Namal Institute Mianwali

Computer Networks Laboratory Manual #10

Static Routing

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Course Title	Computer Networks	**Course Number**	CS – 331 L
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Static Routing

Static routing is a form of routing that occurs when a router uses a manually configured routing entry, rather than information from a dynamic routing traffic.

Routers forward packets using either route information from route table entries that you manually configure or the route information that is calculated using dynamic routing algorithms.

IP route command is used to configure the static route. In this article we will explain IP route command and its parameters in details. Static routing is useful in small network where numbers of routes are limited. In static routing we need to add route manually with IP route command. Like other routing methods static routing also has its pros and cons.

Advantage of static routing

- It is easy to implement.
- It is most secure way of routing, since no information is shared with other routers.
- It puts no overhead on resources such as CPU or memory.

Disadvantage of static routing

- It is suitable only for small network.
- If a link fails static route cannot reroute the traffic.

Static routes, which define explicit paths between two routers, cannot be automatically updated; you must manually reconfigure static routes when network changes occur. Static routes use less bandwidth than dynamic routes. No CPU cycles are used to calculate and analyze routing updates.

You can supplement dynamic routes with static routes where appropriate. You can redistribute static routes into dynamic routing algorithms but you cannot redistribute routing information calculated by dynamic routing algorithms into the static routing table.

You should use static routes in environments where network traffic is predictable and where the network design is simple. You should not use static routes in large, constantly changing networks because static routes cannot react to network changes. Most networks use dynamic routes to communicate between routers but might have one or two static routes configured for special cases. Static routes are also useful for specifying a gateway of last resort (a default router to which all unroutable packets are sent).

Important steps for static routing

Step # 01 Design the below given network in packet tracer workspace

Step # 02 Assigning IP address on Fast Ethernet interface of router

Step # 03 Assigning IP address on serial interface of router

Step # 04 Assigning IP address on PCs

Step #05 Apply static Routing on Routers

Step # 06 Verify connectivity among different users (Use ping command)

Step # 01 **Design the below given network in packet tracer workspace**

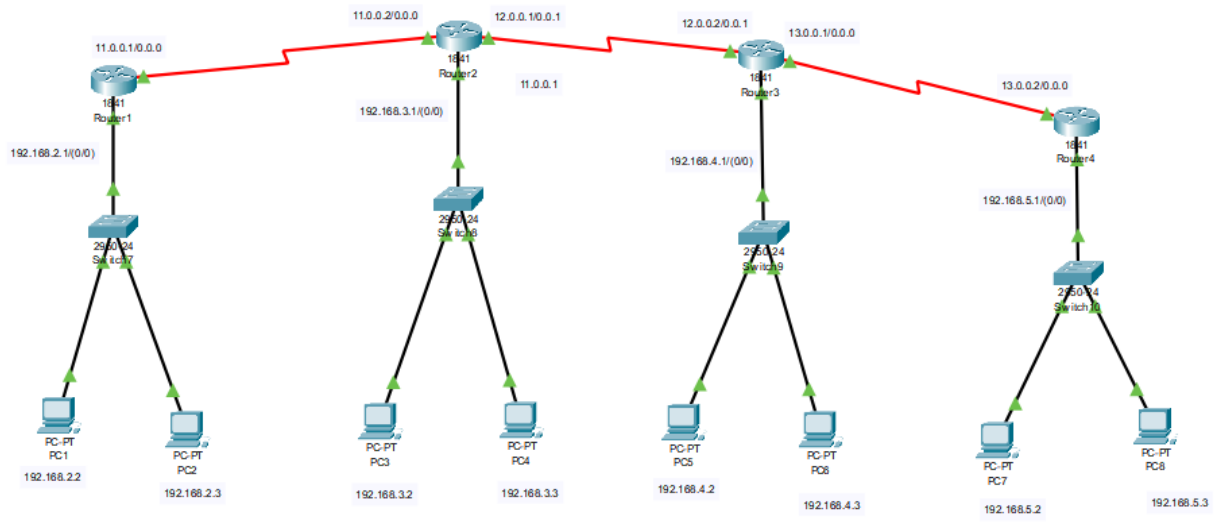


Figure 7.1 shows the network diagram

Table 7.1 shows the list of IP address used in above network

INTERFACE	DEVICE	IP ADDRESS
Fast Ethernet 0/0	R1	192.168.2.1
Serial 0/0/0	R1	11.0.0.1
Fast Ethernet 0/2	PC1	192.168.2.2
Fast Ethernet 0/3	PC2	192.168.2.3
Fast Ethernet 0/0	R2	192.168.3.1
Serial 0/0/0	R2	11.0.0.2
Serial 0/0/1	R2	12.0.0.1
Fast Ethernet 0/2	PC3	192.168.3.2

Fast Ethernet 0/3	PC4	192.168.3.3
Fast Ethernet 0/0	R3	192.168.4.1
Serial 0/0/1	R3	12.0.0.2
Serial 0/0/0	R3	13.0.0.1
Fast Ethernet 0/2	PC5	192.168.4.2
Fast Ethernet 0/3	PC6	192.168.4.3
Fast Ethernet 0/0	R4	192.168.5.1
Serial 0/0/0	R4	13.0.0.2
Fast Ethernet 0/2	PC7	192.168.5.2
Fast Ethernet 0/3	PC8	192.168.5.3

Step # 02 Assigning IP address on Fast Ethernet interface of router

Router (config) #int fastEthernet 0/0

Router (config-if) #ip address 192.168.2.1 255.255.255.0

Router (config-if) #no shutdown

Note: Repeat above steps on all Fast Ethernet interfaces of all routers

Step # 03 Assigning IP address on serial interface of router

Router(config)#int serial 0/0/0

Router(config-if)#ip address 11.0.0.1 255.255.255.0

Router(config-if)#no shutdown

Router(config-if)#exit

Note: Repeat above steps on all serial interfaces of all routers

Note: Clock rate will only be set to DCE end of serial connection but not on DTE end.

Step # 04 Assigning IP address on PCs

Go to Desktop → IP configuration and enter the following:

IP address → 192.168.2.2

Subnet Mask →255.255.255.0

Default Gateway →192.168.2.1

Note: Repeat above steps on all PCs

Step #05 Apply static Routing on Routers

Router (config) ip route destination network subnet mask next- hop

Router (config)#ip route 192.168.3.1 255.255.255.0 11.0.0.2

Note: Repeat above steps on all routers

Step # 06 Verify connectivity among different users (Use ping command)

```
C:\>ping 192.168.5.2

Pinging 192.168.5.2 with 32 bytes of data:

Reply from 192.168.5.2: bytes=32 time=3ms TTL=124
Reply from 192.168.5.2: bytes=32 time=27ms TTL=124
Reply from 192.168.5.2: bytes=32 time=10ms TTL=124
Reply from 192.168.5.2: bytes=32 time=12ms TTL=124

Ping statistics for 192.168.5.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 3ms, Maximum = 27ms, Average = 13ms
```

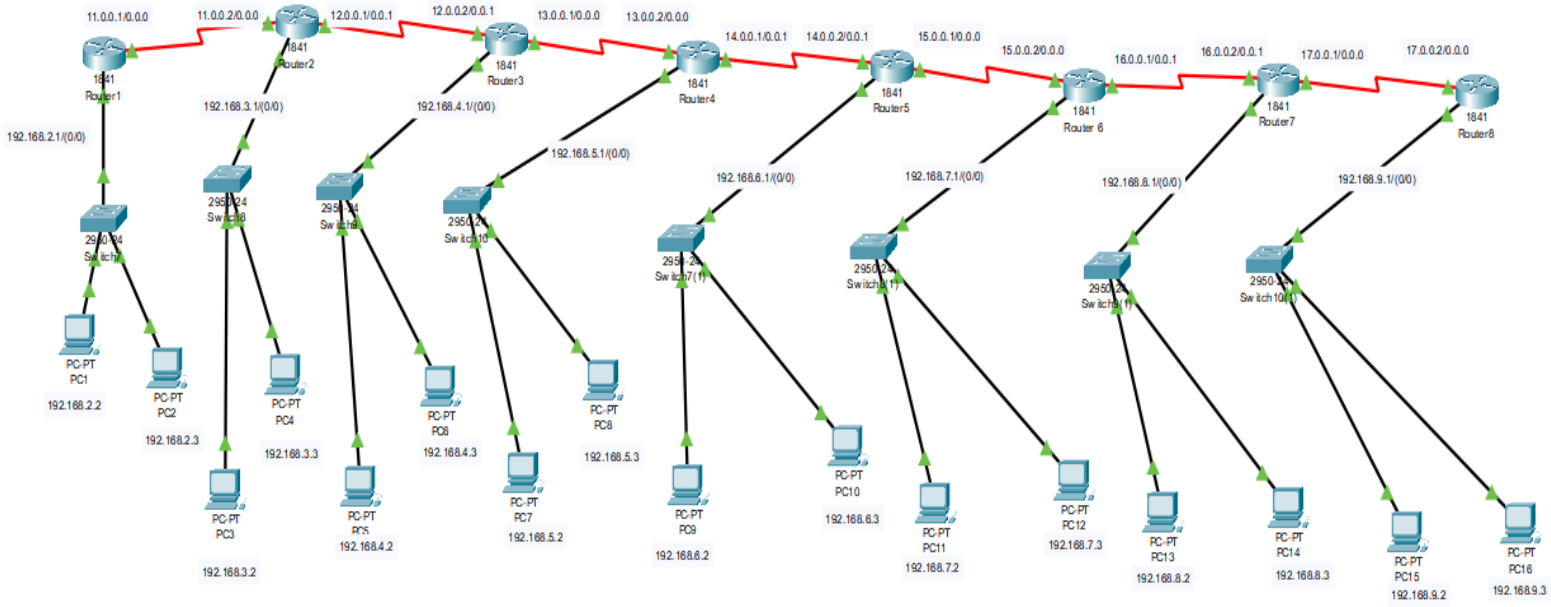
Note: Repeat above steps on all PCs

Exercise:

Using different IP address design 8 networks with minimum two users in each network and apply static routing. Make a table of all IP addresses of routers and PCs as given in this experiment.

Task to do

- Show ip configuration
- Show Ping Responses



IP Configuration:

The list of IP addresses used in the above network.

INTERFACE	DEVICE	IP ADDRESS
Fast Ethernet 0/0/0	R1	192.168.2.1
Serial 0/2/0	R1	11.0.0.1/24
Fast Ethernet 0/2	PC0	192.168.2.2
Fast Ethernet 0/3	PC1	192.168.2.3
Fast Ethernet 0/0/0	R2	192.168.3.1
Serial 0/2/0	R2	11.0.0.2/24
Serial 0/2/1	R2	12.0.0.1/24
Fast Ethernet 0/2	PC2	192.168.3.2
Fast Ethernet 0/3	PC3	192.168.3.3
Fast Ethernet 0/0/0	R3	192.168.4.1
Serial 0/2/1	R3	12.0.0.2/24
Serial 0/2/0	R3	13.0.0.1/24
Fast Ethernet 0/2	PC4	192.168.4.2

Fast Ethernet 0/3	PC5	192.168.4.3
Fast Ethernet 0/0/0	R4	192.168.5.1
Serial 0/2/0	R4	13.0.0.2/24
Serial 0/2/1	R4	14.0.0.1/24
Fast Ethernet 0/2	PC6	192.168.5.2
Fast Ethernet 0/3	PC7	192.168.5.3
Fast Ethernet 0/0/0	R5	192.168.6.1
Serial 0/2/1	R5	14.0.0.2/24
Serial 0/2/0	R5	15.0.0.1/24
Fast Ethernet 0/2	PC8	192.168.6.2
Fast Ethernet 0/3	PC9	192.168.6.3
Fast Ethernet 0/0/0	R6	192.168.7.1
Serial 0/2/0	R6	15.0.0.2/24
Serial 0/2/1	R6	16.0.0.1/24
Fast Ethernet 0/2	PC10	192.168.7.2
Fast Ethernet 0/3	PC11	192.168.7.3
Fast Ethernet 0/0/0	R7	192.168.8.1
Serial 0/2/1	R7	16.0.0.2/24
Serial 0/2/0	R7	17.0.0.1/24
Fast Ethernet 0/2	PC12	192.168.8.2
Fast Ethernet 0/3	PC13	192.168.8.3
Fast Ethernet 0/0/0	R8	192.168.9.1
Serial 0/2/0	R8	17.0.0.2/24
Fast Ethernet 0/2	PC14	192.168.9.2
Fast Ethernet 0/3	PC15	192.168.9.3

Ping Responses:

Ping from PC 1 to PC3, PC5, PC7, PC9, PC11, PC13, PC15

```
C:\>ping 192.168.3.3

Pinging 192.168.3.3 with 32 bytes of data:

Reply from 192.168.3.3: bytes=32 time=19ms TTL=126
Reply from 192.168.3.3: bytes=32 time=3ms TTL=126
Reply from 192.168.3.3: bytes=32 time=1ms TTL=126
Reply from 192.168.3.3: bytes=32 time=11ms TTL=126

Ping statistics for 192.168.3.3:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 1ms, Maximum = 19ms, Average = 8ms
```

```
C:\>ping 192.168.4.3

Pinging 192.168.4.3 with 32 bytes of data:

Reply from 192.168.4.3: bytes=32 time=24ms TTL=125
Reply from 192.168.4.3: bytes=32 time=2ms TTL=125
Reply from 192.168.4.3: bytes=32 time=28ms TTL=125
Reply from 192.168.4.3: bytes=32 time=2ms TTL=125

Ping statistics for 192.168.4.3:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 2ms, Maximum = 28ms, Average = 14ms
```

```
C:\>ping 192.168.5.3

Pinging 192.168.5.3 with 32 bytes of data:

Reply from 192.168.5.3: bytes=32 time=4ms TTL=124
Reply from 192.168.5.3: bytes=32 time=14ms TTL=124
Reply from 192.168.5.3: bytes=32 time=11ms TTL=124
Reply from 192.168.5.3: bytes=32 time=10ms TTL=124

Ping statistics for 192.168.5.3:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 4ms, Maximum = 14ms, Average = 9ms
```

```
C:\>ping 192.168.6.3

Pinging 192.168.6.3 with 32 bytes of data:

Reply from 192.168.6.3: bytes=32 time=16ms TTL=123
Reply from 192.168.6.3: bytes=32 time=14ms TTL=123
Reply from 192.168.6.3: bytes=32 time=4ms TTL=123
Reply from 192.168.6.3: bytes=32 time=41ms TTL=123

Ping statistics for 192.168.6.3:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 4ms, Maximum = 41ms, Average = 18ms
```

```
C:\>ping 192.168.7.3

Pinging 192.168.7.3 with 32 bytes of data:

Reply from 192.168.7.3: bytes=32 time=54ms TTL=122
Reply from 192.168.7.3: bytes=32 time=53ms TTL=122
Reply from 192.168.7.3: bytes=32 time=5ms TTL=122
Reply from 192.168.7.3: bytes=32 time=55ms TTL=122

Ping statistics for 192.168.7.3:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 5ms, Maximum = 55ms, Average = 41ms
```

```
C:\>ping 192.168.8.3

Pinging 192.168.8.3 with 32 bytes of data:

Reply from 192.168.8.3: bytes=32 time=90ms TTL=121
Reply from 192.168.8.3: bytes=32 time=6ms TTL=121
Reply from 192.168.8.3: bytes=32 time=37ms TTL=121
Reply from 192.168.8.3: bytes=32 time=14ms TTL=121

Ping statistics for 192.168.8.3:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 6ms, Maximum = 90ms, Average = 36ms
```

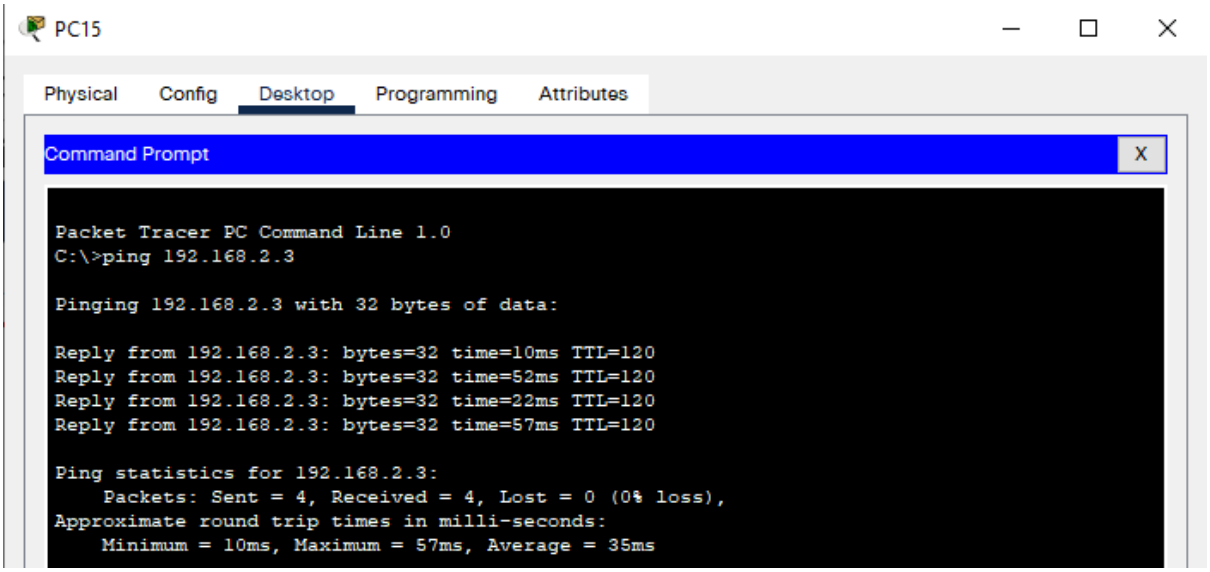
```
C:\>ping 192.168.9.3

Pinging 192.168.9.3 with 32 bytes of data:

Reply from 192.168.9.3: bytes=32 time=78ms TTL=120
Reply from 192.168.9.3: bytes=32 time=16ms TTL=120
Reply from 192.168.9.3: bytes=32 time=42ms TTL=120
Reply from 192.168.9.3: bytes=32 time=15ms TTL=120

Ping statistics for 192.168.9.3:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 15ms, Maximum = 78ms, Average = 37ms
```

Ping from PC15 to PC1, PC3, PC5, PC7, PC9, PC11, PC13




```
C:\>ping 192.168.3.3

Pinging 192.168.3.3 with 32 bytes of data:

Reply from 192.168.3.3: bytes=32 time=6ms TTL=121
Reply from 192.168.3.3: bytes=32 time=31ms TTL=121
Reply from 192.168.3.3: bytes=32 time=46ms TTL=121
Reply from 192.168.3.3: bytes=32 time=20ms TTL=121

Ping statistics for 192.168.3.3:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 6ms, Maximum = 46ms, Average = 25ms
```

```
C:\>ping 192.168.4.3

Pinging 192.168.4.3 with 32 bytes of data:

Reply from 192.168.4.3: bytes=32 time=33ms TTL=122
Reply from 192.168.4.3: bytes=32 time=51ms TTL=122
Reply from 192.168.4.3: bytes=32 time=6ms TTL=122
Reply from 192.168.4.3: bytes=32 time=44ms TTL=122

Ping statistics for 192.168.4.3:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 6ms, Maximum = 51ms, Average = 33ms
```

```
C:\>ping 192.168.5.3

Pinging 192.168.5.3 with 32 bytes of data:

Reply from 192.168.5.3: bytes=32 time=4ms TTL=123
Reply from 192.168.5.3: bytes=32 time=58ms TTL=123
Reply from 192.168.5.3: bytes=32 time=36ms TTL=123
Reply from 192.168.5.3: bytes=32 time=23ms TTL=123

Ping statistics for 192.168.5.3:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 4ms, Maximum = 58ms, Average = 30ms
```

```
C:\>ping 192.168.6.3

Pinging 192.168.6.3 with 32 bytes of data:

Reply from 192.168.6.3: bytes=32 time=5ms TTL=124
Reply from 192.168.6.3: bytes=32 time=15ms TTL=124
Reply from 192.168.6.3: bytes=32 time=59ms TTL=124
Reply from 192.168.6.3: bytes=32 time=3ms TTL=124

Ping statistics for 192.168.6.3:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 3ms, Maximum = 59ms, Average = 20ms
```

```
C:\>ping 192.168.7.3

Pinging 192.168.7.3 with 32 bytes of data:

Reply from 192.168.7.3: bytes=32 time=31ms TTL=125
Reply from 192.168.7.3: bytes=32 time=11ms TTL=125
Reply from 192.168.7.3: bytes=32 time=2ms TTL=125
Reply from 192.168.7.3: bytes=32 time=2ms TTL=125

Ping statistics for 192.168.7.3:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 2ms, Maximum = 31ms, Average = 11ms
```

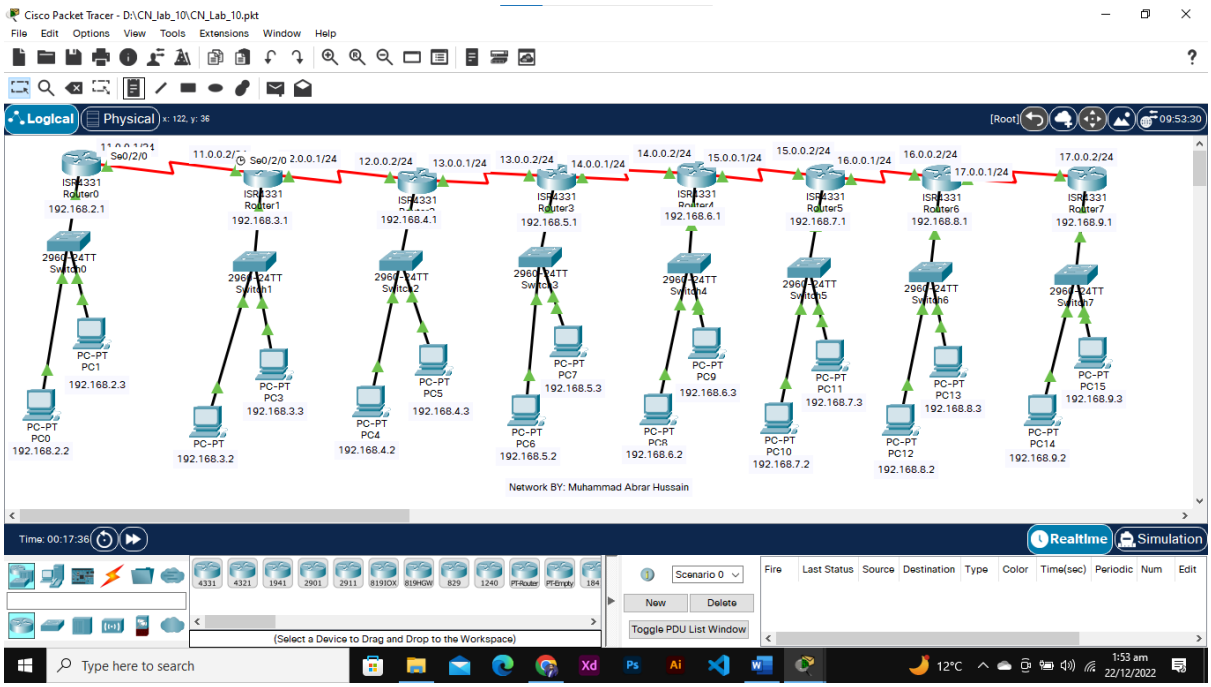
```
C:\>ping 192.168.8.3

Pinging 192.168.8.3 with 32 bytes of data:

Reply from 192.168.8.3: bytes=32 time=30ms TTL=126
Reply from 192.168.8.3: bytes=32 time=13ms TTL=126
Reply from 192.168.8.3: bytes=32 time=23ms TTL=126
Reply from 192.168.8.3: bytes=32 time=1ms TTL=126

Ping statistics for 192.168.8.3:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 1ms, Maximum = 30ms, Average = 16ms
```

Note: Attach the solution here also upload the **(.pkt)** file to QoBE.



.pkt file attach in same zip file.

Rubrics Sheet

Activities	Marks

Static Routing Configuration on Routers	**8**
Ping Response Screenshots	**2**