LAB NO :4
WORKING MECHANISM OF LAYER 1 AND LAYER 2 DEVICES

OBJECTIVE:

- The primary objective of this lab is to understand and analyze the working mechanisms of Layer 1 (Physical Layer) and Layer 2 (Data Link Layer) devices in a computer network.

THEORY:

The OSI model is a framework that describes how data moves through a network. It has seven layers, with Layer 1 and Layer 2 being the focus for this lab.

1. Layer 1: Physical Layer

- **Function:** Transmits raw data over physical mediums (cables, etc.).
- **Devices:** Hubs, repeaters, cables.
- **Mechanism:** Moves electrical/optical signals without changing the data.

2. Layer 2: Data Link Layer

- **Function:** Manages data transfer and error detection.
- **Devices:** Switches, bridges.
- **Mechanism:** Uses MAC addresses to direct data and correct errors.

PROCEDURE:

Part 1: Working with Layer 1 Devices

- **Setting Up the Network with Hubs:**
  - Open Cisco Packet Tracer and create a new workspace.
  - From the device list, drag and drop a **hub** onto the workspace.
  - Add at least three **PCs** to the workspace.
  - Connect each PC to the hub using **Copper Straight-Through**
  - Assign **IP addresses** to each PC by clicking on them, going to the **Desktop** tab, selecting **IP Configuration**, and entering IP addresses (e.g., 192.168.56.1, 192.168.56.2, 192.168.56.3).

Part 2: Working with Layer 2 Devices

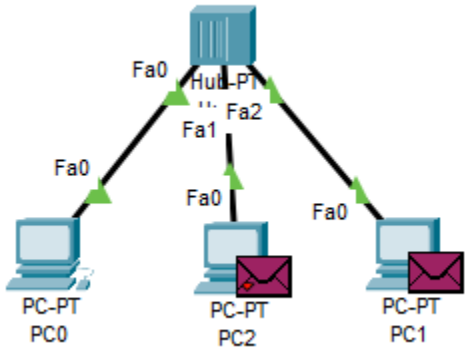
- **Setting Up the Network with Switches:**
  - Open Cisco Packet Tracer and create a new workspace.
  - From the device list, drag and drop a **switch** onto the workspace.
  - Add at least three **PCs** to the workspace.
  - Connect each PC to the switch using **Copper Straight-Through cables**
  - Assign **IP addresses** to each PC by clicking on them, going to the **Desktop** tab, selecting **IP Configuration**, and entering IP addresses (e.g., 192.168.56.1, 192.168.56.2, 192.168.56.3).

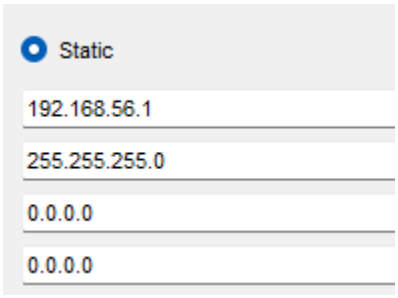
DEMONSTRATION:

LAYER 1 DEVICE: (HUB)

- Assign an IP address to the PC, such as 192.168.56.3.

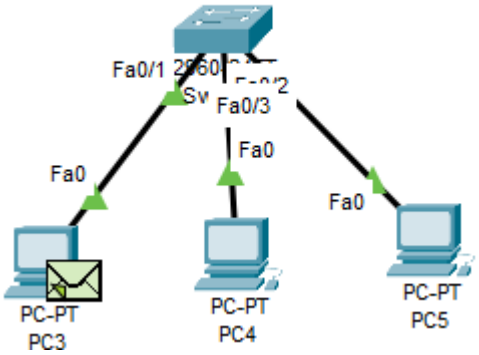
- Select one of the PCs and switch to **Simulation** mode in Cisco Packet Tracer.
- Monitor the data packets. You'll notice that the hub sends the packets to all connected devices, regardless of the target IP address.

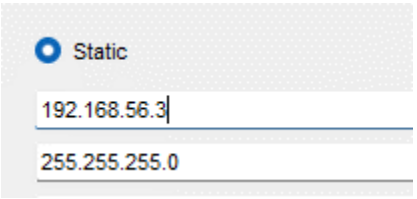




LAYER 2 :(SWITCH)

- Assign an IP address to the PC, such as 192.168.56.3.
- Select one of the PCs and switch to **Simulation** mode in Cisco Packet Tracer.
- Monitor the data packets. Notice that the switch forwards the packets only to the specific device with the matching destination MAC address, avoiding unnecessary broadcasts to all devices.





CONCLUSION:

This lab demonstrated the basic functions of Layer 1 and Layer 2 devices. We observed that hubs (Layer 1) broadcast data to all devices, while switches (Layer 2) intelligently direct data to specific devices, making the network more efficient and reducing data collisions. This understanding is essential for effective network design.

LAB NO :5
CLASSFUL IP ADDRESSING AND THE WORKING MECHANISM OF LAYER 3 DEVICES

OBJECTIVE:

- To understand Classful IP Addressing and examine how Layer 3 devices, like routers, manage and route data between different networks.

THEORY:

1)Classful IP Addressing:

Classful IP addressing is a method where IP addresses are divided into five classes: A, B, C, D, and E. Each class has a specific range of IP addresses and a default subnet mask.

- **Class A:**
  - **Range:** 1.0.0.0 to 126.0.0.0
  - **Default Subnet Mask:** 255.0.0.0
  - **Usage:** Large networks with many devices.
- **Class B:**
  - **Range:** 128.0.0.0 to 191.255.0.0
  - **Default Subnet Mask:** 255.255.0.0
  - **Usage:** Medium-sized networks.
- **Class C:**
  - **Range:** 192.0.0.0 to 223.255.255.0
  - **Default Subnet Mask:** 255.255.255.0
  - **Usage:** Small networks.
- **Class D:** Reserved for multicast.
- **Class E:** Reserved for experimental purposes.

2. Layer 3 Devices (Routers):

Layer 3, the Network Layer, is responsible for routing packets across different networks. Routers are the primary devices operating at this layer.

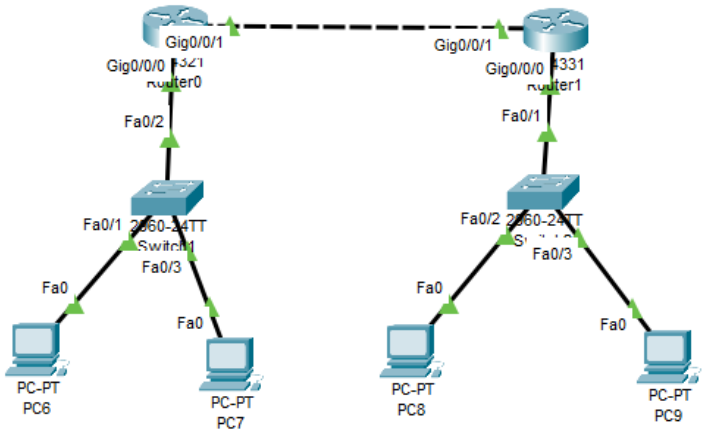
- **Function:** Routers determine the best path for data packets to travel from the source to the destination across different networks.
- **Working Mechanism:** Routers use IP addresses to route data between networks. They forward packets based on the destination IP address, utilizing routing tables and protocols to find the optimal path.

PROCEDURE

Step 1:

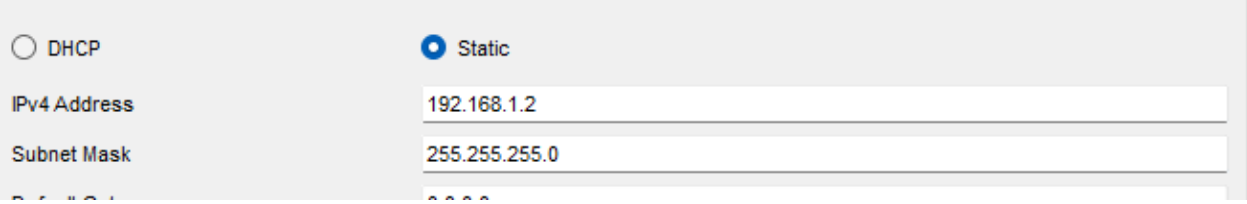
1. **Open Cisco Packet Tracer** and create a new workspace.
2. From the device list, drag and drop a **router** onto the workspace.

3. Add at least two **PCs** and connect them to the router using **Cable.**



Step 2 : Assign Ip address

Pc0: 192.168.1.2/24
Pc1: 192.168.1.3/24
Pc3: 192.168.2.2/24
Pc4: 192.168.2.3/24



Step 3 : Configure the ip address to the router;

Router 0 :

1. (Interface GigabitEthernet0/0/0 -> 192.168.1.1)

```
Sabin(config)#interface g
Sabin(config)#interface gigabitEthernet 0/0/0
Sabin(config-if)#ip address 192.168.1.1 255.255.255.0
Sabin(config-if)#no sh
Sabin(config-if)#no shutdown
```

2. (interface GigabitEthernet 0/0/1 - > 192.168.3.1)

Router 1 :

1) Interface GigabitEthernet 0/0/0 - > 192.168.2.1 (Link between router 0 and router 1)

```
Router#conf
Router#configure ter
Router#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#int
Router(config)#interface br
Router(config)#interface g
Router(config)#interface gigabitEthernet 0/0/0
Router(config-if)#ip address 192.168.2.1 255.255.255.0
Router(config-if)#no sh
Router(config-if)#no shutdown
```

2) Interface GigabitEthernet0/0/1 - > 192.168.3.2 (Link between router 0 and router 1)

Step 3: Configuring router

Router 0:

```
Sabin(config)#ip route 192.168.2.0 255.255.255.0 192.168.3.2
Sabin(config)#ip route 192.168.2.0 255.255.255.0 192.168.3.2
Sabin(config)#
Sabin(config)#ip route 192.168.2.0 255.255.255.0 192.168.3.2
Sabin(config)#
```

Router 1:

```
Router(config)#ip route 192.168.1.0 255.255.255.0 192.168.3.1
Router(config)#ip route 192.168.1.0 255.255.255.0 192.168.3.1
Router(config)#
```

CONCLUSION:

This lab explored classful IP addressing and Layer 3 devices. We saw that classful addressing organizes IPs into classes with fixed subnet masks, while Layer 3 devices like routers use IP addresses to route data between networks efficiently. Understanding these concepts is key for effective network design and management.

LAB NO :6
SUBNETTING

OBJECTIVE:

- To divide the IP address 192.168.56.0/24 into smaller subnets and calculate subnet details using subnetting principles.

THEORY:

Subnetting involves dividing a larger network into smaller, manageable subnets to optimize IP address usage and improve network efficiency. By adjusting the subnet mask, we can create multiple subnets, each with a specific range of IP addresses. The subnet mask determines the number of bits used for network and host portions, affecting the number of subnets and hosts per subnet.

Procedure:

1. **Initial IP Address and Subnet Mask:**
   - IP Address: 192.168.56.0
   - Subnet Mask: /27
2. **Determine New Subnet Mask:**
   - To create 4 subnets, use a /27 subnet mask.
3. **Calculate Subnet Details:**
   - **Subnet 1**: 192.168.56.0/27
     - Usable IP Range: 192.168.56.1 to 192.168.56.30
   - **Subnet 2**: 192.168.56.32/27
     - Usable IP Range: 192.168.56.33 to 192.168.56.62
   - **Subnet 3**: 192.168.56.64/27
     - Usable IP Range: 192.168.56.65 to 192.168.56.94
   - **Subnet 4**: 192.168.56.96/27
     - Usable IP Range: 192.168.56.97 to 192.168.56.127

NETWORK SETUP IN CISCO PACKET TRACER

Step 1 :

- **Open Cisco Packet Tracer:**

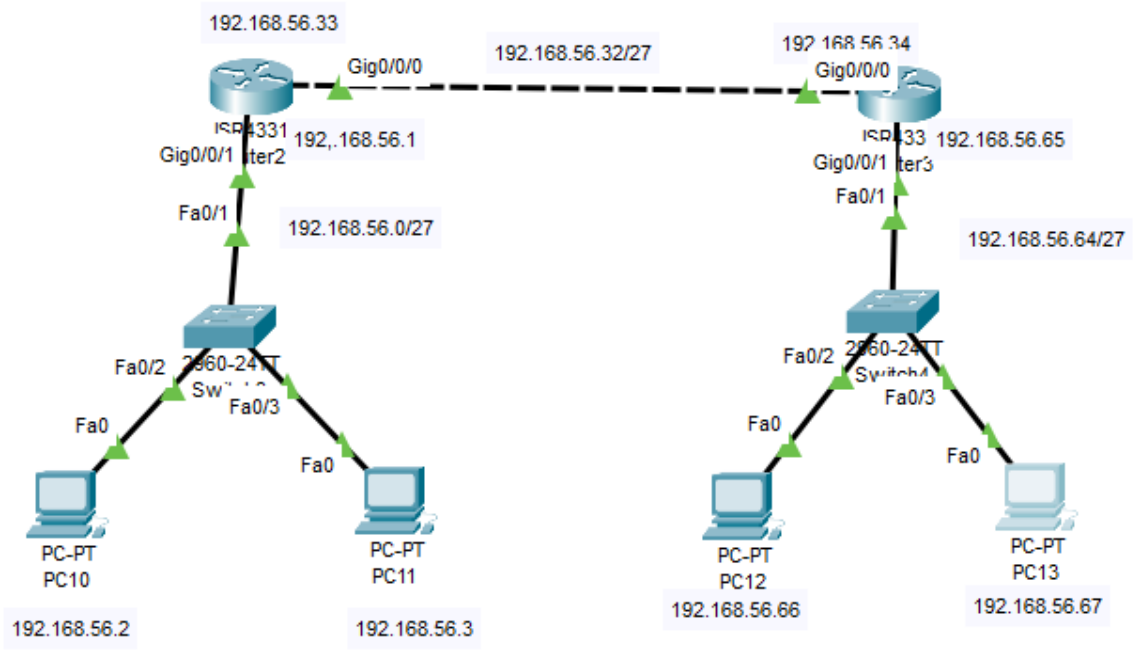
  Launch Cisco Packet Tracer to start designing your network.
- **Add Devices:**

  Routers: Drag and drop routers from the device list onto the workspace.

  Switches: Add switches to connect devices within the same network segment.

  End Devices: Add PCs or servers to the network to act as endpoints.
- **Connect Devices:**

  Use appropriate cables to connect devices:
  - **Copper Straight-Through**: For connecting different types of devices (e.g., PC to switch).
  - **Copper Cross-Over**: For connecting similar devices (e.g., switch to switch).



Step 2 : Assign IP address

Subnet 1 (192.168.56.0/27):

- Router 0 Gig0/0/1: 192.168.56.1

```
Sabin(config)#
Sabin(config)#int
Sabin(config)#interface g
Sabin(config)#interface gigabitEthernet 0/0/1
Sabin(config-if)#ip address 192.168.56.1 255.255.255.224
Sabin(config-if)#no sh
Sabin(config-if)#no shutdown

Sabin(config-if)#
%LINK-5-CHANGED: Interface GigabitEthernet0/0/1, changed state to up
```

Pcs: 192.168.56.2 & 192.168.56.3

Subnet 2 (192.168.56.32/27)

- Router 0 Interface Gig 0/0/0 : 192.168.56.33

```
Sabin#conf
Sabin#configure ter
Sabin#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Sabin(config)#int
Sabin(config)#interface g
Sabin(config)#interface gigabitEthernet 0/0/0
Sabin(config-if)#ip address 192.168.56.33 255.255.255.224
Sabin(config-if)#no sh
Sabin(config-if)#no shutdown
```

Router 1 Interface Gig0/0/0 (Router connection)

```
Router#conf
Router#configure ter
Router#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#int
Router(config)#interface g
Router(config)#interface gigabitEthernet 0/0/0
Router(config-if)#ip address 192.168.56.34 255.255.255.224
Router(config-if)#no sh
Router(config-if)#no shutdown
```

Subnet 3 (192.168.56.64/27)

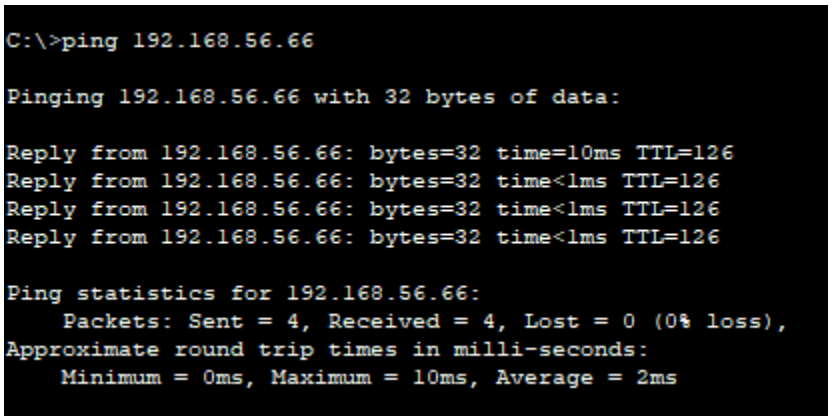
- Router 1 Interface Gig 0/0/1 : 192.168.56.65

```
Router#configure ter
Router#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#int
Router(config)#interface g
Router(config)#interface gigabitEthernet 0/0/1
Router(config-if)#ip address 192.168.56.65 255.255.255.224
Router(config-if)#no sh
Router(config-if)#no shutdown
```

Pcs: 192.168.56.66 & 192.168.56.67

Testing Connectivity:

1. Use PING command for each pc to test connectivity between different subnet.
2. Verify that PC's from different subnet can communicate through router
   for eg : pc 1 (192.168.56.2 Ping 192.168.56.66)



CONCLUSION:

Subnetting 192.168.56.0/24 into 4 subnets with a /26 mask effectively partitions the network into smaller segments, each with 62 usable IP addresses. This process improves IP address management and network efficiency by reducing broadcast traffic and facilitating better network organization.

LAB NO :6
DISTRIBUTED NETWORK AND ROUTING INFORMATION PROTOCOL (RIP)

OBJECTIVE:

- The objective of this lab is to configure a distributed network using three routers and the 192.168.56.0/27 subnet. The goal is to implement Routing Information Protocol (RIP) to enable dynamic routing, ensuring seamless communication between different subnets.

Equivement and Software:

- **Cisco Packet Tracker**
- **3 Router**
- **3 Switch**
- **6 Pcs**

THEORY:

Routing Information Protocol (RIP) is a distance-vector routing protocol used to dynamically exchange routing information between routers. It operates by sending updates to neighboring routers every 30 seconds, using hop count as a metric to determine the best path. In this lab, the network uses the 192.168.56.0/27 subnet, which is divided into smaller subnets. RIP version 2 (RIPv2) is used to allow for more flexible subnetting, enabling routers to automatically share routing tables and efficiently route data across the network.

1. **Initial IP Address and Subnet Mask:**
   - IP Address: 192.168.56.0
   - Subnet Mask: /27
2. **Determine New Subnet Mask:**
   - To create 4 subnets, use a /27 subnet mask.
3. **Calculate Subnet Details:**
   - **Subnet 1: 192.168.56.0/27**
     - Usable IP Range: 192.168.56.1 to 192.168.56.30
   - **Subnet 2: 192.168.56.32/27**
     - Usable IP Range: 192.168.56.33 to 192.168.56.62
   - **Subnet 3: 192.168.56.64/27**
     - Usable IP Range: 192.168.56.65 to 192.168.56.94
   - **Subnet 4: 192.168.56.96/27**
     - Usable IP Range: 192.168.56.97 to 192.168.56.127
   - **Subnet 5: 192.168.56.128/27**
     - Usable IP Range: 192.168.56.129 to 192.168.56.158
   - **Subnet 6: 192.168.56.160/27**
     - Usable IP Range: 192.168.56.161 to 192.168.56.190
   - **Subnet 7: 192.168.56.192/27**
     - Usable IP Range: 192.168.56.193 to 192.168.56.222
   - **Subnet 8: 192.168.56.224/27**
     - Usable IP Range: 192.168.56.225 to 192.168.56.254

NETWORK SETUP IN CISCO PACKET TRACER

Step 1 :

- **Open Cisco Packet Tracer:**

Launch Cisco Packet Tracer to start designing your network.

- **Add Devices:**

  Routers: Drag and drop routers from the device list onto the workspace.

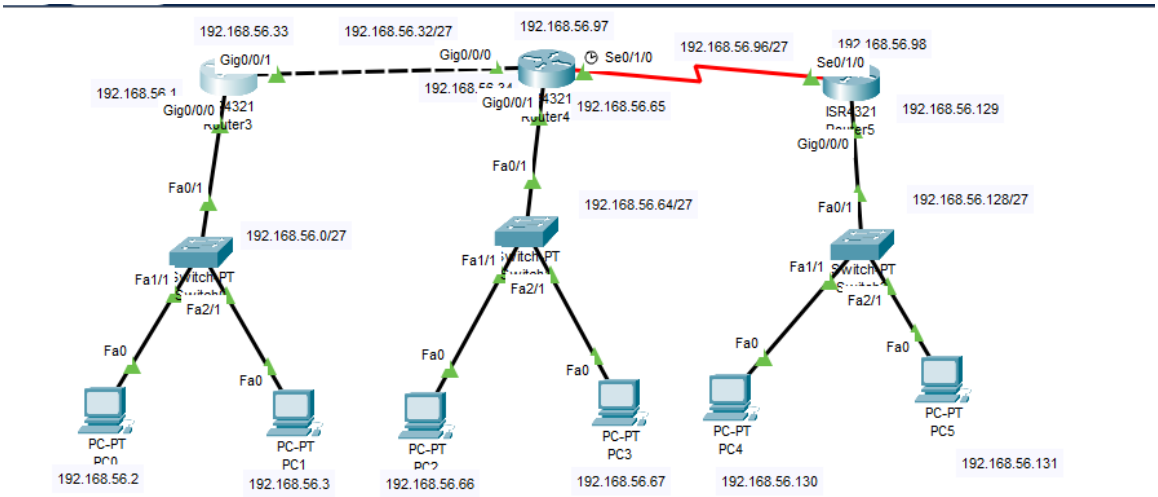
  Switches: Add switches to connect devices within the same network segment.

  End Devices: Add PCs or servers to the network to act as endpoints.

- **Connect Devices:**

  Use appropriate cables to connect devices:

  - **Copper Straight-Through**: For connecting different types of devices (e.g., PC to switch).



Step 2 : Configuration

- **Assign IP address to the router interface according to the subnet scheme.**
- **Enable RIP on each router.**

Router 0 :

1) Interface Gig0/0/0

```
Sabin(config)#
Sabin(config)#int
Sabin(config)#interface g
Sabin(config)#interface gigabitEthernet 0/0/0
Sabin(config-if)#ip address 192.168.56.1 255.255.255.224
Sabin(config-if)#no sh
Sabin(config-if)#no shutdown
```

2) Interface Gig0/0/1

```
Sabin(config)#int
Sabin(config)#interface g
Sabin(config)#interface gigabitEthernet 0/0/1
Sabin(config-if)#ip address 192.168.56.33 255.255.255.224
Sabin(config-if)#no sh
Sabin(config-if)#no shutdown

Sabin(config-if)#
%LINK-5-CHANGED: Interface GigabitEthernet0/0/1, changed state to up
```

Router 1 :

1) Interface Gig0/0/0

```
Sabin(config)#
Sabin(config)#int
Sabin(config)#interface ter
Sabin(config)#interface g
Sabin(config)#interface gigabitEthernet 0/0/0
Sabin(config-if)#ip address 192.168.56.34 255.255.255.224
Sabin(config-if)#no sh
Sabin(config-if)#no shutdown
```

2) Interface Gig0/0/1

```
Sabin#conf
Sabin#configure ter
Sabin#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Sabin(config)#int
Sabin(config)#interface g
Sabin(config)#interface gigabitEthernet 0/0/1
Sabin(config-if)#ip address 192.168.56.65 255.255.255.224
Sabin(config-if)#no sh
```

3) Interface serial 0/1/0

```
Sabin#configure ter
Sabin#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Sabin(config)#int
Sabin(config)#interface s
Sabin(config)#interface serial 0/1/0
Sabin(config-if)#ip address 192.168.56.97 255.255.255.224
Sabin(config-if)#no sh
Sabin(config-if)#no shutdown
```

Router 2 :

1) interface serial 0/1/0

```
Sabin(config)#int
Sabin(config)#interface s
Sabin(config)#interface serial 0/1/0
Sabin(config-if)#ip address 192.168.56.98 255.255.255.224
Sabin(config-if)#no sh
Sabin(config-if)#no shutdown
```

2) interface gig0/0/0

```
Sabin#conf
Sabin#configure ter
Sabin#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Sabin(config)#int
Sabin(config)#interface g
Sabin(config)#interface gigabitEthernet 0/0/0
Sabin(config-if)#ip address 192.168.56.129 255.255.255.224
Sabin(config-if)#no sh
Sabin(config-if)#no shutdown
```

ROUTING INFORMATION PROTOCOL (RIP)

Router 1 :

```
Sabin>enable
Sabin#
Sabin#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Sabin(config)#router rip
Sabin(config-router)#network 192.168.56.0
Sabin(config-router)#
Sabin(config-router)#network 192.168.56.32
Sabin(config-router)#network 192.168.56.64
Sabin(config-router)#exit
```

Router 2:

```
Enter configuration commands, one per line.  End
Sabin(config)#router rip
Sabin(config-router)#network 192.168.56.0
Sabin(config-router)#no network 192.168.56.0
Sabin(config-router)#
Sabin(config-router)#no network 192.168.56.0
Sabin(config-router)#network 192.168.56.0
Sabin(config-router)#network 192.168.56.96
Sabin(config-router)#network 192.168.56.128
Sabin(config-router)#exit
Sabin(config)#exit
Sabin#write
```

Router 3:

```
Sabin#configure ter
Sabin#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Sabin(config)#router rip
Sabin(config-router)#network 192.168.56.96
Sabin(config-router)#network 192.168.56.64
Sabin(config-router)#exit
Sabin(config)#exit
```

Testing Connectivity:

1. Use PING command for each pc to test connectivity between different subnet.
2. Verify that PC's from different subnet can communicate through router
   for eg : pc 1 (192.168.56.2 Ping 192.168.56.130)

```
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 192.168.56.130

Pinging 192.168.56.130 with 32 bytes of data:

Reply from 192.168.56.130: bytes=32 time=13ms TTL=125
Reply from 192.168.56.130: bytes=32 time=1ms TTL=125
Reply from 192.168.56.130: bytes=32 time=2ms TTL=125
Reply from 192.168.56.130: bytes=32 time=1ms TTL=125

Ping statistics for 192.168.56.130:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 1ms, Maximum = 13ms, Average = 4ms

C:\>
```

Routing Table Check

```
Sabin#sh ip route
Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
       i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
       * - candidate default, U - per-user static route, o - ODR
       P - periodic downloaded static route

Gateway of last resort is not set

     192.168.56.0/24 is variably subnetted, 7 subnets, 2 masks
C       192.168.56.0/27 is directly connected, GigabitEthernet0/0/0
L       192.168.56.1/32 is directly connected, GigabitEthernet0/0/0
C       192.168.56.32/27 is directly connected, GigabitEthernet0/0/1
L       192.168.56.33/32 is directly connected, GigabitEthernet0/0/1
R       192.168.56.64/27 [120/1] via 192.168.56.34, 00:00:16, GigabitEthernet0/0/1
R       192.168.56.96/27 [120/1] via 192.168.56.34, 00:00:16, GigabitEthernet0/0/1
R       192.168.56.128/27 [120/2] via 192.168.56.34, 00:00:16, GigabitEthernet0/0/1

Sabin#
```

CONCLUSION:

The lab successfully demonstrated the implementation of a distributed network using rip in Cisco Packet Tracer the network was divided into multiple subnets and the rip protocol was used to ensure connectivity between different subnets. All devices communicated effectively and the RIP routing tables were correctly populated. The lab provided hands-on experience with subnetting, router configuration and the use of RIP in a simulated network environment.