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Lab 4
Static Routing and Default Route

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Title

Static Routing and Default Route

Objectives

- To be familiar with Static Routing and its configuration
- To be familiar with route aggregation
- To be familiar with default route and its configuration

Required Tools

- Network simulation tool: Packet Tracer

Activities

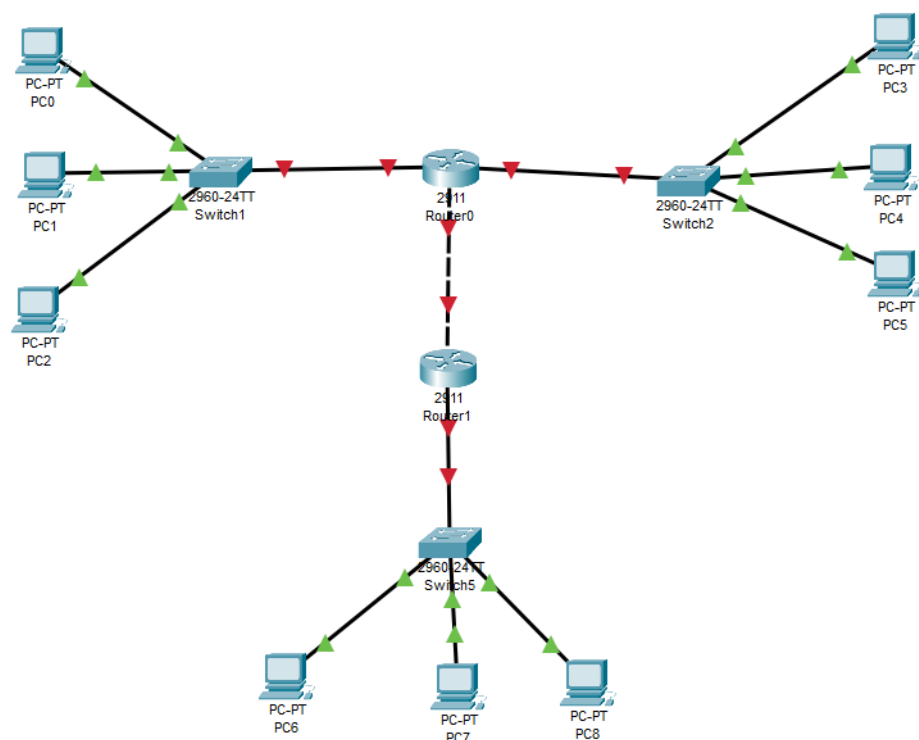A Following network was created using Packet Tracer:

Figure 1: Activity A Setup

1 IP Address and subnet mask of given computers were set as:

- PC0: 200.200.20.2 255.255.255.224

1

- PC1: 200.200.20.3 255.255.255.224
- PC2: 200.200.20.4 255.255.255.224
- PC3: 200.200.20.34 255.255.255.224
- PC4: 200.200.20.35 255.255.255.224
- PC5: 200.200.20.36 255.255.255.224
- PC6: 200.200.20.100 255.255.255.224
- PC7: 200.200.20.101 255.255.255.224
- PC8: 200.200.20.102 255.255.255.224

2 **Hostname, console password, vty password and enable password was configured in both routers.**
For Router0:

- Hostname = Bishal
- Console password = Bishal
- enable password = cisco
- vty password = Katuwal

```
Router(config)#Hostname Bishal
Bishal(config)#line console 0
Bishal(config-line)#password Bishal
Bishal(config-line)#login
Bishal(config-line)#exit
Bishal(config)#enable password cisco
Bishal(config)#line vty 0 4
Bishal(config-line)#password Katuwal
Bishal(config-line)#login
Bishal(config-line)#exit
```

For Router1:

- Hostname = Katuwal
- Console password = Bishal
- enable password = cisco
- vty password = Katuwal

```
Router(config)#Hostname Katuwal
Katuwal(config)#line console 0
Katuwal(config-line)#password Bishal
Katuwal(config-line)#login
Katuwal(config-line)#exit
Katuwal(config)#enable password cisco
Katuwal(config)#line vty 0 4
Katuwal(config-line)#password Katuwal
Katuwal(config-line)#login
Katuwal(config-line)#exit
```

3 Interfaces of Routers were configured with following IP addresses and turned on:

- Router0:GigabitEthernet 0/0 interface 200.200.20.1 255.255.255.224
- Router0:GigabitEthernet 0/1 interface 200.200.20.33 255.255.255.224
- Router0:GigabitEthernet 0/2 interface 200.200.20.65 255.255.255.224

```
Bishal(config)#interface GigabitEthernet 0/0
Bishal(config-if)#ip address 200.200.20.1 255.255.255.224
Bishal(config-if)#no shutdown
Bishal(config-if)#
%LINK-5-CHANGED: Interface GigabitEthernet0/0, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0,
changed state to up
Bishal(config-if)#exit

Bishal(config)#interface GigabitEthernet 0/1
Bishal(config-if)#ip address 200.200.20.33 255.255.255.224
Bishal(config-if)#no shutdown
Bishal(config-if)#
%LINK-5-CHANGED: Interface GigabitEthernet0/1, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/1,
changed state to up
Bishal(config-if)#exit

Bishal(config)#interface GigabitEthernet 0/2
Bishal(config-if)#ip address 200.200.20.65 255.255.255.224
Bishal(config-if)#no shutdown
Bishal(config-if)#
%LINK-5-CHANGED: Interface GigabitEthernet0/2, changed state to up
Bishal(config-if)#exit
```

- Router1: GigabitEthernet 0/0 interface 200.200.20.66 255.255.255.224
- Router1: GigabitEthernet 0/1 interface 200.200.20.99 255.255.255.224

```
Katuwal(config)#interface GigabitEthernet 0/0
Katuwal(config-if)#ip address 200.200.20.66 255.255.255.224
Katuwal(config-if)#no shutdown
Katuwal(config-if)#
%LINK-5-CHANGED: Interface GigabitEthernet0/0, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0,
changed state to up
Katuwal(config-if)#exit

Katuwal(config)#interface GigabitEthernet0/1
Katuwal(config-if)#ip address 200.200.20.99 255.255.255.224
Katuwal(config-if)#no shutdown
```

```
Katuwal(config-if)#
%LINK-5-CHANGED: Interface GigabitEthernet0/1, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/1,
changed state to up
Katuwal(config-if)#exit
```
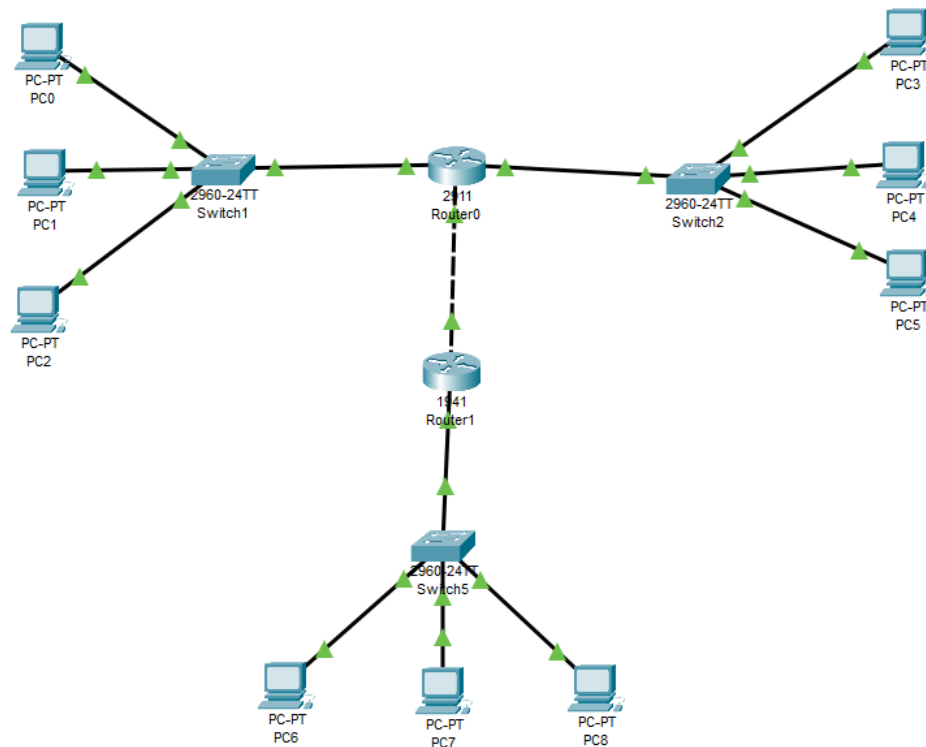

Figure 2: Activity A setup with interface

4 Output of the command "show ip route" was observed and noted in each router.

For Router 0:

There are six direct connections for router 0. From the figure, we can see that router 0 is connected to three devices, two switches and router 1. The table further shows that out of six, three are connected whereas three are local address. We can conclude that the addresses are of to three connected devices via three interfaces.

For Router 1:

There are four direct connections for router 1. From the figure, we can see that router 1 is connected to two devices, a switch and router 0. The table further shows that out of four, two are connected whereas two are local address. We can conclude that the addresses are of to two connected devices via two interfaces.

```
Bishal#show ip route
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

Gateway of last resort is not set

      200.200.20.0/24 is variably subnetted, 6 subnets, 2 masks
C        200.200.20.0/27 is directly connected, GigabitEthernet0/0
L        200.200.20.1/32 is directly connected, GigabitEthernet0/0
C        200.200.20.32/27 is directly connected, GigabitEthernet0/1
L        200.200.20.33/32 is directly connected, GigabitEthernet0/1
C        200.200.20.64/27 is directly connected, GigabitEthernet0/2
L        200.200.20.65/32 is directly connected, GigabitEthernet0/2
```

Figure 3: ip route for Router 0

```
Katuwal#show ip route
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

Gateway of last resort is not set

      200.200.20.0/24 is variably subnetted, 4 subnets, 2 masks
C        200.200.20.64/27 is directly connected, GigabitEthernet0/0
L        200.200.20.66/32 is directly connected, GigabitEthernet0/0
C        200.200.20.96/27 is directly connected, GigabitEthernet0/1
L        200.200.20.99/32 is directly connected, GigabitEthernet0/1
```

Figure 4: ip route for Router 1

5 **Ping command was used from PC0 to PC0, PC1, PC2, PC3, PC4, PC5, PC6, PC7, PC8, Router0 and Router1.**
PC0 could connect to PC0, PC1, PC2 and 200.200.20.1 interface of Router 0 but not others.

6 **Ping command was used from PC3 to PC0, PC1, PC2, PC3, PC4, PC5, PC6, PC7, PC8, Router0 and Router1.**
PC3 could connect to PC3, PC4, PC5 and 200.200.20.33 interface of router 0 but nor others.

7 **Ping command was used from PC6 to PC0, PC1, PC2, PC3, PC4, PC5, PC6, PC7, PC8, Router0 and Router1.**
PC6 could connect to PC6, PC7, PC8 and 200.200.20.99 interface of router 1 but not others.

8 **Ping command was used from Router0 to PC0, PC1, PC2, PC3, PC4, PC5, PC6, PC7, PC8 and Router1.**

```
Bishal#ping 200.200.20.2
```

```
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 200.200.20.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 0/0/0 ms

Bishal#ping 200.200.20.3
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 200.200.20.3, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 0/0/0 ms

Bishal#ping 200.200.20.4
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 200.200.20.4, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 0/0/0 ms

Bishal#ping 200.200.20.34
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 200.200.20.34, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 0/0/0 ms

Bishal#ping 200.200.20.35
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 200.200.20.35, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 0/0/4 ms

Bishal#ping 200.200.20.36
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 200.200.20.36, timeout is 2 seconds:
.!!!!
Success rate is 80 percent (4/5), round-trip min/avg/max = 0/0/0 ms

Bishal#ping 200.200.20.100
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 200.200.20.100, timeout is 2 seconds:
.....
Success rate is 0 percent (0/5)

Bishal#ping 200.200.20.101
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 200.200.20.101, timeout is 2 seconds:
.....
Success rate is 0 percent (0/5)

Bishal#ping 200.200.20.102
```

```
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 200.200.20.102, timeout is 2 seconds:
.....
Success rate is 0 percent (0/5)

Bishal#ping 200.200.20.66
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 200.200.20.66, timeout is 2 seconds:
.!!!!
Success rate is 80 percent (4/5), round-trip min/avg/max = 0/0/0 ms

Bishal#ping 200.200.20.99
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 200.200.20.99, timeout is 2 seconds:
.....
Success rate is 0 percent (0/5)
```

Router 0 could connect to PC0, PC1, PC2, PC3, PC4, PC5 and 200.200.20.66 interface of router 1 but not others.

9 **Ping command was used from Router1 to PC0, PC1, PC2, PC3, PC4, PC5, PC6, PC7, PC8 and Router0.**

```
Katuwal#ping 200.200.20.2
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 200.200.20.2, timeout is 2 seconds:
.....
Success rate is 0 percent (0/5)

Katuwal#ping 200.200.20.3
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 200.200.20.3, timeout is 2 seconds:
.....
Success rate is 0 percent (0/5)

Katuwal#ping 200.200.20.4
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 200.200.20.4, timeout is 2 seconds:
.....
Success rate is 0 percent (0/5)

Katuwal#ping 200.200.20.34
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 200.200.20.34, timeout is 2 seconds:
.....
Success rate is 0 percent (0/5)

Katuwal#ping 200.200.20.35
```

```
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 200.200.20.35, timeout is 2 seconds:
.....
Success rate is 0 percent (0/5)

Katuwal#ping 200.200.20.36
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 200.200.20.36, timeout is 2 seconds:
.....
Success rate is 0 percent (0/5)

Katuwal#ping 200.200.20.100
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 200.200.20.100, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 0/0/0 ms

Katuwal#ping 200.200.20.101
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 200.200.20.101, timeout is 2 seconds:
.!!!!
Success rate is 80 percent (4/5), round-trip min/avg/max = 0/0/0 ms

Katuwal#ping 200.200.20.102
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 200.200.20.102, timeout is 2 seconds:
.!!!!
Success rate is 80 percent (4/5), round-trip min/avg/max = 0/2/9 ms

Katuwal#ping 200.200.20.1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 200.200.20.1, timeout is 2 seconds:
.....
Success rate is 0 percent (0/5)

Katuwal#ping 200.200.20.33
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 200.200.20.33, timeout is 2 seconds:
.....
Success rate is 0 percent (0/5)

Katuwal#ping 200.200.20.65
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 200.200.20.65, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 0/0/0 ms
```

Router 1 could connect to PC6, PC7, PC8 and 200.200.20.65 interface of router

0 but not others.

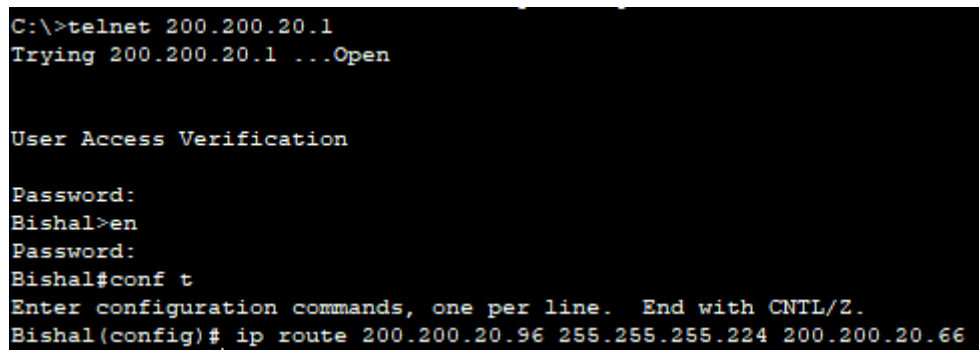10 **Default gateway of each of the computer was assigned as:**

- For PC0, PC1 and PC2:- 200.200.20.1
- For PC3, PC4 and PC5:- 200.200.20.33
- For PC6, PC7 and PC8:- 200.200.20.99

11 **Steps 5 to 9 were repeated.**
- PC0 could connect to PC0, PC1, PC2, PC3, PC4, PC5 and all ports of router 0 but not others.
- PC3 could connect to PC0, PC1, PC2, PC3, PC4, PC5 and all ports of router 0 but not others.
- PC6 could connect to PC6, PC7, PC8 and all ports of router 1 but not others.
- Router 0 could connect to PC0, PC1, PC2, PC3, PC4, PC5 and 200.200.20.66 interface of router 1 but not others.
- Router 1 could connect to PC6, PC7, PC8 and 200.200.20.65 interface of router 0 but not others.

12 **Router0 was entered from PC0 using telnet and the static route for destination network of Network 3 was configured as:**
ip route 200.200.20.96 255.255.255.224 200.200.20.66


```
C:\>telnet 200.200.20.1
Trying 200.200.20.1 ...Open


User Access Verification

Password:
Bishal>en
Password:
Bishal#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
Bishal(config)# ip route 200.200.20.96 255.255.255.224 200.200.20.66
```

Figure 5: Telnet to Router 0

13 **From Router0 Router1 was entered using telnet and following static routes were set.**
ip route 200.200.20.0 255.255.255.224 200.200.20.65
ip route 200.200.20.32 255.255.255.224 200.200.20.65

9

Figure 6: Telnet to Router 1

14 Steps from 4 to 9 were repeated.

- 4
  - For Router 0

Figure 7: Routes for Router 0

As compared to previous, a static connection was set up as done in activity A12.

  - For Router 1

As compared to previous, two static connection was set up as done in activity A12.

```
Katuwal#show ip route
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

Gateway of last resort is not set

     200.200.20.0/24 is variably subnetted, 6 subnets, 2 masks
S       200.200.20.0/27 [1/0] via 200.200.20.65
S       200.200.20.32/27 [1/0] via 200.200.20.65
C       200.200.20.64/27 is directly connected, GigabitEthernet0/0
L       200.200.20.66/32 is directly connected, GigabitEthernet0/0
C       200.200.20.96/27 is directly connected, GigabitEthernet0/1
L       200.200.20.99/32 is directly connected, GigabitEthernet0/1
```

Figure 8: Routes for Router 1

- 5
  PC0 could connect to all PCs and Routers.
- 6
  PC3 could connect to all PCs and Routers.
- 7
  PC6 could connect to all PCs and Routers.
- 8
  Router 0 could connect to all PCs and Routers.
- 9
  Router 1 could connect to all PCs and Routers.

After setting up static routes, each PC and each router could connect to all other PCs and Routers. This is different from previous (11) because now inter-router connections are possible.

15 **Both routes added in step 12 was removed by using no ip route command.**

```
Katuwal(config)#no ip route 200.200.20.32 255.255.255.224 200.200.20.65
Katuwal(config)#no ip route 200.200.20.0 255.255.255.224 200.200.20.65
```

16 **Network 1 and 2 were aggregated.**

```
Katuwal(config)#ip route 200.200.20.0 255.255.255.192 200.200.20.65
```

17 **Steps 4 to 9 were repeated.**
The results were same as 14. It was concluded that there is no difference between connecting two consecutive addresses separately and aggregating them.

B Following network was created using Packet Tracer:
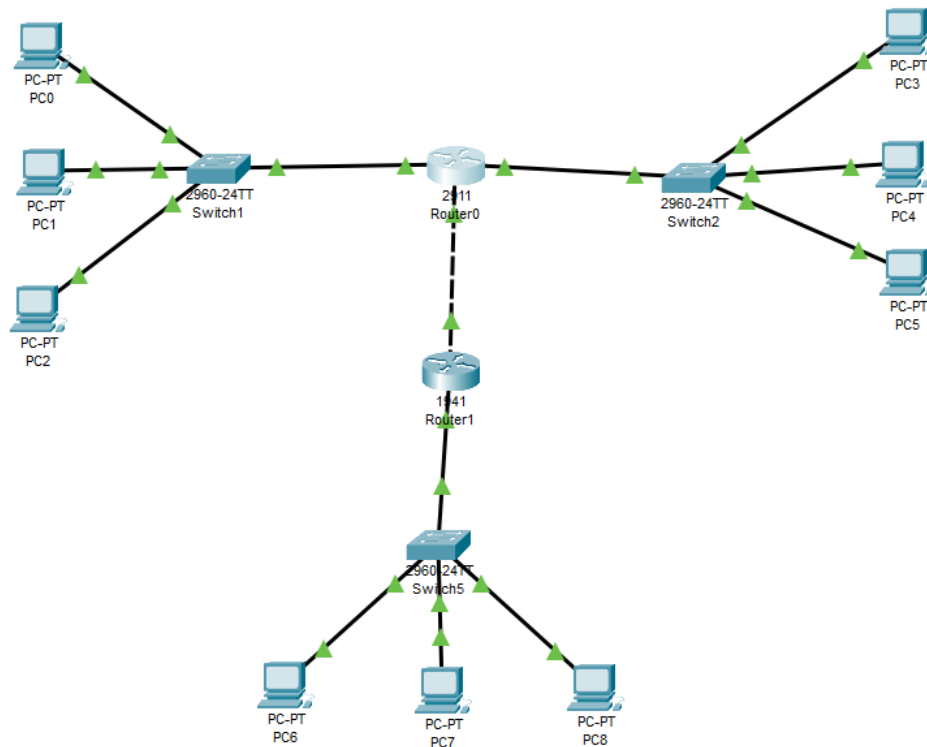
Figure 9: Setup of activity B

1 **All static routes configured in activity A was removed and default route was configured.**
For router0:

```
Bishal(config)#no ip route 200.200.20.96 255.255.255.224 200.200.20.66
Bishal(config)#exit
Bishal#
%SYS-5-CONFIG_I: Configured from console by console
show ip route
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 a
       * - candidate default, U - per-user static route, o - ODR
       P - periodic downloaded static route

Gateway of last resort is not set

       200.200.20.0/24 is variably subnetted, 6 subnets, 2 masks
C         200.200.20.0/27 is directly connected, GigabitEthernet0/0
```

```
L       200.200.20.1/32 is directly connected, GigabitEthernet0/0
C       200.200.20.32/27 is directly connected, GigabitEthernet0/1
L       200.200.20.33/32 is directly connected, GigabitEthernet0/1
C       200.200.20.64/27 is directly connected, GigabitEthernet0/2
L       200.200.20.65/32 is directly connected, GigabitEthernet0/2
```

For router 1:

```
Katuwal(config)#no ip route 200.200.20.0 255.255.255.192 200.200.20.65
Katuwal(config)#exit
Katuwal#
%SYS-5-CONFIG_I: Configured from console by console
show ip route
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 a
        * - candidate default, U - per-user static route, o - ODR
        P - periodic downloaded static route

Gateway of last resort is not set

     200.200.20.0/24 is variably subnetted, 4 subnets, 2 masks
C        200.200.20.64/27 is directly connected, GigabitEthernet0/0
L        200.200.20.66/32 is directly connected, GigabitEthernet0/0
C        200.200.20.96/27 is directly connected, GigabitEthernet0/1
L        200.200.20.99/32 is directly connected, GigabitEthernet0/1
```

To set default route:

```
Bishal(config)#Bishal(config)#ip route 0.0.0.0 0.0.0.0 200.200.20.66
Katuwal(config)#ip route 0.0.0.0 0.0.0.0 200.200.20.65
```

2 **The connectivity from PC0, PC3 and PC6 to each of the given PC and router was tested using the ping command.**
All PCs and routers could be pinged.
The nodes were connected.

3 **The output of show ip route in each router was observed.**

```
Gateway of last resort is 200.200.20.66 to network 0.0.0.0

      200.200.20.0/24 is variably subnetted, 6 subnets, 2 masks
C        200.200.20.0/27 is directly connected, GigabitEthernet0/0
L        200.200.20.1/32 is directly connected, GigabitEthernet0/0
C        200.200.20.32/27 is directly connected, GigabitEthernet0/1
L        200.200.20.33/32 is directly connected, GigabitEthernet0/1
C        200.200.20.64/27 is directly connected, GigabitEthernet0/2
L        200.200.20.65/32 is directly connected, GigabitEthernet0/2
S*    0.0.0.0/0 [1/0] via 200.200.20.66
```

Figure 10: IP route for router 0

```
Gateway of last resort is 200.200.20.65 to network 0.0.0.0

  *   200.200.20.0/24 is variably subnetted, 4 subnets, 2 masks
C        200.200.20.64/27 is directly connected, GigabitEthernet0/0
L        200.200.20.66/32 is directly connected, GigabitEthernet0/0
C        200.200.20.96/27 is directly connected, GigabitEthernet0/1
L        200.200.20.99/32 is directly connected, GigabitEthernet0/1
S*    0.0.0.0/0 [1/0] via 200.200.20.65
```

Figure 11: IP route for router 1

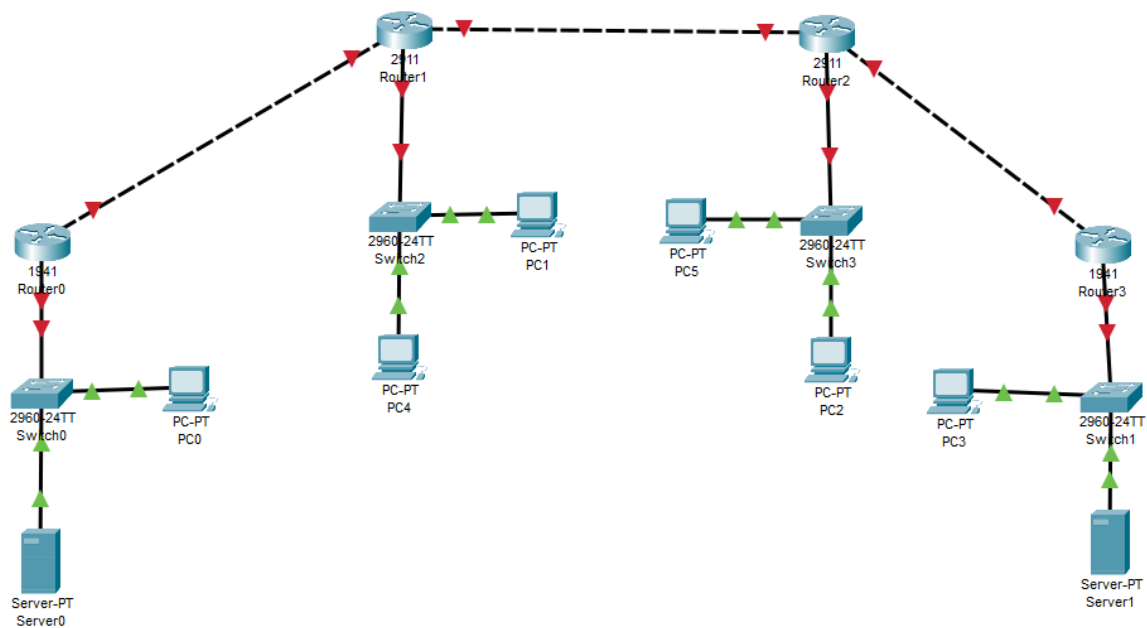C Following topology was created in Packet Tracer:

Figure 12: Setup for Activity C

1 **Hostname, console password, vty password and enable password was set for all routers.**

   - For Router 0:

     ```
     Router(config)#hostname Bishal_0
     ```

14

```
Bishal_0(config)#line console 0
Bishal_0(config-line)#password Bishal
Bishal_0(config-line)#login
Bishal_0(config-line)#exit
Bishal_0(config)#enable password cisco
Bishal_0(config)#line vty 0 4
Bishal_0(config-line)#password class
Bishal_0(config-line)#login
Bishal_0(config-line)#exit
```

- For router 1:

```
Router(config)#hostname Bishal_1
Bishal_1(config)#line console 0
Bishal_1(config-line)#password Bishal
Bishal_1(config-line)#login
Bishal_1(config-line)#exit
Bishal_1(config)#enable password cisco
Bishal_1(config)#line vty 0 4
Bishal_1(config-line)#password class
Bishal_1(config-line)#login
Bishal_1(config-line)#exit
```

- For Router 2:

```
Router(config)#hostname Bishal_2
Bishal_2(config)#line console 0
Bishal_2(config-line)#password Bishal
Bishal_2(config-line)#login
Bishal_2(config-line)#exit
Bishal_2(config)#enable password cisco
Bishal_2(config)#line vty 0 4
Bishal_2(config-line)#password class
Bishal_2(config-line)#login
Bishal_2(config-line)#exit
```

- For Router 3:

```
Router(config)#hostname Bishal_3
Bishal_3(config)#line console 0
Bishal_3(config-line)#password Bishal
Bishal_3(config-line)#login
Bishal_3(config-line)#exit
Bishal_3(config)#enable password cisco
Bishal_3(config)#line vty 0 4
Bishal_3(config-line)#password class
Bishal_3(config-line)#login
Bishal_3(config-line)#exit
```

2 Router interfaces were configured as:

- Router 0: 202.60.0.1 and 202.60.1.1
- Router 1: 202.60.1.2, 202.60.2.1 and 202.60.3.1
- Router 2: 202.60.3.2, 202.60.4.1 and 202.60.5.1
- Router 3: 202.60.5.2 and 202.60.6.1

3 **IP address, subnet mask and default gateway on each computer were configured.**

- PC0:202.60.0.3(ip), 255.255.255.0(subnet mask), 202.60.0.0(gateway)
- PC1:202.60.2.2(ip),255.255.255.0(subnet mask),202.60.2.0(gateway)
- PC2:202.60.4.3(ip),255.255.255.0(subnet mask),202.60.4.0(gateway)
- PC4:202.60.2.3(ip),255.255.255.0(subnet mask),202.60.2.0(gateway)
- PC3:202.60.6.3(ip),255.255.255.0(subnet mask),202.60.6.0(gateway)
- PC5:202.60.4.2(ip),255.255.255.0(subnet mask),202.60.4.0(gateway)
- Server0:202.60.0.2(ip),255.255.255.0(subnet mask),202.60.0.0(gateway)
- Server1:202.60.6.2(ip),255.255.255.0(subnet mask),202.60.6.0(gateway)

4 **"show ip route" command was issued in each router.**

- Router0:

```
        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
```

- Router1:

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

- Router2:

```
        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
```

- Router3:

```
        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
```

5 **Ping command from PC0 to PC0, PC1, PC2, PC3, Server0, Server1,Router0, Router1, Router2 and Router3.**
Router0 and Server0 responded successfully.
While pinging the Router1 with IP 202.60.1.2, the ping was timed out.
But for all other machines, the ping command was responded with host unreachable as there was no routing available from Router0 to all other devices or network.

6 **Ping command from PC1 to PC0, PC1, PC2, PC3, Server0, Server1,Router0, Router1, Router2 and Router3.**
Router1 and PC4 responded successfully.
While pinging the Router1 with IP 202.60.1.1 and Router2 with IP 202.60.3.2, the ping was timed out.
But for all other machines, the ping command responded with host unreachable as there was no routing available from Router1 to all other devices or network.

7 **Ping command from PC2 to PC0, PC1, PC2, PC3, Server0, Server1,Router0, Router1, Router2 and Router3.**
Router2 and PC5 responded successfully.
While pinging the Router1 with IP 202.60.3.1 and Router 3 with IP 202.60.5.2, the ping was timed out.
But for all other machines, the ping command responded with host unreachable as there was no routing available from Router2 to all other devices or network.

8 **Ping command from PC3 to PC0, PC1, PC2, PC3, Server0, Server1,Router0, Router1, Router2 and Router3.**
Router3 and Server1 responded successfully.
While pinging the Router2 with IP 202.60.5.1, the ping was timed out.
But for all other machines, the ping command responded with host unreachable as there was no routing available from Router3 to all other devices or network.

9 **From Router0, ping command was used to connect to Router1, Router2, Router3, PC0, PC1, PC2 and PC3**
Router1 with IP in network of 202.60.1.0/24, PC0 and Server0 responded successfully.
All other devices timed out.

10 **From Router1, ping command was used to connect to Router0, Router2, Router3, PC0, PC1, PC2 and PC3**
Router1 with IP in network of 202.60.3.0/24, Router3 with IP in network 202.60.5.0/24, PC2 and PC5 responded successfully.
All other devices timed out.

11 **From Router2, ping command was used to connect to Router1,**

Router0, Router3, PC0, PC1, PC2 and PC3

Router1 with IP in network of 202.60.3.0/24, Router3 with IP in network 202.60.5.0/24, PC2 and PC5 responded successfully.

All other devices timed out.

12 **From Router3, ping command was used to connect to Router1, Router2, Router0, PC0, PC1, PC2 and PC3**

Router2 with IP in network of 202.60.5.0/24, PC3 and Server1 responded successfully.

All other devices timed out.

13 **Router0 was entered from PC0 using telnet and the static route for each destination network was configured.**

14 **Router1 was entered from above using telnet and the static route for each destination network was configured.**

15 **The static route in Router2 and Router3 for each destination network were configured.**

16 **Step 4 to 12 were repeated.**

For ip routes:

- Router0:

```
      202.60.0.0/24 is variably subnetted, 2 subnets, 2 masks
  C   202.60.0.0/24 is directly connected, GigabitEthernet0/0
  L   202.60.0.1/32 is directly connected, GigabitEthernet0/0
      202.60.1.0/24 is variably subnetted, 2 subnets, 2 masks
  C   202.60.1.0/24 is directly connected, GigabitEthernet0/1
  L   202.60.1.1/32 is directly connected, GigabitEthernet0/1
  S   202.60.2.0/24 [1/0] via 202.60.1.2
  S   202.60.3.0/24 [1/0] via 202.60.1.2
  S   202.60.4.0/24 [1/0] via 202.60.3.2
  S   202.60.5.0/24 [1/0] via 202.60.3.2
  S   202.60.6.0/24 [1/0] via 202.60.5.2
```

- Router1:

```
  S   202.60.0.0/24 [1/0] via 202.60.1.1
      202.60.1.0/24 is variably subnetted, 2 subnets, 2 masks
  C   202.60.1.0/24 is directly connected, GigabitEthernet0/0
  L   202.60.1.2/32 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, GigabitEthernet0/1
  L   202.60.2.1/32 is directly connected, GigabitEthernet0/1
      202.60.3.0/24 is variably subnetted, 2 subnets, 2 masks
  C   202.60.3.0/24 is directly connected, GigabitEthernet0/2
  L   202.60.3.1/32 is directly connected, GigabitEthernet0/2
  S   202.60.4.0/24 [1/0] via 202.60.3.2
  S   202.60.5.0/24 [1/0] via 202.60.3.2
```

- Router2:

```
S    202.60.0.0/24 [1/0] via 202.60.1.1
S    202.60.1.0/24 [1/0] via 202.60.3.1
S    202.60.2.0/24 [1/0] via 202.60.3.1
     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, GigabitEthernet0/1
L    202.60.4.1/32 is directly connected, GigabitEthernet0/1
     202.60.5.0/24 is variably subnetted, 2 subnets, 2 masks
C    202.60.5.0/24 is directly connected, GigabitEthernet0/2
L    202.60.5.1/32 is directly connected, GigabitEthernet0/2
```

- Router3:
```
S    202.60.0.0/24 [1/0] via 202.60.1.1
S    202.60.1.0/24 [1/0] via 202.60.3.1
S    202.60.2.0/24 [1/0] via 202.60.3.1
S    202.60.3.0/24 [1/0] via 202.60.5.1
S    202.60.4.0/24 [1/0] via 202.60.5.1
     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
```

All connections were pingable.

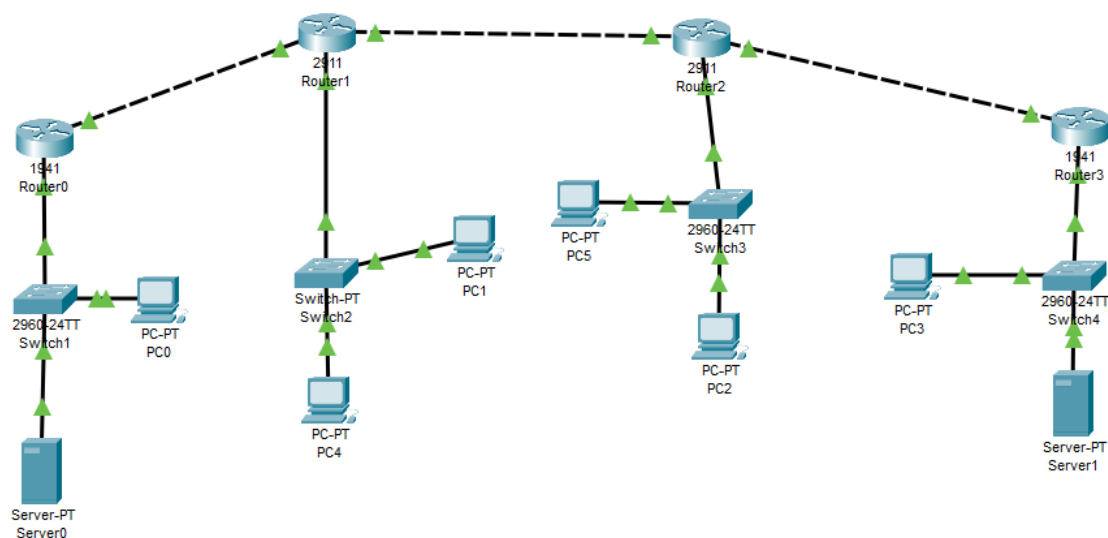D Following topology was created in Packet Tracer:

Figure 13: Setup for Activity D

1 **All static routes configured in activity C were removed and default route in each router was configured.**

```
Bishal_0(config)#no ip route 202.60.2.0 255.255.255.0 202.60.1.2
Bishal_0(config)#no ip route 202.60.3.0 255.255.255.0 202.60.1.2
Bishal_0(config)#no ip route 202.60.4.0 255.255.255.0 202.60.3.2
Bishal_0(config)#no ip route 202.60.5.0 255.255.255.0 202.60.3.2
Bishal_0(config)#no ip route 202.60.6.0 255.255.255.0 202.60.5.2
Bishal_0(config)#ip route 0.0.0.0 0.0.0.0 202.60.1.2

Bishal_1(config)#no ip route 202.60.0.0 255.255.255.0 202.60.1.1
Bishal_1(config)#no ip route 202.60.4.0 255.255.255.0 202.60.3.2
Bishal_1(config)#no ip route 202.60.6.0 255.255.255.0 202.60.5.2
Bishal_1(config)#no ip route 202.60.5.0 255.255.255.0 202.60.3.2
Bishal_1(config)#no ip route 202.60.3.0 255.255.255.0 202.60.1.1
Bishal_1(config)#ip route 0.0.0.0 0.0.0.0 202.60.3.2
Bishal_1(config)#ip route 0.0.0.0 0.0.0.0 202.60.1.1

Bishal_2(config)#no ip route 202.60.6.0 255.255.255.0 202.60.5.2
Bishal_2(config)#no ip route 202.60.0.0 255.255.255.0 202.60.1.1
Bishal_2(config)#no ip route 202.60.1.0 255.255.255.0 202.60.3.1
Bishal_2(config)#no ip route 202.60.2.0 255.255.255.0 202.60.3.1
Bishal_2(config)#ip route 0.0.0.0 0.0.0.0 202.60.3.1
Bishal_2(config)#ip route 0.0.0.0 0.0.0.0 202.60.5.2

Bishal_3(config)#no ip route 202.60.4.0 255.255.255.0 202.60.5.1
Bishal_3(config)#no ip route 202.60.1.0 255.255.255.0 202.60.3.1
Bishal_3(config)#no ip route 202.60.0.0 255.255.255.0 202.60.1.1
Bishal_3(config)#no ip route 202.60.2.0 255.255.255.0 202.60.3.1
Bishal_3(config)#no ip route 202.60.3.0 255.255.255.0 202.60.5.1
Bishal_3(config)#ip route 0.0.0.0 0.0.0.0 202.60.5.1
```

2 **Connectivity from PC0, PC1, PC2 and PC3 to each of the given PC and router was tested using ping command.**
All connections were possible.

3 **The output of show ip route was observed in each router.**

- Router0

- Router1

- Router2

- Router3

```
Gateway of last resort is 202.60.1.2 to network 0.0.0.0

     202.60.0.0/24 is variably subnetted, 2 subnets, 2 masks
C       202.60.0.0/24 is directly connected, GigabitEthernet0/0
L       202.60.0.1/32 is directly connected, GigabitEthernet0/0
     202.60.1.0/24 is variably subnetted, 2 subnets, 2 masks
C       202.60.1.0/24 is directly connected, GigabitEthernet0/1
L       202.60.1.1/32 is directly connected, GigabitEthernet0/1
S*   0.0.0.0/0 [1/0] via 202.60.1.2
```

Figure 14: Route for Router 0 at the end of Activity D

```
Gateway of last resort is 202.60.3.2 to network 0.0.0.0

     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, GigabitEthernet0/1
L       202.60.2.1/32 is directly connected, GigabitEthernet0/1
     202.60.3.0/24 is variably subnetted, 2 subnets, 2 masks
C       202.60.3.0/24 is directly connected, GigabitEthernet0/2
L       202.60.3.1/32 is directly connected, GigabitEthernet0/2
S*   0.0.0.0/0 [1/0] via 202.60.3.2
```

Figure 15: Route for Router 1 at the end of Activity D

```
Gateway of last resort is 202.60.3.1 to network 0.0.0.0

     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, GigabitEthernet0/1
L       202.60.4.1/32 is directly connected, GigabitEthernet0/1
     202.60.5.0/24 is variably subnetted, 2 subnets, 2 masks
C       202.60.5.0/24 is directly connected, GigabitEthernet0/2
L       202.60.5.1/32 is directly connected, GigabitEthernet0/2
S*   0.0.0.0/0 [1/0] via 202.60.3.1
               [1/0] via 202.60.5.2
```

Figure 16: Route for Router 2 at the end of Activity D

```
Gateway of last resort is 202.60.5.1 to network 0.0.0.0

     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
S*   0.0.0.0/0 [1/0] via 202.60.5.1
```

Figure 17: Route for Router 3 at the end of Activity D

Conclusion

In this way "Lab 4: Static Routing and Default Route" was completed with the help of Cisco Packet Tracer.

Exercises

1. **How does a sending host know whether the destination computer is on the same network or on a different network? How is the data packet forwarded in each case from the sending host? Explain.**
To identify whether the destination computer is on the same network or not, the host performs a series of AND operations.

   - First, the host ANDs its own IP address with its subnet mask.
   - Next, the host ANDs the destination IP address with its subnet mask.
   - If the results are identical, the destination lies within the same network. If not, the destination is in another network.

   In each case, if the destination lies within the same network, the host can directly communicate with the destination. If the destination is in another network, the host passes the message/packet to router which then forwards them to next network or next node in path to the destination network.

2. **What is routing? Explain static routing and configuration of static routing in a router with its syntax. Also mention how the routing table of a router can be observed.**
Routing, as the name suggests, is a process of creating routes between networks. In other words, routing is the process of creating a path between or among networks to establish communication link between them.
Static routing is a process of manually configuring a network route such that routing decisions are made on the basis of this preconfigured path. The syntax for configuration of static routing in a router is:

   ```
   ip route Destination_Network Subnet_Mask [next-hop-address]
   ```

   Routing table in a router can be observed by following command:

   ```
   show ip route
   ```

3. **What is a default route? What is its significance? Explain the default route configuration command with its syntax.**
Default route is the route that a packet takes if no static or connected route leads to the destination. It is the last resort path taken if a suitable path is absent in route table.
The significance of default path are:

   - It reduces the size of route table.
   - It removes the need of static routing when new devices are added.
   - It provides a last ditch effort for routing a destination address.

   The default route configuration is:

22

```
device(config)# ip route 0.0.0.0 0.0.0.0 [next hop address]
```

23

Optionally, following commands can also be added.

```
device(config)# ip route next-hop-recursion
device(config)# ip route next-hop-enable-default
```

4. **Note down the observation of each step with necessary commands specified in activities A, B, C and D mentioned above and comment on it.**
   Refer to Activity section on lab sheet.