

**VISVESVARAYA TECHNOLOGICAL UNIVERSITY**  
“JnanaSangama”, Belgaum -590014, Karnataka.



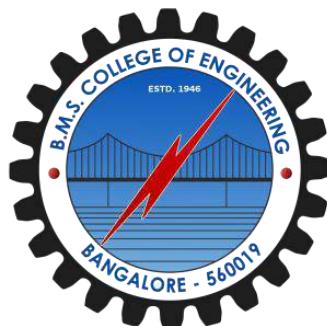
**LAB REPORT**  
on

**Computer Networks**  
(22CS4PCCON)

*Submitted by:*

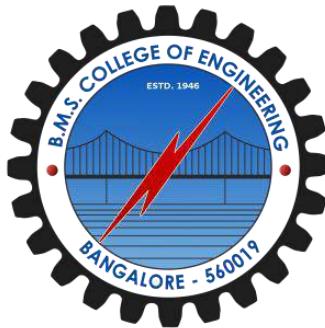
**Sanchay Agrawal (1BM21CS186)**

*in partial fulfillment for the award of the degree of*  
**BACHELOR OF ENGINEERING**  
*in*  
**COMPUTER SCIENCE AND ENGINEERING**



**B.M.S. COLLEGE OF ENGINEERING**  
(Autonomous Institution under VTU)  
**BENGALURU-560019**  
**June 2023 - August 2023**

**B. M. S. College of Engineering,  
Bull Temple Road, Bangalore 560019**  
(Affiliated To Visvesvaraya Technological University, Belgaum)  
**Department of Computer Science and Engineering**



**CERTIFICATE**

This is to certify that the Lab work entitled “**Computer Networks**” carried out by **Sanchay Agrawal (1BM21CS186)**, who is bonafide student of **B. M. S. College of Engineering**. It is in partial fulfillment for the award of **Bachelor of Engineering in Computer Science and Engineering** of the Visvesvaraya Technological University, Belgaum during the year 2022-23. The Lab report has been approved as it satisfies the academic requirements in respect of **Computer Networks - (22CS4PCCON)** work prescribed for the said degree.

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# 1. Course Outcomes

**CO1:** Apply the fundamental concepts of communication in networking.

**CO2:** Analyze the various protocols, techniques in TCP/IP network architecture.

**CO3:** Develop programs that demonstrate the functionalities of physical, Data Link, Network, Transport or Application layer.

# 2. Experiments

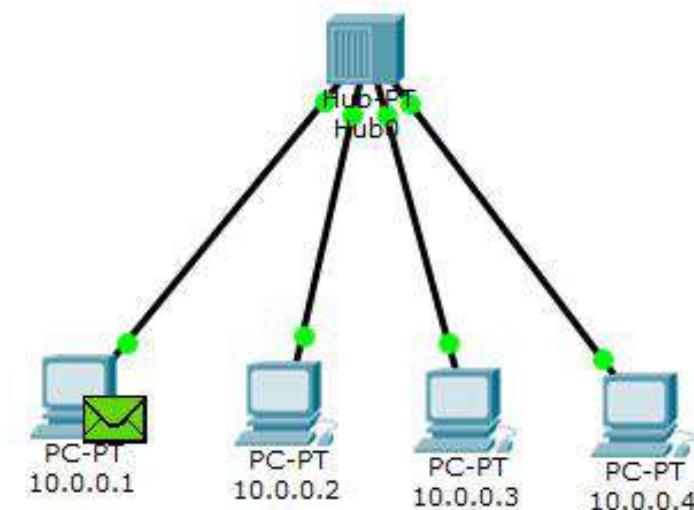
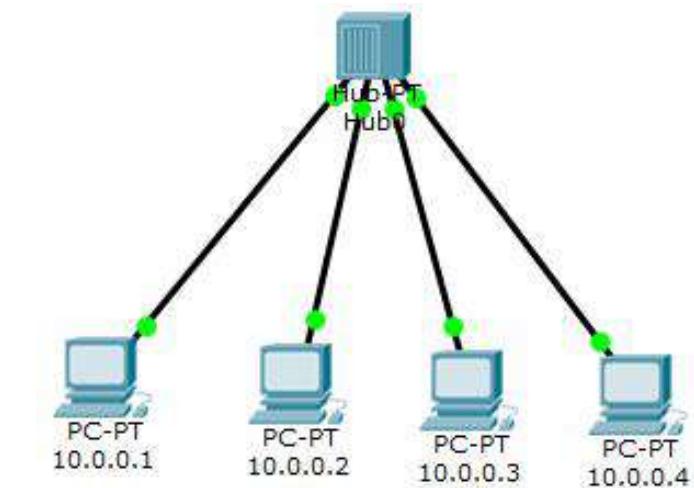
## 2.1 Experiment - 1:

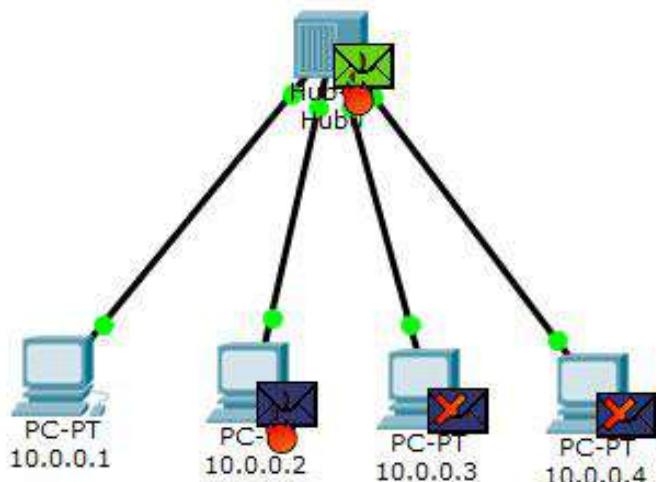
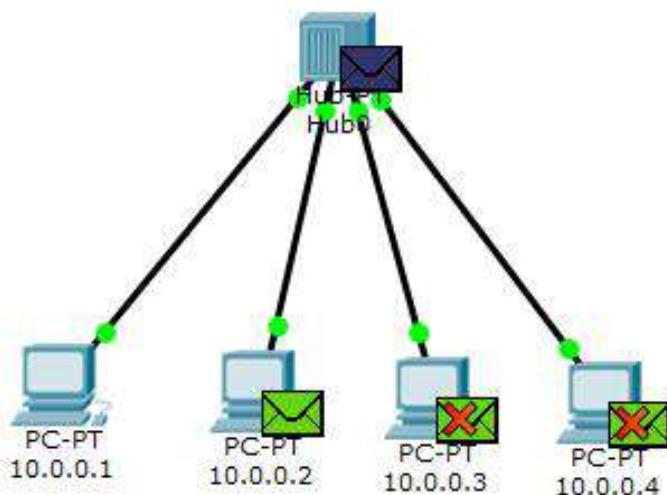
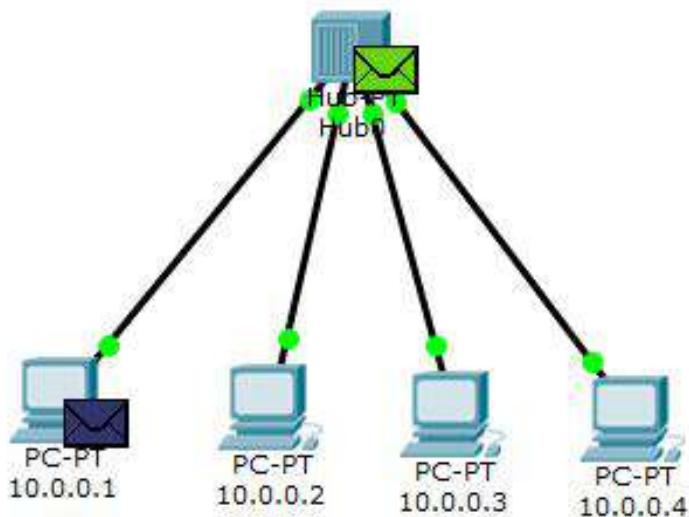
### 2.1.1 Question:

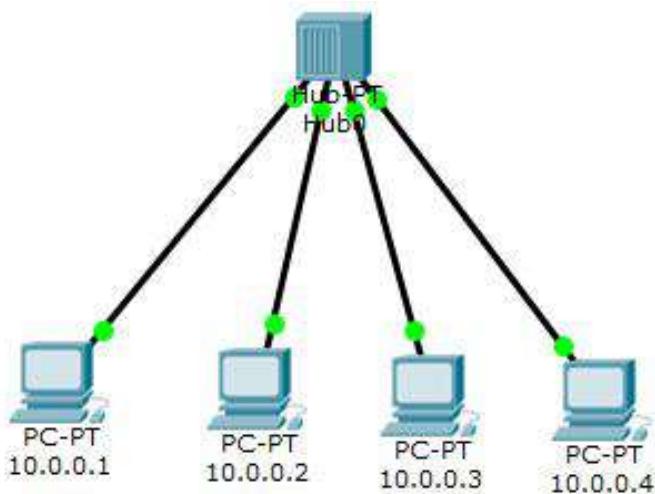
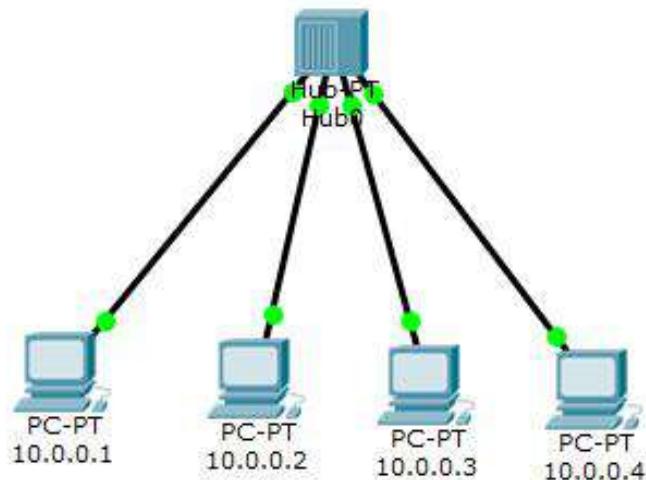
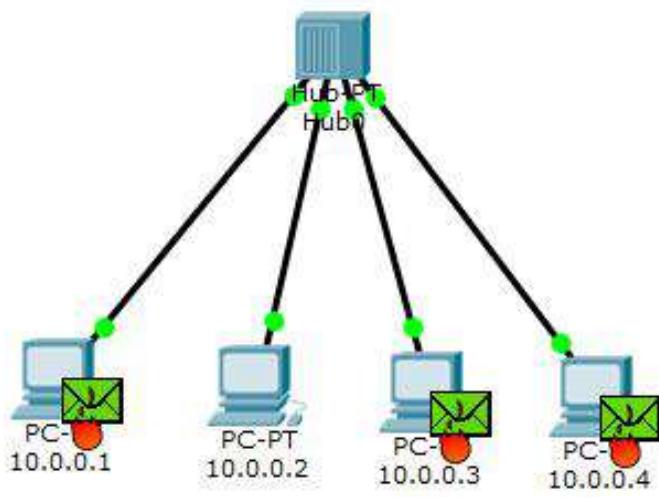
Create a topology and simulate sending a simple PDU from source to destination using hub and switch as connecting devices and demonstrate ping message.

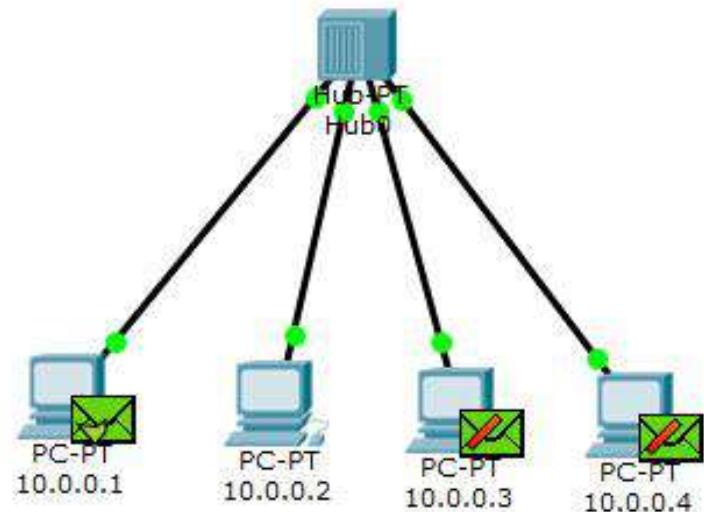
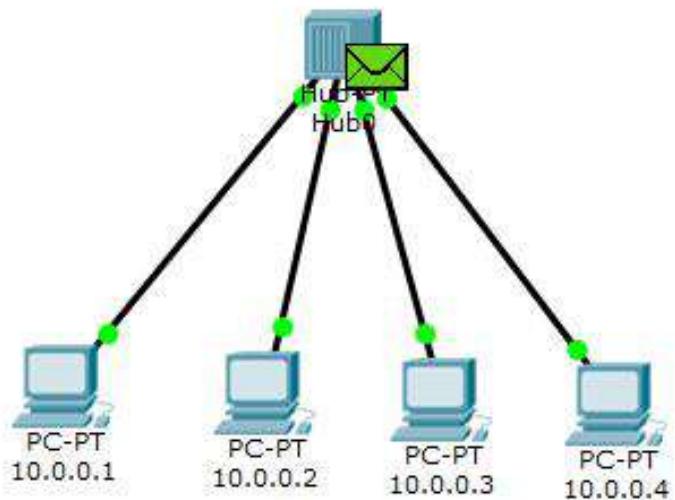
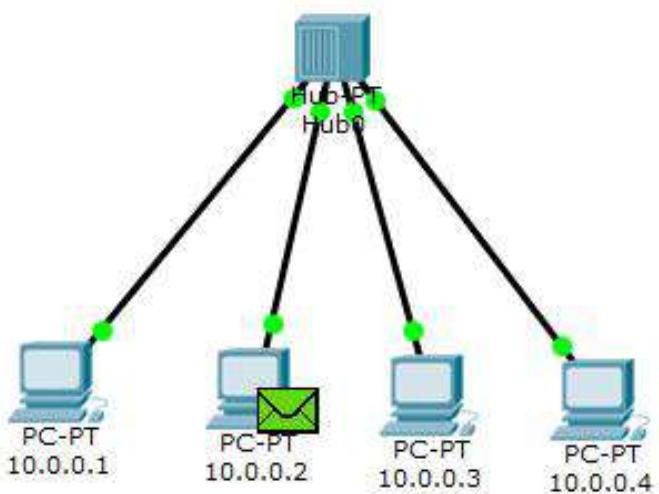
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#### Topology - 1:









10.0.0.1

Physical Config Desktop Custom Interface

## Command Prompt X

```
Packet Tracer PC Command Line 1.0
PC>ping 10.0.0.0

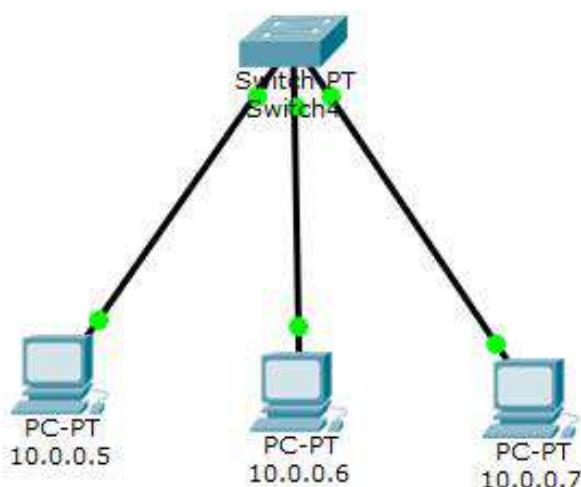
Pinging 10.0.0.0 with 32 bytes of data:

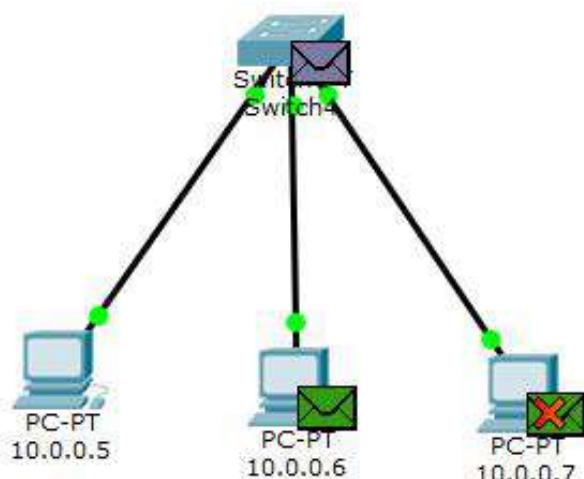
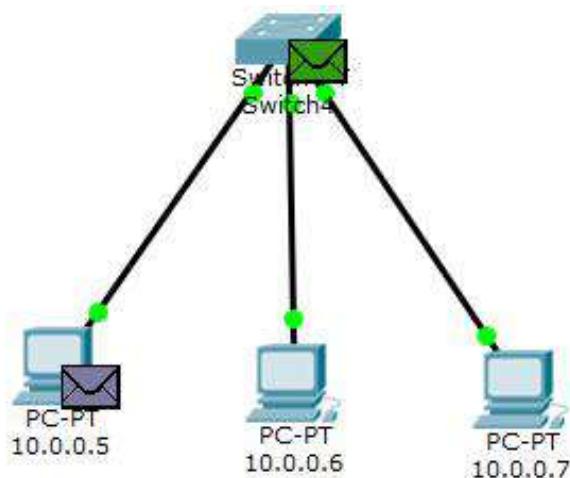
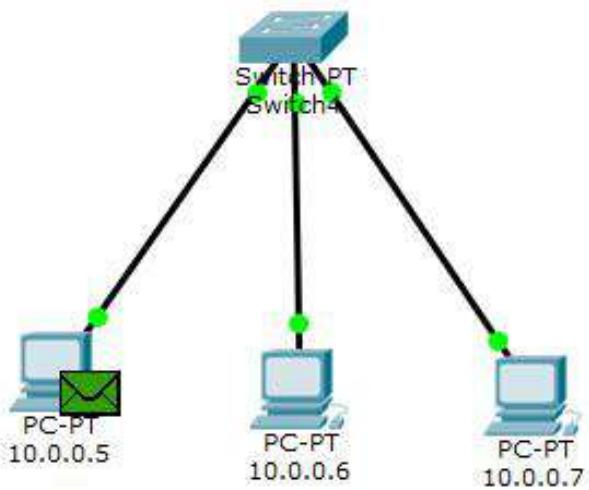
Reply from 10.0.0.4: bytes=32 time=0ms TTL=128

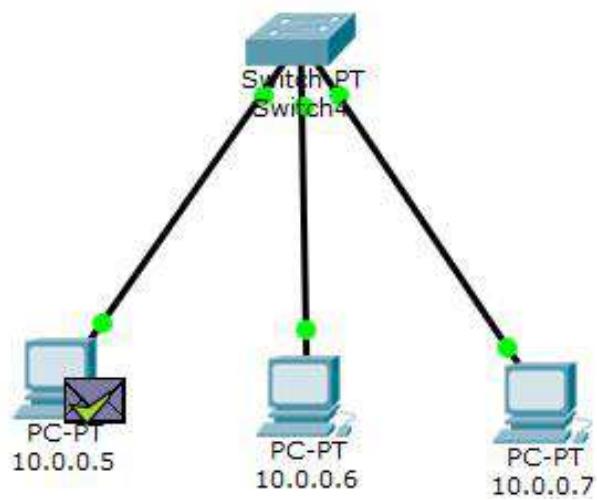
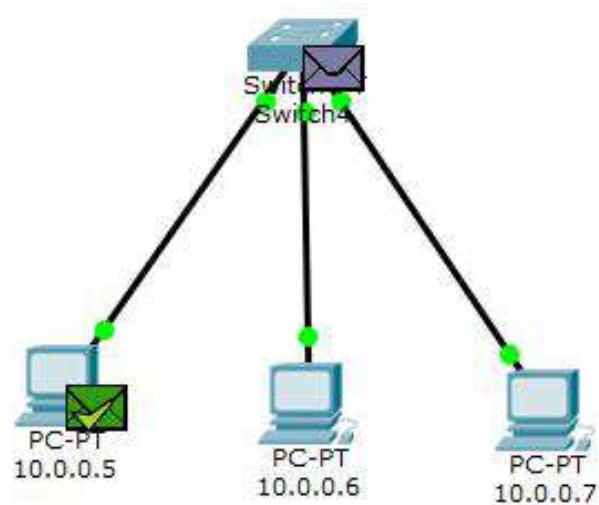
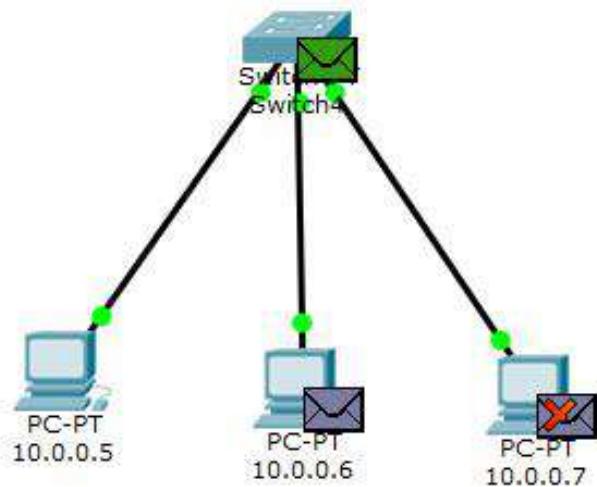
Ping statistics for 10.0.0.0:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms

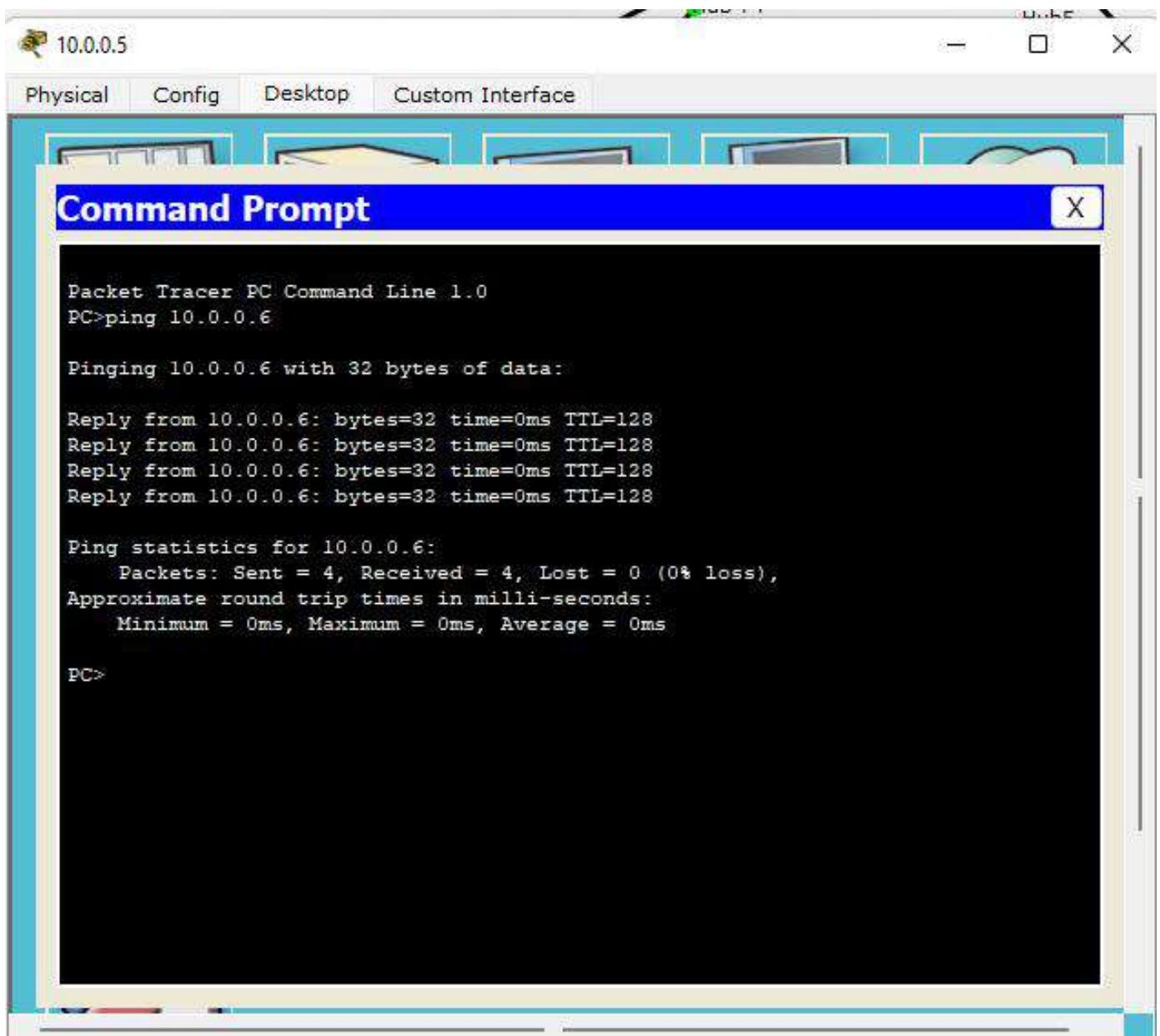
PC>|
```

### Topology - 2:

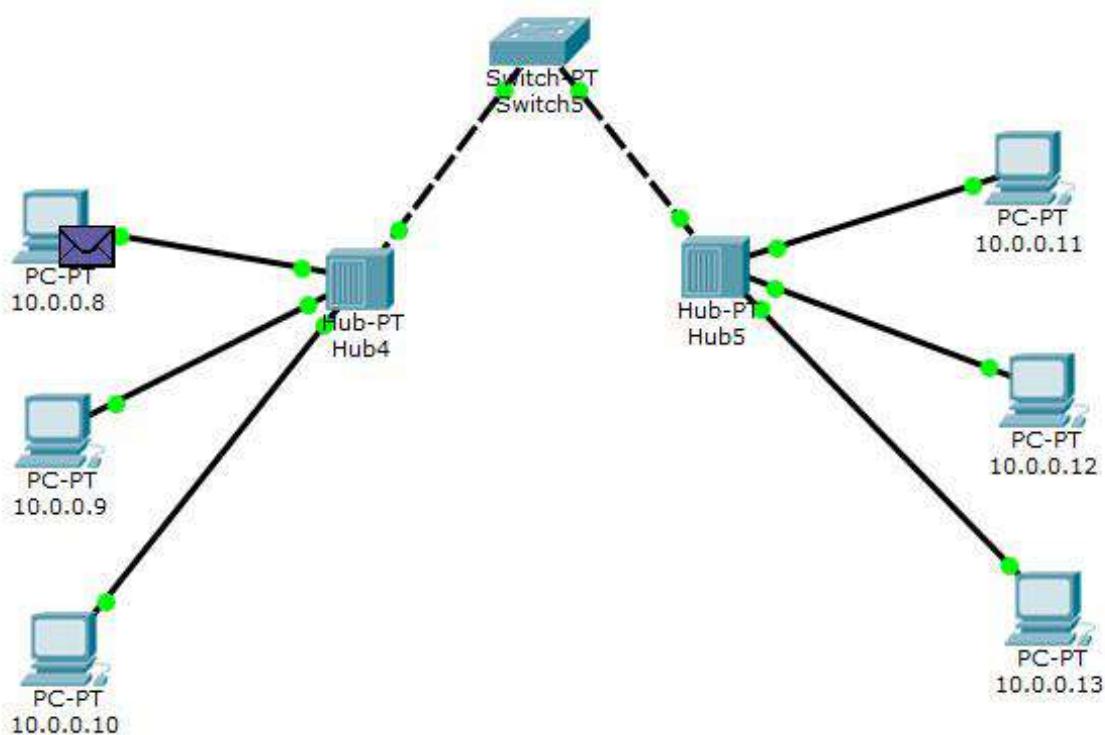
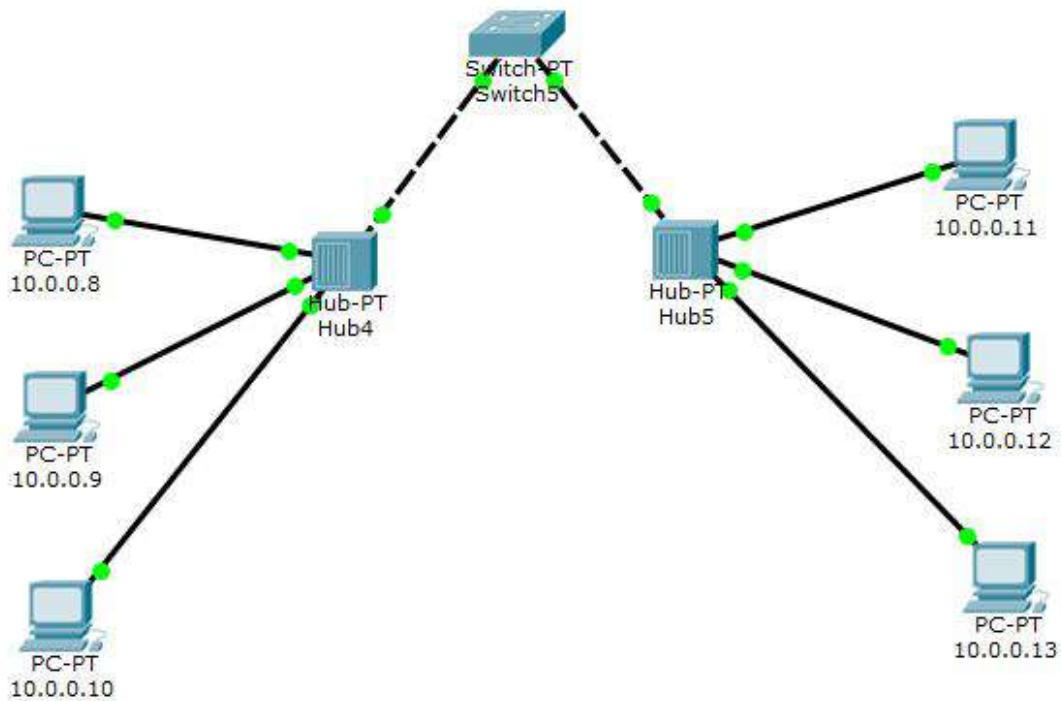


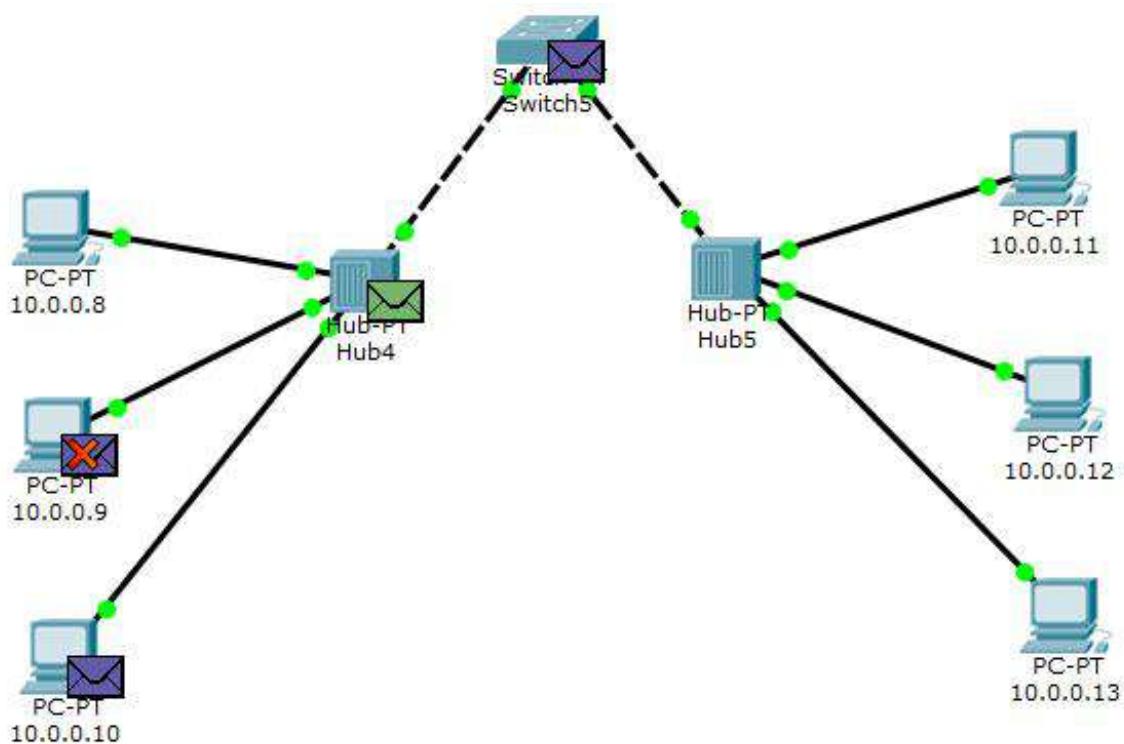
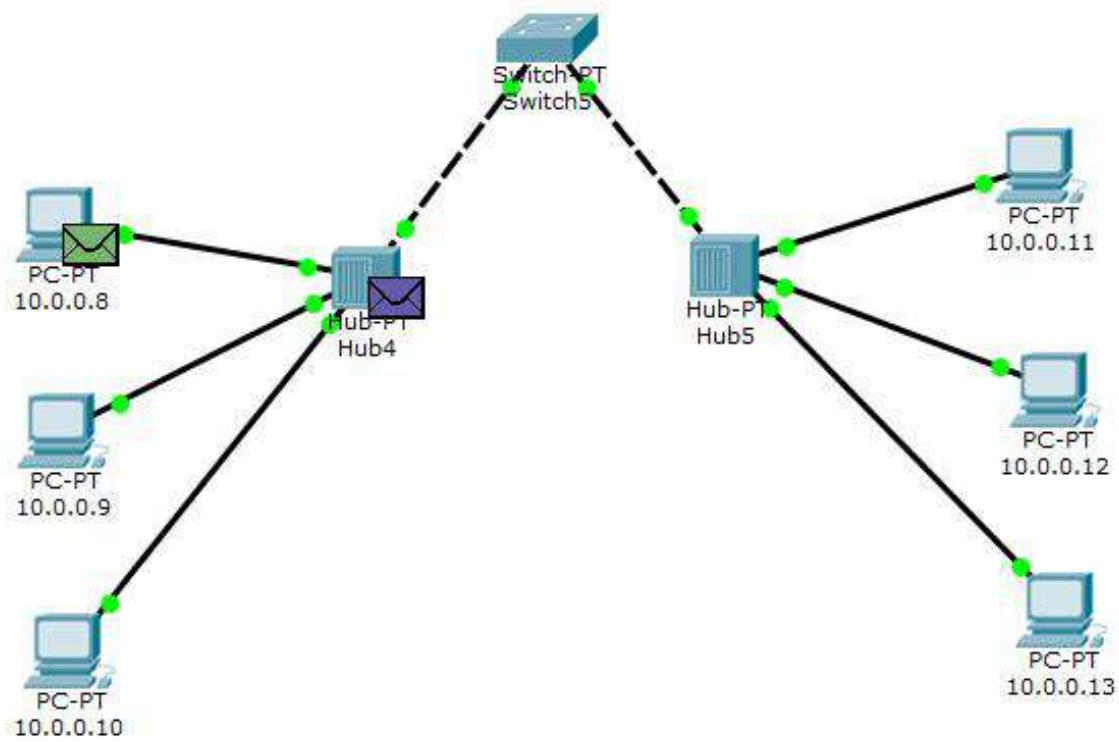


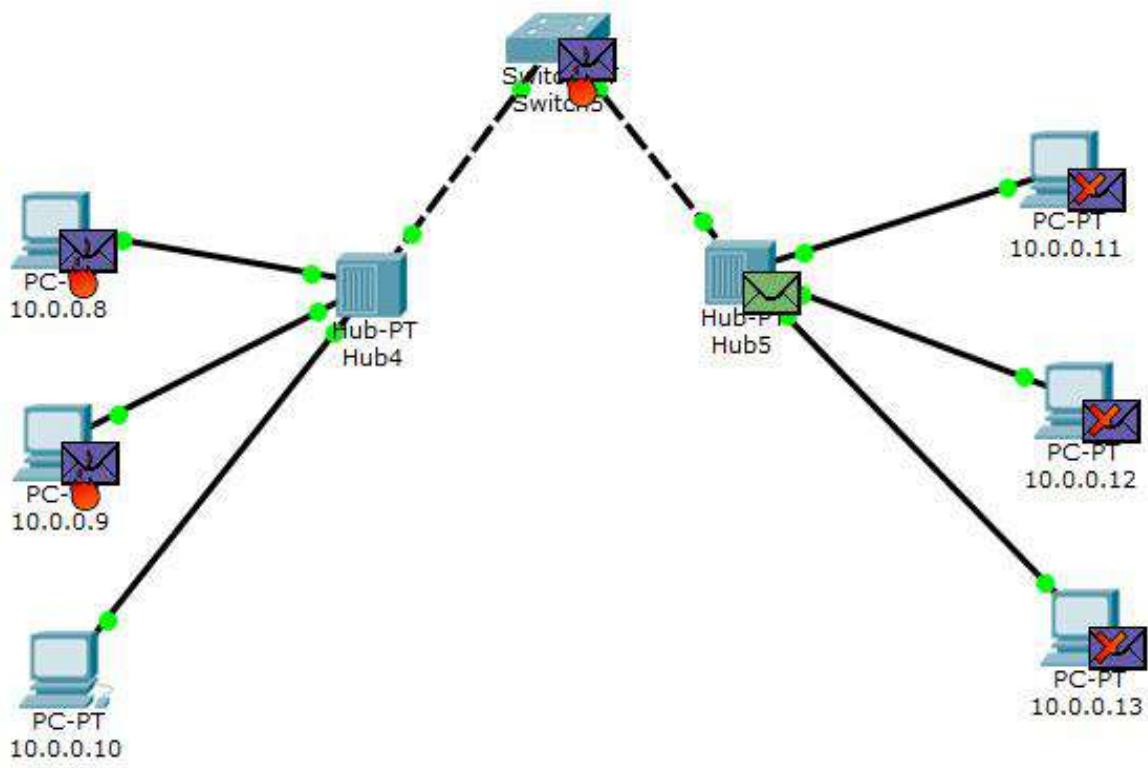
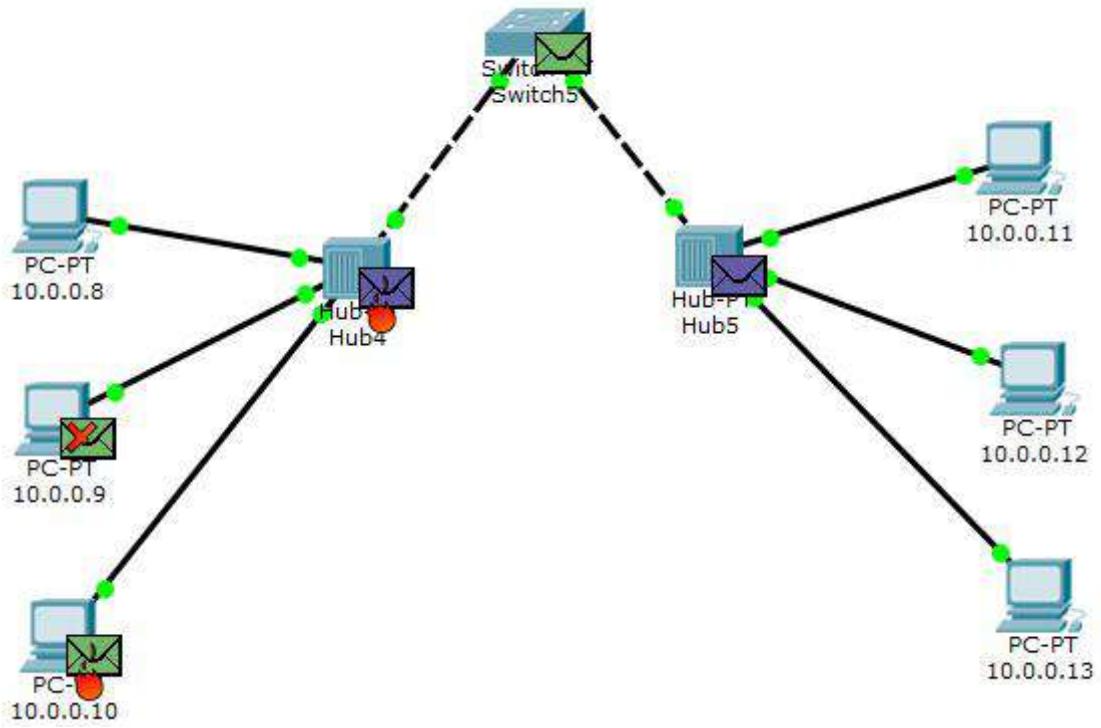


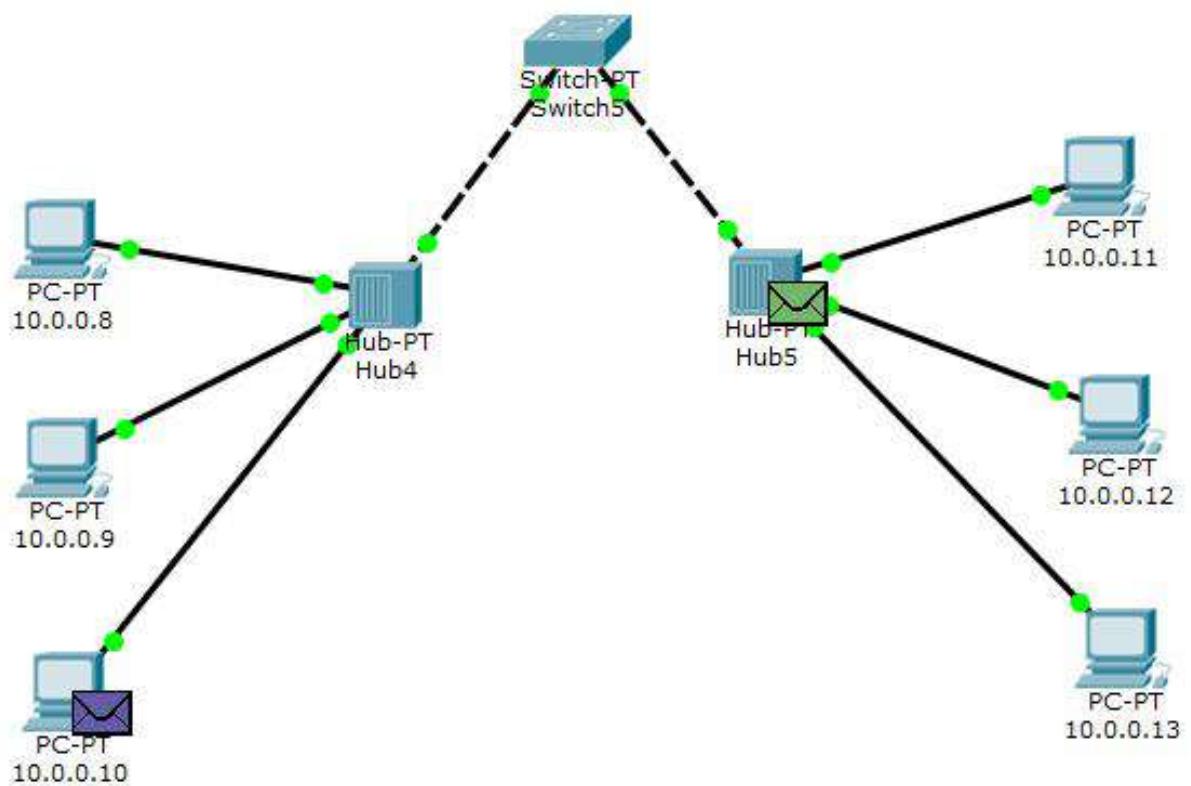
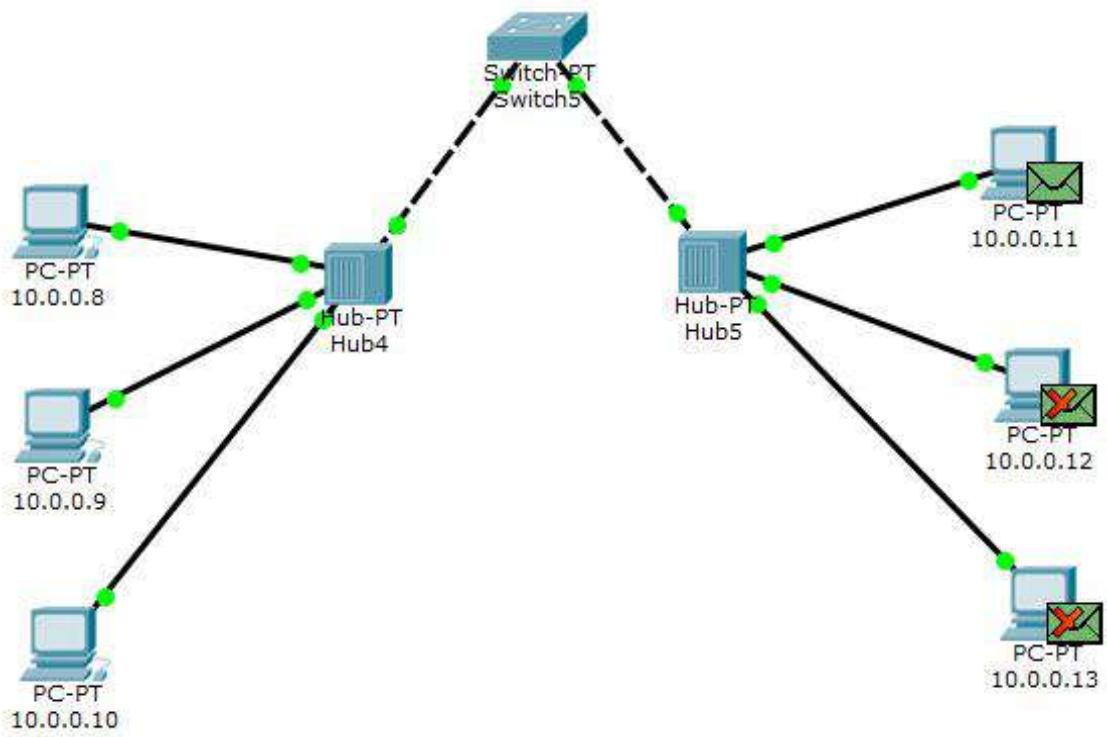


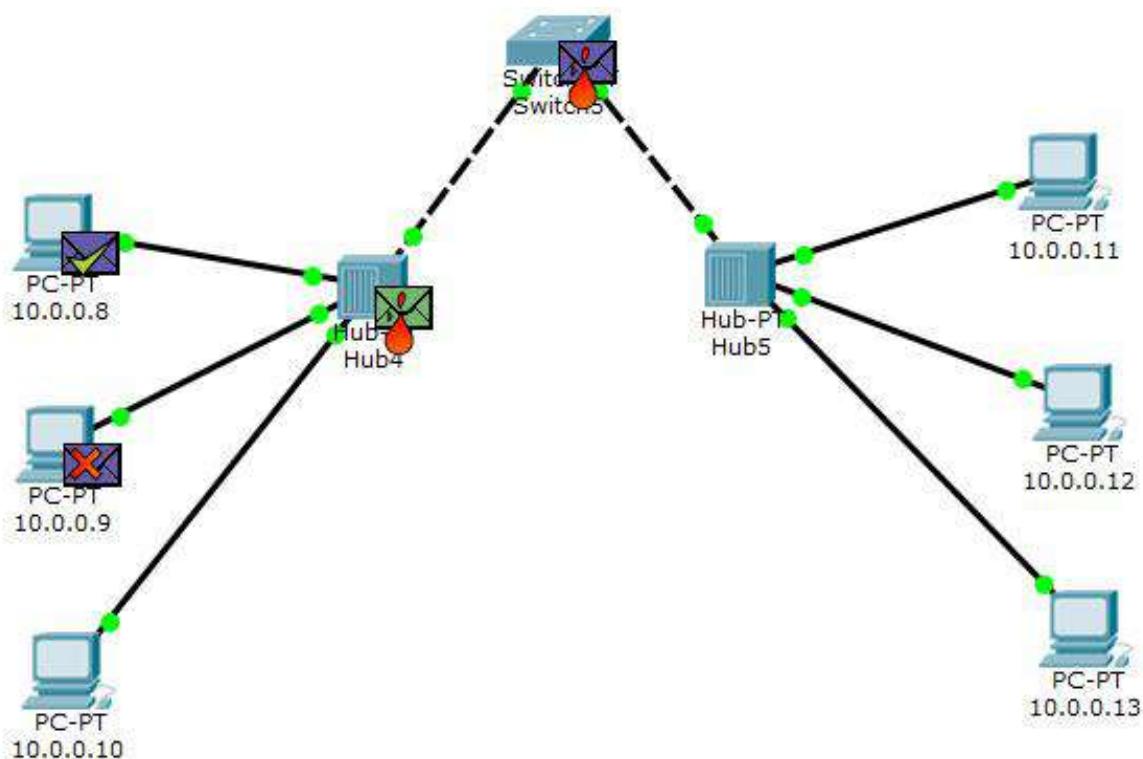
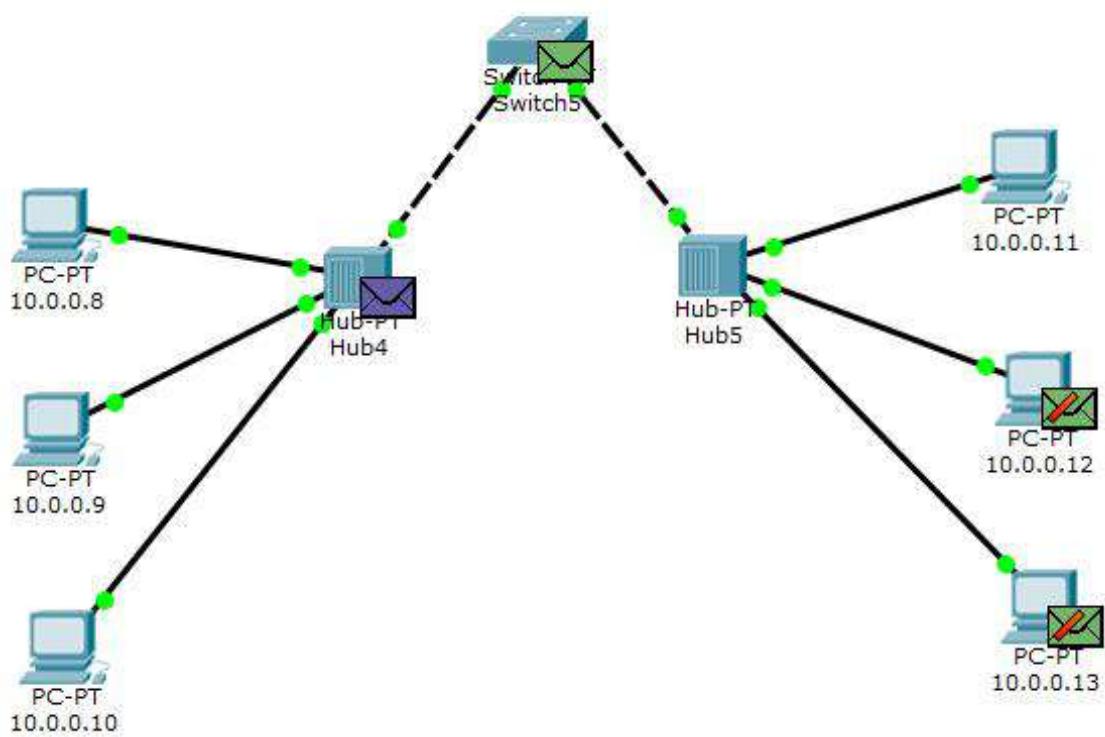
### Topology - 3:

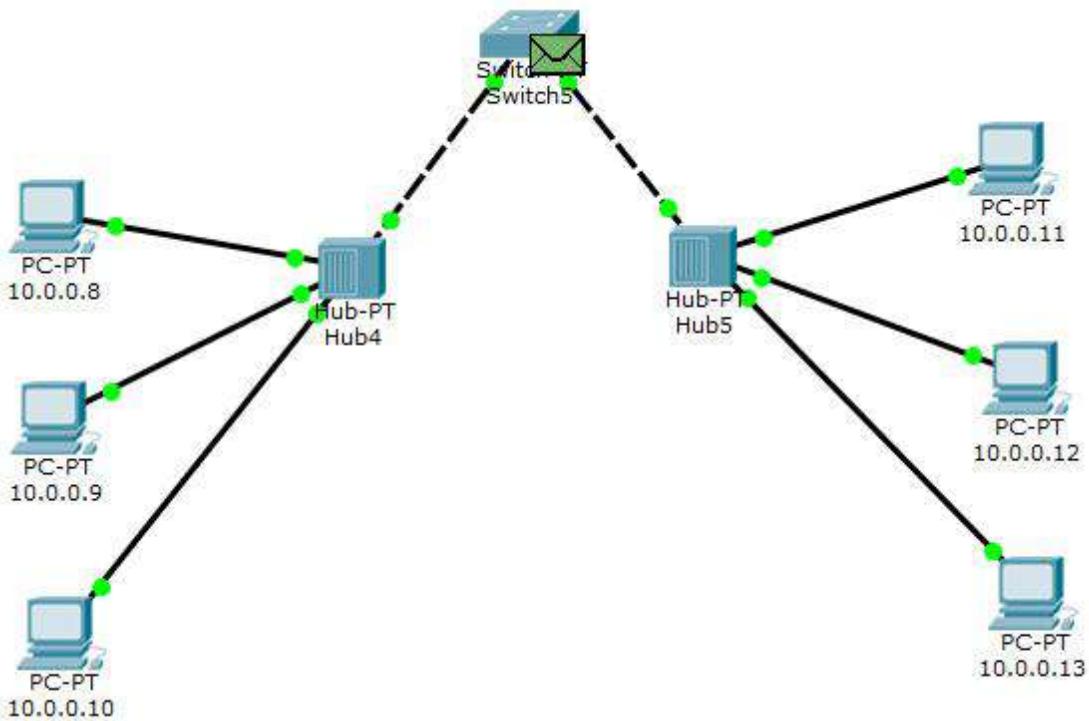
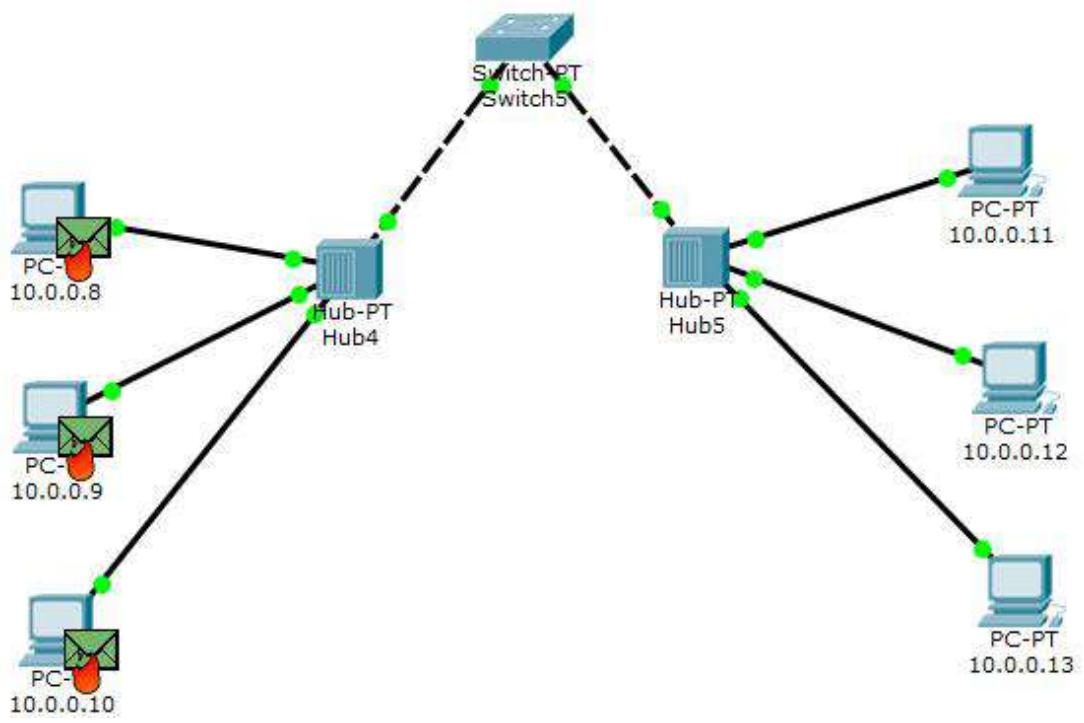


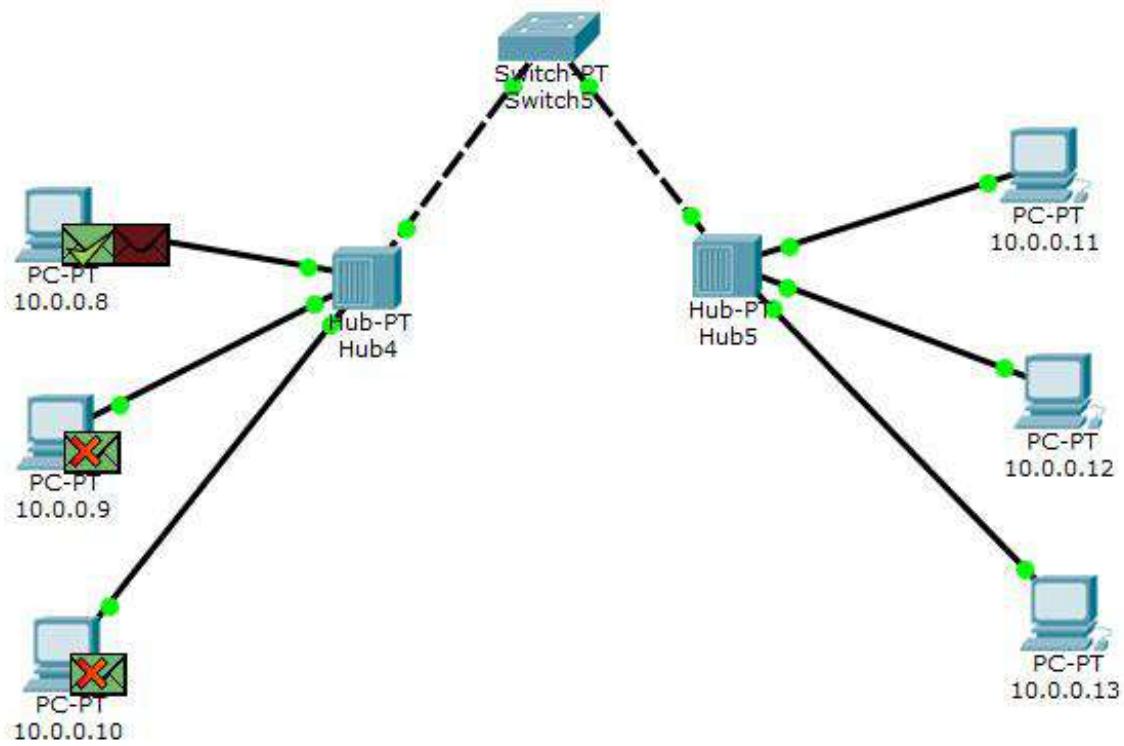
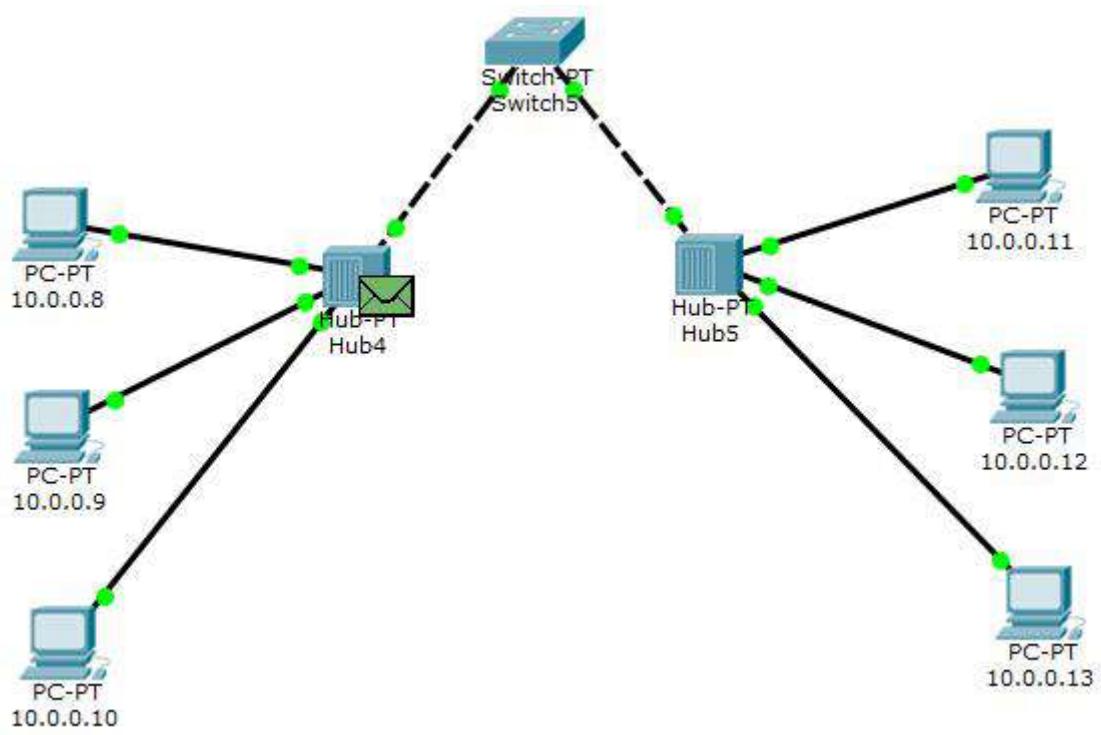












10.0.0.8

Physical Config Desktop Custom Interface

## Command Prompt X

```
Packet Tracer PC Command Line 1.0
PC>ping 10.0.0.13

Pinging 10.0.0.13 with 32 bytes of data:

Reply from 10.0.0.13: bytes=32 time=1ms TTL=128
Reply from 10.0.0.13: bytes=32 time=0ms TTL=128
Reply from 10.0.0.13: bytes=32 time=0ms TTL=128
Reply from 10.0.0.13: bytes=32 time=0ms TTL=128

Ping statistics for 10.0.0.13:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 1ms, Average = 0ms

PC>ping 10.0.0.10

Pinging 10.0.0.10 with 32 bytes of data:

Reply from 10.0.0.10: bytes=32 time=0ms TTL=128

Ping statistics for 10.0.0.10:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms

PC>
```

### 2.1.3 Observation Book Pictures:

PAGE NO.  
DATE : 16/06/2023

Experiment - 1

(i) Create a topology consisting of 3 or more devices connected with the help of a hub.

Aim: To understand the working of a hub.

Topology:

Procedure:

1. Add a generic hub and 3 PCs. Connect the PC0 to hub using Copper straight-through wire from Fast Ethernet0 port on PC0 to Port 0 on Hub. Similarly do it for the rest of the PC1 and PC2 to Port 1 and Port 2 of the hub respectively.
2. Set the static IP address of all PCs under Config → Interface → Fast Ethernet0 → IP address
3. ~~Send a simple PDU message from one PC to another PC in Simulation mode.~~
4. In real-time mode, click on PC 0 and under Desktop, open Command Prompt and ping one of the end devices on the network.

(Eg: ping 10.0.0.2)

Result: (In Simulation Mode)

1. The simple PDU is sent from PC0 to Hub.
2. Hub sends the PDU to all ~~ports~~ except the input port.
3. The PDU is rejected by PC2.
4. PC1 sends an acknowledgement to hub, which is again broadcasted.
5. PC0 receives this acknowledgement that the transfer is completed.

(In Realtime Mode)

PC > ping 10.0.0.2

Pinging 10.0.0.2 with 32 bytes of data:

Reply from 10.0.0.2: bytes = 32 time = 0ms TTL = 128

Reply from 10.0.0.2: bytes = 32 time = 0ms TTL = 128

Reply from 10.0.0.2: bytes = 32 time = 0ms TTL = 128

Reply from 10.0.0.2: bytes = 32 time = 0ms TTL = 128

Ping statistics for 10.0.0.2:

Packets: Sent = 4, Received = 4, Lost = 0 (0% Loss)

Approximate round trip times in milli-seconds:

Minimum = 0ms, Maximum = 0ms, Average = 0ms

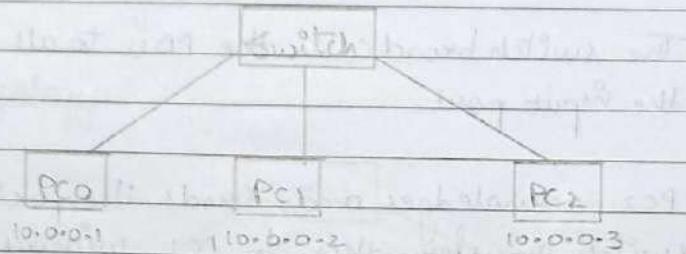
Observation:

Hub doesn't store any data and all incoming packets are broadcasted to all ports except the input port.  
The receiver should acknowledge the packet when received.

- (ii) Create a topology consisting of 3 or more devices connected with the help of a switch.

Aim: To understand the working of a switch.

Topology:



Procedure:

1. Add a Generic Switch and 3 PCs. Connect the PC0 to switch using Copper straight-through wire from FastEthernet0 port on PC0 to FastEthernet0 port on the switch. Similarly connect PC1, PC2 to switch using FastEthernet0 ports on PC1 and PC2 to FastEthernet 1/1 and FastEthernet 2/1 port on switch respectively.
2. Wait for PC and switch connectors to be established.
3. Set up IP-addresses for all end devices.  
Click on PC0 → Config → Interface → FastEthernet0  
→ IP address (10.0.0.1, 10.0.0.2, 10.0.0.3)
4. Send a simple PDU from PC0 to PC2 in Simulation mode.

5. In realtime mode, ping PC2 from PC0  
Click on PC0 → Desktop → Command prompt

Result:

In Simulation Mode:

1. PDU is sent from PC0 to PC2
2. The switch broadcasts the PDU to all ports except the input port.
3. PC2 acknowledges and sends the packet. The switch transfers this to PC1 without broadcast.

In Real-time Mode

PC > ping 10.0.0.3

Pinging 10.0.0.3 with 32 bytes data:

Reply from 10.0.0.3: bytes = 32 time = 0ms TTL = 128

Reply from 10.0.0.3: bytes = 32 time = 0ms TTL = 128

Reply from 10.0.0.3: bytes = 32 time = 0ms TTL = 128

Reply from 10.0.0.3: bytes = 32 time = 0ms TTL = 128

Ping statistics for 10.0.0.3

Packet: Sent = 4, Received = 4, Lost = 0 (0% loss).

Approximate round trip times in milli-seconds:

Minimum = 0 ms, Maximum = 1 ms, Average = 0 ms

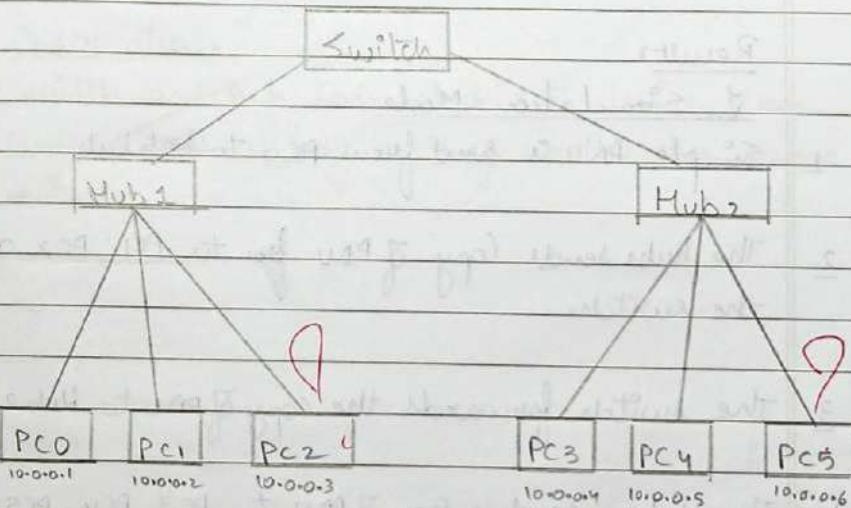
Observation:

Switch takes time for new connections to be established. In the first transfer, the switch broadcasts the packet to all end devices. In following transfer, the switch transfers the packets to destination end device.

- (iii) Create a topology and simulate sending a simple PSDU from source to destination using hub and switch as connecting devices and demonstrate ping message.

Aim: To understand the working of hub and switch together.

Topology:



Procedure:

- 1. Add a generic hub, 2 switches and 6 PCs.  
~~Connect PC to switch using copper straight-through wire from Ethernet0 port of PC to FastEthernet0/1 port of switch. Similarly do this for all end devices to connect them to switch.~~
- 2. Connect the switch to hub using copper cross-over wire.
- 3. Wait for the switch-Hub connection to be established.

3. Set IP addresses for all PCs such that they are in the same network.  
(IP addresses - 10.0.0.1, 10.0.0.2, 10.0.0.3, 10.0.0.4, 10.0.0.5, 10.0.0.6)
4. Send a simple PDU from PC0 to PC5 in Simulation mode.
5. In Real-time mode, ping PC5 from PC0.

Result:

In Simulation Mode,

1. Simple PDU is sent from PC0 to ~~the~~ hub
2. The hub sends copy of PDU to PC1, PC2 and the switch.
3. The switch forwards the copy of PDU to Hub2
4. The Hub2 sends a copy of ADV to PC3, PC4, PC5.
5. PC5 accepts the message and sends an acknowledgement to the Hub2.
6. This acknowledgement is sent to Switch, then to Hub1 and finally to PC0 and transfer of message is complete.

In Realtime Mode:

PC0 ping 10.0.0.6

Pinging 10.0.0.6 with 32 bytes of data:



Reply from 10.0.0.6: bytes = 32 time = 0ms TTL = 128

Reply from 10.0.0.6: bytes = 32 time = 0ms TTL = 128

Reply from 10.0.0.6: bytes = 32 time = 0ms TTL = 128

Reply from 10.0.0.6: bytes = 32 time = 0ms TTL = 128

Ping statistics for 10.0.0.6:

Packets: Sent = 4, Received = 4, lost = 0 (0% loss).

Approximate round trip times in milli-seconds:

Minimum = 0ms, Maximum = 0ms, Average = 0ms

Observation:

Switch and hub connected end-devices can communicate as long as they are on the same network.

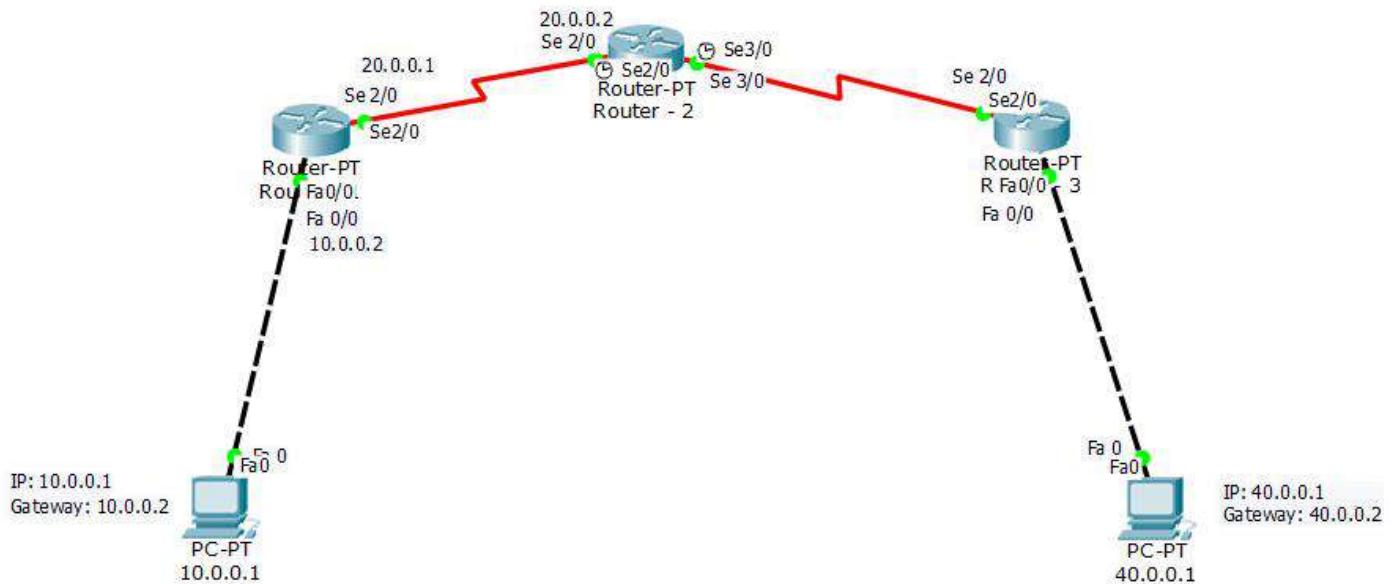
## 2.2 Experiment - 2:

### 2.2.1 Question:

Configure IP address to routers in packet tracer. Explore the following messages: ping responses, destination unreachable, request timed out, reply.

### 2.2.2 Screenshots (Topology, Configurations & Output):

#### Topology:



#### Configuring Router - 1:

```
Router - 1
Physical Config CLI
IOS Command Line Interface
System Configuration Dialog
Continue with configuration dialog? [yes/no]: n
Press RETURN to get started!

Router>enable
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#interface Fa0/0
Router(config-if)#ip address 10.0.0.2 255.0.0.0
Router(config-if)#no shutdown

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

Router(config-if)#exit
Router(config)#interface Se2/0
Router(config-if)#ip address 20.0.0.1 255.0.0.0
Router(config-if)#no shutdown

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

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```

Router - 1

Physical Config CLI

IOS Command Line Interface

```
*LINK 0 CHANGED: interface Serial2/0, changed state to up
*LINEPROTO-5-UPDOWN: Line protocol on Interface Serial2/0, changed state to up

Router con0 is now available

Press RETURN to get started.
```

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Router - 1

Physical Config CLI

IOS Command Line Interface

```
Router>show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
      D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
      N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
      E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
      i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
      * - candidate default, U - per-user static route, o - ODR
      P - periodic downloaded static route

Gateway of last resort is not set

C    10.0.0.0/8 is directly connected, FastEthernet0/0
C    20.0.0.0/8 is directly connected, Serial2/0
Router>enable
Router#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#ip route 40.0.0.0 255.0.0.0 20.0.0.2
Router(config)#exit
Router#
*SYS-5-CONFIG_I: Configured from console by console

Router#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
      D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
      N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
      E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
      i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
      * - candidate default, U - per-user static route, o - ODR
      P - periodic downloaded static route
```

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Router - 1

Physical Config CLI

IOS Command Line Interface

```
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

C    10.0.0.0/8 is directly connected, FastEthernet0/0
C    20.0.0.0/8 is directly connected, Serial2/0
S    40.0.0.0/8 [1/0] via 20.0.0.2
Router#
```

Router con0 is now available

Press RETURN to get started.

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## Configuring Router - 2:

Router - 2

Physical Config CLI

IOS Command Line Interface

```
Continue with configuration dialog? [yes/no]: no

Press RETURN to get started!

Router>enable
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#interface Se2/0
Router(config-if)#ip address 20.0.0.2 255.0.0.0
Router(config-if)#no shutdown

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

Router(config-if)#exit
Router(config)#interface
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial2/0, changed st
Router(config)#interface Se3/0
Router(config-if)#ip address 30.0.0.1 255.0.0.0
Router(config-if)#no shutdown

Router(config-if)#
%LINK-5-CHANGED: Interface Serial3/0, changed state to up

Router(config-if)#exit
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial3/0, changed state to up
```

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**Router - 2**

Physical Config CLI

### IOS Command Line Interface

```

Router>show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
      D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
      N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
      E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
      i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
      * - candidate default, U - per-user static route, o - ODR
      P - periodic downloaded static route

Gateway of last resort is not set

C    20.0.0.0/8 is directly connected, Serial2/0
C    30.0.0.0/8 is directly connected, Serial3/0
Router>enable
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#ip route 40.0.0.0 255.0.0.0 30.0.0.2
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console

Router#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
      D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
      N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
      E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
      i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
      * - candidate default, U - per-user static route, o - ODR
      P - periodic downloaded static route

```

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**Router - 2**

Physical Config CLI

### IOS Command Line Interface

```

Gateway of last resort is not set

C    20.0.0.0/8 is directly connected, Serial2/0
C    30.0.0.0/8 is directly connected, Serial3/0
S    40.0.0.0/8 [1/0] via 30.0.0.2
Router>enable
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#ip route 10.0.0.0 255.0.0.0 20.0.0.1
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console

Router#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
      D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
      N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
      E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
      i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
      * - candidate default, U - per-user static route, o - ODR
      P - periodic downloaded static route

Gateway of last resort is not set

S    10.0.0.0/8 [1/0] via 20.0.0.1
C    20.0.0.0/8 is directly connected, Serial2/0
C    30.0.0.0/8 is directly connected, Serial3/0
S    40.0.0.0/8 [1/0] via 30.0.0.2
Router#

```

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**Router - 2**

Physical Config CLI

### IOS Command Line Interface

```

Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#ip route 10.0.0.0 255.0.0.0 20.0.0.1
Router(config)#exit
Router#
*SYS-5-CONFIG_I: Configured from console by console

Router#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
      D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
      N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
      E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
      i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
      * - candidate default, U - per-user static route, o - ODR
      P - periodic downloaded static route

Gateway of last resort is not set

S    10.0.0.0/8 [1/0] via 20.0.0.1
C    20.0.0.0/8 is directly connected, Serial2/0
C    30.0.0.0/8 is directly connected, Serial3/0
S    40.0.0.0/8 [1/0] via 30.0.0.2
Router#
*LINK-5-CHANGED: Interface Serial3/0, changed state to down
*LINEPROTO-5-UPDOWN: Line protocol on Interface Serial3/0, changed state to down
*LINK-5-CHANGED: Interface Serial3/0, changed state to up
*LINEPROTO-5-UPDOWN: Line protocol on Interface Serial3/0, changed state to up

```

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### Configuring Router - 3:

**Router - 3**

Physical Config CLI

### IOS Command Line Interface

```

Router>enable
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#interface Fa0/0
Router(config-if)#ip address 40.0.0.2 255.0.0.0
Router(config-if)#no shutdown

Router(config-if)#
*LINK-5-CHANGED: Interface FastEthernet0/0, changed state to up
*LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to up

Router(config-if)#exit
Router(config)#interface Se2/0
Router(config-if)#ip address 30.0.0.2 255.0.0.0
Router(config-if)#no shutdown

*LINK-5-CHANGED: Interface Serial2/0, changed state to down
Router(config-if)#exit
Router(config)#
*LINK-5-CHANGED: Interface Serial2/0, changed state to up
*LINEPROTO-5-UPDOWN: Line protocol on Interface Serial2/0, changed state to up

```

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Router - 3

Physical Config CLI

### IOS Command Line Interface

```
Router>show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
      D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
      N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
      E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
      i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
      * - candidate default, U - per-user static route, o - ODR
      P - periodic downloaded static route

Gateway of last resort is not set

C    30.0.0.0/8 is directly connected, Serial2/0
C    40.0.0.0/8 is directly connected, FastEthernet0/0
Router>enable
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#ip route 40.0.0.0 255.0.0.0 40.0.0.2
%Invalid next hop address (it's this router)
Router(config)#ip route 40.0.0.0 255.0.0.0 40.0.0.1
Router(config)#exit
Router#
*SYS-5-CONFIG_I: Configured from console by console

Router#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
      D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
      N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
      E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
      i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
```

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Router - 3

Physical Config CLI

### IOS Command Line Interface

```
Router#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
      D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
      N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
      E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
      i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
      * - candidate default, U - per-user static route, o - ODR
      P - periodic downloaded static route

Gateway of last resort is not set

C    30.0.0.0/8 is directly connected, Serial2/0
C    40.0.0.0/8 is directly connected, FastEthernet0/0
Router#enable
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#ip route 40.0.0.0 255.0.0.0 20.0.0.2
Router(config)#exit
Router#
*SYS-5-CONFIG_I: Configured from console by console

Router#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
      D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
      N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
      E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
      i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
      * - candidate default, U - per-user static route, o - ODR
      P - periodic downloaded static route
```

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Router - 3

Physical Config CLI

### IOS Command Line Interface

```
Gateway of last resort is not set

C      30.0.0.0/8 is directly connected, Serial2/0
C      40.0.0.0/8 is directly connected, FastEthernet0/0
Router#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
       i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
       * - candidate default, U - per-user static route, o - ODR
       P - periodic downloaded static route

Gateway of last resort is not set

C      30.0.0.0/8 is directly connected, Serial2/0
C      40.0.0.0/8 is directly connected, FastEthernet0/0
Router#enable
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#ip route 40.0.0.0 255.0.0.0 10.0.0.2
Router(config)#exit
Router#
*SYS-5-CONFIG_I: Configured from console by console

Router#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
       i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
       * - candidate default, U - per-user static route, o - ODR
       P - periodic downloaded static route
```

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Router - 3

Physical Config CLI

### IOS Command Line Interface

```
Router#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
       i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
       * - candidate default, U - per-user static route, o - ODR
       P - periodic downloaded static route

Gateway of last resort is not set

C      30.0.0.0/8 is directly connected, Serial2/0
C      40.0.0.0/8 is directly connected, FastEthernet0/0
Router#enable
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#ip route 40.0.0.0 255.0.0.0 10.0.0.2
*SLINK-5-CHANGED: Interface Serial2/0, changed state to down

*SLINEPROTO-5-UPDOWN: Line protocol on Interface Serial2/0, changed state to down
*SLINK-5-CHANGED: Interface Serial2/0, changed state to up

*SLINEPROTO-5-UPDOWN: Line protocol on Inter
Router(config)#exit
Router#
*SYS-5-CONFIG_I: Configured from console by console
show ip config
```

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**Router - 3**

Physical Config CLI

### IOS Command Line Interface

```
*LINEPROTO-5-UPDOWN: Line protocol on Interface Serial2/0, changed state to down
*LINK-5-CHANGED: Interface Serial2/0, changed state to up
*LINEPROTO-5-UPDOWN: Line protocol on Inter
Router(config)#exit
Router#
*SYS-5-CONFIG_I: Configured from console by console
show ip config
^
* Invalid input detected at '^' marker.

Router#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
      D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
      N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
      E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
      i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
      * - candidate default, U - per-user static route, o - ODR
      P - periodic downloaded static route

Gateway of last resort is not set

C    30.0.0.0/8 is directly connected, Serial2/0
C    40.0.0.0/8 is directly connected, FastEthernet0/0
Router#enable
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#ip route 10.0.0.0 255.0.0.0 30.0.0.1
```

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**Router - 3**

Physical Config CLI

### IOS Command Line Interface

```
* 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

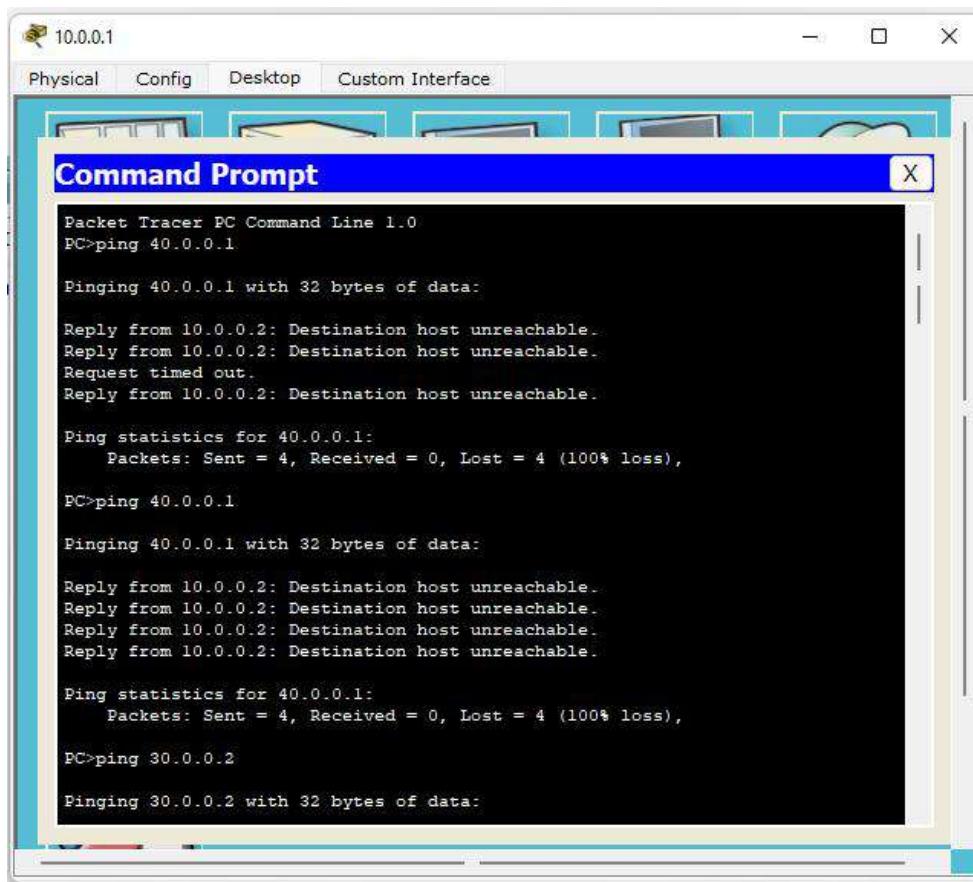
C    30.0.0.0/8 is directly connected, Serial2/0
C    40.0.0.0/8 is directly connected, FastEthernet0/0
Router#enable
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#ip route 10.0.0.0 255.0.0.0 30.0.0.1
Router(config)#exit
Router#
*SYS-5-CONFIG_I: Configured from console by console
show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
      D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
      N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
      E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
      i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
      * - candidate default, U - per-user static route, o - ODR
      P - periodic downloaded static route

Gateway of last resort is not set

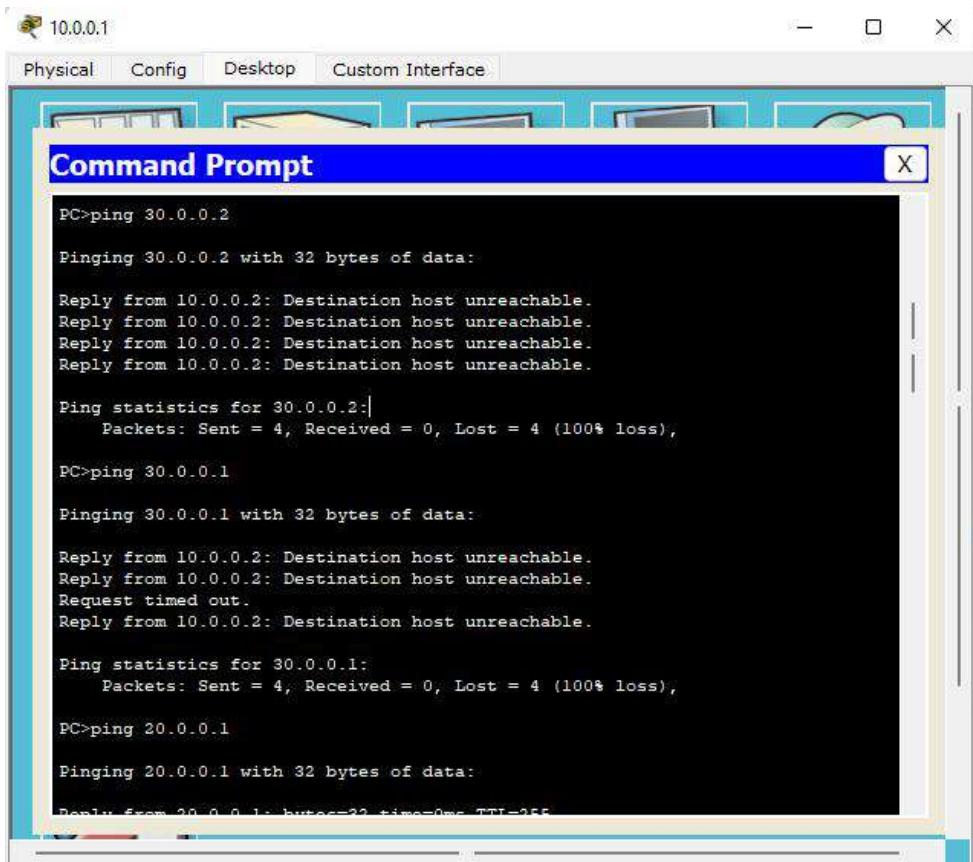
S    10.0.0.0/8 [1/0] via 30.0.0.1
C    30.0.0.0/8 is directly connected, Serial2/0
C    40.0.0.0/8 is directly connected, FastEthernet0/0
Router#
```

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## Initial Ping (Failure):



Packet Tracer PC Command Line 1.0  
PC>ping 40.0.0.1  
  
Pinging 40.0.0.1 with 32 bytes of data:  
  
Reply from 10.0.0.2: Destination host unreachable.  
Reply from 10.0.0.2: Destination host unreachable.  
Request timed out.  
Reply from 10.0.0.2: Destination host unreachable.  
  
Ping statistics for 40.0.0.1:  
Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),  
  
PC>ping 40.0.0.1  
  
Pinging 40.0.0.1 with 32 bytes of data:  
  
Reply from 10.0.0.2: Destination host unreachable.  
  
Ping statistics for 40.0.0.1:  
Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),  
  
PC>ping 30.0.0.2  
  
Pinging 30.0.0.2 with 32 bytes of data:

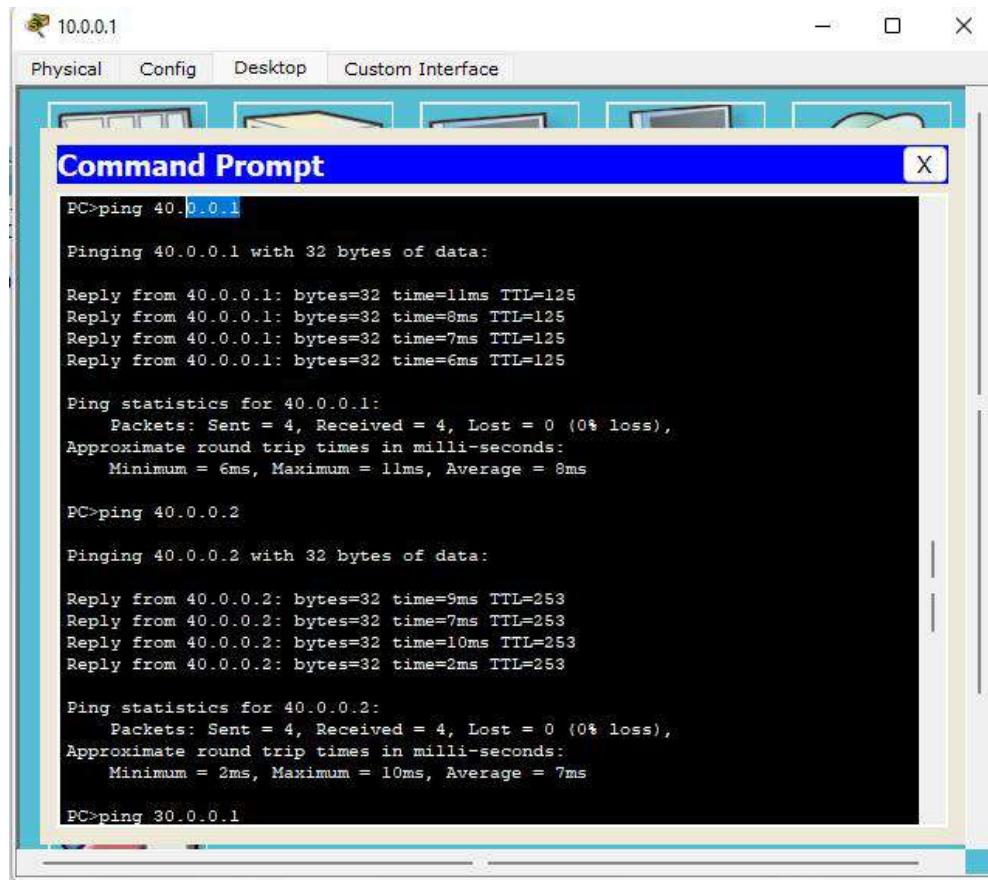


PC>ping 30.0.0.2  
  
Pinging 30.0.0.2 with 32 bytes of data:  
  
Reply from 10.0.0.2: Destination host unreachable.  
  
Ping statistics for 30.0.0.2:  
Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),  
  
PC>ping 30.0.0.1  
  
Pinging 30.0.0.1 with 32 bytes of data:  
  
Reply from 10.0.0.2: Destination host unreachable.  
Reply from 10.0.0.2: Destination host unreachable.  
Request timed out.  
Reply from 10.0.0.2: Destination host unreachable.  
  
Ping statistics for 30.0.0.1:  
Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),  
  
PC>ping 20.0.0.1  
  
Pinging 20.0.0.1 with 32 bytes of data:  
  
Reply from 20.0.0.1: bytes=32 time=0ms TTL=255

PC>ping 20.0.0.1  
Pinging 20.0.0.1 with 32 bytes of data:  
Reply from 20.0.0.1: bytes=32 time=0ms TTL=255  
Ping statistics for 20.0.0.1:  
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),  
Approximate round trip times in milli-seconds:  
Minimum = 0ms, Maximum = 0ms, Average = 0ms  
PC>ping 20.0.0.2  
Pinging 20.0.0.2 with 32 bytes of data:  
Request timed out.  
Request timed out.  
Request timed out.  
Request timed out.  
Ping statistics for 20.0.0.2:  
Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),  
PC>ping 40.0.0.2  
Pinging 40.0.0.2 with 32 bytes of data:

PC>ping 40.0.0.2  
Pinging 40.0.0.2 with 32 bytes of data:  
Reply from 10.0.0.2: Destination host unreachable.  
Ping statistics for 40.0.0.2:  
Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),  
PC>ping 40.0.0.1  
Pinging 40.0.0.1 with 32 bytes of data:  
Request timed out.  
Request timed out.  
Request timed out.  
Request timed out.  
Ping statistics for 40.0.0.1:  
Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),  
PC>ping 40.0.0.1  
Pinging 40.0.0.1 with 32 bytes of data:  
Reply from 40.0.0.1: bytes=32 time=1ms TTL=125

## Ping After Adding Static Routes:



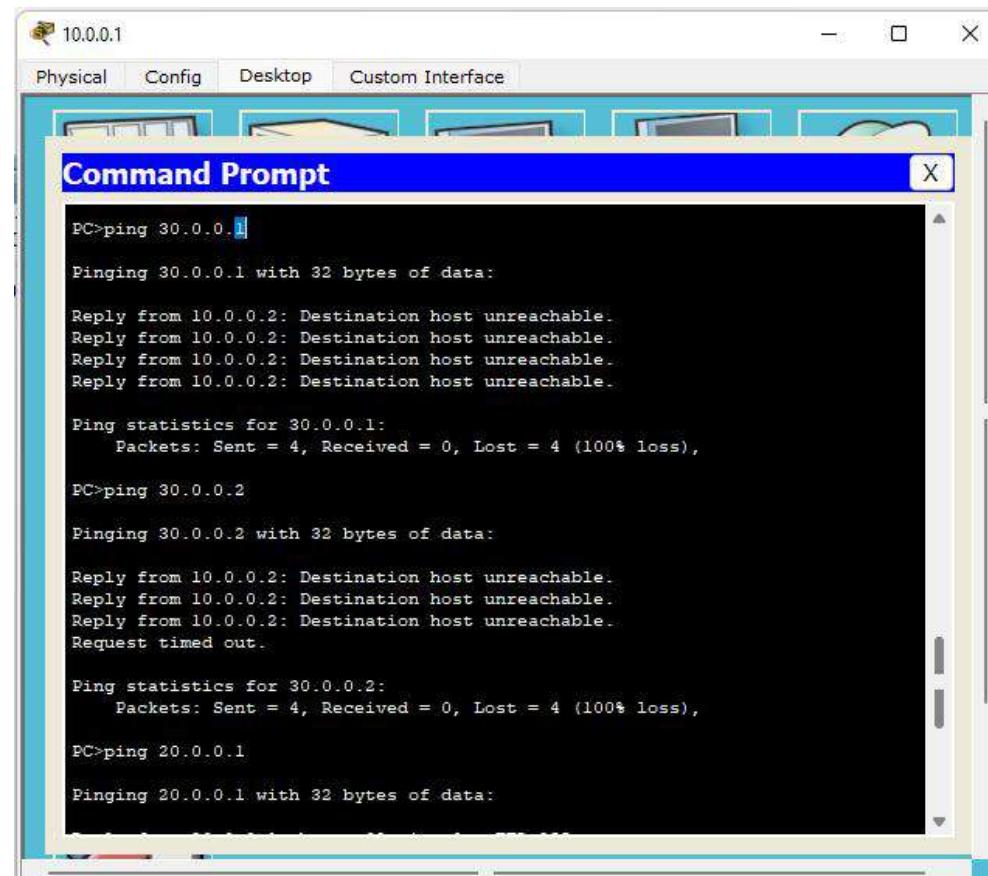
```
PC>ping 40.0.0.1
Pinging 40.0.0.1 with 32 bytes of data:
Reply from 40.0.0.1: bytes=32 time=11ms TTL=125
Reply from 40.0.0.1: bytes=32 time=8ms TTL=125
Reply from 40.0.0.1: bytes=32 time=7ms TTL=125
Reply from 40.0.0.1: bytes=32 time=6ms TTL=125

Ping statistics for 40.0.0.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 6ms, Maximum = 11ms, Average = 8ms

PC>ping 40.0.0.2
Pinging 40.0.0.2 with 32 bytes of data:
Reply from 40.0.0.2: bytes=32 time=9ms TTL=253
Reply from 40.0.0.2: bytes=32 time=7ms TTL=253
Reply from 40.0.0.2: bytes=32 time=10ms TTL=253
Reply from 40.0.0.2: bytes=32 time=2ms TTL=253

Ping statistics for 40.0.0.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 2ms, Maximum = 10ms, Average = 7ms

PC>ping 30.0.0.1
```



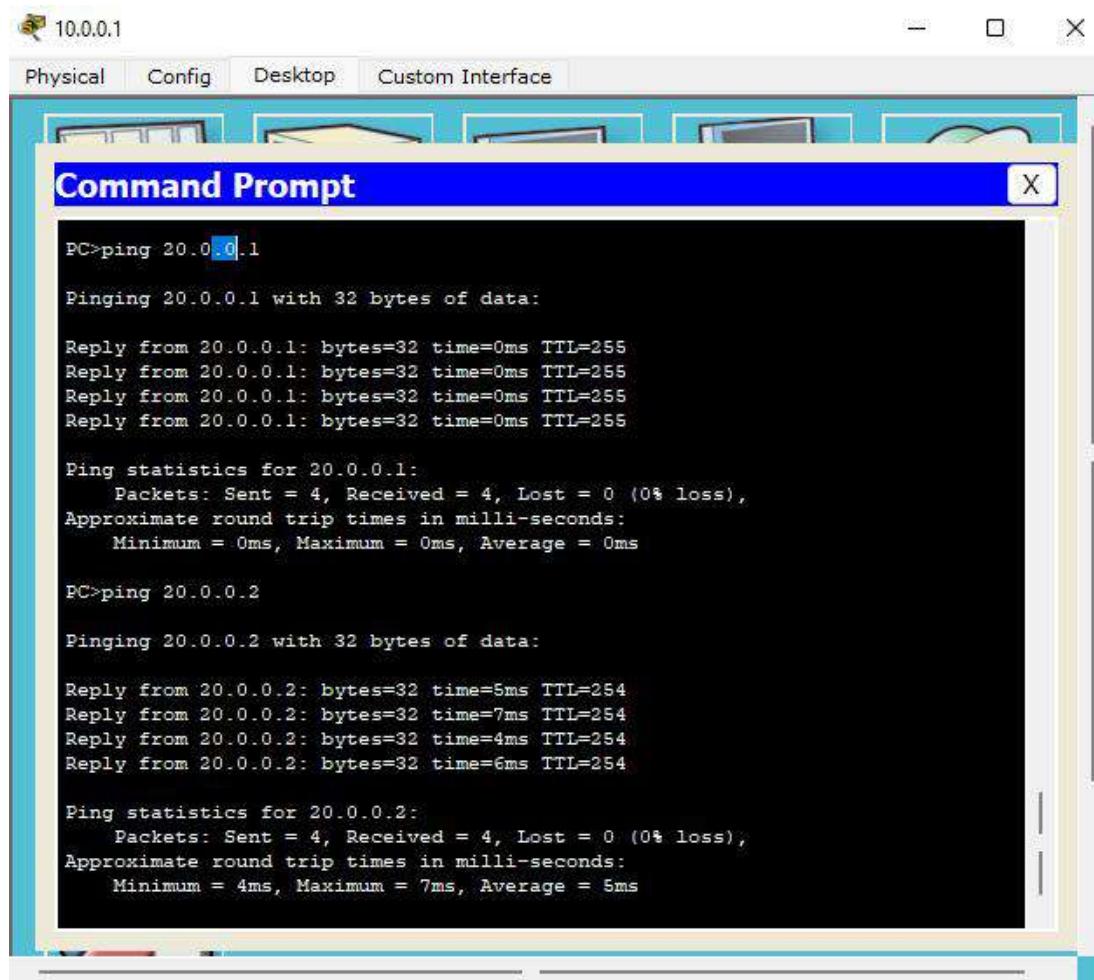
```
PC>ping 30.0.0.1
Pinging 30.0.0.1 with 32 bytes of data:
Reply from 10.0.0.2: Destination host unreachable.

Ping statistics for 30.0.0.1:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),

PC>ping 30.0.0.2
Pinging 30.0.0.2 with 32 bytes of data:
Reply from 10.0.0.2: Destination host unreachable.
Reply from 10.0.0.2: Destination host unreachable.
Reply from 10.0.0.2: Destination host unreachable.
Request timed out.

Ping statistics for 30.0.0.2:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),

PC>ping 20.0.0.1
Pinging 20.0.0.1 with 32 bytes of data:
```



### 2.2.3 Observation Book Pictures:

PAGE NO.  
DATE 23/06/2023

Experiment - 2

Configure IP address to routers in packet tracer.  
Explore the following messages: ping responses, destination unreachable, request timed out, reply.

Aim: To understand different ping messages and when they are caused.

(i) Topology:

```
graph TD; Router --- PC0[PC0  
10.0.0.1]; Router --- PC1[PC1  
20.0.0.1]
```

Procedure:

1. Add 2 PCs and a router.  
Connect PC to router using Copper Cables - Over wire from FastEthernet0 port on PC to FastEthernet0/0 port on switch. Similarly do this for PC1 and switch.
2. Configure the PCs by setting their IP address to 10.0.0.1 and 20.0.0.1 respectively to PC0 and PC1.
3. Click on Router → CLI
4. Type no for "Continue with configuration dialog? [yes/no]" and press Enter.

5. Router > enable

Router # configure terminal

Router (config)# interface Fa0/0

Router (config-if) # ip address 10.0.0.2 255.0.0.0

Router (config-if) # no shutdown

Router (config-if) # exit

6. Repeat step 5 for Fa1/0 interface with ip address 20.0.0.2 and Subnet mask 255.0.0.0.

7. Ping PC1 from PC0

8. Set default gateway for PC0 as 10.0.0.2 and 20.0.0.2 for PC1. (Click on PC0 → Config → Gateway)

Result:

In Real-Time Mode:

⇒ Before setting the default gateway

PC > ping 20.0.0.1

Pinging 20.0.0.1 with 32 bytes of data.

~~Request timed out~~

~~Request timed out~~

~~Request timed out~~

~~Request timed out~~

Ping statistics for 20.0.0.1 :

Packets: Sent = 4, Received = 0, Lost = 4 (100% loss)



⇒ After setting default gateway  
 PC > ping 20.0.0.1

Pinging 20.0.0.1 with 32 bytes of data:

Reply from 20.0.0.1: bytes = 32 time = 0 ms TTL = 128

Reply from 20.0.0.1: bytes = 32 time = 0 ms TTL = 128

Reply from 20.0.0.1: bytes = 32 time = 0 ms TTL = 128

Reply from 20.0.0.1: bytes = 32 time = 0 ms TTL = 128

Ping statistics for 20.0.0.1:

Packets: Sent = 4, Received = 4, Lost = 0 (0% loss)

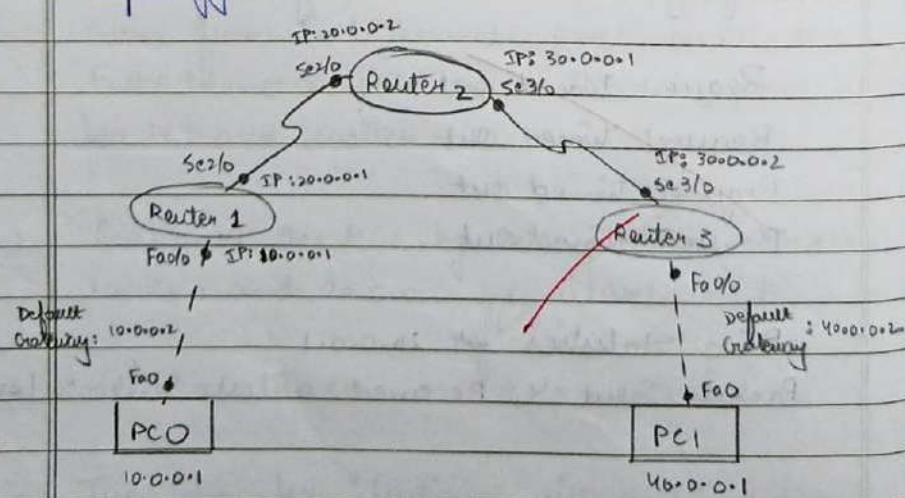
Approximate round trip times in milli-seconds:

Minimum = 0 ms, Maximum = 1 ms, Average = 0 ms.

Observation:

For 2 end devices to communicate, default gateway is required during inter-network communication.

## (ii) Topology:



### Procedure:

1. Add 3 routers and 2 end devices.  
Connect the end devices (PC0 and PC1) to Router 1 and Router 3 using Copper cross-over wire from Fast Ethernet 0 port on Ac to Fast Ethernet 0 port on the Router 1 and 3.  
Connect Router 1 and Router 3 to Router 2 using Serial XCF wire from Serial 2/0 port to Serial 2/0 port.
2. Set the IP address of end devices. Here each end device is considered to be a separate network.
3. Go to CLI of routers and configure the IP address of the ports. (Router → CLI)
4. Type "no" for 'Continue with configuration dialog? [yes/no]' and press Enter.
5. Router > enable  
Router# Configure terminal  
Router(config)# interface Fa0/0  
Router(config-if)# ip address 10.0.0.2 255.0.0.0  
Router(config-if)# no-shutdown  
Router(config-if)# exit.
6. Repeat step -5 for port Sc 2/0, Sc 3/0 of routers Router 1, 2, 3.



(For Router 1, port Se2/0)

Router (config) # interface Se2/0

Router (config-if) # ip address 20.0.0.1 255.0.0.0

Router (config-if) # no shutdown

Router (config-if) # exit.

(For Router 2, port Se2/0)

Router (config) # interface Se2/0

Router (config-if) # ip address 20.0.0.2 255.0.0.0

Router (config-if) # no shutdown

Router (config-if) # exit.

(For Router 2, port Se3/0)

Router (config) # interface Se3/0

Router (config-if) # ip address 30.0.0.1 255.0.0.0

Router (config-if) # no shutdown

Router (config-if) # exit.

(For Router 3, port Se3/0)

Router (config) # interface Se3/0

Router (config-if) # ip address 30.0.0.2 255.0.0.0

Router (config-if) # no shutdown

Router (config-if) # exit.

(For Router 3, port Fa0/0)

Router (config) # interface Fa0/0

Router (config-if) # ip address 40.0.0.2 255.0.0.0

Router (config-if) # no shutdown

Router (config-if) # exit.

The connection b/w routers 1,2,3 is now green

Router 1  
Router 2  
Router 3

8. Set default gateways for PC0 and PC1 to 10.0.0.2 and

40.0.0.2 respectively

9. Send a ping from PC0 to PC1.

10. Go to CLI in Router configuration. Enter the following command : "show ip route".

This command is used to display the IPv4 routing table of a router. The router provides additional route information, including how the route was learned, how long the route has been in the table, and which specific interface to use to get to a predefined destination.

11. Set the ip route for all the 3 routers.

For Router 1:

Router > enable

Router # configure terminal

Router (config) # ip route 40.0.0.0 255.0.0.0 20.0.0.2

Router (config) # exit.

Output for above:

Router # show ip route.

C 10.0.0.0/8 is directly connected, FastEthernet 0/0

C 20.0.0.0/8 is directly connected, Serial 2/0

S 40.0.0.0/8 [1/0] via 20.0.0.2

For Router 2:

Router > enable

Router # configure terminal

Router (config) # ip route 40.0.0.0 255.0.0.0 30.0.0.2

Router (config) # ip route 10.0.0.0 255.0.0.0 20.0.0.1

Router (config) # exit

Output for above:

Router # show ip route

S 10.0.0.0/8 [1/0] via 20.0.0.1

C 20.0.0.0/8 is directly connected, Serial 2/0

C 30.0.0.0/8 is directly connected, Serial 3/0

S 40.0.0.0/8 [1/0] via 30.0.0.2

For Router 3:

Router # enable

Router # configure terminal

Router (config) # ip route 10.0.0.0 255.0.0.0 30.0.0.1

Router (config) # exit.

Output for above.

Router # show ip route

S 10.0.0.0/8 [1/0] via 30.0.0.1

C is directly connected, Serial 2/0

C is directly connected, FastEthernet 0/0

Result:

Initial Ping (without setting ip route)

PC > ping 40.0.0.1

Pinging 40.0.0.1 with 32 bytes of data:

Reply from 40.0.0.1: Destination host unreachable

Ping statistics for 40.0.0.1 :

Bytes: Sent = 4, Received = 0, Lost = 4 (100% loss)

PC > ping 20.0.0.2

Pinging 20.0.0.2 with 32 bytes of data:

Request timed out

Request timed out

Request timed out

Request timed out.

Ping statistics for 20.0.0.2:

Packet: Sent = 4, Received = 0, Lost = 4 (100% loss)

Ping (After adding routes)

PC > ping 40.0.0.1

Pinging 40.0.0.1 with 32 bytes of data:

Reply from 40.0.0.1: bytes = 32, time = 11 ms, TTL = 125

Reply from 40.0.0.1: bytes = 32, time = 9 ms, TTL = 125

Reply from 40.0.0.1: bytes = 32, time = 7 ms, TTL = 125

Reply from 40.0.0.1: bytes = 32, time = 6 ms, TTL = 125

Ping statistics for 40.0.0.1

Packet: Sent = 4, Received = 4, Lost = 0 (0% loss)

Approximate round trip times in milli-seconds:

Minimum = 6 ms, Maximum = 11 ms, Average = 8 ms.

Observation:

The packets reach destination successfully but this time default routing was used on routers connected to end devices. Default routing implies it can go to any of the connected networks ~~and it takes the shortest path~~.

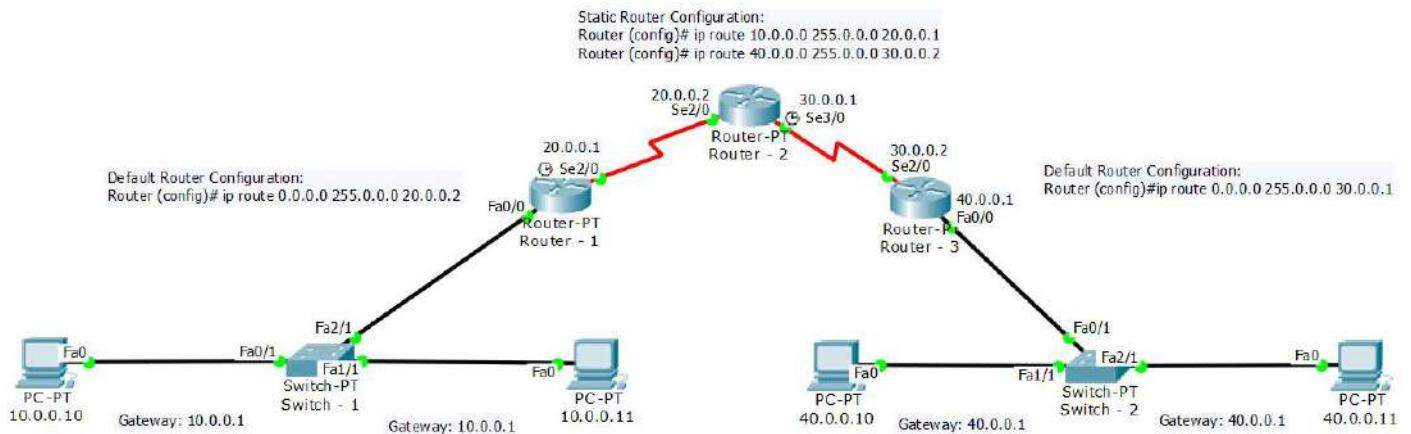
## 2.3 Experiment - 3:

### 2.3.1 Question:

Configure default route, static route to the Router.

### 2.3.2 Screenshots (Topology, Configurations & Output):

#### Topology:



#### Configuring Router - 1:

Router - 1

Physical    Config    CLI

IOS Command Line Interface

```
Continue with configuration dialog? [yes/no]: n

Press RETURN to get started!

Router>enable
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#interface Fa0/0
Router(config-if)#ip address 10.0.0.1 255.0.0.0
Router(config-if)#no shutdown

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

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

Router(config-if)#exit
Router(config)#interface Se2/0
Router(config-if)#ip address 20.0.0.1 255.0.0.0
Router(config-if)#no shutdown

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

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Router - 1

Physical Config CLI

### IOS Command Line Interface

```
*LINEPROTO-5-UPDOWN: Line protocol on Interface Serial2/0, changed state to up
Router(config)#exit
Router#
*SYS-5-CONFIG_I: Configured from console by console

Router#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
      D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
      N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
      E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
      i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
      * - candidate default, U - per-user static route, o - ODR
      P - periodic downloaded static route

Gateway of last resort is not set

C    10.0.0.0/8 is directly connected, FastEthernet0/0
C    20.0.0.0/8 is directly connected, Serial2/0
Router#enable
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#ip route 10.0.0.1 255.0.0.0 20.0.0.2
*S>Inconsistent address and mask
Router(config)#ip route 10.0.0.1 255.0.0.0 20.0.0.1
*S>Inconsistent address and mask
Router(config)#ip route 10.0.0.0 255.0.0.0 20.0.0.2
Router(config)#exit
Router#
```

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Router - 1

Physical Config CLI

### IOS Command Line Interface

```
*SYS-5-CONFIG_I: Configured from console by console

Router#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
      D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
      N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
      E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
      i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
      * - candidate default, U - per-user static route, o - ODR
      P - periodic downloaded static route

Gateway of last resort is not set

C    10.0.0.0/8 is directly connected, FastEthernet0/0
C    20.0.0.0/8 is directly connected, Serial2/0
Router#enable
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#ip route 40.0.0.0 255.0.0.0 20.0.0.2
Router(config)#exit
Router#
*SYS-5-CONFIG_I: Configured from console by console

Router#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
      D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
      N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
      E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
      i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
      * - candidate default, U - per-user static route, o - ODR
```

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Router - 1

Physical Config CLI

### IOS Command Line Interface

```
P - periodic downloaded static route

Gateway of last resort is not set

C      10.0.0.0/8 is directly connected, FastEthernet0/0
C      20.0.0.0/8 is directly connected, Serial2/0
S      40.0.0.0/8 [1/0] via 20.0.0.2
Router#
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#ip route 0.0.0.0 0.0.0.0 20.0.0.2
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console
show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
       i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
       * - candidate default, U - per-user static route, o - ODR
       P - periodic downloaded static route

Gateway of last resort is 20.0.0.2 to network 0.0.0.0

C      10.0.0.0/8 is directly connected, FastEthernet0/0
C      20.0.0.0/8 is directly connected, Serial2/0
S      40.0.0.0/8 [1/0] via 20.0.0.2
S*    0.0.0.0/0 [1/0] via 20.0.0.2
Router#configure terminal
```

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Router - 1

Physical Config CLI

### IOS Command Line Interface

```
candidate default, o - per user static route, o - ODR
P - periodic downloaded static route

Gateway of last resort is 20.0.0.2 to network 0.0.0.0

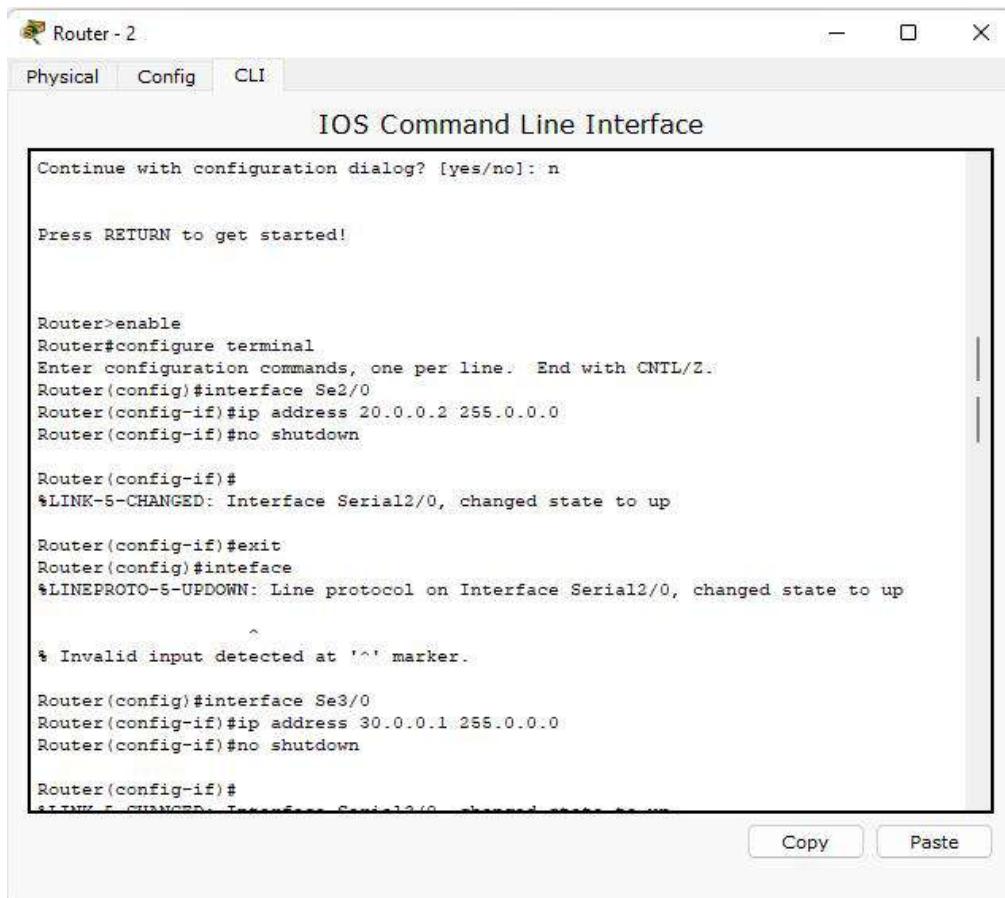
C      10.0.0.0/8 is directly connected, FastEthernet0/0
C      20.0.0.0/8 is directly connected, Serial2/0
S      40.0.0.0/8 [1/0] via 20.0.0.2
S*    0.0.0.0/0 [1/0] via 20.0.0.2
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#no ip route 40.0.0.0 255.0.0.0 20.0.0.2
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console
show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
       i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
       * - candidate default, U - per-user static route, o - ODR
       P - periodic downloaded static route

Gateway of last resort is 20.0.0.2 to network 0.0.0.0

C      10.0.0.0/8 is directly connected, FastEthernet0/0
C      20.0.0.0/8 is directly connected, Serial2/0
S*    0.0.0.0/0 [1/0] via 20.0.0.2
Router#
```

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## Configuring Router - 2:



Router - 2

Physical Config CLI

IOS Command Line Interface

```
Continue with configuration dialog? [yes/no]: n

Press RETURN to get started!

Router>enable
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#interface Se2/0
Router(config-if)#ip address 20.0.0.2 255.0.0.0
Router(config-if)#no shutdown

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

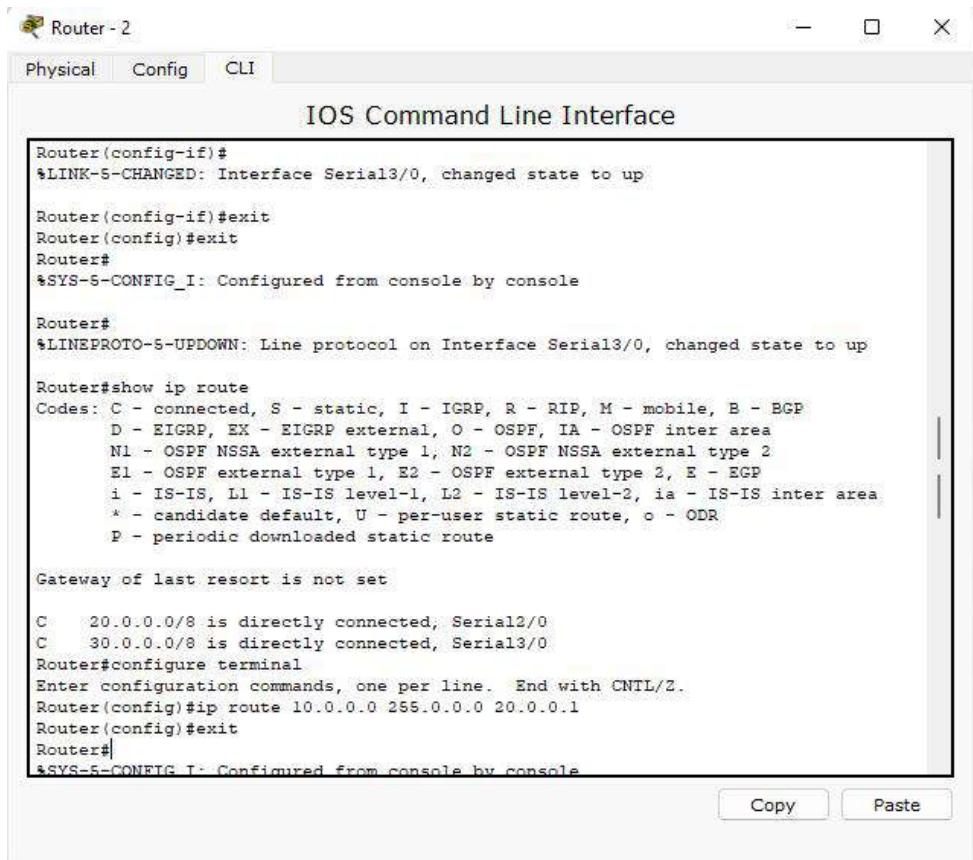
Router(config-if)#exit
Router(config)#inteface
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial2/0, changed state to up

^
* Invalid input detected at '^' marker.

Router(config)#interface Se3/0
Router(config-if)#ip address 30.0.0.1 255.0.0.0
Router(config-if)#no shutdown

Router(config-if)#
www.suryan.com
```

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Router - 2

Physical Config CLI

IOS Command Line Interface

```
Router(config-if)#
%LINK-5-CHANGED: Interface Serial3/0, changed state to up

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

Router#
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial3/0, changed state to up

Router#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
      D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
      N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
      E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
      i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
      * - candidate default, U - per-user static route, o - ODR
      P - periodic downloaded static route

Gateway of last resort is not set

C    20.0.0.0/8 is directly connected, Serial2/0
C    30.0.0.0/8 is directly connected, Serial3/0
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#ip route 10.0.0.0 255.0.0.0 20.0.0.1
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console
```

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Router - 2

Physical Config CLI

### IOS Command Line Interface

```
*SYS-5-CONFIG_I: Configured from console by console

Router#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
      D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
      N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
      E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
      i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
      * - candidate default, U - per-user static route, o - ODR
      P - periodic downloaded static route

Gateway of last resort is not set

S    10.0.0.0/8 [1/0] via 20.0.0.1
C    20.0.0.0/8 is directly connected, Serial2/0
C    30.0.0.0/8 is directly connected, Serial3/0
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#ip route 40.0.0.0 255.0.0.0 30.0.0.2
Router(config)#exit
Router#
*SYS-5-CONFIG_I: Configured from console by console

Router#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
      D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
      N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
      E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
      i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
      * - candidate default, U - per-user static route, o - ODR
```

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Router - 2

Physical Config CLI

### IOS Command Line Interface

```
* - candidate default, U - per-user static route, o - ODR
P - periodic downloaded static route

Gateway of last resort is not set

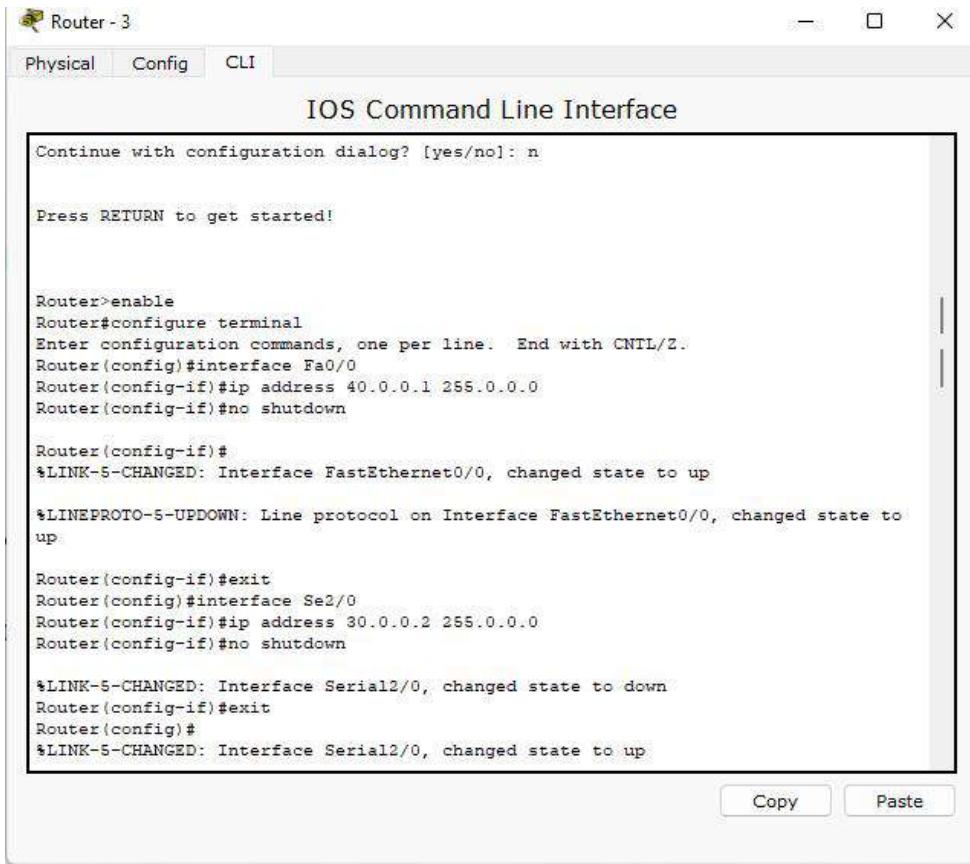
S    10.0.0.0/8 [1/0] via 20.0.0.1
C    20.0.0.0/8 is directly connected, Serial2/0
C    30.0.0.0/8 is directly connected, Serial3/0
S    40.0.0.0/8 [1/0] via 30.0.0.2
Router#

Router con0 is now available

Press RETURN to get started.
```

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### Configuring Router - 3:



Router - 3

Physical Config CLI

IOS Command Line Interface

```
Continue with configuration dialog? [yes/no]: n

Press RETURN to get started!

Router>enable
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#interface Fa0/0
Router(config-if)#ip address 40.0.0.1 255.0.0.0
Router(config-if)#no shutdown

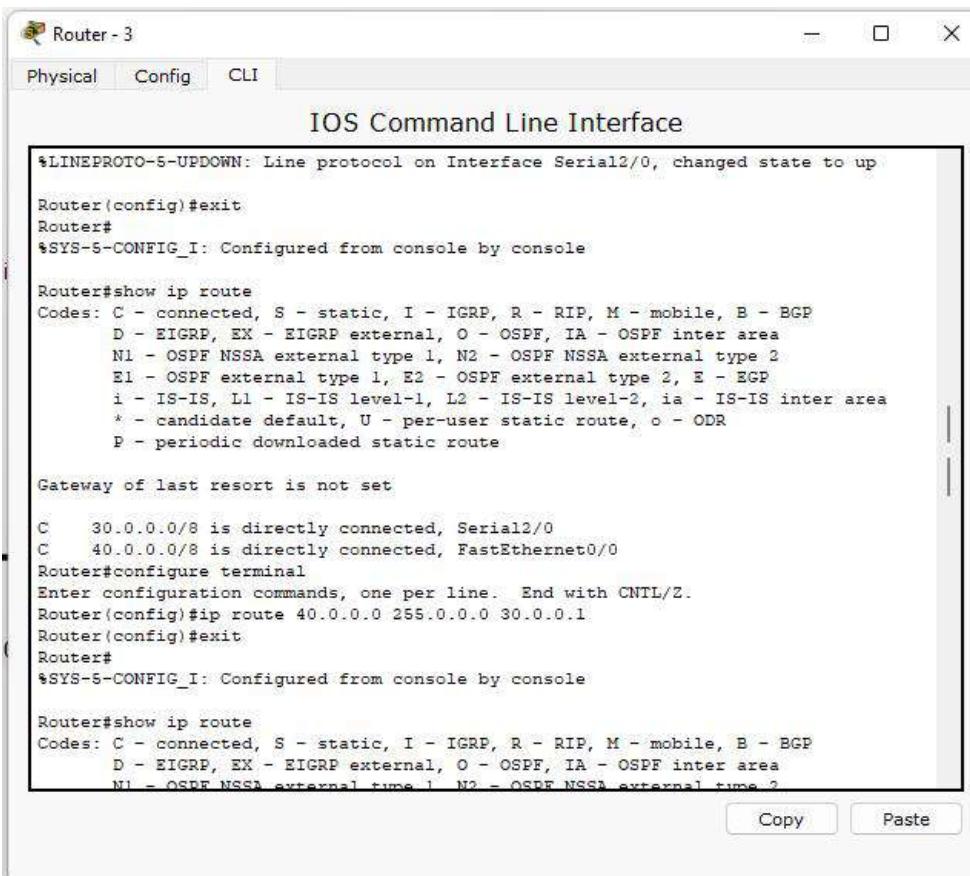
Router(config-if)#
%LINK-5-CHANGED: Interface FastEthernet0/0, changed state to up

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

Router(config-if)#exit
Router(config)#interface Se2/0
Router(config-if)#ip address 30.0.0.2 255.0.0.0
Router(config-if)#no shutdown

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

Copy Paste



Router - 3

Physical Config CLI

IOS Command Line Interface

```
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial2/0, changed state to up

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

Router#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
      D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
      N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
      E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
      i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
      * - candidate default, U - per-user static route, o - ODR
      P - periodic downloaded static route

Gateway of last resort is not set

C    30.0.0.0/8 is directly connected, Serial2/0
C    40.0.0.0/8 is directly connected, FastEthernet0/0
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#ip route 40.0.0.0 255.0.0.0 30.0.0.1
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console

Router#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
      D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
      N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
```

Copy Paste

Router - 3

Physical Config CLI

### IOS Command Line Interface

```
Router#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
      D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
      N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
      E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
      i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
      * - candidate default, U - per-user static route, o - ODR
      P - periodic downloaded static route

Gateway of last resort is not set

C      30.0.0.0/8 is directly connected, Serial2/0
C      40.0.0.0/8 is directly connected, FastEthernet0/0
Router#enable
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#ip route 10.0.0.0 255.0.0.0 30.0.0.1
Router(config)#exit
Router#
*SYS-5-CONFIG_I: Configured from console by console

Router#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
      D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
      N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
      E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
      i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
      * - candidate default, U - per-user static route, o - ODR
      P - periodic downloaded static route
```

Copy Paste

Router - 3

Physical Config CLI

### IOS Command Line Interface

```
Gateway of last resort is not set

S      10.0.0.0/8 [1/0] via 30.0.0.1
C      30.0.0.0/8 is directly connected, Serial2/0
C      40.0.0.0/8 is directly connected, FastEthernet0/0
Router#

Router con0 is now available

Press RETURN to get started.
```

Copy Paste

**Router - 3**

Physical Config CLI

IOS Command Line Interface

```

Router>enable
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#no ip route 10.0.0.0 255.0.0.0 30.0.0.1
Router(config)#ip route 0.0.0.0 0.0.0.0 30.0.0.1
Router(config)#exit
Router#
*SYS-5-CONFIG_I: Configured from console by console

Router#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
      D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
      N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
      E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
      i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
      * - candidate default, U - per-user static route, o - ODR
      p - periodic downloaded static route

Gateway of last resort is 30.0.0.1 to network 0.0.0.0

C    30.0.0.0/8 is directly connected, Serial2/0
C    40.0.0.0/8 is directly connected, FastEthernet0/0
S*   0.0.0.0 [1/0] via 30.0.0.1
Router#

```

Copy Paste

### Pinging from PC-PT(10.0.0.10) to PC-PT(40.0.0.10):

**10.0.0.10**

Physical Config Desktop Custom Interface

Command Prompt X

```

Packet Tracer PC Command Line 1.0
PC>ping 40.0.0.10

Pinging 40.0.0.10 with 32 bytes of data:

Request timed out.
Reply from 40.0.0.10: bytes=32 time=2ms TTL=125
Reply from 40.0.0.10: bytes=32 time=11ms TTL=125
Reply from 40.0.0.10: bytes=32 time=7ms TTL=125

Ping statistics for 40.0.0.10:
  Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
  Approximate round trip times in milli-seconds:
    Minimum = 2ms, Maximum = 11ms, Average = 6ms

PC>ping 40.0.0.10

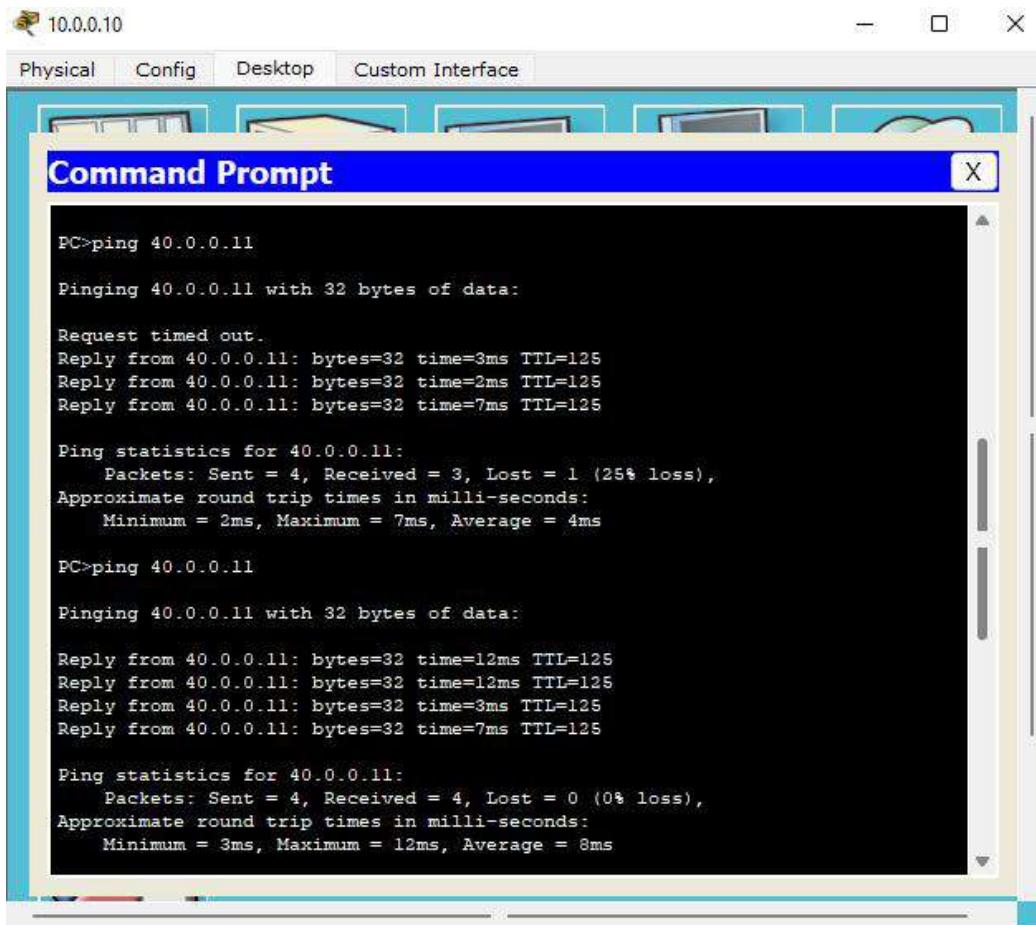
Pinging 40.0.0.10 with 32 bytes of data:

Reply from 40.0.0.10: bytes=32 time=9ms TTL=125
Reply from 40.0.0.10: bytes=32 time=2ms TTL=125
Reply from 40.0.0.10: bytes=32 time=3ms TTL=125
Reply from 40.0.0.10: bytes=32 time=17ms TTL=125

Ping statistics for 40.0.0.10:
  Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
  Approximate round trip times in milli-seconds:
    Minimum = 2ms, Maximum = 17ms, Average = 7ms

```

## Pinging from PC-PT(10.0.0.10) to PC-PT(40.0.0.11):



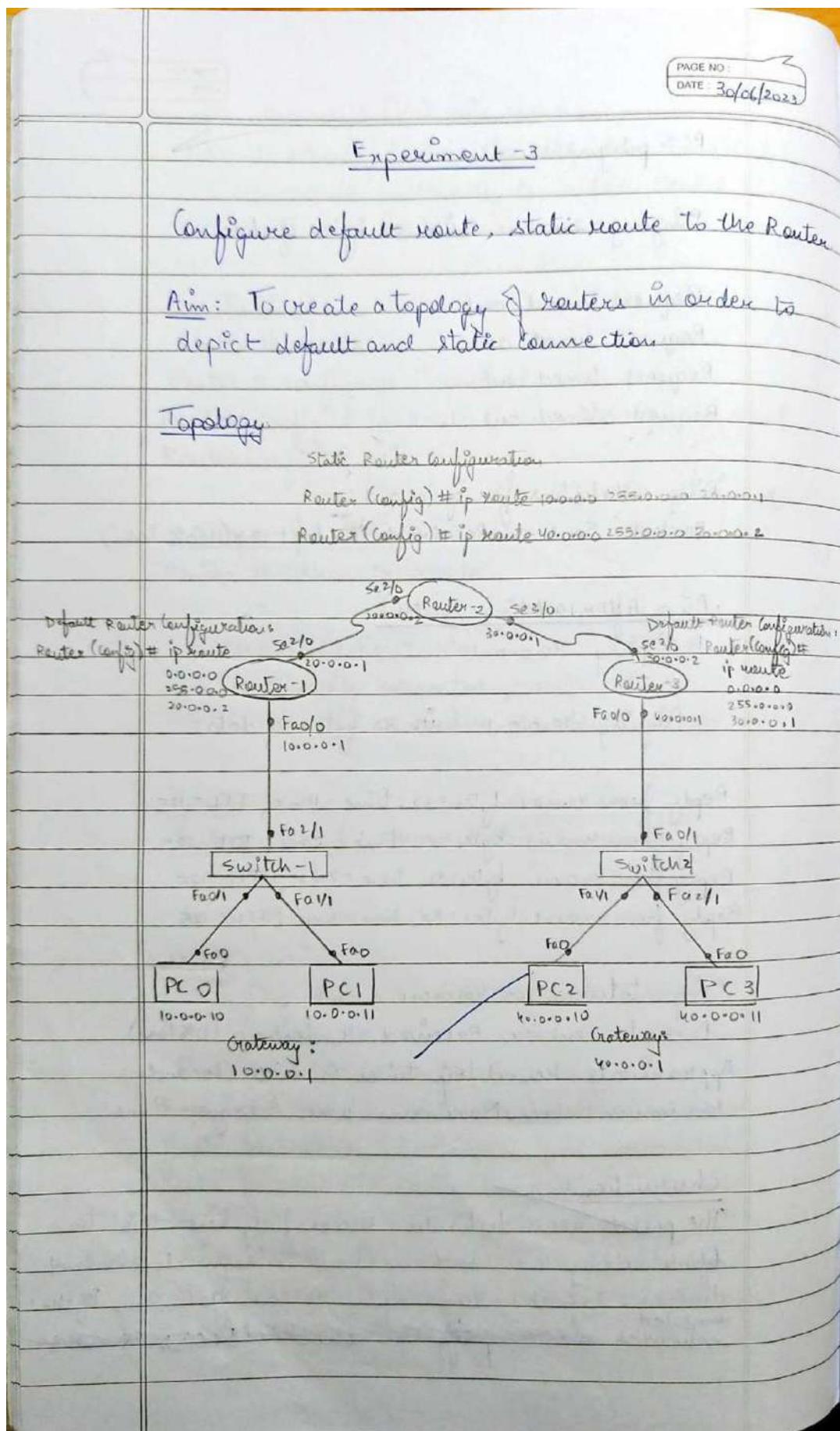
```
PC>ping 40.0.0.11
Pinging 40.0.0.11 with 32 bytes of data:
Request timed out.
Reply from 40.0.0.11: bytes=32 time=3ms TTL=125
Reply from 40.0.0.11: bytes=32 time=2ms TTL=125
Reply from 40.0.0.11: bytes=32 time=7ms TTL=125

Ping statistics for 40.0.0.11:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
Approximate round trip times in milli-seconds:
    Minimum = 2ms, Maximum = 7ms, Average = 4ms

PC>ping 40.0.0.11
Pinging 40.0.0.11 with 32 bytes of data:
Reply from 40.0.0.11: bytes=32 time=12ms TTL=125
Reply from 40.0.0.11: bytes=32 time=12ms TTL=125
Reply from 40.0.0.11: bytes=32 time=3ms TTL=125
Reply from 40.0.0.11: bytes=32 time=7ms TTL=125

Ping statistics for 40.0.0.11:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 3ms, Maximum = 12ms, Average = 8ms
```

### 2.3.3 Observation Book Pictures:



Procedure:

1. Add 3 routers, 2 switches and 4 end devices.  
Connect the end devices (PC0 and PC1) to switch-1 using Copper-straight through wire from FastEthernet 0 port of PC0 and FastEthernet 0 port of PC1 to FastEthernet 0/1 and FastEthernet 1/1 port of switch-1 respectively.  
Repeat the same procedure to connect switch-2, PC2, PC3.
2. Connect switch-1 and switch-2 to Router 1 and Router 3 using <sup>Copper straight through</sup> Serial DCE wire from FastEthernet 2/1 port on switch-1 and FastEthernet 2/1 port on switch-2 to FastEthernet 0/0 of Router-1 and FastEthernet 0/0 of Router-3 respectively.
3. Connect Router-1 and Router-3 to Router-2 using Serial DCE wire from Serial 2/0 port of Router-1 and Serial 2/0 port of Router-3 to Serial 2/0 port of Router-2 and Serial 3/0 port of Router-2 respectively.
4. Set IP addresses of all end devices.
5. Go to CLI of routers and configure the IP address of the ports. (Router → CLI)
6. Type "no" for 'Continue with configuration dialog? [yes/no]:' and press enter.
7.  $\Rightarrow$

### For Router -1

Router > enable

Router # configure terminal

Router (config) # interface Fa0/0

Router (config-if) # ip address 10.0.0.1 255.0.0.0

Router (config-if) # no shutdown

Router (config-if) # exit

Router (config) # interface Sc2/0

Router (config-if) # ip address 20.0.0.1 255.0.0.0

Router (config-if) # no shutdown

Router (config-if) # exit

Router (config) # exit

### For Router -2

Router > enable

Router # configure terminal

Router (config) # interface Sc2/0

Router (config-if) # ip address 20.0.0.2 255.0.0.0

Router (config-if) # no shutdown

Router (config-if) # exit

Router (config) # interface Sc3/0

Router (config-if) # ip address 30.0.0.1 255.0.0.0

Router (config-if) # no shutdown

Router (config-if) # exit

Router (config) # exit

### For Router -3

Router > enable

Router # configure terminal

Router (config) # interface Fa0/0

Router (config-if) # ip address 40.0.0.1 255.0.0.0

Router (config-if) # no shutdown

Router (config-if) # exit

\* → (Static route is a pre-defined/determined pathway that a packet must travel to reach a specific host or network.)

PAGE NO.  
DATE:

```
Router(config)# interface s0 2/0  
Router(config-if)# ip address 30.0.0.2 255.0.0.0  
Router(config-if)# no shutdown  
Router(config-if)# exit  
Router(config)# exit
```

8. The connection b/w all devices is green.

9. Set default gateway for PC0, PC1 as 10.0.0.1.  
Set default gateway for PC2, PC3 as 40.0.0.1.

10. Configure Router-2 as static router.

Configure Router-1 & 3 as default routers.

11. First configure static router: Router-2 \*

Router# Configure terminal.

```
Router(config)# ip route 10.0.0.0 255.0.0.0 20.0.0.1  
Router(config)# ip route 40.0.0.0 255.0.0.0 30.0.0.2  
Router(config)# exit.
```

Router# show ip route.

S 10.0.0.0/8 [1/0] via 20.0.0.1

C 20.0.0.0/8 is directly connected, Serial2/0

C 30.0.0.0/8 is directly connected, Serial3/0

S 40.0.0.0/8 [4/0] via 30.0.0.2



(A default route is used if a known route does not exist  
for a given destination address)

PAGE NO.:  
DATE:

12.

Now Configure Default routers. (Router 1 & 3)

Router - 1:

Router # Configure terminal

Router (config) # ip route 0.0.0.0 255.0.0.0 20.0.0.2

Router (config) # exit

Router # show ip route

C 10.0.0.0/8 is directly connected, FastEthernet0/0

C 20.0.0.0/8 is directly connected, Serial 2/0

\* 0.0.0.0/0 [1/0] via 20.0.0.2

Router - 3:

Router # Configure terminal

Router (config) # ip route 0.0.0.0 0.0.0.0 30.0.0.1

Router (config) # exit

Router # show ip route

C 30.0.0.0/8 is directly connected, Serial 2/0

C 40.0.0.0/8 is directly connected, FastEthernet 0/0

\* 0.0.0.0/0 [1/0] via 30.0.0.1

Result:

Pinging from PC-PT (10.0.0.10) to PC-PT (40.0.0.10):

PC> ping 40.0.0.10

Pinging 40.0.0.10 with 32 bytes of data:

Reply from 40.0.0.10: bytes = 32 time = 9 ms TTL = 125

Reply from 40.0.0.10: bytes = 32 time = 2 ms TTL = 125

Reply from 40.0.0.10: bytes = 32 time = 3 ms TTL = 125

Reply from 40.0.0.10: bytes = 32 time = 17 ms TTL = 125

Ping statistics for 40.0.0.10,

Packets: Sent = 4, Received = 4, Lost = 0 (0% loss)

Approximate round trip times in milli-seconds:

Minimum = 2 ms, Maximum = 17 ms, Average = 7 ms

Pinging from PC-PT(10.0.0.10) to PC-PT(40.0.0.11):

PC > ping 40.0.0.11

Pinging 40.0.0.11 with 32 bytes of data:

Reply from 40.0.0.11: bytes=32 time=12 ms TTL=125

Reply from 40.0.0.11: bytes=32 time=12 ms TTL=125

Reply from 40.0.0.11: bytes=32 time=3 ms TTL=125

Reply from 40.0.0.11: bytes=32 time=7 ms TTL=125

Ping statistics for 40.0.0.11:

Packets: Sent = 4, Received = 4, Lost = 0 (0% loss)

Approximate round-trip times in milli-seconds:

Minimum = 3 ms, Maximum = 12 ms, Average = 8 ms

Observation:

The packets reach destination successfully by setting default and static routes connections.

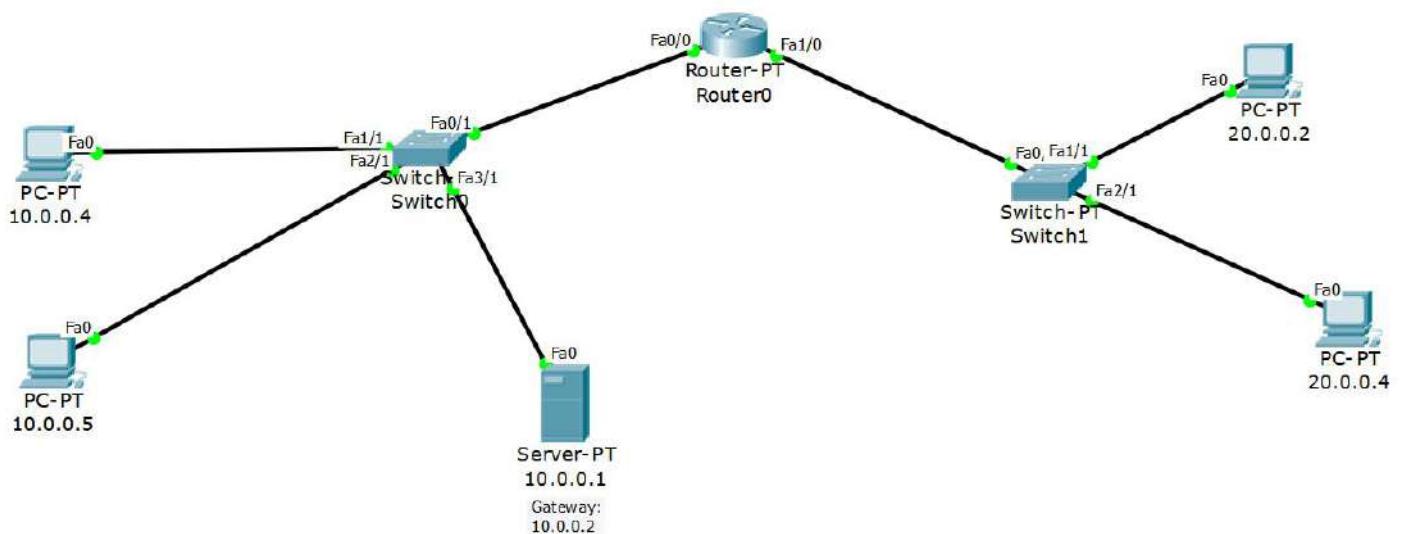
## 2.4 Experiment - 4:

### 2.4.1 Question:

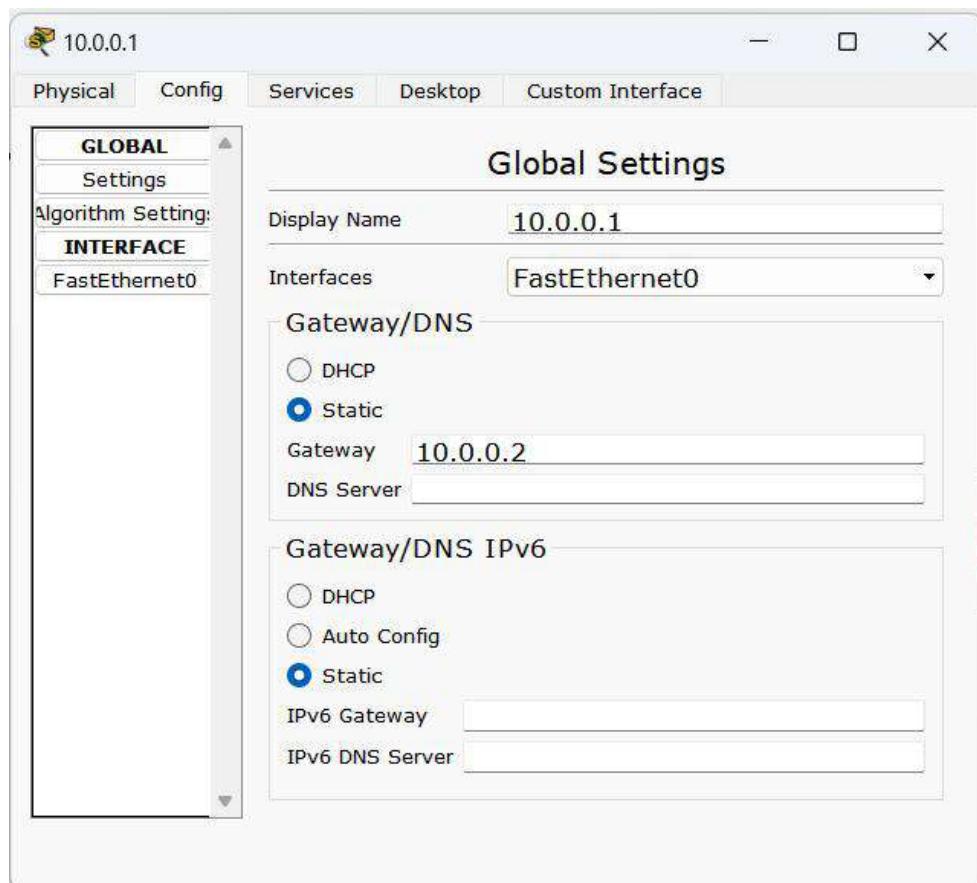
Configure DHCP within a LAN and outside LAN.

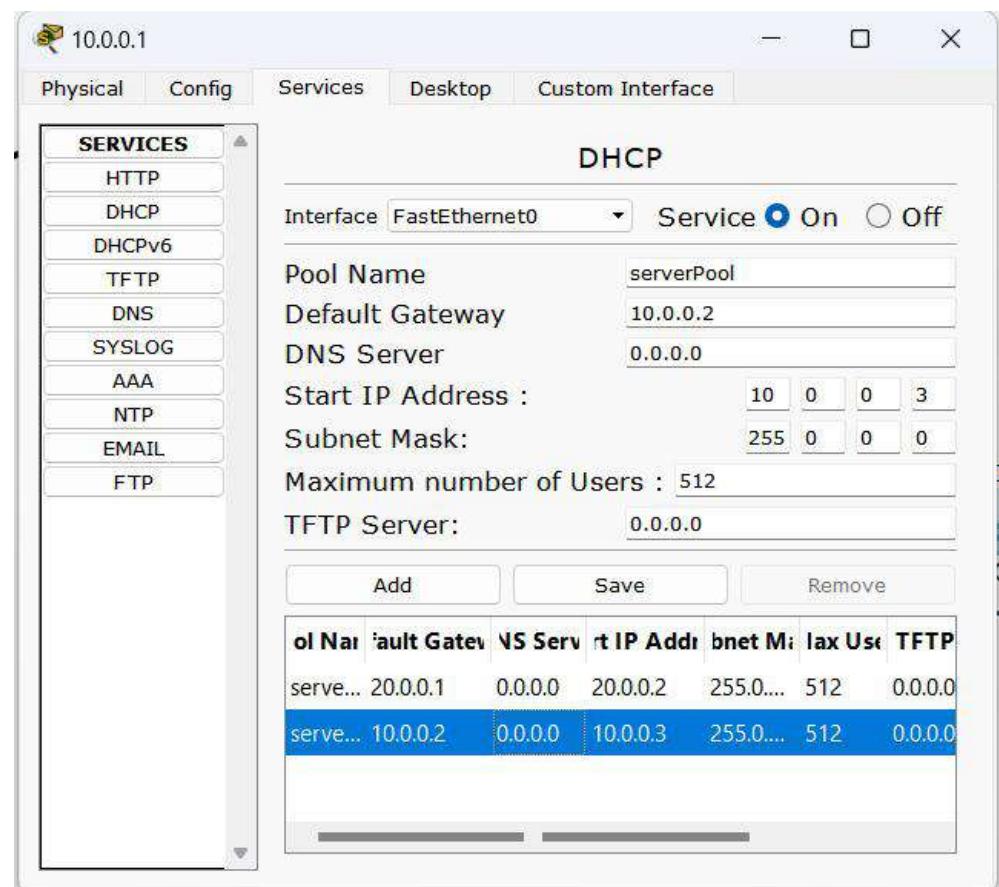
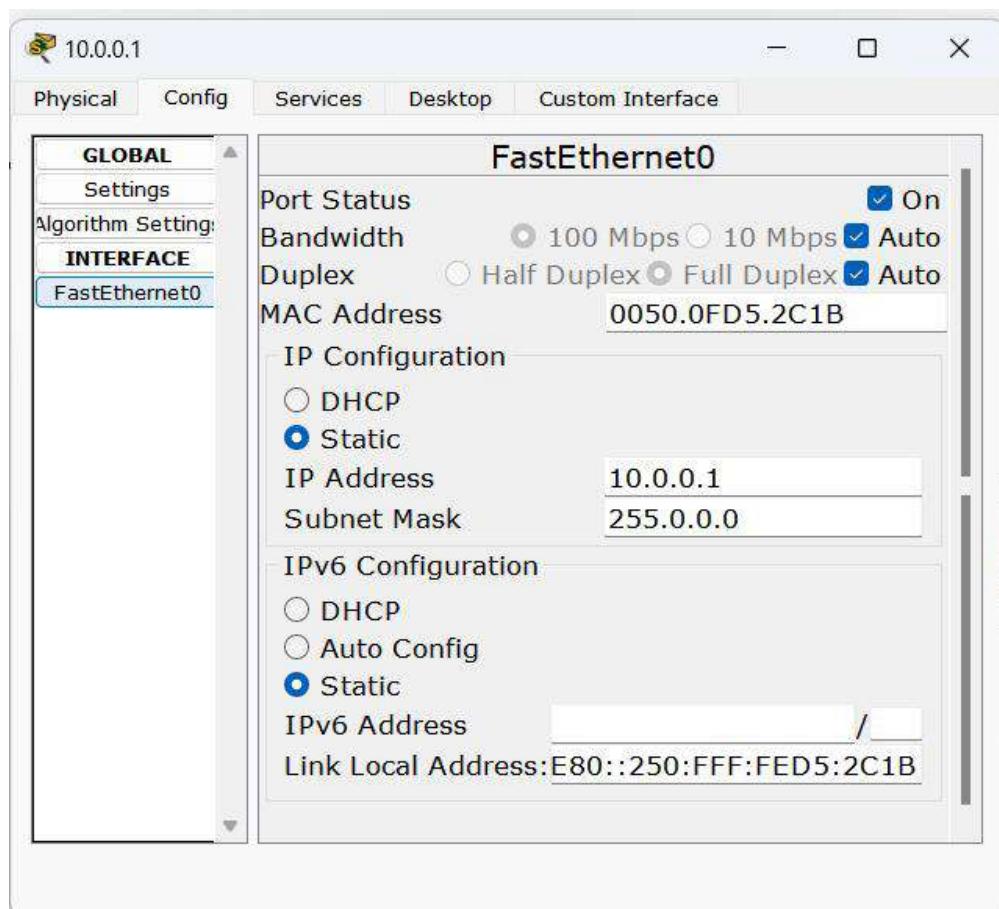
### 2.4.2 Screenshots (Topology, Configurations & Output):

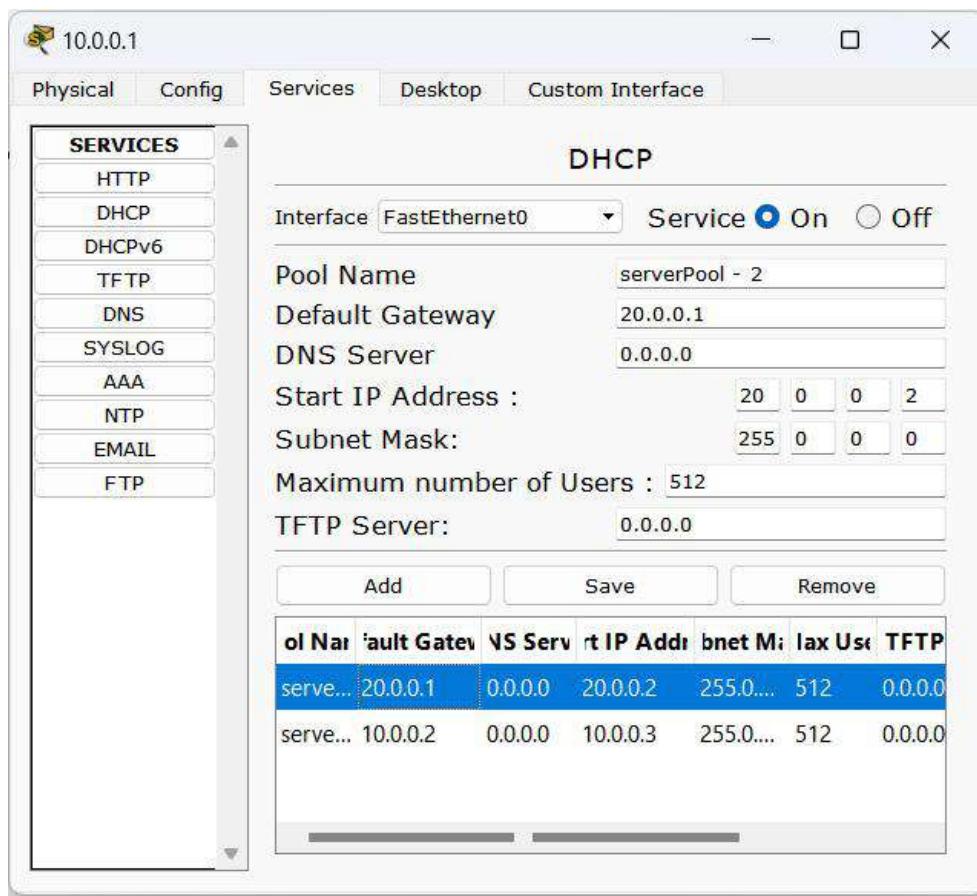
#### Topology - 1:



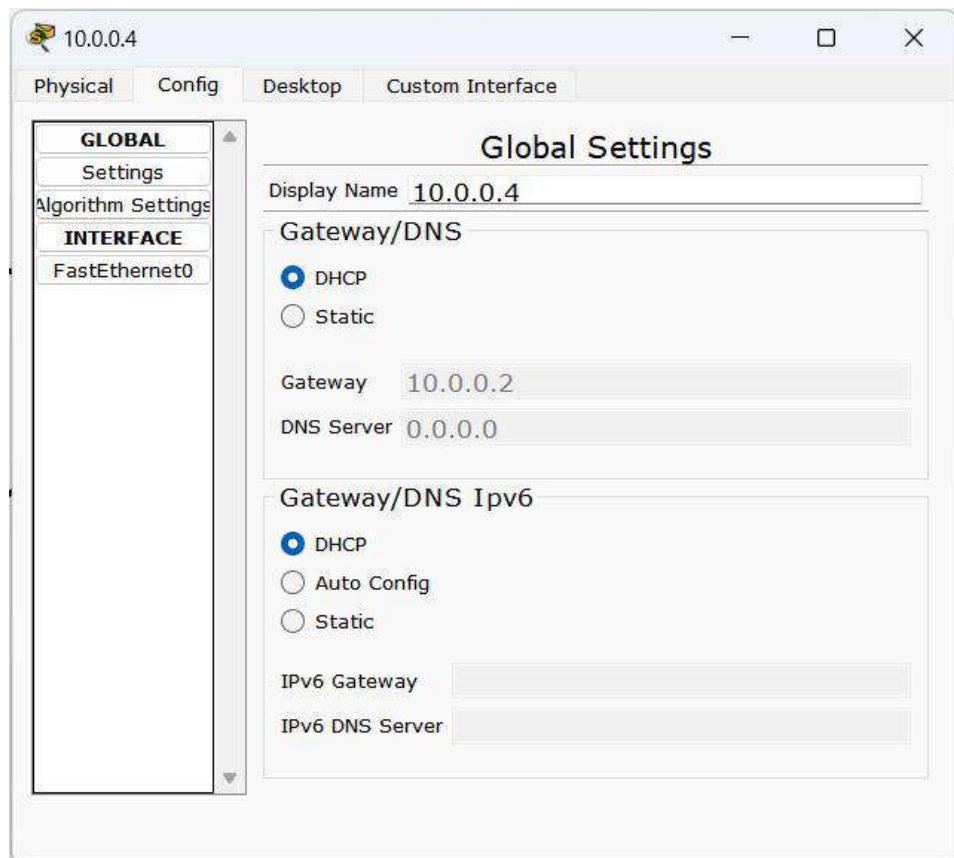
#### Server Configuration:

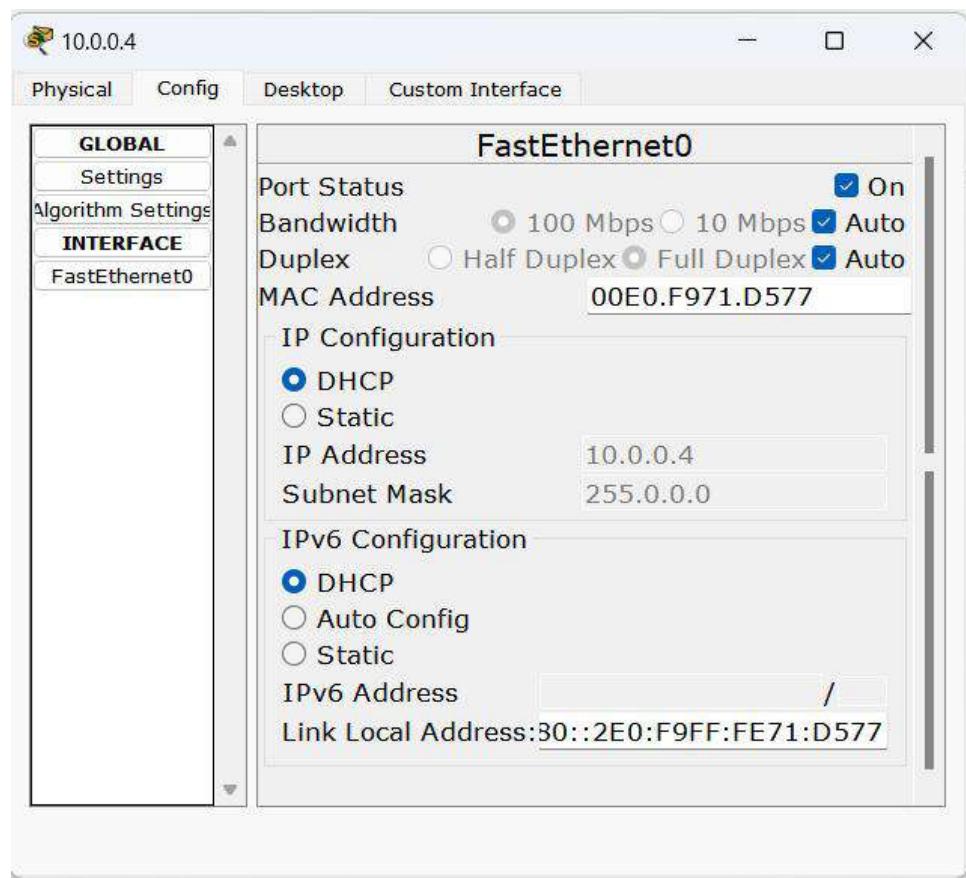




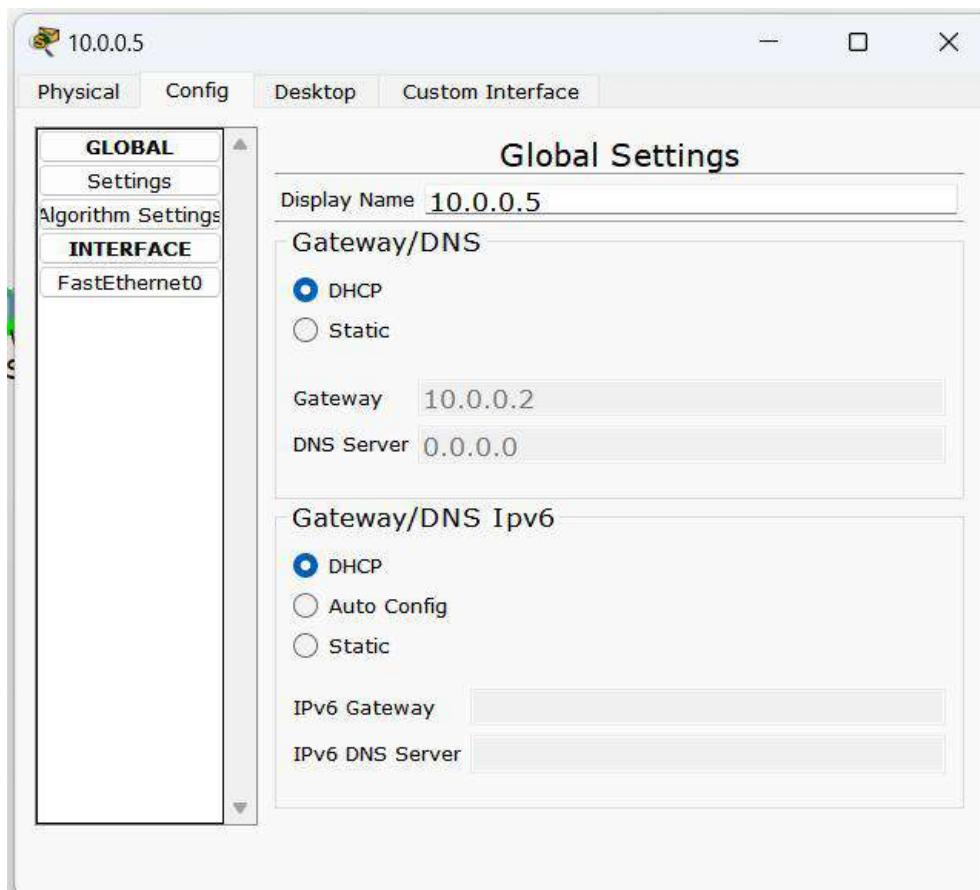


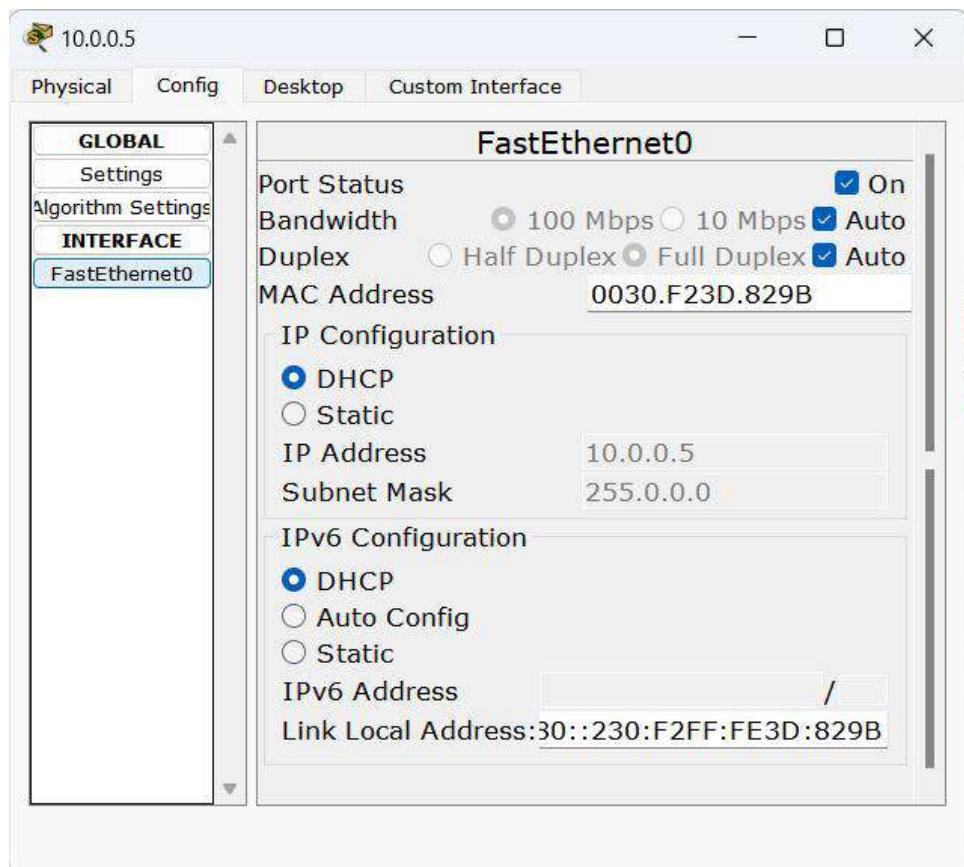
## PC - 1 Configuration(Through DHCP):



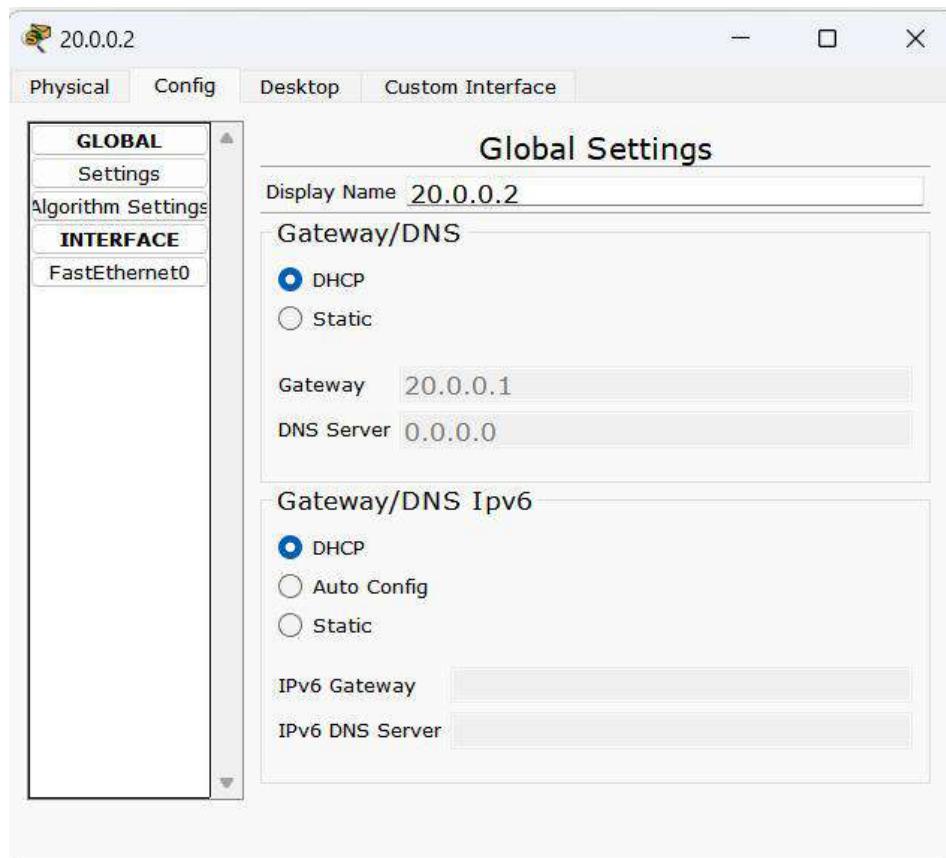


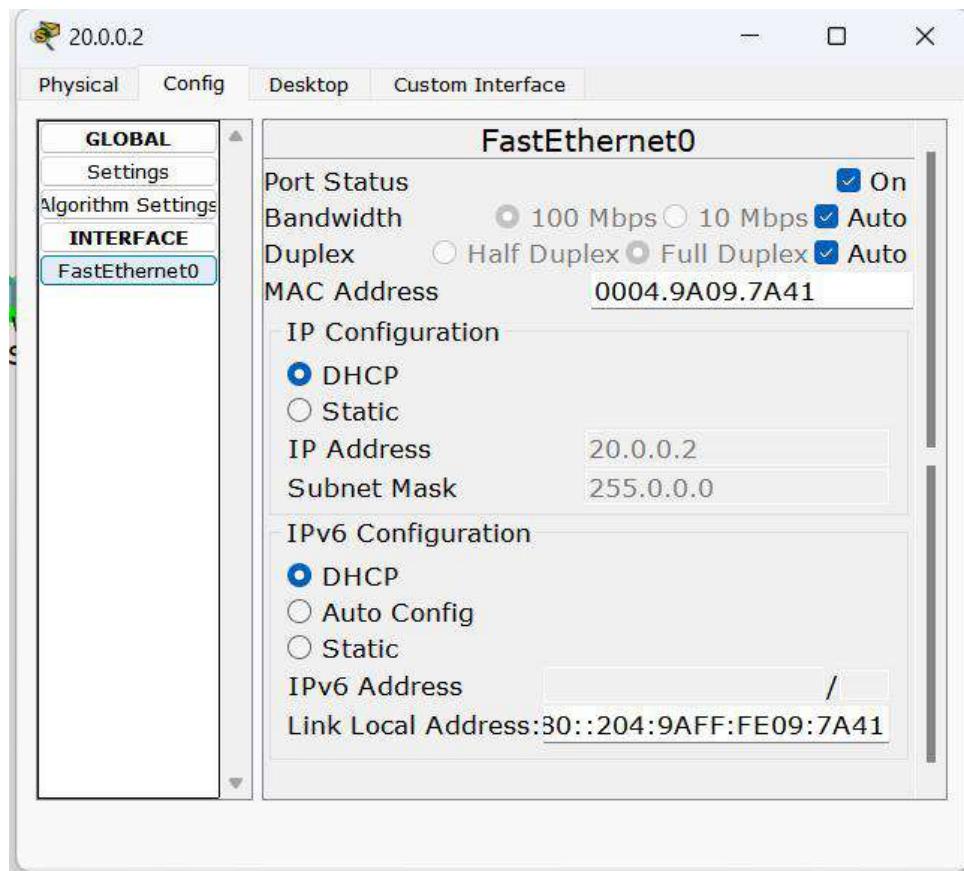
## PC - 2 Configuration (Through DHCP):



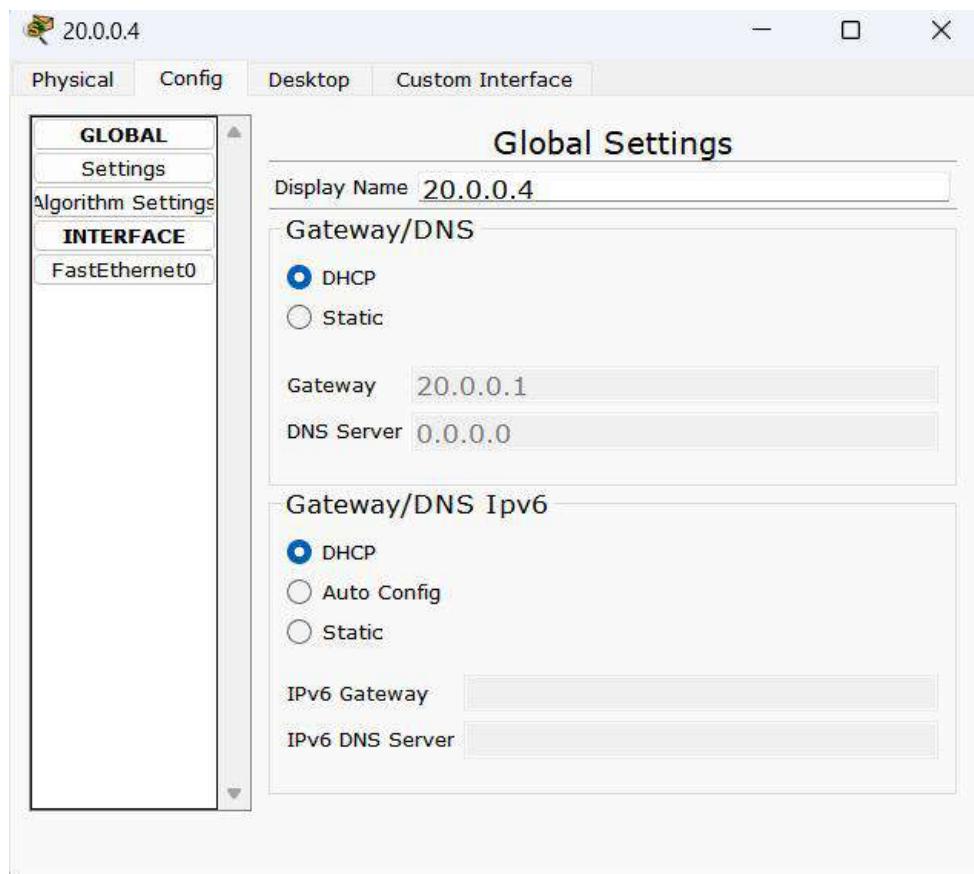


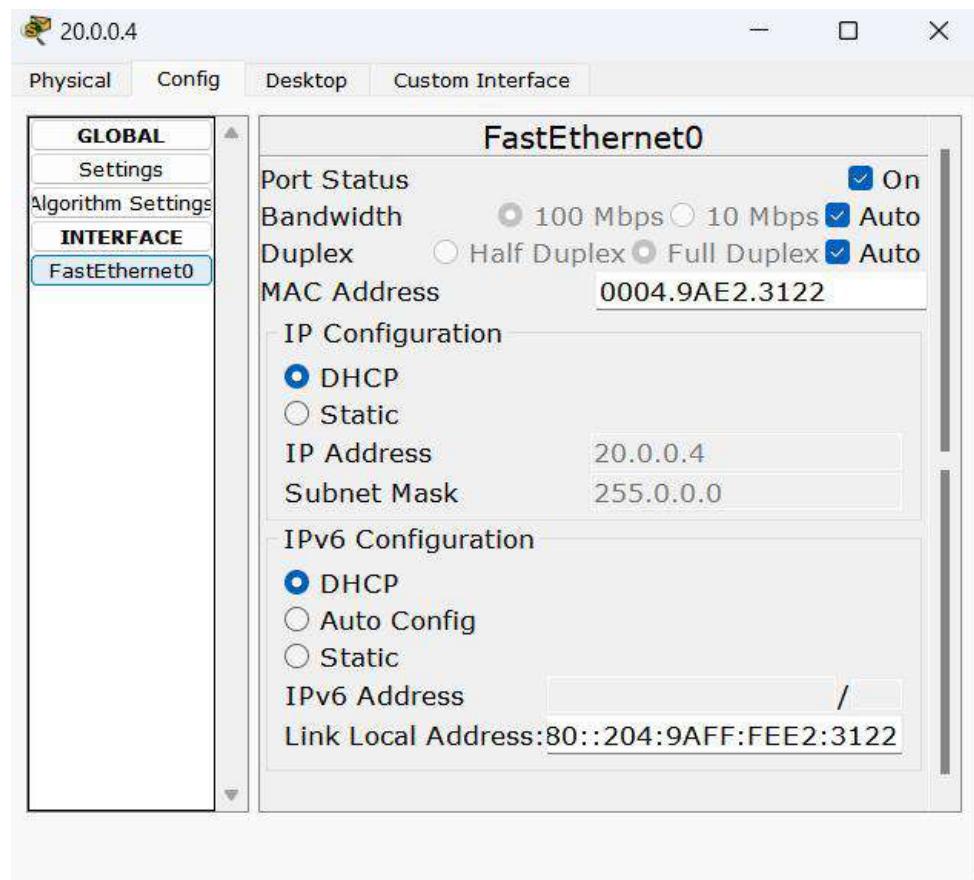
### PC - 3 Configuration (Through DHCP):





## PC - 4 Configuration (Through DHCP):





## Router Configuration:

The screenshot shows a software window titled 'Router0' with a tab bar: Physical, Config, CLI. The 'CLI' tab is selected. The title bar says 'IOS Command Line Interface'. The main area contains the following configuration commands:

```

Router>enable
Router#config t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#interface Fa0/0
Router(config-if)#ip address 10.0.0.2 255.0.0.0
Router(config-if)#no shutdown

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

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

Router(config-if)#exit
Router(config)#interface Fa1/0
Router(config-if)#ip address 20.0.0.1 255.0.0.0
Router(config-if)#no shutdown

Router(config-if)#
%LINK-5-CHANGED: Interface FastEthernet1/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet1/0, changed
state to up

Router(config-if)#exit

```

At the bottom right are 'Copy' and 'Paste' buttons.

 Router0

Physical Config CLI

### IOS Command Line Interface

```
Router(config-if)#
%LINK-5-CHANGED: Interface FastEthernet1/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet1/0, changed
state to up

Router(config-if)#exit
Router(config)#ip helper-address 10.0.0.1
^
% Invalid input detected at '^' marker.

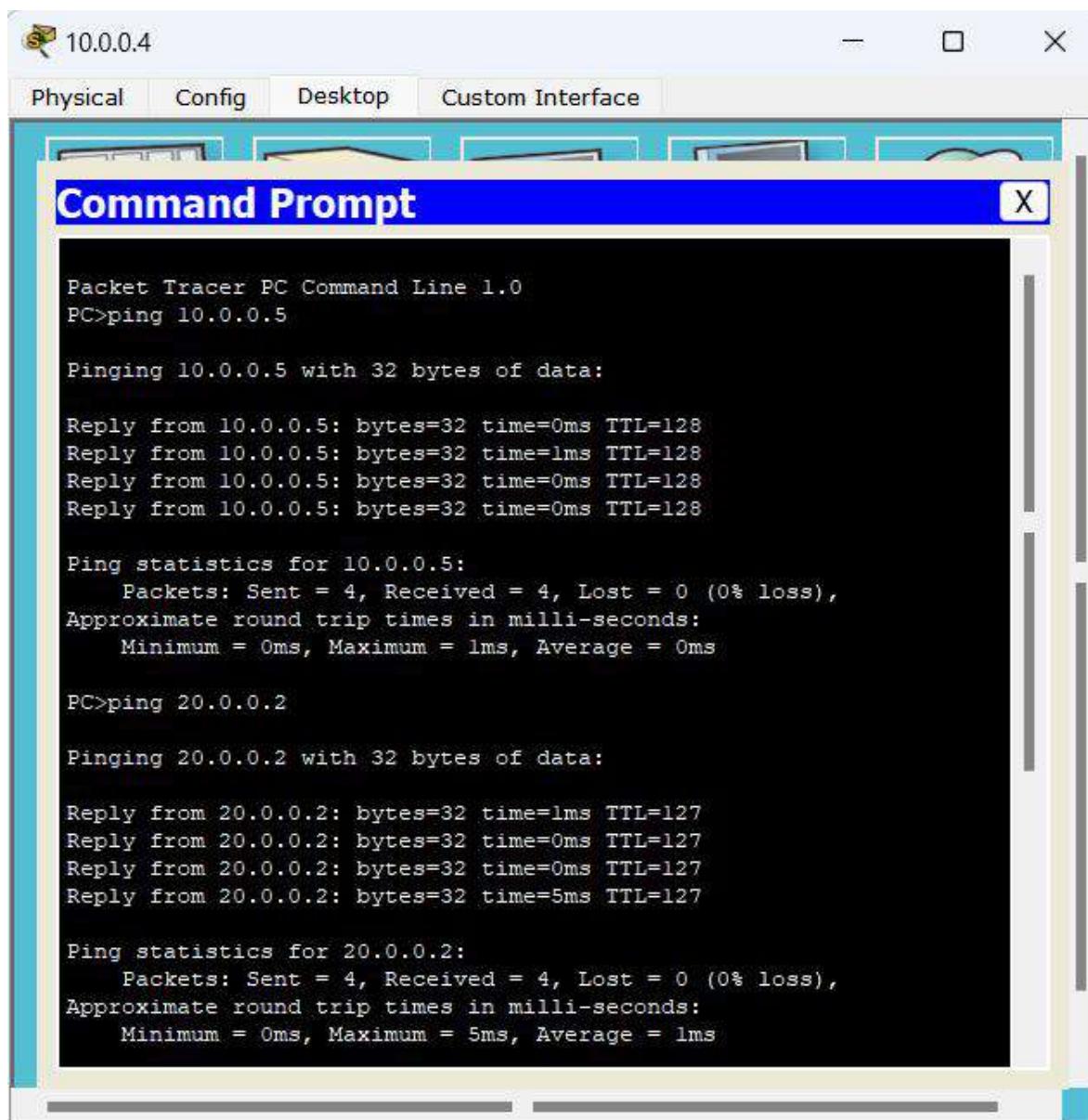
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console

Router#config t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#interface Fa1/0
Router(config-if)#ip helper-address 10.0.0.1
Router(config-if)#exit|
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console

Router#
```

## Output (Ping Messages):

From PC1 to All other PCs:



The screenshot shows a "Command Prompt" window in Packet Tracer. The title bar says "10.0.0.4". The menu bar includes "Physical", "Config", "Desktop", and "Custom Interface". The window content displays ping results:

```
Packet Tracer PC Command Line 1.0
PC>ping 10.0.0.5

Pinging 10.0.0.5 with 32 bytes of data:

Reply from 10.0.0.5: bytes=32 time=0ms TTL=128
Reply from 10.0.0.5: bytes=32 time=1ms TTL=128
Reply from 10.0.0.5: bytes=32 time=0ms TTL=128
Reply from 10.0.0.5: bytes=32 time=0ms TTL=128

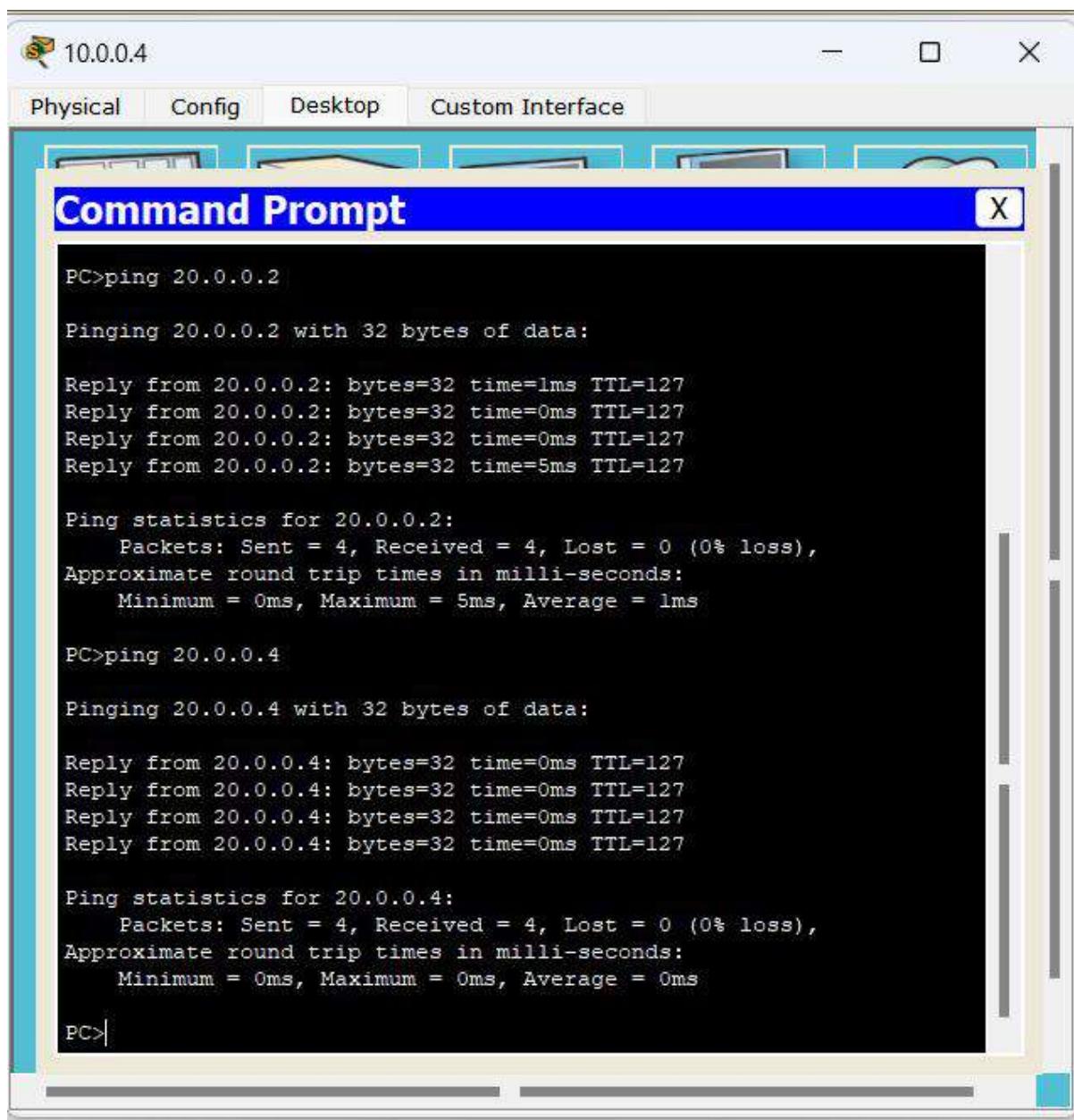
Ping statistics for 10.0.0.5:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 1ms, Average = 0ms

PC>ping 20.0.0.2

Pinging 20.0.0.2 with 32 bytes of data:

Reply from 20.0.0.2: bytes=32 time=1ms TTL=127
Reply from 20.0.0.2: bytes=32 time=0ms TTL=127
Reply from 20.0.0.2: bytes=32 time=0ms TTL=127
Reply from 20.0.0.2: bytes=32 time=5ms TTL=127

Ping statistics for 20.0.0.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 5ms, Average = 1ms
```



The image shows a Cisco router's graphical user interface. At the top, there is a menu bar with tabs: Physical, Config, Desktop, and Custom Interface. The "Physical" tab is currently selected. Below the menu is a toolbar with icons for different interface types. A main window titled "Command Prompt" is open, displaying terminal session output. The output shows two ping commands being run from the IP address 10.0.0.4. The first command is "ping 20.0.0.2" and the second is "ping 20.0.0.4". Both pings are successful, with 100% packet delivery and low round-trip times.

```
PC>ping 20.0.0.2
Pinging 20.0.0.2 with 32 bytes of data:
Reply from 20.0.0.2: bytes=32 time=1ms TTL=127
Reply from 20.0.0.2: bytes=32 time=0ms TTL=127
Reply from 20.0.0.2: bytes=32 time=0ms TTL=127
Reply from 20.0.0.2: bytes=32 time=5ms TTL=127

Ping statistics for 20.0.0.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 5ms, Average = 1ms

PC>ping 20.0.0.4
Pinging 20.0.0.4 with 32 bytes of data:
Reply from 20.0.0.4: bytes=32 time=0ms TTL=127

Ping statistics for 20.0.0.4:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms
```

## From PC2 to All other PCs:

Packet Tracer PC Command Line 1.0  
PC>ping 10.0.0.4

Pinging 10.0.0.4 with 32 bytes of data:

Reply from 10.0.0.4: bytes=32 time=1ms TTL=128  
Reply from 10.0.0.4: bytes=32 time=1ms TTL=128  
Reply from 10.0.0.4: bytes=32 time=0ms TTL=128  
Reply from 10.0.0.4: bytes=32 time=1ms TTL=128

Ping statistics for 10.0.0.4:  
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),  
Approximate round trip times in milli-seconds:  
Minimum = 0ms, Maximum = 1ms, Average = 0ms

PC>ping 20.0.0.2

Pinging 20.0.0.2 with 32 bytes of data:

Request timed out.  
Reply from 20.0.0.2: bytes=32 time=0ms TTL=127  
Reply from 20.0.0.2: bytes=32 time=0ms TTL=127  
Reply from 20.0.0.2: bytes=32 time=13ms TTL=127

Ping statistics for 20.0.0.2:  
Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),  
Approximate round trip times in milli-seconds:  
Minimum = 0ms, Maximum = 13ms, Average = 4ms

10.0.0.5

Physical Config Desktop Custom Interface

## Command Prompt X

```
PC>ping 20.0.0.2
Pinging 20.0.0.2 with 32 bytes of data:
Request timed out.
Reply from 20.0.0.2: bytes=32 time=0ms TTL=127
Reply from 20.0.0.2: bytes=32 time=0ms TTL=127
Reply from 20.0.0.2: bytes=32 time=13ms TTL=127

Ping statistics for 20.0.0.2:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 13ms, Average = 4ms

PC>ping 20.0.0.4
Pinging 20.0.0.4 with 32 bytes of data:
Request timed out.
Reply from 20.0.0.4: bytes=32 time=1ms TTL=127
Reply from 20.0.0.4: bytes=32 time=1ms TTL=127
Reply from 20.0.0.4: bytes=32 time=1ms TTL=127

Ping statistics for 20.0.0.4:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 1ms, Average = 1ms

PC>
```

## From PC3 to All other PCs:

20.0.0.2

Physical Config Desktop Custom Interface

**Command Prompt**

```
Packet Tracer PC Command Line 1.0
PC>ping 10.0.0.4

Pinging 10.0.0.4 with 32 bytes of data:

Reply from 10.0.0.4: bytes=32 time=0ms TTL=127
Reply from 10.0.0.4: bytes=32 time=2ms TTL=127
Reply from 10.0.0.4: bytes=32 time=0ms TTL=127
Reply from 10.0.0.4: bytes=32 time=0ms TTL=127

Ping statistics for 10.0.0.4:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 2ms, Average = 0ms

PC>ping 10.0.0.5

Pinging 10.0.0.5 with 32 bytes of data:

Reply from 10.0.0.5: bytes=32 time=0ms TTL=127
Reply from 10.0.0.5: bytes=32 time=0ms TTL=127
Reply from 10.0.0.5: bytes=32 time=1ms TTL=127
Reply from 10.0.0.5: bytes=32 time=0ms TTL=127

Ping statistics for 10.0.0.5:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 1ms, Average = 0ms
```

The screenshot shows a Cisco router interface titled "20.0.0.2". The top menu bar includes "Physical", "Config", "Desktop", and "Custom Interface". Below the menu is a toolbar with icons for "File", "Edit", "View", "Search", "Tools", and "Help". A "Command Prompt" window is open, displaying the following output:

```
PC>ping 10.0.0.5
Pinging 10.0.0.5 with 32 bytes of data:
Reply from 10.0.0.5: bytes=32 time=0ms TTL=127
Reply from 10.0.0.5: bytes=32 time=0ms TTL=127
Reply from 10.0.0.5: bytes=32 time=1ms TTL=127
Reply from 10.0.0.5: bytes=32 time=0ms TTL=127

Ping statistics for 10.0.0.5:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 1ms, Average = 0ms

PC>ping 20.0.0.4
Pinging 20.0.0.4 with 32 bytes of data:
Reply from 20.0.0.4: bytes=32 time=1ms TTL=128
Reply from 20.0.0.4: bytes=32 time=3ms TTL=128
Reply from 20.0.0.4: bytes=32 time=0ms TTL=128
Reply from 20.0.0.4: bytes=32 time=1ms TTL=128

Ping statistics for 20.0.0.4:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 3ms, Average = 1ms

PC>
```

## From PC4 to All other PCs:

20.0.0.4

Physical Config Desktop Custom Interface

**Command Prompt** X

```
Packet Tracer PC Command Line 1.0
PC>ping 10.0.0.4

Pinging 10.0.0.4 with 32 bytes of data:

Reply from 10.0.0.4: bytes=32 time=0ms TTL=127
Reply from 10.0.0.4: bytes=32 time=0ms TTL=127
Reply from 10.0.0.4: bytes=32 time=0ms TTL=127
Reply from 10.0.0.4: bytes=32 time=1ms TTL=127

Ping statistics for 10.0.0.4:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 1ms, Average = 0ms

PC>ping 10.0.0.5

Pinging 10.0.0.5 with 32 bytes of data:

Reply from 10.0.0.5: bytes=32 time=2ms TTL=127
Reply from 10.0.0.5: bytes=32 time=0ms TTL=127
Reply from 10.0.0.5: bytes=32 time=4ms TTL=127
Reply from 10.0.0.5: bytes=32 time=0ms TTL=127

Ping statistics for 10.0.0.5:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 4ms, Average = 1ms
```

The screenshot shows a Cisco router's command-line interface window titled "Command Prompt". The window title bar includes icons for a file, physical interface, configuration, desktop, and custom interface, along with a close button. The main area displays the output of several ping commands:

```
PC>ping 10.0.0.5
Pinging 10.0.0.5 with 32 bytes of data:
Reply from 10.0.0.5: bytes=32 time=2ms TTL=127
Reply from 10.0.0.5: bytes=32 time=0ms TTL=127
Reply from 10.0.0.5: bytes=32 time=4ms TTL=127
Reply from 10.0.0.5: bytes=32 time=0ms TTL=127

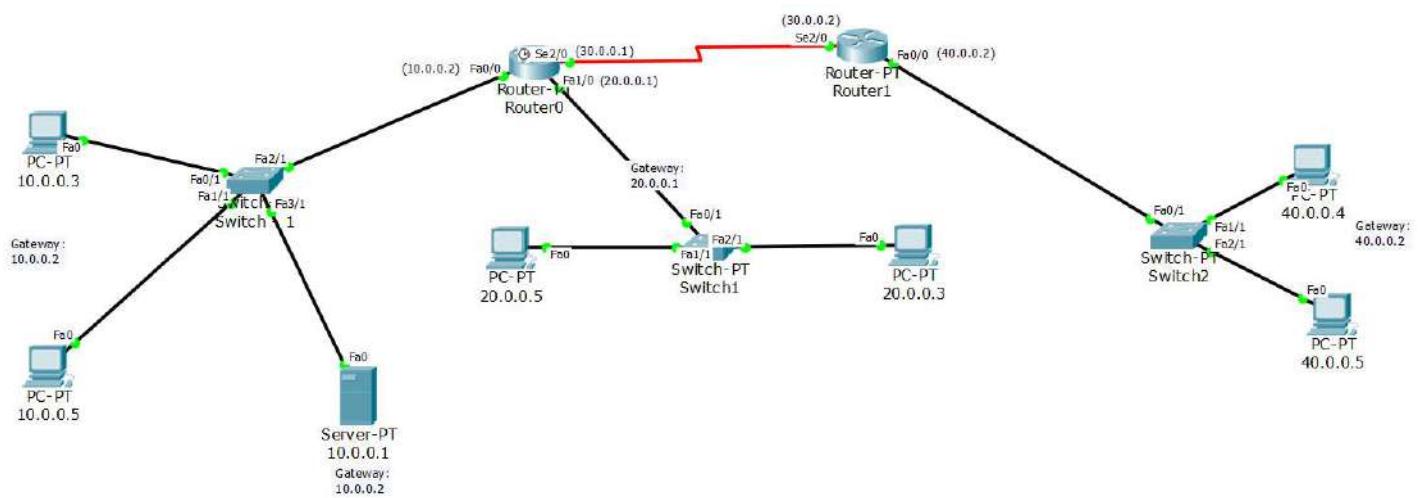
Ping statistics for 10.0.0.5:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 4ms, Average = 1ms

PC>ping 20.0.0.2
Pinging 20.0.0.2 with 32 bytes of data:
Reply from 20.0.0.2: bytes=32 time=1ms TTL=128
Reply from 20.0.0.2: bytes=32 time=0ms TTL=128
Reply from 20.0.0.2: bytes=32 time=0ms TTL=128
Reply from 20.0.0.2: bytes=32 time=6ms TTL=128

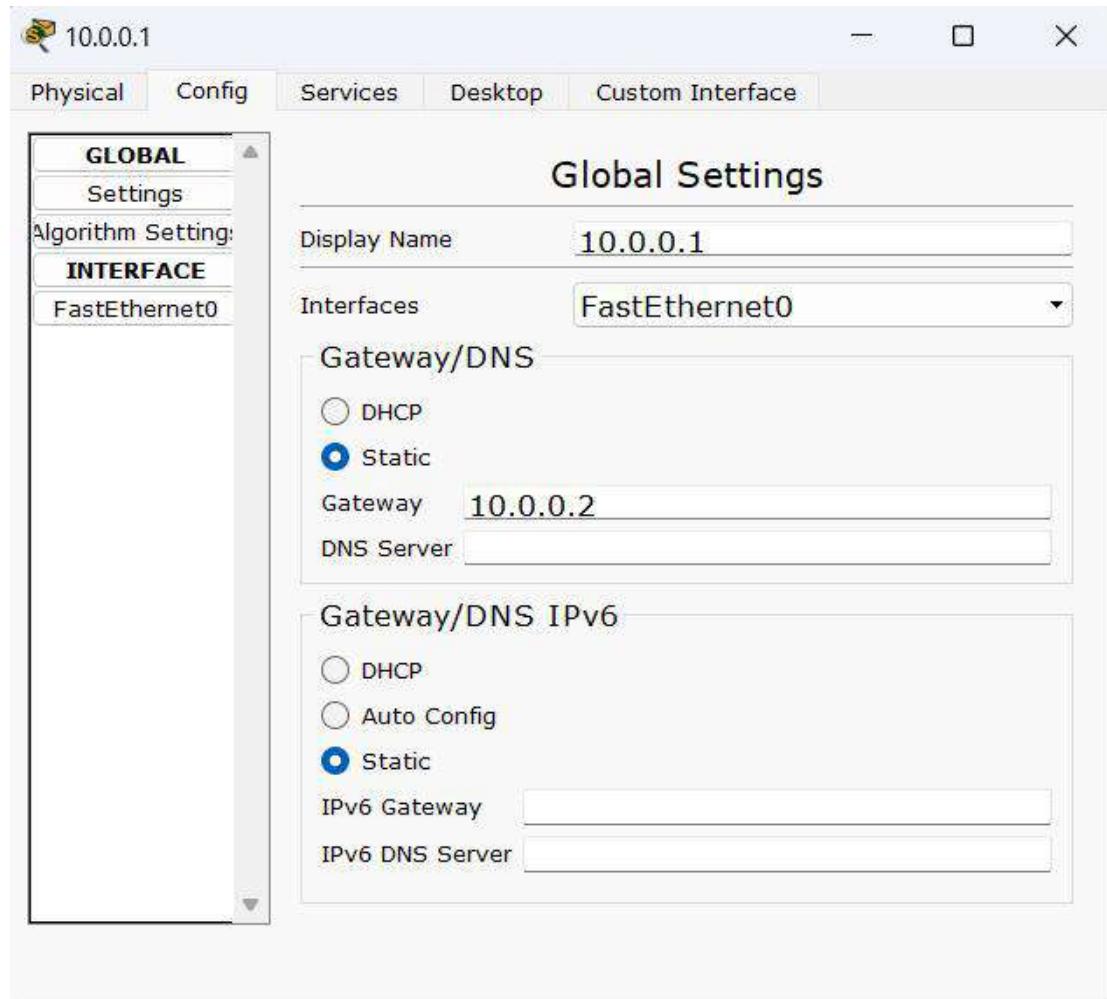
Ping statistics for 20.0.0.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 6ms, Average = 1ms

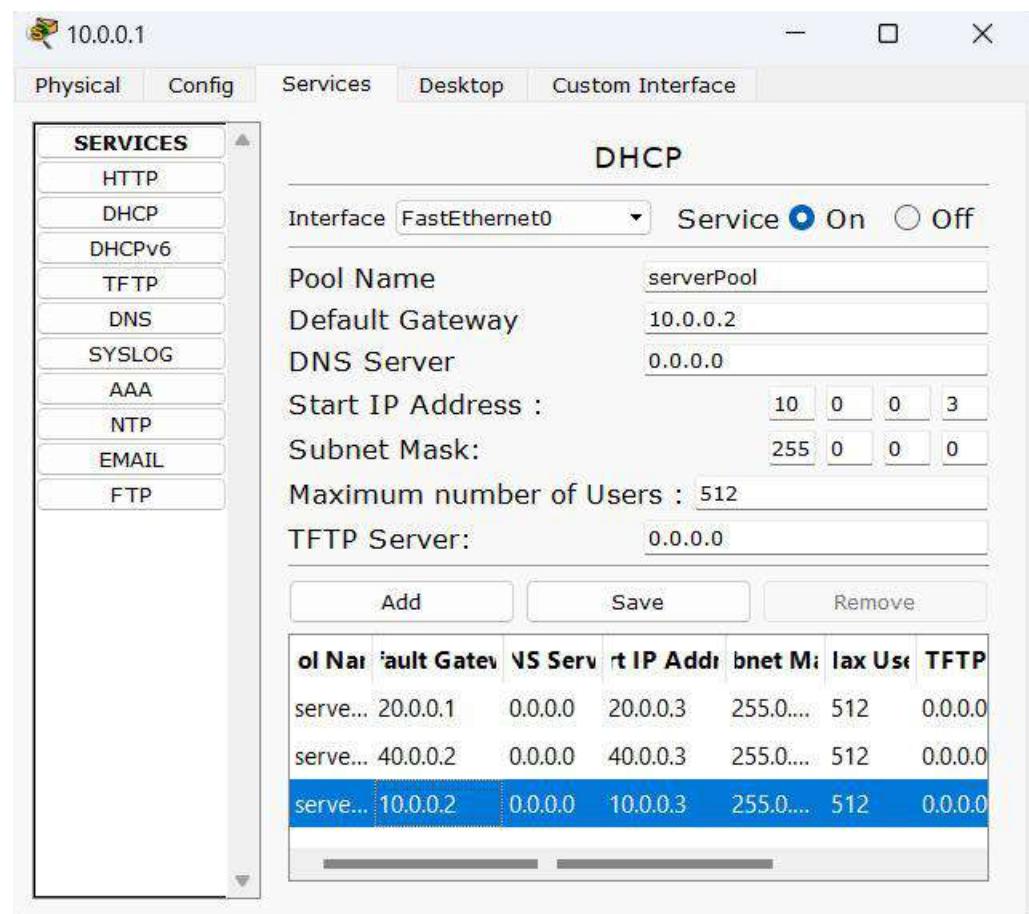
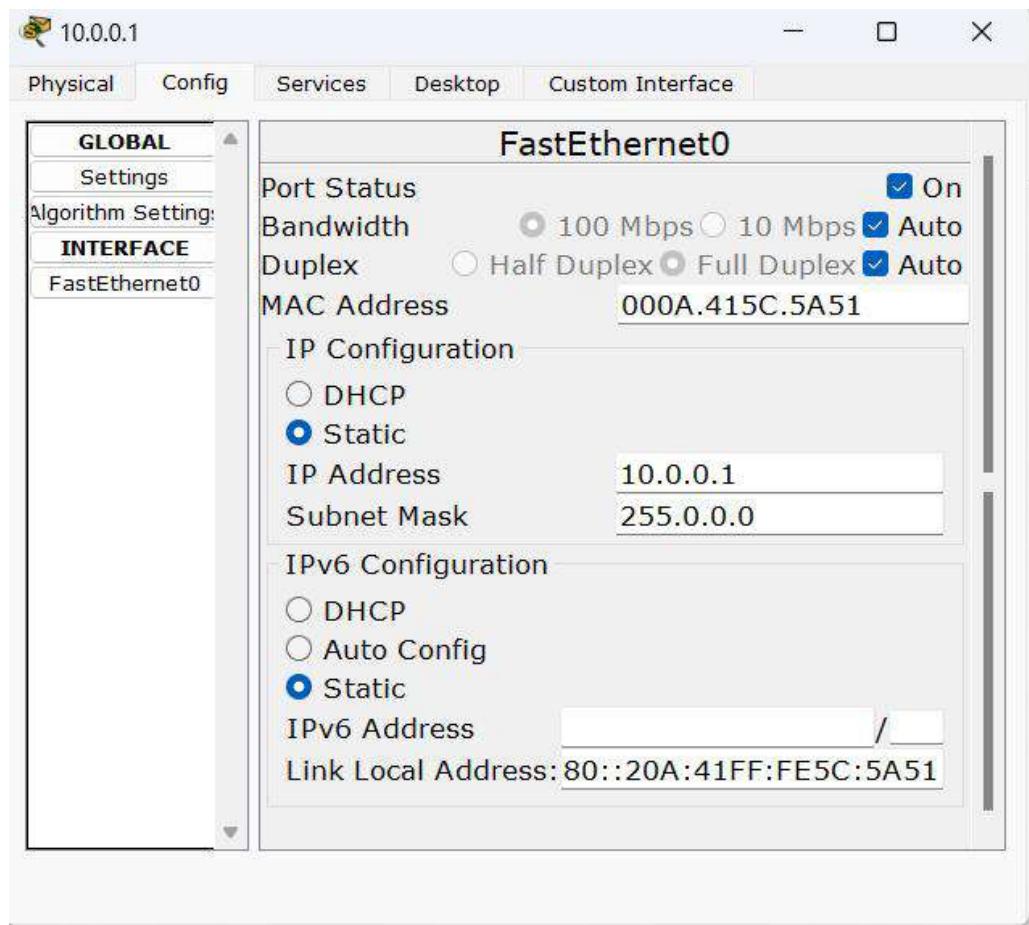
PC>
```

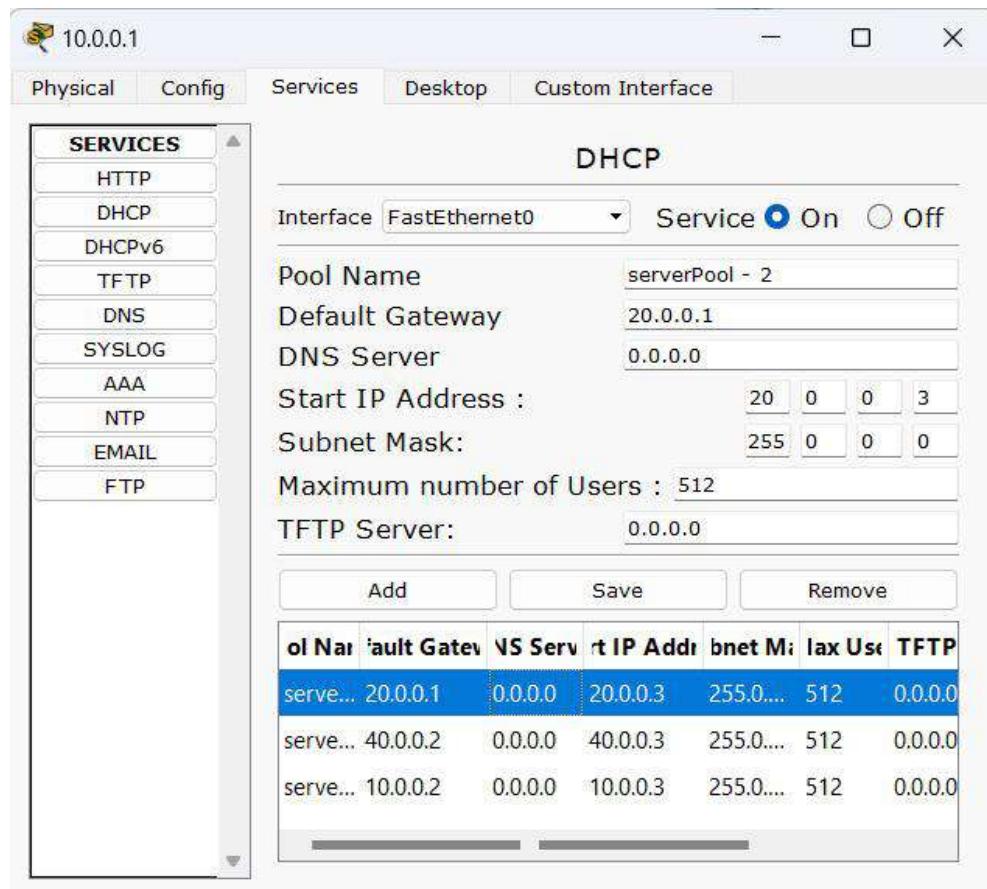
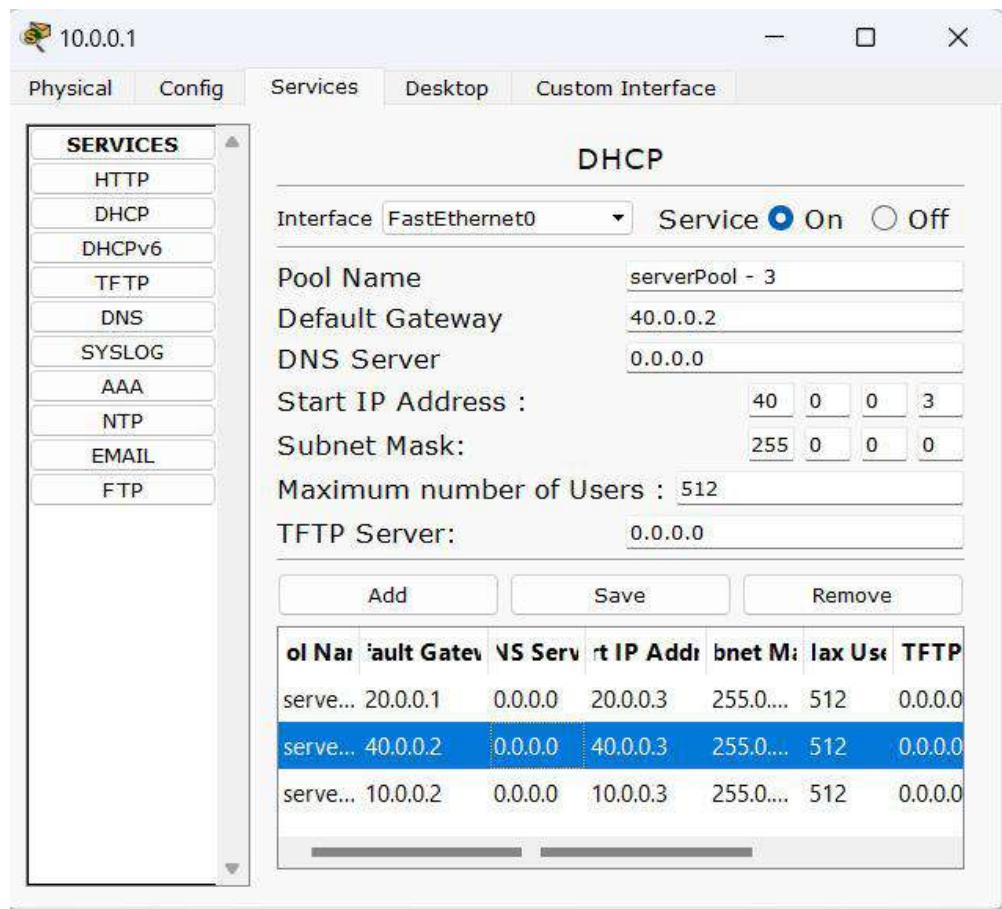
## Topology - 2:



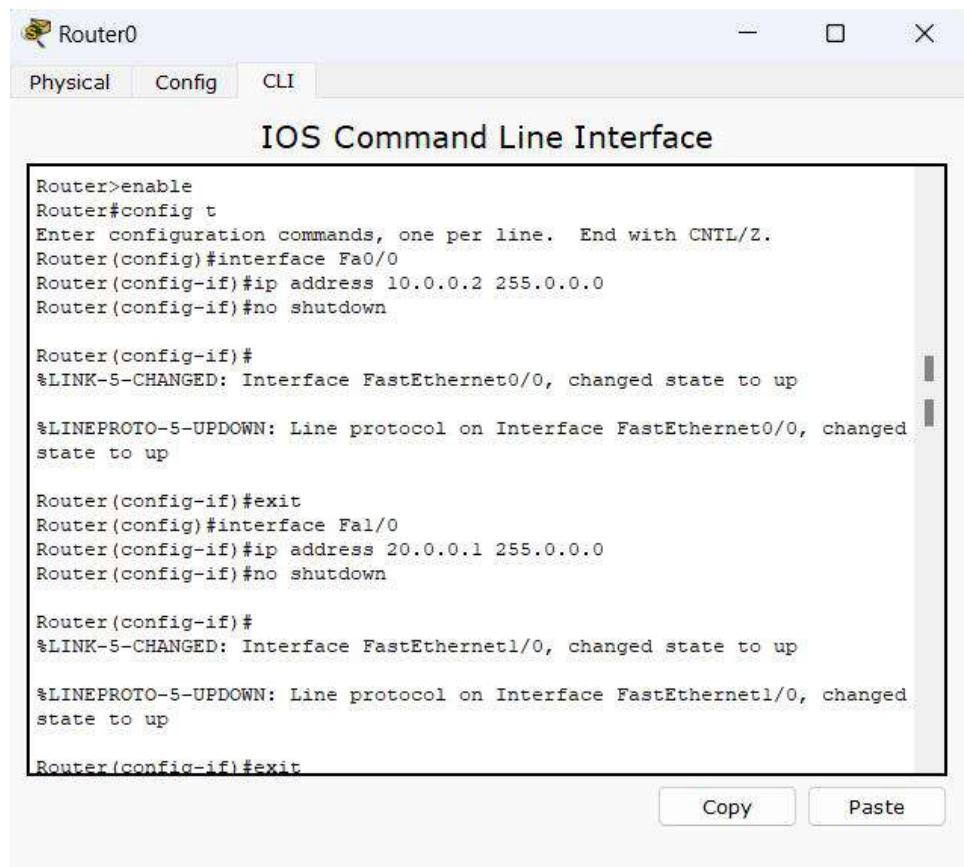
## Server Configuration:







## Router - 0 (Configuration)



The window title is "Router0". The tab bar shows "Physical", "Config" (which is selected), and "CLI". The main area is titled "IOS Command Line Interface". The command history is as follows:

```
Router>enable
Router#config t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#interface Fa0/0
Router(config-if)#ip address 10.0.0.2 255.0.0.0
Router(config-if)#no shutdown

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

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

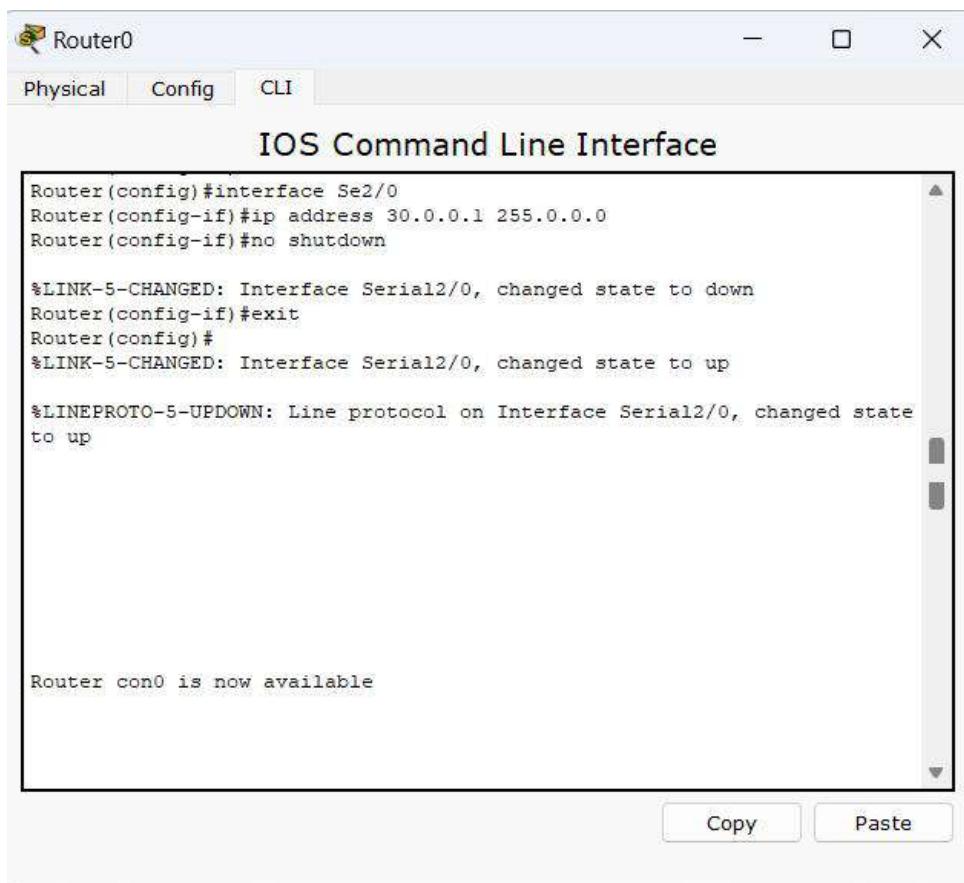
Router(config-if)#exit
Router(config)#interface Fa1/0
Router(config-if)#ip address 20.0.0.1 255.0.0.0
Router(config-if)#no shutdown

Router(config-if)#
%LINK-5-CHANGED: Interface FastEthernet1/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet1/0, changed
state to up

Router(config-if)#exit
```

At the bottom right are "Copy" and "Paste" buttons.



The window title is "Router0". The tab bar shows "Physical", "Config" (which is selected), and "CLI". The main area is titled "IOS Command Line Interface". The command history is as follows:

```
Router(config)#interface Se2/0
Router(config-if)#ip address 30.0.0.1 255.0.0.0
Router(config-if)#no shutdown

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

%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial2/0, changed state
to up

Router con0 is now available
```

At the bottom right are "Copy" and "Paste" buttons.

Router0

Physical Config CLI

### IOS Command Line Interface

```
Router>enable
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#interface FastEthernet0/0
Router(config-if)#ip helper-address 10.0.0.1
Router(config-if)#exit
Router(config)#show ip route
^
% Invalid input detected at '^' marker.

Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console
show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
      D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
      N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
      E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
      i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS
      inter area
      * - candidate default, U - per-user static route, o - ODR
      P - periodic downloaded static route

Gateway of last resort is not set
```

Copy Paste

Router0

Physical Config CLI

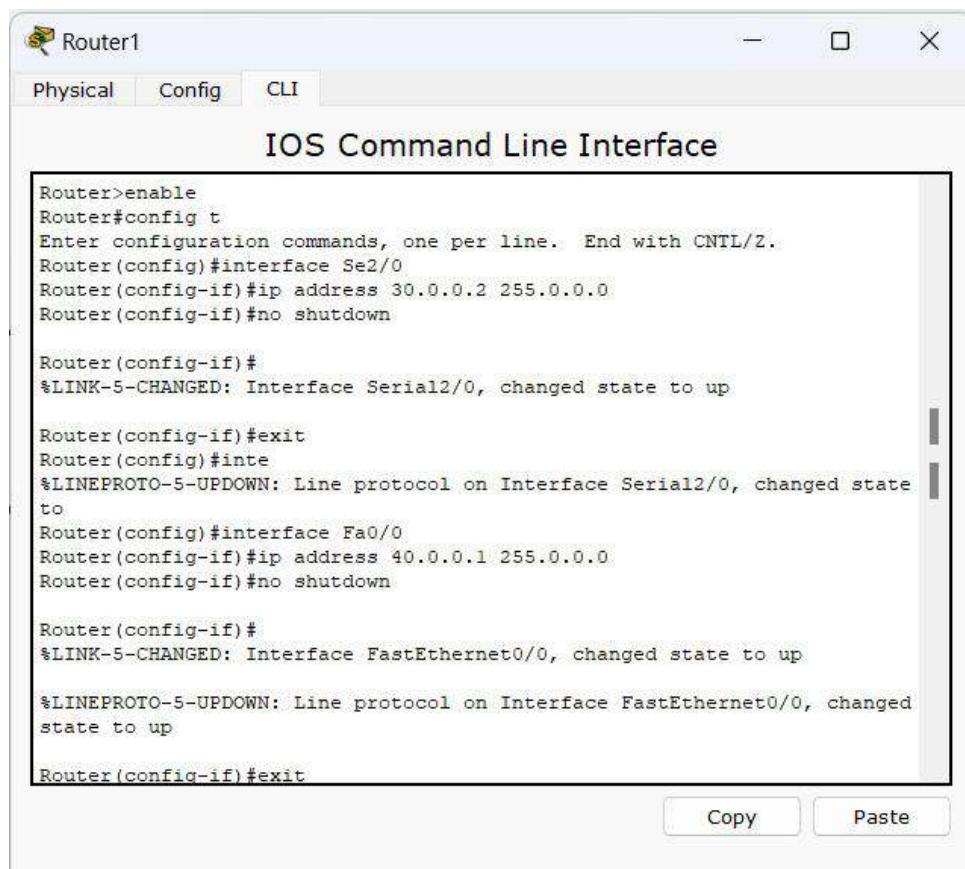
### IOS Command Line Interface

```
C    10.0.0.0/8 is directly connected, FastEthernet0/0
C    20.0.0.0/8 is directly connected, FastEthernet1/0
C    30.0.0.0/8 is directly connected, Serial2/0
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#ip route 40.0.0.0 255.0.0.0 30.0.0.2
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console
configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#ip route 40.0.0.0 255.0.0.0 30.0.0.2

Router con0 is now available
```

Copy Paste

## Router - 1 Configuration:



The screenshot shows the 'Router1' window with the 'CLI' tab selected. The title bar says 'IOS Command Line Interface'. The command-line area contains the following configuration commands:

```
Router>enable
Router#config t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#interface Se2/0
Router(config-if)#ip address 30.0.0.2 255.0.0.0
Router(config-if)#no shutdown

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

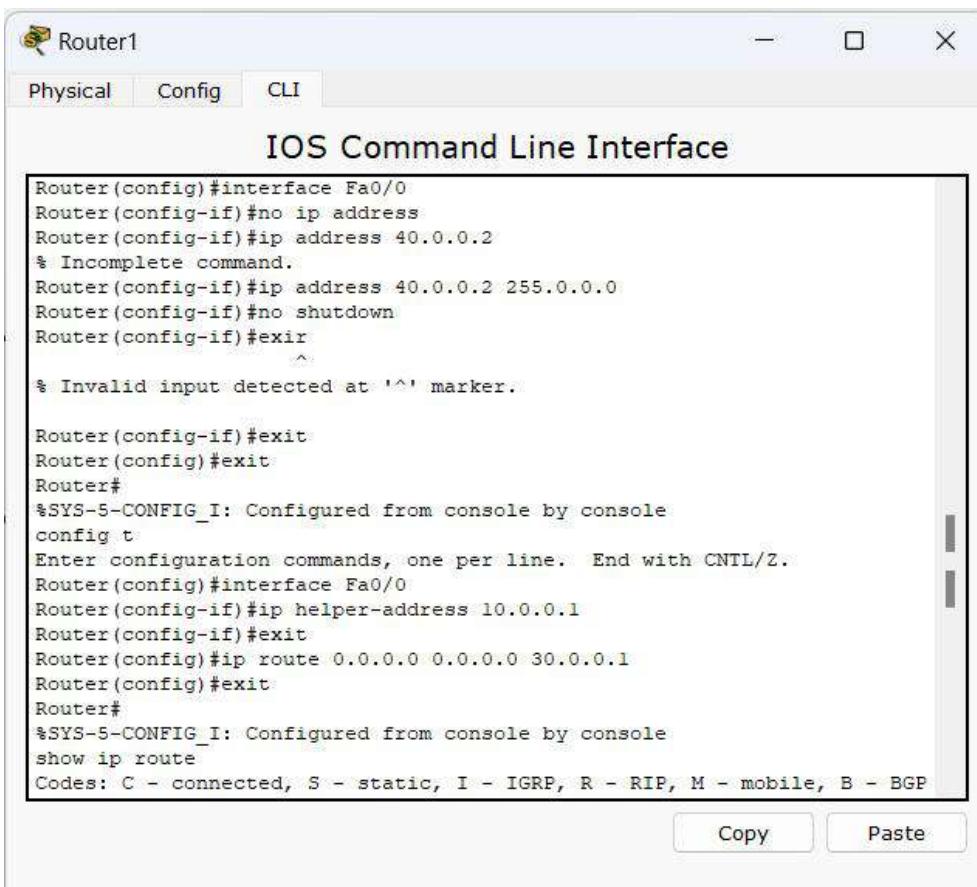
Router(config-if)#exit
Router(config)#inte
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial2/0, changed state to
to
Router(config)#interface Fa0/0
Router(config-if)#ip address 40.0.0.1 255.0.0.0
Router(config-if)#no shutdown

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

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

Router(config-if)#exit
```

At the bottom right of the CLI window are 'Copy' and 'Paste' buttons.



The screenshot shows the 'Router1' window with the 'CLI' tab selected. The title bar says 'IOS Command Line Interface'. The command-line area contains the following configuration commands, with errors indicated by red text:

```
Router(config)#interface Fa0/0
Router(config-if)#no ip address
Router(config-if)#ip address 40.0.0.2
% Incomplete command.
Router(config-if)#ip address 40.0.0.2 255.0.0.0
Router(config-if)#no shutdown
Router(config-if)#exir
^
% Invalid input detected at '^' marker.

Router(config-if)#exit
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console
config t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#interface Fa0/0
Router(config-if)#ip helper-address 10.0.0.1
Router(config-if)#exit
Router(config)#ip route 0.0.0.0 0.0.0.0 30.0.0.1
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console
show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
```

At the bottom right of the CLI window are 'Copy' and 'Paste' buttons.

**Router1**

Physical Config CLI

### IOS Command Line Interface

```

Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
      D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
      N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
      E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
      i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS
      inter area
      * - candidate default, U - per-user static route, o - ODR
      P - periodic downloaded static route

Gateway of last resort is 30.0.0.1 to network 0.0.0.0

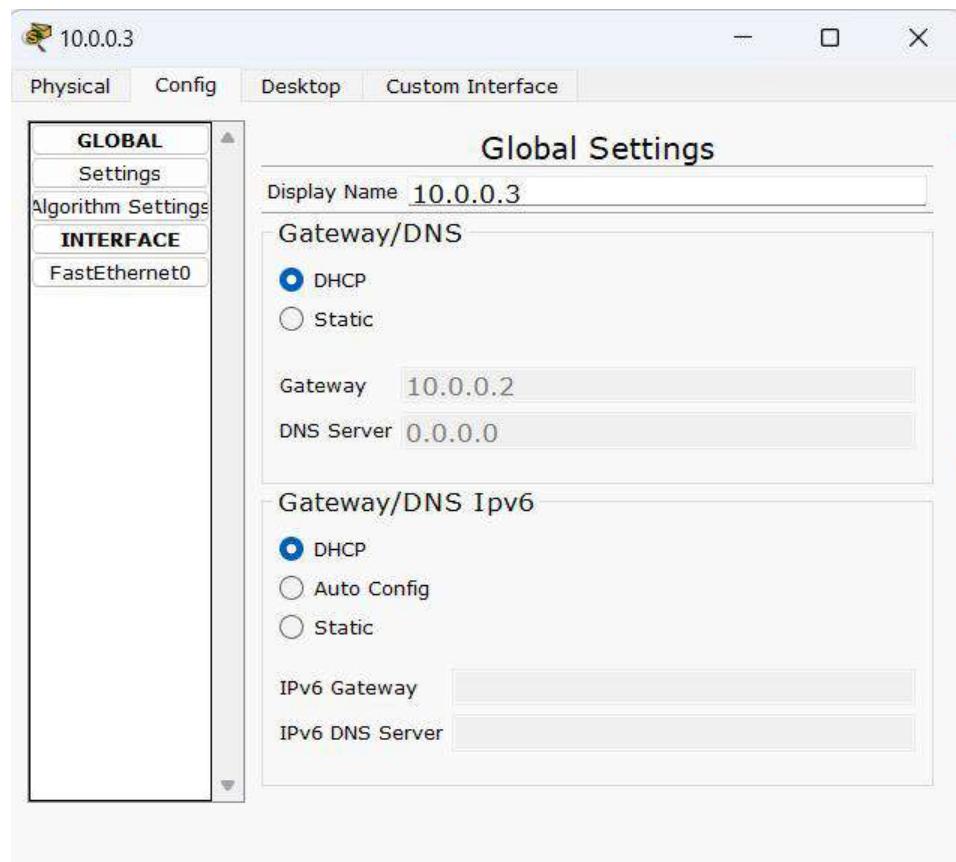
C    30.0.0.0/8 is directly connected, Serial2/0
C    40.0.0.0/8 is directly connected, FastEthernet0/0
S*   0.0.0.0/0 [1/0] via 30.0.0.1
Router#

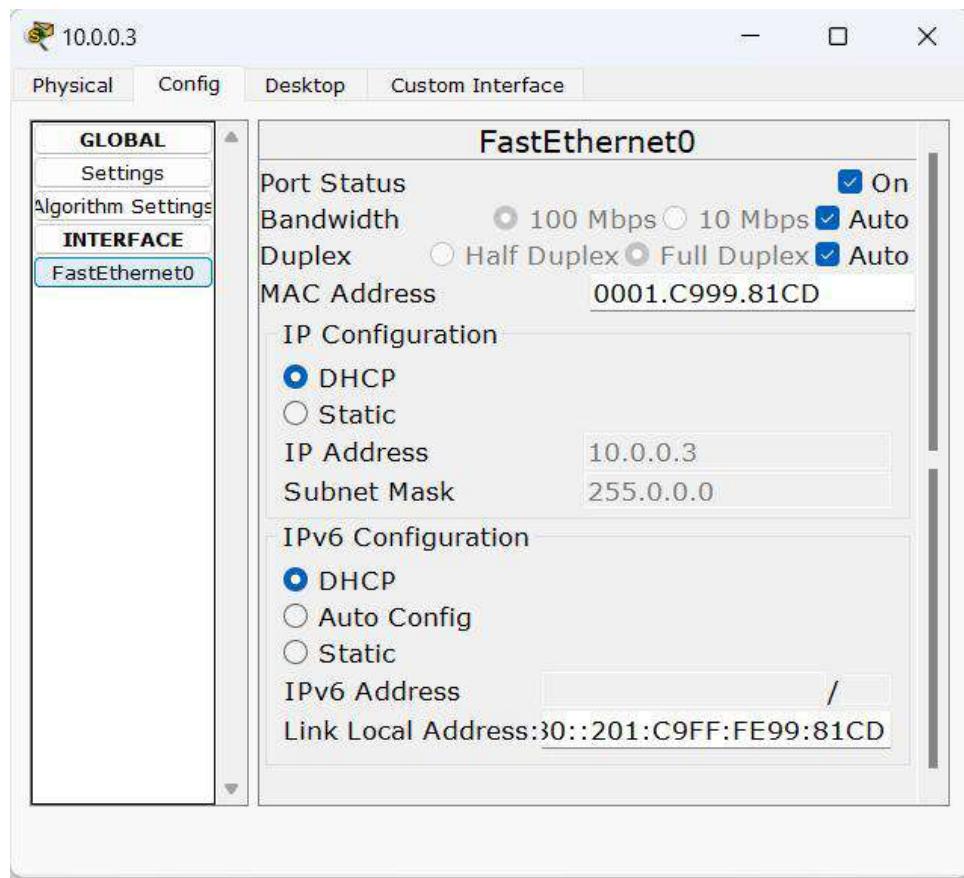
```

Router con0 is now available

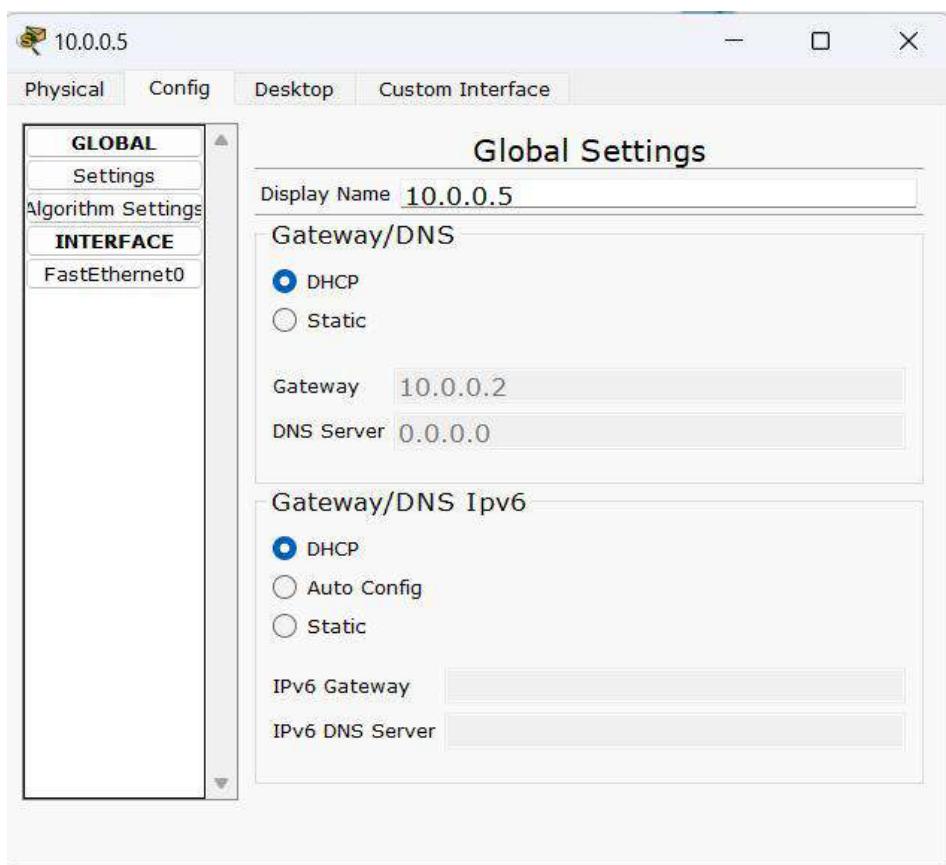
Copy Paste

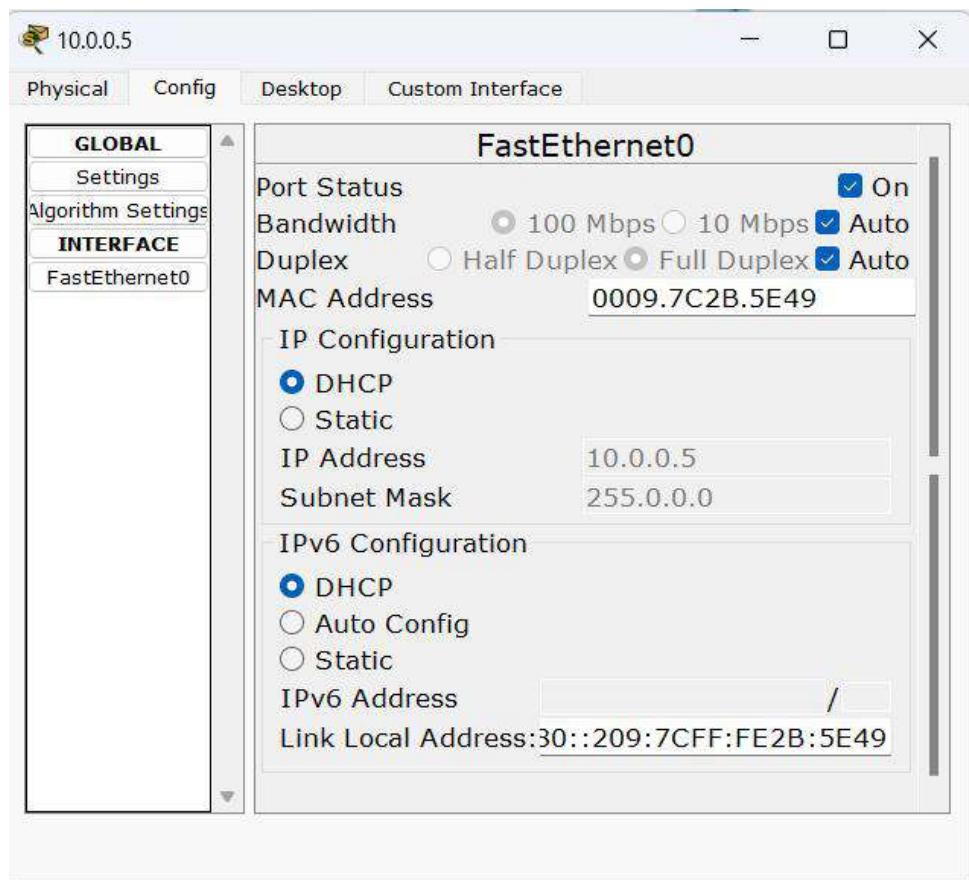
## PC - 1 Configuration (Through DHCP):



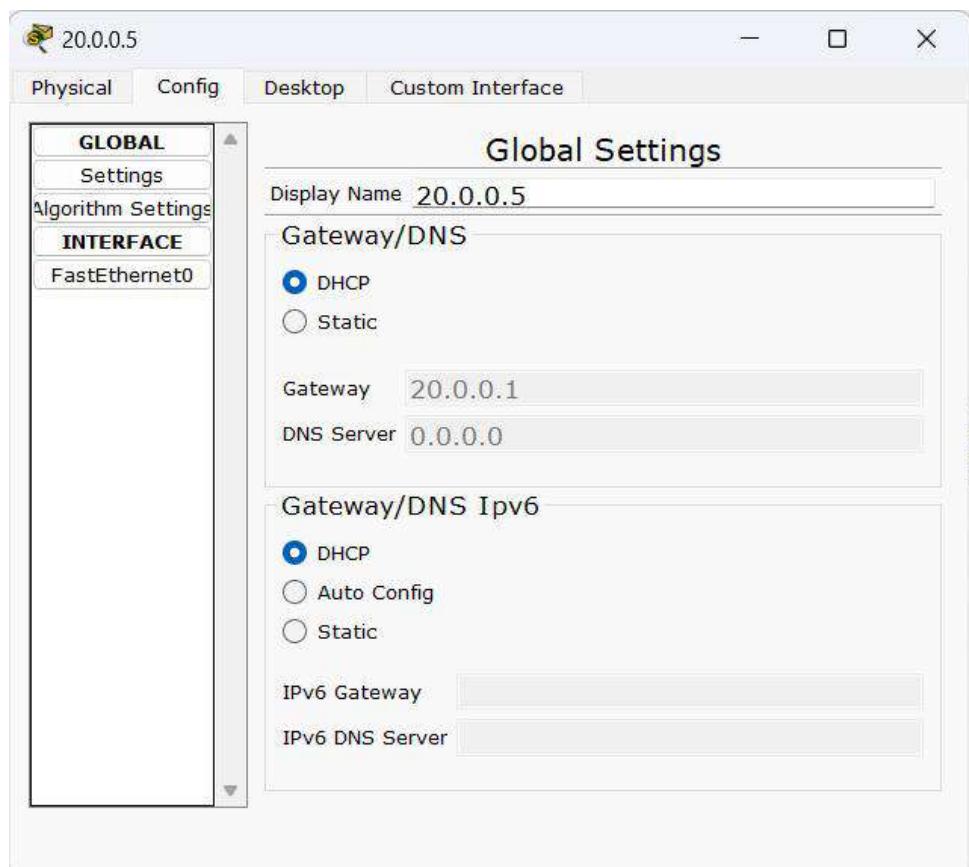


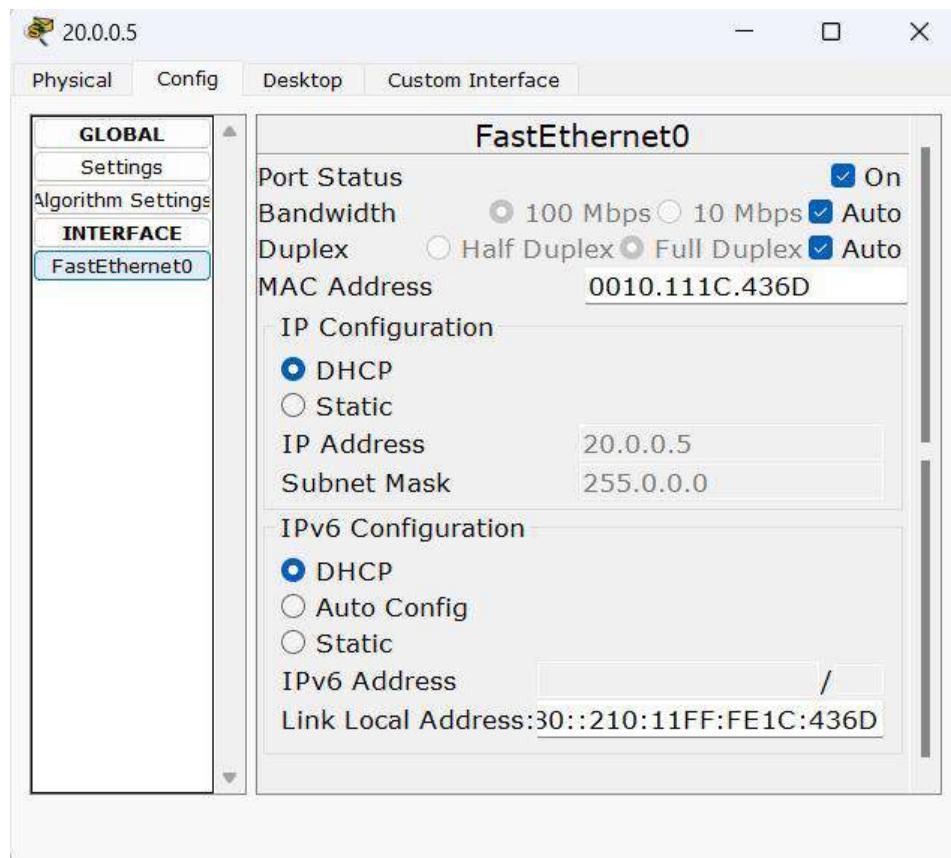
## PC - 2 Configuration (Through DHCP):



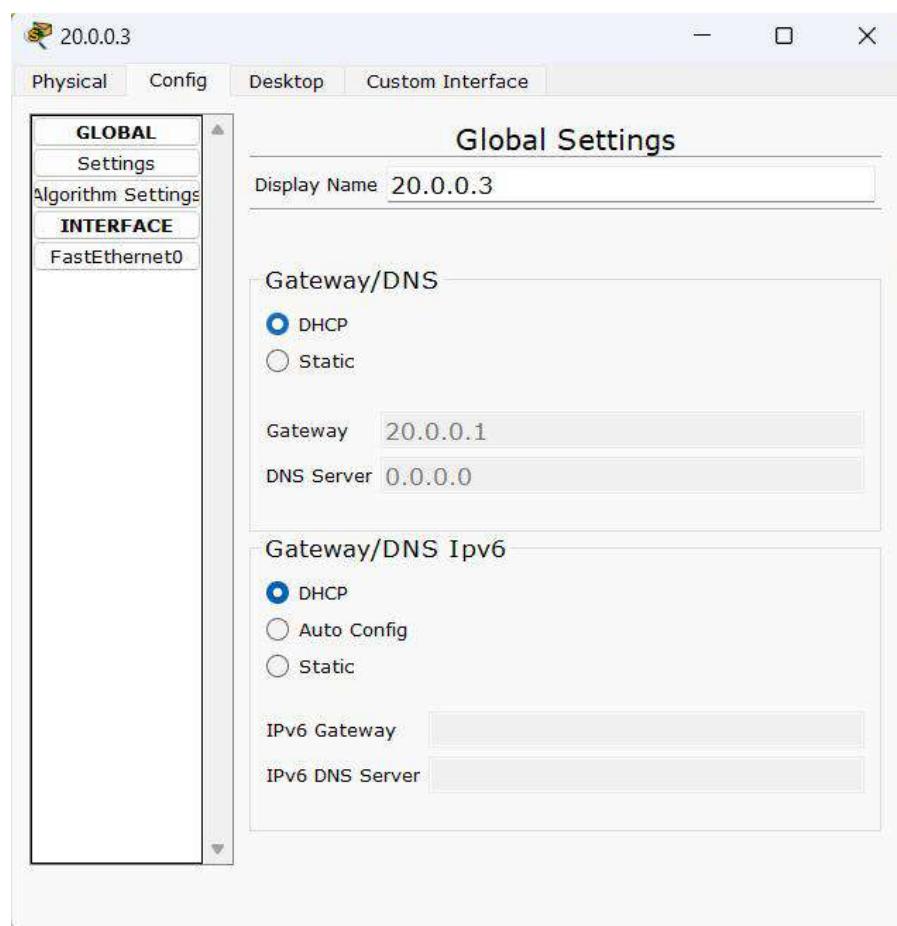


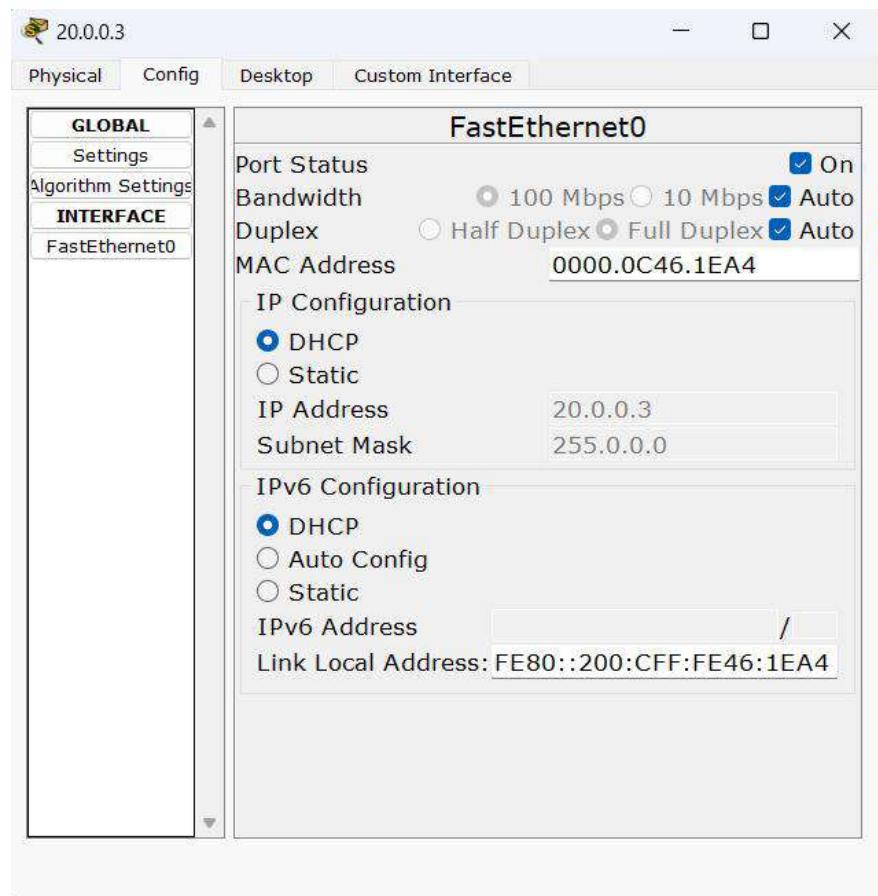
### PC - 3 Configuration (Through DHCP):



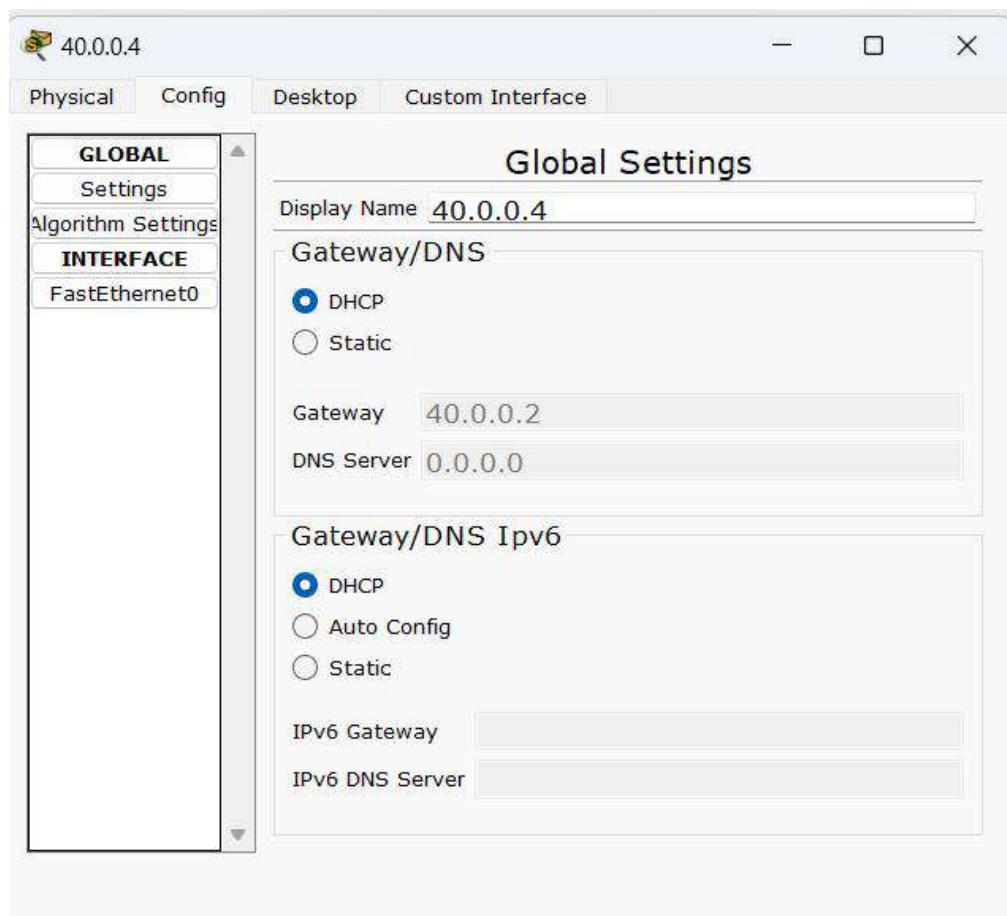


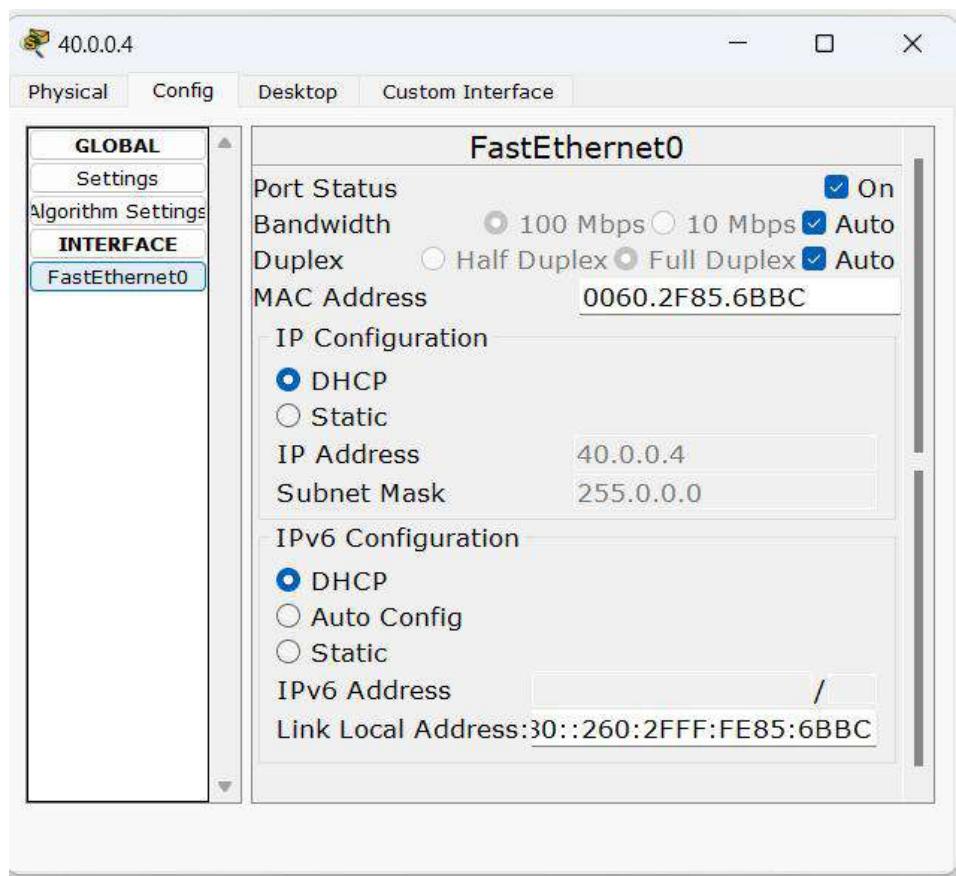
#### PC - 4 Configuration (Through DHCP):



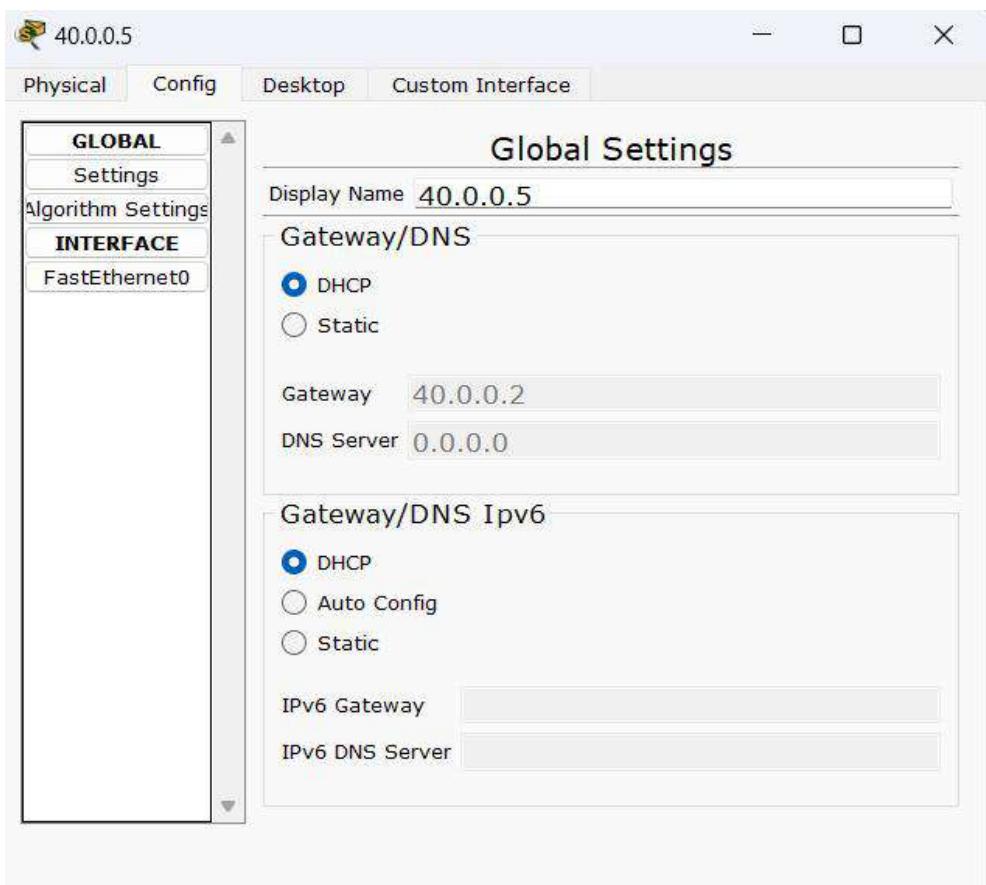


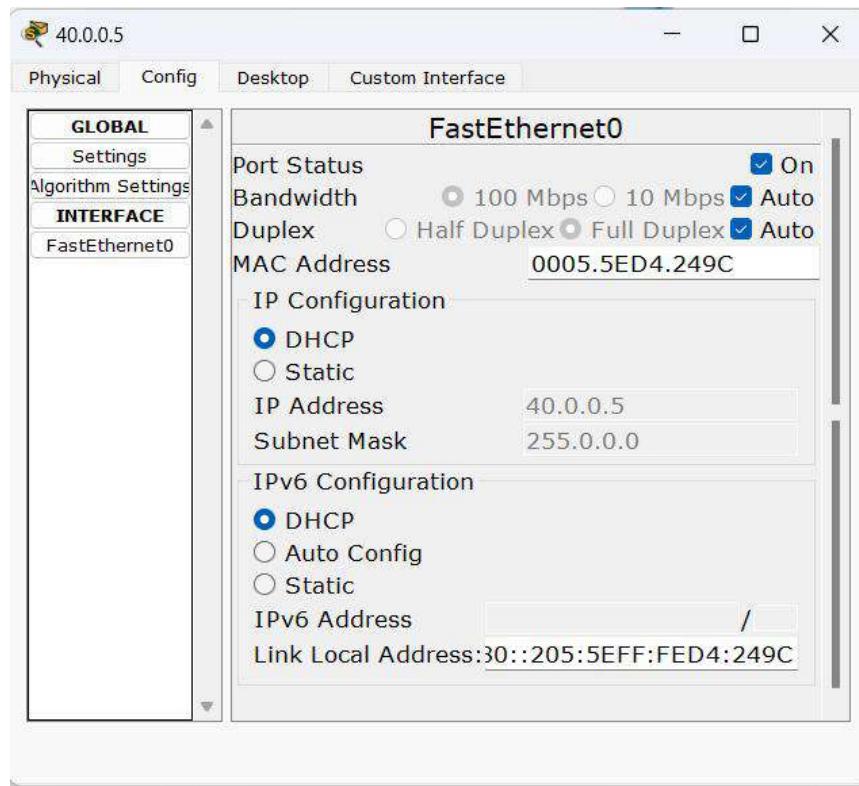
## PC - 5 Configuration (Through DHCP):





## PC - 6 Configuration (Through DHCP):





## Output (Ping Messages)

From PC - 1 to All Other PCs:

```

10.0.0.3
Physical Config Desktop Custom Interface

Command Prompt X

Packet Tracer PC Command Line 1.0
PC>ping 10.0.0.5

Pinging 10.0.0.5 with 32 bytes of data:

Reply from 10.0.0.5: bytes=32 time=0ms TTL=128

Ping statistics for 10.0.0.5:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms

PC>ping 20.0.0.5

Pinging 20.0.0.5 with 32 bytes of data:

Request timed out.
Reply from 20.0.0.5: bytes=32 time=0ms TTL=127
Reply from 20.0.0.5: bytes=32 time=0ms TTL=127
Reply from 20.0.0.5: bytes=32 time=0ms TTL=127

Ping statistics for 20.0.0.5:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms

```

10.0.0.3

Physical Config Desktop Custom Interface

**Command Prompt**

```
PC>ping 20.0.0.3
Pinging 20.0.0.3 with 32 bytes of data:
Request timed out.
Reply from 20.0.0.3: bytes=32 time=1ms TTL=127
Reply from 20.0.0.3: bytes=32 time=0ms TTL=127
Reply from 20.0.0.3: bytes=32 time=7ms TTL=127

Ping statistics for 20.0.0.3:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 7ms, Average = 2ms

PC>ping 40.0.0.4
Pinging 40.0.0.4 with 32 bytes of data:
Request timed out.
Reply from 40.0.0.4: bytes=32 time=6ms TTL=126
Reply from 40.0.0.4: bytes=32 time=14ms TTL=126
Reply from 40.0.0.4: bytes=32 time=1ms TTL=126

Ping statistics for 40.0.0.4:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 14ms, Average = 7ms

PC>ping 40.0.0.5
```

10.0.0.3

Physical Config Desktop Custom Interface

**Command Prompt**

```
PC>ping 40.0.0.4
Pinging 40.0.0.4 with 32 bytes of data:
Request timed out.
Reply from 40.0.0.4: bytes=32 time=6ms TTL=126
Reply from 40.0.0.4: bytes=32 time=14ms TTL=126
Reply from 40.0.0.4: bytes=32 time=1ms TTL=126

Ping statistics for 40.0.0.4:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 14ms, Average = 7ms

PC>ping 40.0.0.5
Pinging 40.0.0.5 with 32 bytes of data:
Request timed out.
Reply from 40.0.0.5: bytes=32 time=12ms TTL=126
Reply from 40.0.0.5: bytes=32 time=4ms TTL=126
Reply from 40.0.0.5: bytes=32 time=5ms TTL=126

Ping statistics for 40.0.0.5:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 4ms, Maximum = 12ms, Average = 7ms

PC>
```

## From PC - 2 to All Other PCs:

```
10.0.0.5
Physical Config Desktop Custom Interface
Command Prompt X
Packet Tracer PC Command Line 1.0
PC>ping 10.0.0.3

Pinging 10.0.0.3 with 32 bytes of data:

Reply from 10.0.0.3: bytes=32 time=0ms TTL=128
Reply from 10.0.0.3: bytes=32 time=5ms TTL=128
Reply from 10.0.0.3: bytes=32 time=0ms TTL=128
Reply from 10.0.0.3: bytes=32 time=0ms TTL=128

Ping statistics for 10.0.0.3:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 5ms, Average = 1ms

PC>ping 20.0.0.5

Pinging 20.0.0.5 with 32 bytes of data:

Reply from 20.0.0.5: bytes=32 time=1ms TTL=127
Reply from 20.0.0.5: bytes=32 time=0ms TTL=127
Reply from 20.0.0.5: bytes=32 time=0ms TTL=127
Reply from 20.0.0.5: bytes=32 time=0ms TTL=127

Ping statistics for 20.0.0.5:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 1ms, Average = 0ms
```

```
10.0.0.5
Physical Config Desktop Custom Interface
Command Prompt X
PC>ping 20.0.0.3

Pinging 20.0.0.3 with 32 bytes of data:

Reply from 20.0.0.3: bytes=32 time=0ms TTL=127

Ping statistics for 20.0.0.3:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms

PC>ping 40.0.0.4

Pinging 40.0.0.4 with 32 bytes of data:

Reply from 40.0.0.4: bytes=32 time=93ms TTL=126
Reply from 40.0.0.4: bytes=32 time=4ms TTL=126
Reply from 40.0.0.4: bytes=32 time=1ms TTL=126
Reply from 40.0.0.4: bytes=32 time=5ms TTL=126

Ping statistics for 40.0.0.4:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 93ms, Average = 25ms

PC>ping 40.0.0.5
```

```
PC>ping 40.0.0.4

Pinging 40.0.0.4 with 32 bytes of data:

Reply from 40.0.0.4: bytes=32 time=93ms TTL=126
Reply from 40.0.0.4: bytes=32 time=4ms TTL=126
Reply from 40.0.0.4: bytes=32 time=1ms TTL=126
Reply from 40.0.0.4: bytes=32 time=5ms TTL=126

Ping statistics for 40.0.0.4:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 93ms, Average = 25ms

PC>ping 40.0.0.5

Pinging 40.0.0.5 with 32 bytes of data:

Reply from 40.0.0.5: bytes=32 time=1ms TTL=126
Reply from 40.0.0.5: bytes=32 time=1ms TTL=126
Reply from 40.0.0.5: bytes=32 time=8ms TTL=126
Reply from 40.0.0.5: bytes=32 time=1ms TTL=126

Ping statistics for 40.0.0.5:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 8ms, Average = 2ms

PC>
```

## From PC - 3 to All Other PCs:

```
Packet Tracer PC Command Line 1.0
PC>ping 10.0.0.3

Pinging 10.0.0.3 with 32 bytes of data:

Reply from 10.0.0.3: bytes=32 time=0ms TTL=127
Reply from 10.0.0.3: bytes=32 time=1ms TTL=127
Reply from 10.0.0.3: bytes=32 time=1ms TTL=127
Reply from 10.0.0.3: bytes=32 time=0ms TTL=127

Ping statistics for 10.0.0.3:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 1ms, Average = 0ms

PC>ping 10.0.0.5

Pinging 10.0.0.5 with 32 bytes of data:

Reply from 10.0.0.5: bytes=32 time=1ms TTL=127
Reply from 10.0.0.5: bytes=32 time=0ms TTL=127
Reply from 10.0.0.5: bytes=32 time=0ms TTL=127
Reply from 10.0.0.5: bytes=32 time=0ms TTL=127

Ping statistics for 10.0.0.5:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 1ms, Average = 0ms
```

20.0.0.5

Physical Config Desktop Custom Interface

**Command Prompt**

```
PC>ping 20.0.0.3
Pinging 20.0.0.3 with 32 bytes of data:
Reply from 20.0.0.3: bytes=32 time=1ms TTL=128
Reply from 20.0.0.3: bytes=32 time=1ms TTL=128
Reply from 20.0.0.3: bytes=32 time=17ms TTL=128
Reply from 20.0.0.3: bytes=32 time=0ms TTL=128

Ping statistics for 20.0.0.3:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 17ms, Average = 4ms

PC>ping 40.0.0.4
Pinging 40.0.0.4 with 32 bytes of data:
Reply from 40.0.0.4: bytes=32 time=1ms TTL=126
Reply from 40.0.0.4: bytes=32 time=1ms TTL=126
Reply from 40.0.0.4: bytes=32 time=16ms TTL=126
Reply from 40.0.0.4: bytes=32 time=6ms TTL=126

Ping statistics for 40.0.0.4:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 16ms, Average = 6ms

PC>ping 40.0.0.5
```

20.0.0.5

Physical Config Desktop Custom Interface

**Command Prompt**

```
PC>ping 40.0.0.4
Pinging 40.0.0.4 with 32 bytes of data:
Reply from 40.0.0.4: bytes=32 time=1ms TTL=126
Reply from 40.0.0.4: bytes=32 time=1ms TTL=126
Reply from 40.0.0.4: bytes=32 time=16ms TTL=126
Reply from 40.0.0.4: bytes=32 time=6ms TTL=126

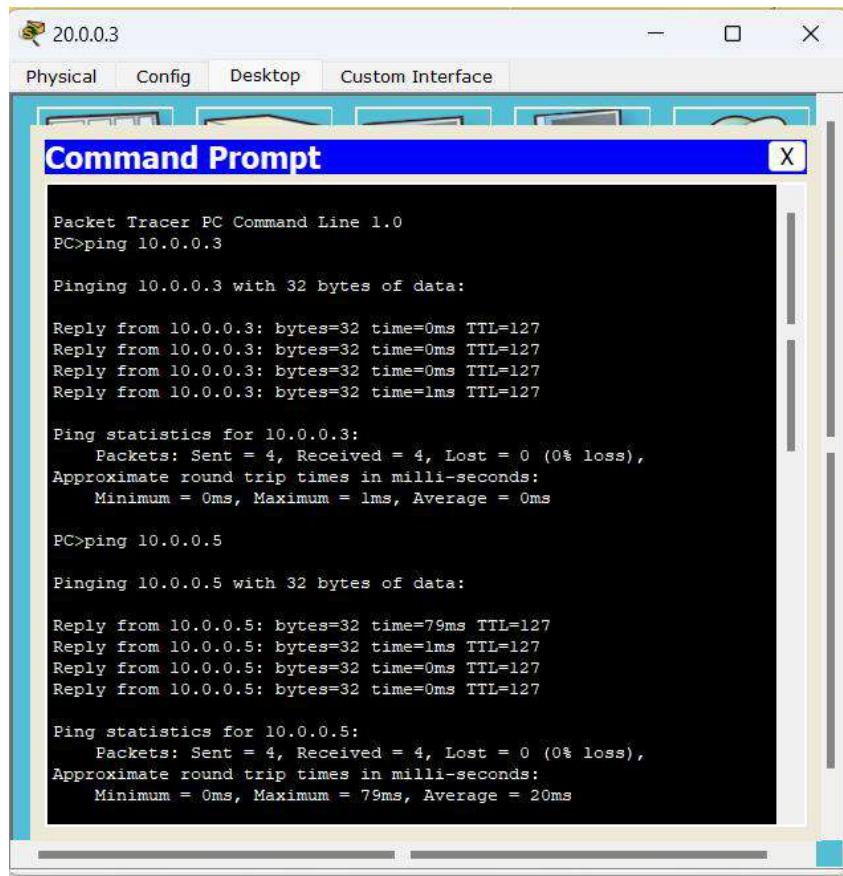
Ping statistics for 40.0.0.4:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 16ms, Average = 6ms

PC>ping 40.0.0.5
Pinging 40.0.0.5 with 32 bytes of data:
Reply from 40.0.0.5: bytes=32 time=1ms TTL=126
Reply from 40.0.0.5: bytes=32 time=6ms TTL=126
Reply from 40.0.0.5: bytes=32 time=1ms TTL=126
Reply from 40.0.0.5: bytes=32 time=5ms TTL=126

Ping statistics for 40.0.0.5:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 6ms, Average = 3ms

PC>
```

## From PC - 4 to All Other PCs:



```
20.0.0.3
Physical Config Desktop Custom Interface
Command Prompt X
Packet Tracer PC Command Line 1.0
PC>ping 10.0.0.3

Pinging 10.0.0.3 with 32 bytes of data:

Reply from 10.0.0.3: bytes=32 time=0ms TTL=127
Reply from 10.0.0.3: bytes=32 time=0ms TTL=127
Reply from 10.0.0.3: bytes=32 time=0ms TTL=127
Reply from 10.0.0.3: bytes=32 time=1ms TTL=127

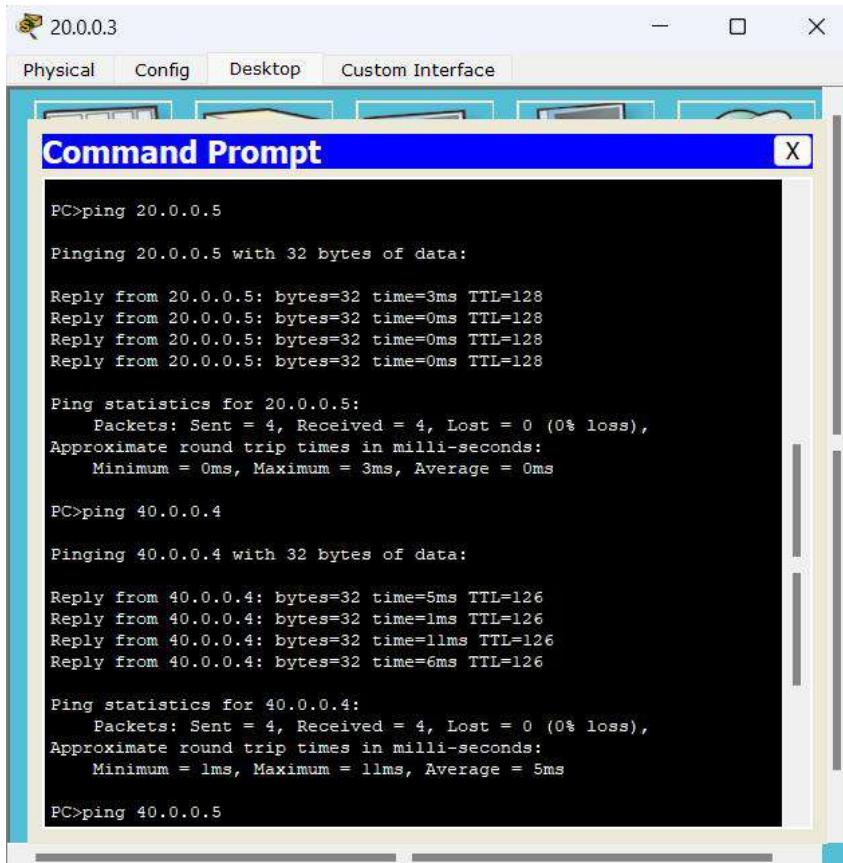
Ping statistics for 10.0.0.3:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 1ms, Average = 0ms

PC>ping 10.0.0.5

Pinging 10.0.0.5 with 32 bytes of data:

Reply from 10.0.0.5: bytes=32 time=79ms TTL=127
Reply from 10.0.0.5: bytes=32 time=1ms TTL=127
Reply from 10.0.0.5: bytes=32 time=0ms TTL=127
Reply from 10.0.0.5: bytes=32 time=0ms TTL=127

Ping statistics for 10.0.0.5:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 79ms, Average = 20ms
```



```
20.0.0.3
Physical Config Desktop Custom Interface
Command Prompt X
PC>ping 20.0.0.5

Pinging 20.0.0.5 with 32 bytes of data:

Reply from 20.0.0.5: bytes=32 time=3ms TTL=128
Reply from 20.0.0.5: bytes=32 time=0ms TTL=128
Reply from 20.0.0.5: bytes=32 time=0ms TTL=128
Reply from 20.0.0.5: bytes=32 time=0ms TTL=128

Ping statistics for 20.0.0.5:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 3ms, Average = 0ms

PC>ping 40.0.0.4

Pinging 40.0.0.4 with 32 bytes of data:

Reply from 40.0.0.4: bytes=32 time=5ms TTL=126
Reply from 40.0.0.4: bytes=32 time=1ms TTL=126
Reply from 40.0.0.4: bytes=32 time=11ms TTL=126
Reply from 40.0.0.4: bytes=32 time=6ms TTL=126

Ping statistics for 40.0.0.4:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 11ms, Average = 5ms

PC>ping 40.0.0.5
```

```

20.0.0.3
Physical Config Desktop Custom Interface

Command Prompt X

PC>ping 40.0.0.4
Pinging 40.0.0.4 with 32 bytes of data:
Reply from 40.0.0.4: bytes=32 time=5ms TTL=126
Reply from 40.0.0.4: bytes=32 time=1ms TTL=126
Reply from 40.0.0.4: bytes=32 time=11ms TTL=126
Reply from 40.0.0.4: bytes=32 time=6ms TTL=126

Ping statistics for 40.0.0.4:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 11ms, Average = 5ms

PC>ping 40.0.0.5
Pinging 40.0.0.5 with 32 bytes of data:
Reply from 40.0.0.5: bytes=32 time=1ms TTL=126
Reply from 40.0.0.5: bytes=32 time=1ms TTL=126
Reply from 40.0.0.5: bytes=32 time=2ms TTL=126
Reply from 40.0.0.5: bytes=32 time=1ms TTL=126

Ping statistics for 40.0.0.5:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 2ms, Average = 1ms

PC>

```

## From PC - 5 to All Other PCs:

```

40.0.0.4
Physical Config Desktop Custom Interface

Command Prompt X

Packet Tracer PC Command Line 1.0
PC>ping 10.0.0.3
Pinging 10.0.0.3 with 32 bytes of data:
Reply from 10.0.0.3: bytes=32 time=1ms TTL=126
Reply from 10.0.0.3: bytes=32 time=3ms TTL=126
Reply from 10.0.0.3: bytes=32 time=4ms TTL=126
Reply from 10.0.0.3: bytes=32 time=87ms TTL=126

Ping statistics for 10.0.0.3:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 87ms, Average = 23ms

PC>ping 10.0.0.5
Pinging 10.0.0.5 with 32 bytes of data:
Reply from 10.0.0.5: bytes=32 time=1ms TTL=126
Reply from 10.0.0.5: bytes=32 time=1ms TTL=126
Reply from 10.0.0.5: bytes=32 time=82ms TTL=126
Reply from 10.0.0.5: bytes=32 time=3ms TTL=126

Ping statistics for 10.0.0.5:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 82ms, Average = 21ms

```

40.0.0.4

Physical Config Desktop Custom Interface

### Command Prompt

```
PC>ping 20.0.0.5
Pinging 20.0.0.5 with 32 bytes of data:
Reply from 20.0.0.5: bytes=32 time=6ms TTL=126
Reply from 20.0.0.5: bytes=32 time=1ms TTL=126
Reply from 20.0.0.5: bytes=32 time=1ms TTL=126
Reply from 20.0.0.5: bytes=32 time=1ms TTL=126

Ping statistics for 20.0.0.5:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 6ms, Average = 2ms

PC>ping 20.0.0.3
Pinging 20.0.0.3 with 32 bytes of data:
Reply from 20.0.0.3: bytes=32 time=11ms TTL=126
Reply from 20.0.0.3: bytes=32 time=1ms TTL=126
Reply from 20.0.0.3: bytes=32 time=4ms TTL=126
Reply from 20.0.0.3: bytes=32 time=4ms TTL=126

Ping statistics for 20.0.0.3:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 11ms, Average = 5ms

PC>ping 40.0.0.5
```

40.0.0.4

Physical Config Desktop Custom Interface

### Command Prompt

```
PC>ping 20.0.0.3
Pinging 20.0.0.3 with 32 bytes of data:
Reply from 20.0.0.3: bytes=32 time=11ms TTL=126
Reply from 20.0.0.3: bytes=32 time=1ms TTL=126
Reply from 20.0.0.3: bytes=32 time=4ms TTL=126
Reply from 20.0.0.3: bytes=32 time=4ms TTL=126

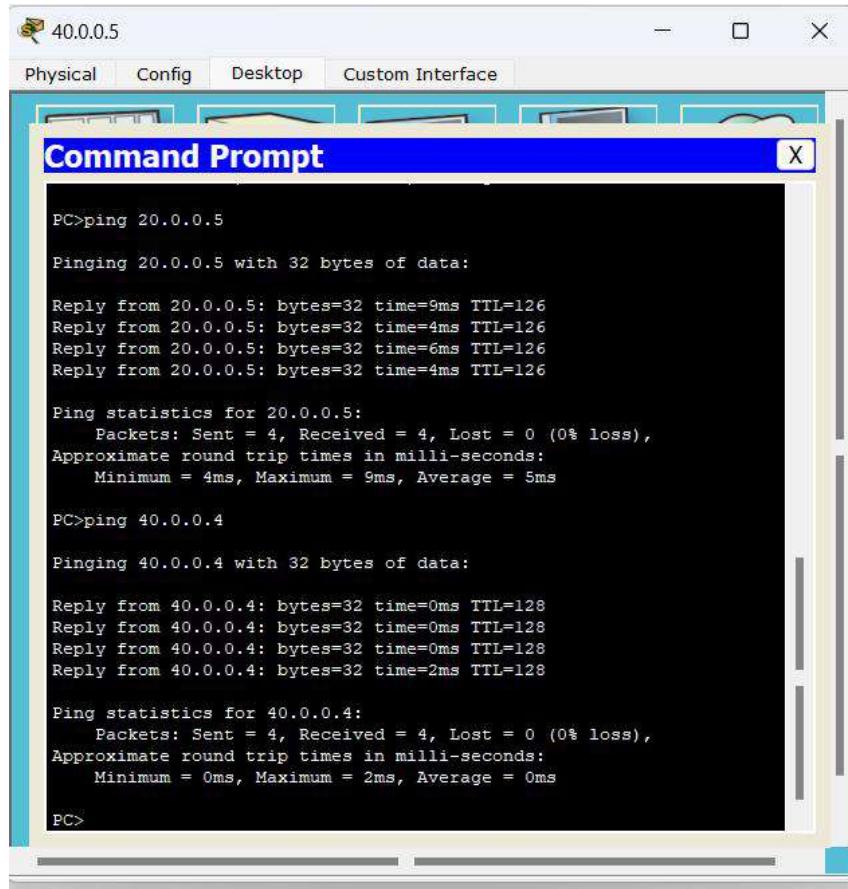
Ping statistics for 20.0.0.3:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 11ms, Average = 5ms

PC>ping 40.0.0.5
Pinging 40.0.0.5 with 32 bytes of data:
Reply from 40.0.0.5: bytes=32 time=4294967295ms TTL=128
Reply from 40.0.0.5: bytes=32 time=0ms TTL=128
Reply from 40.0.0.5: bytes=32 time=0ms TTL=128
Reply from 40.0.0.5: bytes=32 time=0ms TTL=128

Ping statistics for 40.0.0.5:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 4294967295ms, Average = 1073741823ms

PC>
```

## From PC - 6 to All Other PCs:



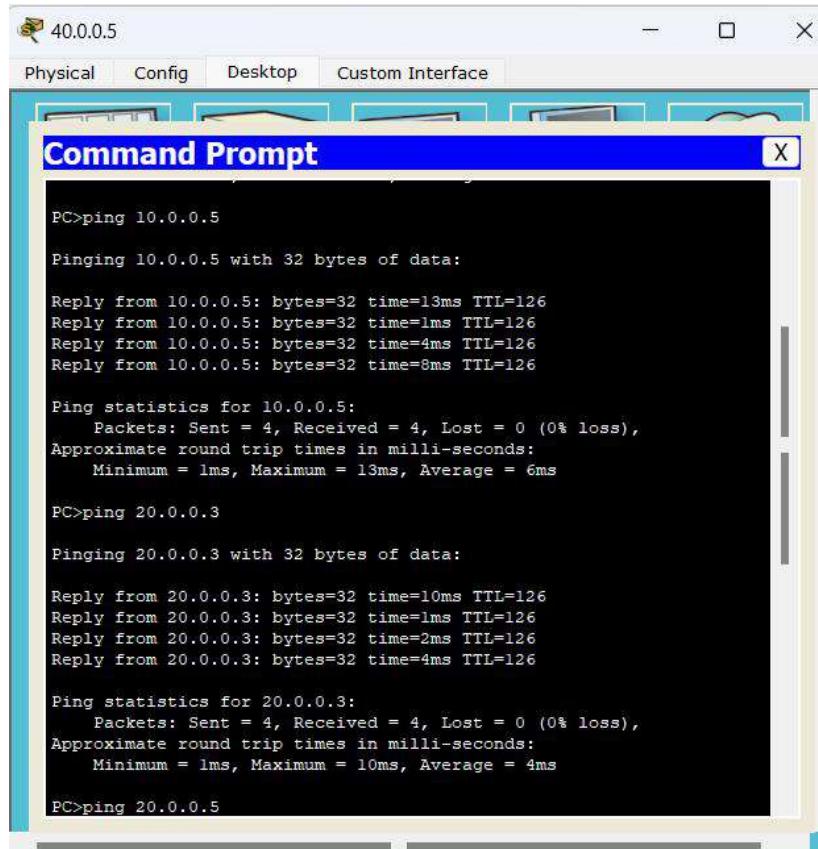
```
PC>ping 20.0.0.5
Pinging 20.0.0.5 with 32 bytes of data:
Reply from 20.0.0.5: bytes=32 time=9ms TTL=126
Reply from 20.0.0.5: bytes=32 time=4ms TTL=126
Reply from 20.0.0.5: bytes=32 time=6ms TTL=126
Reply from 20.0.0.5: bytes=32 time=4ms TTL=126

Ping statistics for 20.0.0.5:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 4ms, Maximum = 9ms, Average = 5ms

PC>ping 40.0.0.4
Pinging 40.0.0.4 with 32 bytes of data:
Reply from 40.0.0.4: bytes=32 time=0ms TTL=128
Reply from 40.0.0.4: bytes=32 time=0ms TTL=128
Reply from 40.0.0.4: bytes=32 time=0ms TTL=128
Reply from 40.0.0.4: bytes=32 time=2ms TTL=128

Ping statistics for 40.0.0.4:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 2ms, Average = 0ms

PC>
```



```
PC>ping 10.0.0.5
Pinging 10.0.0.5 with 32 bytes of data:
Reply from 10.0.0.5: bytes=32 time=13ms TTL=126
Reply from 10.0.0.5: bytes=32 time=1ms TTL=126
Reply from 10.0.0.5: bytes=32 time=4ms TTL=126
Reply from 10.0.0.5: bytes=32 time=8ms TTL=126

Ping statistics for 10.0.0.5:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 13ms, Average = 6ms

PC>ping 20.0.0.3
Pinging 20.0.0.3 with 32 bytes of data:
Reply from 20.0.0.3: bytes=32 time=10ms TTL=126
Reply from 20.0.0.3: bytes=32 time=1ms TTL=126
Reply from 20.0.0.3: bytes=32 time=2ms TTL=126
Reply from 20.0.0.3: bytes=32 time=4ms TTL=126

Ping statistics for 20.0.0.3:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 10ms, Average = 4ms

PC>ping 20.0.0.5
```

40.0.0.5

Physical Config Desktop Custom Interface

**Command Prompt**

```
Packet Tracer PC Command Line 1.0
PC>ping 10.0.0.3

Pinging 10.0.0.3 with 32 bytes of data:

Reply from 10.0.0.3: bytes=32 time=1ms TTL=126
Reply from 10.0.0.3: bytes=32 time=8ms TTL=126
Reply from 10.0.0.3: bytes=32 time=5ms TTL=126
Reply from 10.0.0.3: bytes=32 time=4ms TTL=126

Ping statistics for 10.0.0.3:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 1ms, Maximum = 8ms, Average = 4ms

PC>ping 10.0.0.5

Pinging 10.0.0.5 with 32 bytes of data:

Reply from 10.0.0.5: bytes=32 time=13ms TTL=126
Reply from 10.0.0.5: bytes=32 time=1ms TTL=126
Reply from 10.0.0.5: bytes=32 time=4ms TTL=126
Reply from 10.0.0.5: bytes=32 time=8ms TTL=126

Ping statistics for 10.0.0.5:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 1ms, Maximum = 13ms, Average = 6ms
```

### 2.4.3 Observation Book Pictures:

PAGE NO: \_\_\_\_\_  
DATE: 14/07/2023

Experiment - 4

Configure DHCP within a LAN and outside LAN

Aim: To configure DHCP within a LAN

Topology:

(a)

Procedure :

1. Add 2 Computers, 1 Server and a Switch.  
Connect the PC0 and PC1 to switch via Copper Straight through wire. Connect FastEthernet0 port of PC0 and FastEthernet0 of PC1 to FastEthernet 0/1 and FastEthernet 1/1 port of Switch.  
Connect server to switch via Copper Straight through wire. Connect FastEthernet0 port of Server to FastEthernet 2/1 port of Switch.
2. Configure Servers:  
Click on Server. Then go to Interface → Fast Ethernet  
Enter the static IP address (i.e. 10.0.0.1 and subnet mask: 255.0.0.0).  
Click on Config → Global → Settings.  
Set Gateway (i.e., <sup>state</sup> 10.0.0.2)

→ Server pool decides the pool of IP addresses from which end devices can choose their IP)

PAGE NO.:  
DATE:

Click on services → DHCP.

Turn Service → ON

Set PoolName (i.e. serverPool)

Set Default gateway (i.e. 10.0.0.2)

Set Start IP address (i.e. 10.0.0.3)

Then click on Save button.

### 3. Configure PC0.

Click on PC0 → Config → Interface → Fast Ethernet 0.

Under IP Configuration, select DHCP.

Go to Global Setting → Gateway/DNS. Select DHCP.

Similarly repeat step 3 for PC1 configuration.

#### Result:

For PC0, when we select DHCP, the server assigns an available IP address to PC0 with default gateway.

Similarly, the server does the same for PC1.

#### For PC0:

Gateway: 10.0.0.2

DNS Server: 0.0.0.0

IP address: 10.0.0.4

Subnet mask: 255.0.0.0

#### For PC1:

Gateway: 10.0.0.2

DNS Server: 0.0.0.0

IP address: 10.0.0.5

Subnet mask: 255.0.0.0

Ping from PC0 to PC1:  
PC > ping 10.0.0.5

Pinging 10.0.0.5 with 32 bytes of data:

Reply from 10.0.0.5: bytes=32 time=0 ms TTL=128

Reply from 10.0.0.5: bytes=32 time=1ms TTL=128

Reply from 10.0.0.5: bytes=32 time=0ms TTL=128

Reply from 10.0.0.5: bytes=32 time=0ms TTL=128

Ping statistics for 10.0.0.5:

Packets: Sent = 4, Received = 4, Lost = 0 (0% loss)

Approximate round trip times in milli-seconds:

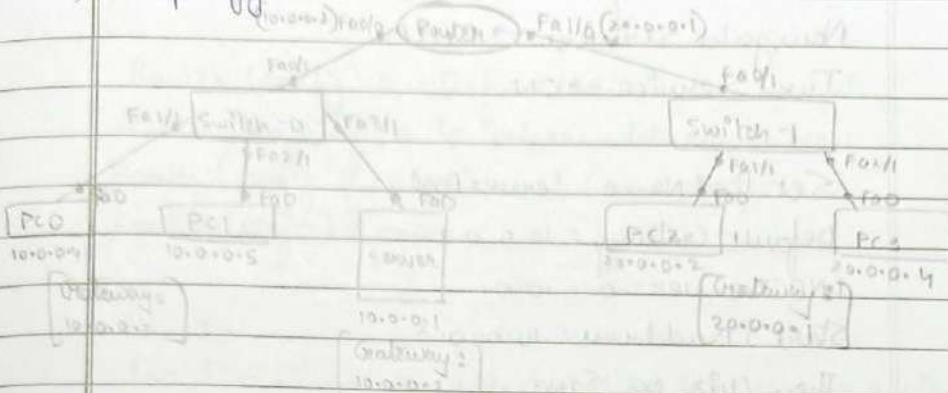
Minimum = 0ms Maximum = 1ms, Average = 0ms

Observation:

DHCP servers are used to allocate IP addresses for end devices in networks where the no. of users is very high. DHCP can allocate IP addresses, default gateway, and DNS server address.

Aim: To configure DHCPS for 2 networks connected via Router.

(b) Topology:



Procedure:

1. Add 4 PCs, 2 switches, 1 router, 1 server. Connect PC0 and PC1 to switch 0 through Copper straight through wire via Fast Ethernet 0/0 port on PC0 and Fast Ethernet 1/1 port on PC1 to Fast Ethernet 0/1 and Fast Ethernet 1/1 ports on switch 0 respectively. Connect switch to server via Copper straight through wire via Fast Ethernet 0/0 port on server to Fast Ethernet 3/1 port on switch.

Similarly repeat the same steps to connect PC2 and PC3 to switch-1.

Connect Switch-0 and switch-1 to Router-0 through Copper straight through wire via Fast Ethernet 0/1 port on Switch-0 and Fast Ethernet 0/1 to Fast Ethernet 0/0 and Fast Ethernet 1/0 ports on Router-0 respectively.

2. Configure Server:

Click on Server → Config → Interface → Fast Ethernet 0. Under IP-configuration, set static IP address (e.g.: 10.0.0.1) and subnet mask 255.0.0.0.

Now Go to Config → Global → Settings.

Set Gateway → 10.0.0.2.

Now, go to Services → DHCP.

Turn Service → ON.

Set Pool Name: ServerPool

Default Gateway: 10.0.0.2

DNS Server: 0.0.0.0

Start IP address: 10.0.0.3

Then click on Save.

Now,

Set Pool Name: ServerPool - 2

Default Gateway: 20.0.0.1

DNS Server: 0.0.0.0

Start IP address: 20.0.0.2

Then Click on Save.

### 3. Router Configuration:

Click on Router → CLI

Set IP addresses for interfaces Fa0/0 & Fa1/0

Router > enable

Router # Configure terminal

Router (config) # interface Fa0/0

Router (config-if) # ip address 10.0.0.2 255.0.0.0

Router (config-if) # no shutdown

Router (config-if) # exit.

Router (config) # interface Fa1/0

Router (config-if) # ip address 20.0.0.1 255.0.0.0

Router (config-if) # no shutdown

Router (config-if) # exit

Now,

```
Router (config) # interface Fa1/0.  
Router (config-if) # ip helper-address 10.0.0.1  
Router (config-if) # exit  
Router (config) # exit
```

Result:

For PC0 when we select DHCP, the server assigns an available IP address to PC0.

By for PC1, PC2 & PC3.

For PC0:

Gateway: 10.0.0.2

DNS Server: 0.0.0.0

IP address: 10.0.0.4

Subnet Mask: 255.0.0.0

For PC1:

Gateway: 10.0.0.2

DNS Server: 0.0.0.0

IP address: 10.0.0.5

Subnet Mask: 255.0.0.0

For PC2:

Gateway: 20.0.0.1

DNS Server: 0.0.0.0

IP address: 20.0.0.2

Subnet Mask: 255.0.0.0



For PC3:

Gateway: 20.0.0.1

DNS Server: 0.0.0.6

IP Address: 20.0.0.4

Subnet Mask: 255.0.0.0

Ping from PC0 to PC3:  
PC > ping 20.0.0.4

Pinging 20.0.0.4 with 32 bytes of data:

Reply from 20.0.0.4: bytes=32 time=0ms TTL=127

Ping statistics for 20.0.0.4:

Packets: Sent=4, Received=4, Lost=0 (0% loss)

Approximate round-trip times in milliseconds:

Minimum=0ms, Maximum=0ms, Average=0ms

Observation:

To configure ip ~~helper~~ address of a network with no DHCP server, the interface of router it is connected to should be provided with ip ~~helper~~ address that is same as ip of DHCP server.

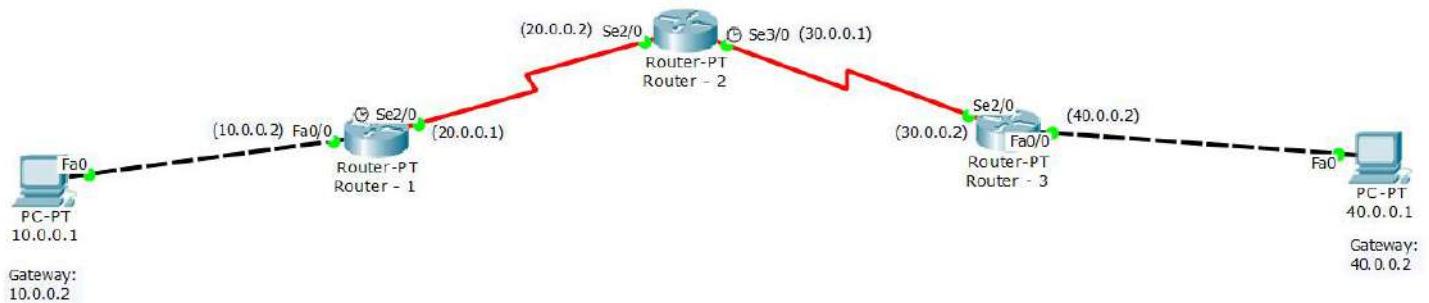
## 2.5 Experiment - 5:

### 2.5.1 Question:

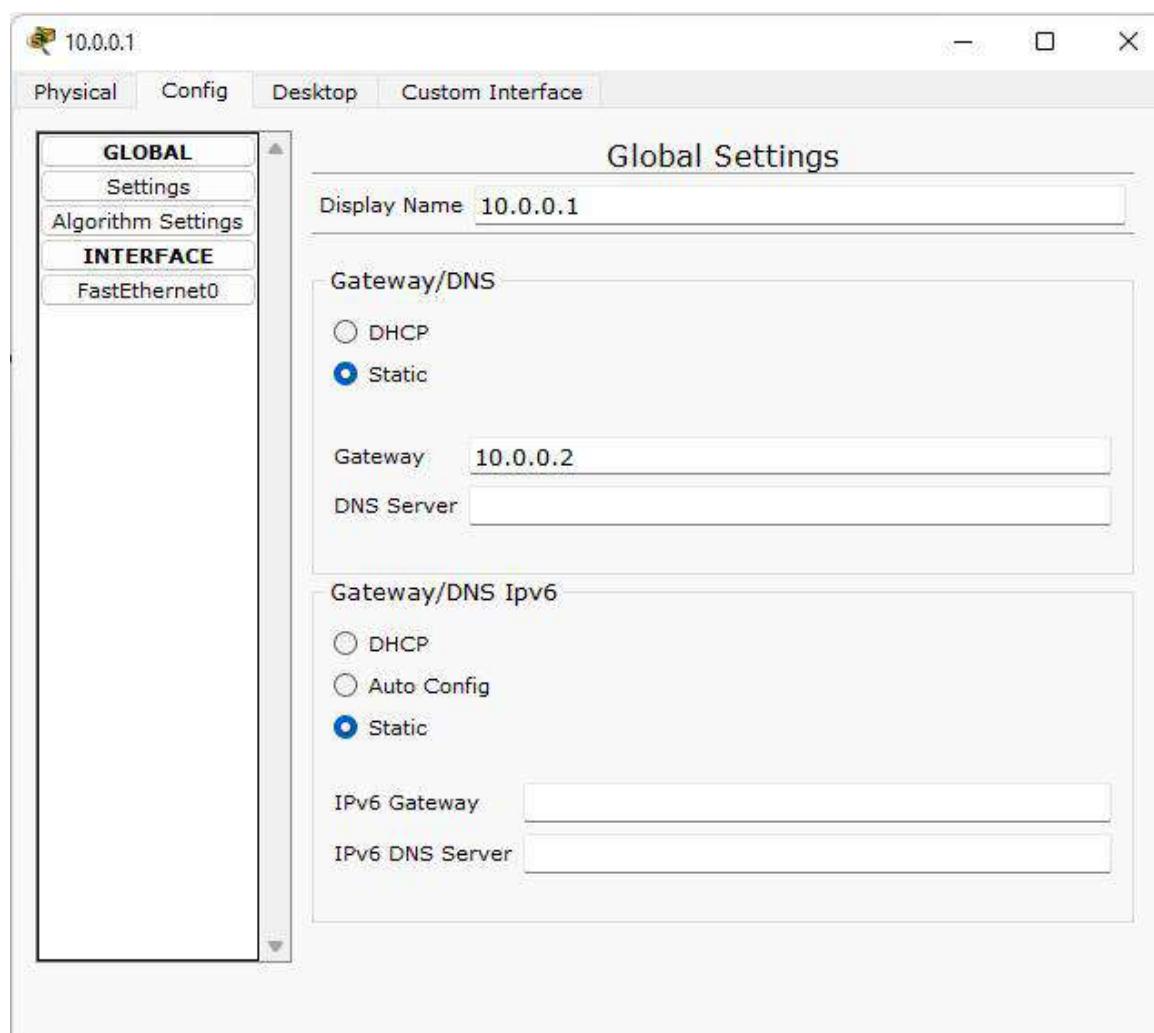
Configure RIP routing Protocol in Routers.

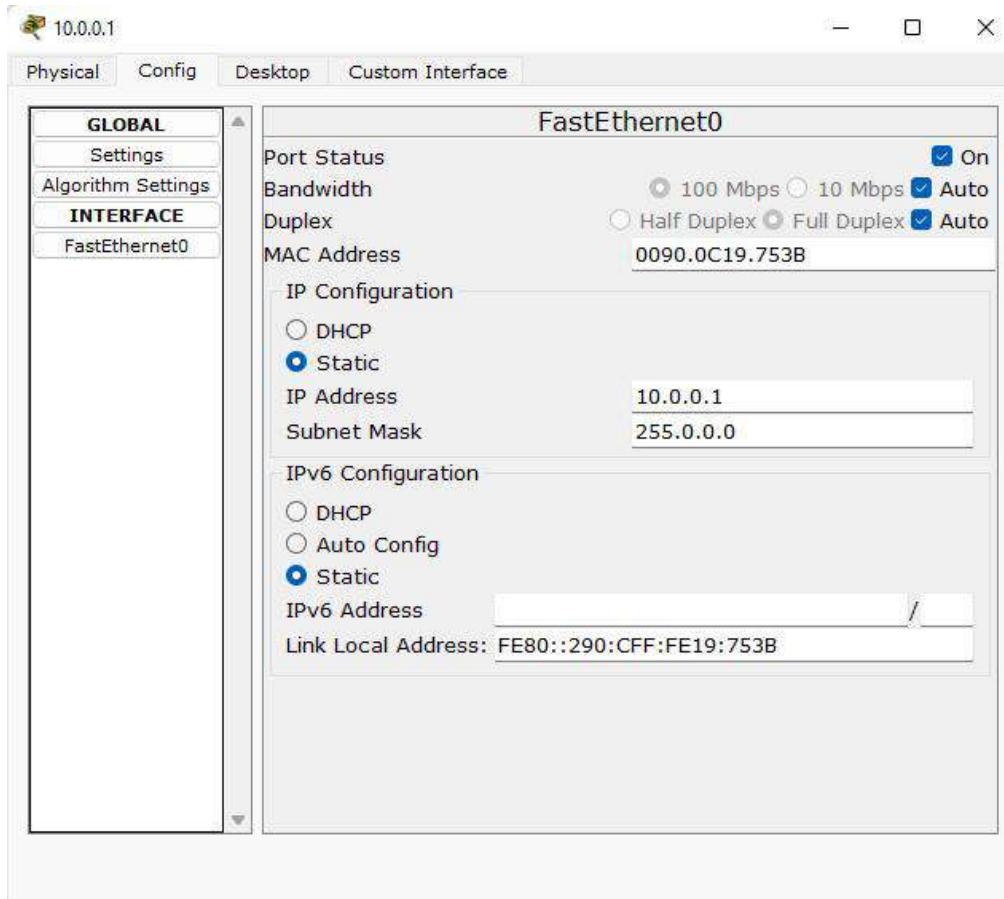
### 2.5.2 Screenshots (Topology, Configurations & Output):

#### Topology:

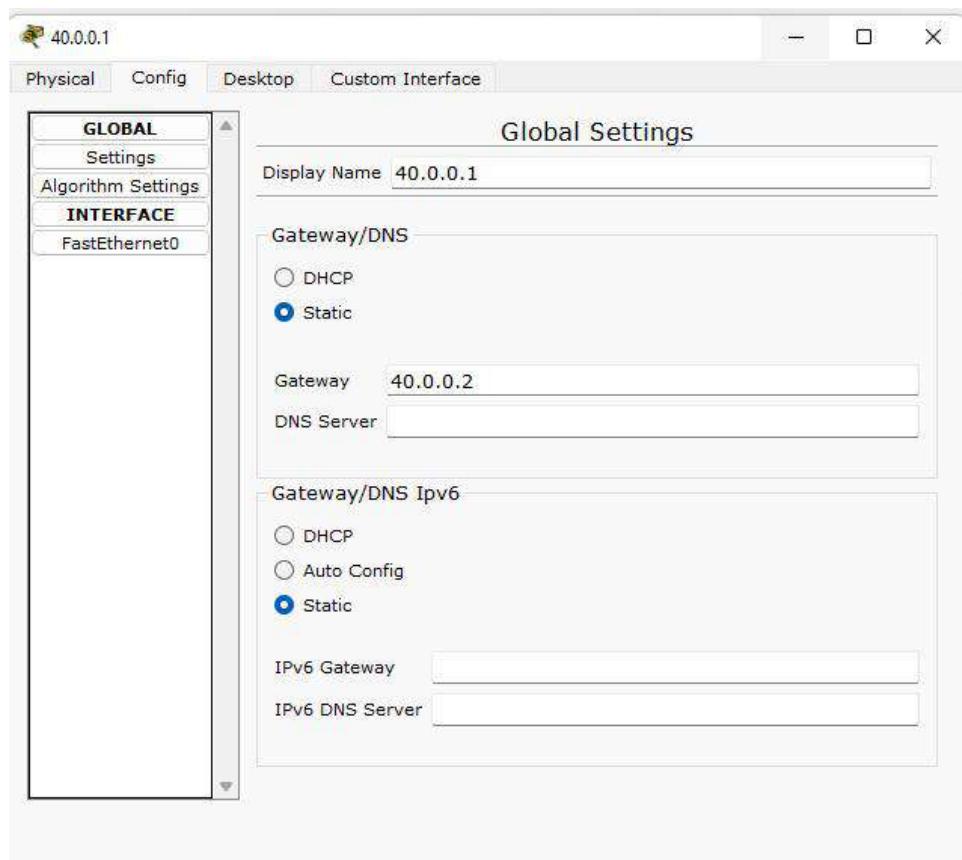


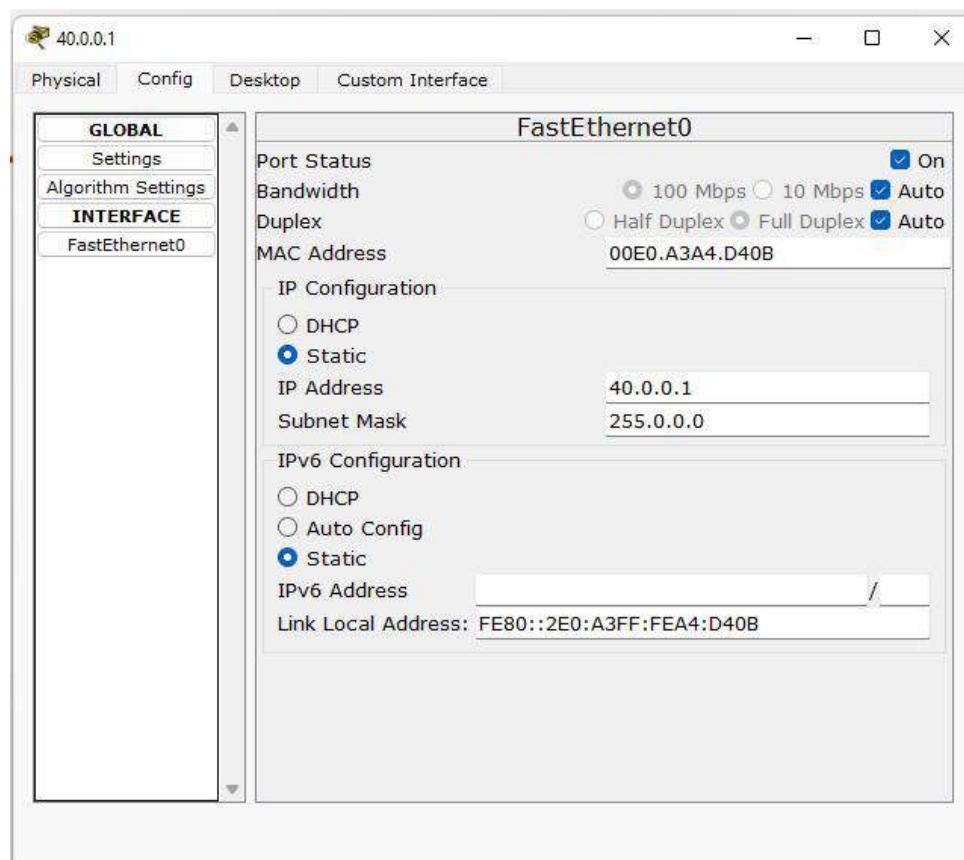
#### PC - 1 Configuration:





## PC - 2 Configuration:





## Router - 1 Configuration:

Router - 1

Physical Config CLI

IOS Command Line Interface

```

Continue with configuration dialog? [yes/no]: no

Press RETURN to get started!

Router>enable
Router#configure terminal
Enter configuration commands, one per line.. End with CNTL/Z.
Router(config)#interface Fa0/0
Router(config-if)#ip address 10.0.0.2 255.0.0.0
Router(config-if)#no shutdown

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

Router(config-if)#wxit
^C
% Invalid input detected at '^' marker.

Router(config-if)#exit
Router(config)#interface Se2/0
Router(config-if)#ip address 20.0.0.1 255.0.0.0
Router(config-if)#no shutdown

%LINK-5-CHANGED: Interface Serial2/0, changed state to down
Router(config-if)#encapsulation ppp
Router(config-if)#clock rate 64000
Router(config-if)#exit

```

Copy Paste

Router - 1

Physical Config CLI

IOS Command Line Interface

```
Router(config-if)#  
%LINK-5-CHANGED: Interface FastEthernet0/0, changed state to up  
  
Router(config-if)#wxit  
^  
% Invalid input detected at '^' marker.  
  
Router(config-if)#exit  
Router(config)#interface Se2/0  
Router(config-if)#ip address 20.0.0.1 255.0.0.0  
Router(config-if)#no shutdown  
  
%LINK-5-CHANGED: Interface Serial2/0, changed state to down  
Router(config-if)#encapsulation ppp  
Router(config-if)#clock rate 64000  
Router(config-if)#exit  
Router(config)#  
%LINK-5-CHANGED: Interface Serial2/0, changed state to up  
  
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial2/0, changed state to up  
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to up  
  
Router(config)#route rip  
Router(config-router)#network 10.0.0.0  
Router(config-router)#network 20.0.0.0  
Router(config-router)#exit  
Router(config)#
```

Copy Paste

## Router - 2 Configuration:

Router - 2

Physical Config CLI

IOS Command Line Interface

```
Continue with configuration dialog? [yes/no]: n  
  
Press RETURN to get started!  
  
Router>enable  
Router#config t  
Enter configuration commands, one per line. End with CNTL/Z.  
Router(config)#interface Se2/0  
Router(config-if)#ip address 20.0.0.2 255.0.0.0  
Router(config-if)#no shutdown  
  
Router(config-if)#  
%LINK-5-CHANGED: Interface Serial2/0, changed state to up  
  
Router(config-if)#encapsulation ppp  
Router(config-if)#  
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial2/0, changed state to up  
  
Router(config-if)#exit  
Router(config)#interface Se3/0  
Router(config-if)#ip address 30.0.0.1 255.0.0.0  
Router(config-if)#no shutdown  
  
%LINK-5-CHANGED: Interface Serial3/0, changed state to down  
Router(config-if)#encapsulation ppp  
Router(config-if)#exit
```

Copy Paste

Router - 2

Physical Config CLI

IOS Command Line Interface

```
Router(config) interface serial1/0 no shutdown
Router(config-if)#
%LINK-5-CHANGED: Interface Serial1/0, changed state to up

Router(config-if) encapsulation ppp
Router(config-if)#
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial1/0, changed state to up

Router(config-if) exit
Router(config) interface Se3/0
Router(config-if) ip address 30.0.0.1 255.0.0.0
Router(config-if) no shutdown

%LINK-5-CHANGED: Interface Serial3/0, changed state to down
Router(config-if) encapsulation ppp
Router(config-if) exit
Router(config)#
%LINK-5-CHANGED: Interface Serial3/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial3/0, changed state to up

Router(config) interface Se3/0
Router(config-if) clock rate 64000
Router(config-if) exit
Router(config) route rip
Router(config-router) network 20.0.0.0
Router(config-router) network 30.0.0.0
Router(config-router) exit
Router(config)#

```

Copy Paste

## Router - 3 Configuration:

Router - 3

Physical Config CLI

IOS Command Line Interface

```
Continue with configuration dialog? [yes/no]: no

Press RETURN to get started!

Router>enable
Router#config t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#interface Se2/0
Router(config-if) ip address 30.0.0.2 255.0.0.0
Router(config-if) no shutdown

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

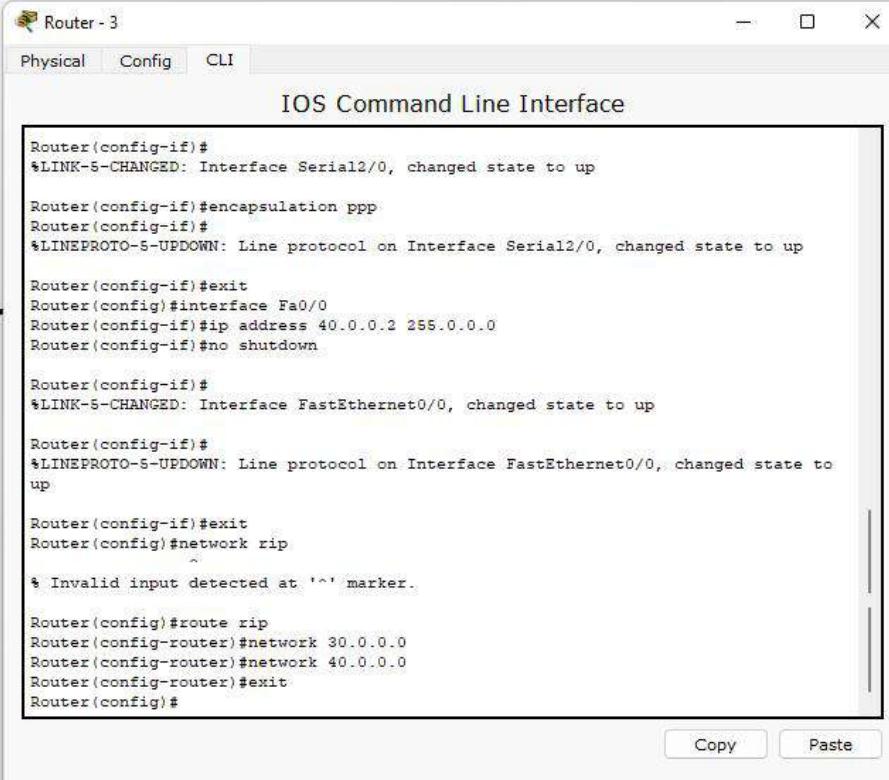
Router(config-if) encapsulation ppp
Router(config-if)#
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial2/0, changed state to up

Router(config-if) exit
Router(config) interface Fa0/0
Router(config-if) ip address 40.0.0.2 255.0.0.0
Router(config-if) no shutdown

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

```

Copy Paste



The screenshot shows the Router - 3 window with the CLI tab selected. The terminal window displays the following configuration commands:

```

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

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

Router(config-if)#exit
Router(config)#interface Fa0/0
Router(config-if)#ip address 40.0.0.2 255.0.0.0
Router(config-if)#no shutdown

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

Router(config-if)#
*LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to up

Router(config-if)#exit
Router(config)#network rip
^
* Invalid input detected at '^' marker.

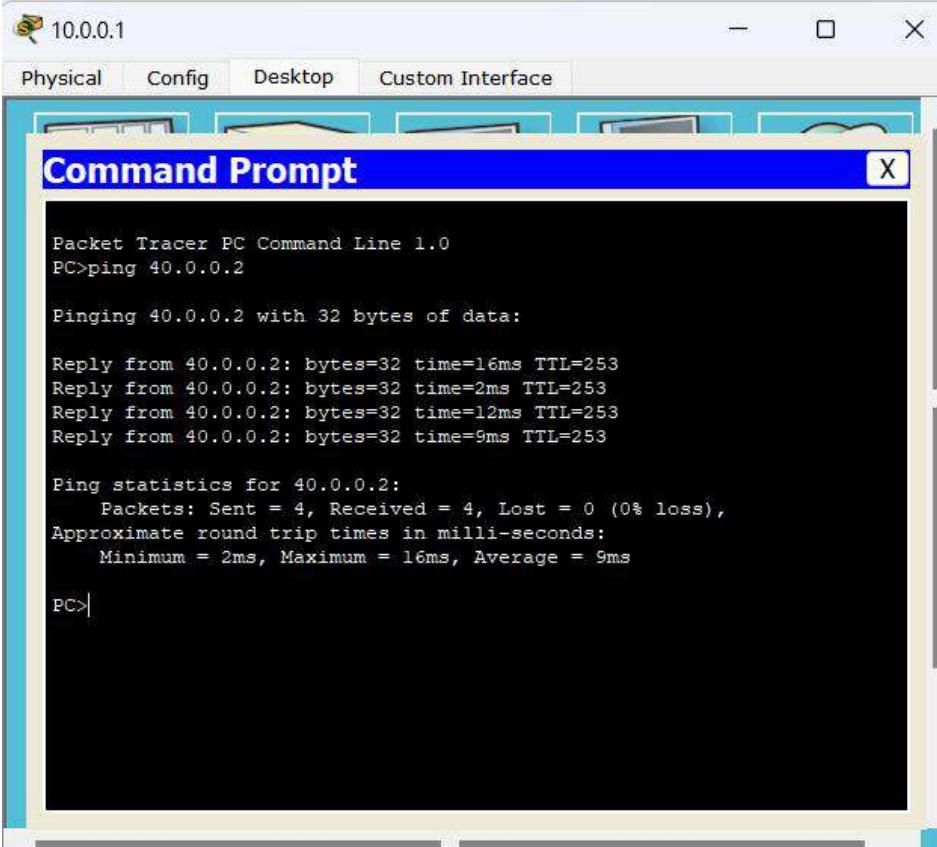
Router(config)#route rip
Router(config-router)#network 30.0.0.0
Router(config-router)#network 40.0.0.0
Router(config-router)#exit
Router(config)#

```

At the bottom of the terminal window, there are "Copy" and "Paste" buttons.

## Output:

Ping from PC - 1 to PC - 2:



The screenshot shows the PC - 1 window with the Custom Interface tab selected. The terminal window titled "Command Prompt" displays the following ping results:

```

Packet Tracer PC Command Line 1.0
PC>ping 40.0.0.2

Pinging 40.0.0.2 with 32 bytes of data:

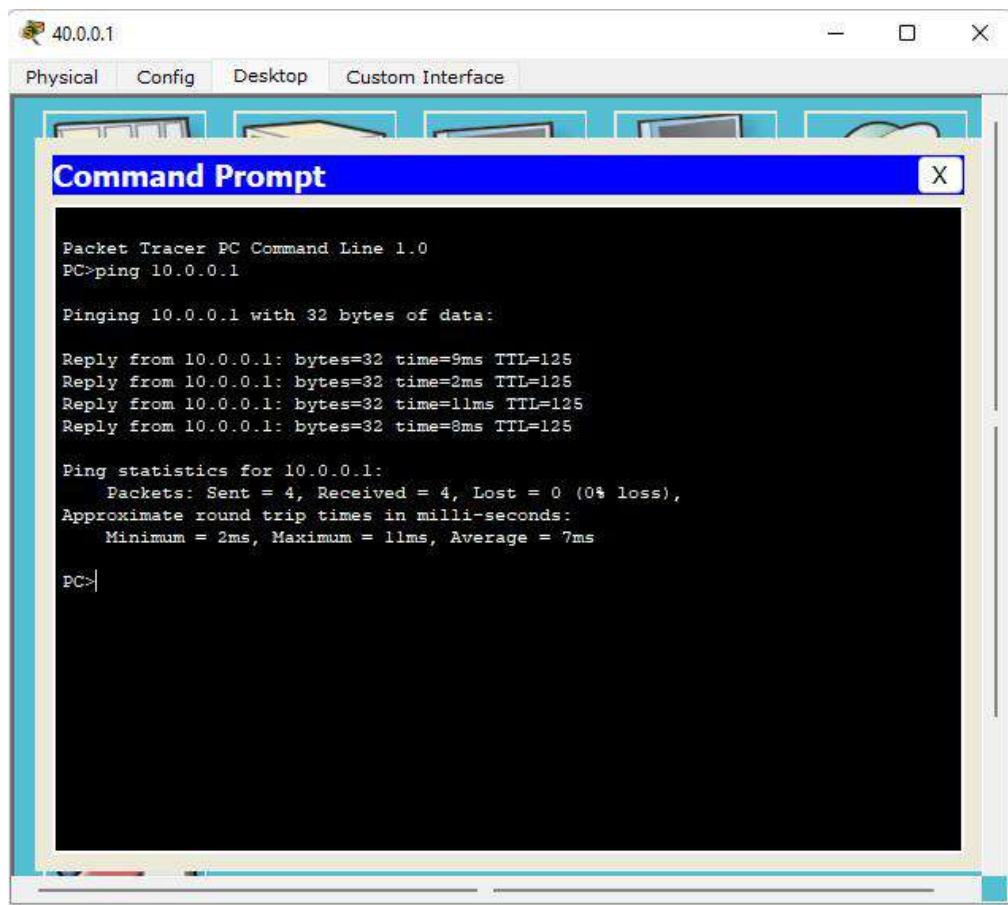
Reply from 40.0.0.2: bytes=32 time=16ms TTL=253
Reply from 40.0.0.2: bytes=32 time=2ms TTL=253
Reply from 40.0.0.2: bytes=32 time=12ms TTL=253
Reply from 40.0.0.2: bytes=32 time=9ms TTL=253

Ping statistics for 40.0.0.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 2ms, Maximum = 16ms, Average = 9ms

PC>

```

## Ping from PC - 2 to PC - 1:



The screenshot shows a Windows-style window titled "Command Prompt" running on a virtual machine. The title bar includes icons for a mouse, the IP address 40.0.0.1, and tabs for Physical, Config, Desktop, and Custom Interface. The main window displays the output of a ping command:

```
Packet Tracer PC Command Line 1.0
PC>ping 10.0.0.1

Pinging 10.0.0.1 with 32 bytes of data:

Reply from 10.0.0.1: bytes=32 time=5ms TTL=125
Reply from 10.0.0.1: bytes=32 time=2ms TTL=125
Reply from 10.0.0.1: bytes=32 time=11ms TTL=125
Reply from 10.0.0.1: bytes=32 time=8ms TTL=125

Ping statistics for 10.0.0.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 2ms, Maximum = 11ms, Average = 7ms

PC>
```

### 2.5.3 Observation Book Pictures:

PAGE NO :  
DATE : 21/07/2023

Experiment - 5

Configure RIP routing Protocol in Routers.

Aim : Simulate RIP using 3 Routers

Topology :

Procedure :

1. Add 3 routers and 2 PCs.
2. Connect PC1 to Router1 using Copper cross over wire from Fast Ethernet 0 port of PC1 to FastEthernet0/0 port of Router-1. Similarly repeat this step to connect PC2 to Router-3. Now connect Router-1 to Router-2 using Serial DCE wire from Serial2/0 port of Router-1 to Serial 2/0 port of Router-2. Similarly connect Router-3 to Router-2 using serial DCE wire from Serial 2/0 port of Router-3 to Serial 3/0 port of Router-2.

2. PC-1 Configuration

Click on PC-1 → Config → Interface → FastEthernet0.

Assign static IP address to PC-1 [(10.0.0.1) and Subnet mask : 255.0.0.0]

Set default gateway → 10.0.0.2

→

3. PC-2 Configuration :

Click on PC-2 → Config → Interface → FastEthernet0.

Assign static IP address to PC-2 [i.e. 40.0.0.1] and subnet mask : 255.0.0.0.

Set default gateway → 40.0.0.2.

4. a) Router-1 Configuration : (assign ip addresses to interfaces)

Router > enable

Router # Configure terminal

Router (config) # interface Fa0/0

Router (config-if) # ip address 10.0.0.1 255.0.0.0

Router (config-if) # no shutdown

Router (config-if) # exit

Router (config) # interface Sc2/0

Router (config-if) # ip address 20.0.0.1 255.0.0.0

Router (config-if) # no shutdown

b) Router-2 Configuration : (assign ip addresses to interfaces)

Router > enable

Router # Configure terminal

Router (config) # interface Sc2/0

Router (config-if) # ip address 20.0.0.2 255.0.0.0

Router (config-if) # no shutdown

Router (config-if) # exit

Router (config) # interface Sc3/0

Router (config-if) # ip address 30.0.0.1 255.0.0.0

Router (config-if) # no shutdown

Router (config-if) # exit

C) Router-3 Configuration (assign ip addresses to interfaces)

Router > enable

Router # configure terminal

Router (config) # interface Se2/0

Router(config-if) # ip address 30.0.0.2 255.0.0.0

Router(config-if) # no shutdown

Router(config-if) # exit

Router(config) # interface Fa0/0

Router(config-if) # ip address 40.0.0.2 255.0.0.0

Router(config-if) # no shutdown

Router(config-if) # exit

5. Connection b/w all devices is green.

6. Now we use RIP routing protocols in all routers.

RIP stands for Routing information protocol. RIP is a distance vector protocol that uses hop count as its primary metric. RIP defines how routers should share information when moving traffic among an interconnected group of local area networks.

Point-to-point Protocol (PPP) is a layer 2 communications protocol. PPP encapsulates multiprotocol data over point-to-point links. PPP encapsulation is the default encapsulation type for physical interfaces.

The clock rate command is used only on serial interfaces that are acting as DCE (data circuit terminating equipment) interfaces. DCE interfaces are responsible for providing the clock signal for the line. If we use the clock rate 64000 command on a serial interface, it will physically transfer transmit at 64 Kbps. →

So a serial interface transmits at 10.544 Mbps by default, we can change that by using the 'clock rate' command to set a transmit rate in Kbps.

7. a) Router-1 Configuration: (apply step-6)

```
Router (config) # interface Se 2/0  
Router (config-if) # encapsulation ppp  
Router (config-if) # clock rate 64000  
Router (config-if) # exit.
```

```
Router (config) # route rip.  
Router (config-router) # network 10.0.0.0  
Router (config-router) # network 20.0.0.0  
Router (config-router) # exit.
```

b) Router-2 Configuration (apply step-6)

```
Router (config) # interface Se 3/0  
Router (config-if) # encapsulation ppp  
Router (config-if) # clock rate 64000  
Router (config-if) # exit.
```

```
Router (config) # route rip.  
Router (config-router) # network 20.0.0.0  
Router (config-router) # network 30.0.0.0  
Router (config-router) # exit.
```

```
Router (config) # interface Se 2/0  
Router (config-if) # encapsulation ppp  
Router (config-if) # exit.
```



Q) Router-3 Configuration : (apply step-6)

Router (config) # interface Se2/0

Router (config-if) # encapsulation ppp

Router (config-if) # exit

Router (config) # route rip.

Router (config-router) # network 30.0.0.0

Router (config-router) # network 40.0.0.0

Router (config-router) # exit

### Result:

② Ping from PC-1 to PC-2

PC > ping 40.0.0.1

Pinging 40.0.0.1 with 32 bytes of data

Reply from 40.0.0.1: bytes = 32 time = 16 ms TTL = 253

Reply from 40.0.0.1: bytes = 32 time = 2 ms TTL = 253

Reply from 40.0.0.1: bytes = 32 time = 12 ms TTL = 253

Reply from 40.0.0.1: bytes = 32 time = 9 ms TTL = 253

Ping statistics for 40.0.0.1:

Packet: Sent = 4, Received = 4, lost = 0 (0% loss)

Approximate round-trip times in milli-seconds:

Minimum = 2 ms, Maximum = 16 ms, Average = 9 ms

b) Ping from PC-2 to PC-1

PC > ping 10.0.0.1

Pinging 10.0.0.1 with 32 bytes of data:

Reply from 10.0.0.1: bytes = 32 time = 9 ms TTL = 125

Reply from 10.0.0.1: bytes = 32 time = 2 ms TTL = 125

Reply from 10.0.0.1 : byter=32, time = 11ms, TTL=125  
Reply from 10.0.0.1 : byter=32, time = 8ms, TTL=125

Ping statistics for 10.0.0.1:

Packets: Sent = 4, Received = 4, Lost = 0 (0% loss)

Approximate round trip times in milli-seconds:

Minimum = 2ms, Maximum = 11ms, Average = 7ms.

#### Observation:

PPP encapsulates multiprotocol data over point-to-point links. The clock rate command is used only on serial interfaces that are acting as DCE. DCE interfaces are responsible for providing clock signal for the line. RIP defines how routers should share info. when moving traffic among an interconnected group of local area networks.

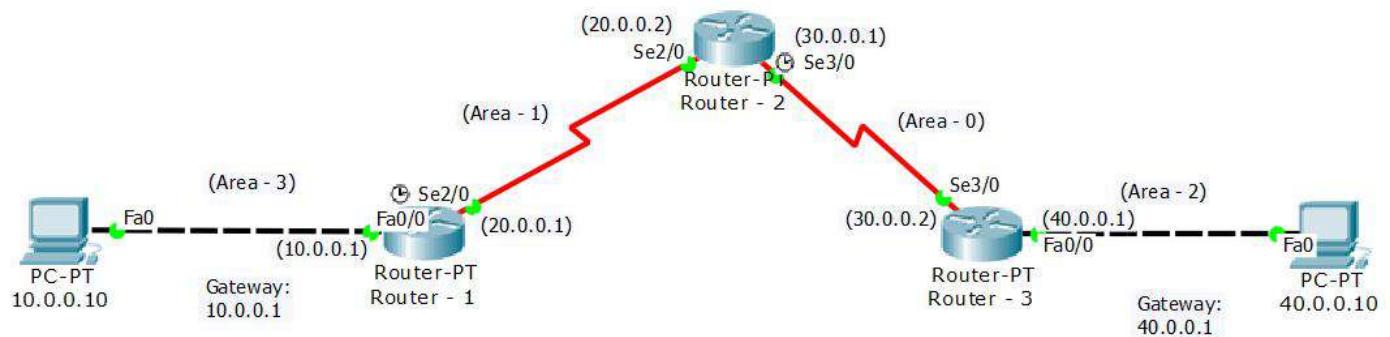
## 2.6 Experiment - 6:

### 2.6.1 Question:

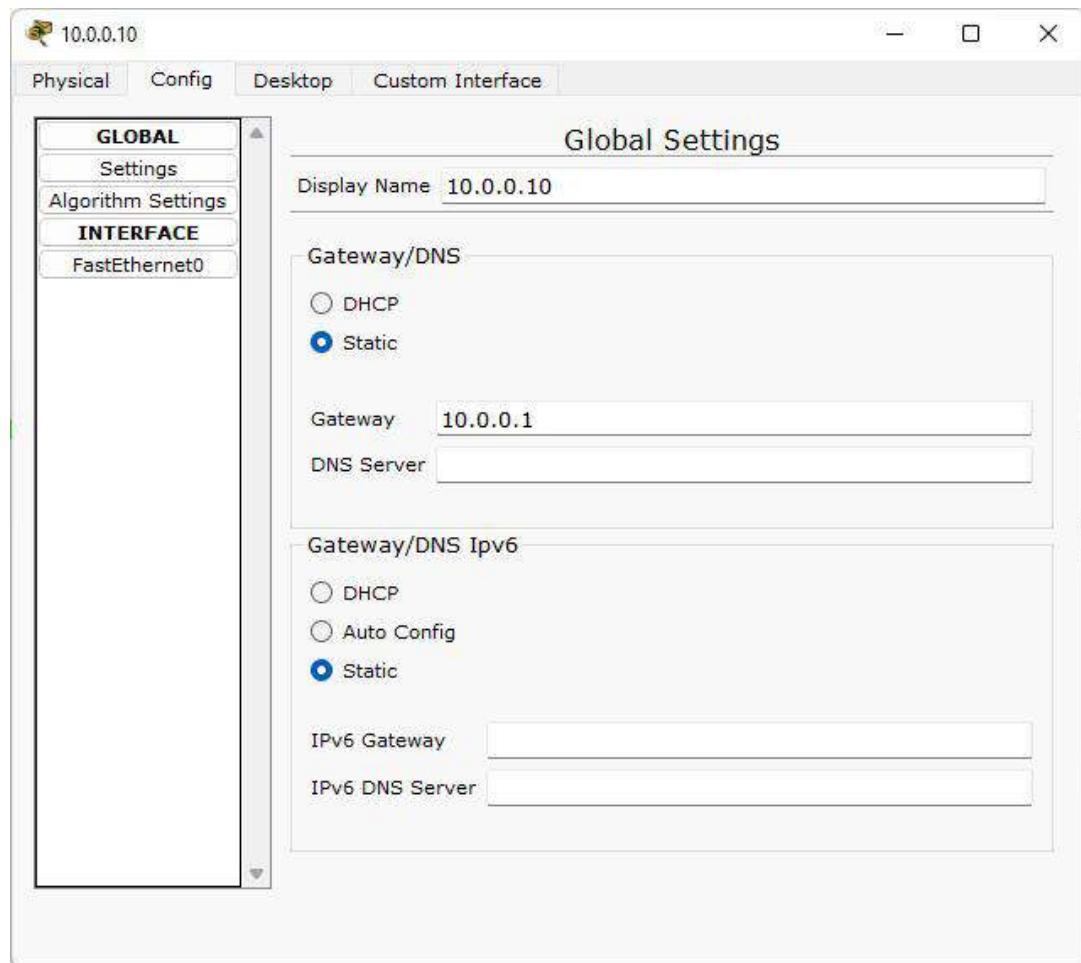
Configure OSPF routing protocol.

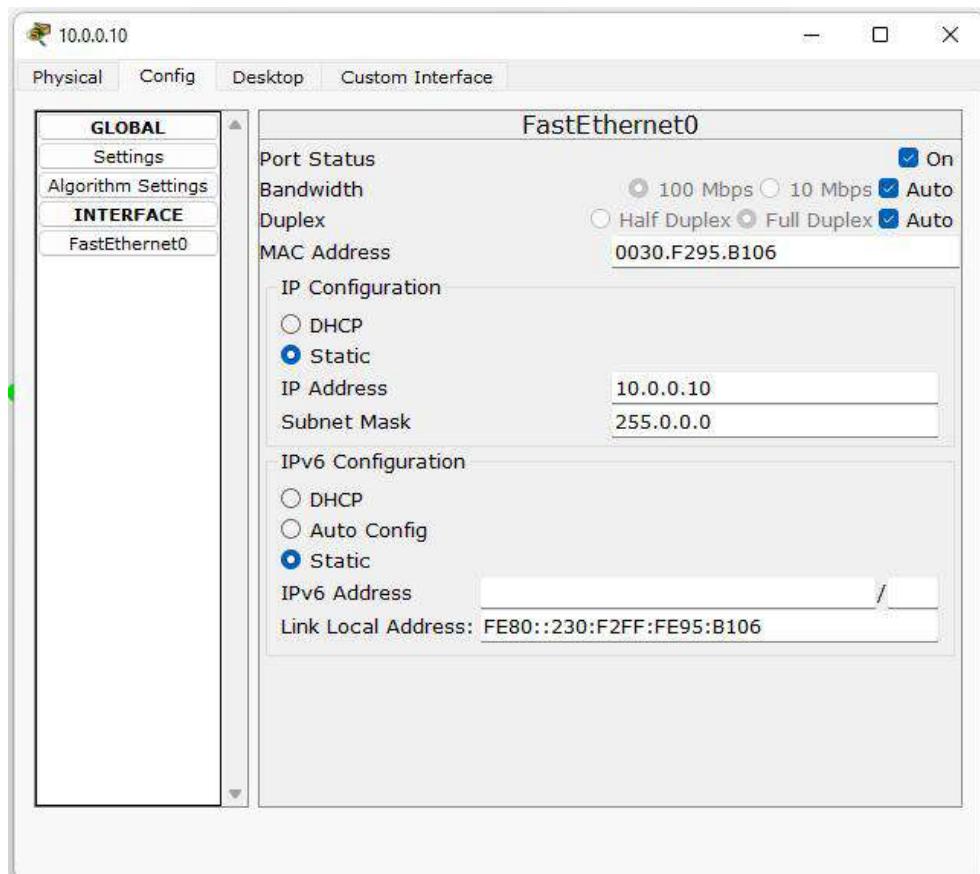
### 2.6.2 Screenshots (Topology, Configurations & Output):

#### Topology:

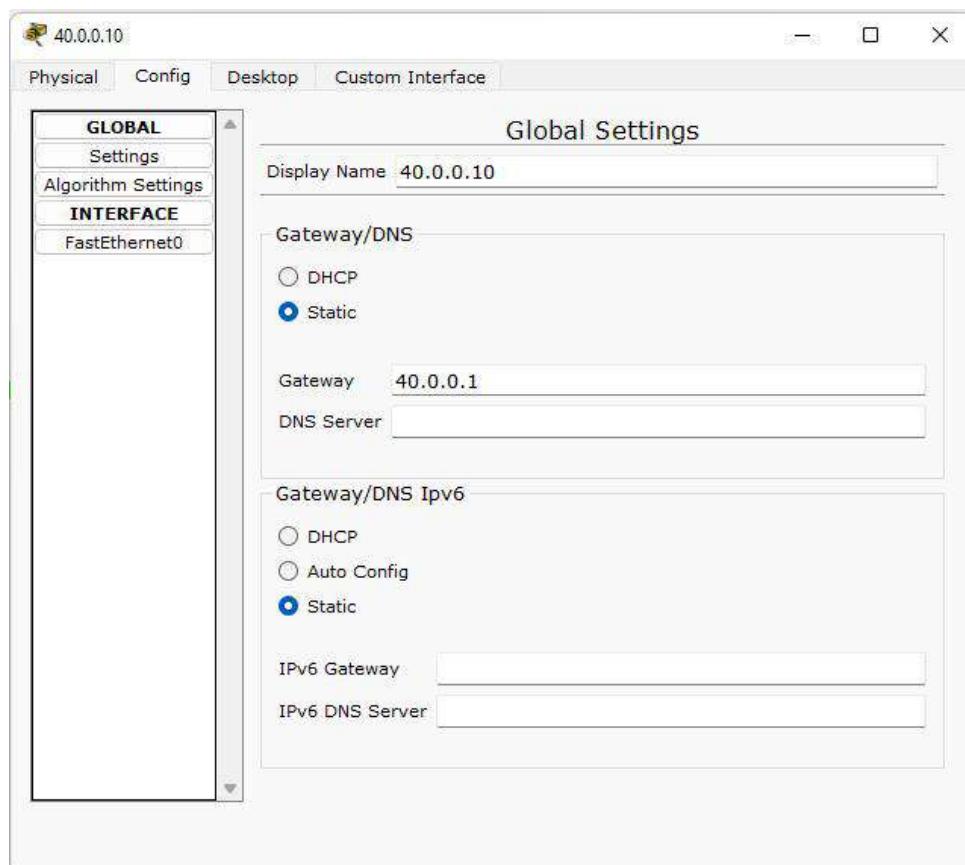


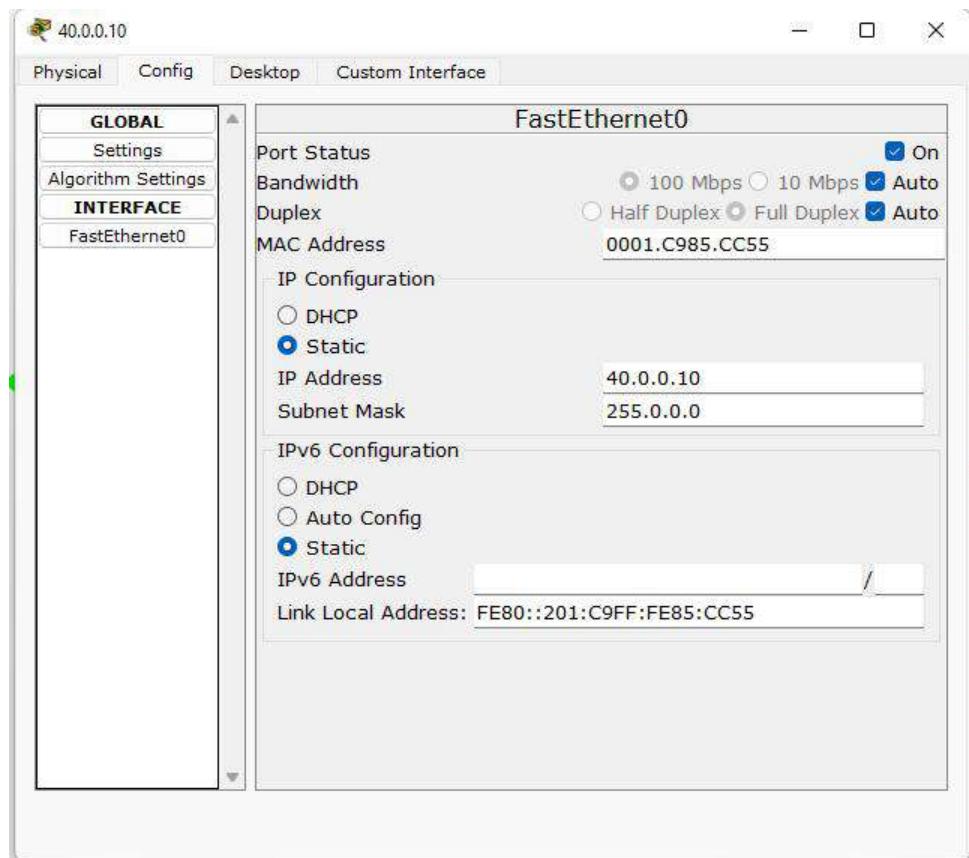
#### PC - 1 Configuration:





## PC - 2 Configuration:





## Router - 1 Configuration:

The screenshot shows the "IOS Command Line Interface" window with the title "Router - 1". The tabs at the top are "Physical", "Config", and "CLI", with "Config" selected. The main area displays the configuration commands entered:

```
Router>enable
Router#config t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#interface Fa0/0
Router(config-if)#ip address 10.0.0.1 255.0.0.0
Router(config-if)#no shut

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

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

Router(config-if)#exit
^
* Invalid input detected at '^' marker.

Router(config-if)#exit
Router(config)#interface Se2/0
Router(config-if)#ip address 20.0.0.1 255.0.0.0
Router(config-if)#encapsulation ppp
Router(config-if)#clock rate 64000
Router(config-if)#no shut

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

*LINEPROTO-5-UPDOWN: Line protocol on Interface Serial2/0, changed state to up
```

At the bottom right of the CLI window, there are "Copy" and "Paste" buttons.

Router - 1

Physical Config CLI

IOS Command Line Interface

```
Router>enable
Router#config t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#interface Fa0/0
Router(config-if)#ip address 10.0.0.1 255.0.0.0
Router(config-if)#no shut

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

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

Router(config-if)#exit
^
* Invalid input detected at '^' marker.

Router(config-if)#exit
Router(config)#interface Se2/0
Router(config-if)#ip address 20.0.0.1 255.0.0.0
Router(config-if)#encapsulation ppp
Router(config-if)#clock rate 64000
Router(config-if)#no shut

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

*LINEPROTO-5-UPDOWN: Line protocol on Interface Serial2/0, changed state to up

Router(config)#exit
```

Copy Paste

Router - 1

Physical Config CLI

IOS Command Line Interface

```
Router>enable
Router#config t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#router ospf 1
Router(config-router)#router-id 1.1.1.1
Router(config-router)#network 10.0.0.0 0.255.255.255 area 3
Router(config-router)#network 20.0.0.0 0.255.255.255 area 1
Router(config-router)#exit
Router(config)#
00:14:47: %OSPF-5-ADJCHG: Process 1, Nbr 2.2.2.2 on Serial2/0 from LOADING to FULL, Loading Done

Router(config)#interface Se2/0
Router(config-if)#interface loopback 0

Router(config-if)#
*LINK-5-CHANGED: Interface Loopback0, changed state to up

*LINEPROTO-5-UPDOWN: Line protocol on Interface Loopback0, changed state to up

Router(config-if)#ip address 172.16.1.252 255.255.0.0
Router(config-if)#no shut
Router(config-if)#exit
Router(config)#router ospf 1
Router(config-router)#area 1 virtual-link 2.2.2.2
Router(config-router)#exit
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console

Router#
```

Copy Paste

**Router - 1**

Physical Config CLI

IOS Command Line Interface

```

Router(config-if)#no shut
Router(config-if)#exit
Router(config)#router ospf 1
Router(config-router)#area 1 virtual-link 2.2.2.2
Router(config-router)#exit
Router(config)#exit
Router#
*SYS-5-CONFIG_I: Configured from console by console

Router#
00:22:08: %OSPF-5-ADJCHG: Process 1, Nbr 2.2.2.2 on OSPF_VL0 from LOADING to FULL,
Loading Done

Router#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
      D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
      N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
      E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
      i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
      * - candidate default, U - per-user static route, o - ODR
      P - periodic downloaded static route

Gateway of last resort is not set

C    10.0.0.0/8 is directly connected, FastEthernet0/0
     20.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C      20.0.0.0/8 is directly connected, Serial2/0
C      20.0.0.2/32 is directly connected, Serial2/0
O     30.0.0.0/8 [110/128] via 20.0.0.2, 00:00:04, Serial2/0
O  IA 40.0.0.0/8 [110/129] via 20.0.0.2, 00:00:04, Serial2/0
C     172.16.0.0/16 is directly connected, Loopback0
Router#

```

Copy Paste

## Router - 2 Configuration:

**Router - 2**

Physical Config CLI

IOS Command Line Interface

```

Router>enable
Router#config t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#interface Se2/0
Router(config-if)#ip address 20.0.0.2 255.0.0.0
Router(config-if)#encapsulation ppp
Router(config-if)#no shut

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

Router(config-if)#ex
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial2/0, changed state to u
Router(config-if)#exit
Router(config)#interface Se3/0
Router(config-if)#ip address 30.0.0.1 255.0.0.0
Router(config-if)#encapsulation ppp
Router(config-if)#clock rate 64000
Router(config-if)#no shut

%LINK-5-CHANGED: Interface Serial3/0, changed state to down
Router(config-if)#
Router(config-if)#exit
Router(config)#
%LINK-5-CHANGED: Interface Serial3/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial3/0, changed state to up
Router(config)#exit
Router#

```

Copy Paste

**Router - 2**

Physical Config CLI

### IOS Command Line Interface

```

Router>enable
Router#config t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#router ospf 1
Router(config-router)#router-id 2.2.2.2
Router(config-router)#network 20.0.0.0 0.255.255.255 area 1
Router(config-router)#net
00:14:46: %OSPF-5-ADJCHG: Process 1, Nbr 1.1.1.1 on Serial2/0 from LOADING to
FULL, Loading Done
* Ambiguous command: "ne"
Router(config-router)#network 30.0.0.0 0.255.255.255 area 0
Router(config-router)#exit
Router(config)#
00:16:02: %OSPF-5-ADJCHG: Process 1, Nbr 3.3.3.3 on Serial3/0 from LOADING to
FULL, Loading Done

Router(config)#interface Se2/0
Router(config-if)#interface loopback 0

Router(config-if)#
%LINK-5-CHANGED: Interface Loopback0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface Loopback0, changed state to up

Router(config-if)#ip address 172.16.1.253 255.255.0.0
Router(config-if)#no shut
Router(config-if)#exit
Router(config)#
00:20:56: %OSPF-4-ERRRCV: Received invalid packet: mismatch area ID, from backbone
area must be virtual-link but not found from 20.0.0.2, Serial2/0

```

Copy Paste

**Router - 2**

Physical Config CLI

### IOS Command Line Interface

```

00:21:06: %OSPF-4-ERRRCV: Received invalid packet: mismatch area ID, from backbone
area must be virtual-link but not found from 20.0.0.2, Serial2/0

Router(config)#router os
00:21:16: %OSPF-4-ERRRCV: Received invalid packet: mismatch area ID, from backbone
area must be virtual-link but not found from 20.0.0.2, Serial2/0
* Incomplete command.
Router(config)#router ospf 1
Router(config-router)#
00:21:26: %OSPF-4-ERRRCV: Received invalid packet: mismatch area ID, from backbone
area must be virtual-link but not found from 20.0.0.2, Serial2/0

Router(config-router)#area 1 virtual-1
00:21:36: %OSPF-4-ERRRCV: Received invalid packet: mismatch area ID, from backbone
area must be virtual-link but not found from 20.0.0.2, Serial2/0

* Invalid input detected at '^' marker.

Router(config-router)#area 1 virtual-link 1.1.1.1
^
* Invalid input detected at '^' marker.

Router(config-router)#
00:21:46: %OSPF-4-ERRRCV: Received invalid packet: mismatch area ID, from backbone
area must be virtual-link but not found from 20.0.0.2, Serial2/0

Router(config-router)#area 1 virtual-link 1.1.1.1
Router(config-router)#exit

```

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**Router - 2**

Physical Config CLI

**IOS Command Line Interface**

```

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

Router#
00:22:06: %OSPF-5-ADJCHG: Process 1, Nbr 1.1.1.1 on OSPF_VL0 from LOADING to FULL,
Loading Done

Router#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
      D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
      N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
      E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
      i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
      * - candidate default, U - per-user static route, o - ODR
      P - periodic downloaded static route

Gateway of last resort is not set

O IA 10.0.0.0/8 [110/65] via 20.0.0.1, 00:00:04, Serial2/0
  20.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C       20.0.0.0/8 is directly connected, Serial2/0
C       20.0.0.1/32 is directly connected, Serial2/0
  30.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C       30.0.0.0/8 is directly connected, Serial3/0
C       30.0.0.2/32 is directly connected, Serial3/0
O IA 40.0.0.0/8 [110/65] via 30.0.0.2, 00:06:03, Serial3/0
C       172.16.0.0/16 is directly connected, Loopback0
Router#

```

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## Router - 3 Configuration:

**Router - 3**

Physical Config CLI

**IOS Command Line Interface**

```

Router>enable
Router#config t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#interface Se3/0
Router(config-if)#ip address 30.0.0.2 255.0.0.0
Router(config-if)#encapsulation ppp
Router(config-if)#no shut

Router(config-if)#
%LINK-5-CHANGED: Interface Serial3/0, changed state to up

Router(config-if)#exit
Router(config)#interfa
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial3/0, changed state
Router(config)#interface Fa0/0
Router(config-if)#ip address 40.0.0.1 255.0.0.0
Router(config-if)#no shut

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

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

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

Router#exit

```

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**Router - 3**

Physical Config CLI

### IOS Command Line Interface

```

Router>enable
Router#config t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#router ospf 1
Router(config-router)#router-id 3.3.3.3
Router(config-router)#network 30.0.0.0 0.255.255.255 area 0
Router(config-router)#
00:16:01: %OSPF-5-ADJCHG: Process 1, Nbr 2.2.2.2 on Serial3/0 from LOADING to
FULL, Loading Done

Router(config-router)#network 40.0.0.0 0.255.255.255 area 2
Router(config-router)#exit
Router(config)#interface Se3/0
Router(config-if)#interface loopback 0

Router(config-if)#
%LINK-5-CHANGED: Interface Loopback0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface Loopback0, changed state to up

Router(config-if)#ip address 172.16.1.254 255.255.0.0
Router(config-if)#no shut
Router(config-if)#exit
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console

Router#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
      D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
      N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
      L1 - OSPF external type 1, L2 - OSPF external type 2, ia - IS-IS inter area
      * - candidate default, U - per-user static route, o - ODR
      P - periodic downloaded static route

```

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**Router - 3**

Physical Config CLI

### IOS Command Line Interface

```

Router(config-if)#
%LINK-5-CHANGED: Interface Loopback0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface Loopback0, changed state to up

Router(config-if)#ip address 172.16.1.254 255.255.0.0
Router(config-if)#no shut
Router(config-if)#exit
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console

Router#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
      D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
      N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
      L1 - OSPF external type 1, L2 - 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

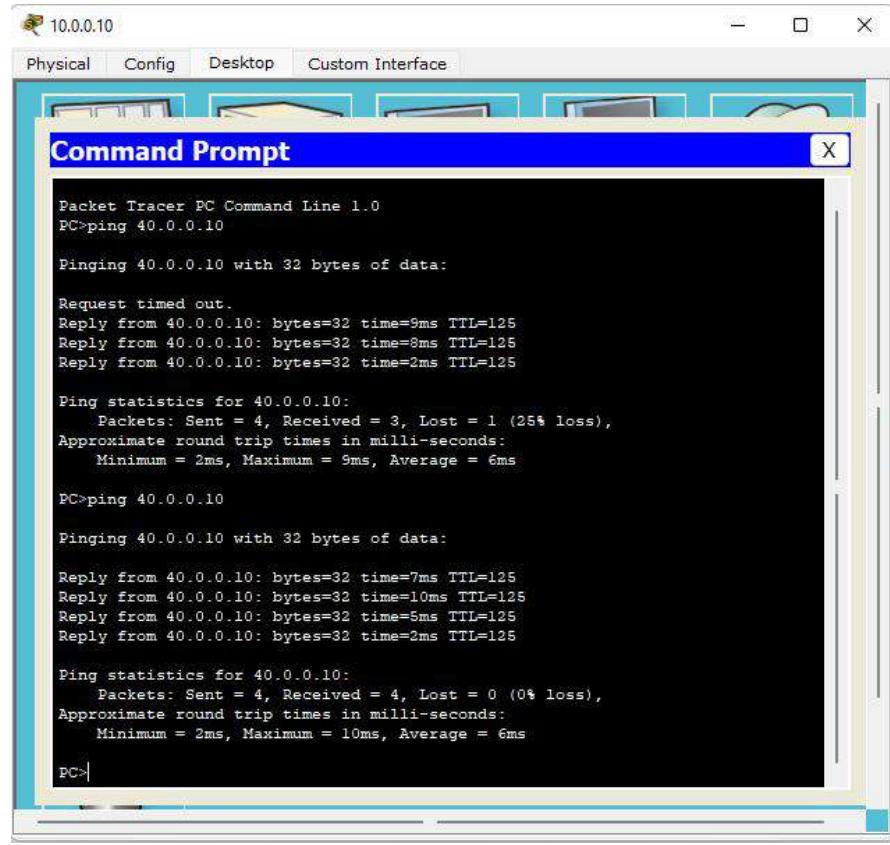
O IA 10.0.0.0/8 [110/129] via 30.0.0.1, 00:00:32, Serial3/0
O IA 20.0.0.0/8 [110/128] via 30.0.0.1, 00:06:36, Serial3/0
      30.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C     30.0.0.0/8 is directly connected, Serial3/0
C     30.0.0.1/32 is directly connected, Serial3/0
C     40.0.0.0/8 is directly connected, FastEthernet0/0
C     172.16.0.0/16 is directly connected, Loopback0
Router#

```

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## Output:

### Pinging from PC - 1 to PC - 2:



```
Packet Tracer PC Command Line 1.0
PC>ping 40.0.0.10

Pinging 40.0.0.10 with 32 bytes of data:

Request timed out.
Reply from 40.0.0.10: bytes=32 time=9ms TTL=125
Reply from 40.0.0.10: bytes=32 time=8ms TTL=125
Reply from 40.0.0.10: bytes=32 time=2ms TTL=125

Ping statistics for 40.0.0.10:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 2ms, Maximum = 9ms, Average = 6ms

PC>ping 40.0.0.10

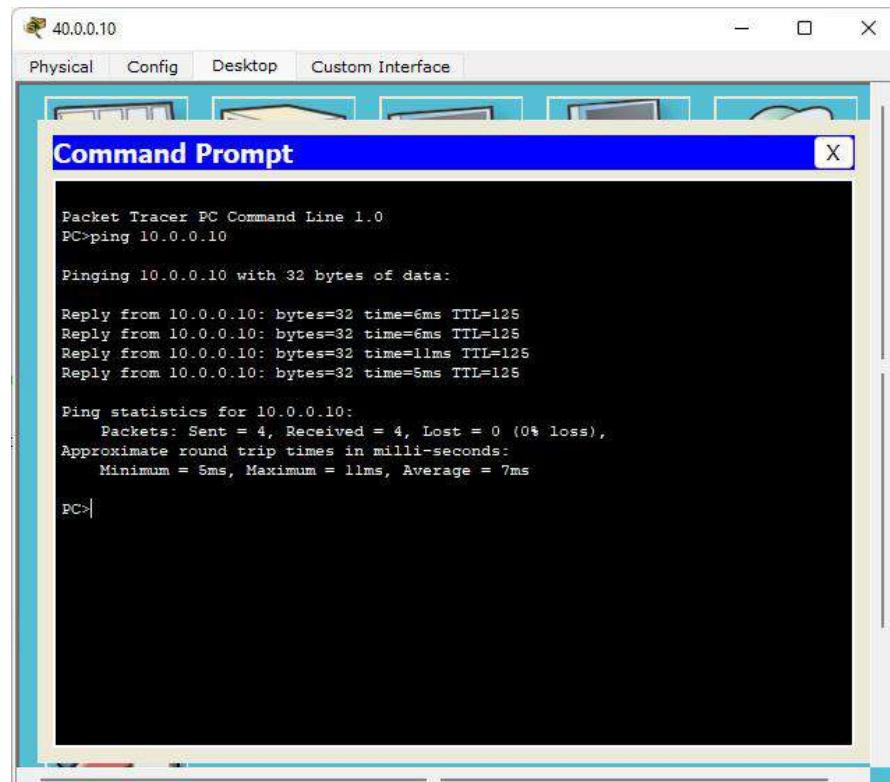
Pinging 40.0.0.10 with 32 bytes of data:

Reply from 40.0.0.10: bytes=32 time=7ms TTL=125
Reply from 40.0.0.10: bytes=32 time=10ms TTL=125
Reply from 40.0.0.10: bytes=32 time=5ms TTL=125
Reply from 40.0.0.10: bytes=32 time=2ms TTL=125

Ping statistics for 40.0.0.10:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 2ms, Maximum = 10ms, Average = 6ms

PC>
```

### Pinging from PC - 2 to PC - 1:



```
Packet Tracer PC Command Line 1.0
PC>ping 10.0.0.10

Pinging 10.0.0.10 with 32 bytes of data:

Reply from 10.0.0.10: bytes=32 time=6ms TTL=125
Reply from 10.0.0.10: bytes=32 time=6ms TTL=125
Reply from 10.0.0.10: bytes=32 time=11ms TTL=125
Reply from 10.0.0.10: bytes=32 time=5ms TTL=125

Ping statistics for 10.0.0.10:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 5ms, Maximum = 11ms, Average = 7ms

PC>
```

### 2.6.3 Observation Book Pictures:

PAGE NO:  
DATE: 04/09/2023

Experiment - 7

Configure OSPF routing protocol

Aim: To demonstrate OSPF protocol in routers

Topology:

Router-1: (Area 3)  
 Router-2: (Area 0)  
 Router-3: (Area 0)

PC-1: 10.0.0.10  
 PC-2: 40.0.0.10

Procedure:

1. Place 3 routers and 2 PCs.
- Connect PC-1 to Router-1 using Copper cross-over wire from Fast Ethernet 0 port of PC-1 to Fast Ethernet 0/0 port of Router-1.
- Connect PC-2 to Router-3 using Copper cross-over wire from Fast Ethernet 0 port of PC-2 to Fast Ethernet 0/0 port of Router 3.
- Connect Router-1 to Router-2 using serial DCE wire from Serial 2/0 port of Router-1 to Serial 2/0 port of Router-2.
- Connect Router-2 to Router-3 using serial DCE wire from Serial 3/0 port of Router-2 to Serial 3/0 port of Router-3.

2. PC-1 Configuration:  
 Click on PC-1 → Config → Interface → Fast Ethernet 0

Assign static IP address to PC-1 [10.0.0.10 and Subnet Mask: 255.0.0.0]

Set default gateway: 10.0.0.1

3. PC-2 Configuration:

Click on PC-2 → Config → Interface → Fast Ethernet 0

Assign static IP address to PC-2 [40.0.0.10 and Subnet Mask: 255.0.0.0]

Set default gateway: 40.0.0.1

4. a) Router-1 Configuration: (assign ip addresses to interfaces)

Router > enable

Router# Config

Router(Config)# interface Fa0/0

Router(Config-if)# ip address 10.0.0.1 255.0.0.0

Router(Config-if)# no shut

Router(Config-if)# exit

Router(Config)# interface Se2/0

Router(Config-if)# ip address 20.0.0.1 255.0.0.0

Router(Config-if)# encapsulation ppp

Router(Config-if)# clock rate 64000

~~Router(Config-if)# no shut~~

~~Router(Config-if)# exit~~

b) Router-2 Configuration: (assign ip addresses to interfaces)

Router > enable

Router# Config t.

Router(Config)# interface Se2/0

Router(Config-if)# ip address 20.0.0.2 255.0.0.0

Router(Config-if)# encapsulation ppp

Router(Config-if)# no shut

Router(Config-if)# exit

Router(Config) # interface Se 3/0

Router(Config-if) # ip address 30.0.0.1 255.0.0.0

Router(Config-if) # encapsulation ppp

Router(Config-if) # clock rate 64000

Router(Config-if) # no shut

Router(Config-if) # exit

Router-3 Configuration : (assign ip addresses to interfaces)

Router > enable

Router # Config t

Router(Config) # interface Se 3/0

Router(Config-if) # ip address 30.0.0.2 255.0.0.0

Router(Config-if) # encapsulation ppp

Router(Config-if) # no shut

Router(Config-if) # exit

Router(Config) # interface Fa 0/0

Router(Config-if) # ip address 40.0.0.1 255.0.0.0

Router(Config-if) # no shut

Router(Config-if) # exit

5. Now, enable ip routing by configuring ospf routing protocol in all routers.

6. Open Shortest path First (OSPF) is a link-state routing protocol that was developed for IP networks and is based on the Shortest Path First (SPF) algorithm. OSPF is an Interior Gateway Protocol (IGP).

In an OSPF network, routers or systems within the same area maintain an identical link-state database that describes the topology of the area. Each router or system in the area generates its link-state database from the link-state advertisements (LSAs) that it receives from

all the other routers or systems in the same area and the LSAs <sup>itself</sup> that generates. An LSA is a packet that contains information about neighbours and path costs. Based on the link-state database, each router or system calculates a shortest-path spanning tree, with itself as the root, using the SPF algorithm.

a) Router-1 Configuration : (OSPF)

Router > enable

Router # config t

Router (config) # router ospf 1

Router (config-router) # router-id 1.1.1.1

Router (config-router) # network 10.0.0.0 0.255.255.255  
area 3

Router (config-router) # network 20.0.0.0 0.255.255.255

Router (config-router) # exit

b) Router-2 Configuration : (OSPF)

Router > enable

Router # config t

Router (config) # router ospf 1

Router (config-router) # router-id 2.2.2.2

Router (config-router) # network 20.0.0.0 0.255.255.255  
area 1

Router (config-router) # network 30.0.0.0 0.255.255.255  
area 0

Router (config-router) # exit

c) Router-3 Configuration : (OSPF)

Router > enable

Router # config t

Router (config) # router ospf 1

Router (config-router) # router-id 3.3.3.3

Router (config-router) # network 30.0.0.0 0.255.255.255 area 0

Router (config-router) # network 40.0.0.0 0.255.255.255 area 2

Router (config-router) # exit.

8. There must be one interface up to keep ospf process up. So we configure loopback address to router. It is a virtual interface which never goes down once we configure it.

9. a) Router-1 Configuration: (loopback configuration):

Router (config) # interface Se2/0

Router (config-if) # interface loopback 0

Router (config-if) # ip address 172.16.1.252 255.255.0.0

Router (config-if) # no shut

Router (config-if) # exit.

b) Router-2 Configuration: (loopback configuration):

Router (config) # interface Se2/0

Router (config-if) # interface loopback 0

Router (config-if) # ip address 172.16.1.253 255.255.0.0

Router (config-if) # no shut

Router (config-if) # exit.

c) Router-3 Configuration: (loopback configuration):

Router (config) # interface Se3/0

Router (config-if) # interface loopback 0

Router (config-if) # ip address 172.16.1.254 255.255.0.0

Router (config-if) # no shut

Router (config-if) # exit



10. Create a virtual link between R<sub>1</sub> and R<sub>2</sub>. By this we can create virtual link <sup>W/o</sup> R<sub>1</sub> and R<sub>2</sub> to connect area 3 to area 0.

11. a) Router -1 Configuration : (virtual link configuration)

Router (config) # router ospf 1

Router (config-router) # area 1 virtual-link 2.2.2.2

Router (config-router) # exit.

b) Router -2 Configuration: (Virtual link configuration)

Router (config) # router ospf 1

Router (config-router) # area 1 virtual-link 1.1.1.1

Router (config-router) # exit.

12. R<sub>2</sub> and R<sub>3</sub> gets updates about Area 3. Now check the routing tables.

13. a) Router -1 : (Routing table).

Router # show ip route.

C 10.0.0.0/8 is directly connected, FastEthernet 0

20.0.0.0/8 is variably subnetted, 2 subnets, 2 masks

C 20.0.0.0/8 is directly connected, Serial 2/0

C 20.0.0.32/32 is directly connected, Serial 2/0

O 30.0.0.0/8 [110/128] via 20.0.0.2, 00:00:04, Serial 2/0

O IA 40.0.0.0/8 [110/129] via 20.0.0.2, 00:00:04, Serial 2/0

C 172.16.0.0/16 is directly connected, loopback 0.



b) Router-2 : (Routing table)

Router # show ip route.

- o IA 10.0.0.0/8 [110/65] via 20.0.0.1, 00:00:04, Serial 2/0  
20.0.0.0/8 is variably subnetted, 2 subnets, 2 masks.
- c 20.0.0.0/8 is directly connected, Serial 2/0
- 20.0.0.1/32 is directly connected, Serial 2/0
- 30.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
- c 30.0.0.0/8 is directly connected, Serial 3/0
- c 30.0.0.1/32 is directly connected, Serial 3/0
- o IA 40.0.0.0/8 [110/65] via 30.0.0.2, 00:06:03, Serial 3/0
- c 172.16.0.0/16 is directly connected, Loopback 0

c) Router-3 : (Routing table)

Router # show ip route.

- o IA 10.0.0.0/8 [110/129] via 30.0.0.1, 00:00:32, Serial 3/0
- o IA 20.0.0.0/8 [110/128] via 30.0.0.1, 00:06:36, Serial 3/0  
30.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
- c 30.0.0.0/8 is directly connected, Serial 3/0
- c 30.0.0.1/32 is directly connected, Serial 3/0
- c 40.0.0.0/8 is directly connected, FastEthernet 0/0
- c 172.16.0.0/16 is directly connected, Loopback 0

Result:

1. Pinging from PC-1 to PC-2

PC > ping 40.0.0.10

Pinging 40.0.0.10 with 32 bytes of data:

Reply from 40.0.0.10: bytes=32 time=7ms TTL=125

Reply from 40.0.0.10: bytes=32 time=10ms TTL=125

Reply from 10.0.0.10 : bytes = 32 time = 5ms TTL = 125  
Reply from 10.0.0.10 : bytes = 32 time = 2ms TTL = 125

Ping statistics for 10.0.0.10 :

Packets: Sent = 4, Received = 4, Lost = 0 (0% loss)

Approximate round trip times in milli-seconds :

Minimum = 2ms, Maximum = 10ms, Average = 6ms

## 2. Pinging PC-2 to PC-1

PC > ping 10.0.0.0.10 :

Pinging 10.0.0.10 with 32 bytes of data:

Reply from 10.0.0.10 : bytes = 32 time = 6ms TTL = 125

Reply from 10.0.0.10 : bytes = 32 time = 6ms TTL = 125

Reply from 10.0.0.10 : bytes = 32 time = 11ms TTL = 125

Reply from 10.0.0.10 : bytes = 32 time = 5ms TTL = 125

Ping statistics for 10.0.0.10 :

Packets: Sent = 4, Received = 4, Lost = 0 (0% loss)

Approximate round trip times in milli-seconds :

Minimum = 5ms, Maximum = 11ms, Average = 7ms

## Observation:

Routers connected to networks using Internet Protocol (IP) and OSPF is a Router protocol used to find the best path for packets as they pass through a set of connected networks.

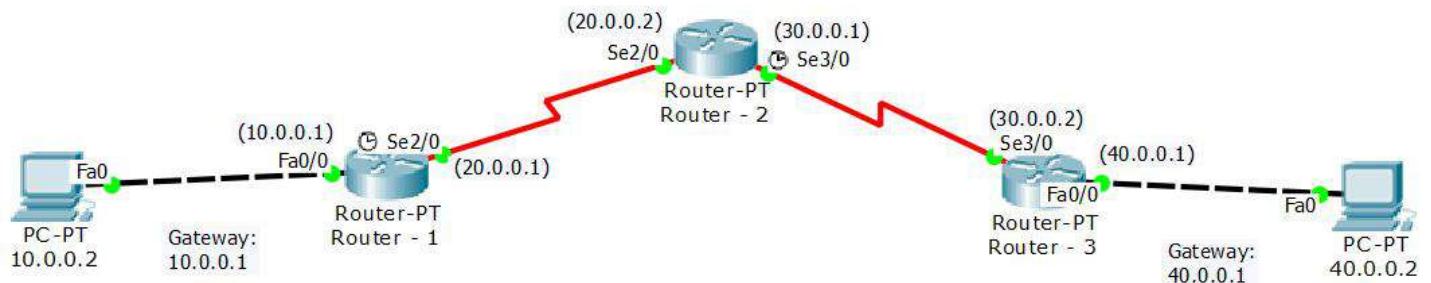
## 2.7 Experiment - 7:

### 2.7.1 Question:

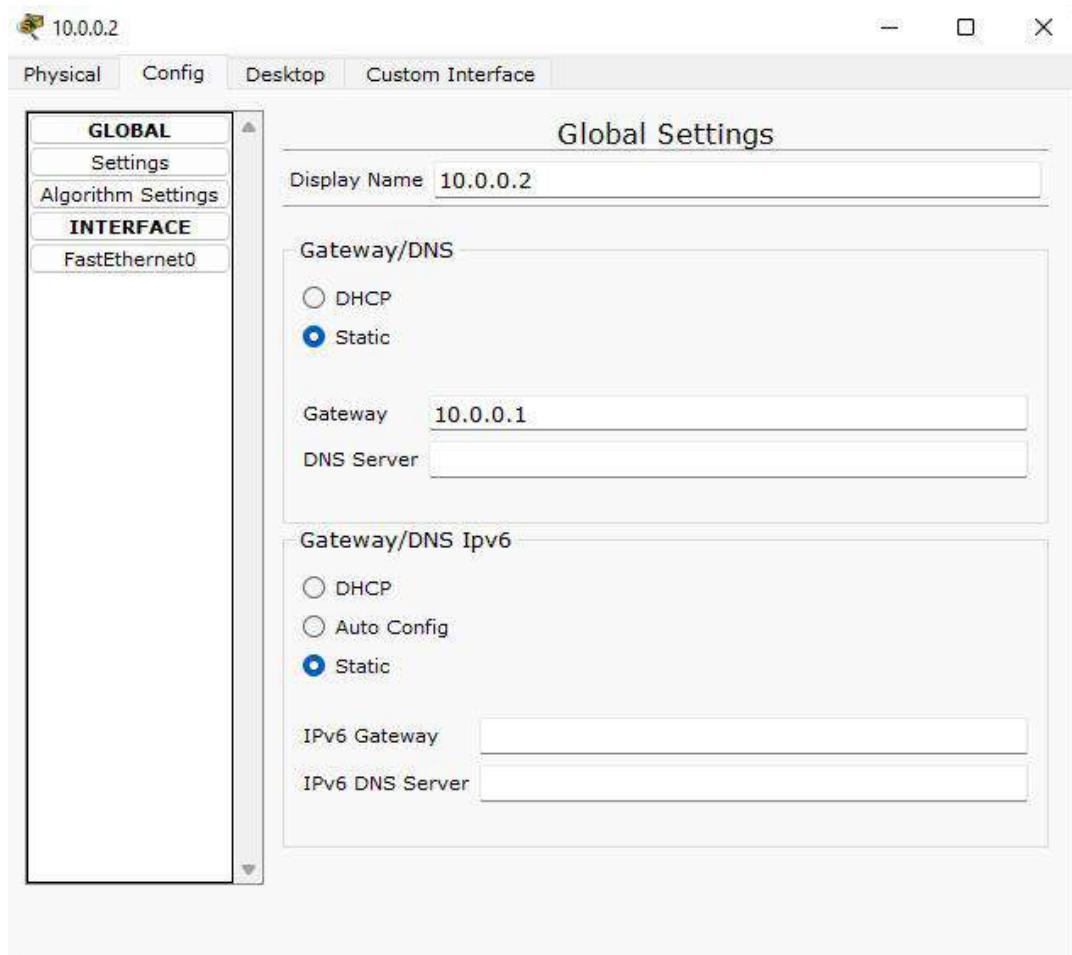
Demonstrate the TTL/ Life of a Packet.

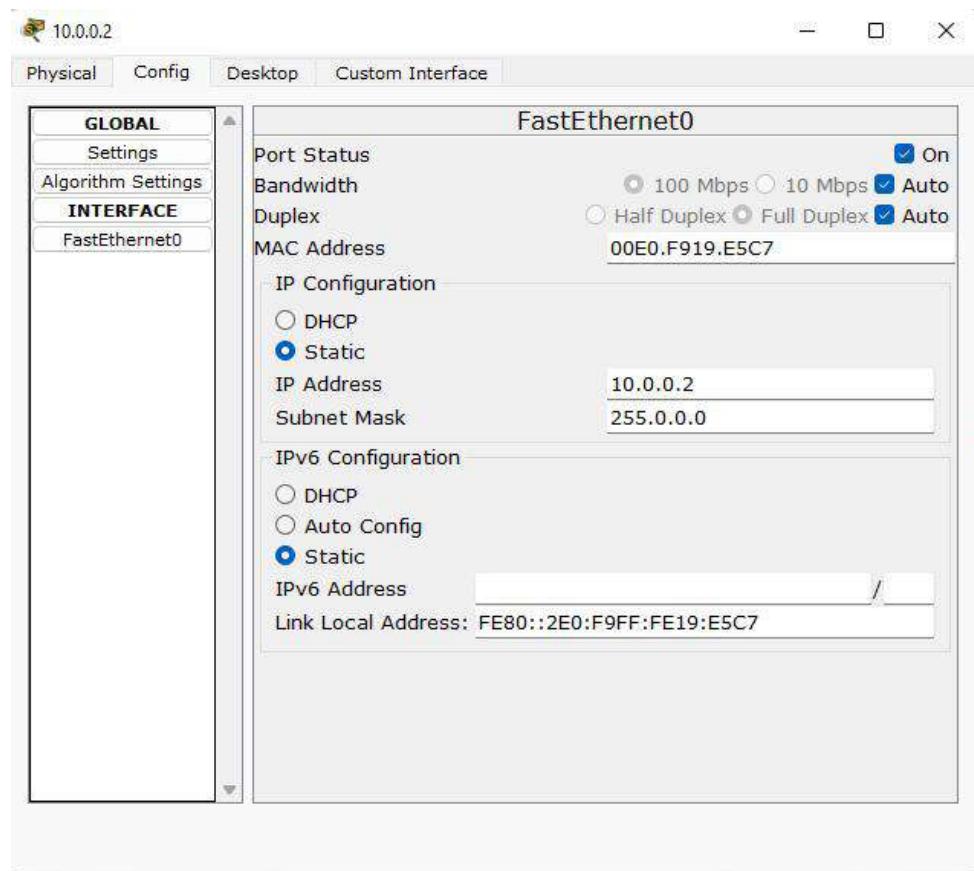
### 2.7.2 Screenshots (Topology, Configurations & Output):

#### Topology:

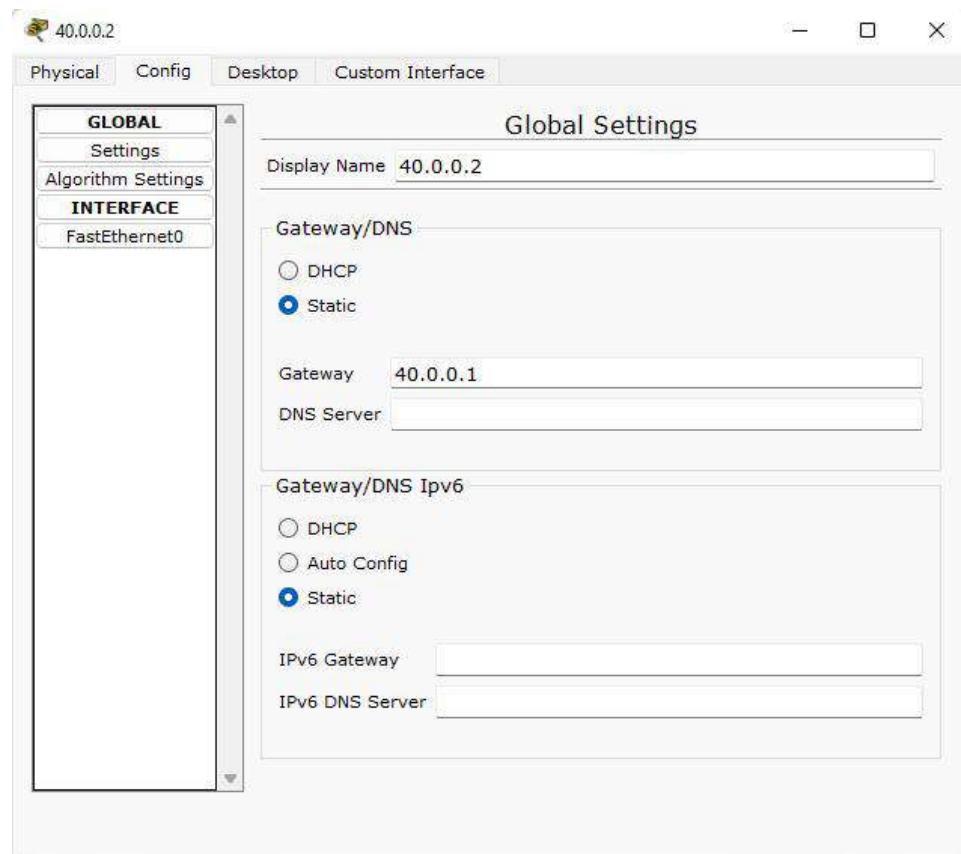


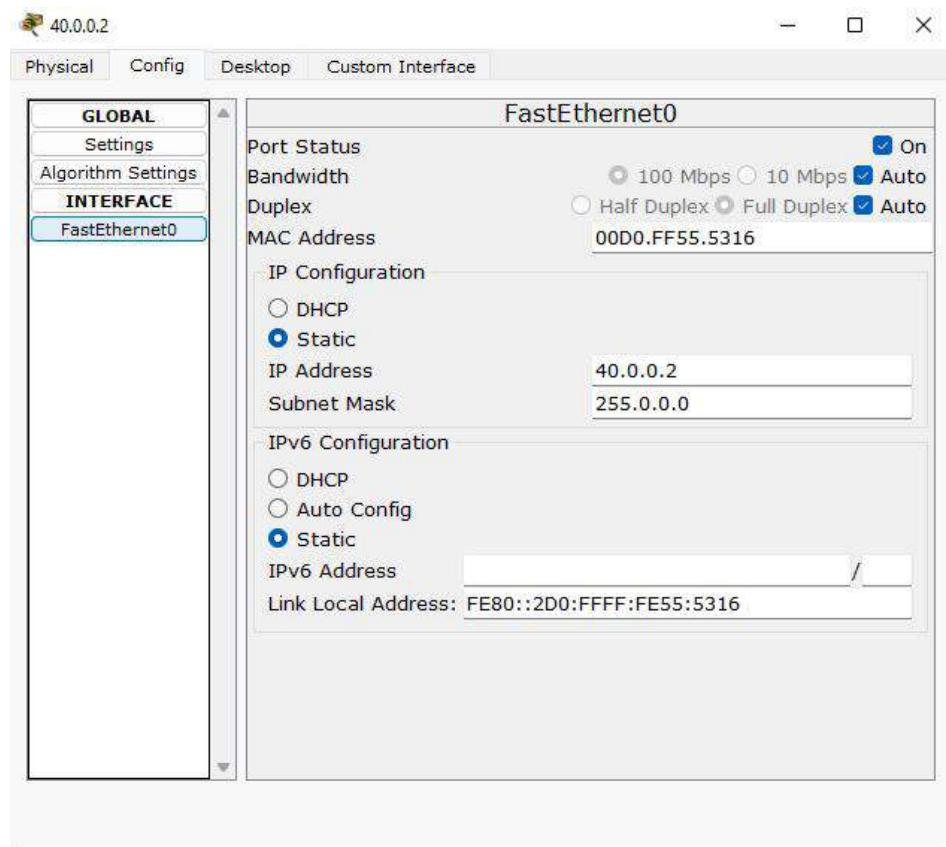
#### PC - 1 Configuration:





## PC - 2 Configuration:





## Router - 1 Configuration:

The screenshot shows the Router - 1 CLI interface. The top bar has tabs for Physical, Config, and CLI, with CLI selected. The main window displays the IOS Command Line Interface (CLI) configuration session:

```
Router>enable
Router#config t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#interface fa0/0
Router(config-if)#ip add 10.0.0.1 255.0.0.0
Router(config-if)#no shut

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

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to
up
exit
Router(config)#interface se2/0
Router(config-if)#ip add 20.0.0.1 255.0.0.0
Router(config-if)#no shut

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

%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial2/0, changed state to up

Router(config)#interface se2/0
Router(config-if)#exit
Router(config)#ip route 0.0.0.0 0.0.0.0 20.0.0.2
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console
```

At the bottom right of the CLI window are 'Copy' and 'Paste' buttons.

Router - 1

Physical Config CLI

### IOS Command Line Interface

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

*LINEPROTO-5-UPDOWN: Line protocol on Interface Serial2/0, changed state to up

Router(config)#interface se2/0
Router(config-if)#exit
Router(config)#ip route 0.0.0.0 0.0.0.0 20.0.0.2
Router(config)#exit
Router#
*SYS-5-CONFIG_I: Configured from console by console

Router#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
      D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
      N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
      E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
      i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
      * - candidate default, U - per-user static route, o - ODR
      P - periodic downloaded static route

Gateway of last resort is 20.0.0.2 to network 0.0.0.0

C    10.0.0.0/8 is directly connected, FastEthernet0/0
C    20.0.0.0/8 is directly connected, Serial2/0
S*   0.0.0.0/0 [1/0] via 20.0.0.2
Router#
```

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## Router - 2 Configuration:

Router - 2

Physical Config CLI

### IOS Command Line Interface

```
Router>enable
Router#config t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#interface se2/0
Router(config-if)#ip add 20.0.0.2 255.0.0.0
Router(config-if)#no shut

Router(config-if)#
*LINK-5-CHANGED: Interface Serial2/0, changed state to up
exit
Router(config)#interface se3/0
Router(config-if)#
*LINEPROTO-5-UPDOWN: Line protocol on Interface Serial2/0, changed state to u
Router(config-if)#ip add 30.0.0.1 255.0.0.0
Router(config-if)#no shut

*LINK-5-CHANGED: Interface Serial3/0, changed state to down
Router(config-if)#exit
Router(config)#
*LINK-5-CHANGED: Interface Serial3/0, changed state to up

*LINEPROTO-5-UPDOWN: Line protocol on Interface Serial3/0, changed state to up

Router(config)#ip route 10.0.0.0 255.0.0.0 20.0.0.1
Router(config)#ip route 40.0.0.0 255.0.0.0 30.0.0.2
Router(config)#exit
Router#
*SYS-5-CONFIG_I: Configured from console by console
```

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**Router - 2**

Physical Config CLI

### IOS Command Line Interface

```
*LINK-5-CHANGED: Interface Serial3/0, changed state to down
Router(config-if)#exit
Router(config)#
*LINK-5-CHANGED: Interface Serial3/0, changed state to up

*LINEPROTO-5-UPDOWN: Line protocol on Interface Serial3/0, changed state to up

Router(config)#ip route 10.0.0.0 255.0.0.0 20.0.0.1
Router(config)#ip route 40.0.0.0 255.0.0.0 30.0.0.2
Router(config)#exit
Router#
*SYS-5-CONFIG_I: Configured from console by console

Router#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
      D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
      N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
      E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
      i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
      * - candidate default, U - per-user static route, o - ODR
      P - periodic downloaded static route

Gateway of last resort is not set

S    10.0.0.0/8 [1/0] via 20.0.0.1
C    20.0.0.0/8 is directly connected, Serial2/0
C    30.0.0.0/8 is directly connected, Serial3/0
S    40.0.0.0/8 [1/0] via 30.0.0.2
Router#
```

[Copy](#) [Paste](#)

## Router - 3 Configuration:

**Router - 3**

Physical Config CLI

### IOS Command Line Interface

```
Router>enabl
Router#config t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#interface se3/0
Router(config-if)#ip address 30.0.0.2 255.0.0.0
Router(config-if)#no shut

Router(config-if)#
*LINK-5-CHANGED: Interface Serial3/0, changed state to up

Router(config-if)#exit
Router(config)#interface
*LINEPROTO-5-UPDOWN: Line protocol on Interface Serial3/0, changed state to up

* Incomplete command.
Router(config)#interface Fa0/0
Router(config-if)#ip address 40.0.0.1 255.0.0.0
Router(config-if)#no shut

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

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

Router(config-if)#exit
Router(config)#ip route 0.0.0.0 0.0.0.0 30.0.0.1
Router(config)#exit
Router#
*SYS-5-CONFIG_I: Configured from console by console
```

[Copy](#) [Paste](#)

Router - 3

Physical Config CLI

IOS Command Line Interface

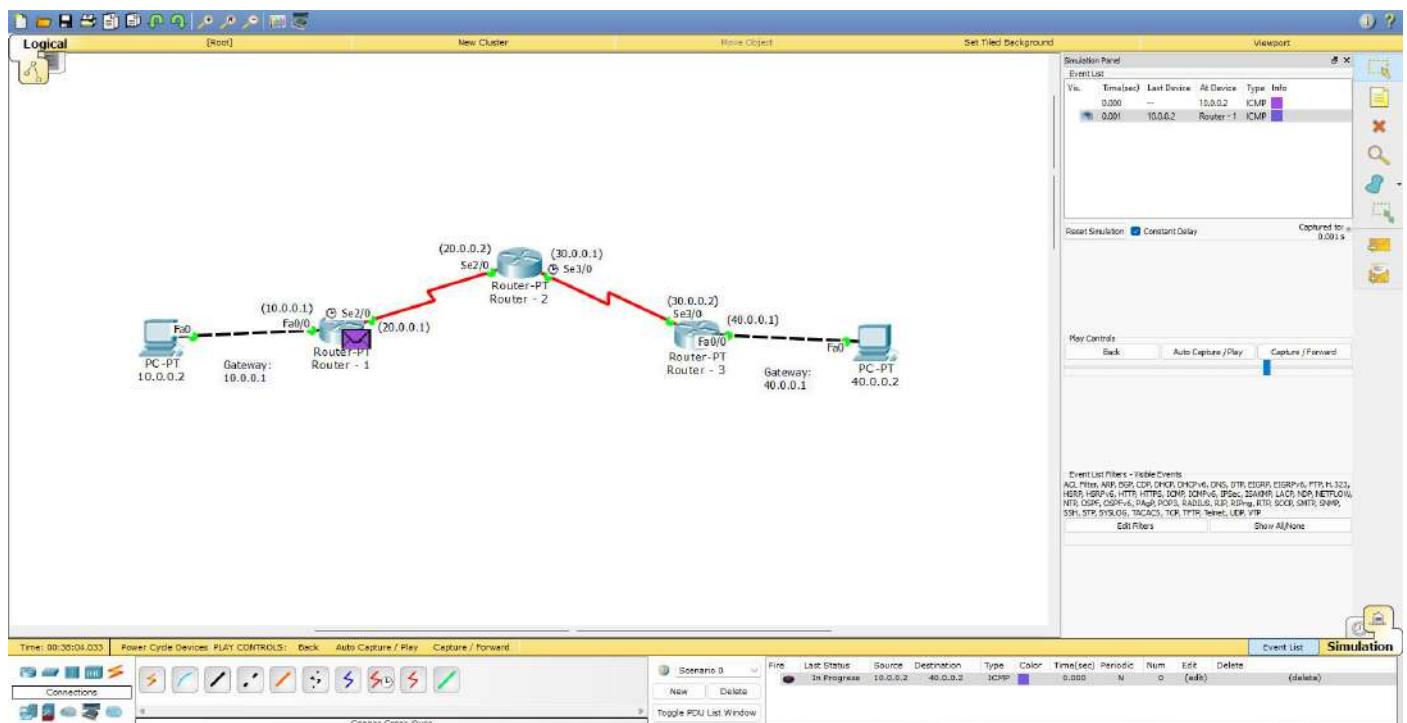
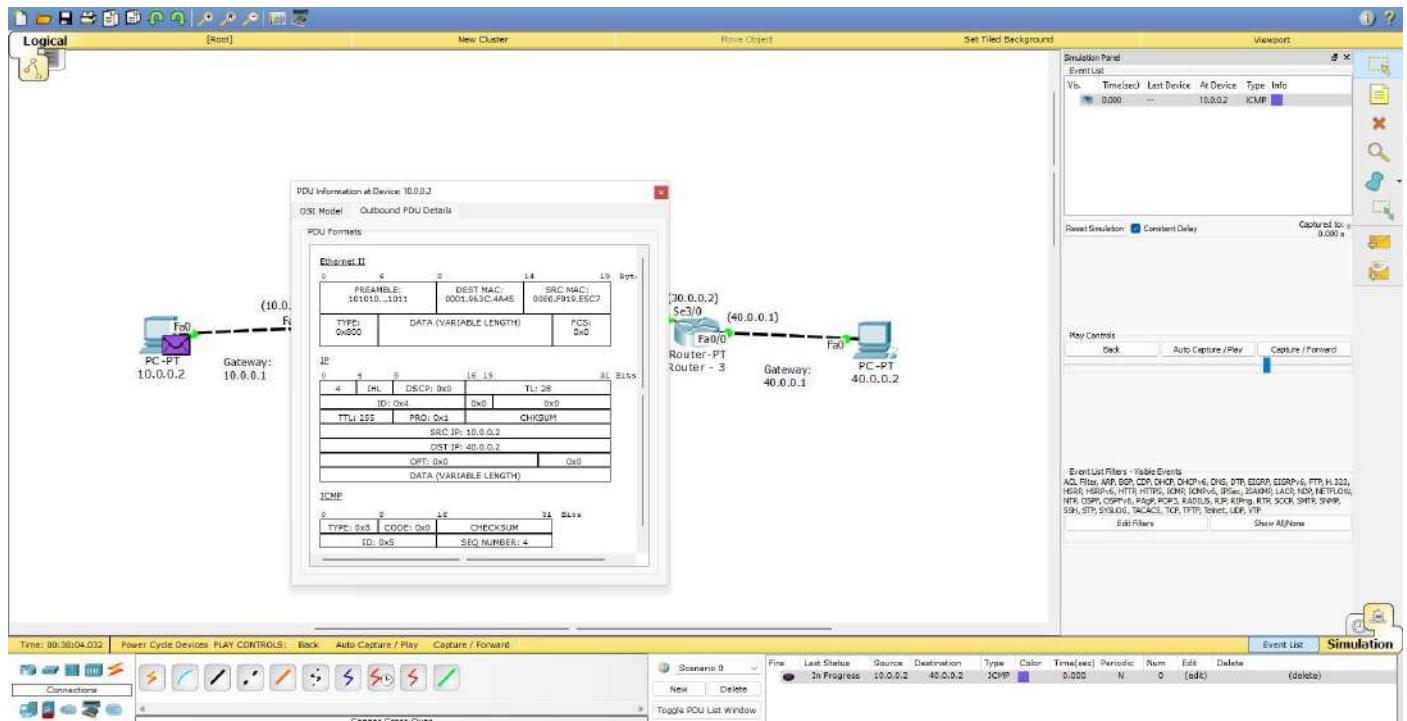
```
Router>
Router>enable
Router#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
      D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
      N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
      E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
      i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
      * - candidate default, U - per-user static route, o - ODR
      P - periodic downloaded static route

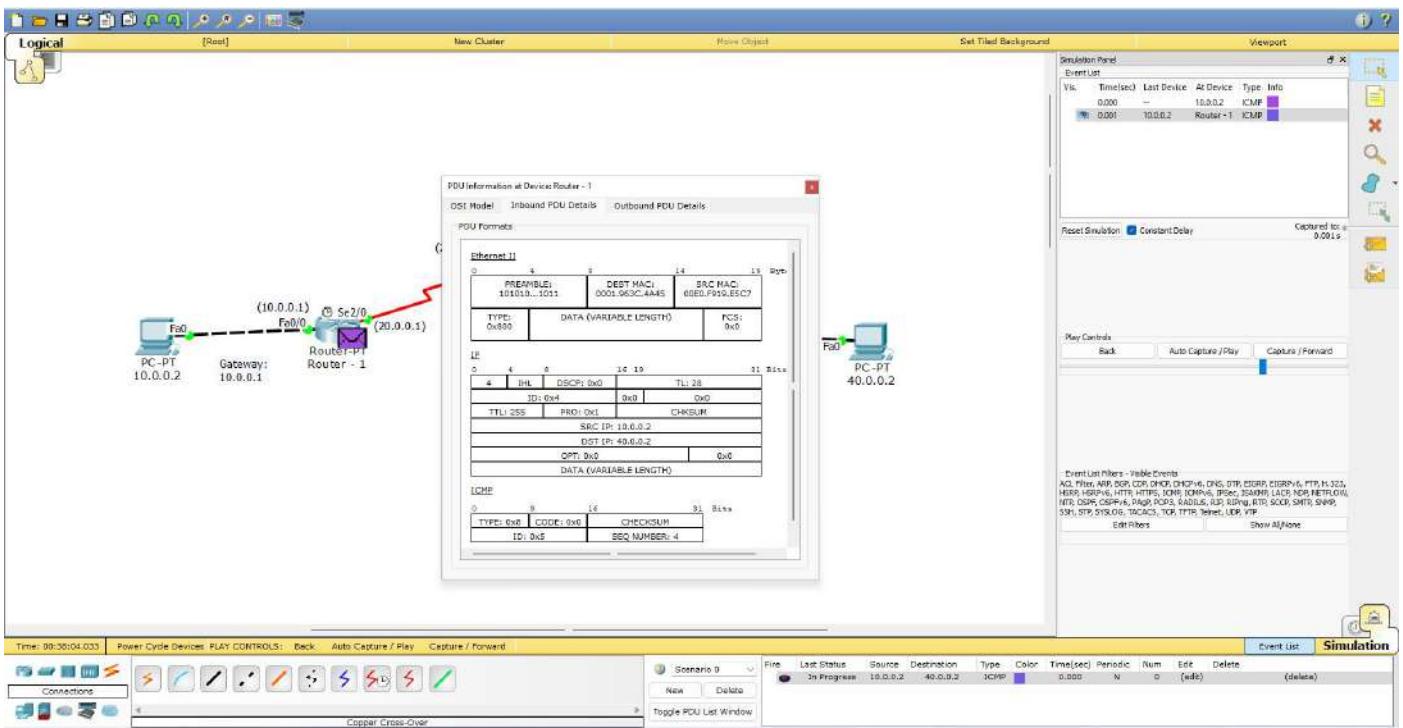
Gateway of last resort is 30.0.0.1 to network 0.0.0.0

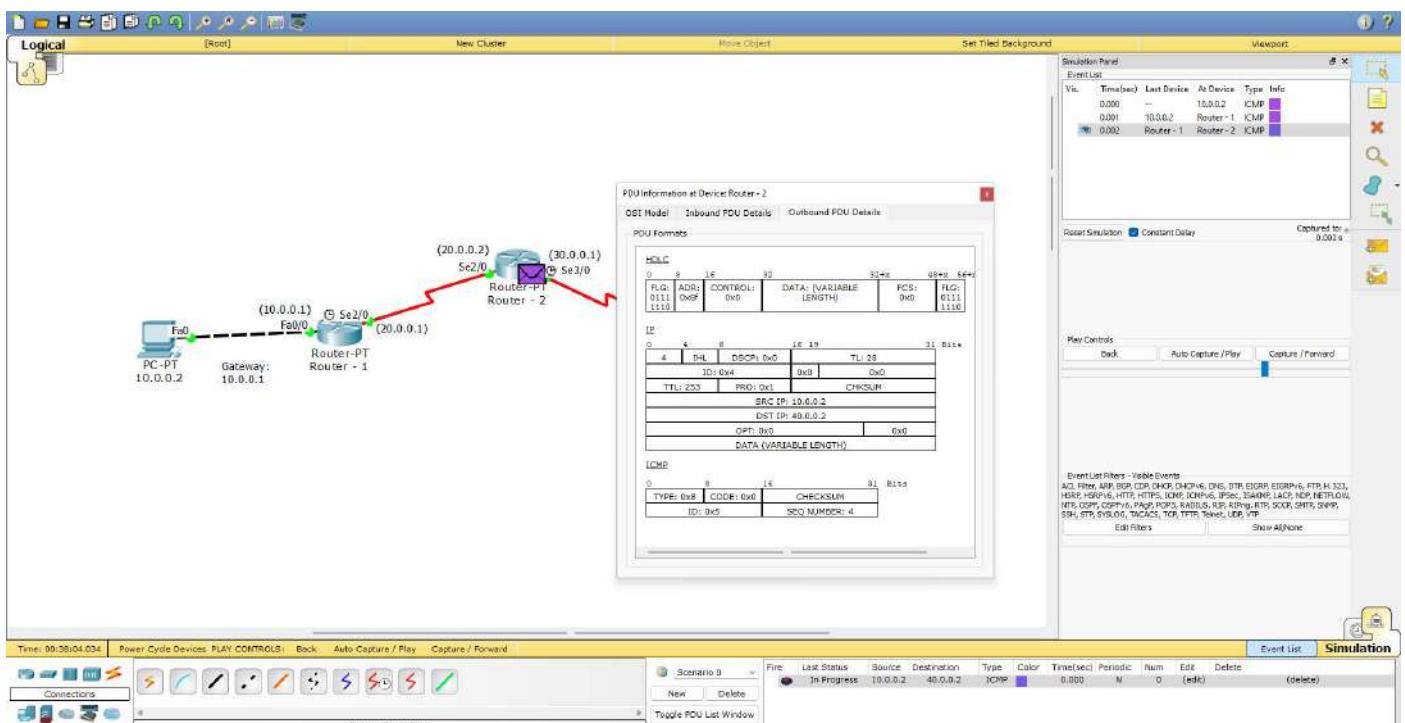
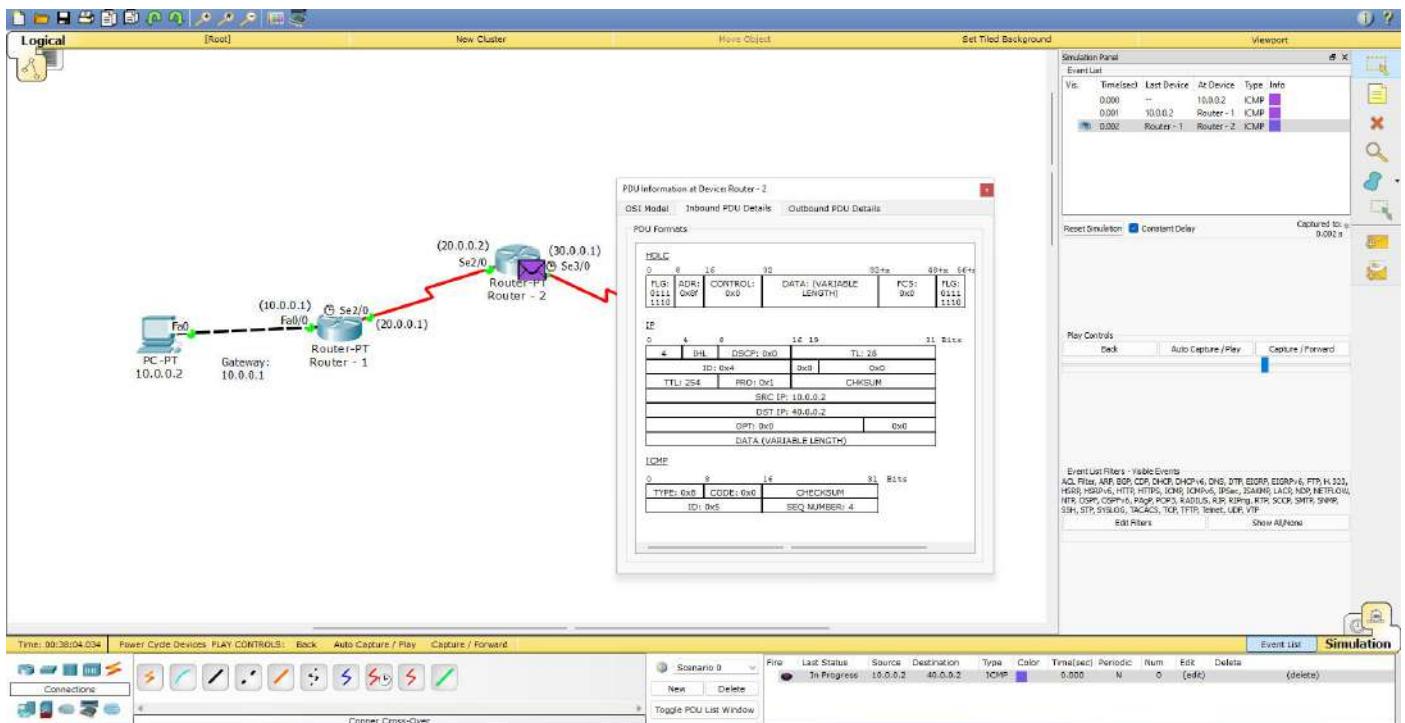
C    30.0.0.0/8 is directly connected, Serial3/0
C    40.0.0.0/8 is directly connected, FastEthernet0/0
S*   0.0.0.0/0 [1/0] via 30.0.0.1
Router#
```

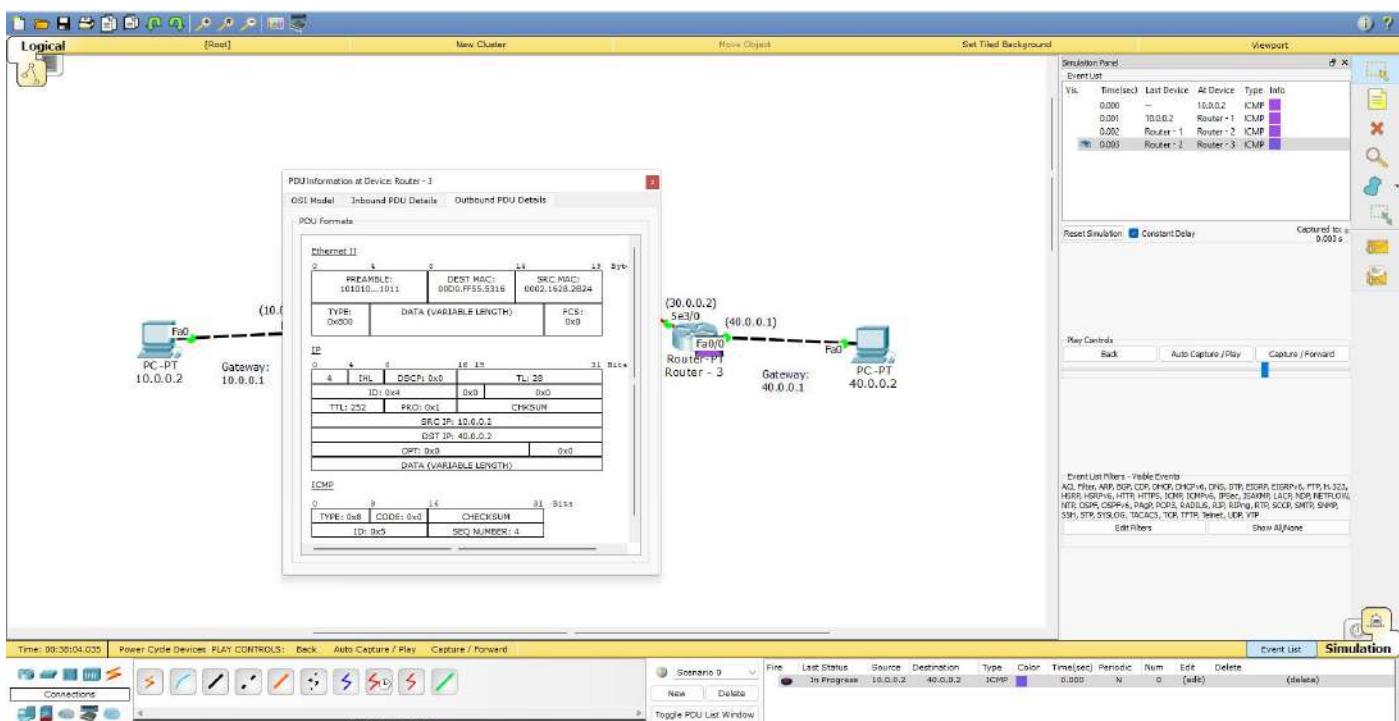
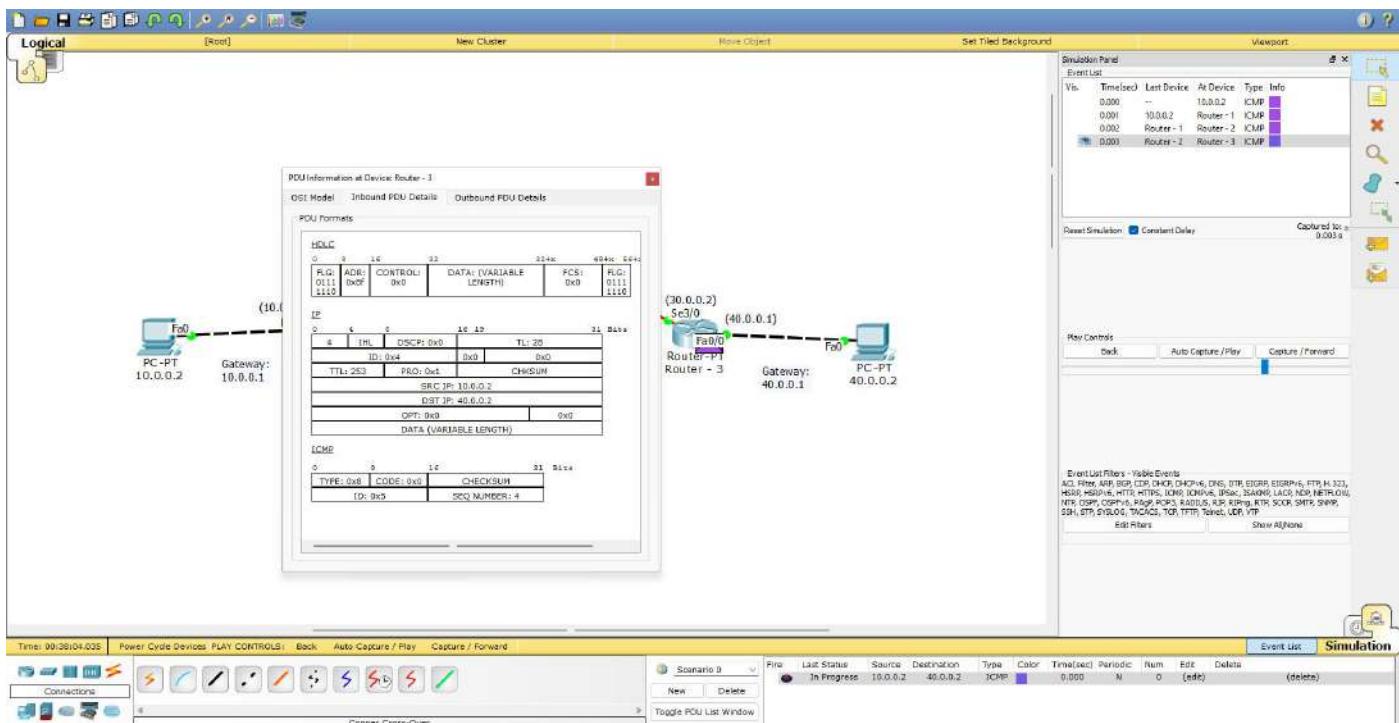
Copy Paste

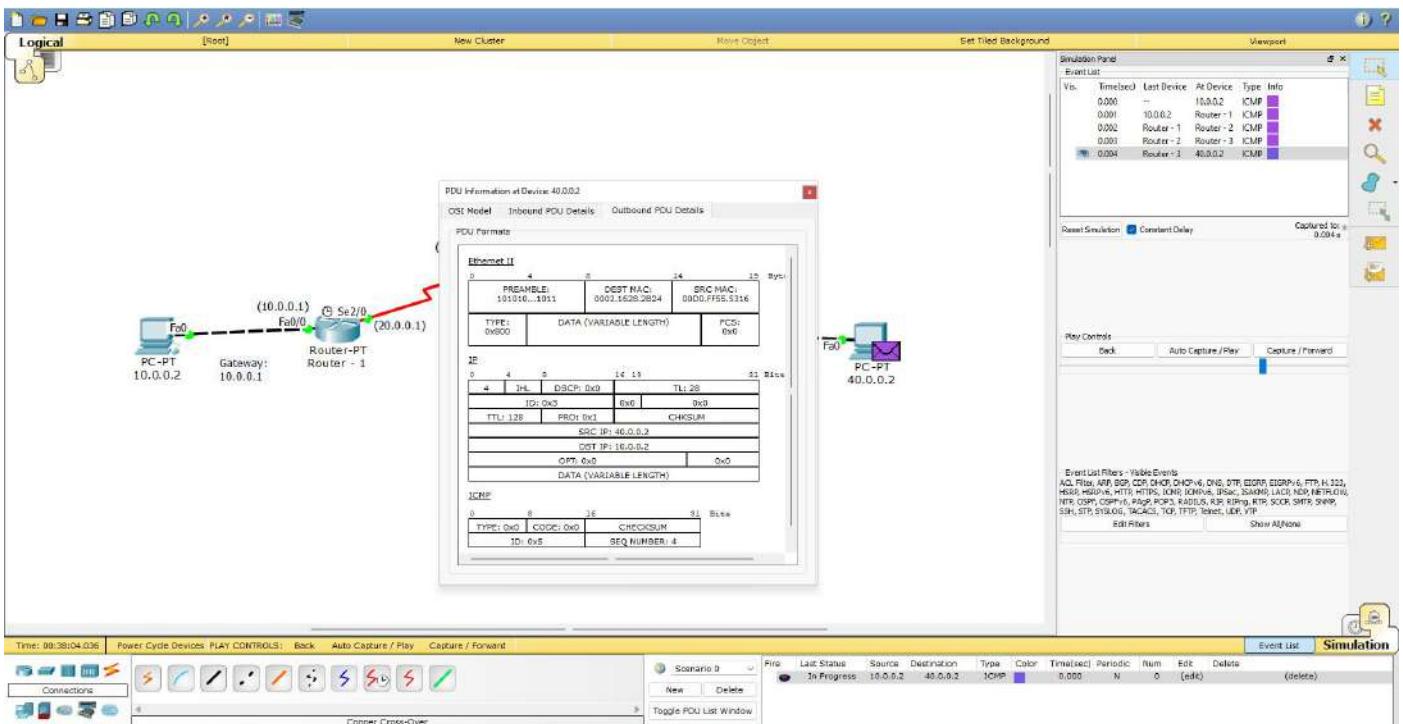
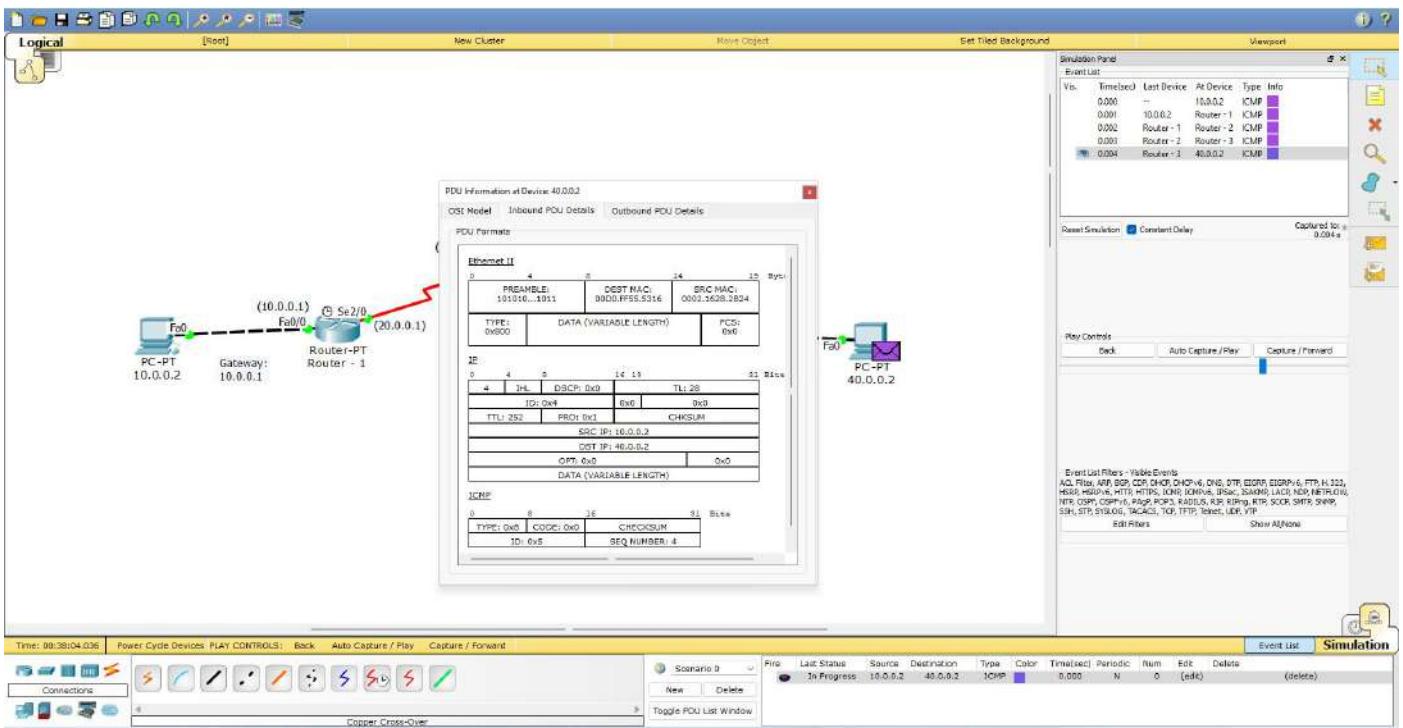
## Sending a PDU from PC - 1 to PC - 2:

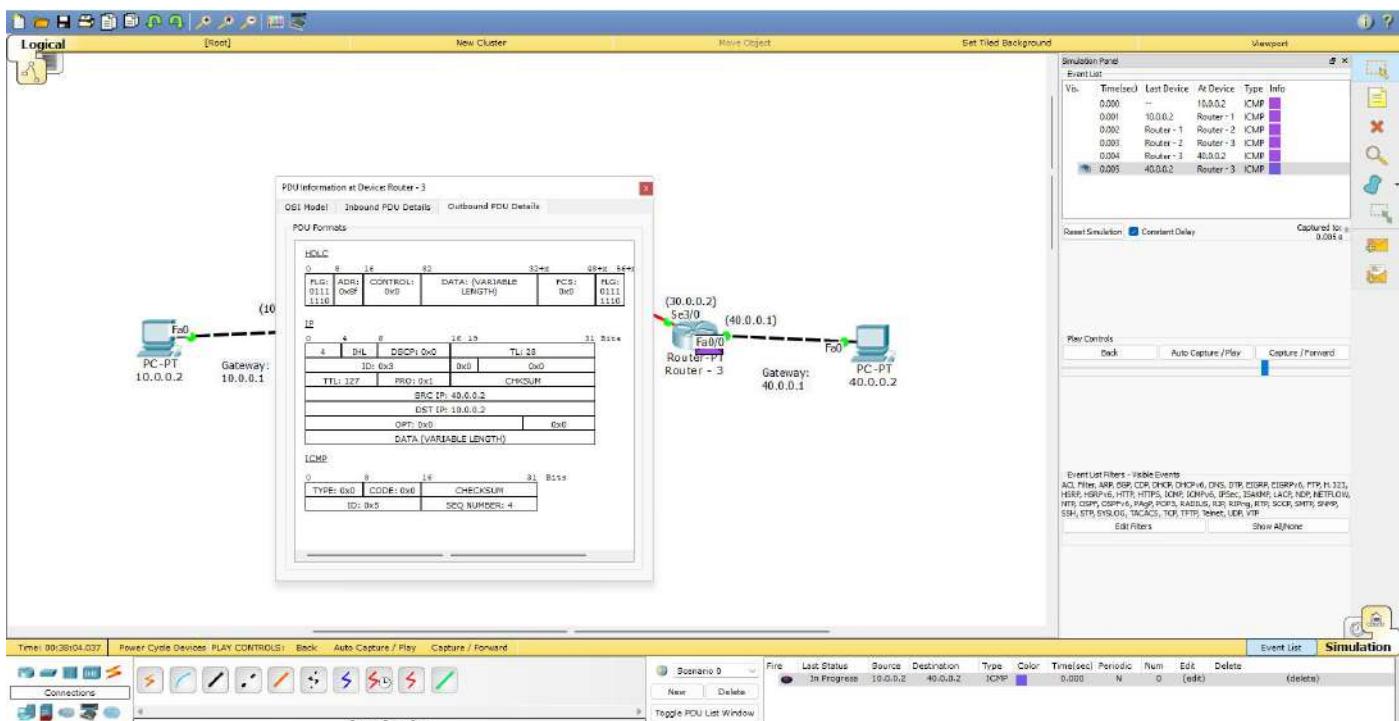
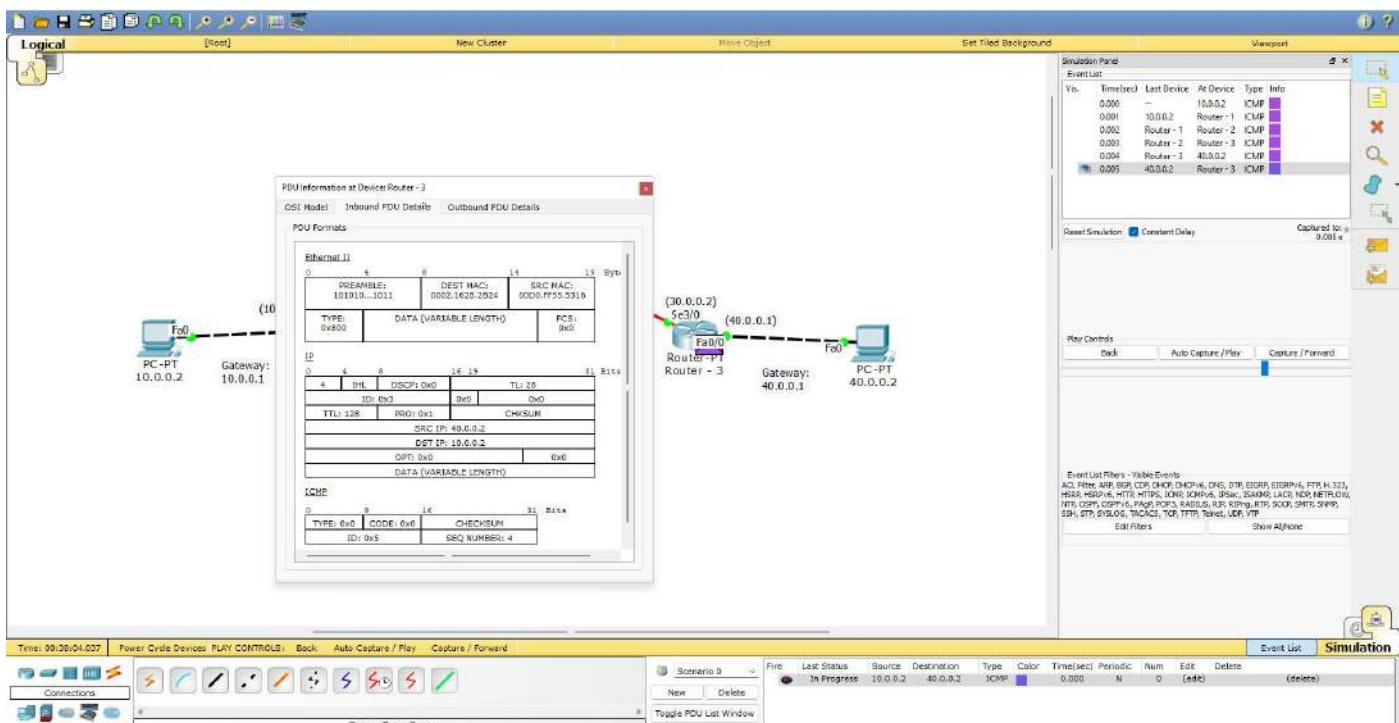


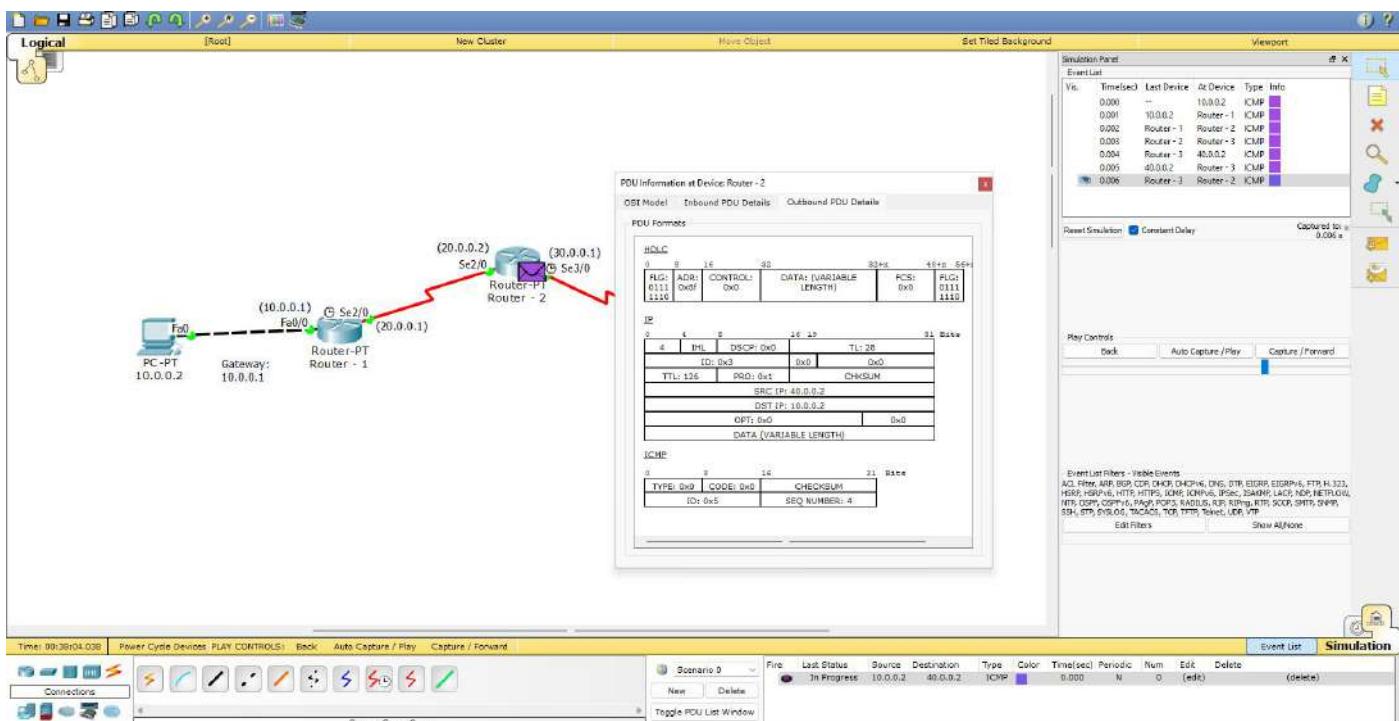
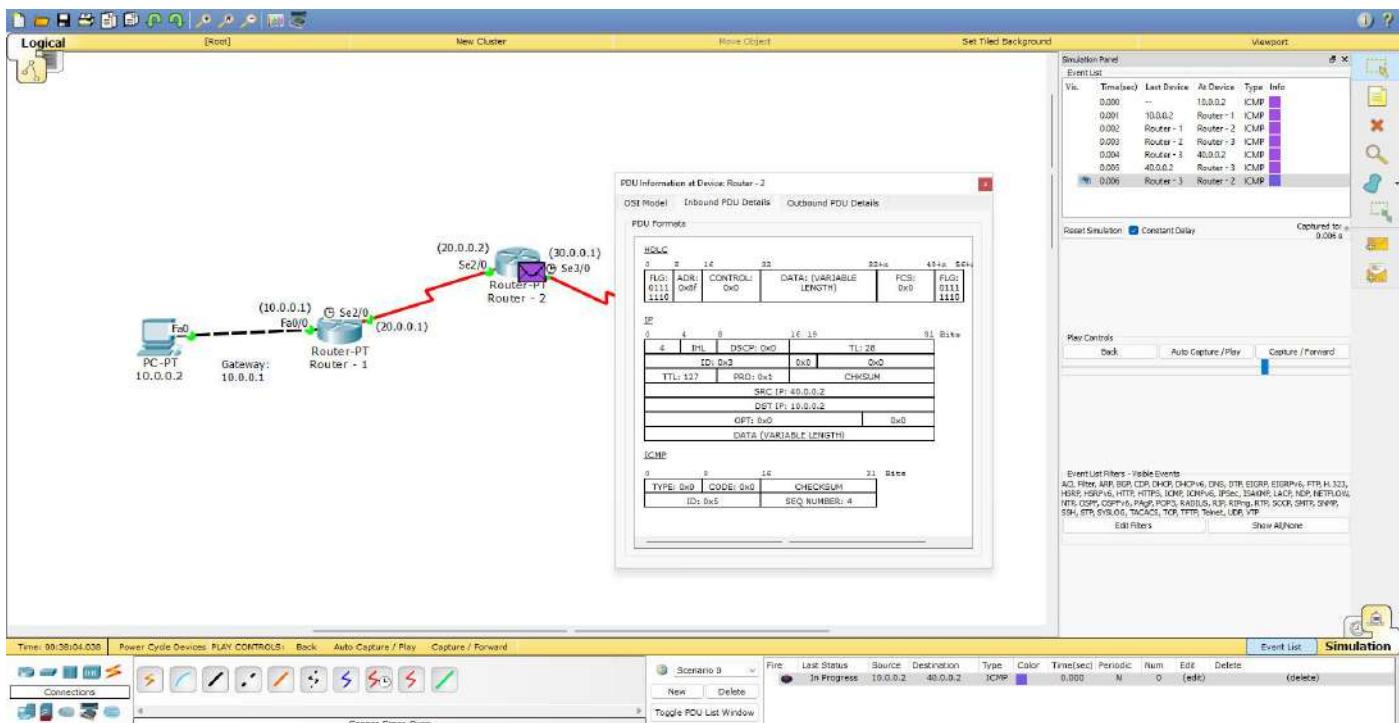


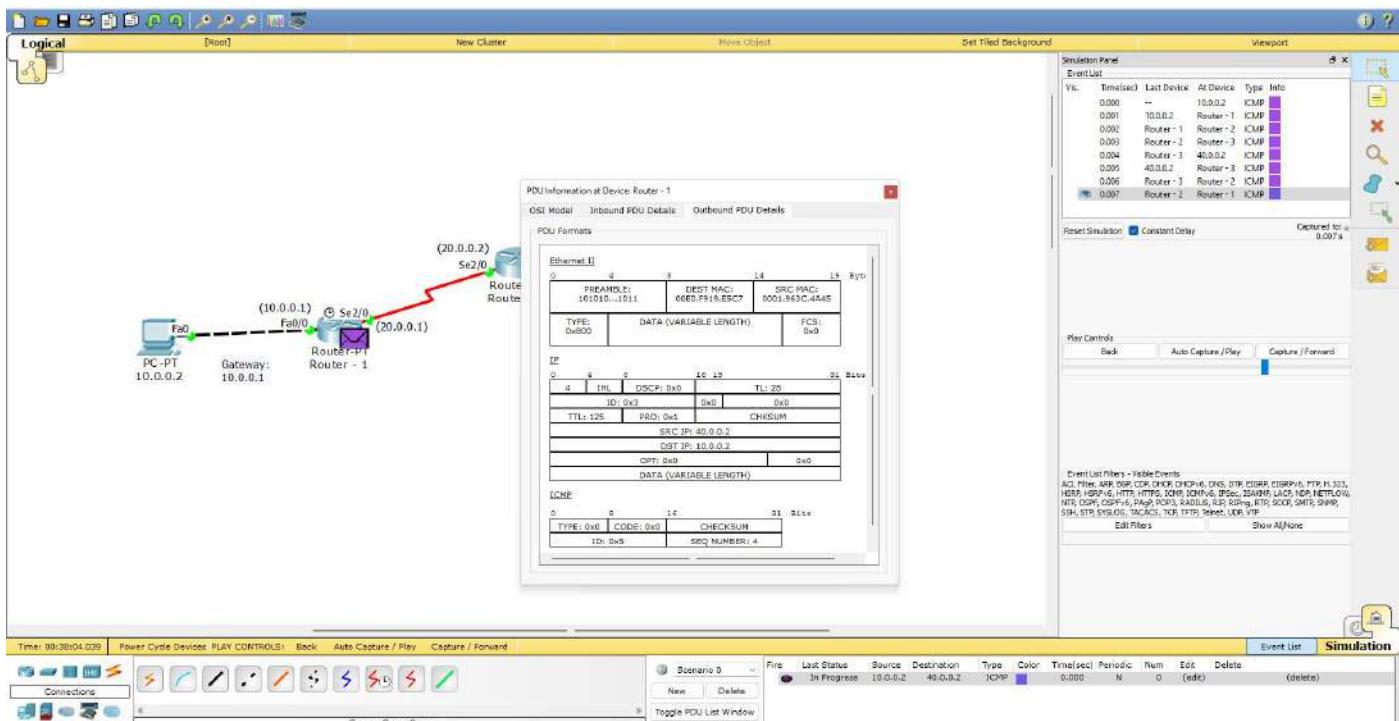
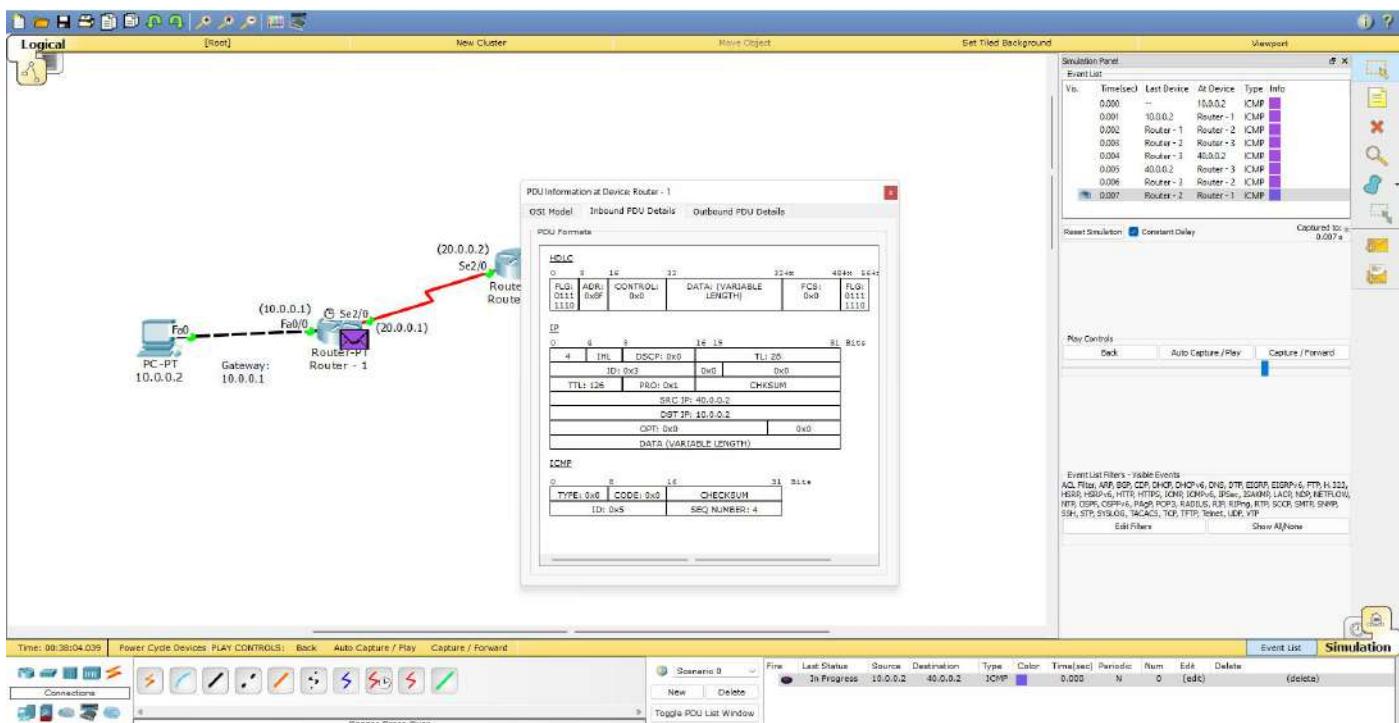


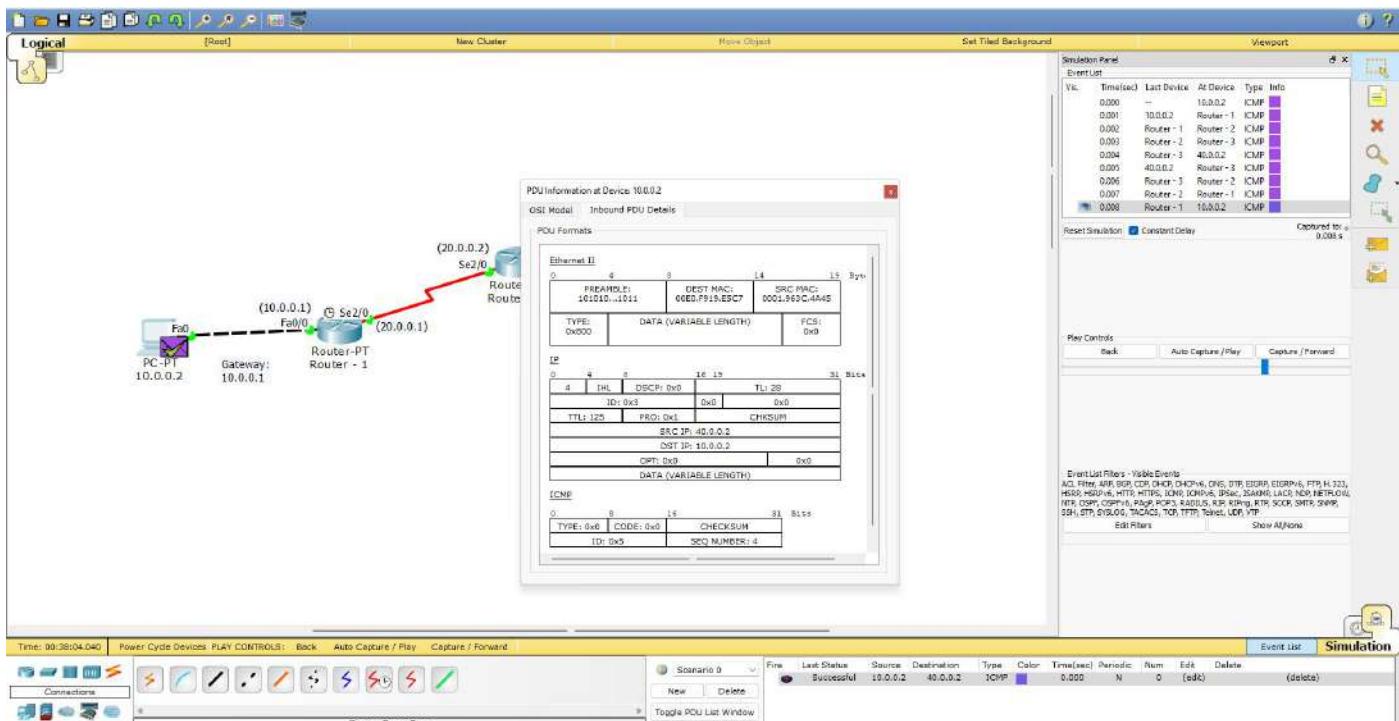




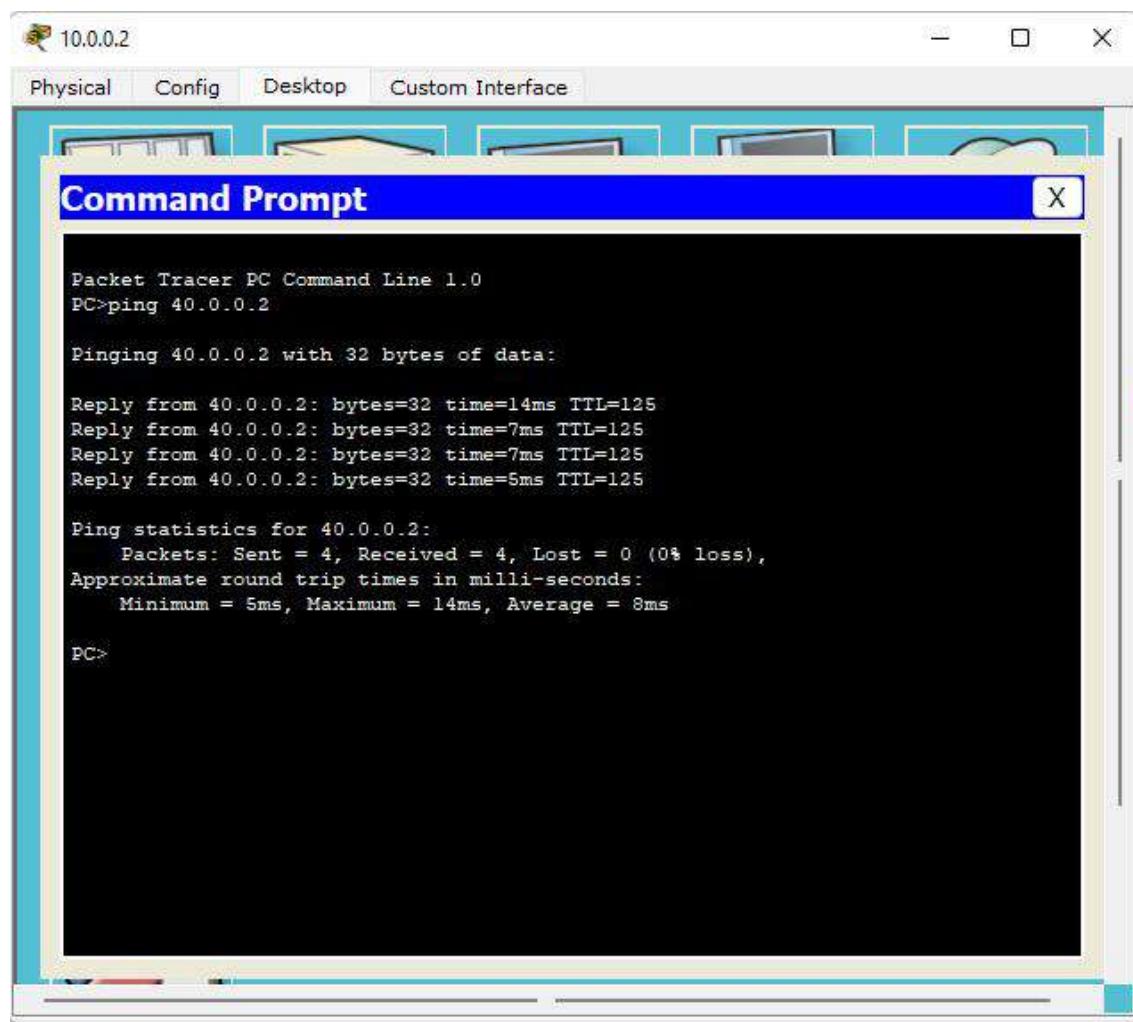




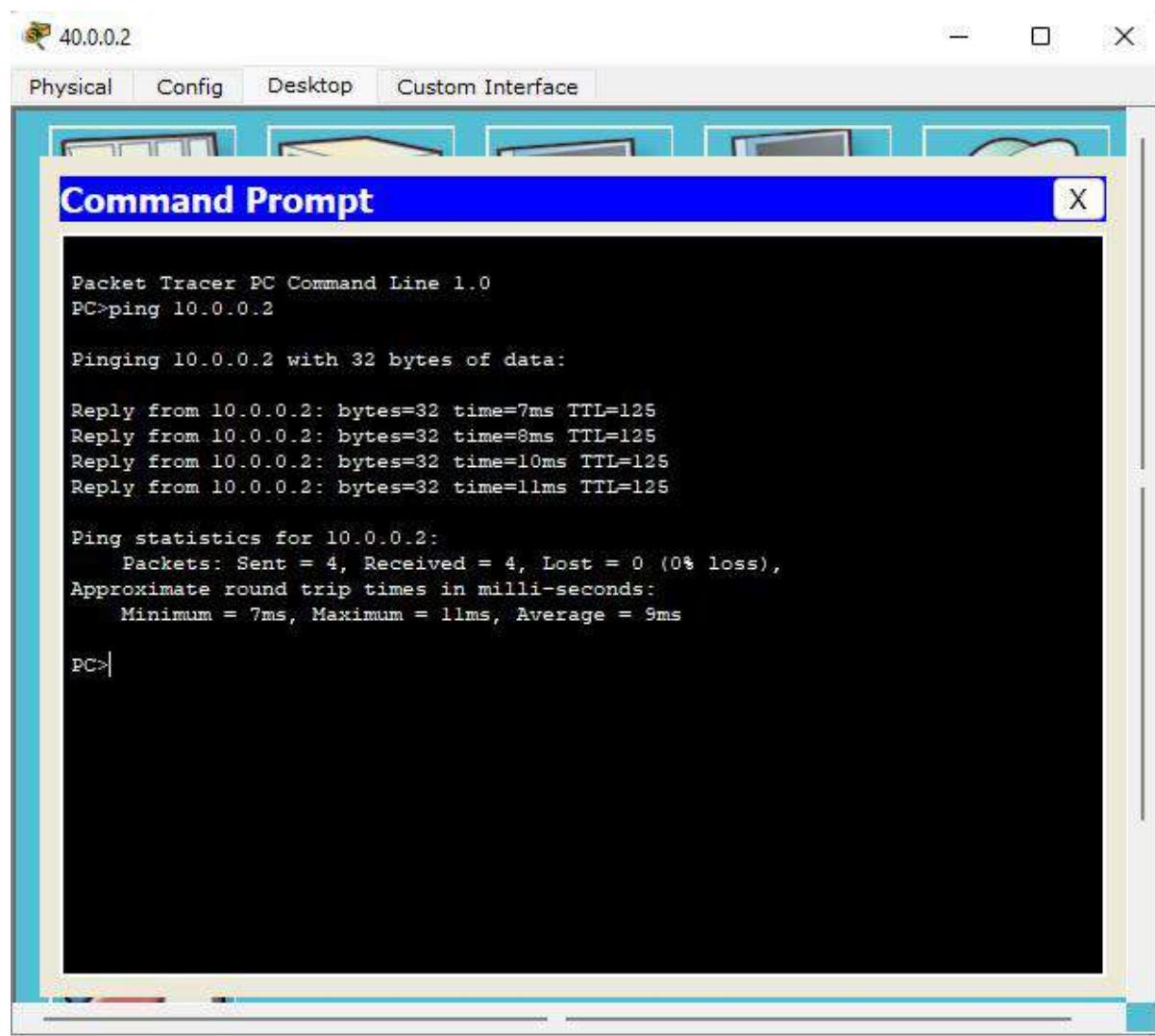




## Pinging from PC - 1 to PC - 2:



## Pinging from PC - 2 to PC - 1:



The screenshot shows a Cisco Packet Tracer interface. At the top, there's a toolbar with icons for Physical, Config, Desktop, and Custom Interface. Below the toolbar is a row of five network interface cards. A window titled "Command Prompt" is open, showing the output of a ping command. The output is as follows:

```
Packet Tracer PC Command Line 1.0
PC>ping 10.0.0.2

Pinging 10.0.0.2 with 32 bytes of data:

Reply from 10.0.0.2: bytes=32 time=7ms TTL=125
Reply from 10.0.0.2: bytes=32 time=8ms TTL=125
Reply from 10.0.0.2: bytes=32 time=10ms TTL=125
Reply from 10.0.0.2: bytes=32 time=11ms TTL=125

Ping statistics for 10.0.0.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 7ms, Maximum = 11ms, Average = 9ms

PC>|
```

### 2.7.3 Observation Book Pictures:

PAGE NO.:  
DATE: 11/08/23

Experiment - 9

Demonstrate the TTL / Life of a Packet

Aim: To demonstrate life of a packet

Topology:

Procedure:

- Add 3 routers and 2 PCs.  
Connect PC-1 to Router-1 using Copper Straight through wire from Fast Ethernet 0 port of PC-1 to Fast Ethernet 0 port of Router-1. Similarly connect PC-2 to Router-3 using Copper - straight through wire from Fast Ethernet 0 port of PC-2 to Fast Ethernet 0 port of Router-3.  
Connect Router-1 and Router-2 to Router-3 using Serial DCE wire from Serial 2/0 port of Router-1 and Serial 3/0 of Router-3 to Serial 2/0 and Serial 3/0 ports of Router-2 respectively.
- a) PC-1 Configuration:  
(Click on PC-1 → Config → Interface → Fast Ethernet 0  
Assign static IP address [10.0.0.2 and Subnet Mask: 255.0.0.0].

Assign static gateway : 10.0.0.1

5) PC-2 Configuration :

Click on PC-2 → Config → Interface → FastEthernet0.

Assign static IP address [40.0.0.2 and Subnet mask, 255.0.0.0].

Assign static gateway : 40.0.0.1

3. Router Configuration :

a) Router-1 Configuration : (Default router)

Router > enable

Router # config t

Router (config) # interface Fa0/0

Router (config-if) # ip address 10.0.0.1 255.0.0.0

Router (config-if) # no shut

Router (config-if) # exit

Router (config) # interface Se2/0

Router (config-if) # ip address 20.0.0.1 255.0.0.0

Router (config-if) # no shut

Router (config-if) # exit

~~Router (config) # interface Se2/0~~

~~Router (config) # ip route 0.0.0.0 0.0.0.0 20.0.0.2~~

~~Router (config) # exit~~

b) Router-2 Configuration : (Static Router) :

Router > enable

Router # config t

Router (config) # interface Se2/0

Router (config-if) # ip address 20.0.0.2 255.0.0.0

Router(config-if)# no shut

Router(config-if)# exit

Router(config)# interface Se3/0

Router(config-if)# ip address 30.0.0.1 255.0.0.0

Router(config-if)# no shut

Router(config-if)# exit

Router(config)# ip route 10.0.0.0 255.0.0.0 20.0.0.1

Router(config)# ip route 40.0.0.0 255.0.0.0 30.0.0.2

Router(config)# exit

② Router-3 (configuration): (Default router)

Router>enable

Router# config t

Router(config)# interface Se3/0

Router(config-if)# ip address 30.0.0.2 255.0.0.0

Router(config-if)# no shut

Router(config-if)# exit

~~Router(config)# interface Fa0/0~~

~~Router(config-if)# ip address 40.0.0.1 255.0.0.0~~

~~Router(config-if)# no shut~~

~~Router(config-if)# exit~~

Router(config)# ip route 0.0.0.0 0.0.0.0 30.0.0.1

Router(config)# exit



u. Show ip route:

a) Router-1:

Router > enable

Router # show ip route

C 10.0.0.0/8 is directly connected, FastEthernet 0/0

C 20.0.0.0/8 is directly connected, Serial 1/0

S\* 0.0.0.0 [1/0] via 20.0.0.2

b) Router-2:

Router > enable

Router # show ip route:

S 10.0.0.0 [1/0] via 20.0.0.1

C 20.0.0.0/8 is directly connected, Serial 2/0

C 30.0.0.0/8 is directly connected, Serial 3/0

S 40.0.0.0/8 [1/0] via 30.0.0.2

c) Router-3:

Router > enable

Router # show ip route

C 30.0.0.0/8 is directly connected, Serial 3/0

C 40.0.0.0/8 is directly connected, Fast Ethernet 0/0

S\* 0.0.0.0/0 [1/0] via 30.0.0.1

5. Send a PDU from PC-1 to PC-2 and check the value of TTL at every step.



Result: (in simulation Mode):

1. Sending a PDU from PC-1 to PC-2:

Outbound PDU details at Device 10.0.0.2:

DEST MAC : 0001.963C.4A45

SRC MAC : 00E0.F919.E5C7

TTL : 255.

At Router-1 :

Inbound PDU details at Device Router-1:

DEST MAC : 0001.963C.4A45

SRC MAC : 00E0.F919.E5C7

TTL : 255

Outbound PDU details at Device Router-1:

DEST MAC : 0001.963C.4A45

SRC MAC : 00E0.F919.E5C7

TTL : 254

At Router-2

Inbound PDU details at Device Router-2:

TTL : 254

Outbound PDU details at Device Router-2:

TTL : 253

At Router-3

Inbound PDU details at Device Router-3:

TTL : 253

Outbound PDU details at Device Router-3:

TTL: 252

At PC-2:

Inbound PDU details at Device 40.0.0.2:

DEST MAC: 0000.0000.0000

SRC MAC: 0002.1628.02B2

TTL: 252

Outbound PDU details at Device 40.0.0.2:

DEST MAC: 0002.1628.02B2

SRC MAC: 0000.0000.0000

TTL: 128

At Router-3

Inbound PDU details at Device Router-3

DEST MAC: 0002.1628.02B2

SRC MAC: 0000.0000.0000

TTL: 128

Outbound PDU details at Device Router-3:

TTL: 127

At Router-2:

Inbound PDU details at Device Router-2:

TTL: 127

Outbound PDU details at Device Router-2:

TTL: 126

At Router 1:

Inbound PDU details at Device Router-1:

TTL: 126

Outbound PDU details at Device Router-1:

DEST MAC: 00E0. F919. E5C7

SRC MAC: 0001. 963C. 4A45

TTL: 125

At PC-1:

Inbound PDU details at Device 10.0.0.2:

DEST MAC: 00E0. F919. E5C7

SRC MAC: 0001. 963C. 4A45

TTL: 125

2. Pinging From PC-1 to PC-2

PC > ping 10.0.0.2

Pinging 10.0.0.2 with 32 bytes of data:

Reply from 10.0.0.2: bytes = 32 time = 14 ms TTL = 125

Reply from 10.0.0.2: bytes = 32 time = 7 ms TTL = 125

Reply from 10.0.0.2: bytes = 32 time = 7 ms TTL = 125

Reply from 10.0.0.2: bytes = 32 time = 5 ms TTL = 125

Ping statistics for 10.0.0.2

Packets: Sent = 4, Received = 4, Lost = 0 (0% loss)

Approximate round trip times in milli-seconds:

Minimum = 5ms, Maximum = 14ms, Average = 8ms

### Observation:

TTL (Time-to-live) is a value in an Internet Protocol packet that tells a network router when the packet has been in the network too long and should be discarded. The TTL value instructs a network router when a packet should be discarded.

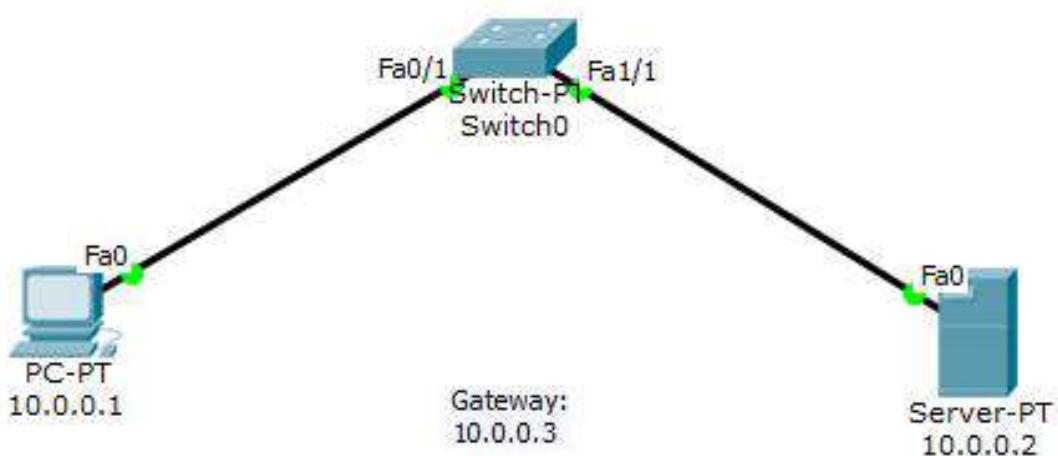
## 2.8 Experiment - 8:

### 2.8.1 Question:

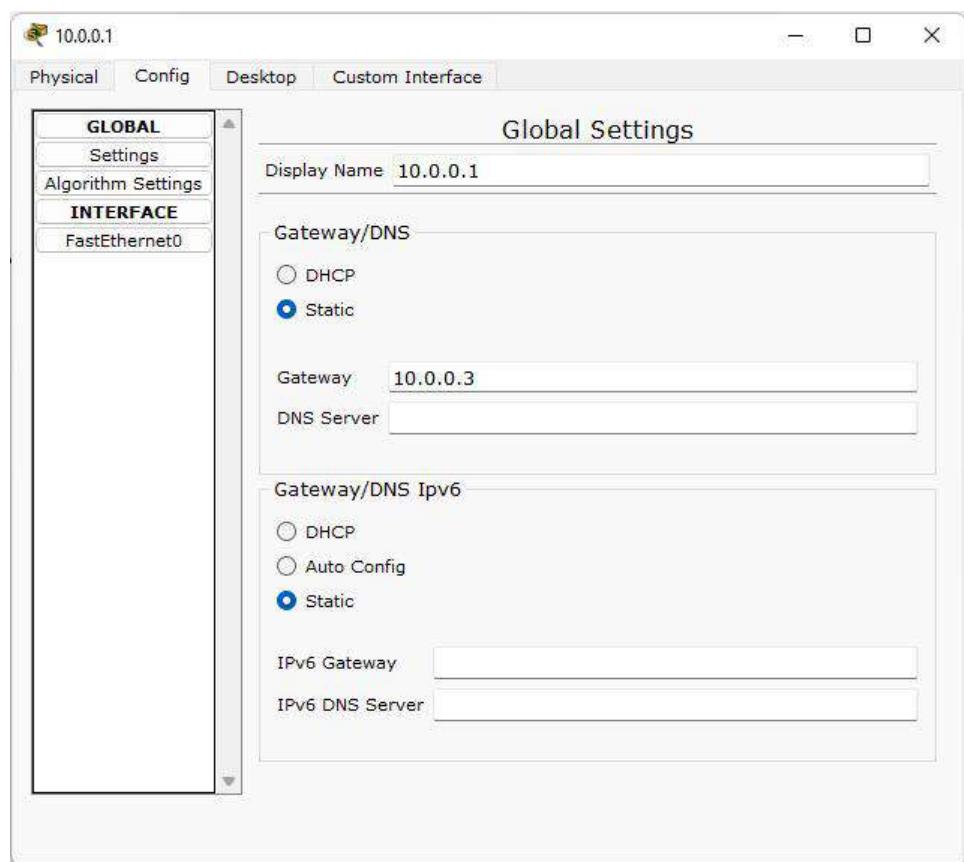
Configure Web Server, DNS within a LAN.

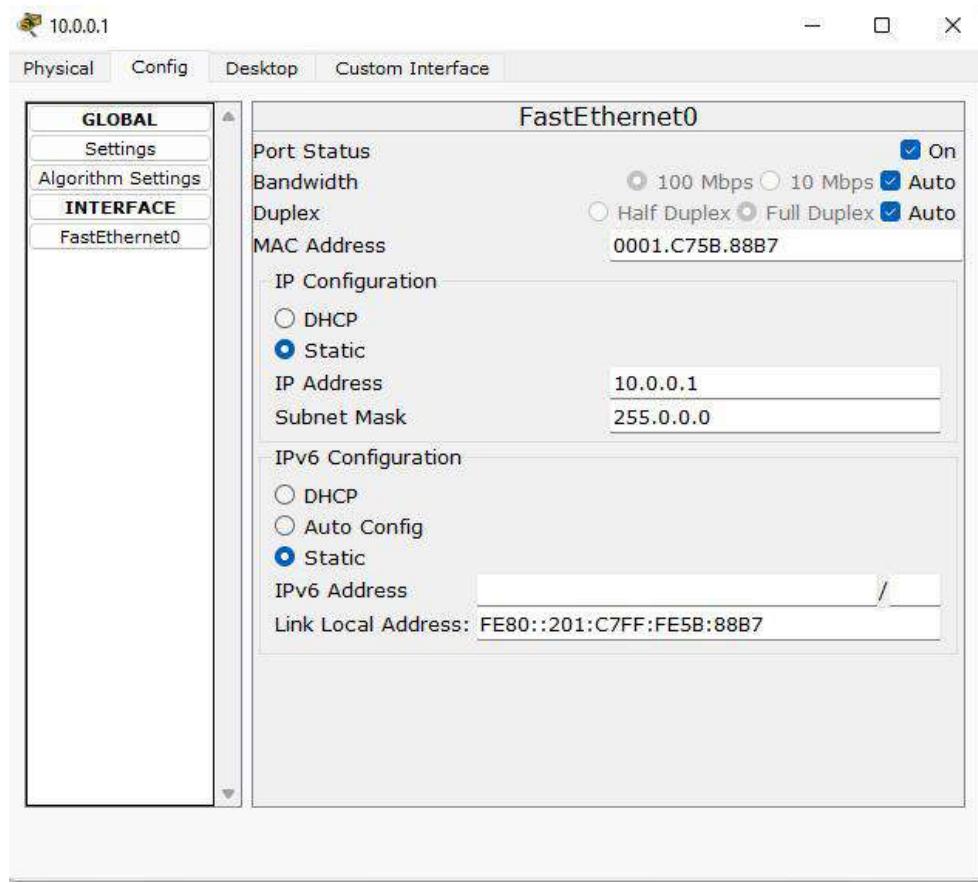
### 2.8.2 Screenshots (Topology, Configurations & Output):

#### Topology:

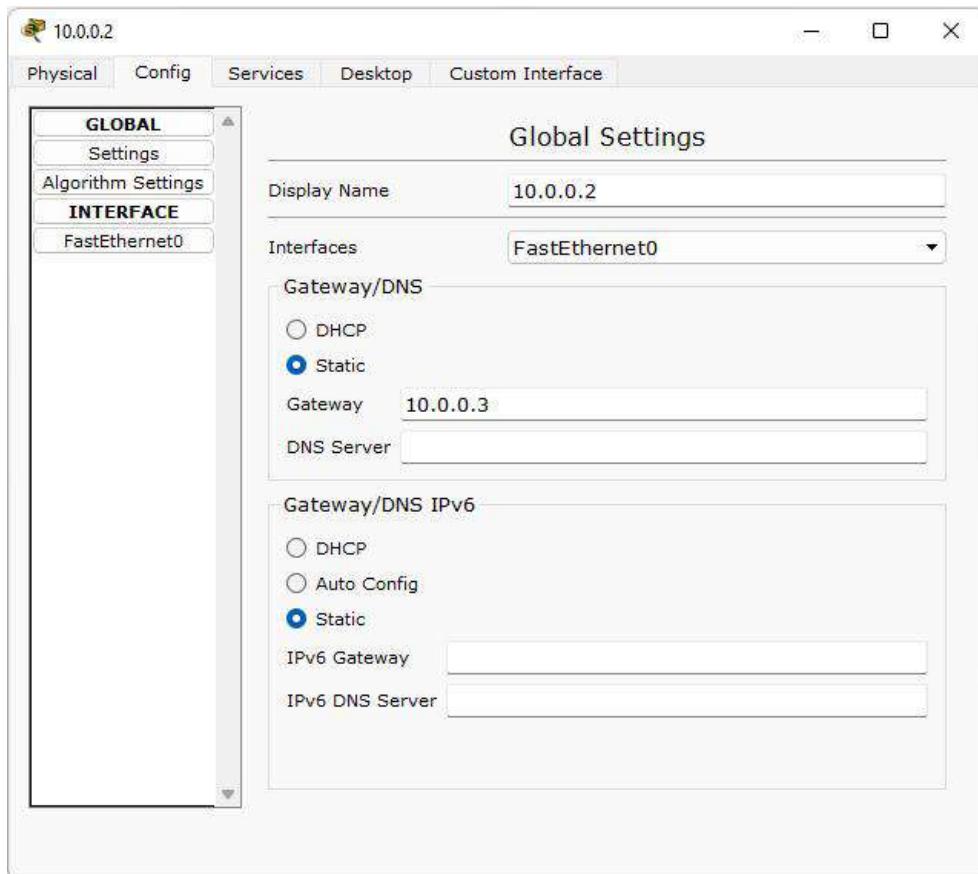


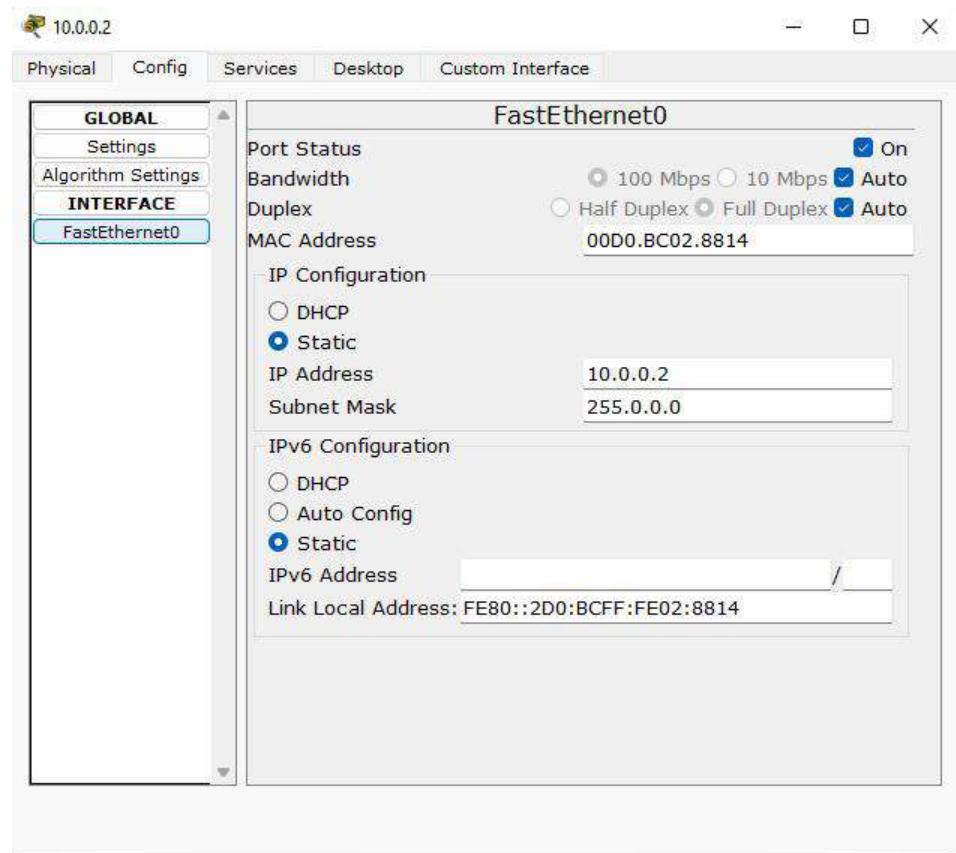
#### PC - 1 Configuration:



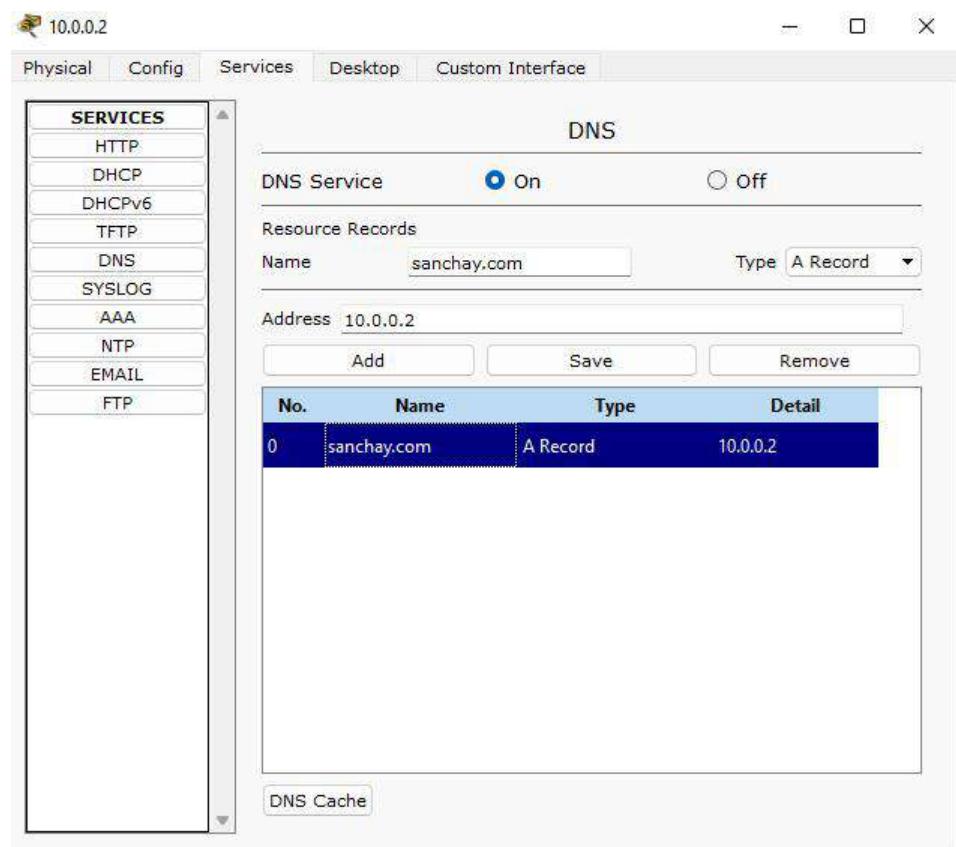


## Server Configuration:

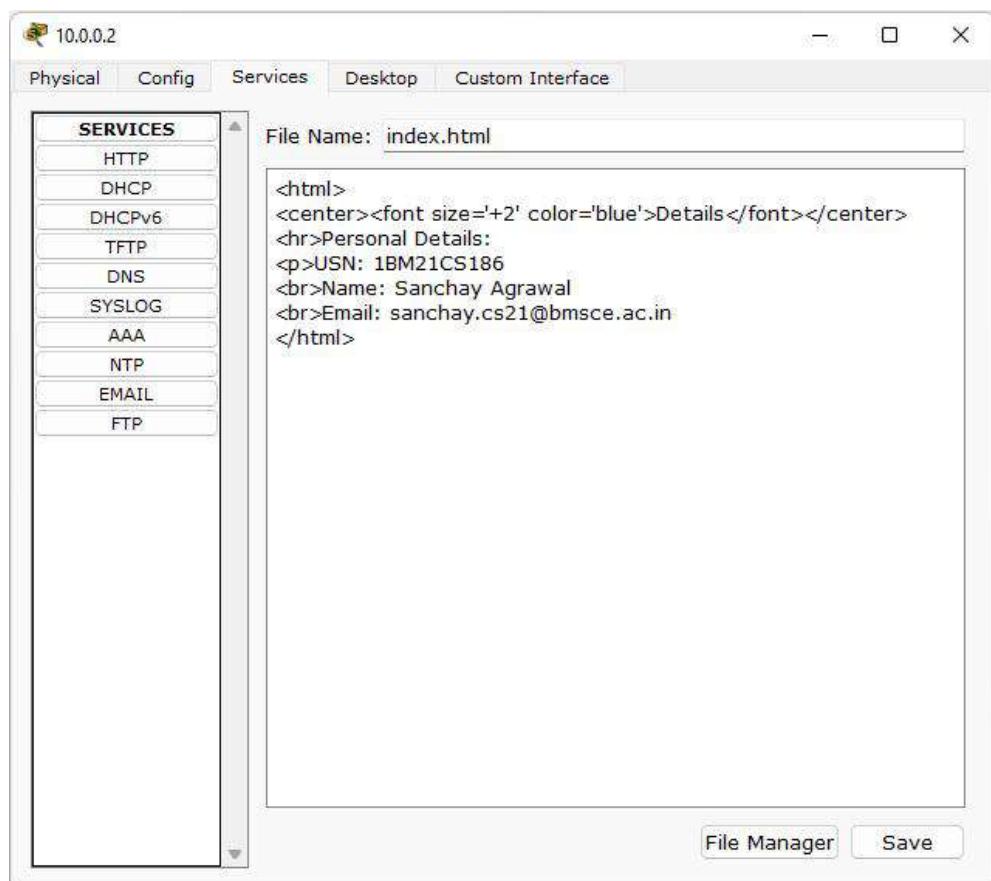
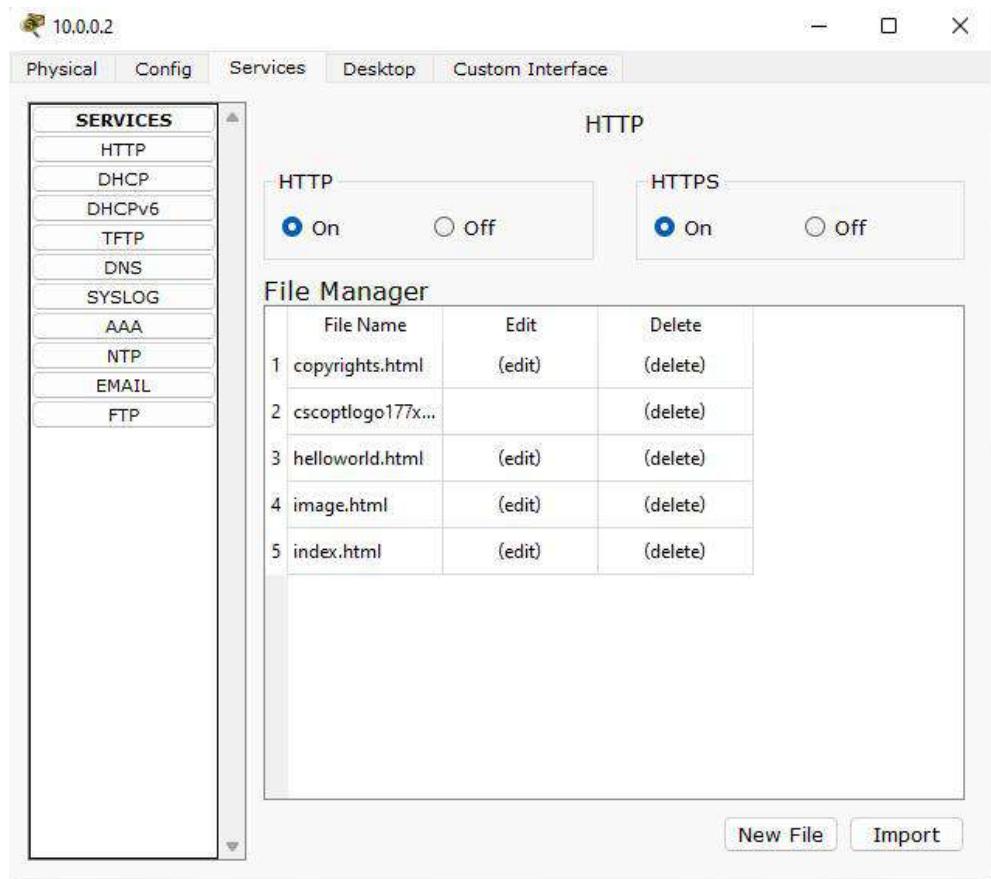




## Configuring DNS in Server:

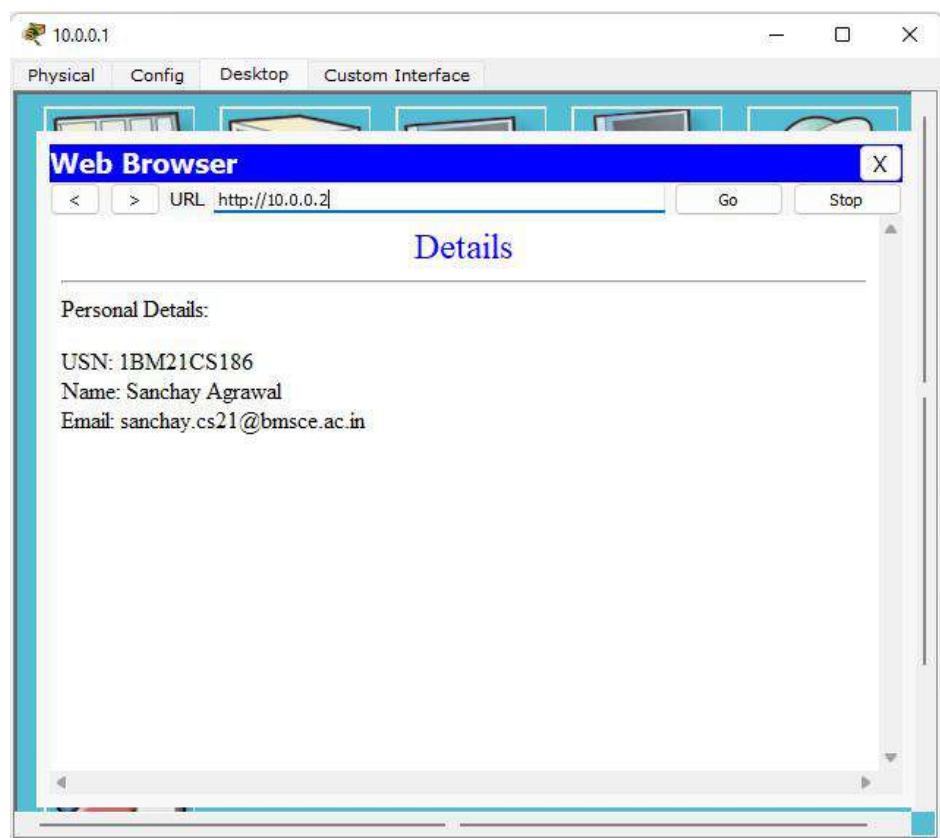
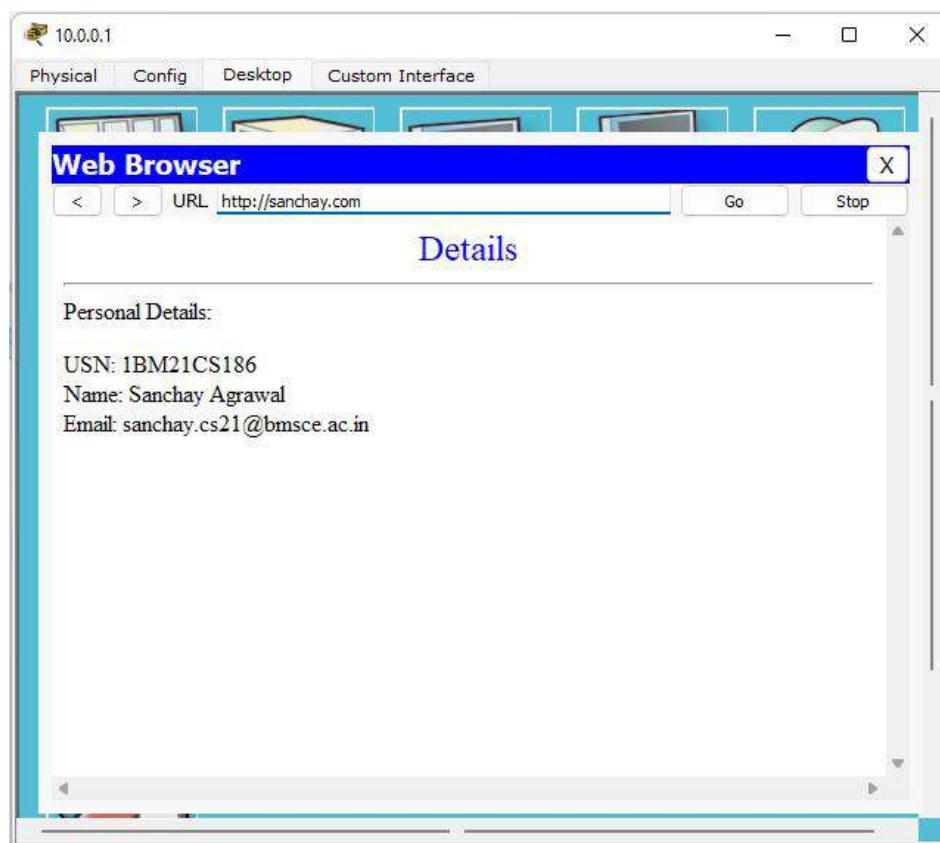


## Editing the index.html page:



## Output:

### Accessing the HTML page using Web Browser of PC:



### 2.8.3 Observation Book Pictures:

PAGE NO :  
DATE : 21/07/2023

Experiment - 6

Configure Web Server, DNS within a LAN.

Aim: To simulate a simple configuration of web server, DNS within a LAN.

Topology:

Procedure :

1. Add a PC, Switch and a Server.  
Connect the PC to the Switch using Copper Straight-through wire from FastEthernet 0 port on PC to FastEthernet 0/1 port of switch.  
Connect the Server to the switch using Copper Straight Through wire from FastEthernet 0 port on Server to FastEthernet 0/1 port on switch.
2. PC-1 Configuration:  
Click on PC-1 → Config → Interface → fastEthernet 0  
Assign a static ip address to PC-1 [i.e 10.0.0.1 & Subnet Mask: 255.0.0.0]  
Set Gateway : 10.0.0.3
3. Server Configuration:  
Click on Server → Config → Interface → FastEthernet 0.  
Assign a static ip address to Server [i.e 10.0.0.2 &

Subnet Mask: 255.0.0.0].

Set Gateway: 10.0.0.3

4. Configuring DNS in Server:

Click on Server → Services → DNS

Turn ON the DNS Service.

Under Resource Records:

Set Name: sanchay.com

Address: 10.0.0.2

Then Click on Add.

Click on Server → Services → HTTP

Turn ON both HTTP and HTTPS

Under File Manager, Click edit on index.html.

File name: index.html

<html>

<center><font size='+2' color='blue'> Details </font>  
</center>

<hr> Personal Details :

<p> USN: 1BM21CS106

<br> Name: Sanchay Agrawal

<br> E-mail: ~~sanchay.cse21@bmsce.ac.in~~

</html>

Click on Save.

Result:

To access the Web-page, Click on PC-1 → Web-Browser

In URL, type: sanchay.com (CR 10.0.0.2)

⇒

Our web-page will open.

Details

Personal Details:

USN : 1BM21CS186

Name : Sanchar Agarwal

E-mail : sanchar.cs21@bmsce.ac.in.

The webpage is accessed using the server.

Observation:

DNS server is used to store Domain names  
~~mapped to their respective IPs.~~

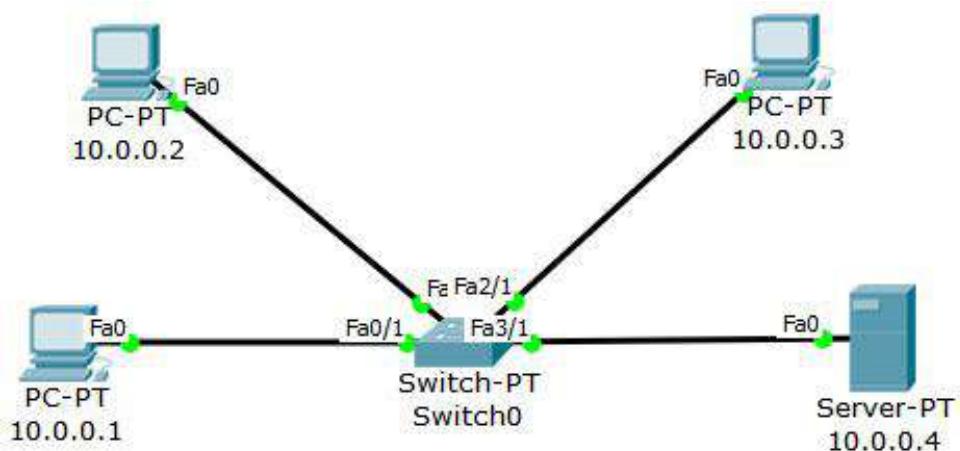
## 2.9 Experiment - 9:

### 2.9.1 Question:

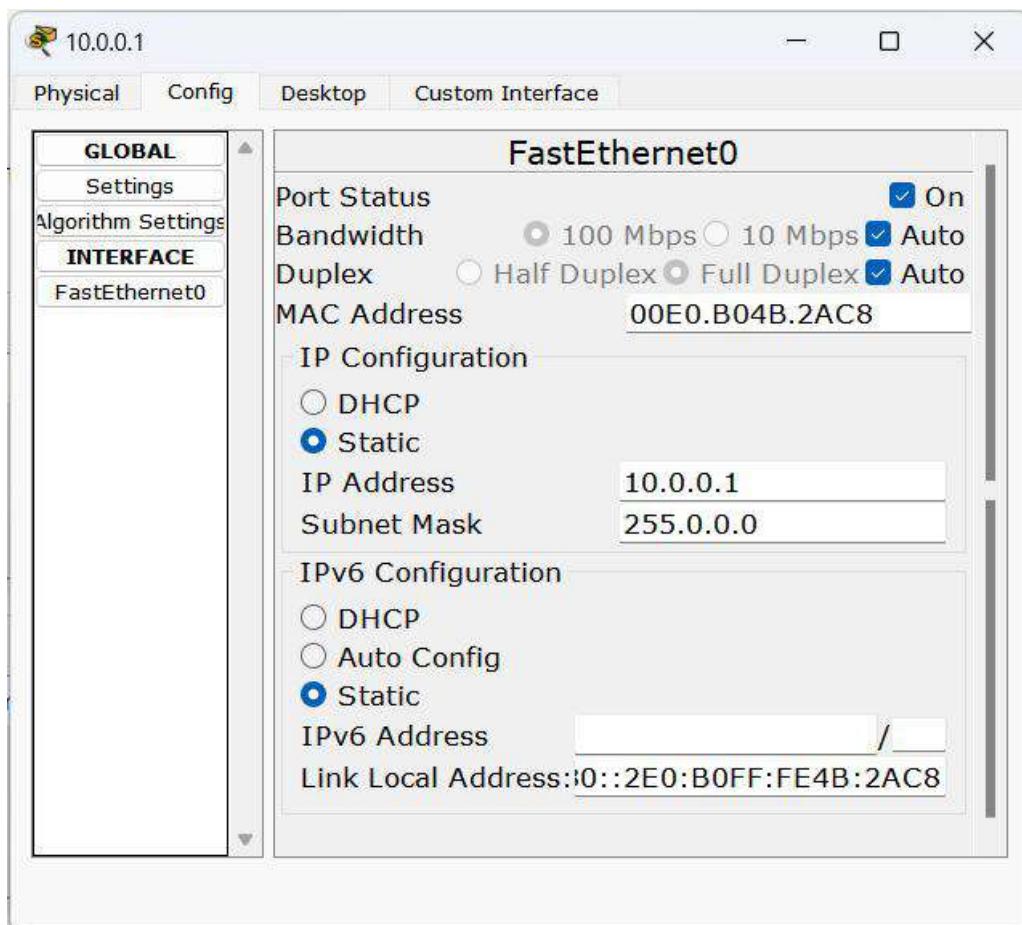
To construct simple LAN and understand the concept and operation of Address Resolution Protocol (ARP).

### 2.9.2 Screenshots (Topology, Configurations & Output):

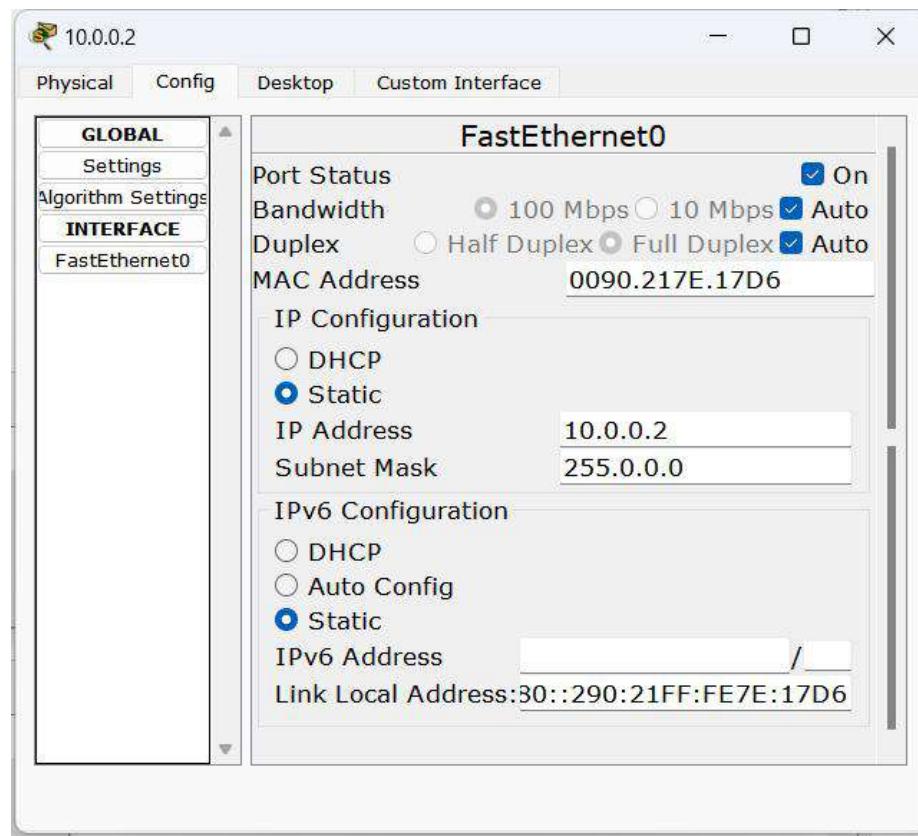
#### Topology:



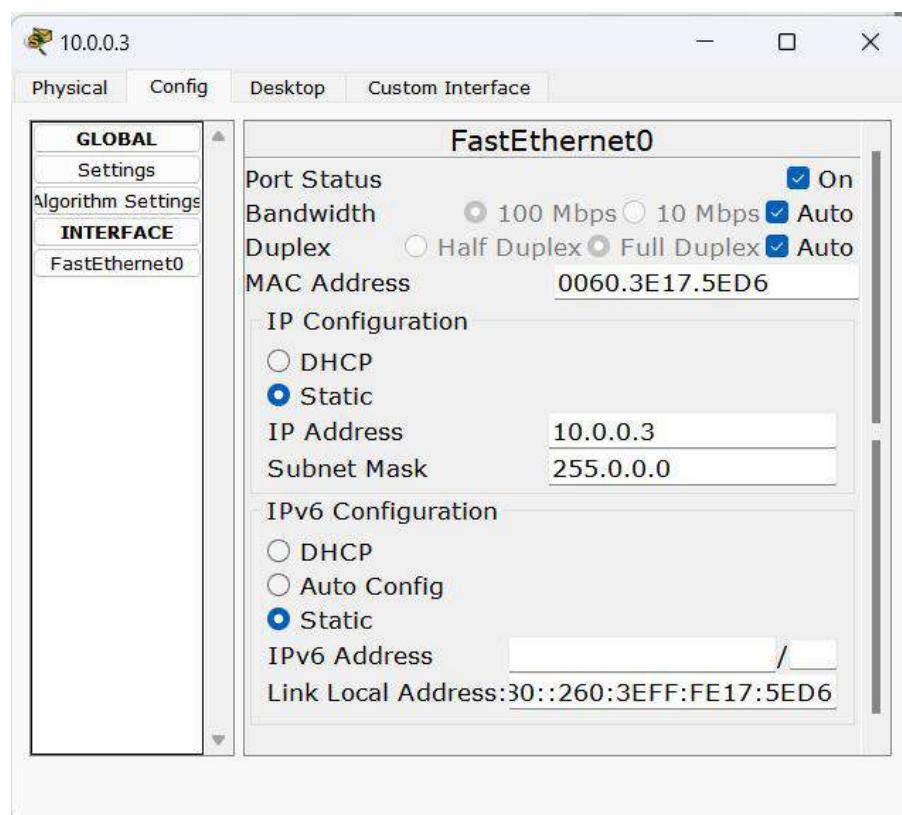
#### PC - 1 Configuration:



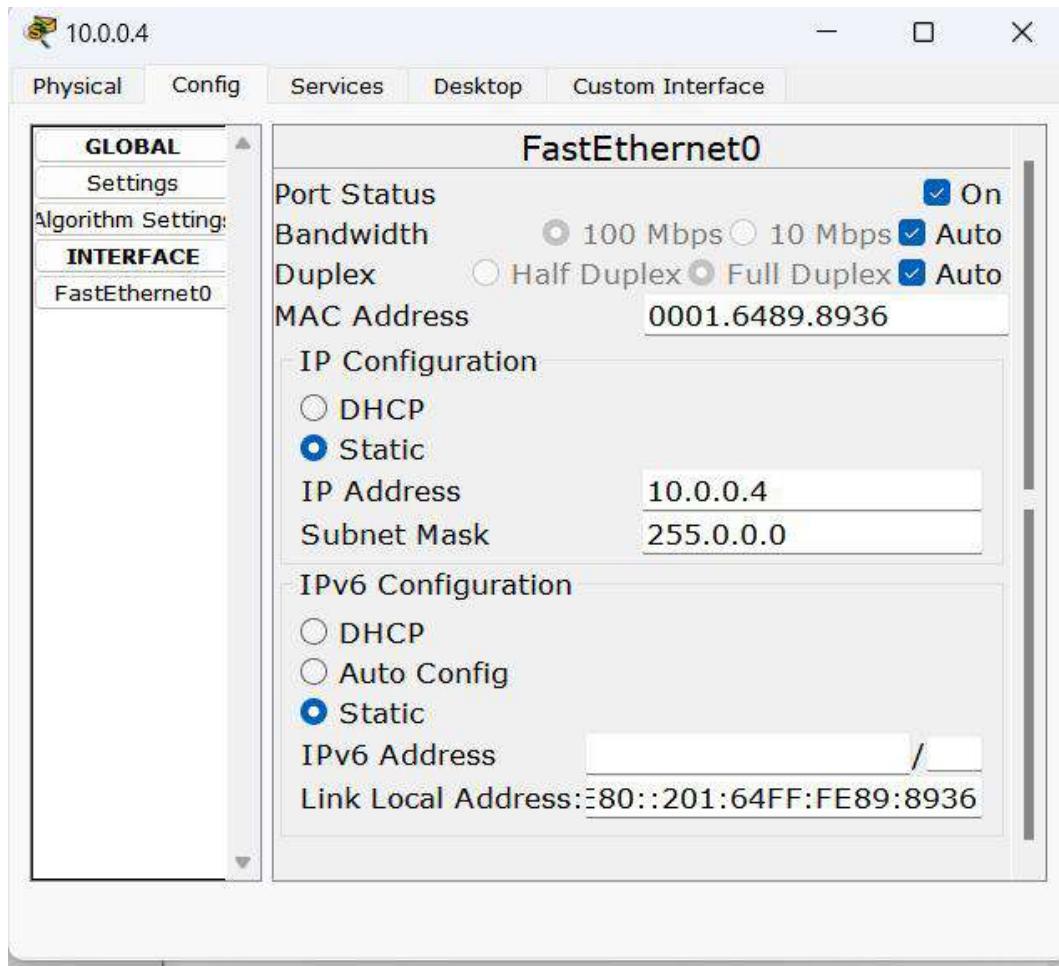
## PC - 2 Configuration:



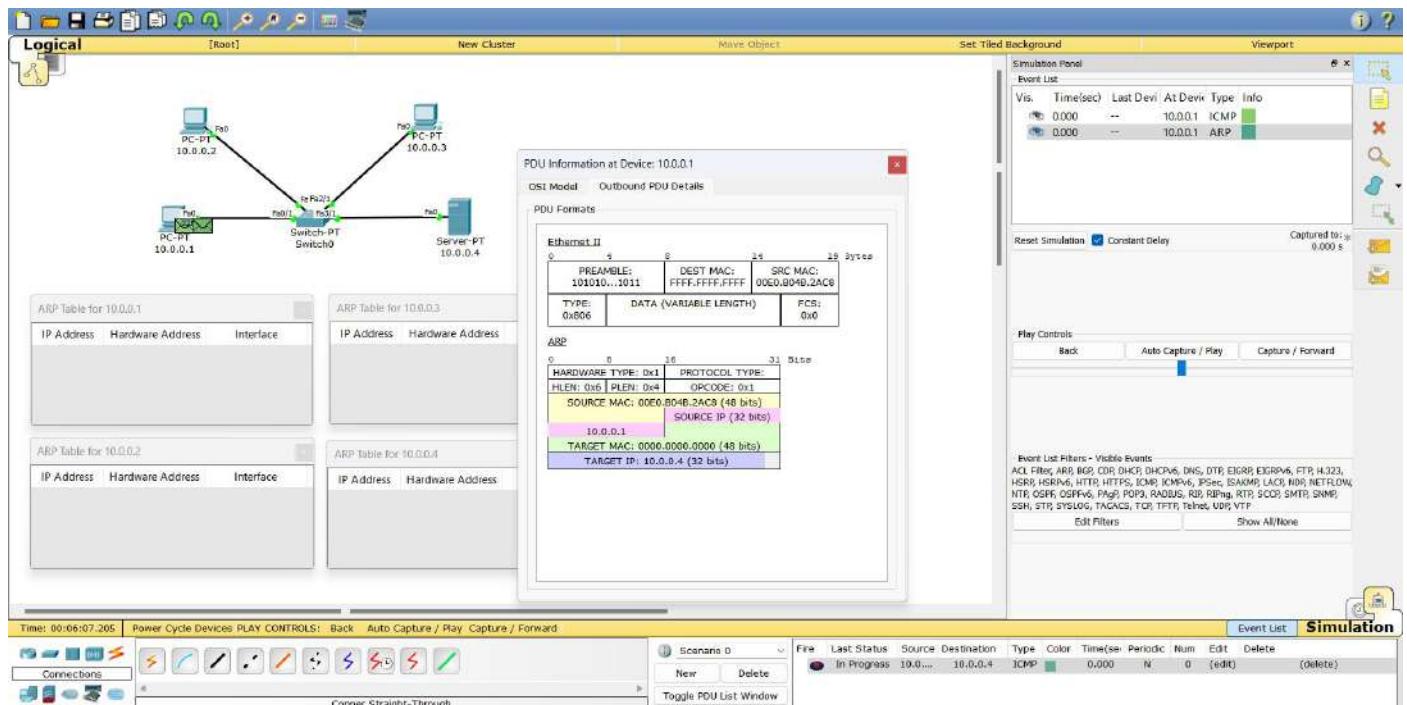
## PC - 3 Configuration:

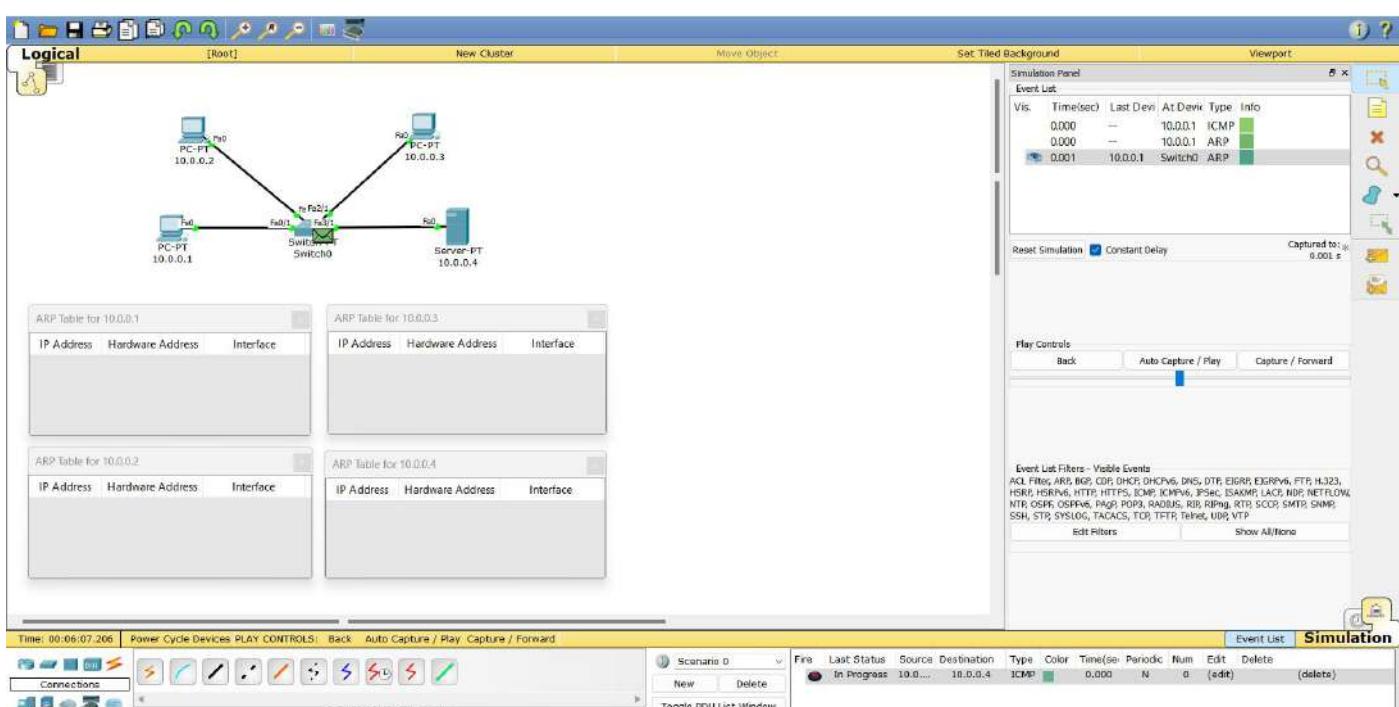
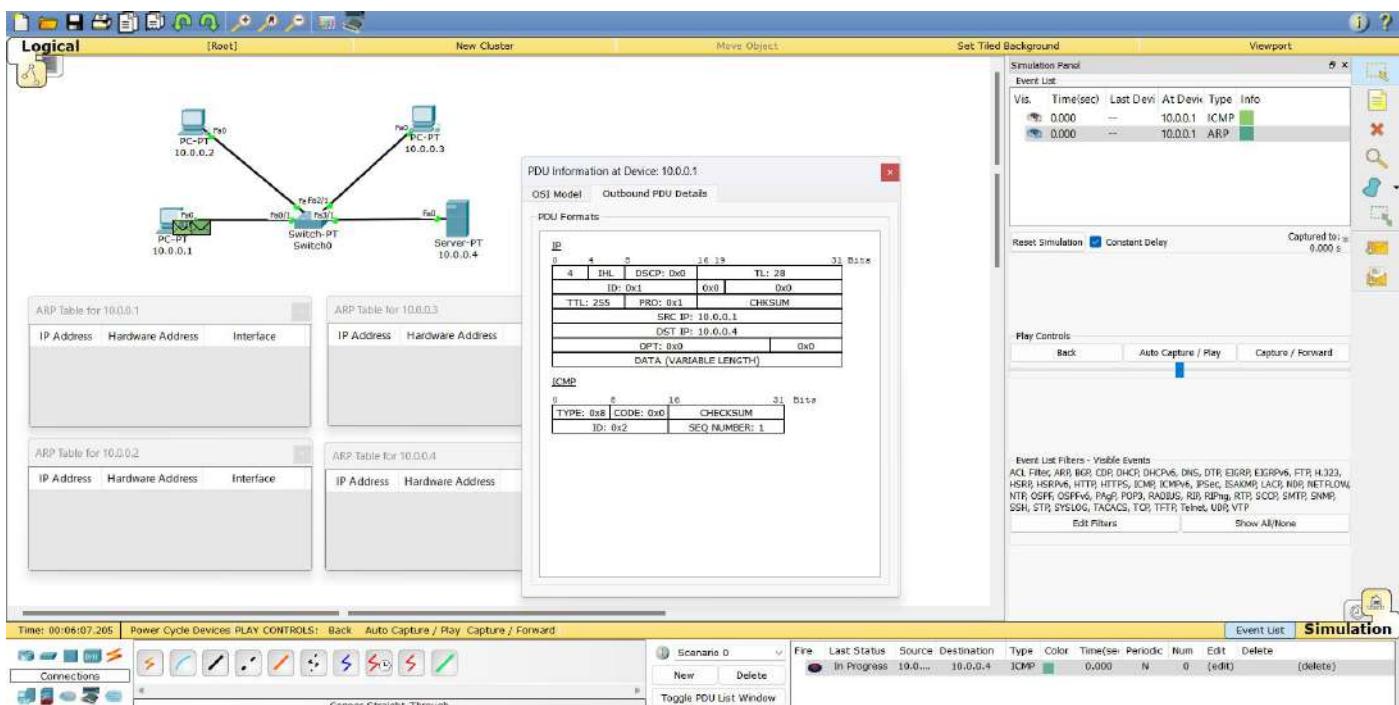


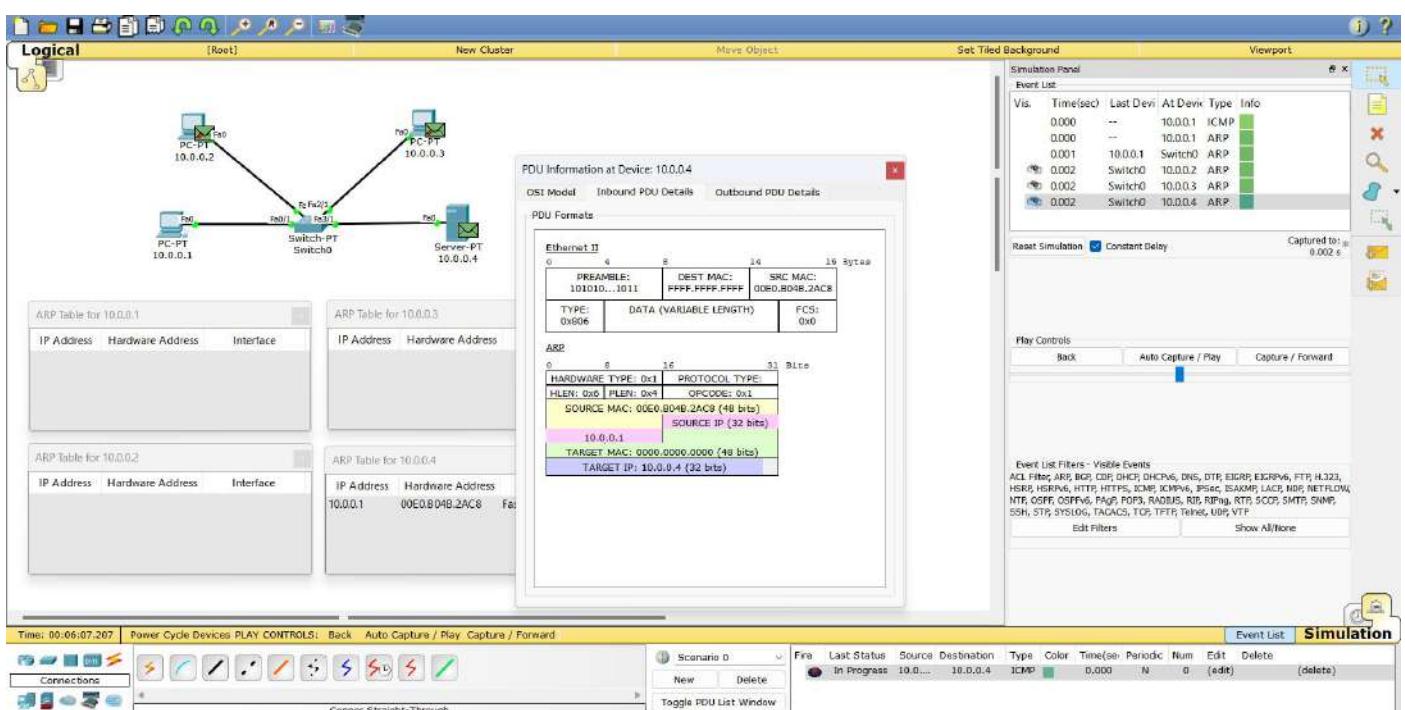
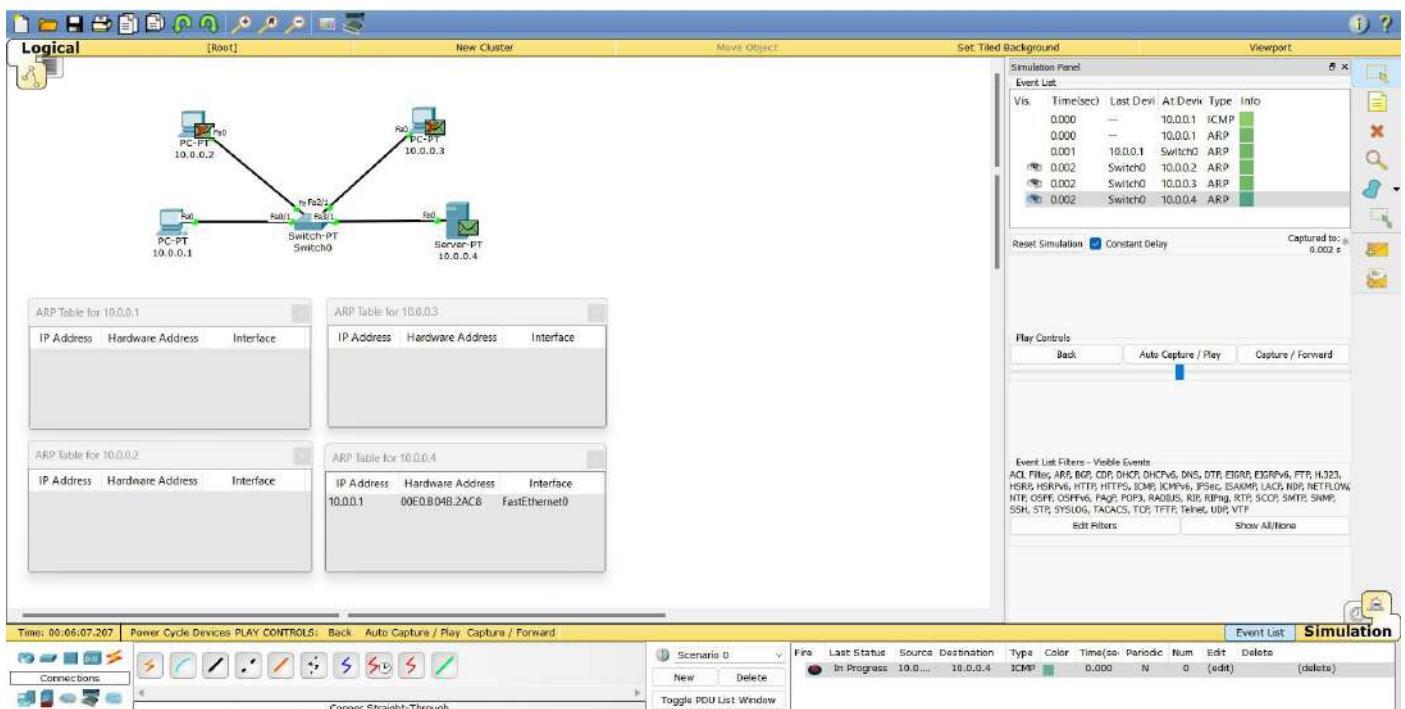
## Server Configuration:

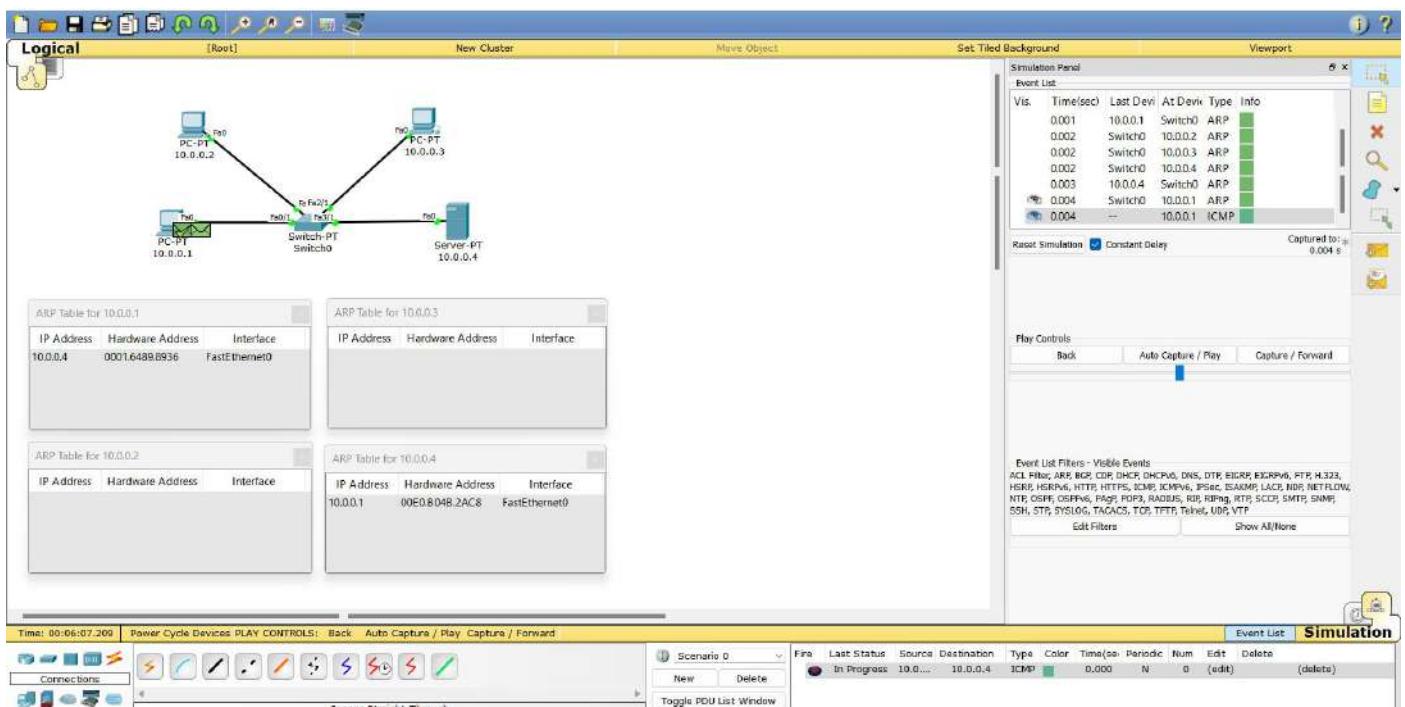
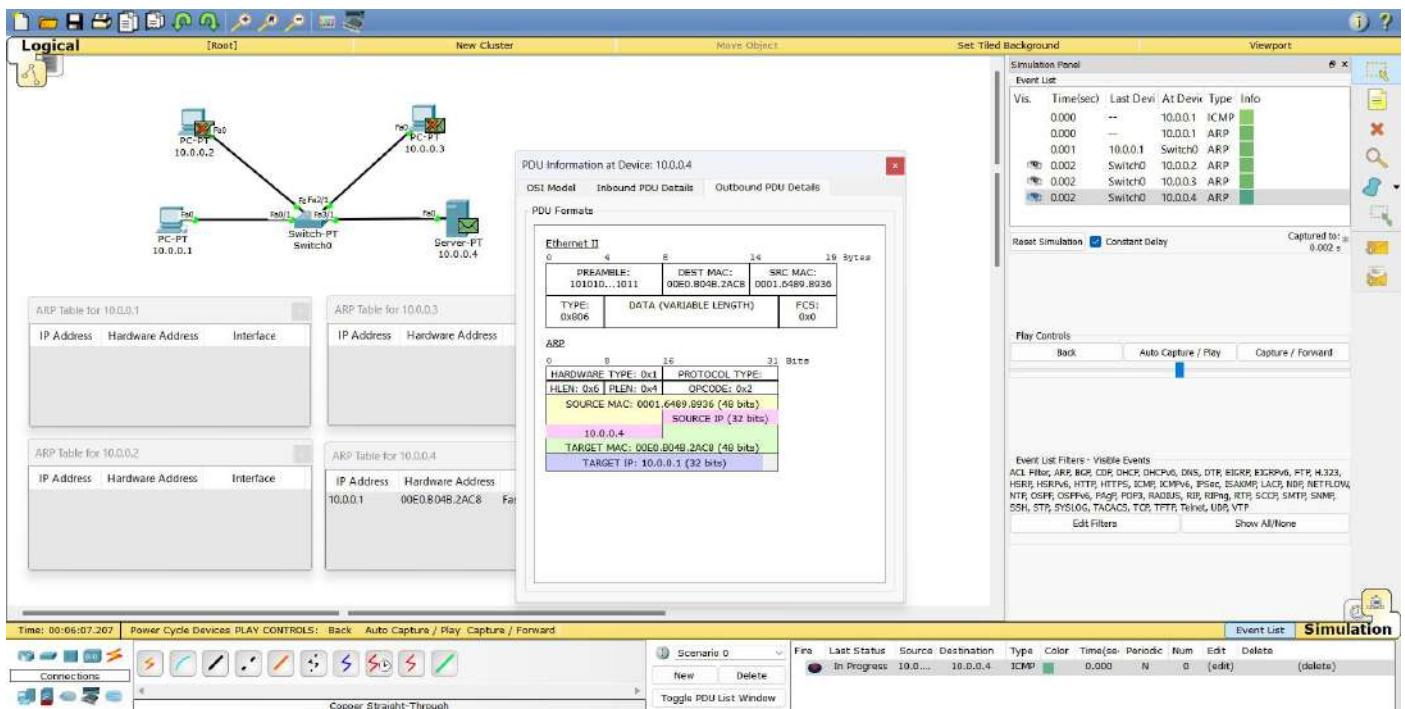


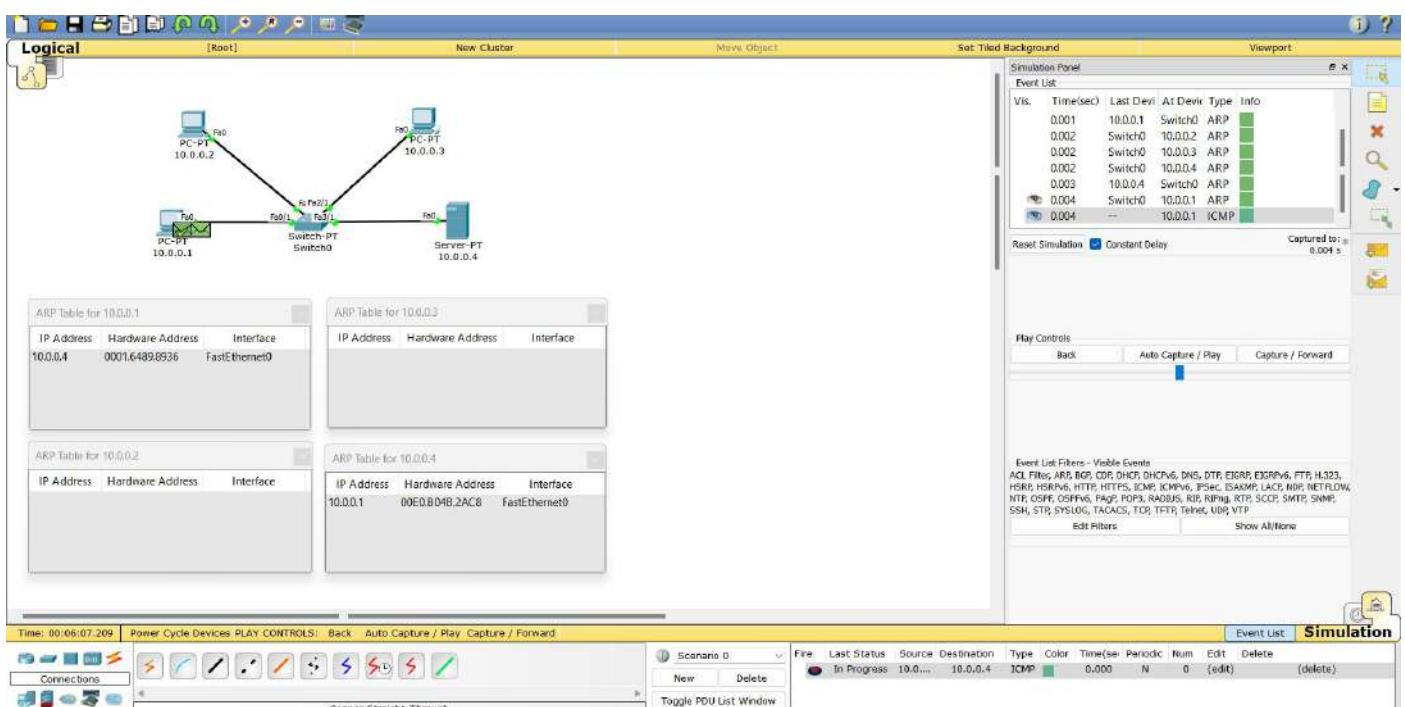
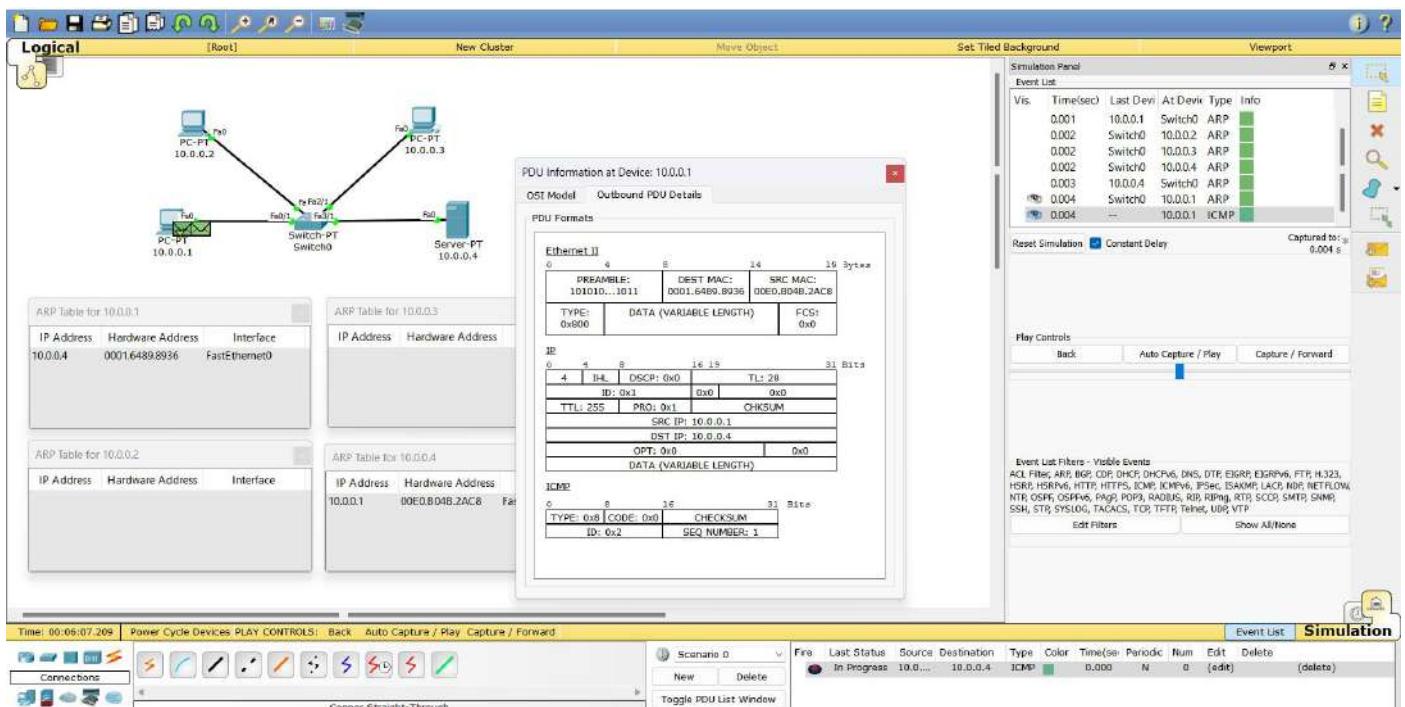
## Sending PDU from PC - 1 to Server:



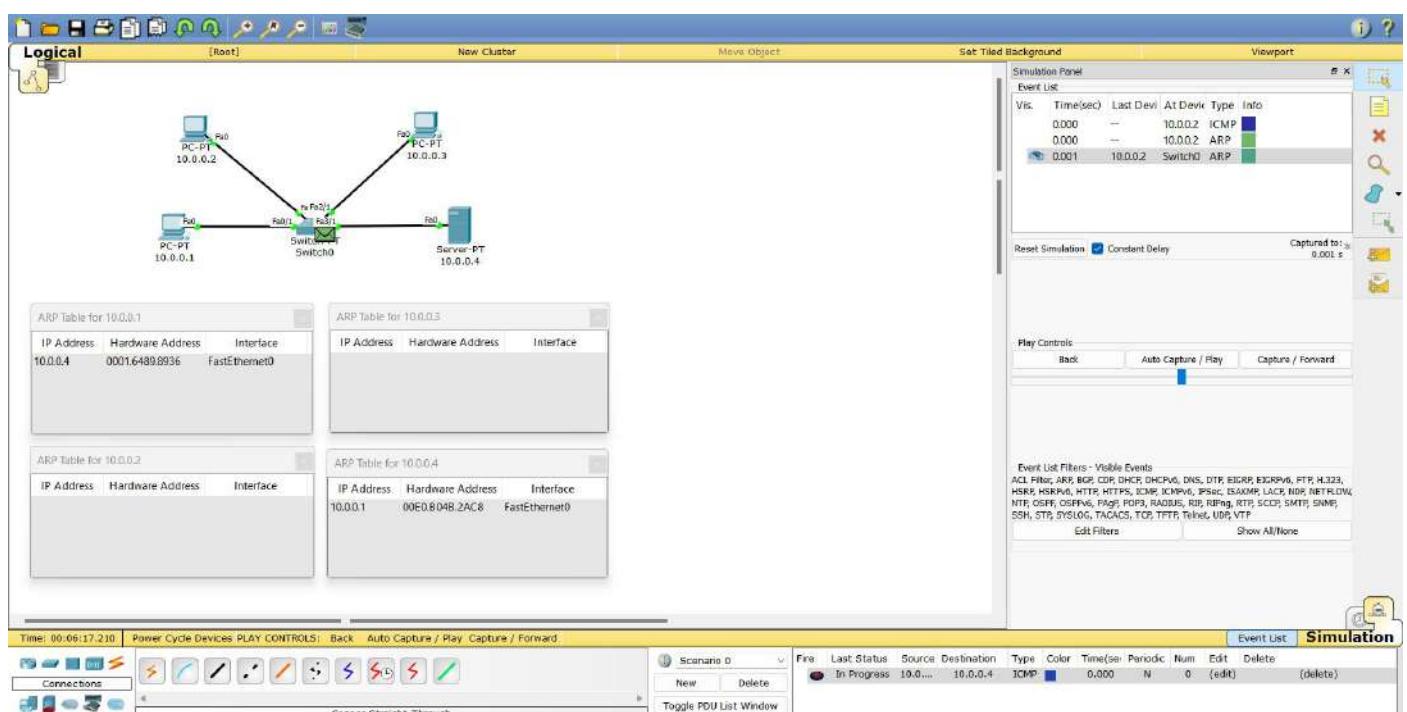
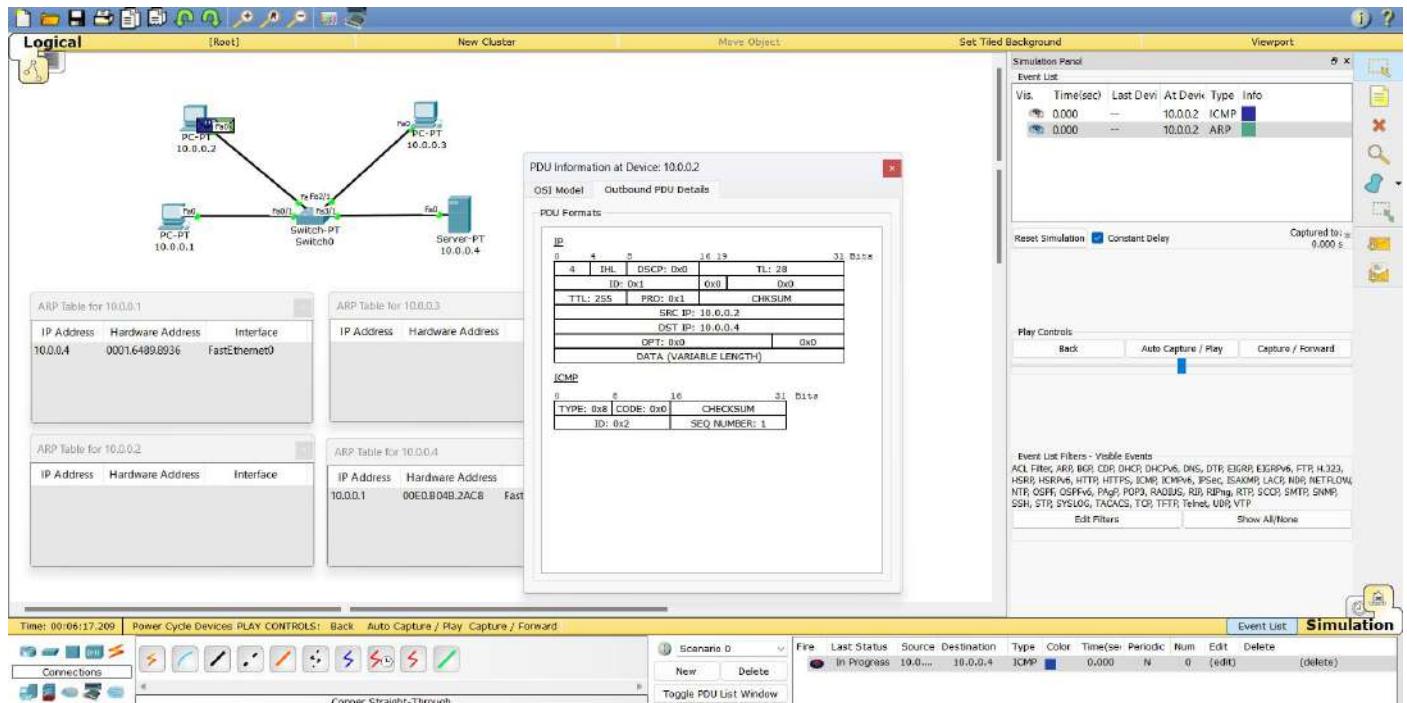


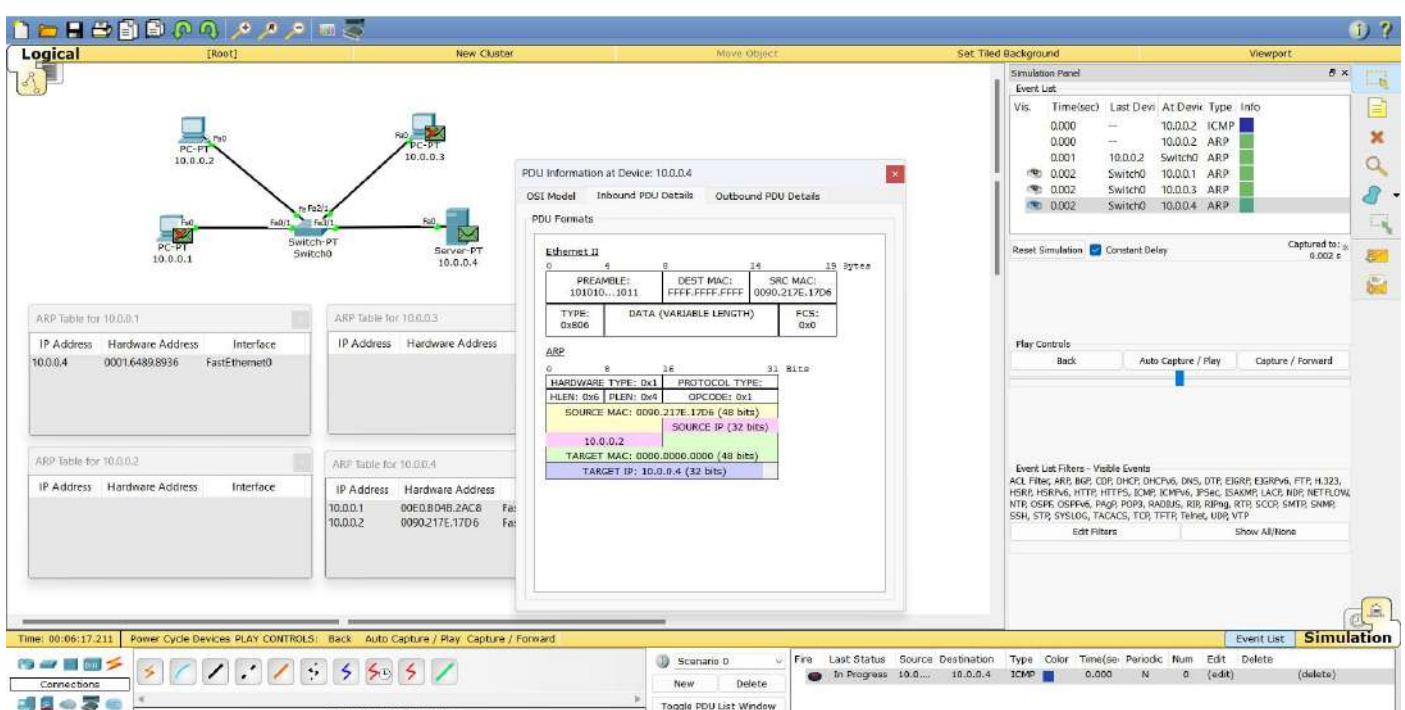
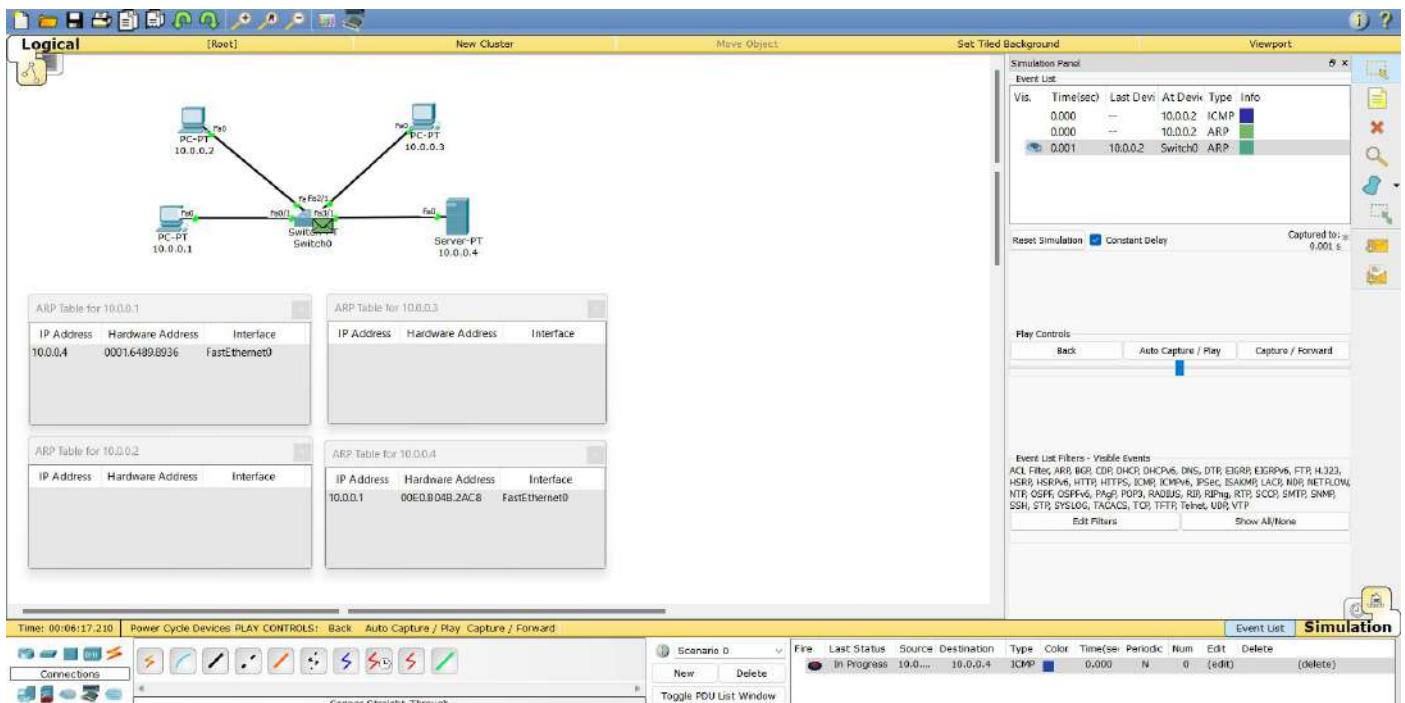


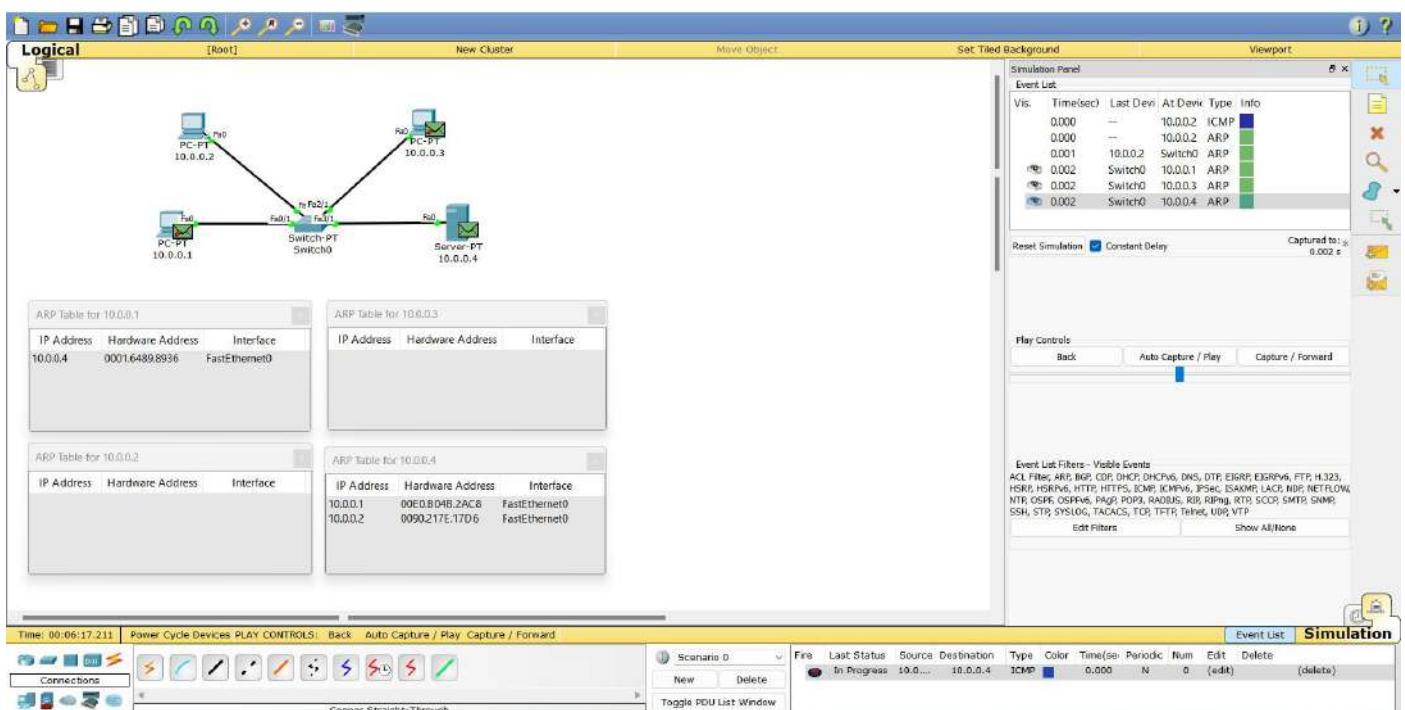
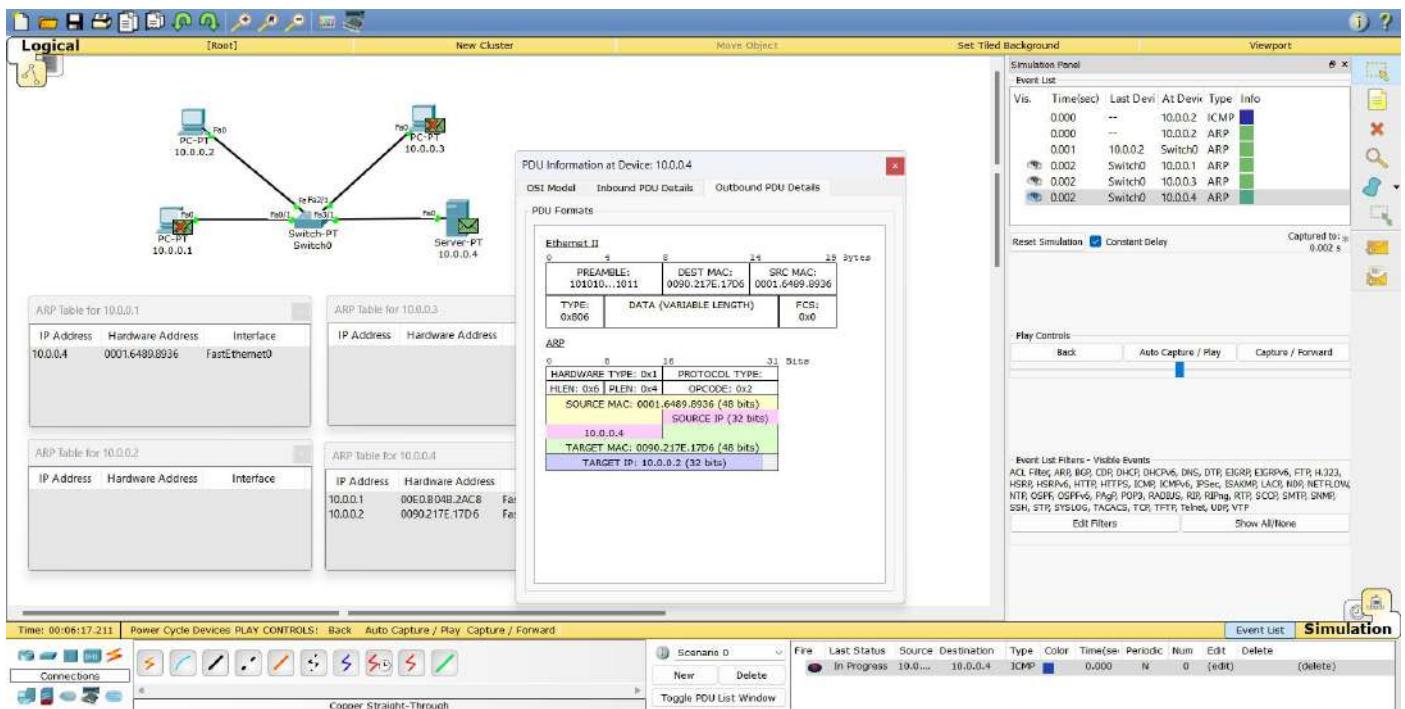


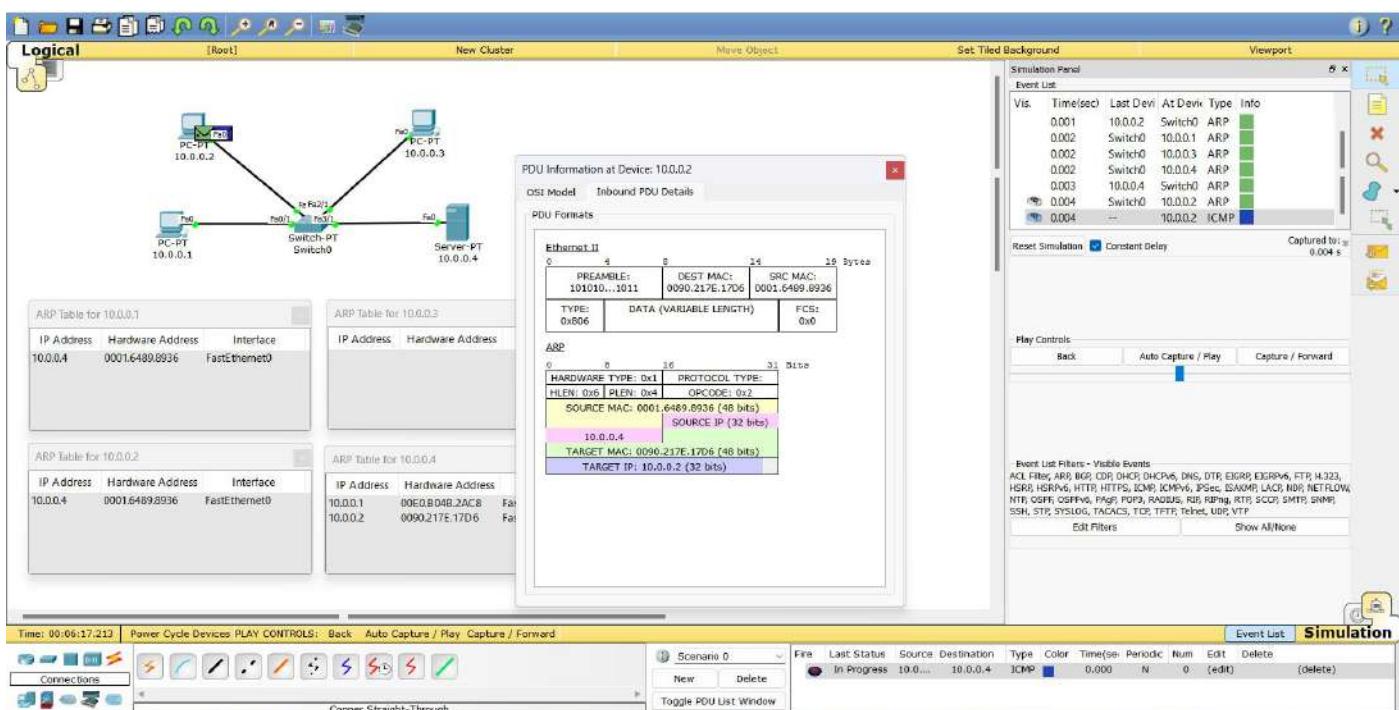
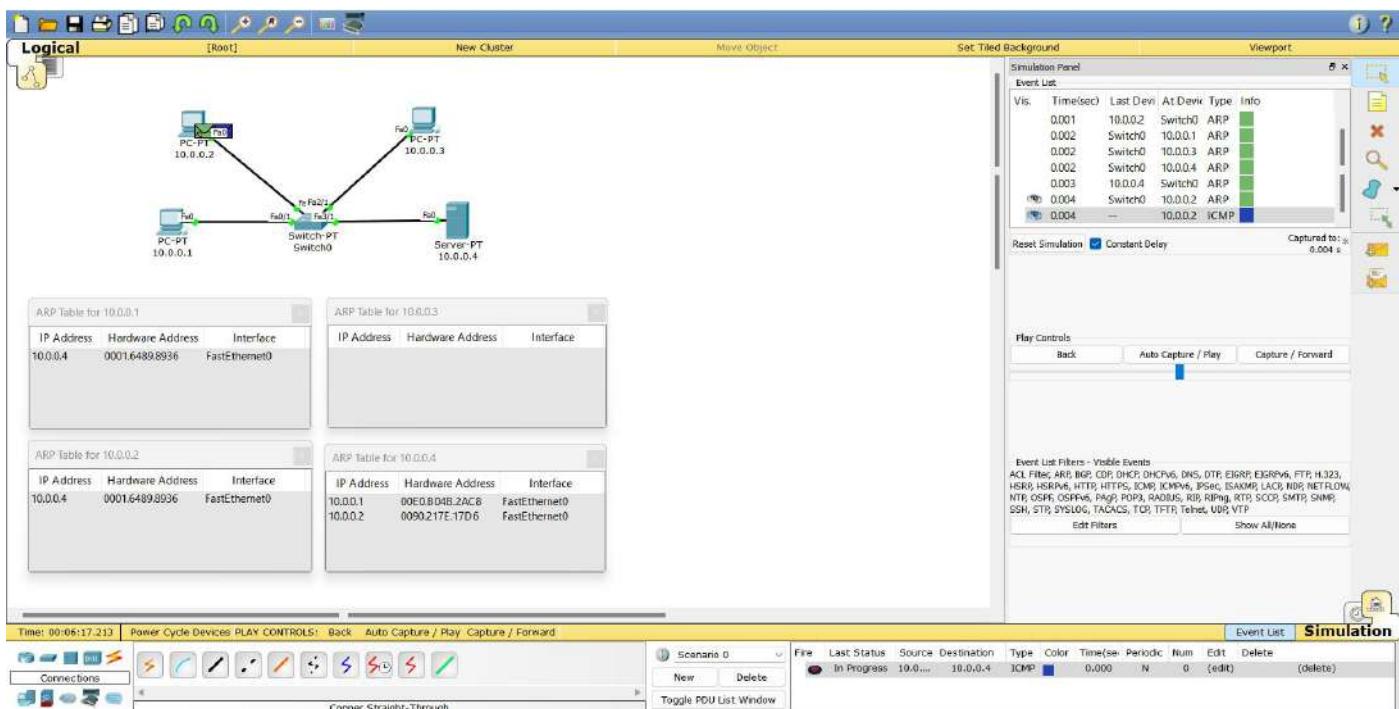


## Sending PDU from PC - 2 to Server:

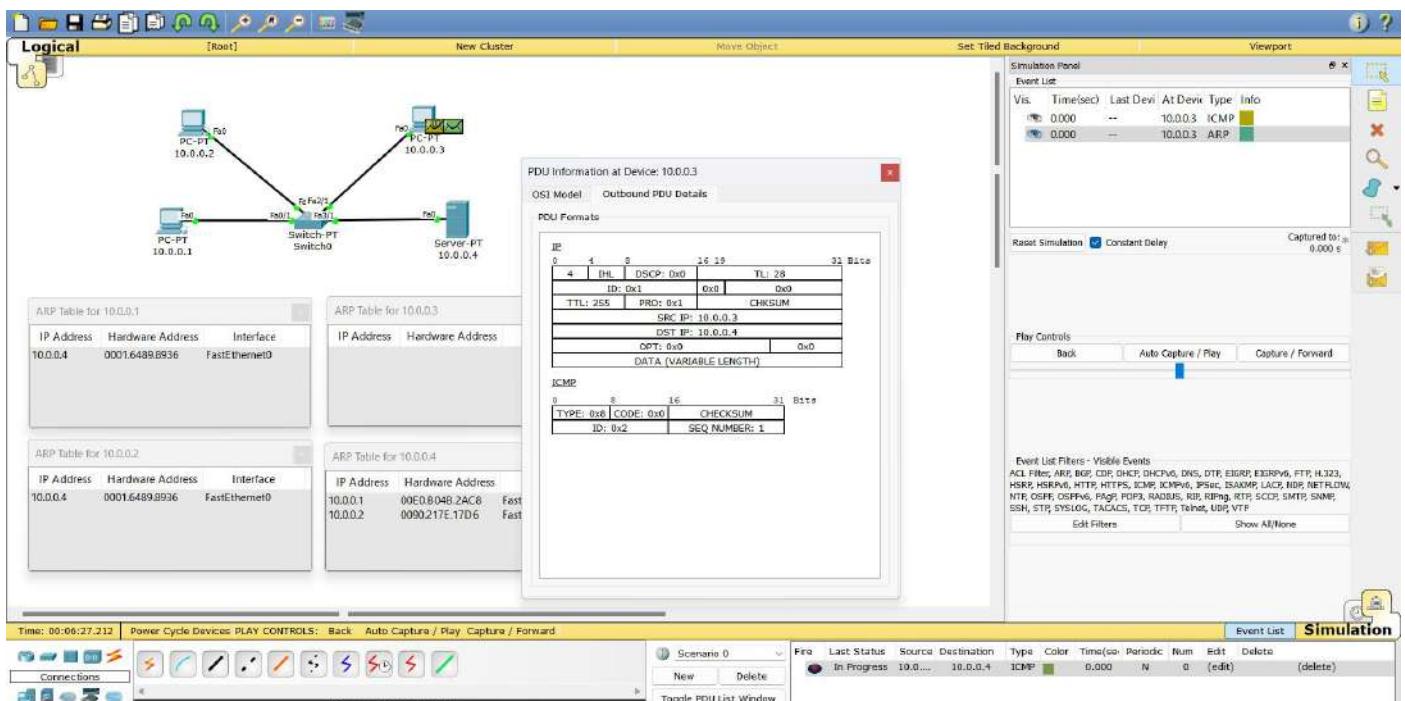
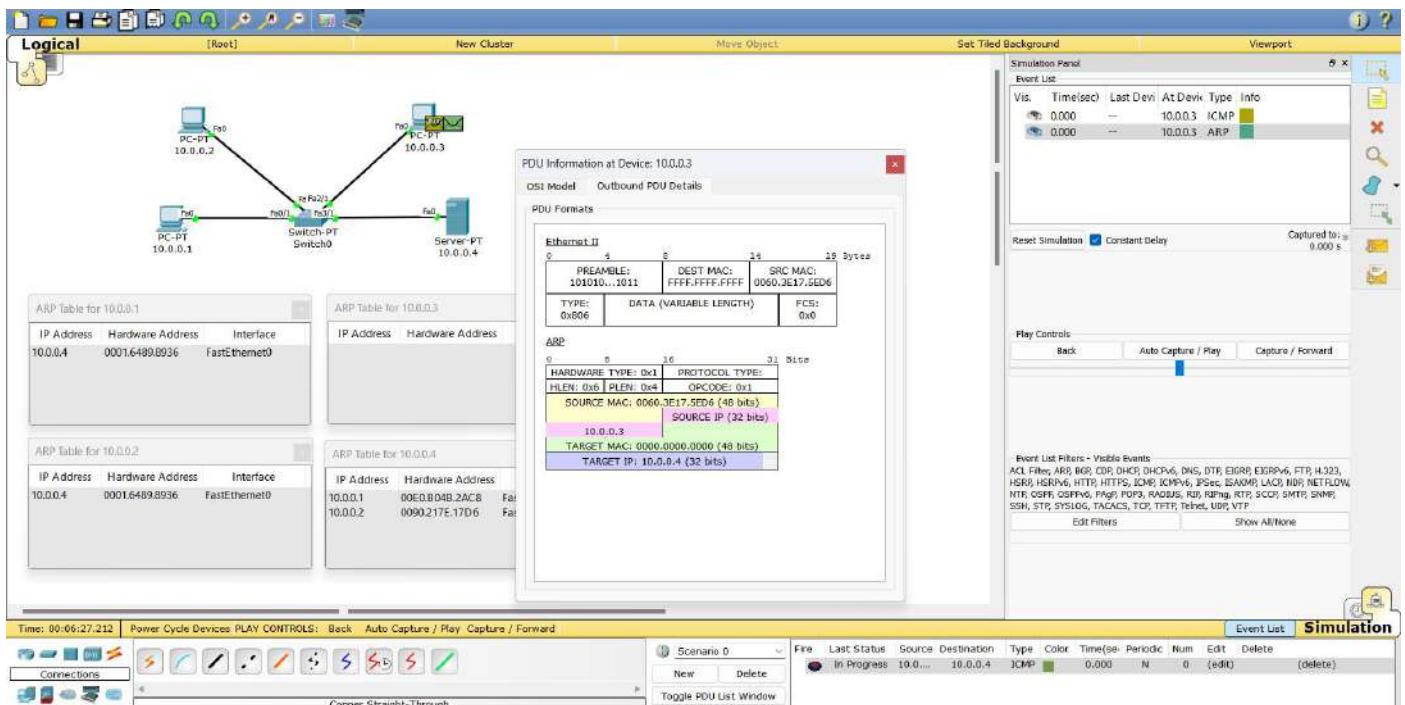


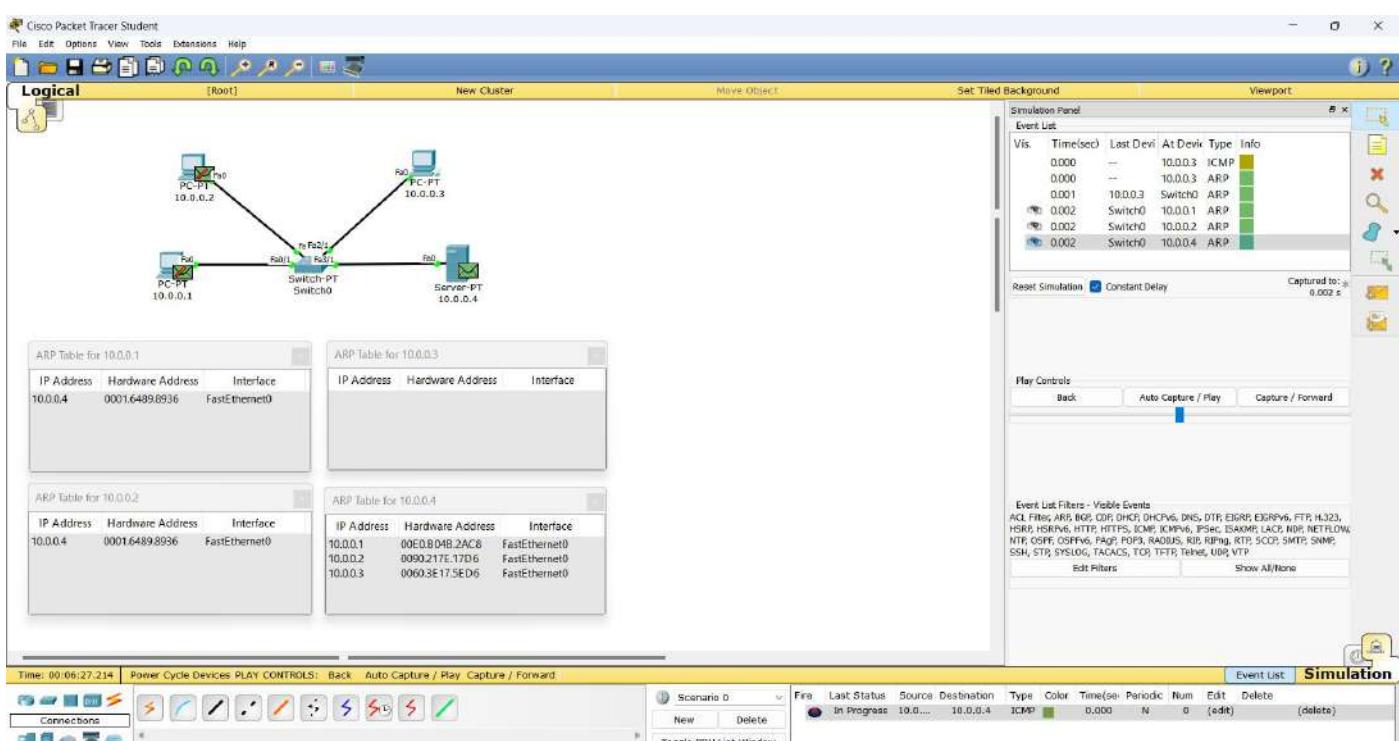
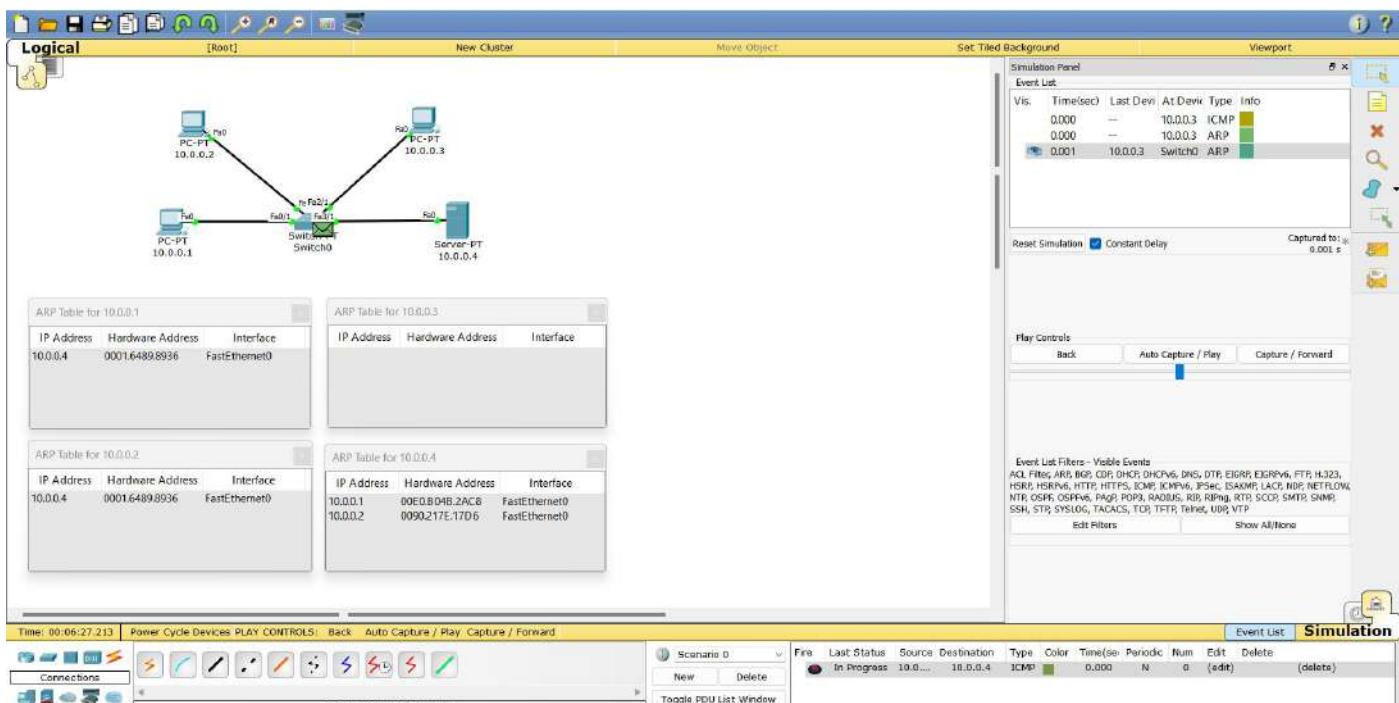


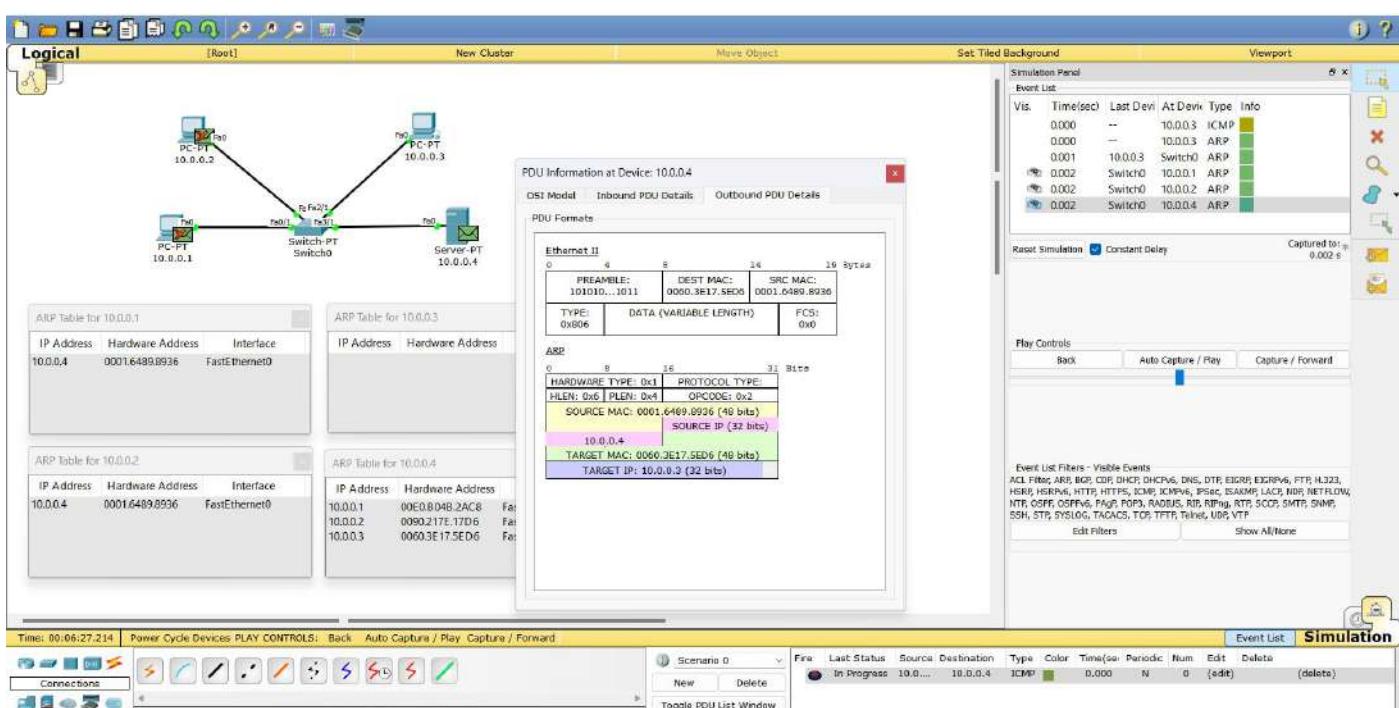
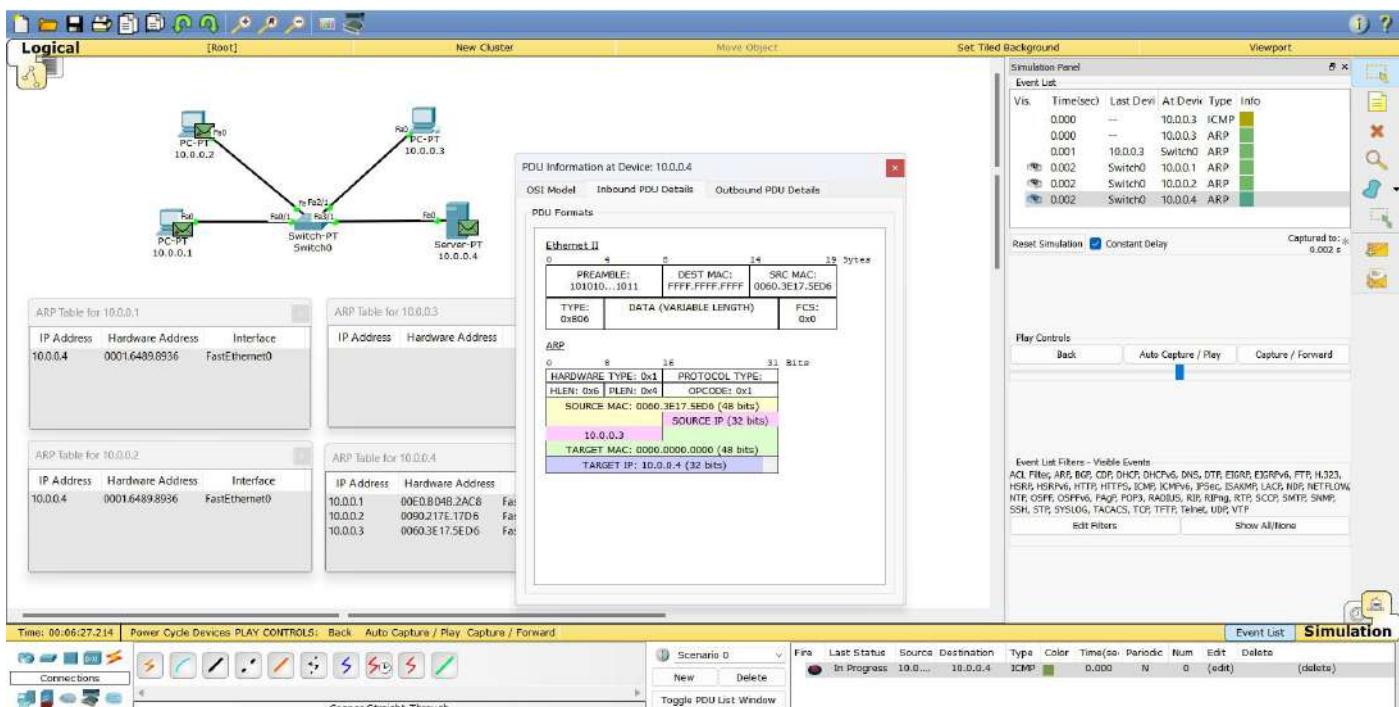


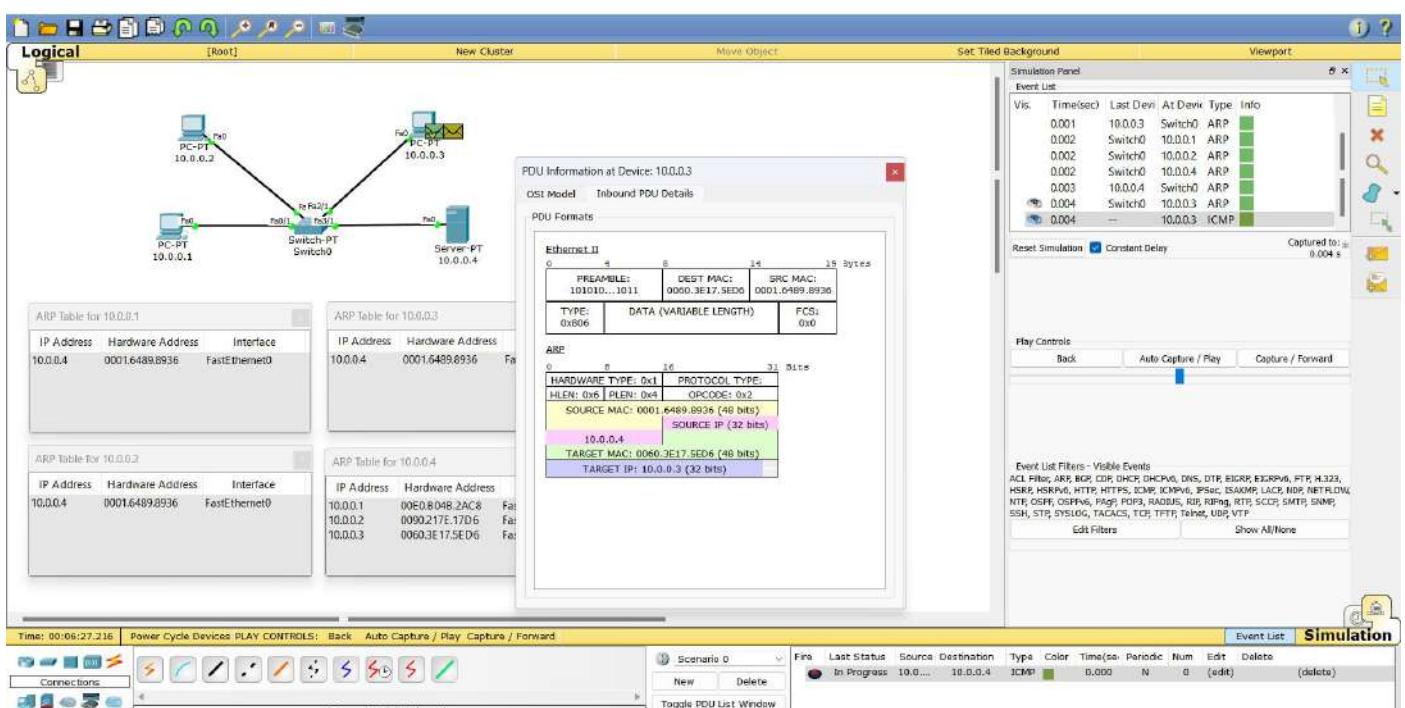
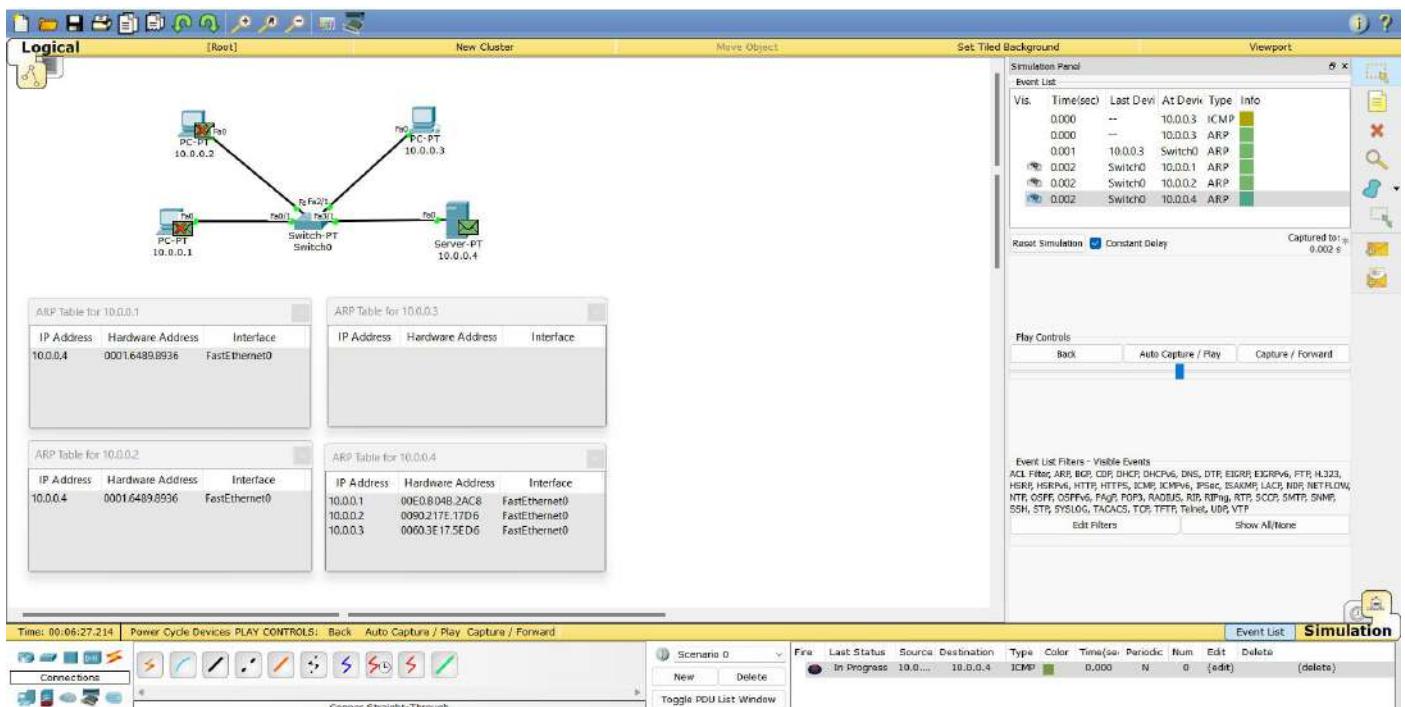


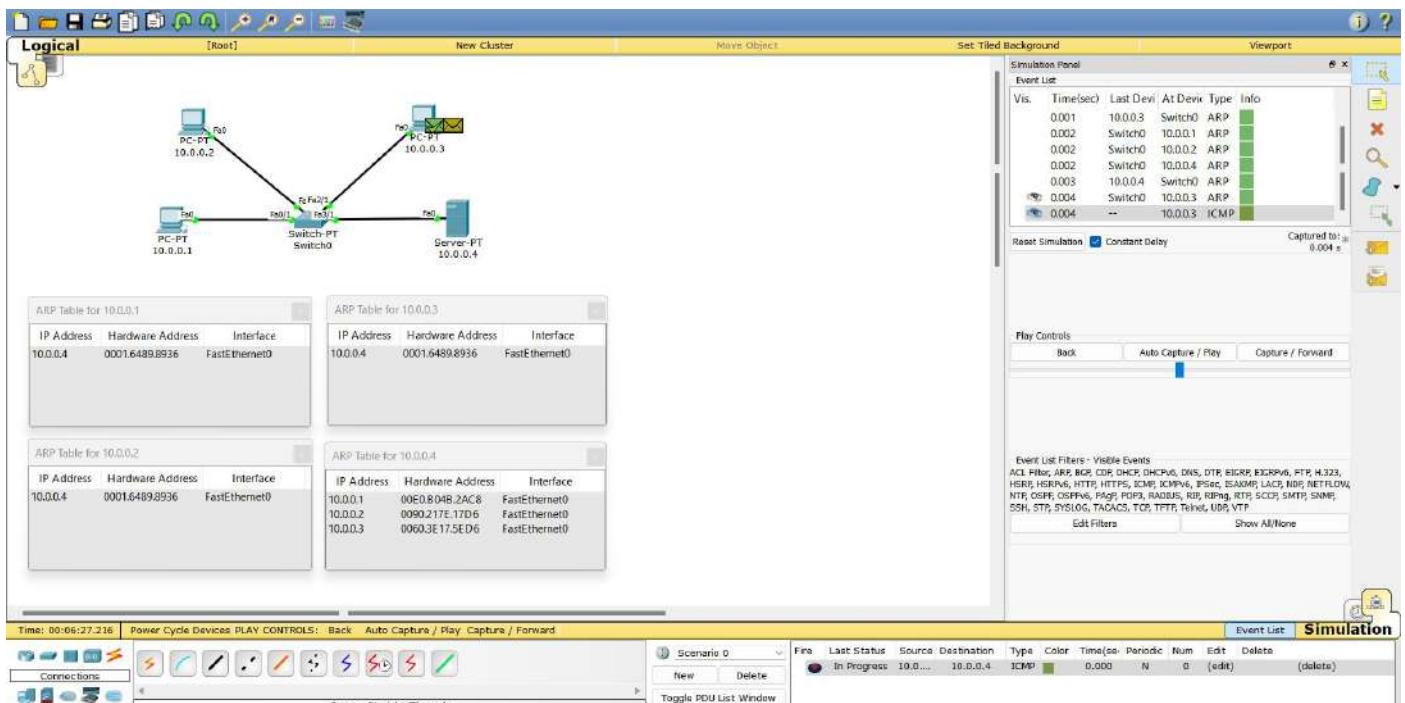
## Sending PDU from PC - 3 to Server:



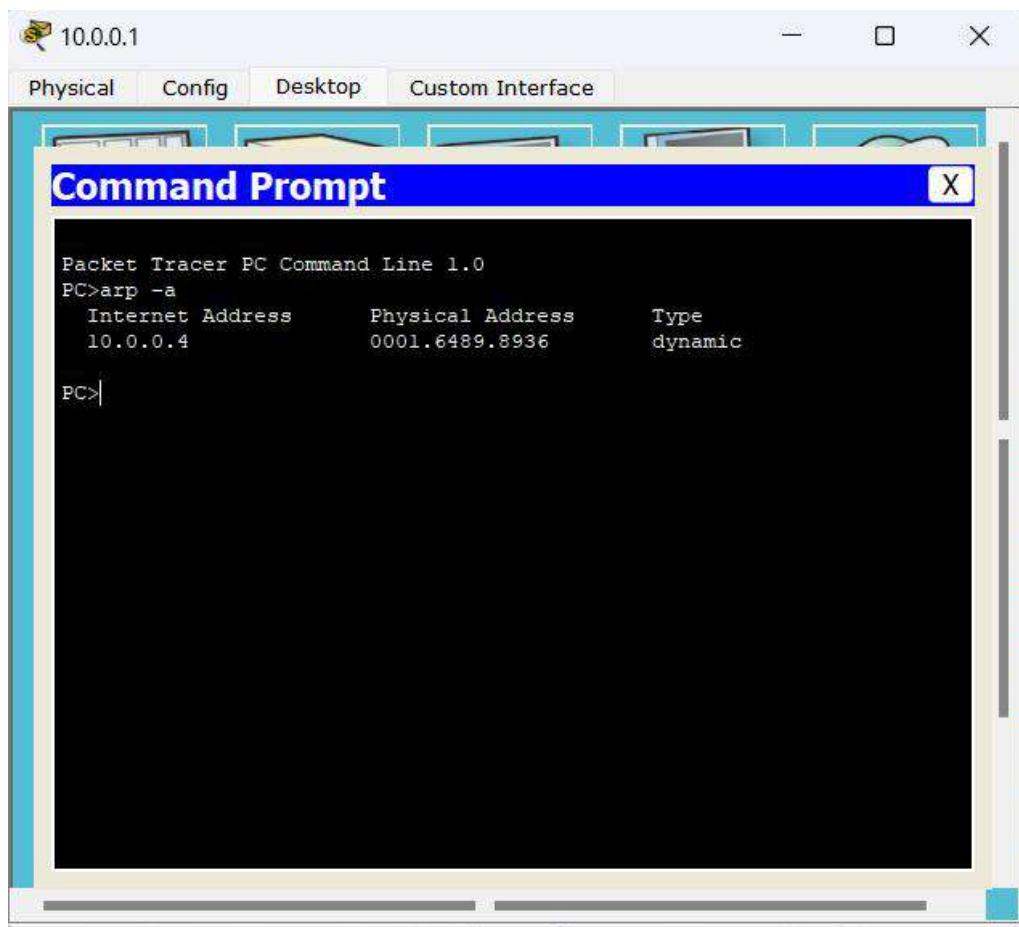


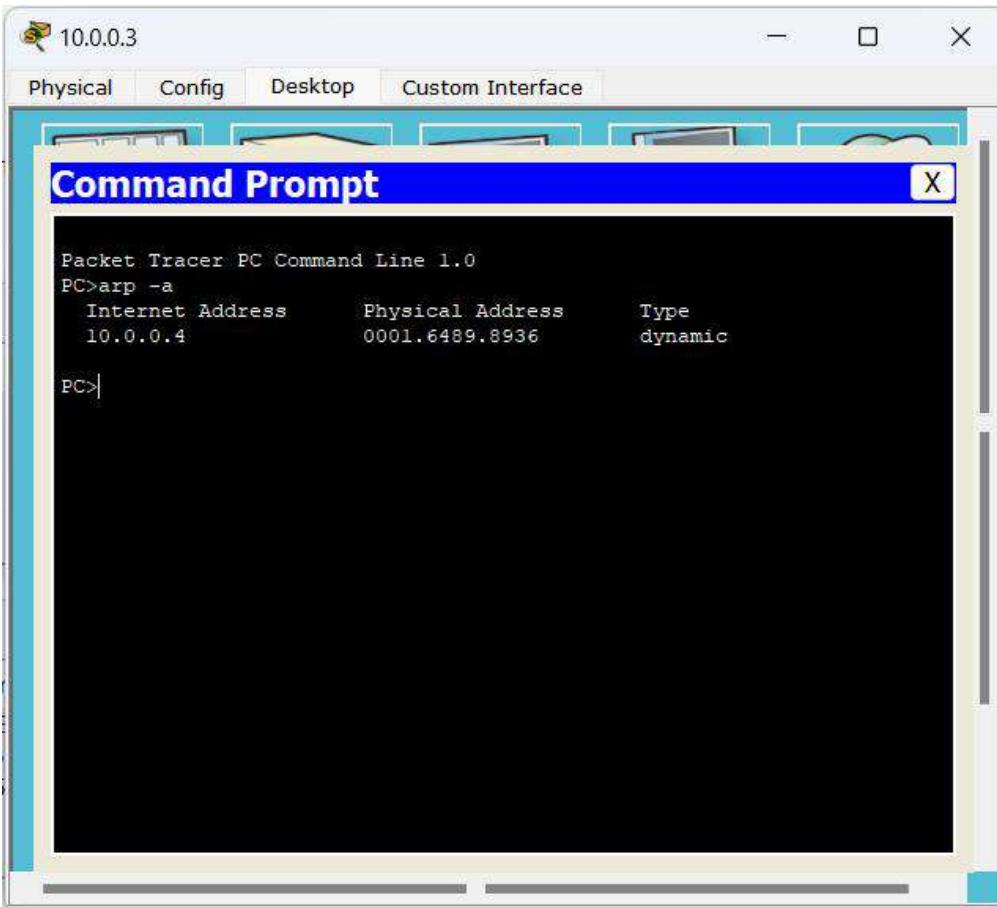
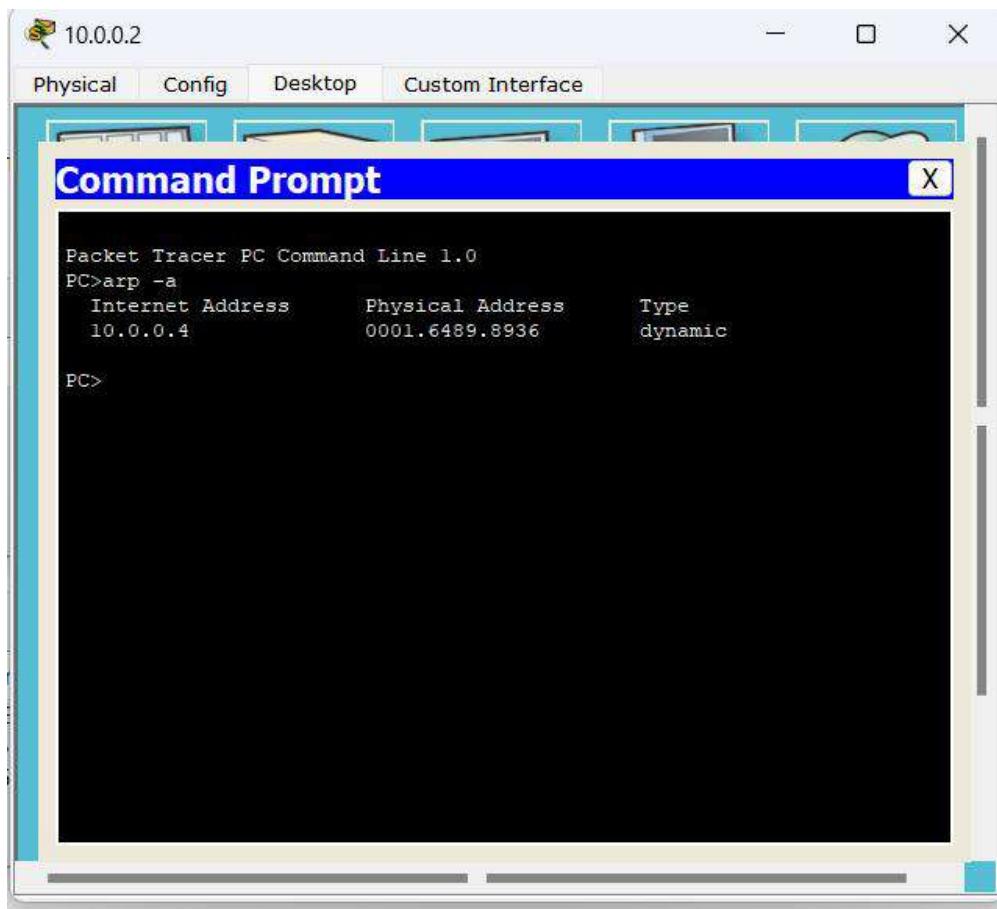






## Checking ARP Table through Command Prompt:





Packet Tracer SERVER Command Line 1.0  
SERVER>arp -a

Internet Address	Physical Address	Type
10.0.0.1	00e0.b04b.2ac8	dynamic
10.0.0.2	0090.217e.17d6	dynamic
10.0.0.3	0060.3e17.5ed6	dynamic

SERVER>

ARP Table for 10.0.0.1

IP Address	Hardware Address	Interface
10.0.0.4	0001.6489.8936	FastEthernet0

ARP Table for 10.0.0.3

IP Address	Hardware Address	Interface
10.0.0.4	0001.6489.8936	FastEthernet0

ARP Table for 10.0.0.2

IP Address	Hardware Address	Interface
10.0.0.4	0001.6489.8936	FastEthernet0

ARP Table for 10.0.0.4

IP Address	Hardware Address	Interface
10.0.0.1	00E0.B04B.2AC8	FastEthernet0
10.0.0.2	0090.217E.17D6	FastEthernet0
10.0.0.3	0060.3E17.5ED6	FastEthernet0

### 2.9.3 Observation Book Pictures:

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Experiment - 8

To construct simple LAN and understand the concept and operation of Address Resolution Protocol (ARP)

Aim: To demonstrate ARP protocol ~~in network~~

Topology:

Procedure:

- Place 4 PCs and 1 switch.  
Connect PC-1 to switch using copper straight-through wire from Fast Ethernet 0 port of PC-1 to Fast Ethernet 1 port of switch.  
Similarly repeat this step to connect PC-2, PC-3, PC-4 to Fa1/1, Fa2/1 and Fa3/1 ports of switch respectively.
- a) PC-1 Configuration:  
Click on PC-1 → Config → Interface → Fast Ethernet 0  
Assign static IP address to PC-1 [10.0.0.1 and Subnet Mask: 255.0.0.0]
- b) PC-2 Configuration:  
Click on PC-2 → Config → Interface → Fast Ethernet 0  
Assign static IP address to PC-2 [10.0.0.2 and Subnet Mask: 255.0.0.0]

2) PC-3 Configuration:

Click on PC-3 → Config → Interface → FastEthernet0  
Assign static IP address to PC-3 [10.0.0.3 and Subnet Mask: 255.0.0.0].

3) Server Configuration:

Click on Server → Config → Interface → FastEthernet0.  
Assign static IP address to Server [10.0.0.4 and Subnet Mask: 255.0.0.0].

4) Send a PDU from PC-1, PC-2 and PC-3 to Server.

The IP addresses of PCs is updated in ARP table of Server and the IP, Hardware address of Server gets updated in ARP table of all PCs once a PDU reaches the server and back to PCs.

Result: (in Simulation Mode):

1) Sending PDU from PC-1 to Server:

Outbound PDU details at Device 10.0.0.1:

Dest Mac: FFFF.FFFF.FFFF

SRC MAC: 00E0.B04B.2AC8

This PDU is sent through Switch to Server.

At Server:

Inbound PDU details at Device 10.0.0.4:

Dest Mac: FFFF.FFFF.FFFF

SRC MAC: 00E0.B04B.2AC8

Outbound PDU details at Device 10.0.0.4:

Dest MAC: 00E0.B04B.2AC8

SRC MAC: 0001.6489.8936



ARP table of Server is updated with details of PC-1 (IP address, Hardware address, Interface).

The PDU goes back to PC-1 through switch.  
Upon being reached back successfully, the details of server (like IP address, Hardware address, Interface) is updated in ARP table of PC-1.

At PC-1

Inbound PDU details at device 10.0.0.1:

DEST MAC : 00E0-B04B-2AC8

SRC MAC : 0001-6489-8936.

2. Sending PDU from PC-2 to Server:

Outbound PDU details at Device 10.0.0.2 :

DEST MAC : FFFF.FFFF.FFFF

SRC MAC : 0090-217E-17D6

This PDU is sent through Switch to Server.

At Server:

Inbound PDU details at device 10.0.0.4:

DEST MAC : FFFF.FFFF.FFFF

SRC MAC : 0090-217E-17D6

Outbound PDU details at device 10.0.0.4.

DEST MAC : 0090-217E-17D6.

SRC MAC : 0001-6489-8936.

ARP table of Server is updated with details of PC-2 (IP address, Hardware address, Interface)

The PDU goes back to PC-2 through switch.  
Upon reached back successfully, the details  
of Server (like IP address, Hardware Address,  
Interface) is updated in ARP table of PC-2

At PC-2:

Inbound PDU details at device 10.0.0.2:  
DEST MAC: 0090.217E.17D6  
SRC MAC: 0001.6489.8936.

3. Sending PDU from PC-3 to Server:

Outbound PDU details at Device 10.0.0.3:  
DEST MAC: FFFF.FFFF.FFFF  
SRC MAC: 0060.3E17.5ED6.

This PDU is sent through Switch to Server.

At Server:

Inbound PDU details at device 10.0.0.4:  
DEST MAC: FFFF.FFFF.FFFF  
SRC MAC: 0060.3E17.5ED6

~~Outbound PDU details at device 10.0.0.4:~~

~~DEST MAC: 0060.3E17.5ED6  
SRC MAC: 0001.6489.8936.~~

ARP table of Server is updated with details of  
PC-3 (IP address, Hardware address, Interface).

The PDU goes back to PC-3 through Switch.

Upon being reached back successfully, the details  
of Server (IP address, Hardware Address, Interface)  
is updated in ARP table of PC-3.

At PC-3:

Inbound PDU details at device 10.0.0.3:

DEST MAC : 0060.3E17.5ED6

SRC MAC : 0001.6489.8936

4. ARP Tables for PCs & Server:

ARP Table for 10.0.0.1 (PC-1)

IP address      Hardware Address      Interface

10.0.0.4	0001.6489.8936	Fast Ethernet 0
----------	----------------	-----------------

ARP Table for 10.0.0.2 (PC-2)

IP address      Hardware Address      Interface

10.0.0.4	0001.6489.8936	Fast Ethernet 0
----------	----------------	-----------------

ARP Table for 10.0.0.3 (PC-3)

IP address      Hardware Address      Interface

10.0.0.4	0001.6489.8936	Fast Ethernet 0
----------	----------------	-----------------

ARP Table for 10.0.0.4 (server)

IP address      Hardware Address      Interface

10.0.0.1	00E0.B04B.2AC8	Fast Ethernet 0
----------	----------------	-----------------

10.0.0.2	0090.217E.17D6	Fast Ethernet 0
----------	----------------	-----------------

10.0.0.3	0060.3E17.5ED6	Fast Ethernet 0
----------	----------------	-----------------

5. Checking ARP Table through Command Prompt:

a) PC-1

Click on PC-1 → Desktop → Command Prompt

Before sending PDU:

PC > arp -a

No ARP Entries Found

After successfully sending PDU:

PC > arp -a

Internet Address	Physical Address	Type
10.0.0.4	0001.6489.8936	dynamic.

b) PC-2

Click on PC-2 → Desktop → Command Prompt.

Before sending PDU:

PC > arp -a

No ARP Entries Found.

After successfully sending PDU:

PC > arp -a

Internet Address	Physical Address	Type
10.0.0.4	0001.6489.8936	dynamic

c) PC-3

Click on PC-3 → Desktop → Command Prompt.

Before sending PDU:

PC > arp -a

~~No ARP Entries Found.~~

After successfully sending PDU:

PC > arp -a

Internet Address	Physical Address	Type
10.0.0.4	0001.6489.8936	dynamic



d)Server:

Click on Server → Desktop → Command Prompt.

Before Sending PDU:

PC > arp -a

No ARP Entries Found.

After Successfully Sending PDU:

PC > arp -a

Internet Address	Physical Address	Type
10.0.0.1	00e0.b04h.2ac8	dynamic
10.0.0.2	0090.217e.17d6	dynamic
10.0.0.3	0060.3e17.5edb	dynamic

Observation:

The Address Resolution Protocol is a layer 2 protocol used to map MAC addresses to IP addresses. All hosts on a network are located by their IP address, but NICs do not have MAC addresses. ARP is the protocol used to associate the IP address to a MAC address.

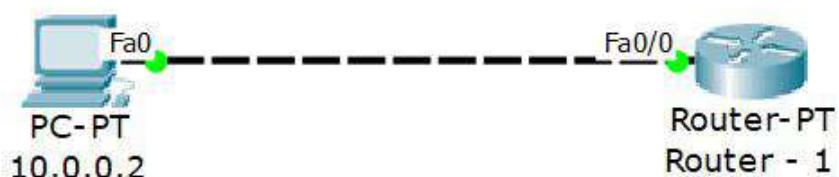
## 2.10 Experiment - 10:

### 2.10.1 Question:

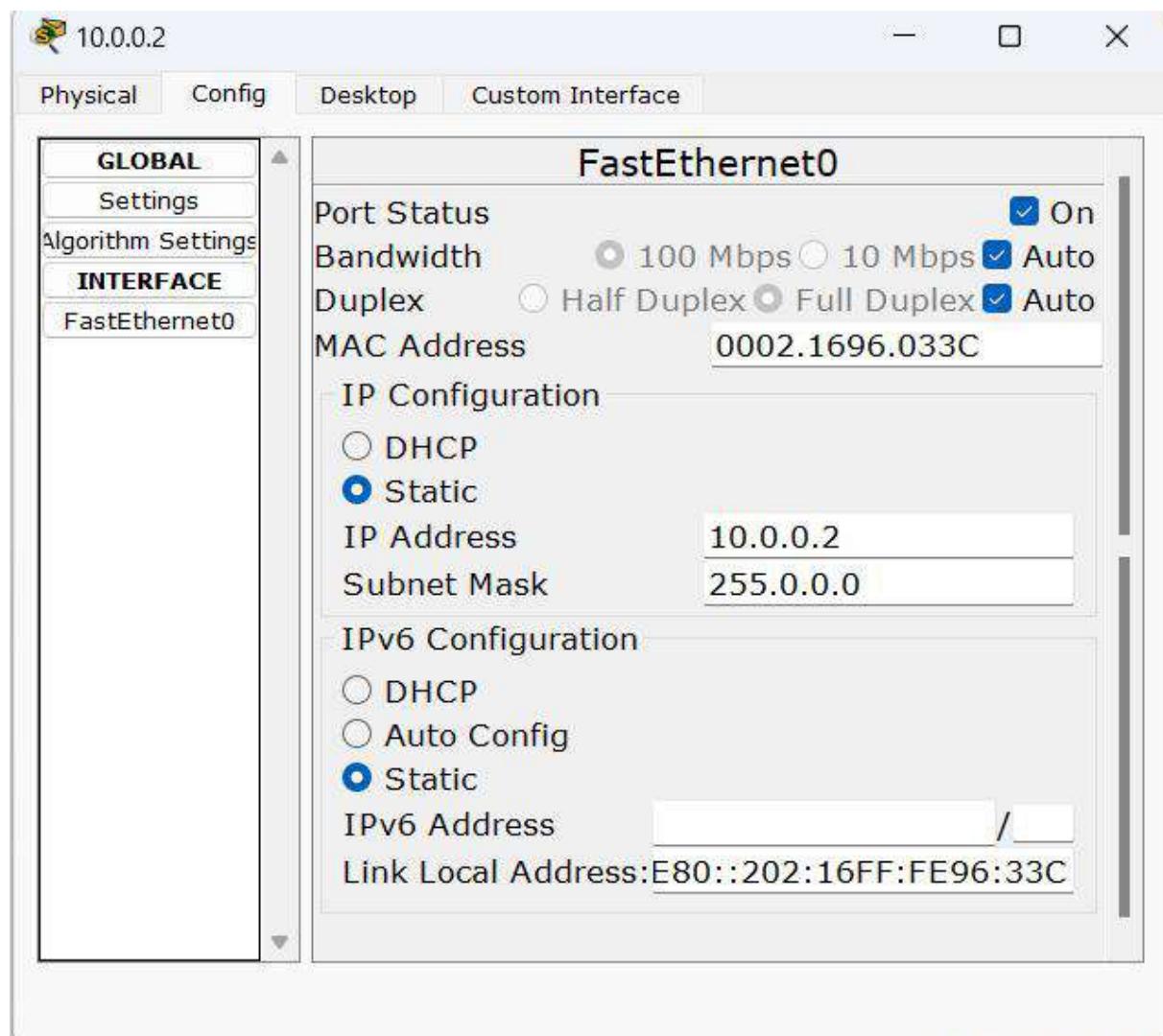
To understand the operation of TELNET by accessing the router in server room from a PC in IT office.

### 2.10.2 Screenshots (Topology, Configurations & Output):

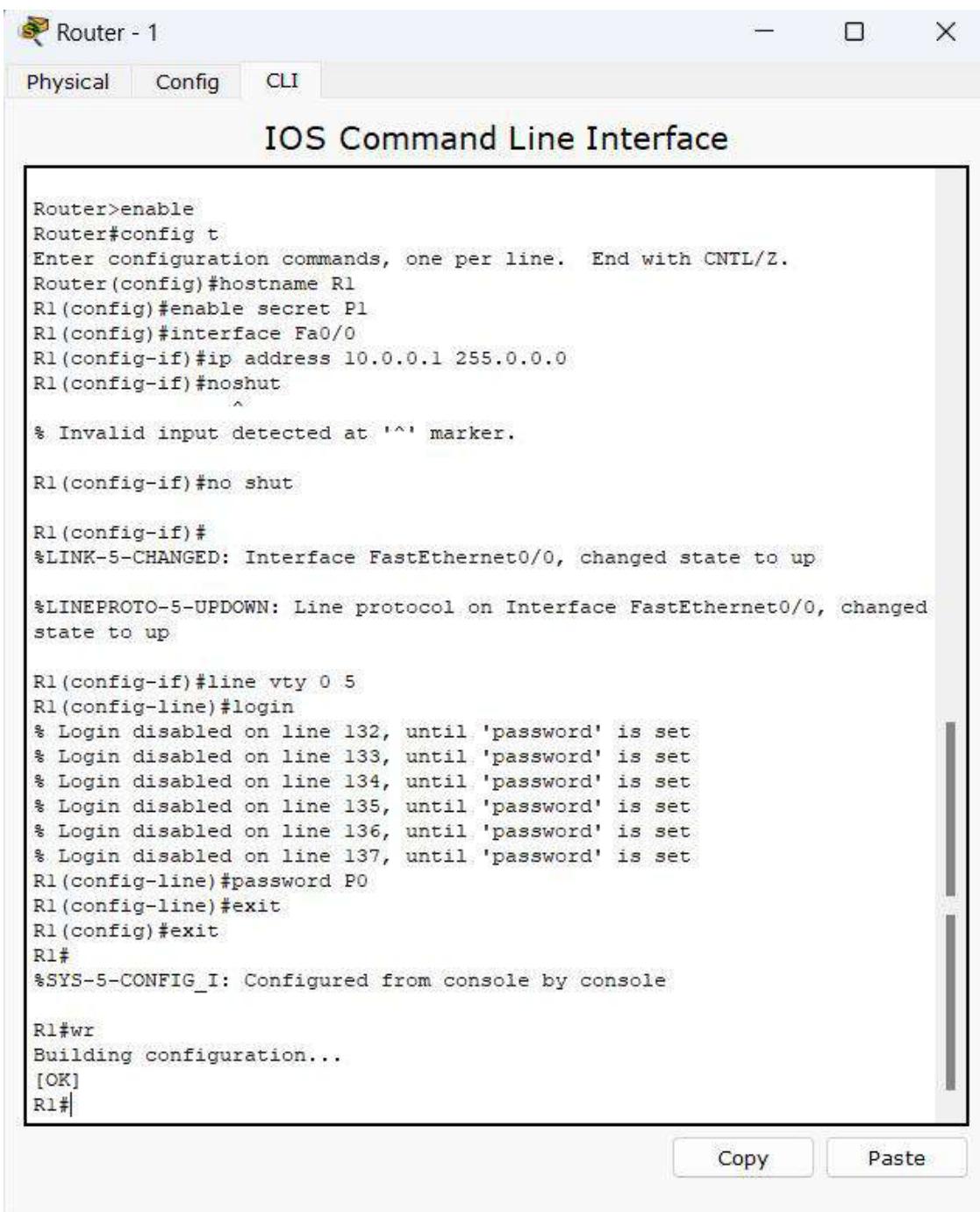
#### Topology:



#### PC - 1 Configuration:



## Router - 1 Configuration:



The image shows a software interface titled "Router - 1" with three tabs: "Physical", "Config" (which is selected), and "CLI". The main area is labeled "IOS Command Line Interface". It displays the configuration commands entered for Router 1, including setting the hostname to R1, enabling secret level 1, configuring interface Fa0/0 with IP address 10.0.0.1 and subnet mask 255.0.0.0, and enabling VTY lines 0-5. The configuration concludes with a write operation and a successful build.

```
Router>enable
Router#config t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#hostname R1
R1(config)#enable secret 1
R1(config)#interface Fa0/0
R1(config-if)#ip address 10.0.0.1 255.0.0.0
R1(config-if)#no shutdown
^
% Invalid input detected at '^' marker.

R1(config-if)#no shutdown

R1(config-if)#
%LINK-5-CHANGED: Interface FastEthernet0/0, changed state to up

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

R1(config-if)#line vty 0 5
R1(config-line)#login
% Login disabled on line 132, until 'password' is set
% Login disabled on line 133, until 'password' is set
% Login disabled on line 134, until 'password' is set
% Login disabled on line 135, until 'password' is set
% Login disabled on line 136, until 'password' is set
% Login disabled on line 137, until 'password' is set
R1(config-line)#password 1
R1(config-line)#exit
R1(config)#exit
R1#
%SYS-5-CONFIG_I: Configured from console by console

R1#wr
Building configuration...
[OK]
R1#
```

## PC - 1 (Command Prompt):

The screenshot shows a Windows-style window titled "Command Prompt" running on a Cisco Packet Tracer PC. The window title bar says "10.0.0.2". The menu bar includes "Physical", "Config", "Desktop", and "Custom Interface". The main window displays the following command-line session:

```
Packet Tracer PC Command Line 1.0
PC>ping 10.0.0.1

Pinging 10.0.0.1 with 32 bytes of data:

Reply from 10.0.0.1: bytes=32 time=0ms TTL=255

Ping statistics for 10.0.0.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms

PC>telnet 10.0.0.1
Trying 10.0.0.1 ...Open

User Access Verification

Password:
R1>enable
Password:
R1#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
      D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
      N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
      E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
      i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter
area
      * - candidate default, U - per-user static route, o - ODR
      P - periodic downloaded static route

Gateway of last resort is not set

C    10.0.0.0/8 is directly connected, FastEthernet0/0
R1#
```

Password for User Access Verification is: **P0**

Password for enable is: **P1**

### 2.10.3 Observation Book Pictures:

PAGE NO:  
DATE: 18/08/2023

Experiment-10

To understand the operation of TELNET by accessing the router in server room from a PC in IT office.

Aim: Create a topology to depict TELNET within a LAN

Topology:

Diagram showing a network topology:

```
graph LR; PC[PC-1] --- F00[F0/0]; F00 --- F10a[F1/0]; F10a --- Router[Router-1]
```

Procedure:

1. Add a PC and a Router.  
Connect PC to Router-1 using Copper Cross-Over wire from Fast Ethernet port of PC to Fast Ethernet port of Router-1.
2. PC-1 Configuration:  
Click on PC-1 → Config → Interface → FastEthernet  
Assign a static IP address [10.0.0.2 and Subnet Mask 255.0.0.0].
3. Router-1 Configuration:

Router>enable  
Router# config t  
Router(config)# hostname R1  
R1(config)# enable secret R1  
R1(config)# interface Fa0/0  
R1(config-if)# ip address 10.0.0.1 255.0.0.0  
R1(config-if)# no shut

→

R1 (config-if)# line vty 0 5

R1 (config-line)# login

% login disabled on line 132, until 'password' is set.

% login disabled on line 133, until 'password' is set

% login disabled on line 134, until 'password' is set

% login disabled on line 135, until 'password' is set

% login disabled on line 136, until 'password' is set

% login disabled on line 137, until 'password' is set.

R1 (config-line)# password fo

R1 (config-line)# exit

R1 (config)# exit.

R1# wr

Building configuration...  
[ok]

Result:

Pinging Router-1 through PC-1 via Command

Prompt:

PC> ping 10.0.0.1

Pinging 10.0.0.1 with 32 bytes of data:

Reply from 10.0.0.1: bytes=32 time=0ms TTL=255

Ping statistics for 10.0.0.1

Packets: Sent = 4, Received = 4, Lost = 0 (0% loss)

Approximate round trip times in milli-seconds:

Minimum = 0ms, Maximum = 0ms, Average = 0ms

Accessing Router CLI from PC:

PC > telnet 10.0.0.1

Telnet 10.0.0.1 ... open

User Access Verification:

Password:

R1 >enable

Password:

R1# show ip route

C 10.0.0.0/8 is directly connected, FastEthernet0/0

[ Password for User Access Verification: P0  
Password for enable: P1 ]

Observation:

Telnet stands for Teletype Network. It is a protocol that provides a command line interface for communication with a remote device or server.

~~It is used for accessing remote computers over TCP/IP networks like the internet.~~

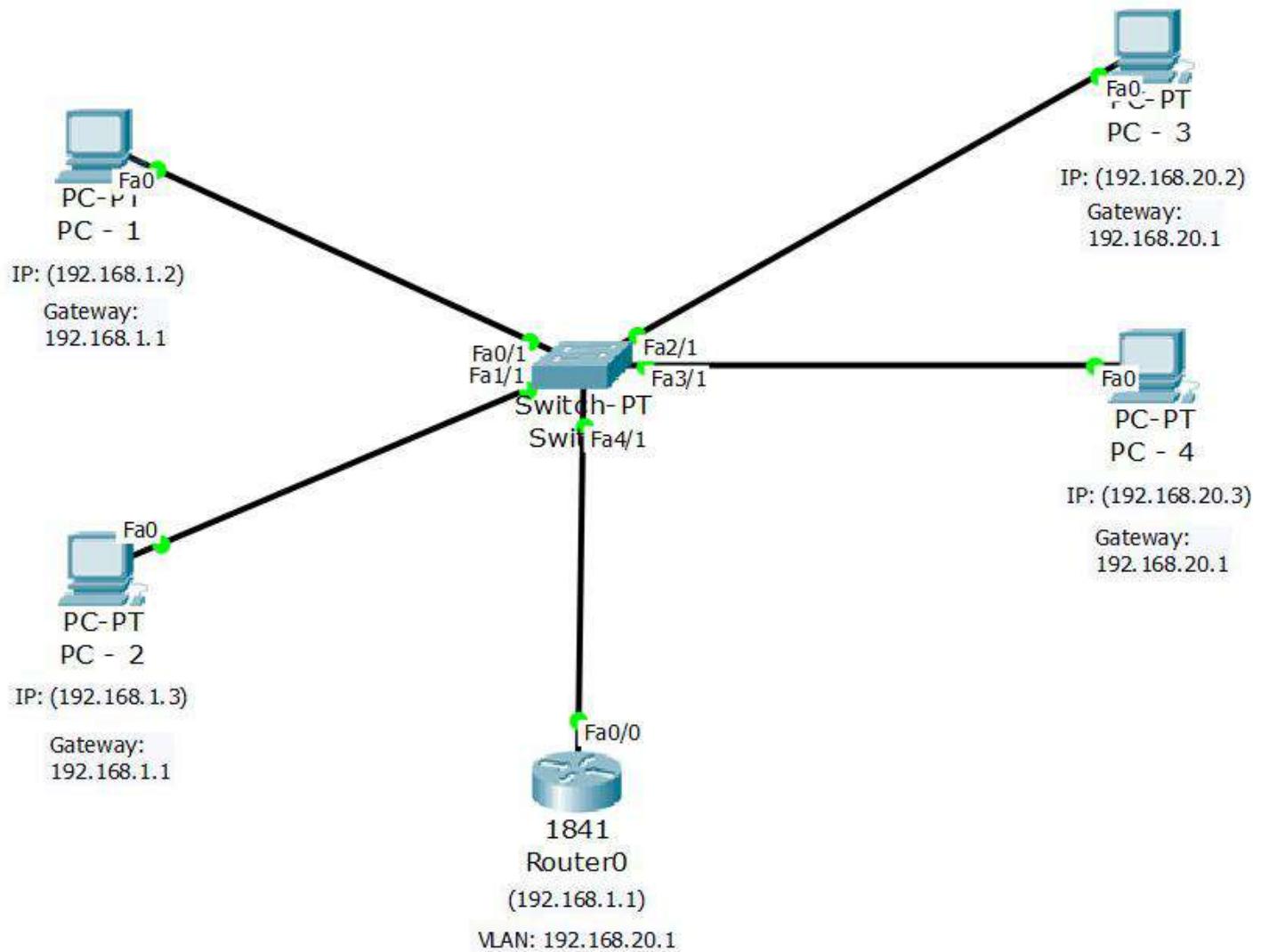
## 2.11 Experiment - 11:

### 2.11.1 Question:

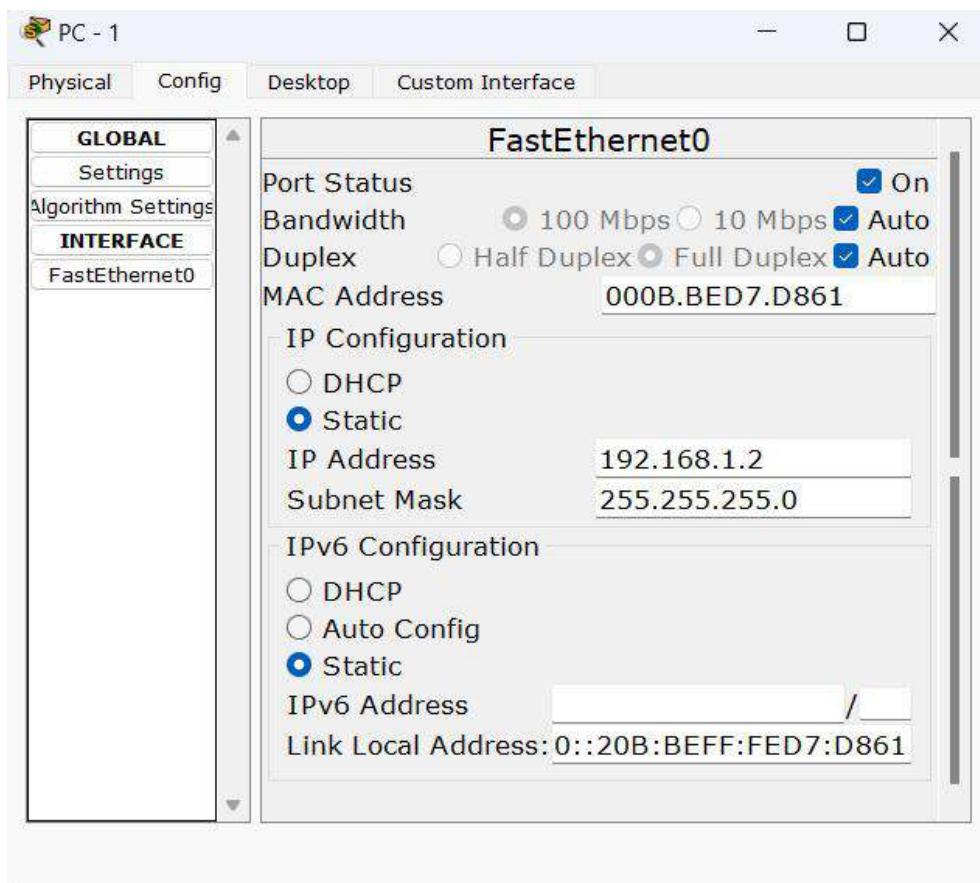
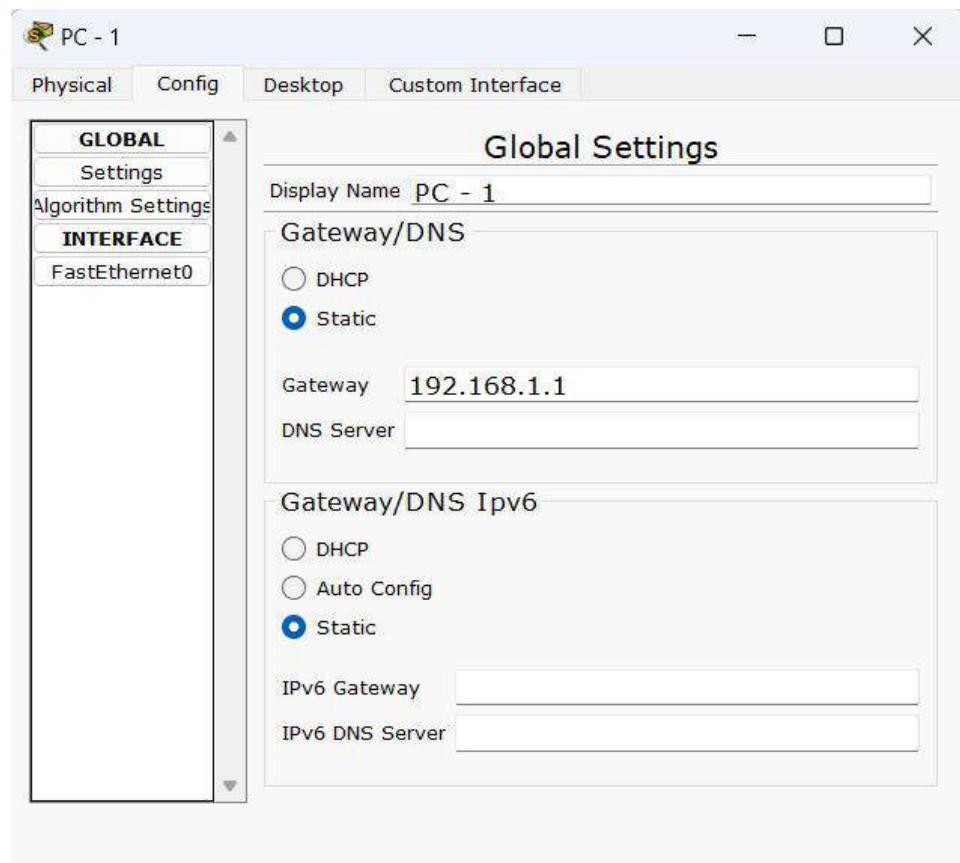
To construct a VLAN and make the PC's communicate among a VLAN

### 2.11.2 Screenshots (Topology, Configurations & Output):

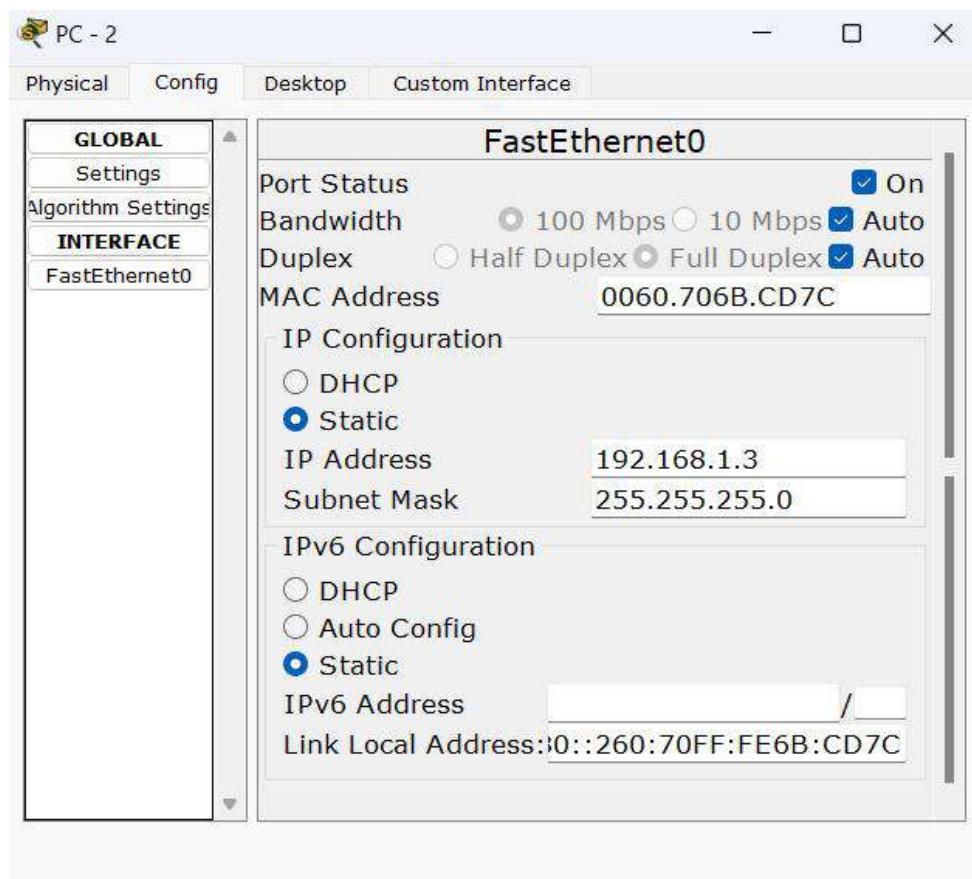
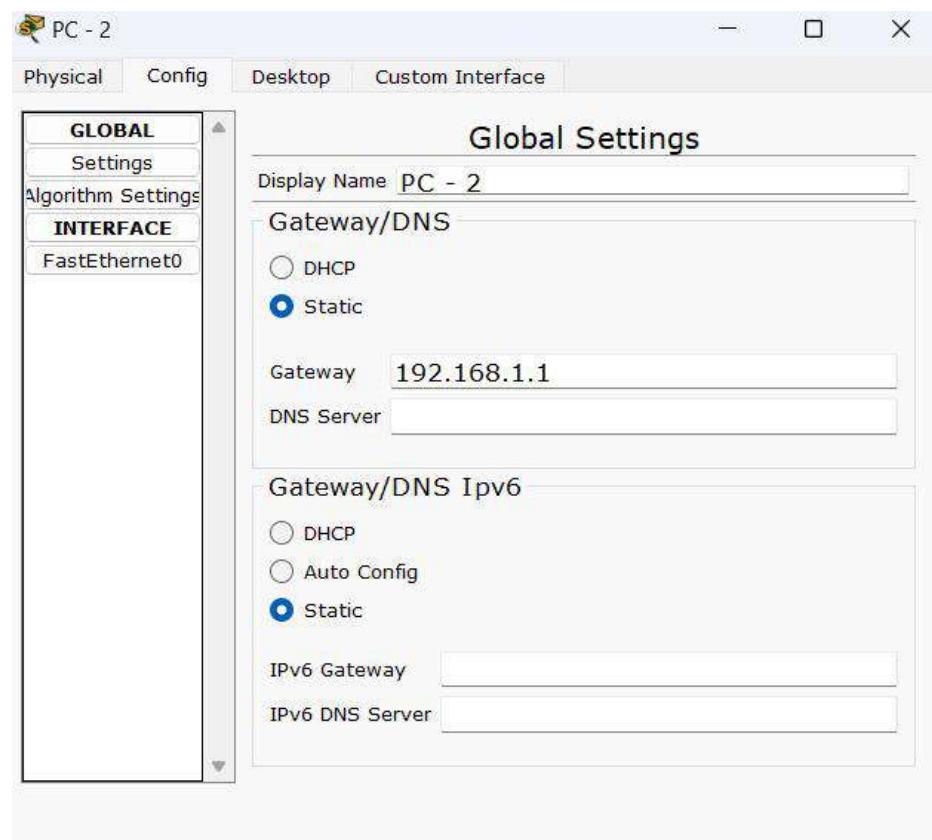
#### Topology:



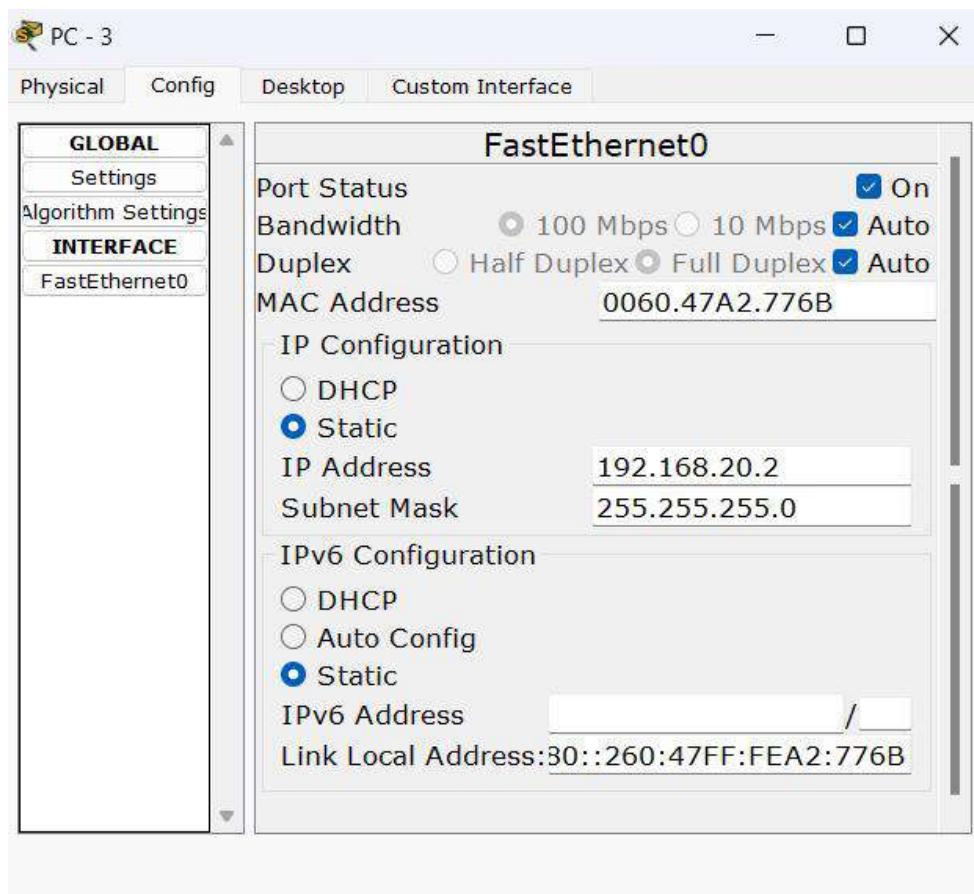
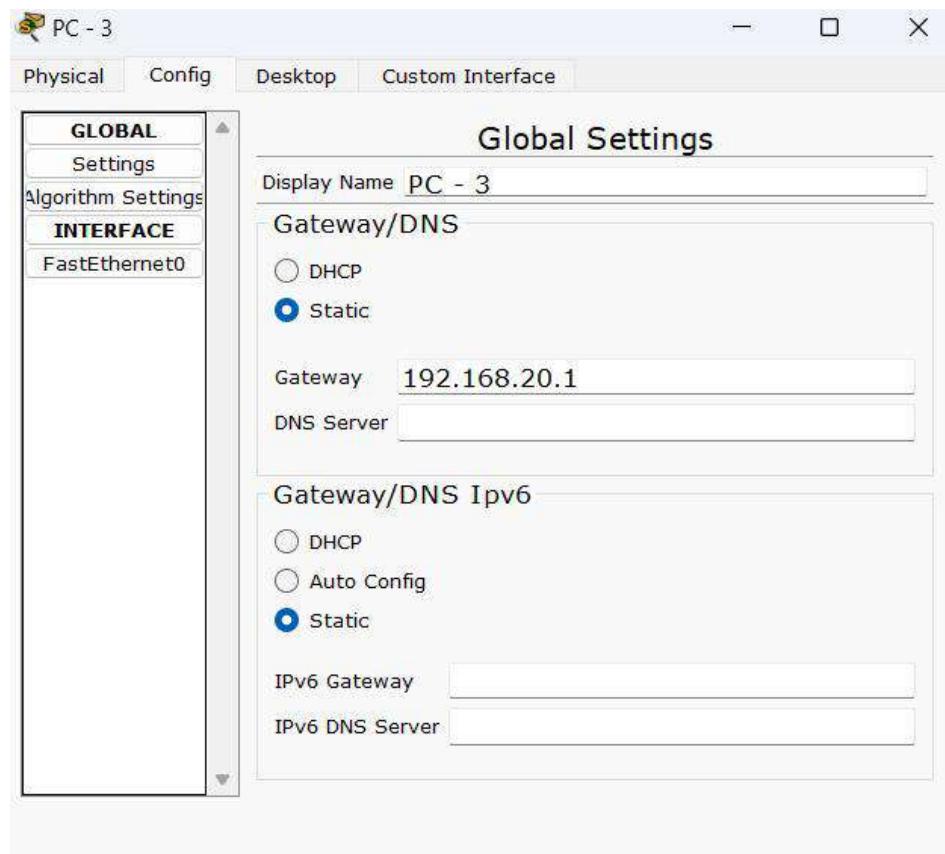
## PC - 1 Configuration:



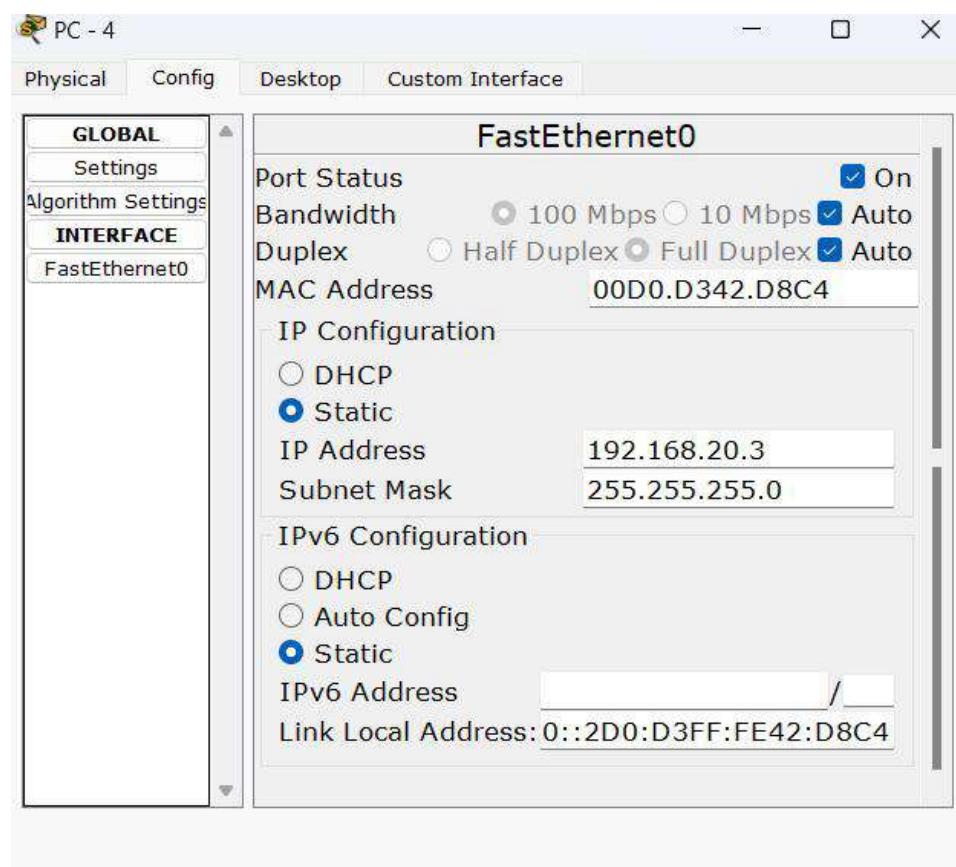
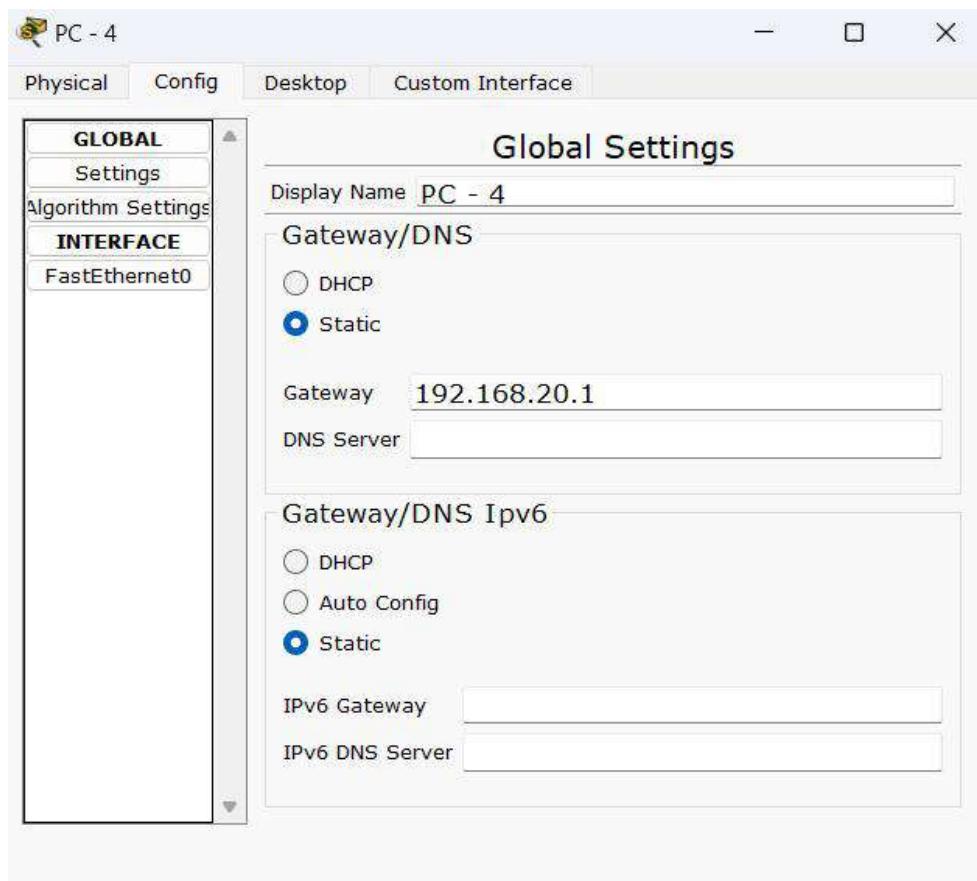
## PC - 2 Configuration:



## PC - 3 Configuration:



## PC - 4 Configuration:



## Router - 1 Configuration:

The screenshot shows the Router0 CLI interface. The title bar says "Router0". The tabs are "Physical", "Config" (which is selected), and "CLI". The main window title is "IOS Command Line Interface". The text area contains the following configuration commands:

```
Continue with configuration dialog? [yes/no]: n

Press RETURN to get started!

Router>enable
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#interface FastEthernet0/0
Router(config-if)#no shutdown

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

*LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed
state to up
ip address 192.168.1.1 255.255.255.0
Router(config-if)#


```

At the bottom right of the text area are "Copy" and "Paste" buttons.

The screenshot shows the Router0 Config tab. On the left is a navigation menu with options: GLOBAL, Settings, Algorithm Settings, ROUTING, Static, RIP, SWITCHING, VLAN Database, and INTERFACE. Under INTERFACE, "FastEthernet0/0" and "FastEthernet0/1" are listed. The main window title is "VLAN Configuration". It shows a table of VLANs:

VLAN No	VLAN Name
1	default
2	NEWVLAN
1002	fddi-default
1003	token-ring-default
1004	fddinet-default
1005	trnet-default

Below the table are "Add" and "Remove" buttons. At the bottom of the window, under "Equivalent IOS Commands", is the command:

```
Router#vlan database
% Warning: It is recommended to configure VLAN from config mode,
as VLAN database mode is being deprecated. Please consult user
documentation for configuring VTP/VLAN in config mode.

Router(vlan)#


```

 Router0

Physical Config CLI

### IOS Command Line Interface

```
Router>enable
Router#vlan database
% Warning: It is recommended to configure VLAN from config mode,
as VLAN database mode is being deprecated. Please consult user
documentation for configuring VTP/VLAN in config mode.

Router(vlan)#vlan 2 name NEWVLAN
VLAN 2 modified:
  Name: NEWVLAN
Router(vlan)#
Router(vlan)#exit
APPLY completed.
Exiting....
Router#config t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#interface Fa0/0.1
Router(config-subif)#
%LINK-5-CHANGED: Interface FastEthernet0/0.1, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0.1,
changed state to up

Router(config-subif)#encapsulation dot1q 2
Router(config-subif)#ip address 192.168.20.1 255.255.255.0
```

Copy Paste

 Router0

Physical Config CLI

### IOS Command Line Interface

```
Router(config-subif)#no shut
^
% Invalid input detected at '^' marker.

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

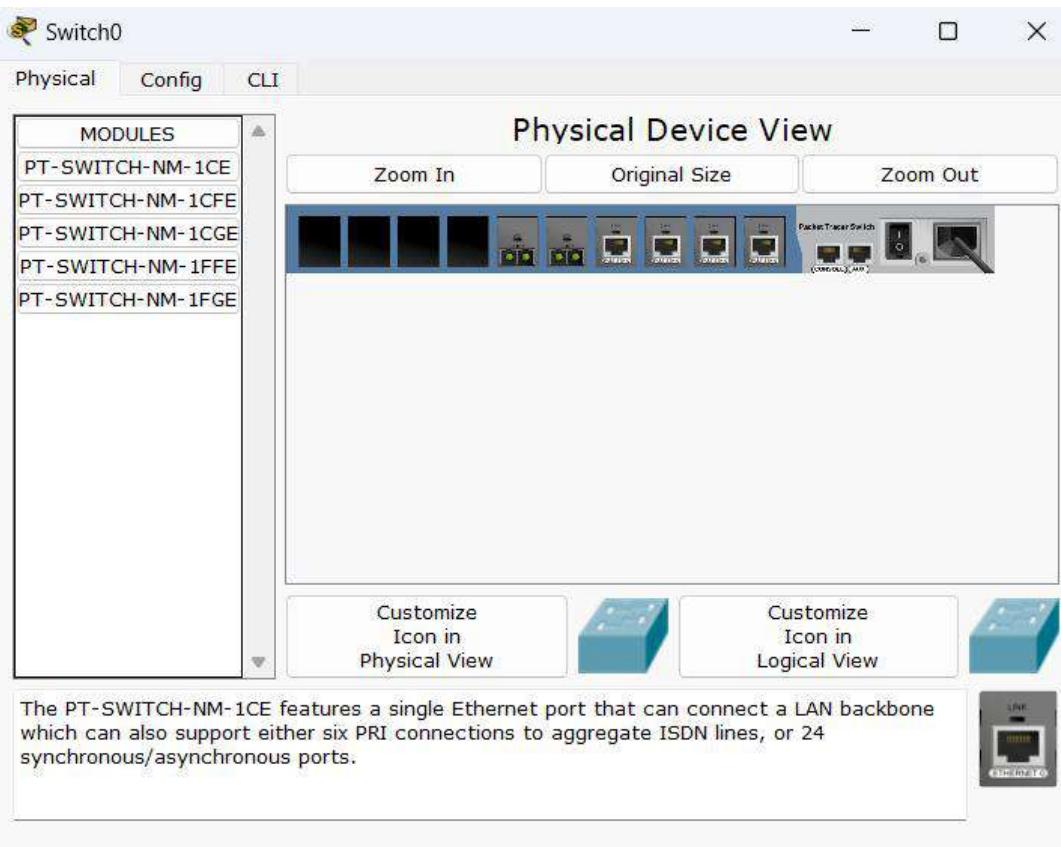
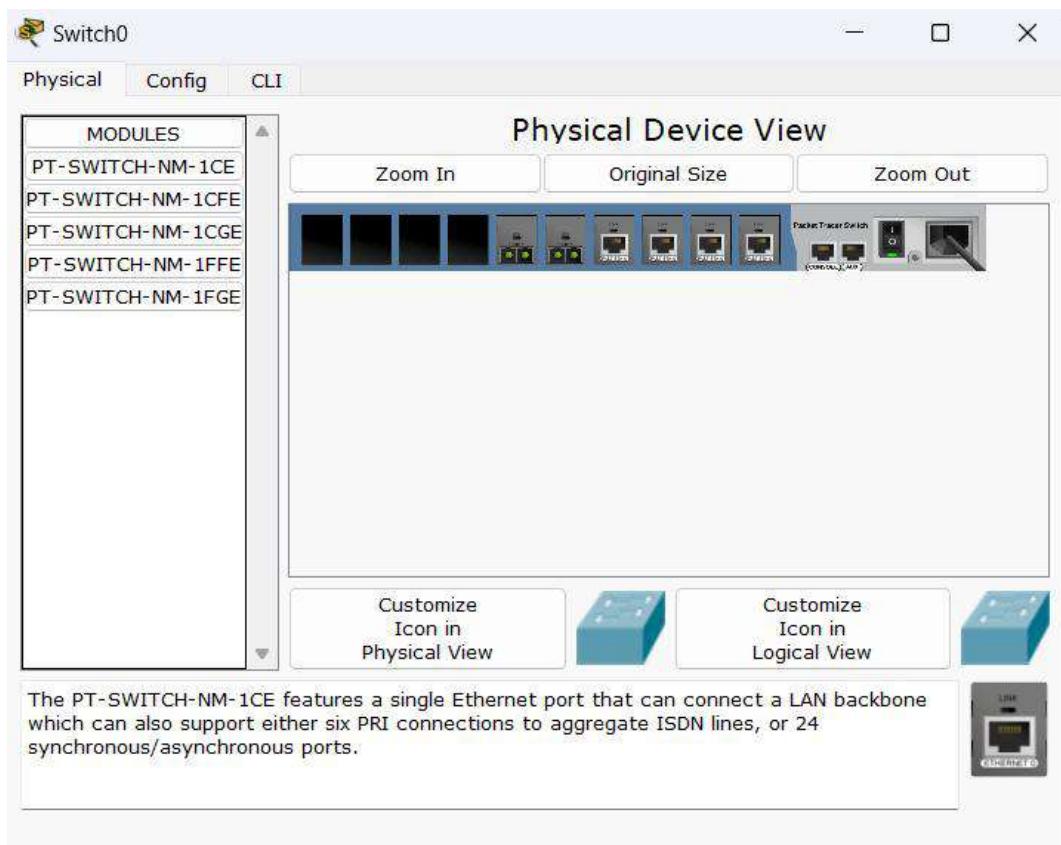
Router#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
      D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
      N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
      E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
      i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS
      inter area
      * - candidate default, U - per-user static route, o - ODR
      P - periodic downloaded static route

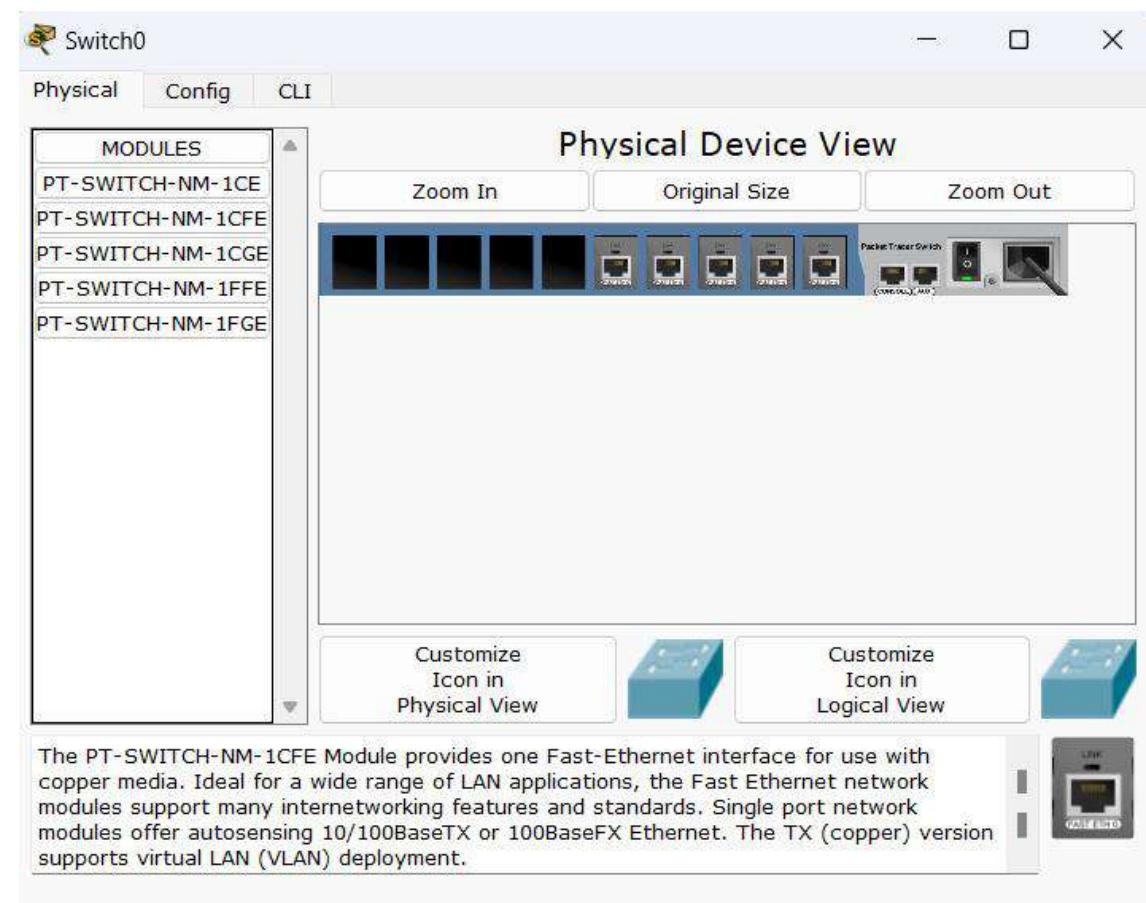
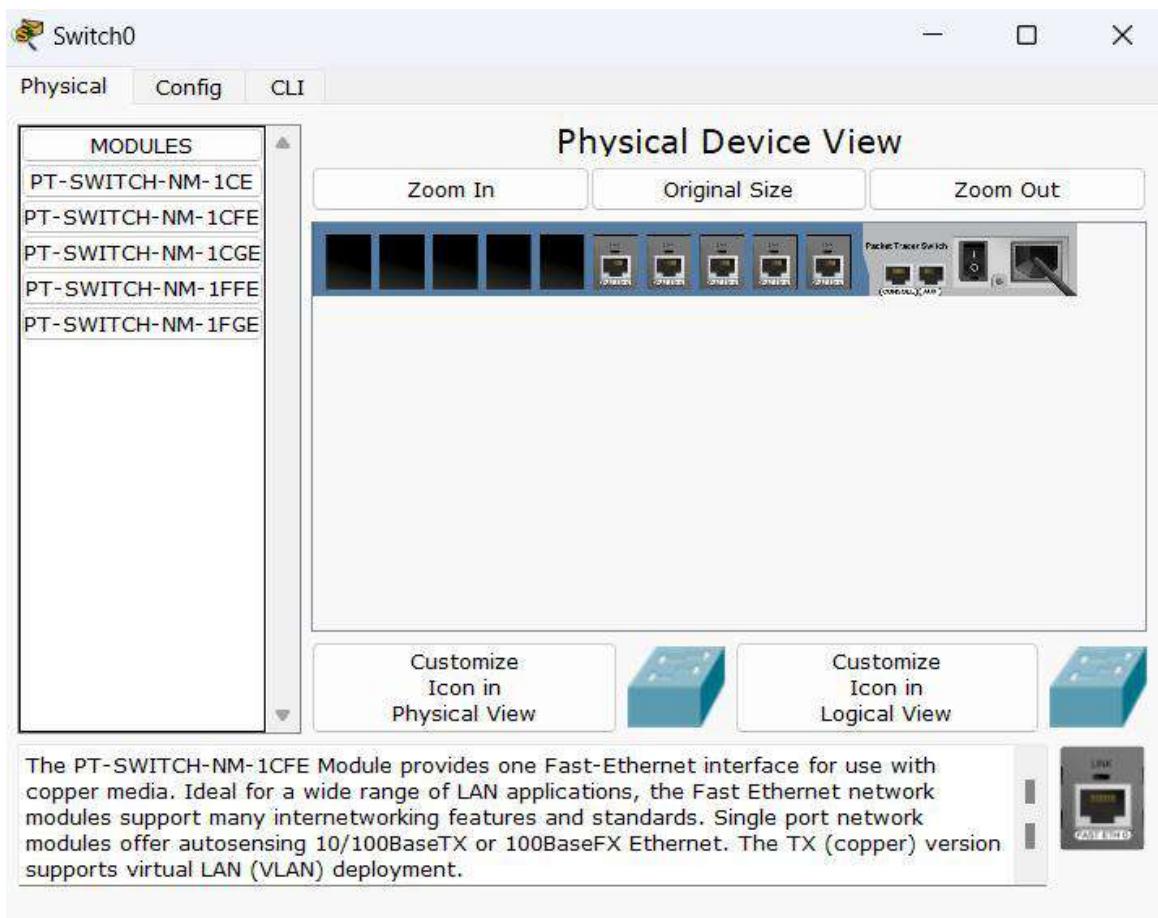
Gateway of last resort is not set

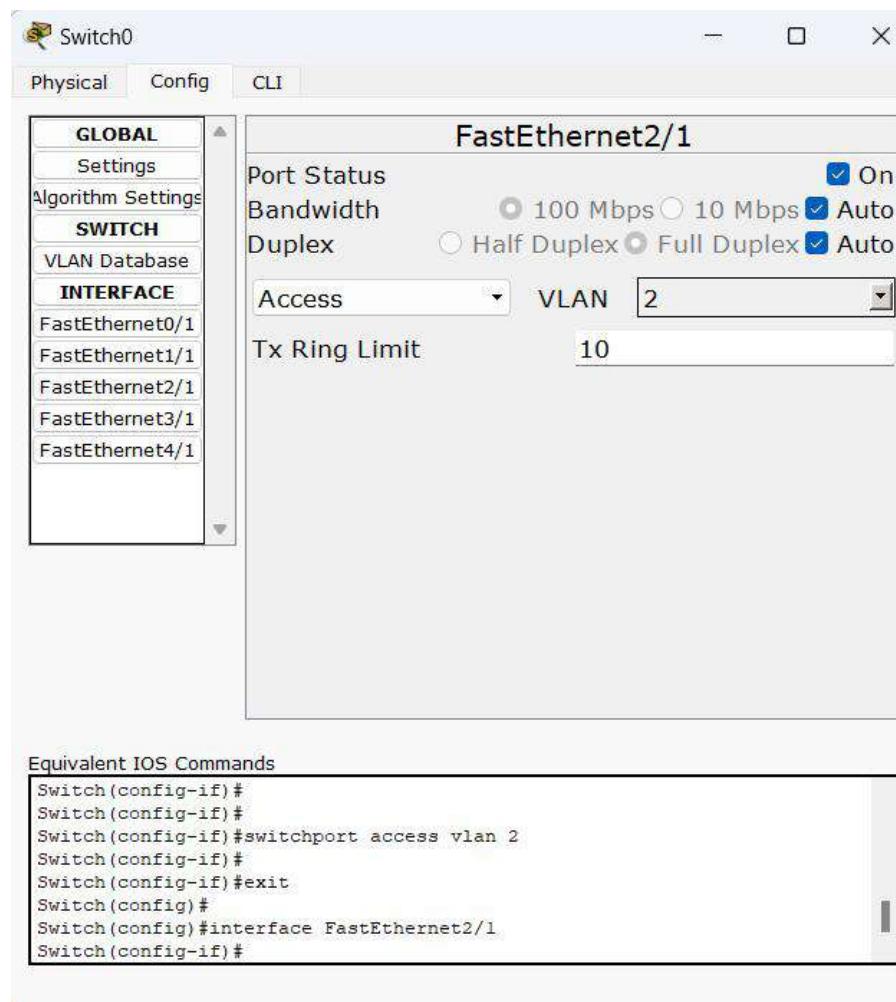
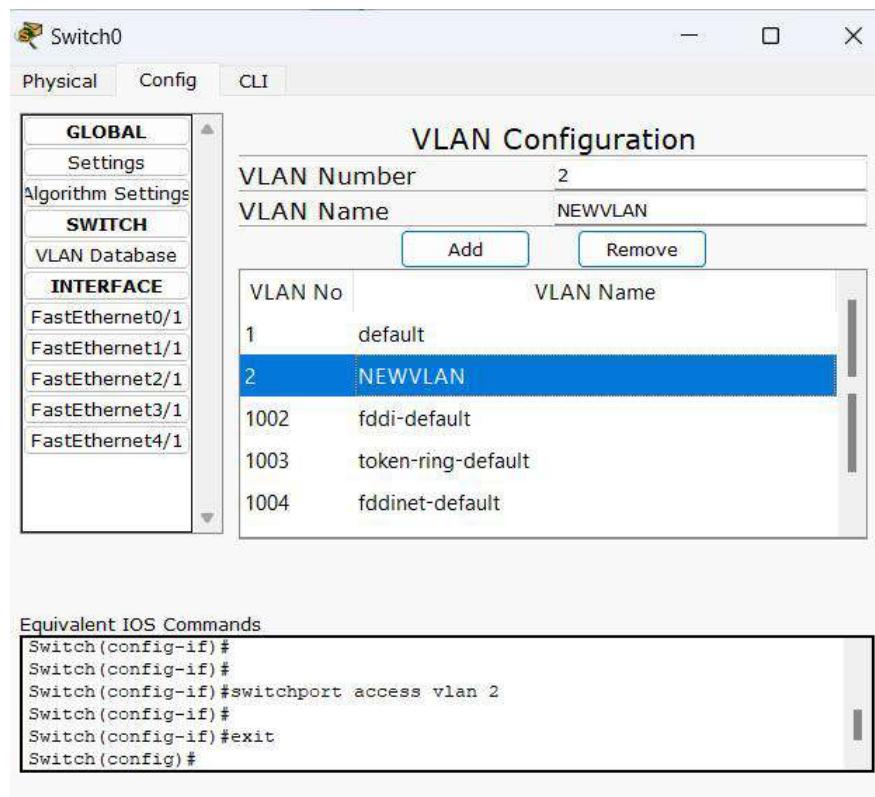
C    192.168.1.0/24 is directly connected, FastEthernet0/0
C    192.168.20.0/24 is directly connected, FastEthernet0/0.1
Router#
```

Copy Paste

## Switch - 1 Configuration:







Switch0

Physical Config CLI

**GLOBAL**

Settings

Algorithm Settings

**SWITCH**

VLAN Database

**INTERFACE**

FastEthernet0/1

FastEthernet1/1

FastEthernet2/1

FastEthernet3/1

FastEthernet4/1

FastEthernet3/1

Port Status  On

Bandwidth  100 Mbps  10 Mbps  Auto

Duplex  Half Duplex  Full Duplex  Auto

Access VLAN 2

Tx Ring Limit 10

This screenshot shows a software interface for managing network ports. On the left, a sidebar lists global settings, switch parameters, and various interfaces (FastEthernet0/1 to 4/1). The main panel is focused on 'FastEthernet3/1' and displays its current configuration: port status is set to 'On' (checked), bandwidth is '100 Mbps' (radio button selected), duplex mode is 'Full Duplex' (radio button selected), and it is assigned to 'Access' mode with VLAN 2. The 'Tx Ring Limit' is set to 10. Below this, a section titled 'Equivalent IOS Commands' contains the following configuration commands:

```
Switch(config-if)#
Switch(config-if)#exit
Switch(config)#
Switch(config)#interface FastEthernet2/1
Switch(config-if)#
Switch(config-if)#exit
Switch(config)#interface FastEthernet3/1
Switch(config-if)#

```

Switch0

Physical Config CLI

**GLOBAL**

Settings

Algorithm Settings

**SWITCH**

VLAN Database

**INTERFACE**

FastEthernet0/1

FastEthernet1/1

FastEthernet2/1

FastEthernet3/1

FastEthernet4/1

**FastEthernet4/1**

Port Status  On

Bandwidth  100 Mbps  10 Mbps  Auto

Duplex  Half Duplex  Full Duplex  Auto

Trunk VLAN 1-1005

Tx Ring Limit 10

This screenshot shows a software interface for managing network ports. On the left, a sidebar lists global settings, switch parameters, and interfaces (FastEthernet0/1 to 4/1). The main panel is focused on 'FastEthernet4/1' and displays its current configuration: Port Status is set to On (checked), Bandwidth is 100 Mbps (selected), Duplex is Full Duplex (selected), and it is configured as a Trunk port belonging to VLAN 1-1005. The Tx Ring Limit is set to 10. Below this, a section titled 'Equivalent IOS Commands' lists the corresponding configuration commands.

Equivalent IOS Commands

```
Switch(config)#interface FastEthernet2/1
Switch(config-if)#
Switch(config-if)#exit
Switch(config)#interface FastEthernet3/1
Switch(config-if)#
Switch(config-if)#exit
Switch(config)#interface FastEthernet4/1
Switch(config-if)#

```

## IOS Command Line Interface

```
Switch>enable
Switch#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#vlan 2
Switch(config-vlan)#name NEWVLAN
Switch(config-vlan)#exit
Switch(config)#
Switch(config)#interface FastEthernet4/1
Switch(config-if)#
Switch(config-if)#switchport mode trunk

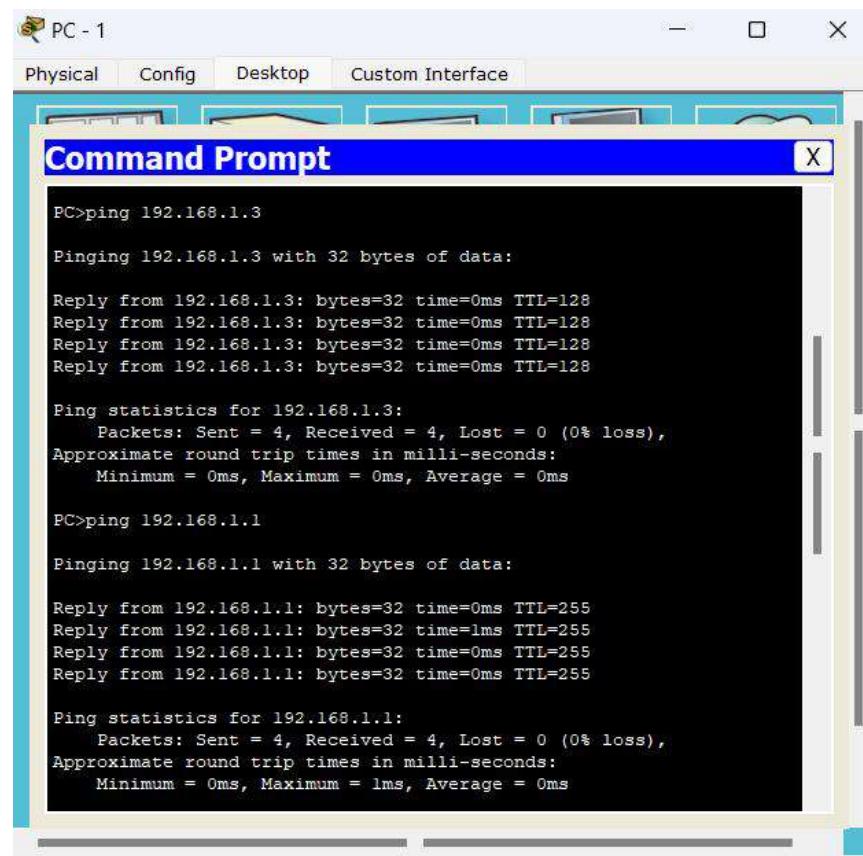
Switch(config-if)#
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet4/1, changed
state to down

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet4/1, changed
state to up

Switch(config-if)#exit
Switch(config)#interface FastEthernet2/1
Switch(config-if)#
Switch(config-if)#
Switch(config-if)#switchport access vlan 2
Switch(config-if)#
Switch(config-if)#exit
Switch(config)#interface FastEthernet3/1
Switch(config-if)#
Switch(config-if)#
Switch(config-if)#switchport access vlan 2
Switch(config-if)#
Switch(config-if)#exit
Switch(config)#

```

## Ping from PC - 1 to all other devices:



```
PC>ping 192.168.1.3

Pinging 192.168.1.3 with 32 bytes of data:

Reply from 192.168.1.3: bytes=32 time=0ms TTL=128

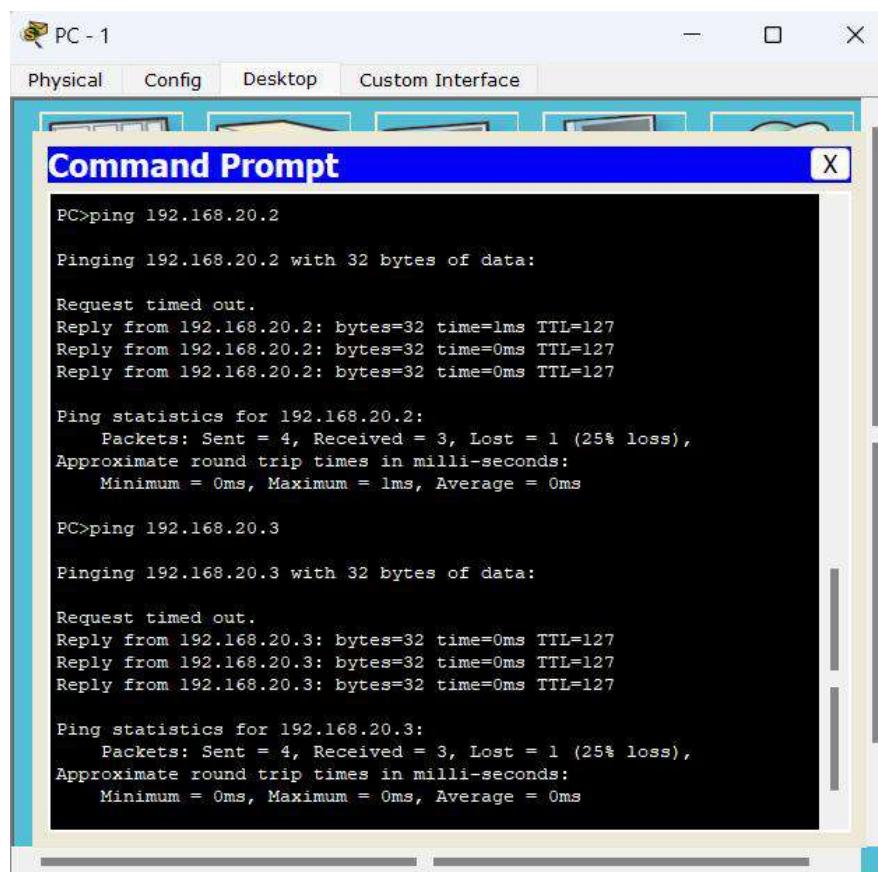
Ping statistics for 192.168.1.3:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms

PC>ping 192.168.1.1

Pinging 192.168.1.1 with 32 bytes of data:

Reply from 192.168.1.1: bytes=32 time=0ms TTL=255
Reply from 192.168.1.1: bytes=32 time=1ms TTL=255
Reply from 192.168.1.1: bytes=32 time=0ms TTL=255
Reply from 192.168.1.1: bytes=32 time=0ms TTL=255

Ping statistics for 192.168.1.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 1ms, Average = 0ms
```



```
PC>ping 192.168.20.2

Pinging 192.168.20.2 with 32 bytes of data:

Request timed out.
Reply from 192.168.20.2: bytes=32 time=1ms TTL=127
Reply from 192.168.20.2: bytes=32 time=0ms TTL=127
Reply from 192.168.20.2: bytes=32 time=0ms TTL=127

Ping statistics for 192.168.20.2:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 1ms, Average = 0ms

PC>ping 192.168.20.3

Pinging 192.168.20.3 with 32 bytes of data:

Request timed out.
Reply from 192.168.20.3: bytes=32 time=0ms TTL=127
Reply from 192.168.20.3: bytes=32 time=0ms TTL=127
Reply from 192.168.20.3: bytes=32 time=0ms TTL=127

Ping statistics for 192.168.20.3:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms
```

## Ping from PC - 2 to all other devices:

```
PC - 2
Physical Config Desktop Custom Interface
Command Prompt X
Packet Tracer PC Command Line 1.0
PC>ping 192.168.1.2

Pinging 192.168.1.2 with 32 bytes of data:

Reply from 192.168.1.2: bytes=32 time=0ms TTL=128
Reply from 192.168.1.2: bytes=32 time=7ms TTL=128
Reply from 192.168.1.2: bytes=32 time=0ms TTL=128
Reply from 192.168.1.2: bytes=32 time=0ms TTL=128

Ping statistics for 192.168.1.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 7ms, Average = 1ms

PC>ping 192.168.1.1

Pinging 192.168.1.1 with 32 bytes of data:

Reply from 192.168.1.1: bytes=32 time=1ms TTL=255
Reply from 192.168.1.1: bytes=32 time=0ms TTL=255
Reply from 192.168.1.1: bytes=32 time=0ms TTL=255
Reply from 192.168.1.1: bytes=32 time=0ms TTL=255

Ping statistics for 192.168.1.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 1ms, Average = 0ms
```

```
PC - 2
Physical Config Desktop Custom Interface
Command Prompt X
PC>ping 192.168.20.2

Pinging 192.168.20.2 with 32 bytes of data:

Reply from 192.168.20.2: bytes=32 time=5ms TTL=127
Reply from 192.168.20.2: bytes=32 time=1ms TTL=127
Reply from 192.168.20.2: bytes=32 time=0ms TTL=127
Reply from 192.168.20.2: bytes=32 time=0ms TTL=127

Ping statistics for 192.168.20.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 5ms, Average = 1ms

PC>ping 192.168.20.3

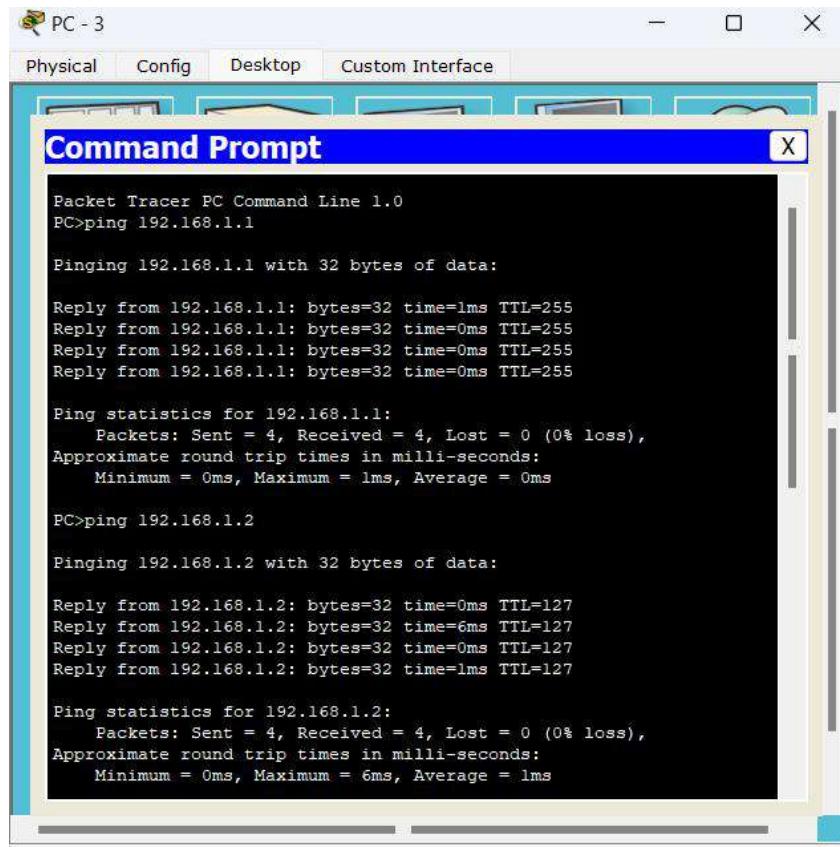
Pinging 192.168.20.3 with 32 bytes of data:

Reply from 192.168.20.3: bytes=32 time=1ms TTL=127
Reply from 192.168.20.3: bytes=32 time=0ms TTL=127
Reply from 192.168.20.3: bytes=32 time=0ms TTL=127
Reply from 192.168.20.3: bytes=32 time=0ms TTL=127

Ping statistics for 192.168.20.3:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 1ms, Average = 0ms

PC>
```

## Ping from PC - 3 to all other devices:



```
Packet Tracer PC Command Line 1.0
PC>ping 192.168.1.1

Pinging 192.168.1.1 with 32 bytes of data:

Reply from 192.168.1.1: bytes=32 time=lms TTL=255
Reply from 192.168.1.1: bytes=32 time=0ms TTL=255
Reply from 192.168.1.1: bytes=32 time=0ms TTL=255
Reply from 192.168.1.1: bytes=32 time=0ms TTL=255

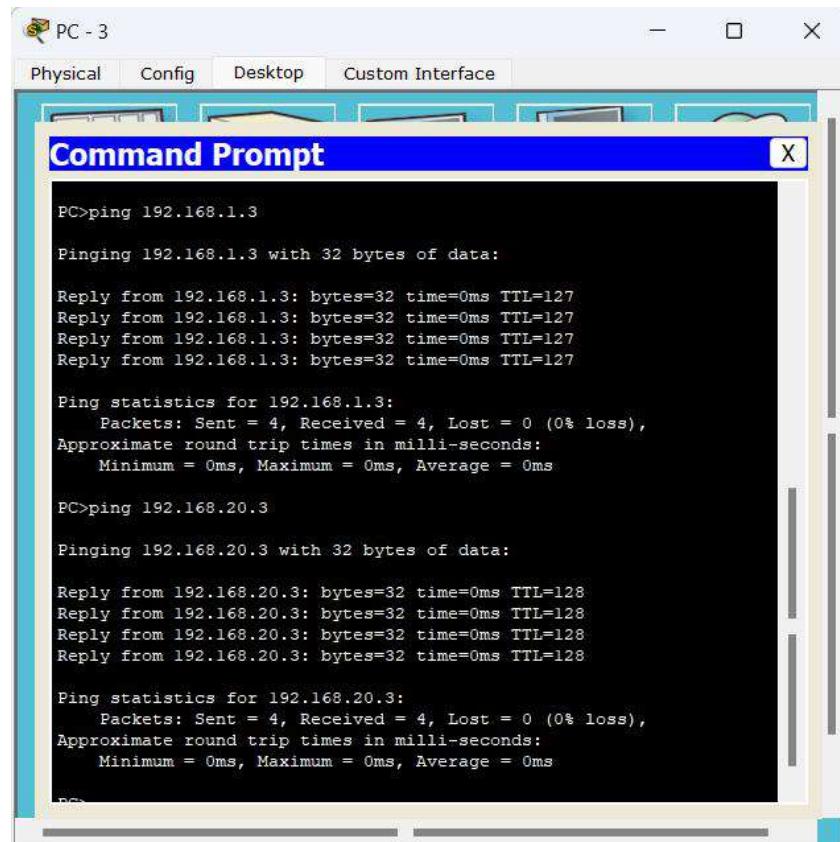
Ping statistics for 192.168.1.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 1ms, Average = 0ms

PC>ping 192.168.1.2

Pinging 192.168.1.2 with 32 bytes of data:

Reply from 192.168.1.2: bytes=32 time=0ms TTL=127
Reply from 192.168.1.2: bytes=32 time=6ms TTL=127
Reply from 192.168.1.2: bytes=32 time=0ms TTL=127
Reply from 192.168.1.2: bytes=32 time=1ms TTL=127

Ping statistics for 192.168.1.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 6ms, Average = 1ms
```



```
PC>ping 192.168.1.3

Pinging 192.168.1.3 with 32 bytes of data:

Reply from 192.168.1.3: bytes=32 time=0ms TTL=127

Ping statistics for 192.168.1.3:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms

PC>ping 192.168.20.3

Pinging 192.168.20.3 with 32 bytes of data:

Reply from 192.168.20.3: bytes=32 time=0ms TTL=128

Ping statistics for 192.168.20.3:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms
```

## Ping from PC - 4 to all other devices:

```
PC>ping 192.168.1.1

Pinging 192.168.1.1 with 32 bytes of data:

Reply from 192.168.1.1: bytes=32 time=lms TTL=255
Reply from 192.168.1.1: bytes=32 time=0ms TTL=255
Reply from 192.168.1.1: bytes=32 time=0ms TTL=255
Reply from 192.168.1.1: bytes=32 time=lms TTL=255

Ping statistics for 192.168.1.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 1ms, Average = 0ms

PC>ping 192.168.1.2

Pinging 192.168.1.2 with 32 bytes of data:

Reply from 192.168.1.2: bytes=32 time=lms TTL=127
Reply from 192.168.1.2: bytes=32 time=0ms TTL=127
Reply from 192.168.1.2: bytes=32 time=0ms TTL=127
Reply from 192.168.1.2: bytes=32 time=lms TTL=127

Ping statistics for 192.168.1.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 1ms, Average = 0ms
```

```
PC>ping 192.168.20.2

Pinging 192.168.20.2 with 32 bytes of data:

Reply from 192.168.20.2: bytes=32 time=lms TTL=128
Reply from 192.168.20.2: bytes=32 time=0ms TTL=128
Reply from 192.168.20.2: bytes=32 time=0ms TTL=128
Reply from 192.168.20.2: bytes=32 time=lms TTL=128

Ping statistics for 192.168.20.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 1ms, Average = 0ms

PC>ping 192.168.1.3

Pinging 192.168.1.3 with 32 bytes of data:

Reply from 192.168.1.3: bytes=32 time=0ms TTL=127
Reply from 192.168.1.3: bytes=32 time=0ms TTL=127
Reply from 192.168.1.3: bytes=32 time=lms TTL=127
Reply from 192.168.1.3: bytes=32 time=lms TTL=127

Ping statistics for 192.168.1.3:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 1ms, Average = 0ms
```

### 2.11.3 Observation Book Pictures:

PAGE NO.:  
DATE: 13/03/2023

Experiment - 11

To construct a VLAN and make the PC's communicate among a VLAN.

Aim: To understand communication of PCs among a VLAN

Topology:

PC-1: 192.168.1.2  
PC-2: 192.168.1.3  
PC-3: 192.168.20.2  
PC-4: 192.168.20.3

Gateway: 192.168.1.1

Switch: VLAN 10 (192.168.20.1)

VLAN: 192.168.20.1

Procedure:

1. Place a Router, a switch and 4 PCs.
2. Switch Configuration:  
Click on Switch → Physical  
Turn off the Switch.  
Remove the 2 ports (PT-SWITCH-NM-1FFF) by dragging and dropping them in Modules.  
Add the port (PT-SWITCH-NM-1CFF) by dragging it.

from Modules and placing onto the empty slots in switch.

Now Turn on the Switch.

By doing this, we have 5 Fast Ethernet ports to connect 4 PCs and a router.

3. Connect PC-1, PC-2, PC-3, PC-4 from FastEthernet0 ports of each PCs to Fa0/1, Fa1/1, Fa2/1 and Fa3/1 using Copper straight through wire.

Connect Fa0/0 port of Router to Fa4/1 Port of switch using Copper straight through wire.

#### 4. a) PC-1 Configuration:

Click on PC-1 → Config → Interface → FastEthernet0

Assign a static ip address [192.168.1.2 and Subnet Mask: 255.255.255.0].

Assign static gateway : 192.168.1.1

#### b) PC-2 Configuration:

Click on PC-2 → Config → Interface → FastEthernet0

Assign a static ip address [192.168.1.3 and Subnet Mask: 255.255.255.0].

Assign static gateway : 192.168.1.1

#### c) PC-3 Configuration:

Click on PC-3 → Config → Interface → FastEthernet0

Assign a static ip address [192.168.20.2 and Subnet Mask: 255.255.255.0].

Assign static gateway : 192.168.20.1.

#### d) PC-4 Configuration:

Click on PC-4 → Config → Interface → FastEthernet0

Assign a static ip address [192.168.20.3 and Subnet Mask: 255.255.255.0].

Assign a static gateway: 192.168.20.1

5. a) In Switch, go to Config. Select VLAN database.

#### VLAN CONFIGURATION

VLAN NUMBER : 2 (Give any no except 1)

VLAN NAME : NEWVLAN (Give any name)

Then click on Add.

b) Select the interface [i.e FastEthernet 4/1] (port connecting switch and router).

Change Access to Trunk

c) VLAN Trunking allows switches to forward frames from different VLAN's over a single link called trunk.

d) Select interface FastEthernet 2/1. Under VLAN, change from 1 to 2.

Select interface FastEthernet 3/1. Under VLAN, change from 1 to 2.

This makes the switch understand NEW VLAN.

6. Router configuration -

Router > enable

Router# config t

Router(config) # interface FastEthernet 0/0

Router(config-if) # ip address 192.168.1.1 255.255.255.0

Router(config-if) # no shut

Router(config-if) # exit

Router(config) # exit

Now the router is to understand NEWVLAN.

Click on Router → Config → Switching → VLAN database.

VLAN Configuration

VLAN Number : 2

VLAN Name : NEWVLAN

Click on add.

(Above step in Router CLI)

Router>enable

Router# vlan database

Router(vlan)# vlan 2 name NEWVLAN

VLAN 2 modified :

Name : NEWVLAN

Router(vlan)# exit

APPLY completed.

Exiting ...

Router# Config t

Router(Config)# interface Fa0/0.1

Router(Config-subif)# encapsulation dot1q 2

Router(Config-subif)# ip address 192.168.20.1 255.255.255.0

Router(Config-subif)# exit.

Router(Config)# exit.

Router# show ip route

c 192.168.1.0/24 is directly connected, FastEthernet 0/0

c 192.168.20.0/24 is directly connected, FastEthernet 0/0.1



### Result:

a) Pinging PC-1 to PC-2 :

PC > ping 192.168.1.3

Pinging 192.168.1.3 with 32 bytes of data:

Reply from 192.168.1.3 : bytes = 32 time = 0ms TTL = 128

Reply from 192.168.1.3 : bytes = 32 time = 0ms TTL = 128

Reply from 192.168.1.3 : bytes = 32 time = 0ms TTL = 128

Reply from 192.168.1.3 : bytes = 32 time = 0ms TTL = 128

Ping statistics for 192.168.1.3:

Packets: Sent = 4, Received = 4, Lost = 0 (0% loss)

Approximate round trip times in milli-seconds:

Minimum = 0ms, Maximum = 0ms, Average = 0ms

b) Pinging PC-1 to PC-3 :

PC > ping 192.168.20.2

Reply from 192.168.20.2 : bytes = 32 time = 0ms TTL = 127

Reply from 192.168.20.2 : bytes = 32 time = 0ms TTL = 127

Reply from 192.168.20.2 : bytes = 32 time = 0ms TTL = 127

Reply from 192.168.20.2 : bytes = 32 time = 0ms TTL = 127

Ping statistics for 192.168.20.2:

Packets: Sent = 4, Received = 4, Lost = 0 (0% loss)

Approximate round trip times in milli-seconds:

Minimum = 0ms, Maximum = 0ms, Average = 0ms.

Observation:

A virtual local area network (VLAN) is a virtualized connection that connects multiple devices and network nodes from different LANs into one logical network.

IEEE 802.1Q, often referred to as DOT1Q or 1Q, is the networking standard that supports virtual LANs (VLANs) on an IEEE 802.3 Ethernet network. It is the most widely used encapsulation method for VLAN Tagging.

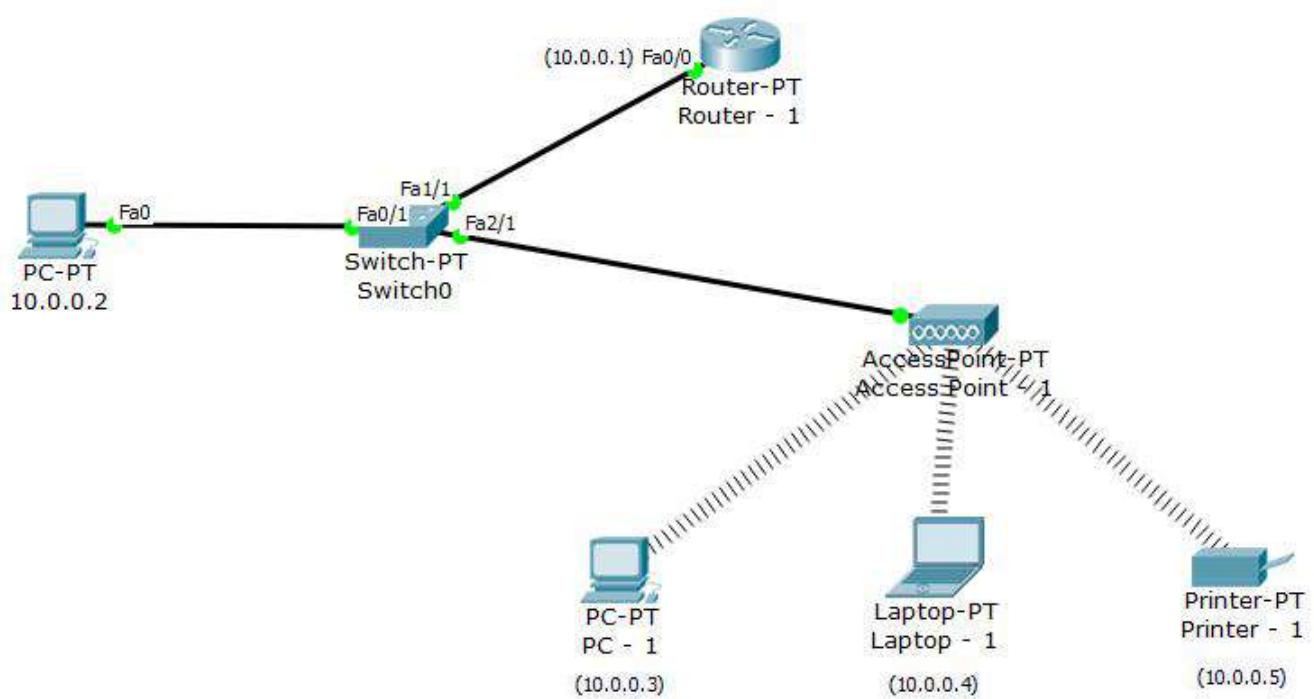
## 2.12 Experiment - 12:

### 2.12.1 Question:

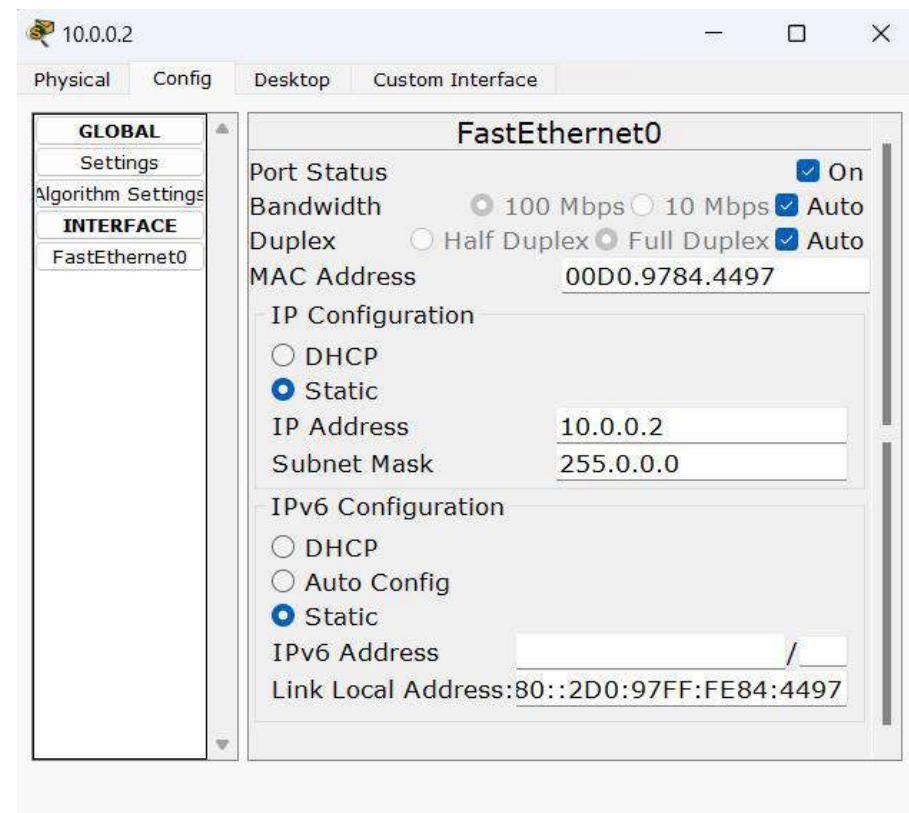
To construct a WLAN and make the nodes communicate wirelessly.

### 2.12.2 Screenshots (Topology, Configurations & Output):

Topology:



## PC Configuration:



## Router - 1 Configuration:

The screenshot shows a software window titled 'Router - 1' with tabs for Physical, Config, and CLI. The CLI tab is selected, displaying the 'IOS Command Line Interface'. The interface shows the following configuration session:

```
Press RETURN to get started!

Router>enable
Router#config t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#interface Fa0/0
Router(config-if)#ip address 10.0.0.1 255.0.0.0
Router(config-if)#no shut

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

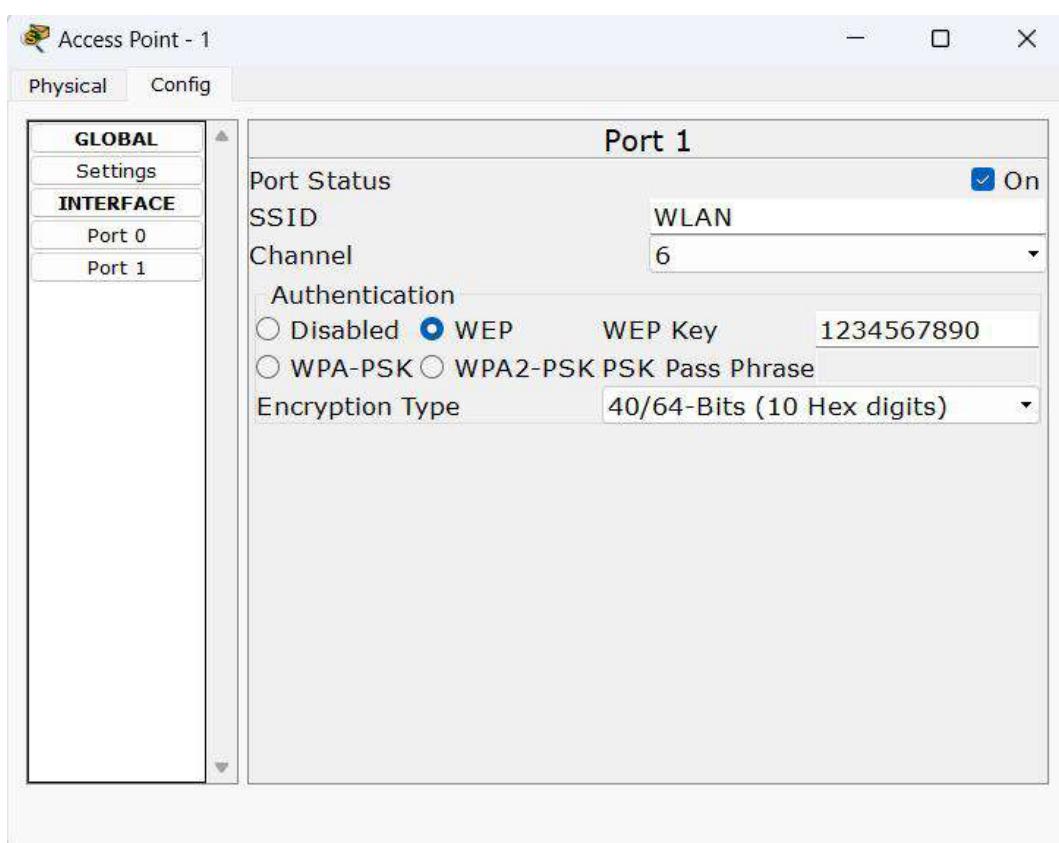
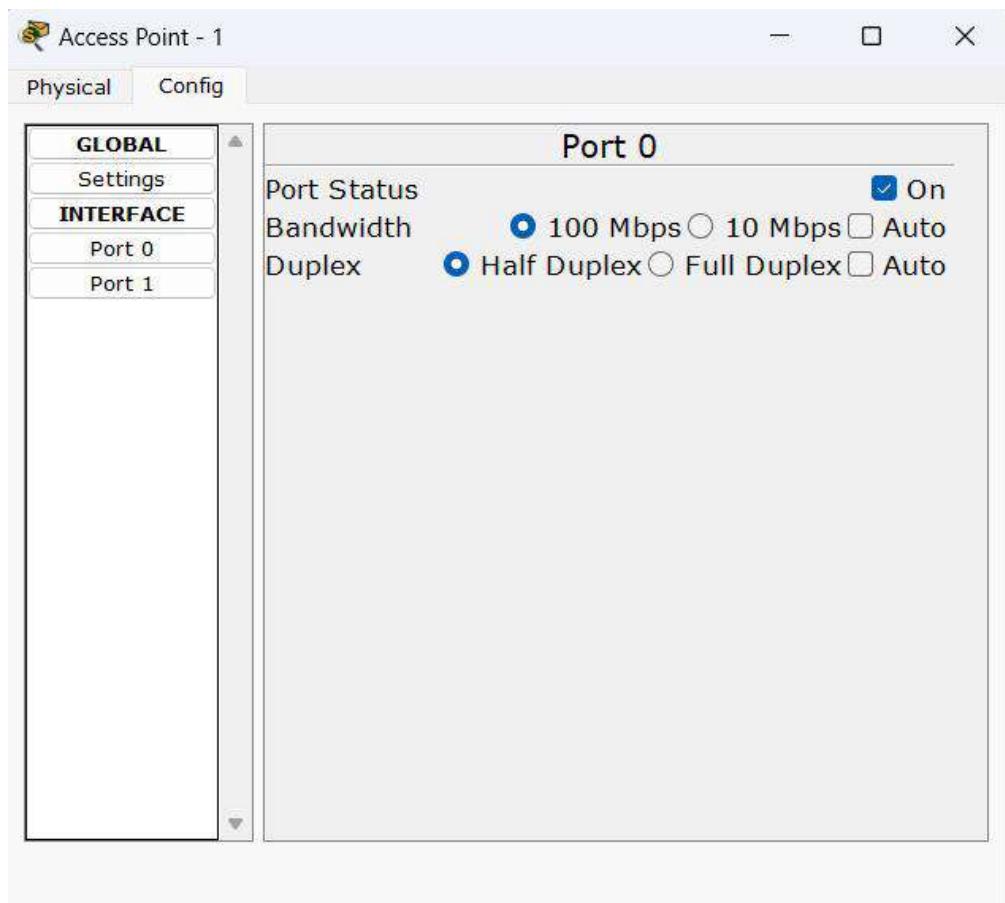
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed
state to up

Router(config-if)#exit
Router(config)#

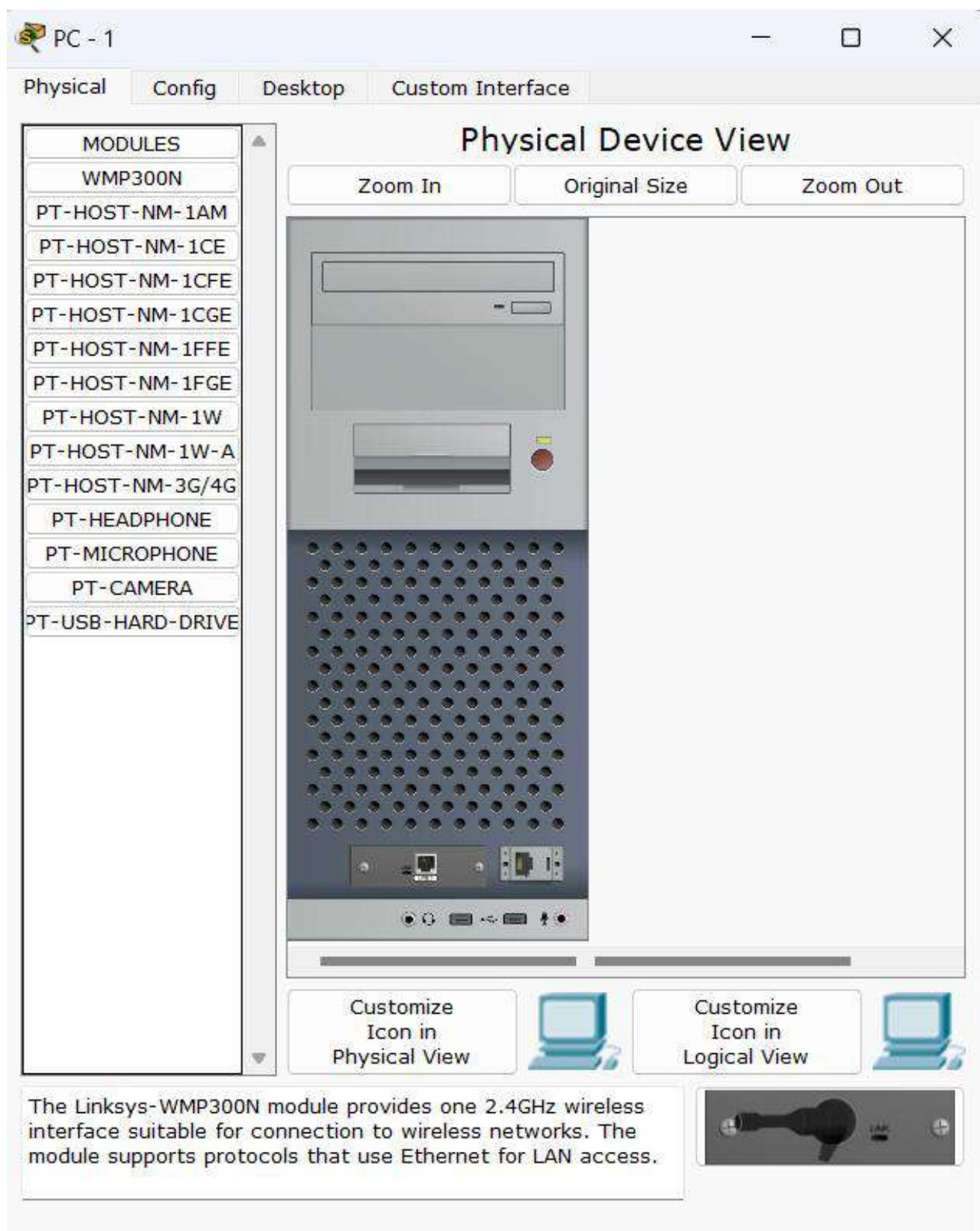
```

At the bottom are 'Copy' and 'Paste' buttons.

## Access Point - 1 Configuration:



## PC - 1 Configuration:



PC - 1

Physical Config Desktop Custom Interface

### Physical Device View

Zoom In Original Size Zoom Out

MODULES

- WMP300N
- PT-HOST-NM-1AM
- PT-HOST-NM-1CE
- PT-HOST-NM-1CFE
- PT-HOST-NM-1CGE
- PT-HOST-NM-1FFE
- PT-HOST-NM-1FGE
- PT-HOST-NM-1W
- PT-HOST-NM-1W-A
- PT-HOST-NM-3G/4G
- PT-HEADPHONE
- PT-MICROPHONE
- PT-CAMERA
- PT-USB-HARD-DRIVE

Customize Icon in Physical View

Customize Icon in Logical View

The Linksys-WMP300N module provides one 2.4GHz wireless interface suitable for connection to wireless networks. The module supports protocols that use Ethernet for LAN access.

[Physical](#) [Config](#) [Desktop](#) [Custom Interface](#)

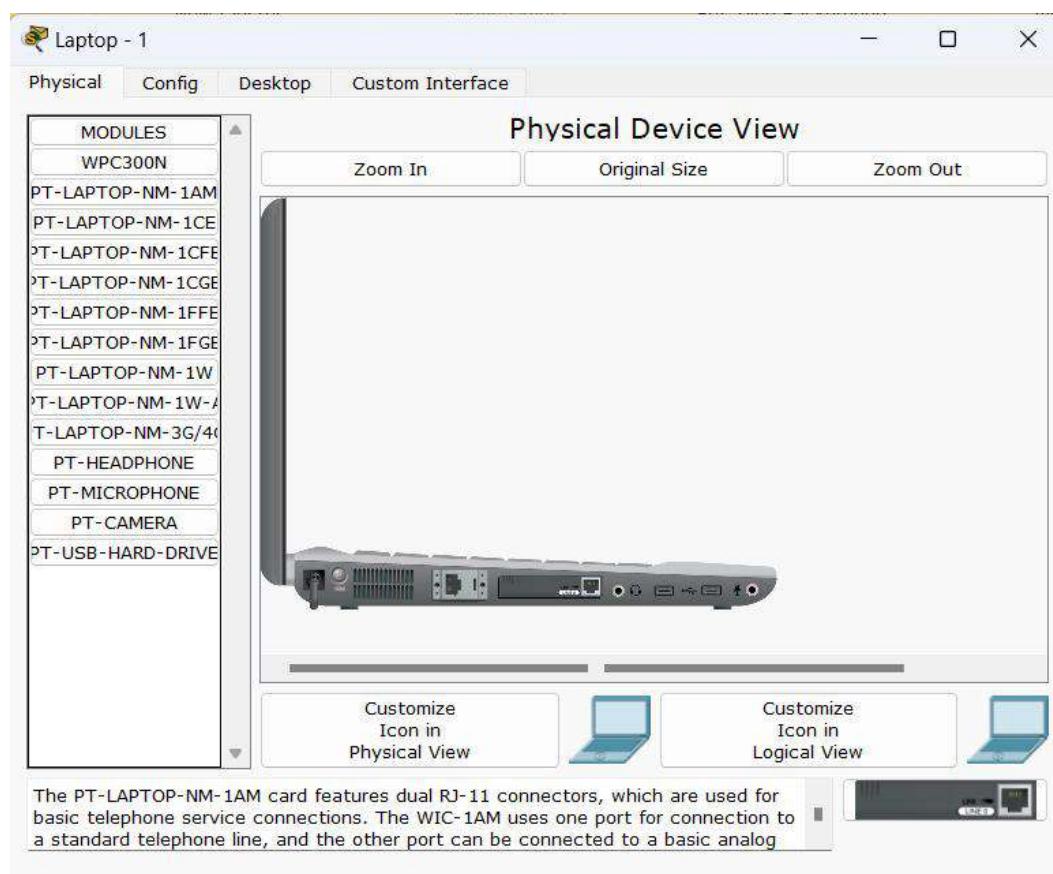
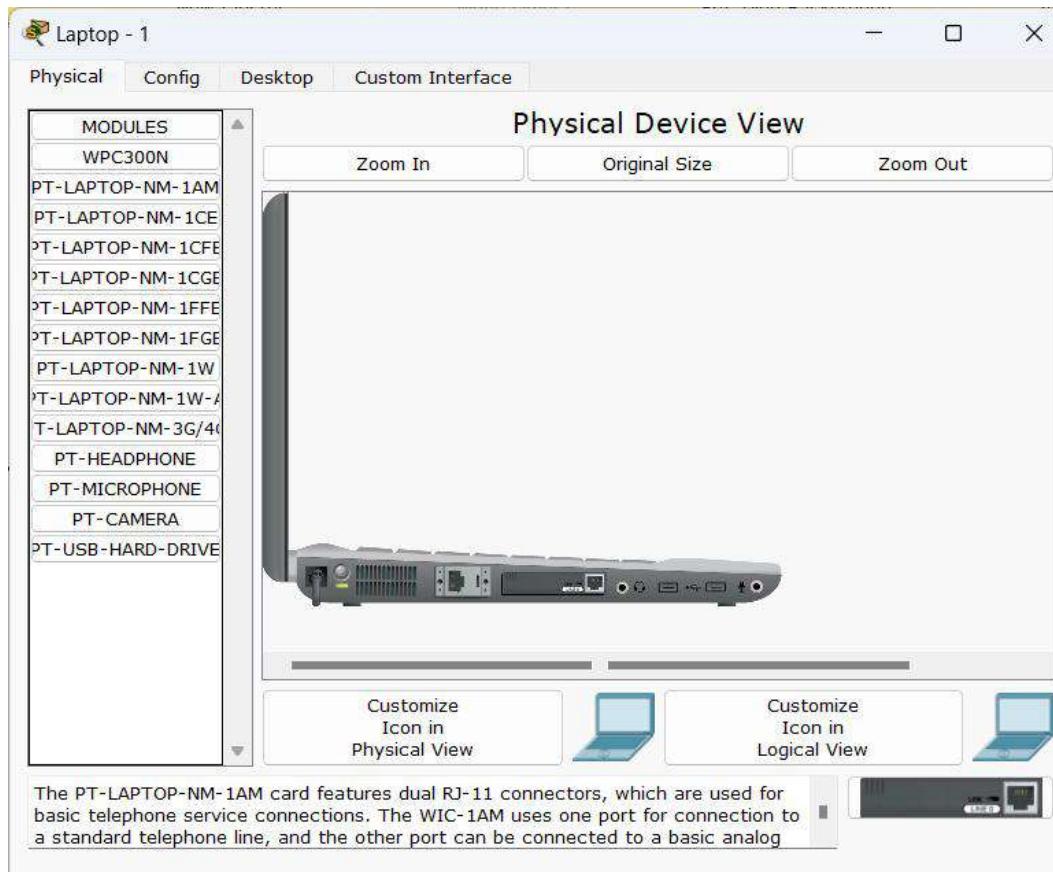
MODULES
WMP300N
PT-HOST-NM-1AM
PT-HOST-NM-1CE
PT-HOST-NM-1CFE
PT-HOST-NM-1CGE
PT-HOST-NM-1FFE
PT-HOST-NM-1FGE
PT-HOST-NM-1W
PT-HOST-NM-1W-A
PT-HOST-NM-3G/4G
PT-HEADPHONE
PT-MICROPHONE
PT-CAMERA
PT-USB-HARD-DRIVE

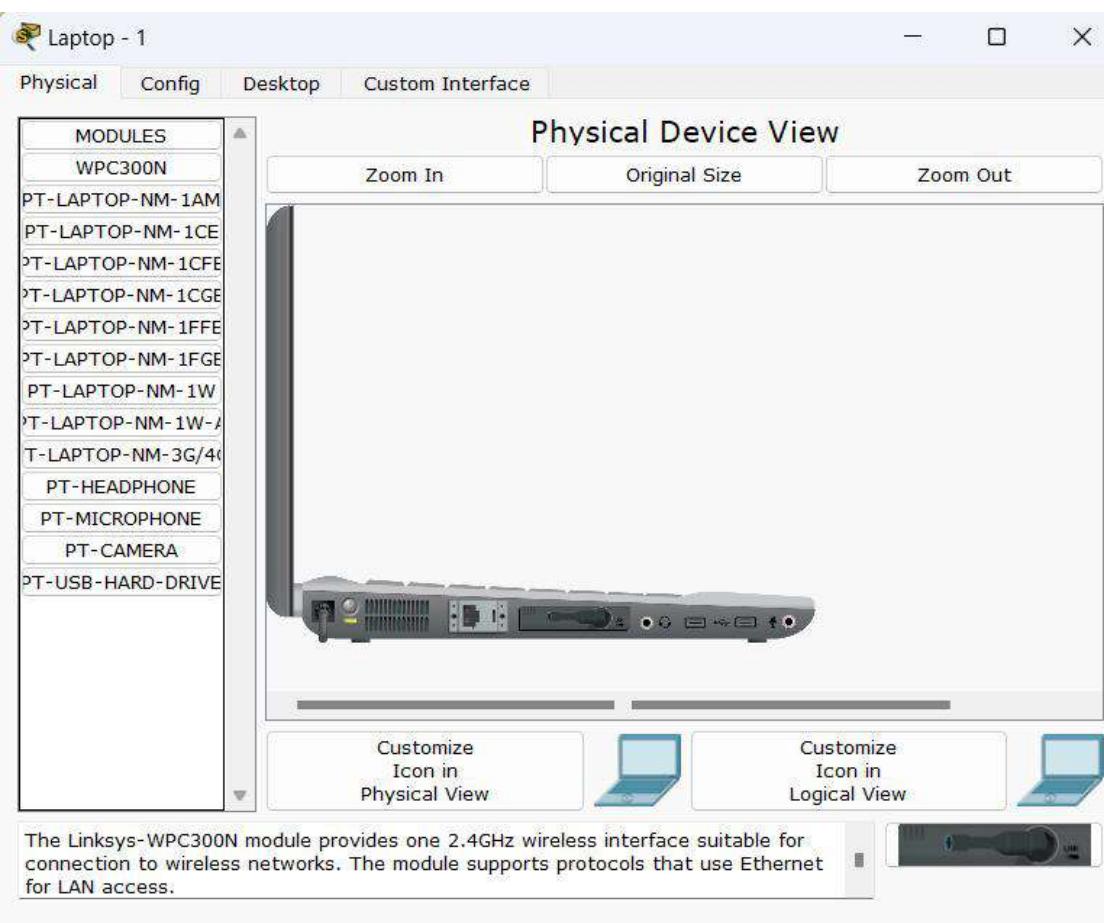
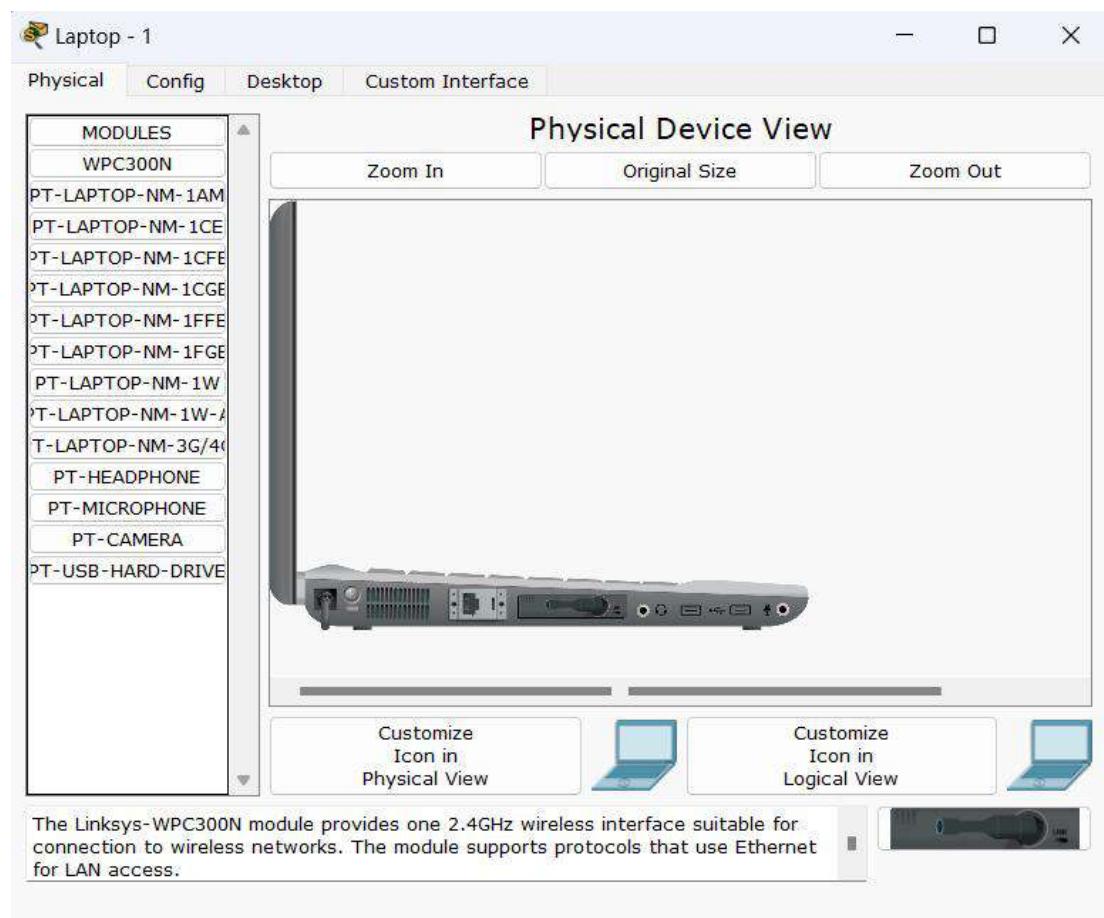
## Physical Device View

[Zoom In](#)[Original Size](#)[Zoom Out](#)[Customize  
Icon in  
Physical View](#)[Customize  
Icon in  
Logical View](#)

The Linksys-WMP300N module provides one 2.4GHz wireless interface suitable for connection to wireless networks. The module supports protocols that use Ethernet for LAN access.

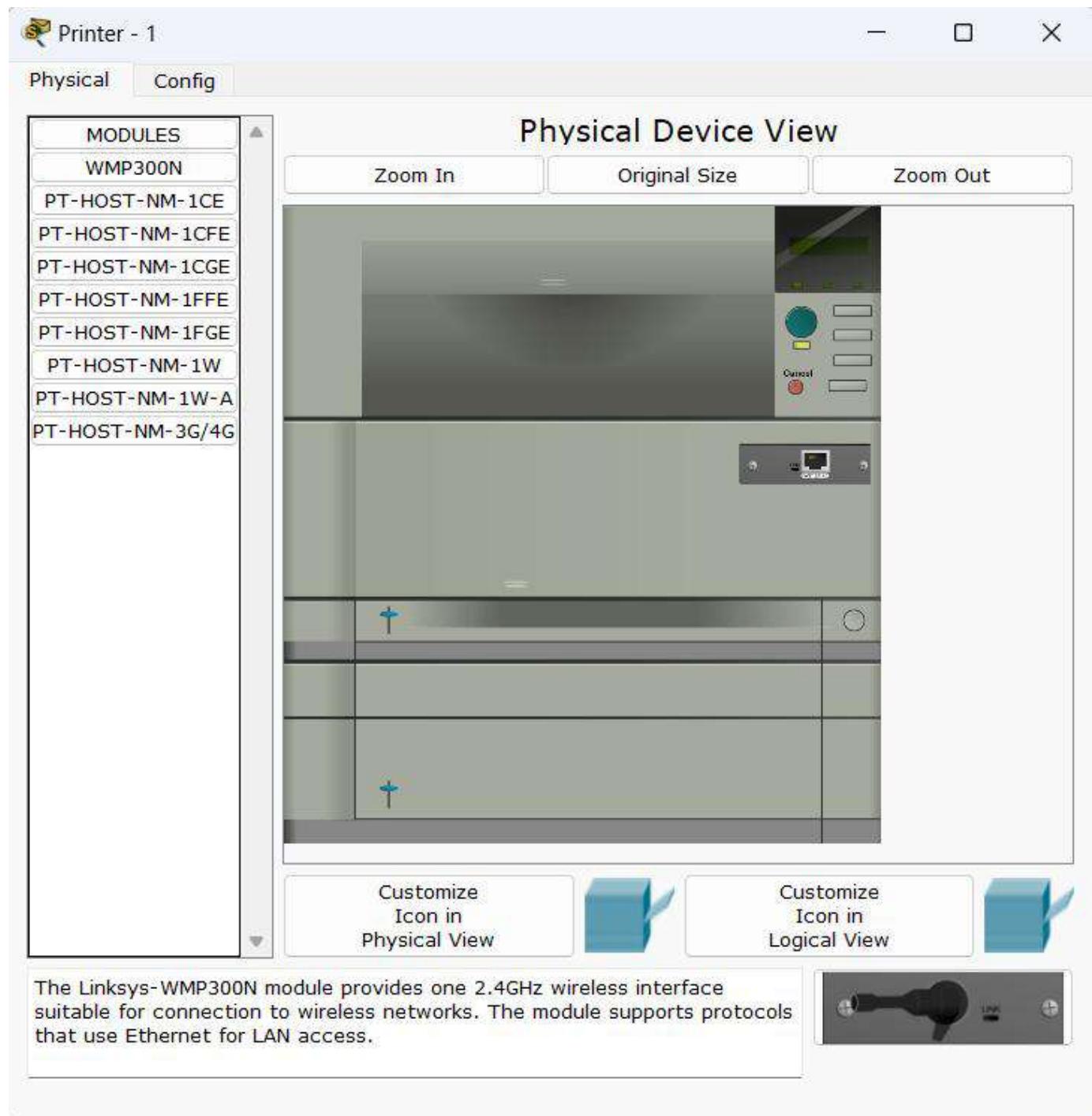
## Laptop - 1 Configuration:





<b>GLOBAL</b>			
Settings			
Algorithm Settings			
<b>INTERFACE</b>			
Wireless0			
<b>Wireless0</b>			
Port Status	<input checked="" type="checkbox"/> On		
Bandwidth	11 Mbps		
MAC Address	0001.97C7.3DDE		
SSID	WLAN		
Authentication			
<input type="radio"/> Disabled	<input checked="" type="radio"/> WEP	WEP Key	1234567890
<input type="radio"/> WPA-PSK	<input type="radio"/> WPA2-PSK	PSK Pass Phrase	
<input type="radio"/> WPA	<input type="radio"/> WPA2	User ID	
		Password	
Encryption Type	40/64-Bits (10 Hex digits)		
IP Configuration			
<input type="radio"/> DHCP			
<input checked="" type="radio"/> Static			
IP Address	10.0.0.4		
Subnet Mask	255.0.0.0		
IPv6 Configuration			
<input type="radio"/> DHCP			
<input type="radio"/> Auto Config			
<input checked="" type="radio"/> Static			
IPv6 Address			
Link Local Address:	FE80::201:97FF:FEC7:3DDE /		

## Printer - 1 Configuration:



Physical Config

## MODULES

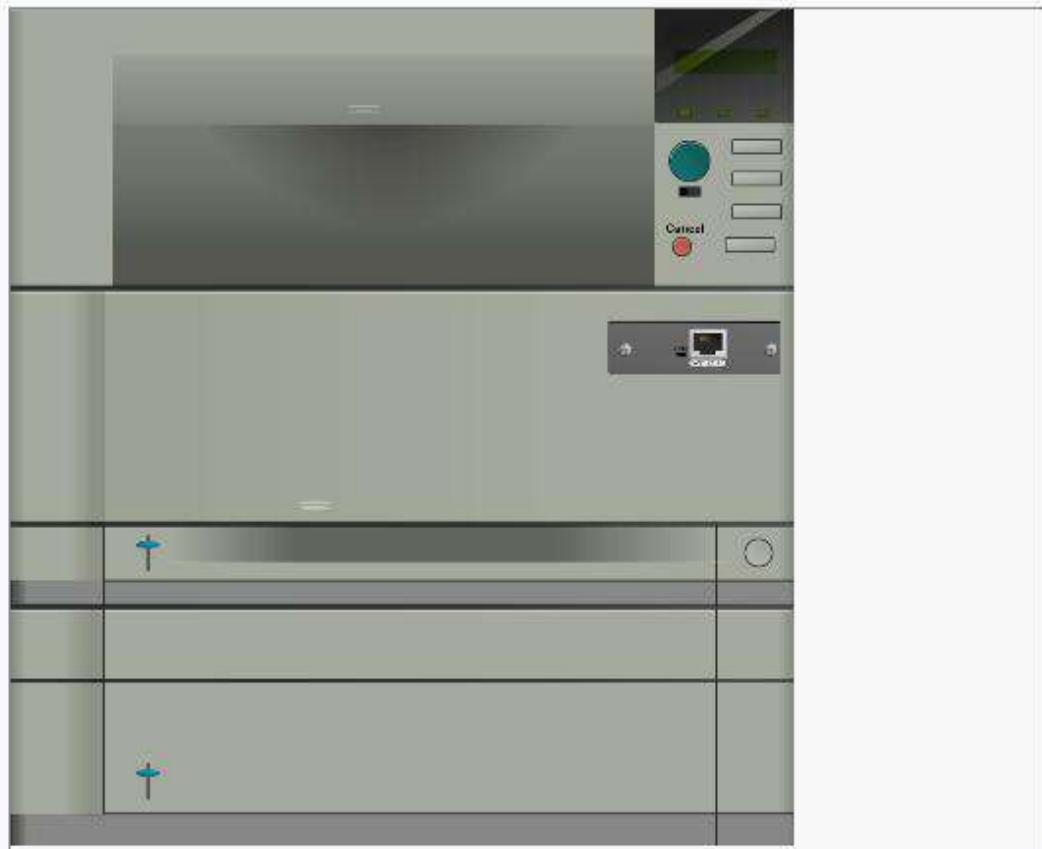
- WMP300N
- PT-HOST-NM-1CE
- PT-HOST-NM-1CFE
- PT-HOST-NM-1CGE
- PT-HOST-NM-1FFE
- PT-HOST-NM-1FGE
- PT-HOST-NM-1W
- PT-HOST-NM-1W-A
- PT-HOST-NM-3G/4G

## Physical Device View

Zoom In

Original Size

Zoom Out



Customize  
Icon in  
Physical View



Customize  
Icon in  
Logical View



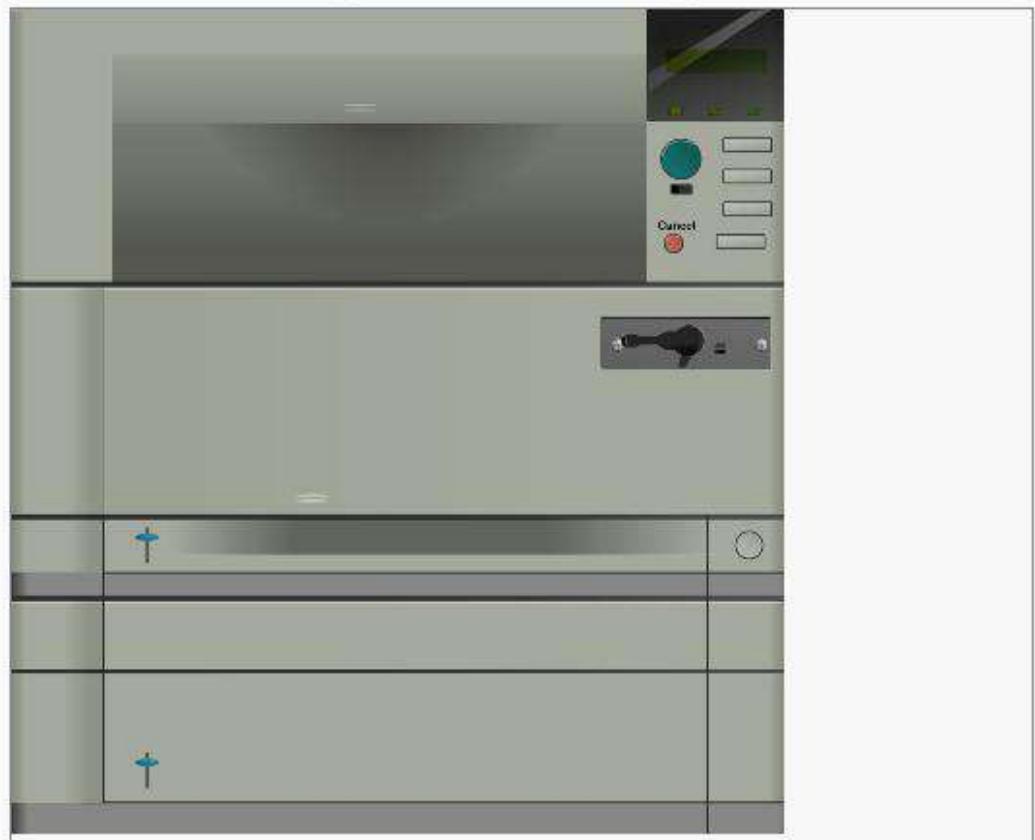
The Linksys-WMP300N module provides one 2.4GHz wireless interface suitable for connection to wireless networks. The module supports protocols that use Ethernet for LAN access.



Physical Config

**MODULES**

- WMP300N
- PT-HOST-NM-1CE
- PT-HOST-NM-1CFE
- PT-HOST-NM-1CGE
- PT-HOST-NM-1FFE
- PT-HOST-NM-1FGE
- PT-HOST-NM-1W
- PT-HOST-NM-1W-A
- PT-HOST-NM-3G/4G

**Physical Device View**[Zoom In](#)[Original Size](#)[Zoom Out](#)[Customize  
Icon in  
Physical View](#)[Customize  
Icon in  
Logical View](#)

The Linksys-WMP300N module provides one 2.4GHz wireless interface suitable for connection to wireless networks. The module supports protocols that use Ethernet for LAN access.



Printer - 1

Physical Config

MODULES

- WMP300N
- PT-HOST-NM-1CE
- PT-HOST-NM-1CFE
- PT-HOST-NM-1CGE
- PT-HOST-NM-1FFE
- PT-HOST-NM-1FGE
- PT-HOST-NM-1W
- PT-HOST-NM-1W-A
- PT-HOST-NM-3G/4G

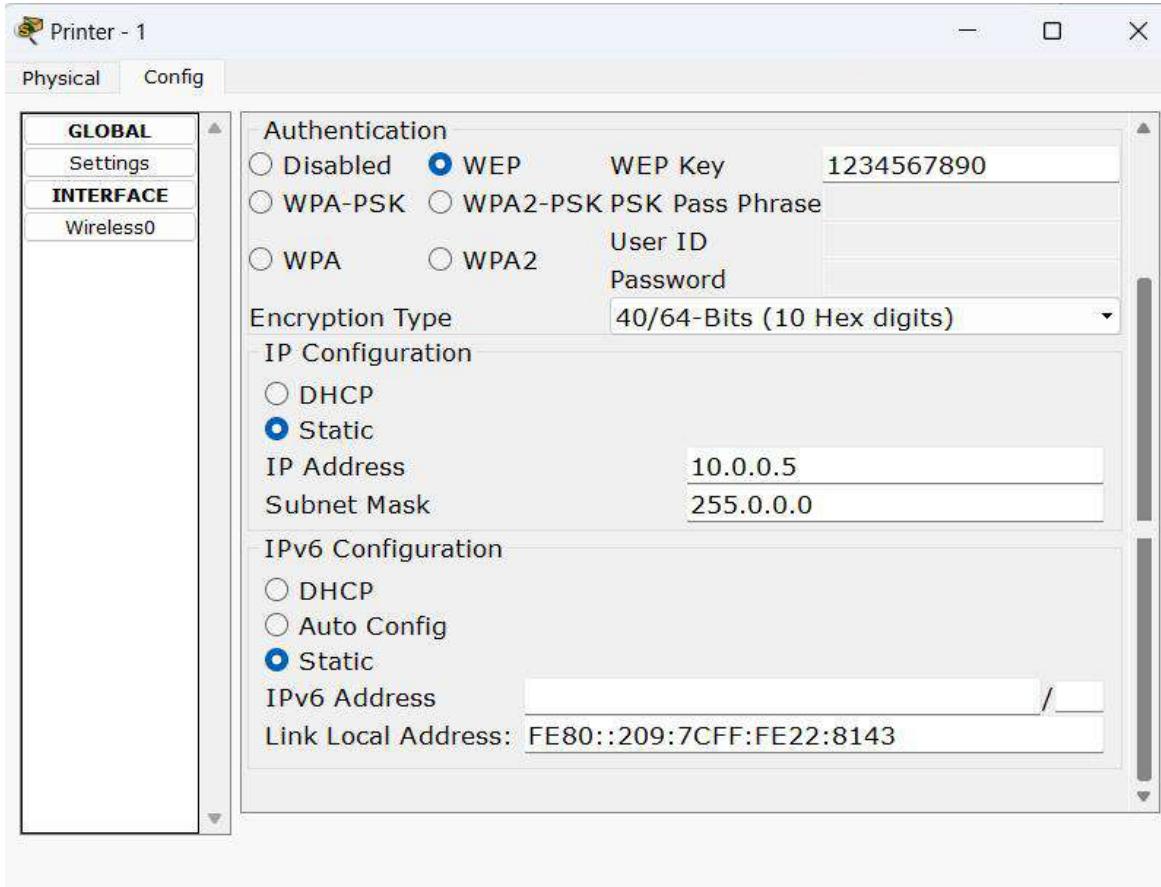
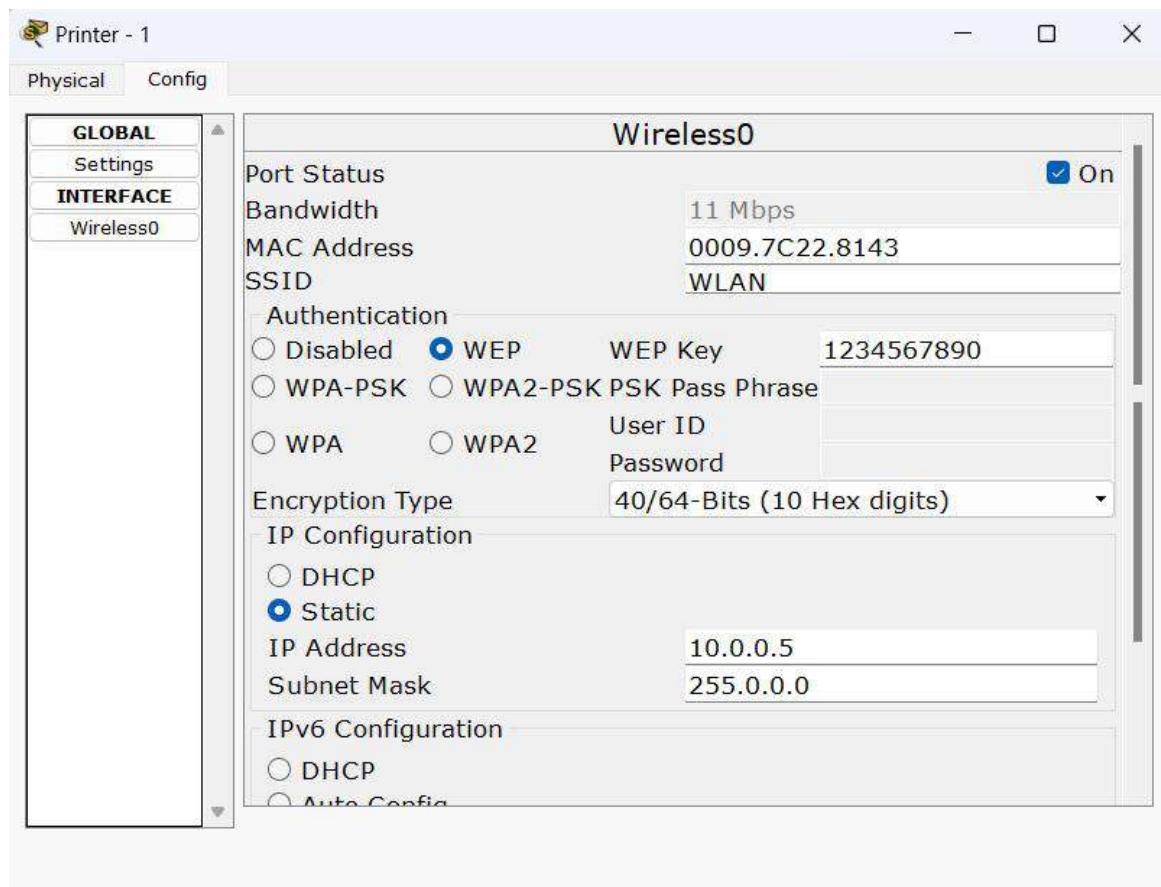
### Physical Device View

Zoom In Original Size Zoom Out

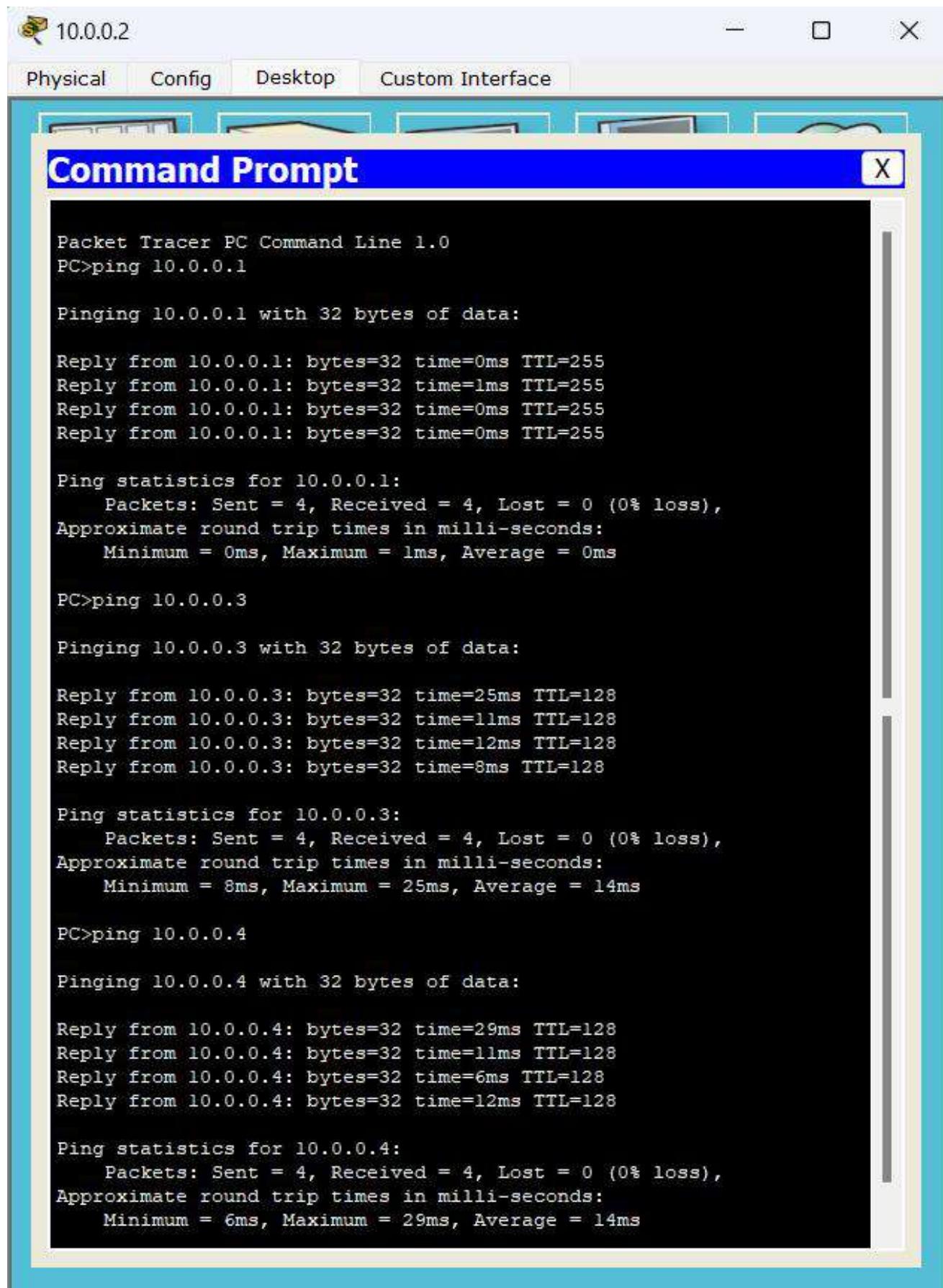
Customize Icon in Physical View

Customize Icon in Logical View

The Linksys-WMP300N module provides one 2.4GHz wireless interface suitable for connection to wireless networks. The module supports protocols that use Ethernet for LAN access.



## Ping From PC to all other devices:



The screenshot shows a Cisco Packet Tracer interface with a "Command Prompt" window open. The window title is "Command Prompt". The content of the window shows the results of several ping commands issued from an IP address of 10.0.0.2. The output is as follows:

```
Packet Tracer PC Command Line 1.0
PC>ping 10.0.0.1

Pinging 10.0.0.1 with 32 bytes of data:

Reply from 10.0.0.1: bytes=32 time=0ms TTL=255
Reply from 10.0.0.1: bytes=32 time=1ms TTL=255
Reply from 10.0.0.1: bytes=32 time=0ms TTL=255
Reply from 10.0.0.1: bytes=32 time=0ms TTL=255

Ping statistics for 10.0.0.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 1ms, Average = 0ms

PC>ping 10.0.0.3

Pinging 10.0.0.3 with 32 bytes of data:

Reply from 10.0.0.3: bytes=32 time=25ms TTL=128
Reply from 10.0.0.3: bytes=32 time=11ms TTL=128
Reply from 10.0.0.3: bytes=32 time=12ms TTL=128
Reply from 10.0.0.3: bytes=32 time=8ms TTL=128

Ping statistics for 10.0.0.3:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 8ms, Maximum = 25ms, Average = 14ms

PC>ping 10.0.0.4

Pinging 10.0.0.4 with 32 bytes of data:

Reply from 10.0.0.4: bytes=32 time=29ms TTL=128
Reply from 10.0.0.4: bytes=32 time=11ms TTL=128
Reply from 10.0.0.4: bytes=32 time=6ms TTL=128
Reply from 10.0.0.4: bytes=32 time=12ms TTL=128

Ping statistics for 10.0.0.4:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 6ms, Maximum = 29ms, Average = 14ms
```

## Ping From PC - 1 to all other devices:

The screenshot shows a Cisco Packet Tracer Command Line interface window titled "Command Prompt". The window contains the following text output from pinging three hosts:

```
Packet Tracer PC Command Line 1.0
PC>ping 10.0.0.1

Pinging 10.0.0.1 with 32 bytes of data:

Reply from 10.0.0.1: bytes=32 time=31ms TTL=255
Reply from 10.0.0.1: bytes=32 time=10ms TTL=255
Reply from 10.0.0.1: bytes=32 time=11ms TTL=255
Reply from 10.0.0.1: bytes=32 time=10ms TTL=255

Ping statistics for 10.0.0.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 10ms, Maximum = 31ms, Average = 15ms

PC>ping 10.0.0.2

Pinging 10.0.0.2 with 32 bytes of data:

Reply from 10.0.0.2: bytes=32 time=15ms TTL=128
Reply from 10.0.0.2: bytes=32 time=16ms TTL=128
Reply from 10.0.0.2: bytes=32 time=8ms TTL=128
Reply from 10.0.0.2: bytes=32 time=13ms TTL=128

Ping statistics for 10.0.0.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 8ms, Maximum = 16ms, Average = 13ms

PC>ping 10.0.0.4

Pinging 10.0.0.4 with 32 bytes of data:

Reply from 10.0.0.4: bytes=32 time=29ms TTL=128
Reply from 10.0.0.4: bytes=32 time=18ms TTL=128
Reply from 10.0.0.4: bytes=32 time=14ms TTL=128
Reply from 10.0.0.4: bytes=32 time=15ms TTL=128

Ping statistics for 10.0.0.4:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 14ms, Maximum = 29ms, Average = 19ms

PC>
```

## Ping From Laptop - 1 to all other devices:

```
Laptop - 1
Physical Config Desktop Custom Interface

Command Prompt X

Packet Tracer PC Command Line 1.0
PC>ping 10.0.0.1

Pinging 10.0.0.1 with 32 bytes of data:

Reply from 10.0.0.1: bytes=32 time=24ms TTL=255
Reply from 10.0.0.1: bytes=32 time=17ms TTL=255
Reply from 10.0.0.1: bytes=32 time=14ms TTL=255
Reply from 10.0.0.1: bytes=32 time=10ms TTL=255

Ping statistics for 10.0.0.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 10ms, Maximum = 24ms, Average = 16ms

PC>ping 10.0.0.2

Pinging 10.0.0.2 with 32 bytes of data:

Reply from 10.0.0.2: bytes=32 time=9ms TTL=128
Reply from 10.0.0.2: bytes=32 time=9ms TTL=128
Reply from 10.0.0.2: bytes=32 time=12ms TTL=128
Reply from 10.0.0.2: bytes=32 time=7ms TTL=128

Ping statistics for 10.0.0.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 7ms, Maximum = 12ms, Average = 9ms

PC>ping 10.0.0.3

Pinging 10.0.0.3 with 32 bytes of data:

Reply from 10.0.0.3: bytes=32 time=16ms TTL=128
Reply from 10.0.0.3: bytes=32 time=20ms TTL=128
Reply from 10.0.0.3: bytes=32 time=17ms TTL=128
Reply from 10.0.0.3: bytes=32 time=16ms TTL=128

Ping statistics for 10.0.0.3:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 16ms, Maximum = 20ms, Average = 17ms

PC>
```

### 2.12.3 Observation Book Pictures:

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Experiment - 12

To construct a WLAN and make the <sup>nodes</sup> communicate among a WLAN wirelessly.

Aim: To understand communication of Nodes wirelessly.

Topology:

```
graph TD; PC[PC] -- Fa0/0 --> Switch[Switch]; PC -- Fa0/1 --> Router((Router)); Router -- Fa2/1 --> Switch; Router -- Fa0/0["Fa0/0 (10.0.0.1)"] --> AP[Access-point]; AP --- PC1[PC-1]; AP --- Laptop[laptop]
```

Procedure:

1. Place 2 PCs, a laptop, a switch, a Router, access point.  
Connect PC to switch using Copper straight through wire from Fa0 port of PC to Fa0/1 port of switch.
2. Connect Router to switch using Copper straight through wire from Fa2/1 port of switch to Fa0/0 port of Router.
3. Connect switch to Access-point using Copper straight through wire from Fa2/1 port of switch to Port0 port of Access Point.

2. PC Configuration:

Click on PC → Config → Interface → Fast Ethernet 0.  
Assign static IP address [10.0.0.2] and Subnet Mask:  
255.0.0.0

3. Router Configuration:

Router > enable

Router # config t

Router(config)# interface Fast0

Router(config-if)# ip address 10.0.0.1 255.0.0.0

Router(config-if)# no shut.

Router(config-if)# exit

Router(config)# exit.

4. Access Point Configuration:

Click on Access-Point → Config → Interface → Port 1

Turn Port Status 'ON'

SSID : WLAN

Authentication : WEP

WEP Key : 1234567890

5. PC-1 Configuration:

Click on PC-1 → Physical.

Turn off the PC

Remove the port [PT-MOST-NM-LAN] by dragging  
and dropping it in Modules List.

Drag and place port [WMP300N] in the PC in the  
empty slot.

Switch on the PC.

In the Config tab, a new wireless interface would  
have been added.



In Wireless Interface,

SSID : WLAN

Authentication : WEP  
case

WEP Key : 1234567890

IP Configuration

Static

IP Address : 10.0.0.3

Subnet Mask : 255.0.0.0

6

Laptop - 1 Configuration:

Click on laptop - 1 → Physical

Turn off the laptop.

Remove the port [PT-LAPTOP-NM-1AM] by dragging  
dropping it in the Modules list.

Drag and place the port [WPC 300N] in the laptop in  
the empty slot.

switch on the laptop

In the Config tab, a new wireless interface would  
have been added.

In Wireless Interface,

SSID : WLAN

Authentication : WEP

WEP KEY : 1234567890

IP Configuration

Static

IP address : 10.0.0.4

Subnet Mask : 255.0.0.0

7. Ping from one device to every other device

Result:

a) Pinging from PC to PC-1

PC > ping 10.0.0.3

Pinging 10.0.0.3 with 32 bytes of data:

Reply from 10.0.0.3 : bytes=32 time=25 ms TTL=128

Reply from 10.0.0.3 : bytes=32 time=11 ms TTL=128

Reply from 10.0.0.3 : bytes=32 time=12 ms TTL=128

Reply from 10.0.0.3 : bytes=32 time=8 ms TTL=128

Ping statistics for 10.0.0.3:

Packets: Sent = 4, Received = 4, Lost = 0 (0% loss)

Approximate round trip times in milli-seconds:

Minimum = 8ms, Maximum = 25ms, Average = 14ms

b) Pinging from PC to laptop-1:

PC > ping 10.0.0.4

Pinging 10.0.0.4 with 32 bytes of data:

Reply from 10.0.0.4 : bytes=32 time=29 ms TTL=128

Reply from 10.0.0.4 : bytes=32 time=11 ms TTL=128

Reply from 10.0.0.4 : bytes=32 time=6 ms TTL=128

Reply from 10.0.0.4 : bytes=32 time=12 ms TTL=128

Ping statistics for 10.0.0.4:

Packets: Sent = 4, Received = 4, Lost = 0 (0% loss)

Approximate round trip times in milli-seconds:

Minimum = 6ms, Maximum = 29ms, Average = 14ms.

### Observation:

A wireless local-area network (WLAN) is a group of colocated computers or other devices that form a network based on radio transmission rather than wired connections. A Wi-Fi network is a type of WLAN. Data is sent in packets. The packets contain layers and instructions that, along with unique MAC (Media Access Control) addresses assigned to end points, enabling routing to intended locations.

## Cycle - 2

### 2.13 Experiment - 13:

#### 2.13.1 Question:

Write a program for error detecting code using CRC-CCITT (16-bits).

#### 2.13.2 Code:

```
#include <stdio.h>
#include <string.h>

char data[100], crc[16], gen[17];
int len, i, j;

void calc_crc() {
    for (i = 0; i < strlen(gen); i++)
        crc[i] = data[i];
    do {
        if (crc[0] == '1') {
            for (j = 1; j < strlen(gen); j++)
                crc[j] = ((crc[j] == gen[j]) ? '0' : '1');
        }
        for (j = 0; j < strlen(gen) - 1; j++)
            crc[j] = crc[j + 1];
        crc[j] = data[i++];
    } while (i <= len + strlen(gen) - 1);
}

int main() {
    printf("Enter Bit string: ");
    scanf("%s", data);
    len = strlen(data);

    printf("Enter generating polynomial (16 bits): ");
    scanf("%s", gen);
    if (strlen(gen) != 16) {
        printf("Generator polynomial must be 16 bits.\n");
        return 1;
    }

    printf("Generating Polynomial: %s\n", gen);

    for (i = len; i < len + strlen(gen) - 1; i++)
        data[i] = '0';
}
```

```

printf("Modified Data is: %s\n", data);
calc_crc();
printf("Checksum is: %s\n", crc);

for (i = len; i < len + strlen(gen) - 1; i++)
    data[i] = crc[i - len];

printf("Final Codeword is: %s\n", data);
printf("Test Error detection\n1(Yes) / 0(No)? : ");
scanf("%d", &i);

if (i == 1) {
    printf("Enter position to insert an error: ");
    scanf("%d", &i);
    data[i] = (data[i] == '0') ? '1' : '0';
    printf("Erroneous data: %s\n", data);
}

calc_crc();

for (i = 0; (i < strlen(gen) - 1) && (crc[i] != '1'); i++);

if (i < strlen(gen) - 1)
    printf("Error detected.\n");
else
    printf("No Error Detected.\n");

return 0;
}

```

### 2.13.3 Output:

```

C:\Users\Acer\Desktop\Notes (4th Semester)\Labs\Computer Networks (CN)\Cycle 2\Experiment - 1>gcc CRC.c
C:\Users\Acer\Desktop\Notes (4th Semester)\Labs\Computer Networks (CN)\Cycle 2\Experiment - 1>a
Enter Bit string: 110110101
Enter generating polynomial (16 bits): 1101100000000001
Generating Polynomial: 1101100000000001
Modified Data is: 110110101000000000000000
Checksum is: 101000100000110
Final Codeword is: 110110101101000100000110
Test Error detection
1(Yes) / 0(No)? : 0
No Error Detected.

C:\Users\Acer\Desktop\Notes (4th Semester)\Labs\Computer Networks (CN)\Cycle 2\Experiment - 1>a
Enter Bit string: 110110101
Enter generating polynomial (16 bits): 1101100000000001
Generating Polynomial: 1101100000000001
Modified Data is: 110110101000000000000000
Checksum is: 101000100000110
Final Codeword is: 110110101101000100000110
Test Error detection
1(Yes) / 0(No)? : 1
Enter position to insert an error: 7
Erroneous data: 110110111101000100000110
Error detected.

```

## 2.13.4 Observation Book Pictures:

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Experiment - 1

Write a program for error detecting code using CRC-CITT (16-bit)

Program:

```
#include <stdio.h>
#include <string.h>

char data[50], crc[50], gen[20];
int len, i, j;
```

```
void calc_crc()
{
    for (i = 0; i < strlen(gen); i++)
        crc[i] = data[i];
    do
    {
        if (crc[0] == '1')
            for (j = 1; j < strlen(gen); j++)
                crc[j] = ((crc[j] == gen[j]) ? '0' : '1');
    }
    for (j = 0; j < strlen(gen) - 1; j++)
        crc[j] = crc[j + 1];
    crc[j] = data[i + j];
}
while (i <= len + strlen(gen) - 1);
```

```
int main()
{
    printf("Enter Bit string: ");
    scanf("%s", data);
    len = strlen(data);
    printf("Enter generating polynomial: ");
    scanf("%s", gen);
    →
```

```
printf("Generating Polynomial : %s\n", gen);
```

```
for(i = len; i < len + strlen(gen) - 1; i++)
    data[i] = '0';
```

```
printf("Modified Data is : %s\n", data);
```

```
calc-crc();
```

```
printf("Checksum is : %s\n", crc);
```

```
for(i = len; i < len + strlen(gen) - 1; i++)
    data[i] = crc[i - len];
```

```
printf("Final Codeword is : %s\n", data);
```

```
printf("Test Error detection\n1 (yes) / 0 (No) ? : ");
```

```
scanf("%d", &i);
```

```
if (i == 1)
```

```
{ printf("Enter position to insert an error : ");
  scanf("%d", &i); }
```

```
data[i] = (data[i] == '0') ? '1' : '0';
```

```
} printf("Errorous data : %s\n", data);
```

```
calc-crc();
```

```
for(i=0; (i < strlen(gen) - 1) && (crc[i] != '1'); i++);
```

```
if (i < strlen(gen) - 1)
```

```
printf("Error detected\n");
```

```
else
```

```
printf("No Error detected\n");
```

```
return 0;
```

Output:

Enter Bit String : 110110101

Enter generating polynomial : 1101100000000001

Generating Polynomial : 1101100000000001

Modified data is : 11011000100000000

Checksum is : 10010111011001111

Final Codeword is: ~~10010111011001111~~ 1101101010010111

Test Error detection

1(Yes) / 0(No) ? : 0

No error detected.

## 2.14 Experiment - 14:

### 2.14.1 Question:

Write a program for congestion control using Leaky bucket algorithm.

### 2.14.2 Code:

```
#include <stdio.h>
#include <stdlib.h>
struct packet
{
    int time;
    int size;
} p[50];

int main()
{
    int i, n, m, k = 0;
    int bsize, bfilled, outrate;
    printf("Enter the number of packets:");
    scanf("%d", &n);
    printf("Enter packets in the order of their arrival time\n");
    for (i = 0; i < n; i++)
    {
        printf("Enter the time and size:");
        scanf("%d%d", &p[i].time, &p[i].size);
    }
    printf("Enter the bucket size:");
    scanf("%d", &bsize);
    printf("Enter the output rate:");
    scanf("%d", &outrate);

    m = p[n - 1].time;
    i = 1;
    k = 0;
    bfilled = 0;
    while (i <= m || bfilled != 0)
    {
        printf("\n\nAt time %d", i);

        if (p[k].time == i)
        {
            if (bsize >= bfilled + p[k].size)
            {
                bfilled = bfilled + p[k].size;
                printf("\n%dbyte packet is inserted", p[k].size);
            }
        }
    }
}
```

```

        k = k + 1;
    }
else
{
    printf("\n%dbyte packet is discarded", p[k].size);
    k = k + 1;
}

if (bfilled == 0)
{
    printf("\nNo packets to transmitte");
}
else if (bfilled >= outrate)
{
    bfilled = bfilled - outrate;
    printf("\n%dbytes transferred", outrate);
}
else
{
    printf("\n%dbytes transferred", bfilled);
    bfilled = 0;
}
printf("\nPackets in the bucket %d byte", bfilled);
i++;
}
return 0;
}

```

### 2.14.3 Output:

```
C:\Users\Acer\Desktop\Notes (4th Semester)\Labs\Computer Networks (CN)\Cycle 2\Experiment - 2>
gcc Leaky_Bucket.c

C:\Users\Acer\Desktop\Notes (4th Semester)\Labs\Computer Networks (CN)\Cycle 2\Experiment - 2>
a
Enter the number of packets:2
Enter packets in the order of their arrival time
Enter the time and size:1 5
Enter the time and size:3 8
Enter the bucket size:10
Enter the output rate:6

At time 1
5byte packet is inserted
5bytes transferred
Packets in the bucket 0 byte

At time 2
No packets to transmitte
Packets in the bucket 0 byte

At time 3
8byte packet is inserted
6bytes transferred
Packets in the bucket 2 byte

At time 4
2bytes transferred
Packets in the bucket 0 byte
```

## 2.14.4 Observation Book Pictures:

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Experiment - 2

Write a program for congestion control using leaky bucket algorithm

Program:

```
#include < stdio.h>
#include < stdlib.h>

struct packet
{
    int time;
    int size;
} p[50];

int main()
{
    int i, n, m, k=0;
    int bsize, bfilled, outrate;
    printf("Enter the number of packets: ");
    scanf("%d", &n);
    printf("Enter packets in the order of their arrival time: ");
    for(i=0; i<n; i++)
    {
        printf(" Enter the time and size: ");
        scanf("%d%d", &p[i].time, &p[i].size);
    }
    printf("Enter the bucket size: ");
    scanf("%d", &bsize);
    printf("Enter the outrate: ");
    scanf("%d", &outrate);

    m = p[n-1].time;
    i = 1;
    k = 0;
```

```

bfilled = 0;
while (i <= m || bfilled != 0)
{
    printf ("In %d At time %d : , i );
    if (p[k].time == i)
    {
        if (bsize >= bfilled + p[k].size)
        {
            bfilled = bfilled + p[k].size;
            printf ("In %d byte packet is inserted",
                    p[k].size);
            k = k + 1;
        }
    }
    else
    {
        printf ("In %d byte packet is discarded",
                p[k].size);
        k = k + 1;
    }
}

```

```

if (bfilled == 0)
{
    printf ("In No packet transmitted");
}
else if (bfilled >= outrate)
{
    bfilled = bfilled - outrate;
    printf ("In %d bytes transferred", outrate);
}
else
{
    printf ("In %d bytes transferred", bfilled);
    bfilled = 0;
}
printf ("In %d packets in bucket %d byte", bfilled);
i++;
}

```

return 0;



Output:

Enter the number of packets = 2

Enter the packets in the order of their arrival time:

Enter the time and size = 1 5

Enter the time and size = 3 8

Enter the bucket size = 10

Enter the output rate = 6

At time 1:

5 byte packet is inserted

5 bytes transferred

Packets in the bucket = 0 byte.

At time 2:

No packets to transmit

Packets in the bucket = 0 byte

At time 3:

8 byte packet is inserted

6 bytes transferred

Packets in the bucket = 2 byte

At time 4:

2 bytes transferred

Packets in the bucket = 0 byte.

## **2.15 Experiment - 15:**

### **2.15.1 Question:**

Using TCP/IP sockets, write a client-server program to make client sending the file name and the server to send back the contents of the requested file if present.

### **2.15.2 Code:**

#### **ClientTCP.py**

```
from socket import *
serverName = '127.0.0.1'
serverPort = 12000
clientSocket = socket(AF_INET, SOCK_STREAM)
clientSocket.connect((serverName,serverPort))
sentence = input("\nEnter file name: ")

clientSocket.send(sentence.encode())
filecontents = clientSocket.recv(1024).decode()
print ('\nFrom Server:\n')
print(filecontents)
clientSocket.close()
```

#### **ServerTCP.py**

```
from socket import *
serverName="127.0.0.1"
serverPort = 12000
serverSocket = socket(AF_INET,SOCK_STREAM)
serverSocket.bind((serverName,serverPort))
serverSocket.listen(1)
while 1:
    print ("The server is ready to receive")
    connectionSocket, addr = serverSocket.accept()
    sentence = connectionSocket.recv(1024).decode()

    file=open(sentence,"r")
    l=file.read(1024)

    connectionSocket.send(l.encode())
    print ('\nSent contents of ' + sentence)
    file.close()
    connectionSocket.close()
```

### 2.15.3 Output:

```
C:\Users\Acer\Desktop\Notes (4th Semester)\Labs\Computer Networks (CN)\Cycle 2\Experiment - 3>python ServerTCP.py
The server is ready to receive

Sent contents of ServerTCP.py
The server is ready to receive
```

```
C:\Users\Acer\Desktop\Notes (4th Semester)\Labs\Computer Networks (CN)\Cycle 2\Experiment - 3>python ClientTCP.py

Enter file name: ServerTCP.py

From Server:

from socket import *
serverName="127.0.0.1"
serverPort = 12000
serverSocket = socket(AF_INET,SOCK_STREAM)
serverSocket.bind((serverName,serverPort))
serverSocket.listen(1)
while 1:
    print ("The server is ready to receive")
    connectionSocket, addr = serverSocket.accept()
    sentence = connectionSocket.recv(1024).decode()

    file=open(sentence,"r")
    l=file.read(1024)

    connectionSocket.send(l.encode())
    print ('\nSent contents of ' + sentence)
    file.close()
    connectionSocket.close()
```

## 2.15.4 Observation Book Pictures:

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Experiment - 3

Using a TCP/IP sockets, write a Client-server program to make client sending the file name and the server to send back the contents of the requested file if present.

Program:

ClientTCP.py

```
from socket import *
serverName = "127.0.0.1"
serverPort = 12000
clientSocket = socket(AF_INET, SOCK_STREAM)
clientSocket.connect((serverName, serverPort))
sentence = input("nEnter file name: ")
clientSocket.send(sentence.encode())
fileContent = clientSocket.recv(1024).decode()
print ("nFrom Server: ", fileContent)
clientSocket.close()
```

~~ServerTCP.py~~

```
from socket import *
serverName = "127.0.0.1"
serverPort = 12000
serverSocket = socket(AF_INET, SOCK_STREAM)
serverSocket.bind((serverName, serverPort))
serverSocket.listen(5)
```

while 1:

print ("The server is ready to receive")

connectionSocket, addr = serverSocket.accept()

sentence = connectionSocket.recv(1024).decode()

file = open(sentence, "r")

l = file.read(1024)

connectionSocket.send(l.encode())

print ('In Sent contents of' + sentence)

file.close()

connectionSocket.close()

Output:

1. Run ServerTCP.py  
The server is ready to receive
2. Then run ClientTCP.py

Enter file name:ServerTCP.py

From Server:

from socket import \*

serverName = "127.0.0.1"

serverPort = 12000

serverSocket = socket (AF\_INET, SOCK\_STREAM)

serverSocket.bind ((serverName, serverPort))

serverSocket.listen (1)

while 1:

print ("The server is ready to receive")

connectionSocket, addr = serverSocket.accept()

sentence = connectionSocket.recv(1024).decode()

```
file = open(sentence, "r")
l = file.read(1024)
connectionSocket.send(l.encode())
print("Sent contents of " + sentence)
file.close()
connectionSocket.close()
```

## 2.16 Experiment - 16:

### 2.16.1 Question:

Using UDP sockets, write a client-server program to make client sending the file name and the server to send back the contents of the requested file if present.

### 2.16.2 Code:

#### ClientUDP.py

```
from socket import *
serverName = "127.0.0.1"
serverPort = 12000
clientSocket = socket(AF_INET, SOCK_DGRAM)

sentence = input("\nEnter file name: ")

clientSocket.sendto(bytes(sentence,"utf-8"),(serverName, serverPort))

filecontents,serverAddress = clientSocket.recvfrom(2048)
print ('\nReply from Server:\n')
print (filecontents.decode("utf-8"))
# for i in filecontents:
#     print(str(i), end = "")
clientSocket.close()
clientSocket.close()
```

#### ServerUDP.py

```
from socket import *
serverPort = 12000
serverSocket = socket(AF_INET, SOCK_DGRAM)
serverSocket.bind(("127.0.0.1", serverPort))
print ("The server is ready to receive")
while 1:
    sentence, clientAddress = serverSocket.recvfrom(2048)
    sentence = sentence.decode("utf-8")
    file=open(sentence,"r")
    con=file.read(2048)

    serverSocket.sendto(bytes(con,"utf-8"),clientAddress)

    print ('\nSent contents of ', end = ' ')
    print (sentence)
    # for i in sentence:
    #     print (str(i), end = "")
    file.close()
```

### 2.16.3 Output:

```
C:\Users\Acer\Desktop\Notes (4th Semester)\Labs\Computer Networks (CN)\Cycle 2\Experiment - 4>python ServerUDP.py
The server is ready to receive

Sent contents of  ServerUDP.py

C:\Users\Acer\Desktop\Notes (4th Semester)\Labs\Computer Networks (CN)\Cycle 2\Experiment - 4>python ClientUDP.py

Enter file name:  ServerUDP.py

Reply from Server:

from socket import *
serverPort = 12000
serverSocket = socket(AF_INET, SOCK_DGRAM)
serverSocket.bind(("127.0.0.1", serverPort))
print ("The server is ready to receive")
while 1:
    sentence, clientAddress = serverSocket.recvfrom(2048)
    sentence = sentence.decode("utf-8")
    file=open(sentence,"r")
    con=file.read(2048)

    serverSocket.sendto(bytes(con,"utf-8"),clientAddress)

    print ('\nSent contents of ', end = ' ')
    print (sentence)
    # for i in sentence:
    #     print (str(i), end = '')
    file.close()
```

## 2.16.4 Observation Book Pictures:

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Experiment - 4

Using UDP sockets, write a Client - Server program to make client sending the file name and the server to send back the contents of the requested file if present.

Program:

ClientUDP.py

```
from socket import *
serverName = "127.0.0.1"
serverPort = 12000
clientSocket = socket(AF_INET, SOCK_DGRAM)
sentence = input("Enter file name:")
clientSocket.sendto(sentence.encode("utf-8"), (serverName, serverPort))

fileContent, serverAddress = clientSocket.recvfrom(4096)
print('In Reply from Server:\n')
print(fileContent.decode("utf-8"))
# for i in fileContent:
#     print(f"\t{i}", end = "")
clientSocket.close()
```

ServerUDP.py

```
from socket import *
serverPort = 9200
serverSocket = socket(AF_INET, SOCK_DGRAM)
serverSocket.bind(("127.0.0.1", serverPort))
print("The server is ready to receive")
```

while 1:

```
sentence, clientAddress = serverSocket.recvfrom(2048)
sentence = sentence.decode("utf-8")
file = open(sentence, "r")
con = file.read(2048)
```

serverSocket.sendto(bytel(con, "utf-8"), clientAddress)

```
print('InSent contents of ', end = ' ')
print(sentence)
# for i in sentence
#     print(str(i), end = '')
file.close()
```

Output:

1. Run Server UDP.py.

The server is ready to receive.

2. Run Client UDP.py

~~Enter file name : serverUDP.py.~~

Reply from server :

```
from socket import *
serverPort = 12000
serverSocket = socket(AF_INET, SOCK_DGRAM)
serverSocket.bind(("127.0.0.1", serverPort))
print("The server is ready to receive")
```



while 1:

```
print("The server is ready to receive")
sentence, clientAddress = serverSocket.recvfrom(2048)
sentence = sentence.decode("utf-8")
file = open(sentence, "r")
l = file.read(2048)
```

```
serverSocket.sendto(bytes(l, "utf-8"), clientAddress)
```

```
print('In Server contents of', end=' ')
print(sentence)
# for i in sentence
#     print(str(i), end=' ')
file.close()
```

Dr  
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