VISVESVARAYA TECHNOLOGICAL UNIVERSITY

“JnanaSangama”, Belgaum -590014, Karnataka.

LAB RECORD

Computer Network Lab (23CS5PCCON)

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

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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 Network (23CS5PCCON)" carried out by **(1BM23CS085),** who is 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.

Sarala D V Assistant Professor Department of CSE, BMSCE	Dr. Kavitha Sooda Professor & HOD Department of CSE, BMSCE

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Github Link:

https://github.com/Yohitesh/CN-LAB

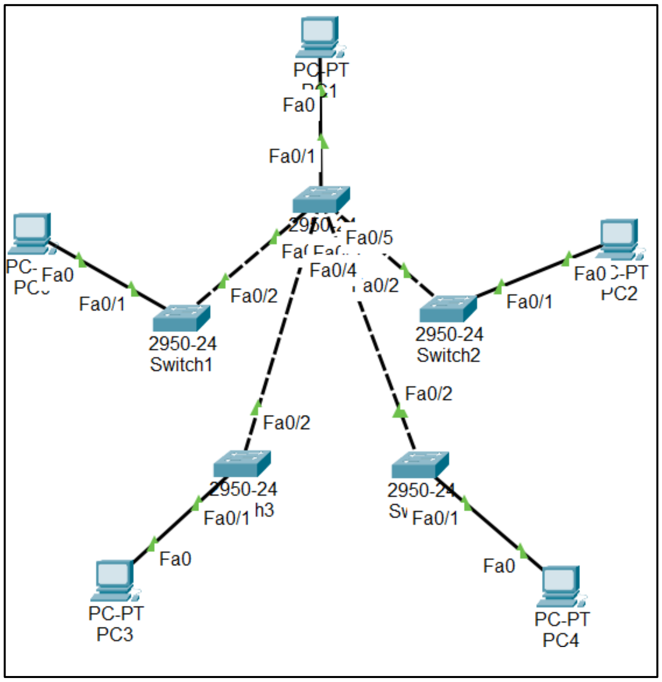
PART - A

Program 1:

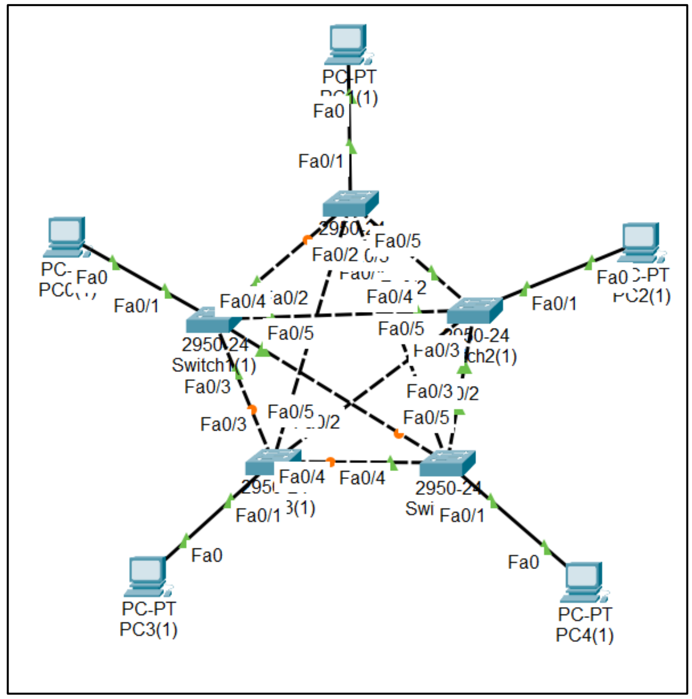
Aim: Create a topology and simulate sending a simple PDU from source to destination using hub and switch as connecting devices and demonstrate ping message.

Topology:

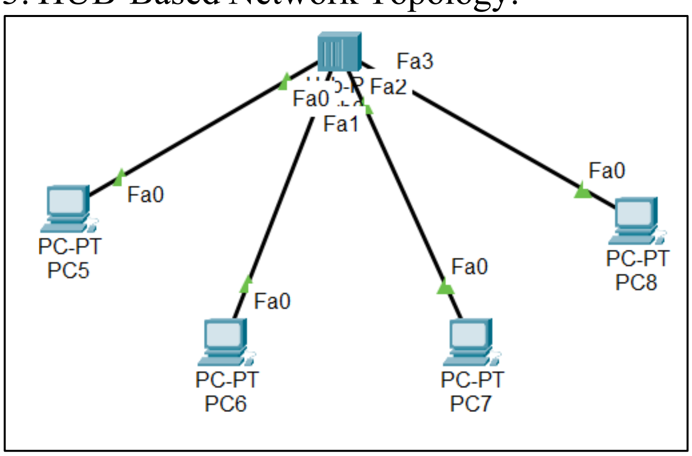
1. STAR Topology with Switch:



2. MESH Topology with Switch:



3. HUB-Based Network Topology:



Procedure:

1. Create STAR Topology Using a Switch

1. Open Cisco Packet Tracer and go to the End Devices section.
2. Drag and drop PCs (PC0, PC1, PC2, PC3, PC4) into the workspace.
3. From Switches, drag a 2950-24 switch to the center.
4. Connect each PC to the switch using Copper Straight-Through cables:
   - PC0 → Switch (Fa0/1)
   - PC1 → Switch (Fa0/2)
   - PC2 → Switch (Fa0/5)
   - PC3 → Switch (Fa0/3)
   - PC4 → Switch (Fa0/4)
5. Assign IP addresses to PCs:
   - Go to PC → Desktop → IP Configuration
   - Enter the IP address/subnet for each PC (any address in same network).
6. Test connectivity:
   - Use Add Simple PDU tool to send a ping from one PC to another.

2. Create MESH Topology Using Switches

1. Drag and drop PCs (PC0, PC1, PC2, PC3, PC4).
2. Add two 2950-24 switches to the workspace.
3. Create mesh-style interconnections:
   - Connect each PC to the nearest switch.
   - Connect Switch1 ↔ Switch2 with multiple redundant links (e.g., Fa0/1 ↔ Fa0/3, Fa0/2 ↔ Fa0/4).
4. Assign IP addresses to all PCs within the same network.
5. Verify STP operation automatically blocks redundant paths.
6. Use Simple PDU (ICMP) to test ping between:
   - PC0 → PC3
   - PC1 → PC4
   - PC2 → any node
7. View packet movement under Simulation Mode.

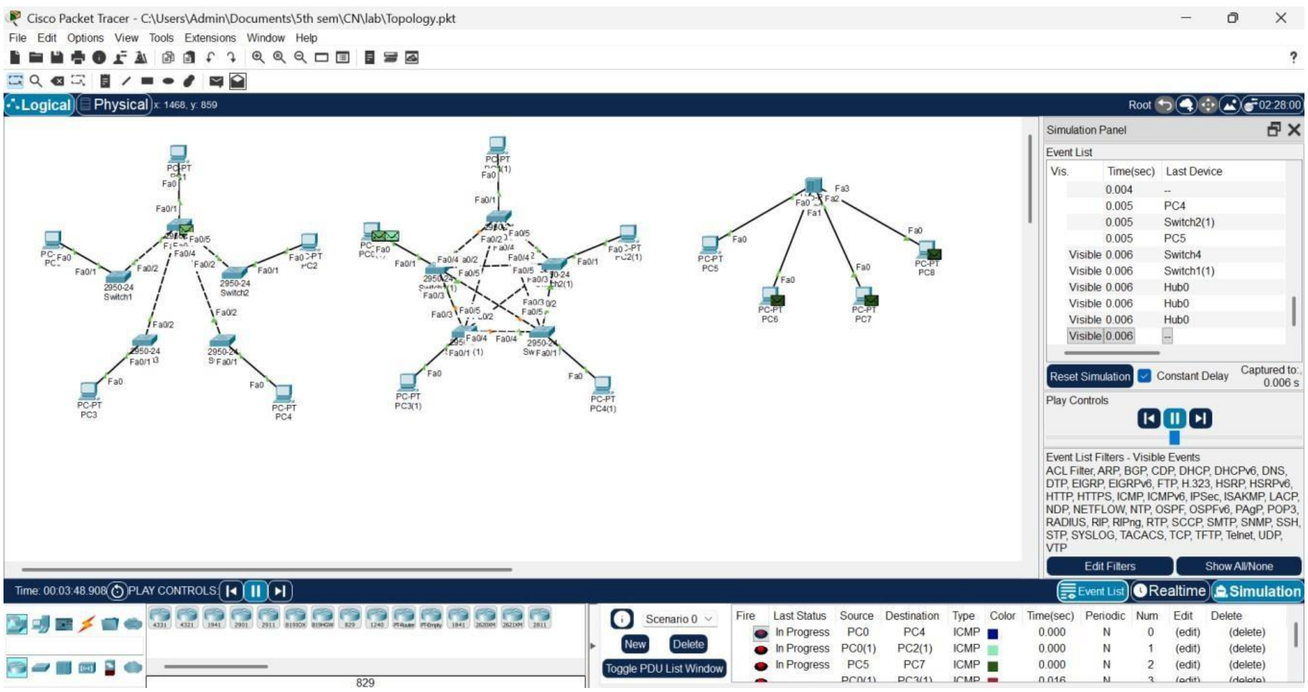
3. Create HUB-Based Topology

1. Drag and drop PCs (PC5, PC6, PC7, PC8, PC9).
2. From Hubs section, drag a Generic Hub (Hub0).
3. Connect each PC to the hub using Copper Straight-Through cable:
   - PC5 → Hub Fa0
   - PC6 → Hub Fa1
   - PC7 → Hub Fa2
   - PC8 → Hub Fa3
   - PC9 → Hub Fa4
4. Assign IP addresses within the same network for all PCs.
5. Use Simulation mode to send Simple PDU.
6. Observe broadcast behavior:
   - Hub sends the packet to all devices.

4. Demonstrate Ping Message (ICMP)

1. Switch to Simulation Mode from bottom-right corner.
2. Select the Simple PDU Tool (envelope icon).
3. Click on Source PC, then Destination PC.
4. Playback controls:
   - Play to observe step-by-step
   - Fast Forward for quick simulation
5. Watch the ICMP request and reply in the Event List window

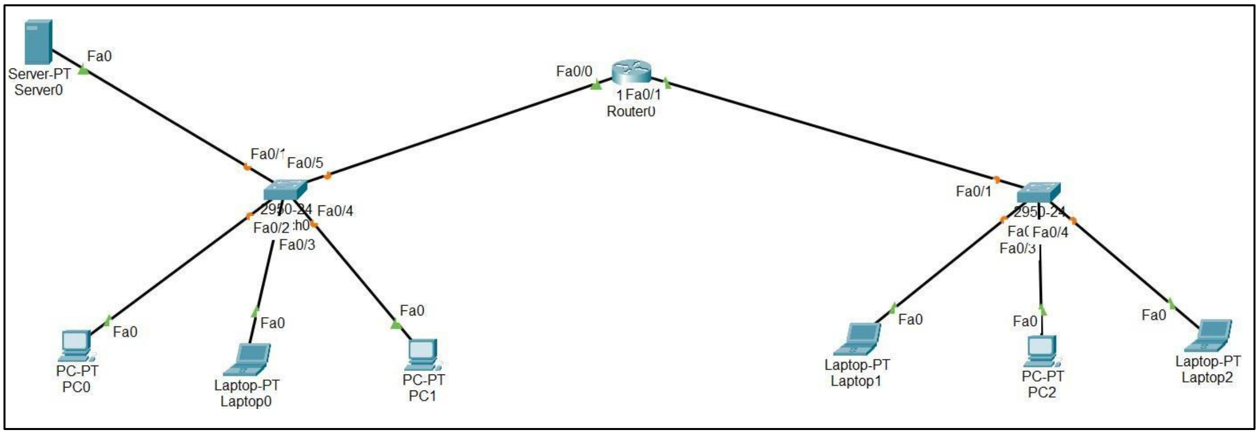
Output:



Program 2:

Aim: Configure DHCP within a LAN and outside LAN.

Topology:



Procedure:

1. **Configure DHCP Server:**
in DHCP server go to Desktop>IP-Config, assign static IP – 192.168.10.2 and gateway 192.168.10.1

2. **Open Services>DHCP and add following two dhcp pool:**

(a) Pool Name: switch1

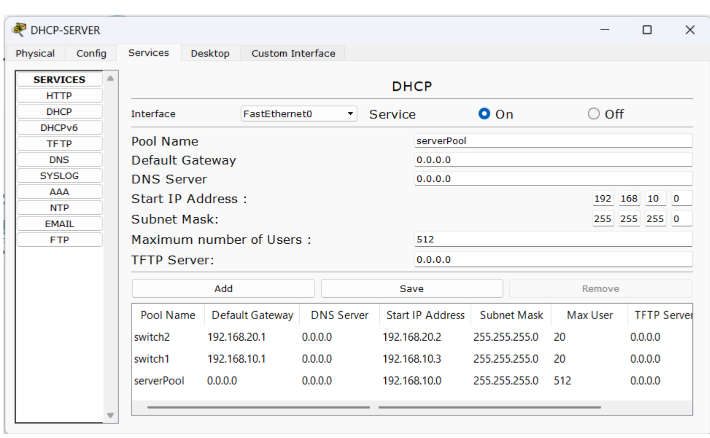
Gateway: 192.168.10.1

Start Ip: 192.168.10.3
Subnet Mask: 255.255.255.0
Max Users: 20

(b) Pool Name: switch2

Gateway: 192.168.20.1

Start Ip: 192.168.10.2
Subnet Mask: 255.255.255.0
Max Users: 20



3. **Configure Router**

i. Router>enable

ii. Router#configure terminal

(Within Lan)

iii. Router(config)# int fa0/0

iv. Router(config-if)# ip address 192.168.10.1 255.255.255.0

v. Router(config-if)# ip helper-address 192.168.10.2

vi. Router(config-if)# no shutdown

vii. Router(config-if)# exit

(Outside Lan)

viii. Router(config)# int fa0/1

ix. Router(config-if)# ip address 192.168.20.1 255.255.255.0

x. Router(config-if)# ip helper-address 192.168.10.2

xi. Router(config-if)# no shutdown

xii. Router(config-if)# exit

xiii. Router(config)# exit

xiv. Router# write memory

Output:

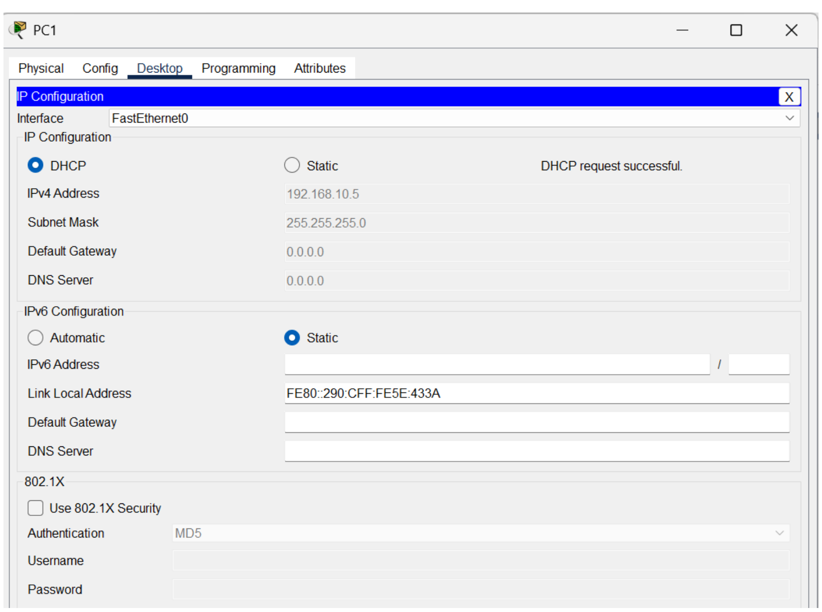


Fig 1. Ip address assigned by DHCP server within Lan (PC1)

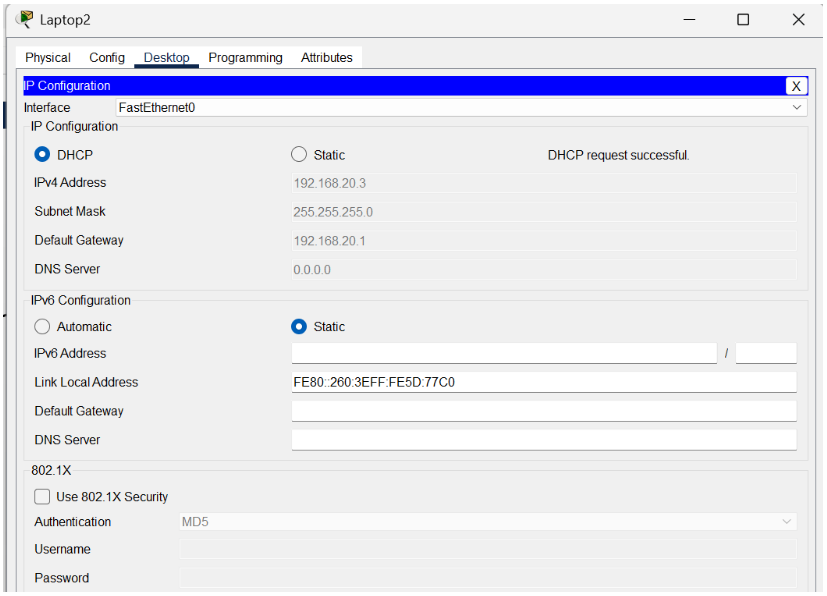
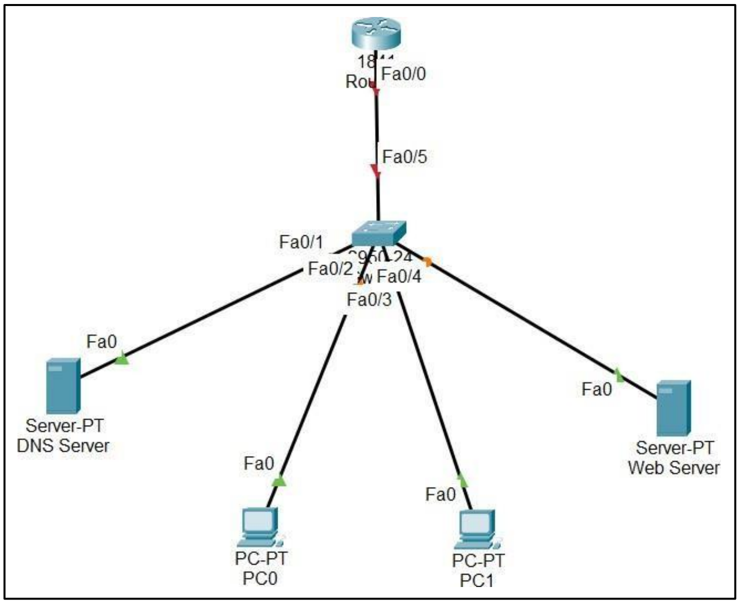


Fig 2. Ip address assigned by DHCP server outside Lan (laptop2)

Program 3:

Aim: Configure Web Server, DNS within a LAN.

Topology:



Procedure:

1. Create the Network

1. Place 1 Router, 1 Switch, 1 DNS Server, 1 Web Server, and two PCs.
2. Connect all devices using Copper Straight-Through cables.

2. Assign IP Addresses

1. On each device: Desktop → IP Configuration
   - Assign IPs in same network (e.g., 192.168.1.x).
   - Set Gateway = Router's interface IP.

3. Configure DNS Server

1. Open DNS Server → Services → DNS.
2. Turn DNS Service = On.
3. Add A-Record:
   - Name: letslearn.com

- Address: IP of Web Server

4. Click Add → Save.

4. Configure Web Server

1. Open Web Server → Services → HTTP.
2. Turn HTTP = On (HTTPS optional).
3. Ensure index.html exists (default file is fine).
4. Edit HTML if needed.

5. Test from PC

1. Open PC → Desktop → Web Browser.
2. Enter URL:
3. http://www.letslearn.com/index.html
4. The webpage should load, confirming DNS + Web Server working.

Output:

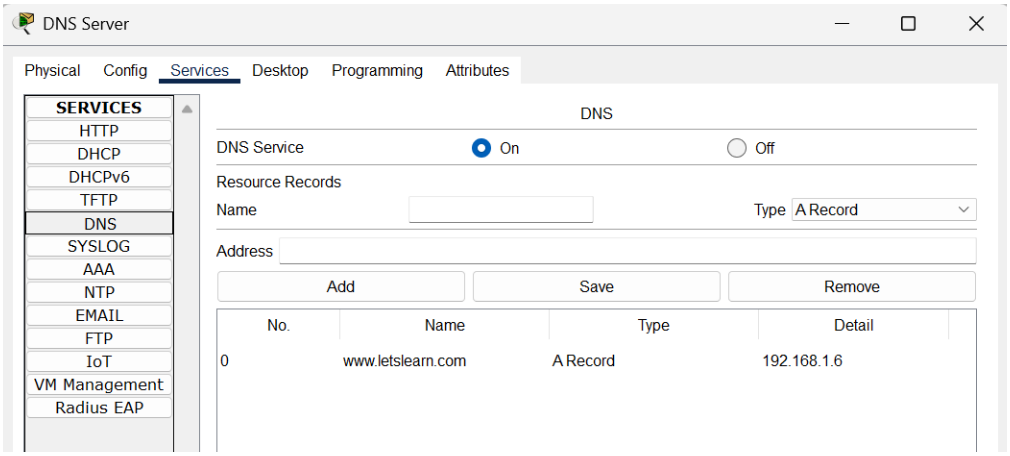


Fig 1. DNS server – DNS Services

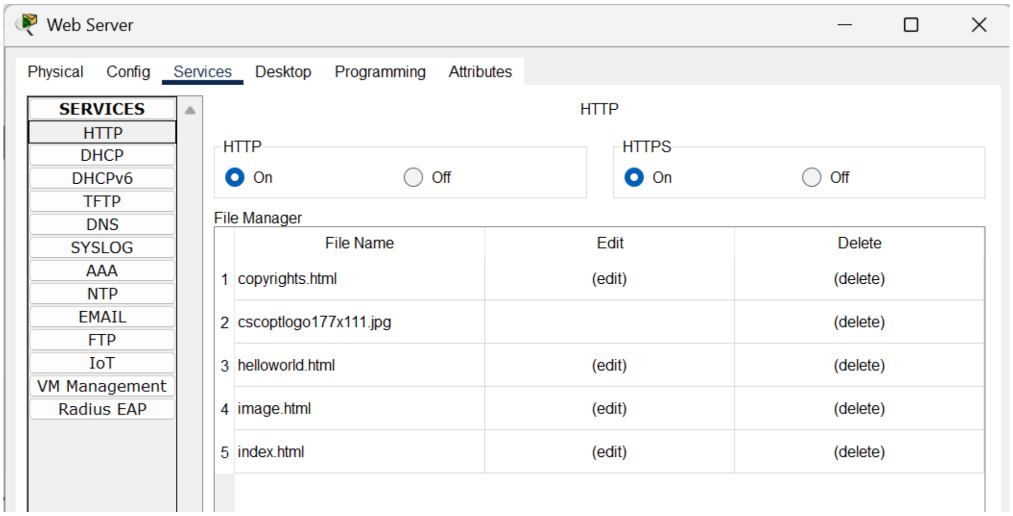


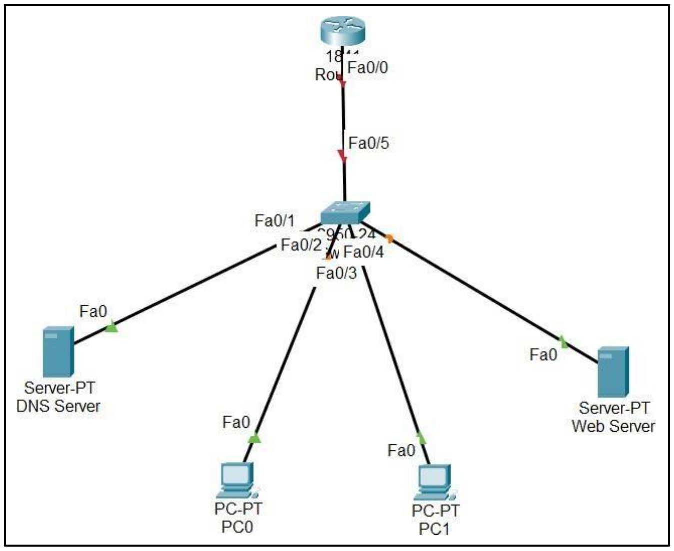
Fig 2. WEB server – HTTP Services

Fig 3. PC0 – accessing data from web browser

Program 4:

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

Topology:



Procedure:

1. Assign IP Addresses to Router Interfaces

1. Click the Router → Config → Interfaces.
2. **Configure and enable:**
   - Fa0/0 → IP: 192.168.1.1 /24
   - Fa0/5 → IP: 192.168.2.1 /24
3. **Turn Port Status = On for each interface**.

2. Assign IP Addresses to PCs and Servers

1. On each device → Desktop → IP Configuration.
2. Use matching networks:
   - Devices connected to Fa0/0 → IP: 192.168.1.x, Gateway: 192.168.1.1
   - Devices connected to Fa0/5 → IP: 192.168.2.x, Gateway: 192.168.2.1

3. Verify Connectivity with Ping

1. Open PC → Desktop → Command Prompt.
2. Test different responses:

- Ping reply → reachable IP
- Request timed out → device powered off / link down
- Destination unreachable → wrong gateway or missing route

3. Observe the output for each case.

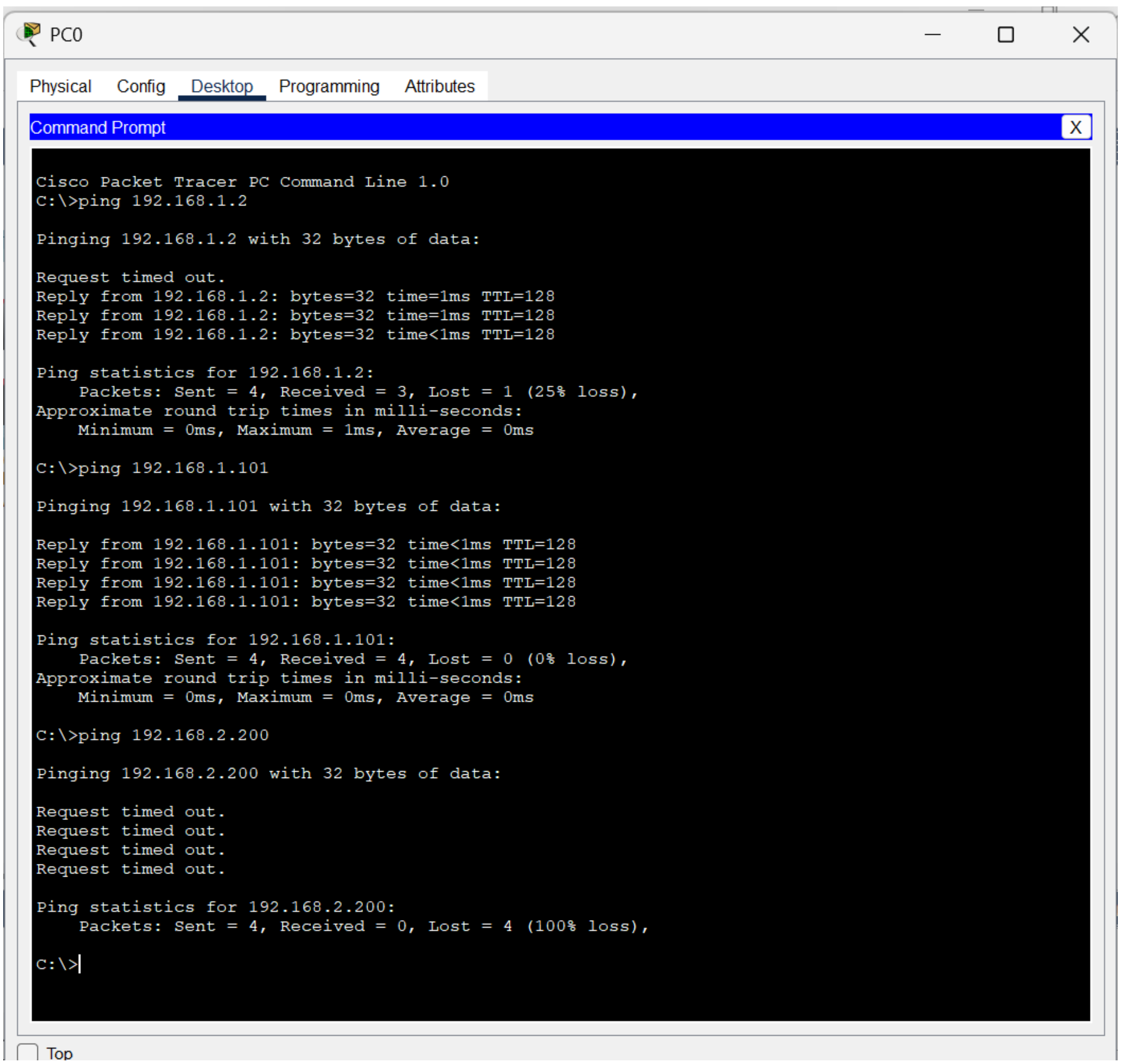
   Example commands:

   ping 192.168.1.2

   ping 192.168.1.101

   ping 192.168.2.200

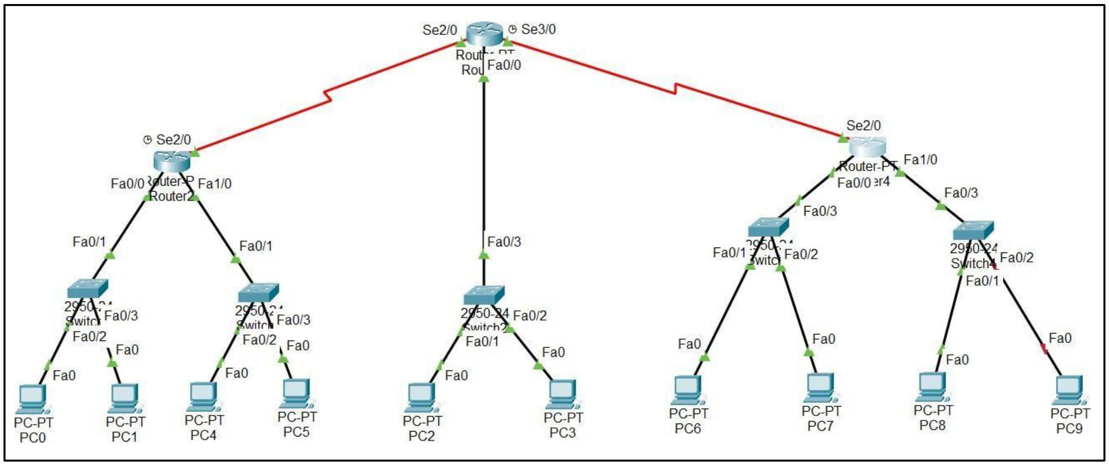
Output:



Program 5:

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

Topology:



Procedure:

1. Assign IP Addresses

1. On each router → Config → Interfaces
2. Set IP addresses for all FastEthernet and Serial interfaces according to the network diagram.
3. Turn Port Status = On for each interface.

2. Configure Static Routes

Perform on each router:

Router 2

1. Go to Config → Routing → Static
2. Add routes for networks behind Router 3 and Router 4:
   - Network: 192.168.3.0 /24 → Next Hop: 192.168.4.2
   - Network: 192.168.5.0 /24 → Next Hop: 192.168.4.2
   - Network: 192.168.6.0 /24 → Next Hop: 192.168.4.2
   - Network: 192.168.7.0 /24 → Next Hop: 192.168.4.2

Router 3

1. Go to Config → Routing → Static
2. Add routes toward Router 2 and Router 4:
   - 192.168.1.0 /24 → via 192.168.4.1
   - 192.168.2.0 /24 → via 192.168.4.1
   - 192.168.5.0 /24 → via 192.168.7.2
   - 192.168.6.0 /24 → via 192.168.7.2

Router 4

1. Go to Config → Routing → Static
2. Add routes toward Router 2 and Router 3:
   - 192.168.1.0 /24 → via 192.168.7.1

- 192.168.2.0 /24 → via 192.168.7.1
- 192.168.3.0 /24 → via 192.168.7.1
- 192.168.4.0 /24 → via 192.168.7.1

3. Configure Default Route (Optional)
If needed, add:
0.0.0.0 /0 → next-hop IP
(from each router toward the main/central router)

4. Test Connectivity

1. On any PC → Command Prompt
2. Use ping to reach devices in other networks.
3. Successful reply = routing configured correctly.

Output:

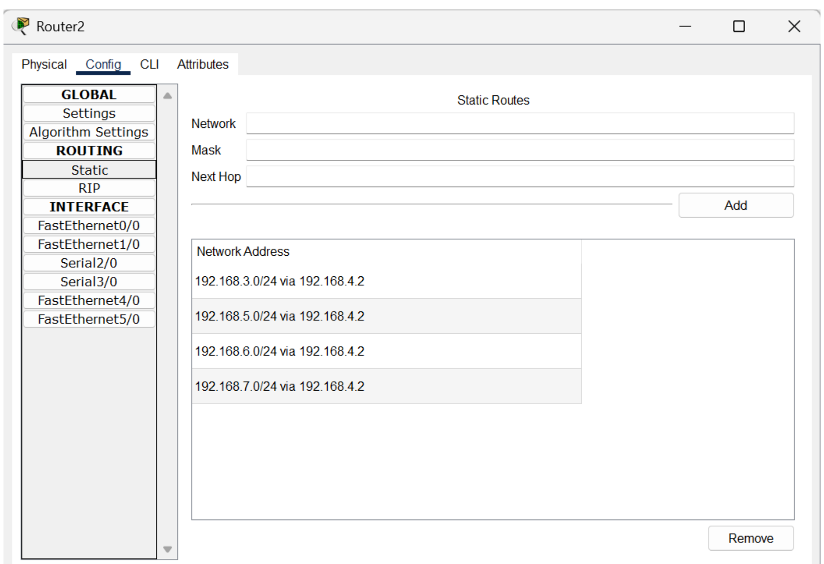


Fig 1. Router 2 – Static routing

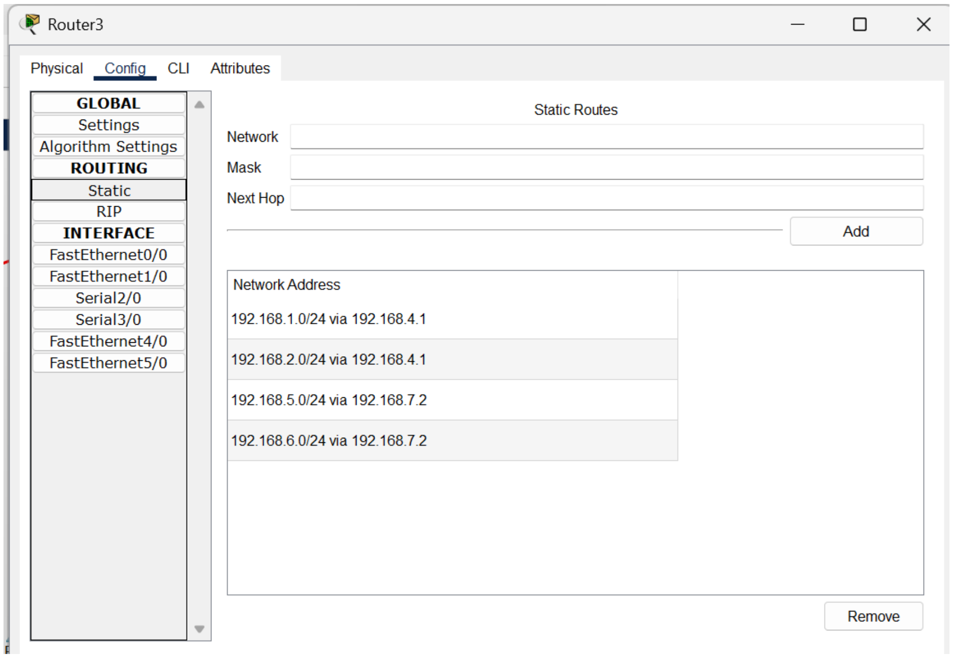


Fig 2. Router 3 – Static routing

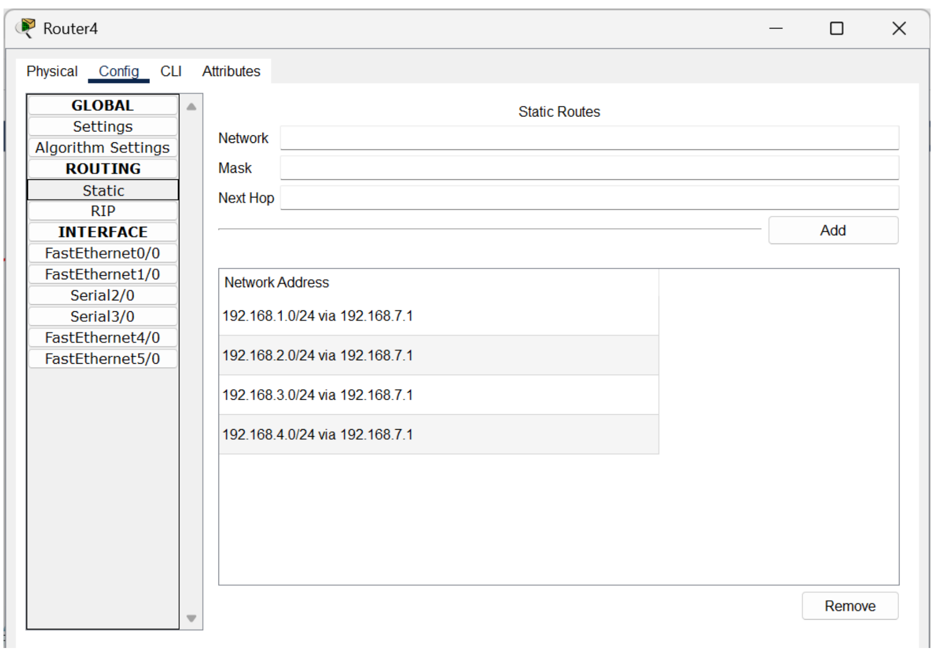
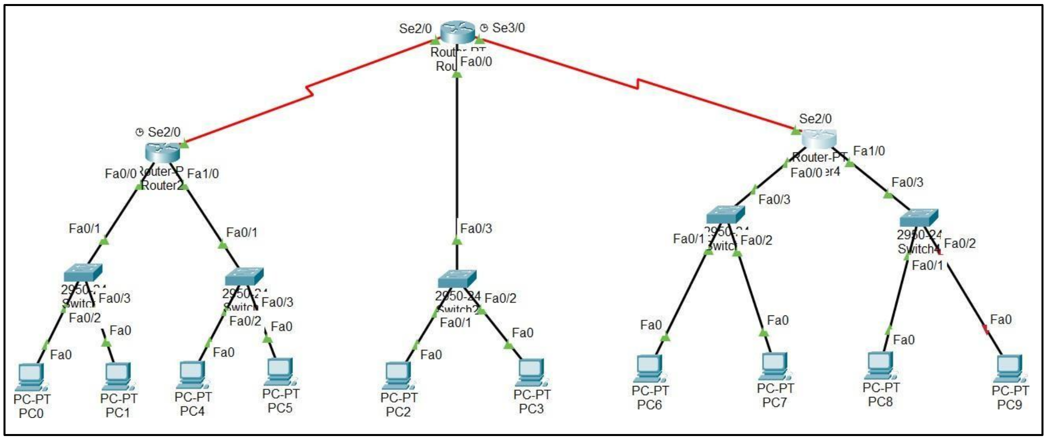


Fig 3. Router 4 – Static routing

Program 6:

Aim: Configure RIP routing Protocol in Routers.

Topology:



Procedure

1. Assign IP Addresses

1. On each router → Config → Interfaces
2. Configure IPs for all FastEthernet and Serial interfaces as per the network diagram.
3. Turn Port Status = On.

2. Enable RIP on Each Router

Router 2

1. Go to Config → Routing → RIP
2. Add directly connected networks:
   - 192.168.1.0
   - 192.168.2.0
   - 192.168.4.0

Router 3

1. Go to Config → Routing → RIP
2. Add networks:
   - 192.168.3.0
   - 192.168.4.0
   - 192.168.7.0

Router 4

1. Go to Config → Routing → RIP
2. Add networks:
   - 192.168.5.0
   - 192.168.6.0
   - 192.168.7.0

3. Verify Routing

1. On any router → CLI
2. Use:
3. show ip route

→ RIP routes should appear with the letter R.

4. Test Connectivity

1. From PCs across different networks, use:
2. ping <destination IP>
3. Successful replies confirm RIP routing is working.

Output:

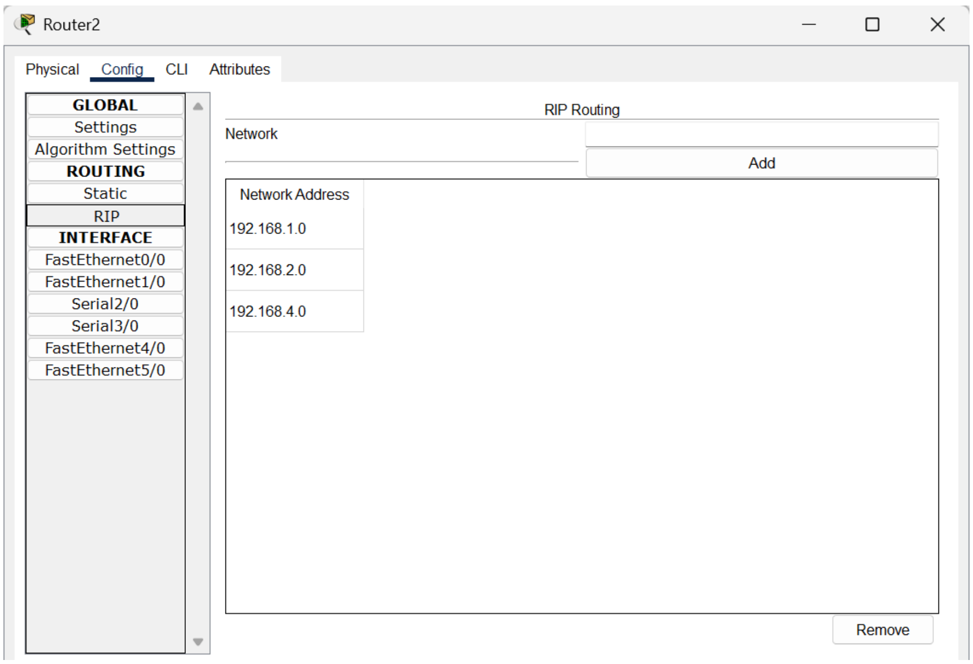


Fig 1. Router 2 – RIP routing

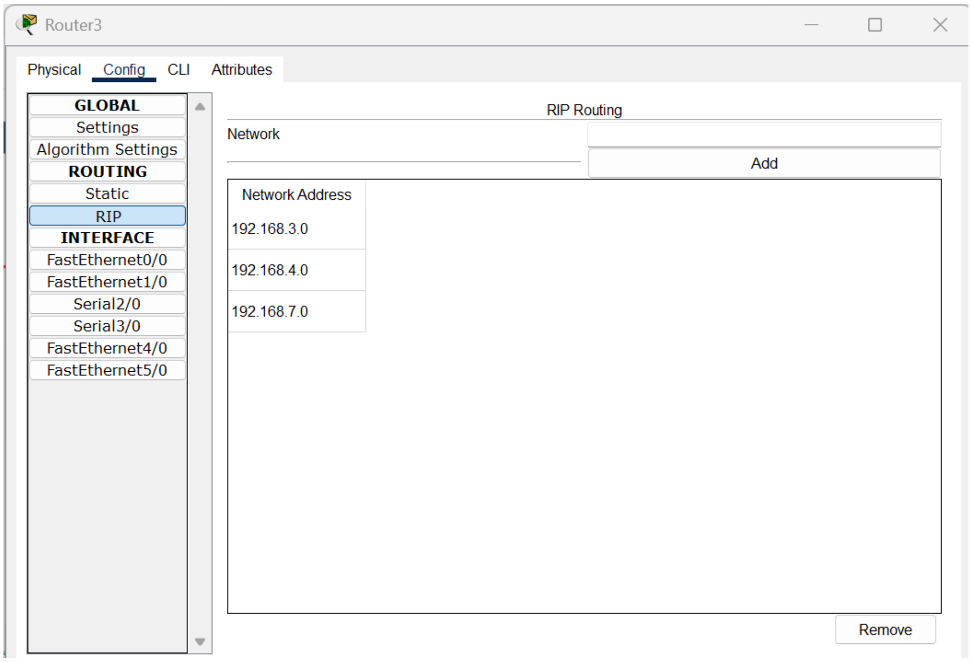


Fig 2. Router 3 – RIP routing

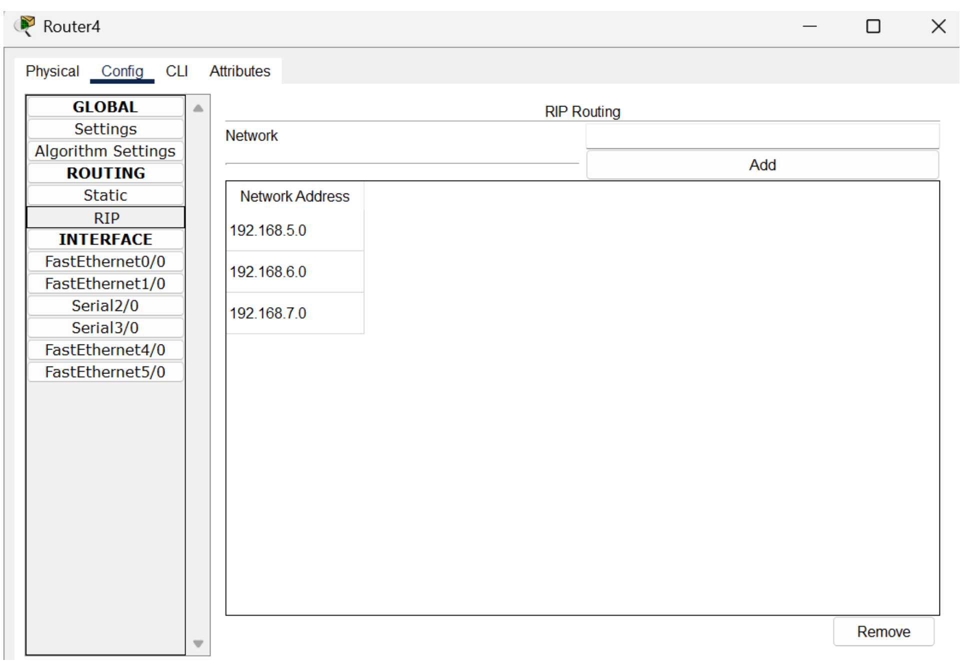
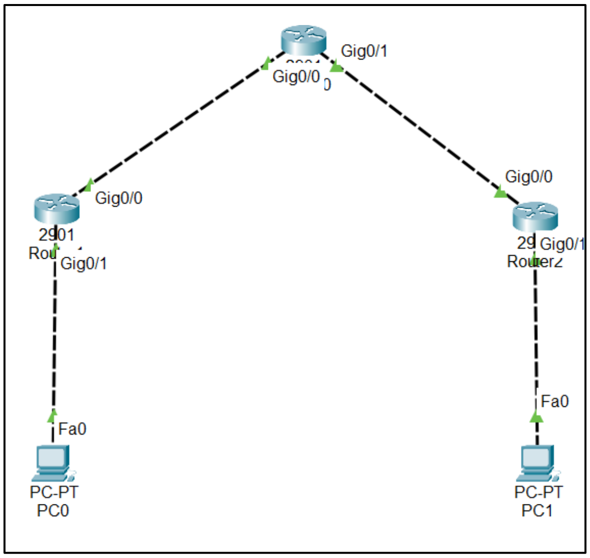


Fig 3. Router 4 – RIP routing

Program 7:

Aim: Configure OSPF routing protocol.

Topology:



Procedure:

1. Assign IP Addresses

1. On each router → Config → Interfaces
2. Assign IPs to Gig0/0, Gig0/1, and PC-facing interfaces as per the diagram.
3. Enable all interfaces (Port Status = On).

2. Configure OSPF on All Routers

Router 0

1. Go to Config → Routing → OSPF
2. Set Process ID = 1
3. Add networks:
    - 192.168.1.0 /24
    - 10.0.0.0 /30 (link to center router)

Router 1 (Center Router)

1. Process ID = 1
2. Add networks:
    - 10.0.0.0 /30 (left link)

- 20.0.0.0 /30 (right link)

Router 2

1. Process ID = 1
2. Add networks:
   - 192.168.2.0 /24
   - 20.0.0.0 /30 (link to center router)

3. Test Connectivity

1. From PC0 → PC1, send PDU or use ping command.
2. Successful ICMP reply confirms OSPF is working.

Output:

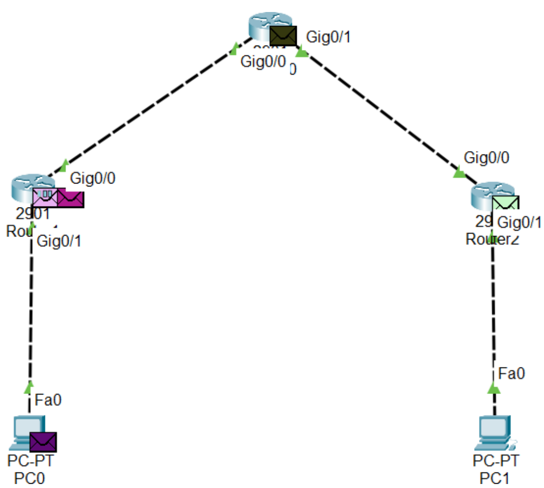


Fig 1. Sending PDU message from PC0 to PC1


PDU List Window

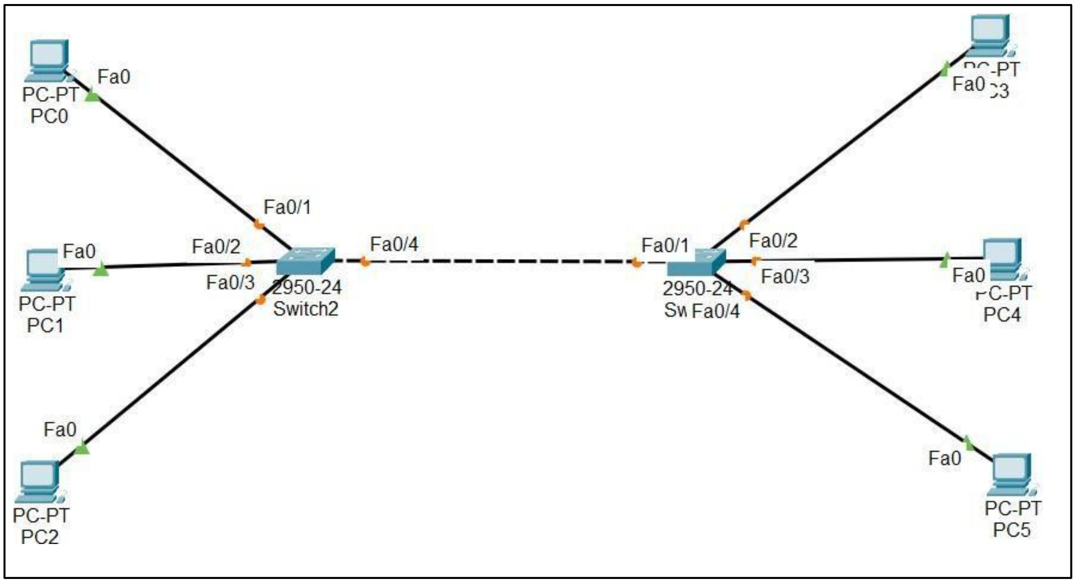
Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit	Delete
	Successful	PC0	PC1	ICMP		0.000	N	0	(edit)	(delete)
	Successful	PC0	Router2	ICMP		0.000	N	1	(edit)	(delete)
	Successful	PC0	Router0	ICMP		0.000	N	2	(edit)	(delete)
	Successful	Router0	PC1	ICMP		0.000	N	3	(edit)	(delete)
	Successful	Router1	PC1	ICMP		0.000	N	4	(edit)	(delete)
	Successful	Router1	Router2	ICMP		0.000	N	5	(edit)	(delete)

Fig 2. Checking PDU messages

Program 8:

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

Topology:



Procedure:

1. Create VLANs on Both Switches

1. Open each switch → Config → VLAN Database
2. Create VLANs (example):
   - VLAN 10
   - VLAN 20

2. Assign Ports to VLANs

Assign PCs to the required VLAN:

Switch 1 (Left Side)

- PC0 (Fa0/1) → VLAN 10
- PC1 (Fa0/2) → VLAN 10
- PC2 (Fa0/3) → VLAN 20

Switch 2 (Right Side)

- PC3 (Fa0/2) → VLAN 10
- PC4 (Fa0/3) → VLAN 10

- PC5 (Fa0/4) → VLAN 20

3. Configure Trunk Between Switches

1. Select the link between Fa0/4 (Switch1) ↔ Fa0/1 (Switch2)
2. On both ends → Config → Interface
3. Set Mode = Trunk
4. Allow VLANs 10 and 20 on the trunk.

4. Assign IPs to PCs

1. On each PC → Desktop → IP Configuration
2. Assign IPs in VLAN-specific networks (example):
    - VLAN 10 → 192.168.10.x
    - VLAN 20 → 192.168.20.x

5. Test Connectivity

1. Use Add Simple PDU or ping:
    - Devices in the *same VLAN* should communicate.
    - Devices in *different VLANs* should not communicate.

Output:

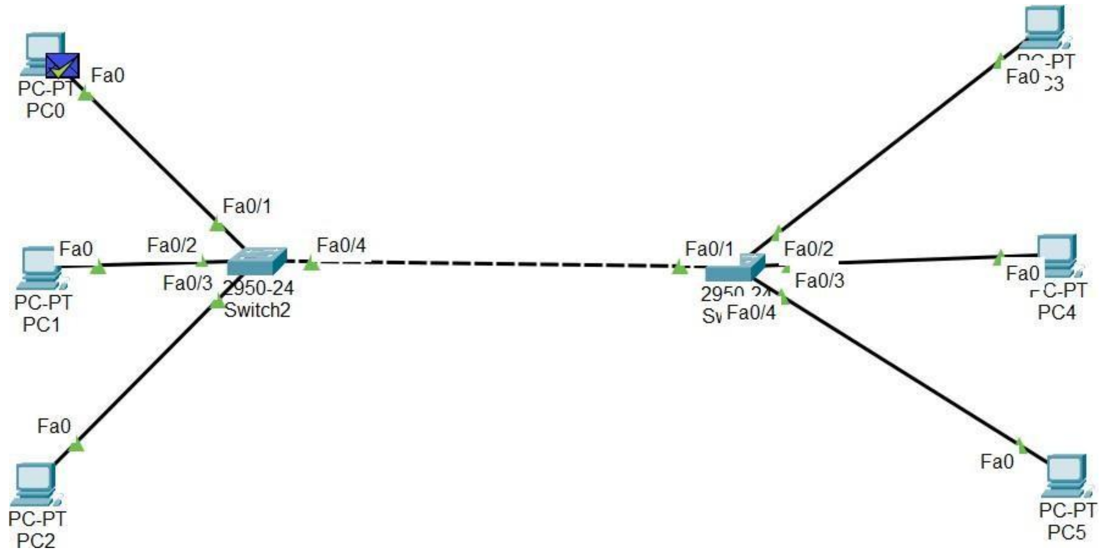
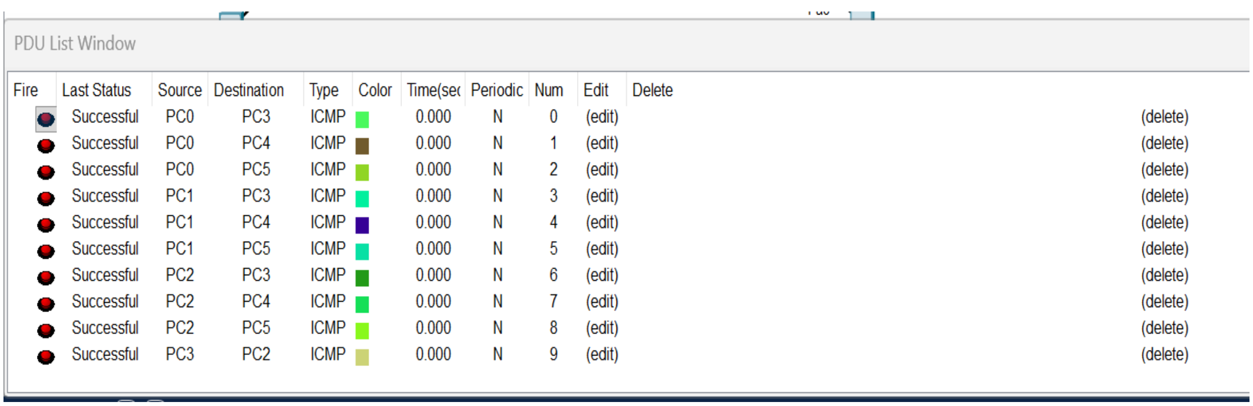


Fig 1. Sending PDU message from PC0 to PC5


PDU List Window

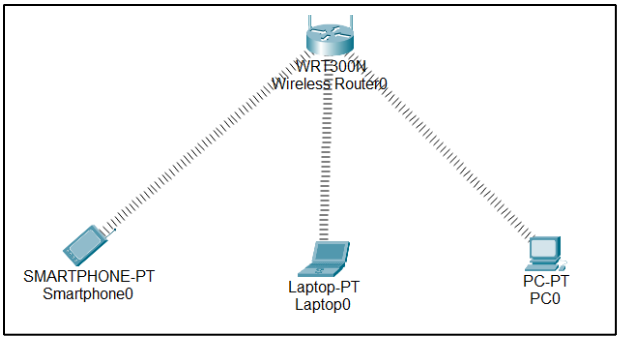
Fire	Last Status	Source	Destination	Type	Color	Time(sec	Periodic	Num	Edit	Delete
	Successful	PC0	PC3	ICMP		0.000	N	0	(edit)	(delete)
	Successful	PC0	PC4	ICMP		0.000	N	1	(edit)	(delete)
	Successful	PC0	PC5	ICMP		0.000	N	2	(edit)	(delete)
	Successful	PC1	PC3	ICMP		0.000	N	3	(edit)	(delete)
	Successful	PC1	PC4	ICMP		0.000	N	4	(edit)	(delete)
	Successful	PC1	PC5	ICMP		0.000	N	5	(edit)	(delete)
	Successful	PC2	PC3	ICMP		0.000	N	6	(edit)	(delete)
	Successful	PC2	PC4	ICMP		0.000	N	7	(edit)	(delete)
	Successful	PC2	PC5	ICMP		0.000	N	8	(edit)	(delete)
	Successful	PC3	PC2	ICMP		0.000	N	9	(edit)	(delete)

Fig 2. Checking PDU messages

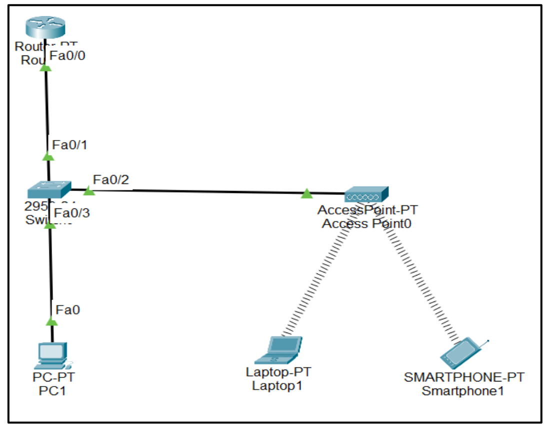
Program 9:

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

Topology:



Configuration 1



Configuration 2

Procedure:

1. Add Wireless Devices

1. Place Wireless Router, Access Point, Laptops, Smartphones, and PCs as shown.
2. For laptops/PCs without wireless modules →
   - Power off → Insert Wireless NIC → Power on.

2. Configure Wireless Router / Access Point

1. Click the Wireless Router / AP → Config → Wireless
2. Set:
   - SSID = BMSCE
   - Authentication = WPA2-PSK
   - Passphrase = bmsce123
3. Keep channel and encryption default.

3. Configure Wireless Settings on Laptop & Smartphone

1. Open device → Desktop → PC Wireless / Wi-Fi
2. Select SSID BMSCE
3. Enter password bmsce123
4. Connect.

4. Assign IP Addresses (if required)

1. Use DHCP (automatic) or manually assign from the same network.

5. Test Wireless Communication

1. Use Add Simple PDU or ping between wireless devices.
2. Successful replies confirm WLAN communication.

Output:

1. Do Physical Connections In:

- Laptop
- PC

Fig 1.1 Step1: Turn off light / Power off laptop

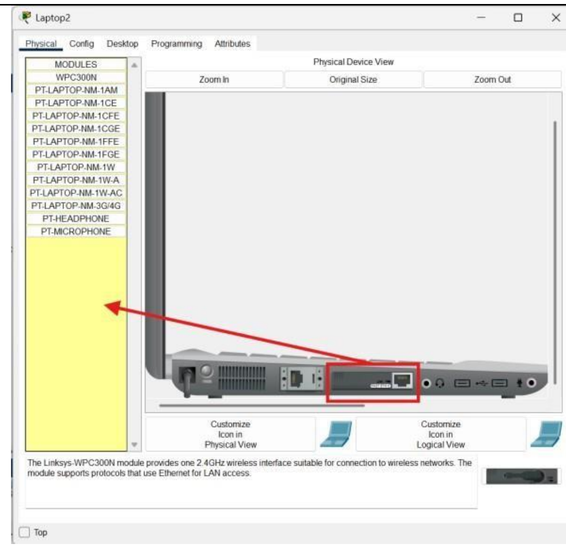


Fig 1.2 Step2: Drag and Drop the Ethernet into pointed location

Fig 1.3 Step3: Drag and Drop the device into pointed location and Turn on light/Laptop

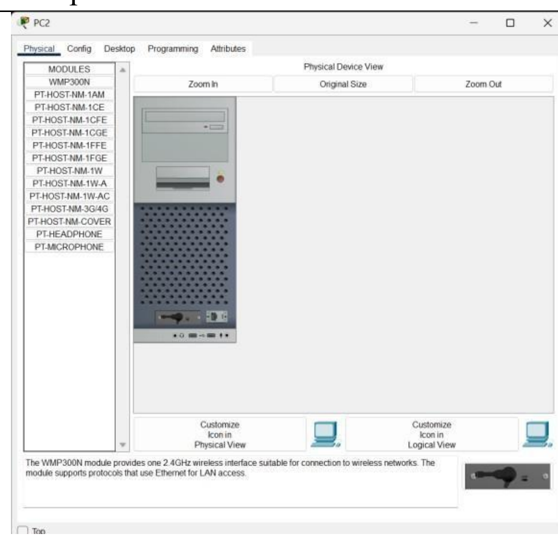


Fig 2. PC physical connection (combined 3 steps)

2. Do Wireless Connection in:

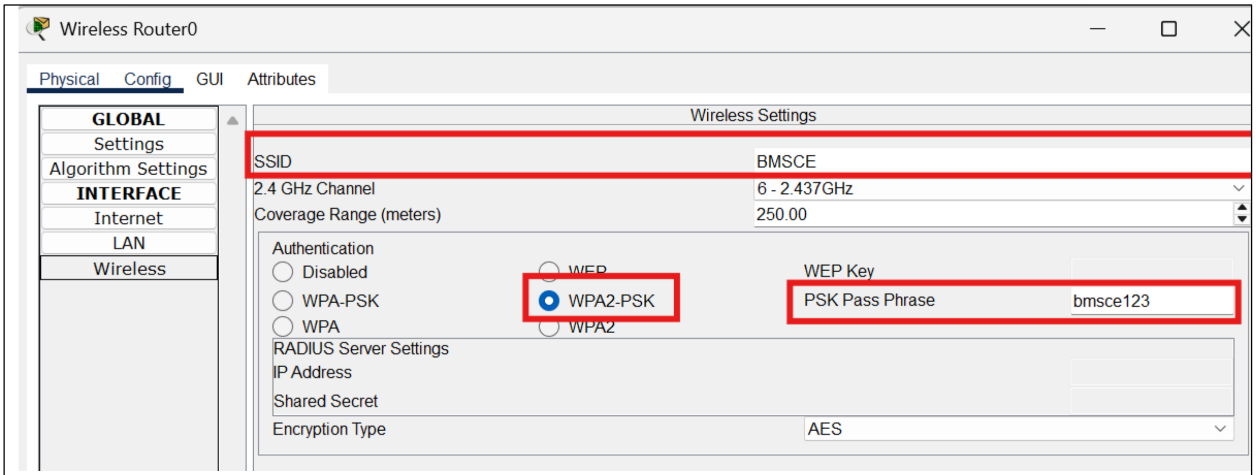


Fig 1. Config at Device Wireless Router0

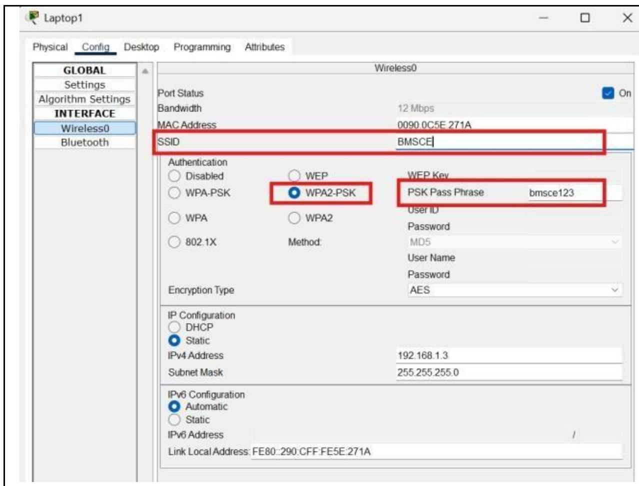


Fig 2. Config at Device Laptop0

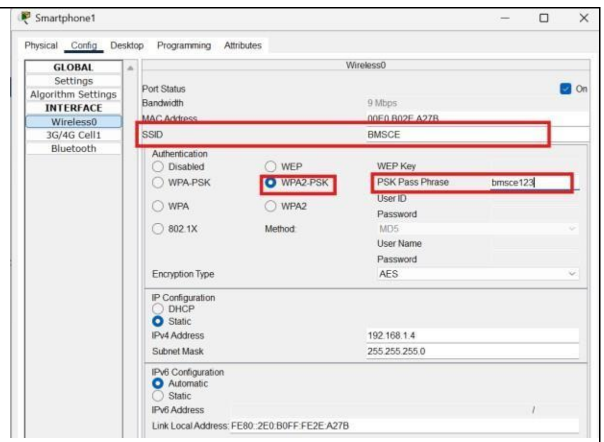
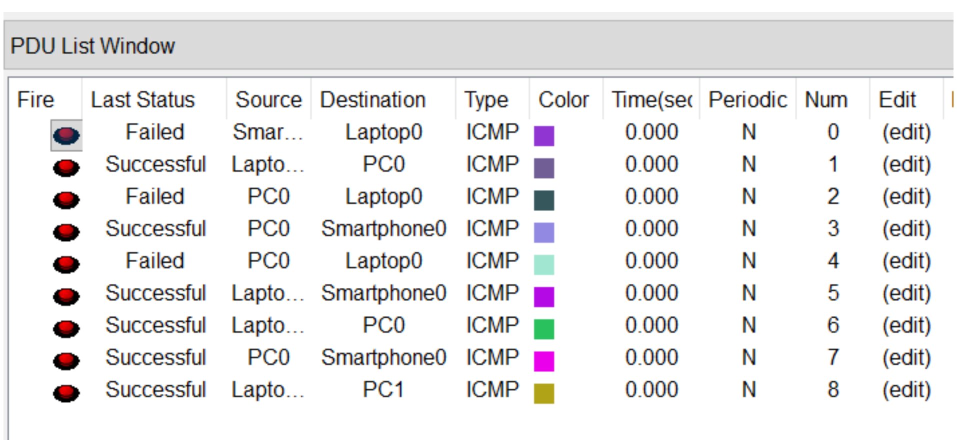


Fig 3. Config at Device Smartphone0


PDU List Window

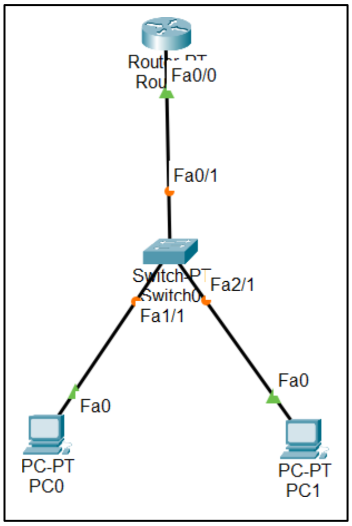
Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit
	Failed	Smar...	Laptop0	ICMP		0.000	N	0	(edit)
	Successful	Lapto...	PC0	ICMP		0.000	N	1	(edit)
	Failed	PC0	Laptop0	ICMP		0.000	N	2	(edit)
	Successful	PC0	Smartphone0	ICMP		0.000	N	3	(edit)
	Failed	PC0	Laptop0	ICMP		0.000	N	4	(edit)
	Successful	Lapto...	Smartphone0	ICMP		0.000	N	5	(edit)
	Successful	Lapto...	PC0	ICMP		0.000	N	6	(edit)
	Successful	PC0	Smartphone0	ICMP		0.000	N	7	(edit)
	Successful	Lapto...	PC1	ICMP		0.000	N	8	(edit)

Fig 3. Checking PDU messages

Program 10:

Aim: Demonstrate the TTL/ Life of a Packet.

Topology:



Procedure:

Create the Network

1. Place one Router, one Switch, and two PCs as shown in the topology.
2. Connect:
   - Router → Switch (Fa0/0 to Fa0/1)
   - Switch → PC0 (Fa1/1)
   - Switch → PC1 (Fa2/1)

2. Assign IP Addresses

1. On each PC → Desktop → IP Configuration
   - PC0: 192.168.1.2 /24
   - PC1: 192.168.1.3 /24
   - Gateway: 192.168.1.1
2. On Router → Config → Interface Fa0/0
   - IP: 192.168.1.1 /24
   - Turn Port Status = On

3. Switch to Simulation Mode

1. Click Simulation Mode (bottom right).
2. Select Add Simple PDU tool.

4. Send the Packet

1. Click PC0 → then click PC1 to send an ICMP (ping) PDU.
2. Observe packet movement step-by-step.

5. Check TTL (Time To Live)

1. Click the PDU in the event list.
2. Open Inbound PDU Details and Outbound PDU Details.
3. Note the TTL value:
   - At source PC → TTL usually starts at 255
   - After passing Router → TTL reduces (example: 128)

6. Observe TTL Decrement

Each time a packet passes through a router, TTL decreases by 1, demonstrating the packet's lifespan on the network.

Output:

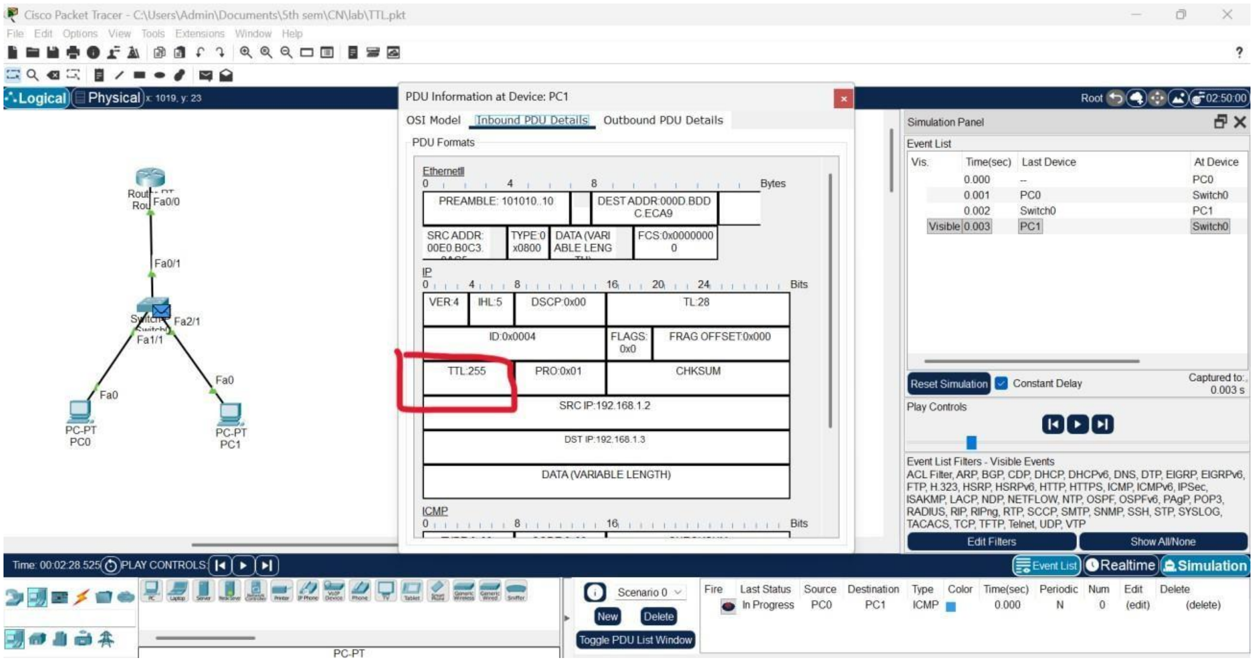


Fig 1. Inbound PDU Details at Device PC1

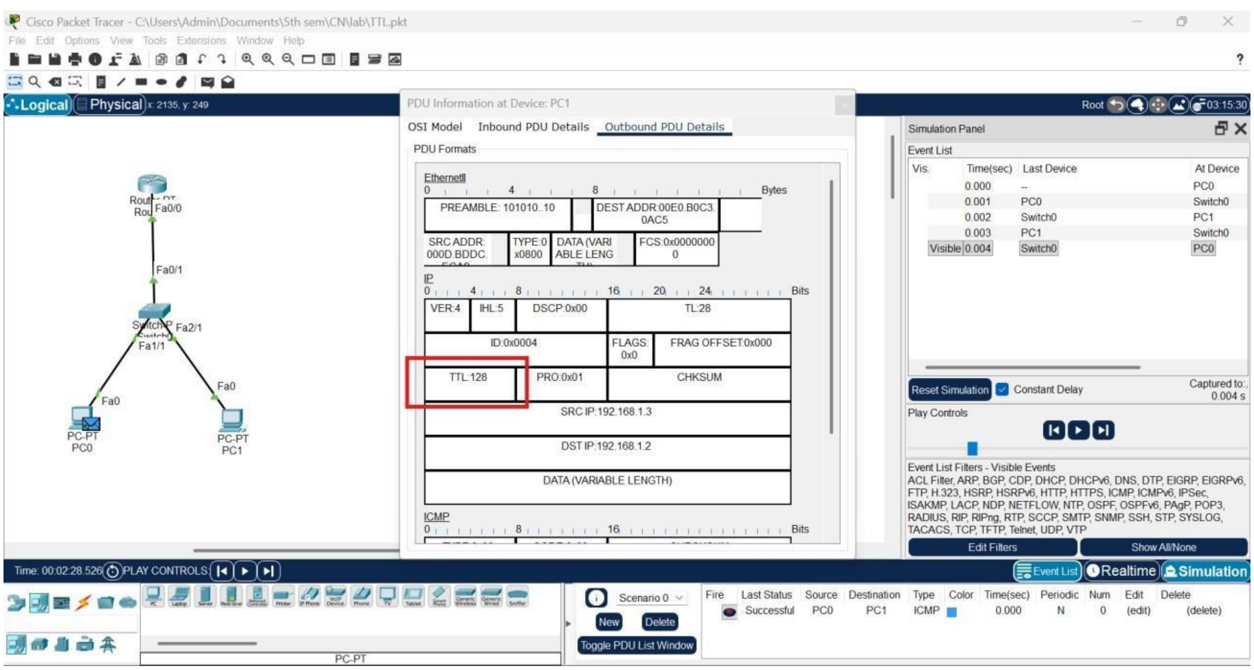
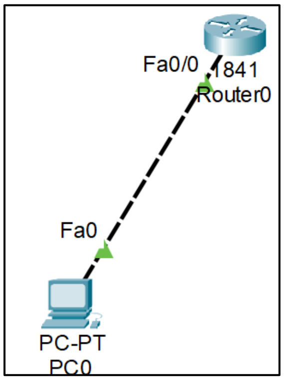


Fig 1. Outbound PDU Details at Device PC1

Program 11:

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

Topology:



Procedure:

Procedure

1. Configure the Router for Telnet

1. Open Router0 → CLI and enter:
2. enable
3. configure terminal
4. hostname R1
5. line vty 0 4
6. login
7. password cisco
8. enable secret tp
9. interface fa0/0
10. ip address 192.168.1.1 255.255.255.0
11. no shutdown
12. exit
13. end
14. Verify interface status:
15. show ip interface brief

2. Assign IP to PC

1. On PC0 → Desktop → IP Configuration:
    - IP Address: 192.168.1.2
    - Subnet Mask: 255.255.255.0
    - Gateway: 192.168.1.1

3. Test Connectivity

1. On PC0 → Command Prompt, ping the router:
2. ping 192.168.1.1

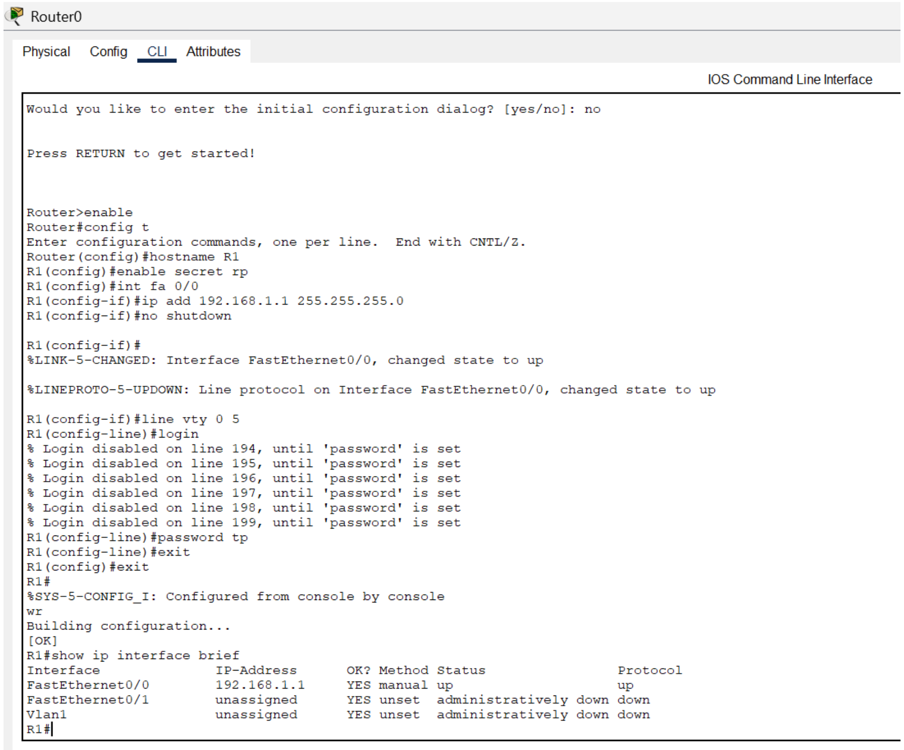
4. Access Router Using Telnet

1. On PC0 → Command Prompt:
2. telnet 192.168.1.1
3. Enter password: cisco to log in.
4. You now have remote access to the router.

5. Verify Telnet Access

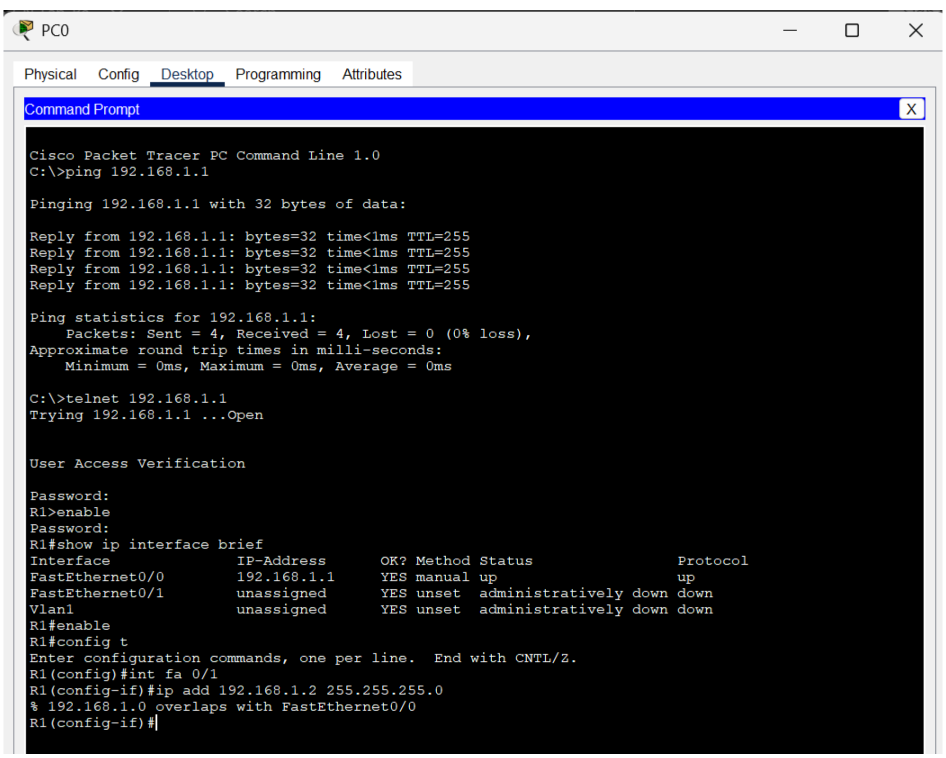
1. Execute any router command remotely, e.g.:
   show ip interface brief.

Output:




```
Would you like to enter the initial configuration dialog? [yes/no]: no


Press RETURN to get started!



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

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

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

R1(config-if)#line vty 0 5
R1(config-line)#login
% Login disabled on line 194, until 'password' is set
% Login disabled on line 195, until 'password' is set
% Login disabled on line 196, until 'password' is set
% Login disabled on line 197, until 'password' is set
% Login disabled on line 198, until 'password' is set
% Login disabled on line 199, until 'password' is set
R1(config-line)#password tp
R1(config-line)#exit
R1(config)#exit
R1#
%SYS-5-CONFIG_I: Configured from console by console
wr
Building configuration...
[OK]
R1#show ip interface brief
Interface              IP-Address      OK? Method Status                Protocol
FastEthernet0/0        192.168.1.1     YES manual up                    up
FastEthernet0/1        unassigned      YES unset  administratively down down
Vlan1                  unassigned      YES unset  administratively down down
R1#
```

Fig 1. Router0 – CLI commands




```
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 192.168.1.1

Pinging 192.168.1.1 with 32 bytes of data:

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

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

C:\>telnet 192.168.1.1
Trying 192.168.1.1 ...Open


User Access Verification

Password:
R1>enable
Password:
R1#show ip interface brief
Interface              IP-Address      OK? Method Status                Protocol
FastEthernet0/0        192.168.1.1     YES manual up                    up
FastEthernet0/1        unassigned      YES unset  administratively down down
Vlan1                  unassigned      YES unset  administratively down down
R1#enable
R1#config t
Enter configuration commands, one per line.  End with CNTL/Z.
R1(config)#int fa 0/1
R1(config-if)#ip add 192.168.1.2 255.255.255.0
% 192.168.1.0 overlaps with FastEthernet0/0
R1(config-if)#
```

Fig2. PC command line prompt

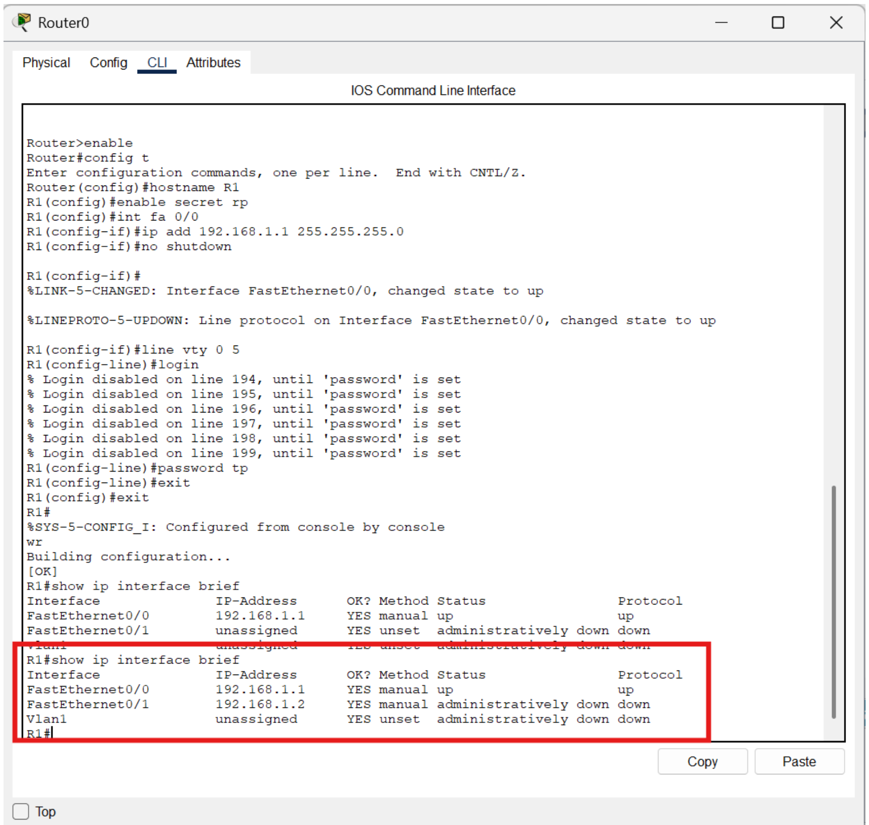


Fig 3. Updated the changes into Router0

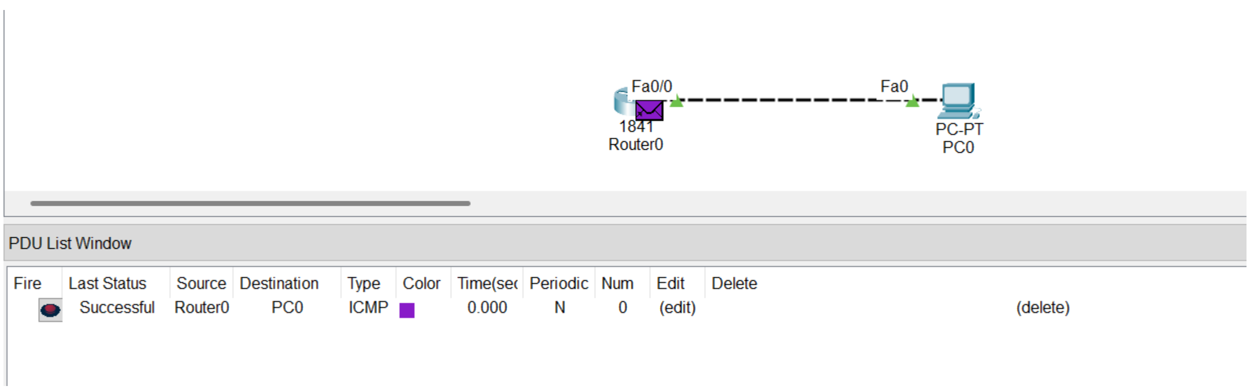
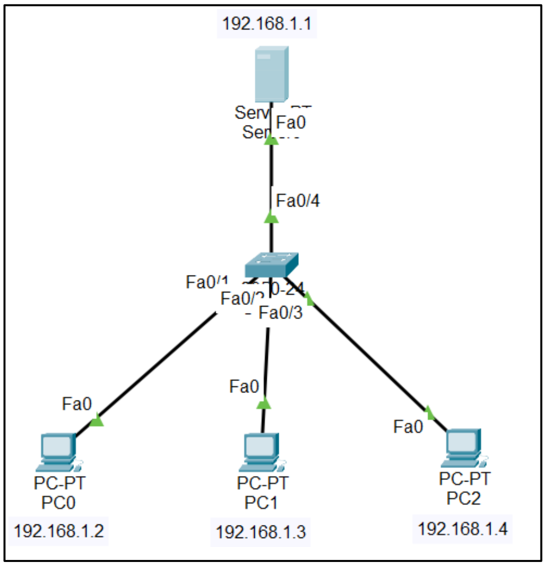


Fig 4. PDU message Successful

Program 12:

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

Topology:



Procedure:

1. Create the LAN

1. Place one server, one switch, and three PCs as shown.
2. Connect all devices to the switch using straight-through cables.

2. Assign IP Addresses

1. On each PC and the Server → Desktop → IP Configuration
   - Server: 192.168.1.1
   - PC0: 192.168.1.2
   - PC1: 192.168.1.3
   - PC2: 192.168.1.4
   - Subnet Mask: 255.255.255.0
   - Gateway: (none needed for LAN)

3. Check ARP Table (Before Communication)

1. On each device → Command Prompt
2. Type:
3. arp -a
4. The ARP table will be empty initially.

4. Generate Traffic (Ping)

1. On PC0 → Command Prompt:
2. ping 192.168.1.1

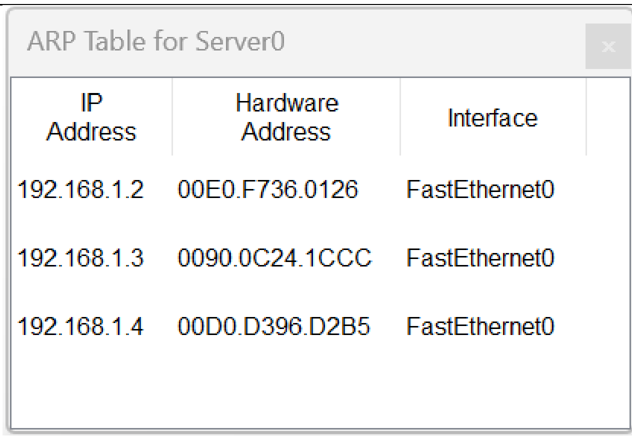
3. PC0 sends an ARP request → switch → server.
4. Server replies with its MAC address.

5. Check ARP Table (After Communication)

1. On each device, again run:
2. arp -a
3. Entries now appear showing:
    - IP Address
    - MAC Address
    - Interface

This demonstrates how ARP resolves IP → MAC mapping.

Output:



ARP Table for Server0

IP Address	Hardware Address	Interface
192.168.1.2	00E0.F736.0126	FastEthernet0
192.168.1.3	0090.0C24.1CCC	FastEthernet0
192.168.1.4	00D0.D396.D2B5	FastEthernet0

Fig 1.1 ARP table at Server0

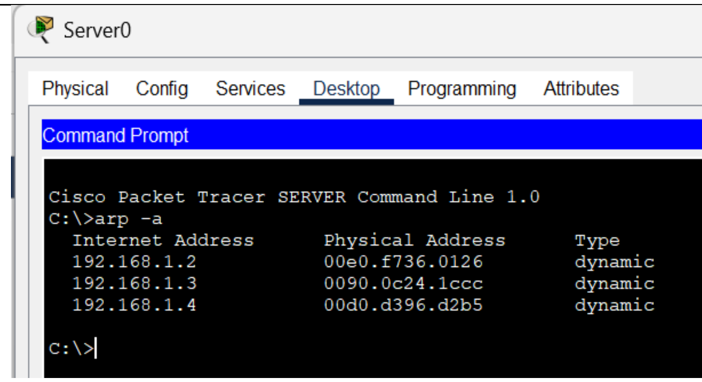
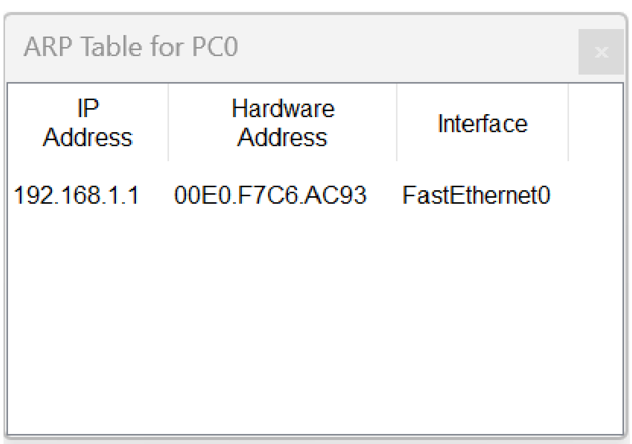


Fig 1.2 Command Prompt at Server0



ARP Table for PC0

IP Address	Hardware Address	Interface
192.168.1.1	00E0.F7C6.AC93	FastEthernet0

Fig 2.1 ARP table at PC0

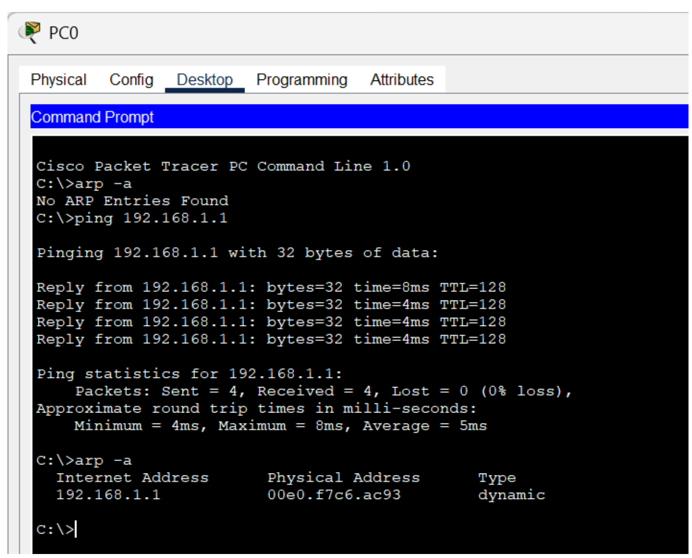


Fig 2.2 Command Prompt at PC0

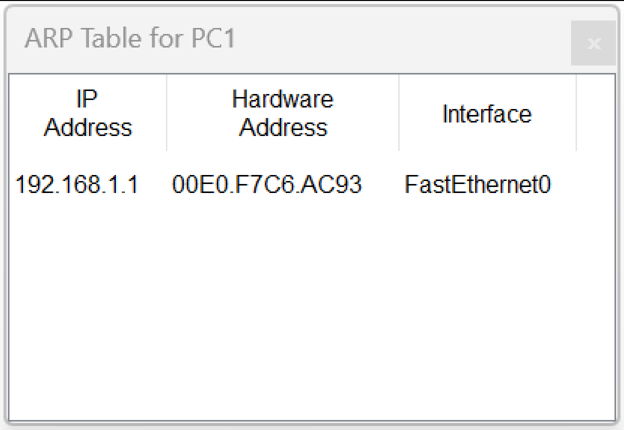


Fig 3.1 ARP table at PC1

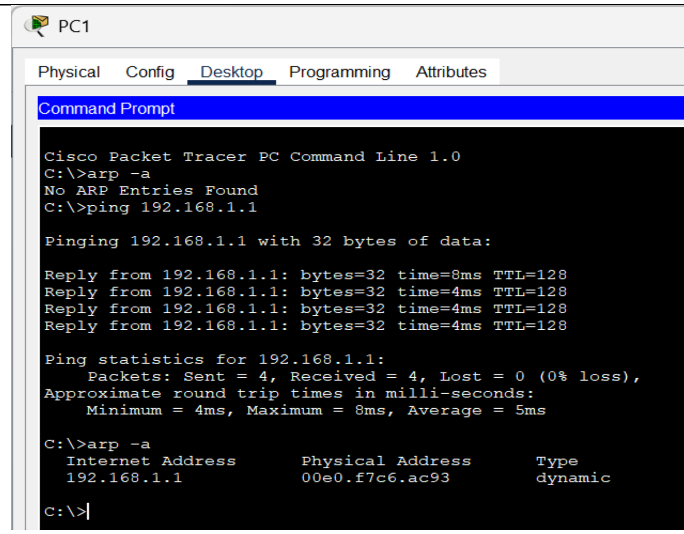


Fig 3.2 Command Prompt at PC1

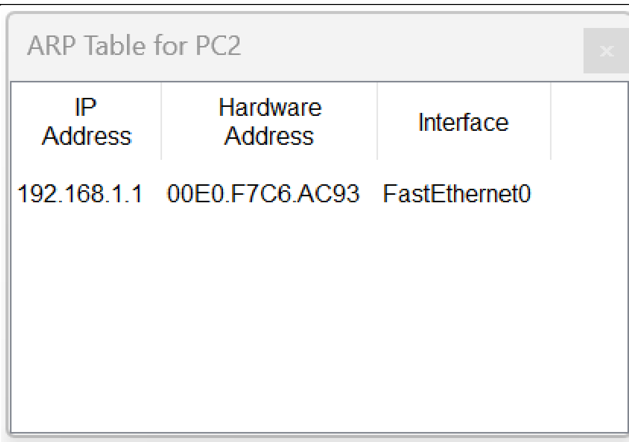


Fig 4.1 ARP table at PC2

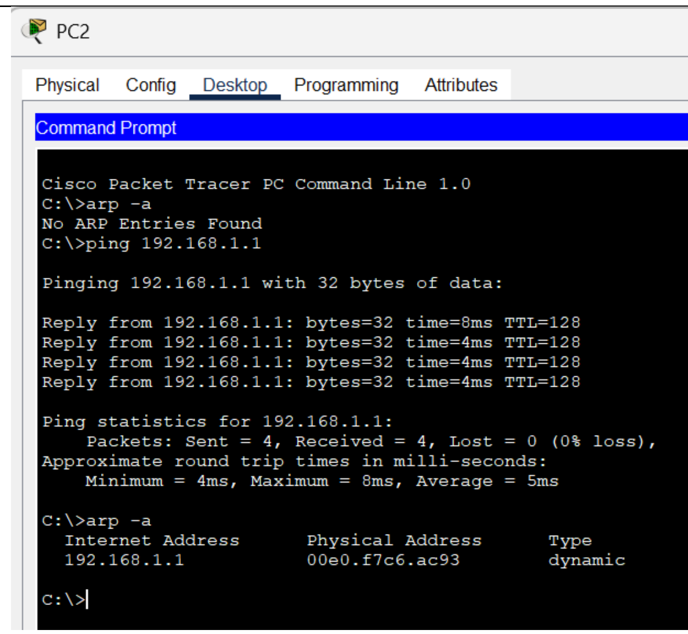


Fig 4.2 Command Prompt at PC2

PART - B

Program 1:

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

Code:

```
#include <stdio.h>


int min(int x, int y) {
    if (x < y)
        return x;
    else
        return y;
}



int main() {
    int drop = 0, mini, nsec, cap, count = 0, i, inp[25],
process;


    printf("Enter the bucket size:\n");
    scanf("%d", &cap);


    printf("Enter the processing rate:\n");
    scanf("%d", &process);


    printf("Enter the number of seconds you want to
simulate:\n");
    scanf("%d", &nsec);


    for (i = 0; i < nsec; i++) {
        printf("Enter the size of the packet entering at %d
sec:\n", i + 1);
```

```
        scanf("%d", &inp[i]);
    }

    printf("\nSecond | Packet Received | Packet Sent | Packet
Left | Dropped\n");
    printf("---------------------------------------------------------------------------------------------------------------------------------------------------------------------------\n");

    for (i = 0; i < nsec; i++) {
        count += inp[i];

        if (count > cap) {
            drop = count - cap;
            count = cap;
        }

        printf("%d\t  %d\t\t", i + 1, inp[i]);

        mini = min(count, process);
        printf("%d\t\t", mini);

        count = count - mini;
        printf("%d\t\t %d\n", count, drop);

        drop = 0;
    }

    // Remaining packets after time ends
    for (; count != 0; i++) {
        if (count > cap) {
```

```
            drop = count - cap;
            count = cap;
        }

        printf("%d\t  0\t\t", i + 1);

        mini = min(count, process);
        printf("%d\t\t", mini);

        count = count - mini;
        printf("%d\t\t %d\n", count, drop);

        drop = 0;
    }

    return 0;
}
```

Output:

```
pradeep-g@Pradeep-G: ~/Documents/Leaky Bucket
pradeep-g@Pradeep-G:~/Documents/Leaky Bucket$ gcc leaky_bucket.c -o leaky_bucket
pradeep-g@Pradeep-G:~/Documents/Leaky Bucket$ ./leaky_bucket
Enter the bucket size:
10
Enter the processing rate:
4
Enter the number of seconds you want to simulate:
5
Enter the size of the packet entering at 1 sec:
3
Enter the size of the packet entering at 2 sec:
7
Enter the size of the packet entering at 3 sec:
4
Enter the size of the packet entering at 4 sec:
6
Enter the size of the packet entering at 5 sec:
5

Second | Packet Received | Packet Sent | Packet Left | Dropped
-----------------------------------------------------------------
1        3            3             0               0
2        7            4             3               0
3        4            4             3               0
4        6            4             5               0
5        5            4             6               0
6        0            4             2               0
7        0            2             0               0
pradeep-g@Pradeep-G:~/Documents/Leaky Bucket$
```

Program 2:

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.

Code:

```
# tcp_client.py


import socket


# Step 1: Create TCP socket

client_socket =
socket.socket(socket.AF_INET,
socket.SOCK_STREAM)


# Step 2: Connect to server

client_socket.connect(('localhost',
8080))


# Step 3: Send filename

filename = input("Enter filename to
request: ")


client_socket.send(filename.encode())


# Step 4: Receive file contents

data =
client_socket.recv(4096).decode()


print("\n--- File Content ---\n")

print(data)


# Step 5: Close connection

client_socket.close()
```

```
# tcp_server.py

import socket

# Step 1: Create a TCP socket
server_socket =
socket.socket(socket.AF_INET,
socket.SOCK_STREAM)

# Step 2: Bind to address and port
server_socket.bind(('localhost',
8080))

# Step 3: Listen for client
connections
server_socket.listen(1)
print("Server is listening on port
8080...")

# Step 4: Accept connection
conn, addr = server_socket.accept()
print("Connected by:", addr)

# Step 5: Receive file name
filename =
conn.recv(1024).decode().strip()

try:
    # Step 6: Open and read file
    with open(filename, 'r') as f:
        data = f.read()

    conn.send(data.encode())  # Send
file contents

except FileNotFoundError:
    conn.send(b"File not found on
server.")

# Step 7: Close connection
conn.close()
server_socket.close()
```

Output:

Server side Terminal:

```
pradeep-g@Pradeep-G: ~/Documents/TCP        pradeep-g@Pradeep-G: ~/Documents/TCP
pradeep-g@Pradeep-G:~/Documents/TCP$ python3 server.py
Server is listening on port 8080...
Connected by: ('127.0.0.1', 47790)
pradeep-g@Pradeep-G:~/Documents/TCP$
```

Client side Terminal:

```
pradeep-g@Pradeep-G: ~/Documents/TCP        pradeep-g@Pradeep-G: ~/Documents/TCP
pradeep-g@Pradeep-G:~/Documents/TCP$ python3 client.py
Enter filename to request: hello.txt

--- File Content ---

Hi i am Pradeep G
Welcome to my WORLD!

pradeep-g@Pradeep-G:~/Documents/TCP$
```

<u>Program 3</u>:

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.

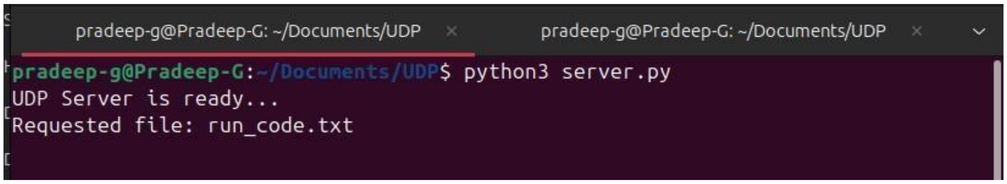
Code:

```python
# udp_client.py


import socket


# Step 1: Create UDP socket

client_socket =
socket.socket(socket.AF_INET,
socket.SOCK_DGRAM)


server_address = ('localhost',
8081)


filename = input("Enter filename
to request: ")


# Step 2: Send filename to
server

client_socket.sendto(filename.en
code(), server_address)


# Step 3: Receive response

data, addr =
client_socket.recvfrom(4096)


print("\n--- File Content ---
\n")

print(data.decode())


# Step 4: Close socket

client_socket.close()
```

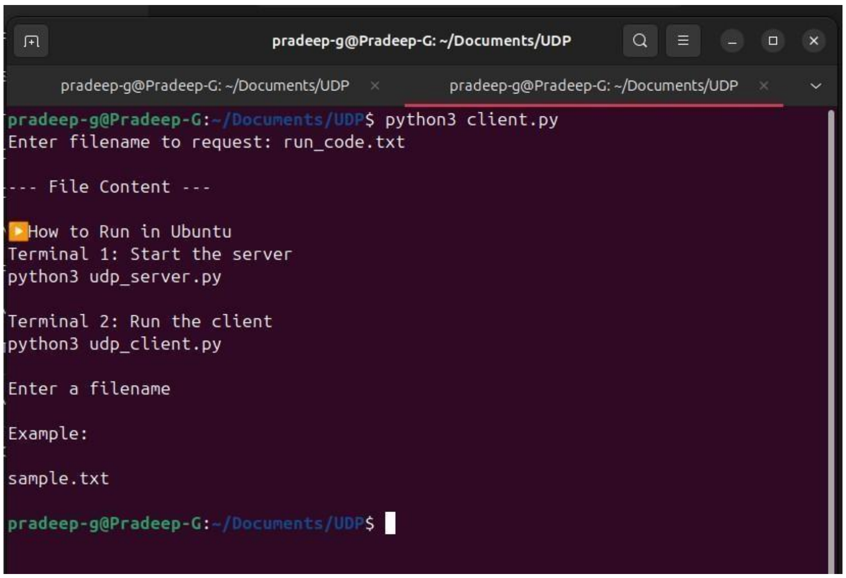
```python
# udp_server.py

import socket

# Step 1: Create UDP socket
server_socket =
socket.socket(socket.AF_INET,
socket.SOCK_DGRAM)

# Step 2: Bind to address and port
server_socket.bind(('localhost',
8081))

print("UDP Server is ready...")

while True:
    # Step 3: Receive filename
from client
    filename, addr =
server_socket.recvfrom(1024)
    filename =
filename.decode().strip()

    print(f"Requested file:
{filename}")

    try:
        # Step 4: Open file and
send content
        with open(filename, 'r')
as f:
            data = f.read()

        server_socket.sendto(data.
encode(), addr)

    except FileNotFoundError:
        server_socket.sendto(b"Fil
e not found on server.", addr)
```

Output:

Server side Terminal:



Client side Terminal:



Program 4:

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

Code:

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

int main() {
    char rem[50], a[50], s[50], c, msj[50], gen[30];
    int i, genlen, t, j, flag = 0, k, n;

    printf("Enter the generation polynomial:\n");
    gets(gen);
    printf("Generator polynomial is CRC-CCITT: %s\n", gen);

    genlen = strlen(gen);
    k = genlen - 1;

    printf("Enter the message:\n");
    n = 0;
    while ((c = getchar()) != '\n') {
        msj[n] = c;
        n++;
    }
    msj[n] = '\0';

    for (i = 0; i < n; i++)
        a[i] = msj[i];
```

```
for (i = 0; i < k; i++)
    a[n + i] = '0';
a[n + k] = '\0';

printf("\nMessage polynomial appended with zeros:\n");
puts(a);

for (i = 0; i < n; i++) {
    if (a[i] == '1') {
        t = i;
        for (j = 0; j <= k; j++) {
            if (a[t] == gen[j])
                a[t] = '0';
            else
                a[t] = '1';
            t++;
        }
    }
}



for (i = 0; i < k; i++)
    rem[i] = a[n + i];
rem[k] = '\0';

printf("Checksum (remainder):\n");
puts(rem);

printf("\nMessage with checksum appended:\n");
for (i = 0; i < n; i++) a[i] = msj[i];
```

```
for (i = 0; i < k; i++) a[n + i] =
rem[i];
         a[n + k] = '\0';
         puts(a);

         n = 0;
         printf("Enter the received message:\n");
         while ((c = getchar()) != '\n') {
             s[n] = c;
             n++;
         }
         s[n] = '\0';

         for (i = 0; i < n; i++) {
             if (s[i] == '1') {
                 t = i;
                 for (j = 0; j <= k; j++, t++) {
                     if (s[t] == gen[j])
                         s[t] = '0';
                     else
                         s[t] = '1';
                 }
             }
         }



         for (i = 0; i < k; i++)
             rem[i] = s[n + i];
         rem[k] = '\0';
for (i = 0; i < k; i++)
```

```
if (rem[i] == '1') flag = 1;
        }

        if (flag == 0)
            printf("Received polynomial is error-free \n");
        else
            printf("Received polynomial contains error \n");

        return 0;
    }
```

Output: