Experiment No: 6
Experiment Name: Study and Implementation of Dynamic Routing Protocols (RIP) Using Cisco Packet Tracer.

Objectives:

- To understand the concept of **dynamic routing** and how it differs from static routing.
- To study the **RIP (Routing Information Protocol)** and its operation in exchanging routing information.
- To configure RIP on Cisco routers using **Cisco Packet Tracer.**
- To observe how RIP automatically updates routing tables between routers.
- To verify connectivity between networks using **ping and traceroute** commands.
- To analyze the advantages and limitations of RIP as a distance-vector routing protocol.
- To troubleshoot RIP-related routing issues in a simulated network environment

What is RIP?

- RIP (Routing Information Protocol) is one of the oldest dynamic routing protocols.
- It's a distance-vector routing protocol that uses hop count as a routing metric.
- Maximum hop count allowed by RIP is 15 (16 is considered unreachable).
- Routers using RIP share their routing tables every 30 seconds.
- RIP supports both IPv4 (RIPv1 and RIPv2) and IPv6 (RIPng).
- RIP v2 supports subnet masks (classless routing) and authentication.
- RIP v1 is classful and does not support VLSM.

Why Use RIP?

- Simple to configure and suitable for small to medium-sized networks.
- Automatically adapts to network changes by sharing routing info.
- Good for learning basic dynamic routing concepts.

Advantages:

- Scalable for large networks.
- Automatically adapts to changes (link failure, new routes).
- Reduces administrative overhead.

Disadvantages:

- Uses more CPU, memory, and bandwidth.
- Can be more complex to configure and troubleshoot.
- Routing loops can occur if not properly managed.

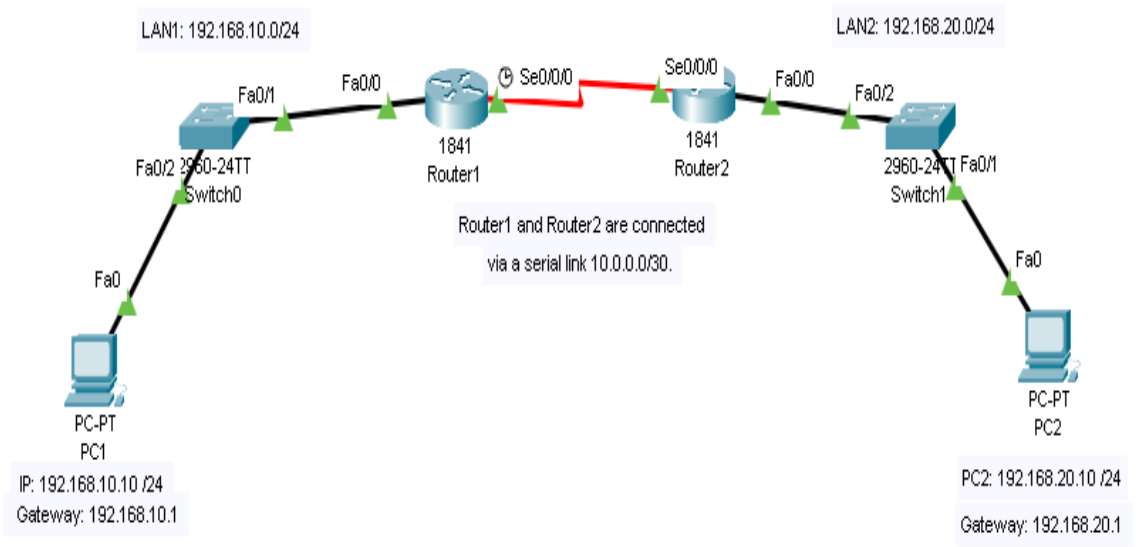
Network Scenario Example-1:

Similar to the static routing example, you have two LANs connected through two routers.

LAN1: 192.168.10.0/24 connected to Router1
LAN2: 192.168.20.0/24 connected to Router2

Router1 and Router2 connected via serial link 10.0.0.0/30.

Network Diagram:



Step 1: Assign IP Addresses and Configure Interfaces

Same as in the static routing example:

On Router1

```
enable
configure terminal
interface FastEthernet0/0
     ip address 192.168.10.1 255.255.255.0
     no shutdown
exit
interface Serial0/0/0
     ip address 10.0.0.1 255.255.255.252
```

```
      no shutdown
exit
```

On Router2

```
enable
configure terminal
interface Serial0/0/0
      ip address 10.0.0.2 255.255.255.252
      no shutdown
exit
interface FastEthernet0/0
      ip address 192.168.20.1 255.255.255.0
      no shutdown
exit
```

Step 2: Enable RIP on Routers

Command for Dynamic Routing

Router(config)# router rip
Router(config-router)# version 2
Router(config-router)# network Network-Address
Router(config-router)# network Network-Address

On **Router1**, enable RIP and advertise connected networks:

```
router rip
version 2
no auto-summary
network 192.168.10.0
network 10.0.0.0
exit
```

On **Router2**, enable RIP similarly:

```
router rip
version 2
no auto-summary
network 192.168.20.0
network 10.0.0.0
exit
```

Notes:

- version 2 enables RIPv2, which supports classless routing and subnet masks.
  - ✓ RIP v2 supports subnet masks (classless routing) and authentication.
  - ✓ RIP v1 is classful and does not support VLSM.
- no auto-summary disables automatic summarization to prevent routing issues in discontiguous networks.

Step 3: Verify RIP Configuration and Routing Table

- Use show ip protocols to verify RIP status.
- Use show ip route to check routing tables — you should see learned routes with an "R" indicating RIP routes.
- From **PC1**, ping **PC2**: ping 192.168.20.10
- From **PC2**, ping **PC1**: ping 192.168.10.10

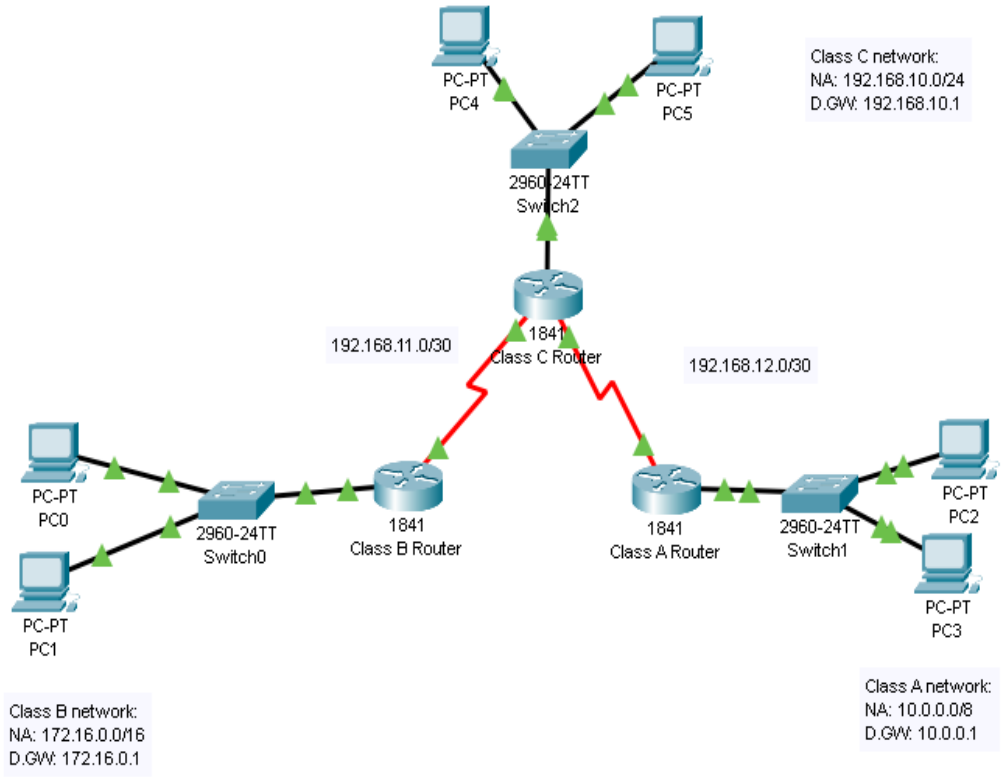
Step 4: Troubleshooting (if needed)

- Use debug ip rip to see RIP updates.
- Confirm interfaces are up (show ip interface brief).
- Confirm IP addresses and subnet masks are correct.
- Ensure routers share a common RIP version (preferably v2).

Summary Table:

Command	Purpose
router rip	Enter RIP routing configuration
version 2	Enable RIP version 2
no auto-summary	Disable automatic summarization
network [network-ip]	Advertise network in RIP
show ip protocols	Check RIP status
show ip route	View routing table
debug ip rip	Monitor RIP packets

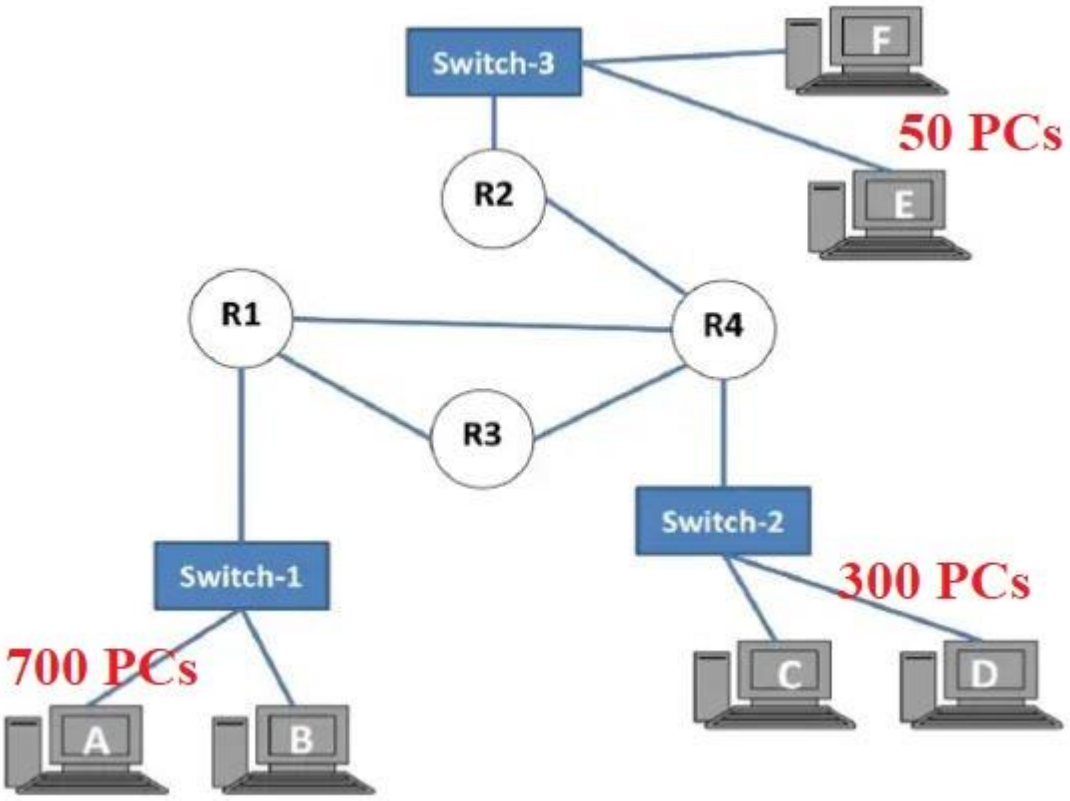
Lab task-1: For the given network scenario, configure dynamic routing (RIP) to enable packet transmission from a PC in one network to PCs in another network.



Hints for Dynamic Routing on R1/Class B Router:

```
router rip
      version 2
      no auto-summary
      network 172.16.0.0
      network 192.168.11.0
exit
```

Network Scenario Example-2: For the given network scenario, configure dynamic routing (RIP) to enable packet transmission from a PC in one network to PCs in another network.



Network Scenario Overview:

Total networks = 6

1. Network A-B (700 PCs)
2. Network C-D (300 PCs)
3. Network E-F (50 PCs)
4. Link between R1-R4
5. Link between R1-R3
6. Link between R2-R4
7. Link between R3-R4

Step 1: Choose a Class C Network

We'll use the **Class C network 192.168.0.0/24** and apply **VLSM** to divide it into required subnets.

Step 2: Calculate Subnets using VLSM

Requirements

Network	Hosts Needed	Subnet Size Needed	CIDR/ Subnet Mask
A-B (700 PCs)	700	2^10=1024	/22
C-D (300 PCs)	300	2^9=512	/23
E-F (50 PCs)	50	2^6=64	/26
R1-R4 (Point-to-Point)	2	2^2=4	/30
R1-R3	2	2^2=4	/30
R2-R4	2	2^2=4	/30
R3-R4	2	2^2=4	/30

VLSM Subnet Allocation

Subnet	Address	CIDR	Usable Hosts	Usage
Subnet A-B	192.168.0.0/22	/22	1022	700 PCs
Subnet C-D	192.168.4.0/23	/23	510	300 PCs
Subnet E-F	192.168.6.0/26	/26	62	50 PCs
R1–R4	192.168.6.64/30	/30	2	P2P Link
R1–R3	192.168.6.68/30	/30	2	P2P Link
R2–R4	192.168.6.72/30	/30	2	P2P Link
R3–R4	192.168.6.76/30	/30	2	P2P Link

Step 3: Assign IP Addresses

PCs Networks:

- **A-B (192.168.0.0/22)**
  - Gateway (R1): 192.168.0.1
- **C-D (192.168.4.0/23)**
  - Gateway (R4): 192.168.4.1
- **E-F (192.168.6.0/26)**
  - Gateway (R2): 192.168.6.1

Router Interfaces:

Link	Router 1 IP	Router 2 IP
R1–R4	192.168.6.65	192.168.6.66
R1–R3	192.168.6.69	192.168.6.70
R2–R4	192.168.6.73	192.168.6.74
R3–R4	192.168.6.77	192.168.6.78

Step 4: Configure RIP v2 on All Routers

RIP only works with **classful boundaries unless no auto-summary is used**, so we use **RIP version 2**.

R1 Configuration

```
router rip
 version 2
 no auto-summary
 network 192.168.0.0
 network 192.168.6.64
 network 192.168.6.68
```

R2 Configuration

```
router rip
 version 2
 no auto-summary
 network 192.168.6.0
 network 192.168.6.72
```

R3 Configuration

```
router rip
 version 2
 no auto-summary
 network 192.168.6.68
 network 192.168.6.76
```

R4 Configuration

```
router rip
 version 2
 no auto-summary
 network 192.168.4.0
 network 192.168.6.72
 network 192.168.6.76
```

Step 5: Final Checklist

Task	Status
Subnetting with VLSM	✓ Done
Unique IPs assigned	✓ Done
RIP v2 enabled	✓ Done
No auto-summary used	✓ Done
Routers know all subnets	✓ Done
Communication between PCs	✓ Possible

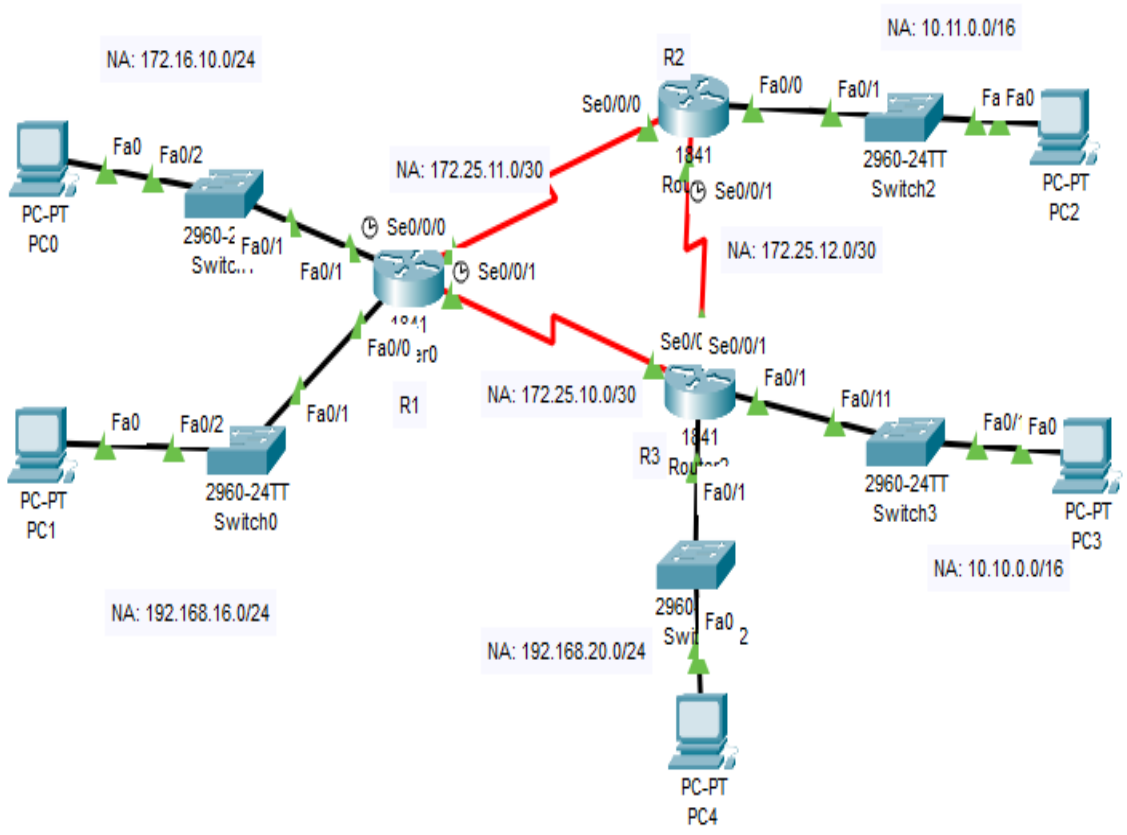
Step 6: Test Connectivity

On PC A (in network A-B), ping:

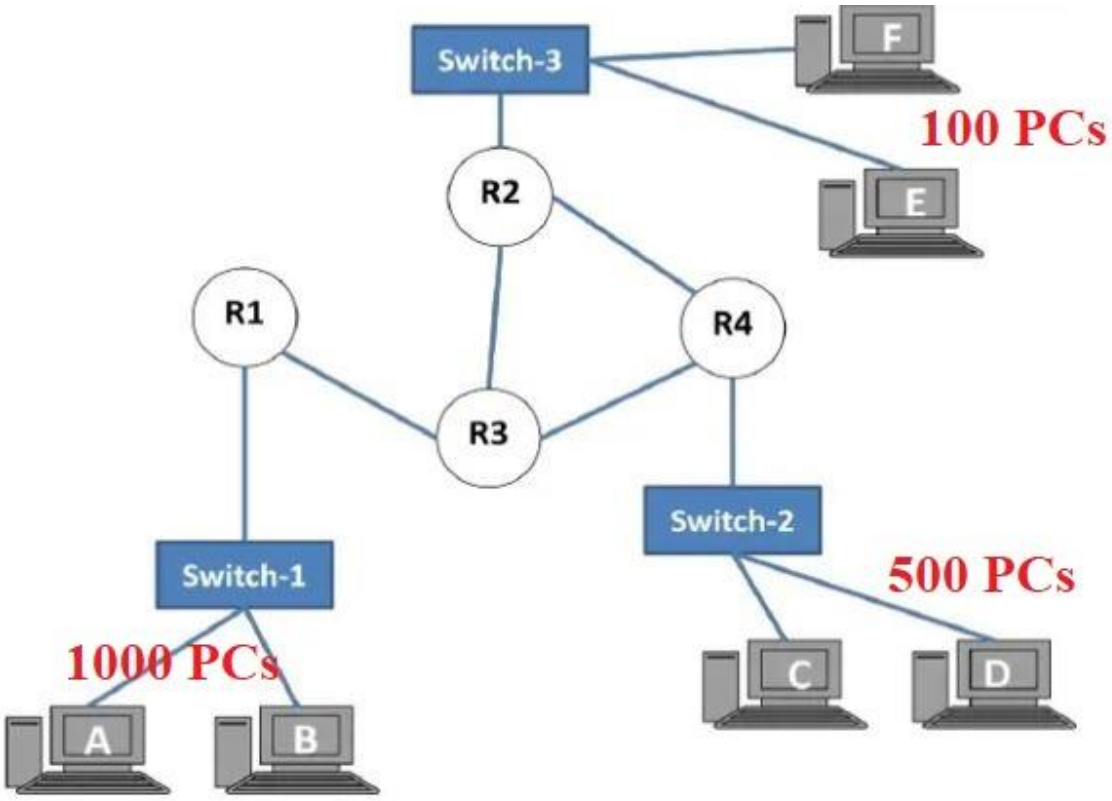
```
ping 192.168.4.10  (PC in C-D)
ping 192.168.6.10  (PC in E-F)
```

If routing is set correctly, you should get successful replies.

Lab task-2: For the given network scenario, configure dynamic routing (RIP) to enable packet transmission from a PC in one network to PCs in another network.



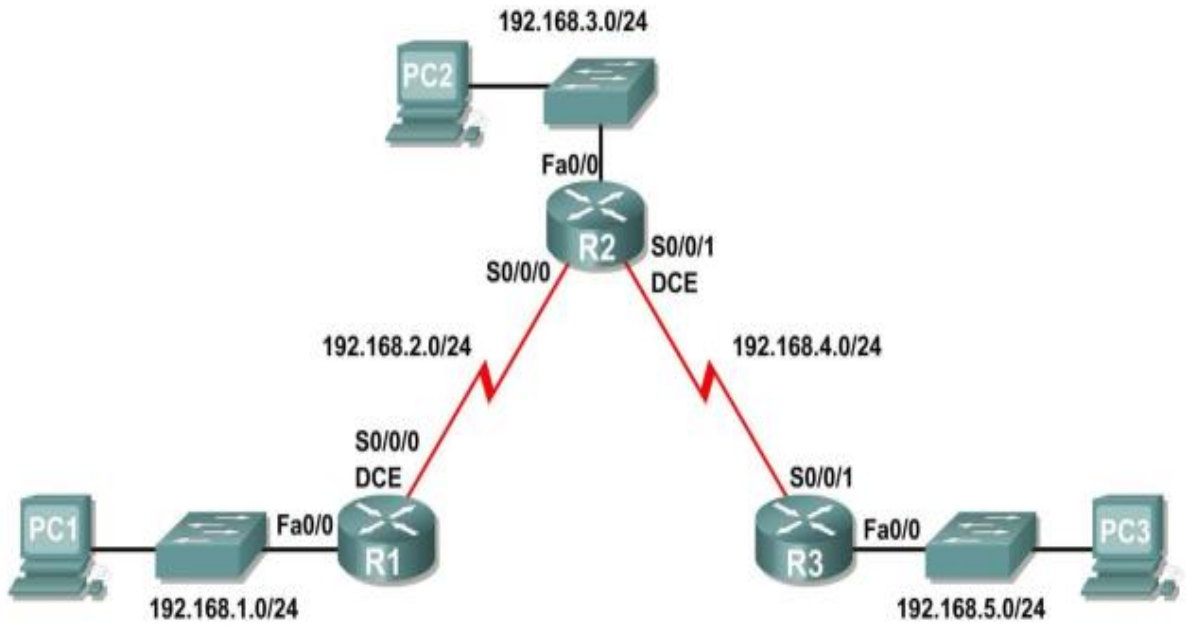
Lab task-3: For the given network scenario, configure dynamic routing (RIP) to enable packet transmission from a PC in one network to PCs in another network.



Lab task-4:

Scenario A: Running RIPv1 on Classful Networks

Topology Diagram



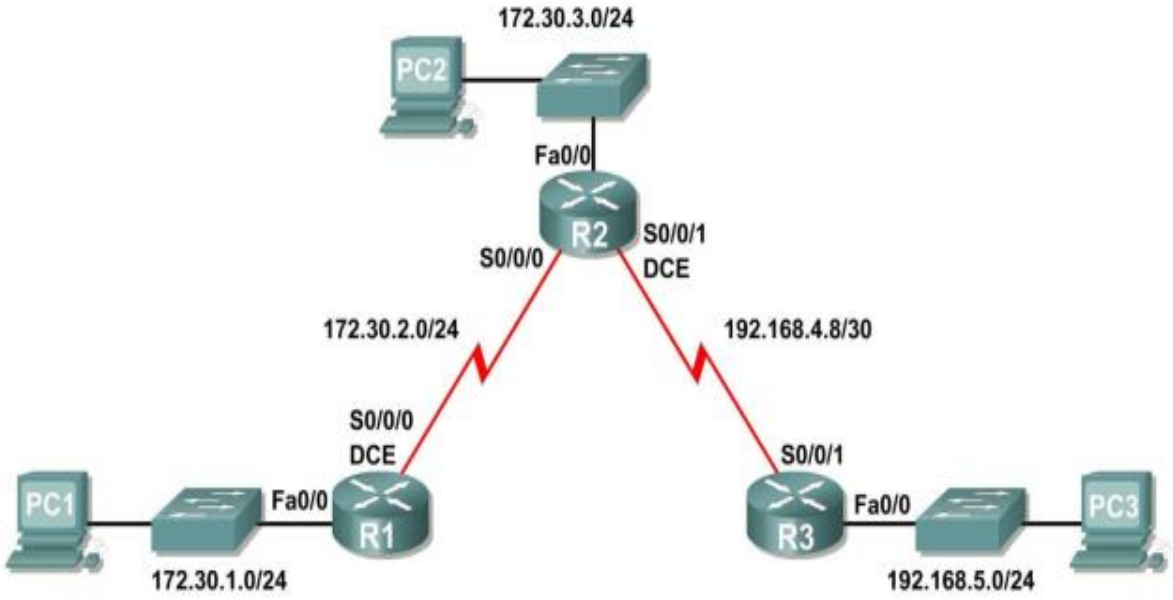
Addressing Table:

Device	Interface	IP Address	Subnet Mask	Default Gateway
R1	Fa0/0	192.168.1.1	255.255.255.0	N/A
	S0/0/0	192.168.2.1	255.255.255.0	N/A
R2	Fa0/0	192.168.3.1	255.255.255.0	N/A
	S0/0/0	192.168.2.2	255.255.255.0	N/A
	S0/0/1	192.168.4.2	255.255.255.0	N/A
R3	Fa0/0	192.168.5.1	255.255.255.0	N/A
	S0/0/1	192.168.4.1	255.255.255.0	N/A
PC1	NIC	192.168.1.10	255.255.255.0	192.168.1.1
PC2	NIC	192.168.3.10	255.255.255.0	192.168.3.1
PC3	NIC	192.168.5.10	255.255.255.0	192.168.5.1

Lab task-5:

Scenario B: Running RIPv2 with Subnets and Between Classless Networks

Topology Diagram



Addressing Table:

Device	Interface	IP Address	Subnet Mask	Default Gateway
R1	Fa0/0	172.30.1.1	255.255.255.0	N/A
	S0/0/0	172.30.2.1	255.255.255.0	N/A
R2	Fa0/0	172.30.3.1	255.255.255.0	N/A
	S0/0/0	172.30.2.2	255.255.255.0	N/A
	S0/0/1	192.168.4.9	255.255.255.252	N/A
R3	Fa0/0	192.168.5.1	255.255.255.0	N/A
	S0/0/1	192.168.4.10	255.255.255.252	N/A
PC1	NIC	172.30.1.10	255.255.255.0	172.30.1.1
PC2	NIC	172.30.3.10	255.255.255.0	172.30.3.1
PC3	NIC	192.168.5.10	255.255.255.0	192.168.5.1