VISVESVARAYA TECHNOLOGICAL UNIVERSITY

"JnanaSangama", Belgaum -590014, Karnataka.

LAB REPORT on

COMPUTER NETWORKS LAB

Submitted by

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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)

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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 LAB" carried out by **Archit Mehrotra (1BM21CS031),** 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 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.

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Index

Cycle - 1

Experiment 1

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

Topology:

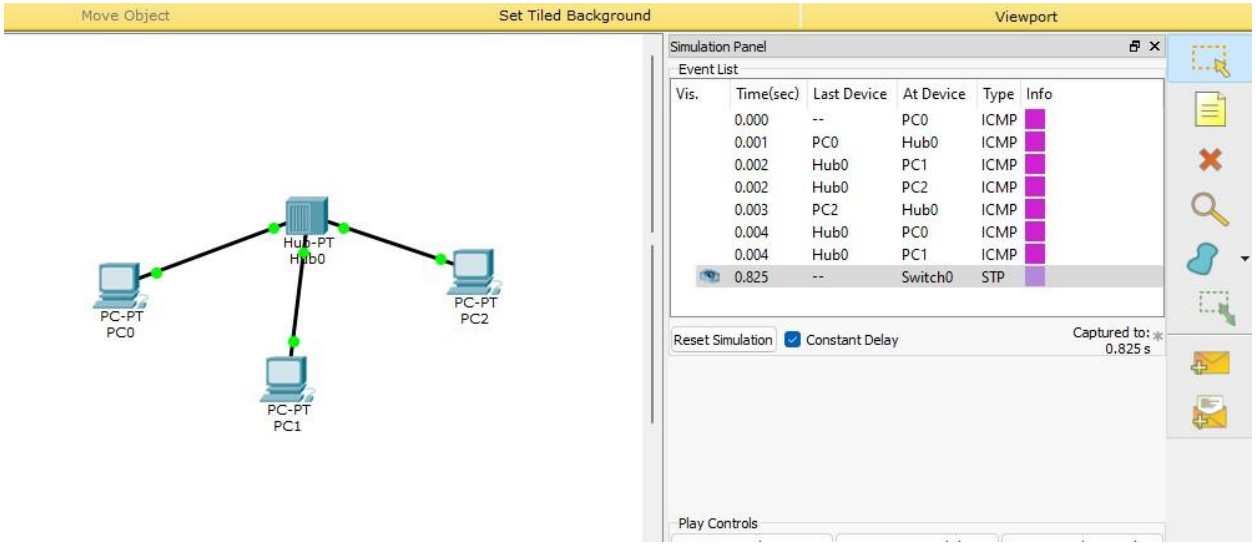


Fig 1: Topology with hub as connecting device

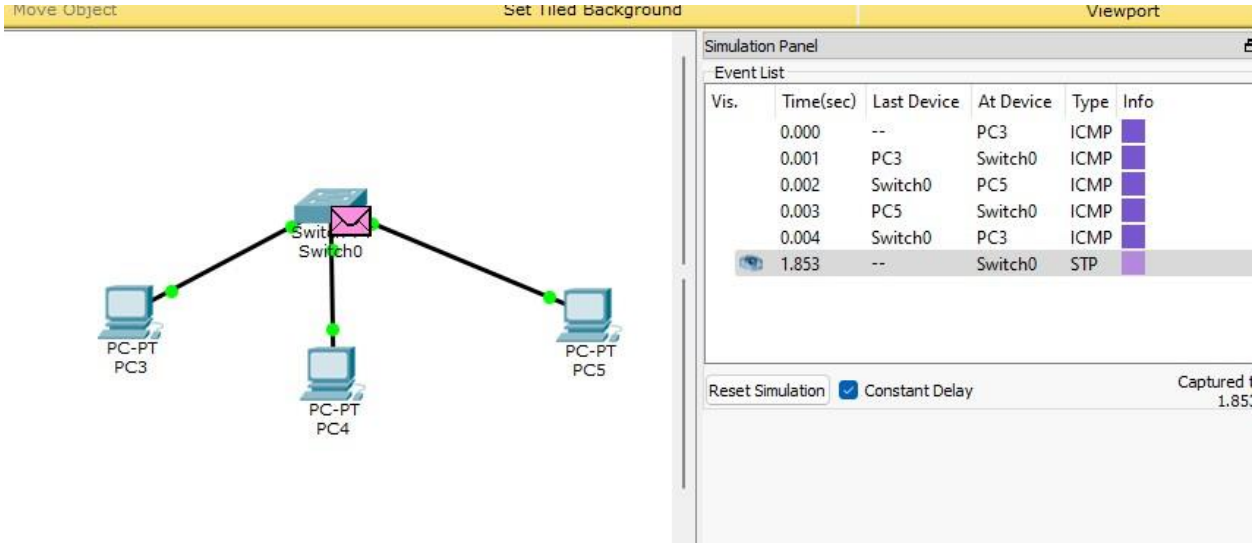
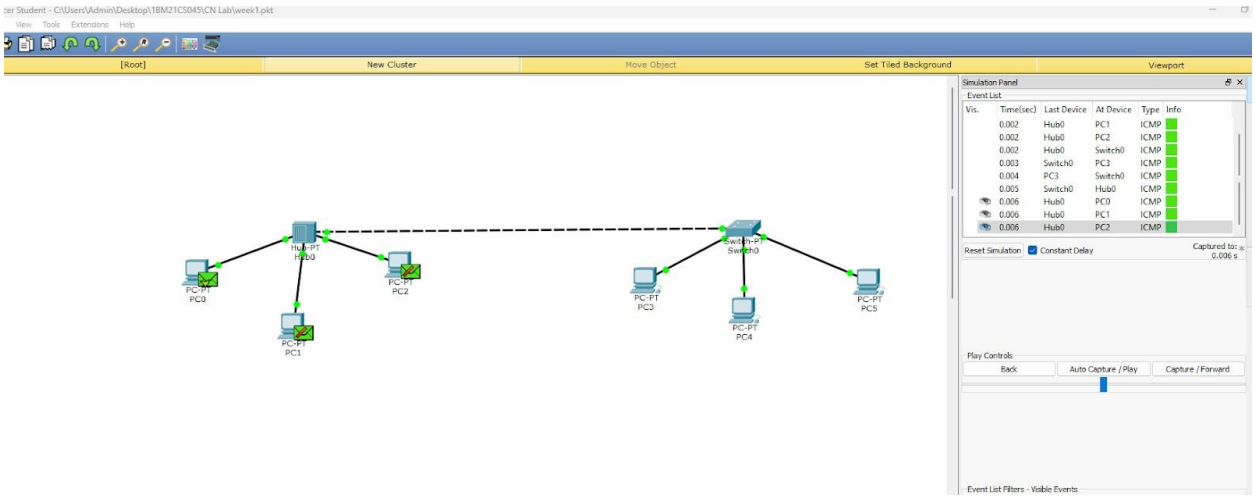


Fig 2: Topology with switch as connecting device



Observation:

Lab-01

Experiment - 1

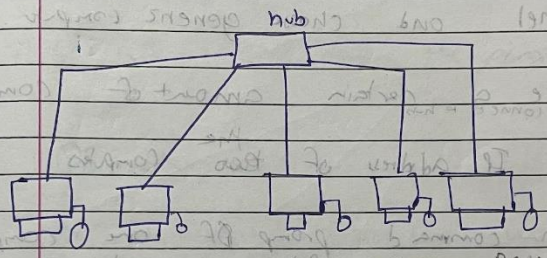
Date __/__/__
Page

Aim

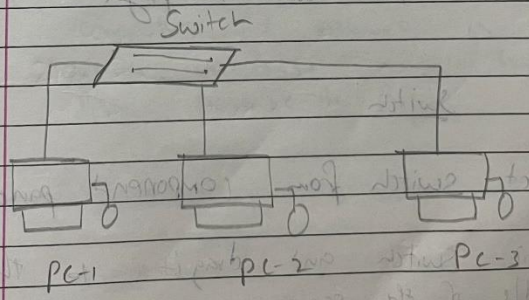
To create a topology and simulate sending a simple PDU from source to destination using hub and switch as connecting devices and demonstrate ping message

Topology

Hub to pc



Switch to pc



Date / /
Page

Procedure:

1) Select hub from component panel
2) Choose generic hub-PT and drag in to the middle of the screen
3) Select end devices from the component panel and choose generic computer.
4) Place a certain amount of computers and connect to hub
5) Set IP address of the computers
6) Open command prompt of one computer and type 'ping' followed by the IP of the computer message should be send to.
7) See and note down the ping.

Switch

1) select switch from component panel
2) generic switch and drag it to the middle of the screen
3) Select end devices from component panel and choose generic computer

Date / /
Page

4) place a certain amount of computers and connect to swith

5) set IP address of the computers

6) open command prompt of one computer and type 'ping' followed by the IP of the computer the message should be send to

7) Secand note down the ping

Observation

On starting a Simulation we can see the hub, switch start to send blank messages or check for message to be send on each computer. This mode can be used to see if each how the computer we require is recieving the message and how it is send. Observe the Ping

Result

hub

packets:- Send = 4, Recieved = 4, Lost = 0

Ping:- Minimum = 0ms, Maximum = 0ms
Average = 0ms

Switch

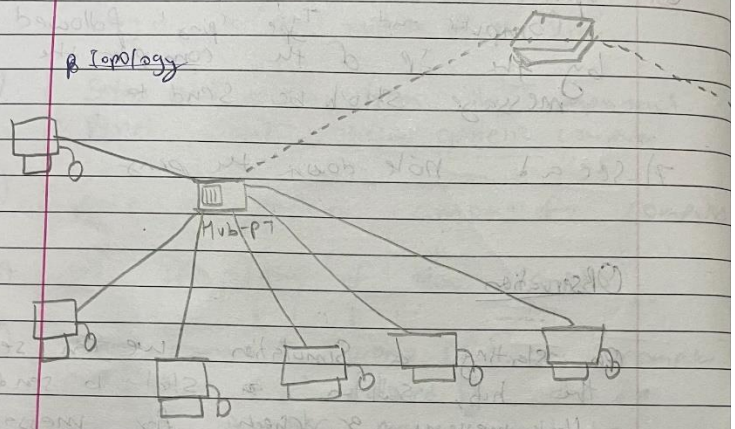
packets Sent = 4 Recieved = 4, lost = 0

Date / /
Page

Ping: Minimum = 0ms, Maximum = 1ms, Averge

hub & Switch

Topology



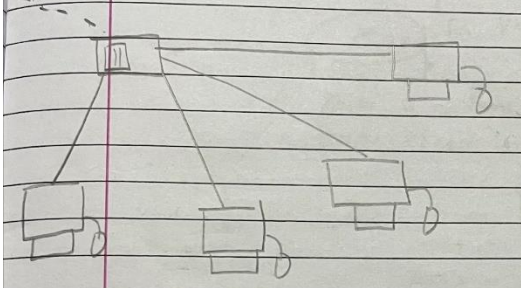
procedure

1) Select hub and Switch from component panel

2) Choose generic hub-PT and switch and place 1 switch and 2 hubs on the screen connecting both the hubs with switch

3) Place a certain amount of computer connecting to both the hubs

Date __/__/__
Page



4/ Set Ip address of the computers

5/ open command prompt and ping a computer with a certain Ip address and the message to be sent.

Observation

1.) Switch broadcasts the packet to all the devices during first iteration & records Ip address > Ip of intended destination & Sends packet to all devices and the device to specified destination.

Date __/__/__
Page _____

2. Hub broadcasts packet to all devices and the device which is intended to receive packet discards & intended device recieves packet & send the acknowlegement.

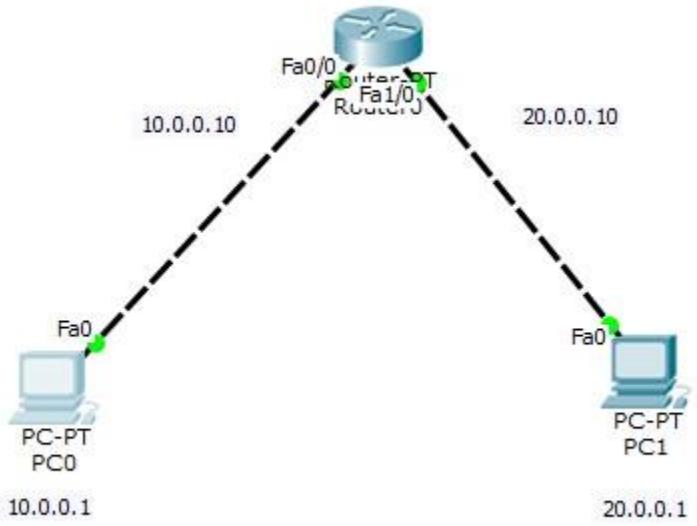
Experiment 2

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

2A:

Topology:

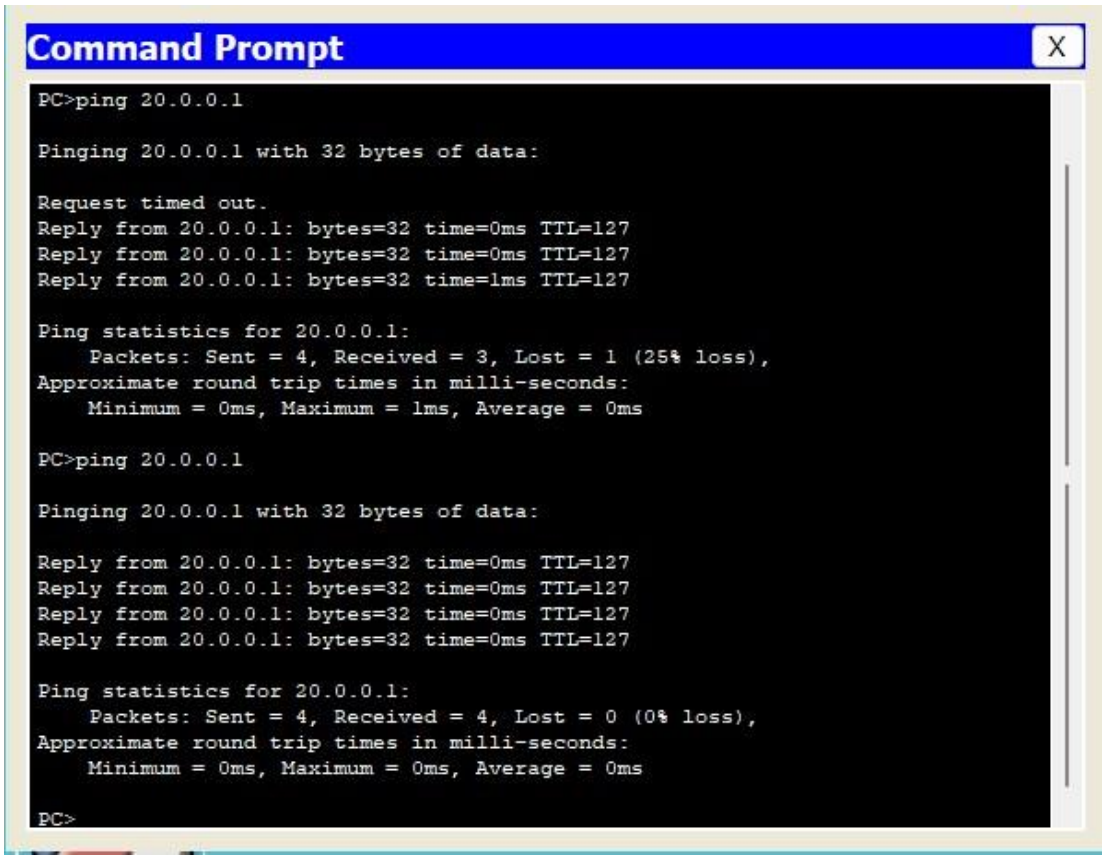
Topology with 1 router and 2 PCs:



Configuration of Router:

```
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 fastethernet0/0
Router(config-if)#ip address 10.0.0.10 255.0.0.0
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 fastethernet1/0
Router(config-if)#ip address 20.0.0.10 255.0.0.0
Router(config-if)#no shut

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
exit
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

C    10.0.0.0/8 is directly connected, FastEthernet0/0
C    20.0.0.0/8 is directly connected, FastEthernet1/0
Router#
```

Ping Output:



Observation:

Lab 2

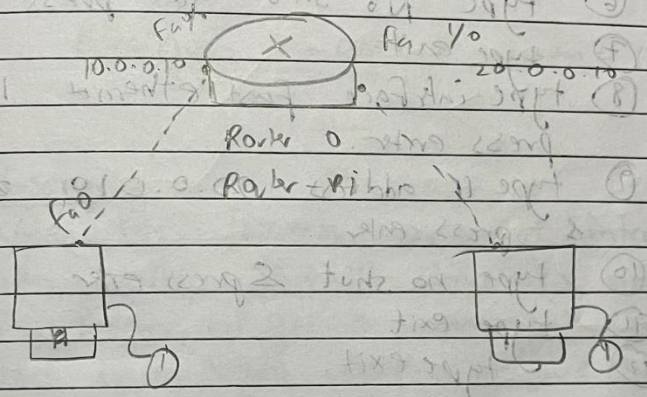
Experiment:-2

Date / /
Page

Aim

Configure IP address to a single router. Explore the following messages. Ping message, destination unreachable request timed out reply.

Topology



procedure

1. Select one Generic router & 2 generic PC's. Connect PC's to router using copper cross-over cable.
2. Set the IP address of both PC's by clicking on PC & config tab. Along with IP address set gateway in settings.
3. To set IP address of router, click on it and go to CLI tab and type the following commands

1. type No and press enter
2. type enable and press enter
3. type config and press enter
4. type interface Fast ethernet 0/0 & press enter.
5. type IP address 10.0.0.10 255.0.0.0 & press enter
6. type No shut and press enter.
7. type exit
8. type interface fast ethernet 1/0 & press enter.
9. type IP address 20.0.0.10 255.0.0.0 & press enter
10. type no shut & press enter
11. type exit
12. type exit.

Show ip route (shows all connections)

4. Close the tab and click on PC & go to command prompt

Ping Output

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

Date __/__/__
Page

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

Ping Statistics for 20.0.0.1
Packets : Sent = 4, Recieved = 3, lost = 1
(25% loss).
Approximate round trip tims in milli-seconds
Minimum = 0ms, Maximum = 10ms, Average = 3ms.

Observation

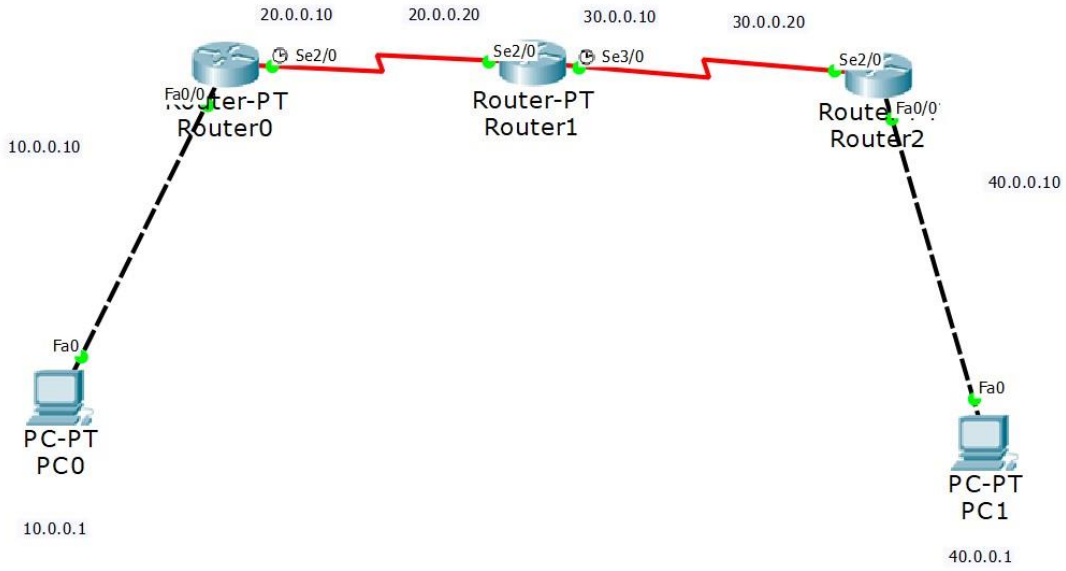
When the routers are not introduced with other two IP addresses and we ping them we get a message saying host unreachable. Once when we introduce routers with other two IP addresses and we ping now we get message Sent Successfully with 0% loss.

Observation

When we ping the destination, we get allocated with 32 bytes out of which first 8 bytes is request timed out which learns about router and addresses of end devices. Rest bytes are used for sending packets to destination address with 25% loss. If pinged again all bytes are used for sending message without request timed-out message.

2B:

Topology:



Configuration of Routers:

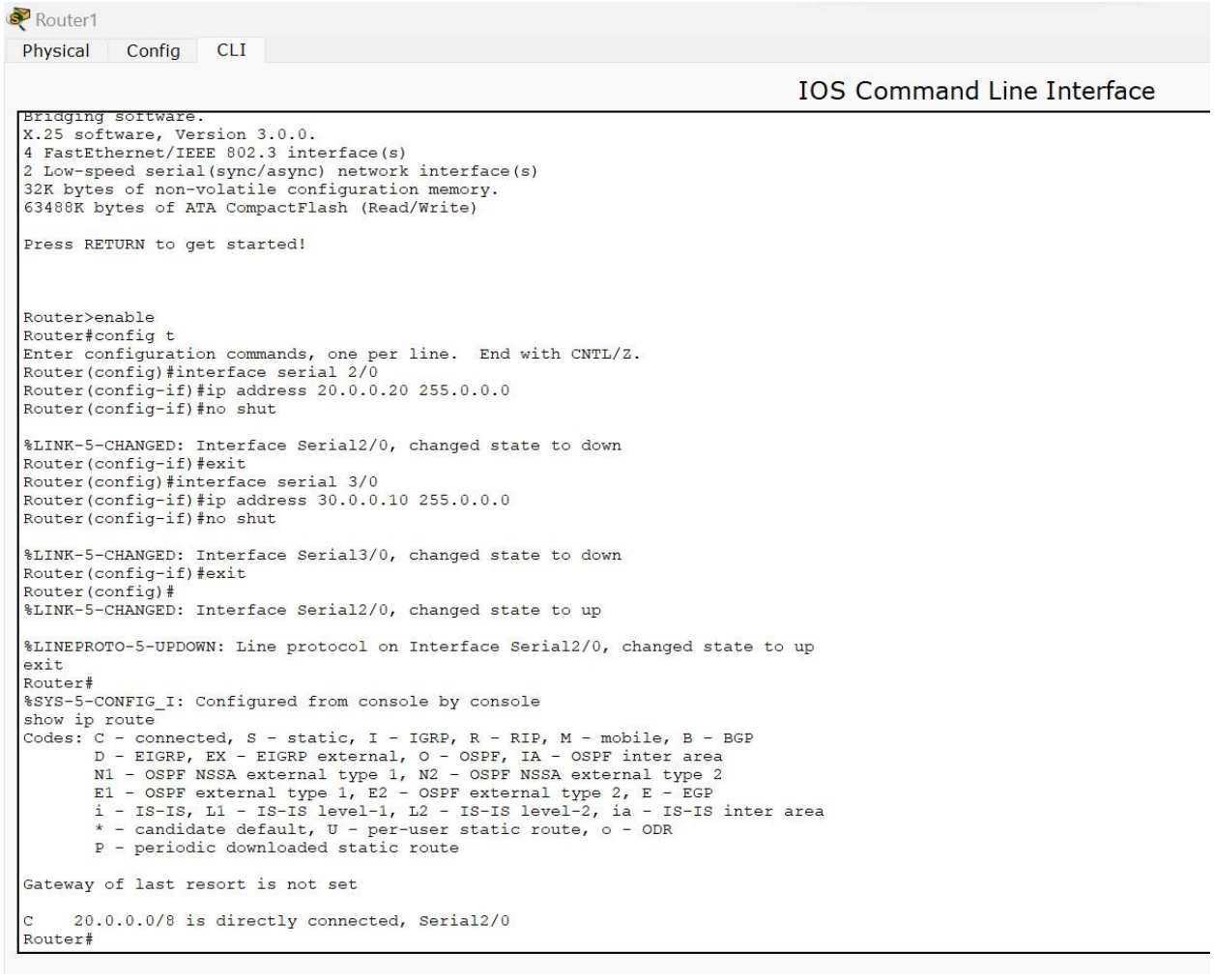
Router0

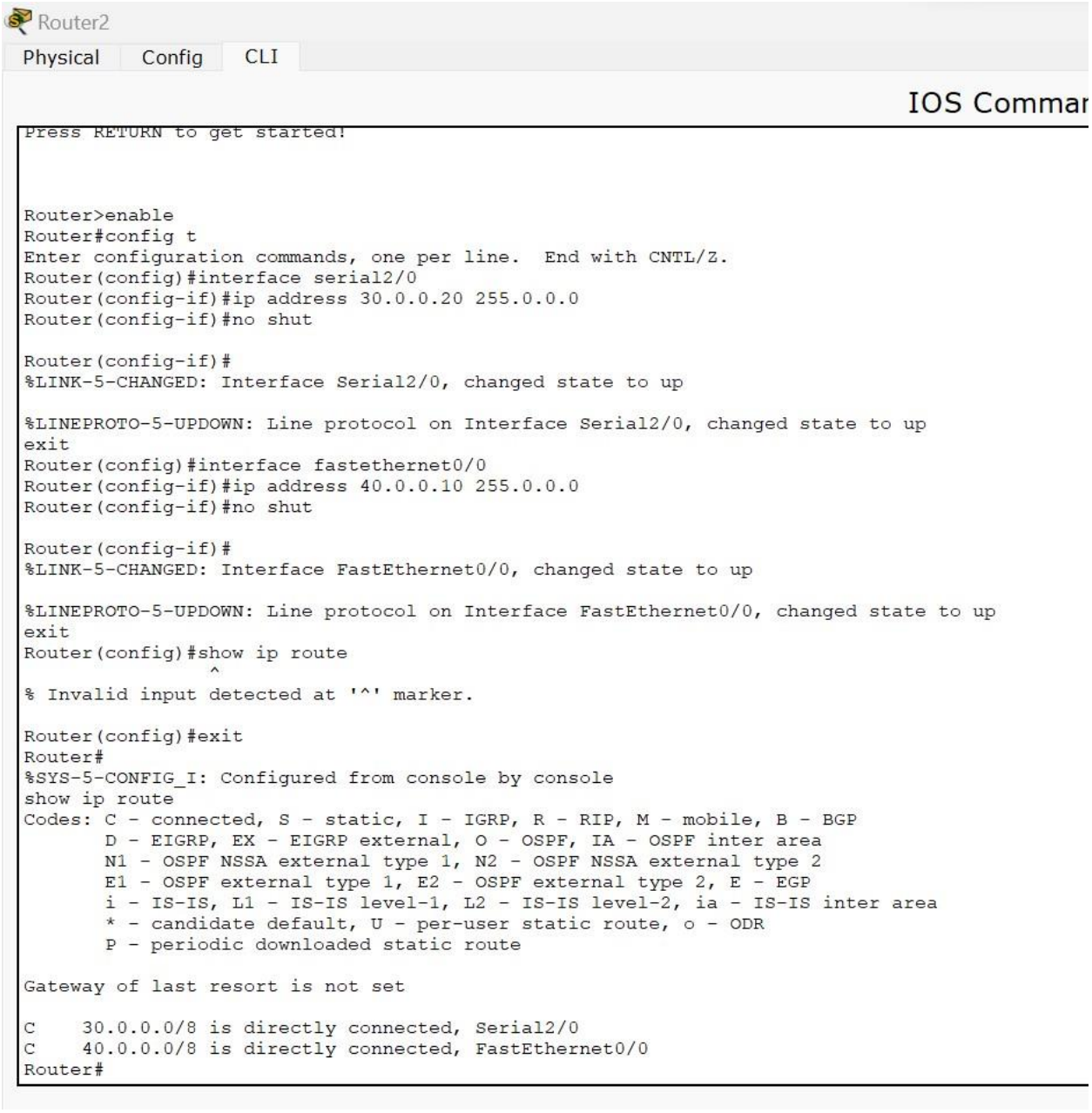
Physical | Config | CLI

IOS Command Line Interface

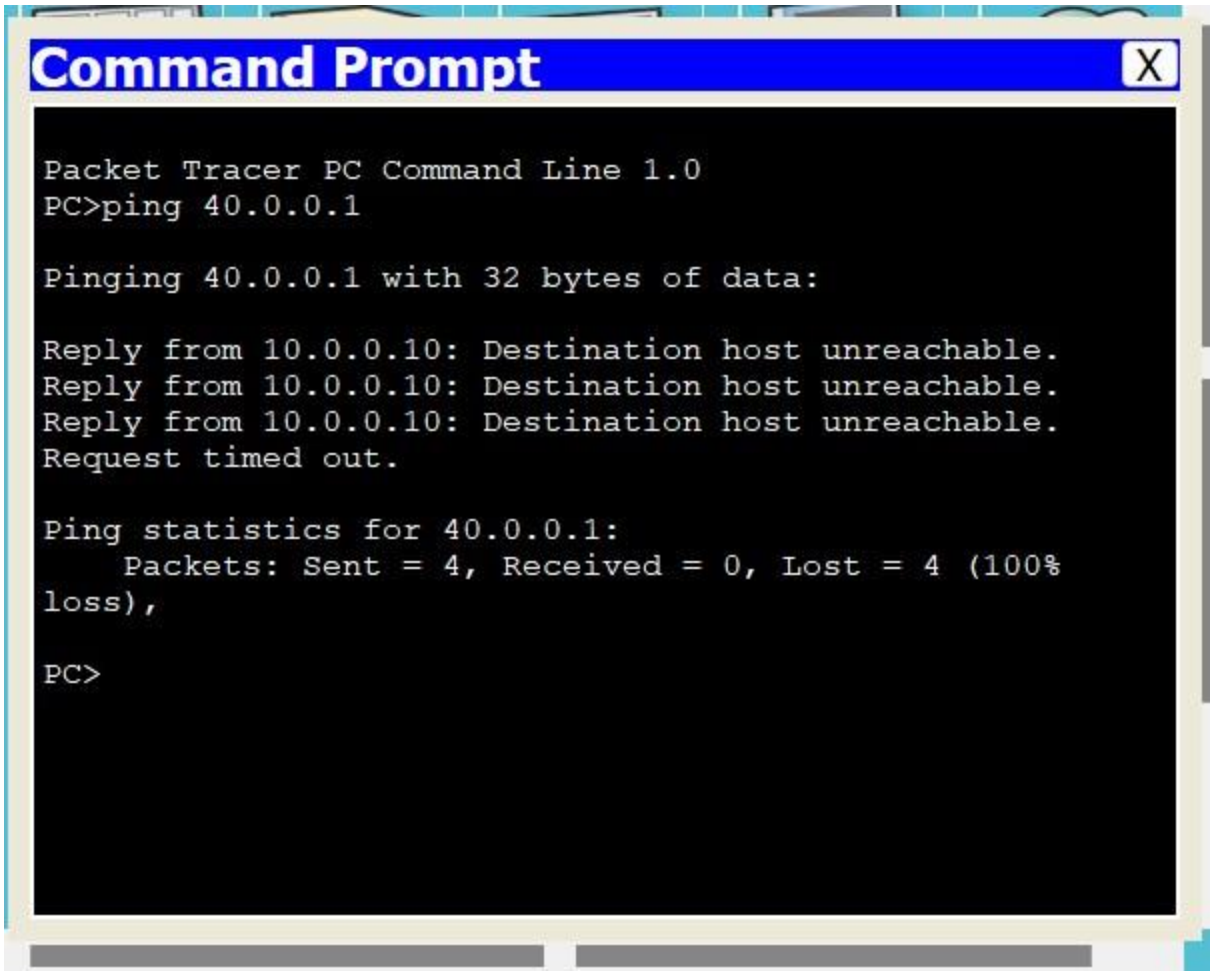
```
.
Processor board ID PT0123 (0123)
PT2005 processor: part number 0, mask 01
Bridging software.
X.25 software, Version 3.0.0.
4 FastEthernet/IEEE 802.3 interface(s)
2 Low-speed serial(sync/async) network interface(s)
32K bytes of non-volatile configuration memory.
63488K bytes of ATA CompactFlash (Read/Write)

Press RETURN to get started!



Router>n
Translating "n"...domain server (255.255.255.255)
% Unknown command or computer name, or unable to find computer address

Router>enable
Router#config t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#interface fastethernet0/0
Router(config-if)#ip address 10.0.0.10 255.0.0.0
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)#exit
Router#
```

```
Router#config t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#interface serial2/0
Router(config-if)#ip address 20.0.0.10 255.0.0.0
Router(config-if)#no shut

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
exit
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

C    10.0.0.0/8 is directly connected, FastEthernet0/0
C    20.0.0.0/8 is directly connected, Serial2/0
Router#
```


Router1
Physical
Config
CLI
IOS Command Line Interface
Bridging software.
X.25 software, Version 3.0.0.
4 FastEthernet/IEEE 802.3 interface(s)
2 Low-speed serial(sync/async) network interface(s)
32K bytes of non-volatile configuration memory.
63488K bytes of ATA CompactFlash (Read/Write)
Press RETURN to get started!
Router>enable
Router#config t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#interface serial 2/0
Router(config-if)#ip address 20.0.0.20 255.0.0.0
Router(config-if)#no shut
%LINK-5-CHANGED: Interface Serial2/0, changed state to down
Router(config-if)#exit
Router(config)#interface serial 3/0
Router(config-if)#ip address 30.0.0.10 255.0.0.0
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 Serial2/0, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial2/0, changed state to up
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
C 20.0.0.0/8 is directly connected, Serial2/0
Router#



Ping output before static routing:



Router 0 :

```
Router>enable
Router#config t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#ip route 30.0.0.0 255.0.0.0 20.0.0.20
```

```
Router(config)#ip route 40.0.0.0 255.0.0.0 20.0.0.20
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

C    10.0.0.0/8 is directly connected, FastEthernet0/0
C    20.0.0.0/8 is directly connected, Serial2/0
S    30.0.0.0/8 [1/0] via 20.0.0.20
S    40.0.0.0/8 [1/0] via 20.0.0.20
Router#
```

Router 1:

```
Router>enable
Router#config t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#ip route 10.0.0.0 255.0.0.0 20.0.0.10
Router(config)#ip route 40.0.0.0 255.0.0.0 30.0.0.20
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 20.0.0.10
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 30.0.0.20
Router#
```

Router 2:

```
Router>enable
Router#config t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#ip route 10.0.0.0 255.0.0.0 30.0.0.10
Router(config)#ip route 20.0.0.0 255.0.0.0 30.0.0.10
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 30.0.0.10
S    20.0.0.0/8 [1/0] via 30.0.0.10
C    30.0.0.0/8 is directly connected, Serial2/0
C    40.0.0.0/8 is directly connected, FastEthernet0/0
Router#
```

Ping output after static routing:

```
PC>ping 40.0.0.1

Pinging 40.0.0.1 with 32 bytes of data:

Request timed out.
Reply from 40.0.0.1: bytes=32 time=2ms TTL=125
Reply from 40.0.0.1: bytes=32 time=2ms TTL=125
Reply from 40.0.0.1: bytes=32 time=2ms TTL=125

Ping statistics for 40.0.0.1:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
Approximate round trip times in milli-seconds:
    Minimum = 2ms, Maximum = 2ms, Average = 2ms

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=35ms TTL=125
Reply from 40.0.0.1: bytes=32 time=4ms TTL=125
Reply from 40.0.0.1: bytes=32 time=27ms TTL=125
Reply from 40.0.0.1: bytes=32 time=13ms 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 = 4ms, Maximum = 35ms, Average = 19ms

PC>
```

Observation :

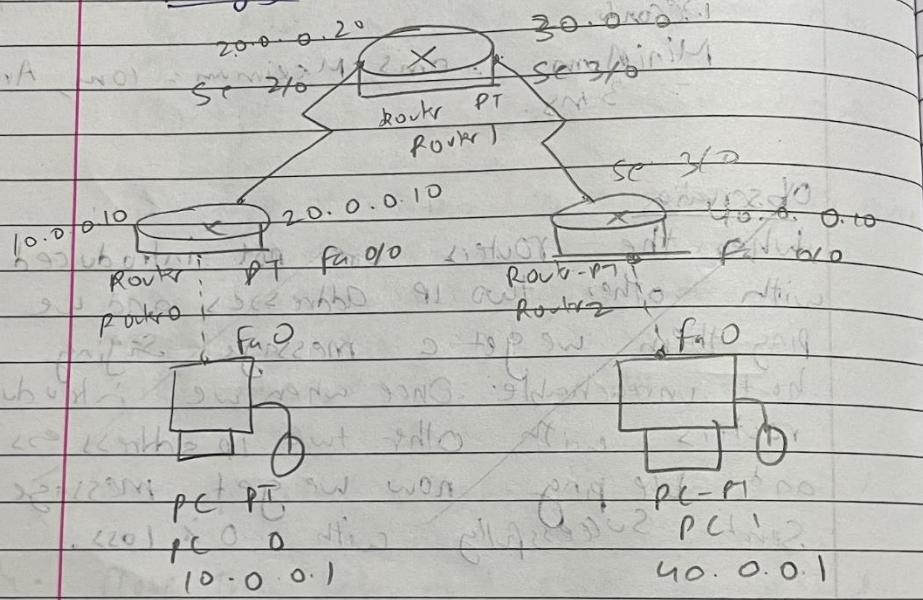
Date / /
Page

Experiment - 3

Aim

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

Topology



procedure

1. Connect 2 PC's and 3 routers using copper cross over cable for PC to router & Serial DCE cable to connect router to rater.

2. Set IP address of both PC's and their gateway number.

3. Now for setting IP address & gateway number to routers

Select a router and perform the follow commands.

① type No and press enter
② type enable and press enter
③ type config and press enter
④ type interface fast ethernet 0/0 press enter.
⑤ type IP address 10.0.0.10 255.0.0.0 & press enter
⑥ type no shut & press enter
⑦ type exit
⑧ typer interface se 2/0 & press en
⑨ type IP address 20.0.0.10 255. & press enter
⑩ type no shut and press enter.
⑪ type exit
⑫ type exit

4. Repeat these commands for other t routers as well with their respective gateway address

5. Now to introduce other two IP addresses in the first router follow these steps:
① type config t and press enter.
② type IP router 20.0.0.0 255 20.0.0.20
③ type IP router 40.0.0.0 255.0. 20.0.0.20
④ type exit
⑤ type exit

6. Repeat same steps for other two routers with their appropriate addresses.

7. Go to command prompt of PC 0 & config tab and ping the second PC, PC1.

Ping output

Output 1:

```
PC> ping 40.0.0.1
Pinging 40.0.0.1 with 32 bytes of data.
Reply from 10.0.0.1: Destination host unreachable
Reply from 10.0.0.1: Destination host unreachable
Reply from 10.0.0.1: Destination host unreachable
Request timed out.
Ping statistics for 40.0.0.1:
Packets: sent=4, Recieved=0, Lost=4 (100% loss)
```

Output 2:

```
PC> ping 10.0.0.1
Pinging with 32 bytes of data.
Reply from 10.0.0.1: bytes=32 time=2ms TTL=125
Reply from 10.0.0.1: bytes=32 time=2ms TTL=125
Reply from 10.0.0.1: bytes=32 time=2ms TTL=125
Reply from 10.0.0.1 bytes=32 time=2ms TTL=125
Ping Statistics for 10.0.0.1:
Packets: Sent=4, Recieved=4, Lost=0 (0% loss)
Approximate round trips times in milli seconds.
Minimum=2ms, Maximum=8ms, Average=3ms
```

Date / /
Page

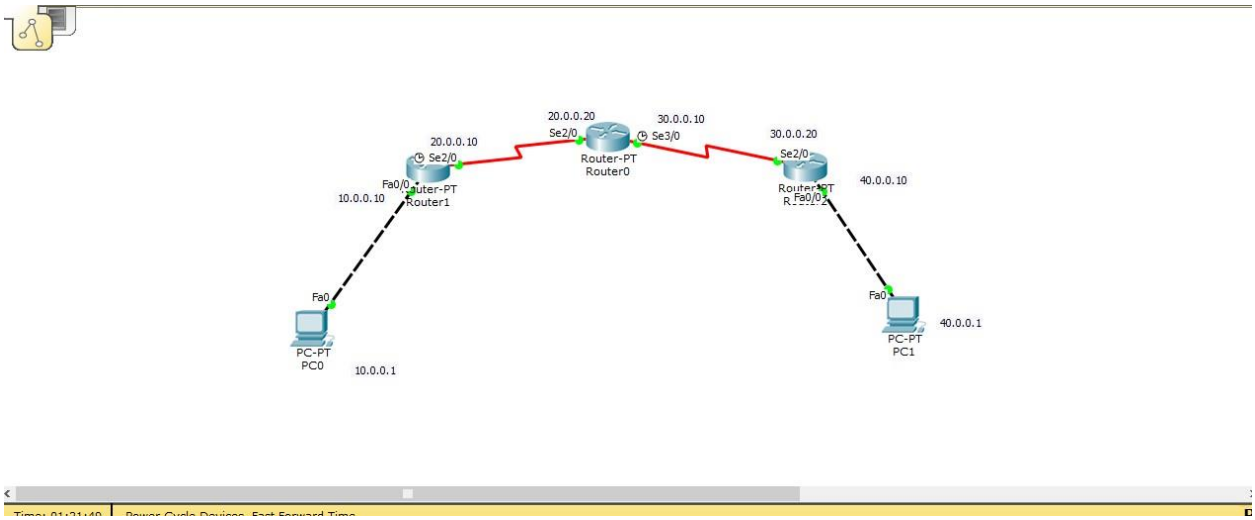
Observation

When the routers are not introduced with other two IP addresses and we ping them, we get a message saying host unreachable. Once when we introduce routers with other two IP addresses and we ping now we get message sent Sucessfully with 0% loss.

Experiment 3

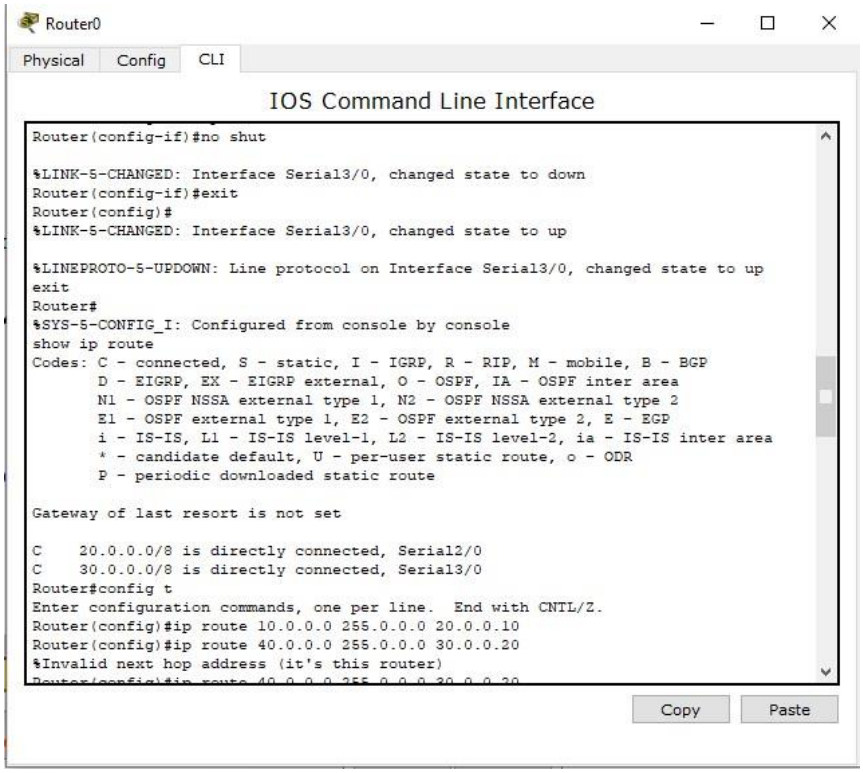
Aim: Configure default route, static route to the Router

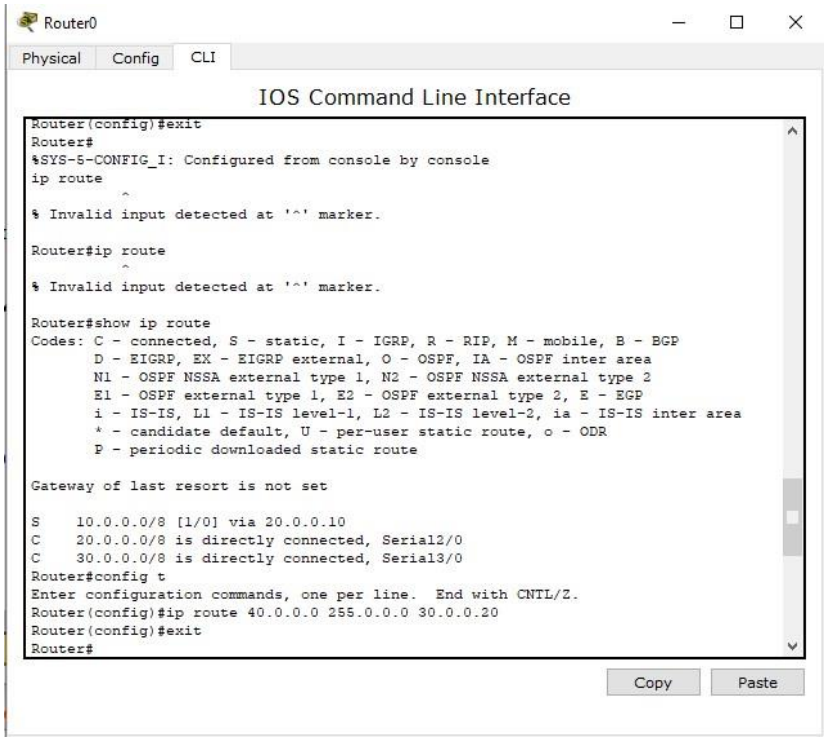
Topology :



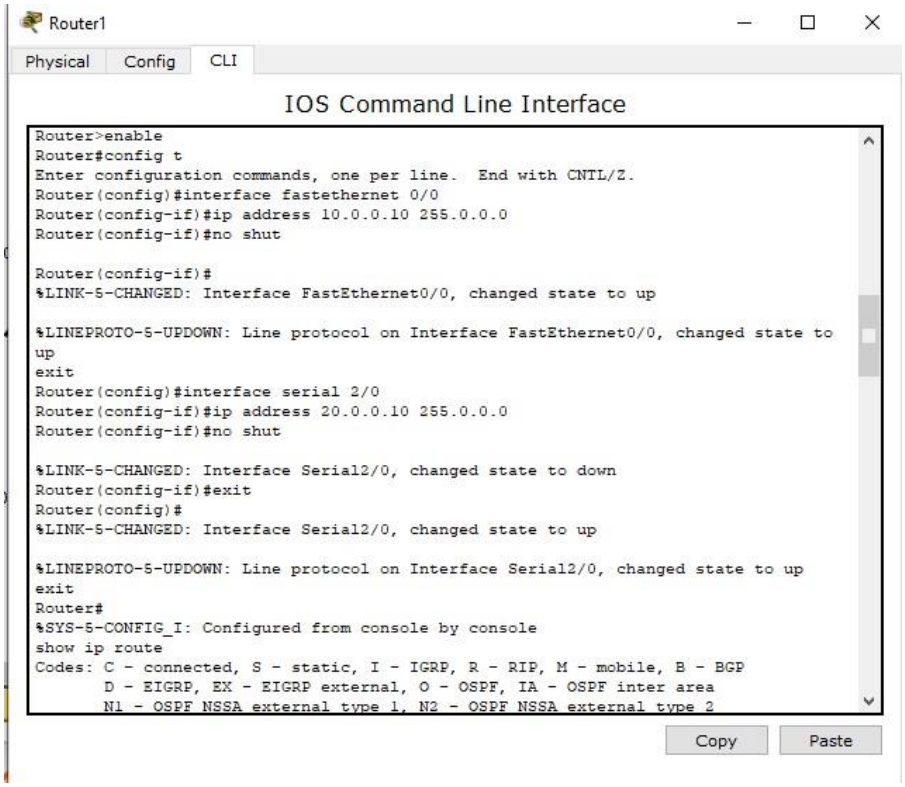
Configurations:

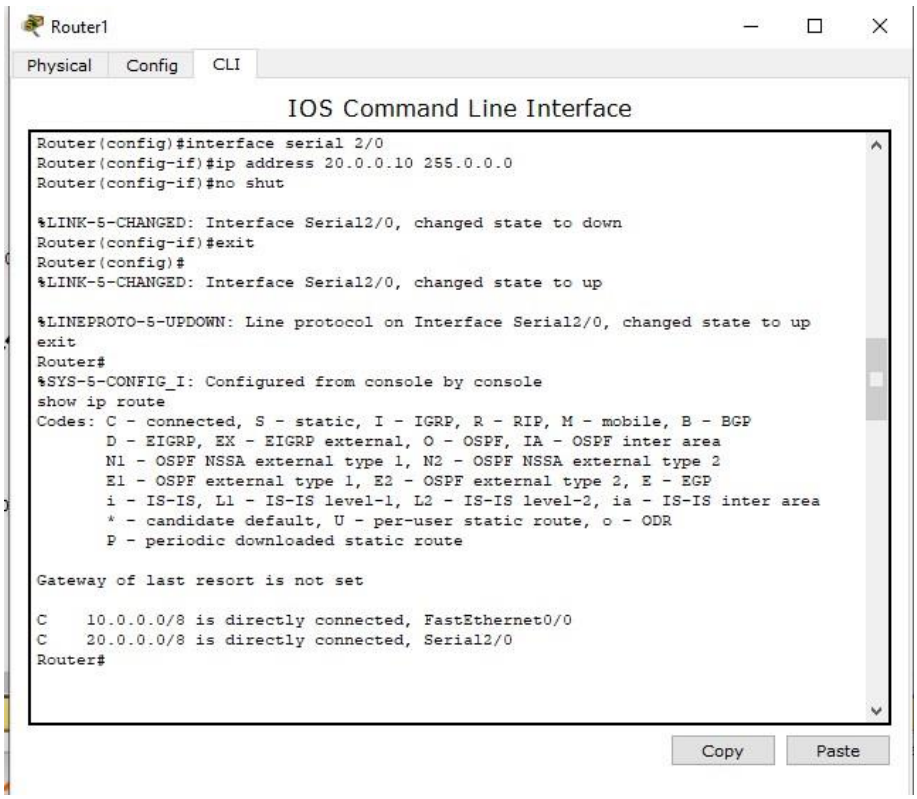
Roter 0 :


Router0
Physical
Config
CLI
IOS Command Line Interface
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
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
C 20.0.0.0/8 is directly connected, Serial2/0
C 30.0.0.0/8 is directly connected, Serial3/0
Router#config t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#ip route 10.0.0.0 255.0.0.0 20.0.0.10
Router(config)#ip route 40.0.0.0 255.0.0.0 30.0.0.20
%Invalid next hop address (it's this router)
Copy
Paste

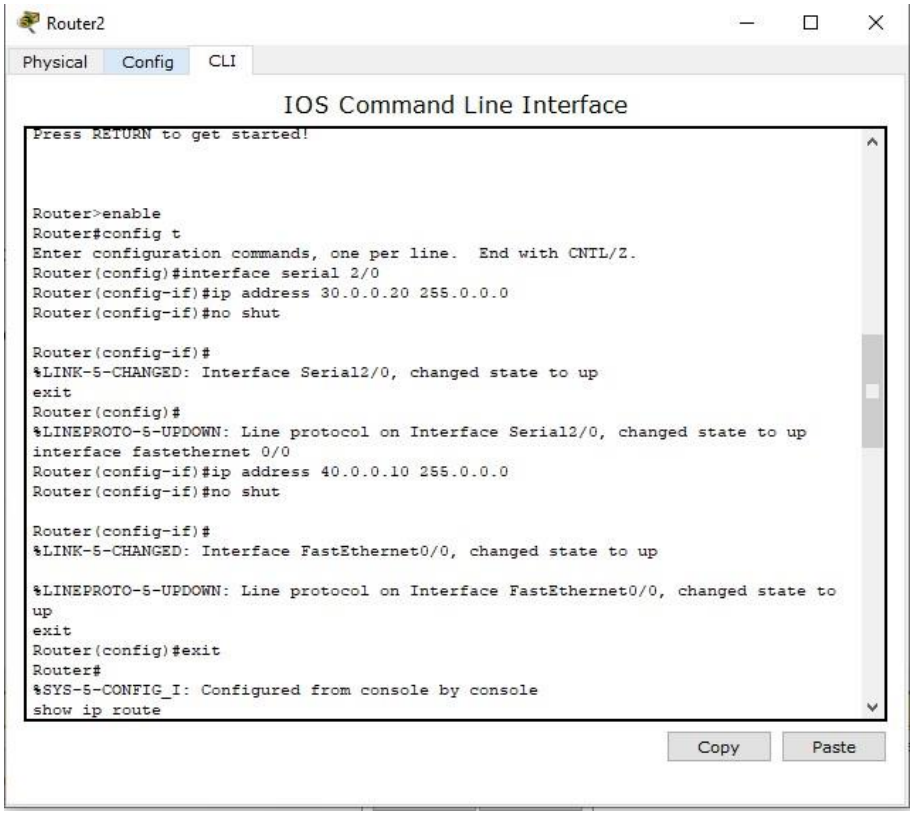

Router0
Physical
Config
CLI
IOS Command Line Interface
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console
ip route
^
% Invalid input detected at '^' marker.
Router#ip route
^
% Invalid input detected at '^' marker.
Router#show ip route
Codes: C - connected, S - static, I - 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
S 10.0.0.0/8 [1/0] via 20.0.0.10
C 20.0.0.0/8 is directly connected, Serial2/0
C 30.0.0.0/8 is directly connected, Serial3/0
Router#config t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#ip route 40.0.0.0 255.0.0.0 30.0.0.20
Router(config)#exit
Router#
Copy
Paste

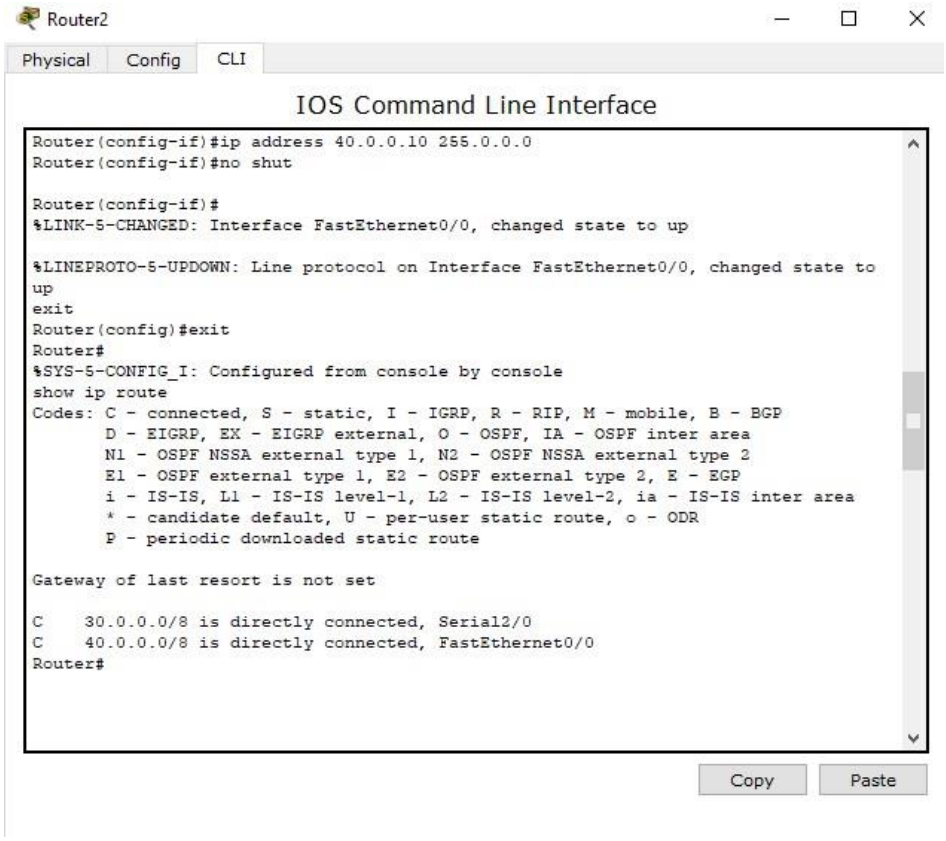
Roter 1 :


Router1
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 fastethernet 0/0
Router(config-if)#ip address 10.0.0.10 255.0.0.0
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 serial 2/0
Router(config-if)#ip address 20.0.0.10 255.0.0.0
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
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
Copy
Paste

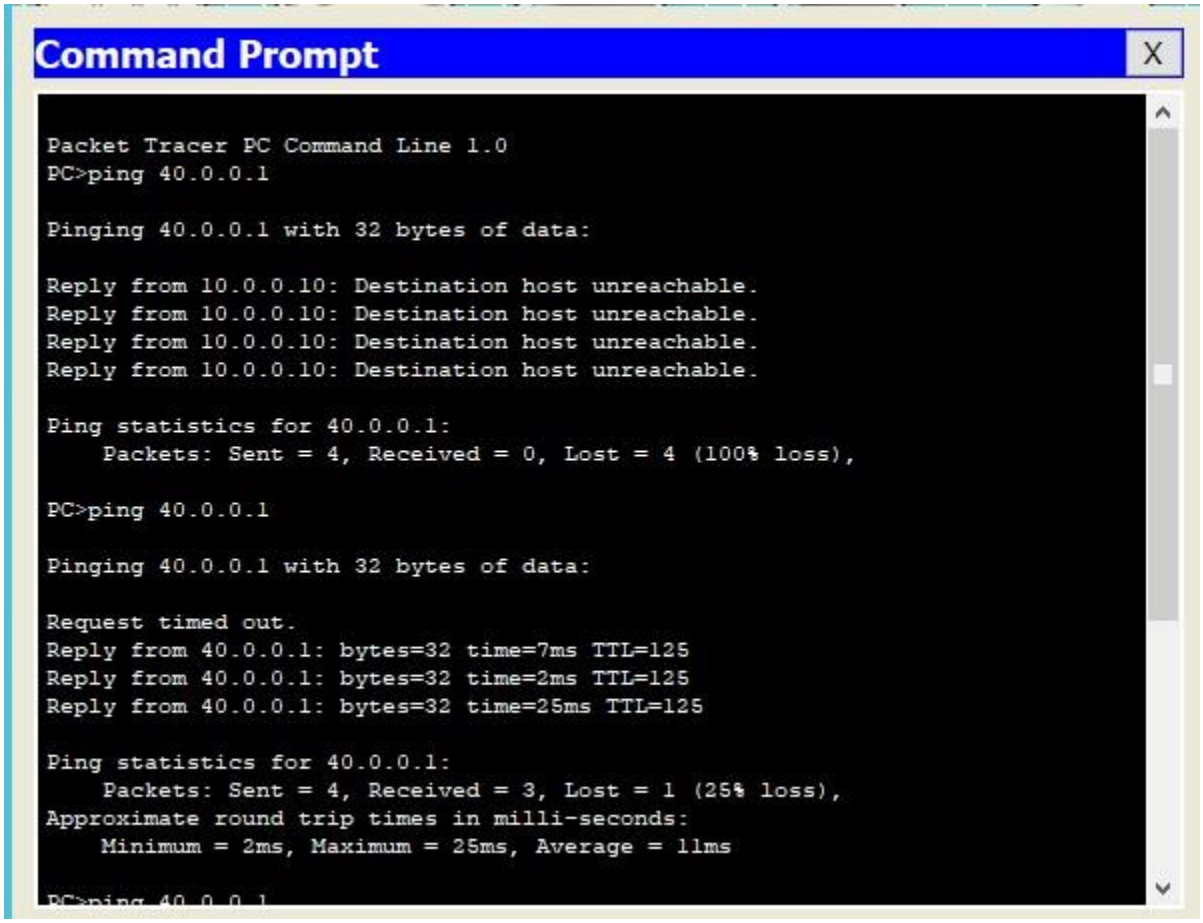

Router1
Physical
Config
CLI
IOS Command Line Interface
Router(config)#interface serial 2/0
Router(config-if)#ip address 20.0.0.10 255.0.0.0
Router(config-if)#no shut
%LINK-5-CHANGED: Interface Serial2/0, changed state to down
Router(config-if)#exit
Router(config)#
%LINK-5-CHANGED: Interface Serial2/0, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial2/0, changed state to up
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
C 10.0.0.0/8 is directly connected, FastEthernet0/0
C 20.0.0.0/8 is directly connected, Serial2/0
Router#
Copy
Paste

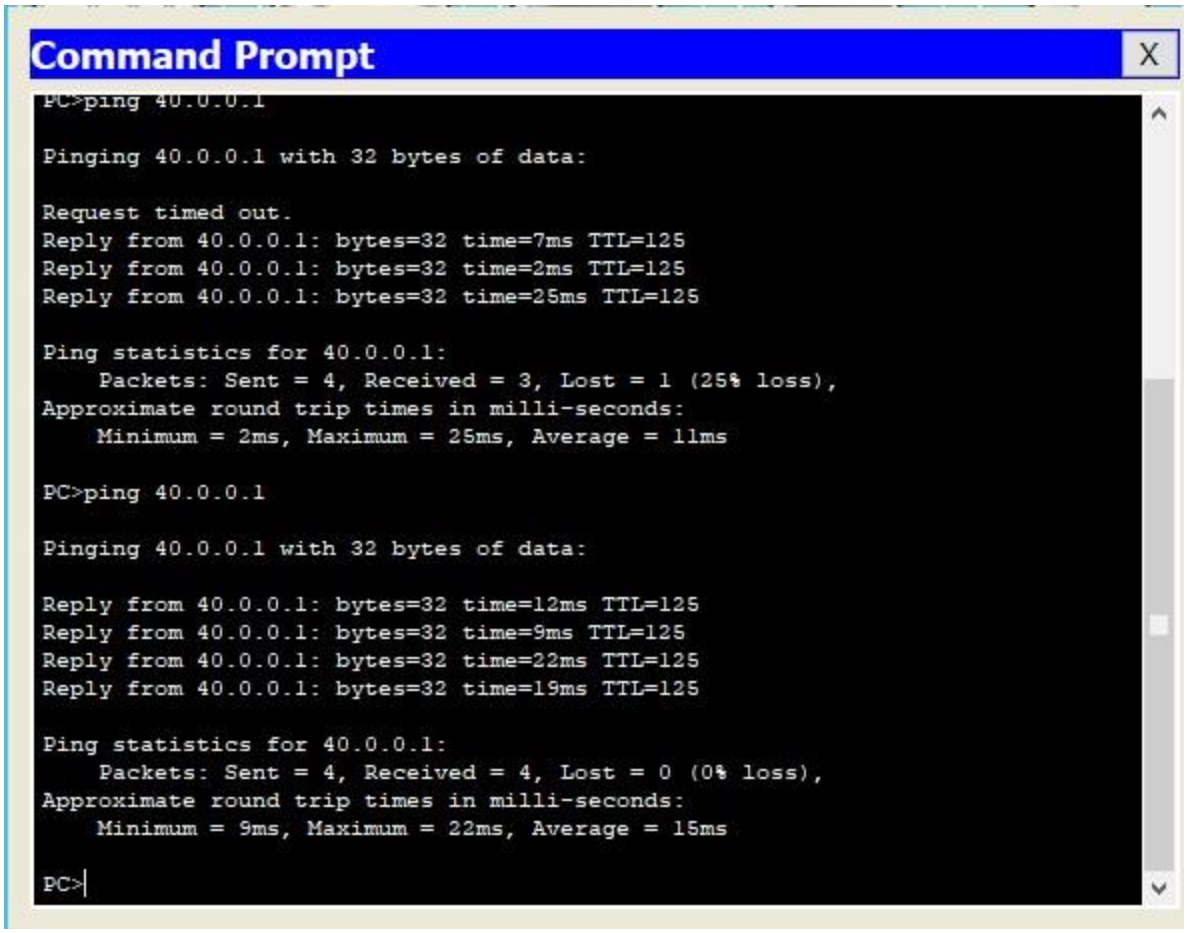
Roter 2 :


Router2
Physical
Config
CLI
IOS Command Line Interface
Press RETURN to get started!
Router>enable
Router#config t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#interface serial 2/0
Router(config-if)#ip address 30.0.0.20 255.0.0.0
Router(config-if)#no shut
Router(config-if)#
%LINK-5-CHANGED: Interface Serial2/0, changed state to up
exit
Router(config)#
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial2/0, changed state to up
interface fastethernet 0/0
Router(config-if)#ip address 40.0.0.10 255.0.0.0
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)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console
show ip route
Copy
Paste


Router2
Physical
Config
CLI
IOS Command Line Interface
Router(config-if)#ip address 40.0.0.10 255.0.0.0
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)#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
C 30.0.0.0/8 is directly connected, Serial2/0
C 40.0.0.0/8 is directly connected, FastEthernet0/0
Router#
Copy
Paste

Ping Output:


Command Prompt
X
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 10.0.0.10: Destination host unreachable.
Reply from 10.0.0.10: Destination host unreachable.
Reply from 10.0.0.10: Destination host unreachable.
Reply from 10.0.0.10: 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:
Request timed out.
Reply from 40.0.0.1: bytes=32 time=7ms TTL=125
Reply from 40.0.0.1: bytes=32 time=2ms TTL=125
Reply from 40.0.0.1: bytes=32 time=25ms TTL=125
Ping statistics for 40.0.0.1:
Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
Approximate round trip times in milli-seconds:
Minimum = 2ms, Maximum = 25ms, Average = 11ms



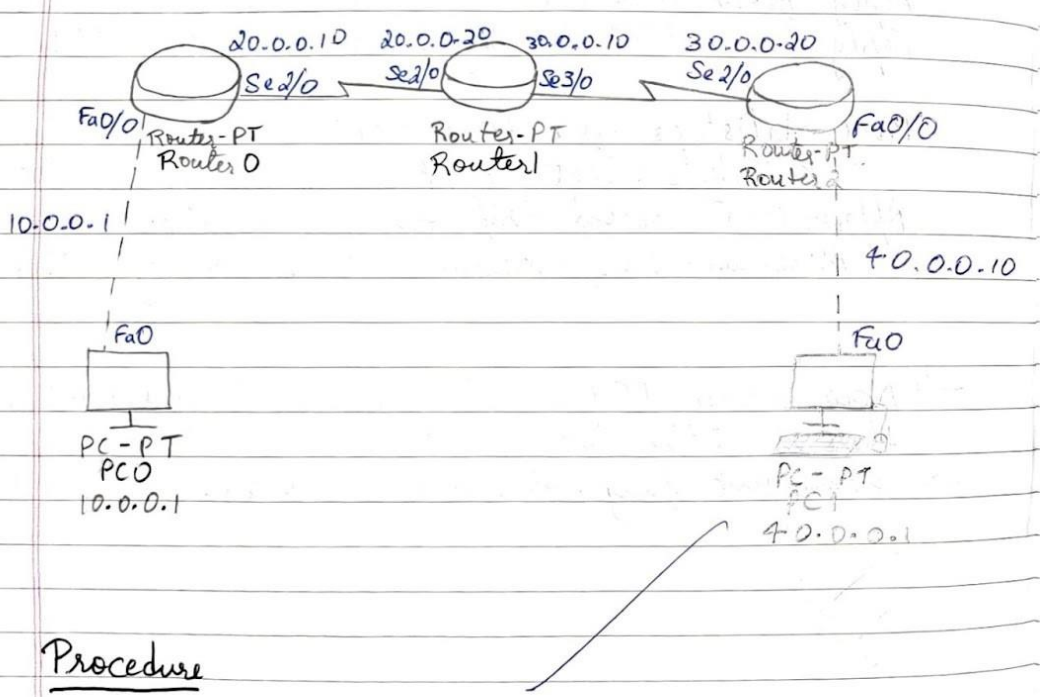
Observation:

13/7/'23

Lab 3 :

Aim: Configure default route, static route to the Router.

Topology :



Procedure

→ Create the same topology as 2B experiment.

→ Setup IP address of PC0 & PC1

PC0 → 10.0.0.1

PC1 → 40.0.0.1

config → Fastethernet0 → IP address

→ Config IP address of Router 0, Router1 & Router 2 following steps in 2B experiment.

→ Setup Gateway for PC0 & PC1 :

PC0 : 10.0.0.10

PC1 : 40.0.0.10

→ Setup static routing for Router1 ~~and Router 2~~ following steps in 2B experiment

→ For Router 0 and Router 2, we will setup default routing.

Router 0:

Router(config) # ip route 0.0.0.0 0.0.0.0 20.0.0.20

Router # show ip route

C 10.0.0.0/8 is directly connected, FastEthernet0/0
C 20.0.0.0/8 is directly connected,
S* 0.0.0.0/0 [1/0] via 20.0.0.20

Router 2.

Router(config) # ip route 0.0.0.0 0.0.0.0 30.0.0.10

Router # Show ip route

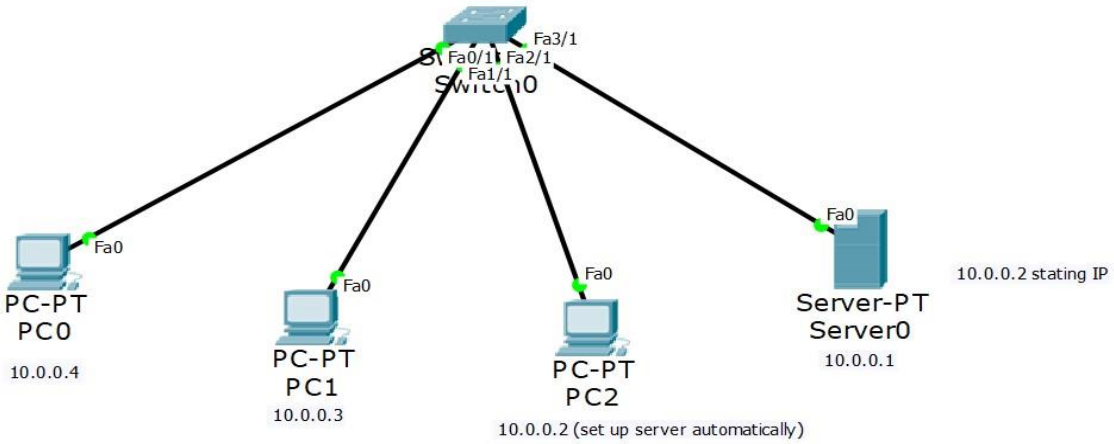
C 30.0.0.0/8 is directly connected, Serial 2/0
C 40.0.0.0/8 is directly connected, FastEthernet 0/0
S* 0.0.0.0/0 [1/0] via 30.0.0.10

Experiment 4

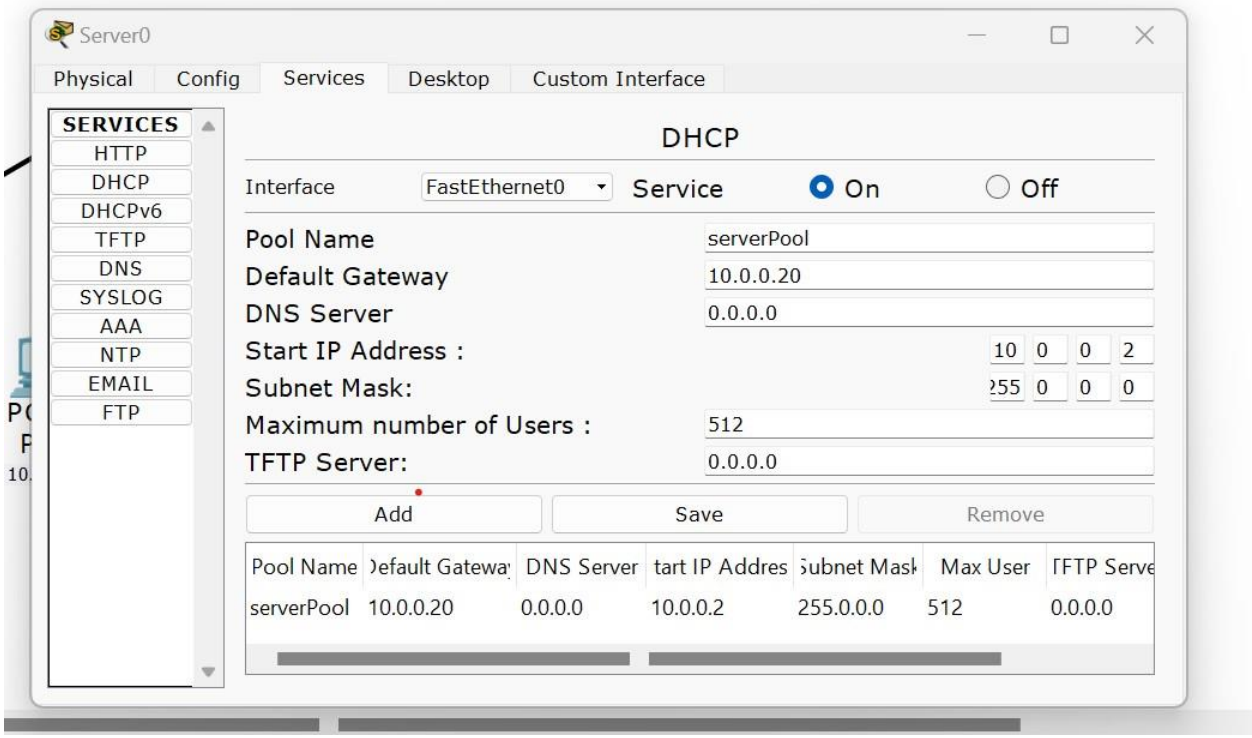
Aim: Configure DHCP within a LAN and outside LAN.

4A: Within a LAN.

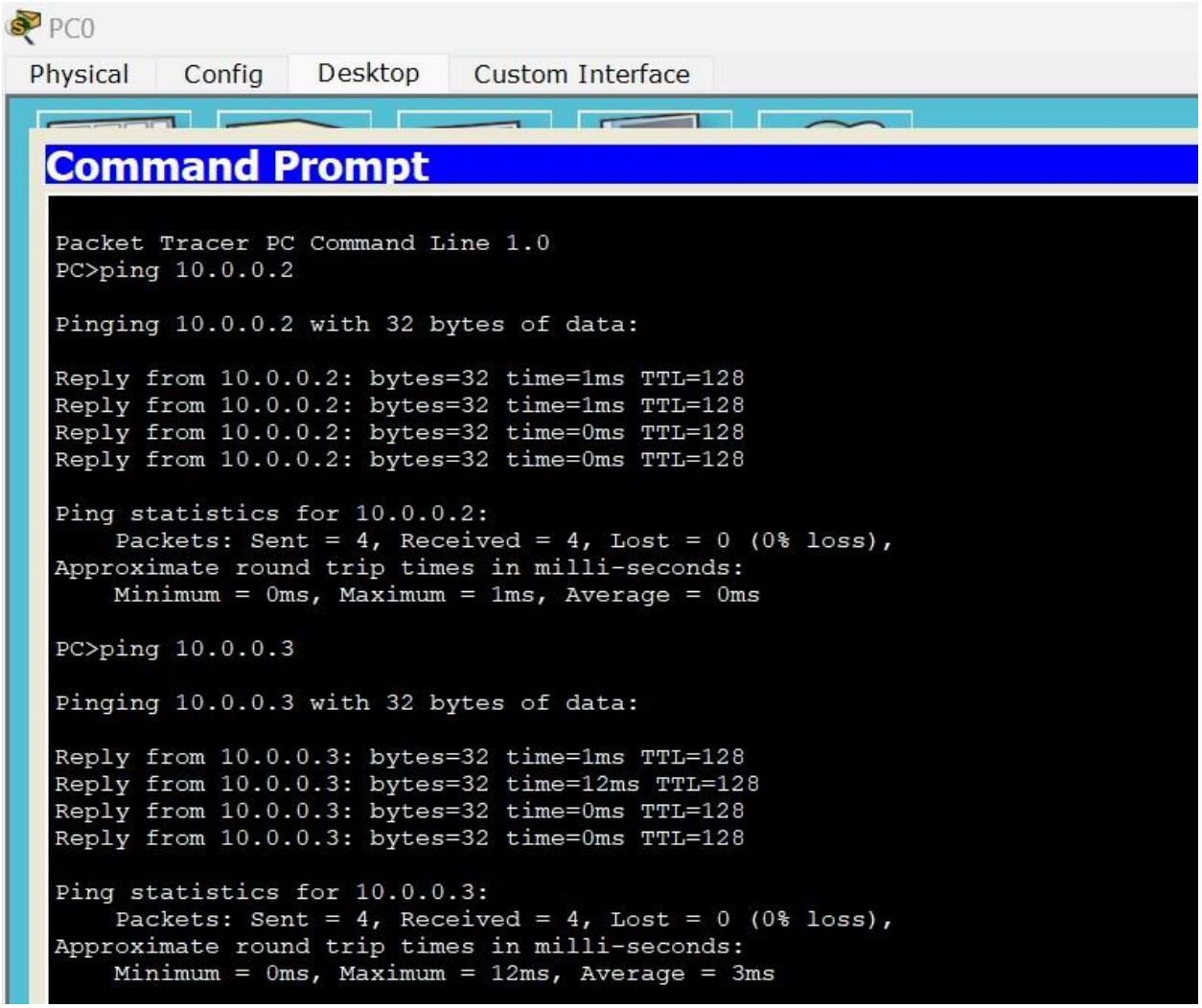
Topology :



Server 0 :



Ping Output :



Observation :

Date __/__/__
Page _____

① Enable
② configt
③ interface fast ethernet 0/0.
④ ip address 10.0.0.10 255.0.0.0
⑤ No shut
⑥ Exit
⑦ Interface se 2/0
⑧ ip address 20.0.0.10 255.0.0.0
⑨ No shut
⑩ Exit

4. Repeat these commands for other two routers.

5. For router 1, set ip route of its adjacent routers statically
① configt
② ip route 10.0.0.0 255.0.0.0 20.0.0.10
③ ip route 40.0.0.0 255.0.0.0 30.0.0.20
④ exit
⑤ exit
⑥ show ip route (to view route table).

6. We set default ip routes (to view route table. to router 0 & router 2 which tells it can access any ip address with any subnet mask address.

7. Set default ip route by following commands.
① config t
② ip route 0.0.0.0
③ ip route 0.0.0.0

8- Go to pc0 command prompt & give ping to send message

Ping output

PC> ping 40.0.0.1

Pinging 40.0.0.1 with 32 bytes of data:

Request timed out.
Reply from 40.0.0.1: bytes=32 time=2ms TTL=128
Reply from 40.0.0.1: bytes=32 time=2ms TTL=128
Reply from 40.0.0.1: bytes=32 time=2ms TTL=128

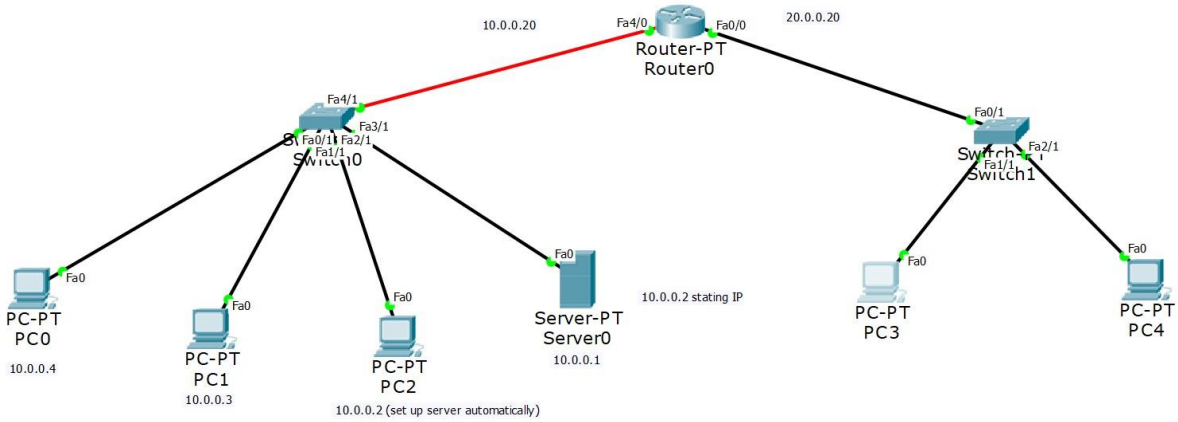
Ping statistics for 40.0.0.1
Packets: Sent=4, Received=3, Lost=1 (25% loss)
Approximate round trip time in milli seconds:
Minimum = 2ms, Maximum = 9ms, Average = 4ms

Observation

A default is given to routers which takes effect when no other route is available for an IP address destination if packets is recieved, default first checks IP destination address, if it is not available it check if routing table packet is forwarded to next hop towards destination process repeats until packet is delivered

4B: Outside a LAN.

Topology :

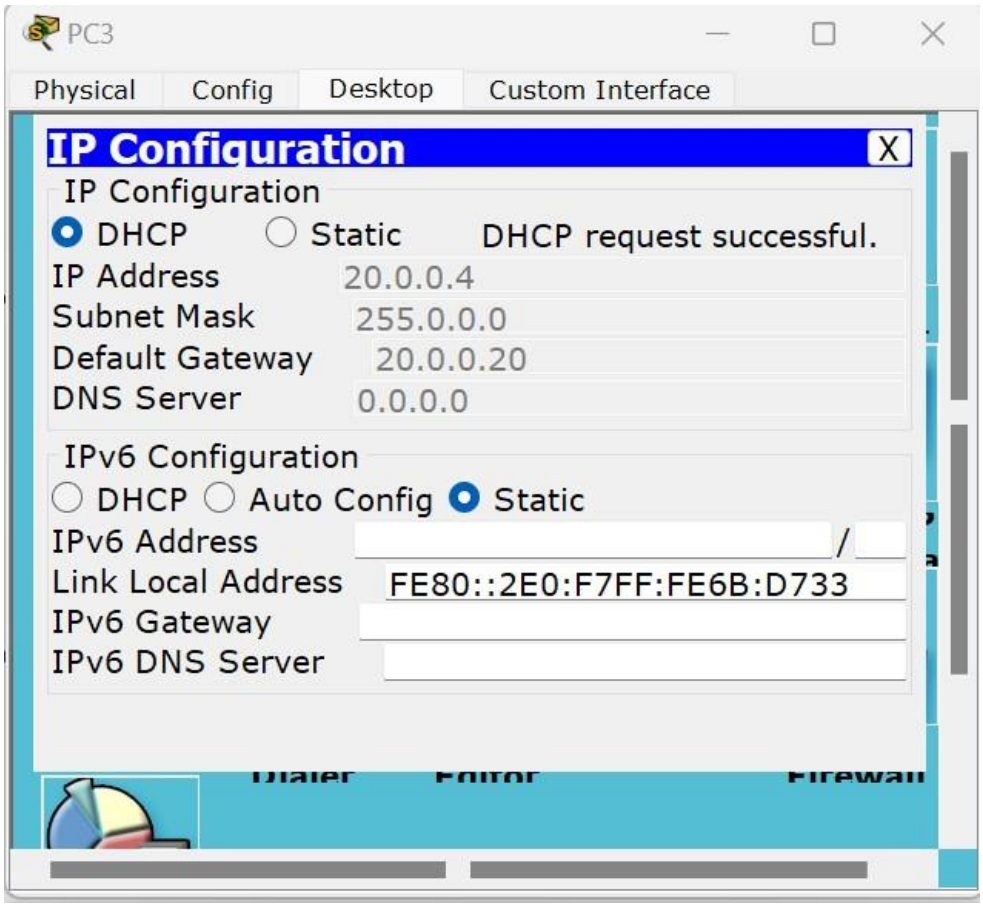


Configurations :

Router 0 :

```
Router#config t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#interface serial2/0
Router(config-if)#ip address 20.0.0.10 255.0.0.0
Router(config-if)#no shut

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
exit
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

C    10.0.0.0/8 is directly connected, FastEthernet0/0
C    20.0.0.0/8 is directly connected, Serial2/0
Router#
```

Automation IP is assigned in the PCs by Server 0 via DHCP:



Ping Output :

```
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=0ms 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 = 1ms, Average = 0ms
```

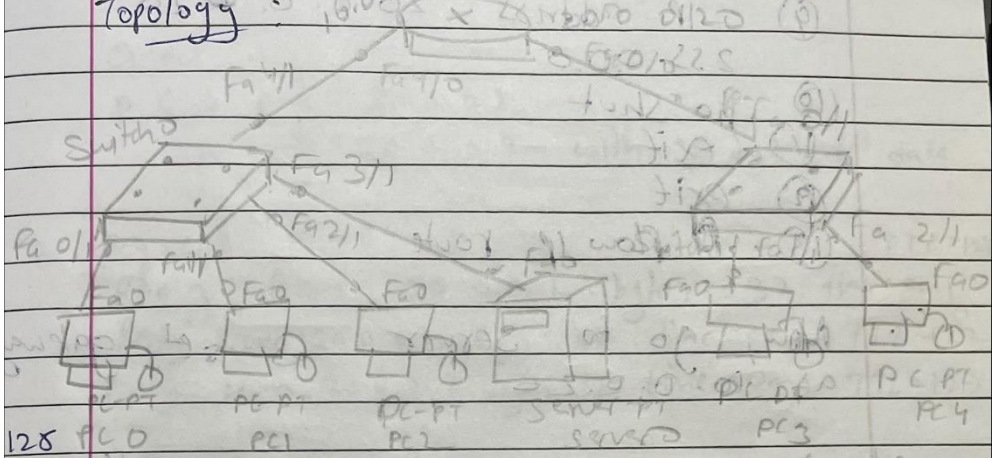
Observation :

Experiment :- 6

Date / /
Page

Aim
Configure DHCP within a LAN and outside Lan.

Topology :



Precudure

1. Add a router, a switch, 2 pc's to praias program. Connect the router to both switches.

2. Set the server IP address of server and with help of server set the first 3 pc's IP address through DHCP.

3. Now set router IP address with following commands
   1. No
   2. enable
   3. config
   4. interface fastethernet 4/0

(5) ip address 10.0.0.20 255.0.0.0
(6) no shut
(7) exit
(8) interface fast ethernet 0/0
(9) ip address 20.0.0.20
255.00.0
(10) no shut
(11) exit
(12) exit
(13) flow ip route

4. Now, go to server & set gateway as 10.0.0.20

5) Again go to router CLI & follow commands
(1) config
(2) interface fast ethernet 0/0
(3) ip helper-address
(4) no shut
(5) exit

6) Now, go to Server services & add on man- pool name as Server pool & start IP address as 20.0.0.2 & defaut gateway as 20.0.0.20.

7) Now set other two PC's IP address by going to their Desktop -> IP config & select DHCP which will automatically generate its IP address

Date __/__/__
Page

8| Now the network is complete & ready to serial packets from pc to other by typing ping address in command prompt

Output :-

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 = 0ms TTL = 127

Ping statistics for 20.0.0.2:-

Packets Sent = 4, Received = 3 lost = 1 (25% loss)

Approximate round trip times in milliseconds.

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

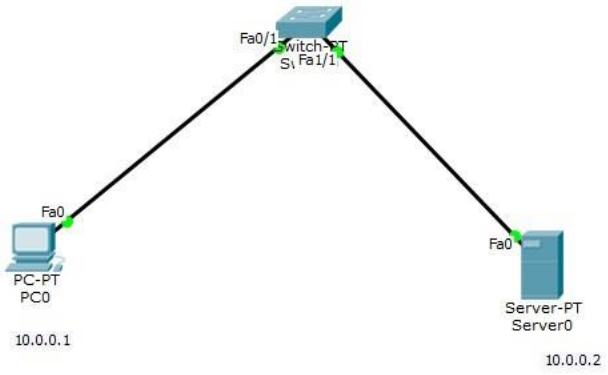
Observation

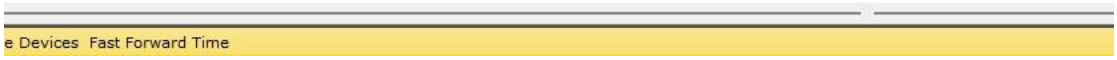
DHCP is used to assign IP addresses dynamically to different devices. To assign continuous IP address we create a server pool where assign the starting IP address and default gateway number. For PC's under different switches we create a different server pool again and start. This takes care of delivering the packets to correct destination IP address & also sends back ack to initial device.

Experiment 5

Aim : Configure Web Server, DNS within a LAN.

Topology :





Observation:

Date __/__/__
Page

6) Go to PC Web browser and type 10.0.0.2

7) Go to server Services -> DNS & switch on DNS services. Now add a Domain name & its IP address which is 10.0.0.2. Press add & save it

8) Go to PC web browser & type the domain name given & click go.

Output:

Web Browser

< > URL http://revu Go Stop

My CV

Archit Mehrotra

USN: 1BM21CS031

Languages C/C++/Java

Image

Date __/__/__
Page

6) Go to PC Web browser and type 10.0.0.2

7) Go to server Services -> DNS & switch On DNS services. Now add a Domain name & its IP address which is 10.0.0.2. Press add & save it

8) Go to PC web browser & type the domain name given & click go.

Output:

Web Browser

< > URL http://revu Go Stop

My CV

Archit Mehrotra

USN: 1BM21CS031

Languages C/C++/Java

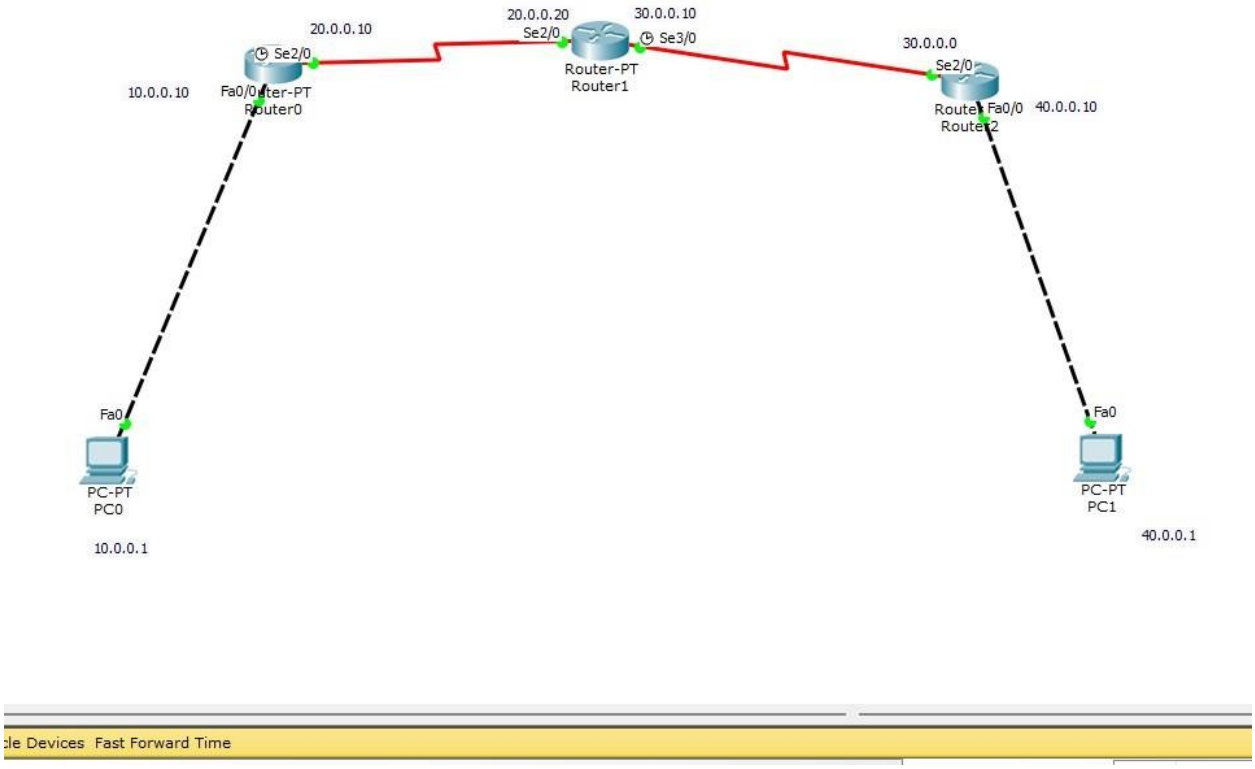
Image

31/8/22

Experiment 6

Aim: Configure RIP routing Protocol in Routers.

Topology :



Configuration:

Ping Outputs:

P0:

IOS Command Line Interface

```
Router>enable
Router#config t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#interface fastethernet0/0
Router(config-if)#ip address 10.0.0.10 255.0.0.0
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 serial2/0
Router(config-if)#ip address 20.0.0.10 255.0.0.0
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)#router rip
Router(config-router)#network 10.0.0.0
Router(config-router)#network 20.0.0.0
Router(config-router)#exit
```

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```
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 20.0.0.20 to network 0.0.0.0

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       20.0.0.20/32 is directly connected, Serial2/0
R    30.0.0.0/8 [120/1] via 20.0.0.20, 00:00:06, Serial2/0
R    40.0.0.0/8 [120/2] via 20.0.0.20, 00:00:06, Serial2/0
R*   0.0.0.0/0 [120/1] via 20.0.0.20, 00:00:06, Serial2/0
Router#
```

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Router1

Physical | Config | CLI

IOS Command Line Interface

```
Router#config t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#interface serial2/0
Router(config-if)#ip address 20.0.0.20
% Incomplete command.
Router(config-if)#ip address 20.0.0.20 255.0.0.0
Router(config-if)#encapsulation ppp
Router(config-if)#no shut

Router(config-if)#
%LINK-5-CHANGED: Interface Serial2/0, changed state to up
exi
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial2/0, changed state to up
exit
                     ^
% Invalid input detected at '^' marker.

Router(config-if)#interface serial3/0
Router(config-if)#ip address 30.0.0.10
% Incomplete command.
Router(config-if)#ip address 30.0.0.10 255.0.0.0
Router(config-if)#encapsulate ppp
                              ^
% Invalid input detected at '^' marker.

Router(config-if)#encapsulation ppp
Router(config-if)#clock rate 64000
Router(config-if)#no shut
```

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Router1

Physical | Config | CLI

IOS Command Line Interface

```
Router(config-if)#encapsulate ppp
                              ^
% Invalid input detected at '^' marker.

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

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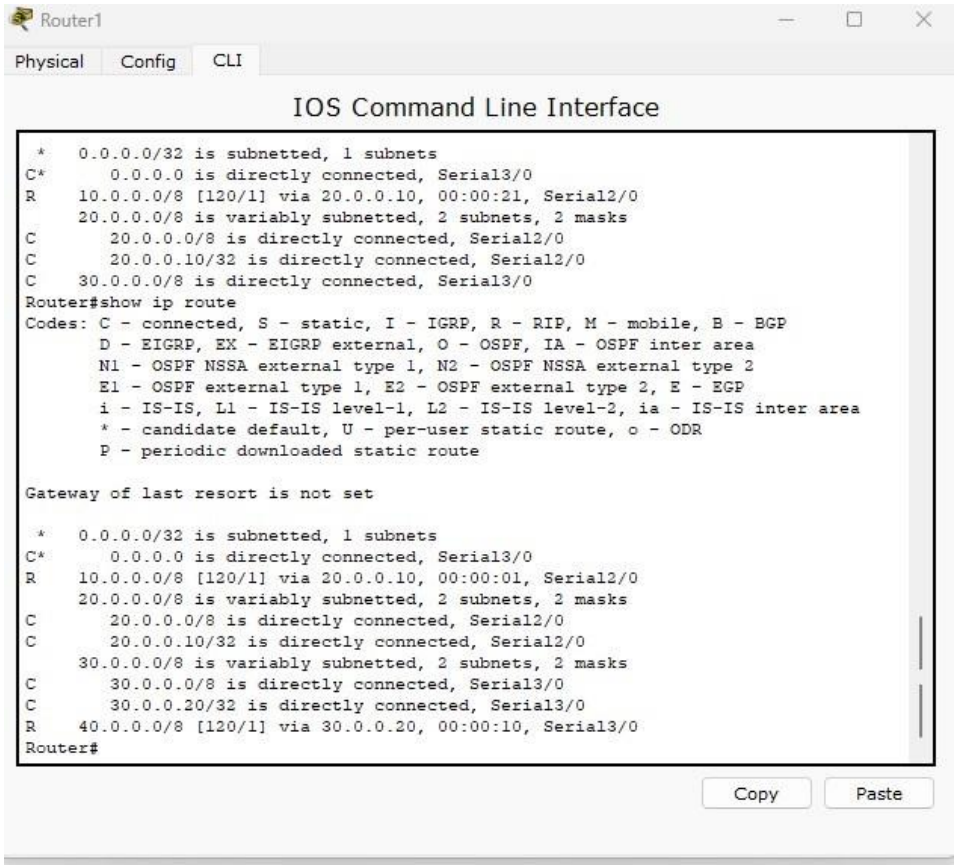
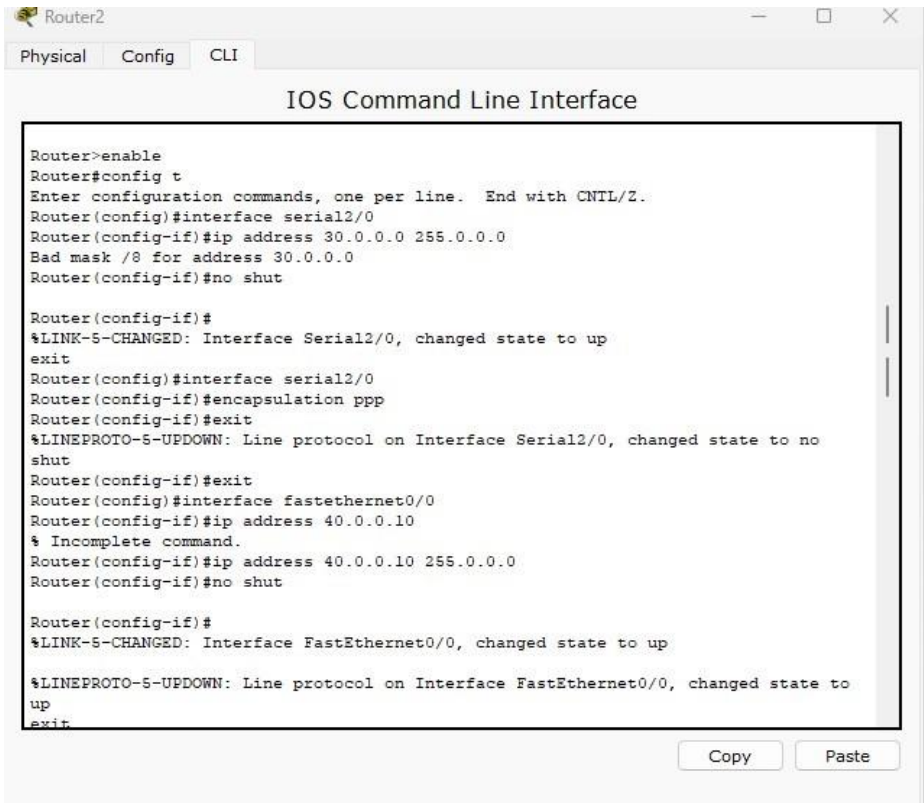
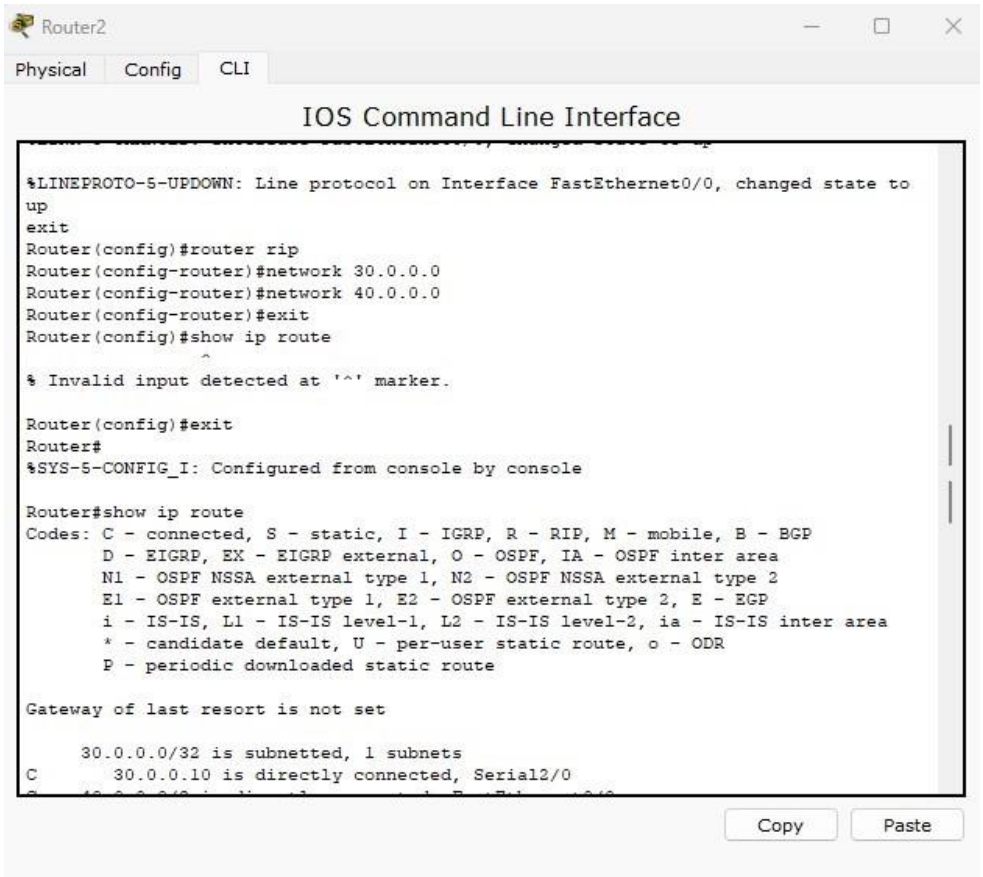

Router1
Physical
Config
CLI
IOS Command Line Interface
* 0.0.0.0/32 is subnetted, 1 subnets
C* 0.0.0.0 is directly connected, Serial3/0
R 10.0.0.0/8 [120/1] via 20.0.0.10, 00:00:21, Serial2/0
20.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C 20.0.0.0/8 is directly connected, Serial2/0
C 20.0.0.10/32 is directly connected, Serial2/0
C 30.0.0.0/8 is directly connected, Serial3/0
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
* 0.0.0.0/32 is subnetted, 1 subnets
C* 0.0.0.0 is directly connected, Serial3/0
R 10.0.0.0/8 [120/1] via 20.0.0.10, 00:00:01, 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 20.0.0.10/32 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 30.0.0.20/32 is directly connected, Serial3/0
R 40.0.0.0/8 [120/1] via 30.0.0.20, 00:00:10, Serial3/0
Router#
Copy
Paste


Router2
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 serial2/0
Router(config-if)#ip address 30.0.0.0 255.0.0.0
Bad mask /8 for address 30.0.0.0
Router(config-if)#no shut
Router(config-if)#
%LINK-5-CHANGED: Interface Serial2/0, changed state to up
exit
Router(config)#interface serial2/0
Router(config-if)#encapsulation ppp
Router(config-if)#exit
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial2/0, changed state to no
shut
Router(config-if)#exit
Router(config)#interface fastethernet0/0
Router(config-if)#ip address 40.0.0.10
% Incomplete command.
Router(config-if)#ip address 40.0.0.10 255.0.0.0
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
Copy
Paste


Router2
Physical
Config
CLI
IOS Command Line Interface
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to up
exit
Router(config)#router rip
Router(config-router)#network 30.0.0.0
Router(config-router)#network 40.0.0.0
Router(config-router)#exit
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
30.0.0.0/32 is subnetted, 1 subnets
C 30.0.0.10 is directly connected, Serial2/0
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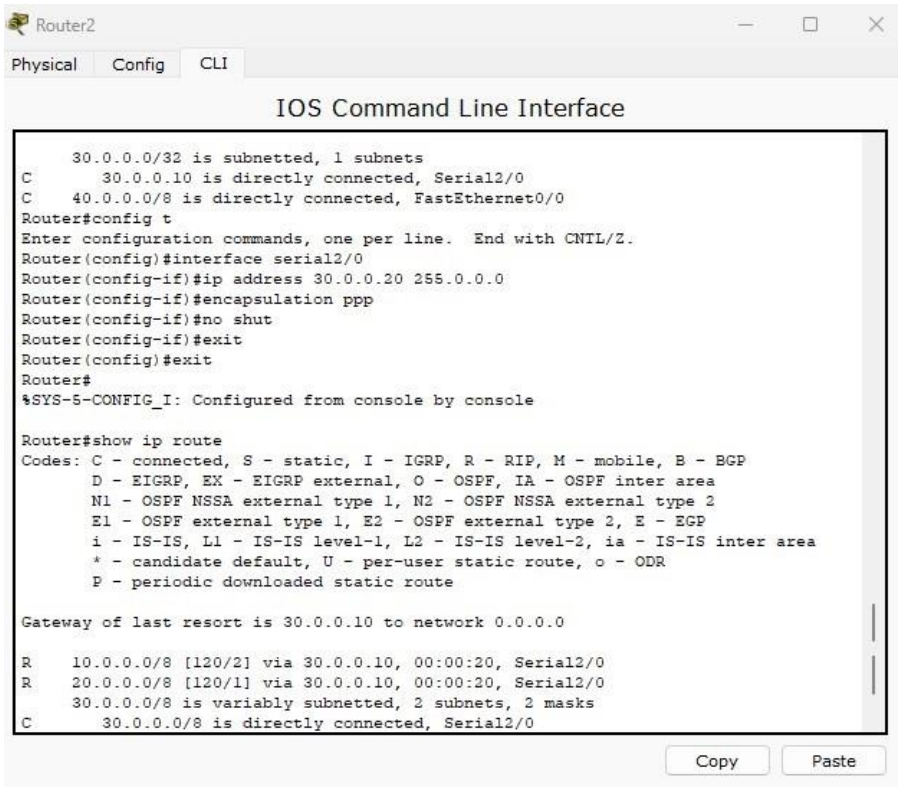
Router2
Physical
Config
CLI
IOS Command Line Interface
30.0.0.0/32 is subnetted, 1 subnets
C 30.0.0.10 is directly connected, Serial2/0
C 40.0.0.0/8 is directly connected, FastEthernet0/0
Router#config t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#interface serial2/0
Router(config-if)#ip address 30.0.0.20 255.0.0.0
Router(config-if)#encapsulation ppp
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
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 30.0.0.10 to network 0.0.0.0
R 10.0.0.0/8 [120/2] via 30.0.0.10, 00:00:20, Serial2/0
R 20.0.0.0/8 [120/1] via 30.0.0.10, 00:00:20, Serial2/0
30.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C 30.0.0.0/8 is directly connected, Serial2/0
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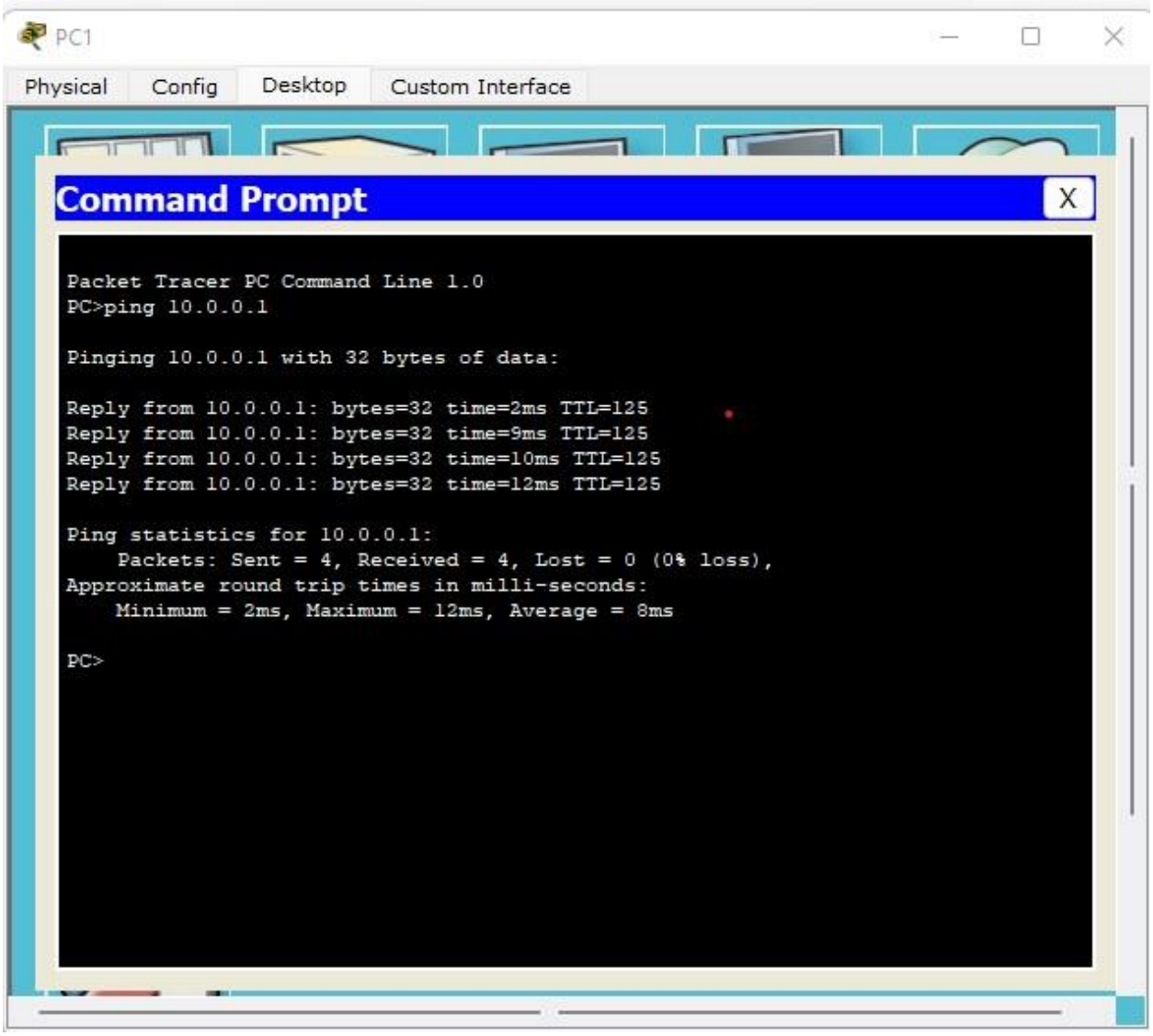
P1:



Observation :

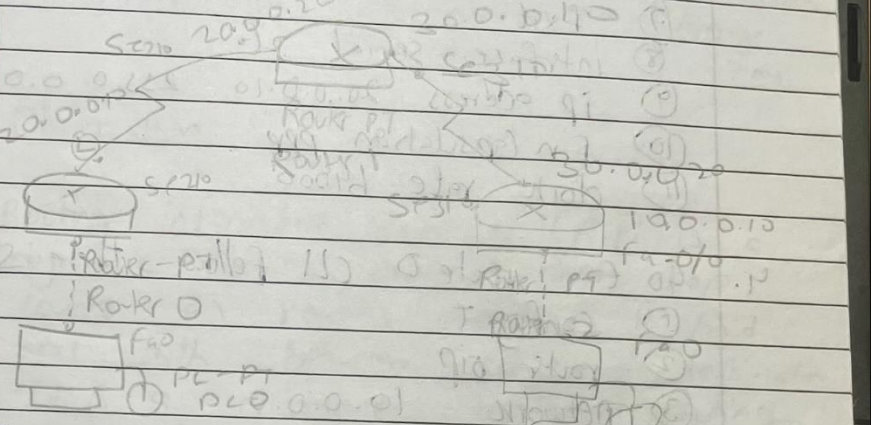
Experiment : 8

Date __/__/__
Page

Aim

Configure RIP routing protocol in Router.

Topology:



Procedure

1. Create a Network using 3 raters & 2 PC's. Routers are connected using Serial DCE Cable & connection between PC & router is using copper-cross over Cable

2. Set IP address & gateway of both PC's

10.0.0.1 10.0.0.10 - PC 0.
40.0.0.1 40.0.0.10 - PC1
respectively

3. Go to CLI of Router & follow these Commands:

① No
② Enable

(3) config
(4) interface fa 0/0
(5) ip address 10.0.0.10 255.0.0.0
(6) No shut
(7) Exit
(8) interface serial 2/0
(9) ip address 20.0.0.10 255.0.0.0
(10) Encapsulation ppp
(11) clock rate 64000

4. Go to route 0 CLI follow these steps:
(1) config t
(2) router rip
(3) network 10.0.0.0
(4) network 20.0.0.0
(5) exit

5. Repeat these to all routers.

6. Go to PC 0 command prompt and ping PC 1.

Output:

PC > ping 40.0.0.1
Pinging 40.0.0.1 with 32 bytes of data

Request timed out
Reply from 40.0.0.1 : bytes = 32 time = 8ms TTL = 125
Reply from 40.0.0.1: bytes = 32 time: 8ms TTL = 125
Reply from 40.0.0.1: bytes = 32 time = 10ms TTL = 125

Date / /
Page

Ping statistic for 40.0.0.1:
Packets: Sent 4, Received = 3, Lost = 1 (25% loss)
Approximate round trip times in milliseconds
Minimum = 5ms, Maximum = 10ms, Average = 7ms.

Observation:

Routing information protocol (RIP) is a dynamic routing protocol that hop count as routing metric to find best path between source & destination It is a distance vector routing protocol.

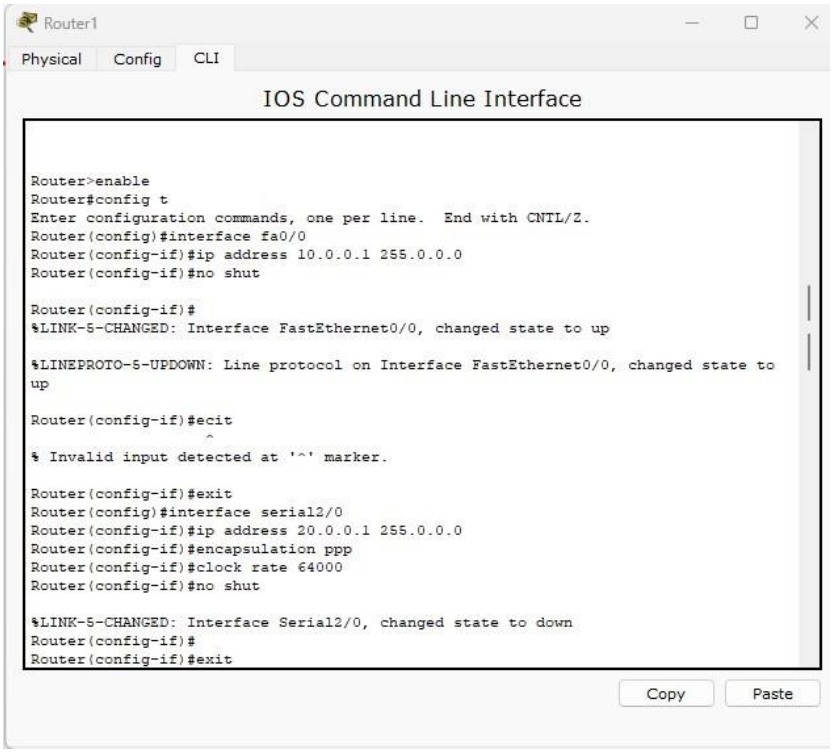
Hop count is no. of routers between source & destination.

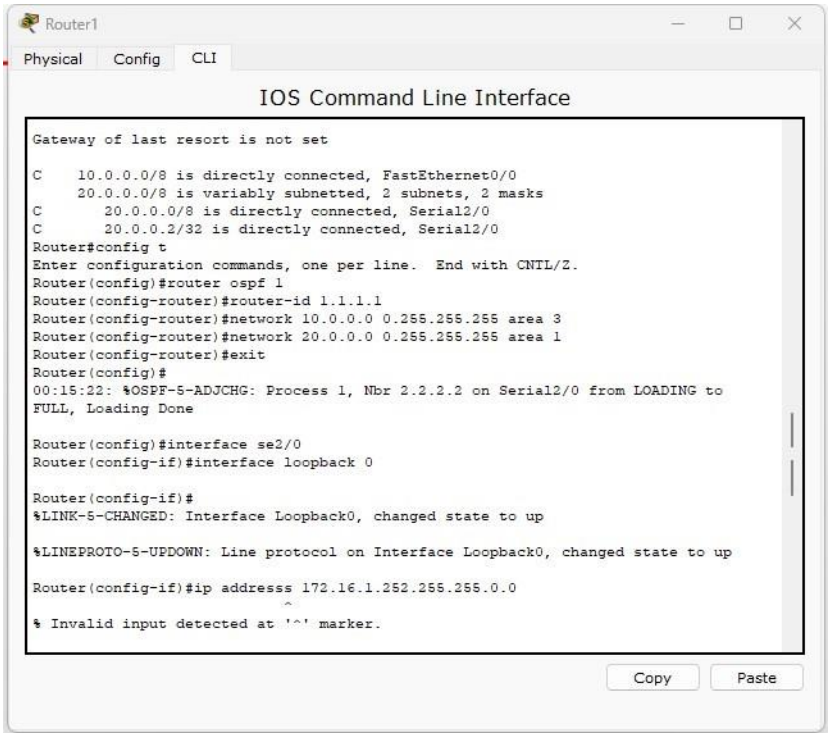
Experiment 7

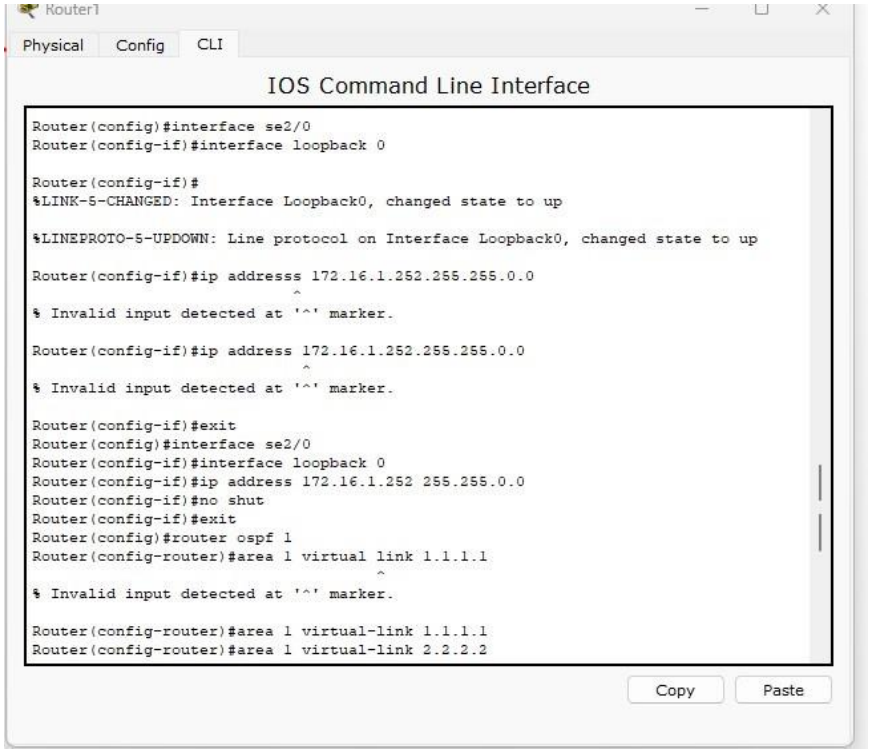
Aim : Configure OSPF routing protocol.

Topology :

Configurations:






Router1
Physical
Config
CLI
IOS Command Line Interface
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 addresss 172.16.1.252.255.255.0.0
^
% Invalid input detected at '^' marker.
Router(config-if)#ip address 172.16.1.252.255.255.0.0
^
% Invalid input detected at '^' marker.
Router(config-if)#exit
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
Router(config)#router ospf 1
Router(config-router)#area 1 virtual link 1.1.1.1
^
% Invalid input detected at '^' marker.
Router(config-router)#area 1 virtual-link 1.1.1.1
Router(config-router)#area 1 virtual-link 2.2.2.2
Copy
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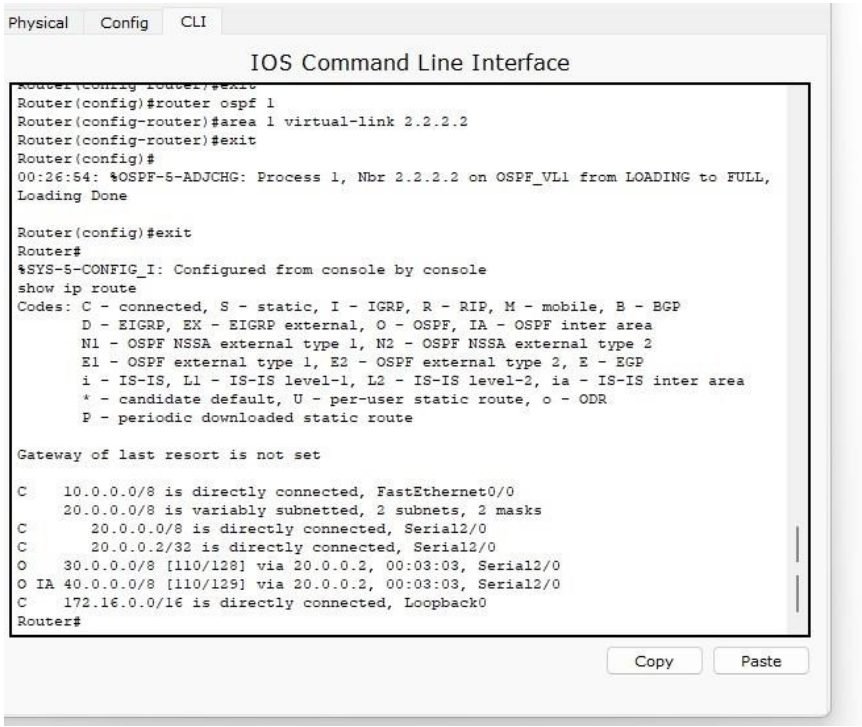
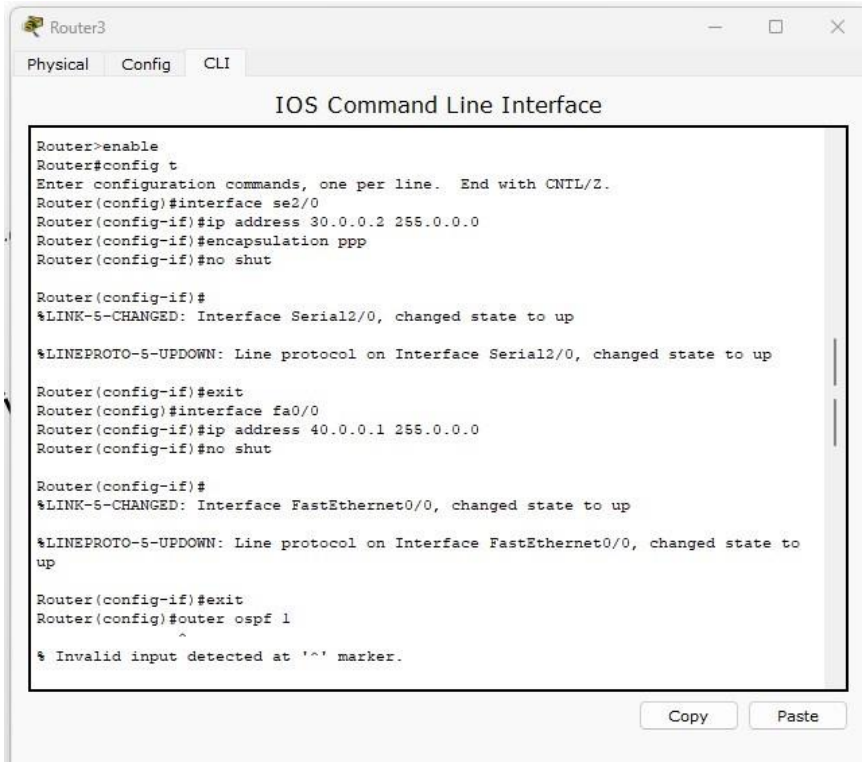
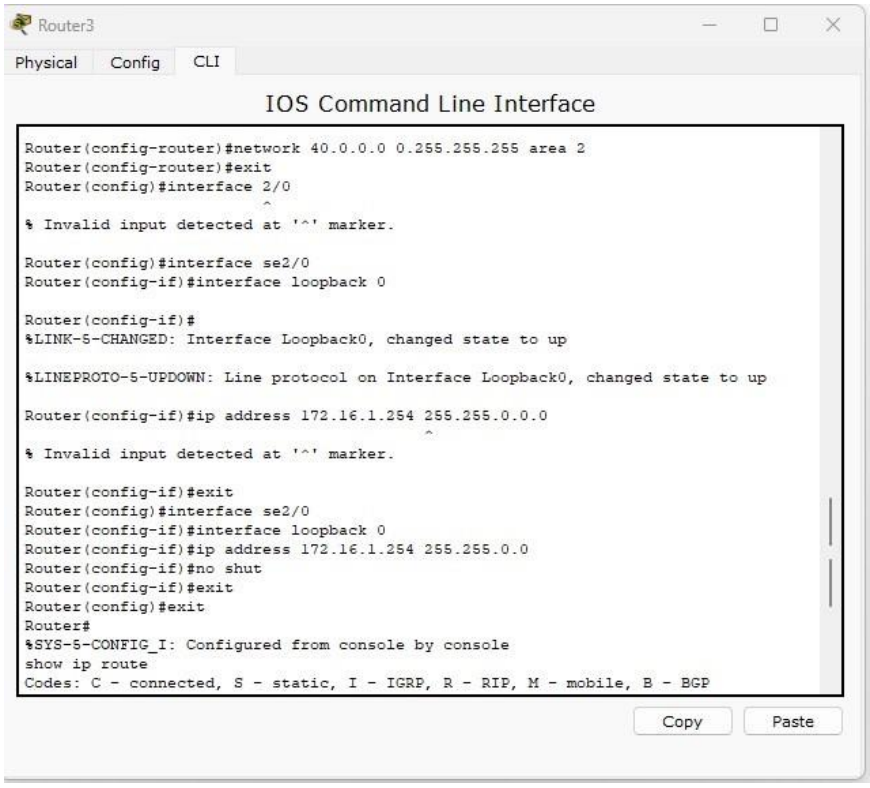
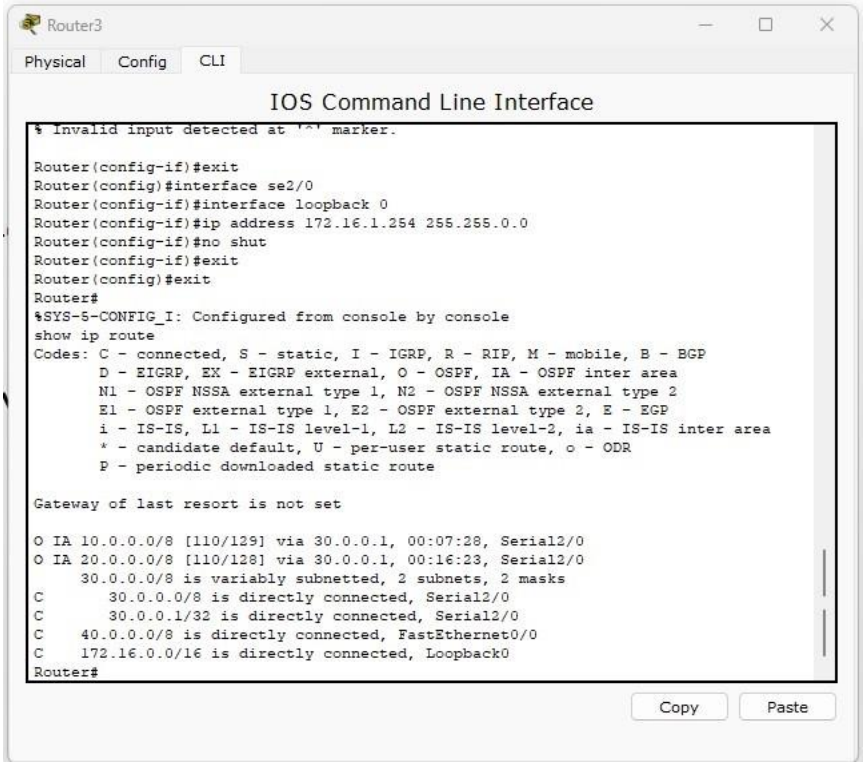
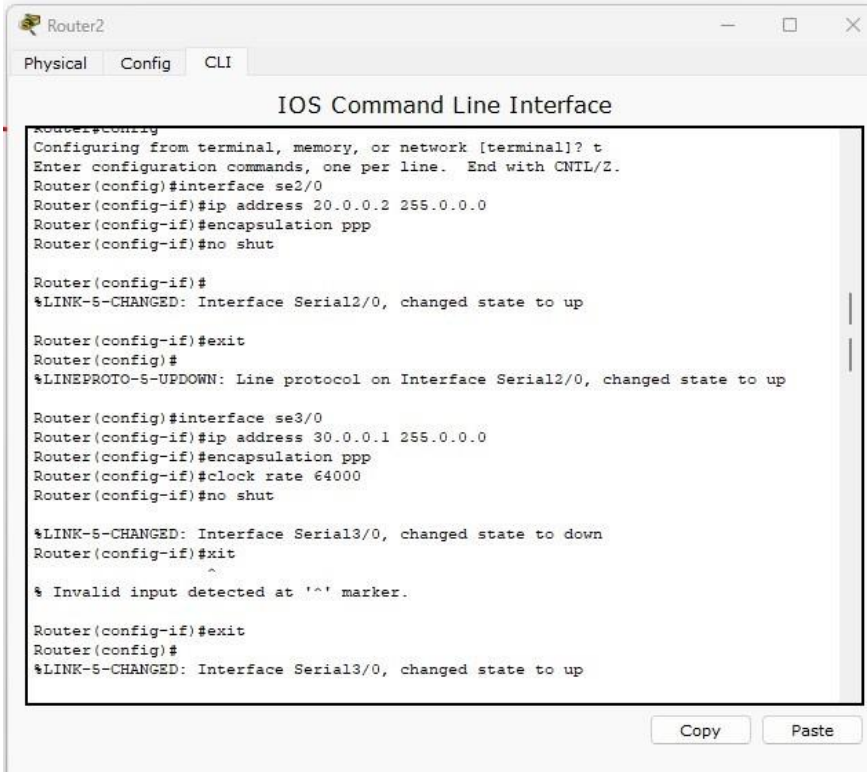
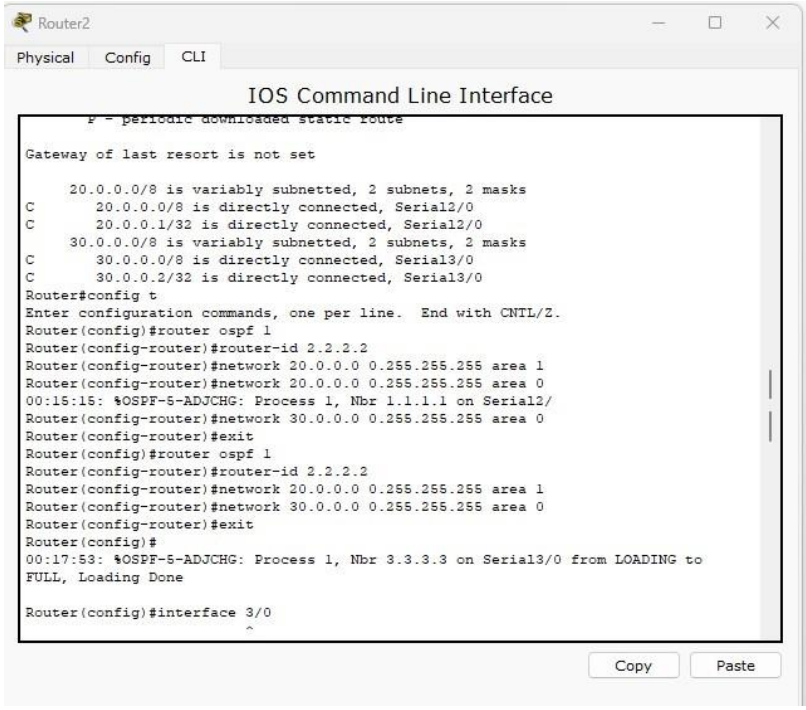

Physical
Config
CLI
IOS Command Line Interface
Router(config)#router ospf 1
Router(config-router)#area 1 virtual-link 2.2.2.2
Router(config-router)#exit
Router(config)#
00:26:54: %OSPF-5-ADJCHG: Process 1, Nbr 2.2.2.2 on OSPF_VL1 from LOADING to FULL,
Loading Done
Router(config)#exit
Router#
%SYS-5-CONFIG_I: 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
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, 00:03:03, Serial2/0
O IA 40.0.0.0/8 [110/129] via 20.0.0.2, 00:03:03, Serial2/0
C 172.16.0.0/16 is directly connected, Loopback0
Router#
Copy
Paste

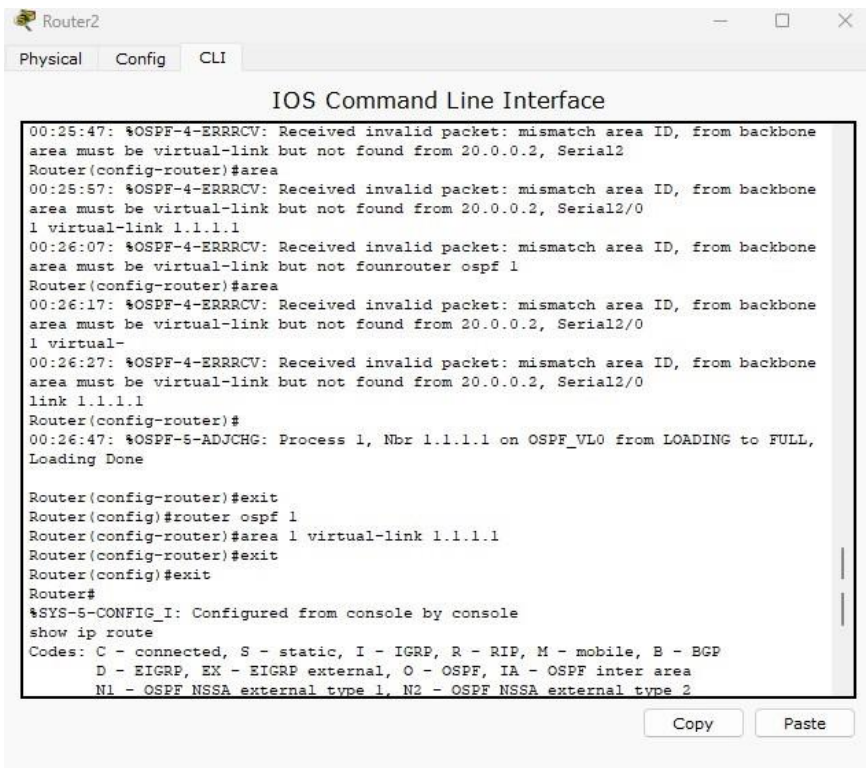

Router3
Physical
Config
CLI
IOS Command Line Interface
Router>enable
Router#config t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#interface se2/0
Router(config-if)#ip address 30.0.0.2 255.0.0.0
Router(config-if)#encapsulation ppp
Router(config-if)#no shut
Router(config-if)#
%LINK-5-CHANGED: Interface 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 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)#outer ospf 1
% Invalid input detected at '^' marker.
Copy
Paste

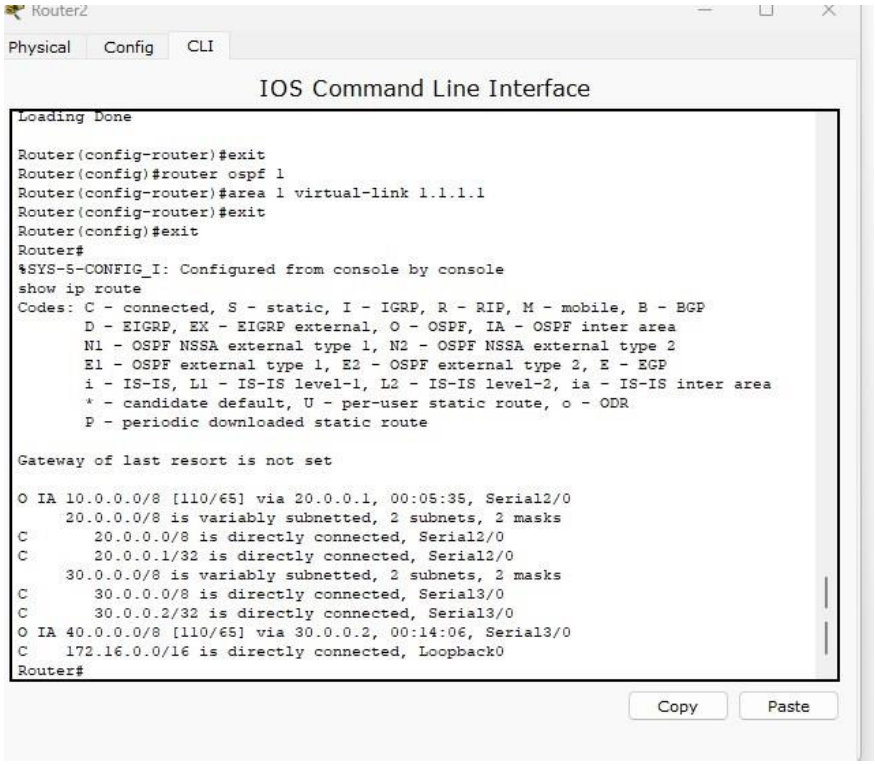

Router3
Physical
Config
CLI
IOS Command Line Interface
Router(config-router)#network 40.0.0.0 0.255.255.255 area 2
Router(config-router)#exit
Router(config)#interface 2/0
% Invalid input detected at '^' marker.
Router(config)#interface se2/0
Router(config-if)#interface loopback 0
Router(config-if)#
%LINK-5-CHANGED: Interface Loopback0, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface Loopback0, changed state to up
Router(config-if)#ip address 172.16.1.254 255.255.0.0.0
% Invalid input detected at '^' marker.
Router(config-if)#exit
Router(config)#interface se2/0
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
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
Copy
Paste


Router3
Physical
Config
CLI
IOS Command Line Interface
% Invalid input detected at '^' marker.
Router(config-if)#exit
Router(config)#interface se2/0
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
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
O IA 10.0.0.0/8 [110/129] via 30.0.0.1, 00:07:28, Serial2/0
O IA 20.0.0.0/8 [110/128] via 30.0.0.1, 00:16:23, Serial2/0
30.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C 30.0.0.0/8 is directly connected, Serial2/0
C 30.0.0.1/32 is directly connected, Serial2/0
C 40.0.0.0/8 is directly connected, FastEthernet0/0
C 172.16.0.0/16 is directly connected, Loopback0
Router#
Copy
Paste


Router2
Physical
Config
CLI
IOS Command Line Interface
Configuring from terminal, memory, or network [terminal]? 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)#exit
Router(config)#
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial2/0, changed state to up
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)#xit
^
% Invalid input detected at '^' marker.
Router(config-if)#exit
Router(config)#
%LINK-5-CHANGED: Interface Serial3/0, changed state to up
Copy
Paste

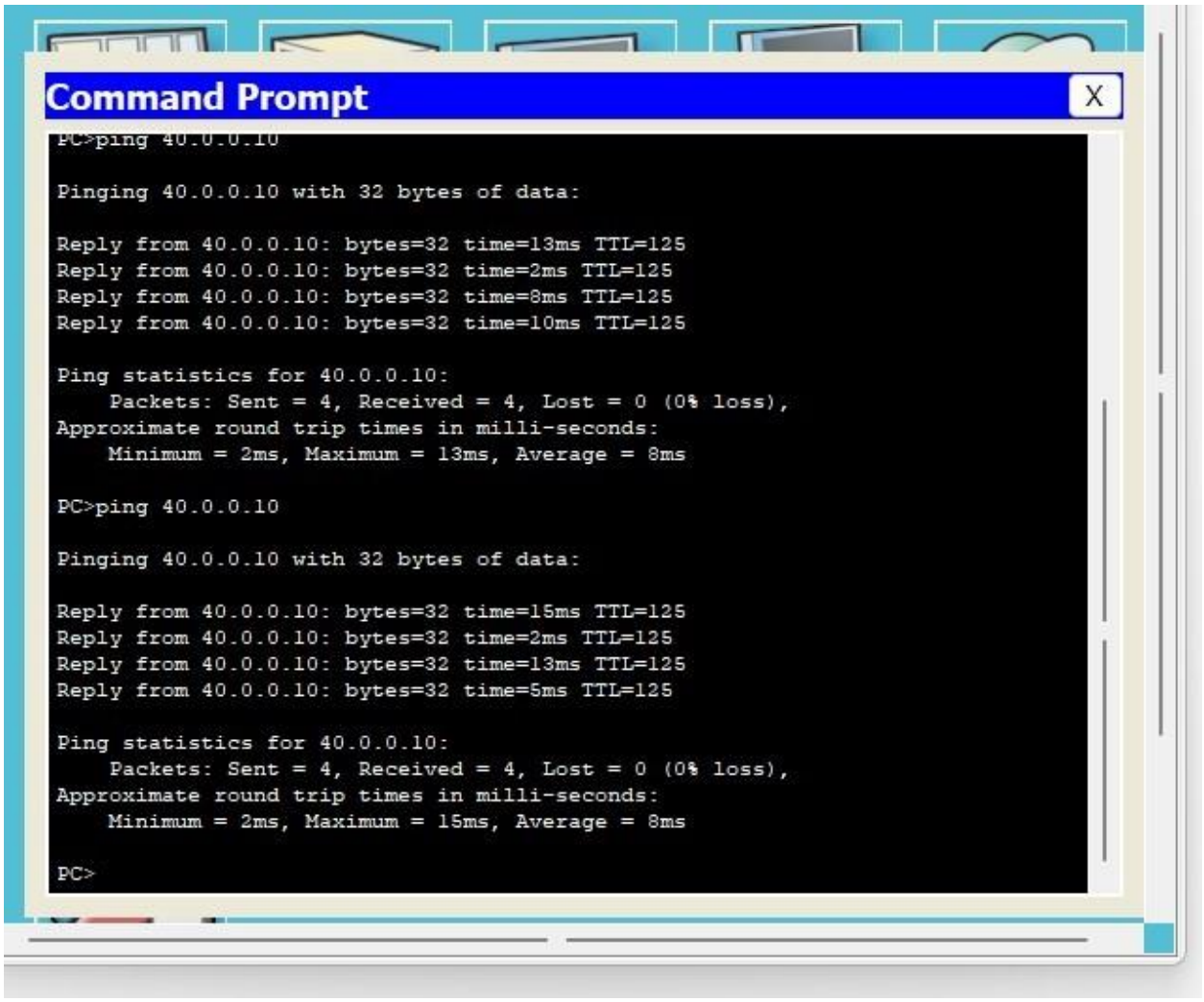

Router2
Physical
Config
CLI
IOS Command Line Interface
P - periodic downloaded static route
Gateway of last resort is not set
20.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C 20.0.0.0/8 is directly connected, Serial2/0
C 20.0.0.1/32 is directly connected, Serial2/0
30.0.0.0/8 is variably subnetted, 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
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)#network 20.0.0.0 0.255.255.255 area 0
00:15:15: %OSPF-5-ADJCHG: Process 1, Nbr 1.1.1.1 on Serial2/
Router(config-router)#network 30.0.0.0 0.255.255.255 area 0
Router(config-router)#exit
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
Router(config)#
00:17:53: %OSPF-5-ADJCHG: Process 1, Nbr 3.3.3.3 on Serial3/0 from LOADING to FULL, Loading Done
Router(config)#interface 3/0
^
Copy
Paste


Router2
Physical
Config
CLI
IOS Command Line Interface
00:25:47: %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
Router(config-router)#area
00:25:57: %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
1 virtual-link 1.1.1.1
00:26:07: %OSPF-4-ERRRCV: Received invalid packet: mismatch area ID, from backbone area must be virtual-link but not founrouter ospf 1
Router(config-router)#area
00:26:17: %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
1 virtual-
00:26:27: %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
link 1.1.1.1
Router(config-router)#
00:26:47: %OSPF-5-ADJCHG: Process 1, Nbr 1.1.1.1 on OSPF_VL0 from LOADING to FULL, Loading Done
Router(config-router)#exit
Router(config)#router ospf 1
Router(config-router)#area 1 virtual-link 1.1.1.1
Router(config-router)#exit
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
Copy
Paste


Router2
Physical
Config
CLI
IOS Command Line Interface
Loading Done
Router(config-router)#exit
Router(config)#router ospf 1
Router(config-router)#area 1 virtual-link 1.1.1.1
Router(config-router)#exit
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
O IA 10.0.0.0/8 [110/65] via 20.0.0.1, 00:05:35, 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, 00:14:06, Serial3/0
C 172.16.0.0/16 is directly connected, Loopback0
Router#
Copy
Paste

Ping Output:

P0:



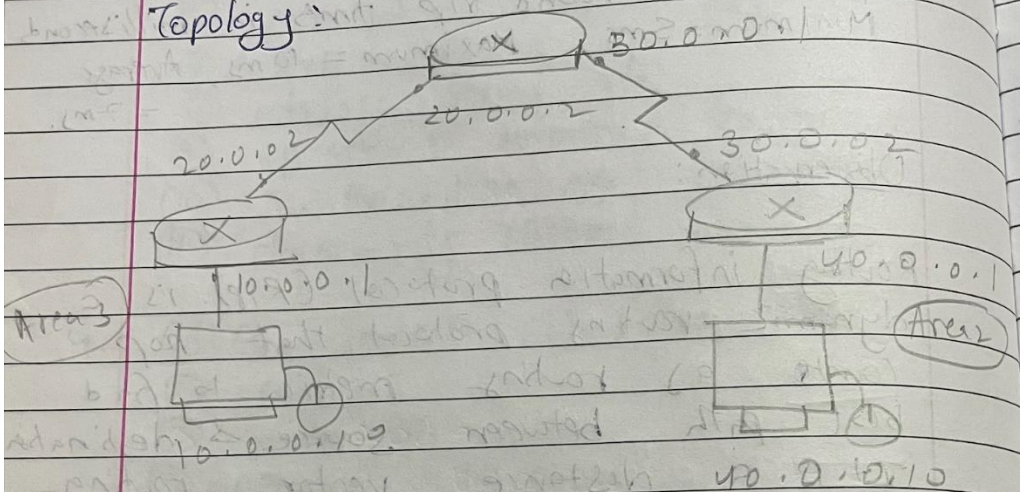
Observation :

Date
Page

Lab-7 Experiment - 9

Aim
Configure OSPF routing protocol

Topology:



Procedure

1. Configure routers & PCs with IP address and gateway according to topology shown above.

2. Configure each router according to topology.

3) Encapsulation PPP and clock rate need to be set as done in RIP protocol experiment.

4) To set protocol follow these steps:
   ① R1(config)# router ospf 1
   ② R1(config-router)# router-id 1.1.1.1
   ③ # network 10.0.0.0 0.255.255.255
   ④ # network 20.0.0.0 0.255.255.255

Date __/__/__
Page _____

5. Repeat the same following steps to each individual router with their respective addresses.

6. Set loopbacks to the router by following these steps.
   ① R1 (config-if) #interface loopback 0.
   ② R1 (config-if) # ip add 172.16.1.252 225.255.00
   ③ R1 (config-if) # no shut

7. Repeat the same for all other routers by changing ip address 172.16.1.253, 172.16.1.254.

8) Create a virtual link between R1, R2 as area 3.0 is not connected to the backbone.
   ① R1 (config) # router ospf 1
   ② R1 (config-router) # area 1 virtual-link 2.2.2.2 (id of router 2)

9. Now execute commands in router 3
   ① R2 (config) # router ospf 1
   ② R2 (config-router) # area 1 virtual-link 1.1.1.1 → id of router 1
   ③ R2 (config-if-router) # area 0, virtual link 3.3
   ④ R2 (config-router) # exit.

10) In R3

area 3
area 1

R3 (config-router) router ospf 3

① R3 (config-router) #area 0 virtual link

② R1 & R2 get updated about area 1
R2 & R3 get updated about area 0.

- Now check connectivity dept n 2 Staff. by pinging each other

Result

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

Ping statistics for 40.0.0.10:
packets: sent=4, Received=3, loss=1
(25% loss)

Approx round trip in milli-seconds:
Minimum=5ms, Maximum=7ms
Average=5ms

Date / /
Page

Observation

- OSPF stand for open shortest path first, a link-state protocol and as the name suggests it is used to find the best and the optimal pathway between the starting point and the destination target router using its own shortest path first algorithm
- OSPF marks on port no 89
- OSPF generates a topological map of the network form available router : each network-to-network connection is designed as an area - (area 1, 1, 0, 0 2)
- After the virtual links are made between areas, which is connected to the backbone area, we can ping messages successfully.

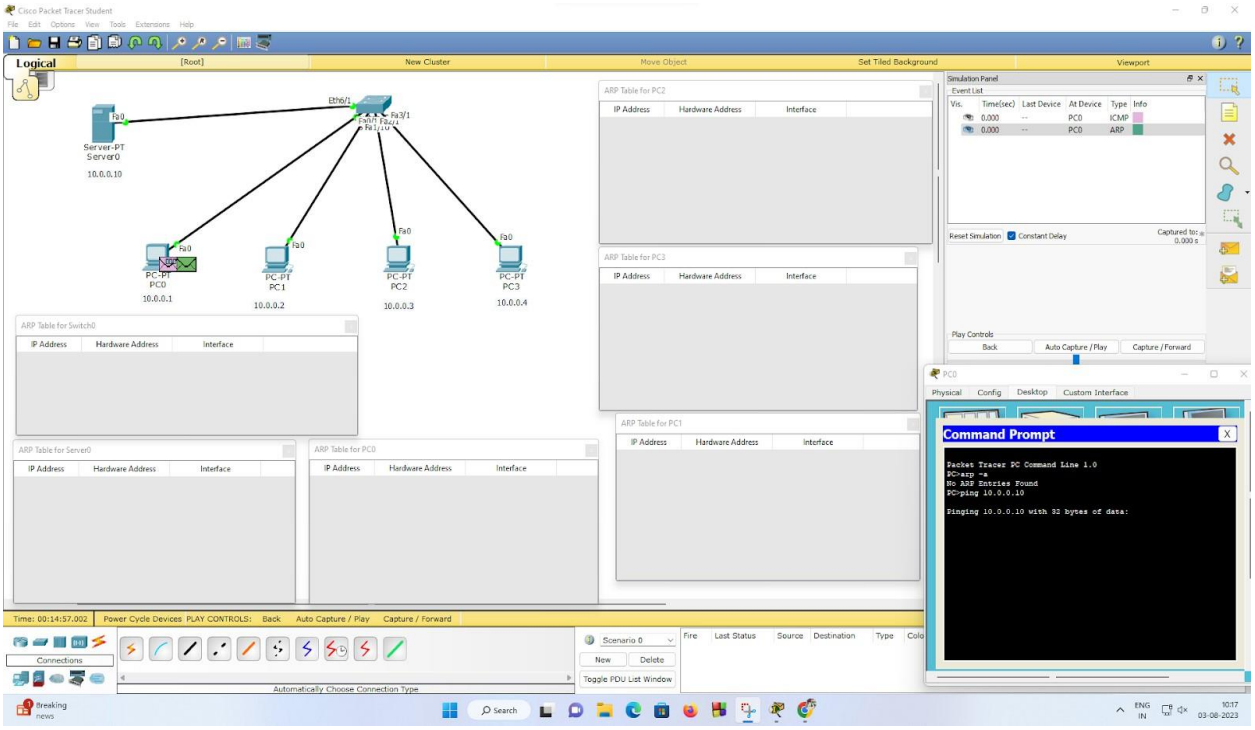
Experiment 8

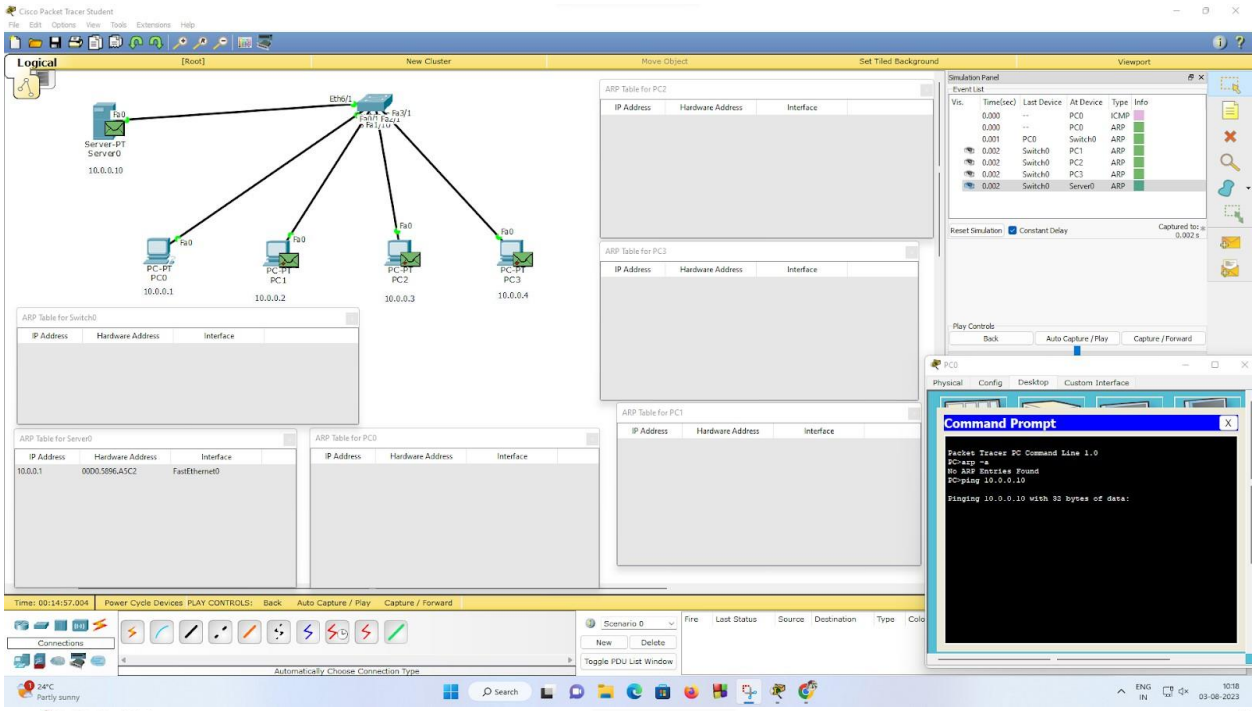
Aim : To construct simple LAN and understand the concept and operation of Address Resolution Protocol (ARP)

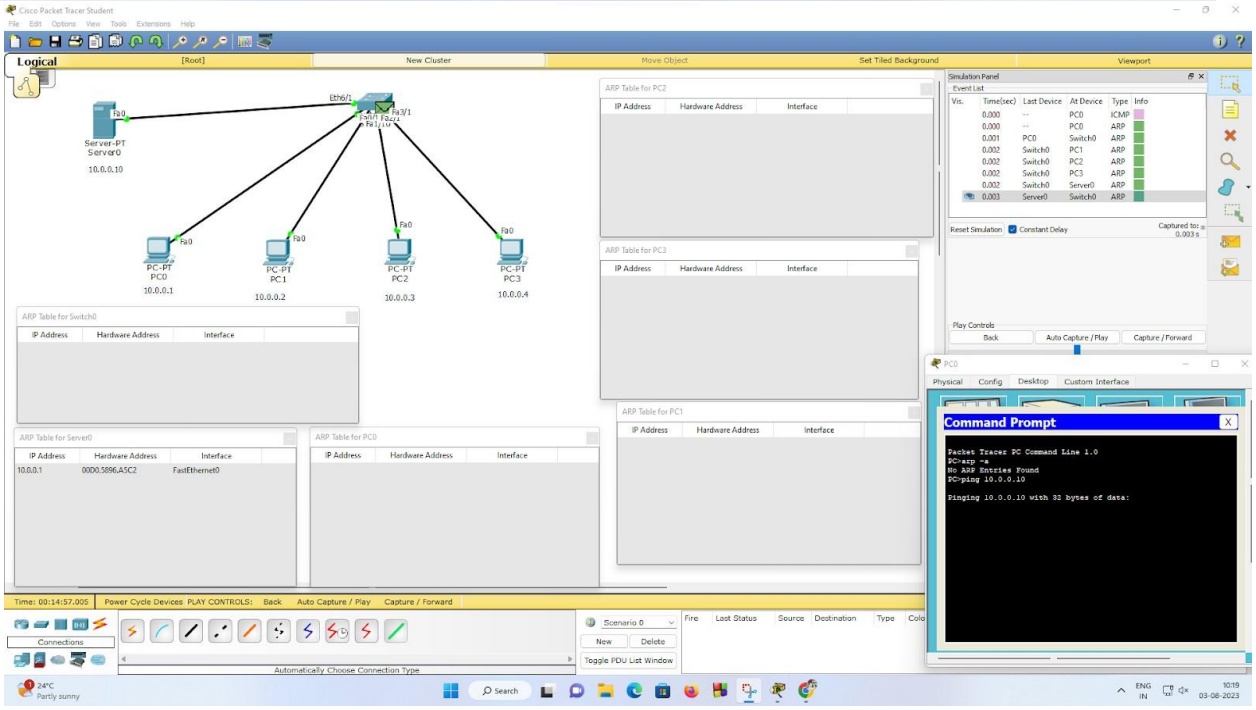
Topology :

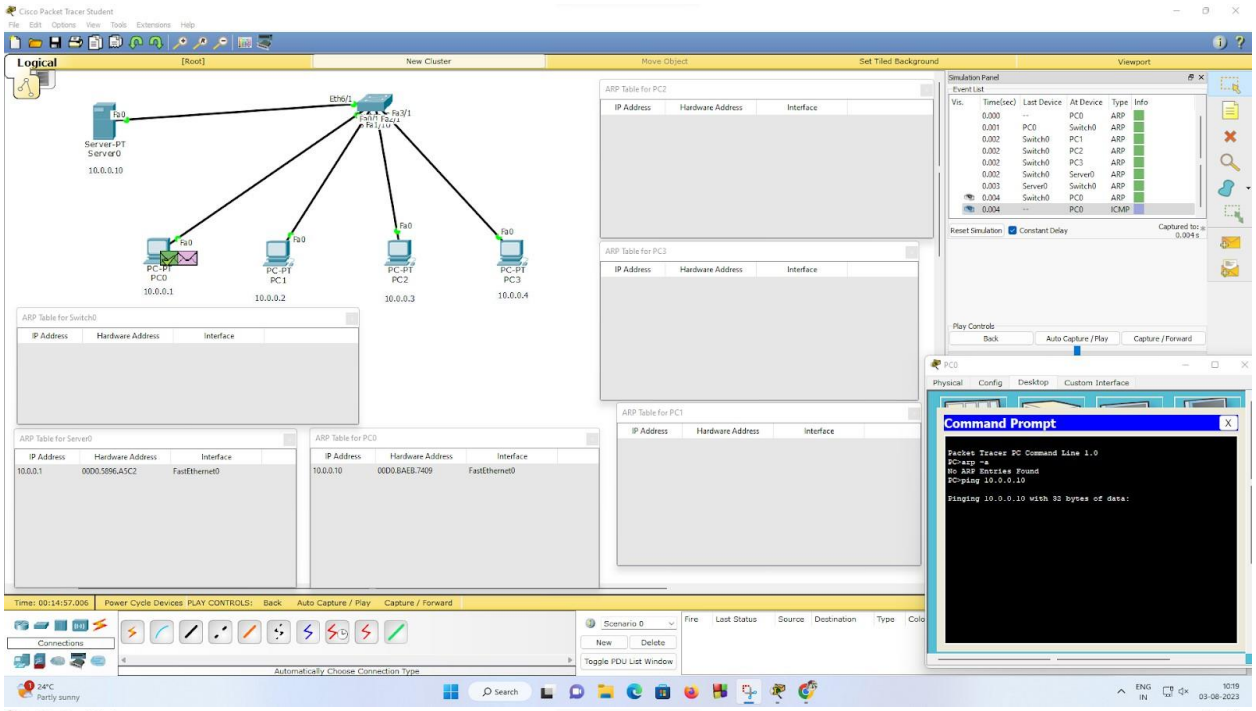
ARP Tables while pinging :

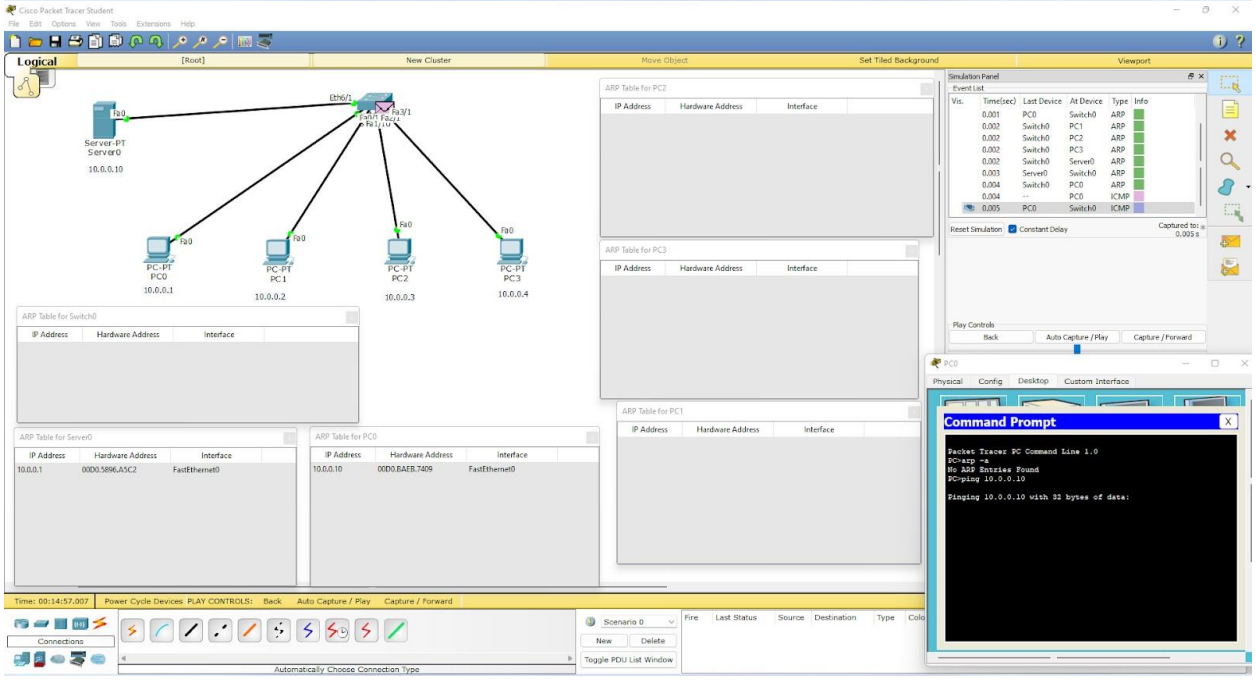
Ping from PC0 to Server0:

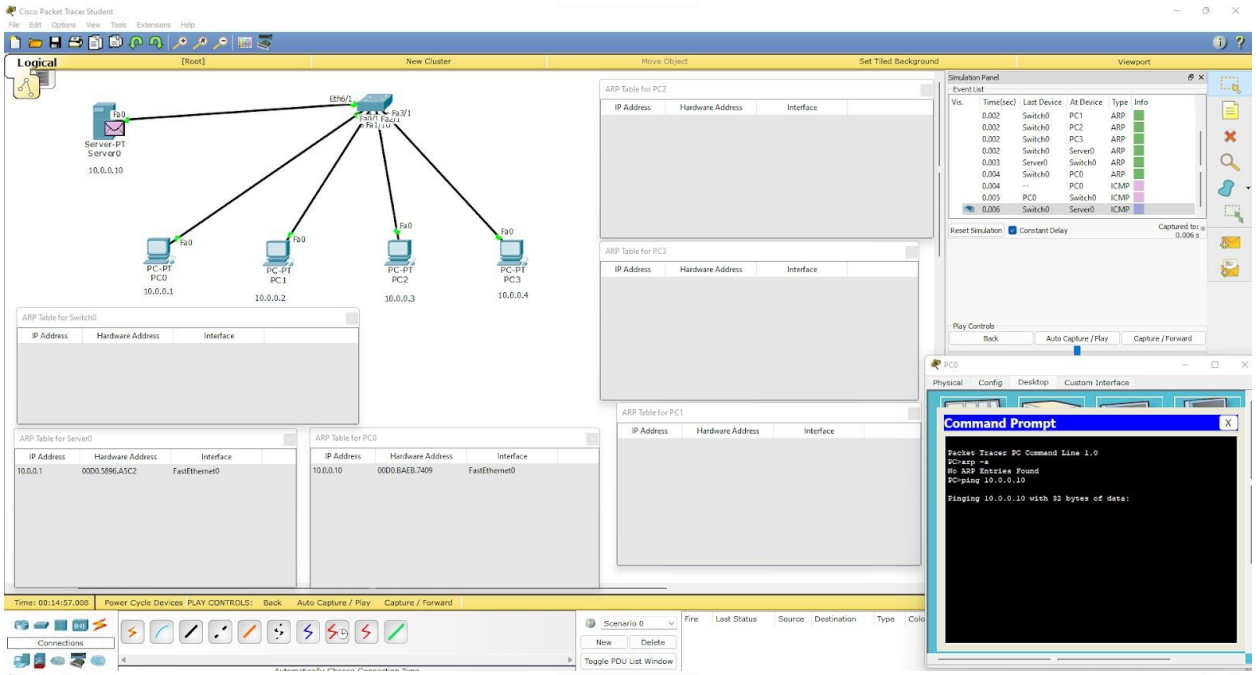


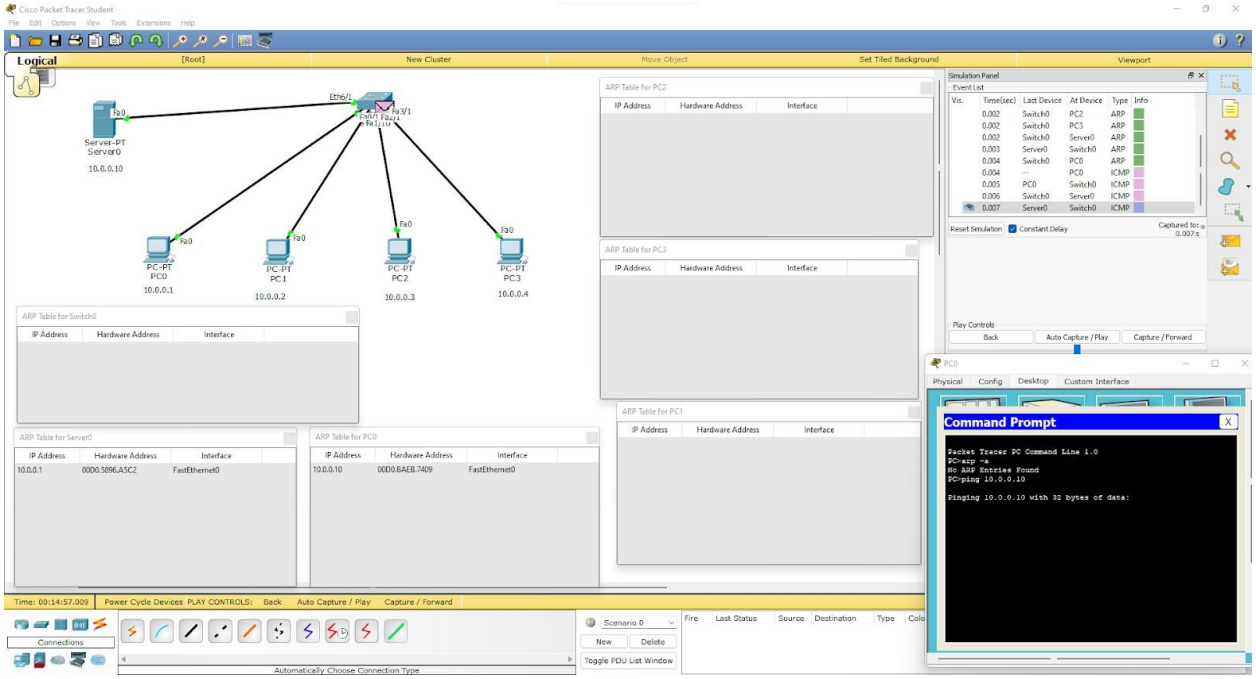

Logical
[Root]
New Cluster
Move Object
Set Tiled Background
Viewport
Server-PT Server0
10.0.0.10
PC-PT PC0
10.0.0.1
PC-PT PC1
10.0.0.2
PC-PT PC2
10.0.0.3
PC-PT PC3
10.0.0.4
Command Prompt
Packet Tracer PC Command Line 1.0
PC>arp -a
No ARP Entries Found
PC>ping 10.0.0.10
Pinging 10.0.0.10 with 32 bytes of data:

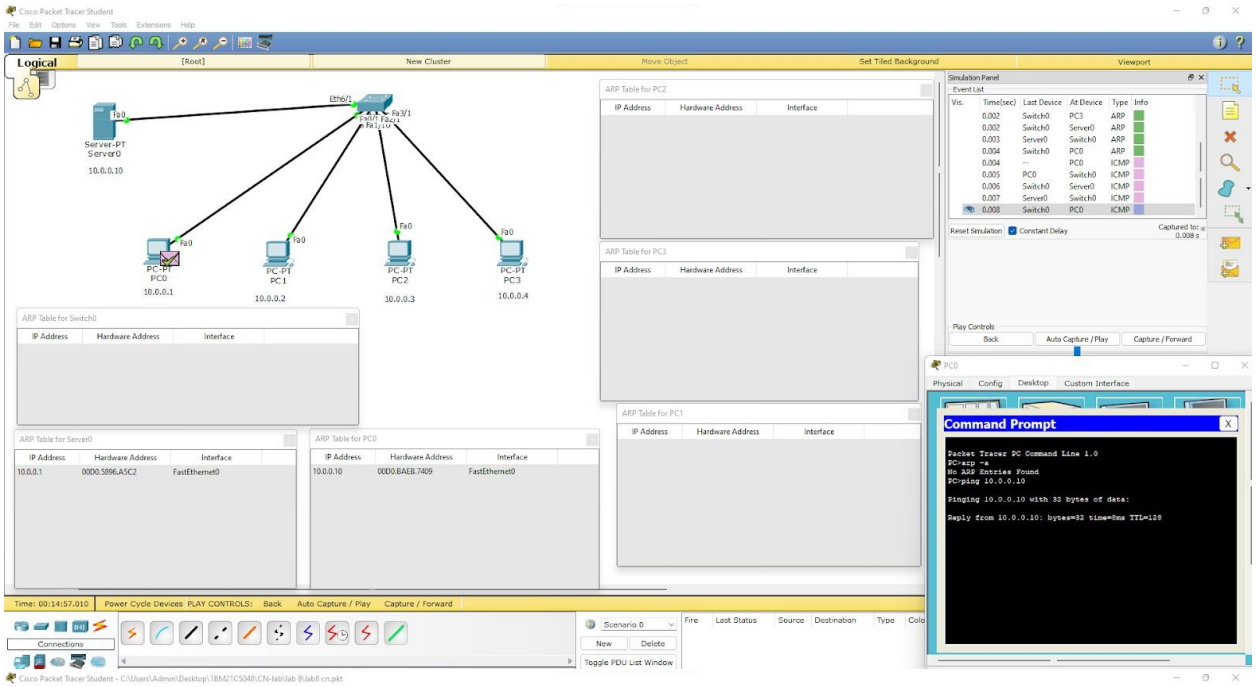

Logical
[Root]
New Cluster
Move Object
Set Tiled Background
Viewport
Server-PT Server0
10.0.0.10
PC-PT PC0
10.0.0.1
PC-PT PC1
10.0.0.2
PC-PT PC2
10.0.0.3
PC-PT PC3
10.0.0.4
Command Prompt
Packet Tracer PC Command Line 1.0
PC>arp -a
No ARP Entries Found
PC>ping 10.0.0.10
Pinging 10.0.0.10 with 32 bytes of data:

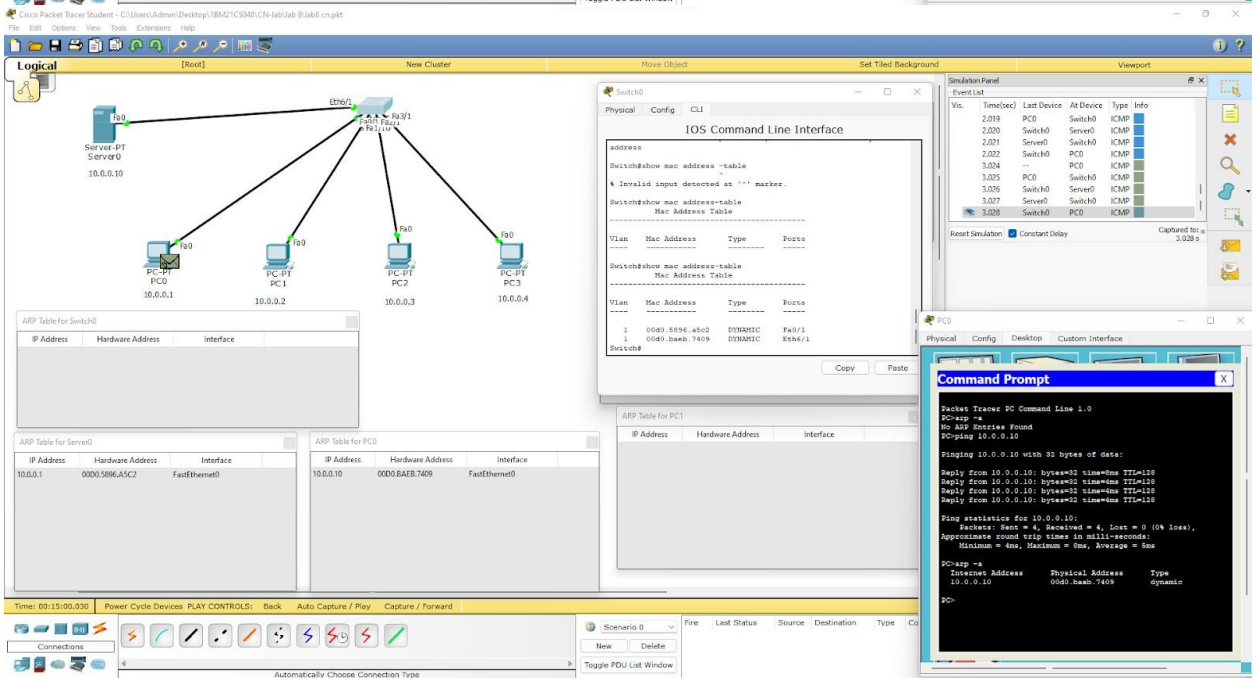

Logical
[Root]
New Cluster
Move Object
Set Tiled Background
Viewport
Server-PT Server0
10.0.0.10
PC-PT PC0
10.0.0.1
PC-PT PC1
10.0.0.2
PC-PT PC2
10.0.0.3
PC-PT PC3
10.0.0.4
Command Prompt
Packet Tracer PC Command Line 1.0
PC>arp -a
No ARP Entries Found
PC>ping 10.0.0.10
Pinging 10.0.0.10 with 32 bytes of data:


Logical
[Root]
New Cluster
Move Object
Set Tiled Background
Viewport
Server-PT Server0
10.0.0.10
PC-PT PC0
10.0.0.1
PC-PT PC1
10.0.0.2
PC-PT PC2
10.0.0.3
PC-PT PC3
10.0.0.4
Command Prompt
Packet Tracer PC Command Line 1.0
PC>arp -a
No ARP Entries Found
PC>ping 10.0.0.10
Pinging 10.0.0.10 with 32 bytes of data:

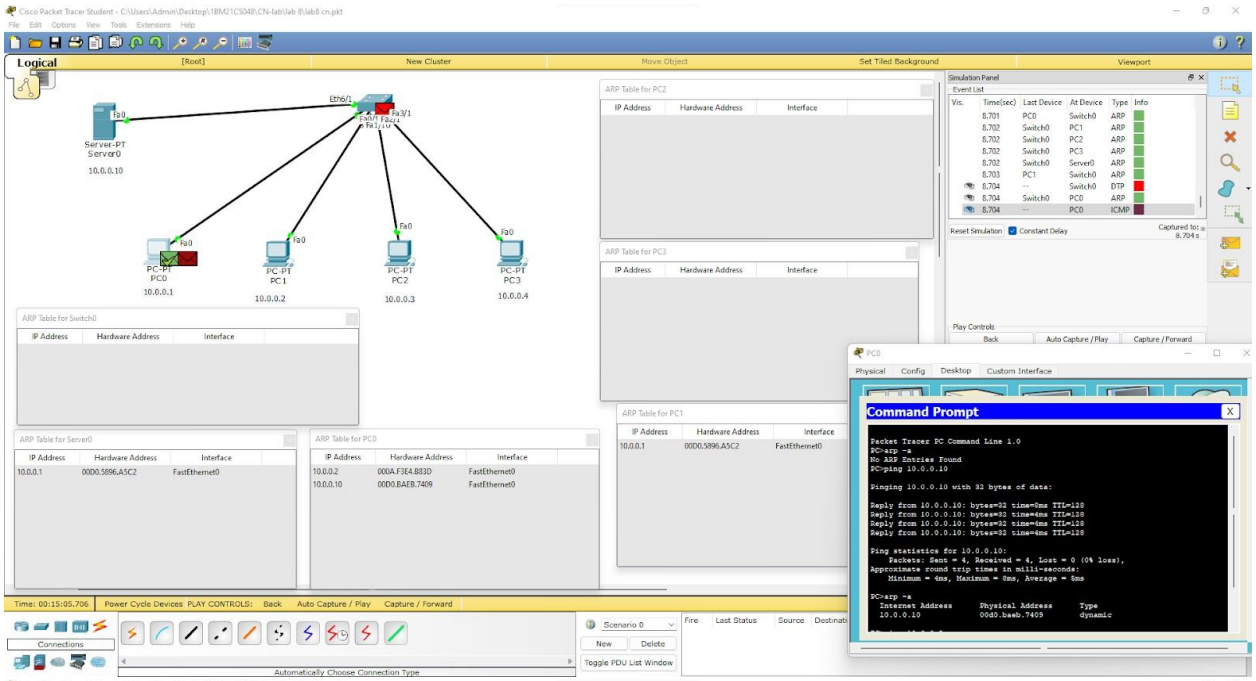

Logical
[Root]
New Cluster
Move Object
Set Tiled Background
Viewport
Server-PT Server0
10.0.0.10
PC-PT PC0
10.0.0.1
PC-PT PC1
10.0.0.2
PC-PT PC2
10.0.0.3
PC-PT PC3
10.0.0.4
Command Prompt
Packet Tracer PC Command Line 1.0
PC>arp -a
No ARP Entries Found
PC>ping 10.0.0.10
Pinging 10.0.0.10 with 32 bytes of data:

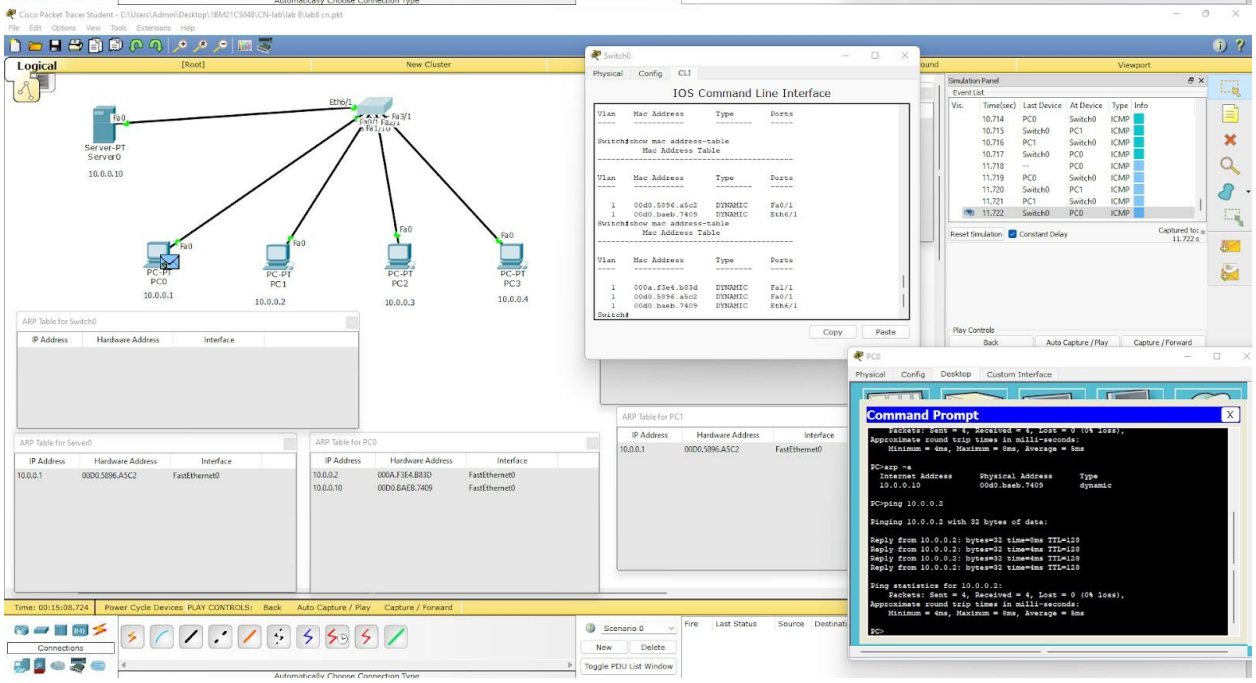

Logical
[Root]
New Cluster
Move Object
Set Tiled Background
Viewport
Server-PT Server0
10.0.0.10
PC-PT PC0
10.0.0.1
PC-PT PC1
10.0.0.2
PC-PT PC2
10.0.0.3
PC-PT PC3
10.0.0.4
Command Prompt
Packet Tracer PC Command Line 1.0
PC>arp -a
No ARP Entries Found
PC>ping 10.0.0.10
Pinging 10.0.0.10 with 32 bytes of data:



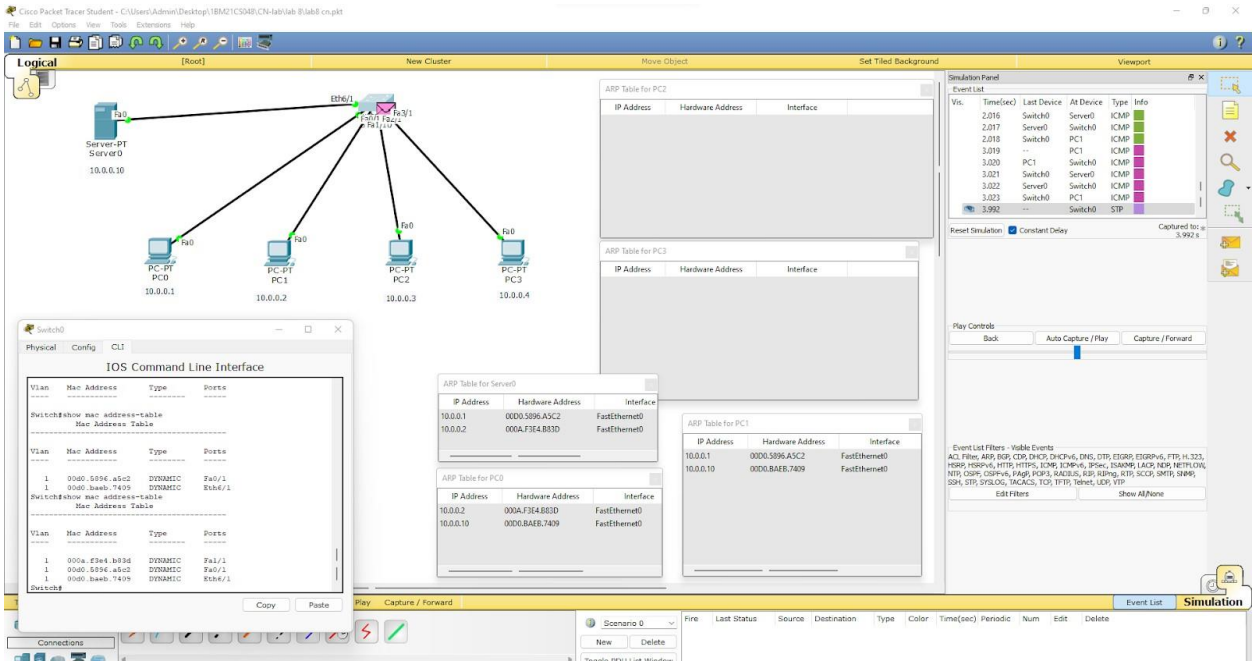


Ping from PC0 to PC1:





Final ARP Tables after pinging:



Observation:

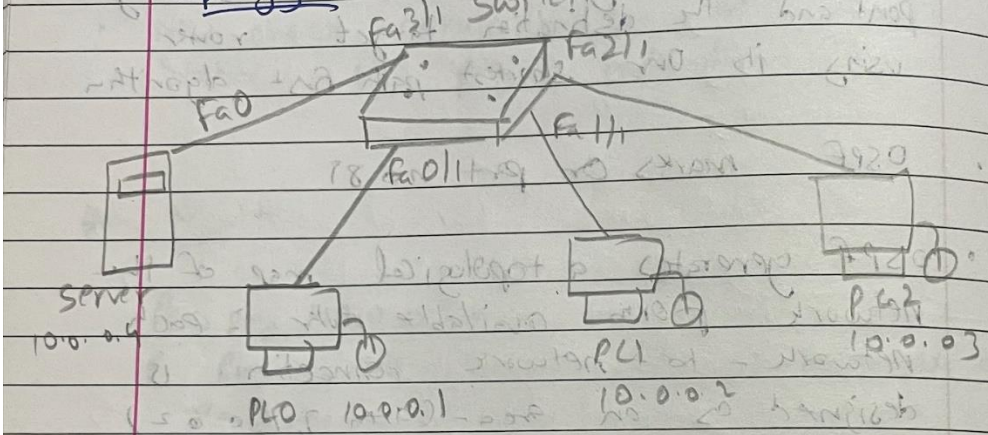
Lab-8 Experiment: 10

Date / /
Page

Aim

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

- Topology



Procedure

- Place a generic switch, 3 generic PCs, and 1 hub in the workspace
- Connect the PCs and hub to the Switch as shown in the above topology. Set IP address for the device.
- Next go to the command prompt of any pc and type: arp-a
  Initially there will be no arp entrees
- Go to the command prompt and ping all the connected devices using the IP address one by one. Go to

Date __/__/__
Page

Simulation mode in each case and click capture to see packets moving.

- Using Inspect (open ARP table for each device.

- In CLI of switch, type show mac address-table to view mac address table.

Result

command prompt of PL0:

PC>arp-a

Internet Address	physical Address	type
10.0.0.2	0001.c770.60Ga	dynamic
10.0.0.3	0001.[illegible].22a0	dynamic
10.0.0.4	0001.c7aa.6994	dynamic

CLI of switch

Switch > show mac address-table

Mac Address Table

Vlan	Mac Address	type	Port
1	0001.c778.608a	Dynamic	Fa 1/1
1	0061.c7aa.6994	Dynamic	Fa 3/1
1	0060.7054.22a0	Dynamic	Fa 2/1
1	00d0.be1a.1482	Dynamic	Fa 0/1

Date __/__/__
Page

Observation

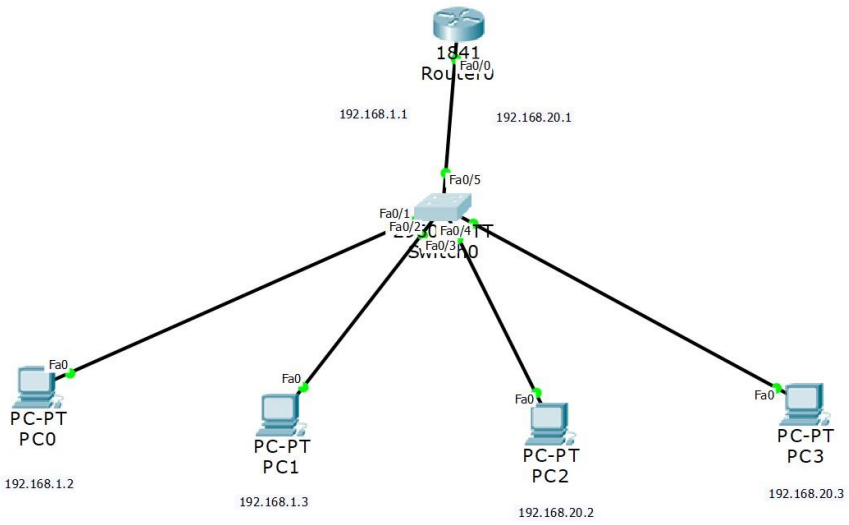
- ARP in Address Resolution Protocol It uses the IP address to find out the physical address / MAC address / Link layer address.

- When we Ping a device using IP, ARP under an ARP request to the given IP, which responds by giving the MAC address. This MAC address is stored in the MAC address table.

Experiment 9

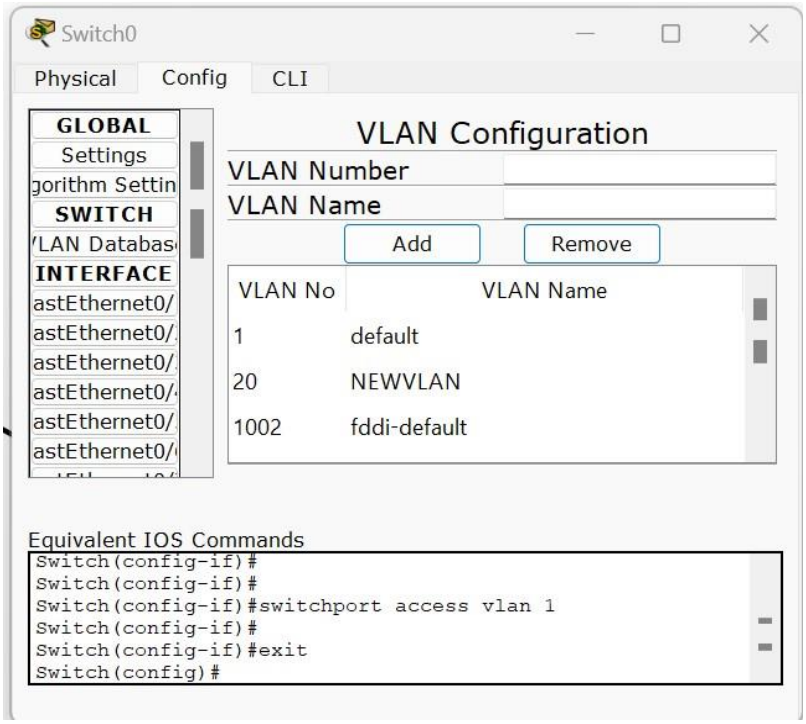
Aim : To construct a VLAN and make the PC's communicate among a VLAN

Topology :

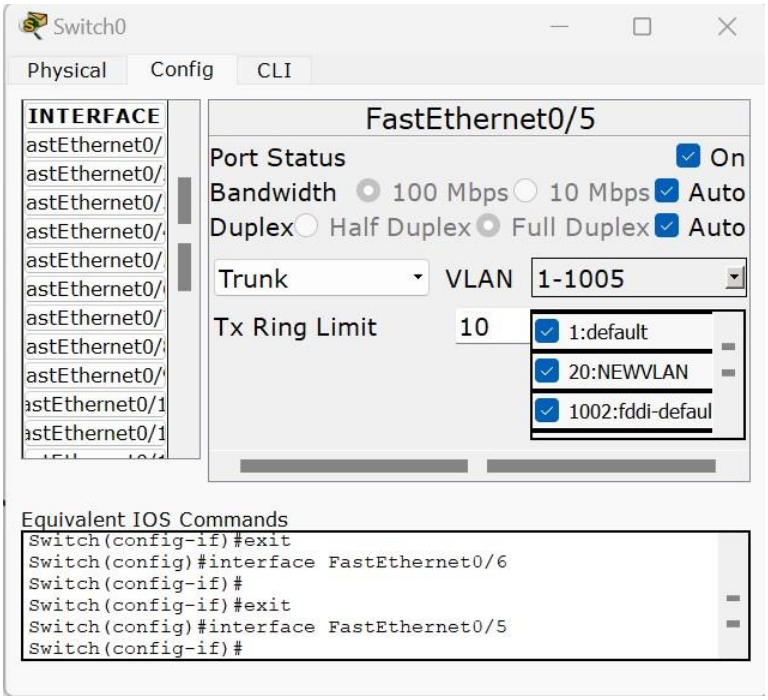


Configurations:

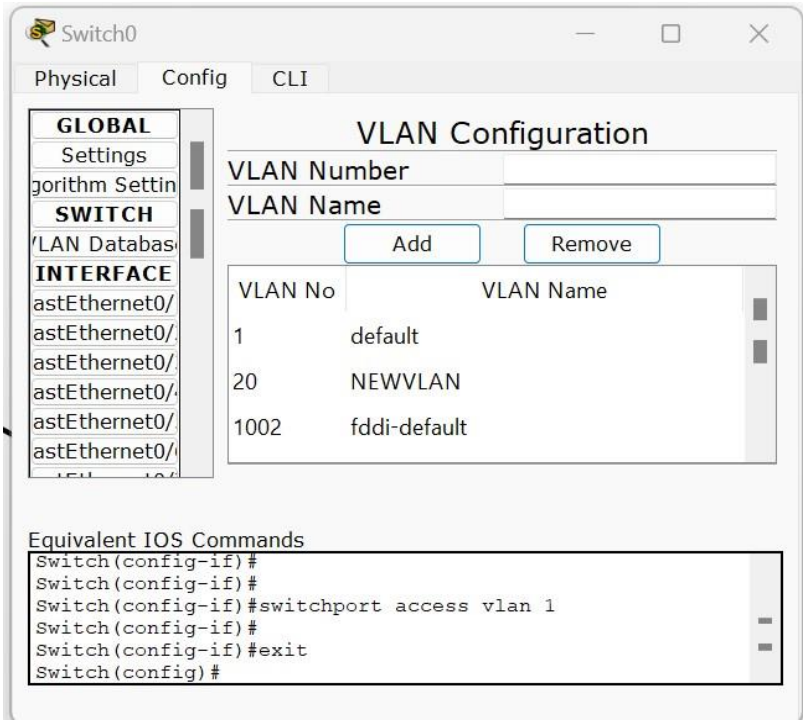
Switch VLAN Database:



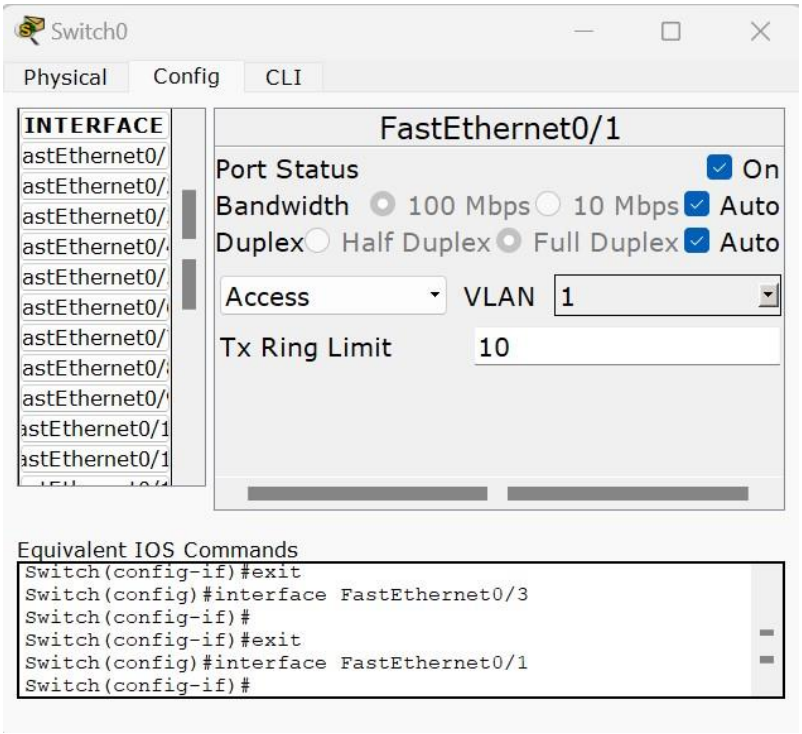
Switch FastEthernet0/5



Switch FastEthernet0/3 and FastEthernet0/4

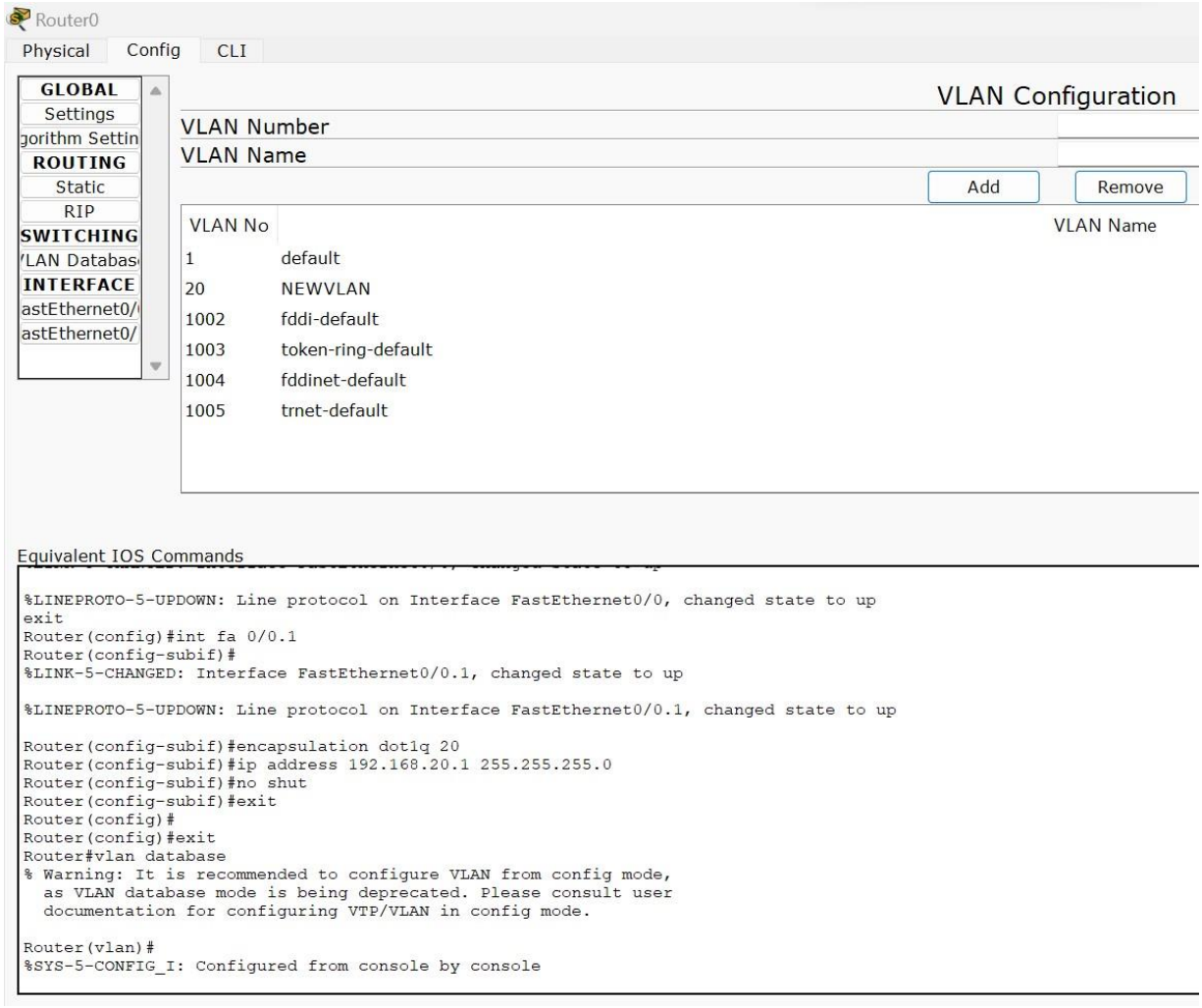


Switch FastEthernet0/1 and FastEthernet0/2



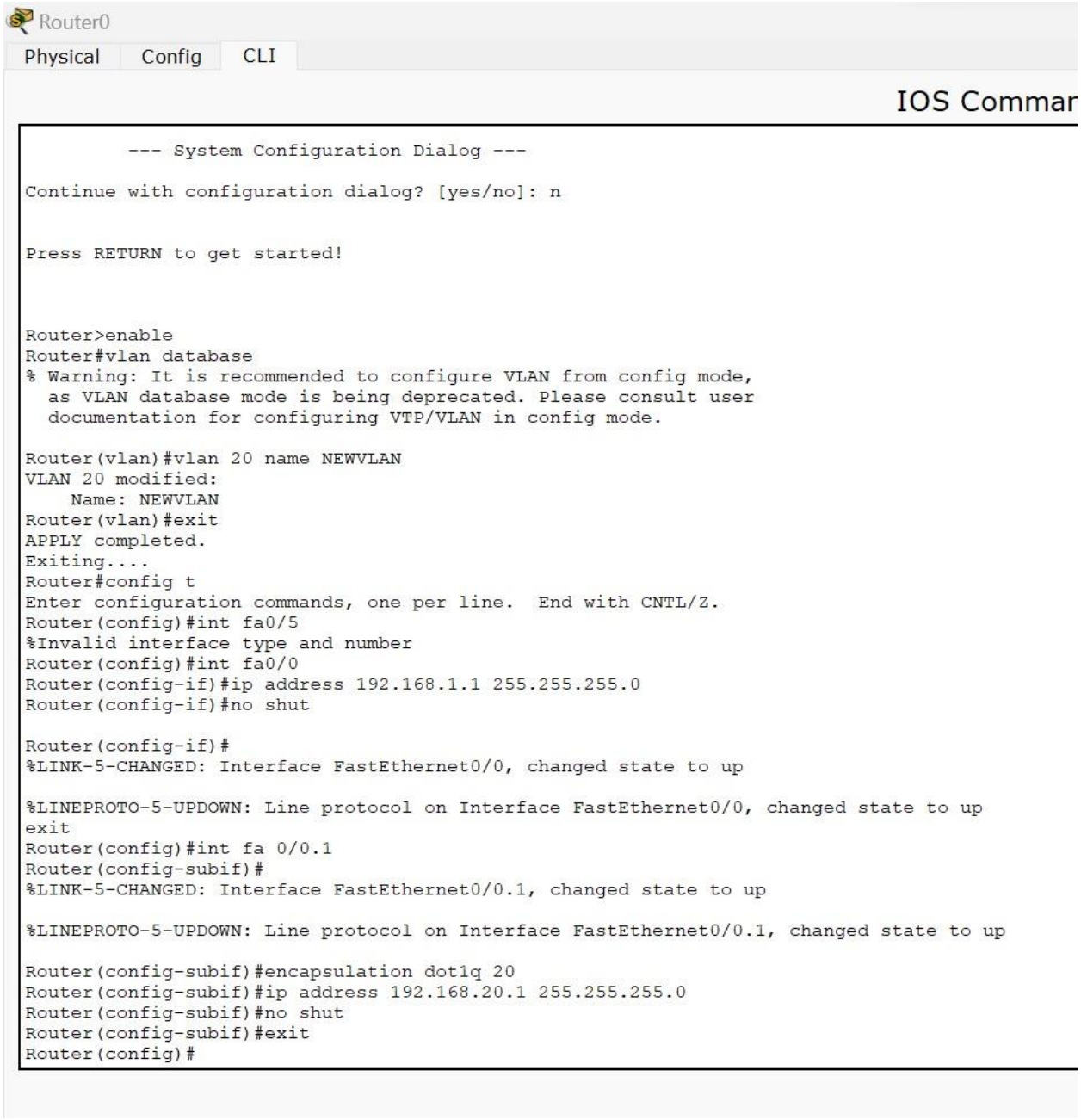
Router 0 :

VLAN DataBase:



Router 0 :

CLI:

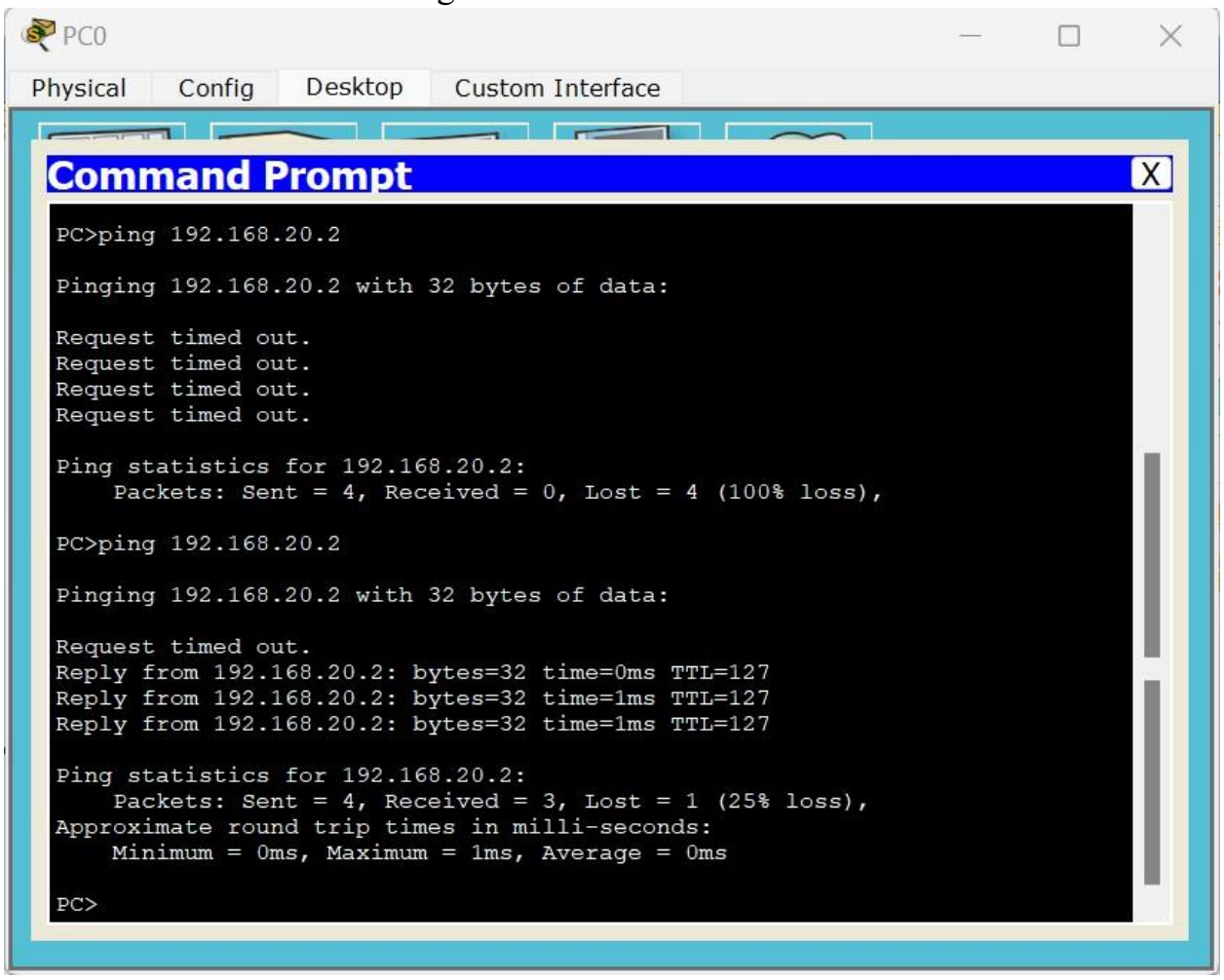



```
         --- System Configuration Dialog ---

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


Press RETURN to get started!



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 20 name NEWVLAN
VLAN 20 modified:
    Name: NEWVLAN
Router(vlan)#exit
APPLY completed.
Exiting....
Router#config t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#int fa0/5
%Invalid interface type and number
Router(config)#int fa0/0
Router(config-if)#ip address 192.168.1.1 255.255.255.0
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)#int fa 0/0.1
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 192.168.20.1 255.255.255.0
Router(config-subif)#no shut
Router(config-subif)#exit
Router(config)#
```

Ping Outputs:

P0:

Before and after VLAN configuration was successful.



Observation:

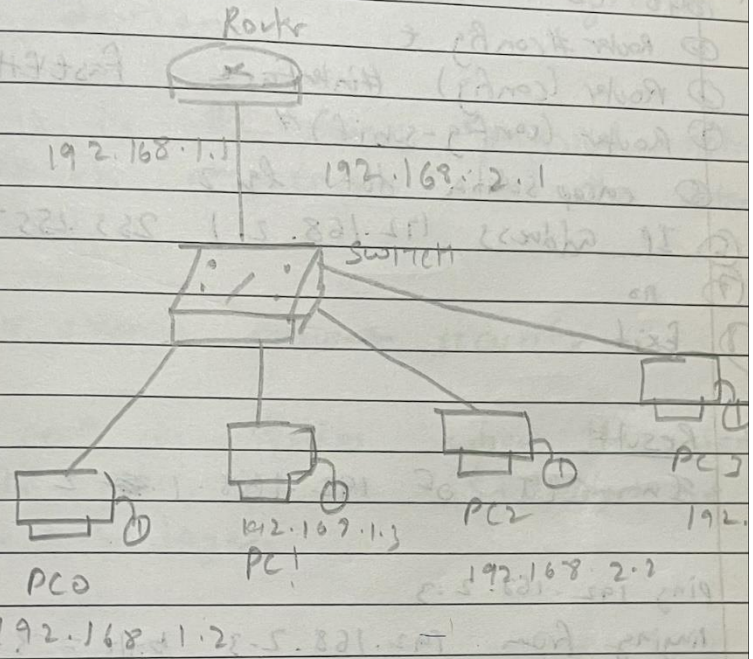
Exprimant:-11

Date __/__/__
Page

Aim

To conduct A VLAN and make the p
communicate among a VLAN

Topology



procedure

- Place a router (1841), a Switch and 4 P
in the workspace and connect them
according to the topology.

- In Switch go to config and select
Select FastEthernet and make it
Thin allow Switch to forward fram
from different VLANs over a
single link.

Date __/__/__
Page

- Go to config of router and select VLAN and enter the number and name of VLAN.

- Go to CLI
  1. Router #config t
  2. Router (config) #interface fastEthernet 0/0
  3. Router (config-subif) #
  4. encapsulation dot1q 2
  5. Ip address 192.168.2.1 255.255.255.0
  6. no
  7. Exit

* Result

In CLI of 192.168.1.~~2~~ 2

ping 192.168.2.3
pinging from 192.168.2.3 byte = 32 time = 11ms
TTL = 128
Reply from 192.168.2.3 byte = 32 time = 7ms TTL = 128
Reply from 192.168.2.3 byte = 32 time = 7ms TTL = 128
Reply from 192.168.2.3 byte = 32 time = 8ms TTL = 128
ping statistics from 192.168.2.3
Packet send = 4 / Recieved = 4, Lost = 0 (0% loss)
Approximate Round trip time in mili-second
minimum = 7ms, Maximum = 9ms, Average = 7ms.

Date __/__/__
Page _____

Observation

- VLAN in virtual Local Area Network, Here, a network is subdivided into a small network for a group of devices.

- It is in the same physical network. It operates at Layer 2 of the network (DLL)

- VLAN improve network security

- A number of devices when the same physical LAN, but are subdivided in the data link layer.

TTL = 128

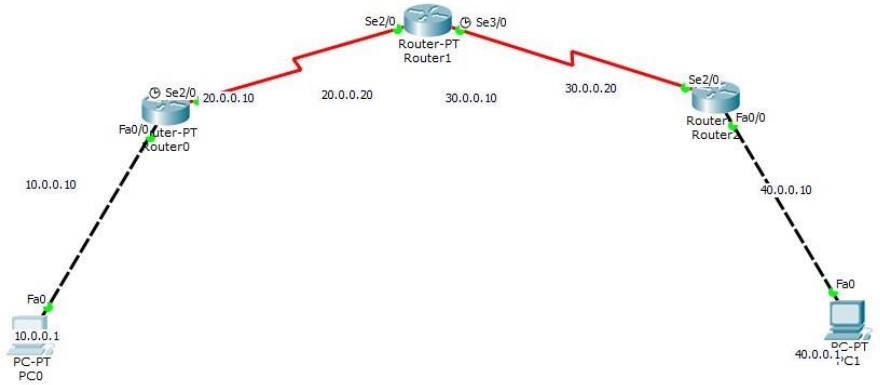
= 127

TTL = 126

Experiment 10

Aim : Demonstrate the TTL/ Life of a Packet

Topology :



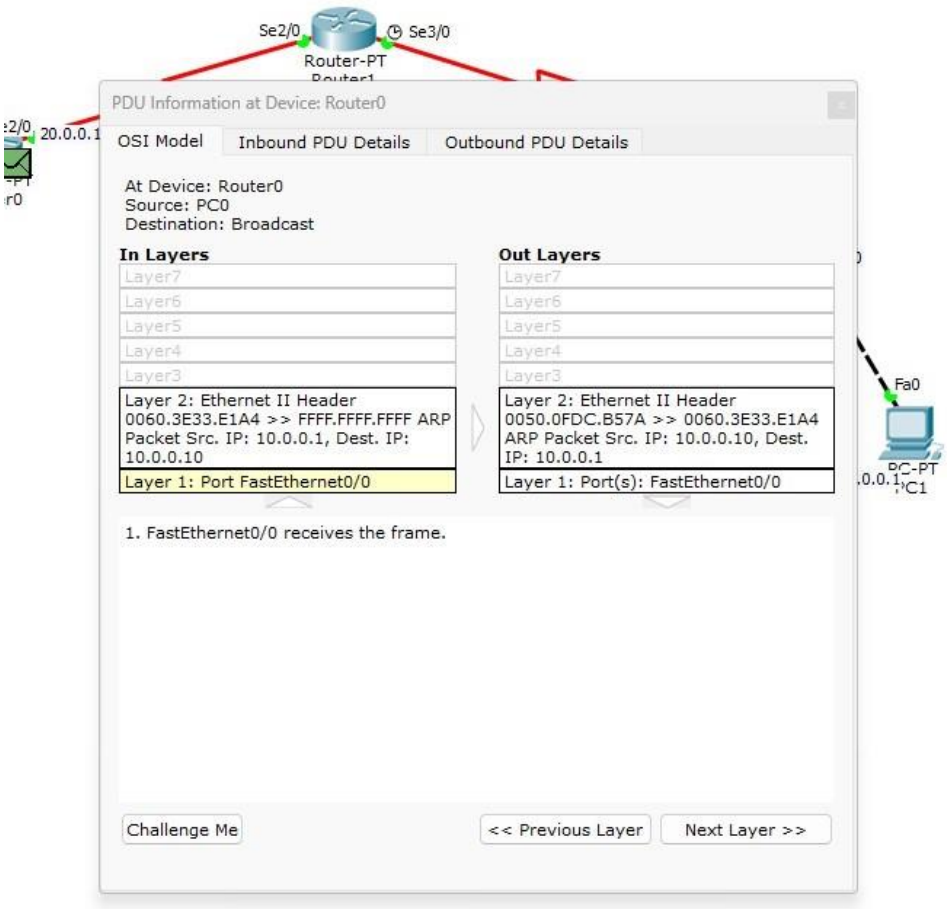
Configurations :

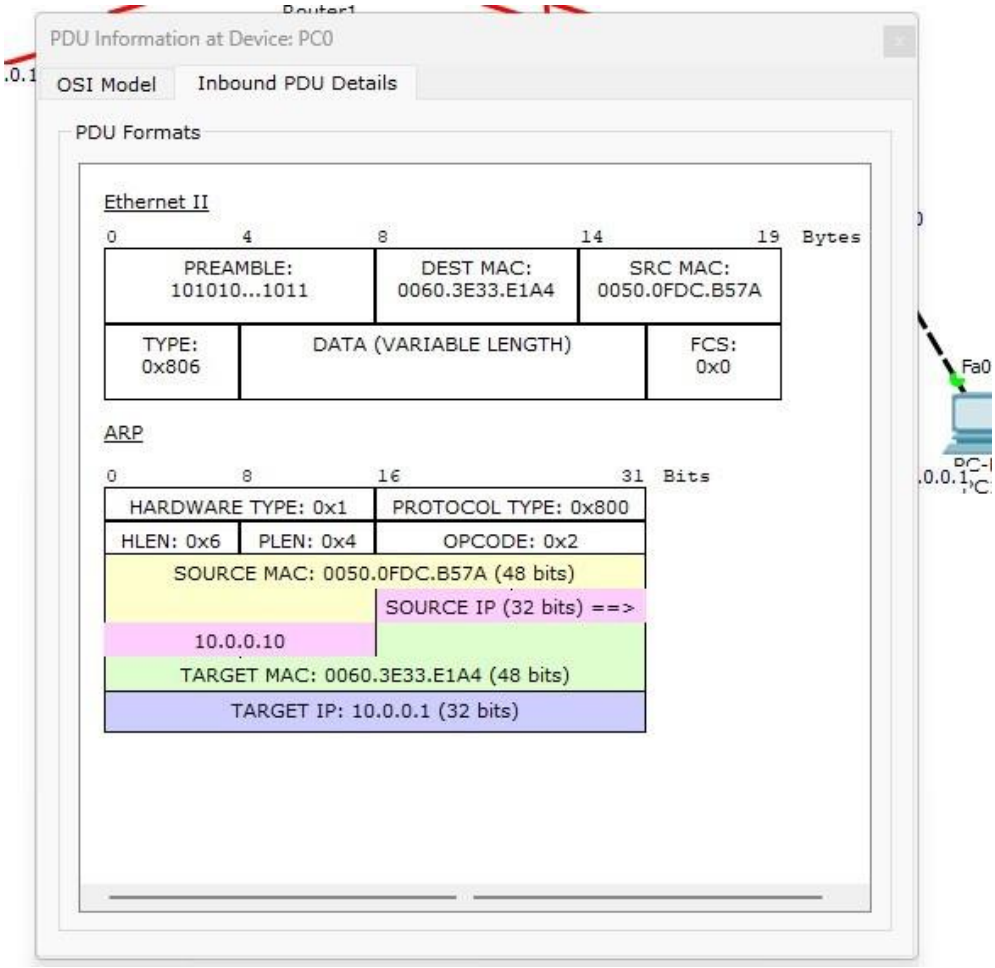
Configure the devices as per static / default / dynamic routing.

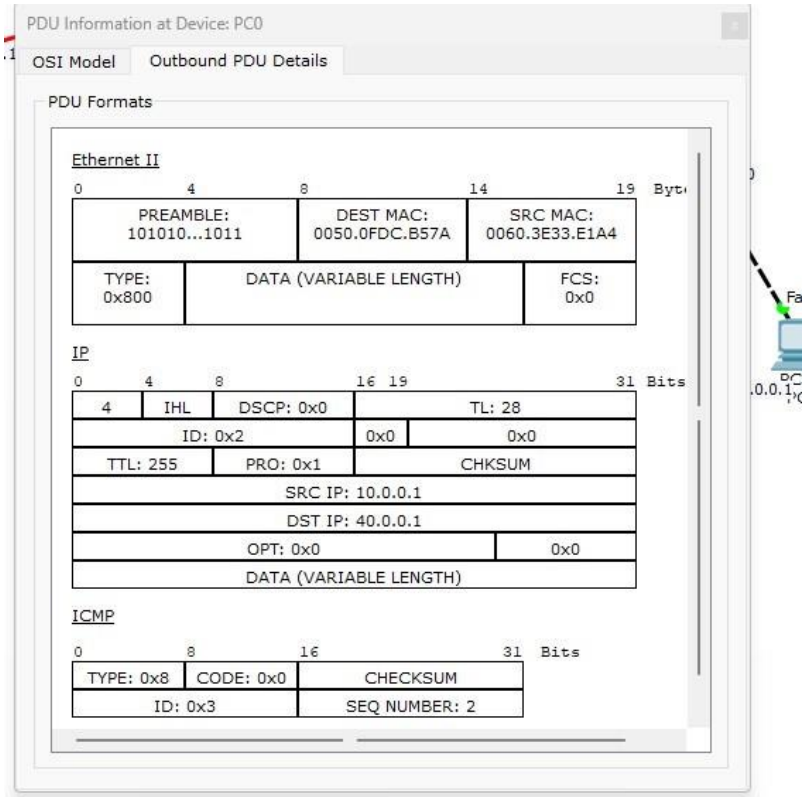
Above is done using static routing.

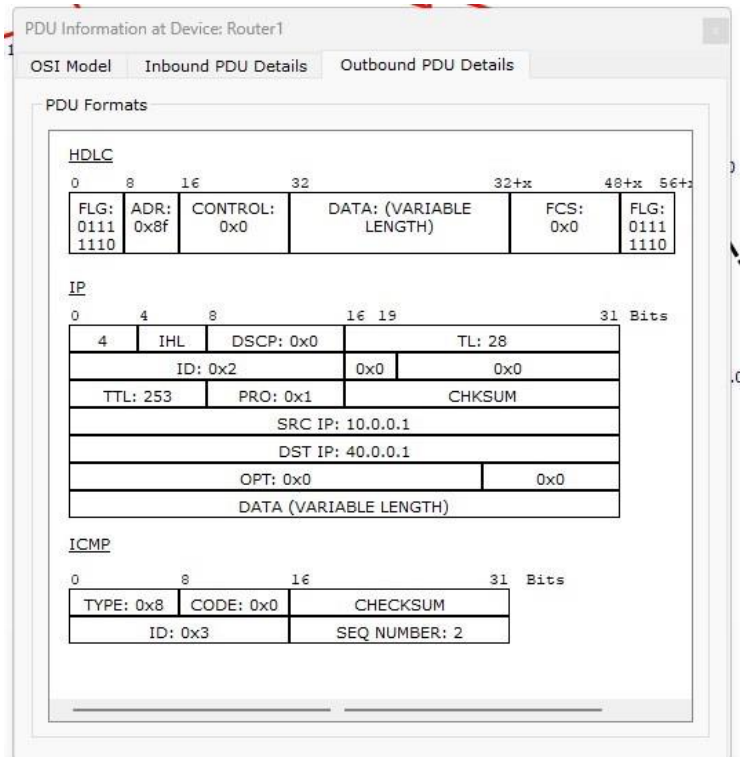
Output and PDU Details:

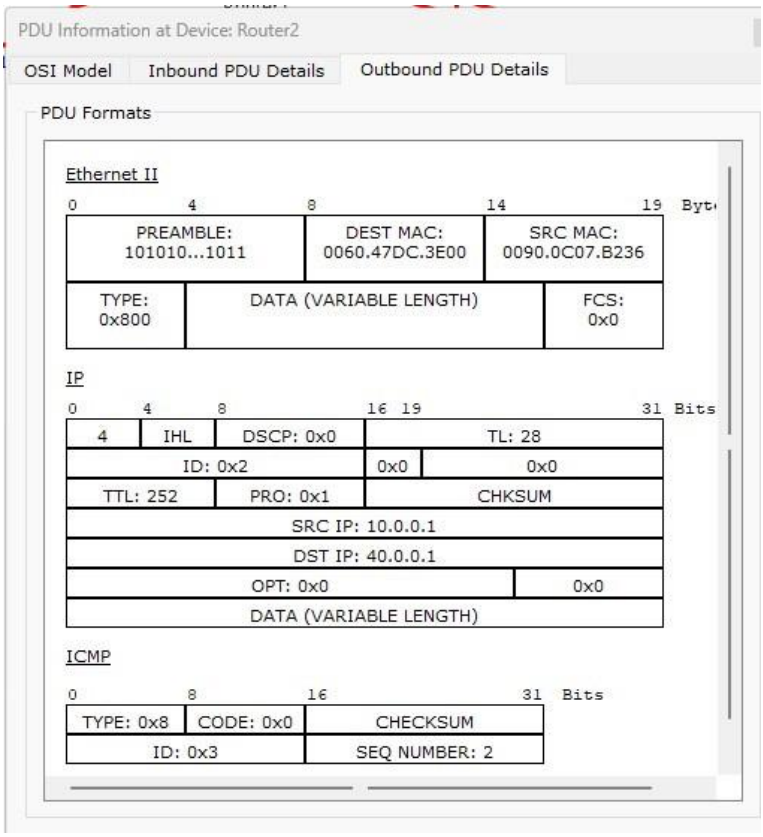
Simple PDU sent from PC0 to PC1 in simulation mode.




Router1
PDU Information at Device: PC0
OSI Model
Inbound PDU Details
PDU Formats
Ethernet II
0 4 8 14 19 Bytes
PREAMBLE: 101010...1011
DEST MAC: 0060.3E33.E1A4
SRC MAC: 0050.0FDC.B57A
TYPE: 0x806
DATA (VARIABLE LENGTH)
FCS: 0x0
ARP
0 8 16 31 Bits
HARDWARE TYPE: 0x1
PROTOCOL TYPE: 0x800
HLEN: 0x6
PLEN: 0x4
OPCODE: 0x2
SOURCE MAC: 0050.0FDC.B57A (48 bits)
SOURCE IP (32 bits) ==>
10.0.0.10
TARGET MAC: 0060.3E33.E1A4 (48 bits)
TARGET IP: 10.0.0.1 (32 bits)
Fa0


PDU Information at Device: PC0
OSI Model
Outbound PDU Details
PDU Formats
Ethernet II
0 4 8 14 19 Byt
PREAMBLE: 101010...1011
DEST MAC: 0050.0FDC.B57A
SRC MAC: 0060.3E33.E1A4
TYPE: 0x800
DATA (VARIABLE LENGTH)
FCS: 0x0
IP
0 4 8 16 19 31 Bits
4
IHL
DSCP: 0x0
TL: 28
ID: 0x2
0x0
0x0
TTL: 255
PRO: 0x1
CHKSUM
SRC IP: 10.0.0.1
DST IP: 40.0.0.1
OPT: 0x0
0x0
DATA (VARIABLE LENGTH)
ICMP
0 8 16 31 Bits
TYPE: 0x8
CODE: 0x0
CHECKSUM
ID: 0x3
SEQ NUMBER: 2


PDU Information at Device: Router1
OSI Model
Inbound PDU Details
Outbound PDU Details
PDU Formats
HDLC
0 8 16 32 32+x 48+x 56+x
FLG: 0111 1110
ADR: 0x8f
CONTROL: 0x0
DATA: (VARIABLE LENGTH)
FCS: 0x0
FLG: 0111 1110
IP
0 4 8 16 19 31 Bits
4
IHL
DSCP: 0x0
TL: 28
ID: 0x2
0x0
0x0
TTL: 253
PRO: 0x1
CHKSUM
SRC IP: 10.0.0.1
DST IP: 40.0.0.1
OPT: 0x0
0x0
DATA (VARIABLE LENGTH)
ICMP
0 8 16 31 Bits
TYPE: 0x8
CODE: 0x0
CHECKSUM
ID: 0x3
SEQ NUMBER: 2



Observation :

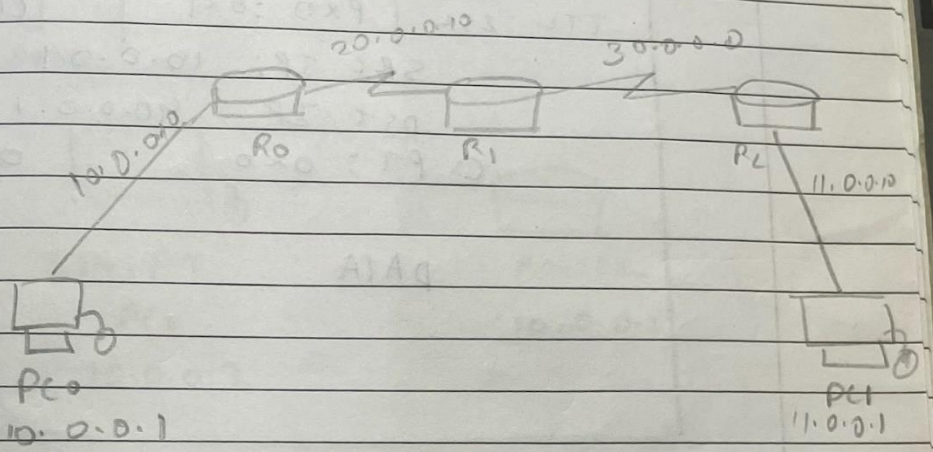
Experiment - 13

Date __/__/__
Page

Aim

Demonstrate the TTL / life of a packet.

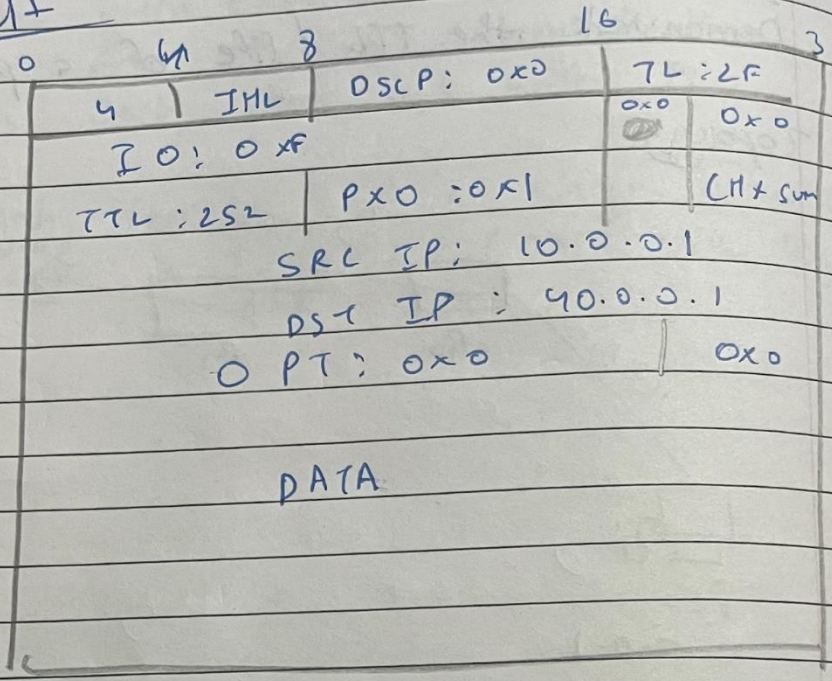
Topology



procedure

- Place 3 router and 2 PCs and connect them accordingly to the given topology
- Configure the router as per static & default routing
- Go to Simulation mode and run a Simple PDU from PC0 to PC1. Use capture at every transfer.
- Click on the PDU at every transfer to inbound and outbound PDU details. Every time the packet comes a router, there is a reduce in TTL

Result



Observation

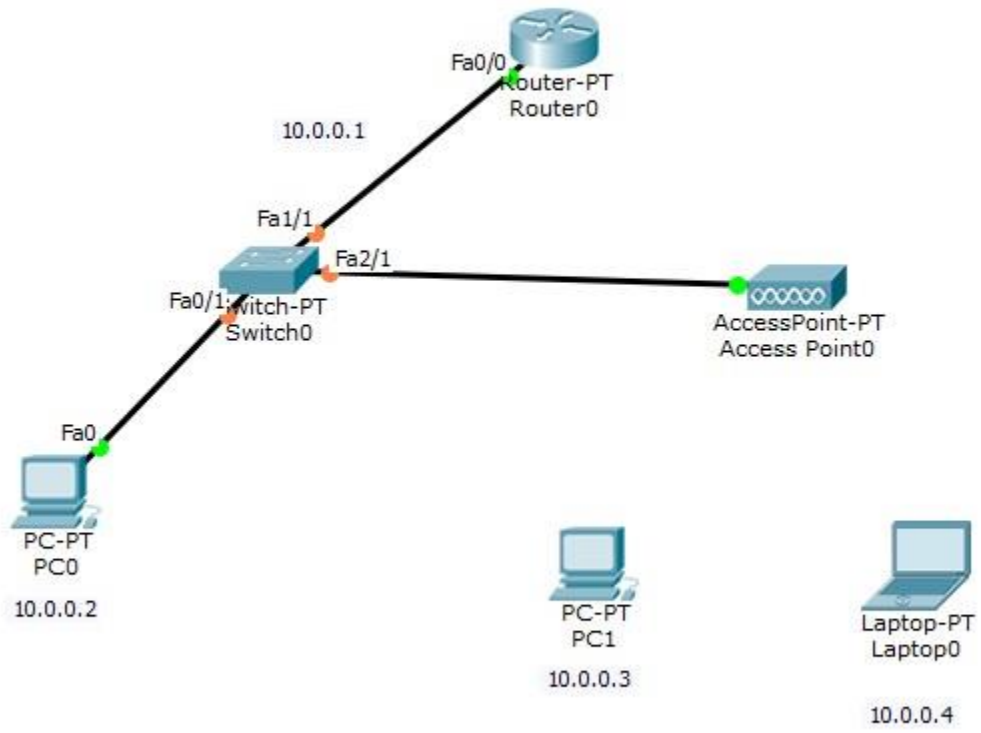
1. TTL is time to Live of a packet. Every time a packet (PDU) passes through a router, we can see that TTL is reduced by 1.

2. TTL is used to ensure a packet does not get lost and never bouncing randomly

Experiment 11

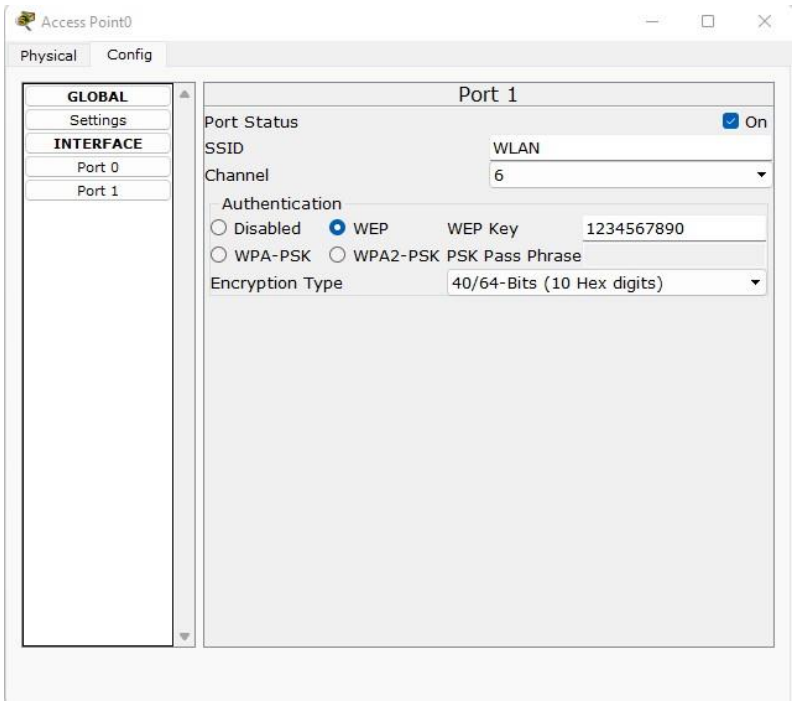
Aim : To construct a WLAN and make the nodes communicate wirelessly

Topology :

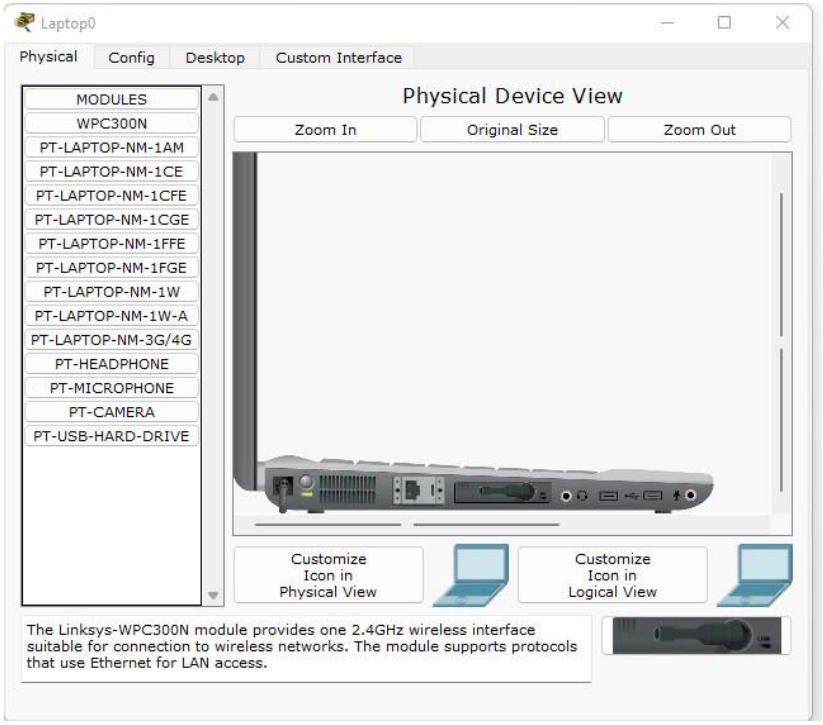


Configurations:

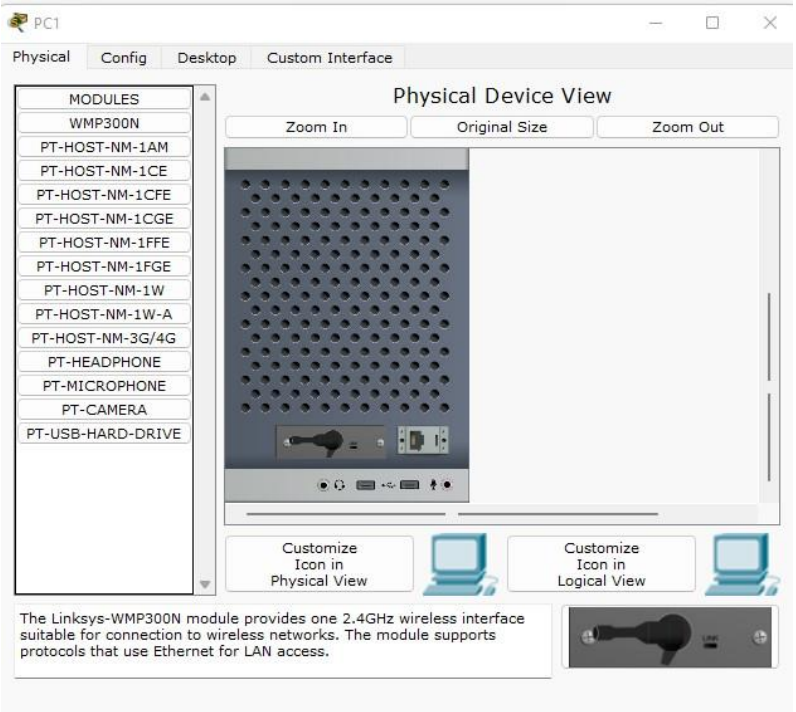
Access Point0:



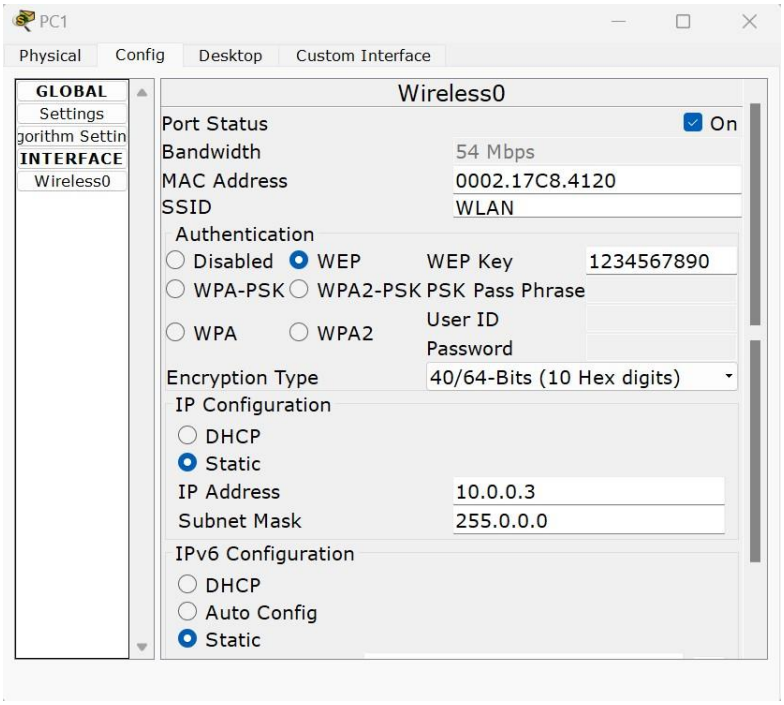
Laptop0 Physical port change:



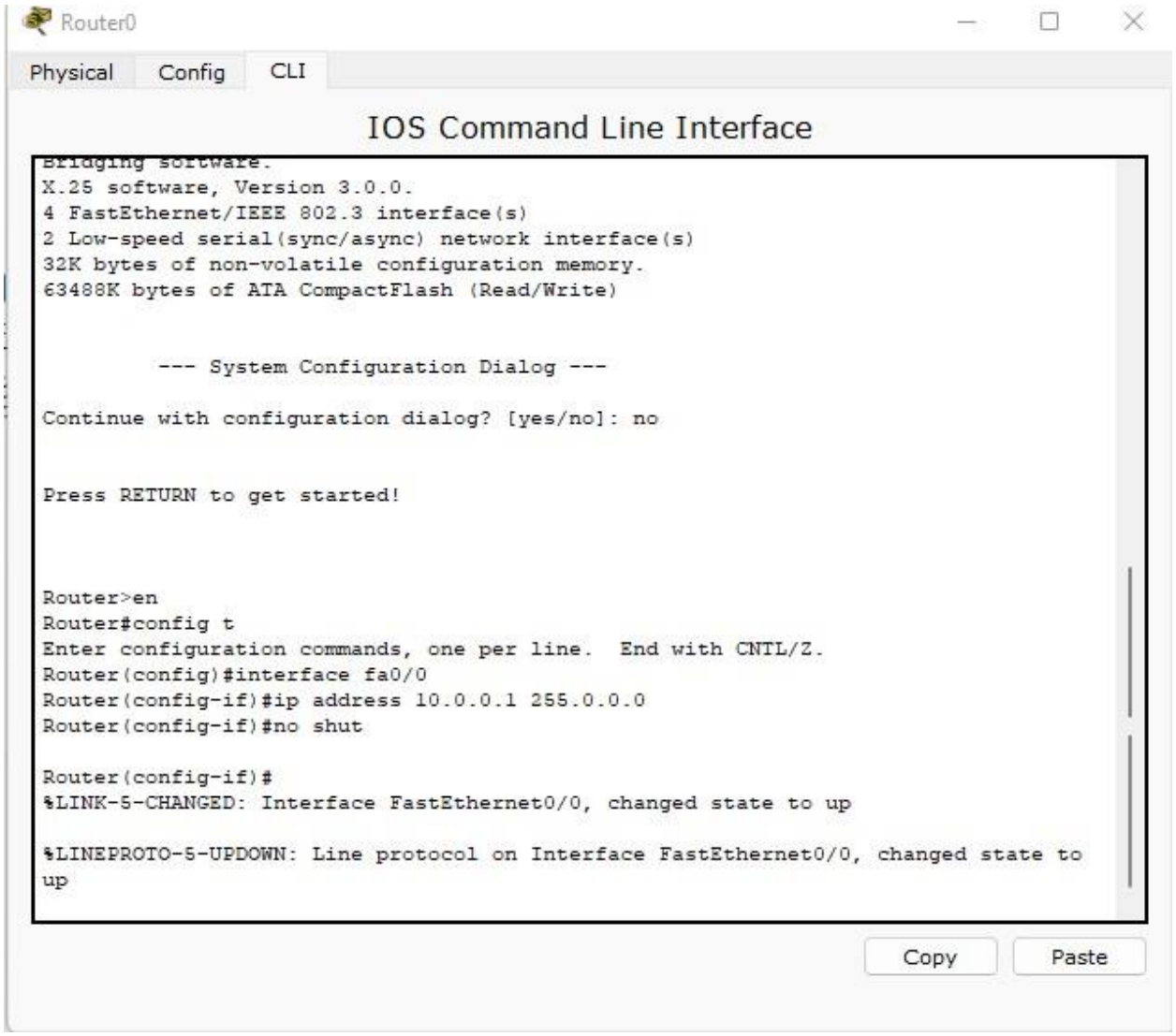
PC0 Physical port change:



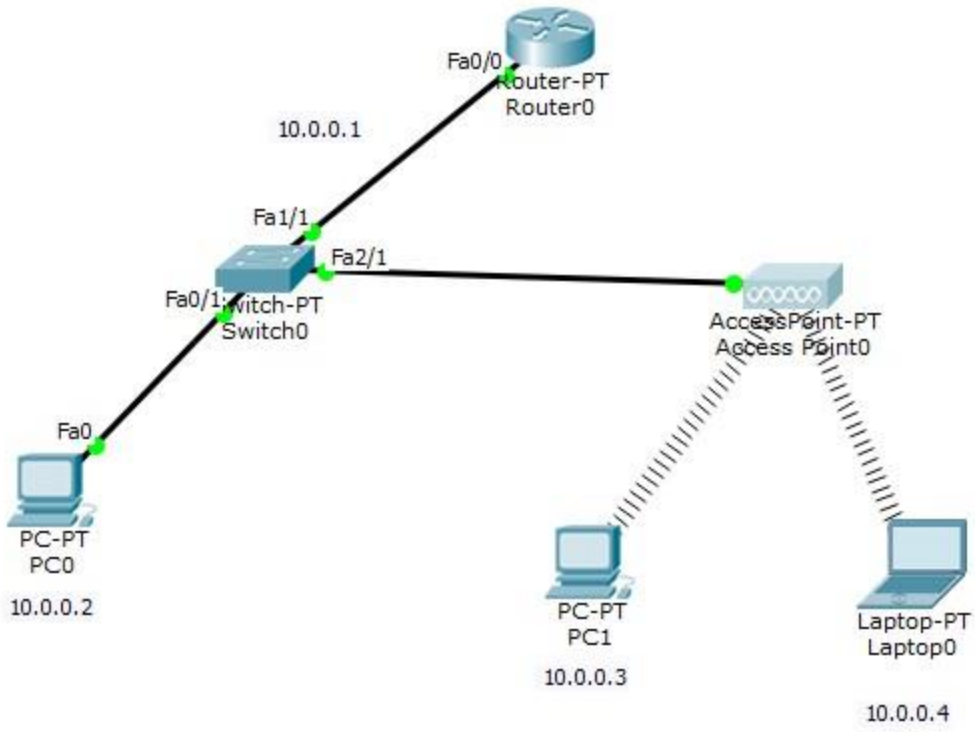
PC0 and Laptop0 Wireless configuration:



Router 0 CLI:

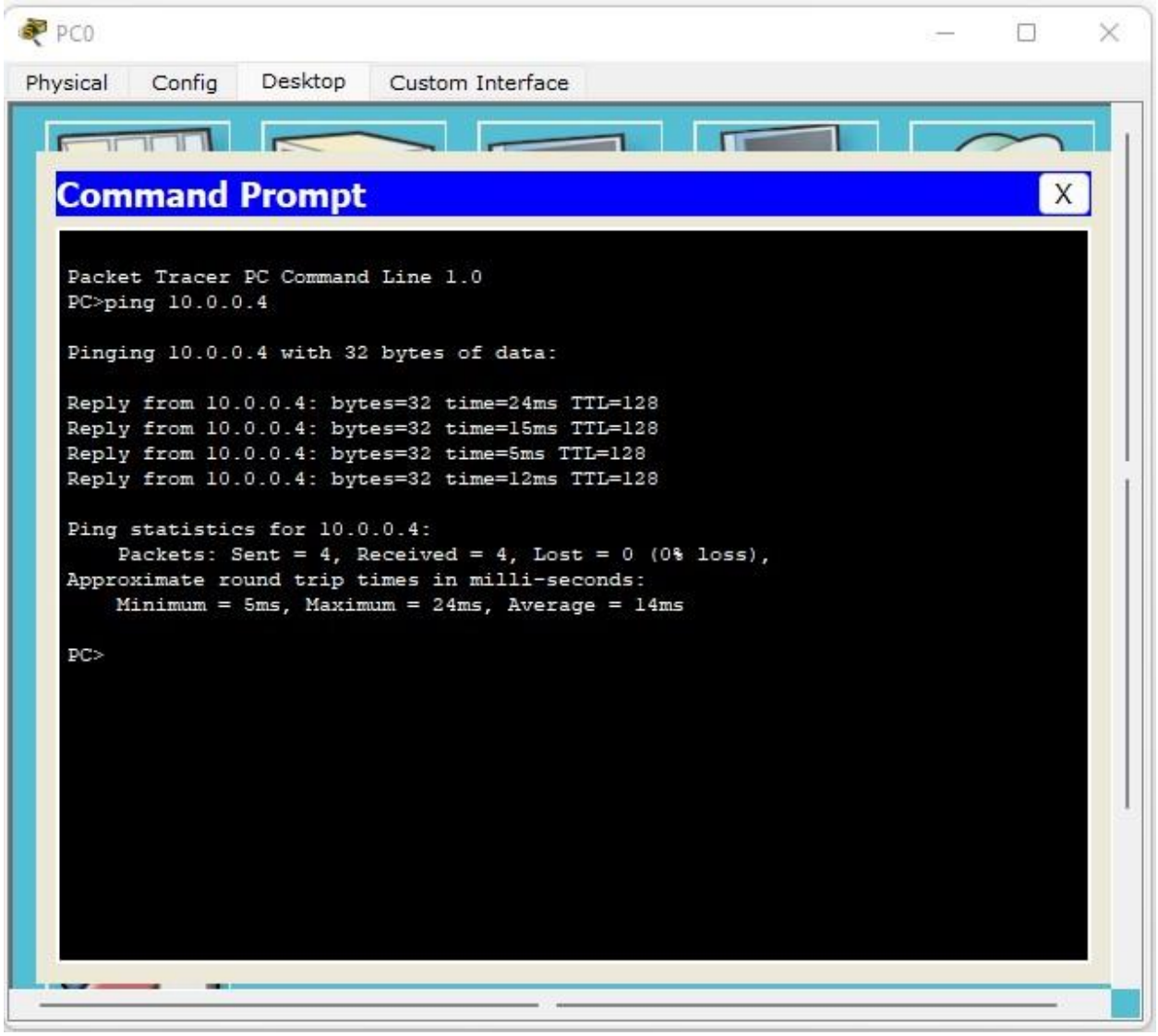


Final Topology:

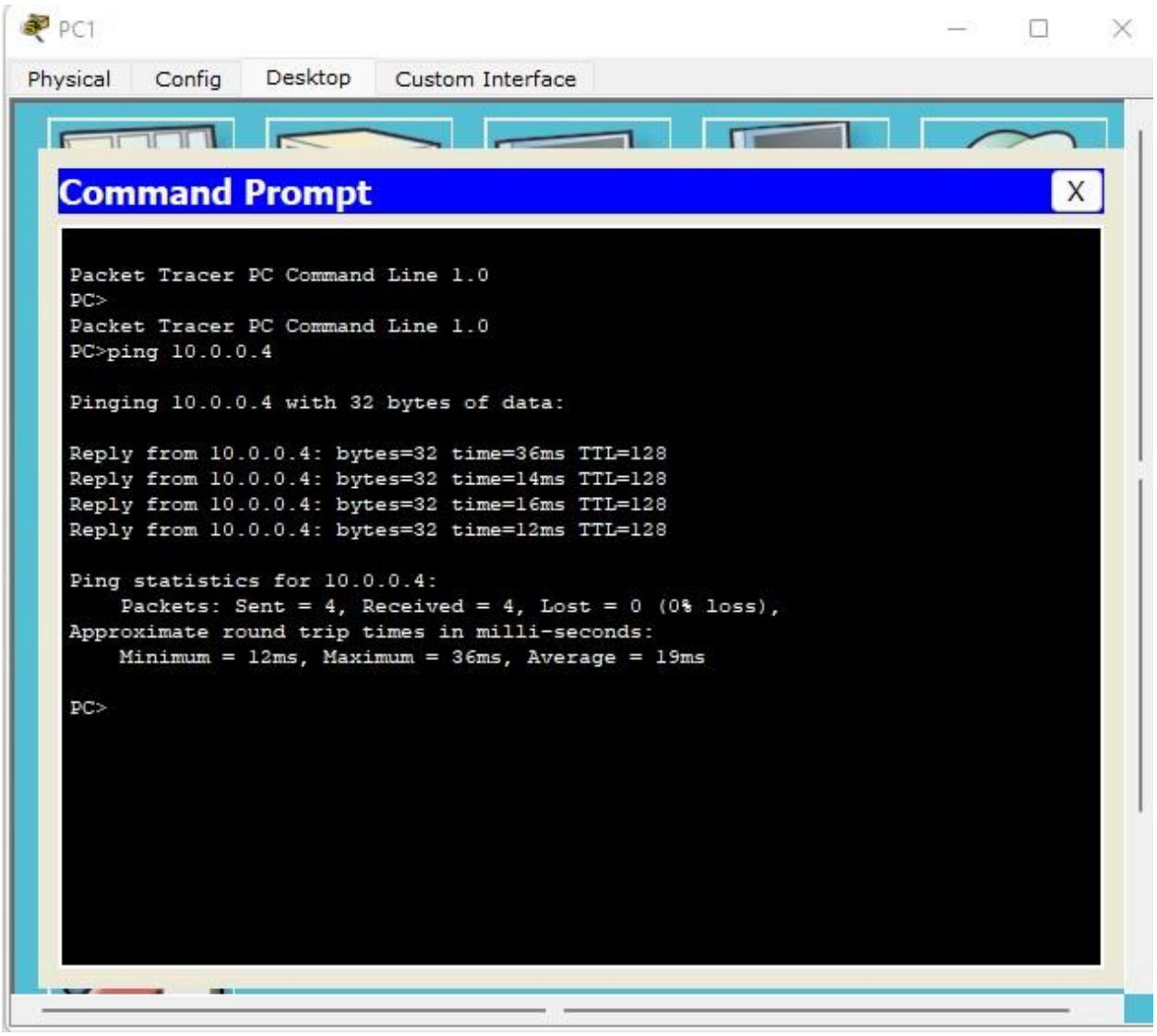


Ping Output :

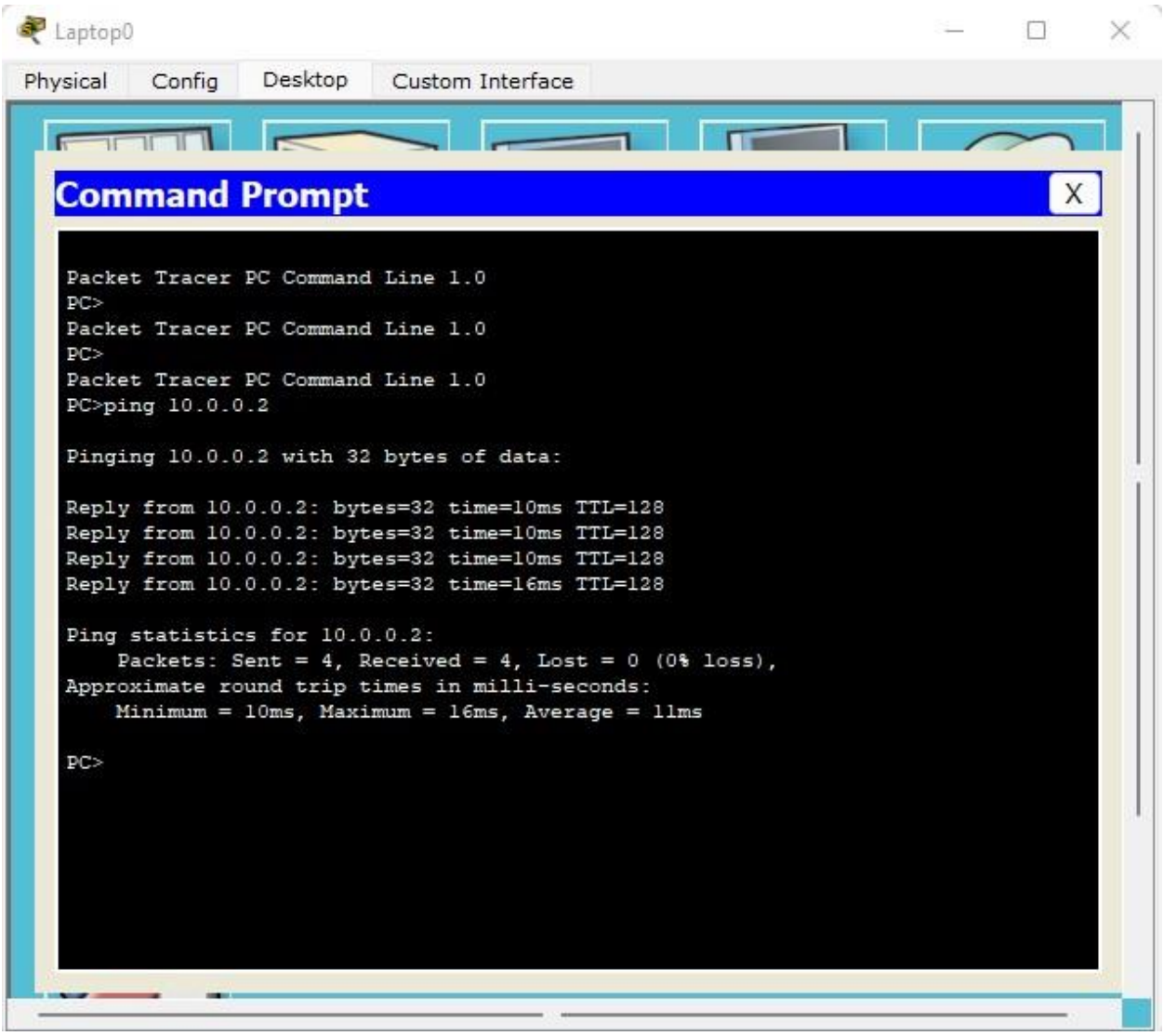
PC0 to Laptop0 :



PC1 to Laptop0 :



Laptop0 to PC0:



Observation :

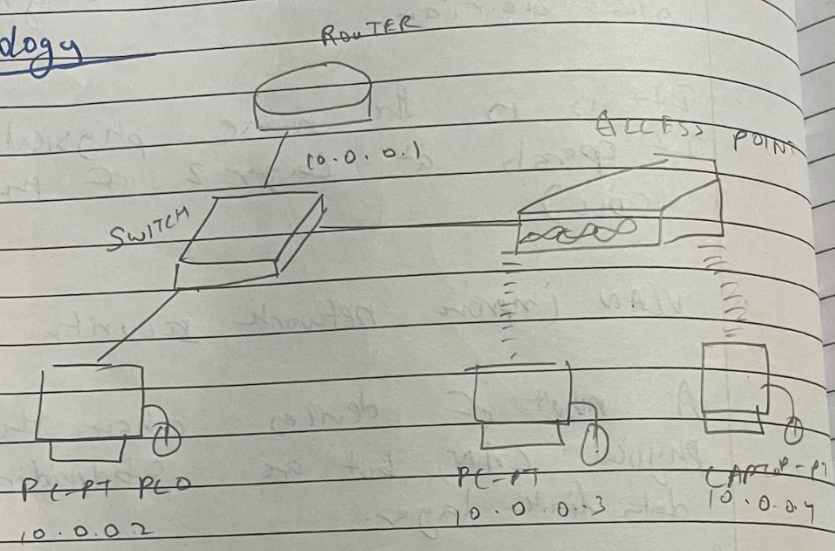
Date / /
Page

Experiment :- 12

Aim

To construct a WLAN and make the nodes communicate wirelessly.

Topology



Procedure

- Place a router, switch, 2 PCs, 1 access point and 1 laptop and connect them as shown in the Above topology
- Configure the router to IP 10.0.0.1 set IP and gateway to PC0 as normally done
- Configure access point - port 1. Set SSID Name a WLAN select WEP and set password 1234567890

Date __/__/__
Page _____

Switch off PC1 and laptop and replace ethernet port with WMP300N (wireless). Then turn them on and select GUEP to configure them wirelessly. Configure according to appropriate IP and gateway.

Result

In CLI of 10.0.0.2

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 = 4ms TTL = 128
Reply from 10.0.0.4: bytes = 32 time = 39ms TTL = 128
Reply from 10.0.0.4: bytes = 32 time = 7ms TTL = 128
Reply from 10.0.0.4: bytes = 32 time = 8ms TTL = 128

Ping statistics from 10.0.0.4
packets: sent = 4, Recieved = 4, Lost = 0 (0% Loss)

Approximate round-trip times in milliseconds.
Minimum = 7ms, Maximum = 19ms, Average = 10ms

Observation

WLAN in wireless local Area Network. It is a local network where devices within the network are able to communicate with each other wirelessly.

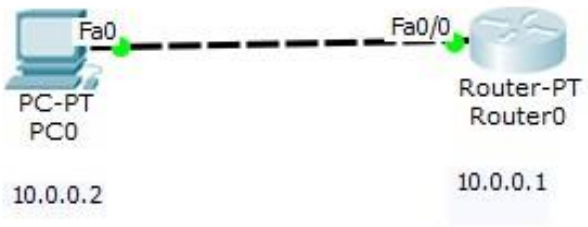
Date __/__/__
Page

- In the given experiment, PC1 and the laptop are able to communicate wirelessly with each other and with PC0.
- WLAN consider of a single network. It operates in Layer 2 (DATA Link Layer).

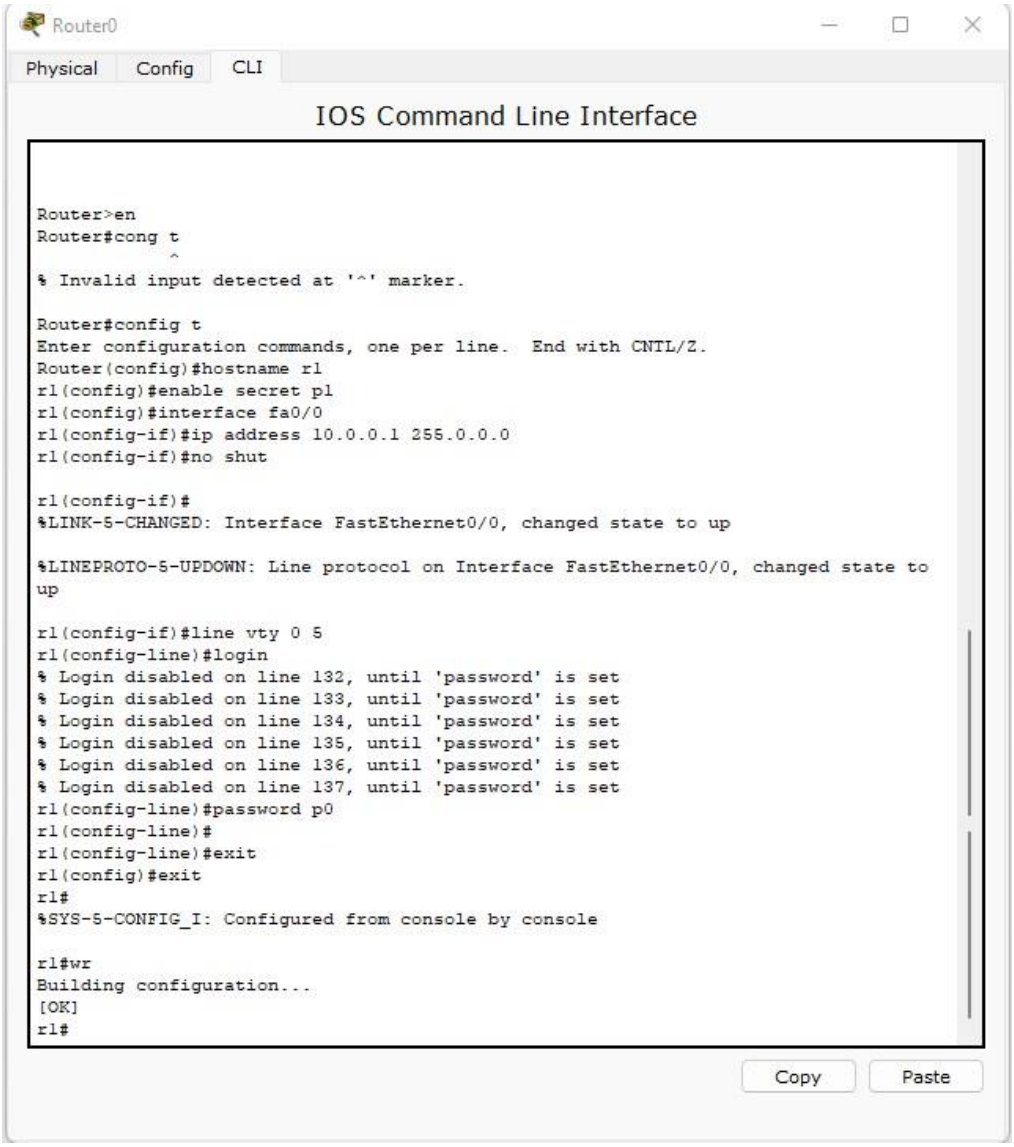
Experiment 12

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

Topology :

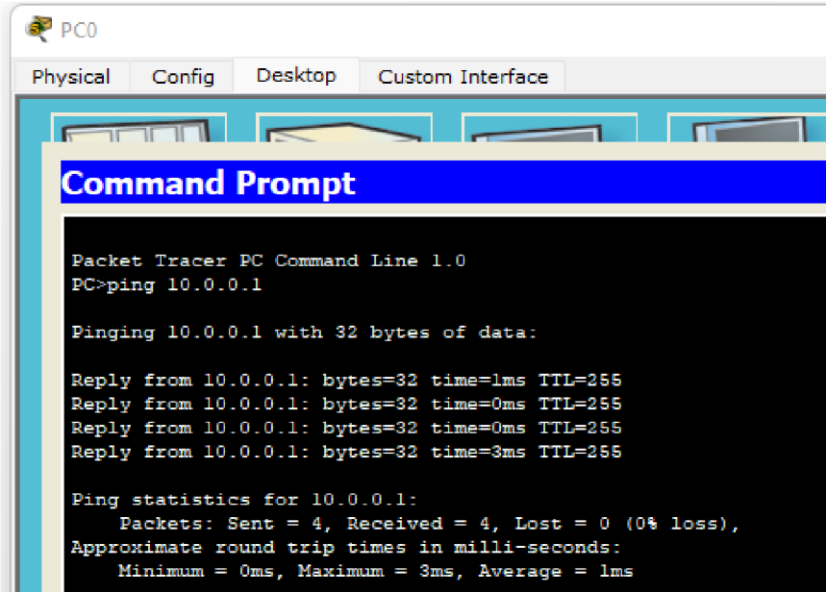


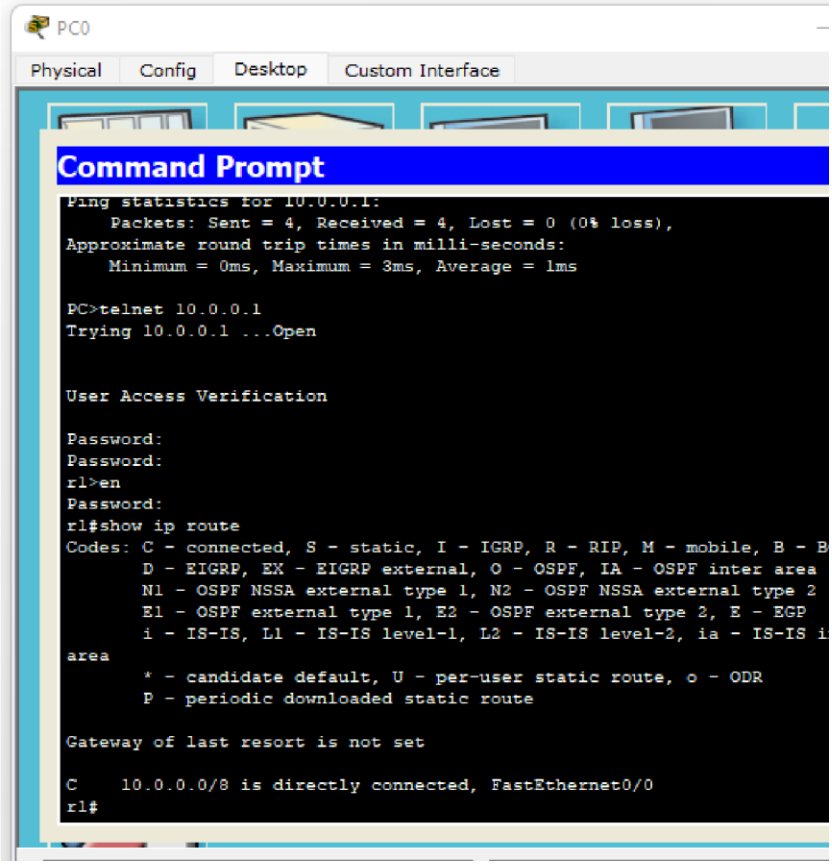
Configuration:
Router 0 CLI:



Ping Output:

PC0 to Router:





Observation :

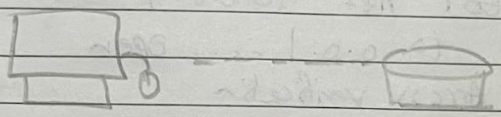
Experiment: 14

Date __/__/__
Page

Aim

To understand the operation of TELENT by accessing a router in server room of a PC.

Topology



PC-PT
PC0
10.0.0.2

ROUTER
10.0.0.1

Procedure

- Place a PC and router and connect them as shown in the topology.

. Configure the router:

1. enable
2. config t
3. hostname R1
4. enable secret P1
5. interface fastethernet 0/0
6. ip address 10.0.0.1 255.0.0.0
7. no shut
8. line vty 0 5 // allow virtual terminal access for 6 users
9. login
10. password P0
11. exit
12. write // to save router changes

- Ping the router from the PC

Result

In PC CLI
PC> telnet 10.0.0.1
Trying 10.0.0.1 .... open
User Access verification
password : P0
r> enable
password : P1
r#

Observation

- TELNET in teletype Network. It provides a command line interface to communicate with a server.

in this case router.

1 Using TELNET, we are able to run commands in the PC or would be run in router CLI. If we type Show ip route in the PC CLI, we will see the router in response to the command.

Cycle - 2

Experiment 13

Aim : Write a program for error detecting code using CRC CCITT (16-bits).

Experiment :-15

Date __/__/__
Page

Aim
Write a program for error detecting code using CRC - CCITT (16-bits)

- JAVA program

```
import java.util.Scanner;

Class Main
{
    public static void main (String args[])
    {
        Scanner in = new Scanner (System.in);
        System.out.println (" Enter menage/data bits: ");
        String menage = in.nextLine();
        System.out.println (" Enter Generator : ");
        String generator = in.nextLine ();
        int data[] = new int [menage.length() +
        generator.length() - 1];
        int divisor [] = new int [generator.length()];

        For (int i = 0; i< menage.length(); i++)
        data[i] = Integer.parseInt (message.charAt(i)
                                    + " ");

        for (int i = 0; i< generator.length(); i++)
            divisor[i] = Integer.parseInt (generator.charAt (i)
                                    + " ");

        For (int i = 0; i< menage.length(); i++)
        {
            if (data[i] == 1)
```

```
        for (int j=0; j<divisor.length(); j++)
            data[i+j] = divisor[j];

    }
    System.out.println("The checksum code is:");
    for(int i=0; i<message.length(); i++)
        data[i] = Integer.parseInt(message.charAt(i)
                  + "");

    for(int i=0; i<data.length; i++)
        System.out.println(data[i]);
    System.out.println();

    System.out.println("Enter checksum code:");
    message = in.nextLine();
    System.out.println("Enter generator:");
    generator = in.nextLine();

    for(int i=0; i<message.length(); i++)
        data[i]= Integer.parseInt(message.charAt(i)+
                 "");

    for(int i=0; i<generator.length(); i++)
        divisor[i] = Integer.parseInt(generator.charAt(i)
                     + "");

    for(int i=0; i<message.length(); i++)
    {
        if(data[i]==1)
            for(int j=0; j<divisor.length; j++)
                data[i+j] = divisor[j];
    }
```

```
boolean valid = true;
for (int i = 0; i<data.length; i++)
{
    if (data[i] == 1)
    { valid = false;
      break;
    }
}
if (valid) System.out.println("Data stream is
valid !");

else System.out.println("Data stream is
invalid ! CRC error");

in.close();
return 0;
}
}
```

Output

- Enter message / data bits : 1110000
  Enter generator : 1001
  The checksum code is : 1110001111
  Enter checksum code : 1110001111
  Enter generator : 1001
  Data stream is valid!

- Enter message / data bits : 1110000
  Enter generator : 1001
  The checksum code is : 1110001111
  Enter checksum code : 1110001110 //error

Date __/__/__
Page

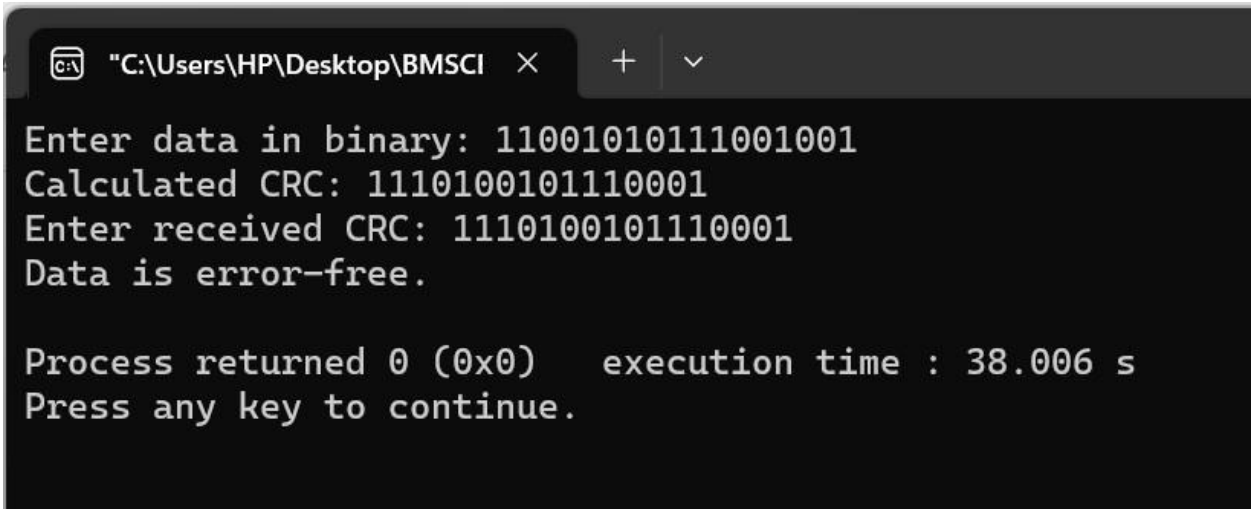
Enter generator : 1001
Data Stream is not valid ! CRC error

Program:

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

// CRC-CCITT polynomial: x^16 + x^12 + x^5 + 1 (0x1021)
//#define CRC_POLY 0x1021

// Function to perform bitwise XOR on binary strings  void
binaryXOR(char *result, const char *a, const char *b) {  for
(int i = 0; i < 16; i++) {  result[i] = (a[i] == b[i]) ? '0' : '1';
    }
    result[16] = '\0';
}

// Function to calculate CRC-CCITT checksum  void
calculateCRC(const char *data, int length, char *checksum) {
char crc[17];  for (int i = 0; i < 16; i++) {  crc[i] = '0';
    }
    crc[16] = '\0';

    for (int i = 0; i < length; i++) {
      for (int j = 0; j < 8; j++) {
          char msb = crc[0];  for (int
         k = 0; k < 16; k++) {  crc[k]
         = crc[k + 1];
          }
          crc[15] = '0';

          if (msb == '1') {
              char temp[17];  binaryXOR(temp, crc, "10001000000100001"); //
             CRC_POLY in binary  strcpy(crc, temp);
          }
       }
       crc[15] = (data[i] == '1') ? '1' : '0';
    }
    strcpy(checksum, crc);
}

void main() {
```

```
    char data[100]; // Replace with your actual
    data  printf("Enter data in binary: ");
    scanf("%s", data);

    int dataLength = strlen(data);  char
    checksum[17];  calculateCRC(data,
    dataLength, checksum);  printf("Calculated
    CRC: %s\n", checksum);

    // Simulating error by changing a bit
    // data[2] ^= 0x01; // Uncomment this line to introduce an error

    // Verify the received data  char
    receivedChecksum[17];
    printf("Enter received CRC: ");
    scanf("%s",
    receivedChecksum);

    if (strcmp(receivedChecksum, checksum) == 0)
        printf("Data is error-free.\n");

    else
        printf("Data contains errors.\n");
}
```

Output :



Experiment 14

Aim : Write a program for congestion control using Leaky bucket algorithm.

Experiment:-16

Date __/__/__
Page

Aim

Write a program for congestion control using leaky bucket Algorithm.

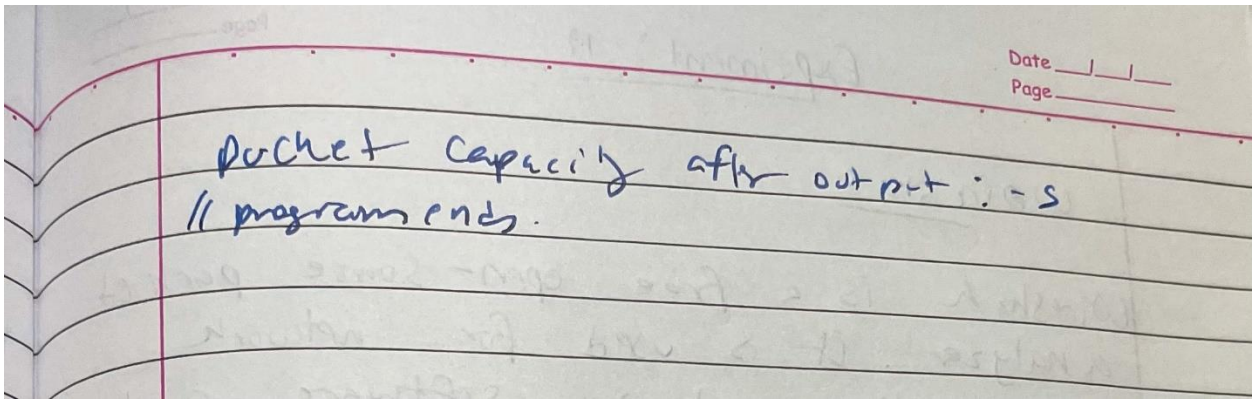
C program:

```
#include <stdio.h>
#include <stdlib.h>
#define capacity 10


void main()
{
  int timelimit = 10, bucketCapacity = 0,
  OutputRate = 5;

  while (timeLimit < 20)
  {
     int newpacket;
     printf("Enter new packet size: ");
     scanf("%d", &newPacket);

     if (new packet < capacity)
     {
        bucketCapacity t = new packet;
        printf("\n Bucket Capacity = %d",
              bucketCapacity);
        bucketCapacity -= OutputRate;
        printf("\n Bucket capacity after
        otput: %d", bucketCapacity);
        timelimit++;
  }
```

```
else if (newpacket > capacity || (newPacket
  + bucket(capacity) > capacity))
{
    printf("\n New packet Cannot
    be added to packet");
    bucketCapacity -= outputRate;
    printf("\n Bucket Capacity after
     output : %d ", bucketCapacity);
    timelimit++;
}
else
 {
    bucketCapacity = 0;
    printf("\n Bucket Capacity after output:
      %d ", bucketCapacity);
    timelimit ++;
    exit(0);
 }
  }
}
```

Output

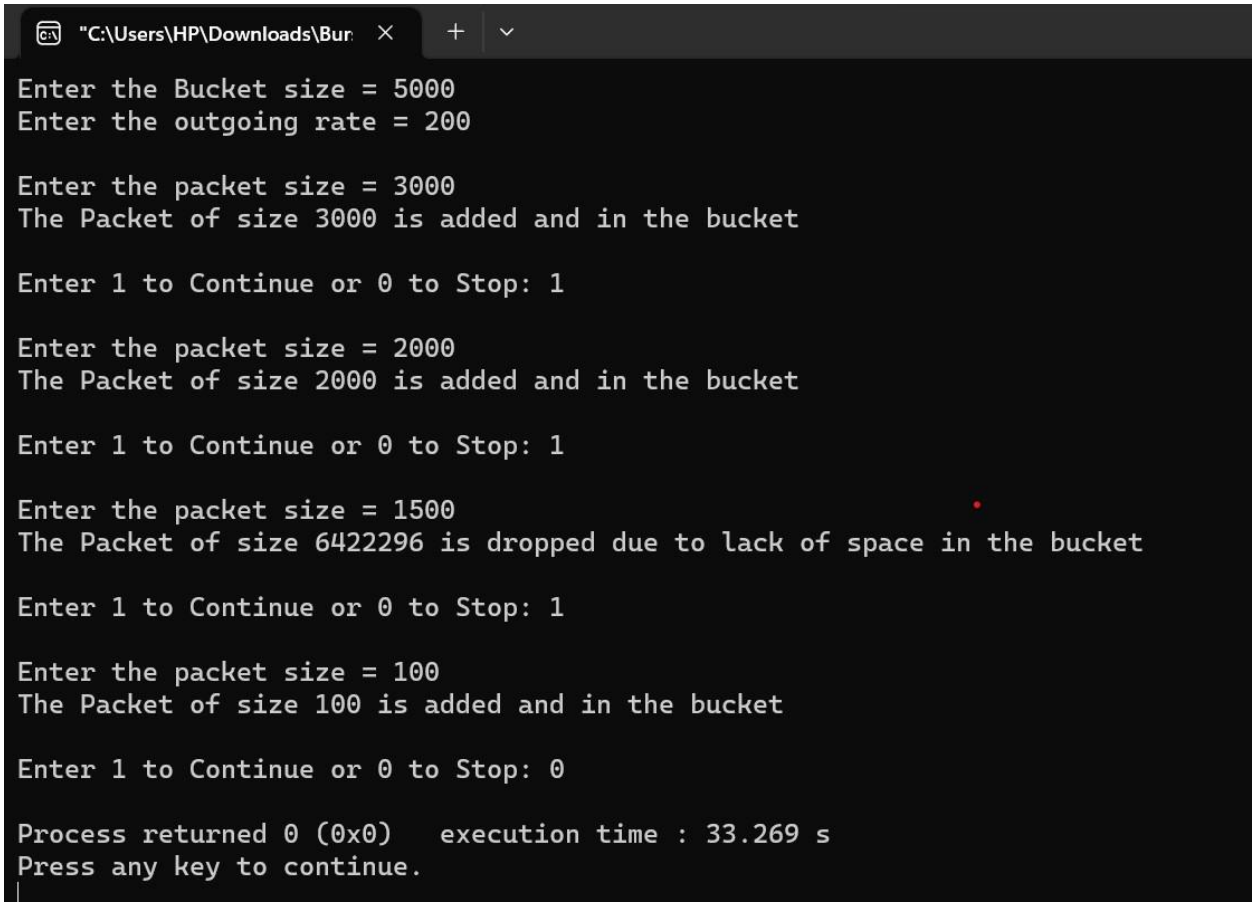
```
Enter new packet size : 15
bucket Capacity : 10
Enter new packet size: 22
new packet Cannot be added to bucket
bucket Capacity after output: 5
Enter new packet size: 0
bucket Capacity : 5
bucket Capacity after output : 0
Enter new Packet size: 0
```


Date
Page
Pocket capacity after output : - 5
// program ends.

Program:

```
#include<stdio.h>

void main()
{
   int
  psize,bsize,outgoing,emptyspace,choice;
  printf("Enter the Bucket size = ");
  scanf("%d",&bsize);  emptyspace=bsize;
  printf("Enter the outgoing rate = ");
  scanf("%d",&outgoing);  while(1)
   {
      printf("\nEnter the packet size = ");
     scanf("%d",&psize);

      if(psize<bsize&&psize<=emptyspace)
      {
         emptyspace=emptyspace-psize;  printf("The Packet of size %d is
        added and in the bucket \n",psize);  emptyspace+=outgoing;
      }

      else
      {
        printf("The Packet of size %d is dropped due to lack of space in the bucket\n");
      }

      printf("\nEnter 1 to Continue or 0 to Stop:
     ");  scanf("%d",&choice);  if(choice==0)
     break;

   }
}
```

Output :


"C:\Users\HP\Downloads\Bur
Enter the Bucket size = 5000
Enter the outgoing rate = 200
Enter the packet size = 3000
The Packet of size 3000 is added and in the bucket
Enter 1 to Continue or 0 to Stop: 1
Enter the packet size = 2000
The Packet of size 2000 is added and in the bucket
Enter 1 to Continue or 0 to Stop: 1
Enter the packet size = 1500
The Packet of size 6422296 is dropped due to lack of space in the bucket
Enter 1 to Continue or 0 to Stop: 1
Enter the packet size = 100
The Packet of size 100 is added and in the bucket
Enter 1 to Continue or 0 to Stop: 0
Process returned 0 (0x0) execution time : 33.269 s
Press any key to continue.

Experiment 15

Aim : 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.

Program:

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 serve is ready to receive")
   connectionSocket,addr = serverSocket.accept()
   sentence=connectionSocket.recv(1024).decode()

    file=open(sentence,"r")
   l=file.read(1024)
```

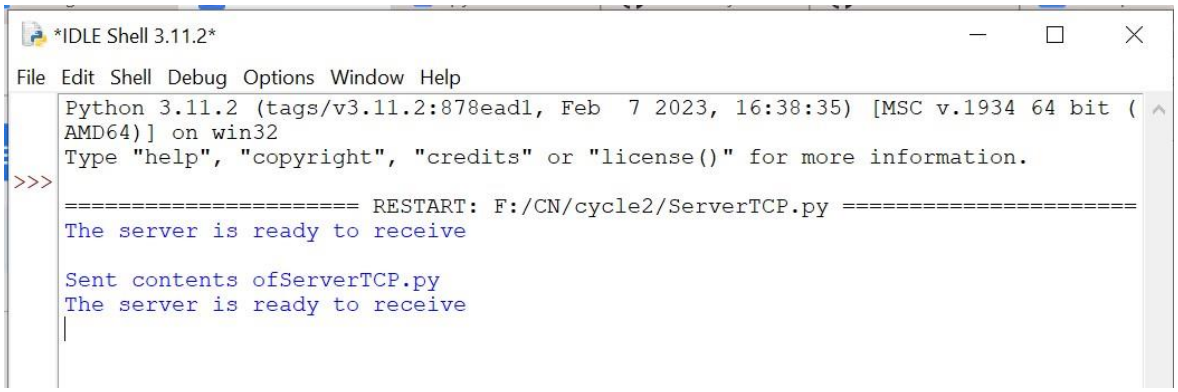
```
    connectionSocket.send(l.encode())
    print('\nSent contents of'+sentence)
    file.close()
    connectionSocket.close()
```

ClientTCP.py:

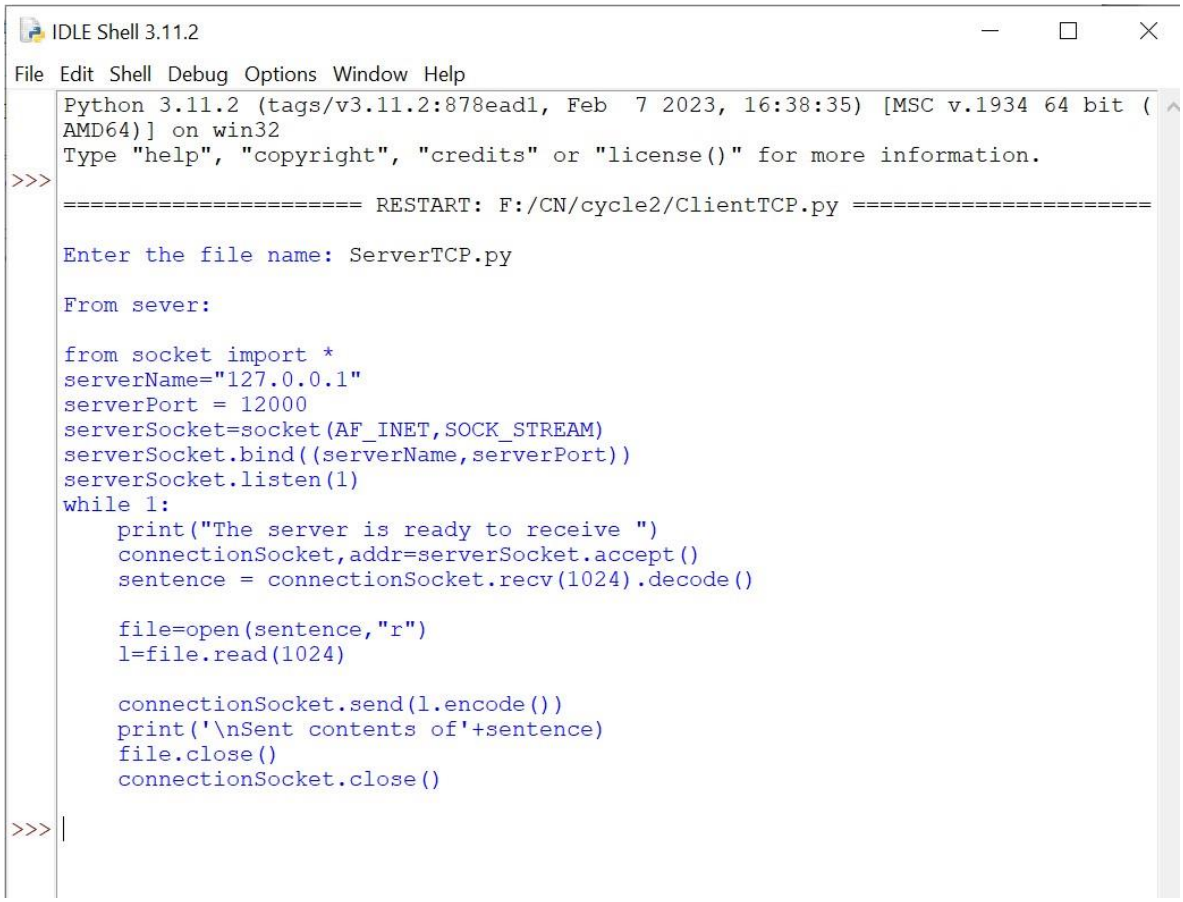
```
from socket import *  serverName='127.0.0.1'
serverPort=12000
clientSocket=socket(AF_INET,SOCK_STREAM)
clientSocket.connect((serverName,serverPort))
sentence=input("\nEnter file name: ")

clientSocket.send(sentence.encode())
filecontents=clientSocket.recv(1024).decode()
print('\nFrom Server:\n')  print(filecontents)
clientSocket.close()
```

Output :

Server instance:



Client instance:



Experiment 16

Aim : 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:

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)

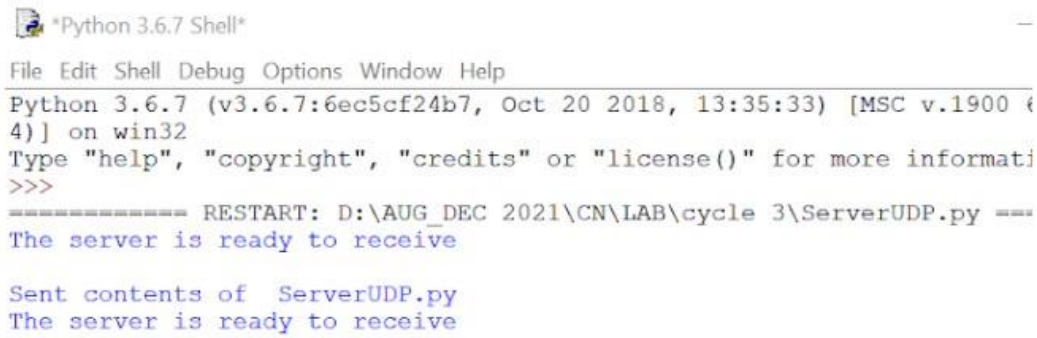
```
serverSocket.sendto(bytes(con,"utf-
8"),clientAddress)

 print('\nSent contents
of',end='')  print(sentence)
file.close()
```

ClientUDP.py:

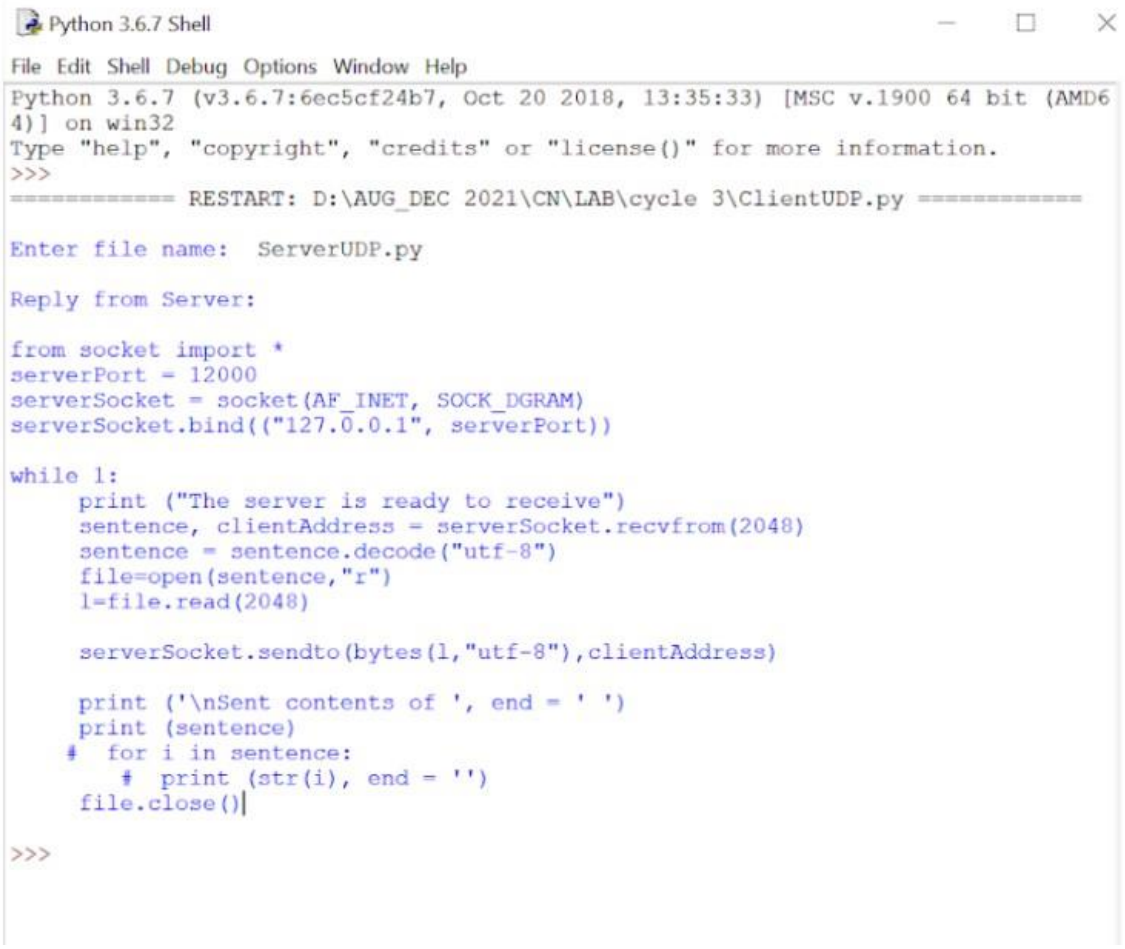
```
from socket import *  serverPort=12000
serverName="127.0.0.1"
clientSocket=socket(AF_INET,SOCK_DGRAM)

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"))
clientSocket.close()  clientSocket.close()
```

Output :

Server instance :



Client instance :



Experiment 17

Aim : Tool Exploration -Wireshark.

Experiment:- 17

Date / /
Page

Wireshark

Wireshark is a free open-source packet analyzer. It is used for network troubleshooting, analysis, software and communication protocol development and education.

Wireshark is mainly used to capture packets of data moving through a network. It allows user to put network interface controllers (NICs) into promiscuous mode to observe most traffic.

When capturing packets, Wireshark colour codes packets based on protocols. This means each packet can be coloured differently based on the protocol. This makes the GUI more user friendly and easy to understand. To begin capturing, you must select the type of connection. Options are mostly Ethernet, loopback traffic, LAN connection, wireless (WIFI). Upon double clicking one of the option, we begin to capture packets travelling through that medium.

Field captured are: packet number, source, destination, protocol, length and info. A filter option allows user to capture specific packets based on protocol, source IP, destination IP, packet length.

Date __/__/__
Page _____

These filter further improve the user experience and make the application beginner friendly. We can also retrieve information such as checksum, source port, destination port, payload, port, time to live, and header information. After capturing we can move the capture to stop capture we can use either Ctrl+E or the stop button.

Captured data interface contain 3 main button. Packet limit, Packet details, packet bytes

Packet list contain all packets captured. It include packet no, time source IP, destination IP, protocol, length in bytes, additional info on the packet.

packet detail in an extension of packet limit and it shows more information of the packets. Some of the information is source port and destination port number checksum and time to live,

Packet byte displays the raw data of the selected packet in hexadecimal view. Then dump contain 16 hexadecimal bytes and 16 ASCII bytes alongside the data effect. Upon right clicking we can display this information in bits.