VISVESVARAYA TECHNOLOGICAL UNIVERSITY

"JnanaSangama", Belgaum -590014, Karnataka.

LAB REPORT

on

COMPUTER NETWORKS

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**" carried out by **BHOOMIKA HEGDE(1BM22CS342)** 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 2024-25. The Lab report has been approved as it satisfies the academic requirements in respect of **Computer Networks Lab - (23CS5PCCON)** work prescribed for the said degree.

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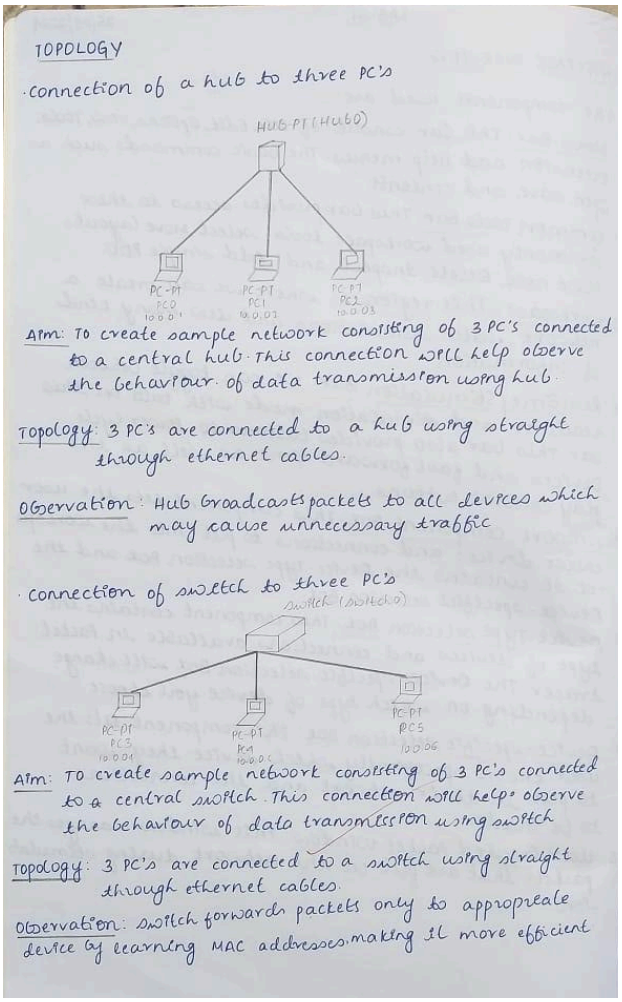
CYCLE-1

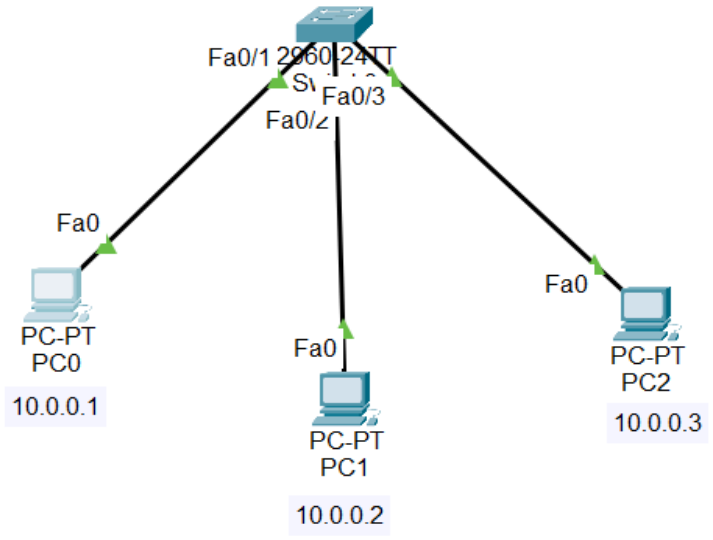
Question 1:

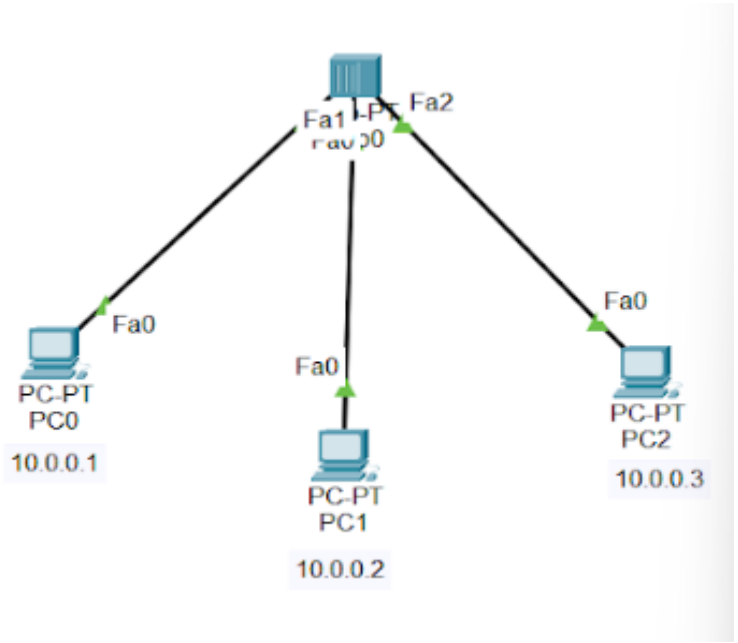
Create a topology and simulate sending a simple PDU from source to destination using hub and switch as connecting devices and demonstrate ping message.

Observation:

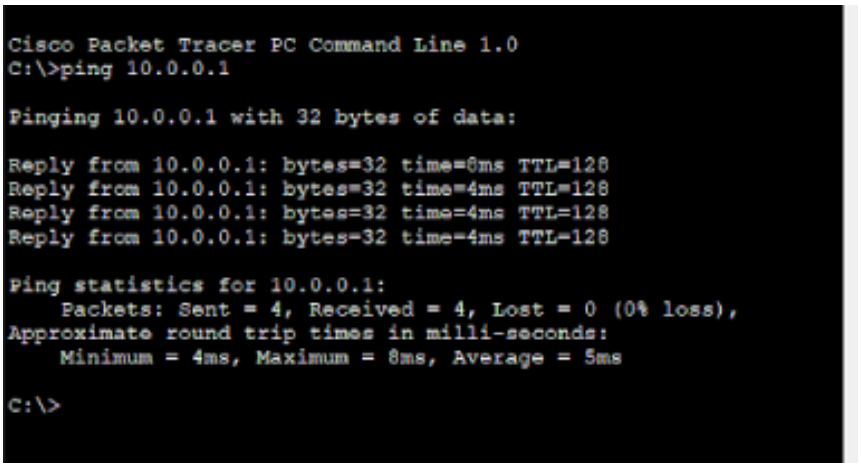


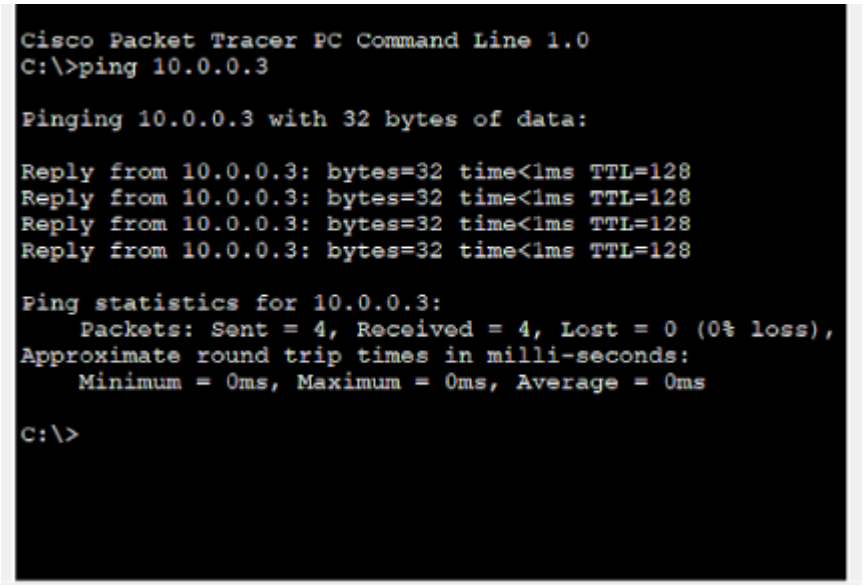
Screenshot of the topology:





Screenshot of the output:

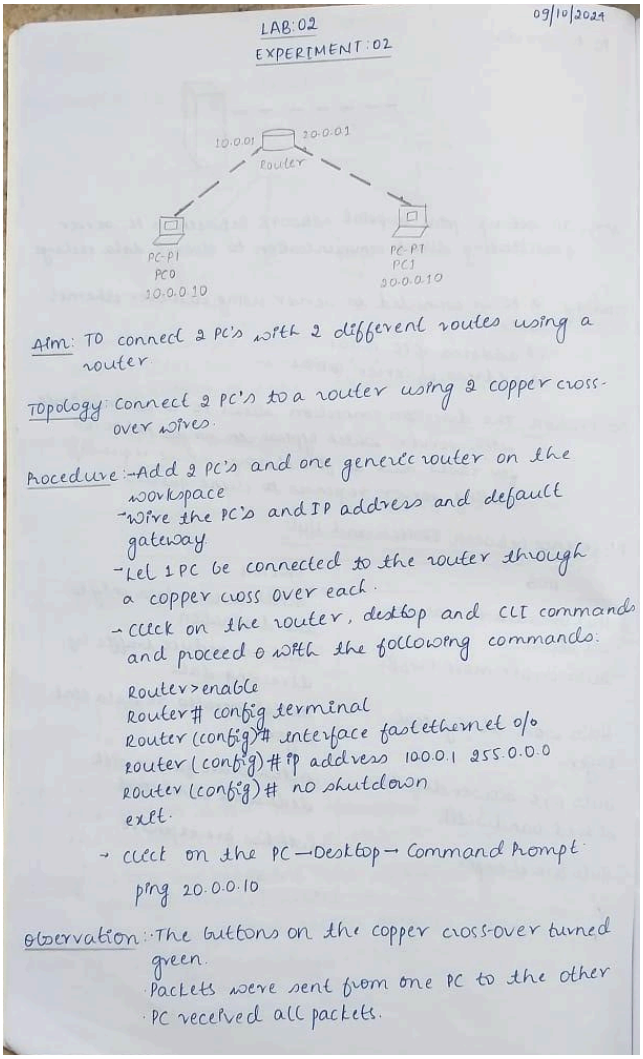




Question 2:

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

Observation:



LAB: 02 09/10/2024

EXPERIMENT: 02

Aim: TO connect 2 PC's with 2 different routes using a router

Topology: Connect 2 PC's to a router using 2 copper cross-over wires.

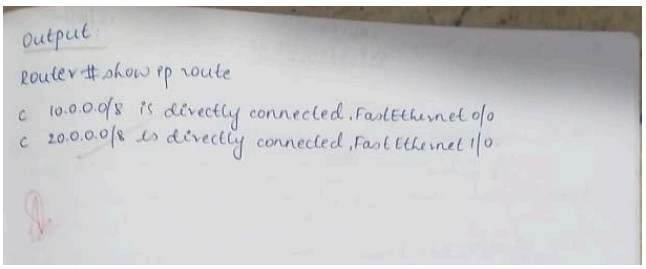
Procedure:
- Add 2 PC's and one generic router on the workspace
- Wire the PC's and IP address and default gateway
- Let 1 PC be connected to the router through a copper cross over each.
- Click on the router, desktop and CLI commands and proceed with the following commands:

```
Router>enable
Router# config terminal
Router(config)# interface fastethernet 0/0
Router(config)# ip address 100.0.1 255.0.0.0
Router(config)# no shutdown
exit
```

- Click on the PC → Desktop → Command Prompt:

```
ping 20.0.0.10
```

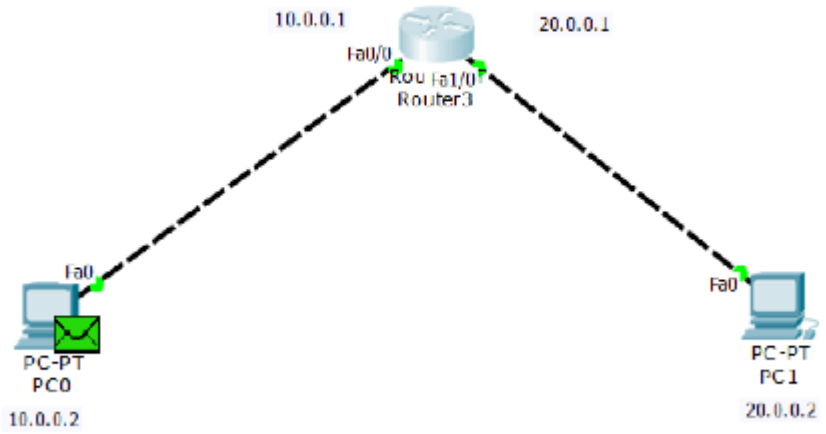
Observation:
- The buttons on the copper cross-over turned green.
- Packets were sent from one PC to the other
- PC received all packets.



Output:

```
Router# show ip route
C  10.0.0.0/8 is directly connected, FastEthernet 0/0
C  20.0.0.0/8 is directly connected, FastEthernet 1/0
```

Screenshot of the topology:



Screenshot of the output:

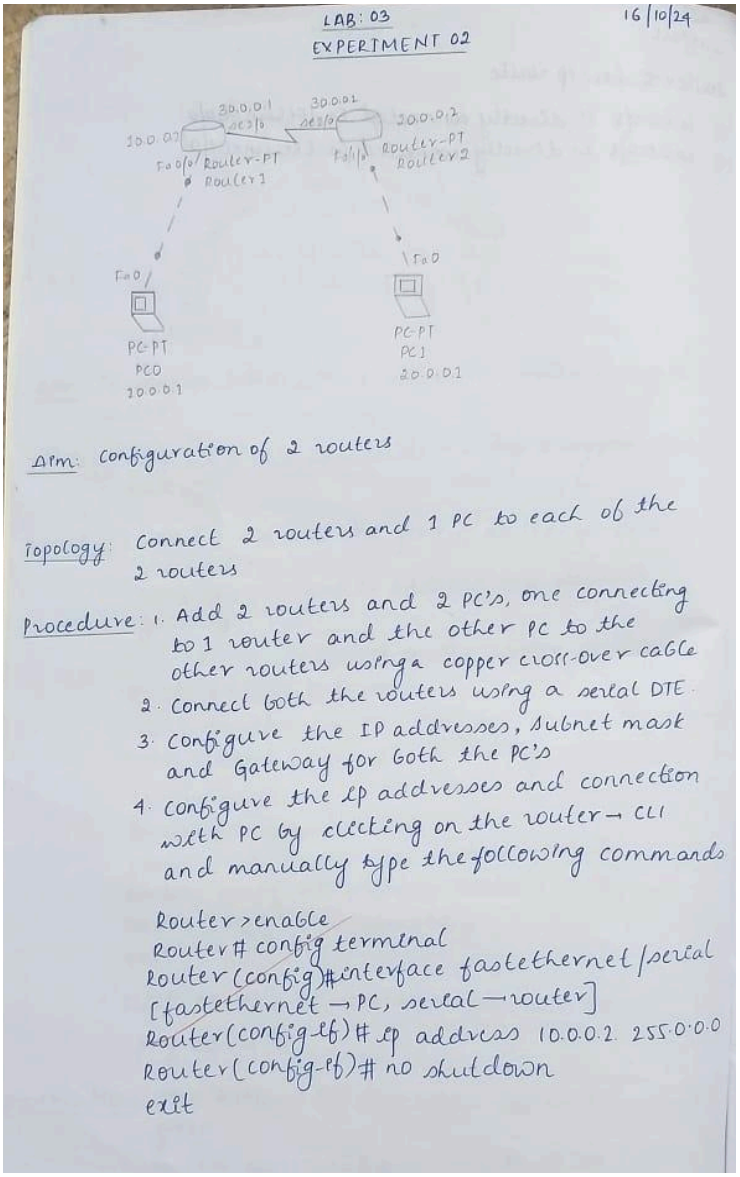
```
C    10.0.0.0/8 is directly connected, FastEthernet0/0
C    20.0.0.0/8 is directly connected, FastEthernet1/0
```

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

Pinging 10.0.0.2 with 32 bytes of data:

Reply from 10.0.0.2: bytes=32 time=4ms TTL=127
Reply from 10.0.0.2: bytes=32 time=4ms TTL=127
Reply from 10.0.0.2: bytes=32 time=4ms TTL=127
Reply from 10.0.0.2: bytes=32 time=4ms TTL=127

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

Question 3:

Configure default route, static route to the Router

Observation:



LAB: 03 16/10/24

EXPERIMENT 02

Aim: Configuration of 2 routers

Topology: Connect 2 routers and 1 PC to each of the 2 routers

Procedure:
1. Add 2 routers and 2 PC's, one connecting to 1 router and the other PC to the other routers using a copper cross-over cable
2. Connect both the routers using a serial DTE.
3. Configure the IP addresses, Subnet mask and Gateway for both the PC's
4. Configure the ip addresses and connection with PC by clicking on the router → CLI and manually type the following commands

```
Router>enable
Router# config terminal
Router(config)#interface fastethernet/serial
[fastethernet → PC, serial → router]
Router(config-if)# ip address 10.0.0.2 255.0.0.0
Router(config-if)# no shutdown
exit
```

5. This completes the connection between 2 routers and router to PC.

6.

Observation: The PC's are not communicating even when they are connected through the routers.

- On pinging PC0 to Fa0/0 port of the router the message is pinged
- On pinging PC0 to the other network, the message is not reachable.

EXPERIMENT:03 (a)

Aim: TO connect the default, static route to the router

Procedure:

1. By continuing the perious procedure, to connect the PC's so they can communicate with each other, go to router, CLI and continue with the following commands

ip route 20.0.0.0 255.0.0.0 30.0.0.2

(ip address of neighbour network (router))

2. This should be repeated for the other router, which completes the static routing.

Observation: The PC's are now communicated with each other on pinging.

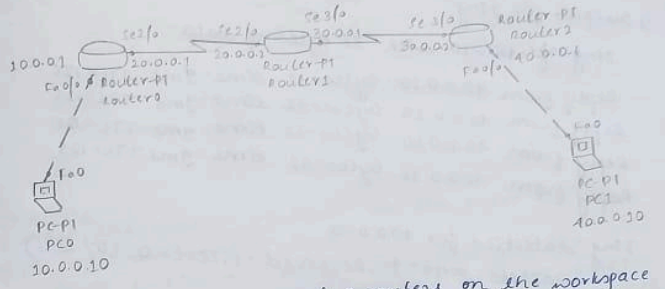
LAB: 01

EXPERIMENT:043 (b) 23/10/21

Question: Configure default route and static route to the Router

Aim: TO configure default routing

Topology:



Procedure: 1) Place 2 PC's and 3 routers on the workspace

2) setup the IP addresses, and Gateway of the PC's

3) setup the IP addresses and connection of the routers in its corresponding CLI

4) Go to CLI of Router1 and follow the below commands

Router# config terminal

Router(config)# ip route 10.0.0.0 255.0.0.0 20.0.0.1

Router(config)# ip route 40.0.0.0 255.0.0.0 30.0.0.2

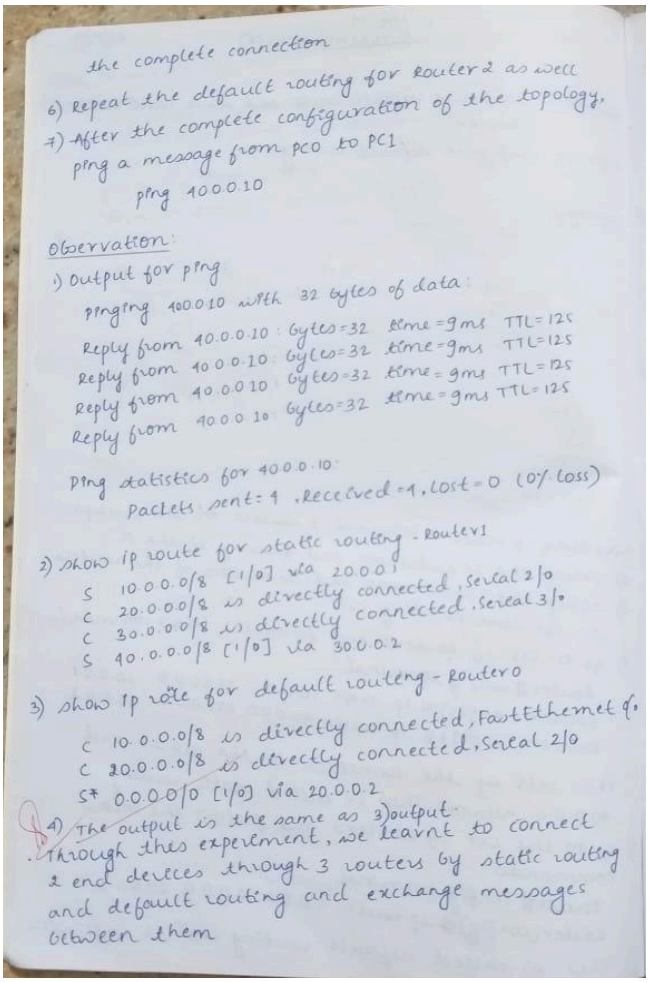
This sets up the connection to the 10.0.0.0 and 40.0.0.0 network. This is called static routing

5) Go to the CLI of Router0 and follow the below commands

Router# config terminal

Router(config)# ip route 0.0.0.0 0.0.0.0 20.0.0.2

This is called default routing and it helps with



the complete connection

6) Repeat the default routing for Router2 as well

7) After the complete configuration of the topology, ping a message from PC0 to PC1

ping 100.0.10

Observation:

1) Output for ping

Pinging 100.0.10 with 32 bytes of data

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

Ping statistics for 40.0.0.10:
Packets sent=4, Received=4, Lost=0 (0% loss)

2) show ip route for static routing - Router1

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

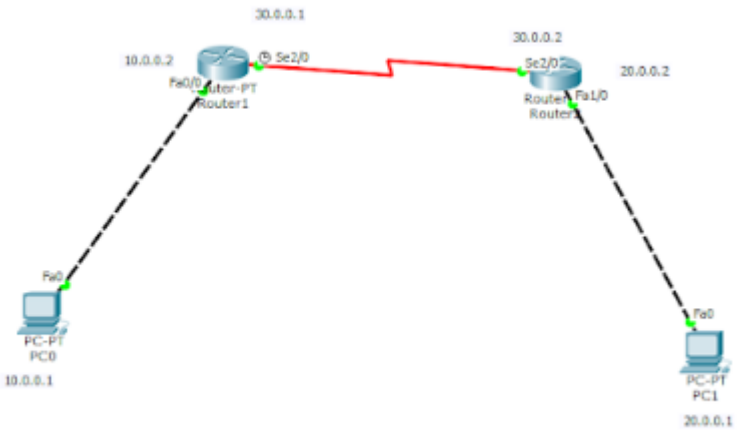
3) show ip route for default routing - Router0

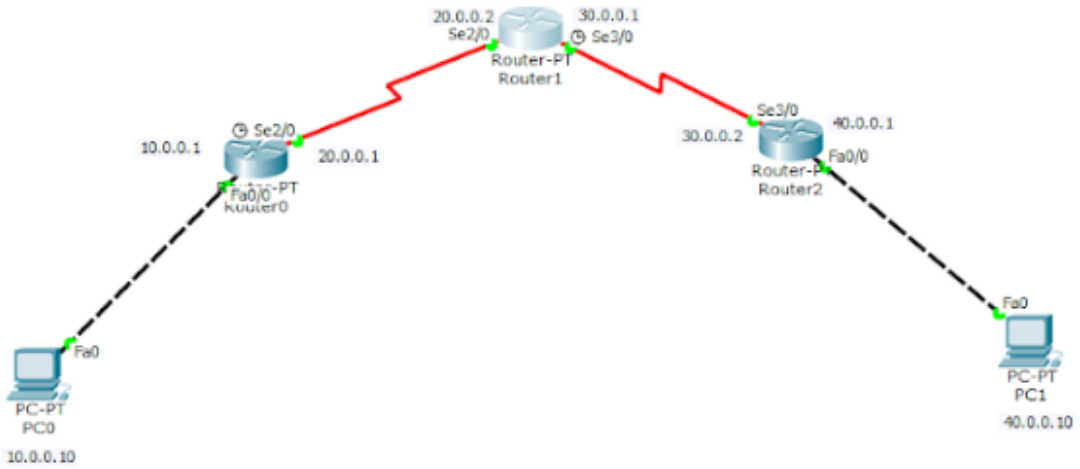
C 10.0.0.0/8 is directly connected, FastEthernet 0/0
C 20.0.0.0/8 is directly connected, Serial 2/0
S* 0.0.0.0/0 [1/0] via 20.0.0.2

4) The output is the same as 3) output

Through this experiment, we learnt to connect 2 end devices through 3 routers by static routing and default routing and exchange messages between them

Screenshot of the topology:





Screenshot of the output:

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

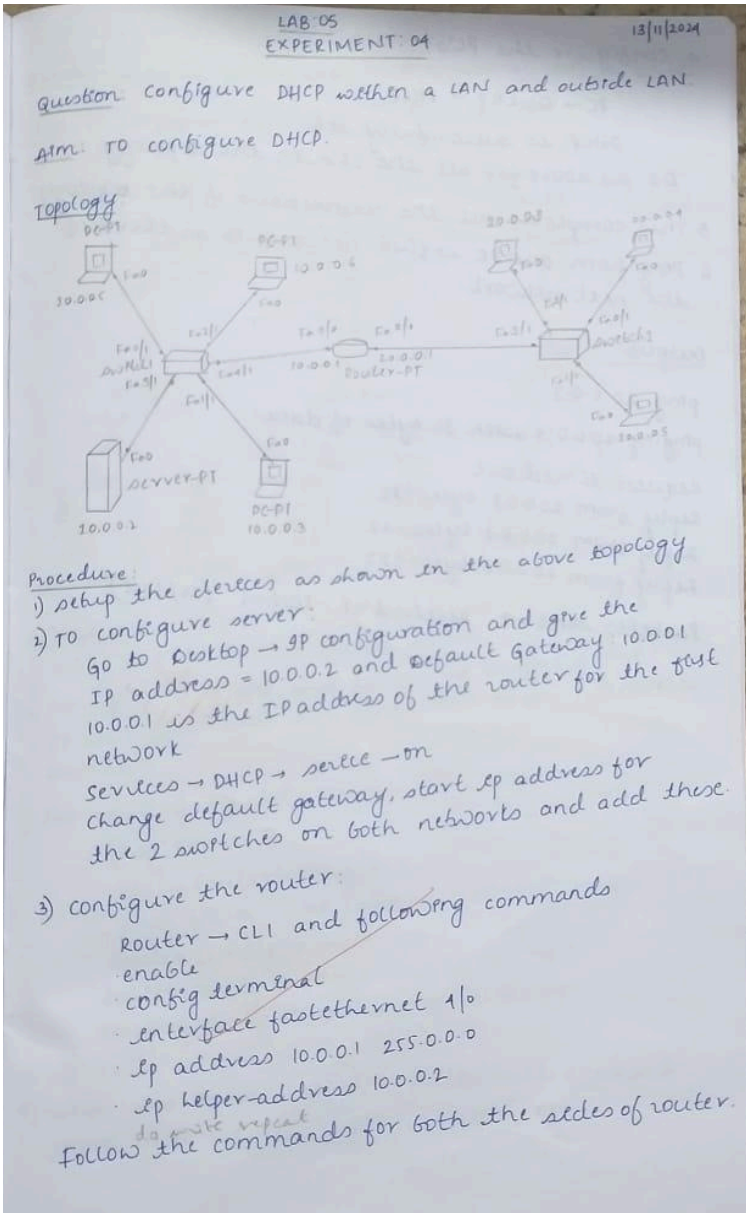
```
C    10.0.0.0/8 is directly connected, FastEthernet0/0
C    20.0.0.0/8 is directly connected, Serial2/0
S*   0.0.0.0/0 [1/0] via 20.0.0.2
```

```
PC>ping 40.0.0.10

Pinging 40.0.0.10 with 32 bytes of data:

Reply from 40.0.0.10: bytes=32 time=9ms TTL=125
Reply from 40.0.0.10: bytes=32 time=9ms TTL=125
Reply from 40.0.0.10: bytes=32 time=5ms TTL=125
Reply from 40.0.0.10: bytes=32 time=11ms TTL=125

Ping statistics for 40.0.0.10:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
```

Question 4:

Configure DHCP within a LAN and outside LAN.

Observation:



LAB 05
EXPERIMENT 04
13/11/2024

Question: Configure DHCP within a LAN and outside LAN

Aim: TO configure DHCP.

Topology

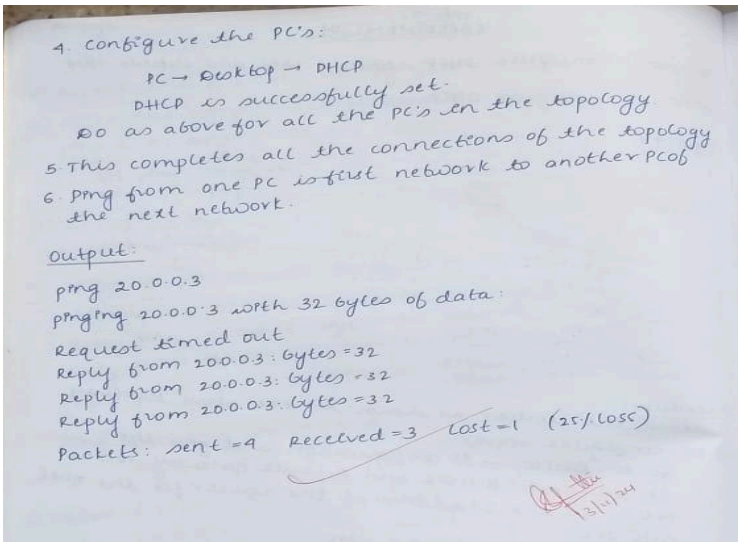
Procedure:

1) setup the devices as shown in the above topology

2) TO configure server:
Go to Desktop → IP configuration and give the IP address = 10.0.0.2 and default Gateway 10.0.0.1 10.0.0.1 is the IP address of the router for the first network
Services → DHCP → service → on
change default gateway, start ip address for the 2 switches on both networks and add these.

3) configure the router:
Router → CLI and following commands
- enable
- config terminal
- interface fastethernet 1/0
- ip address 10.0.0.1 255.0.0.0
- ip helper-address 10.0.0.2
- do write repeat

Follow the commands for both the sides of router.



4. Configure the PC's:

PC → Desktop → DHCP

DHCP is successfully set.

Do as above for all the PC's in the topology.

5. This completes all the connections of the topology.

6. Ping from one PC is first network to another PC of the next network.

Output:

ping 20.0.0.3

Pinging 20.0.0.3 with 32 bytes of data:

Request timed out

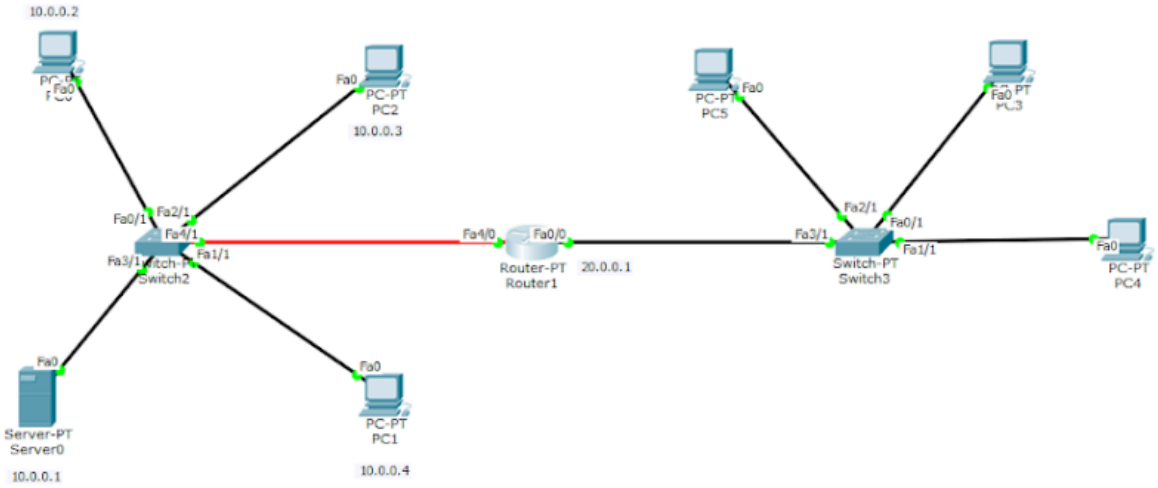
Reply from 20.0.0.3: bytes=32

Reply from 20.0.0.3: bytes=32

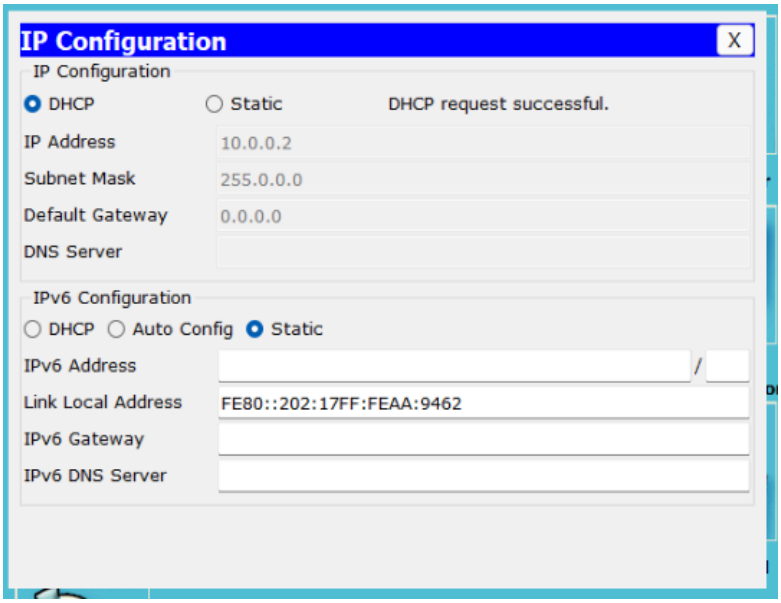
Reply from 20.0.0.3: bytes=32

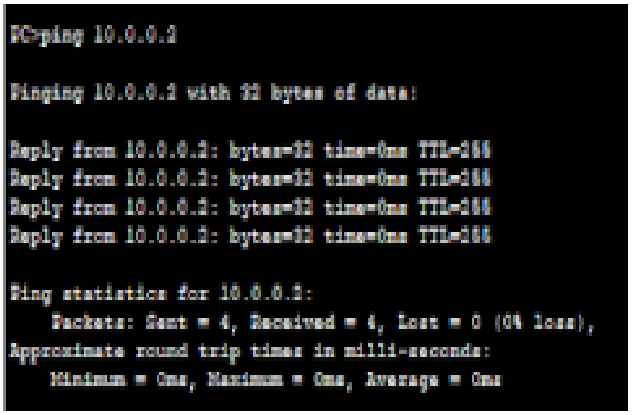
Packets: sent=4 Received=3 Lost=1 (25% loss)

Screenshot of the topology:



Screenshot of the output:

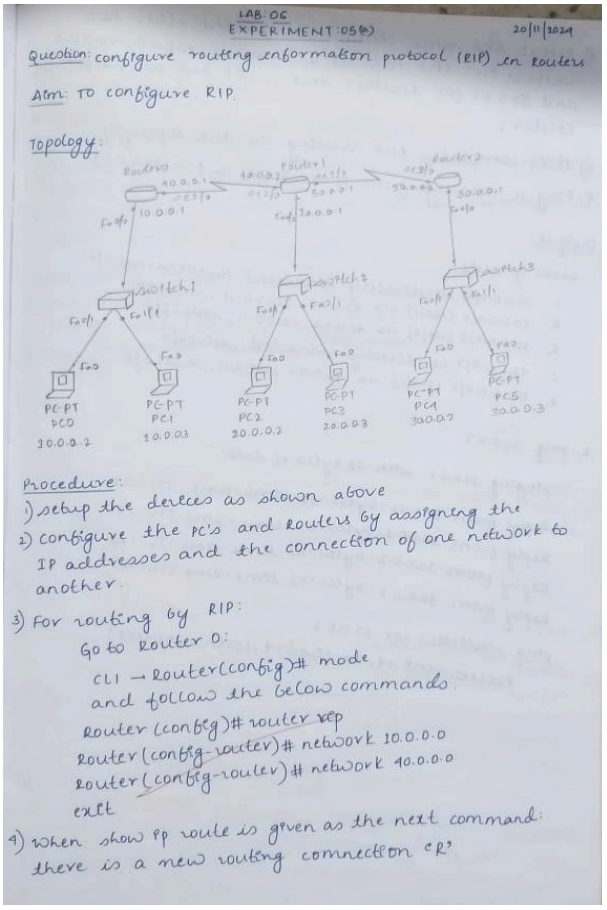




Question 5:

Configure RIP routing Protocol in Routers.

Observation:



LAB: 06
EXPERIMENT: 05(a) 20/11/2024

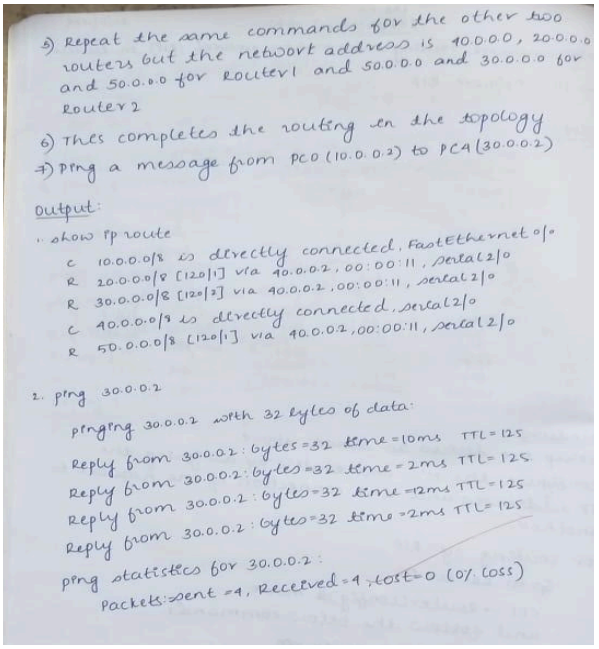
Question: configure routing information protocol (RIP) in Routers

Aim: TO configure RIP

Topology:

Procedure:

1) setup the devices as shown above
2) configure the PC's and Routers by assigning the IP addresses and the connection of one network to another.
3) For routing by RIP:
   Go to Router 0:
   CLI → Router(config)# mode
   and follow the below commands
   Router (config)# router rip
   Router (config-router)# network 10.0.0.0
   Router (config-router)# network 40.0.0.0
   exit
4) When show ip route is given as the next command: there is a new routing connection 'R'



5) Repeat the same commands for the other two routers but the network address is 40.0.0.0, 20.0.0.0 and 50.0.0.0 for Router1 and 50.0.0.0 and 30.0.0.0 for Router2
6) This completes the routing in the topology
7) Ping a message from PC0 (10.0.0.2) to PC4 (30.0.0.2)

Output:

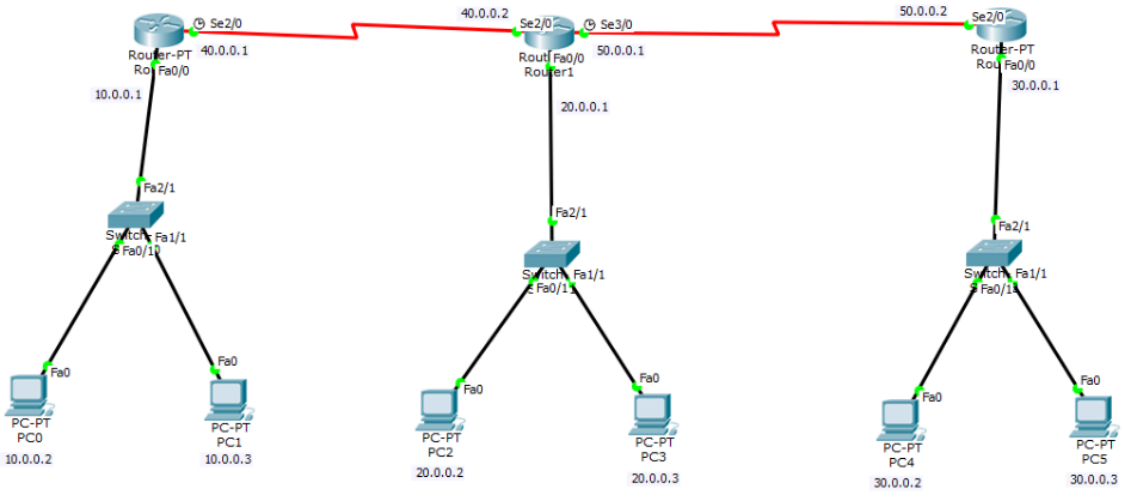
1. show ip route

```
C   10.0.0.0/8 is directly connected, FastEthernet0/0
R   20.0.0.0/8 [120/1] via 40.0.0.2, 00:00:11, Serial2/0
R   30.0.0.0/8 [120/2] via 40.0.0.2, 00:00:11, Serial2/0
C   40.0.0.0/8 is directly connected, Serial2/0
R   50.0.0.0/8 [120/1] via 40.0.0.2, 00:00:11, Serial2/0
```

2. ping 30.0.0.2

```
Pinging 30.0.0.2 with 32 bytes of data:
Reply from 30.0.0.2: bytes=32 time=10ms TTL=125
Reply from 30.0.0.2: bytes=32 time=2ms TTL=125
Reply from 30.0.0.2: bytes=32 time=12ms TTL=125
Reply from 30.0.0.2: bytes=32 time=2ms TTL=125
Ping statistics for 30.0.0.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss)
```

Screenshot of the topology:



Screenshot of the output:

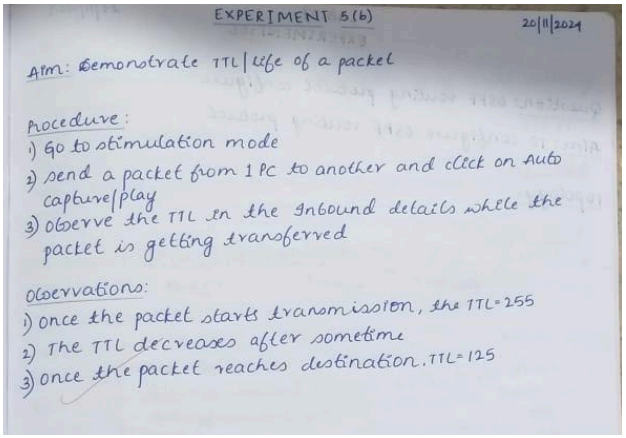
```
R    10.0.0.0/8 [120/2] via 50.0.0.1, 00:00:07, Serial2/0
R    20.0.0.0/8 [120/1] via 50.0.0.1, 00:00:07, Serial2/0
C    30.0.0.0/8 is directly connected, FastEthernet0/0
R    40.0.0.0/8 [120/1] via 50.0.0.1, 00:00:07, Serial2/0
C    50.0.0.0/8 is directly connected, Serial2/0
```

```
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=10ms TTL=125
Reply from 30.0.0.2: bytes=32 time=2ms TTL=125
Reply from 30.0.0.2: bytes=32 time=12ms TTL=125
Reply from 30.0.0.2: bytes=32 time=2ms 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 = 2ms, Maximum = 12ms, Average = 6ms
```

Question 6:

Demonstrate the TTL/ Life of a Packet

Observation writeup images:



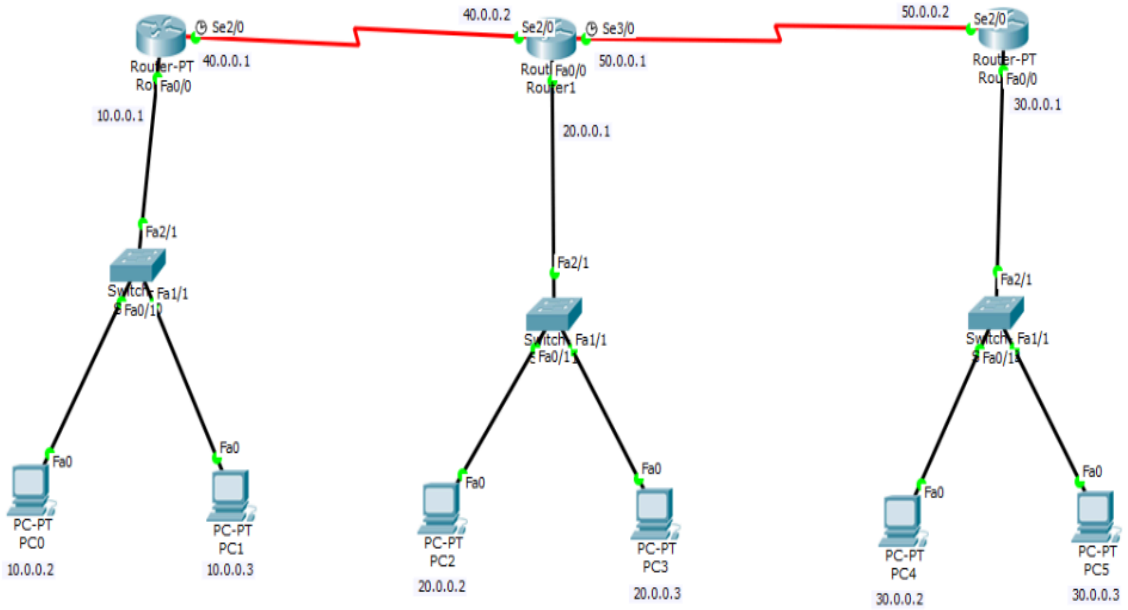
EXPERIMENT 5(b) 20/11/2024

Aim: Demonstrate TTL/life of a packet

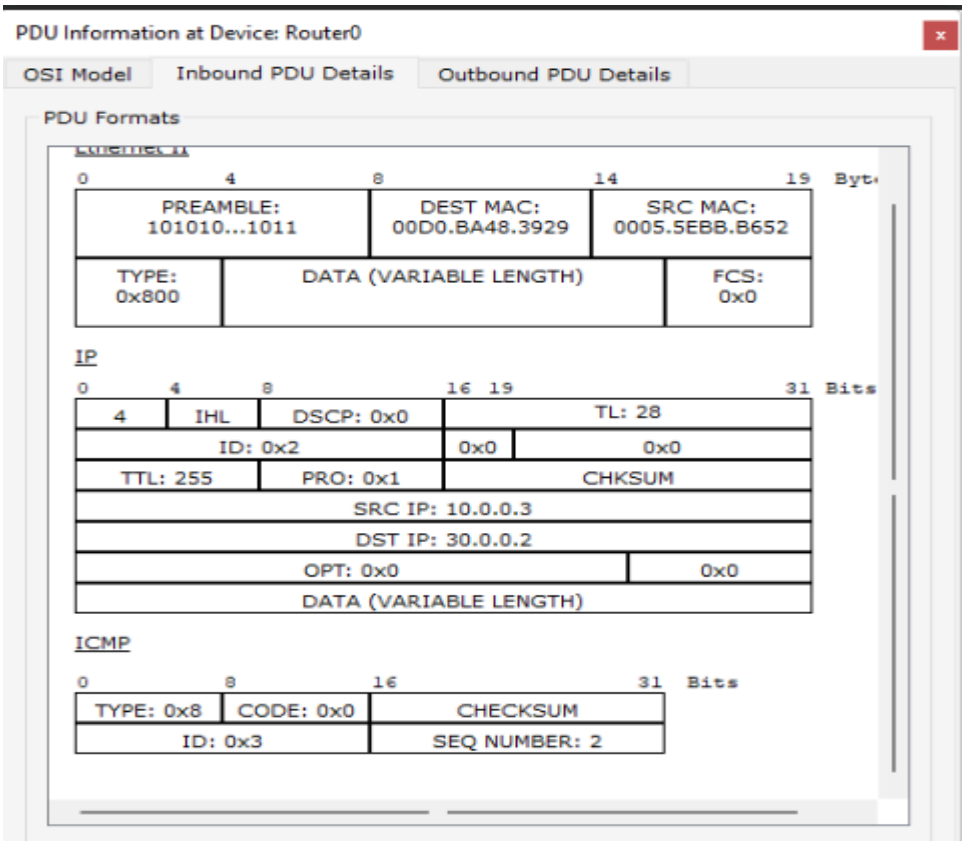
Procedure:
1) Go to simulation mode
2) Send a packet from 1 PC to another and click on Auto capture/play
3) Observe the TTL in the Inbound details while the packet is getting transferred

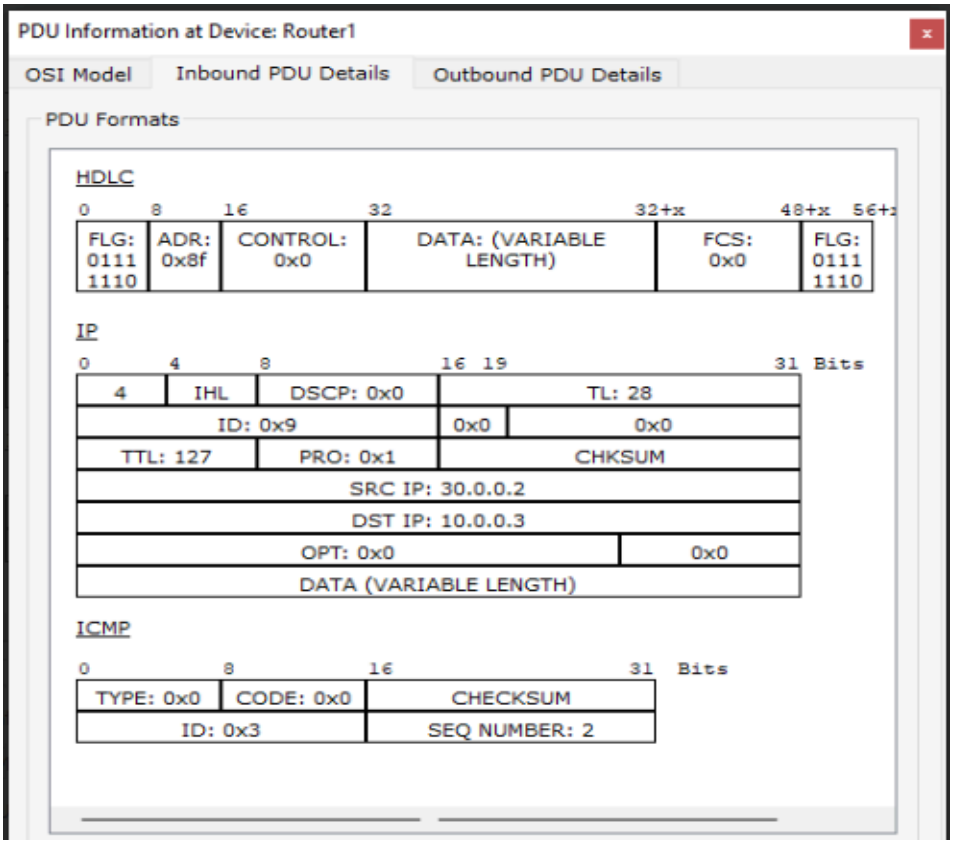
Observations:
1) Once the packet starts transmission, the TTL=255
2) The TTL decreases after sometime
3) Once the packet reaches destination. TTL=125

Screenshot of the topology:



Screenshot of the output:

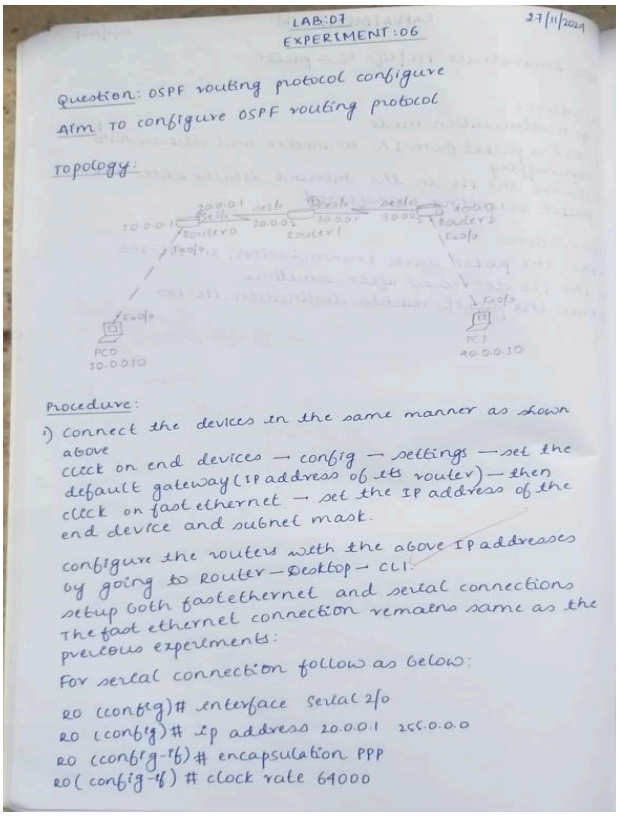




Question 7:

Configure OSPF routing protocol

Observation :



LAB:07 EXPERIMENT:06 27/11/2024

Question: OSPF routing protocol configure

Aim: To configure OSPF routing protocol

Topology:

Procedure:

1) Connect the devices in the same manner as shown above
Click on end devices → config → settings → set the default gateway (IP address of its router) → then click on fast ethernet → set the IP address of the end device and subnet mask.

configure the routers with the above IP addresses by going to Router → Desktop → CLI.
Setup both fastethernet and serial connections
The fast ethernet connection remains same as the previous experiments:
For serial connection follow as below:

```
R0 (config)# interface Serial 2/0
R0 (config)# ip address 20.0.0.1 255.0.0.0
R0 (config-if)# encapsulation PPP
R0(config-if)# clock rate 64000
```

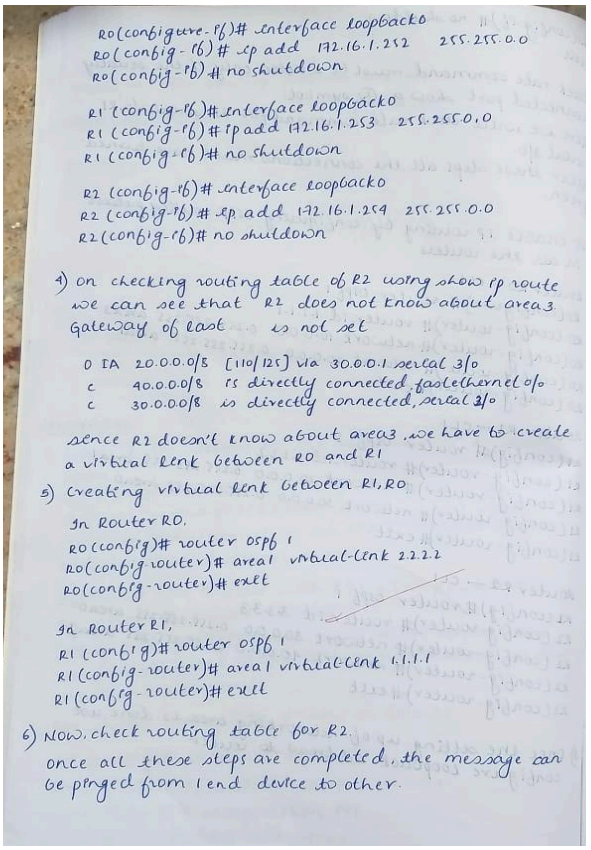
```
R0(config-if)# no shutdow
exit.
```

Clock rate command must be written only if the serially connected port show a ⓢ symbol.
Here we write clock rate command for R0 serial 2/0. R1 serial 3/0.
After these steps all the connections must have turned green.

2) To enable IP routing by configuring OSPF routing protocol in all the routers.

```
Router R0 — CLI
R0(configure)# router ospf 1
R0 (config-router)# router-id 1.1.1.1
R0(config-router)# network 10.0.0.0 0.255.255.255 area3
R0(config-router)# network 20.0.0.0 0.255.255.255 area1
R0 (config-router)# exit

Router R1 — CLI
R1(config)# router ospf 1
R1 (config-router)# router-id 2.2.2.2
R1(config-router)# network 20.0.0.0 0.255.255.255 area1
R1(config-router)# network 30.0.0.0 0.255.255.255 area0
R1(config-router)# exit.

Router R2 — CLI
R2 (config)# router ospf 1
R2 (config-router)# router-id 3.3.3.3
R2 (config-router)# network 30.0.0.0 0.255.255.255 area0
R2 (config-router)# network 40.0.0.0 0.255.255.255 area2
R2 (config-router)# exit
```

3) Once the setting up of networking area is done, use configure loopback address to router



R0(configure-rb)# interface loopback0
R0(config-rb)# ip add 172.16.1.252 255.255.0.0
R0(config-rb)# no shutdown

R1(config-rb)# interface loopback0
R1(config-rb)# ip add 172.16.1.253 255.255.0.0
R1(config-rb)# no shutdown

R2(config-rb)# interface loopback0
R2(config-rb)# ip add 172.16.1.254 255.255.0.0
R2(config-rb)# no shutdown

4) On checking routing table of R2 using show ip route we can see that R2 does not know about area3. Gateway of last is not set

O IA 20.0.0.0/8 [110/125] via 30.0.0.1 serial 3/0
C 40.0.0.0/8 is directly connected fastethernet 0/0
C 30.0.0.0/8 is directly connected, serial 3/0

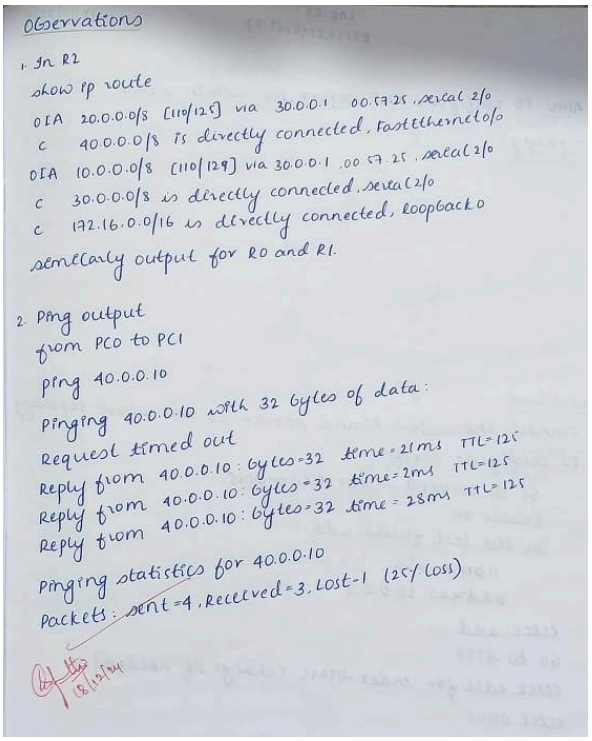
since R2 doesn't know about area3, we have to create a virtual link between R0 and R1

5) Creating virtual link between R1, R0

In Router R0.
R0(config)# router ospf 1
R0(config router)# area1 virtual-link 2.2.2.2
R0(config-router)# exit

In Router R1,
R1(config)# router ospf 1
R1(config-router)# area1 virtual-link 1.1.1.1
R1(config-router)# exit

6) Now, check routing table for R2.
once all these steps are completed, the message can be pinged from 1 end device to other.

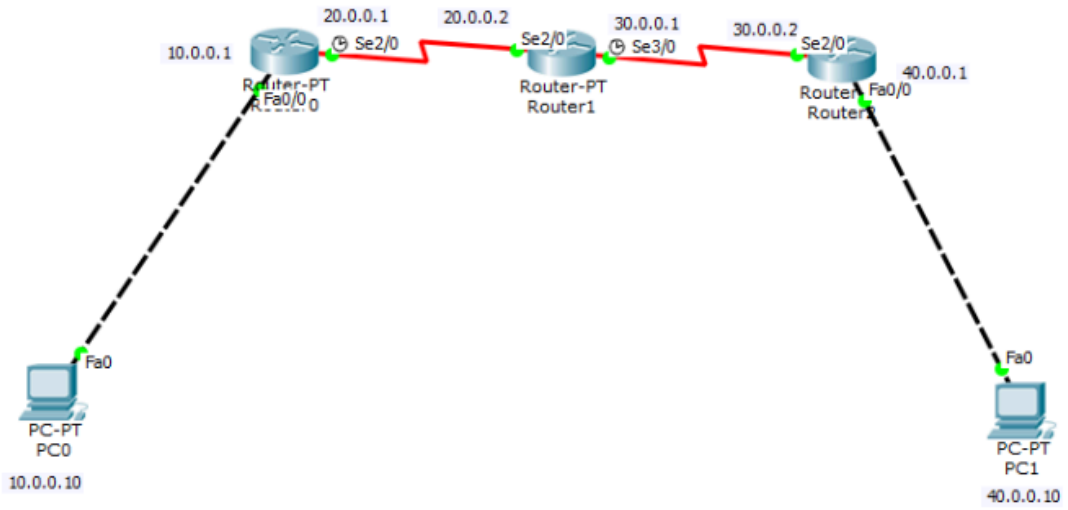


Observations

1. In R2
show ip route
O IA 20.0.0.0/8 [110/125] via 30.0.0.1 00:57:25, serial 2/0
C 40.0.0.0/8 is directly connected, FastEthernet0/0
O IA 10.0.0.0/8 [110/129] via 30.0.0.1 00:57:25, serial 2/0
C 30.0.0.0/8 is directly connected, serial 2/0
C 172.16.0.0/16 is directly connected, loopback0
similarly output for R0 and R1.

2. Ping output
from PC0 to PC1
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=21ms TTL=125
Reply from 40.0.0.10: bytes=32 time=2ms TTL=125
Reply from 40.0.0.10: bytes=32 time=28ms TTL=125
Pinging statistics for 40.0.0.10
Packets: sent=4, Received=3, Lost=1 (25% loss)

Screenshot of the topology:



Screenshot of the output:

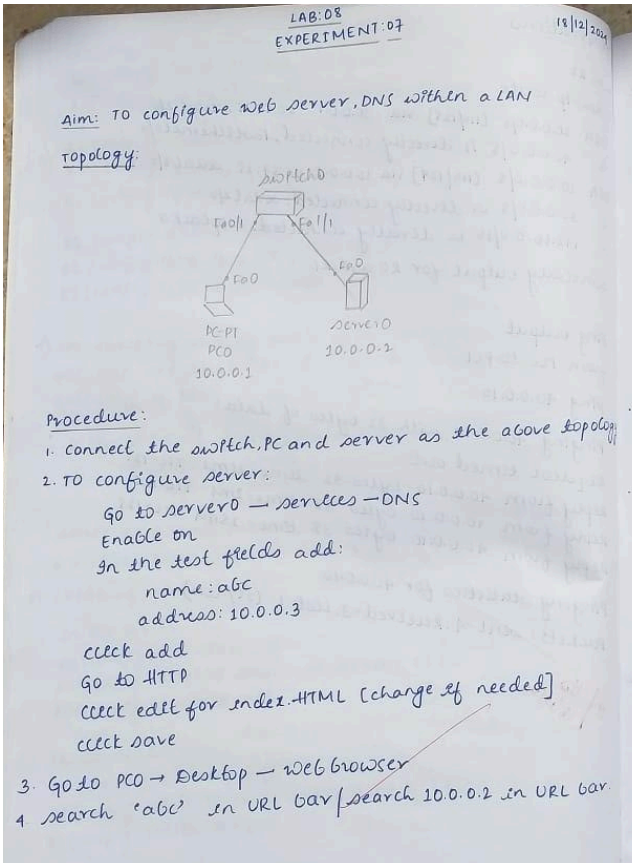
```
C    10.0.0.0/8 is directly connected, FastEthernet0/0
     20.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C       20.0.0.0/8 is directly connected, Serial2/0
C       20.0.0.2/32 is directly connected, Serial2/0
O    30.0.0.0/8 [110/128] via 20.0.0.2, 00:05:09, Serial2/0
O IA 40.0.0.0/8 [110/129] via 20.0.0.2, 00:05:09, Serial2/0
C    172.16.0.0/16 is directly connected, Loopback0
```

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

Ping statistics for 40.0.0.10:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
Approximate round trip times in milli-seconds:
    Minimum = 6ms, Maximum = 9ms, Average = 7ms
```

Question 8:

Configure Web Server, DNS within a LAN.

Observation:



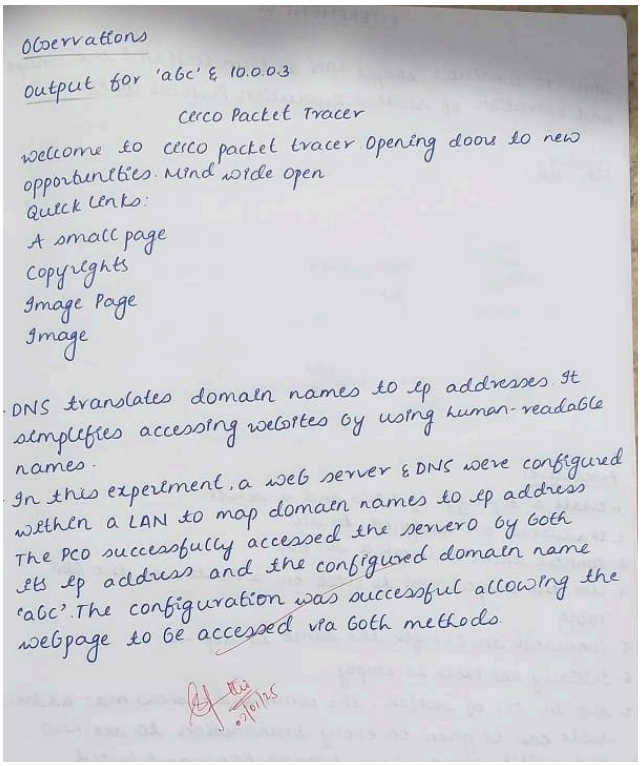
LAB:08
EXPERIMENT:07
19/12/2024

Aim: To configure Web server, DNS within a LAN

Topology:

Procedure:

1. Connect the switch, PC and server as the above topology
2. To configure server:
   Go to server0 — services — DNS
   Enable on
   In the test fields add:
   name: abc
   address: 10.0.0.3
   click add
   Go to HTTP
   click edit for index.HTML [change if needed]
   click save
3. Go to PC0 → Desktop — Web browser
4. search 'abc' in URL bar / search 10.0.0.2 in URL bar.



Observations

Output for 'abc' & 10.0.0.3

Cisco Packet Tracer

Welcome to Cisco packet tracer Opening doors to new opportunities. Mind wide open

Quick Links:

A small page

Copyrights

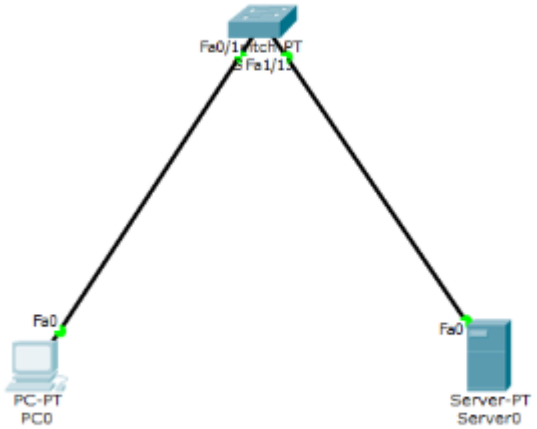
Image Page

Image

DNS translates domain names to ip addresses. It simplifies accessing websites by using human-readable names.

In this experiment, a web server & DNS were configured within a LAN to map domain names to ip address. The PC0 successfully accessed the server0 by both its ip address and the configured domain name 'abc'. The configuration was successful allowing the webpage to be accessed via both methods.

Screenshot of the topology:

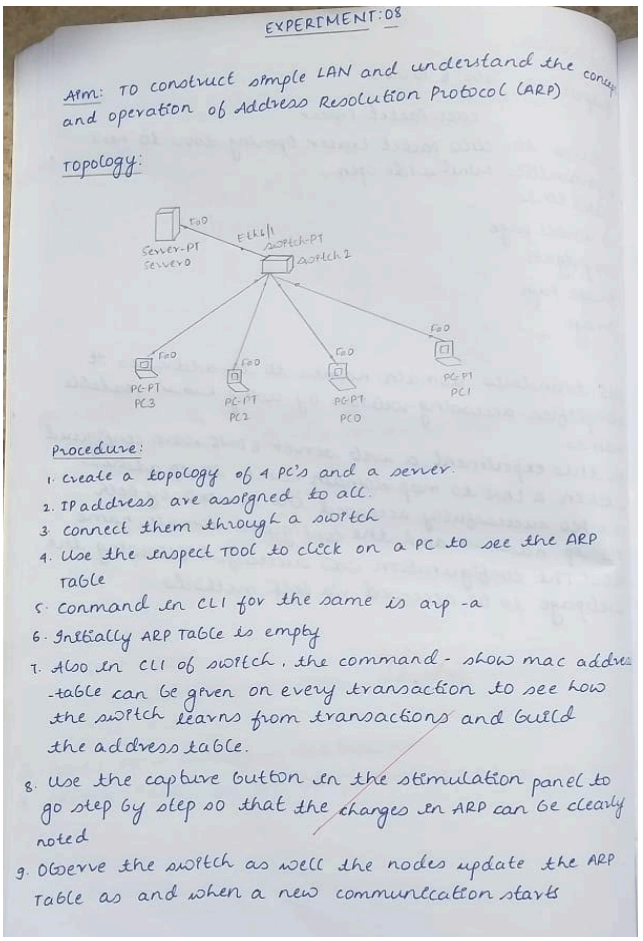


Screenshot of the output:

Question 9:

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

Observation:



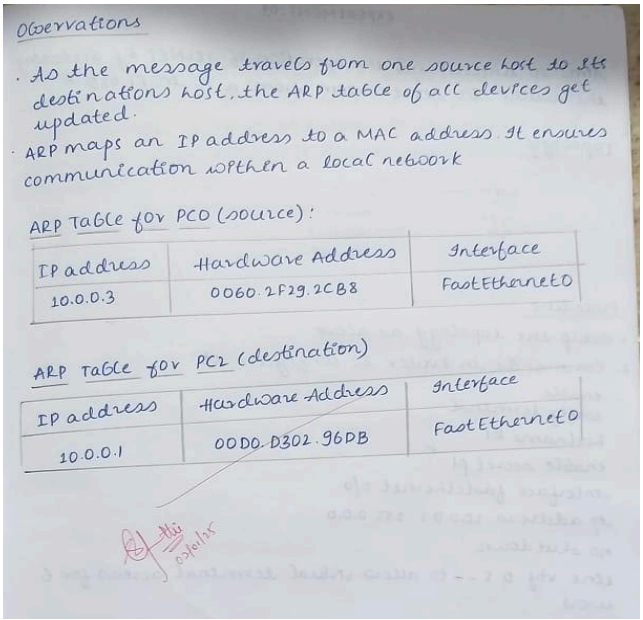
EXPERIMENT:08

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

Topology:

Procedure:

1. Create a topology of 4 PC's and a server
2. IP address are assigned to all.
3. Connect them through a switch
4. Use the inspect TOOL to click on a PC to see the ARP TABLE
5. Command in CLI for the same is arp -a
6. Initially ARP Table is empty
7. Also in CLI of switch, the command - show mac addr -table can be given on every transaction to see how the switch learns from transactions and build the address table.
8. Use the capture button in the stimulation panel to go step by step so that the changes in ARP can be clearly noted
9. Observe the switch as well the nodes update the ARP Table as and when a new communication starts



Observations

- As the message travels from one source host to its destinations host, the ARP table of all devices get updated.
- ARP maps an IP address to a MAC address It ensures communication wpthen a local network

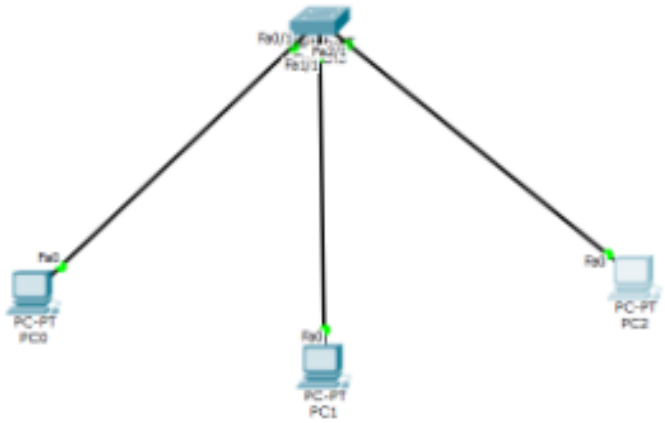
ARP Table for PC0 (source):

IP address	Hardware Address	Interface
10.0.0.3	0060.2F29.2CB8	FastEthernet0

ARP Table for PC2 (destination)

IP address	Hardware Address	Interface
10.0.0.1	00D0.D302.96DB	FastEthernet0

Screenshot of the topology:



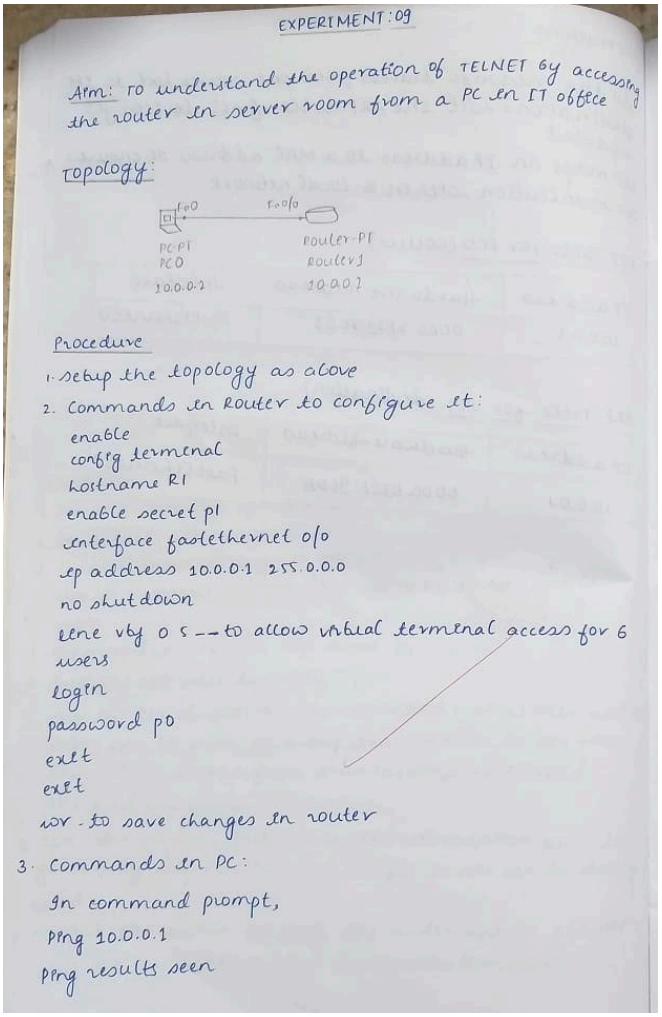
Screenshot of the output:

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

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

   1    000b.bed0.714b    DYNAMIC     Fa2/1
   1    0060.3e41.e693    DYNAMIC     Fa1/1
   1    0090.2ba4.59e4    DYNAMIC     Fa0/1
```

Question 10:

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

Observation:



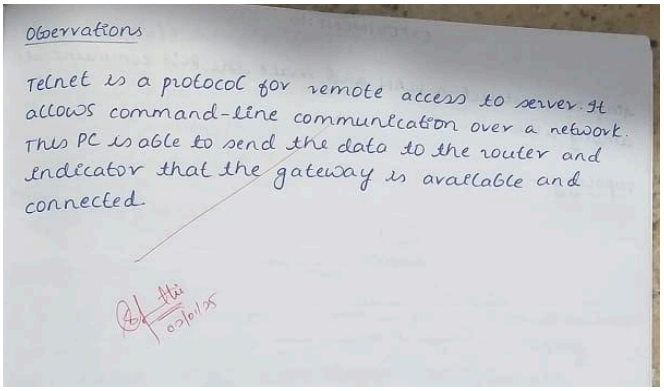
EXPERIMENT: 09

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

Topology:

Procedure

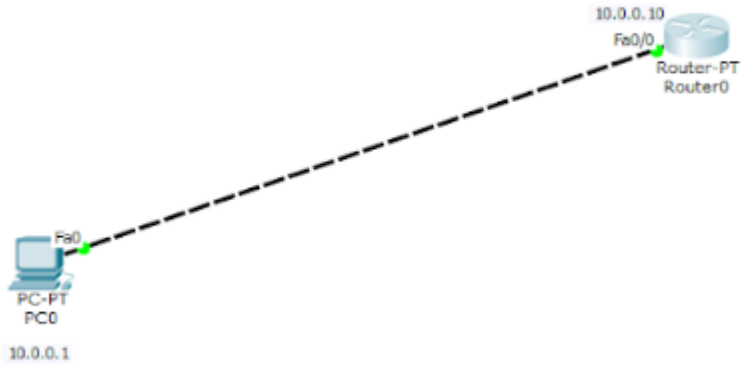
1. setup the topology as above
2. Commands in Router to configure it:
   - enable
   - config termenal
   - hostname R1
   - enable secret p1
   - interface fastethernet 0/0
   - ip address 10.0.0.1 255.0.0.0
   - no shutdown
   - line vty 0 5 --- to allow virtual termenal access for 6 users
   - login
   - password p0
   - exit
   - exit
   - wr - to save changes in router
3. Commands in PC:
   - In command prompt,
   - Ping 10.0.0.1
   - Ping results seen



Observations

Telnet is a protocol for remote access to server. It allows command-line communication over a network. This PC is able to send the data to the router and indicator that the gateway is available and connected.

Screenshot of the topology:



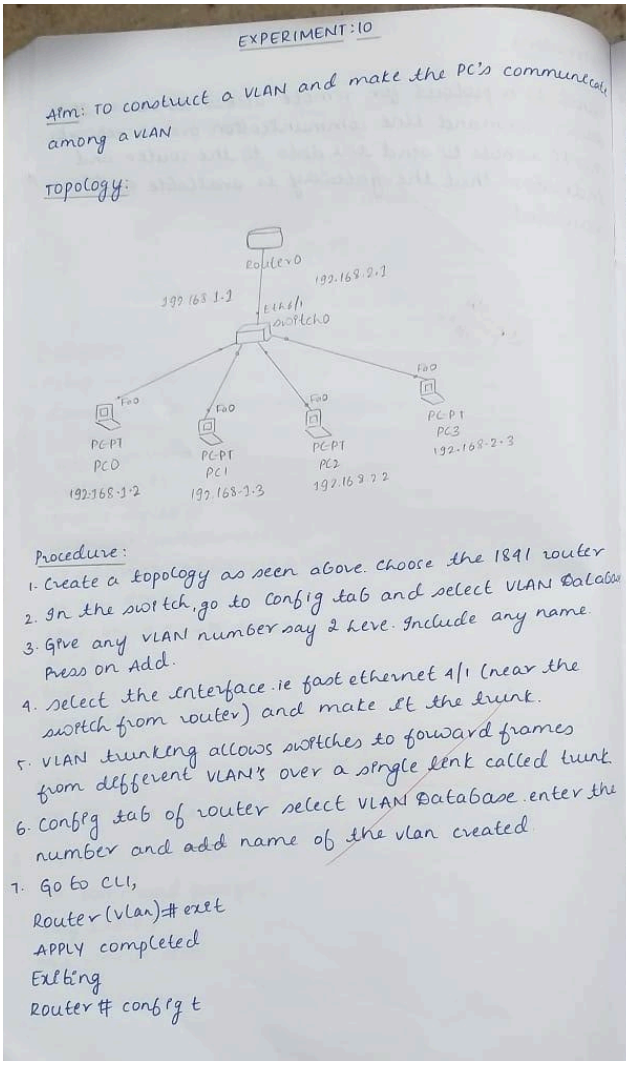
Screenshot of the output:

```
PC>telnet 10.0.0.10
Trying 10.0.0.10 ...Open


User Access Verification

Password:
Password:
R1>pl
Translating "pl"...domain server (255.255.255.255)
% Unknown command or computer name, or unable to find computer address

R1>enable
Password:
Password:
R1#
```

Question 11:

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

Observation:



EXPERIMENT:10

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

Topology:

Procedure:

1. Create a topology as seen above. choose the 1841 router
2. In the switch, go to config tab and select VLAN Database
3. Give any VLAN number say 2 here. Include any name Press on Add.
4. select the interface. ie fast ethernet 4/1 (near the switch from router) and make it the trunk.
5. VLAN trunking allows switches to foward frames from different VLAN's over a single link called trunk.
6. Config tab of router select VLAN Database. enter the number and add name of the vlan created
7. Go to CLI,

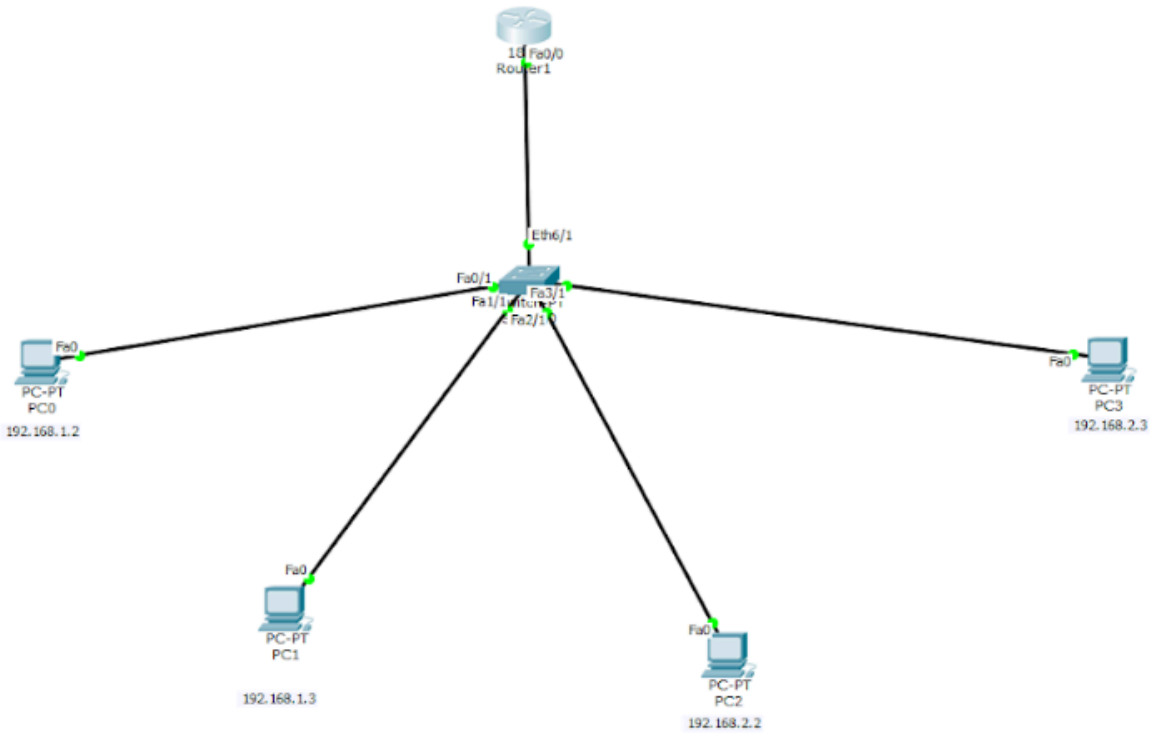
```
Router(vlan)# exit
APPLY completed
Exiting
Router# config t
```

```
Router(config)# interface fastethernet 0/0.1
Router(config-subif)#
Router(config-subif)# encapsulation dot1q 2
Router(config-subif)# ip address 192.168.2.1 255.255.255.0
Router(config-subif)# no shut
Router(config-subif)# exit
Router(config)# exit
```

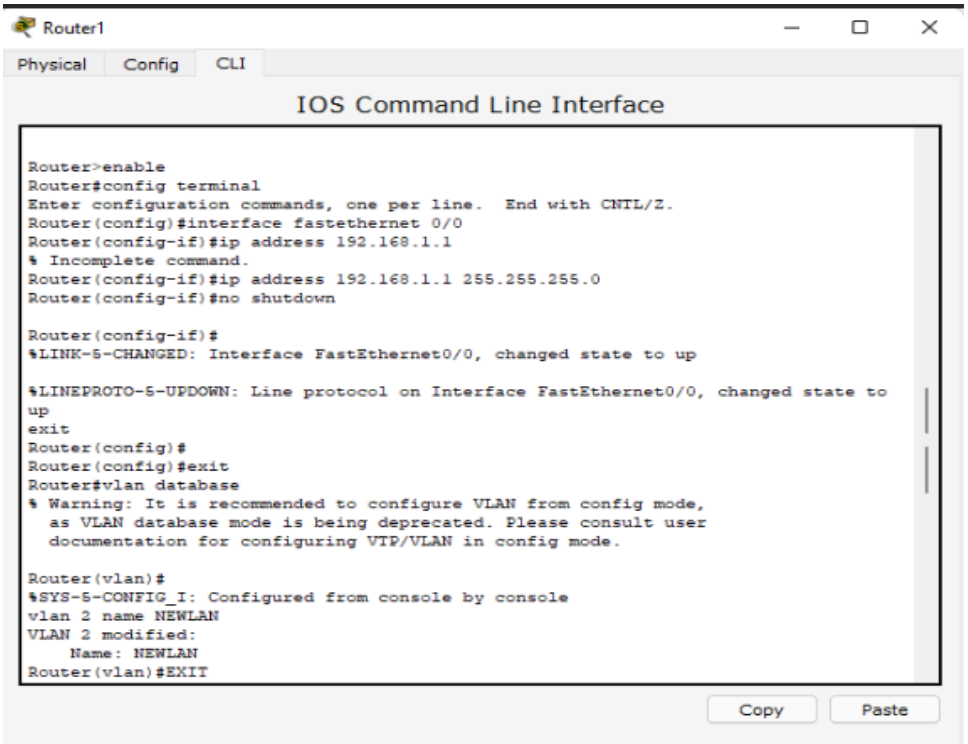
Observations

A VLAN segments a network into virtual groups. It enhances security and reduces broadcast traffic. On pinging over the VLAN, the PC's are able to communicate.

Screenshot of the topology:



Screenshot of the output:

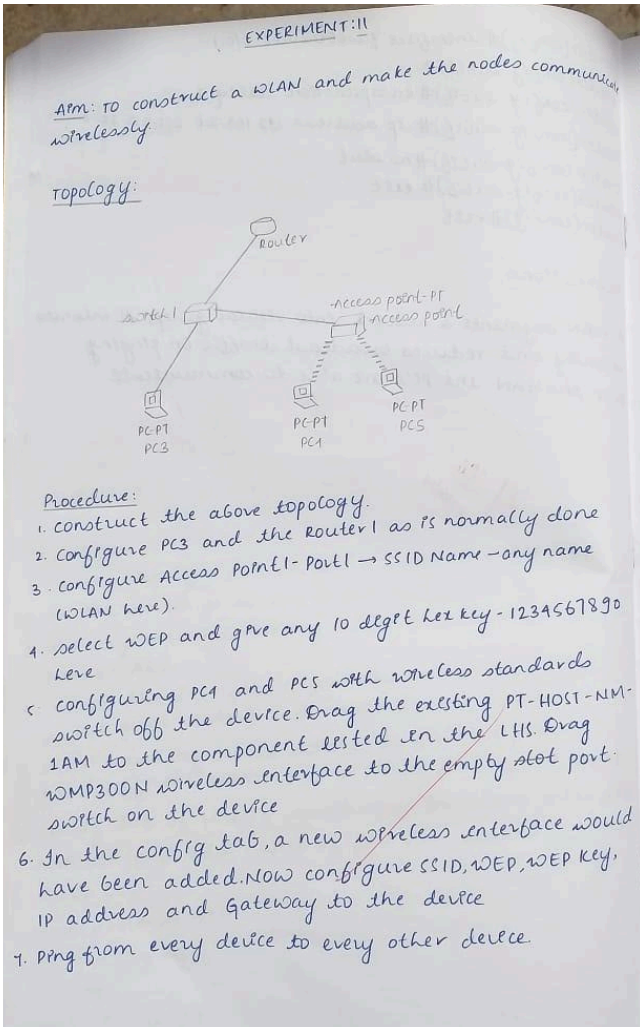


```
PC>ping 192.168.1.3

Pinging 192.168.1.3 with 32 bytes of data:

Reply from 192.168.1.3: bytes=32 time=0ms TTL=128
Reply from 192.168.1.3: bytes=32 time=0ms TTL=128
Reply from 192.168.1.3: bytes=32 time=3ms TTL=128
Reply from 192.168.1.3: bytes=32 time=0ms TTL=128

Ping statistics for 192.168.1.3:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 3ms, Average = 0ms
```

Question 12:

To construct a WLAN and make the nodes communicate wirelessly

Observation :



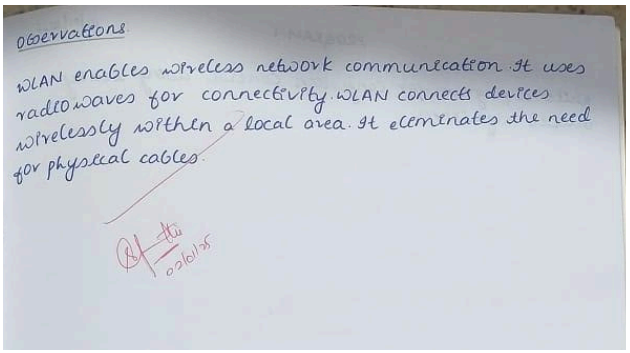
EXPERIMENT:11

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

Topology:

Procedure:

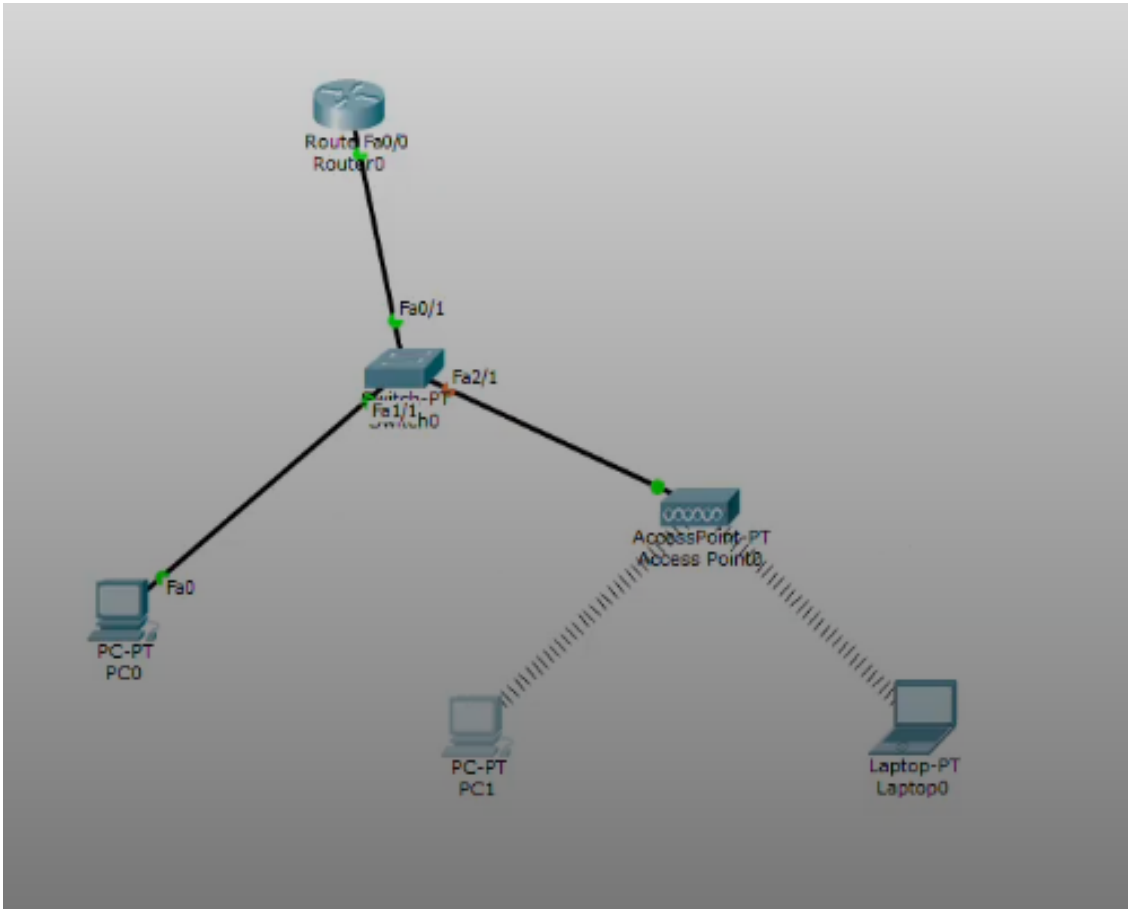
1. construct the above topology.
2. Configure PC3 and the Router1 as is normally done
3. Configure Access Point1- Port1 → SSID Name - any name (WLAN here).
4. select WEP and give any 10 digit hex key - 1234567890 here
5. configuring PC1 and PC5 with wireless standards switch off the device. Drag the existing PT-HOST-NM-1AM to the component listed in the LHS. Drag WMP300N wireless interface to the empty slot port. switch on the device
6. In the config tab, a new wireless interface would have been added. Now configure SSID, WEP, WEP key, IP address and Gateway to the device
7. Ping from every device to every other device.



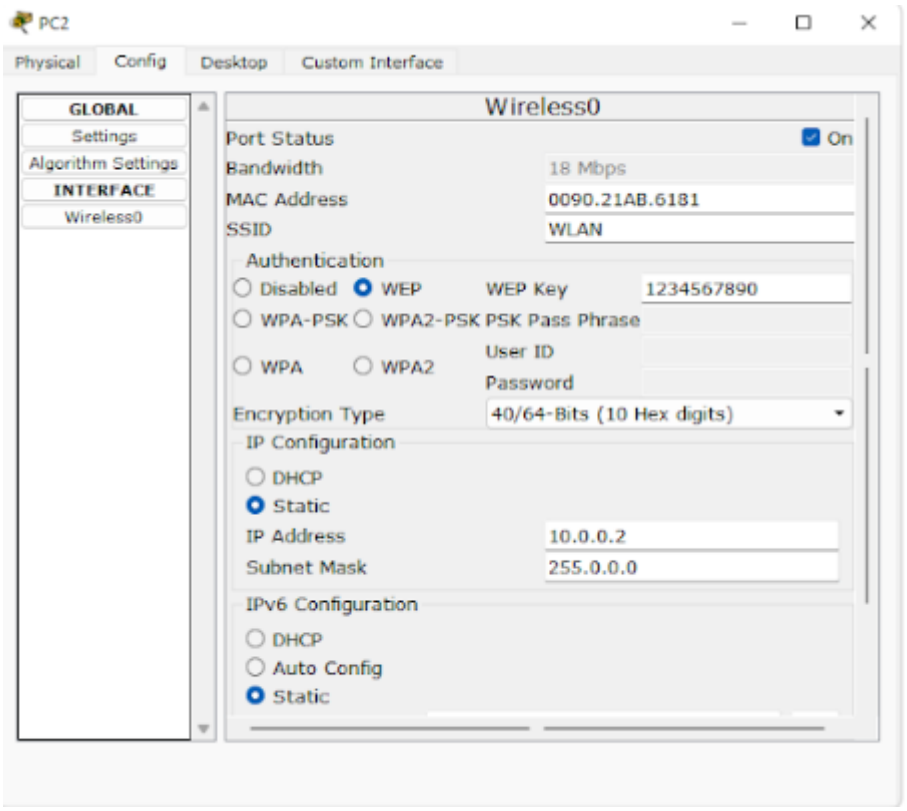
Observations

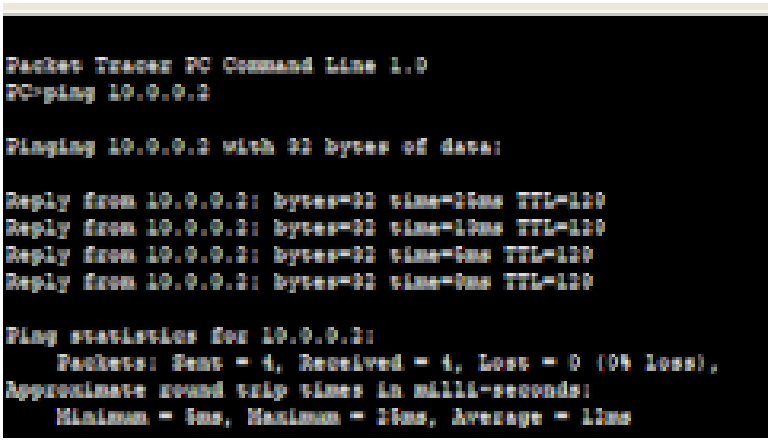
WLAN enables wireless network communication. It uses radio waves for connectivity. WLAN connects devices wirelessly within a local area. It eliminates the need for physical cables.

Screenshot of the topology:



Screenshot of the output:



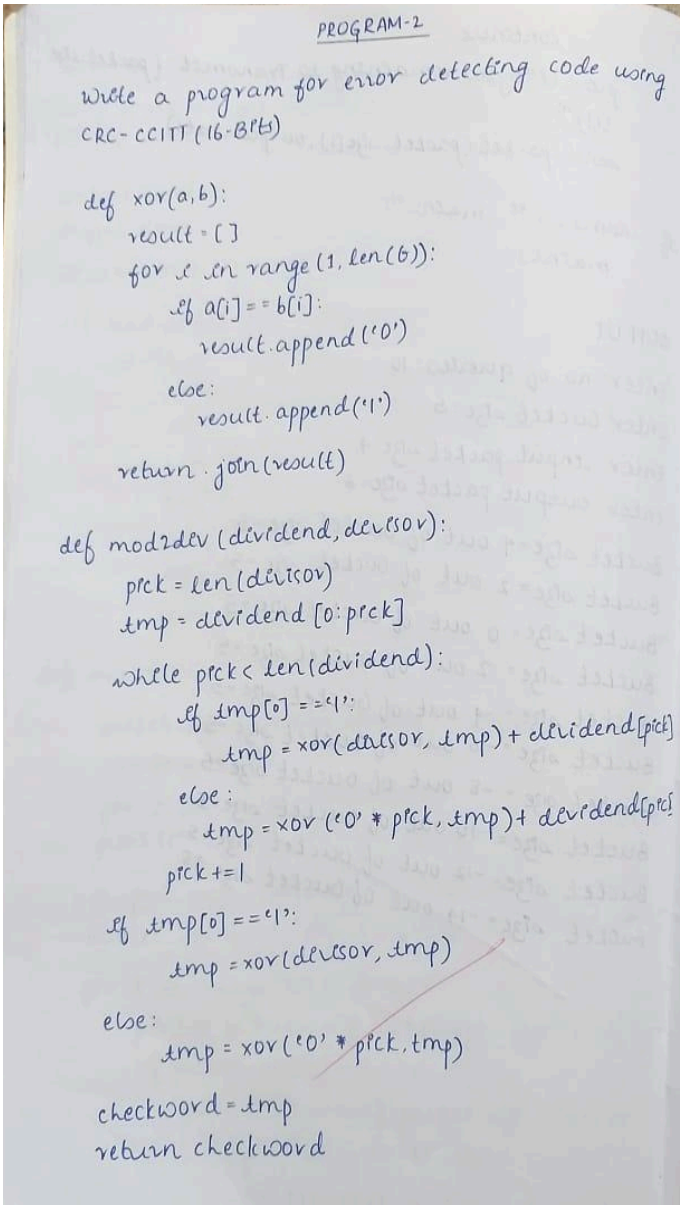


CYCLE-2

Question 1:

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

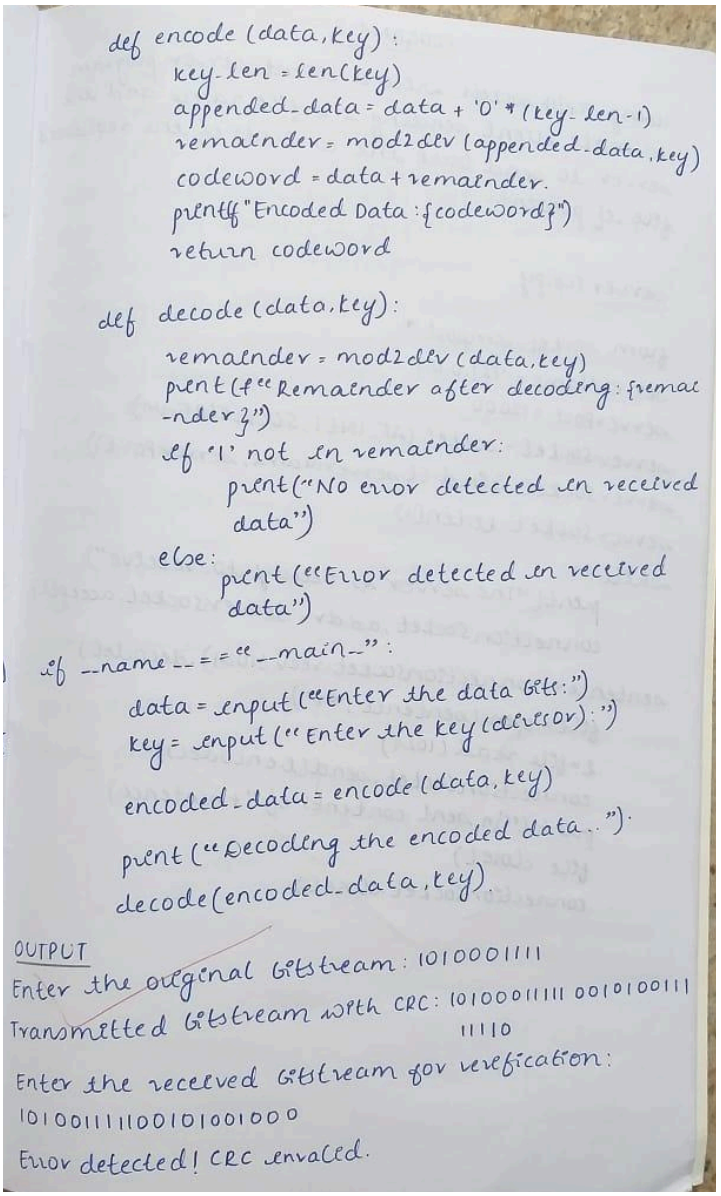
Program:



PROGRAM-2

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

```
def xor(a,b):
    result = []
    for i in range(1, len(b)):
        if a[i] == b[i]:
            result.append('0')
        else:
            result.append('1')
    return ''.join(result)

def mod2div(dividend, divisor):
    pick = len(divisor)
    tmp = dividend[0:pick]
    while pick < len(dividend):
        if tmp[0] == '1':
            tmp = xor(divisor, tmp) + dividend[pick]
        else:
            tmp = xor('0' * pick, tmp) + dividend[pic
        pick += 1
    if tmp[0] == '1':
        tmp = xor(divisor, tmp)
    else:
        tmp = xor('0' * pick, tmp)
    checkword = tmp
    return checkword
```



```
def encode(data,key):
    key_len = len(key)
    appended_data = data + '0'*(key_len-1)
    remainder = mod2div(appended_data,key)
    codeword = data + remainder.
    printf"Encoded Data :{codeword}")
    return codeword

def decode(data,key):
    remainder = mod2div(data,key)
    print(f"Remainder after decoding: {remainder}")
    if '1' not in remainder:
        print("No error detected in received data")
    else:
        print("Error detected in received data")

if __name__=="__main__":
    data = input("Enter the data bits:")
    key = input("Enter the key(divisor):")
    encoded_data = encode(data,key)
    print("Decoding the encoded data..").
    decode(encoded_data,key).
```

OUTPUT

```
Enter the original bitstream: 1010001111
Transmitted bitstream with CRC: 10100011111 0010100111
                                11110
Enter the received bitstream for verification:
10100111110010100100 0
Error detected! CRC invalid.
```

Code:

```
def crc_ccitt_16_bitstream(bitstream: str, poly: int = 0x1021, init_crc: int = 0xFFFF) -> int:
    crc = init_crc
    for bit in bitstream:
        crc ^= int(bit) << 15  # Align the bit with CRC's uppermost bit
        for _ in range(8):  # Process each bit
            if crc & 0x8000:  # Check if the leftmost bit is set
                crc = (crc << 1) ^ poly
            else:
```

```
            crc <<= 1
        crc &= 0xFFFF  # Ensure CRC remains 16-bit
    return crc

def append_crc_to_bitstream(bitstream: str) -> str:
    """
    Append the calculated 16-bit CRC to the given bitstream.
    """
    crc = crc_ccitt_16_bitstream(bitstream)
    crc_bits = f"{crc:016b}"  # Convert CRC to a 16-bit binary string
    return bitstream + crc_bits

def verify_crc_bitstream(bitstream_with_crc: str) -> bool:
    """
    Verify the CRC of the given bitstream with CRC appended.
    """
    if len(bitstream_with_crc) < 16:
        return False  # Not enough bits to contain CRC
    data, received_crc = bitstream_with_crc[:-16], bitstream_with_crc[-16:]
    calculated_crc = crc_ccitt_16_bitstream(data)
    return calculated_crc == int(received_crc, 2)

# Main Program
if __name__ == "__main__":
    # User input for original bitstream
    message_bits = input("Enter the original bitstream (e.g., 11010011101100): ").strip()
```

```
# Validate input
if not all(bit in "01" for bit in message_bits):
    print("Invalid input. Please enter a binary bitstream (e.g., 11010011101100).")
else:
    # Calculate and append CRC
    bitstream_with_crc = append_crc_to_bitstream(message_bits)
    print(f"Transmitted bitstream with CRC: {bitstream_with_crc}")

    # User input for received bitstream
    user_bitstream = input("Enter the received bitstream for verification: ").strip()

    # Validate received input
    if not all(bit in "01" for bit in user_bitstream):
        print("Invalid input. Please enter a valid binary bitstream.")
    elif len(user_bitstream) < 16:
        print("Invalid input. Received bitstream must include at least 16 bits for CRC.")
    else:
        # Verify CRC
        is_valid = verify_crc_bitstream(user_bitstream)
        if is_valid:
            print("No errors detected. CRC valid.")
        else:
            print("Error detected! CRC invalid.")
```

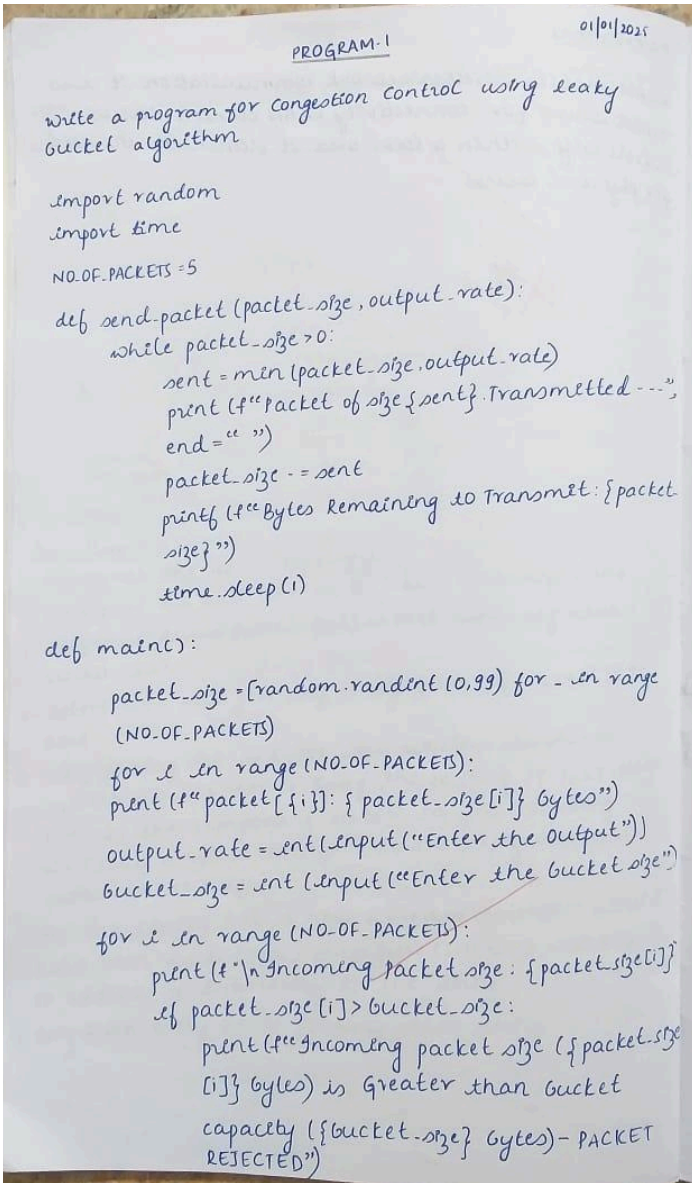
Output:

```
Enter the original bitstream (e.g., 11010011101100): 1100001010101110
Transmitted bitstream with CRC: 11000010101011100000011000000110
Enter the received bitstream for verification:  11000010101011100000011000000110
No errors detected. CRC valid.
```

Question 2:

Write a program for congestion control using Leaky bucket algorithm.

Program:

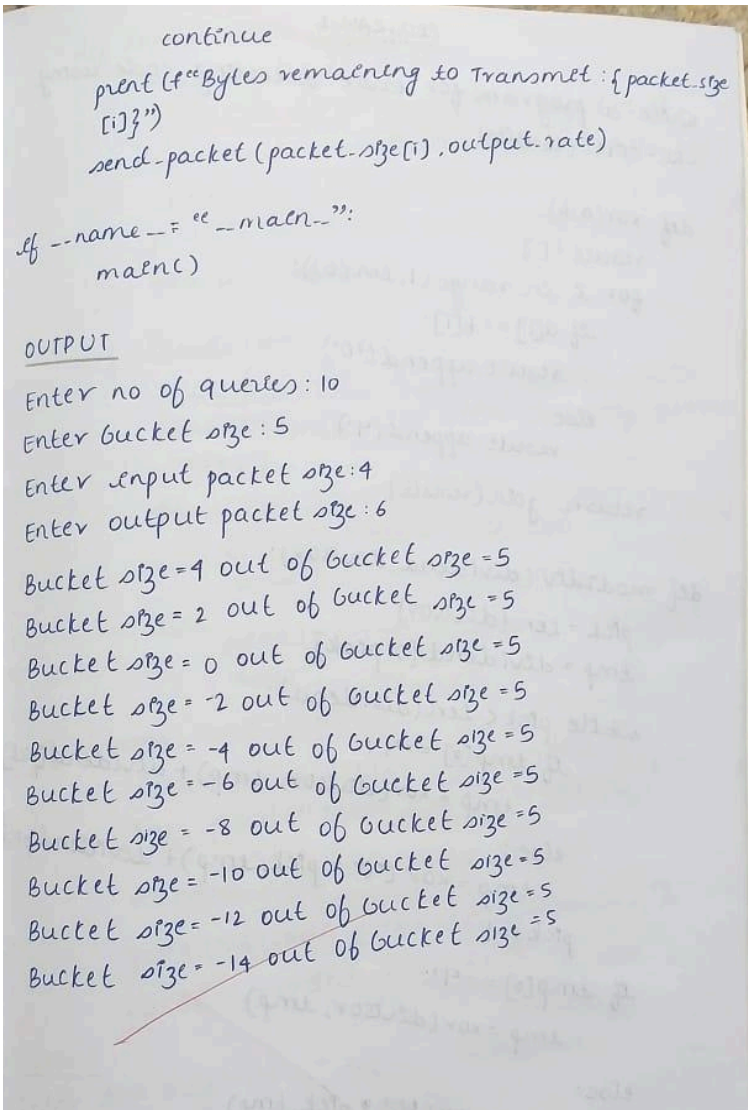


01/01/2025

PROGRAM-1

Write a program for congestion control using leaky bucket algorithm

```
import random
import time

NO_OF_PACKETS = 5

def send_packet(packet_size, output_rate):
    while packet_size > 0:
        sent = min(packet_size, output_rate)
        print(f"Packet of size {sent} Transmitted ---",
        end=" ")
        packet_size -= sent
        print(f"Bytes Remaining to Transmit: {packet
        size}")
        time.sleep(1)

def main():
    packet_size = [random.randint(0,99) for _ in range
    (NO_OF_PACKETS)]
    for i in range(NO_OF_PACKETS):
    print(f"packet[{i}]: {packet_size[i]} Bytes")
    output_rate = int(input("Enter the output"))
    bucket_size = int(input("Enter the bucket size"))
    for i in range(NO_OF_PACKETS):
        print(f"\n Incoming Packet size: {packet_size[i]}
        if packet_size[i] > bucket_size:
            print(f"Incoming packet size ({packet_size
            [i]} Bytes) is Greater than Bucket
            capacity ({bucket_size} Bytes) - PACKET
            REJECTED")
```

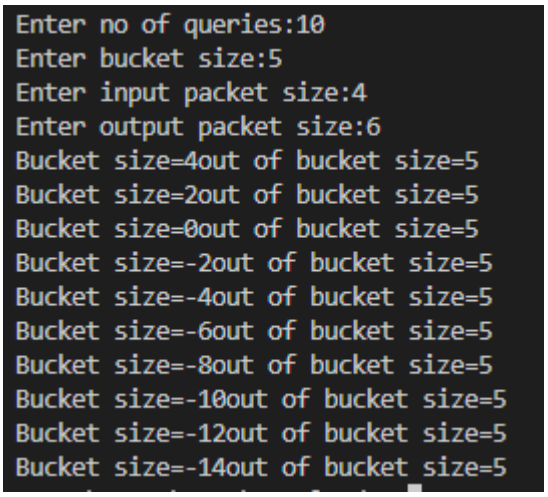


Code:

```
storage=0

noofqueries=int(input("Enter no of queries:"))

bucketsize=int(input("Enter bucket size:"))

inputpktsize=int(input("Enter input packet size:"))

outputpktsize=int(input("Enter output packet size:"))

for i in range(0,noofqueries):

    sizeleft=bucketsize-storage

    if inputpktsize<=sizeleft:

        storage+=inputpktsize
```

```
else:
    print("Packet loss=", inputpktsize)
print(f"Bucket size={storage}out of bucket size={bucketsize}")
storage-=outputpktsize
```

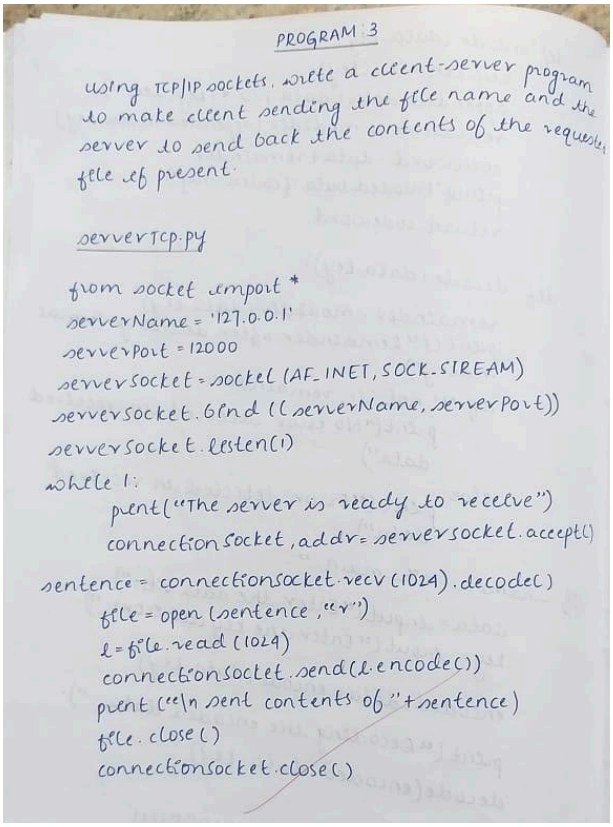
Output:



Question 3:

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:

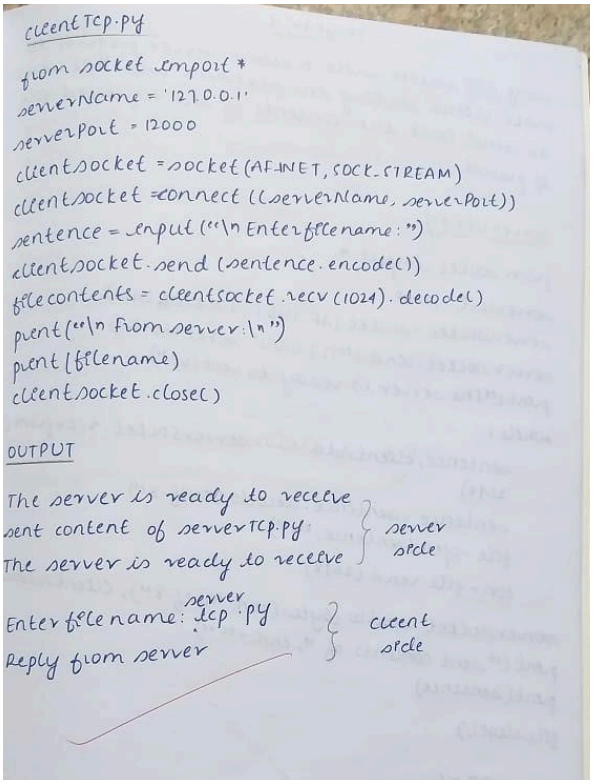


PROGRAM 3

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.

serverTcp.py

```
from socket import *
serverName = '127.0.0.1'
serverPort = 12000
serverSocket = socket (AF_INET, SOCK_STREAM)
serverSocket.bind ((serverName, serverPort))
serverSocket.listen(1)
while 1:
    print("The server is ready to receive")
    connectionSocket, addr= serversocket.accept()
sentence = connectionsocket.recv (1024).decode()
    file = open (sentence, "r")
    l = file.read (1024)
    connectionsocket.send(l.encode())
    print ("\n sent 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 ("\n Enter filename: ")
clientsocket.send (sentence.encode())
filecontents = clientsocket.recv (1024). decode()
print("\n from server:\n")
print [filename)
clientsocket.close()
```

OUTPUT

```
The server is ready to receive
sent content of serverTcp.py        } server side
The server is ready to receive

Enter file name: server tcp.py      } client side
Reply from server
```

Code:

tcpserver.py:

```
from socket import *
serverName="127.0.0.1"
serverPort = 14000
serverSocket = socket(AF_INET,SOCK_STREAM)
serverSocket.bind((serverName,serverPort))
serverSocket.listen(1)
while 1:
    print ("The server is ready to receive")
    connectionSocket, addr = serverSocket.accept()
    sentence = connectionSocket.recv(1024).decode()
    file=open(sentence,"r")
    l=file.read(1024)
    connectionSocket.send(l.encode())
    print ('\nSent contents of ' + sentence)
    file.close()
    connectionSocket.close()
```

tcpclient.py:

```
from socket import *
serverName = '127.0.0.1'
serverPort = 14000
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:

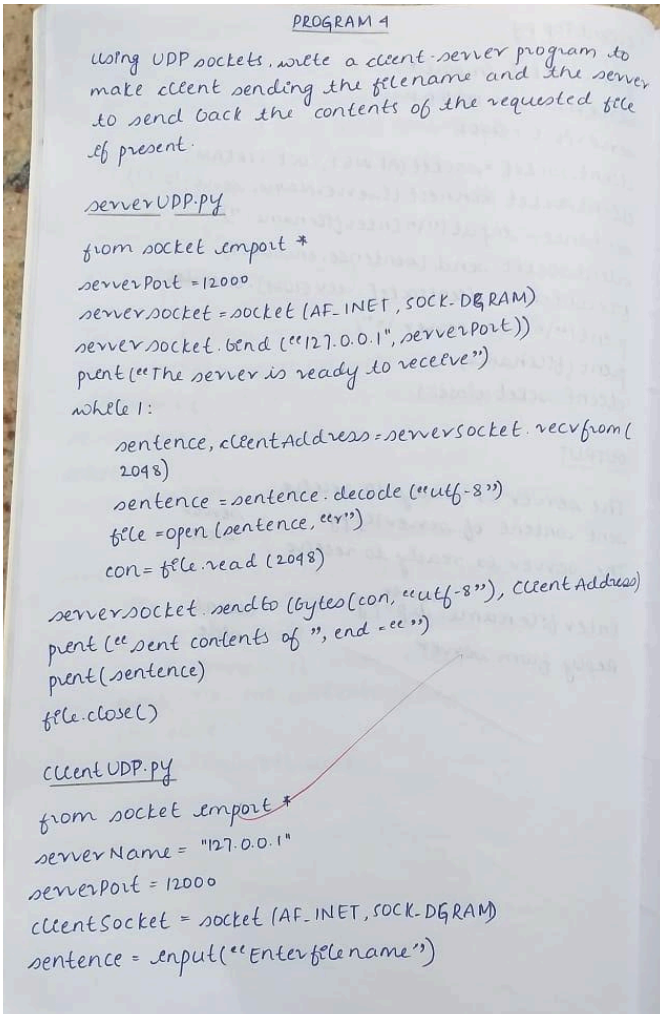
```
The server is ready to receive

Sent contents of tcpserver.py
The server is ready to receive
```

```
Enter file name: tcpserver.py

From Server:

from socket import *
serverName="127.0.0.1"
serverPort = 14000
serverSocket = socket(AF_INET,SOCK_STREAM)
serverSocket.bind((serverName,serverPort))
serverSocket.listen(1)
while 1:
    print ("The server is ready to receive")
    connectionSocket, addr = serverSocket.accept()
    sentence = connectionSocket.recv(1024).decode()
```

Question 4:

Using UDP sockets, write a client-server program to make client sending the file name and the server to send back the contents of the requested file if present.

Program:



PROGRAM 4

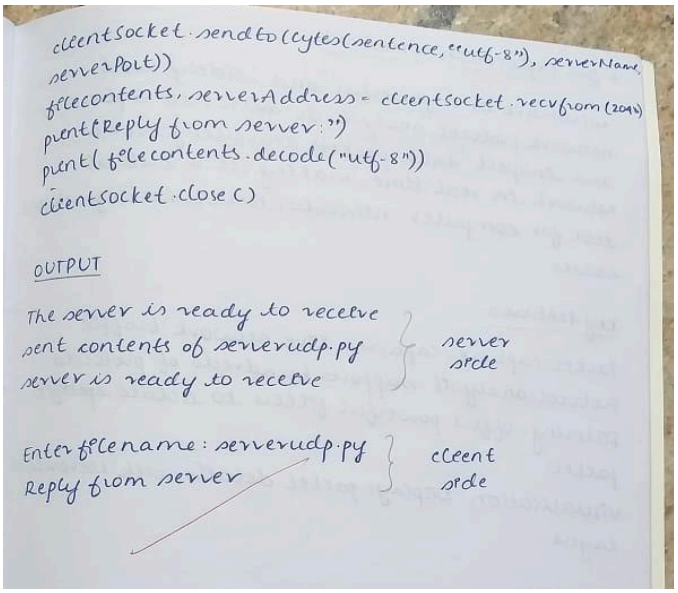
Using UDP sockets, write a client-server program to make client sending the filename and the server to send back the contents of the requested file if present.

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("sent contents of ", end = "")
print(sentence)
file.close()
```

clientUDP.py

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



```
clientSocket.sendto(bytes(sentence, "utf-8"), serverName,
serverPort))
filecontents, serverAddress = clientSocket.recvfrom(2048)
print("Reply from server:")
print(filecontents.decode("utf-8"))
clientSocket.close()
```

OUTPUT

```
The server is ready to receive
sent contents of serverudp.py
server is ready to receive

Enter filename: serverudp.py
Reply from server
```

server side

client side

Code:

udpserver.py:

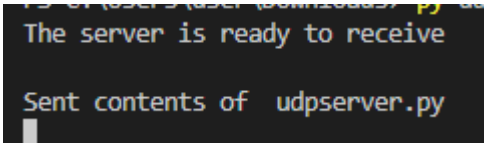
```
from socket import *
serverPort = 12000
serverSocket = socket(AF_INET, SOCK_DGRAM)
serverSocket.bind(("127.0.0.1", serverPort))
print ("The server is ready to receive")
while 1:
    sentence, clientAddress = serverSocket.recvfrom(2048)
    sentence = sentence.decode("utf-8")
    file=open(sentence,"r")
    con=file.read(2048)
    serverSocket.sendto(bytes(con,"utf-8"),clientAddress)
    print ('\nSent contents of ', end = ' ')
    print (sentence)
   #  for i in sentence:
      #  print (str(i), end = '')
    file.close()
```

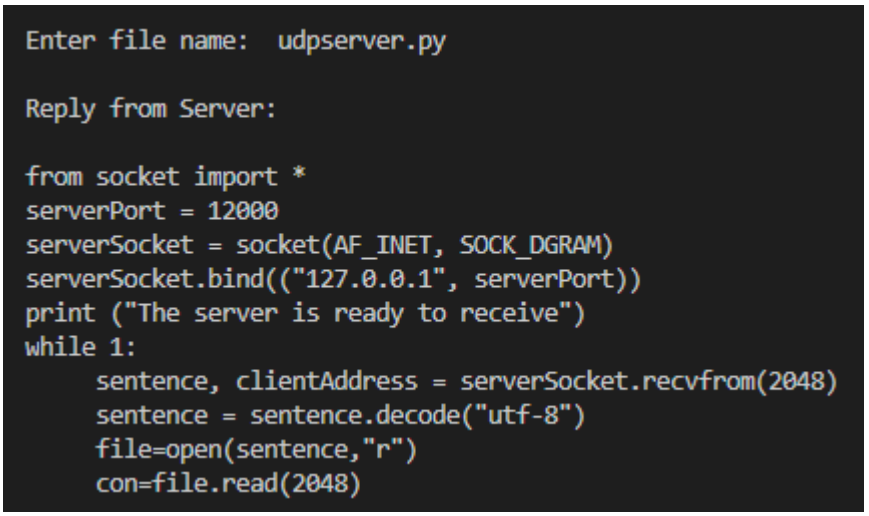
udpclient.py:

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

```
print ('\nReply from Server:\n')

print (filecontents.decode("utf-8"))

# for i in filecontents:

    # print(str(i), end = '')

clientSocket.close()

clientSocket.close()
```

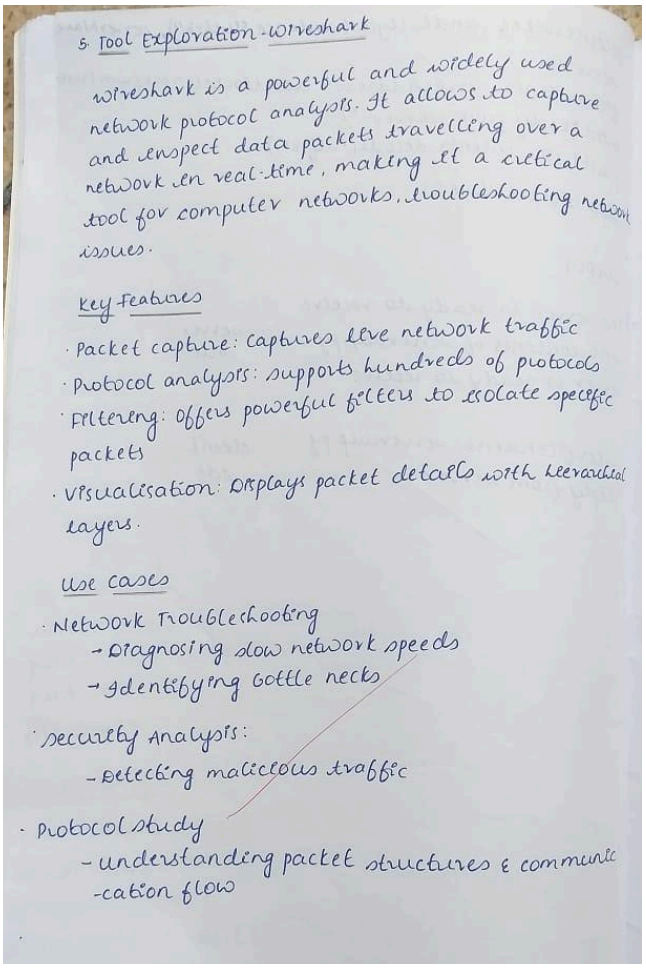
Output:





Question 5:

Tool Exploration -Wireshark



5. Tool Exploration - Wireshark

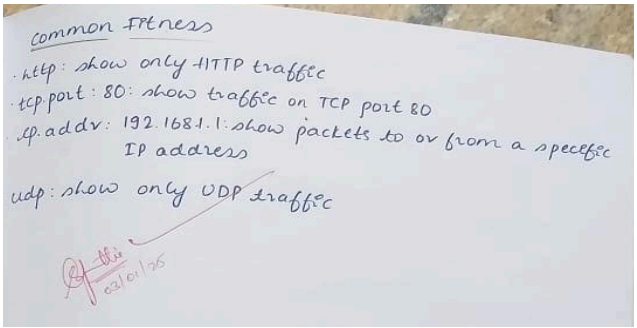
Wireshark is a powerful and widely used network protocol analysis. It allows to capture and inspect data packets travelling over a network in real-time, making it a critical tool for computer networks, troubleshooting network issues.

Key features

- Packet capture: Captures live network traffic
- Protocol analysis: supports hundreds of protocols
- Filtering: Offers powerful filters to isolate specific packets
- Visualisation: Displays packet details with hierarchical layers.

Use cases

- Network Troubleshooting
  - → Diagnosing slow network speeds
  - → Identifying bottle necks
- Security Analysis:
  - Detecting malicious traffic
- Protocol study
  - Understanding packet structures & communication flow



Common Filters

- http: show only HTTP traffic
- tcp.port : 80: show traffic on TCP port 80
- ip.addr: 192.168.1.1: show packets to or from a specific IP address

udp: show only UDP traffic

02/01/25