202.60.6.1
  2    0 ms      0 ms      0 ms      202.60.6.10
  3    0 ms      0 ms      0 ms      202.60.0.3

Trace complete.
```

Listing 48: Observation for tracert from PC3 to PC0

```
C:\>tracert 202.60.2.2

Tracing route to 202.60.2.2 over a maximum of 30 hops:

  1    0 ms      0 ms      0 ms      202.60.6.1
  2    0 ms      0 ms      0 ms      202.60.5.1
  3    0 ms      0 ms      0 ms      202.60.1.2
  4    0 ms      0 ms      0 ms      202.60.2.2

Trace complete.
```

Listing 49: Observation for tracert from PC3 to PC1

```
C:\>tracert 202.60.4.3

Tracing route to 202.60.4.3 over a maximum of 30 hops:

  1    0 ms      0 ms      0 ms      202.60.6.1
```

```

2    0 ms      0 ms      0 ms      202.60.5.1
3    0 ms      0 ms      0 ms      202.60.4.3

Trace complete.

```

Listing 50: Observation for tracert from PC3 to PC2

### Sub activity 3 [Removing link between Router 0 and Router 1]

```

C:\>tracert 202.60.2.2

Tracing route to 202.60.2.2 over a maximum of 30 hops:

 1    0 ms      0 ms      3 ms      202.60.0.1
 2    0 ms      0 ms      0 ms      202.60.0.10
 3   14 ms     13 ms     12 ms     202.60.6.1
 4    0 ms     15 ms     12 ms     202.60.5.1
 5   12 ms     12 ms     15 ms     202.60.3.1
 6   10 ms     10 ms     13 ms     202.60.2.2

Trace complete.

```

Listing 51: Observation for tracert from PC0 to PC1

```

C:\>tracert 202.60.4.3

Tracing route to 202.60.4.3 over a maximum of 30 hops:

 1    1 ms      0 ms      0 ms      202.60.0.1
 2    0 ms      0 ms      0 ms      202.60.0.10
 3   14 ms      0 ms      0 ms      202.60.6.1
 4    0 ms     13 ms     16 ms     202.60.5.1
 5   13 ms     23 ms     12 ms     202.60.4.3

Trace complete.

```

Listing 52: Observation for tracert from PC0 to PC2

```
C:\>tracert 202.60.6.3

Tracing route to 202.60.6.3 over a maximum of 30 hops:

  1    0 ms      0 ms      0 ms      202.60.0.1
  2    0 ms      0 ms      0 ms      202.60.0.10
  3    0 ms      0 ms      0 ms      202.60.6.3

Trace complete.
```

Listing 53: Observation for tracert from PC0 to PC3

```
C:\>tracert 202.60.0.3

Tracing route to 202.60.0.3 over a maximum of 30 hops:

  1    0 ms      0 ms      0 ms      202.60.2.1
  2    0 ms      0 ms      0 ms      202.60.3.2
  3    0 ms      0 ms      0 ms      202.60.5.2
  4    0 ms      0 ms      0 ms      202.60.6.10
  5    0 ms      0 ms      1 ms      202.60.0.3

Trace complete.
```

Listing 54: Observation for tracert from PC1 to PC0

```
C:\>tracert 202.60.4.3

Tracing route to 202.60.4.3 over a maximum of 30 hops:

  1    0 ms      1 ms      0 ms      202.60.2.1
  2    0 ms      0 ms      0 ms      202.60.3.2
  3    0 ms      0 ms      0 ms      202.60.4.3

Trace complete.
```

Listing 55: Observation for tracert from PC1 to PC2

```
C:\>tracert 202.60.6.3

Tracing route to 202.60.6.3 over a maximum of 30 hops:

  1    1 ms      0 ms      0 ms      202.60.2.1
  2    0 ms      0 ms      0 ms      202.60.3.2
  3    0 ms      0 ms      0 ms      202.60.5.2
  4    0 ms      0 ms      0 ms      202.60.6.3
```

```
Trace complete.
```

Listing 56: Observation for tracert from PC1 to PC3

```
C:\>tracert 202.60.0.3

Tracing route to 202.60.0.3 over a maximum of 30 hops:

  1    0 ms      0 ms      0 ms      202.60.4.1
  2    0 ms      0 ms      3 ms      202.60.5.2
  3   12 ms      0 ms      0 ms      202.60.6.10
  4    0 ms     111 ms     41 ms     202.60.0.3

Trace complete.
```

Listing 57: Observation for tracert from PC2 to PC0

```
C:\>tracert 202.60.2.2

Tracing route to 202.60.2.2 over a maximum of 30 hops:

  1    1 ms      0 ms      0 ms      202.60.4.1
  2    0 ms      0 ms      3 ms      202.60.3.1
  3    0 ms     12 ms      0 ms      202.60.2.2

Trace complete.
```

Listing 58: Observation for tracert from PC2 to PC1

```
C:\>tracert 202.60.6.3

Tracing route to 202.60.6.3 over a maximum of 30 hops:

  1    0 ms      0 ms      0 ms      202.60.4.1
  2    0 ms      0 ms      0 ms      202.60.5.2
  3    0 ms      0 ms      0 ms      202.60.6.3

Trace complete.
```

Listing 59: Observation for tracert from PC2 to PC3

```
C:\>tracert 202.60.0.3

Tracing route to 202.60.0.3 over a maximum of 30 hops:
```

```

1    0 ms    0 ms    0 ms    202.60.6.1
2    0 ms    0 ms    0 ms    202.60.6.10
3    0 ms    2 ms    0 ms    202.60.0.3

Trace complete.

```

Listing 60: Observation for tracert from PC3 to PC0

```

C:\>tracert 202.60.2.2

Tracing route to 202.60.2.2 over a maximum of 30 hops:

 1    0 ms    0 ms    0 ms    202.60.6.1
 2    0 ms    0 ms    0 ms    202.60.5.1
 3    0 ms    0 ms    0 ms    202.60.3.1
 4    0 ms    0 ms    0 ms    202.60.2.2

Trace complete.

```

Listing 61: Observation for tracert from PC3 to PC1

```

C:\>tracert 202.60.4.3

Tracing route to 202.60.4.3 over a maximum of 30 hops:

 1    0 ms    0 ms    0 ms    202.60.6.1
 2    0 ms    0 ms    0 ms    202.60.5.1
 3    0 ms    0 ms    0 ms    202.60.4.3

Trace complete.

```

Listing 62: Observation for tracert from PC3 to PC2

```

Ashlesh_0#show ip route
Gateway of last resort is not set

    202.60.0.0/24 is variably subnetted, 2 subnets, 2 masks
C       202.60.0.0/24 is directly connected, GigabitEthernet0/1
L       202.60.0.1/32 is directly connected, GigabitEthernet0/1
R       202.60.2.0/24 [120/4] via 202.60.0.10,00:00:22, GigabitEthernet0/1
R       202.60.3.0/24 [120/3] via 202.60.0.10,00:00:22, GigabitEthernet0/1
R       202.60.4.0/24 [120/3] via 202.60.0.10,00:00:22, GigabitEthernet0/1
R       202.60.5.0/24 [120/2] via 202.60.0.10,00:00:22, GigabitEthernet0/1
R       202.60.6.0/24 [120/1] via 202.60.0.10,00:00:22, GigabitEthernet0/1

```

Listing 63: Observation for show ip route on Router 0



```
Ashlesh_1#show ip route
Gateway of last resort is not set

R    202.60.0.0/24 [120/3] via 202.60.3.2, 00:00:21, GigabitEthernet0/1
    202.60.2.0/24 is variably subnetted, 2 subnets, 2 masks
C    202.60.2.0/24 is directly connected, GigabitEthernet0/2
L    202.60.2.1/32 is directly connected, GigabitEthernet0/2
    202.60.3.0/24 is variably subnetted, 2 subnets, 2 masks
C    202.60.3.0/24 is directly connected, GigabitEthernet0/1
L    202.60.3.1/32 is directly connected, GigabitEthernet0/1
R    202.60.4.0/24 [120/1] via 202.60.3.2, 00:00:21, GigabitEthernet0/1
R    202.60.5.0/24 [120/1] via 202.60.3.2, 00:00:21, GigabitEthernet0/1
R    202.60.6.0/24 [120/2] via 202.60.3.2, 00:00:21, GigabitEthernet0/1
```

Listing 64: Observation for show ip route on Router 1

```
Ashlesh_2#show ip route
Gateway of last resort is not set

R    202.60.0.0/24 [120/2] via 202.60.5.2, 00:00:26, GigabitEthernet0/1
R    202.60.2.0/24 [120/1] via 202.60.3.1, 00:00:12, GigabitEthernet0/0
    202.60.3.0/24 is variably subnetted, 2 subnets, 2 masks
C    202.60.3.0/24 is directly connected, GigabitEthernet0/0
L    202.60.3.2/32 is directly connected, GigabitEthernet0/0
    202.60.4.0/24 is variably subnetted, 2 subnets, 2 masks
C    202.60.4.0/24 is directly connected, GigabitEthernet0/2
L    202.60.4.1/32 is directly connected, GigabitEthernet0/2
    202.60.5.0/24 is variably subnetted, 2 subnets, 2 masks
C    202.60.5.0/24 is directly connected, GigabitEthernet0/1
L    202.60.5.1/32 is directly connected, GigabitEthernet0/1
R    202.60.6.0/24 [120/1] via 202.60.5.2, 00:00:26, GigabitEthernet0/1
```

Listing 65: Observation for show ip route on Router 2

```
Ashlesh_3#show ip route
Gateway of last resort is not set

R    202.60.0.0/24 [120/1] via 202.60.6.10, 00:00:07, GigabitEthernet0/1
R    202.60.2.0/24 [120/2] via 202.60.5.1, 00:00:04, GigabitEthernet0/0
R    202.60.3.0/24 [120/1] via 202.60.5.1, 00:00:04, GigabitEthernet0/0
R    202.60.4.0/24 [120/1] via 202.60.5.1, 00:00:04, GigabitEthernet0/0
    202.60.5.0/24 is variably subnetted, 2 subnets, 2 masks
C    202.60.5.0/24 is directly connected, GigabitEthernet0/0
L    202.60.5.2/32 is directly connected, GigabitEthernet0/0
    202.60.6.0/24 is variably subnetted, 2 subnets, 2 masks
C    202.60.6.0/24 is directly connected, GigabitEthernet0/1
```

```
L      202.60.6.1/32 is directly connected, GigabitEthernet0/1
```

Listing 66: Observation for show ip route on Router 3

#### Sub activity 4 [Removing link between Router 1 and Router 2]

```
C:\>tracert 202.60.2.2

Tracing route to 202.60.2.2 over a maximum of 30 hops:

  1    0 ms      0 ms      5 ms      202.60.0.1
  2    0 ms      0 ms      0 ms      202.60.1.2
  3    0 ms      0 ms      0 ms      202.60.2.2

Trace complete.
```

Listing 67: Observation for tracert from PC0 to PC1

```
C:\>tracert 202.60.4.3

Tracing route to 202.60.4.3 over a maximum of 30 hops:

  1    0 ms      0 ms      0 ms      202.60.0.1
  2    0 ms      0 ms      0 ms      202.60.0.10
  3    0 ms      0 ms      0 ms      202.60.6.1
  4    0 ms      0 ms      1 ms      202.60.5.1
  5    0 ms      0 ms      0 ms      202.60.4.3

Trace complete.
```

Listing 68: Observation for tracert from PC0 to PC2

```
C:\>tracert 202.60.6.3

Tracing route to 202.60.6.3 over a maximum of 30 hops:

  1    0 ms      0 ms      5 ms      202.60.0.1
  2    1 ms      0 ms      0 ms      202.60.0.10
  3    0 ms      0 ms      0 ms      202.60.6.3

Trace complete.
```

Listing 69: Observation for tracert from PC0 to PC3

```
C:\>tracert 202.60.0.3
```

```
Tracing route to 202.60.0.3 over a maximum of 30 hops:
```

1	0 ms	0 ms	1 ms	202.60.2.1
2	0 ms	0 ms	0 ms	202.60.1.1
3	0 ms	0 ms	0 ms	202.60.0.3

```
Trace complete.
```

Listing 70: Observation for tracert from PC1 to PC0

```
C:\>tracert 202.60.4.3
```

```
Tracing route to 202.60.4.3 over a maximum of 30 hops:
```

1	1 ms	0 ms	0 ms	202.60.2.1
2	0 ms	0 ms	0 ms	202.60.1.1
3	0 ms	0 ms	0 ms	202.60.0.10
4	0 ms	1 ms	0 ms	202.60.6.1
5	0 ms	0 ms	0 ms	202.60.5.1
6	0 ms	0 ms	0 ms	202.60.4.3

```
Trace complete.
```

Listing 71: Observation for tracert from PC1 to PC2

```
C:\>tracert 202.60.6.3
```

```
Tracing route to 202.60.6.3 over a maximum of 30 hops:
```

1	1 ms	0 ms	0 ms	202.60.2.1
2	0 ms	0 ms	0 ms	202.60.1.1
3	0 ms	3 ms	0 ms	202.60.0.10
4	0 ms	0 ms	0 ms	202.60.6.3

```
Trace complete.
```

Listing 72: Observation for tracert from PC1 to PC3

```
C:\>tracert 202.60.0.3
```

```
Tracing route to 202.60.0.3 over a maximum of 30 hops:
```

1	0 ms	0 ms	0 ms	202.60.4.1
2	2 ms	0 ms	0 ms	202.60.5.2
3	0 ms	0 ms	0 ms	202.60.6.10
4	0 ms	1 ms	0 ms	202.60.0.3

```
Trace complete.
```

Listing 73: Observation for tracert from PC2 to PC0

```
C:\>tracert 202.60.2.2

Tracing route to 202.60.2.2 over a maximum of 30 hops:

  1  0 ms    0 ms    0 ms    202.60.4.1
  2  0 ms    0 ms    0 ms    202.60.5.2
  3  0 ms    0 ms    1 ms    202.60.6.10
  4  1 ms    1 ms    0 ms    202.60.0.1
  5  0 ms    1 ms    0 ms    202.60.1.2
  6  0 ms    0 ms    0 ms    202.60.2.2

Trace complete.
```

Listing 74: Observation for tracert from PC2 to PC1

```
C:\>tracert 202.60.6.3

Tracing route to 202.60.6.3 over a maximum of 30 hops:

  1  0 ms    0 ms    0 ms    202.60.4.1
  2  0 ms    0 ms    0 ms    202.60.5.2
  3  0 ms    0 ms    0 ms    202.60.6.3

Trace complete.
```

Listing 75: Observation for tracert from PC2 to PC3

```
C:\>tracert 202.60.0.3

Tracing route to 202.60.0.3 over a maximum of 30 hops:

  1  1 ms    0 ms    0 ms    202.60.6.1
  2  0 ms    2 ms    0 ms    202.60.6.10
  3  0 ms    0 ms    0 ms    202.60.0.3

Trace complete.
```

Listing 76: Observation for tracert from PC3 to PC0

```
C:\>tracert 202.60.2.2

Tracing route to 202.60.2.2 over a maximum of 30 hops:
```

```

1    0 ms      0 ms      0 ms      202.60.6.1
2    0 ms      0 ms      0 ms      202.60.6.10
3    0 ms      0 ms      0 ms      202.60.0.1
4    0 ms      0 ms      0 ms      202.60.1.2
5    0 ms      0 ms      0 ms      202.60.2.2

Trace complete.

```

Listing 77: Observation for tracert from PC3 to PC1

```

C:\>tracert 202.60.4.3

Tracing route to 202.60.4.3 over a maximum of 30 hops:

1    0 ms      0 ms      0 ms      202.60.6.1
2    0 ms      0 ms      6 ms      202.60.5.1
3    0 ms      0 ms      0 ms      202.60.4.3

Trace complete.

```

Listing 78: Observation for tracert from PC3 to PC2

```

Ashlesh_0#show ip route
Gateway of last resort is not set

    202.60.0.0/24 is variably subnetted, 2 subnets, 2 masks
C       202.60.0.0/24 is directly connected, GigabitEthernet0/1
L       202.60.0.1/32 is directly connected, GigabitEthernet0/1
    202.60.1.0/24 is variably subnetted, 2 subnets, 2 masks
C       202.60.1.0/24 is directly connected, GigabitEthernet0/0
L       202.60.1.1/32 is directly connected, GigabitEthernet0/0
R       202.60.2.0/24 [120/1] via 202.60.1.2, 00:00:20, GigabitEthernet0/0
R       202.60.4.0/24 [120/3] via 202.60.0.10,00:00:21, GigabitEthernet0/1
R       202.60.5.0/24 [120/2] via 202.60.0.10,00:00:21, GigabitEthernet0/1
R       202.60.6.0/24 [120/1] via 202.60.0.10,00:00:21, GigabitEthernet0/1

```

Listing 79: Observation for show ip route on Router 0

```

Ashlesh_1#show ip route
Gateway of last resort is not set

R       202.60.0.0/24 [120/1] via 202.60.1.1, 00:00:08, GigabitEthernet0/0
    202.60.1.0/24 is variably subnetted, 2 subnets, 2 masks
C       202.60.1.0/24 is directly connected, GigabitEthernet0/0
L       202.60.1.2/32 is directly connected, GigabitEthernet0/0
    202.60.2.0/24 is variably subnetted, 2 subnets, 2 masks

```

```
C      202.60.2.0/24 is directly connected, GigabitEthernet0/2
L      202.60.2.1/32 is directly connected, GigabitEthernet0/2
R      202.60.4.0/24 [120/4] via 202.60.1.1, 00:00:08, GigabitEthernet0/0
R      202.60.5.0/24 [120/3] via 202.60.1.1, 00:00:08, GigabitEthernet0/0
R      202.60.6.0/24 [120/2] via 202.60.1.1, 00:00:08, GigabitEthernet0/0
```

Listing 80: Observation for show ip route on Router 1

```
Ashlesh_2#show ip route
Gateway of last resort is not set

R      202.60.0.0/24 [120/2] via 202.60.5.2, 00:00:17, GigabitEthernet0/1
R      202.60.1.0/24 [120/3] via 202.60.5.2, 00:00:17, GigabitEthernet0/1
R      202.60.2.0/24 [120/4] via 202.60.5.2, 00:00:17, GigabitEthernet0/1
      202.60.4.0/24 is variably subnetted, 2 subnets, 2 masks
C      202.60.4.0/24 is directly connected, GigabitEthernet0/2
L      202.60.4.1/32 is directly connected, GigabitEthernet0/2
      202.60.5.0/24 is variably subnetted, 2 subnets, 2 masks
C      202.60.5.0/24 is directly connected, GigabitEthernet0/1
L      202.60.5.1/32 is directly connected, GigabitEthernet0/1
R      202.60.6.0/24 [120/1] via 202.60.5.2, 00:00:17, GigabitEthernet0/1
```

Listing 81: Observation for show ip route on Router 2

```
Ashlesh_3#show ip route
Gateway of last resort is not set

R      202.60.0.0/24 [120/1] via 202.60.6.10,00:00:05, GigabitEthernet0/1
R      202.60.1.0/24 [120/2] via 202.60.6.10,00:00:05, GigabitEthernet0/1
R      202.60.2.0/24 [120/3] via 202.60.6.10,00:00:05, GigabitEthernet0/1
R      202.60.4.0/24 [120/1] via 202.60.5.1, 00:00:10, GigabitEthernet0/0
      202.60.5.0/24 is variably subnetted, 2 subnets, 2 masks
C      202.60.5.0/24 is directly connected, GigabitEthernet0/0
L      202.60.5.2/32 is directly connected, GigabitEthernet0/0
      202.60.6.0/24 is variably subnetted, 2 subnets, 2 masks
C      202.60.6.0/24 is directly connected, GigabitEthernet0/1
L      202.60.6.1/32 is directly connected, GigabitEthernet0/1
```

Listing 82: Observation for show ip route on Router 3

#### Sub activity 4 [Removing link between Router 2 and Router 3]

```
C:\>tracert 202.60.2.2

Tracing route to 202.60.2.2 over a maximum of 30 hops:

 1    0 ms    0 ms    0 ms    202.60.0.1
```

```

2    0 ms    0 ms    1 ms    202.60.1.2
3    1 ms    0 ms    0 ms    202.60.2.2

Trace complete.

```

Listing 83: Observation for tracert from PC0 to PC1

```

C:\>tracert 202.60.4.3

Tracing route to 202.60.4.3 over a maximum of 30 hops:

 1    0 ms    0 ms    0 ms    202.60.0.1
 2    0 ms    0 ms    0 ms    202.60.1.2
 3    0 ms    0 ms    0 ms    202.60.3.2
 4    0 ms    0 ms    0 ms    202.60.4.3

Trace complete.

```

Listing 84: Observation for tracert from PC0 to PC2

```

C:\>tracert 202.60.6.3

Tracing route to 202.60.6.3 over a maximum of 30 hops:

 1    0 ms    0 ms    0 ms    202.60.0.1
 2    0 ms    0 ms    0 ms    202.60.0.10
 3    0 ms    0 ms    0 ms    202.60.6.3

Trace complete.

```

Listing 85: Observation for tracert from PC0 to PC3

```

C:\>tracert 202.60.0.3

Tracing route to 202.60.0.3 over a maximum of 30 hops:

 1    0 ms    0 ms    0 ms    202.60.2.1
 2    0 ms    0 ms    0 ms    202.60.1.1
 3    2 ms    0 ms    0 ms    202.60.0.3

Trace complete.

```

Listing 86: Observation for tracert from PC1 to PC0

```
C:\>tracert 202.60.4.3

Tracing route to 202.60.4.3 over a maximum of 30 hops:

  1    0 ms      0 ms      0 ms      202.60.2.1
  2    0 ms      0 ms      0 ms      202.60.3.2
  3    0 ms      0 ms      0 ms      202.60.4.3

Trace complete.
```

Listing 87: Observation for tracert from PC1 to PC2

```
C:\>tracert 202.60.6.3

Tracing route to 202.60.6.3 over a maximum of 30 hops:

  1    0 ms      0 ms      7 ms      202.60.2.1
  2    0 ms      0 ms      0 ms      202.60.1.1
  3    0 ms      0 ms      0 ms      202.60.0.10
  4    6 ms      1 ms      0 ms      202.60.6.3

Trace complete.
```

Listing 88: Observation for tracert from PC1 to PC3

```
C:\>tracert 202.60.0.3

Tracing route to 202.60.0.3 over a maximum of 30 hops:

  1    1 ms      0 ms      1 ms      202.60.4.1
  2    0 ms      0 ms      0 ms      202.60.3.1
  3    0 ms      0 ms      0 ms      202.60.1.1
  4    0 ms      0 ms      0 ms      202.60.0.3

Trace complete.
```

Listing 89: Observation for tracert from PC2 to PC0

```
C:\>tracert 202.60.2.2

Tracing route to 202.60.2.2 over a maximum of 30 hops:

  1    1 ms      0 ms      0 ms      202.60.4.1
  2    0 ms      0 ms      1 ms      202.60.3.1
  3    0 ms      0 ms      1 ms      202.60.2.2
```



```
Trace complete.
```

Listing 90: Observation for tracert from PC2 to PC1

```
C:\>tracert 202.60.6.3

Tracing route to 202.60.6.3 over a maximum of 30 hops:

  1    0 ms      0 ms      0 ms      202.60.4.1
  2    0 ms      0 ms      0 ms      202.60.3.1
  3    0 ms      0 ms      0 ms      202.60.1.1
  4    0 ms      0 ms      0 ms      202.60.0.10
  5    0 ms      0 ms      0 ms      202.60.6.3

Trace complete.
```

Listing 91: Observation for tracert from PC2 to PC3

```
C:\>tracert 202.60.0.3

Tracing route to 202.60.0.3 over a maximum of 30 hops:

  1    0 ms      0 ms      0 ms      202.60.6.1
  2    0 ms      0 ms      0 ms      202.60.6.10
  3    0 ms      1 ms      0 ms      202.60.0.3

Trace complete.
```

Listing 92: Observation for tracert from PC3 to PC0

```
C:\>tracert 202.60.2.2

Tracing route to 202.60.2.2 over a maximum of 30 hops:

  1    2 ms      0 ms      0 ms      202.60.6.1
  2    0 ms      0 ms      0 ms      202.60.6.10
  3    0 ms      1 ms      0 ms      202.60.0.1
  4    0 ms      0 ms      0 ms      202.60.1.2
  5    0 ms      0 ms      0 ms      202.60.2.2

Trace complete.
```

Listing 93: Observation for tracert from PC3 to PC1

```
C:\>tracert 202.60.4.3

Tracing route to 202.60.4.3 over a maximum of 30 hops:

  1  0 ms      0 ms      0 ms      202.60.6.1
  2  0 ms      0 ms      0 ms      202.60.6.10
  3  0 ms      0 ms      0 ms      202.60.0.1
  4  0 ms      0 ms      0 ms      202.60.1.2
  5  0 ms      0 ms      0 ms      202.60.3.2
  6  0 ms      0 ms      0 ms      202.60.4.3

Trace complete.
```

Listing 94: Observation for tracert from PC3 to PC2

```
Ashlesh_0#show ip route
Gateway of last resort is not set

    202.60.0.0/24 is variably subnetted, 2 subnets, 2 masks
C       202.60.0.0/24 is directly connected, GigabitEthernet0/1
L       202.60.0.1/32 is directly connected, GigabitEthernet0/1
    202.60.1.0/24 is variably subnetted, 2 subnets, 2 masks
C       202.60.1.0/24 is directly connected, GigabitEthernet0/0
L       202.60.1.1/32 is directly connected, GigabitEthernet0/0
R       202.60.2.0/24 [120/1] via 202.60.1.2, 00:00:02, GigabitEthernet0/0
R       202.60.3.0/24 [120/1] via 202.60.1.2, 00:00:02, GigabitEthernet0/0
R       202.60.4.0/24 [120/2] via 202.60.1.2, 00:00:02, GigabitEthernet0/0
R       202.60.6.0/24 [120/1] via 202.60.0.10,00:00:00, GigabitEthernet0/1
```

Listing 95: Observation for show ip route on Router 0

```
Ashlesh_1#show ip route
Gateway of last resort is not set

R    202.60.0.0/24 [120/1] via 202.60.1.1, 00:00:03, GigabitEthernet0/0
    202.60.1.0/24 is variably subnetted, 2 subnets, 2 masks
C    202.60.1.0/24 is directly connected, GigabitEthernet0/0
L    202.60.1.2/32 is directly connected, GigabitEthernet0/0
    202.60.2.0/24 is variably subnetted, 2 subnets, 2 masks
C    202.60.2.0/24 is directly connected, GigabitEthernet0/2
L    202.60.2.1/32 is directly connected, GigabitEthernet0/2
    202.60.3.0/24 is variably subnetted, 2 subnets, 2 masks
C    202.60.3.0/24 is directly connected, GigabitEthernet0/1
L    202.60.3.1/32 is directly connected, GigabitEthernet0/1
R    202.60.4.0/24 [120/1] via 202.60.3.2, 00:00:17, GigabitEthernet0/1
R    202.60.6.0/24 [120/2] via 202.60.1.1, 00:00:03, GigabitEthernet0/0
```

Listing 96: Observation for show ip route on Router 1

```
Ashlesh_2#show ip route
Gateway of last resort is not set

R    202.60.0.0/24 [120/2] via 202.60.3.1, 00:00:23, GigabitEthernet0/0
R    202.60.1.0/24 [120/1] via 202.60.3.1, 00:00:23, GigabitEthernet0/0
R    202.60.2.0/24 [120/1] via 202.60.3.1, 00:00:23, GigabitEthernet0/0
    202.60.3.0/24 is variably subnetted, 2 subnets, 2 masks
C    202.60.3.0/24 is directly connected, GigabitEthernet0/0
L    202.60.3.2/32 is directly connected, GigabitEthernet0/0
    202.60.4.0/24 is variably subnetted, 2 subnets, 2 masks
C    202.60.4.0/24 is directly connected, GigabitEthernet0/2
L    202.60.4.1/32 is directly connected, GigabitEthernet0/2
R    202.60.6.0/24 [120/3] via 202.60.3.1, 00:00:23, GigabitEthernet0/0
```

Listing 97: Observation for show ip route on Router 2

```
Ashlesh_3#show ip route
Gateway of last resort is not set

R    202.60.0.0/24 [120/1] via 202.60.6.10,00:00:00, GigabitEthernet0/1
R    202.60.1.0/24 [120/2] via 202.60.6.10,00:00:00, GigabitEthernet0/1
R    202.60.2.0/24 [120/3] via 202.60.6.10,00:00:00, GigabitEthernet0/1
R    202.60.3.0/24 [120/3] via 202.60.6.10,00:00:00, GigabitEthernet0/1
R    202.60.4.0/24 [120/4] via 202.60.6.10,00:00:00, GigabitEthernet0/1
    202.60.6.0/24 is variably subnetted, 2 subnets, 2 masks
C    202.60.6.0/24 is directly connected, GigabitEthernet0/1
L    202.60.6.1/32 is directly connected, GigabitEthernet0/1
```

Listing 98: Observation for show ip route on Router 3

### Sub activity 5

From the observations mentioned in sub activity 4 of the activity B, with different links being removed we can see that the dynamic routing configuration automatically chooses the optimal path for the packets. In cases where link between two routers is down for some reason, the routing information from other routers enables the router under consideration to update it's own routing table such that the link that is down is avoided. This way, if any alternative route is available, it is included in the table and hence used by the packets. This way, addition of the router 4 such that there is an alternative route if the tested links are down, allows the packets to reach the destination. The observations for tracert also suggests that the packets take the route that isn't down based on the update in the routing tables of the routers.

## c. Activity C

### Sub activity 1

Subnet	Required Hosts	Network Address	Broadcast Address	Usable IP Addresses	Subnet Mask
A	60	200.100.50.0	200.100.50.63	200.100.50.1 - 200.100.50.62	/26
B	27	200.100.50.64	200.100.50.95	200.100.50.65 - 200.100.50.94	/27
C	25	200.100.50.96	200.100.50.127	200.100.50.97 - 200.100.50.126	/27
D	12	200.100.50.128	200.100.50.143	200.100.50.129 - 200.100.50.142	/28
E	2	200.100.50.144	200.100.50.147	200.100.50.145 - 200.100.50.146	/30
F	2	200.100.50.148	200.100.50.151	200.100.50.149 - 200.100.50.150	/30
G	2	200.100.50.152	200.100.50.155	200.100.50.153 - 200.100.50.154	/30

Table 18: Subnet division as required by Activity C

### Sub activity 2

The gigabitethernet interfaces on the routers were set as,

Gigabitethernet interfaces	IP address	Subnet mask
Router 0: 0/0	200.100.50.145	255.255.255.252
Router 0: 0/1	200.100.50.1	255.255.255.192
Router 1: 0/0	200.100.50.146	255.255.255.252
Router 1: 0/1	200.100.50.149	255.255.255.252
Router 1: 0/2	200.100.50.65	255.255.255.224
Router 2: 0/0	200.100.50.150	255.255.255.252
Router 2: 0/1	200.100.50.153	255.255.255.252
Router 2: 0/2	200.100.50.97	255.255.255.224
Router 3: 0/0	200.100.50.154	255.255.255.252
Router 3: 0/1	200.100.50.129	255.255.255.240

Note: The interfaces are marked on Figure 3.

Table 19: IP address and subnet masks for the gigabitethernet interfaces on the routers

Device	IP address	Subnet mask
PC0	200.100.50.3	255.255.255.192
PC1	200.100.50.66	255.255.255.224
PC2	200.100.50.99	255.255.255.224
PC3	200.100.50.130	255.255.255.240
PC4	200.100.50.67	255.255.255.224
PC5	200.100.50.98	255.255.255.224
Server0	200.100.50.2	255.255.255.192
Server1	200.100.50.131	255.255.255.240

Note: The ip addressess and subnet masks are set using the IP configuration application. The default gateways for the PCs and servers were also set as, PC0 and Server0: 200.100.50.1, PC1 and PC4: 200.100.50.65, PC2 and PC5: 200.100.50.97, PC3 and Server1: 200.100.50.129

Table 20: IP address and subnet masks for the PCs and servers in the network

### Sub activity 3

```
User Access Verification
Password:
Ashlesh_0>enable
Password:
Ashlesh_0#configure terminal
Ashlesh_0(config)#router ospf 1
Ashlesh_0(config-router)#network 200.100.50.0 0.0.0.63 area 0
Ashlesh_0(config-router)#network 200.100.50.144 0.0.0.3 area 0
Ashlesh_0(config-router)#exit
Ashlesh_0(config)#exit
Ashlesh_0#
```

Listing 99: Configuring OSPF on Router 0

```
User Access Verification
Password:
Ashlesh_1>enable
Password:
Ashlesh_1#config terminal
Ashlesh_1(config)#router ospf 1
Ashlesh_1(config-router)#network 200.100.50.144 0.0.0.3 area 0
Ashlesh_1(config-router)#network 200.100.50.148 0.0.0.3 area 0
Ashlesh_1(config-router)#network 200.100.50.64 0.0.0.31 area 0
Ashlesh_1(config-router)#exit
Ashlesh_1(config)#exit
Ashlesh_1#
```

Listing 100: Configuring OSPF on Router 1

```
User Access Verification
Password:
Ashlesh_2>enable
Password:
Ashlesh_2#config terminal
Ashlesh_2(config)#router ospf 1
Ashlesh_2(config-router)#network 200.100.50.148 0.0.0.3 area 0
Ashlesh_2(config-router)#network 200.100.50.96 0.0.0.31 area 0
Ashlesh_2(config-router)#network 200.100.50.152 0.0.0.3 area 0
Ashlesh_2(config-router)#exit
Ashlesh_2(config)#exit
Ashlesh_2#
```

Listing 101: Configuring OSPF on Router 2

```
User Access Verification
Password:
Ashlesh_3>enable
Password:
Ashlesh_3#config terminal
Ashlesh_3(config)#router ospf 1
Ashlesh_3(config-router)#network 200.100.50.152 0.0.0.3 area 0
Ashlesh_3(config-router)#network 200.100.50.128 0.0.0.15 area 0
Ashlesh_3(config-router)#exit
Ashlesh_3(config)#exit
Ashlesh_3#
```

Listing 102: Configuring OSPF on Router 3

```
C:\>ping 200.100.50.66

Pinging 200.100.50.66 with 32 bytes of data:

Reply from 200.100.50.66: bytes=32 time<1ms TTL=126
Reply from 200.100.50.66: bytes=32 time<1ms TTL=126
Reply from 200.100.50.66: bytes=32 time<1ms TTL=126
Reply from 200.100.50.66: bytes=32 time=2ms TTL=126

Ping statistics for 200.100.50.66:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 2ms, Average = 0ms
```

Listing 103: Observation for ping test from PC0 to PC1

```
C:\>ping 200.100.50.99

Pinging 200.100.50.99 with 32 bytes of data:

Reply from 200.100.50.99: bytes=32 time=2ms TTL=125
Reply from 200.100.50.99: bytes=32 time<1ms TTL=125
Reply from 200.100.50.99: bytes=32 time=13ms TTL=125
Reply from 200.100.50.99: bytes=32 time=11ms TTL=125

Ping statistics for 200.100.50.99:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 13ms, Average = 6ms
```

Listing 104: Observation for ping test from PC0 to PC2

```
C:\>ping 200.100.50.99

Pinging 200.100.50.99 with 32 bytes of data:

Reply from 200.100.50.99: bytes=32 time<1ms TTL=126
Reply from 200.100.50.99: bytes=32 time=11ms TTL=126
Reply from 200.100.50.99: bytes=32 time<1ms TTL=126
Reply from 200.100.50.99: bytes=32 time<1ms TTL=126

Ping statistics for 200.100.50.99:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 11ms, Average = 2ms
```

Listing 105: Observation for ping test from PC1 to PC2

```
C:\>ping 200.100.50.130

Pinging 200.100.50.130 with 32 bytes of data:

Reply from 200.100.50.130: bytes=32 time=1ms TTL=125
Reply from 200.100.50.130: bytes=32 time=11ms TTL=125
Reply from 200.100.50.130: bytes=32 time=11ms TTL=125
Reply from 200.100.50.130: bytes=32 time=14ms TTL=125

Ping statistics for 200.100.50.130:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 1ms, Maximum = 14ms, Average = 9ms
```

Listing 106: Observation for ping test from PC1 to PC3

```
C:\>ping 200.100.50.130

Pinging 200.100.50.130 with 32 bytes of data:

Reply from 200.100.50.130: bytes=32 time<1ms TTL=126
Reply from 200.100.50.130: bytes=32 time<1ms TTL=126
Reply from 200.100.50.130: bytes=32 time<1ms TTL=126
Reply from 200.100.50.130: bytes=32 time<1ms TTL=126

Ping statistics for 200.100.50.130:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms
```

Listing 107: Observation for ping test from PC2 to PC3

```
C:\>ping 200.100.50.3

Pinging 200.100.50.3 with 32 bytes of data:

Reply from 200.100.50.3: bytes=32 time<1ms TTL=124
Reply from 200.100.50.3: bytes=32 time=12ms TTL=124
Reply from 200.100.50.3: bytes=32 time<1ms TTL=124
Reply from 200.100.50.3: bytes=32 time=1ms TTL=124

Ping statistics for 200.100.50.3:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 12ms, Average = 3ms
```

Listing 108: Observation for ping test from PC3 to PC0

Sending Host	Destination	Ping status
PC0	PC0	Successful
or	Server0	
PC1	PC1	
or	PC4	
PC2	PC2	
or	PC5	
PC3	PC3	
	Server1	

Table 21: Observation for ping tests from PC0, PC1, PC2 and PC3 to other PCs and servers



#### Sub activity 4

```
C:\>tracert 200.100.50.130

Tracing route to 200.100.50.130 over a maximum of 30 hops:

  1    1 ms    0 ms    0 ms    200.100.50.1
  2    0 ms    0 ms    0 ms    200.100.50.146
  3    0 ms    0 ms    0 ms    200.100.50.150
  4    0 ms    0 ms    0 ms    200.100.50.154
  5    0 ms    0 ms    0 ms    200.100.50.130

Trace complete.
```

Listing 109: Observation for tracert from PC0 to PC3

#### Sub activity 5

```
Ashlesh_0#show ip route
Gateway of last resort is not set

    200.100.50.0/24 is variably subnetted, 9 subnets, 5 masks
C       200.100.50.0/26 is directly connected, GigabitEthernet0/1
L       200.100.50.1/32 is directly connected, GigabitEthernet0/1
O       200.100.50.64/27 [110/2] via 200.100.50.146, 00:30:27,
    GigabitEthernet0/0
O       200.100.50.96/27 [110/3] via 200.100.50.146, 00:30:27,
    GigabitEthernet0/0
O       200.100.50.128/28 [110/4] via 200.100.50.146, 00:30:27,
    GigabitEthernet0/0
C       200.100.50.144/30 is directly connected, GigabitEthernet0/0
L       200.100.50.145/32 is directly connected, GigabitEthernet0/0
O       200.100.50.148/30 [110/2] via 200.100.50.146, 00:30:27,
    GigabitEthernet0/0
O       200.100.50.152/30 [110/3] via 200.100.50.146, 00:30:27,
    GigabitEthernet0/0
```

Listing 110: Observation for show ip route on Router 0

```
Ashlesh_1#show ip route
Gateway of last resort is not set

    200.100.50.0/24 is variably subnetted, 10 subnets, 5 masks
O       200.100.50.0/26 [110/2] via 200.100.50.145, 00:30:52,
    GigabitEthernet0/0
C       200.100.50.64/27 is directly connected, GigabitEthernet0/2
L       200.100.50.65/32 is directly connected, GigabitEthernet0/2
```

```

O      200.100.50.96/27 [110/2] via 200.100.50.150, 01:05:32,
      GigabitEthernet0/1
O      200.100.50.128/28 [110/3] via 200.100.50.150, 01:05:22,
      GigabitEthernet0/1
C      200.100.50.144/30 is directly connected, GigabitEthernet0/0
L      200.100.50.146/32 is directly connected, GigabitEthernet0/0
C      200.100.50.148/30 is directly connected, GigabitEthernet0/1
L      200.100.50.149/32 is directly connected, GigabitEthernet0/1
O      200.100.50.152/30 [110/2] via 200.100.50.150, 01:05:22,
      GigabitEthernet0/1

```

Listing 111: Observation for show ip route on Router 1

```

Ashlesh_2#show ip route
Gateway of last resort is not set

      200.100.50.0/24 is variably subnetted, 10 subnets, 5 masks
O      200.100.50.0/26 [110/3] via 200.100.50.149, 00:31:15,
      GigabitEthernet0/0
O      200.100.50.64/27 [110/2] via 200.100.50.149, 01:06:00,
      GigabitEthernet0/0
C      200.100.50.96/27 is directly connected, GigabitEthernet0/2
L      200.100.50.97/32 is directly connected, GigabitEthernet0/2
O      200.100.50.128/28 [110/2] via 200.100.50.154, 01:05:50,
      GigabitEthernet0/1
O      200.100.50.144/30 [110/2] via 200.100.50.149, 00:31:15,
      GigabitEthernet0/0
C      200.100.50.148/30 is directly connected, GigabitEthernet0/0
L      200.100.50.150/32 is directly connected, GigabitEthernet0/0
C      200.100.50.152/30 is directly connected, GigabitEthernet0/1
L      200.100.50.153/32 is directly connected, GigabitEthernet0/1

```

Listing 112: Observation for show ip route on Router 2

```

Ashlesh_3#show ip route
Gateway of last resort is not set

      200.100.50.0/24 is variably subnetted, 9 subnets, 5 masks
O      200.100.50.0/26 [110/4] via 200.100.50.153, 00:31:42,
      GigabitEthernet0/0
O      200.100.50.64/27 [110/3] via 200.100.50.153, 01:06:17,
      GigabitEthernet0/0
O      200.100.50.96/27 [110/2] via 200.100.50.153, 01:06:17,
      GigabitEthernet0/0
C      200.100.50.128/28 is directly connected, GigabitEthernet0/1
L      200.100.50.129/32 is directly connected, GigabitEthernet0/1
O      200.100.50.144/30 [110/3] via 200.100.50.153, 00:31:42,

```

```
GigabitEthernet0/0
O      200.100.50.148/30 [110/2] via 200.100.50.153, 01:06:17,
      GigabitEthernet0/0
C      200.100.50.152/30 is directly connected, GigabitEthernet0/0
L      200.100.50.154/32 is directly connected, GigabitEthernet0/0
```

Listing 113: Observation for show ip route on Router 3

#### d. Activity D

##### Sub activity 1

A new router, Router 4 is added between Switch 0 and Switch 1 to increase reliability. The interfaces were configured as mentioned in Figure 4.

```
Ashlesh_4>enable
Ashlesh_4#config terminal
Ashlesh_4(config)#router ospf 1
Ashlesh_4(config-router)#network 200.100.50.0 0.0.0.63 area 0
Ashlesh_4(config-router)#network 200.100.50.128 0.0.0.15 area 0
Ashlesh_4(config-router)#exit
Ashlesh_4(config)#exit
Ashlesh_4#
```

Listing 114: Configuring OSPF on Router 4

```
C:\>tracert 200.100.50.3

Tracing route to 200.100.50.3 over a maximum of 30 hops:

  1  0 ms      0 ms      0 ms      200.100.50.129
  2  0 ms      1 ms      0 ms      200.100.50.142
  3  0 ms      0 ms      1 ms      200.100.50.3

Trace complete.
```

Listing 115: Observation for tracert from PC3 to PC0

```
Ashlesh_0>show ip route
Gateway of last resort is not set

      200.100.50.0/24 is variably subnetted, 9 subnets, 5 masks
C      200.100.50.0/26 is directly connected, GigabitEthernet0/1
L      200.100.50.1/32 is directly connected, GigabitEthernet0/1
O      200.100.50.64/27 [110/2] via 200.100.50.146, 00:22:12,
      GigabitEthernet0/0
O      200.100.50.96/27 [110/3] via 200.100.50.146, 00:22:12,
      GigabitEthernet0/0
```

```

O      200.100.50.128/28 [110/2] via 200.100.50.62, 00:05:29,
      GigabitEthernet0/1
C      200.100.50.144/30 is directly connected, GigabitEthernet0/0
L      200.100.50.145/32 is directly connected, GigabitEthernet0/0
O      200.100.50.148/30 [110/2] via 200.100.50.146, 00:22:12,
      GigabitEthernet0/0
O      200.100.50.152/30 [110/3] via 200.100.50.62, 00:05:29,
      GigabitEthernet0/1
                               [110/3] via 200.100.50.146, 00:05:29,
      GigabitEthernet0/0

```

Listing 116: Observation for show ip route on Router 0

```

Ashlesh_1>show ip route
Gateway of last resort is not set

      200.100.50.0/24 is variably subnetted, 10 subnets, 5 masks
O      200.100.50.0/26 [110/2] via 200.100.50.145, 00:06:50,
      GigabitEthernet0/0
C      200.100.50.64/27 is directly connected, GigabitEthernet0/2
L      200.100.50.65/32 is directly connected, GigabitEthernet0/2
O      200.100.50.96/27 [110/2] via 200.100.50.150, 00:22:55,
      GigabitEthernet0/1
O      200.100.50.128/28 [110/3] via 200.100.50.150, 00:06:12,
      GigabitEthernet0/1
                               [110/3] via 200.100.50.145, 00:06:12,
      GigabitEthernet0/0
C      200.100.50.144/30 is directly connected, GigabitEthernet0/0
L      200.100.50.146/32 is directly connected, GigabitEthernet0/0
C      200.100.50.148/30 is directly connected, GigabitEthernet0/1
L      200.100.50.149/32 is directly connected, GigabitEthernet0/1
O      200.100.50.152/30 [110/2] via 200.100.50.150, 00:22:55,
      GigabitEthernet0/1

```

Listing 117: Observation for show ip route on Router 1

```

Ashlesh_3>show ip route
Gateway of last resort is not set

      200.100.50.0/24 is variably subnetted, 9 subnets, 5 masks
O      200.100.50.0/26 [110/2] via 200.100.50.142, 00:07:04,
      GigabitEthernet0/1
O      200.100.50.64/27 [110/3] via 200.100.50.153, 00:23:52,
      GigabitEthernet0/0
O      200.100.50.96/27 [110/2] via 200.100.50.153, 00:23:52,
      GigabitEthernet0/0
C      200.100.50.128/28 is directly connected, GigabitEthernet0/1

```

```
L      200.100.50.129/32 is directly connected, GigabitEthernet0/1
O      200.100.50.144/30 [110/3] via 200.100.50.153, 00:07:04,
      GigabitEthernet0/0
      [110/3] via 200.100.50.142, 00:07:04,
      GigabitEthernet0/1
O      200.100.50.148/30 [110/2] via 200.100.50.153, 00:23:52,
      GigabitEthernet0/0
C      200.100.50.152/30 is directly connected, GigabitEthernet0/0
L      200.100.50.154/32 is directly connected, GigabitEthernet0/0
```

Listing 118: Observation for show ip route on Router 2

```
Ashlesh_3#show ip route
Gateway of last resort is not set

      200.100.50.0/24 is variably subnetted, 9 subnets, 5 masks
O      200.100.50.0/26 [110/4] via 200.100.50.153, 00:31:42,
      GigabitEthernet0/0
O      200.100.50.64/27 [110/3] via 200.100.50.153, 01:06:17,
      GigabitEthernet0/0
O      200.100.50.96/27 [110/2] via 200.100.50.153, 01:06:17,
      GigabitEthernet0/0
C      200.100.50.128/28 is directly connected, GigabitEthernet0/1
L      200.100.50.129/32 is directly connected, GigabitEthernet0/1
O      200.100.50.144/30 [110/3] via 200.100.50.153, 00:31:42,
      GigabitEthernet0/0
O      200.100.50.148/30 [110/2] via 200.100.50.153, 01:06:17,
      GigabitEthernet0/0
C      200.100.50.152/30 is directly connected, GigabitEthernet0/0
L      200.100.50.154/32 is directly connected, GigabitEthernet0/0
```

Listing 119: Observation for show ip route on Router 3

The routing tables shown in Listings 116 to 119 are different than that in Listings 110 to 113. Additional OSPF routes are added to the routing tables. If there are multiple routes such that the number of intermediate hops is same, both are included in the table. If there are multiple routes, but one of them has the least hop, then only that is included in the table. Also, the additional router 4 included in activity D reduces the hop from PC3 to PC0 such that the packet goes through the newly added router rather than the longer route through router 3.

## Sub activity 2 [Removing link between Router 4 and Switch 0]

```
C:\>tracert 200.100.50.0

Tracing route to 200.100.50.0 over a maximum of 30 hops:

  1    1 ms    0 ms    0 ms    200.100.50.129
  2    0 ms    0 ms    0 ms    200.100.50.153
```

3	0 ms	0 ms	0 ms	200.100.50.149
4	0 ms	0 ms	1 ms	200.100.50.145
Trace complete.				

Listing 120: Observation for tracert from PC3 to PC0

```
Ashlesh_0>show ip route
Gateway of last resort is not set

    200.100.50.0/24 is variably subnetted, 9 subnets, 5 masks
C       200.100.50.0/26 is directly connected, GigabitEthernet0/1
L       200.100.50.1/32 is directly connected, GigabitEthernet0/1
O       200.100.50.64/27 [110/2] via 200.100.50.146, 00:38:44,
    GigabitEthernet0/0
O       200.100.50.96/27 [110/3] via 200.100.50.146, 00:38:44,
    GigabitEthernet0/0
O       200.100.50.128/28 [110/4] via 200.100.50.146, 00:03:14,
    GigabitEthernet0/0
C       200.100.50.144/30 is directly connected, GigabitEthernet0/0
L       200.100.50.145/32 is directly connected, GigabitEthernet0/0
O       200.100.50.148/30 [110/2] via 200.100.50.146, 00:38:44,
    GigabitEthernet0/0
O       200.100.50.152/30 [110/3] via 200.100.50.146, 00:03:14,
    GigabitEthernet0/0
```

Listing 121: Observation for show ip route on Router 0

```
Ashlesh_1>show ip route
Gateway of last resort is not set

    200.100.50.0/24 is variably subnetted, 10 subnets, 5 masks
O       200.100.50.0/26 [110/2] via 200.100.50.145, 00:03:01,
    GigabitEthernet0/0
C       200.100.50.64/27 is directly connected, GigabitEthernet0/2
L       200.100.50.65/32 is directly connected, GigabitEthernet0/2
O       200.100.50.96/27 [110/2] via 200.100.50.150, 00:39:07,
    GigabitEthernet0/1
O       200.100.50.128/28 [110/3] via 200.100.50.150, 00:03:37,
    GigabitEthernet0/1
C       200.100.50.144/30 is directly connected, GigabitEthernet0/0
L       200.100.50.146/32 is directly connected, GigabitEthernet0/0
C       200.100.50.148/30 is directly connected, GigabitEthernet0/1
L       200.100.50.149/32 is directly connected, GigabitEthernet0/1
O       200.100.50.152/30 [110/2] via 200.100.50.150, 00:39:07,
    GigabitEthernet0/1
```

Listing 122: Observation for show ip route on Router 1

```

Ashlesh_2>show ip route
Gateway of last resort is not set

    200.100.50.0/24 is variably subnetted, 10 subnets, 5 masks
O       200.100.50.0/26 [110/3] via 200.100.50.149, 00:03:23,
        GigabitEthernet0/0
O       200.100.50.64/27 [110/2] via 200.100.50.149, 00:39:29,
        GigabitEthernet0/0
C       200.100.50.96/27 is directly connected, GigabitEthernet0/2
L       200.100.50.97/32 is directly connected, GigabitEthernet0/2
O       200.100.50.128/28 [110/2] via 200.100.50.154, 00:22:46,
        GigabitEthernet0/1
O       200.100.50.144/30 [110/2] via 200.100.50.149, 00:39:29,
        GigabitEthernet0/0
C       200.100.50.148/30 is directly connected, GigabitEthernet0/0
L       200.100.50.150/32 is directly connected, GigabitEthernet0/0
C       200.100.50.152/30 is directly connected, GigabitEthernet0/1
L       200.100.50.153/32 is directly connected, GigabitEthernet0/1

```

Listing 123: Observation for show ip route on Router 2

```

Ashlesh_3>show ip route
Gateway of last resort is not set

    200.100.50.0/24 is variably subnetted, 9 subnets, 5 masks
O       200.100.50.0/26 [110/4] via 200.100.50.153, 00:03:47,
        GigabitEthernet0/0
O       200.100.50.64/27 [110/3] via 200.100.50.153, 00:39:58,
        GigabitEthernet0/0
O       200.100.50.96/27 [110/2] via 200.100.50.153, 00:39:58,
        GigabitEthernet0/0
C       200.100.50.128/28 is directly connected, GigabitEthernet0/1
L       200.100.50.129/32 is directly connected, GigabitEthernet0/1
O       200.100.50.144/30 [110/3] via 200.100.50.153, 00:04:23,
        GigabitEthernet0/0
O       200.100.50.148/30 [110/2] via 200.100.50.153, 00:39:58,
        GigabitEthernet0/0
C       200.100.50.152/30 is directly connected, GigabitEthernet0/0
L       200.100.50.154/32 is directly connected, GigabitEthernet0/0

```

Listing 124: Observation for show ip route on Router 3

If the link between the router 4 and switch 0 is down for some reason, the packet takes the longer route through router 3 avoiding the damaged route. Since OSPF is a link state routing technique, the changes are reflected almost instantaneously. The routing tables are also updated accordingly. For instance, the router 0 now only has a route to the network 200.100.50.152 through 200.100.50.146 since the link 200.100.50.62 is down. This update is possible due to OSPF configurations on all the routers as mentioned.

### Sub activity 3

The observations are already included for none of the links being removed in Listings 115 to 119.

### Sub activity 4 [Removing link between Router 0 and Router 1]

```
C:\>tracert 200.100.50.66

Tracing route to 200.100.50.66 over a maximum of 30 hops:

  1    1 ms      0 ms      0 ms      200.100.50.1
  2    0 ms      0 ms      0 ms      200.100.50.62
  3    0 ms      0 ms      0 ms      200.100.50.129
  4    0 ms      0 ms      0 ms      200.100.50.153
  5    0 ms      0 ms      0 ms      200.100.50.149
  6    0 ms      0 ms      0 ms      200.100.50.66

Trace complete.
```

Listing 125: Observation for tracert from PC0 to PC1

```
C:\>tracert 200.100.50.99

Tracing route to 200.100.50.99 over a maximum of 30 hops:

  1    0 ms      0 ms      0 ms      200.100.50.1
  2    0 ms      0 ms      0 ms      200.100.50.62
  3    0 ms      0 ms      1 ms      200.100.50.129
  4    0 ms      0 ms      0 ms      200.100.50.153
  5    0 ms      0 ms      0 ms      200.100.50.99

Trace complete.
```

Listing 126: Observation for tracert from PC0 to PC2

```
C:\>tracert 200.100.50.130

Tracing route to 200.100.50.130 over a maximum of 30 hops:

  1    0 ms      0 ms      0 ms      200.100.50.1
  2    0 ms      0 ms      0 ms      200.100.50.62
  3    2 ms      0 ms      0 ms      200.100.50.130

Trace complete.
```

Listing 127: Observation for tracert from PC0 to PC3



```
C:\>tracert 200.100.50.3

Tracing route to 200.100.50.3 over a maximum of 30 hops:

  1    0 ms      0 ms      0 ms      200.100.50.65
  2    0 ms      0 ms      0 ms      200.100.50.150
  3    0 ms      0 ms      0 ms      200.100.50.154
  4    0 ms      5 ms      1 ms      200.100.50.142
  5    0 ms      0 ms      0 ms      200.100.50.3

Trace complete.
```

Listing 128: Observation for tracert from PC1 to PC0

```
C:\>tracert 200.100.50.99

Tracing route to 200.100.50.99 over a maximum of 30 hops:

  1    0 ms      0 ms      0 ms      200.100.50.65
  2    0 ms      0 ms      0 ms      200.100.50.150
  3    0 ms      0 ms      0 ms      200.100.50.99

Trace complete.
```

Listing 129: Observation for tracert from PC1 to PC2

```
C:\>tracert 200.100.50.130

Tracing route to 200.100.50.130 over a maximum of 30 hops:

  1    0 ms      0 ms      0 ms      200.100.50.65
  2    0 ms      0 ms      0 ms      200.100.50.150
  3    1 ms      0 ms      0 ms      200.100.50.154
  4    1 ms      0 ms      1 ms      200.100.50.130

Trace complete.
```

Listing 130: Observation for tracert from PC1 to PC3

```
C:\>tracert 200.100.50.3

Tracing route to 200.100.50.3 over a maximum of 30 hops:

  1    1 ms      0 ms      0 ms      200.100.50.97
  2    0 ms      0 ms      0 ms      200.100.50.154
  3    0 ms      0 ms      0 ms      200.100.50.142
```

```

4      0 ms      0 ms      1 ms      200.100.50.3

Trace complete.

```

Listing 131: Observation for tracert from PC2 to PC0

```

C:\>tracert 200.100.50.66

Tracing route to 200.100.50.66 over a maximum of 30 hops:

  1    1 ms      0 ms      0 ms      200.100.50.97
  2    0 ms      0 ms      0 ms      200.100.50.149
  3    0 ms      0 ms      0 ms      200.100.50.66

Trace complete.

```

Listing 132: Observation for tracert from PC2 to PC1

```

C:\>tracert 200.100.50.130

Tracing route to 200.100.50.130 over a maximum of 30 hops:

  1    0 ms      0 ms      0 ms      200.100.50.97
  2    0 ms      0 ms      0 ms      200.100.50.154
  3    0 ms      0 ms      0 ms      200.100.50.130

Trace complete.

```

Listing 133: Observation for tracert from PC2 to PC3

```

C:\>tracert 200.100.50.3

Tracing route to 200.100.50.3 over a maximum of 30 hops:

  1    4 ms      0 ms      0 ms      200.100.50.129
  2    0 ms      0 ms      0 ms      200.100.50.142
  3    0 ms      0 ms      0 ms      200.100.50.3

Trace complete.

```

Listing 134: Observation for tracert from PC3 to PC0

```

C:\>tracert 200.100.50.66

Tracing route to 200.100.50.66 over a maximum of 30 hops:

```

```

1    1 ms    0 ms    0 ms    200.100.50.129
2    0 ms    0 ms    0 ms    200.100.50.153
3    0 ms    0 ms    0 ms    200.100.50.149
4    0 ms    0 ms    0 ms    200.100.50.66

Trace complete.

```

Listing 135: Observation for tracert from PC3 to PC1

```

C:\>tracert 200.100.50.99

Tracing route to 200.100.50.99 over a maximum of 30 hops:

  1    0 ms    0 ms    0 ms    200.100.50.129
  2    0 ms    0 ms    0 ms    200.100.50.153
  3    0 ms    0 ms    0 ms    200.100.50.99

Trace complete.

```

Listing 136: Observation for tracert from PC3 to PC2

```

Ashlesh_0>show ip route
Gateway of last resort is not set

    200.100.50.0/24 is variably subnetted, 7 subnets, 5 masks
C       200.100.50.0/26 is directly connected, GigabitEthernet0/1
L       200.100.50.1/32 is directly connected, GigabitEthernet0/1
O       200.100.50.64/27 [110/5] via 200.100.50.62, 00:12:11,
        GigabitEthernet0/1
O       200.100.50.96/27 [110/4] via 200.100.50.62, 00:12:11,
        GigabitEthernet0/1
O       200.100.50.128/28 [110/2] via 200.100.50.62, 00:14:26,
        GigabitEthernet0/1
O       200.100.50.148/30 [110/4] via 200.100.50.62, 00:12:11,
        GigabitEthernet0/1
O       200.100.50.152/30 [110/3] via 200.100.50.62, 00:12:11,
        GigabitEthernet0/1

```

Listing 137: Observation for show ip route on Router 0

```

Ashlesh_1>show ip route
Gateway of last resort is not set

    200.100.50.0/24 is variably subnetted, 8 subnets, 5 masks
O       200.100.50.0/26 [110/4] via 200.100.50.150, 00:12:34,
        GigabitEthernet0/1
C       200.100.50.64/27 is directly connected, GigabitEthernet0/2

```

```
L    200.100.50.65/32 is directly connected, GigabitEthernet0/2
O    200.100.50.96/27 [110/2] via 200.100.50.150, 00:58:24,
    GigabitEthernet0/1
O    200.100.50.128/28 [110/3] via 200.100.50.150, 00:12:34,
    GigabitEthernet0/1
C    200.100.50.148/30 is directly connected, GigabitEthernet0/1
L    200.100.50.149/32 is directly connected, GigabitEthernet0/1
O    200.100.50.152/30 [110/2] via 200.100.50.150, 00:58:24,
    GigabitEthernet0/1
```

Listing 138: Observation for show ip route on Router 1

```
Ashlesh_2>show ip route
Gateway of last resort is not set

    200.100.50.0/24 is variably subnetted, 9 subnets, 5 masks
O    200.100.50.0/26 [110/3] via 200.100.50.154, 00:12:53,
    GigabitEthernet0/1
O    200.100.50.64/27 [110/2] via 200.100.50.149, 00:58:43,
    GigabitEthernet0/0
C    200.100.50.96/27 is directly connected, GigabitEthernet0/2
L    200.100.50.97/32 is directly connected, GigabitEthernet0/2
O    200.100.50.128/28 [110/2] via 200.100.50.154, 00:42:00,
    GigabitEthernet0/1
C    200.100.50.148/30 is directly connected, GigabitEthernet0/0
L    200.100.50.150/32 is directly connected, GigabitEthernet0/0
C    200.100.50.152/30 is directly connected, GigabitEthernet0/1
L    200.100.50.153/32 is directly connected, GigabitEthernet0/1
```

Listing 139: Observation for show ip route on Router 2

```
Ashlesh_3>show ip route
Gateway of last resort is not set

    200.100.50.0/24 is variably subnetted, 8 subnets, 5 masks
O       200.100.50.0/26 [110/2] via 200.100.50.142, 00:15:27,
        GigabitEthernet0/1
O       200.100.50.64/27 [110/3] via 200.100.50.153, 00:59:07,
        GigabitEthernet0/0
O       200.100.50.96/27 [110/2] via 200.100.50.153, 00:59:07,
        GigabitEthernet0/0
C       200.100.50.128/28 is directly connected, GigabitEthernet0/1
L       200.100.50.129/32 is directly connected, GigabitEthernet0/1
O       200.100.50.148/30 [110/2] via 200.100.50.153, 00:59:07,
        GigabitEthernet0/0
C       200.100.50.152/30 is directly connected, GigabitEthernet0/0
L       200.100.50.154/32 is directly connected, GigabitEthernet0/0
```

Listing 140: Observation for show ip route on Router 3

#### Sub activity 5 [Removing link between Router 1 and Router 2]

```
C:\>tracert 200.100.50.66

Tracing route to 200.100.50.66 over a maximum of 30 hops:

  1    1 ms      0 ms      0 ms      200.100.50.1
  2    0 ms      0 ms      1 ms      200.100.50.146
  3    0 ms      0 ms      0 ms      200.100.50.66

Trace complete.
```

Listing 141: Observation for tracert from PC0 to PC1

```
C:\>tracert 200.100.50.99

Tracing route to 200.100.50.99 over a maximum of 30 hops:

  1    0 ms      0 ms      0 ms      200.100.50.1
  2    0 ms      0 ms      0 ms      200.100.50.62
  3    0 ms      0 ms      0 ms      200.100.50.129
  4    0 ms      1 ms      0 ms      200.100.50.153
  5    0 ms      0 ms      0 ms      200.100.50.99

Trace complete.
```

Listing 142: Observation for tracert from PC0 to PC2

```
C:\>tracert 200.100.50.130

Tracing route to 200.100.50.130 over a maximum of 30 hops:

  1    1 ms      0 ms      0 ms      200.100.50.1
  2    0 ms      1 ms      0 ms      200.100.50.62
  3    1 ms      0 ms      0 ms      200.100.50.130

Trace complete.
```

Listing 143: Observation for tracert from PC0 to PC3

```
C:\>tracert 200.100.50.3

Tracing route to 200.100.50.3 over a maximum of 30 hops:

  1    0 ms      0 ms      0 ms      200.100.50.65
  2    0 ms      0 ms      0 ms      200.100.50.145
  3    0 ms      0 ms      0 ms      200.100.50.3

Trace complete.
```

Listing 144: Observation for tracert from PC1 to PC0

```
C:\>tracert 200.100.50.99

Tracing route to 200.100.50.99 over a maximum of 30 hops:

  1    0 ms      5 ms      0 ms      200.100.50.65
  2    1 ms      0 ms      1 ms      200.100.50.145
  3    0 ms      1 ms      0 ms      200.100.50.62
  4    0 ms      0 ms      0 ms      200.100.50.129
  5    0 ms      0 ms      8 ms      200.100.50.153
  6    0 ms      10 ms     10 ms     200.100.50.99

Trace complete.
```

Listing 145: Observation for tracert from PC1 to PC2

```
C:\>tracert 200.100.50.130

Tracing route to 200.100.50.130 over a maximum of 30 hops:

  1    0 ms      0 ms      0 ms      200.100.50.65
  2    0 ms      0 ms      0 ms      200.100.50.145
  3    0 ms      0 ms      0 ms      200.100.50.62
```

```

4      0 ms      0 ms      0 ms      200.100.50.130

Trace complete.

```

Listing 146: Observation for tracert from PC1 to PC3

```

C:\>tracert 200.100.50.3

Tracing route to 200.100.50.3 over a maximum of 30 hops:

 1      0 ms      0 ms      0 ms      200.100.50.97
 2      0 ms      0 ms      0 ms      200.100.50.154
 3      0 ms      0 ms      6 ms      200.100.50.142
 4      0 ms      0 ms      0 ms      200.100.50.3

Trace complete.

```

Listing 147: Observation for tracert from PC2 to PC0

```

C:\>tracert 200.100.50.66

Tracing route to 200.100.50.66 over a maximum of 30 hops:

 1      0 ms      0 ms      0 ms      200.100.50.97
 2      0 ms      1 ms      0 ms      200.100.50.154
 3      0 ms      0 ms      0 ms      200.100.50.142
 4      0 ms      1 ms      0 ms      200.100.50.1
 5      0 ms      10 ms     0 ms      200.100.50.146
 6     10 ms      0 ms      0 ms      200.100.50.66

Trace complete.

```

Listing 148: Observation for tracert from PC2 to PC1

```

C:\>tracert 200.100.50.130

Tracing route to 200.100.50.130 over a maximum of 30 hops:

 1      1 ms      0 ms      0 ms      200.100.50.97
 2      0 ms      0 ms      0 ms      200.100.50.154
 3      0 ms      0 ms      0 ms      200.100.50.130

Trace complete.

```

Listing 149: Observation for tracert from PC2 to PC3

```
C:\>tracert 200.100.50.3

Tracing route to 200.100.50.3 over a maximum of 30 hops:

  1    0 ms      0 ms      0 ms      200.100.50.129
  2    0 ms      0 ms      0 ms      200.100.50.142
  3    1 ms      0 ms      0 ms      200.100.50.3

Trace complete.
```

Listing 150: Observation for tracert from PC3 to PC0

```
C:\>tracert 200.100.50.66

Tracing route to 200.100.50.66 over a maximum of 30 hops:

  1    8 ms      0 ms      0 ms      200.100.50.129
  2    0 ms      0 ms      1 ms      200.100.50.142
  3    0 ms      0 ms      5 ms      200.100.50.1
  4    0 ms      0 ms      0 ms      200.100.50.146
  5    1 ms      0 ms      0 ms      200.100.50.66

Trace complete.
```

Listing 151: Observation for tracert from PC3 to PC1

```
C:\>tracert 200.100.50.99

Tracing route to 200.100.50.99 over a maximum of 30 hops:

  1    0 ms      0 ms      0 ms      200.100.50.129
  2    0 ms      0 ms      0 ms      200.100.50.153
  3    0 ms      0 ms      0 ms      200.100.50.99

Trace complete.
```

Listing 152: Observation for tracert from PC3 to PC2

```
Ashlesh_0>show ip route
Gateway of last resort is not set

    200.100.50.0/24 is variably subnetted, 8 subnets, 5 masks
C       200.100.50.0/26 is directly connected, GigabitEthernet0/1
L       200.100.50.1/32 is directly connected, GigabitEthernet0/1
O       200.100.50.64/27 [110/2] via 200.100.50.146, 00:07:11,
        GigabitEthernet0/0
```



```

O      200.100.50.96/27 [110/4] via 200.100.50.62, 00:23:48,
      GigabitEthernet0/1
O      200.100.50.128/28 [110/2] via 200.100.50.62, 00:26:03,
      GigabitEthernet0/1
C      200.100.50.144/30 is directly connected, GigabitEthernet0/0
L      200.100.50.145/32 is directly connected, GigabitEthernet0/0
O      200.100.50.152/30 [110/3] via 200.100.50.62, 00:23:48,
      GigabitEthernet0/1

```

Listing 153: Observation for show ip route on Router 0

```

Ashlesh_1>show ip route
Gateway of last resort is not set

      200.100.50.0/24 is variably subnetted, 8 subnets, 5 masks
O      200.100.50.0/26 [110/2] via 200.100.50.145, 00:07:46,
      GigabitEthernet0/0
C      200.100.50.64/27 is directly connected, GigabitEthernet0/2
L      200.100.50.65/32 is directly connected, GigabitEthernet0/2
O      200.100.50.96/27 [110/5] via 200.100.50.145, 00:07:46,
      GigabitEthernet0/0
O      200.100.50.128/28 [110/3] via 200.100.50.145, 00:07:46,
      GigabitEthernet0/0
C      200.100.50.144/30 is directly connected, GigabitEthernet0/0
L      200.100.50.146/32 is directly connected, GigabitEthernet0/0
O      200.100.50.152/30 [110/4] via 200.100.50.145, 00:07:46,
      GigabitEthernet0/0

```

Listing 154: Observation for show ip route on Router 1

```

Ashlesh_2>show ip route
Gateway of last resort is not set

      200.100.50.0/24 is variably subnetted, 8 subnets, 5 masks
O      200.100.50.0/26 [110/3] via 200.100.50.154, 00:24:54,
      GigabitEthernet0/1
O      200.100.50.64/27 [110/5] via 200.100.50.154, 00:08:17,
      GigabitEthernet0/1
C      200.100.50.96/27 is directly connected, GigabitEthernet0/2
L      200.100.50.97/32 is directly connected, GigabitEthernet0/2
O      200.100.50.128/28 [110/2] via 200.100.50.154, 00:54:01,
      GigabitEthernet0/1
O      200.100.50.144/30 [110/4] via 200.100.50.154, 00:08:17,
      GigabitEthernet0/1
C      200.100.50.152/30 is directly connected, GigabitEthernet0/1
L      200.100.50.153/32 is directly connected, GigabitEthernet0/1

```

Listing 155: Observation for show ip route on Router 2

```
Ashlesh_3>show ip route
Gateway of last resort is not set

    200.100.50.0/24 is variably subnetted, 8 subnets, 5 masks
O       200.100.50.0/26 [110/2] via 200.100.50.142, 00:27:30,
        GigabitEthernet0/1
O       200.100.50.64/27 [110/4] via 200.100.50.142, 00:08:33,
        GigabitEthernet0/1
O       200.100.50.96/27 [110/2] via 200.100.50.153, 01:11:10,
        GigabitEthernet0/0
C       200.100.50.128/28 is directly connected, GigabitEthernet0/1
L       200.100.50.129/32 is directly connected, GigabitEthernet0/1
O       200.100.50.144/30 [110/3] via 200.100.50.142, 00:08:33,
        GigabitEthernet0/1
C       200.100.50.152/30 is directly connected, GigabitEthernet0/0
L       200.100.50.154/32 is directly connected, GigabitEthernet0/0
```

Listing 156: Observation for show ip route on Router 3

#### Sub activity 5 [Removing link between Router 2 and Router 3]

```
C:\>tracert 200.100.50.66

Tracing route to 200.100.50.66 over a maximum of 30 hops:

  1  0 ms      0 ms      0 ms      200.100.50.1
  2  0 ms      0 ms      1 ms      200.100.50.146
  3  0 ms      0 ms      0 ms      200.100.50.66

Trace complete.
```

Listing 157: Observation for tracert from PC0 to PC1

```
C:\>tracert 200.100.50.99

Tracing route to 200.100.50.99 over a maximum of 30 hops:

  1  0 ms      0 ms      0 ms      200.100.50.1
  2  0 ms      0 ms      0 ms      200.100.50.146
  3  0 ms      0 ms      0 ms      200.100.50.150
  4  0 ms      0 ms      0 ms      200.100.50.99

Trace complete.
```

Listing 158: Observation for tracert from PC0 to PC2

```
C:\>tracert 200.100.50.130

Tracing route to 200.100.50.130 over a maximum of 30 hops:

  1    0 ms      0 ms      0 ms      200.100.50.1
  2    0 ms      0 ms      0 ms      200.100.50.62
  3    0 ms      0 ms      1 ms      200.100.50.130

Trace complete.
```

Listing 159: Observation for tracert from PC0 to PC3

```
C:\>tracert 200.100.50.3

Tracing route to 200.100.50.3 over a maximum of 30 hops:

  1    0 ms      0 ms      0 ms      200.100.50.65
  2    0 ms      0 ms      0 ms      200.100.50.145
  3    0 ms      0 ms      0 ms      200.100.50.3

Trace complete.
```

Listing 160: Observation for tracert from PC1 to PC0

```
C:\>tracert 200.100.50.99

Tracing route to 200.100.50.99 over a maximum of 30 hops:

  1    0 ms      0 ms      0 ms      200.100.50.65
  2    0 ms      0 ms      0 ms      200.100.50.150
  3    0 ms      0 ms      0 ms      200.100.50.99

Trace complete.
```

Listing 161: Observation for tracert from PC1 to PC2

```
C:\>tracert 200.100.50.130

Tracing route to 200.100.50.130 over a maximum of 30 hops:

  1    0 ms      0 ms      0 ms      200.100.50.65
  2    0 ms      0 ms      0 ms      200.100.50.145
  3    0 ms      0 ms      0 ms      200.100.50.62
  4    0 ms      0 ms      0 ms      200.100.50.130
```

```
Trace complete.
```

Listing 162: Observation for tracert from PC1 to PC3

```
C:\>tracert 200.100.50.3

Tracing route to 200.100.50.3 over a maximum of 30 hops:

  1    1 ms      0 ms      0 ms      200.100.50.97
  2    0 ms      0 ms      0 ms      200.100.50.149
  3    0 ms      1 ms      0 ms      200.100.50.145
  4    0 ms      0 ms      0 ms      200.100.50.3

Trace complete.
```

Listing 163: Observation for tracert from PC2 to PC0

```
C:\>tracert 200.100.50.66

Tracing route to 200.100.50.66 over a maximum of 30 hops:

  1    1 ms      0 ms      0 ms      200.100.50.97
  2    0 ms      0 ms      0 ms      200.100.50.149
  3    0 ms      0 ms      0 ms      200.100.50.66

Trace complete.
```

Listing 164: Observation for tracert from PC2 to PC1

```
C:\>tracert 200.100.50.130

Tracing route to 200.100.50.130 over a maximum of 30 hops:

  1    0 ms      0 ms      0 ms      200.100.50.97
  2    0 ms      0 ms      0 ms      200.100.50.149
  3    0 ms      0 ms      0 ms      200.100.50.145
  4    0 ms      0 ms      0 ms      200.100.50.62
  5    0 ms      0 ms      0 ms      200.100.50.130

Trace complete.
```

Listing 165: Observation for tracert from PC2 to PC3

```
C:\>tracert 200.100.50.3

Tracing route to 200.100.50.3 over a maximum of 30 hops:
```

```

1    0 ms      0 ms      0 ms      200.100.50.129
2    0 ms      0 ms      0 ms      200.100.50.142
3    0 ms      0 ms      1 ms      200.100.50.3

```

Trace complete.

Listing 166: Observation for tracert from PC3 to PC0

```

C:\>tracert 200.100.50.66

Tracing route to 200.100.50.66 over a maximum of 30 hops:

 1    0 ms      0 ms      0 ms      200.100.50.129
 2    0 ms      0 ms      0 ms      200.100.50.142
 3    0 ms      0 ms      0 ms      200.100.50.1
 4    1 ms      0 ms      0 ms      200.100.50.146
 5    0 ms      1 ms      0 ms      200.100.50.66

```

Trace complete.

Listing 167: Observation for tracert from PC3 to PC1

```

C:\>tracert 200.100.50.99

Tracing route to 200.100.50.99 over a maximum of 30 hops:

 1    0 ms      5 ms      0 ms      200.100.50.129
 2    0 ms      0 ms      0 ms      200.100.50.142
 3    0 ms      0 ms      0 ms      200.100.50.1
 4    0 ms      0 ms      0 ms      200.100.50.146
 5    0 ms      0 ms      0 ms      200.100.50.150
 6    0 ms      0 ms      0 ms      200.100.50.99

```

Trace complete.

Listing 168: Observation for tracert from PC3 to PC2

```

Ashlesh_0>show ip route
Gateway of last resort is not set

    200.100.50.0/24 is variably subnetted, 8 subnets, 5 masks
C       200.100.50.0/26 is directly connected, GigabitEthernet0/1
L       200.100.50.1/32 is directly connected, GigabitEthernet0/1
O       200.100.50.64/27 [110/2] via 200.100.50.146, 01:01:43,
        GigabitEthernet0/0
O       200.100.50.96/27 [110/3] via 200.100.50.146, 00:51:55,

```

```
GigabitEthernet0/0
O      200.100.50.128/28 [110/2] via 200.100.50.62, 01:20:35,
GigabitEthernet0/1
C      200.100.50.144/30 is directly connected, GigabitEthernet0/0
L      200.100.50.145/32 is directly connected, GigabitEthernet0/0
O      200.100.50.148/30 [110/2] via 200.100.50.146, 00:51:55,
GigabitEthernet0/0
```

Listing 169: Observation for show ip route on Router 0

```
Ashlesh_1>show ip route
Gateway of last resort is not set

    200.100.50.0/24 is variably subnetted, 9 subnets, 5 masks
O      200.100.50.0/26 [110/2] via 200.100.50.145, 01:01:57,
GigabitEthernet0/0
C      200.100.50.64/27 is directly connected, GigabitEthernet0/2
L      200.100.50.65/32 is directly connected, GigabitEthernet0/2
O      200.100.50.96/27 [110/2] via 200.100.50.150, 00:52:14,
GigabitEthernet0/1
O      200.100.50.128/28 [110/3] via 200.100.50.145, 01:01:57,
GigabitEthernet0/0
C      200.100.50.144/30 is directly connected, GigabitEthernet0/0
L      200.100.50.146/32 is directly connected, GigabitEthernet0/0
C      200.100.50.148/30 is directly connected, GigabitEthernet0/1
L      200.100.50.149/32 is directly connected, GigabitEthernet0/1
```

Listing 170: Observation for show ip route on Router 1

```
Ashlesh_2>show ip route
Gateway of last resort is not set

    200.100.50.0/24 is variably subnetted, 8 subnets, 5 masks
O      200.100.50.0/26 [110/3] via 200.100.50.149, 00:52:36,
GigabitEthernet0/0
O      200.100.50.64/27 [110/2] via 200.100.50.149, 00:52:36,
GigabitEthernet0/0
C      200.100.50.96/27 is directly connected, GigabitEthernet0/2
L      200.100.50.97/32 is directly connected, GigabitEthernet0/2
O      200.100.50.128/28 [110/4] via 200.100.50.149, 00:52:36,
GigabitEthernet0/0
O      200.100.50.144/30 [110/2] via 200.100.50.149, 00:52:36,
GigabitEthernet0/0
C      200.100.50.148/30 is directly connected, GigabitEthernet0/0
L      200.100.50.150/32 is directly connected, GigabitEthernet0/0
```

Listing 171: Observation for show ip route on Router 2

```

Ashlesh_3>show ip route
Gateway of last resort is not set

    200.100.50.0/24 is variably subnetted, 7 subnets, 5 masks
O       200.100.50.0/26 [110/2] via 200.100.50.142, 01:21:44,
        GigabitEthernet0/1
O       200.100.50.64/27 [110/4] via 200.100.50.142, 01:02:47,
        GigabitEthernet0/1
O       200.100.50.96/27 [110/5] via 200.100.50.142, 00:53:04,
        GigabitEthernet0/1
C       200.100.50.128/28 is directly connected, GigabitEthernet0/1
L       200.100.50.129/32 is directly connected, GigabitEthernet0/1
O       200.100.50.144/30 [110/3] via 200.100.50.142, 01:02:47,
        GigabitEthernet0/1
O       200.100.50.148/30 [110/4] via 200.100.50.142, 00:53:04,
        GigabitEthernet0/1

```

Listing 172: Observation for show ip route on Router 3

**Problem 4**

**How dynamic routing can address the changing topology of a network automatically? Explain with reference to the observations.**

Dynamic routing, as the name suggests is used to dynamically change the routes based on changes in the network topology. Addition of new routes, or routes going out of service, both are handled automatically by dynamic routing. This is possible only if routers in the network can share their routing informations with other routers. This means that any changes detected by one router are reflected on other router's routing tables.

Based on the observations of this lab experiment, we can figure out how the two protocols RIP and OSPF operate. RIP works on distance vector algorithm, such that it uses a metric to determine the shortest path of any route. Any changes are broadcasted to all the neighbouring routers, and when a router receives a route that is not found in its own table, it updates the table to include the route. Further more, if there is a route present in its table that doesn't match its own, it keeps the shorter route in its table. This type of functioning is also known as rumor based routing. For OSPF, each router constructs its own map of the network based on updates from the neighbouring routers. Then, each router applies Dijkstra's algorithm to compute the shortest path to each destination network. This allows the changes to reflect almost instantly as observed.

## 5 Conclusion

The activities provided in the lab sheet were performed in the given order that allowed us to understand the concepts of dynamic routing using RIP and OSPF protocols. While performing activity A, the concepts of RIP were dealt with in gist. The network topology was similar to the one we've already dealt, but this time the routing was handled dynamically rather than statically defining each route. This allowed us to realize the time and effort saved while using dynamic routing. A maximum of 3 RIP routes were included in the routers that represented the interfaces that were connected to different networks. The routing tables showed that other essential routes are automatically learnt by the routers based on the neighbouring router's routing

information. Similarly, performing activity B allowed us to learn in depth about RIP routing, by disabling certain links in the network. Although some links were down in different observations, the connectivity wasn't lost, rather the router routed the packets through alternative routes automatically. This was a key observation since it wasn't possible in static routing. Moreover, performing the activity C allowed us to be familiar with OSPF routing protocol. Although the usage of different areas in the network wasn't dealt directly, the concepts were made clear. OSPF routing allowed the changes to be reflected almost instantaneously. During activity D, the addition and removal of certain routes was visualized using Packet Tracer's simulation environment, which showed that packets were re-routed once a better route was added, or if the routes were out of service. The observations for this particular simulation couldn't be included in the report, however the inclusion of the packet tracer files cuts off the compromise made. Overall, the completion of this lab experiment allows us to be familiar with concepts of dynamic routing using RIP and OSPF, and also observe how dynamic routing handles changes in the network topology.