VISVESVARAYA TECHNOLOGICAL UNIVERSITY

"JnanaSangama", Belgaum -590014, Karnataka.

LAB RECORD

Computer Network Lab (23CS5PCCON)

Submitted by

TUSHAR TYAGI (1BM22CS311)

in partial fulfillment for the award of the degree of

BACHELOR OF ENGINEERING

in

COMPUTER SCIENCE AND ENGINEERING

B.M.S. COLLEGE OF ENGINEERING

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BENGALURU-560019

Academic Year 2024-25 (odd)

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 Network (23CS5PCCON)"** carried out by **TUSHAR TYAGI (1BM22CS311),** who is a bonafide student of **B.M.S. College of Engineering.** It is in partial fulfilment for the award of **Bachelor of Engineering in Computer Science and Engineering** of the Visvesvaraya Technological University, Belgaum. The Lab report has been approved as it satisfies the academic requirements of the above-mentioned subject and the work prescribed for the said degree.

Prof. Sneha P Assistant Professor Department of CSE, BMSCE	Dr. Kavitha Sooda Professor & HOD Department of CSE, BMSCE

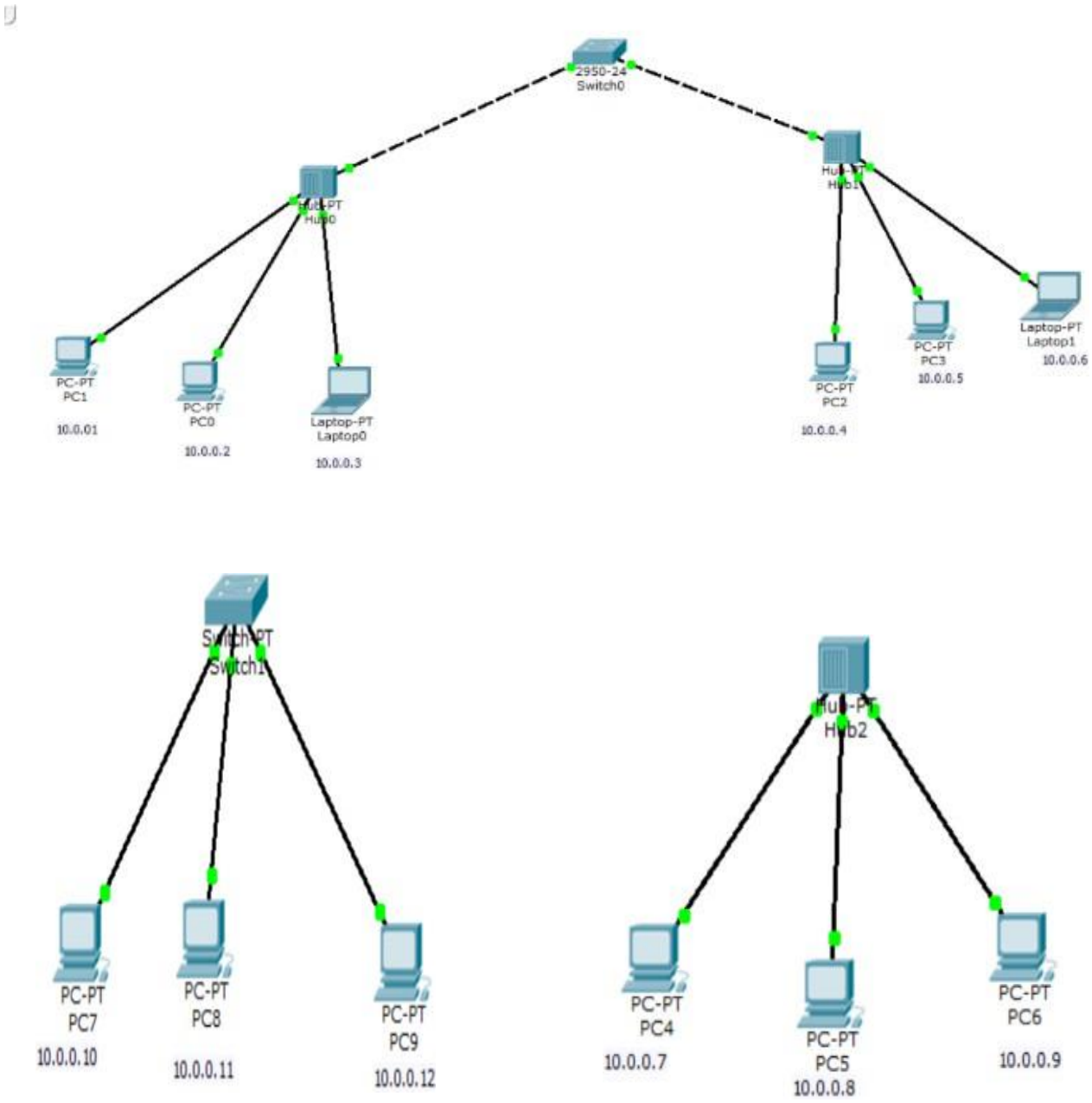
Index

Github Link : [tushartyagi-311 - GitHub]

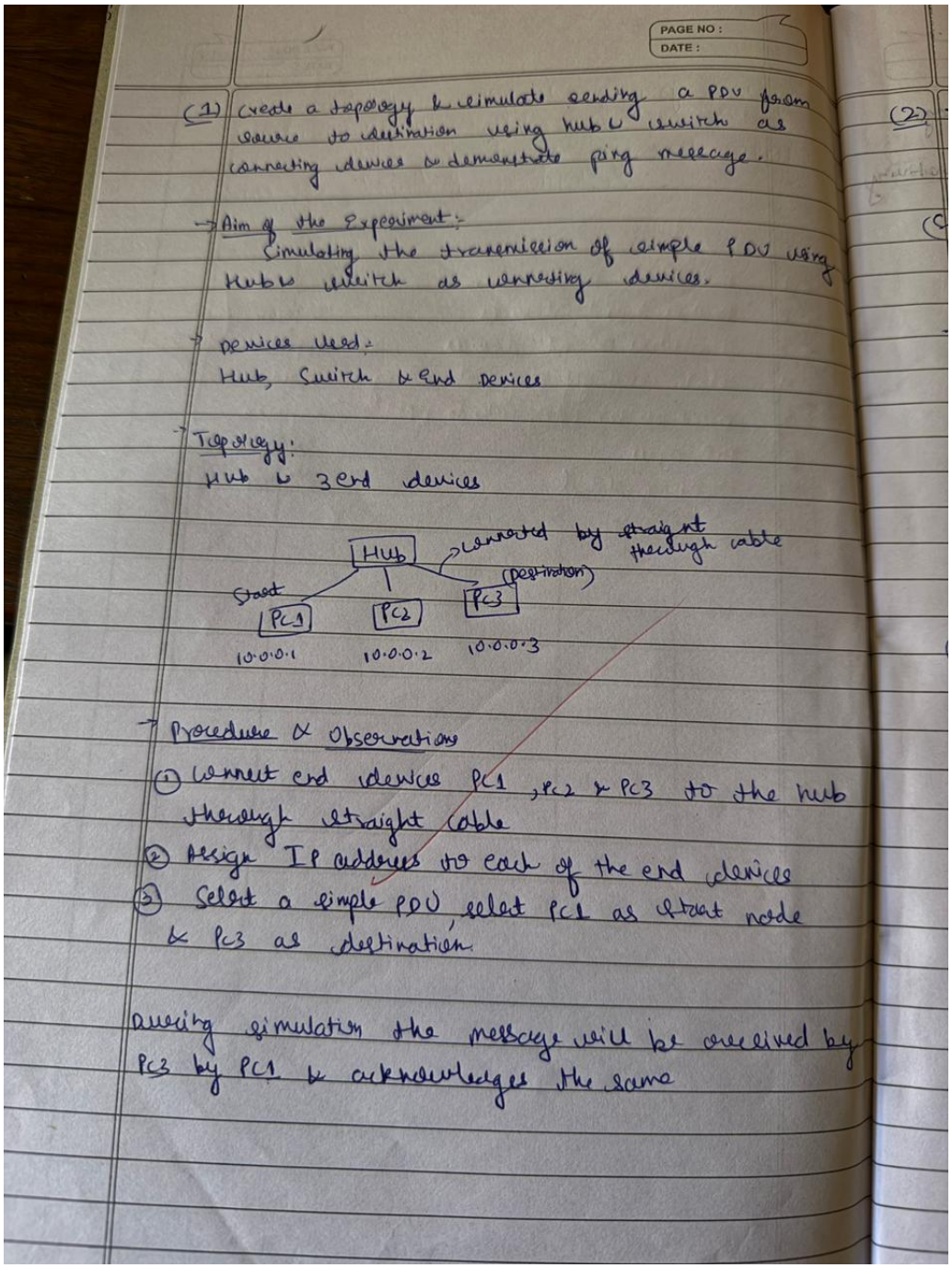
Program 1:

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

Topology:



Procedure and Observations:



PAGE NO :
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(1) Create a topology to simulate sending a PDU from source to destination using hub & switch as connecting devices & demonstrate ping message.

→ Aim of the Experiment:
Simulating the transmission of simple PDU using Hub & switch as connecting devices.

→ Devices Used:
Hub, Switch & End Devices

→ Topology:
Hub & 3 end devices

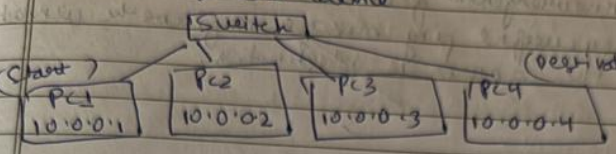
→ Procedure & Observations

1. Connect end devices PC1, PC2 & PC3 to the hub through straight cable
2. Assign IP address to each of the end devices
3. Select a simple PDU, select PC1 as start node & PC3 as destination

During simulation the message will be received by PC3 by PC1 & acknowledges the same

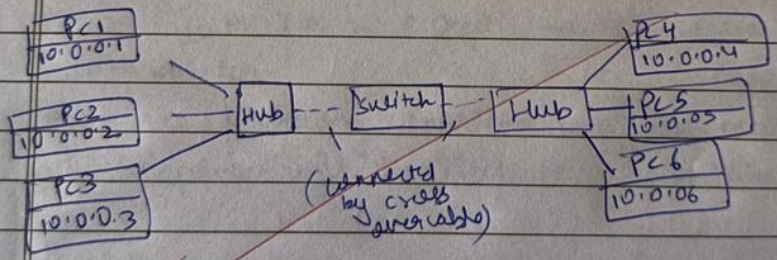
(2)

(2) Topology 2.
Switch & End device



- Connect 4 End devices PC1, PC2, PC3, PC4 to the switch with the mentioned IP addresses.
- Select Simple PDU, PC1 as start & PC4 as destination to simulate
- Connection to be made through straight through cables. The message will be sent from PC1 to PC4 & in between the acknowledgement will be sent from PC4 to PC1

(3) Topology 3.
→ Switch, hub & end devices

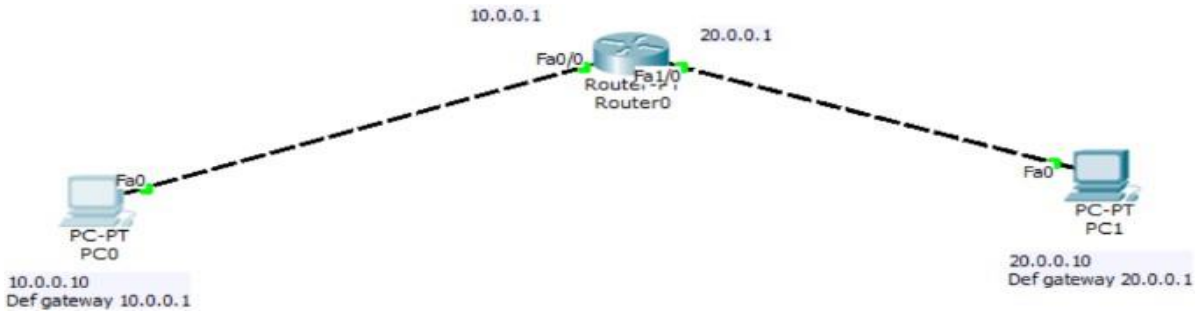


→ Connect the 2 end user devices PC1, PC2, PC3 with mentioned IP addresses to a hub & further is connected to switch. The connection b/w the hub & switch is through a cross over cable. Then connect switch to another hub with 3 end user devices with mentioned IP addresses. Select a simple PDU & assign any one of the first three PC's as destination node. Demonstrate

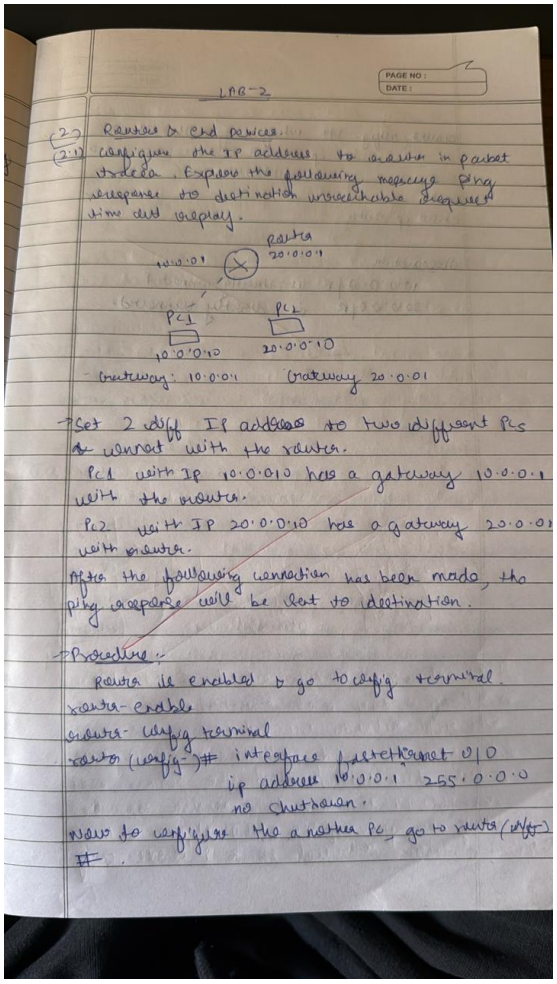
Program 2 :

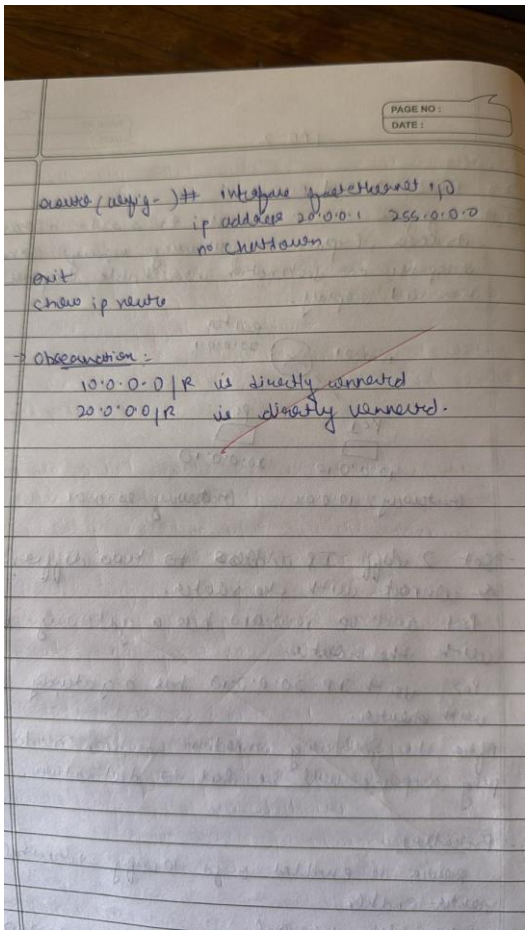
Aim: Configure IP address to routers in packet tracer. Explore the following messages: ping responses, destination unreachable, request timed out, reply.

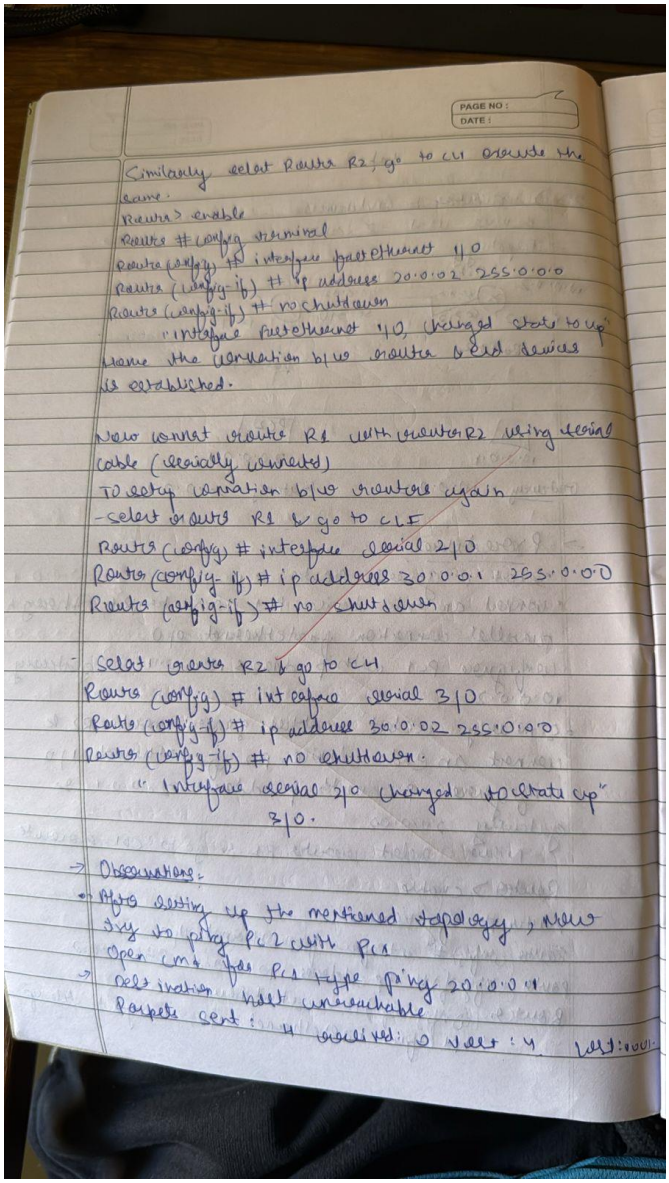
Topology:



Procedure and Observations:





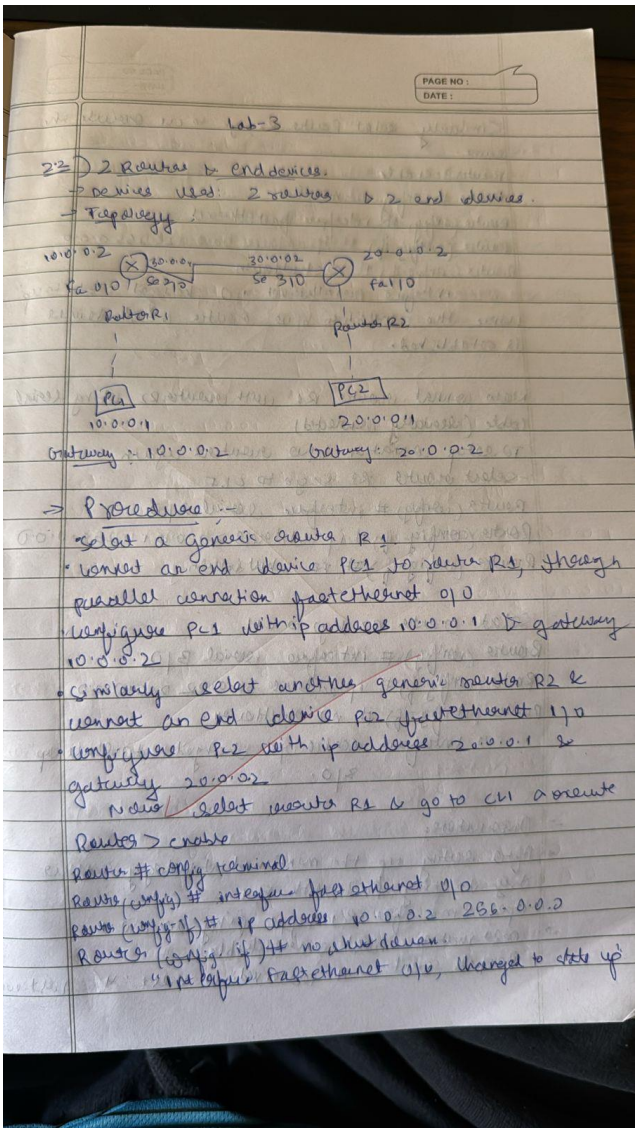


Similarly select Router R2 & go to CLI create the same.
Router> enable
Router # config terminal
Router (config) # interface fastethernet 1/0
Router (config-if) # ip address 20.0.0.2 255.0.0.0
Router (config-if) # no shutdown
"Interface fastethernet 1/0, changed state to up"
Now the connection b/w router & End devices is established.

Now connect router R1 with router R2 using serial cable (crossly connected)
To setup connection b/w routers again
- select router R1 & go to CLI
Router (config) # interface serial 2/0
Router (config-if) # ip address 30.0.0.1 255.0.0.0
Router (config-if) # no shutdown

- select router R2 & go to CLI
Router (config) # int ceface serial 3/0
Router (config-if) # ip address 30.0.0.2 255.0.0.0
Router (config-if) # no shutdown.
"Interface serial 2/0 changed to state up"
3/0.

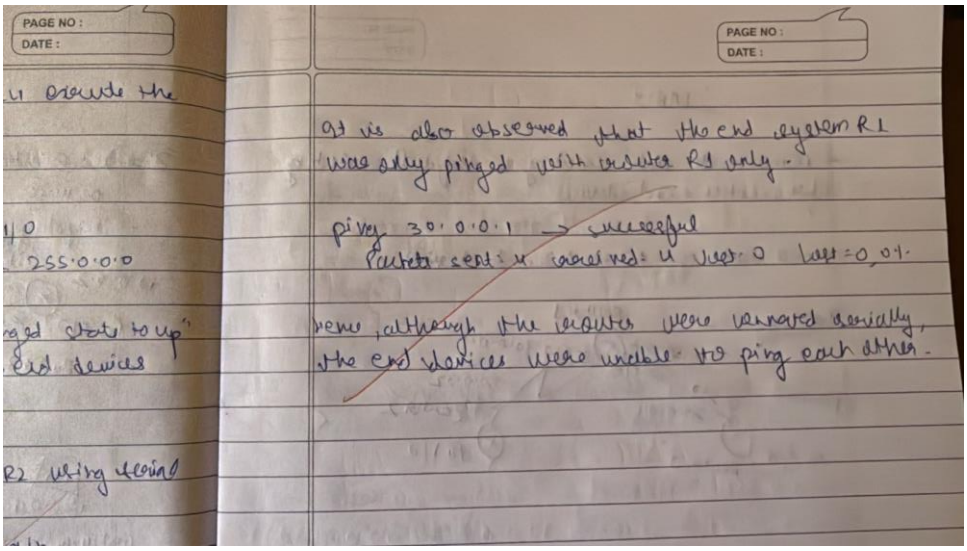
→ Observations:
- After setting up the mentioned topology, now try to ping PC2 with PC1
Open cmd of PC1 type ping 20.0.0.1
Destination host unreachable
Packets sent: 4 received: 0 lost: 4 (100%



Lab-3

2.2) 2 Routers & end devices.
→ Devices used: 2 routers & 2 end devices.
→ Topology:

→ Procedure:-
- Select a generic router R1
- Connect an end device PC1 to router R1, through parallel connection fastethernet 0/0
- Configure PC1 with ip address 10.0.0.1 & gateway 10.0.0.2
- Similarly select another generic router R2 & connect an end device PC2 fastethernet 1/0
- Configure PC2 with ip address 20.0.0.1 & gateway 20.0.0.2
Now select router R1 & go to CLI & create
Router> enable
Router # config terminal
Router (config) # interface fastethernet 0/0
Router (config-if) # ip address 10.0.0.2 255.0.0.0
Router (config-if) # no shutdown
"Interface fastethernet 0/0, changed to state up"



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u create the

4.0
255.0.0.0

ged state to up'
end devices

R2 using ifconfig

PAGE NO :
DATE :

It is also observed that the end system R1 was only pinged with router R1 only.

ping 30.0.0.1 → successful
Packets sent = 4, received = 4, lost = 0, Lost = 0.0%

Hence, although the routers were connected serially, the end devices were unable to ping each other.

PC0

Physical | Config | Desktop | Custom Interface

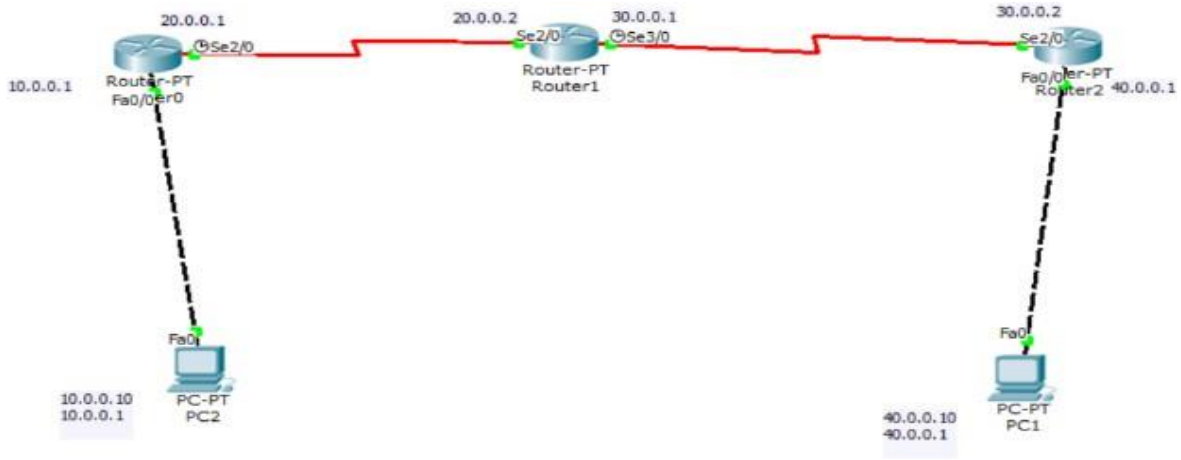
Command Prompt

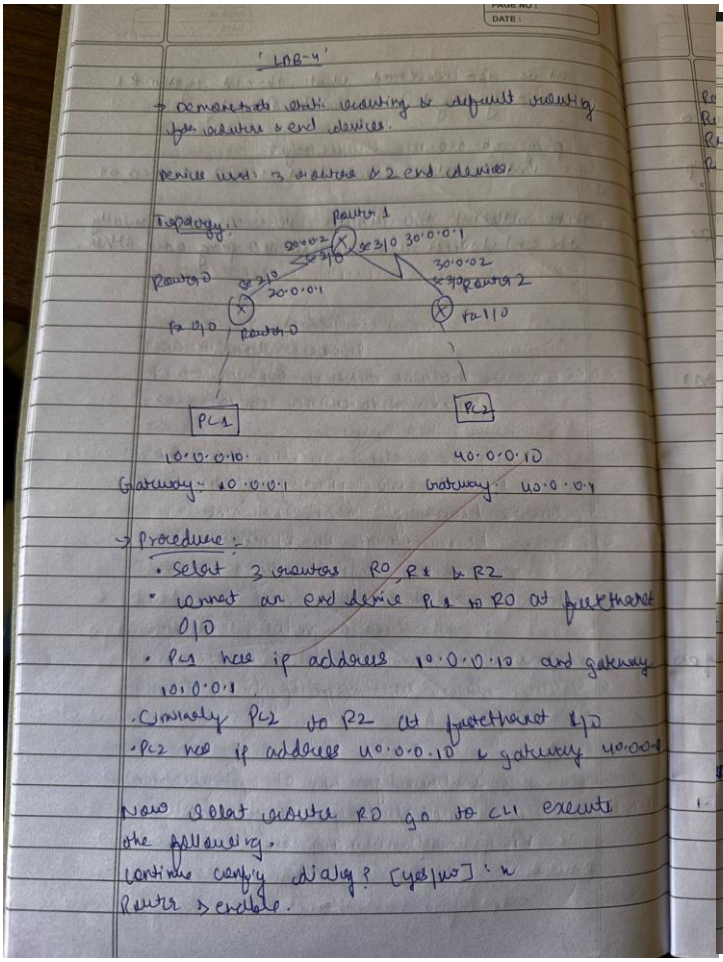
```
Pinging 20.0.0.10 with 32 bytes of data:

Request timed out.
Reply from 20.0.0.10: bytes=32 time=0ms TTL=127
Reply from 20.0.0.10: bytes=32 time=0ms TTL=127
Reply from 20.0.0.10: bytes=32 time=2ms TTL=127

Ping statistics for 20.0.0.10:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 2ms, Average = 0ms

PC>ping 20.0.0.10

Pinging 20.0.0.10 with 32 bytes of data:

Reply from 20.0.0.10: bytes=32 time=1ms TTL=127
Reply from 20.0.0.10: bytes=32 time=1ms TTL=127
Reply from 20.0.0.10: bytes=32 time=0ms TTL=127
Reply from 20.0.0.10: bytes=32 time=2ms TTL=127

Ping statistics for 20.0.0.10:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 2ms, Average = 1ms
```

Program 3:

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

Topology, Procedure and Observations :





'LAB-4'

→ Demonstrate static routing & default routing for routers & end devices.

Device used: 3 routers & 2 end devices.

Topology:

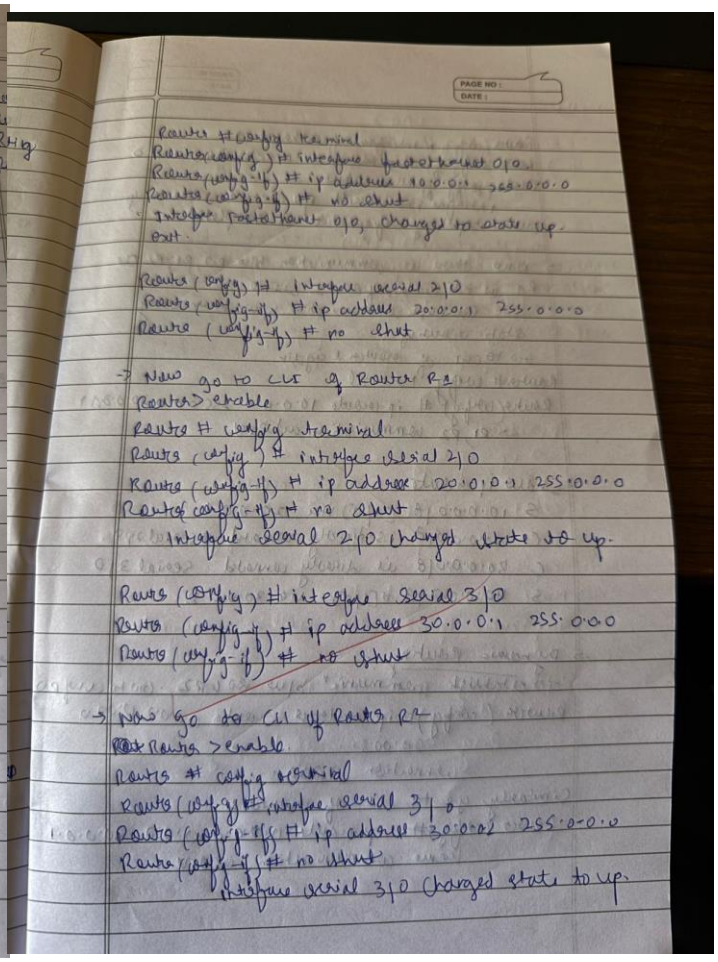
→ Procedure :

- Select 3 routers R0, R1 & R2
- connect an end device PC1 to R0 at fastethernet 0/0
- PC1 have ip address 10.0.0.10 and gateway 10.0.0.1
- Similarly PC2 to R2 at fastethernet 0/0
- PC2 have ip address 40.0.0.10 & gateway 40.0.0.1

Now select router R0 go to CLI execute the following.

Continue config dialog? [yes/no]: n

Router > enable.



Router # config terminal
Router(config)# interface fastethernet 0/0
Router(config-if)# ip address 10.0.0.1 255.0.0.0
Router(config-if)# no shut
Interface fastethernet 0/0, changed to state up.
exit.

Router(config)# interface serial 2/0
Router(config-if)# ip address 20.0.0.1 255.0.0.0
Router(config-if)# no shut

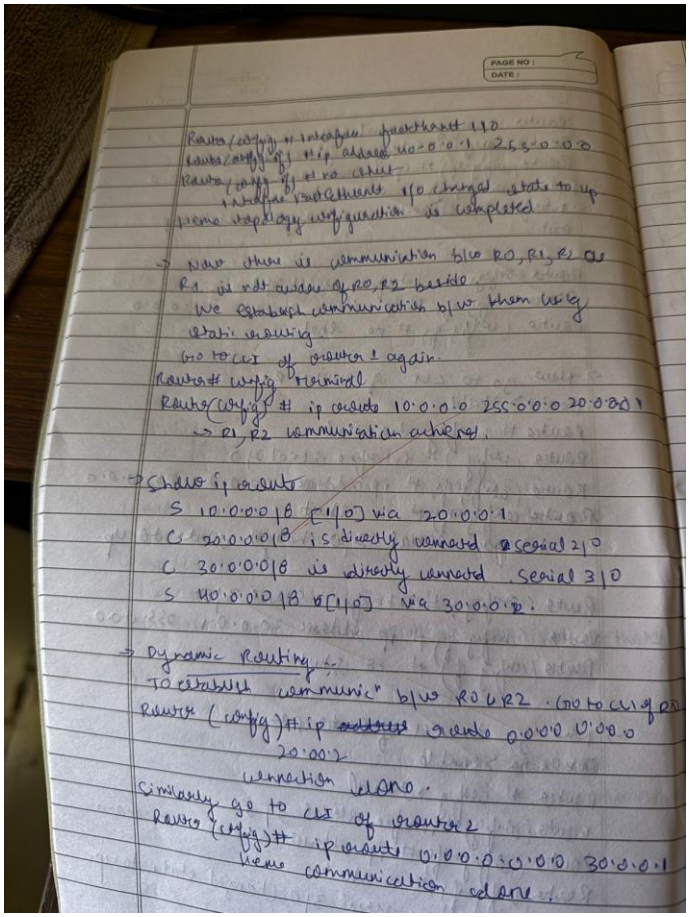
→ Now go to CLI of Router R1

Router > enable
Router # config terminal
Router(config)# interface serial 2/0
Router(config-if)# ip address 20.0.0.1 255.0.0.0
Router(config-if)# no shut
Interface serial 2/0 changed state to up.

Router(config)# interface serial 3/0
Router(config-if)# ip address 30.0.0.1 255.0.0.0
Router(config-if)# no shut

→ Now go to CLI of Router R2

Router > enable.
Router # config terminal
Router(config)# interface serial 3/0
Router(config-if)# ip address 30.0.0.2 255.0.0.0
Router(config-if)# no shut
Interface serial 3/0 changed state to up.

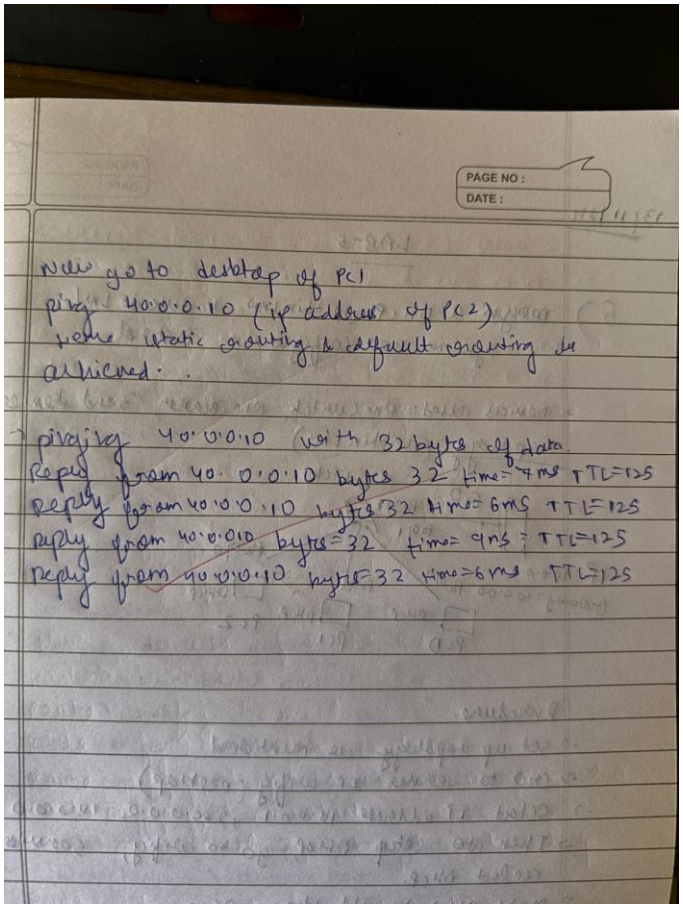


Router(config)# interface fastethernet 1/0
Router(config-if)# ip address 40.0.0.1 255.0.0.0
Router(config-if)# no shut
FastEthernet 1/0 changed state to up
Here topology configuration is completed

→ Now there is communication b/w R0, R1, R2 as R1 is not outside of R0, R2 beside.
We established communication b/w them using static routing.
Go to CLI of router 1 again.
Router# config terminal
Router(config)# ip route 10.0.0.0 255.0.0.0 20.0.0.1
→ R1, R2 communication achieved.

→ Show ip route
S 10.0.0.0/8 [1/0] via 20.0.0.1
C 20.0.0.0/8 is directly connected Serial 2/0
C 30.0.0.0/8 is directly connected Serial 3/0
S 40.0.0.0/8 [1/0] via 30.0.0.2.

→ Dynamic Routing :-
To establish communic" b/w R0 & R2. Go to CLI of R0
Router(config)# ip ~~address~~ route 0.0.0.0 0.0.0.0 20.0.0.2
connection done.
Similarly go to CLI of router 2
Router(config)# ip route 0.0.0.0 0.0.0.0 30.0.0.1
Here communication done.



Now go to desktop of PC1
ping 40.0.0.10 (ip address of PC2)
Here static routing & default routing is achieved.

pinging 40.0.0.10 with 32 bytes of data.
Reply from 40.0.0.10 bytes 32 time=7ms TTL=125
Reply from 40.0.0.10 bytes 32 time=6ms TTL=125
Reply from 40.0.0.10 bytes=32 time=6ms TTL=125
Reply from 40.0.0.10 bytes=32 time=6ms TTL=125

Command Prompt

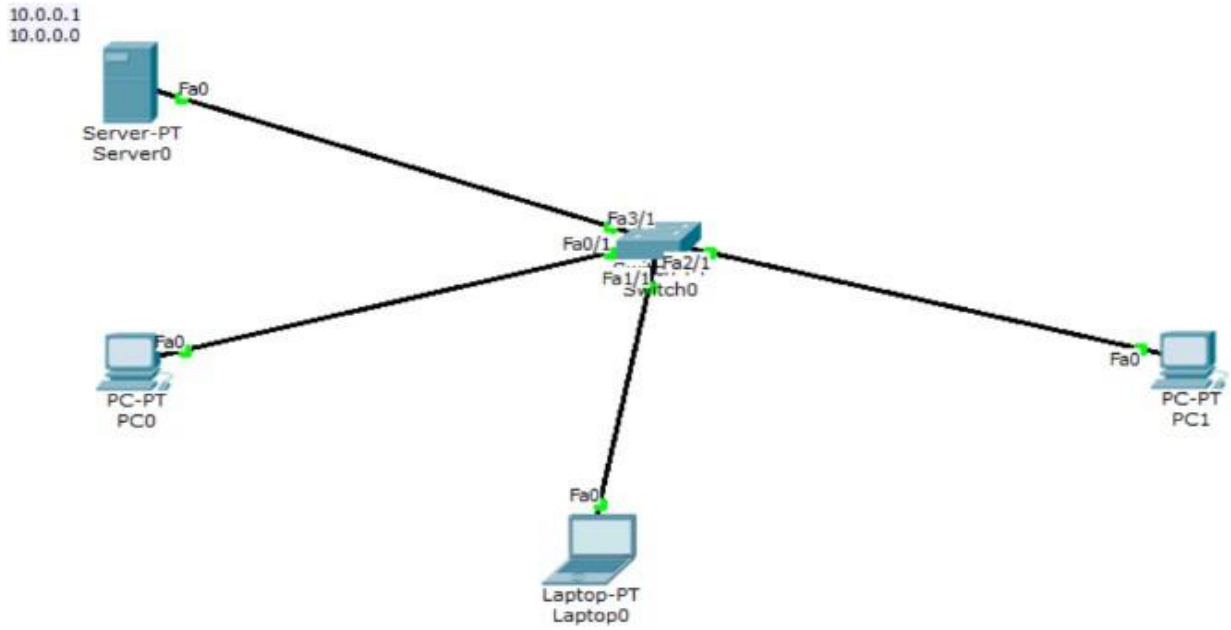
```
Pinging 40.0.0.10 with 32 bytes of data:

Reply from 40.0.0.10: bytes=32 time=6ms TTL=125
Reply from 40.0.0.10: bytes=32 time=8ms TTL=125
Reply from 40.0.0.10: bytes=32 time=6ms TTL=125
Reply from 40.0.0.10: bytes=32 time=8ms TTL=125

Ping statistics for 40.0.0.10:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 6ms, Maximum = 8ms, Average = 7ms

PC>ping 40.0.0.10

Pinging 40.0.0.10 with 32 bytes of data:

Reply from 40.0.0.10: bytes=32 time=8ms TTL=125
Reply from 40.0.0.10: bytes=32 time=6ms TTL=125
Reply from 40.0.0.10: bytes=32 time=9ms TTL=125
Reply from 40.0.0.10: bytes=32 time=7ms TTL=125

Ping statistics for 40.0.0.10:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 6ms, Maximum = 9ms, Average = 7ms

PC>
```

Program 4:

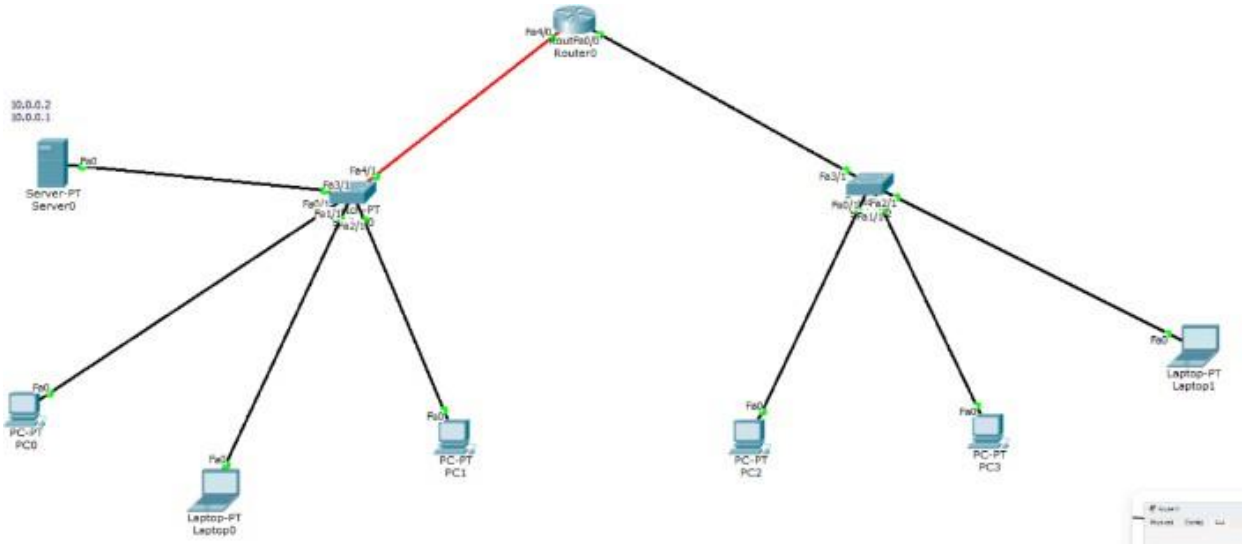
Aim: Configure DHCP within a LAN and outside LAN.

Topology:

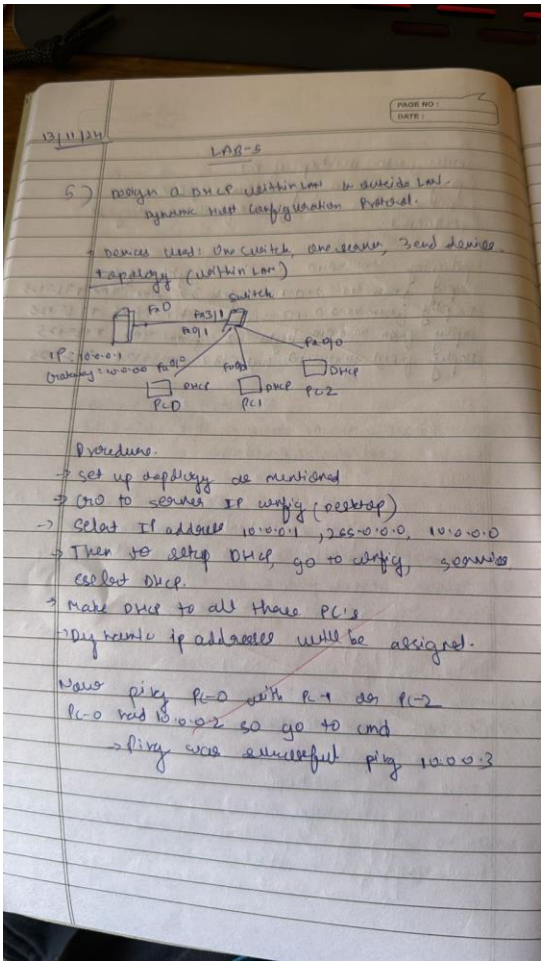
Within LAN

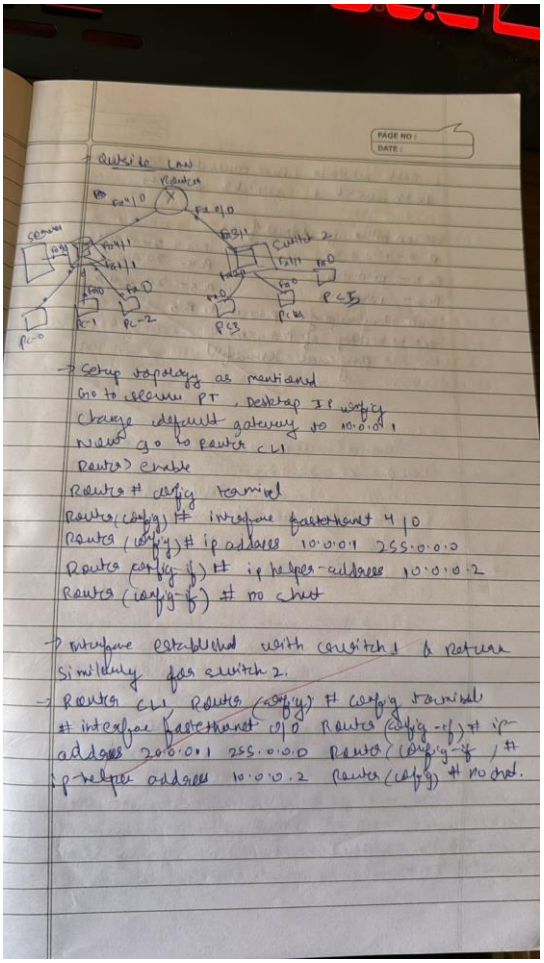


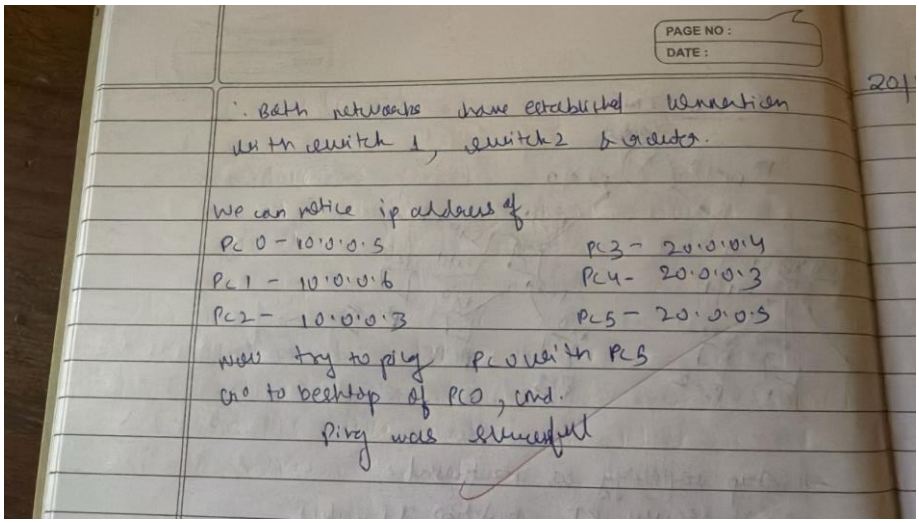
Outside LAN

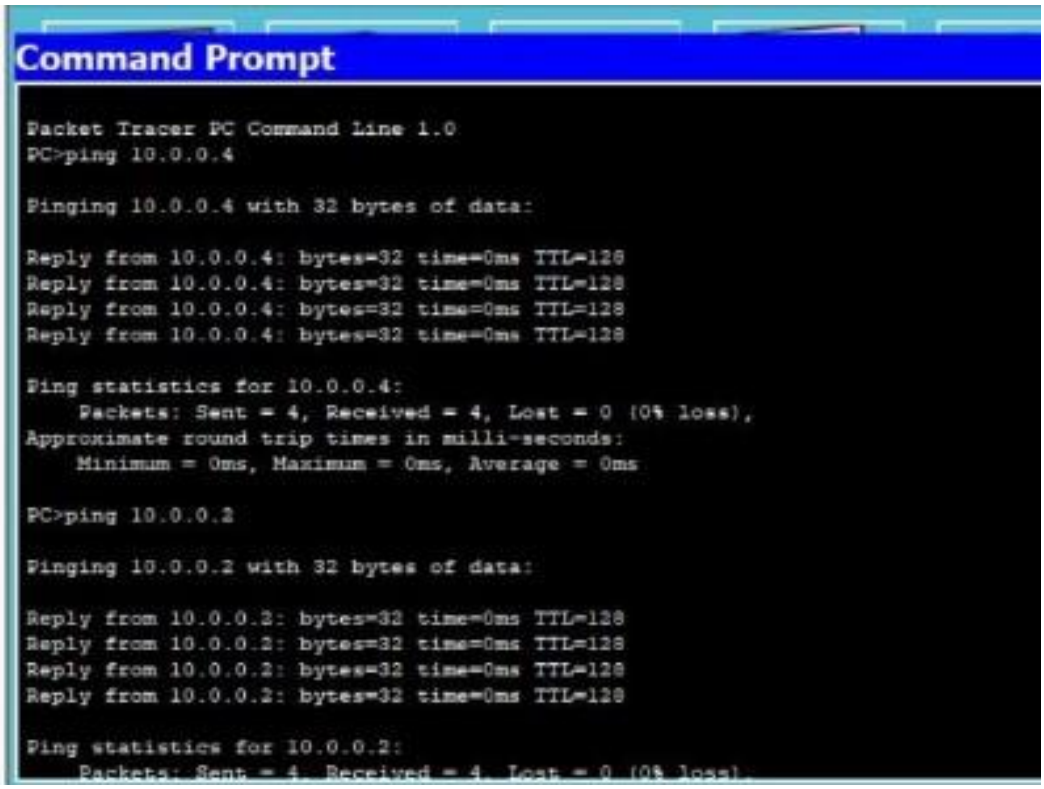


Procedure and Observation:

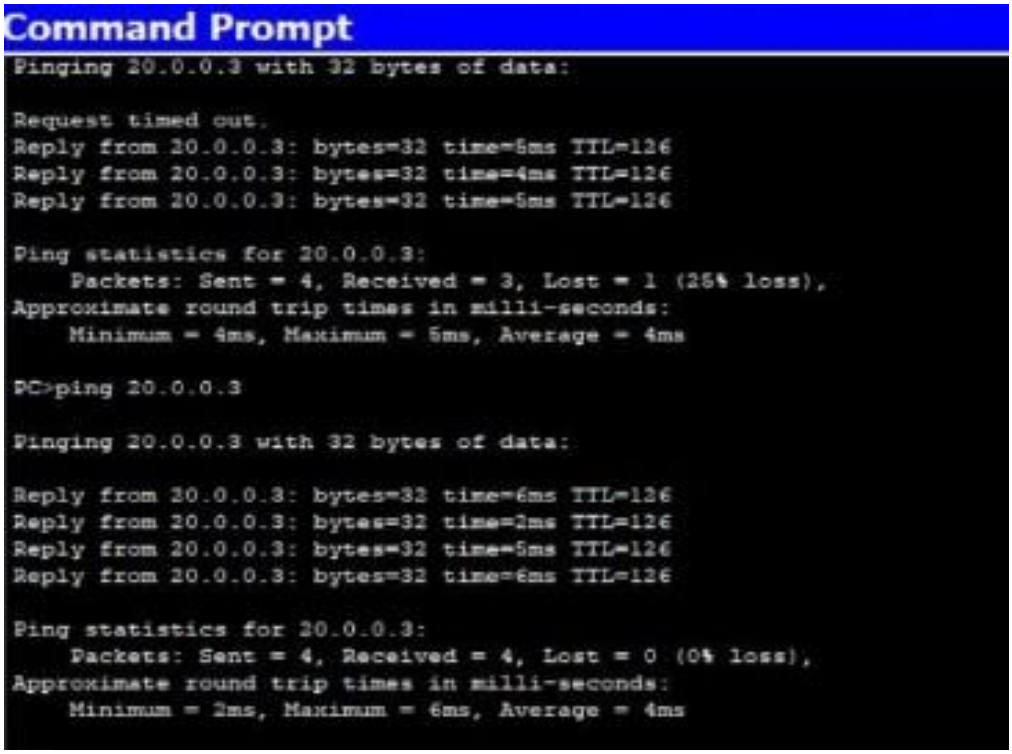








Within LAN

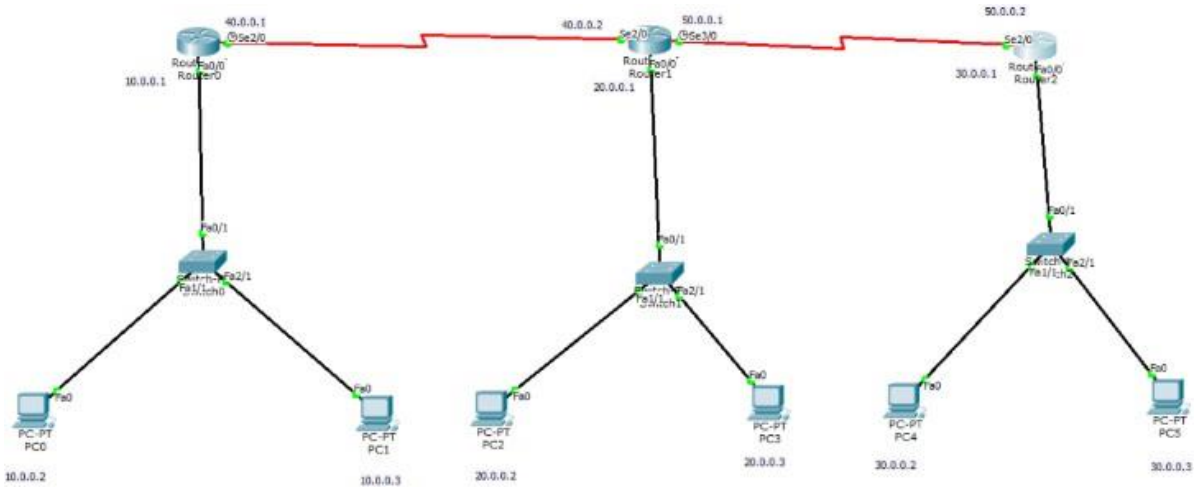


Outside LAN

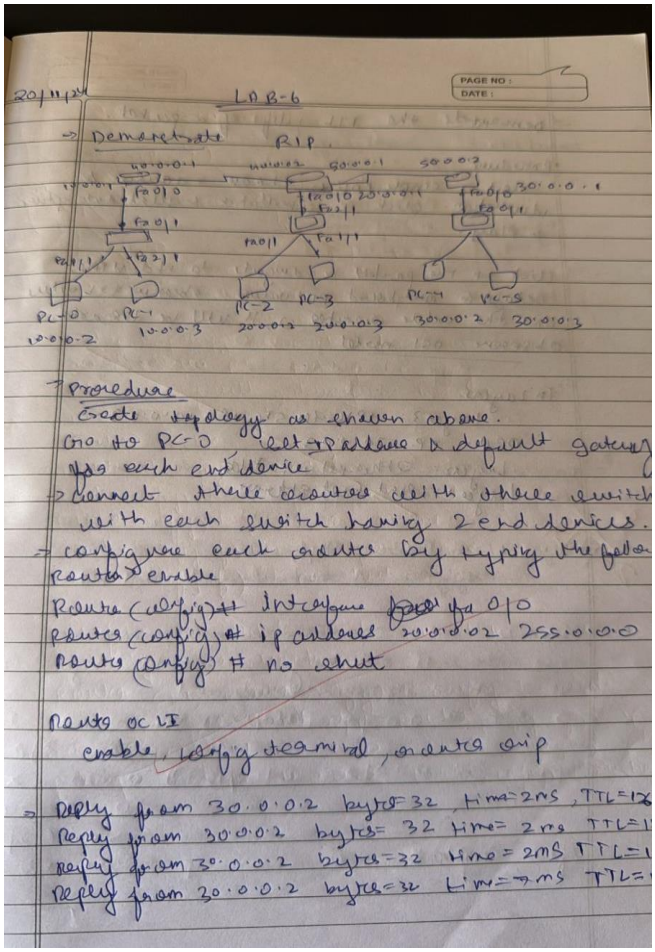
Program 5:

Aim: Configure RIP routing Protocol in Routers.

Topology:



Procedure and Observation:



PAGE NO :
DATE :

→ Demonstrate the TTL / life of a packet.

*Procedure

Select a simple POV & choose a source & destination. Click on simulation & select Autocapture & play.

→ Click on the packet & navigate to inbound PDU. Details & outbound PDU values. Observe TTL value. Once the value reaches 0, it will be discarded.

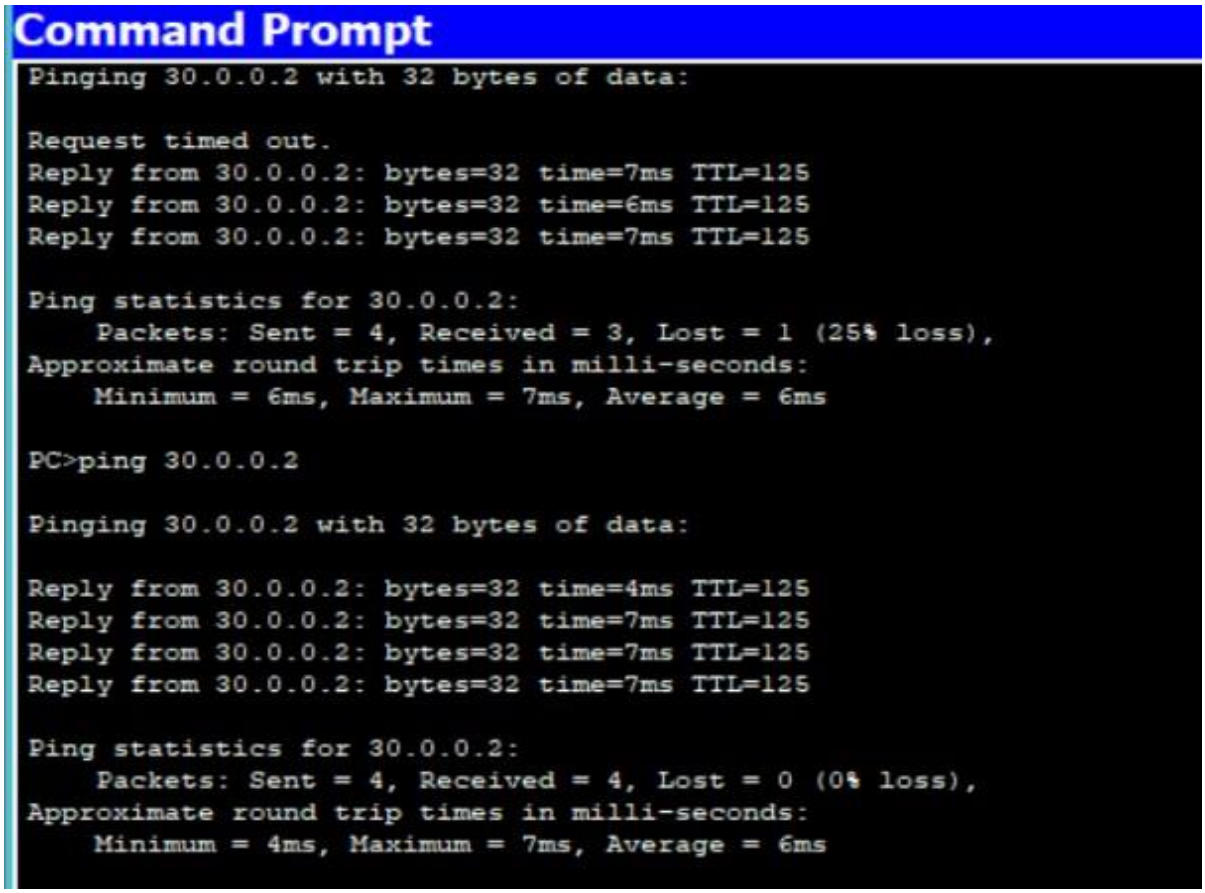
Observe OSI model

In Layer.

Layer 3: IP header SRC IP: 10.0.0.3
DEV. IP: 20.0.0.3

Layer 2: Ethernet II header

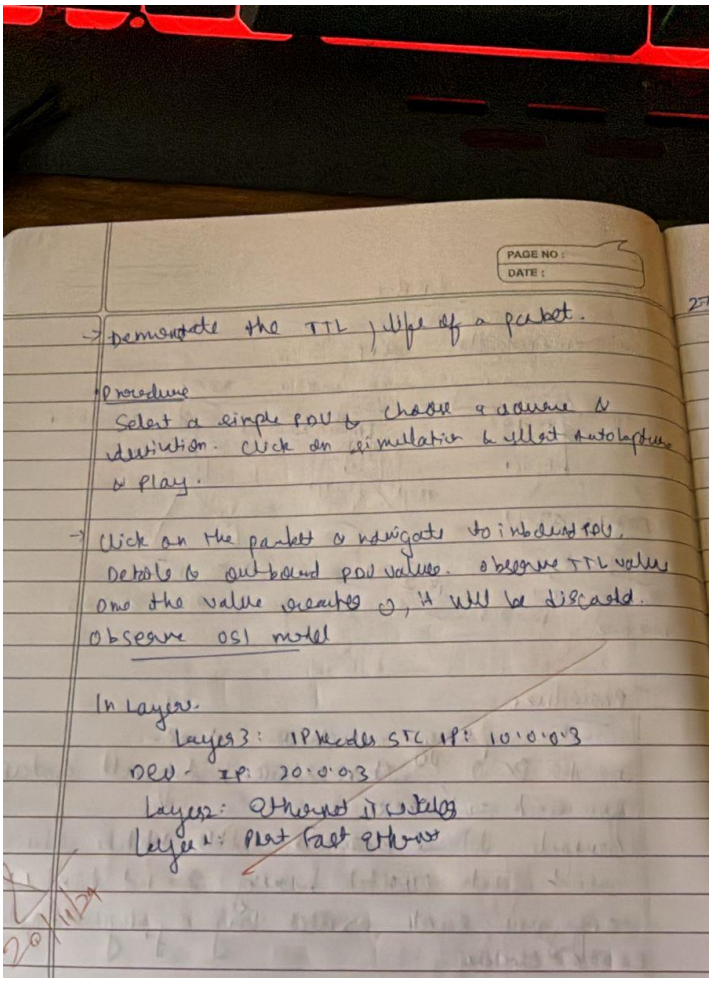
Layer 1: Port Fast Ethernet

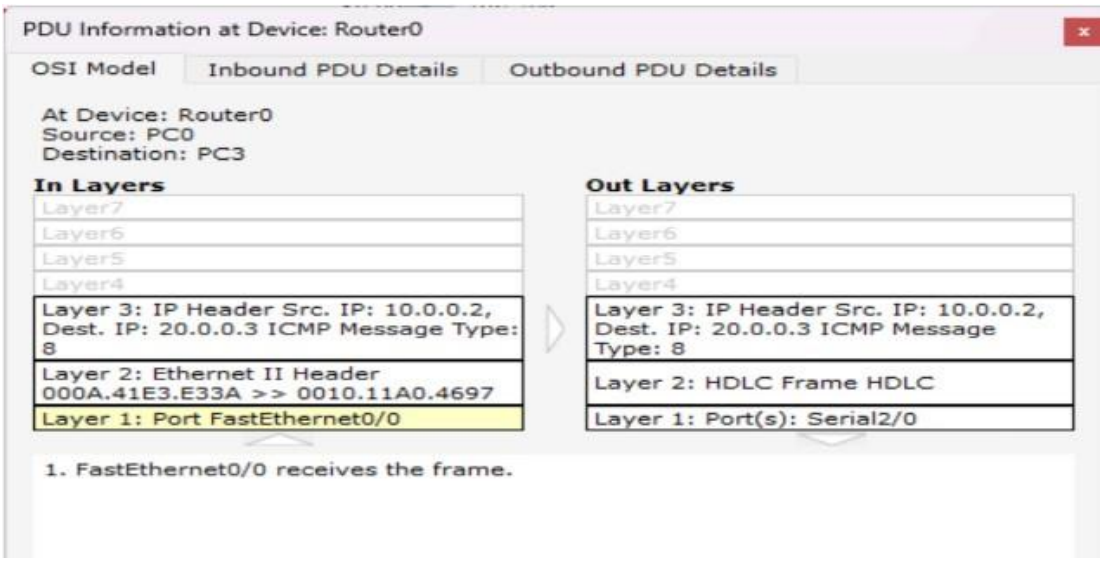

Command Prompt
Pinging 30.0.0.2 with 32 bytes of data:
Request timed out.
Reply from 30.0.0.2: bytes=32 time=7ms TTL=125
Reply from 30.0.0.2: bytes=32 time=6ms TTL=125
Reply from 30.0.0.2: bytes=32 time=7ms TTL=125
Ping statistics for 30.0.0.2:
Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
Approximate round trip times in milli-seconds:
Minimum = 6ms, Maximum = 7ms, Average = 6ms
PC>ping 30.0.0.2
Pinging 30.0.0.2 with 32 bytes of data:
Reply from 30.0.0.2: bytes=32 time=4ms TTL=125
Reply from 30.0.0.2: bytes=32 time=7ms TTL=125
Reply from 30.0.0.2: bytes=32 time=7ms TTL=125
Reply from 30.0.0.2: bytes=32 time=7ms TTL=125
Ping statistics for 30.0.0.2:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
Minimum = 4ms, Maximum = 7ms, Average = 6ms

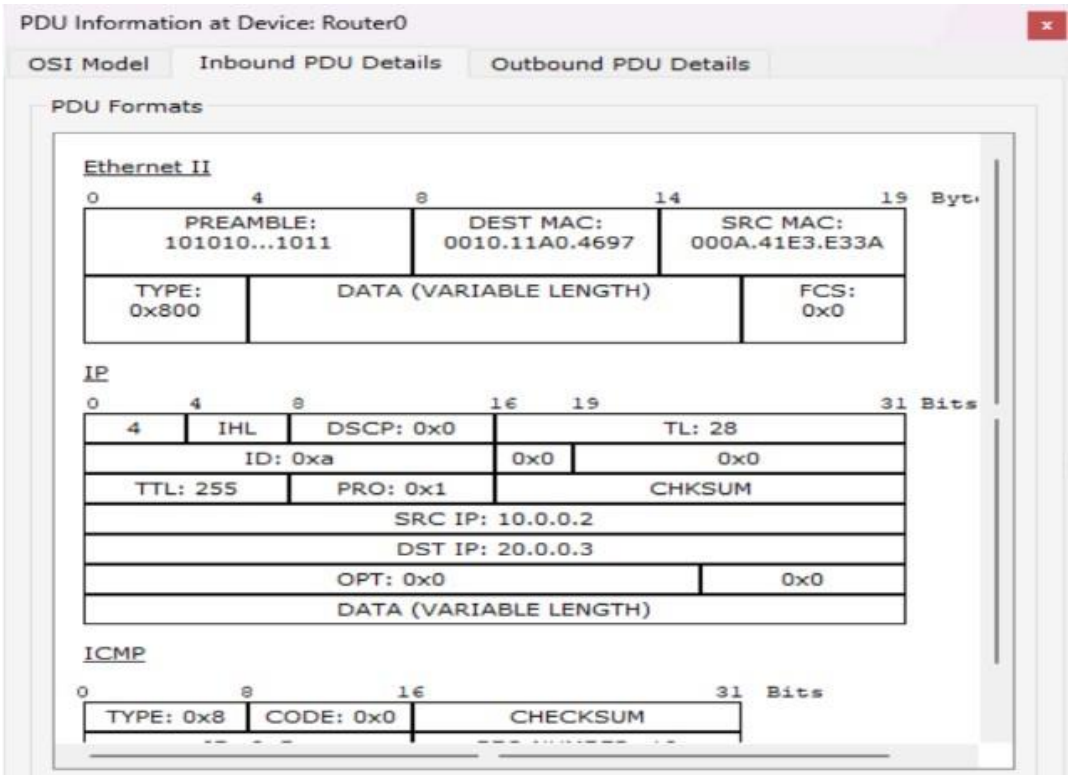
Program 6:

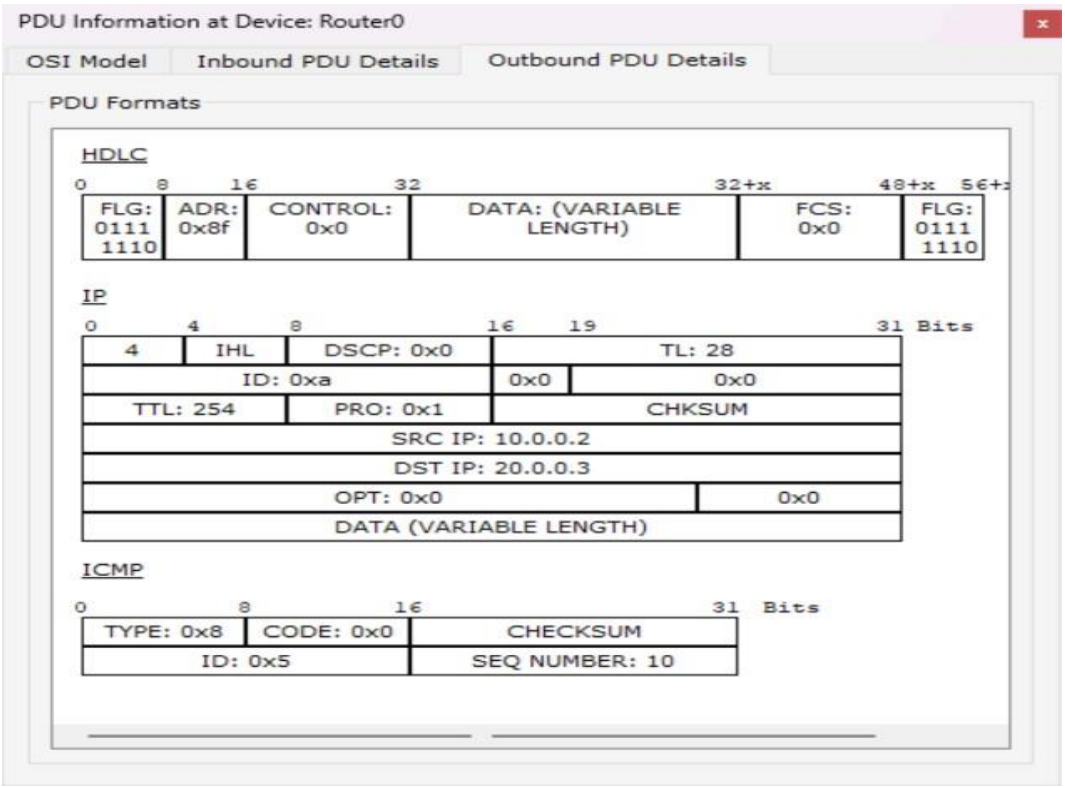
Aim: Demonstrate the TTL/ Life of a Packet.

Procedure and Observation:






PDU Information at Device: Router0
OSI Model
Inbound PDU Details
Outbound PDU Details
PDU Formats
Ethernet II
0 4 8 14 19 Byt
PREAMBLE: 101010...1011
DEST MAC: 0010.11A0.4697
SRC MAC: 000A.41E3.E33A
TYPE: 0x800
DATA (VARIABLE LENGTH)
FCS: 0x0
IP
0 4 8 16 19 31 Bits
4
IHL
DSCP: 0x0
TL: 28
ID: 0xa
0x0
0x0
TTL: 255
PRO: 0x1
CHKSUM
SRC IP: 10.0.0.2
DST IP: 20.0.0.3
OPT: 0x0
0x0
DATA (VARIABLE LENGTH)
ICMP
0 8 16 31 Bits
TYPE: 0x8
CODE: 0x0
CHECKSUM

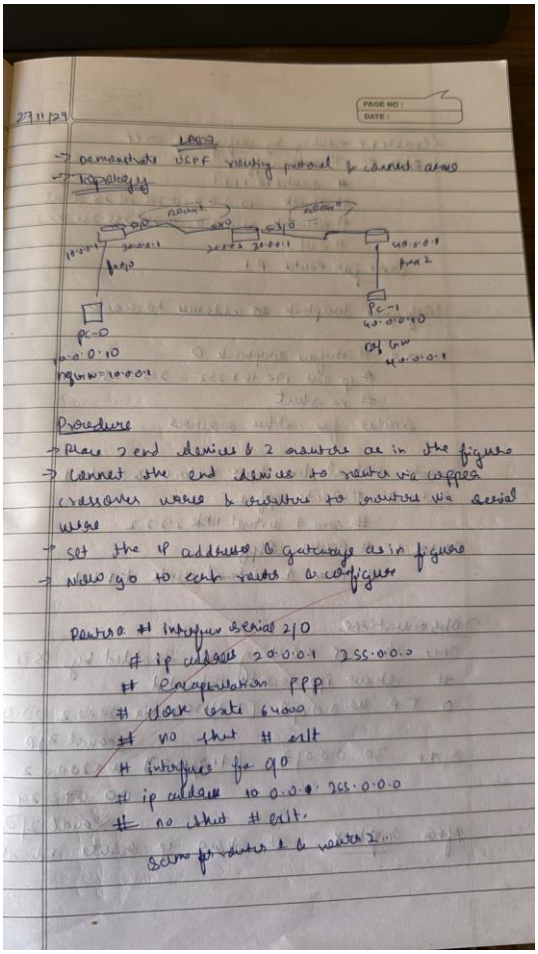

PDU Information at Device: Router0
OSI Model
Inbound PDU Details
Outbound PDU Details
PDU Formats
HDLC
0 8 16 32 32+x 48+x
FLG: 0111 1110
ADR: 0x8f
CONTROL: 0x0
DATA: (VARIABLE LENGTH)
FCS: 0x0
FLG: 0111 1110
IP
0 4 8 16 19 31 Bits
4
IHL
DSCP: 0x0
TL: 28
ID: 0xa
0x0
0x0
TTL: 254
PRO: 0x1
CHKSUM
SRC IP: 10.0.0.2
DST IP: 20.0.0.3
OPT: 0x0
0x0
DATA (VARIABLE LENGTH)
ICMP
0 8 16 31 Bits
TYPE: 0x8
CODE: 0x0
CHECKSUM
ID: 0x5
SEQ NUMBER: 10

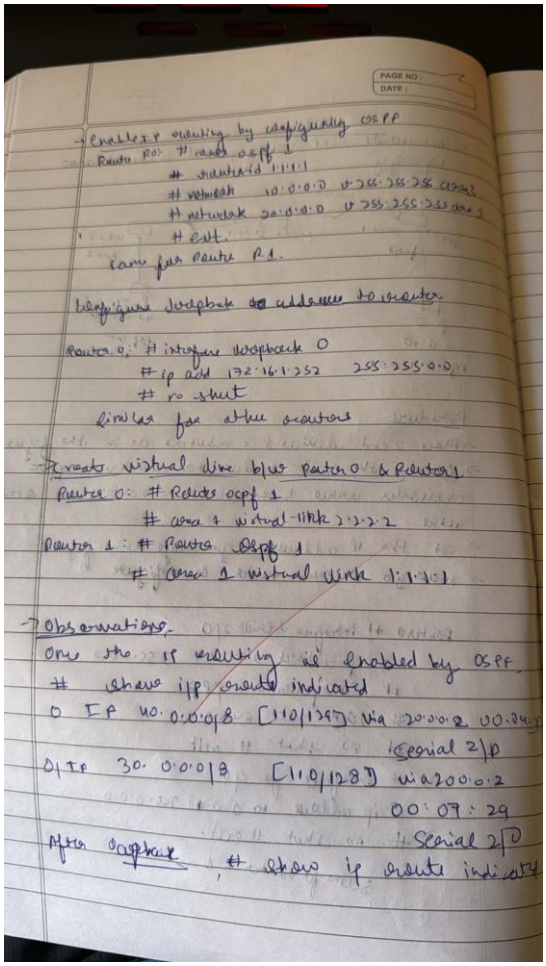
Program 7:

Aim: Configure OSPF routing protocol**.**

Topology:

Procedure and Observation:





PAGE NO :
DATE :

⇒ ping PC1 via PC0 :-
ping 20.0.0.10
ping statistics for 40.0.0.10
packet sent 4 received: 3, lost = 1.
(25% loss)

⇒ ping PC0 via PC1 :-
ping 10.0.0.10
ping statistics for 10.0.0.10
packet - sent = 4, received = 4 lost = 0 (0%

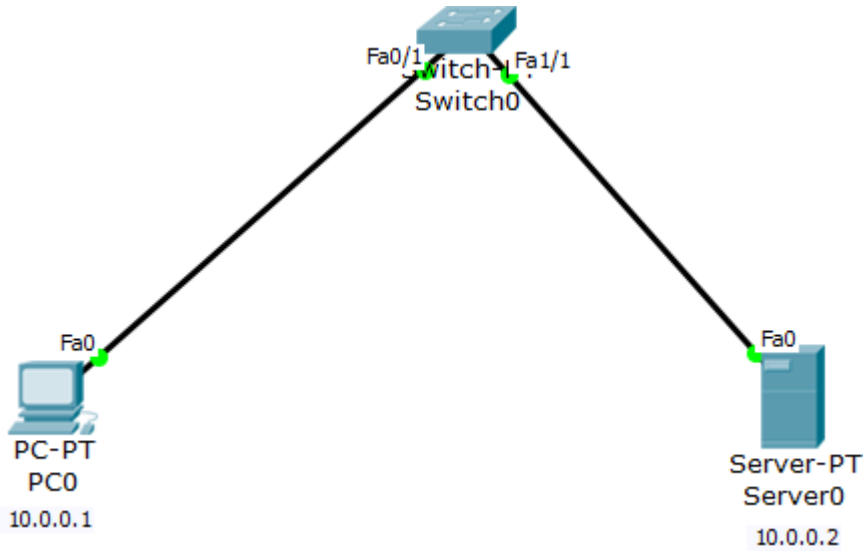
⇒ Here OSPF routing was set up & the ping were successful

```
PC>ping 40.0.0.10

Pinging 40.0.0.10 with 32 bytes of data:

Reply from 40.0.0.10: bytes=32 time=7ms TTL=125
Reply from 40.0.0.10: bytes=32 time=7ms TTL=125
Reply from 40.0.0.10: bytes=32 time=6ms TTL=125
Reply from 40.0.0.10: bytes=32 time=6ms TTL=125

Ping statistics for 40.0.0.10:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 6ms, Maximum = 7ms, Average = 6ms
```

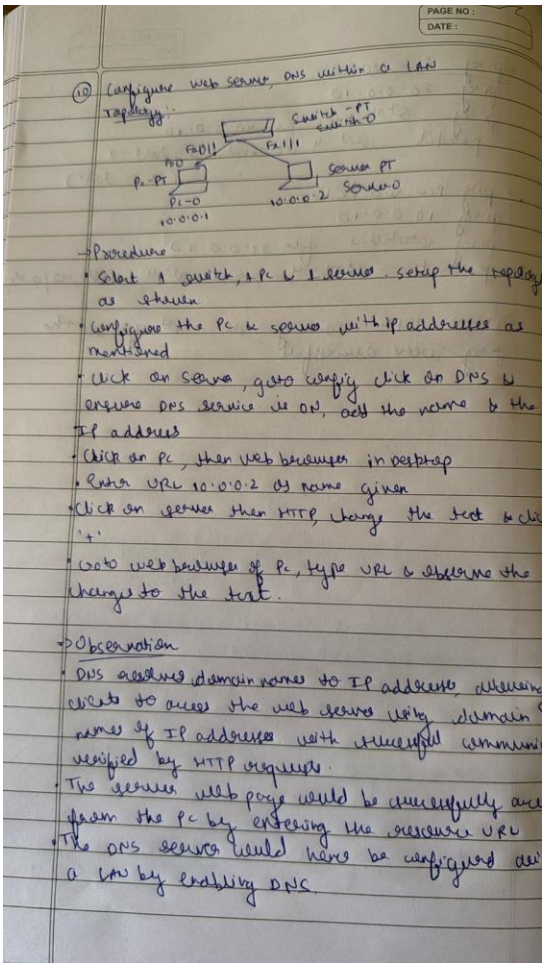
Program 8:

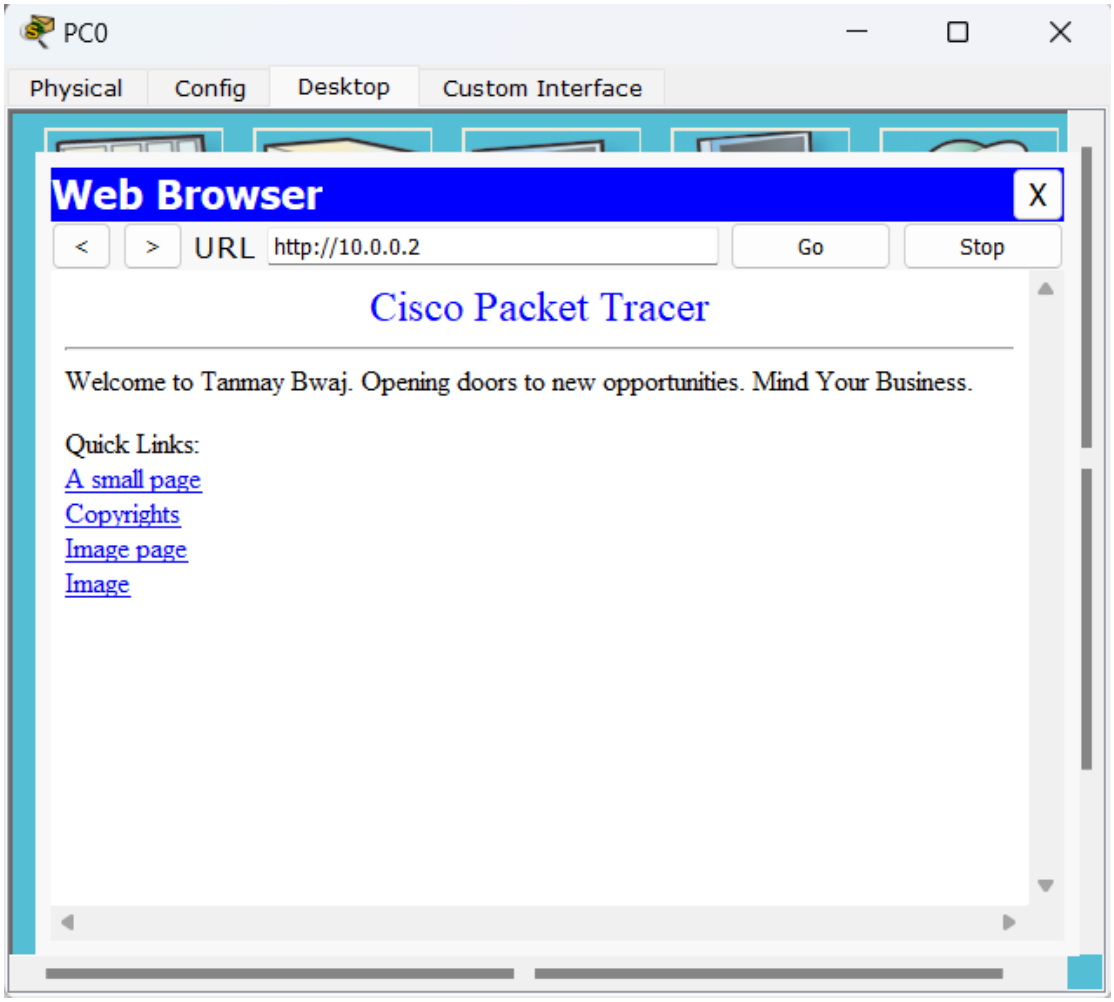
Aim: Configure Web Server, DNS within a LAN**.**

Topology:



Procedure and Observations:

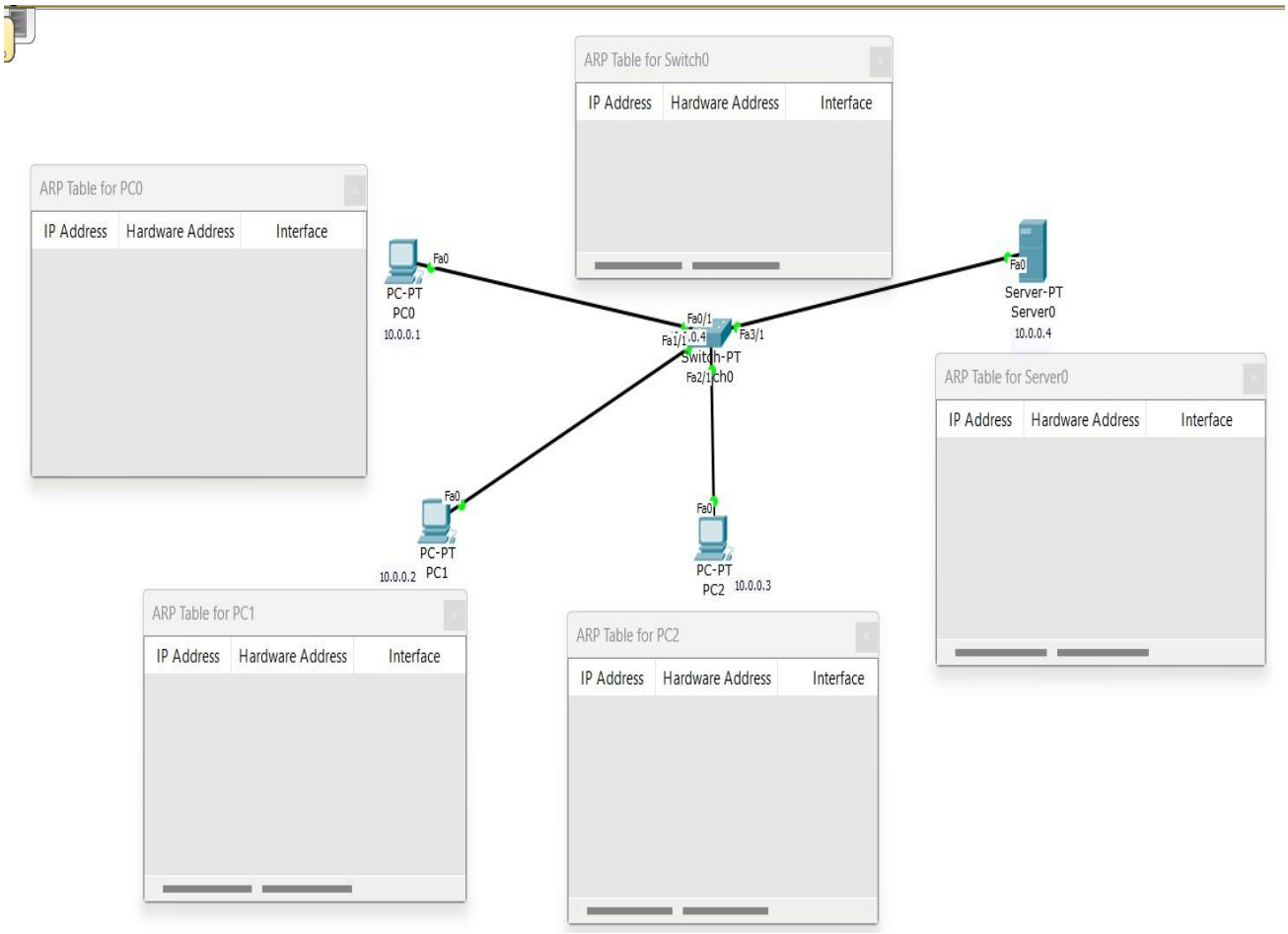



PC0
Physical
Config
Desktop
Custom Interface
Web Browser
X
<
>
URL
http://10.0.0.2
Go
Stop
Cisco Packet Tracer
Welcome to Tanmay Bwaj. Opening doors to new opportunities. Mind Your Business.
Quick Links:
A small page
Copyrights
Image page
Image

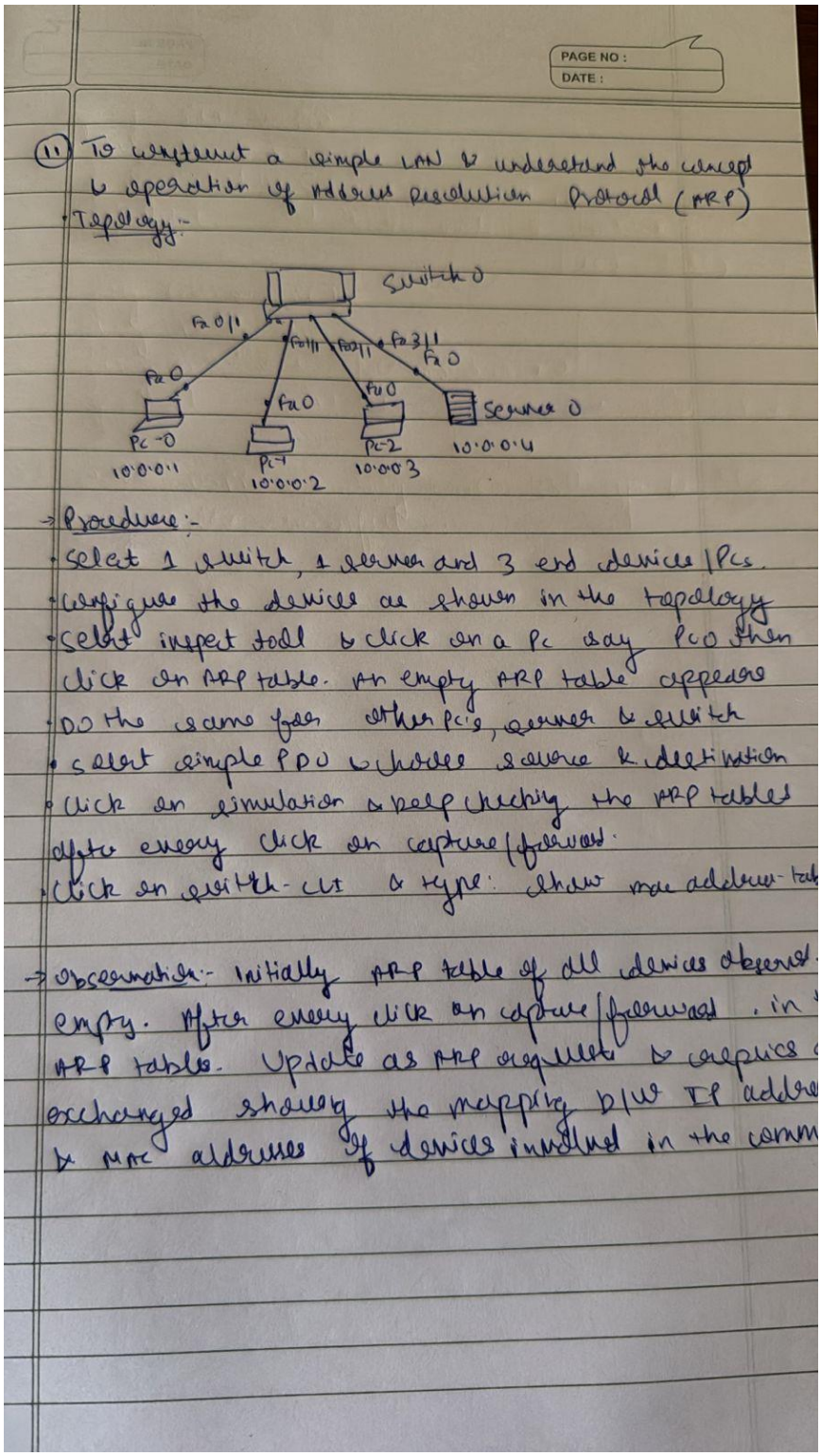
Program 9:

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

Topology:



Procedure and Observations:



PAGE NO :
DATE :

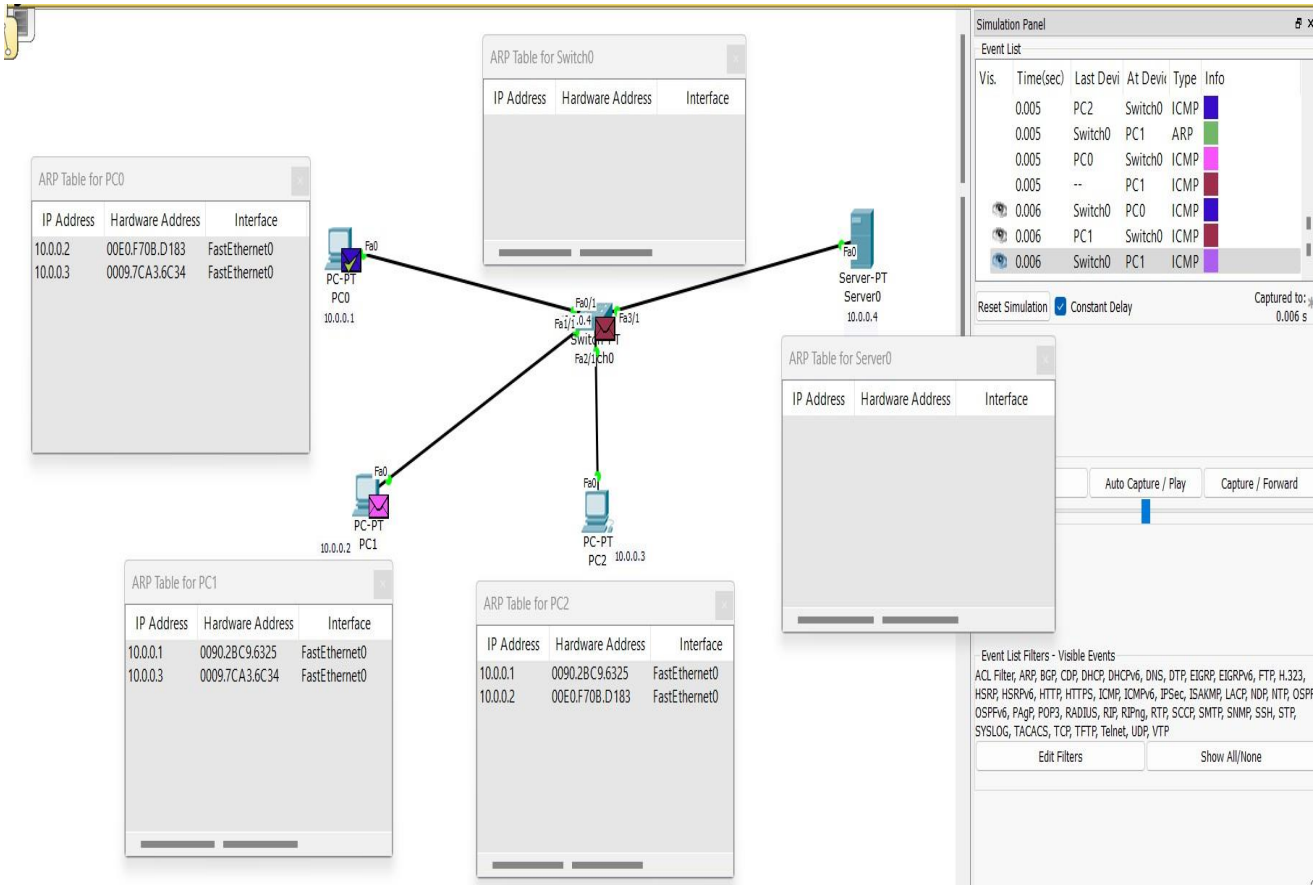
(11) To construct a simple LAN & understand the concept & operation of Address Resolution Protocol (ARP)

• Topology :-

→ Procedure :-

- Select 1 switch, 1 server and 3 end devices / PCs.
- Configure the devices as shown in the topology
- Select inspect tool & click on a PC say PC0 then click on ARP table. An empty ARP table appears
- Do the same for other PC's, server & switch
- Select simple PDU & choose source & destination
- Click on simulation & help checking the ARP tables after every click on capture/forward.
- Click on switch - CLI & type : show mac address-tab

→ Observation :- Initially ARP table of all devices observed empty. After every click on capture/forward . in ARP tables. Update as ARP requests & replies exchanged showing the mapping b/w IP addre & MAC addresses of devices involved in the comm



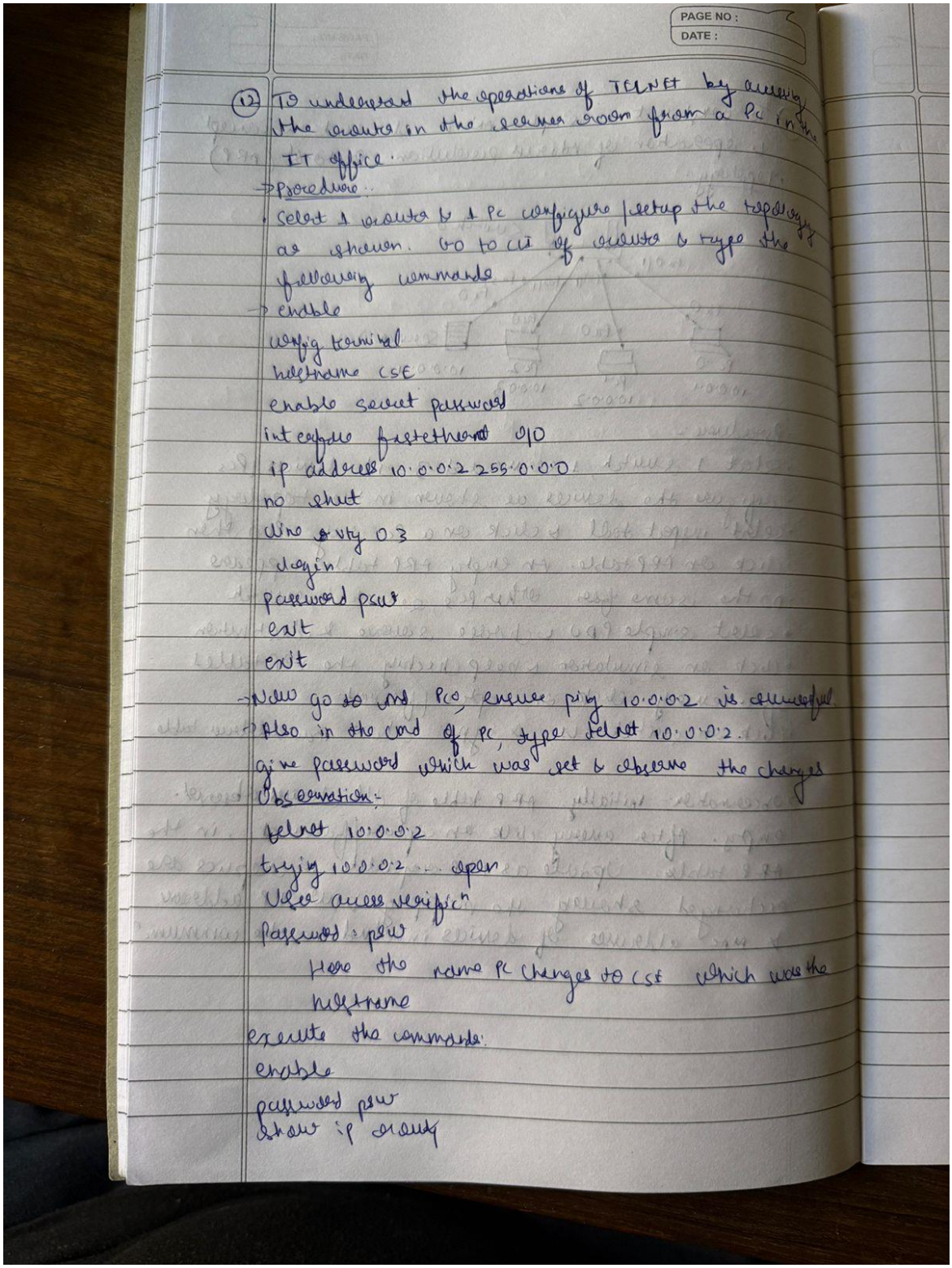

```
Switch>show mac address-table
          Mac Address Table
-------------------------------------------

Vlan    Mac Address       Type        Ports
----    -----------       --------    -----

   1    0009.7ca3.6c34    DYNAMIC     Fa2/1
   1    0090.2bc9.6325    DYNAMIC     Fa0/1
   1    00e0.f70b.d183    DYNAMIC     Fa1/1
Switch>
```

Program 10:

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

Topology :

Procedure and Observations:



PAGE NO :
DATE :

(12) To understand the operations of TELNET by accessing the routers in the server room from a PC in the IT office.

→ Procedure:

- Select 1 router & 1 PC configure/setup the topology as shown. Go to CLI of routers & type the following commands

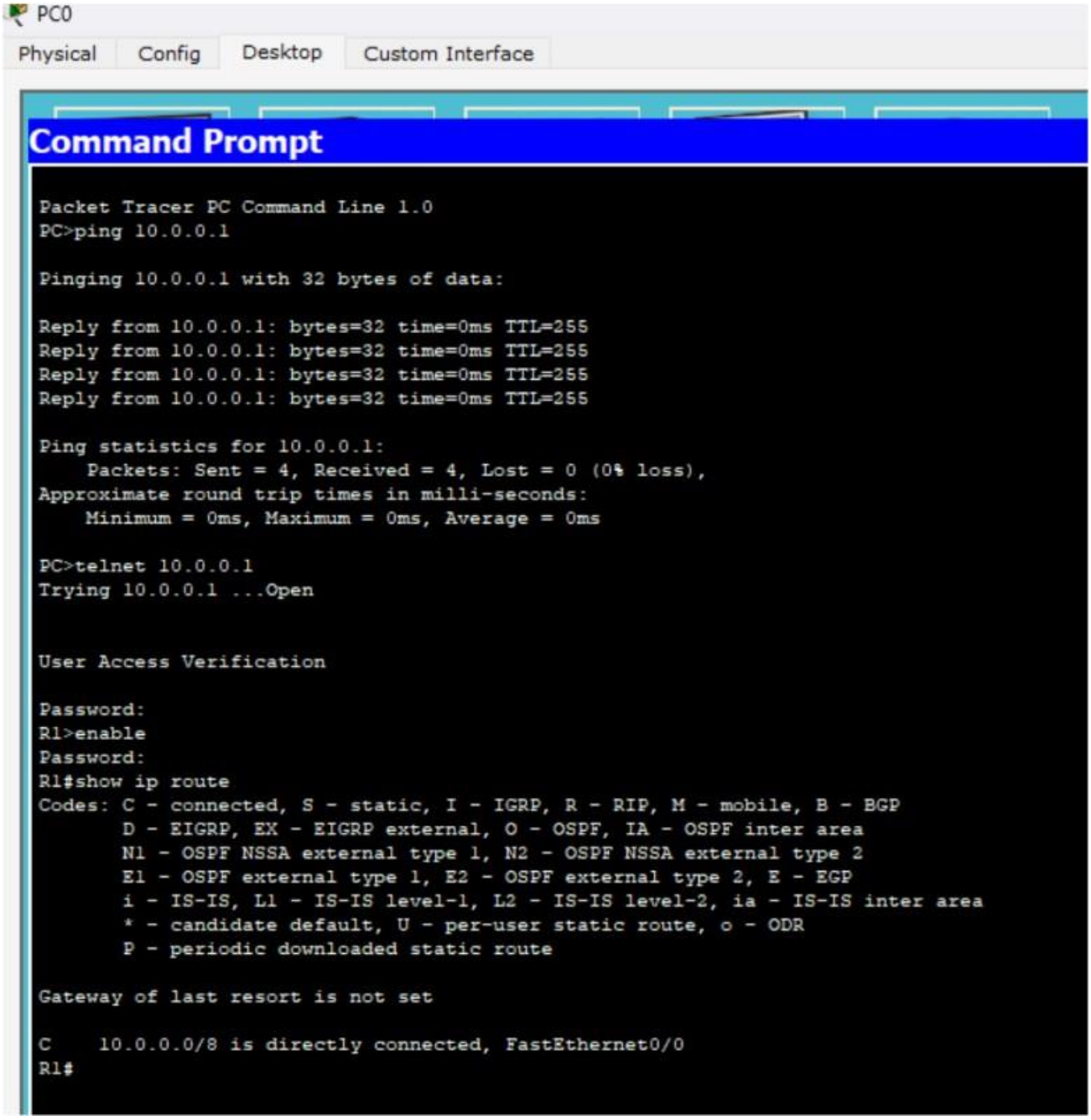
→ enable
config terminal
hostname CSE
enable secret password
int ethernet fastethernet 0/0
ip address 10.0.0.2 255.0.0.0
no shut
line vty 0 3
login
password psw
exit
exit

→ Now go to PC, execute ping 10.0.0.2 is successful
→ Also in the cmd of PC, type telnet 10.0.0.2.
give password which was set & observe the changes

Observation:

telnet 10.0.0.2
trying 10.0.0.2 ... open
User access verification
Password: psw
Here the name PC changes to CSE which was the hostname

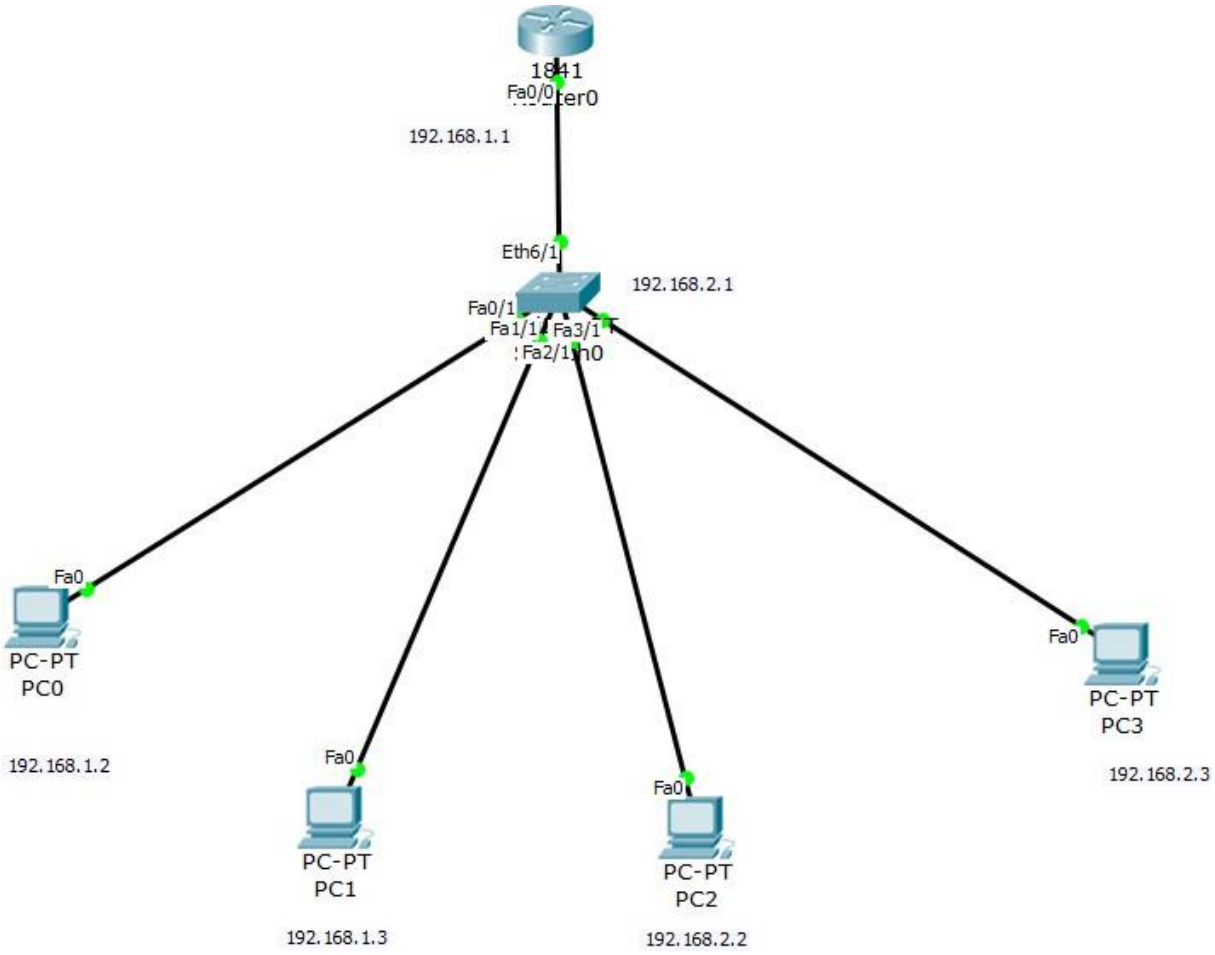
execute the commands.
enable
password psw
show ip route


PC0
Physical
Config
Desktop
Custom Interface
Command Prompt
Packet Tracer PC Command Line 1.0
PC>ping 10.0.0.1
Pinging 10.0.0.1 with 32 bytes of data:
Reply from 10.0.0.1: bytes=32 time=0ms TTL=255
Reply from 10.0.0.1: bytes=32 time=0ms TTL=255
Reply from 10.0.0.1: bytes=32 time=0ms TTL=255
Reply from 10.0.0.1: bytes=32 time=0ms TTL=255
Ping statistics for 10.0.0.1:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
Minimum = 0ms, Maximum = 0ms, Average = 0ms
PC>telnet 10.0.0.1
Trying 10.0.0.1 ...Open
User Access Verification
Password:
R1>enable
Password:
R1#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
* - candidate default, U - per-user static route, o - ODR
P - periodic downloaded static route
Gateway of last resort is not set
C 10.0.0.0/8 is directly connected, FastEthernet0/0
R1#

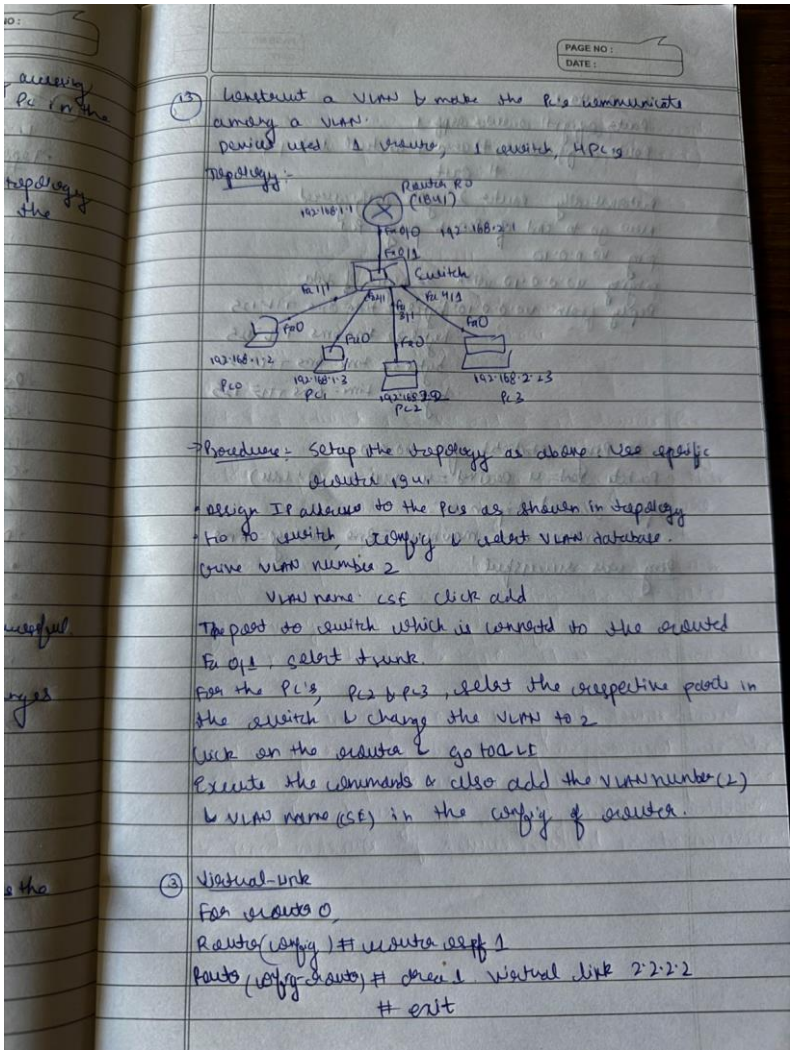
Program 11:

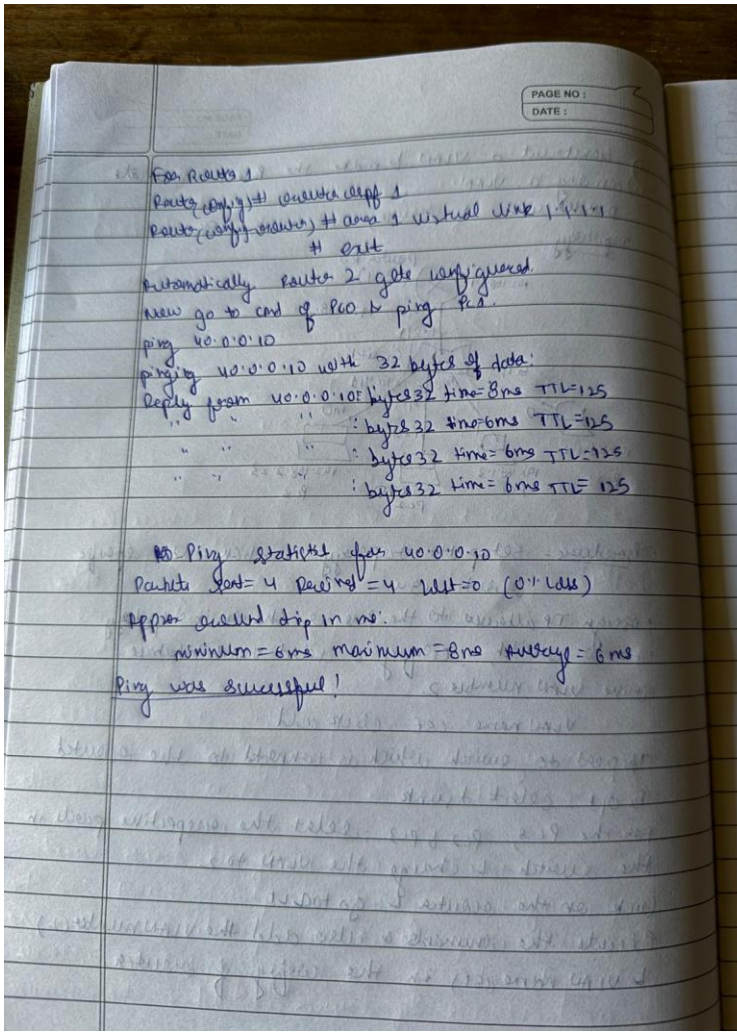
Aim : To construct a VLAN and make the PC's communicate among a VLAN.

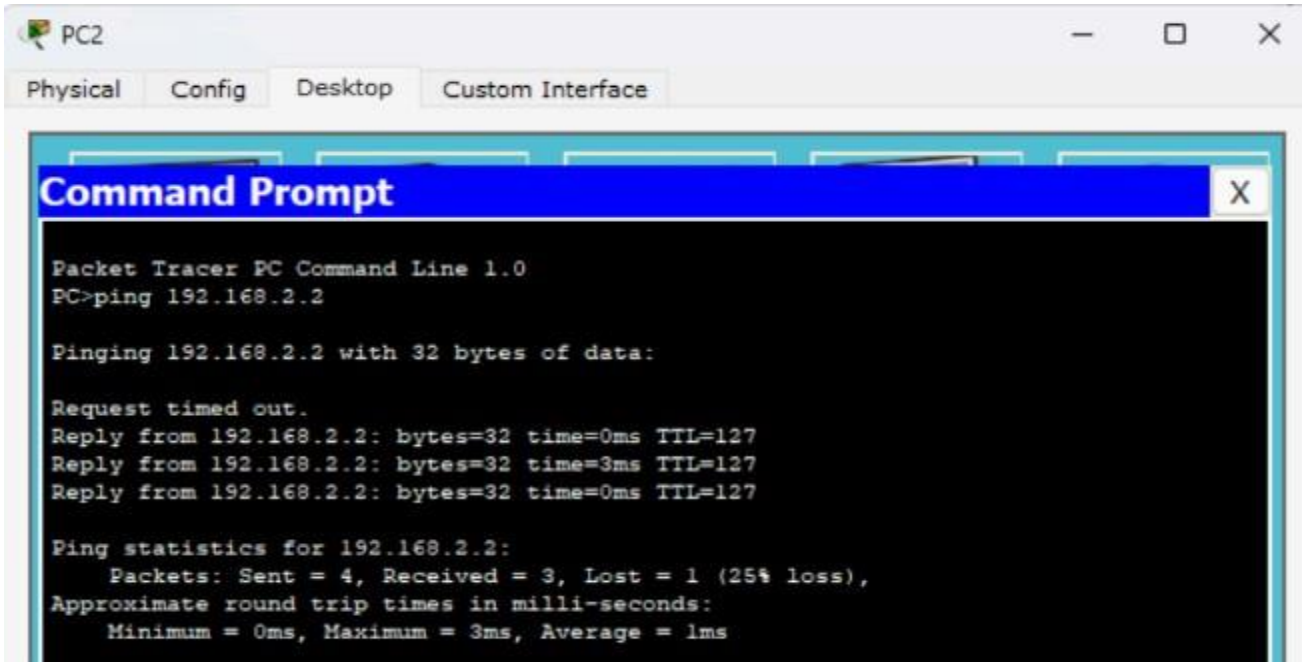
Topology:



Procedure and Observations:



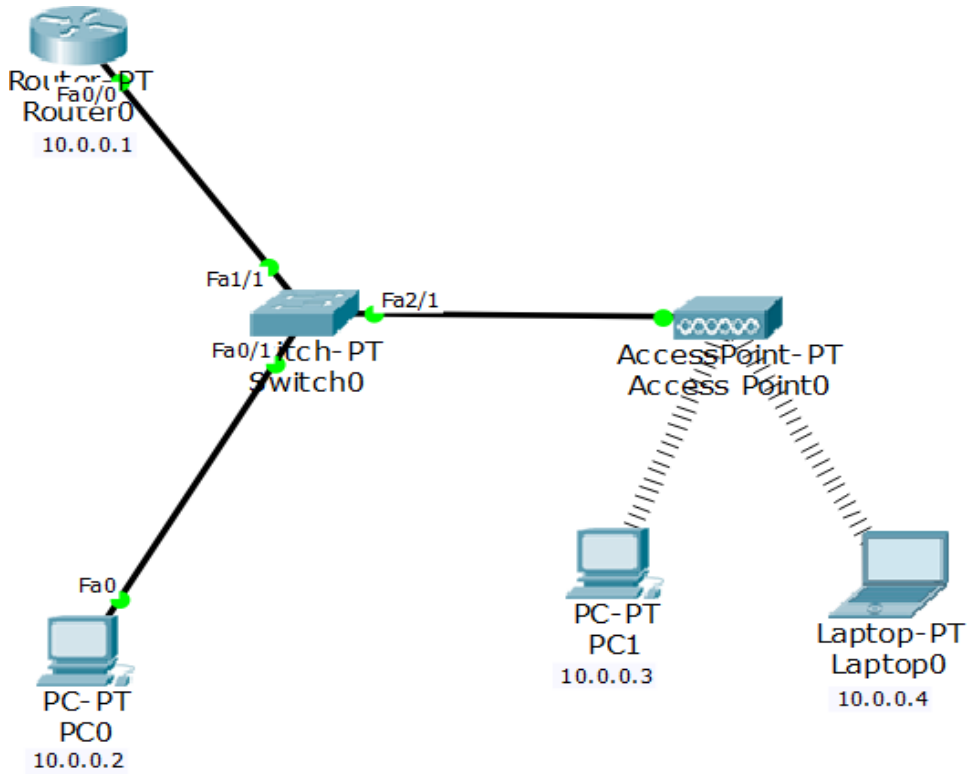




Program 12:

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

Topology:



Procedure and Observations:

DATE :

(14) To construct a WLAN & make the nodes communicate wirelessly.

⇒ Procedure

- Select 1 router, 2 PC's, 1 laptop, a switch & an access point. Set up the topology as shown (initially no connection b/w end & access pt.)

Configure the devices with their IP addresses as shown.

To configure access point, go to part 1.

Give a name, to SSID as CSE

Select WEP & give IP digit WEP key as 1234567890.

Ensure the port status is ON.

Configure the PC1 & laptop with wireless networks

→ For PC, switch off, drag existing PT-HOST-NM-1AM to unpower-set listed to in LHS.

Drag WMP300N wireless interface to the empty port.

Switch on PC.

→ In the config tab a new wireless interface would have been added. Configure SSID, WEP, WEP key, IP address & gateway for the device [Port status should be ON set SSID none]

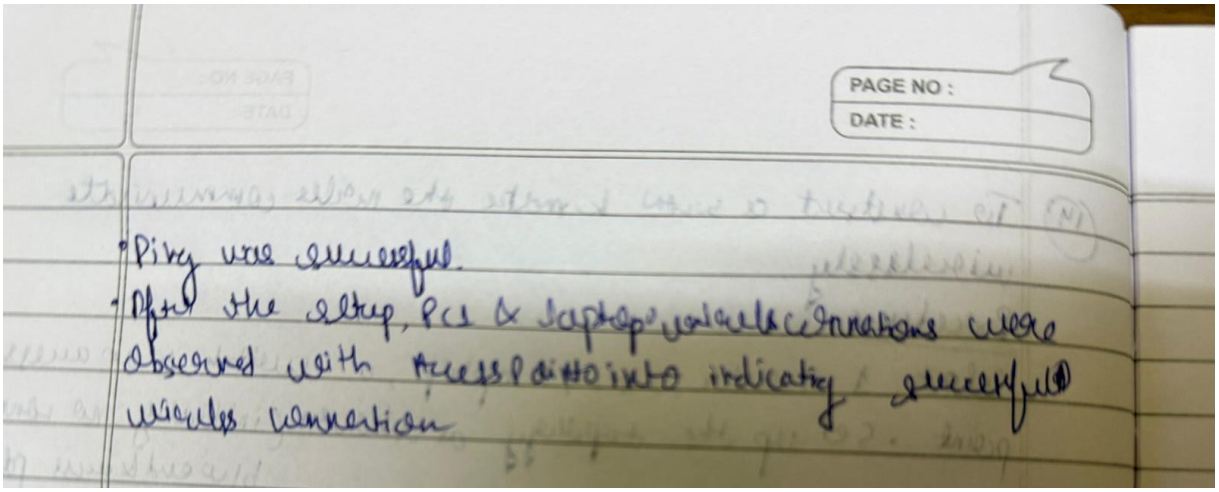
→ DO similar process for laptop.

Ping from every device to all other devices & observe the result

- In PC, laptop, turn system off, remove the ports. Place the wireless port & turn it on. In config, set same SSID & authenticate.

⇒ Observation:-

- Device could connect to WLAN as long as they are in the range of the network.
- Signal strength decrease as increase in distance.



PC0

Physical | Config | Desktop | Custom Interface

Command Prompt X

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

Pinging 10.0.0.3 with 32 bytes of data:

Reply from 10.0.0.3: bytes=32 time=30ms TTL=128
Reply from 10.0.0.3: bytes=32 time=9ms TTL=128
Reply from 10.0.0.3: bytes=32 time=4ms TTL=128
Reply from 10.0.0.3: bytes=32 time=7ms TTL=128

Ping statistics for 10.0.0.3:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 4ms, Maximum = 30ms, Average = 12ms

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=21ms TTL=128
Reply from 10.0.0.4: bytes=32 time=12ms TTL=128
Reply from 10.0.0.4: bytes=32 time=9ms TTL=128
Reply from 10.0.0.4: bytes=32 time=6ms TTL=128

Ping statistics for 10.0.0.4:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 6ms, Maximum = 21ms, Average = 12ms
```

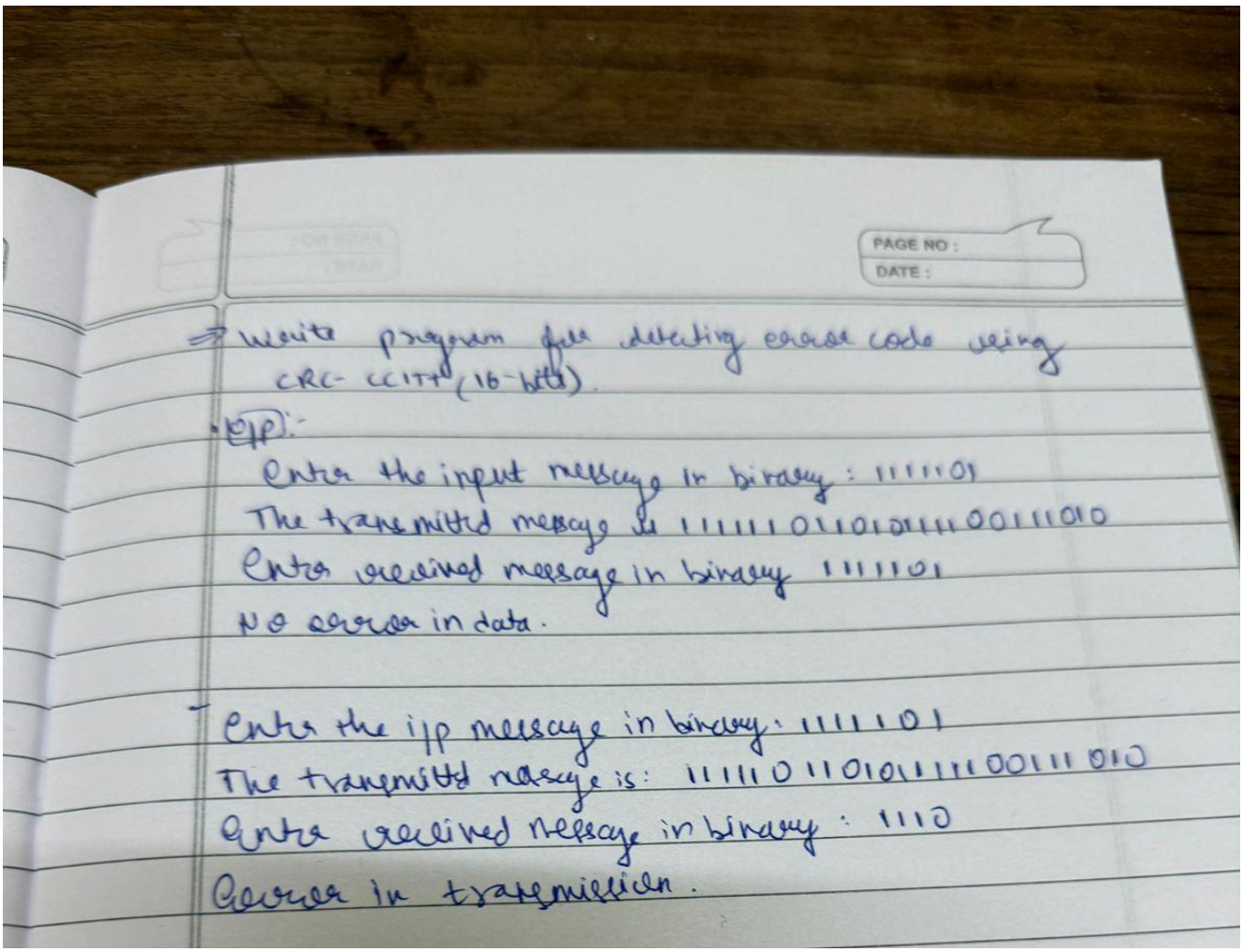
CYCLE - 2

Program 13:

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

```
#include <iostream>
#include <string.h>
using namespace std;

int crc(char *ip, char *op, char *poly, int mode)
{
strcpy(op, ip);
if (mode) {
   for (int i = 1; i < strlen(poly); i++)
        strcat(op, "0");
}
/* Perform XOR on the msg with the selected polynomial */
for (int i = 0; i < strlen(ip); i++) {
     if (op[i] == '1') {
          for (int j = 0; j < strlen(poly); j++) {
               if (op[i + j] == poly[j])
                    op[i + j] = '0';
    else
          op[i + j] = '1';
}}}
/* check for errors. return 0 if error detected */
for (int i = 0; i < strlen(op); i++)
       if (op[i] == '1') return 0;
return 1;
}

int main(){
     char ip[50], op[50], recv[50];
     /* x 16 + x12 + x5 + 1 */
      char poly[] = "10001000000100001";
      cout << "Enter the input message in binary"<< endl;
      cin >> ip;
      crc(ip, op, poly, 1);
      cout << "The transmitted message is: " << ip << op + strlen(ip) << endl;
      cout << "Enter the received message in binary" << endl;
      cin >> recv;
      if (crc(recv, op, poly, 0))
           cout << "No error in data" << endl;
     else
           cout << "Error in data transmission has occurred" << endl;
     return 0;
}
```

Observations:



Program 14:

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

Algorithm:
1. Start
2. Set the bucket size or the buffer size.
3. Set the output rate.
4. Transmit the packets such that there is no overflow.
5. Repeat the process of transmission until all packets are transmitted.
   (Reject packets whosesize is greater than the bucket size.)
6. Stop

Code:
```
#include <iostream>
#include <string.h>
using namespace std;

#include<stdio.h>
#include<stdlib.h>
#include<unistd.h>
#define NOF_PACKETS 10
int rand(int a){
     int rn = (random() % 10) % a;
     return rn == 0 ? 1 : rn;
}
int main() {
   int packet_sz[NOF_PACKETS], i, clk, b_size, o_rate, p_sz_rm=0, p_sz, p_time, op;
   for(i = 0; i<NOF_PACKETS; ++i)
        packet_sz[i] = rand(6) * 10;
   for(i = 0; i<NOF_PACKETS; ++i)
       printf("\npacket[%d]:%d bytes\t", i, packet_sz[i]);
   printf("\nEnter the Output rate:");
   scanf("%d", &o_rate);
   printf("Enter the Bucket Size:");
   scanf("%d", &b_size);
   for(i = 0; i<NOF_PACKETS; ++i){
       if( (packet_sz[i] + p_sz_rm) > b_size)
           if(packet_sz[i] > b_size)/*compare the packet size with bucket size*/
               printf("\n\nIncoming packet size (%dbytes) is Greater than bucket capacity
                           (%dbytes)-PACKET REJECTED", packet_sz[i], b_size);
           else
                printf("\n\nBucket capacity exceeded-PACKETS REJECTED!!");
       else {
           p_sz_rm += packet_sz[i];
           printf("\n\nIncoming Packet size: %d", packet_sz[i]);
           printf("\nBytes remaining to Transmit: %d", p_sz_rm);
           p_time = rand(4) * 10;
```

```
            printf("\nTime left for transmission: %d units", p_time);
           for(clk = 10; clk <= p_time; clk += 10) {
               sleep(1);
                if(p_sz_rm) {
                     if(p_sz_rm <= o_rate)/*packet size remaining comparing with output rate*/
                         op = p_sz_rm, p_sz_rm = 0;
                     else
                         op = o_rate, p_sz_rm -= o_rate;
                      printf("\nPacket of size %d Transmitted", op);
                      printf(" --- Bytes Remaining to Transmit: %d", p_sz_rm);
                }
                else {
                   printf("\nTime left for transmission: %d units", p_time-clk);
                   printf("\nNo packets to transmit!!");
}}}}
return 0;
}
```

OUTPUT:

```
packet[0]:30 bytes
packet[1]:10 bytes
packet[2]:10 bytes
packet[3]:50 bytes
packet[4]:30 bytes
packet[5]:50 bytes
packet[6]:10 bytes
packet[7]:20 bytes
packet[8]:30 bytes
packet[9]:10 bytes
Enter the Output rate:100
Enter the Bucket Size:50
Incoming Packet size: 30
Bytes remaining to Transmit: 30
Time left for transmission: 20 units
Packet of size 30 Transmitted --- Bytes Remaining to Transmit: 0
Time left for transmission: 0 units
No packets to transmit!!

Incoming Packet size: 10
Bytes remaining to Transmit: 10
Time left for transmission: 30 units
Packet of size 10 Transmitted --- Bytes Remaining to Transmit: 0
Time left for transmission: 10 units
No packets to transmit!!
Time left for transmission: 0 units
No packets to transmit!!
Incoming Packet size: 10
Bytes remaining to Transmit: 10
```

Time left for transmission: 10 units
Packet of size 10 Transmitted --- Bytes Remaining to Transmit: 0

Incoming Packet size: 50
Bytes remaining to Transmit: 50
Time left for transmission: 10 units
Packet of size 50 Transmitted --- Bytes Remaining to Transmit: 0

Incoming Packet size: 30
Bytes remaining to Transmit: 30
Time left for transmission: 30 units
Packet of size 30 Transmitted --- Bytes Remaining to Transmit: 0
Time left for transmission: 10 units
No packets to transmit!!
Time left for transmission: 0 units
No packets to transmit!!

Incoming Packet size: 50
Bytes remaining to Transmit: 50
Time left for transmission: 20 units
Packet of size 50 Transmitted --- Bytes Remaining to Transmit: 0
Time left for transmission: 0 units
No packets to transmit!!

Incoming Packet size: 10
Bytes remaining to Transmit: 10
Time left for transmission: 10 units
Packet of size 10 Transmitted --- Bytes Remaining to Transmit: 0
Incoming Packet size: 20
Bytes remaining to Transmit: 20
Time left for transmission: 20 units
Packet of size 20 Transmitted --- Bytes Remaining to Transmit: 0
Time left for transmission: 0 units
No packets to transmit!!

Incoming Packet size: 30
Bytes remaining to Transmit: 30
Time left for transmission: 20 units
Packet of size 30 Transmitted --- Bytes Remaining to Transmit: 0
Time left for transmission: 0 units
No packets to transmit!!
Incoming Packet size: 10
Bytes remaining to Transmit: 10
Time left for transmission: 20 units
Packet of size 10 Transmitted --- Bytes Remaining to Transmit: 0
Time left for transmission: 0 units
No packets to transmit!!

Program 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.

Algorithm:

Client Side

1. Start.
2. Create a socket using the socket() system call.
3. Connect the socket to the server's address using the connect() system call.
4. Send the filename of the required file using the send() system call.
5. Read the contents of the file sent by the server using the recv() system call.
6. Stop.

Code:

```
#include <unistd.h>
int main()
{
    int soc, n;
    char buffer[1024], fname[50];
    struct sockaddr_in addr;
    /* socket creates an endpoint for communication and returns a file descriptor */
    soc = socket(PF_INET, SOCK_STREAM, 0);
    /*
    * sockaddr_in is used for ip manipulation
    * we define the port and IP for the connection.
    */
    addr.sin_family = AF_INET;
    addr.sin_port = htons(7891);
    addr.sin_addr.s_addr = inet_addr("127.0.0.1");
    /* keep trying to establish connection with server */
    while(connect(soc, (struct sockaddr *) &addr, sizeof(addr))) ;
        printf("\nClient is connected to Server");
    printf("\nEnter file name: ");
    scanf("%s", fname);
     /* send the filename to the server */
    send(soc, fname, sizeof(fname), 0);
    printf("\nRecieved response\n");0
     /* keep printing any data received from the server */
     while ((n = recv(soc, buffer, sizeof(buffer), 0)) > 0)
         printf("%s", buffer);
     return 0;
}
```

Algorithm:

Server Side

1. Start.
2. Create a socket using socket() system call.
3. Bind the socket to an address using bind() system call.
4. Listen to the connection using listen() system call.
5. accept connection using accept()
6. Receive filename and transfer contents of file with client.
7. Stop.

Code:

```
#include <stdio.h>
#include <arpa/inet.h>
#include <fcntl.h>
#include <unistd.h>
int main()
{
    int welcome, new_soc, fd, n;
    char buffer[1024], fname[50];
    struct sockaddr_in addr;
    welcome = socket(PF_INET, SOCK_STREAM, 0);
    addr.sin_family = AF_INET;
    addr.sin_port = htons(7891);
    addr.sin_addr.s_addr = inet_addr("127.0.0.1");
    bind(welcome, (struct sockaddr *) &addr, sizeof(addr));
    printf("\nServer is Online");
    /* listen for connections from the socket */
    listen(welcome, 5);
    /* accept a connection, we get a file descriptor */
   new_soc = accept(welcome, NULL, NULL);
   /* receive the filename */
   recv(new_soc, fname, 50, 0);
   printf("\nRequesting for file: %s\n", fname);
   /* open the file and send its contents */
   fd = open(fname, O_RDONLY);
   if (fd < 0)
       send(new_soc, "\nFile not found\n", 15, 0);
   else
      while ((n = read(fd, buffer, sizeof(buffer))) > 0)
  send(new_soc, buffer, n, 0);
  printf("\nRequest sent\n");
  close(fd);
  return 0;
}
```

OUTPUT:

Server is Online.
Requesting for file : test.txt
Request sent.

Client is connected to server
Enter file name : test.txt
Received Response
Hello World.

Program 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.

Code:

```
// server program for udp connection
#include <stdio.h>
#include <strings.h>
#include <sys/types.h>
#include <arpa/inet.h>
#include <sys/socket.h>
#include<netinet/in.h>
#define PORT 5000
#define MAXLINE 1000
// Driver code
int main()
{
    char buffer[100];
    char *message = "Hello Client";
    int listenfd, len;
    struct sockaddr_in servaddr, cliaddr;
    bzero(&servaddr, sizeof(servaddr));
    // Create a UDP Socket
    listenfd = socket(AF_INET, SOCK_DGRAM, 0);
    servaddr.sin_addr.s_addr = htonl(INADDR_ANY);
    servaddr.sin_port = htons(PORT);
    servaddr.sin_family = AF_INET;
    // bind server address to socket descriptor
    bind(listenfd, (struct sockaddr*)&servaddr, sizeof(servaddr));
    //receive the datagram
    len = sizeof(cliaddr);
    int n = recvfrom(listenfd, buffer, sizeof(buffer), 0, (struct sockaddr*)&cliaddr,&len);
    //receive message from server
    buffer[n] = '\0';
    puts(buffer);
    // send the response
    sendto(listenfd, message, MAXLINE, 0,(struct sockaddr*)&cliaddr, sizeof(cliaddr));
}


// udp client driver program
#include <stdio.h>
#include <strings.h>
#include <sys/types.h>
#include <arpa/inet.h>
#include <sys/socket.h>
#include<netinet/in.h>
```

```
#include<unistd.h>
#include<stdlib.h>
#define PORT 5000
#define MAXLINE 1000
// Driver code
int main()
{
    char buffer[100];
    char *message = "Hello Server";
    int sockfd, n;
    struct sockaddr_in servaddr;
    // clear servaddr
    bzero(&servaddr, sizeof(servaddr));
    servaddr.sin_addr.s_addr = inet_addr("127.0.0.1");
    servaddr.sin_port = htons(PORT);
    servaddr.sin_family = AF_INET;
    // create datagram socket
    sockfd = socket(AF_INET, SOCK_DGRAM, 0);
    // connect to server
   if(connect(sockfd, (struct sockaddr *)&servaddr, sizeof(servaddr)) < 0) {
        printf("\n Error : Connect Failed \n");
        exit(0);
    }
    // request to send datagram
    // no need to specify server address in sendto
    // connect stores the peers IP and port
    sendto(sockfd, message, MAXLINE, 0, (struct sockaddr*)NULL, sizeof(servaddr));
    // waiting for response
    recvfrom(sockfd, buffer, sizeof(buffer), 0, (struct sockaddr*)NULL, NULL);
    puts(buffer);
    // close the descriptor
    close(sockfd);
}
```

Output:

```
//Server output
Server is Online.
Hello Server

//Client Output
Hello Client
```