

# VISVESVARAYA TECHNOLOGICAL UNIVERSITY

“JnanaSangama”, Belgaum -590014, Karnataka.



## LAB REPORT on

# Computer Networks

*Submitted by*

**SHRAVANTH J(1BM21CS206)**

*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 May-2023 to July-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 **Shravanth J(1BM21CS206)**, 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 academic semester May2023 to July-2023. The Lab report has been approved as it satisfies the academic requirements in respect of a **Computer Networks (22CS4PCCON)** work prescribed for the said degree.

Lohith J J  
Assistant Professor  
Department of CSE  
BMSCE, Bengaluru

Dr. Jyothi S Nayak  
Professor and Head  
Department of CSE  
BMSCE, Bengaluru

## Index Sheet

| Lab<br>Program<br>No. | CYCLE 1   | Page<br>No. |
|-----------------------|---|-------------|
|                       | Program Details   |             |
| 1                     | Create a topology and simulate sending a simple PDU from source to destination using hub and switch as connecting devices and demonstrate ping message. | 5           |
| 2                     | Configure IP address to routers in packet tracer. Explore the following messages: ping responses, destination unreachable, request timed out, reply.    | 8           |
| 3                     | Configure default route, static route to the Router.  | 11          |
| 4                     | Configure DHCP within a LAN and outside LAN.  | 22          |
| 5                     | Configure RIP routing Protocol in Routers.  | 28          |
| 6                     | Configure OSPF routing protocol.  | 34          |
| 7                     | Demonstrate the TTL/ Life of a Packet.  | 49          |
| 8                     | Configure Web Server, DNS within a LAN.   | 53          |

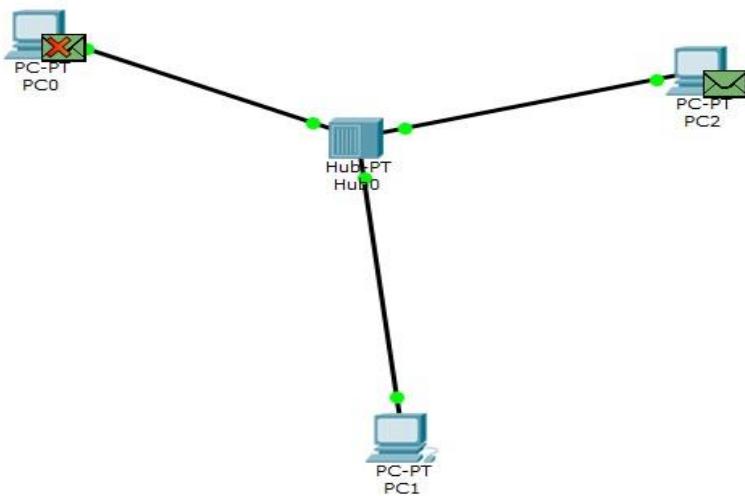
|                        |   |                 |
|------------------------|---|-----------------|
| 9                      | To construct simple LAN and understand the concept and operation of Address Resolution Protocol (ARP).  | 56              |
| 10                     | To understand the operation of TELNET by accessing the router in server room from a PC in IT office.  | 59              |
| 11                     | To construct a WLAN and make the nodes communicate wirelessly.  | 63              |
| 12                     | To construct a VLAN and make the PC's communicate among a VLAN.   | 68              |
| <b>Lab Program No.</b> | <b>CYCLE 2</b>  | <b>Page No.</b> |
|                        | <b>Program Details</b>  |                 |
| 1                      | Write a program for congestion control using Leaky bucket algorithm.  | 72              |
| 2                      | 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. | 74              |
| 3                      | 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.    | 75              |
| 4                      | Write a program for error detecting code using CRCCCITT (16-bits).  | 77              |

## Course Outcome

|     |  |
|-----|--|
| 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. |

**1)Create a topology and simulate sending a simple PDU from source to destination using hub and switch as connecting devices.**

Topology:



**Command Prompt**

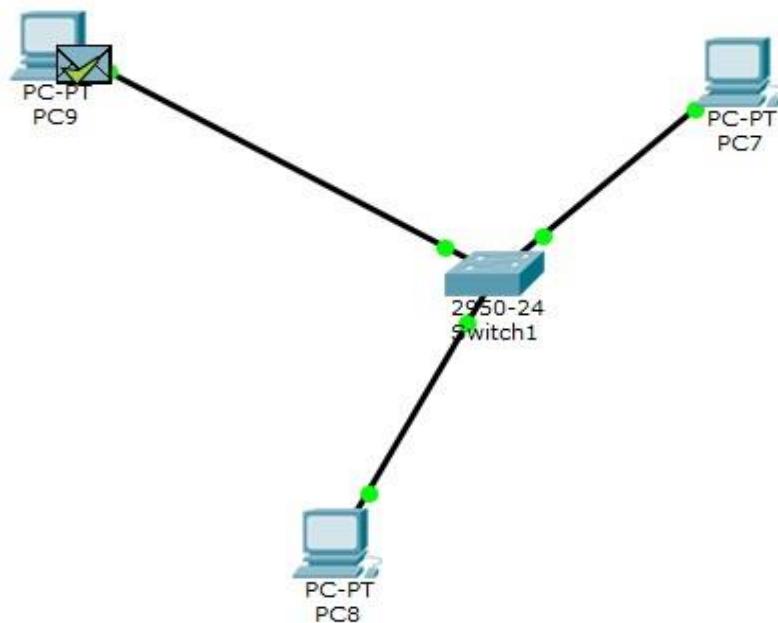
```
PC>ping 10.0.0.3
Pinging 10.0.0.3 with 32 bytes of data:
Reply from 10.0.0.3: bytes=32 time=1ms TTL=128
Reply from 10.0.0.3: bytes=32 time=0ms TTL=128
Reply from 10.0.0.3: bytes=32 time=0ms TTL=128
Reply from 10.0.0.3: bytes=32 time=0ms TTL=128

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

PC>ping 10.0.0.2
Pinging 10.0.0.2 with 32 bytes of data:
Reply from 10.0.0.2: bytes=32 time=1ms TTL=128
Reply from 10.0.0.2: bytes=32 time=3ms 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 = 3ms, Average = 1ms

PC>
```



## Command Prompt

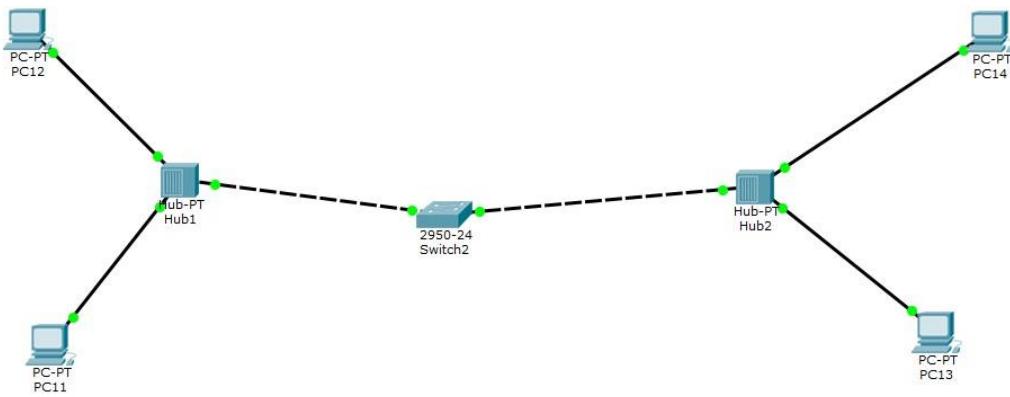
```

Minimum = 4ms, Maximum = 8ms, Average = 5ms
PC>ping 10.0.0.8
Pinging 10.0.0.8 with 32 bytes of data:
Request timed out.
Request timed out.
Request timed out.
Request timed out.

Ping statistics for 10.0.0.8:
  Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),
PC>ping 10.0.0.12
Pinging 10.0.0.12 with 32 bytes of data:
Reply from 10.0.0.12: bytes=32 time=0ms TTL=128

Ping statistics for 10.0.0.12:
  Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
  Minimum = 0ms, Maximum = 0ms, Average = 0ms
PC>

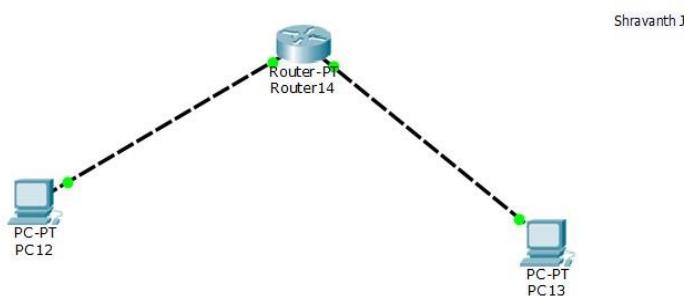
```



PC>ping 10.0.0.23  
 Pinging 10.0.0.23 with 32 bytes of data:  
 Reply from 10.0.0.23: bytes=32 time=1ms TTL=128  
 Reply from 10.0.0.23: bytes=32 time=4ms TTL=128  
 Reply from 10.0.0.23: bytes=32 time=0ms TTL=128  
 Reply from 10.0.0.23: bytes=32 time=0ms TTL=128  
 Ping statistics for 10.0.0.23:  
 Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),  
 Approximate round trip times in milli-seconds:  
 Minimum = 0ms, Maximum = 4ms, Average = 1ms  
 PC>ping 10.0.0.25  
 Pinging 10.0.0.25 with 32 bytes of data:  
 Reply from 10.0.0.25: bytes=32 time=0ms TTL=128  
 Ping statistics for 10.0.0.25:  
 Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),  
 Approximate round trip times in milli-seconds:  
 Minimum = 0ms, Maximum = 0ms, Average = 0ms  
 PC>

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

Topology:



Router9

Physical Config CLI

IOS Command Line Interface

```
Router>config terminal
      ^
% Invalid input detected at '^' marker.

Router>enable
Router#config terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#interface fastEthernet 0/0
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 fastEthernet 1/0
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 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)#

```

Copy Paste

Now configure router interface with ip address and subnet mask then give no shutdown to make this interface and line protocol up(i.e. Carefully configure ip address with proper interfaces in this case f0/0 and f1/0,f is short form of fastethernet).

```
Router(config)#interface fastEthernet 0/0
Router(config-if)#ip address 10.0.0.2 255.0.0.0
Router(config-if)#no shutdown
Router(config-if)#exit
```

Interface Line protocol on FastEthernet0/0, changed state to up

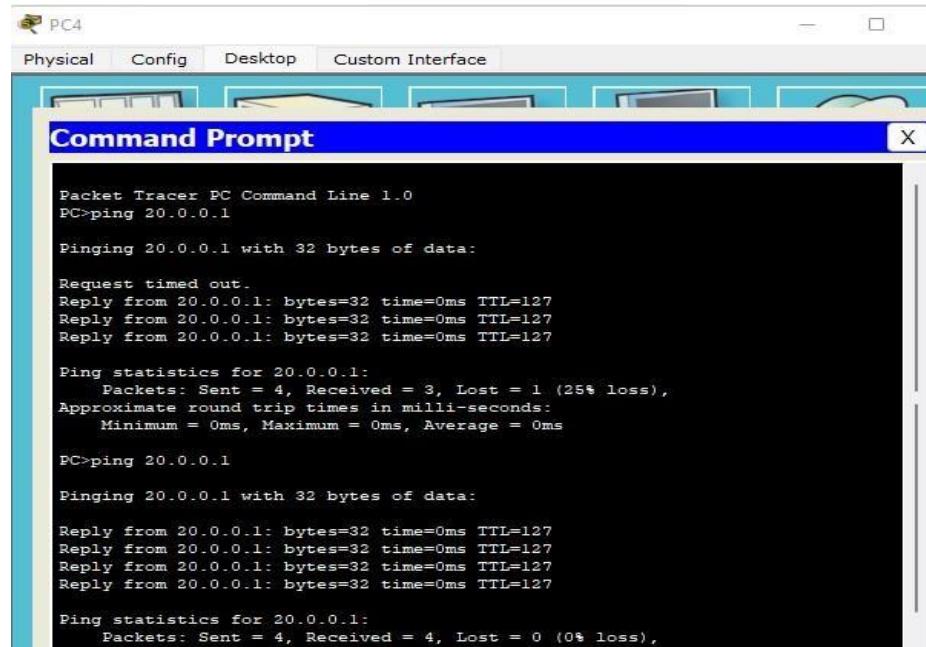
```
Router(config)#interface fastethernet 1/0
Router(config-if)#ip address 20.0.0.2 255.0.0.0
Router(config-if)#no shutdown
Router(config-if)#exit
```

Interface Line protocol on FastEthernet1/0, changed state to up

Now lights on all ports become green from red.Now click on PC1->Desktop->Command Prompt.

Now give this command "ping 20.0.0.1" and press enter.you will get,  
connectivity between 10.0.0.1 and 20.0.0.1 is ok.Now PC1 communicates with PC2

Another way of checking connectivity is,select "simple PDU packet" from right side of packet tracer and select source PC and Destination PC.You will get response at right bottom of the pacter tracer window.



The screenshot shows a Windows-style Command Prompt window titled "Command Prompt". The window contains the following text output:

```
Packet Tracer PC Command Line 1.0
PC>ping 20.0.0.1

Pinging 20.0.0.1 with 32 bytes of data:

Request timed out.
Reply from 20.0.0.1: bytes=32 time=0ms TTL=127
Reply from 20.0.0.1: bytes=32 time=0ms TTL=127
Reply from 20.0.0.1: bytes=32 time=0ms TTL=127

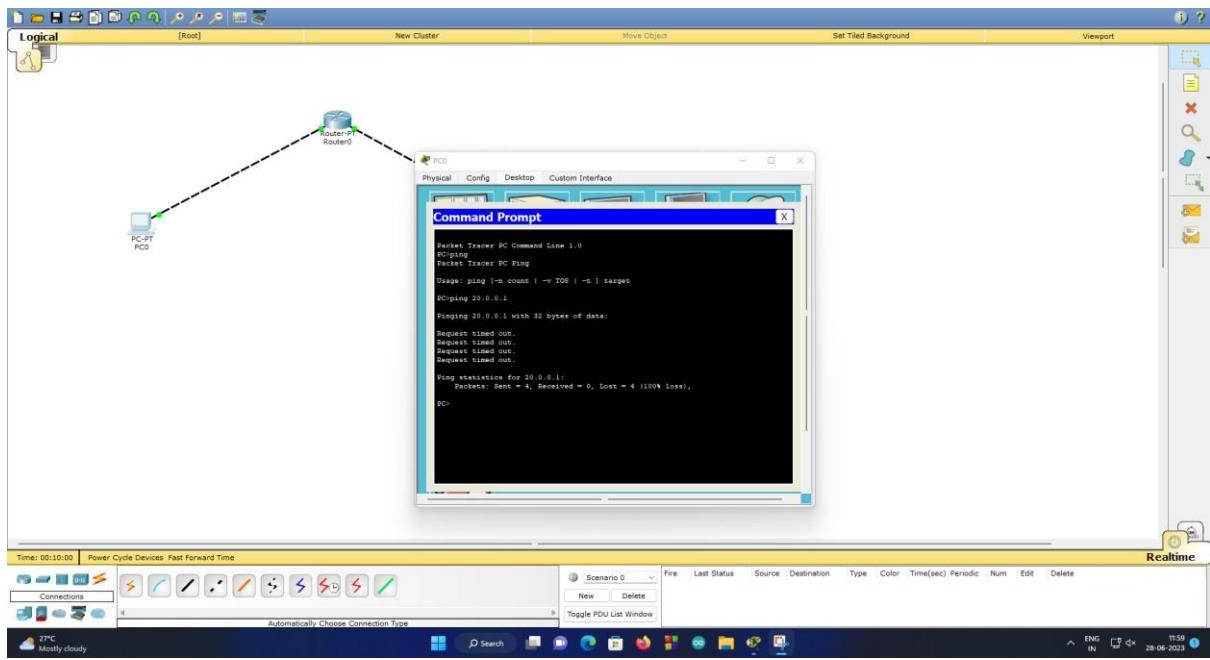
Ping statistics for 20.0.0.1:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms

PC>ping 20.0.0.1

Pinging 20.0.0.1 with 32 bytes of data:

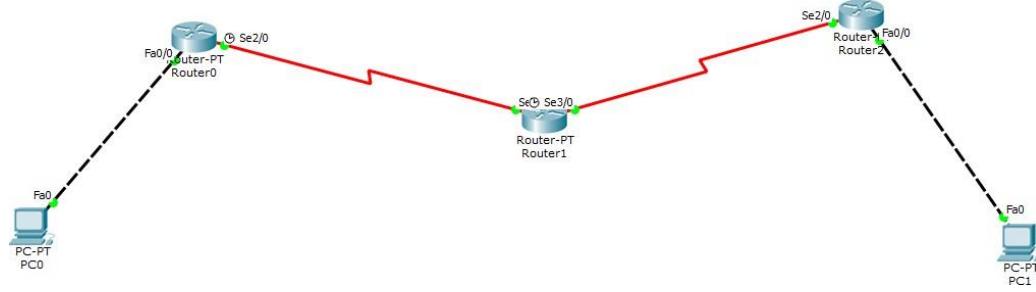
Reply from 20.0.0.1: bytes=32 time=0ms TTL=127

Ping statistics for 20.0.0.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
```



### 3)Configure default, static route to the router.

#### Static routing:



Topology

Configure IP address and default gateway of PC'S

Configure the routers as shown below

R0

Router0

Physical Config CLI

### IOS Command Line Interface

```
Router>configure terminal
Enter configuration commands, one per line. End with
CTRL/Z.
Router(config)#interface fastEthernet0/0
Router(config-if)#ip address 10.0.0.3 255.0.0.0
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 fastEthernet1/0
Router(config-if)#ip address 20.0.0.3 255.0.0.0
Router(config-if)#no shutdown

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

Copy Paste

R2

Router2

Physical Config CLI

### IOS Command Line Interface

```
Enter configuration commands, one per line. End with
CTRL/Z.

Router(config)#interface fastEthernet 0/0
Router(config-if)#ip address 30.0.0.3 255.0.0.0
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 fastEthernet 1/0
Router(config-if)#ip address 40.0.0.3 255.0.0.0
Router(config-if)#no shutdown

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

Copy Paste

Router0

Physical Config CLI

### Serial2/0

|                    |  |
|--------------------|--|
| <b>GLOBAL</b>      | Port Status <input checked="" type="checkbox"/> On |
| Settings           | Duplex <input type="radio"/> Full Duplex           |
| Algorithm Settings | Clock Rate Not Set                                 |
| <b>ROUTING</b>     |  |
| Static             |  |
| RIP                |  |
| <b>INTERFACE</b>   |  |
| FastEthernet0/0    |  |
| FastEthernet1/0    |  |
| Serial2/0          |  |
| Serial3/0          |  |
| FastEthernet4/0    |  |
| Serial2/0          |  |
| Serial3/0          |  |
| FastEthernet4/1    |  |
| Serial2/0          |  |
| Serial3/0          |  |
| FastEthernet4/2    |  |
| Serial2/0          |  |
| Serial3/0          |  |
| FastEthernet4/3    |  |
| Serial2/0          |  |
| Serial3/0          |  |
| FastEthernet4/4    |  |
| Serial2/0          |  |
| Serial3/0          |  |

Equivalent IOS Commands

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

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

Router1

Physical Config CLI

### IOS Command Line Interface

```
Enter configuration commands, one per line. End with
CTRL/Z.
Router(config)#interface serial2/0
Router(config-if)#ip address 50.0.0.3 255.0.0.0
Router(config-if)#no shutdown

%LINK-5-CHANGED: Interface Serial2/0, changed state to
down
Router(config-if)#exit
Router(config)#interface serial 3/0
Router(config-if)#ip address 60.0.0.3 255.0.0.0
Router(config-if)#no shutdown

%LINK-5-CHANGED: Interface Serial3/0, changed state to
down
Router(config-if)#
%LINK-5-CHANGED: Interface Serial2/0, changed state to up

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

%LINK-5-CHANGED: Interface Serial3/0, changed state to up
```

Copy Paste

## IP ROUTE COMMANDS

Router0

Physical Config CLI

### IOS Command Line Interface

```
to up

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

Router(config-if)#exit
Router(config)#
Router(config)#interface Serial2/0
Router(config-if)#ip address 50.0.0.1 255.0.0.0
Router(config-if)#no shutdown

Router(config-if)#
%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-if)#exit
Router(config)#ip route 60.0.0.0 255.0.0.0 50.0.0.3
Router(config)#ip route 30.0.0.0 255.0.0.0 50.0.0.3
Router(config)#ip route 40.0.0.0 255.0.0.0 50.0.0.3
Router(config)#

```

Copy Paste

Router2

Physical Config CLI

### IOS Command Line Interface

```
%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)#interface Serial3/0
Router(config-if)#ip address 60.0.0.1 255.0.0.0
Router(config-if)#no shutdown

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

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

Router(config-if)#exit
Router(config)#ip route 10.0.0.0 255.0.0.0 60.0.0.3
Router(config)#ip route 20.0.0.0 255.0.0.0 60.0.0.3
Router(config)#ip route 50.0.0.0 255.0.0.0 60.0.0.3
Router(config)#+
```

Copy Paste

Router1

Physical Config CLI

### IOS Command Line Interface

```
Router(config-if)#ip address 60.0.0.3 255.0.0.0
Router(config-if)#no shutdown

%LINK-5-CHANGED: Interface Serial3/0, changed state to down
Router(config-if)#
%LINK-5-CHANGED: Interface Serial2/0, changed state to up

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

%LINK-5-CHANGED: Interface Serial3/0, changed state to up

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

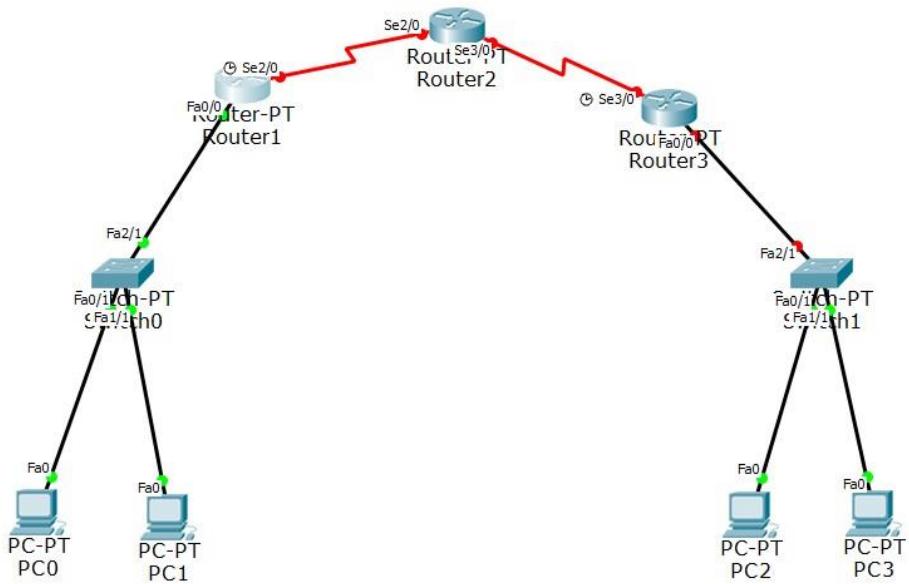
Router(config-if)#exit
Router(config)#ip route 10.0.0.0 255.0.0.0 50.0.0.1
Router(config)#ip route 20.0.0.0 255.0.0.0 50.0.0.1
Router(config)#ip route 30.0.0.0 255.0.0.0 60.0.0.1
Router(config)#ip route 40.0.0.0 255.0.0.0 60.0.0.1
Router(config)#+
```

Copy Paste

```
Ping statistics for 30.0.0.1:  
    Packets: Sent = 4, Received = 3, Lost = 1 (25%  
loss),  
    Approximate round trip times in milli-seconds:  
        Minimum = 2ms, Maximum = 17ms, Average = 11ms  
  
PC>ping 30.0.0.1  
  
Pinging 30.0.0.1 with 32 bytes of data:  
  
Reply from 30.0.0.1: bytes=32 time=12ms TTL=125  
Reply from 30.0.0.1: bytes=32 time=11ms TTL=125  
Reply from 30.0.0.1: bytes=32 time=2ms TTL=125  
Reply from 30.0.0.1: bytes=32 time=2ms TTL=125  
  
Ping statistics for 30.0.0.1:  
    Packets: Sent = 4, Received = 4, Lost = 0 (0%  
loss),  
    Approximate round trip times in milli-seconds:  
        Minimum = 2ms, Maximum = 12ms, Average = 6ms  
  
PC>
```

## Default routing

Set up topology as shown



Router1

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 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)#interface serial2/0
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)#

```

Copy      Paste

## Router 2

```
System configuration dialog

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)#configure terminal
^
% Invalid input detected at '^' marker.

Router(config)#interface serial2/0
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

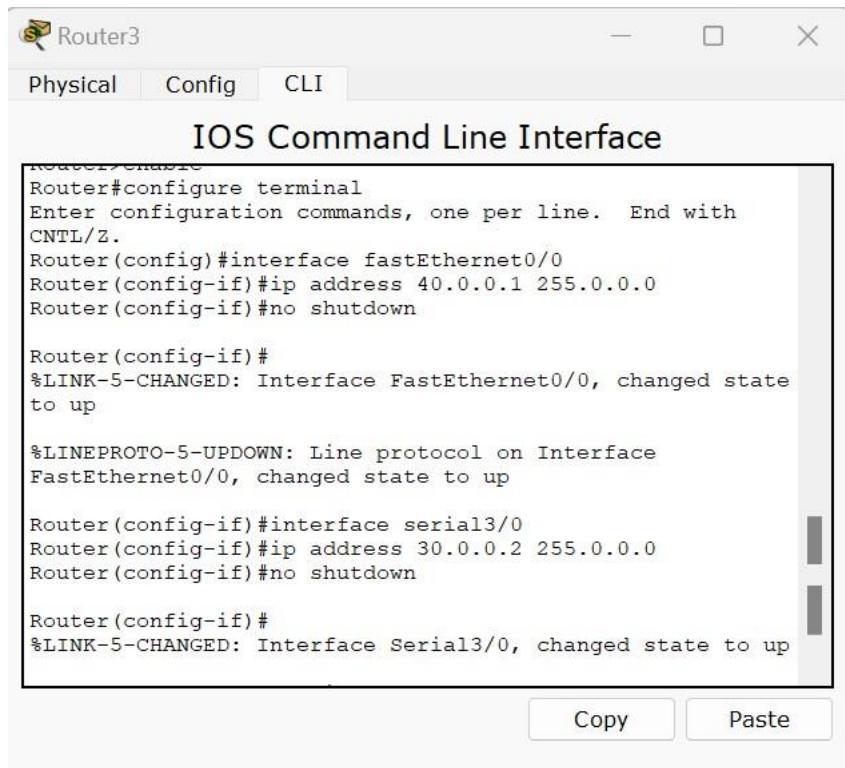
Router(config-if)#exit
Router(config)#
Router(config)#
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial2/0, changed state to up

Router(config)#interface serial3/0
Router(config-if)#ip address 30.0.0.1 255.0.0.0
Router(config-if)#no shutdown

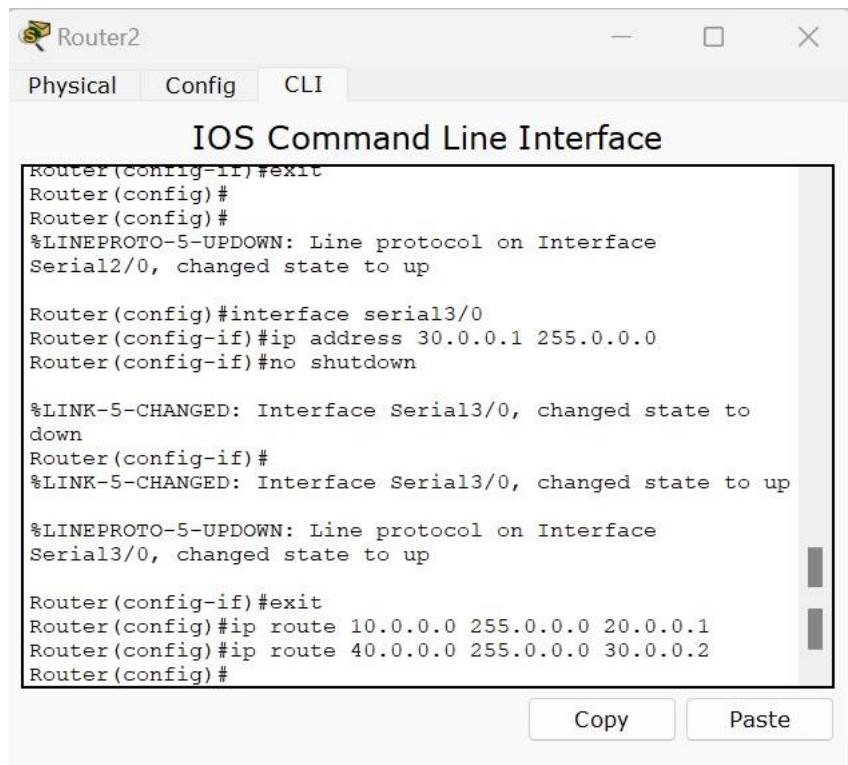
%LINK-5-CHANGED: Interface Serial3/0, changed state to down
Router(config-if)#

```

## Router3



Configure static route for middle router R2 we have to do it for 40 & 10 network.



The window title is "Router2". 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-if)#exit
Router(config)#
Router(config)#
%LINEPROTO-5-UPDOWN: Line protocol on Interface
Serial2/0, changed state to up

Router(config)#interface serial3/0
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)#
%LINK-5-CHANGED: Interface Serial3/0, changed state to up

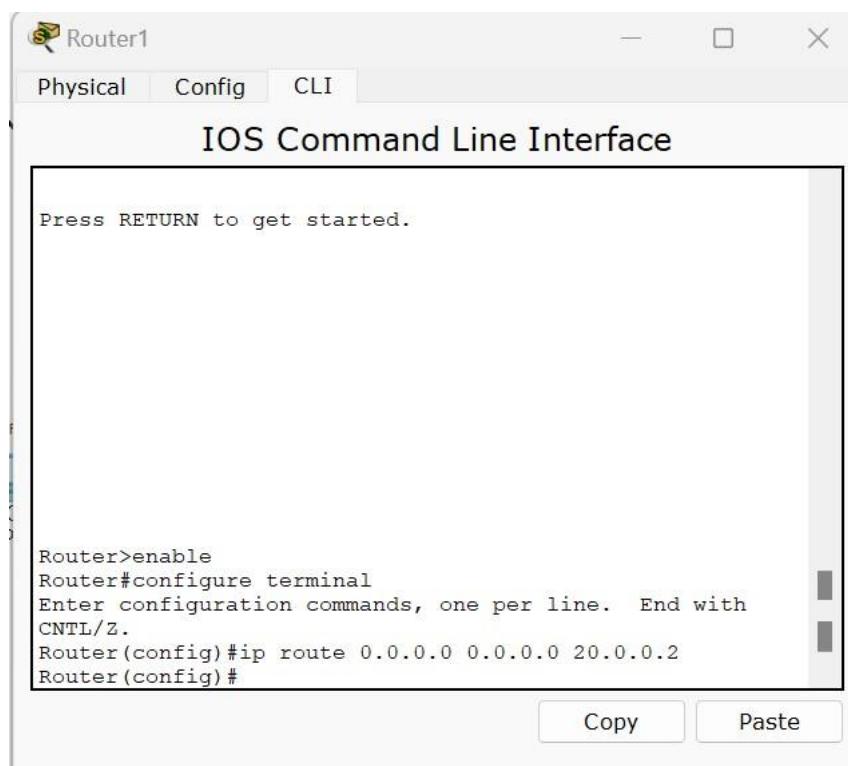
%LINEPROTO-5-UPDOWN: Line protocol on Interface
Serial3/0, changed state to up

Router(config-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)#

```

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

Default routing for router 1 and 3



The window title is "Router1". 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:

```
Press RETURN to get started.

Router>enable
Router#configure terminal
Enter configuration commands, one per line. End with
CRTL/Z.
Router(config)#ip route 0.0.0.0 0.0.0.0 20.0.0.2
Router(config)#

```

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

Router3

Physical Config CLI

### IOS Command Line Interface

```
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)#interface serial3/0
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 Serial3/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface
Serial3/0, 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)#

```

Copy Paste

Ping from pc0 to pc2

PC0

Physical Config Desktop Custom Interface

### Command Prompt

```
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 = 8ms, Average = 4ms

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

PC>
```

 Router1

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 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#
```

 Router2

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

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#
```

 Router3

Physical    Config    CLI

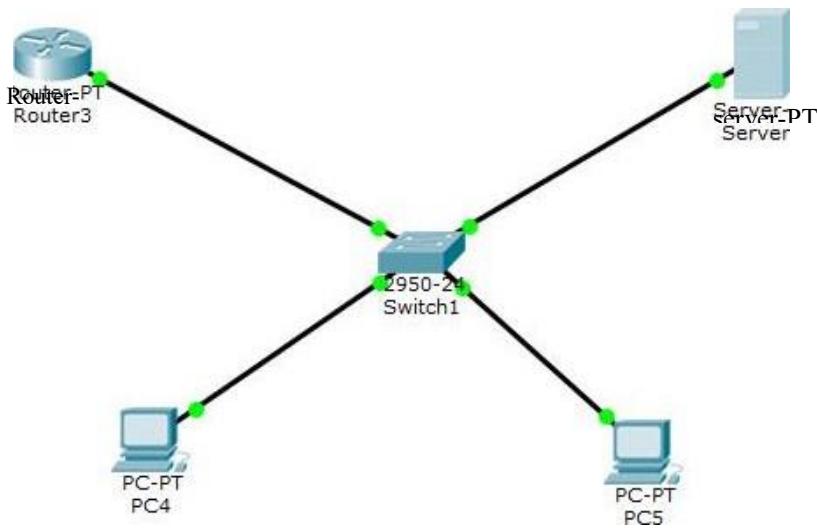
### IOS Command Line Interface

```
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 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#
```

#### 4)Configure DHCP within a LAN and outside LAN.



**Step 1:**Create a LAN like this,

```
Router>enable Router  
#config t Router(config)  
#interface fastethernet0/0 Router(config-if)  
#ip address 10.0.0.1 255.0.0.0 Router(config-if)  
#no shutdown Router(config-if)  
#exit Router(config)
```

**Step 3:**click on server-> config, then assign gateway in our example 10.0.0.1

**Step 4:**Then Click on Fastethernet and assign ip address and subnet mask.I am going to use 10.0.0.2 and subnet mask 255.0.0.0 for our server.

**Step 5:** Click on DHCP,there you can see default pool,

**Step 6:**Just give default gate way,here we are using 10.0.0.1.

**Step 7:**DNS server,Just give our server ip address,10.0.0.2.

**Step 8:**Then just edit start ip address.I am going to give 10.0.0.10 and subnet mask 255.0.0.0

**Step 9:**In Maximum Number of Users,Here we are using Class A Network so we can use 1,67,77,216 ip address.just give how many ip address you want in this pool.I am going to give 500

**Step 10:**Assign TFTP server ip address,just give our server ip address,10.0.0.2.

**Step 11:** And click on save.That's it...

**Step 12:** Now, Click on any of the PC-> then click on Desktop->Ip ser.,erl

Physical Config Services Desktop Custom Interface

**SERVICES**

- HTTP
- DHCP
- DCHPv6
- TFTP
- DNS
- SYSLOG
- AAA
- NTP
- EMAIL
- FTP

**DHCP**

| Interface                 | Service                          | On                    | Off |
|---------------------------|----------------------------------|-----------------------|-----|
| FastEthernet0             | <input checked="" type="radio"/> | <input type="radio"/> |     |
| Pool Name                 | serverPool2                      |                       |     |
| Default Gateway           | 10.0.0.10                        |                       |     |
| DNS Server                | 10.0.0.20                        |                       |     |
| Start IP Address :        | 10                               | 0                     | 0 1 |
| Subnet Mask:              | 255                              | 0                     | 0 0 |
| Maximum number of Users : | 512                              |                       |     |
| TFTP Server:              | 10.0.0.20                        |                       |     |

Add Save Remove

| pool Nam          | efault Gatewa | NS Serve  | art IP Addre | ubnet Mas | Max User | TFTP     |
|-------------------|---------------|-----------|--------------|-----------|----------|----------|
| server...         | 10.0.0.10     | 10.0.0.20 | 10.0.0.1     | 255.0.0.0 | 512      | 10.0.0.2 |
| server...         | 10.0.0.10     | 10.0.2.0  | 10.0.0.1     | 255.0.0.0 | 512      | 10.0.0.2 |
| john<br>john a... | 10.0.0.10     | 10.0.0.20 | 10.0.0.0     | 255.0.0.0 | 512      | 10.0.0.2 |
| server...         | 0.0.0.0       | 0.0.0.0   | 10.0.0.0     | 255.0.0.0 | 512      | 0.0.0.0  |

configuration, and Choose 'DHCP' wait for some time, if your dhcp request failed then try few more times. This is how you should get.

## IP Configuration

IP Configuration

DHCP       Static

IP Address: 10.0.0.1

Subnet Mask: 255.0.0.0

Default Gateway: 0.0.0.0

DNS Server:

IPv6 Configuration

DHCP     Auto Config     Static

IPv6 Address: /

Link Local Address: FE80::290:2BFF:FEBA:84E5

IPv6 Gateway:

IPv6 DNS Server:

## DHCP outside LAN

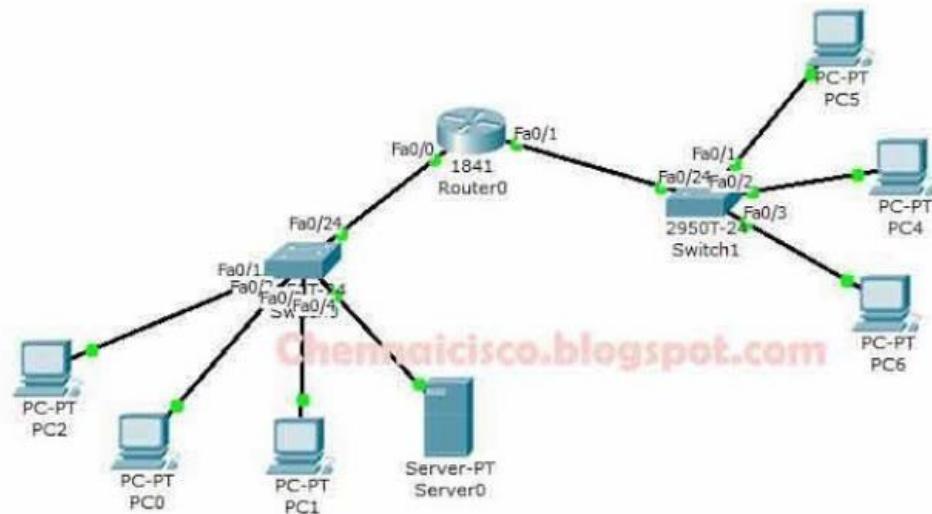
Here we are going to see, how to configure DHCP for multiple networks .Can we get ip address from DHCP that is present in other network? yes we can.Lets see how to do with help of 'ip helper-address'.

**Step 1:**Create a topology like this,

**Step 2:**Configure the router interface fastethernet0/0 and fastethernet 0/1 with ip address .

Router>enable Router

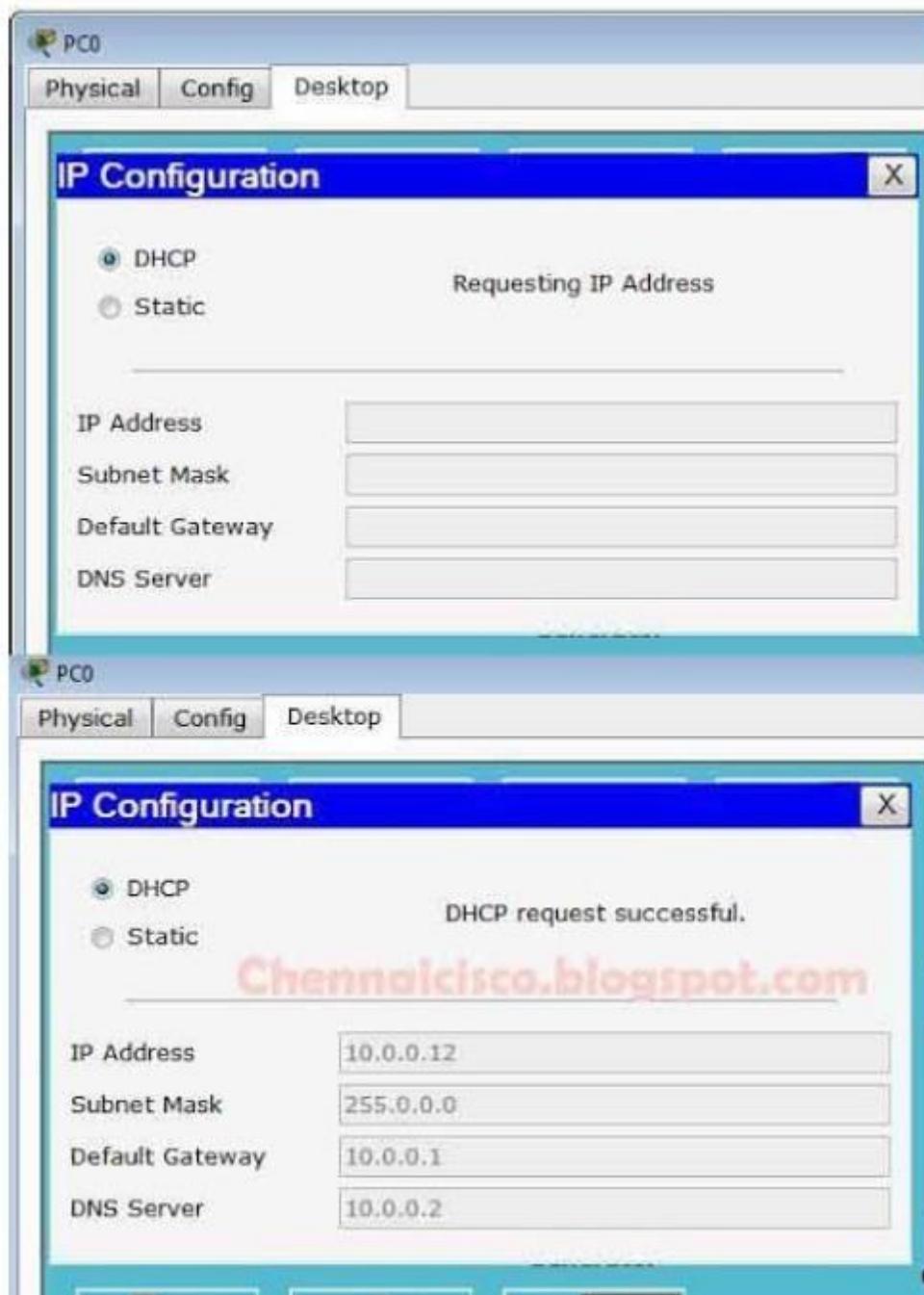
```
#config terminal Router(config)
#interface fastethernet0/0 Router(config-if)
#ip address 10.0.0.1 255.0.0.0 Router(config-if)
#no shutdown Router(config-if)
#exit Router(config)
#interface fastethernet0/1 Router(config-if)
#ip address 20.0.0.1 255.0.0.0 Router(config-if)
#no shutdown Router(config-if)
#exit
```



**Step 3:**Click on server->config->then just give the gateway ip address .Gateway for this network is 10.0.0.1

**Step 4:**Then click on fastethernet assign ip address.I am going to give 10.0.0.2 and subnetmask 255.0.0.0.Once we have configured the ip address for the server,DHCP server automatically assign 10 network for default pool.We don't have to create pool for 10 Network again.Just we need to give ip for DNS,Gateway and TFTP then we may

configure starting ip address or leave it and Save. **Step 5:** Now Click on PC in a LAN with Server and Check whether DHCP working fine in this network. Click on any PC > Desktop -> Ip configuration -> Choose DHCP, then you will get ip from dhcp server for this PC.



**Step 6:** Now, we see how to get ip address for PC that is in a network without Server. For that, first we have to add network pool in a dhcp server. So, Click on Server->Config->DHCP.

**Step 7:** Just edit Pool Name with any other name. I am going to give 20Network. Default Gateway->20.0.0.1, DNS Server->10.0.0.2

Start Ip Address->20.0.0.10 Subnet Mask->255.0.0.0 Maximum Number Of Users->100 TFTP Server 10.0.0.2 Then, Click on Add and Save.

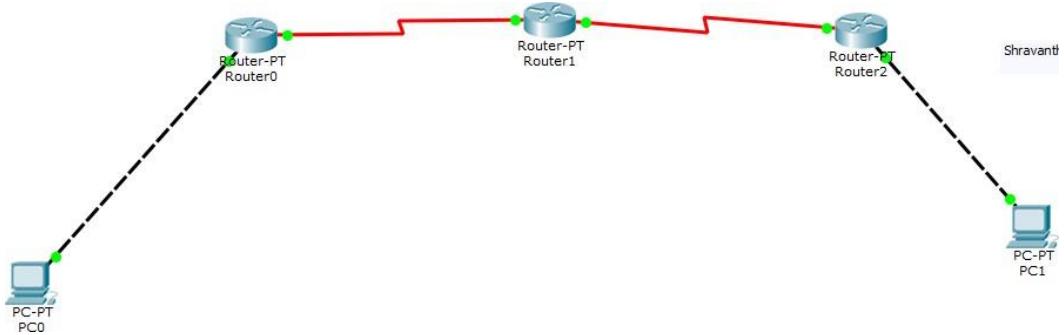
**Step 8:** Now go to router and give ip helper address under fastethernet0/1, that is server address here our server address is 10.0.0.2. Now we can get ip for this network also In Router,(Global configuration mode)

```
Router(config)#interface fastethernet0/1  
Router(config-if)#ip helper-address 10.0.0.2  
Router(config-if)#exit
```

**Step 9:** Now, check whether PC from network without server getting ip from the DHCP server in another Network. Click on any PC->Desktop->Ip configuration->Choose DHCP. Now we have got ip address from dhcp server.

## **5) Configure RIP routing Protocol in Routers**

TOPOLOGY



Configure ip address and gateway of PC's Configure

routers as shown in diagram.

Now configure ppp or point to point protocol for all routers.

Router0

Physical Config CLI

## IOS Command Line Interface

```
Router(config-if)#
Router(config-if)#
%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-if)#exit
Router(config)#interface serial1/0
%Invalid interface type and number
Router(config)#interface serial2/0
Router(config-if)#
Router(config-if)#ip address 20.0.0.1 255.0.0.0
Router(config-if)#encapsulation ppp
Router(config-if)#
%LINEPROTO-5-UPDOWN: Line protocol on Interface
Serial2/0, changed state to down

Router(config-if)#clock rate 64000
Router(config-if)#no shutdown
Router(config-if)#exit
Router(config)#

```

No need to give clk rate in second router

Router1

Physical Config CLI

### IOS Command Line Interface

```
Router(config)#  
Router(config)#  
Router(config)#  
Router(config)#  
Router(config)#  
Router(config)#  
Router(config)#  
Router(config)#interface serial2/0  
Router(config-if)#ip address 20.0.0.2 255.0.0.0  
Router(config-if)#encapsulation ppp  
Router(config-if)#  
%LINEPROTO-5-UPDOWN: Line protocol on Interface  
Serial2/0, changed state to up  
no shutdown  
Router(config-if)#exit  
Router(config)#interface serial3/0  
Router(config-if)#ip address 30.0.0.1 255.0.0.0  
Router(config-if)#encapsulation ppp  
Router(config-if)#  
%LINEPROTO-5-UPDOWN: Line protocol on Interface  
Serial3/0, changed state to down  
no shutdown  
Router(config-if)#

```

Copy Paste

Router2

Physical Config CLI

### IOS Command Line Interface

```
Router(config)#interface fastEthernet 0/2  
Router#  
%SYS-5-CONFIG_I: Configured from console by console  
  
Router#enable  
Router#configure terminal  
Enter configuration commands, one per line. End with  
CNTL/Z.  
Router(config)#interface fastEthernet0/0  
Router(config-if)#ip address 40.0.0.1 255.0.0.0  
Router(config-if)#no shutdown  
Router(config-if)#exit  
Router(config)#interface serial3/0  
Router(config-if)#ip address 30.0.0.2 255.0.0.0  
Router(config-if)#encapsulation ppp  
Router(config-if)#  
%LINEPROTO-5-UPDOWN: Line protocol on Interface  
Serial3/0, changed state to up  
clock rate 64000  
Router(config-if)#no shutdown  
Router(config-if)#exit  
Router(config)#

```

Copy Paste

## CONFIGURE RIP

Router0

Physical Config CLI

### IOS Command Line Interface

```
Router>enable
Router#configure terminal
Enter configuration commands, one per line. End with
CTRL/Z.
Router(config)#router 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

 Router1

Physical Config CLI

### IOS Command Line Interface

```
Router(config-if)#
%LINEPROTO-5-UPDOWN: Line protocol on Interface
Serial2/0, changed state to up
no shutdown
Router(config-if)#exit
Router(config)#interface serial3/0
Router(config-if)#ip address 30.0.0.1 255.0.0.0
Router(config-if)#encapsulation ppp
Router(config-if)#
%LINEPROTO-5-UPDOWN: Line protocol on Interface
Serial3/0, changed state to down
no shutdown
Router(config-if)#
%LINEPROTO-5-UPDOWN: Line protocol on Interface
Serial3/0, changed state to up

Router(config-if)#exit
Router(config)#router 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**

 Router2

Physical Config CLI

### IOS Command Line Interface

```
Router>enable
Router#configure terminal
Enter configuration commands, one per line. End with
CRTL/Z.
Router(config)#interface fastEthernet0/0
Router(config-if)#ip address 40.0.0.1 255.0.0.0
Router(config-if)#no shutdown
Router(config-if)#exit
Router(config)#interface serial3/0
Router(config-if)#ip address 30.0.0.2 255.0.0.0
Router(config-if)#encapsulation ppp
Router(config-if)#
%LINEPROTO-5-UPDOWN: Line protocol on Interface
Serial3/0, changed state to up
clock rate 64000
Router(config-if)#no shutdown
Router(config-if)#exit
Router(config)#router rip
Router(config-router)#network 40.0.0.0
Router(config-router)#network 30.0.0.0
Router(config-router)#exit
Router(config)#

```

**Copy** **Paste**

Execute show ip route

 Router2

Physical Config CLI

### IOS Command Line Interface

```
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

R    10.0.0.0/8 [120/2] via 30.0.0.1, 00:00:06, Serial3/0
R    20.0.0.0/8 [120/1] via 30.0.0.1, 00:00:06, 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
Router#
```

 Router1

Physical Config CLI

### IOS Command Line Interface

```
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

R    10.0.0.0/8 [120/1] via 20.0.0.1, 00:00:21, 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
R    40.0.0.0/8 [120/1] via 30.0.0.2, 00:00:06, Serial3/0
Router#
```

Router0

Physical Config CLI

### IOS Command Line Interface

```
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 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
R      30.0.0.0/8 [120/1] via 20.0.0.2, 00:00:18, Serial2/0
R      40.0.0.0/8 [120/2] via 20.0.0.2, 00:00:18, Serial2/0
Router#
```

Copy Paste

PC0

Physical Config Desktop Custom Interface

### Command Prompt

```
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 = 12ms, Average = 7ms

PC>ping 40.0.0.10

Pinging 40.0.0.10 with 32 bytes of data:

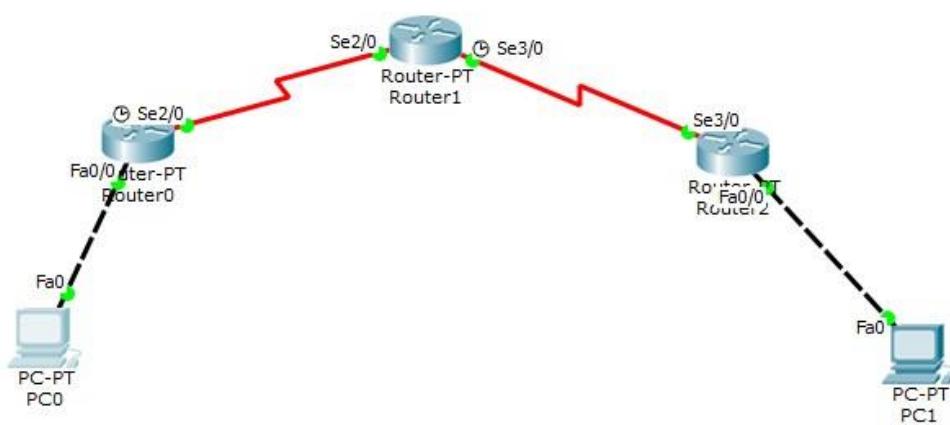
Reply from 40.0.0.10: bytes=32 time=12ms TTL=125
Reply from 40.0.0.10: bytes=32 time=10ms TTL=125
Reply from 40.0.0.10: bytes=32 time=11ms TTL=125
Reply from 40.0.0.10: bytes=32 time=12ms TTL=125

Ping statistics for 40.0.0.10:
    Packets: Sent = 4, Received = 4, Lost = 0 (0%
loss),
Approximate round trip times in milli-seconds:
    Minimum = 10ms, Maximum = 12ms, Average = 11ms

PC>
```

## 6)Configure OSPF routing protocol

Topology.



1.config rip.

## 2. Config ospf

The screenshot shows a Cisco IOS Command Line Interface window titled "Router0". The window has tabs for "Physical", "Config", and "CLI", with "CLI" selected. The main area displays the following configuration commands and errors:

```
Router(config-if)#ip address 20.0.0.1 255.0.0.0
Router(config-if)#encapsulation ppp
Router(config-if)#clock 64000
^
% Invalid input detected at '^' marker.

Router(config-if)#clock rate 64000
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(config)#router ospf1
^
% Invalid input detected at '^' marker.

Router(config)#router ospf 1
Router(config-router)#router id 1.1.1.1
^
% Invalid input detected at '^' marker.

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)#

```

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

 Router1

- □ ×

Physical Config CLI

## IOS Command Line Interface

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

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

Router(config-if)#interface serial 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 shutdown

%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)#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)#
00:15:10: %OSPF-5-ADJCHG: Process 1, Nbr 1.1.1.1 on Serial2/0 from LOADING to
FULL, Loading Done

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

 Router2

Physical Config CLI

## IOS Command Line Interface

```
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

Router(config-if)#interface serial3/0
Router(config-if)#ip address 30.0.0.2 255.0.0.0
Router(config-if)#encapsulation ppp
Router(config-if)#no shutdown

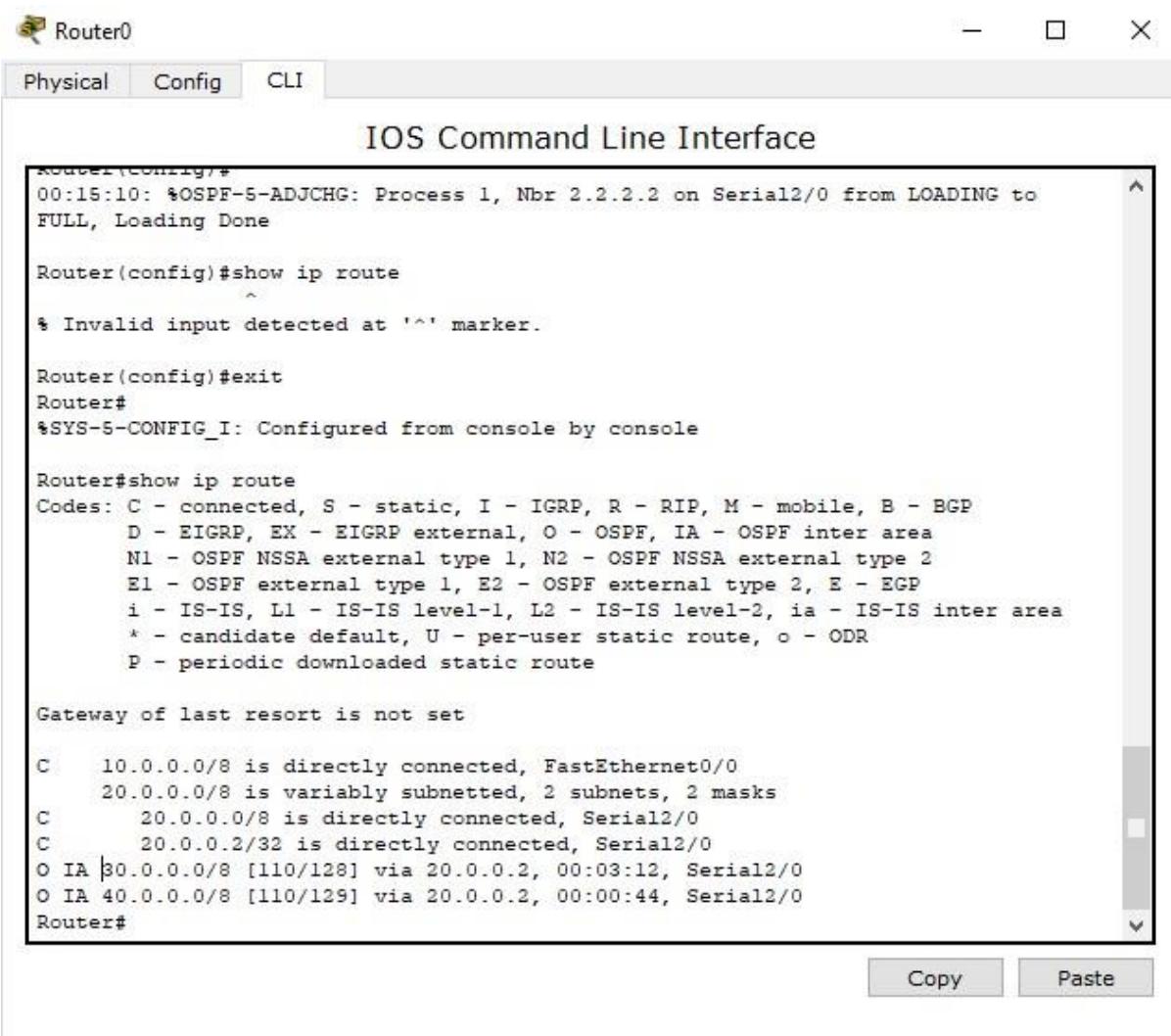
Router(config-if)#
%LINK-5-CHANGED: Interface Serial3/0, changed state to up

Router(config-if)#
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial3/0, changed state to up
xit
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)#
00:17:34: %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)#

```

Show ip route



The image shows a software interface titled "Router0" with three tabs: "Physical", "Config", and "CLI". The "CLI" tab is active, displaying the "IOS Command Line Interface". The terminal window title is "IOS Command Line Interface". The command entered was "show ip route", which resulted in an error message: "% Invalid input detected at '^' marker." After exiting configuration mode with "exit", the command was run again, showing the router's routing table. The table includes entries for direct connections (C) and OSPF routes (O). The legend at the top of the table defines route types: 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. The gateway of last resort is not set.

```
Router(config)#  
00:15:10: %OSPF-5-ADJCHG: Process 1, Nbr 2.2.2.2 on Serial2/0 from LOADING to  
FULL, Loading Done  
  
Router(config)#show ip route  
^  
% Invalid input detected at '^' marker.  
  
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  
      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  IA 30.0.0.0/8 [110/128] via 20.0.0.2, 00:03:12, Serial2/0  
O  IA 40.0.0.0/8 [110/129] via 20.0.0.2, 00:00:44, Serial2/0  
Router#
```

Copy      Paste

Router1

Physical Config CLI

### IOS Command Line Interface

```
Router(config-router)#network 30.0.0.0 0.255.255.255 area 0
Router(config-router)#exit
Router(config)#
00:17:35: %OSPF-5-ADJCHG: Process 1, Nbr 3.3.3.3 on Serial3/0 from LOADING to
FULL, Loading Done

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

      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, 00:03:07, Serial3/0
Router#
```

Copy Paste

Router2

Physical Config CLI

### IOS Command Line Interface

```
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)#
00:17:34: %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)#
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

O IA 20.0.0.0/8 [110/128] via 30.0.0.1, 00:04:33, 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
Router#
```

Copy Paste

Loopback

Router0

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
     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  IA 30.0.0.0/8 [110/128] via 20.0.0.2, 00:03:12, Serial2/0
O  IA 40.0.0.0/8 [110/129] via 20.0.0.2, 00:00:44, Serial2/0
Router#
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#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 add 172.16.1.252 255.255.0.0
Router(config-if)#no shutdown
Router(config-if)#

```

Copy

Paste



Router1

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

      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, 00:03:07, Serial3/0
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#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 add 172.16.1.253 255.255.0.0
Router(config-if)#no shutdown
Router(config-if)#[
```

Router2

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

O IA 20.0.0.0/8 [110/128] via 30.0.0.1, 00:04:33, 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
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#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 add 172.16.1.254 255.255.0.0
Router(config-if)#no shutdown
^
% Invalid input detected at '^' marker.

Router(config-if)#no shutdown
Router(config-if)#exit
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console
```

Copy Paste

Show ip route for R2

The screenshot shows a Windows-style application window titled "Router2". The window has three tabs at the top: "Physical", "Config", and "CLI". The "CLI" tab is selected, displaying the IOS Command Line Interface. The output of the "show ip route" command is shown in the terminal window.

```
Router(config-if)#ip add 172.16.1.254 255.255.0.0
Router(config-if)#no shutdown
^
% Invalid input detected at '^' marker.

Router(config-if)#no shutdown
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
      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 20.0.0.0/8 [110/128] via 30.0.0.1, 00:11:19, 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#
```

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

Router0

Physical Config CLI

### IOS Command Line Interface

```
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 IA 30.0.0.0/8 [110/128] via 20.0.0.2, 00:03:12, Serial2/0
O IA 40.0.0.0/8 [110/129] via 20.0.0.2, 00:00:44, Serial2/0
Router#
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#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 add 172.16.1.252 255.255.0.0
Router(config-if)#no shutdown
Router(config-if)#exit
Router(config)#router ospf 1
Router(config-router)#area 1 virtual link 2.2.2.2
^
* Invalid input detected at '^' marker.

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

Copy Paste
```

Similarly do for R1 you may face some disturbance while typing

Show ip route for R2

Router2

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

O IA 20.0.0.0/8 [110/128] via 30.0.0.1, 00:11:19, 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#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 [110/129] via 30.0.0.1, 00:00:17, Serial3/0
O IA 20.0.0.0/8 [110/128] via 30.0.0.1, 00:19:17, 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#
```

Copy Paste

Ping 40.0.0.0 from 10.0.0.10

Packet Tracer PC Command Line 1.0  
PC>ping 40.0.0.0  
  
Pinging 40.0.0.0 with 32 bytes of data:  
  
Reply from 30.0.0.2: bytes=32 time=3ms TTL=253  
Reply from 30.0.0.2: bytes=32 time=19ms TTL=253  
Reply from 30.0.0.2: bytes=32 time=19ms TTL=253  
Reply from 30.0.0.2: bytes=32 time=2ms TTL=253  
  
Ping statistics for 40.0.0.0:  
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),  
    Approximate round trip times in milli-seconds:  
        Minimum = 2ms, Maximum = 19ms, Average = 10ms  
  
PC>

PC0

Physical Config Desktop Custom Interface

**Command Prompt**

```
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=9ms TTL=125
Reply from 40.0.0.10: bytes=32 time=22ms 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 = 9ms, Maximum = 22ms, Average = 13ms

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=11ms TTL=125
Reply from 40.0.0.10: bytes=32 time=2ms TTL=125
Reply from 40.0.0.10: bytes=32 time=4ms TTL=125
Reply from 40.0.0.10: bytes=32 time=6ms 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 = 11ms, Average = 5ms

PC>
```

## 7) Demonstrate the TTL/ Life of a Packet

Create a topology as shown below with two PCs and three routers.

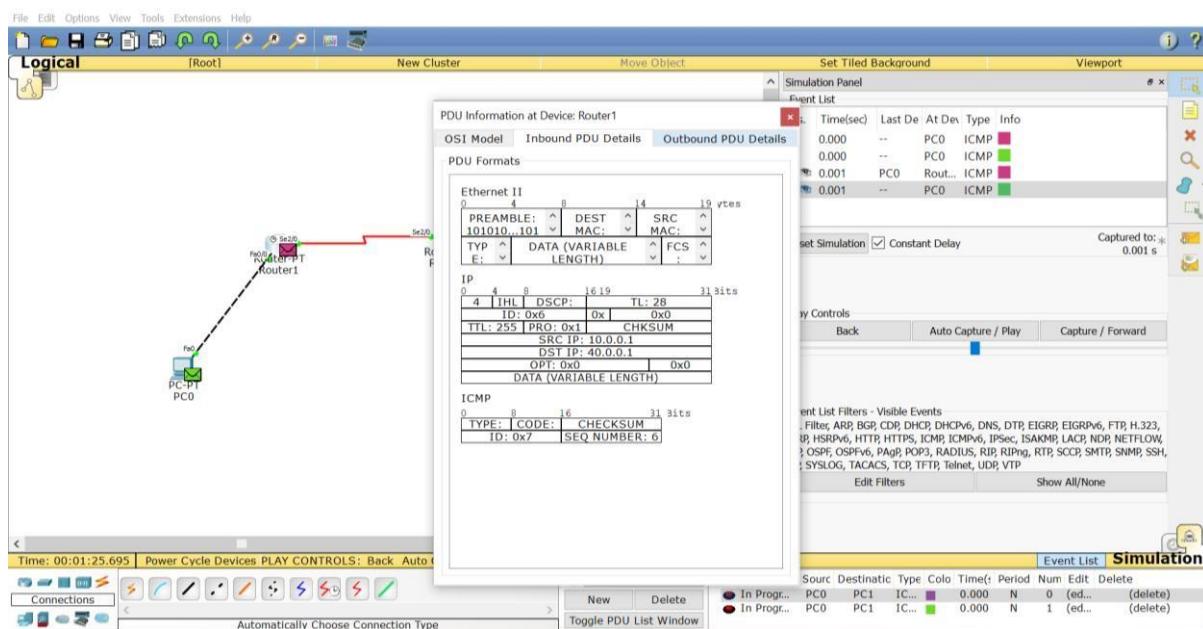
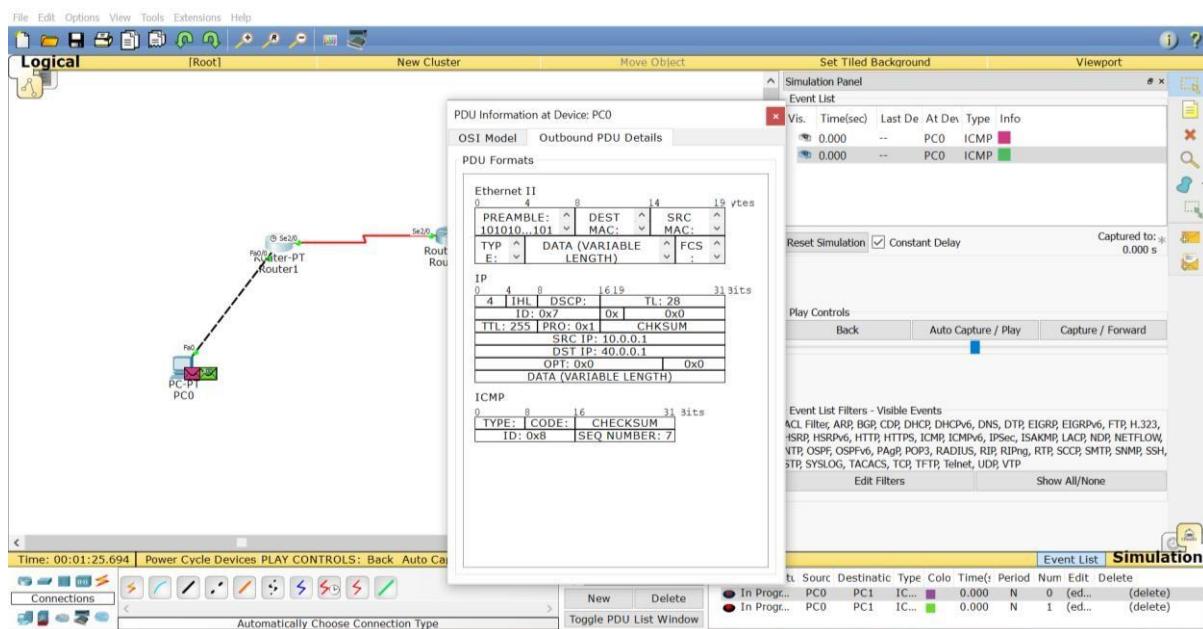
Configure the devices as per static / default / dynamic routing.

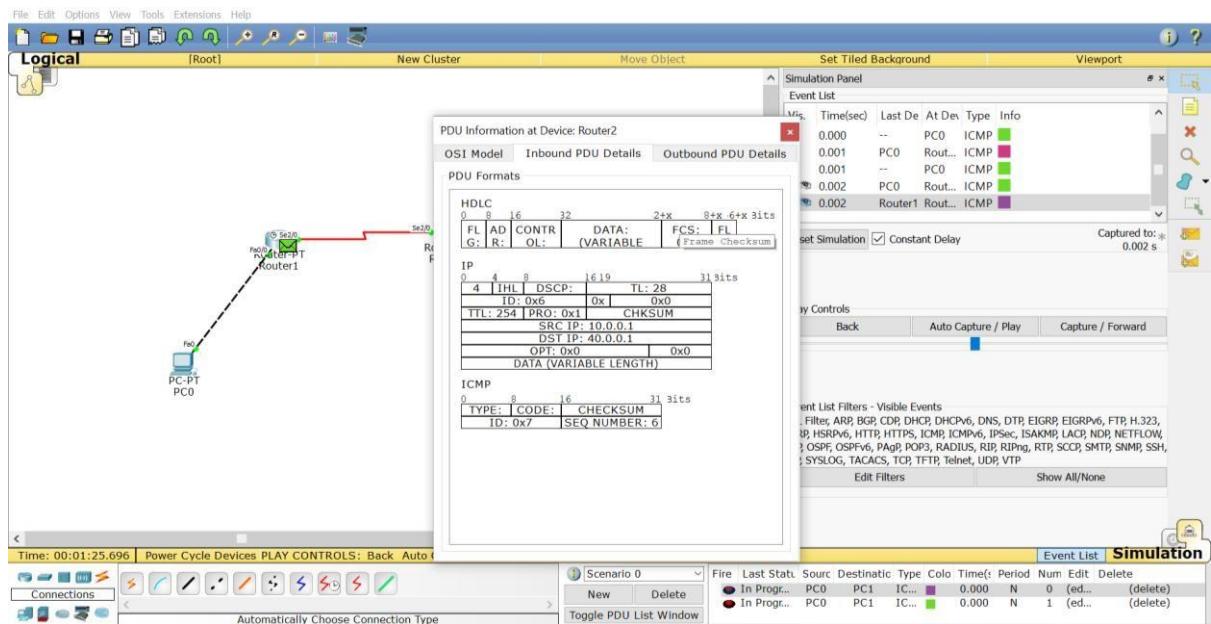
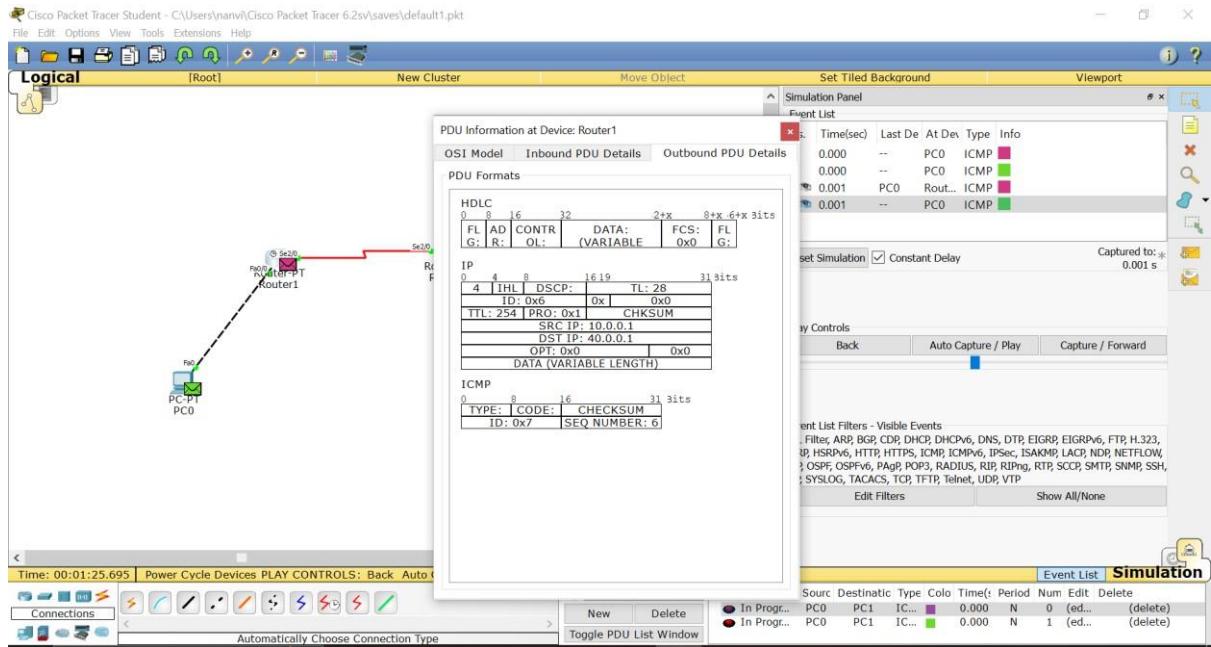
In the simulation mode, send a simple PDU from one PC to another.

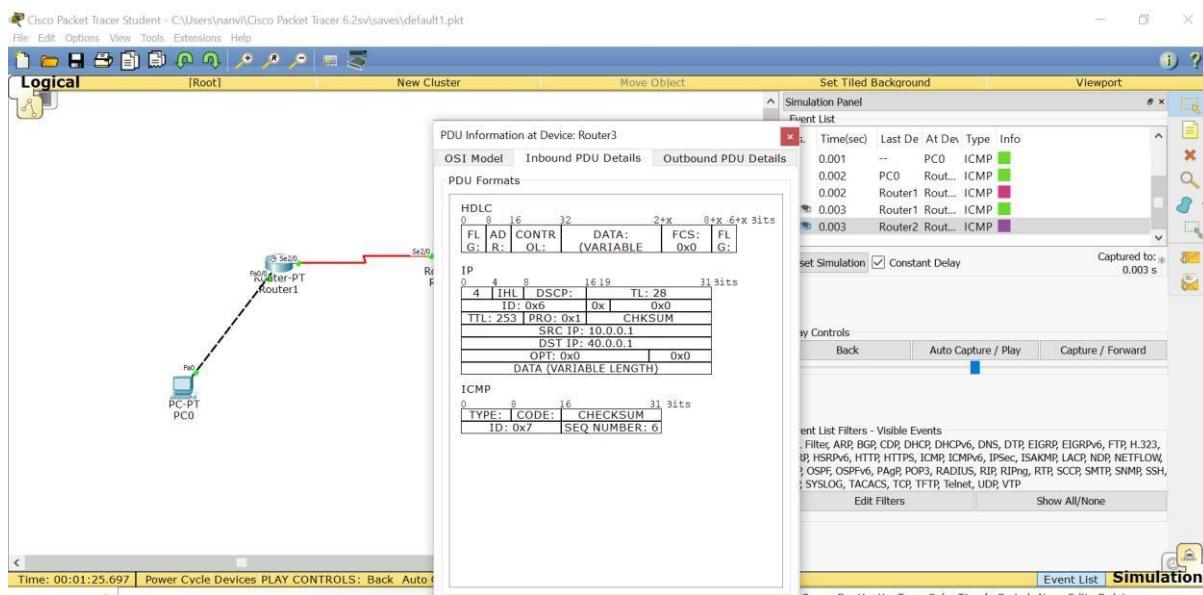
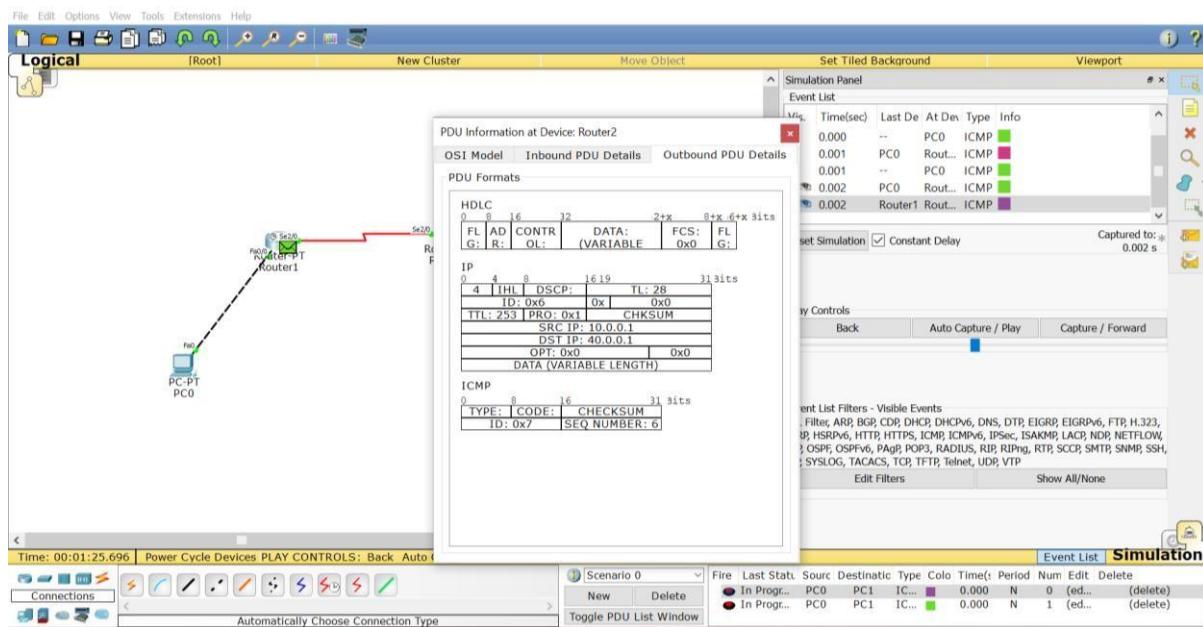
Use capture button to capture every transfer.

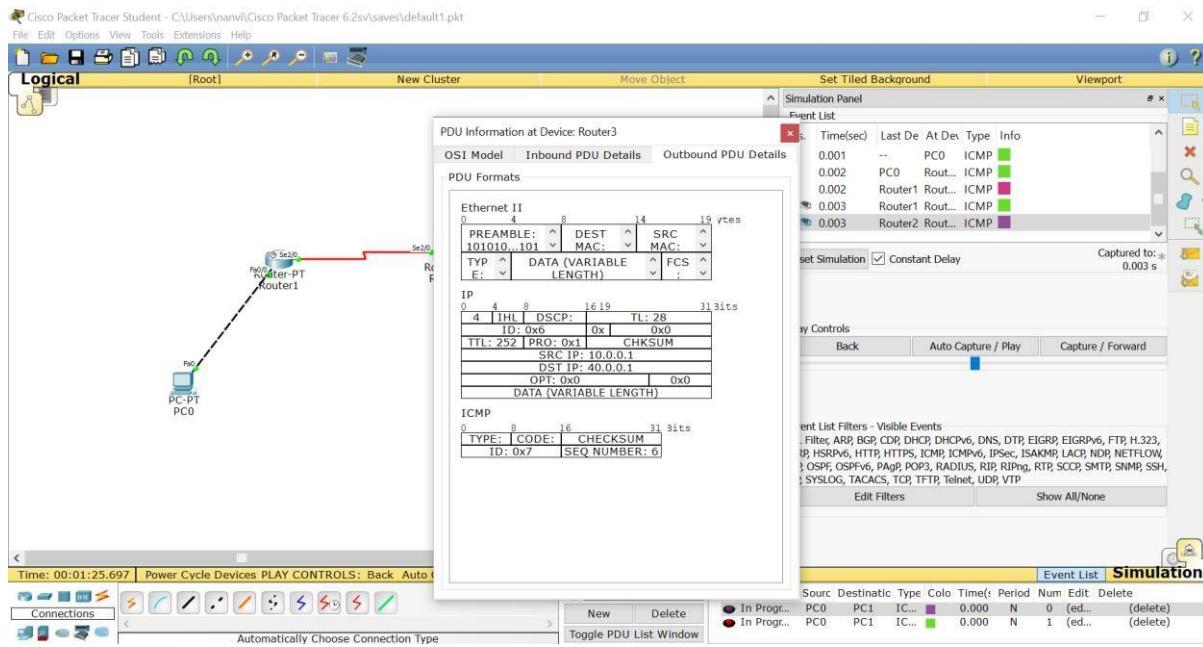
Click on the PDU during every transfer to see the Inbound and outbound PDU details.

Observe that there is a difference of 1 in TTL when it crosses every router.









## 8) Configure Web Server, DNS within a LAN. DNS

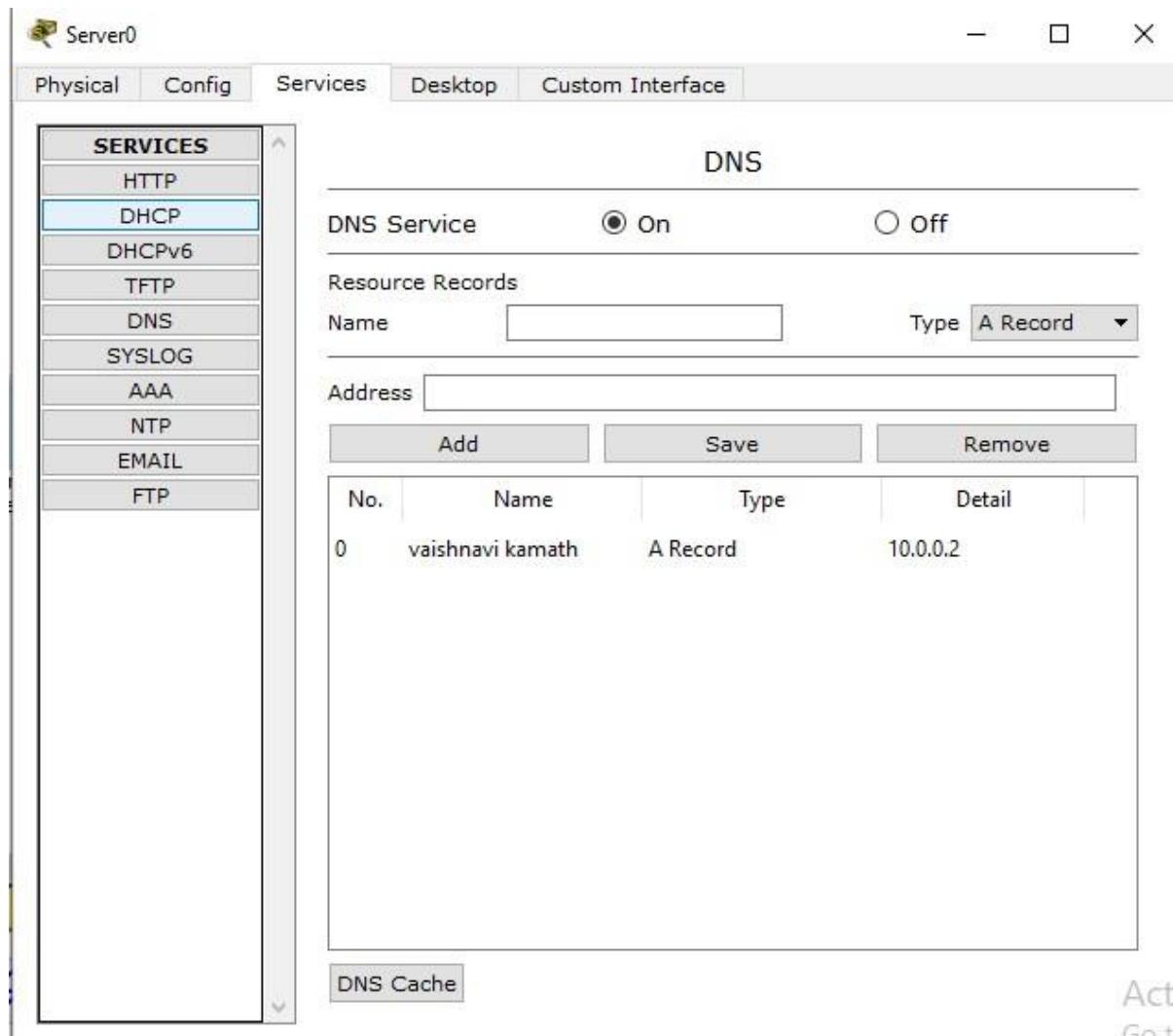
Topology:



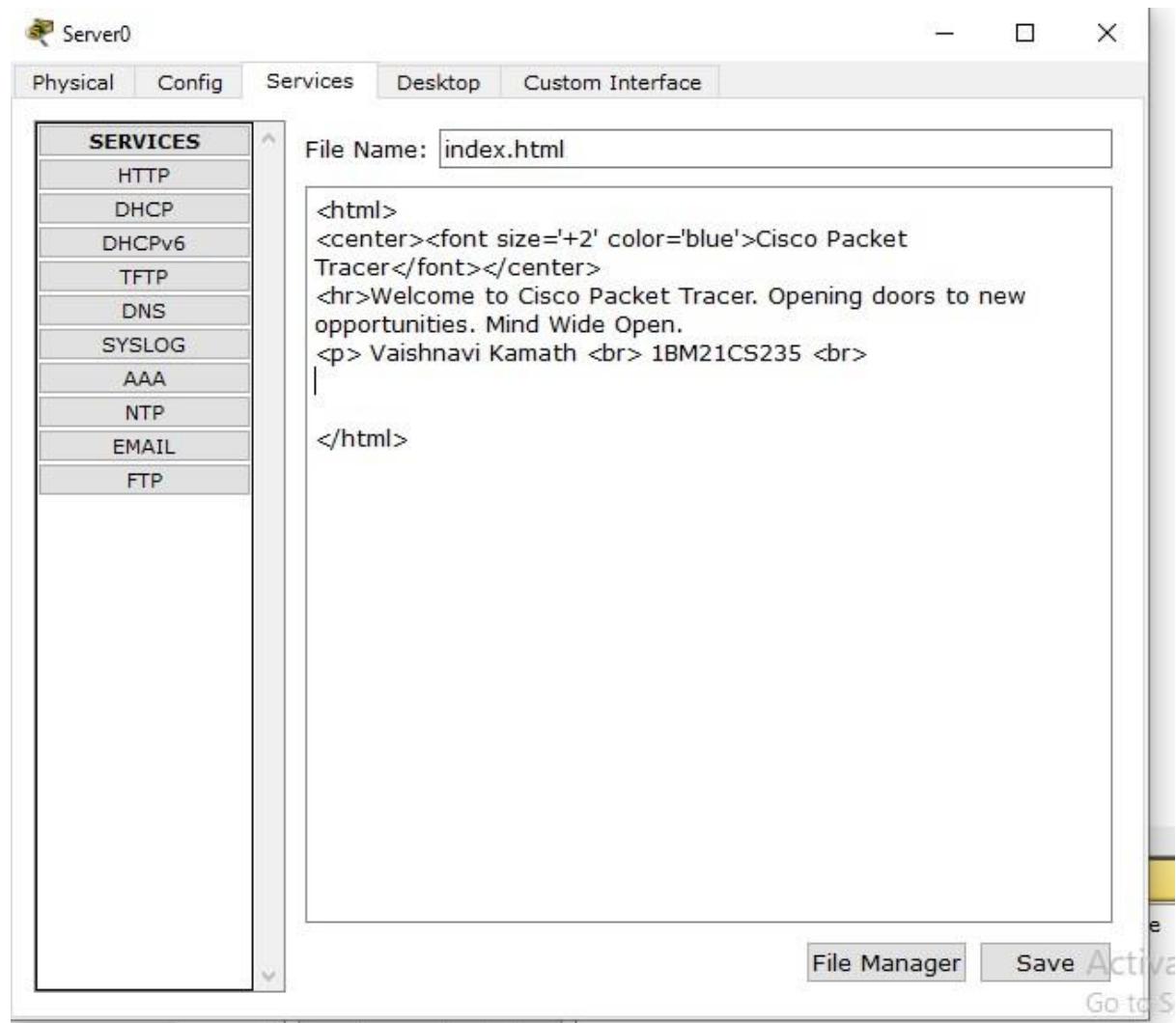
Configure ip address of PC-10.0.0.1

Server-10.0.0.2

Go to services in server select dns and add a new name as Vaishnavi Kamath and address as 10.0.0.2 address of your server.



Go to http index.html and edit index page as shown below.



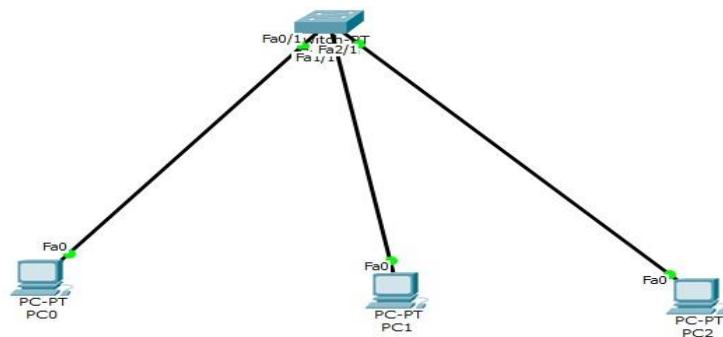
In PC go to desktop - Web browser and try to connect to server using server ip address. Output is shown (type 10.0.0.2)

Next type name which was given in server(vaishnavi kamath) and retry to connect. Following output is obtained.

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

ARP

Topology



```
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=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

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

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 = 0ms, Average = 0ms
```

Configure ip address for pc. No default gateway for switches.

Go to any pc cmd prompt and type as below

## Command Prompt

```
Packet Tracer PC Command Line 1.0
PC>arp -a
No ARP Entries Found
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=1ms 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 = 1ms, Average = 0ms

PC>arp -a
   Internet Address          Physical Address          Type
   10.0.0.2                  00d0.ffb9.3792      dynamic

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=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
```

## Command Prompt

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

PC>arp -a
Internet Address      Physical Address      Type
10.0.0.2                00d0.fffb9.3792    dynamic

PC>ping 10.0.0.3

Pinging 10.0.0.3 with 32 bytes of data:

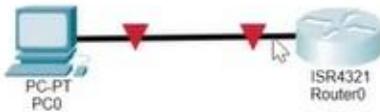
Reply from 10.0.0.3: bytes=32 time=1ms TTL=128
Reply from 10.0.0.3: bytes=32 time=0ms TTL=128
Reply from 10.0.0.3: bytes=32 time=0ms TTL=128
Reply from 10.0.0.3: bytes=32 time=0ms TTL=128

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

PC>arp -a
Internet Address      Physical Address      Type
10.0.0.2                00d0.fffb9.3792    dynamic
10.0.0.3                0000.0c56.799a    dynamic

PC>arp -d
PC>arp -a
No ARP Entries Found
PC>|
```

## 10)To understand the operation of TELNET by accessing the router in server room from a PC in IT off



```
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#
Router(config)#hostname R1
R1(config)#enable secret rp
R1(config)#int g0/0/0
R1(config-if)#ip add 192.168.1.1 255.255.255.0
R1(config-if)#no shut

R1(config-if)#
%LINK-5-CHANGED: Interface GigabitEthernet0/0/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0/0, changed state to up

R1(config-if)#
R1(config-if)#line vty 0 5
R1(config-line)#login
% Login disabled on line 2, until 'password' is set
% Login disabled on line 3, until 'password' is set
% Login disabled on line 4, until 'password' is set
% Login disabled on line 5, until 'password' is set
% Login disabled on line 6, until 'password' is set
% Login disabled on line 7, until 'password' is set
R1(config-line)#password tp
R1(config-line)#exit
R1(config)#
R1(config)#
R1(config)#exit
R1#
%SYS-5-CONFIG_I: Configured from console by console

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

enable config

t hostname

R1 enable

secret p1

interface

fastethernet

0/0 ip

address

10.0.0.1

255.0.0.0 no

shut line vty

0 5 --to

allow virtual

terminal

access for 6

users login

password p0

exit exit wr -

to save

changes in

router

### **Commands in PC**

In command prompt,

Ping 10.0.0.1

## Ping results seen

The image shows two Command Prompt windows from the Cisco Packet Tracer software. Both windows have a blue title bar with the text "Command Prompt".

**Top Window:**

```
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>
```

**Bottom Window:**

```
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

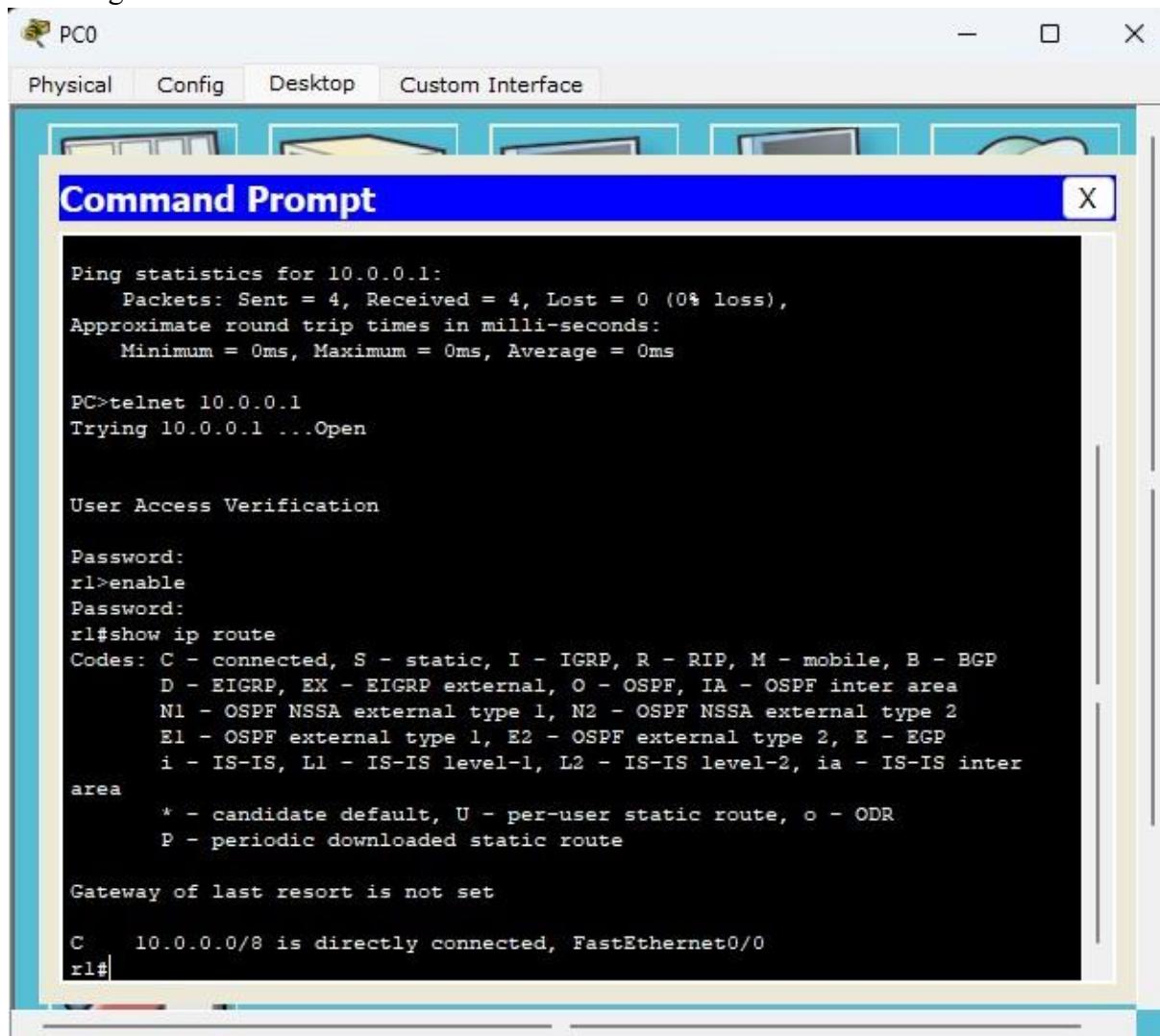
User Access Verification

Password:
rl>enable
Password:
rl#
```

Password for User Access Verification is p0

Password for enable is p1

Accessing router CLI from PC

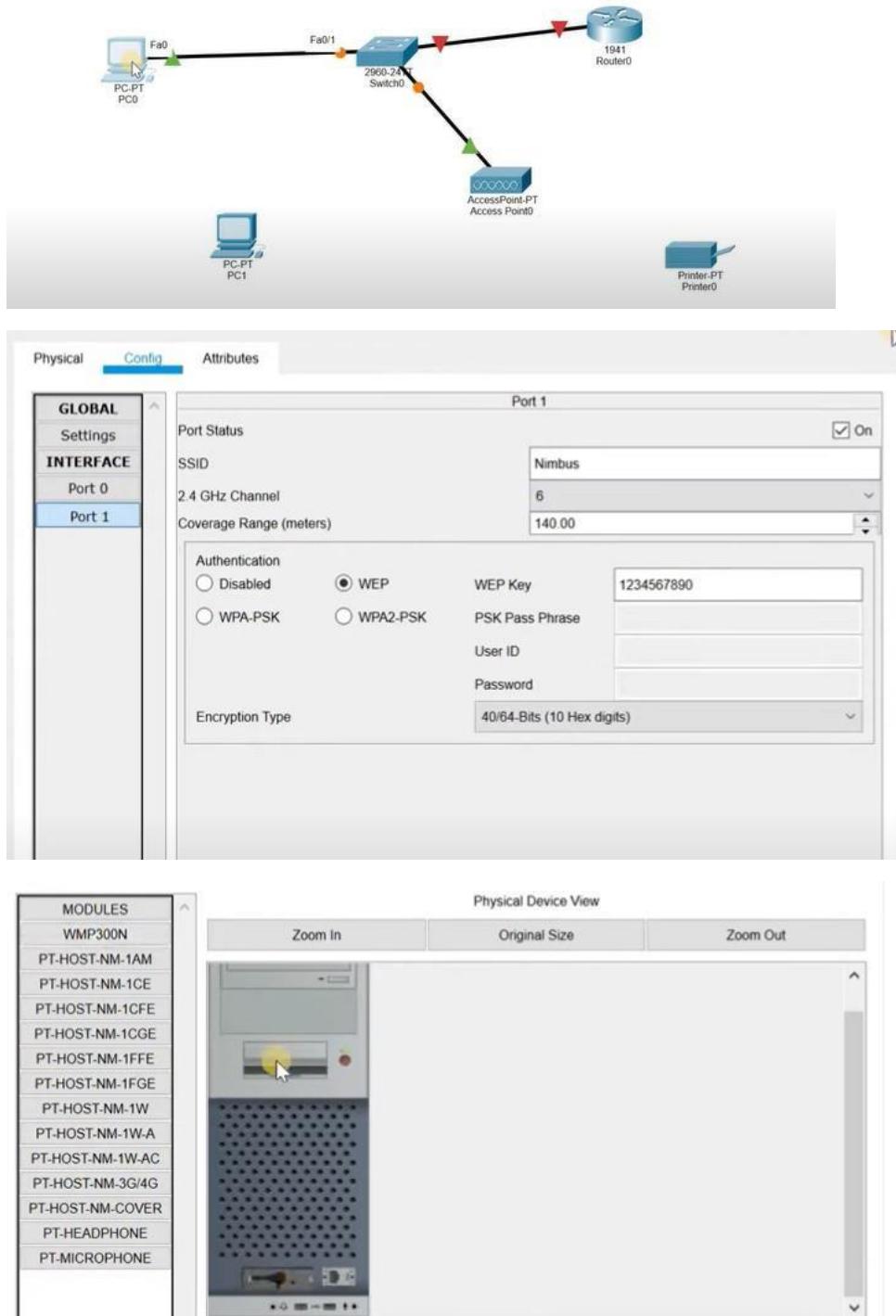


The screenshot shows a Windows Command Prompt window titled "Command Prompt". The window has a blue header bar with the title and a close button (X). Below the header is a toolbar with four icons: Physical, Config, Desktop, and Custom Interface. The main area of the window displays the following text:

```
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:  
rl>enable  
Password:  
rl#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  
rl#
```

The admin in PC is able to run commands as run in router CLI and see the result from PC.

11) To construct a WLAN and make the nodes communicate wirelessly.

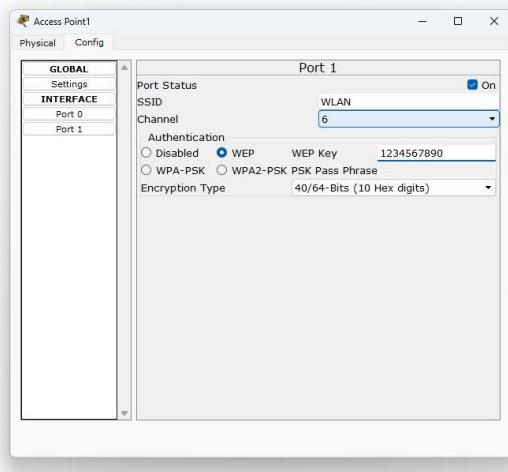


Construct the above topology

Configure PC3 and the Router1 as is normally done

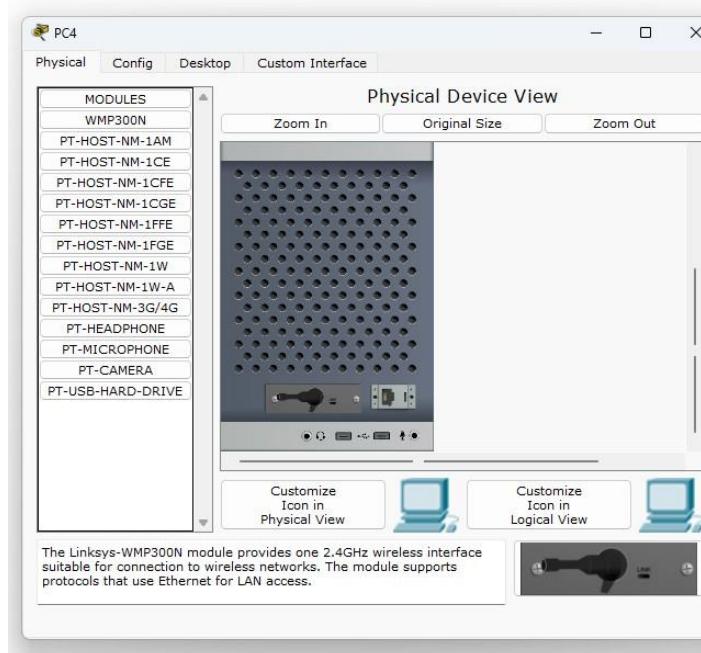
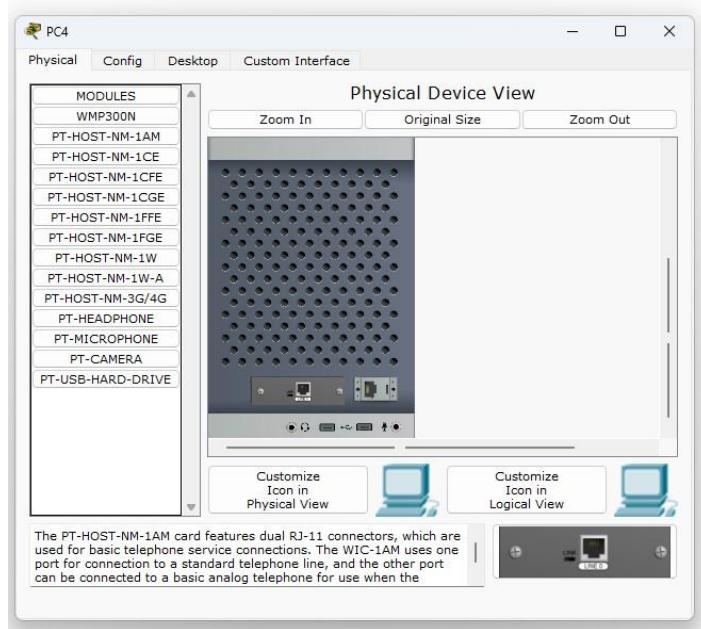
Configure Access Point1 - Port1 -> SSID Name- any name(WLAN here)

Select WEP and give any 10 digit hex key – 1234567890 here

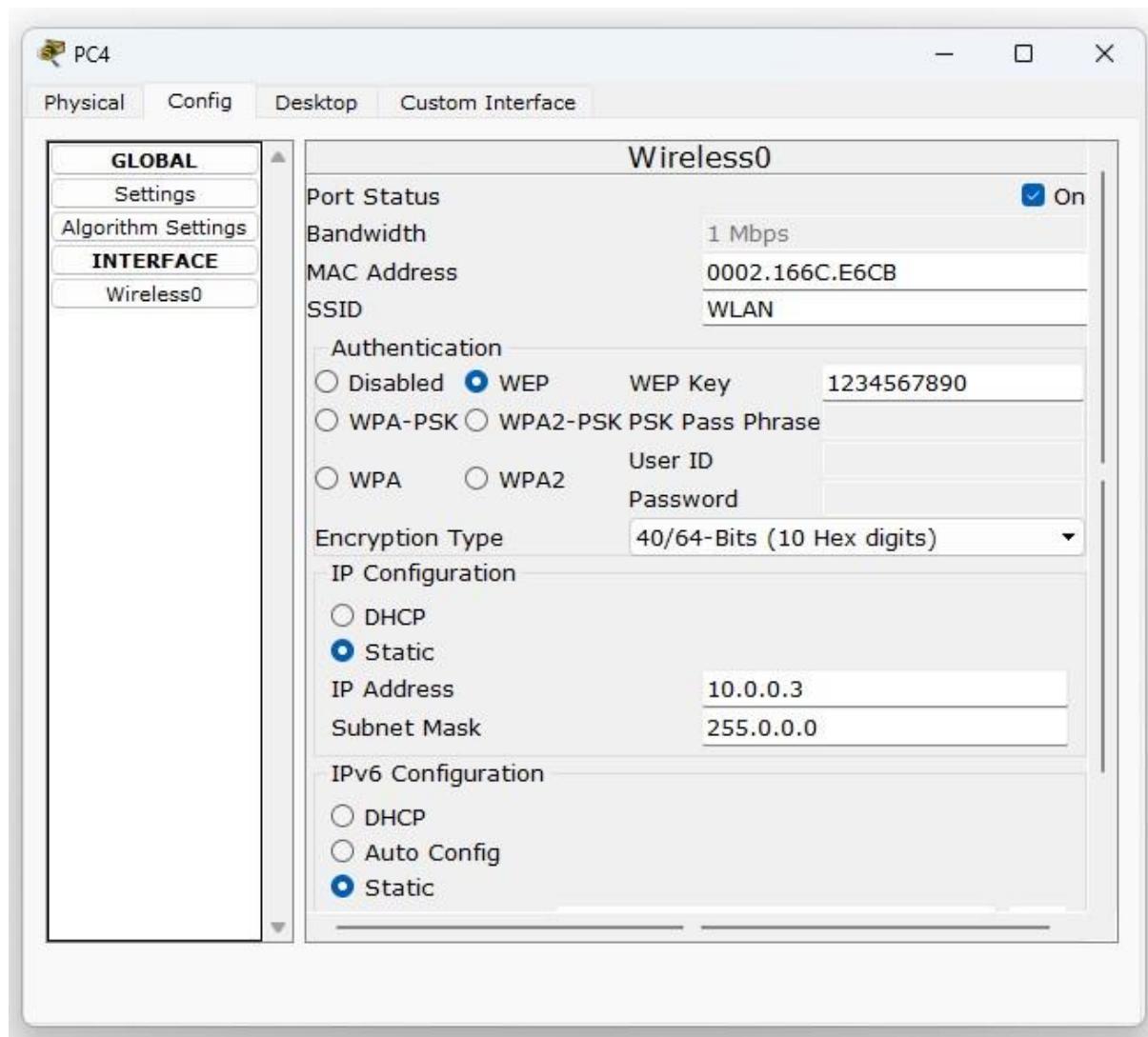


Configuring PC4 and Laptop with Wireless standards

Switch off the device. Drag the existing PT-HOST-NM-1AM to the component listed in the LHS. Drag WMP300N wireless interface to the empty port. Switch On the device.



In the config tab a new wireless interface would have been added. Now configure SSID, WEP, WEP Key, IP address and **Gateway** (as normally done) to the device.



### Final topology on screen

Ping from every device to every other device and see the results

**Link Information** **Connect** **Profiles**

Below is a list of available wireless networks. To search for more wireless networks, click the Refresh button. To view more information about a network, select the wireless network name. To connect to that network, click the Connect button below.

| Wireless Network Name | CH | Signal |
|-----------------------|----|--------|
| Nimbus                | 1  | 43%    |

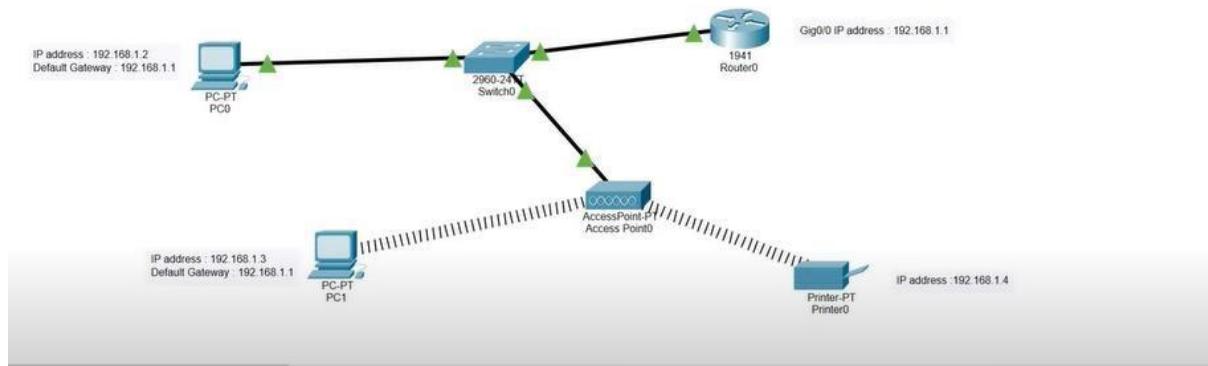
**Site Information**

Wireless Mode: Infrastructure  
 Network Type: Mixed B/G  
 Radio Band: Auto  
 Security: WEP  
 MAC Address: 0002:4A07:501B

**Refresh** **Connect**

2.4G

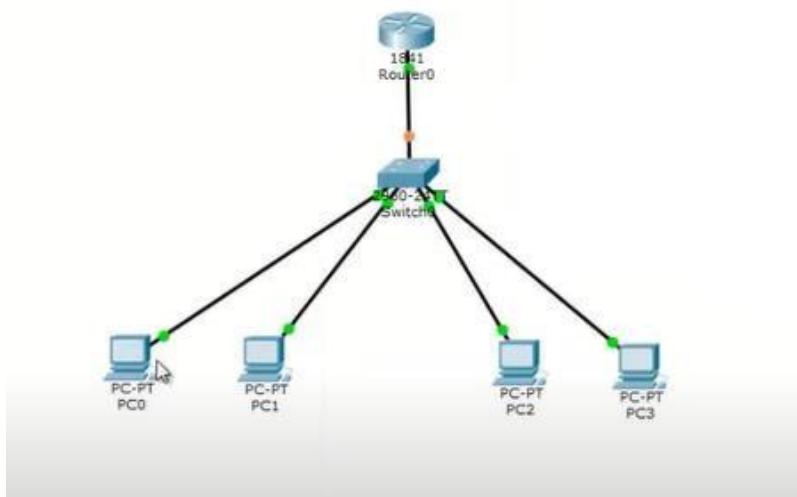
Adapter is installed



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

VLAN

TOPOLOGY



1. Connect pc's as shown.Switch-2960 Router-1841
2. Configure IP address and gateway to pc.
3. Go to switch ->config->VLAN database set any VLAN name. But vlan number must be equal to the last but one number of the ip address (this must not be initially configured as the interface address of router) if we have 2 g/w as 192.168.1.1 and 192.168.20.1 and you have configured basically 192.168.1.1 for router interface then vlan number is 20.
4. In switch select the interface which goes to router and set dropdown to trunk

Switch0

Physical Config CLI

**GLOBAL**

Settings

Algorithm Settings

**SWITCH**

VLAN Database

**INTERFACE**

FastEthernet0/1

FastEthernet0/2

FastEthernet0/3

FastEthernet0/4

FastEthernet0/5

FastEthernet0/6

FastEthernet0/7

FastEthernet0/8

FastEthernet0/9

FastEthernet0/10

**FastEthernet0/5**

Port Status  On  
 100 Mbps  10 Mbps  Auto  
 Half Duplex  Full Duplex  Auto

Bandwidth

Duplex

Trunk VLAN 1-1005

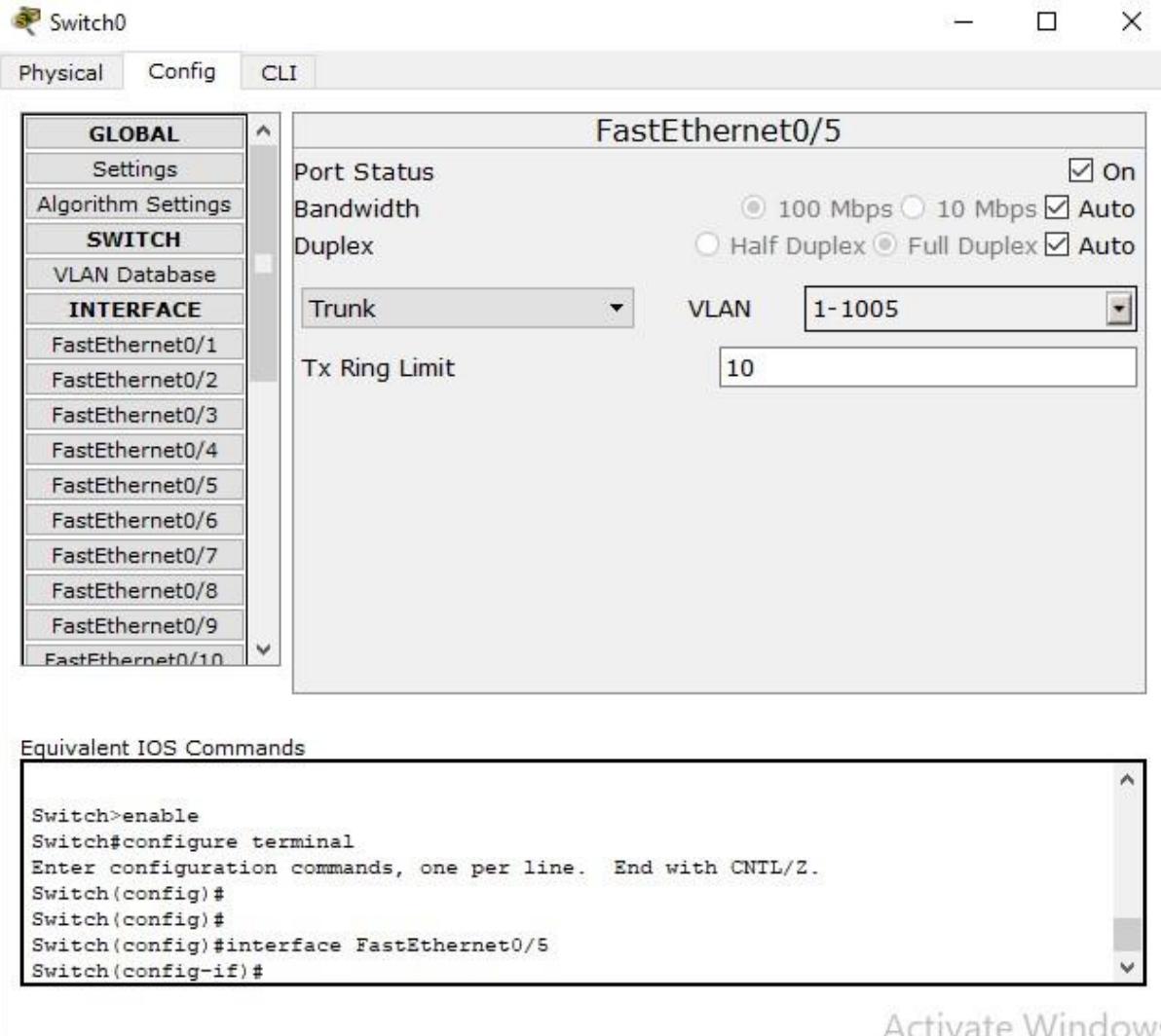
Tx Ring Limit 10

Equivalent IOS Commands

```
Switch>enable
Switch#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#
Switch(config)#
Switch(config)#interface FastEthernet0/5
Switch(config-if)#

```

Activate Windows



5.The right side sys conn to switch must be selected as vlan 20.

Go to router and foll commands.

Router0

Physical Config CLI

### IOS Command Line Interface

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

Router(config-if)#exit
Router(config)#interface fastEthernet0/0.1
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 20
Router(config-subif)#ip address 192.168.20.1
% Incomplete command.
Router(config-subif)#exit
Router(config)#interface FastEthernet0/0
Router(config-if)#encapsulation dot1q 20
^
% Invalid input detected at '^' marker.

Router(config-if)#interface fastEthernet0/0.1
Router(config-subif)#encapsulation dot1q 20
Router(config-subif)#ip address 192.168.20.1 255.255.255.0
Router(config-subif)#no shutdown
Router(config-subif)#exit
Router(config)#

```

Copy Paste

## Command Prompt

```
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=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 = 3, Lost = 1 (25% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, 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=0ms TTL=127
Reply from 192.168.20.2: bytes=32 time=0ms 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

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>
```

## CYCLE-II

### 1)Write a program for congestion control using Leaky bucket algorithm.

```
#include <stdio.h>
#include <stdlib.h>

int main()
{
    int buckets, outlets, k = 1, num, remaining;

    printf("Enter Bucket size and outstream
size\n"); scanf("%d %d", &buckets,
&outlets); remaining = buckets; while (k)

    {
        num = rand() % 1000;

        if(num < remaining)

        {
            remaining = remaining - num; printf("Packet of %d bytes
accepted\n", num);

        }
        else
        {
            printf("Packet of %d bytes is discarded\n", num);
        }
        if (buckets - remaining > outlets)
        {
            remaining += outlets; // Fixed the calculation
        }
        else

            remaining = buckets;

        printf("Remaining bytes: %d \n", remaining);

        printf("If you want to stop input, press 0, otherwise, press
1\n"); scanf("%d", &k);

    }
    while (remaining < buckets)
    { if (buckets - remaining > outlets)
    {
        remaining += outlets;
    }
}
```

```
else remaining = buckets;  
printf("Remaining bytes: %d \n",  
remaining);  
}  
return 0;  
}  
Enter Bucket size and outstream size  
2000  
100  
Packet of 383 bytes accepted  
Remaining bytes: 1717  
If you want to stop input, press 0, otherwise, press 1  
1  
Packet of 886 bytes accepted  
Remaining bytes: 931  
If you want to stop input, press 0, otherwise, press 1  
1  
Packet of 777 bytes accepted  
Remaining bytes: 254  
If you want to stop input, press 0, otherwise, press 1  
1  
Packet of 915 bytes is discarded  
Remaining bytes: 354  
If you want to stop input, press 0, otherwise, press 1  
0
```

**2)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.**

### Server.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 True:    print("The Server is ready to receive") connectionSocket, addr = serverSocket.accept() sentence = connectionSocket.recv(1024).decode()    try:        file = open(sentence, "r") file_contents = file.read(1024) connectionSocket.send(file_contents.encode()) print("\nSent contents of " + sentence) file.close()    except FileNotFoundError:        error_message = "File not found" connectionSocket.send(error_message.encode())    connectionSocket.close()
```

### Client.py

```
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()
```

```
PS C:\Users\shraw\Searches\sercli> python Client.py

Enter file name: res.txt

From Server:

Hi Hello How are you
PS C:\Users\shraw\Searches\sercli> []
```

**3)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.**

**Server.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 True:
    sentence, clientAddress = serverSocket.recvfrom(2048)
    sentence = sentence.decode('utf-8')
    try:
        file = open(sentence, "r")
        content = file.read(2048)
        serverSocket.sendto(content, clientAddress)
        print("\nSent contents of, sentence)

        file.close()
    except FileNotFoundError:
        error_message = "File not found"
        serverSocket.sendto(error_message, clientAddress)
        print("\nFile not found:", sentence)
```

**Client.py**

```
from socket import *
```

```
serverName = '127.0.0.1'
serverPort = 12000
clientSocket = socket(AF_INET, SOCK_DGRAM)
try:
    sentence = input("\nEnter file name: ")
    clientSocket.sendto(bytes(sentence, 'utf-8'), (serverName, serverPort))
    filecontents, serverAddress = clientSocket.recvfrom(2048)
```

```
if filecontents.decode('utf-8') == "File not found":
    print("\nFile not found on the server.")
```

```
else:  
    print("\nReply from Server:\n")  
    print(filecontents.decode('utf8'))  
  
except Exception as e:  
    print(f"An error occurred: {str(e)}")  
  
finally:  
    clientSocket.close()
```

## OUTPUT

```
PS C:\Users\shraw\Searches\sercli> python Server.py  
The Server is ready to receive  
  
Sent contents of res.txt  
The Server is ready to receive  
[]
```

```
PS C:\Users\shraw\Searches\sercli> python Client.py  
  
Enter file name: res.txt  
  
From Server:  
  
Hi Hello How are you  
PS C:\Users\shraw\Searches\sercli> []
```

#### 4)Write a program for error detecting code using CRCCCITT (16-bits).

```
#include<stdio.h> char
m[50],g[50],r[50],q[50],temp[50];
void caltrans(int); void crc(int);
void calram(); void shiftl(); int
main()
{
int n,i=0; char ch,flag=0; printf("Enter the
frame bits:"); while((ch=getc(stdin))!='\n')
m[i++]=ch; n=i; for(i=0;i<16;i++)
m[n++]='0'; m[n]='\0'; printf("Message after
appending 16 zeros:%s",m);
for(i=0;i<=16;i++)
g[i]='0';
g[0]=g[4]=g[11]=g[16]='1';g[17]
='0';
printf("\n generator:%s\n",g);
crc(n);
printf("\n\n quotient:%s",q);
caltrans(n); printf("\n transmitted
frame:%s",m); printf("\nEnter
transmitted frame:");
scanf("\n%s",m); printf("CRC
checking\n"); crc(n);
printf("\n\n last remainder:%s",r);
for(i=0;i<16;i++)
if(r[i]!='0')
flag=1; else continue; if(flag==1)
printf("Error during transmission");
else printf("\n\n Received frame is
correct");
}
void crc(int n)
{ int
i,j;
for(i=0;i<n;i++) temp[i]=m[i];
for(i=0;i<16;i++) r[i]=m[i];
printf("\n intermediate
remainder\n"); for(i=0;i<n-16;i++)
{
if(r[0]=='1'
)
{
q[i]='1';
calram();
}
```

```

else
{
q[i]='0';
shiftl();
}
r[16]=
m[17+i
];
r[17]='\0'; printf("\nremainder
%d.%s",i+1,r);
for(j=0;j<=17;j++) temp[j]=r[j];
}
q[n-16]='\0';
}
void calram()
{ int
i,j;
for(i=1;i<=16;i++) r[i-1]=((int)temp[i]-
48)^((int)g[i]-48)+48;
} void
shiftl()
{
int
i;
for(i=1;i<=16;i++) r[i-
1]=r[i];
}
void caltrans(int n)
{
int i,k=0; for(i=n-16;i<n;i++)
m[i]=((int)m[i]-48)^((int)r[k++]-48)+48; m[i]='\0';
}

```

## OUTPUT

```
Enter the frame bits:100010101
Message after appending 16 zeros:1000101010000000000000000
generator:1000100000100001
```

```
intermediate remainder
```

```
remainder 1:00000101001000010
remainder 2:00001010010000100
remainder 3:00010100100001000
remainder 4:00101001000010000
remainder 5:01010010000100000
remainder 6:10100100001000000
remainder 7:01011000011000010
remainder 8:10110000110000100
remainder 9:0111000110100101
```

```
quotient:100000101
transmitted frame:100010101011000110100101
Enter transmitted frame:100010101011000110100101
CRC checking
```

```
intermediate remainder
```

```
remainder 1:00000101010100001
remainder 2:00001010101000010
remainder 3:00010101010000101
remainder 4:00101010100001010
remainder 5:01010101000010100
remainder 6:10101010000101001
remainder 7:01000100000010000
remainder 8:10001000000100001
remainder 9:00000000000000000
```

```
last remainder:00000000000000000
```

```
Received frame is correct
```