CO513 - Lab 02
Static Routing

LAB EXCERSIZE

PROCEDURE:

The network topology in cisco packet tracer using appropriate devices; routers, switches and end devices shows as follows

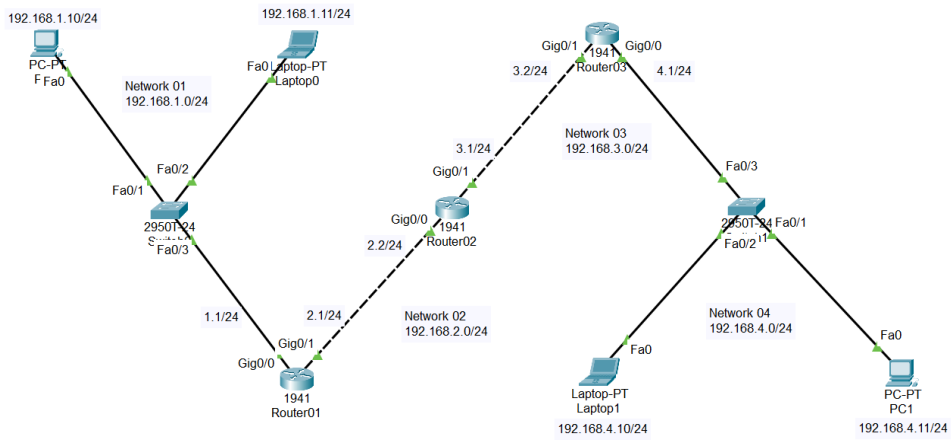

FIGURE 1 : Complete Lab Setup

- Please Consider for Interface IP's of the Routers are mentioned 1.1/24 for ease of understand.
  - 1.1/24 refers to 192.168.1.1/24
  - 2.1/24 refers to 192.168.2.1/24
  - 3.1/24 refers to 192.168.3.1/24
  - 4.1/24 refers to 192.168.4.1/24
- In order to configure routers in practical scenarios console cables are used. But in this activity all the configurations done using the CLI provided for routers.
- Console cable setup for Router01 is mentioned as follows.

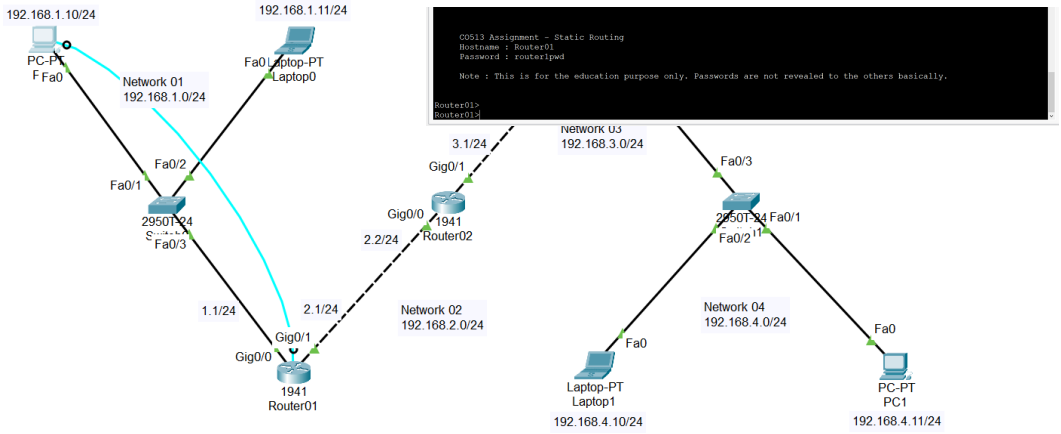

FIGURE 2 : Console cable connection to a Router and terminal view from PC0

IP ASSIGNMENT TO THE END DEVICES AND ROUTERS

Assign the end devices and router ports with appropriate IP addresses.

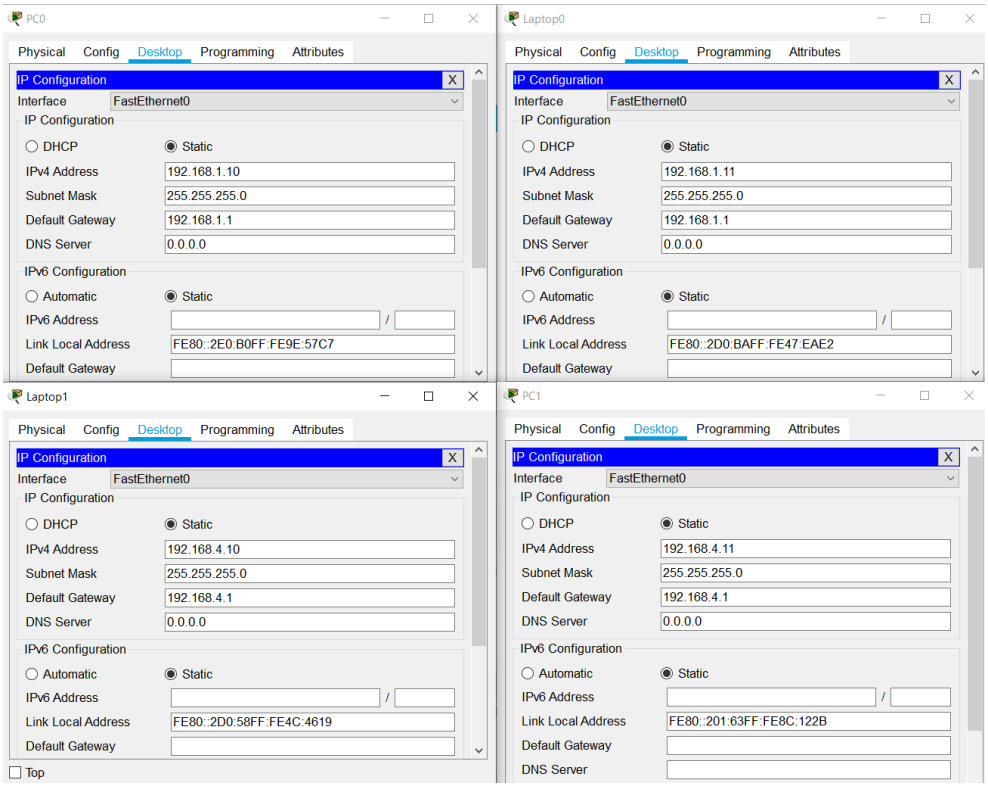

FIGURE 3 : IP configurations of End Devices and Include the Router Paths

ROUTER INTERFACES IP CONFIGURATIONS

Use built in show commands in Cisco IOS to visualize IP configurations in each of the routers

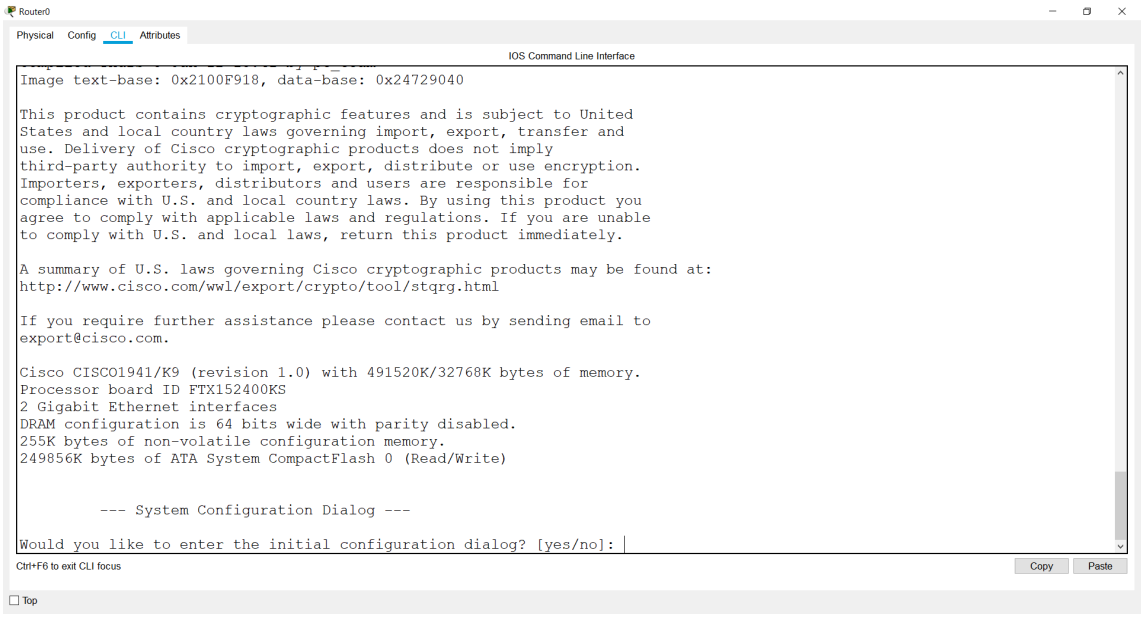

FIGURE 4 : Initial Startup screen when router started

Following Procedure was taken for all routes when Configured

- First of all in user mode enable the user privileged mode. (Figure 5)
- Set the clock time set the time to current time and date. (Figure 5)
- Set the Hostname for identify a Router in the network. (Figure 6)
- Set a not encrypted password for safety. (Figure 6)
- Setup a Banner including relevant information about the router to an administrator. (Figure 7)
- Setup both interfaces using relevant IP addresses. (Figure 8)
- Enable the setup interfaces (Figure 8)

```
Router>enable
Router#show clock
*0:14:1.53 UTC Mon Mar 1 1993
Router#clock set 03:13:00 26 June 2021
Router#show clock
3:13:7.197 UTC Sat Jun 26 2021
Router#
```

FIGURE 5 : User Privileged Mode access and setup time

```
Router#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#hostname Router01
Router01(config)#enable password router1pwd
Router01(config)#
```

FIGURE 6 : Setup Hostname and Password

```
Router01>enable
Password:
Router01#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router01(config)#banner motd *
Enter TEXT message.  End with the character '*'.

     CO513 Assignment - Static Routing
     Hostname : Router01
     Password : router1pwd

     Note : This is for the education purpose only. Passwords are not revealed to the others basically.
*

Router01(config)#
```

FIGURE 7 : Setup Banner Message

```
Router01>enable
Password:
Router01#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
Router01(config)#interface GigabitEthernet 0/0
Router01(config-if)#ip address 192.168.1.1 255.255.255.0
Router01(config-if)#no shutdown

Router01(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

Router01(config-if)#
```

FIGURE 8 : Enable the interfaces giving appropriate IP address

Following basic router configurations are done

- Router01
  - Hostname : Router01
  - Password : router1pwd
  - Interface 0/0 IP Address : 192.168.1.1/24
  - Interface 0/1 IP Address : 192.168.2.1/24

- Router02
  - Hostname : Router02
  - Password : router2pwd
  - Interface 0/0 IP Address : 192.168.2.2/24
  - Interface 0/1 IP Address : 192.168.3.1/24

- Router03
  - Hostname : Router03
  - Password : router3pwd
  - Interface 0/0 IP Address : 192.168.4.1/24
  - Interface 0/1 IP Address : 192.168.3.2/24

PING FROM NETWORK 1 TO NETWORK 4

Use built in show commands in Cisco IOS to visualize IP configurations in each of the routers

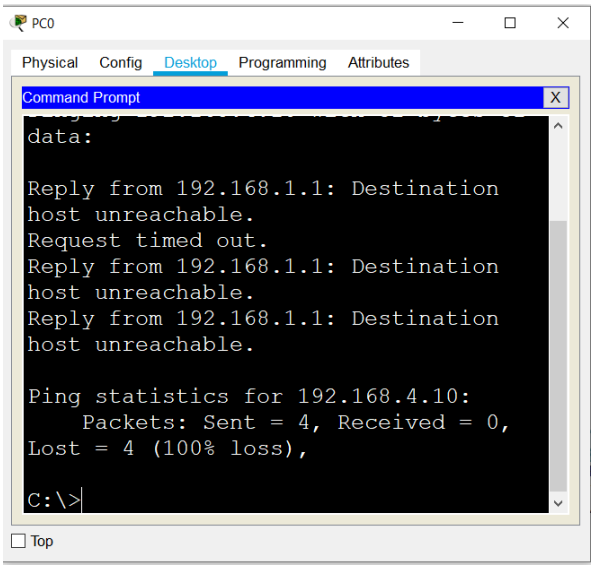

FIGURE 9 : Host Unreachable Error occured when ping 198.168.4.10/24 from 192.168.1.10

Observation : First issue in the observation was the packets could not reached out the to the exit of network from the router (Packets did not reach router in the simulation mode).

- Fix :
  - Initially gateway IP address are not configured Like in the Figure 03. Therefore packets were failed without run into the router

Observation : Second issue in the observation after fix the first issue was the packets are failed at the router then it will reply to the source IP the the packet failed.

- Fix:
  - Make learn the router to the Network 04 can be reached using the Across the 192.168.2.2 Next hop address.

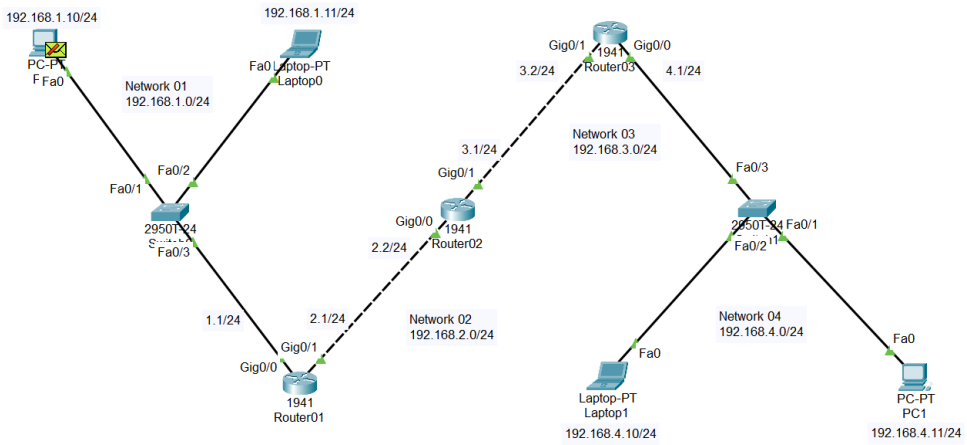

FIGURE 10 : Packets Not transferred from the PC0 First issue in Simulation Mode

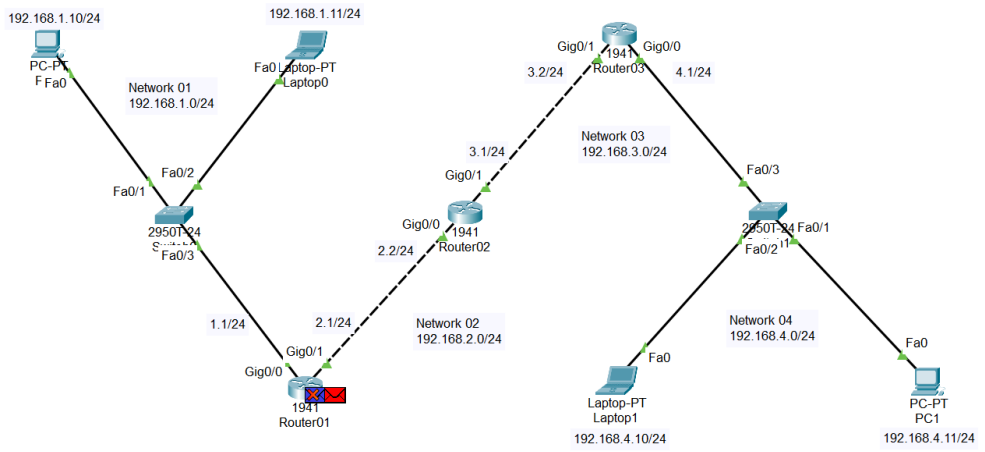

FIGURE 11 : Packets Not transferred from the Router second issue in Simulation Mode

DEFINING STATIC ROUTES IN ROUTERS

Configure Router 1 and Router 2 with appropriate static routes only to the network 4

```
Router01>enable
Password:
Router01#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router01(config)#ip route 192.168.4.0 255.255.255.0 192.168.2.2
Router01(config)#exit
Router01#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

     192.168.1.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.1.0/24 is directly connected, GigabitEthernet0/0
L       192.168.1.1/32 is directly connected, GigabitEthernet0/0
     192.168.2.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.2.0/24 is directly connected, GigabitEthernet0/1
L       192.168.2.1/32 is directly connected, GigabitEthernet0/1
S    192.168.4.0/24 [1/0] via 192.168.2.2

Router01#
```

FIGURE 12 : Creating the static route from Router01 to end device in Network 04
Same for configuring the Router02

Observation : Ping Packets are delivered successfully to the destination. But along the reply The packet not transferred back to the Network 02 (Figure 13)

- Fix :
  - This is because the packet receive can be done after setting up routes at Router01 and Router02. But In order to send the reply also Router03 required to know how to transfer the traffic to reach the non direct network properly. Therefore there should be another static route to Router03 to direct Network 1 traffic.

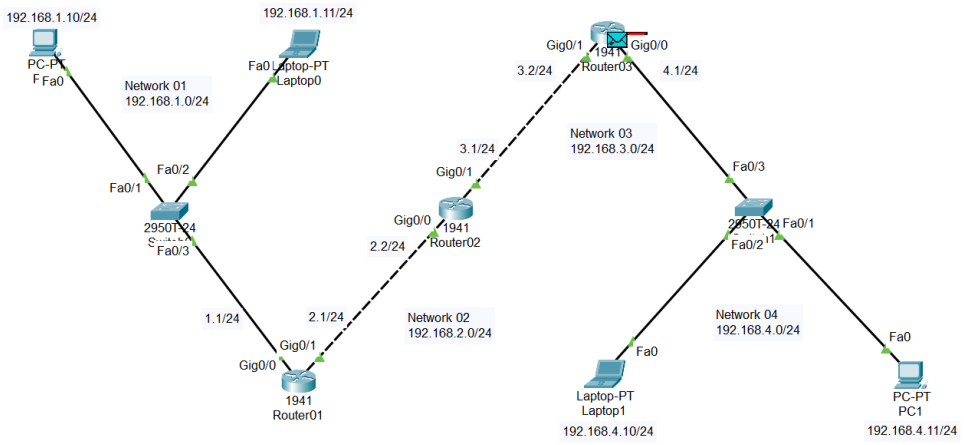

FIGURE 13 : Reply for Ping Packets are not delivered due not knowing where the Network 1 locates

```
Router01#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

     192.168.1.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.1.0/24 is directly connected, GigabitEthernet0/0
L       192.168.1.1/32 is directly connected, GigabitEthernet0/0
     192.168.2.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.2.0/24 is directly connected, GigabitEthernet0/1
L       192.168.2.1/32 is directly connected, GigabitEthernet0/1
S    192.168.4.0/24 [1/0] via 192.168.2.2
```

```
Router02#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

     192.168.2.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.2.0/24 is directly connected, GigabitEthernet0/0
L       192.168.2.2/32 is directly connected, GigabitEthernet0/0
     192.168.3.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.3.0/24 is directly connected, GigabitEthernet0/1
L       192.168.3.1/32 is directly connected, GigabitEthernet0/1
S    192.168.4.0/24 [1/0] via 192.168.3.2
```

FIGURE 14 : Routing tables of Router01 and Router02

DEFINING STATIC ROUTES IN ROUTERS

Configure the Router 2 and Router 3 with static route information to network 1.

```
Router02(config)#exit
Router02#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

S    192.168.1.0/24 [1/0] via 192.168.2.1
     192.168.2.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.2.0/24 is directly connected, GigabitEthernet0/0
L       192.168.2.2/32 is directly connected, GigabitEthernet0/0
     192.168.3.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.3.0/24 is directly connected, GigabitEthernet0/1
L       192.168.3.1/32 is directly connected, GigabitEthernet0/1
S    192.168.4.0/24 [1/0] via 192.168.3.2

Router02#
```

```
Password:
Router03#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router03(config)#
Router03(config)#
Router03(config)#
Router03(config)#ip route 192.168.1.0 255.255.255.0 192.168.3.1
Router03(config)#exit
Router03#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
       * - candidate default, U - per-user static route, o - ODR
       P - periodic downloaded static route

Gateway of last resort is not set

S    192.168.1.0/24 [1/0] via 192.168.3.1
     192.168.3.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.3.0/24 is directly connected, GigabitEthernet0/1
L       192.168.3.2/32 is directly connected, GigabitEthernet0/1
     192.168.4.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.4.0/24 is directly connected, GigabitEthernet0/0
L       192.168.4.1/32 is directly connected, GigabitEthernet0/0

Router03#
```

FIGURE 14 : Routing tables of Router02 and Router03

FINAL SETUP AND SENDING THE PING REQUEST

Perform the ping operation again and observe the command prompt output and final routing tables of each of the routers

```
C:\>ping 192.168.4.10

Pinging 192.168.4.10 with 32 bytes of data:

Request timed out.
Reply from 192.168.4.10: bytes=32 time<1ms TTL=125
Reply from 192.168.4.10: bytes=32 time<1ms TTL=125
Reply from 192.168.4.10: bytes=32 time<1ms TTL=125

Ping statistics for 192.168.4.10:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\>
```

FIGURE 15 : Ping 192.168.4.10/24 device from 192.168.1.10/24 end device

```
C:\>tracert 192.168.4.10

Tracing route to 192.168.4.10 over a maximum of 30 hops:

  1    0 ms      0 ms      0 ms      192.168.1.1
  2    0 ms      0 ms      0 ms      192.168.2.2
  3    0 ms      0 ms      0 ms      192.168.3.2
  4    0 ms      0 ms      1 ms      192.168.4.10

Trace complete.

C:\>
```

FIGURE 16: Trace the route from 192.168.1.10/24 to 192.168.4.10/24

Observation : First Ping request was failed due to timeout because first ping packet required to reveal the path by itself even the path defined therefore a considerable amount of time will be taken.

```
Router01#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

     192.168.1.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.1.0/24 is directly connected, GigabitEthernet0/0
L       192.168.1.1/32 is directly connected, GigabitEthernet0/0
     192.168.2.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.2.0/24 is directly connected, GigabitEthernet0/1
L       192.168.2.1/32 is directly connected, GigabitEthernet0/1
S    192.168.4.0/24 [1/0] via 192.168.2.2
```

```
Router02(config)#exit
Router02#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

S    192.168.1.0/24 [1/0] via 192.168.2.1
     192.168.2.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.2.0/24 is directly connected, GigabitEthernet0/0
L       192.168.2.2/32 is directly connected, GigabitEthernet0/0
     192.168.3.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.3.0/24 is directly connected, GigabitEthernet0/1
L       192.168.3.1/32 is directly connected, GigabitEthernet0/1
S    192.168.4.0/24 [1/0] via 192.168.3.2

Router02#
```

```
Password:
Router03#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router03(config)#
Router03(config)#
Router03(config)#
Router03(config)#ip route 192.168.1.0 255.255.255.0 192.168.3.1
Router03(config)#exit
Router03#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

S    192.168.1.0/24 [1/0] via 192.168.3.1
     192.168.3.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.3.0/24 is directly connected, GigabitEthernet0/1
L       192.168.3.2/32 is directly connected, GigabitEthernet0/1
     192.168.4.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.4.0/24 is directly connected, GigabitEthernet0/0
L       192.168.4.1/32 is directly connected, GigabitEthernet0/0

Router03#
```

FIGURE 17: Final Routing Tables from Router01, Router02 and Router03