Experiment No: 5
Experiment Name: Study and Implementation of Static Routing (Classfull and Classless) Using Cisco Packet Tracer.

Objectives:

- To understand the concept and importance of static routing in computer networks.
- To understand the concept and importance of static routing with VLSM Subnetting.
- To design and configure a simple network topology using Cisco Packet Tracer.
- To implement static routes manually on routers for inter-network communication.
- To verify connectivity and analyze packet flow using simulation tools.
- To develop basic troubleshooting skills in static routing configuration.

What is Static Routing?

- **Static routing** is a manual method of routing where routes are manually configured on routers.
- The network administrator defines explicit paths for traffic.
- It's simple and works well for small or stable networks.
- Unlike dynamic routing, static routes do not change automatically.

Why use Static Routing?

- Easy to configure in small networks.
- No CPU or bandwidth overhead as with dynamic routing protocols.
- Useful for security, control, or when routes are fixed.

Advantages:

- Simple for small networks.
- Predictable and secure because routes don't change automatically.
- Low CPU and memory usage.

Disadvantages:

- Not scalable for large networks.
- Requires manual updates if the network topology changes.
- Can lead to human errors.

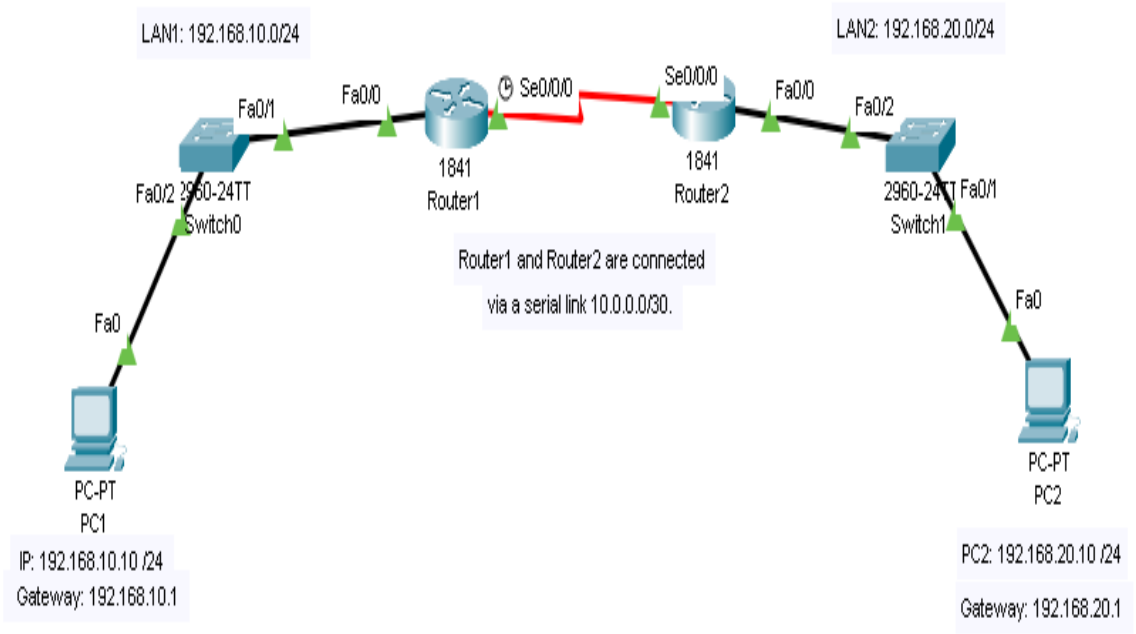
Network Scenario Example-1:

Assume you have two LANs connected via two routers.

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

Router1 and Router2 are connected via a serial link 10.0.0.0/30.

Network Diagram:



Step 1: Assign IP Addresses

- PC1: 192.168.10.10 /24, Gateway: 192.168.10.1
- Router1 (Fa0/0): 192.168.10.1 /24
- Router1 (Serial0/0/0): 10.0.0.1 /30
- Router2 (Serial0/0/0): 10.0.0.2 /30
- Router2 (Fa0/0): 192.168.20.1 /24
- PC2: 192.168.20.10 /24, Gateway: 192.168.20.1

Step 2: Configure Interfaces on Routers

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 3: Configure Static Routes

Command for Static Routing

Router(config)# ip route Network_Address Subnet_Mask Next_Hop_Address

On **Router1**, add route to LAN2 via Router2's serial IP:

```
ip route 192.168.20.0 255.255.255.0 10.0.0.2
```

On **Router2**, add route to LAN1 via Router1's serial IP:

```
ip route 192.168.10.0 255.255.255.0 10.0.0.1
```

Step 4: Verify the Configuration

- Use show ip route on routers to check static routes.
- From PC1, ping PC2: ping 192.168.20.10
- From PC2, ping PC1: ping 192.168.10.10

If pings are successful, static routing works!

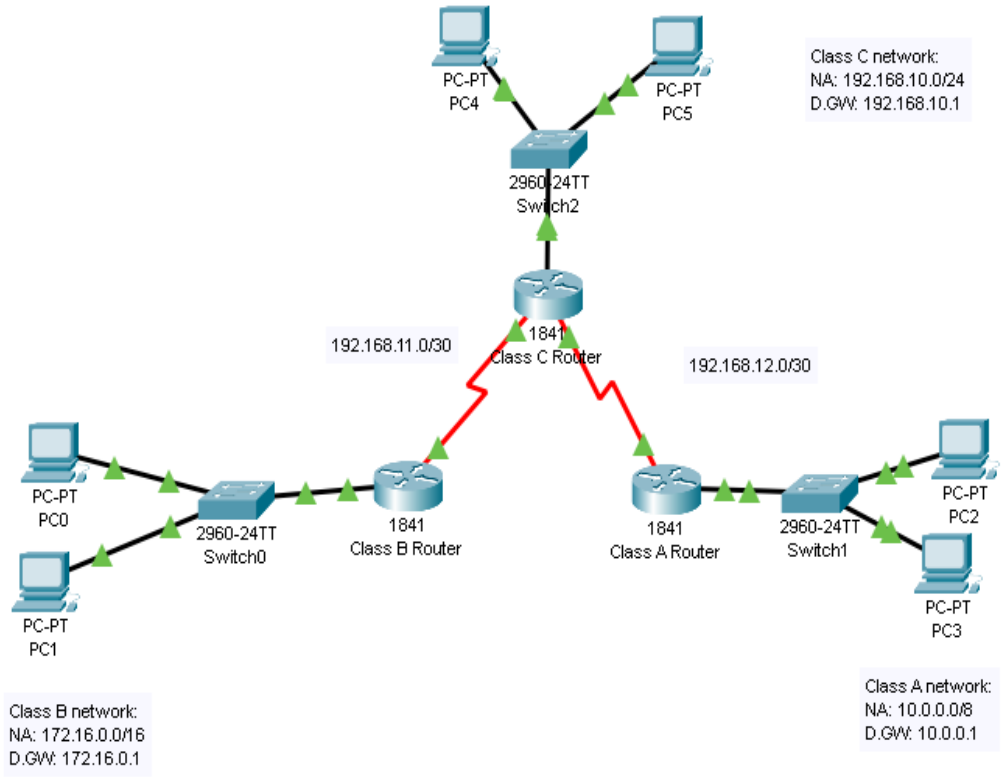
Additional Tips:

- Make sure interfaces are **not administratively down**.
- Use show ip interface brief to check interface status.
- Use debug ip routing to troubleshoot if routes are not working.
- In Packet Tracer, add cables properly (copper straight-through for PC to switch, serial for router-router).

Summary:

Step	Description
Assign IPs	Configure IPs on PCs and Routers
Configure Interfaces	Enable and set IP addresses
Add Static Routes	Use ip route commands
Test Connectivity	Use ping to verify connectivity

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



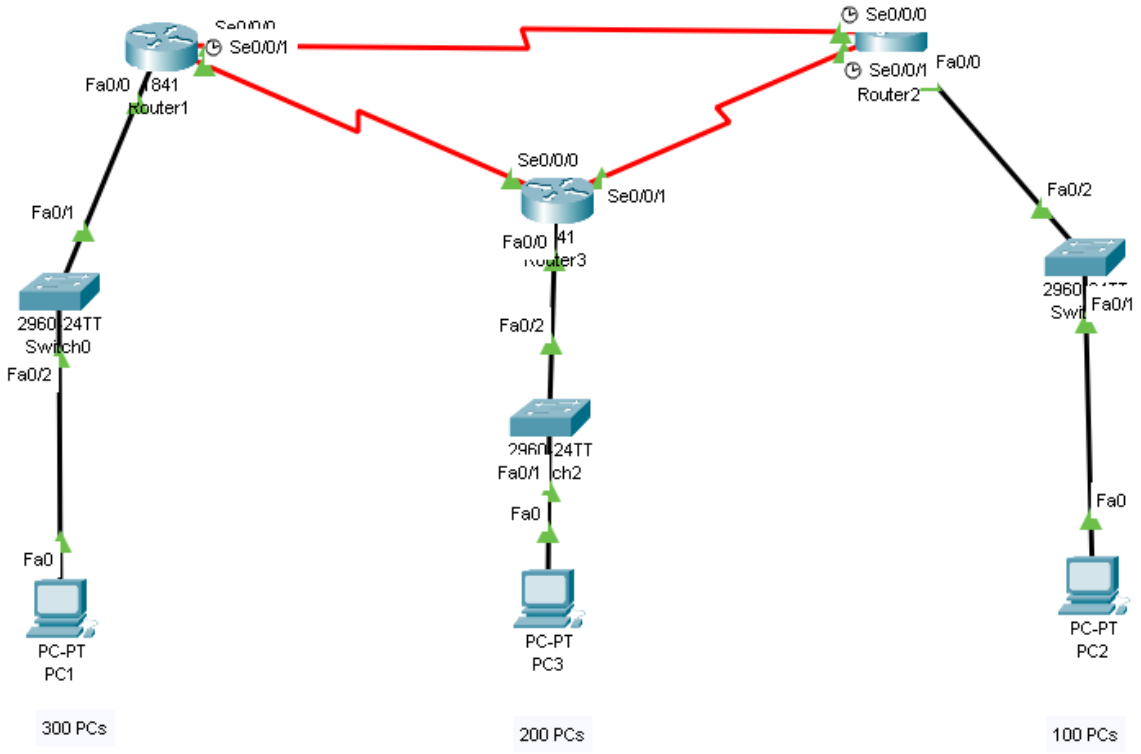
Hints for Static Routing on R1/Class B Router:

```
ip route 192.168.10.0 255.255.255.0 192.168.11.1
ip route 192.168.12.0 255.255.255.252 192.168.11.1
ip route 10.0.0.0 255.0.0.0 192.168.11.1
```

Network Scenario Example-2:

Consider the followings:
Network 1: 300 PCs
Network 2: 200 PCs
Network 3: 100 PCs
Router-to-Router Links (Point-to-Point): Needs 6 IPs

Network Diagram:



Step 1: VLSM Subnetting (Base Network: 192.168.10.0/24)

Network	Hosts Required	Subnet Mask	Subnet Address	Usable IP Range	Notes
Network 1	300	/23	192.168.10.0/23	192.168.10.1 – 192.168.11.254	Supports 510 hosts
Network 2	200	/24	192.168.12.0/24	192.168.12.1 – 192.168.12.254	Supports 254 hosts
Network 3	100	/25	192.168.13.0/25	192.168.13.1 – 192.168.13.126	Supports 126 hosts
Router-to-Router Link 1	2	/30	192.168.20.0/30	192.168.20.1 – 192.168.20.2	2 usable IPs for point-to-point
Router-to-Router Link 2	2	/30	192.168.20.4/30	192.168.20.5 – 192.168.20.6	2 usable IPs for point-to-point
Router-to-Router Link 3	2	/30	192.168.20.8/30	192.168.20.9 – 192.168.20.10	2 usable IPs for point-to-point

Step 2: Assign IP Addresses

- **Network 1 (LAN1)**
  - PCs: 192.168.10.10 – 192.168.10.20, Gateway: 192.168.10.1
  - Router1 (LAN Interface): 192.168.10.1/23
- **Network 2 (LAN2)**
  - PCs: 192.168.12.10 – 192.168.12.20, Gateway: 192.168.12.1
  - Router2 (LAN Interface): 192.168.12.1/24
- **Network 3 (LAN3)**
  - PCs: 192.168.13.10 – 192.168.13.20, Gateway: 192.168.13.1
  - Router3 (LAN Interface): 192.168.13.1/25
- **Router-to-Router Links**
  - R1–R2: 192.168.20.0/30 → R1=192.168.20.1, R2=192.168.20.2
  - R2–R3: 192.168.20.4/30 → R2=192.168.20.5, R3=192.168.20.6
  - R1–R3: 192.168.20.8/30 → R1=192.168.20.9, R3=192.168.20.10

Step 3: Configure Routers

Example Commands (Router1):

```
enable
configure terminal
interface fa0/0
 ip address 192.168.10.1 255.255.254.0
 no shutdown
exit
interface s0/0/0
```

```
 ip address 192.168.20.1 255.255.255.252
 no shutdown
exit
interface s0/0/1
 ip address 192.168.20.9 255.255.255.252
 no shutdown
exit
```

(Similar for Router2 & Router3 with their respective IPs.)

Router2 Configuration

```
enable
configure terminal

! LAN interface for Network 2
interface fa0/0
 ip address 192.168.12.1 255.255.255.0
 no shutdown
exit

! Serial link to Router1
interface s0/0/0
 ip address 192.168.20.2 255.255.255.252
 no shutdown
exit

! Serial link to Router3
interface s0/0/1
 ip address 192.168.20.5 255.255.255.252
 no shutdown
exit
```

Router3 Configuration

```
enable
configure terminal

! LAN interface for Network 3
interface fa0/0
 ip address 192.168.13.1 255.255.255.128
 no shutdown
exit

! Serial link to Router2
```

```
interface s0/0/0
 ip address 192.168.20.6 255.255.255.252
 no shutdown
exit

! Serial link to Router1
interface s0/0/1
 ip address 192.168.20.10 255.255.255.252
 no shutdown
exit
```

Step 4: Configure Static Routes

Router1:

```
ip route 192.168.12.0 255.255.255.0 192.168.20.2
ip route 192.168.13.0 255.255.255.128 192.168.20.10
```

Router2:

```
ip route 192.168.10.0 255.255.254.0 192.168.20.1
ip route 192.168.13.0 255.255.255.128 192.168.20.6
```

Router3:

```
ip route 192.168.10.0 255.255.254.0 192.168.20.9
ip route 192.168.12.0 255.255.255.0 192.168.20.5
```

Step 5: Verify Configuration

- Use ping from PC in Network 1 to PC in Network 2 & 3.
- Use tracert to observe routing paths.
- Use show ip route on each router to verify static routes.

Summary

Step	Description
Assign IPs	Allocate subnets using VLSM (Class C)
Configure Router	Enable interfaces and assign IPs
Add Routes	Configure static routes for all LANs
Test Connectivity	Verify using ping & show ip route

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