NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

DEPARTMENT OF COMPUTER SCIENCE

COMPUTER NETWORKS LAB

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Lab	04
Course	Computer Networks
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🌐 Lab – 04

Performing Initial Router Configuration

💡 Warm-Up Task

(Answer each question in your own words — 3 to 4 lines.)

📡 1. What is a Router?

A **router** is a networking device that connects multiple networks and forwards data packets between them. It determines the most efficient route for information to travel. Think of it as a **digital traffic controller** that directs data to its correct destination.

⚙️ 2. Features of Routers

Routers come with various features that make networking smooth and secure:

- **IP Address Assignment** – Allocates IPs to connected devices.
- 🌐 **Internet Sharing** – Distributes internet access among users.
- 🔒 **Firewall & Security** – Protects against unauthorized access.
- 📶 **Wired & Wireless Support** – Provides both Ethernet and Wi-Fi connectivity.
- **Routing Protocols** – Ensures efficient and accurate data delivery.

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3. Types of Routers

Routers are categorized based on their use and functionality:

🔌 **Wired Router** – Uses Ethernet cables for connectivity.
📡 **Wireless Router** – Connects devices via Wi-Fi.
🏢 **Core Router** – Operates within large, high-speed backbone networks.
🌉 **Edge Router** – Connects internal networks to external ones like the internet.

🏭 4. Popular Router Brands

Several companies design and manufacture high-quality routers:

Cisco – Industry leader in enterprise networking.
TP-Link – Reliable and affordable for home networks.
Netgear – Known for user-friendly and durable routers.
D-Link – Offers versatile networking solutions.
Huawei – Advanced routers with global reach.
Asus – Popular for gaming and high-speed performance.

🚚 5. What is a Routing Table?

A **routing table** is an internal database maintained by a router that stores information about possible network paths. It helps determine the **best route** for forwarding each data packet to its destination efficiently.

🟩 6. OSI Layer Used by Routers

Routers operate at **Layer 3 – the Network Layer** of the **OSI model**. This layer handles **logical addressing (IP addresses)** and makes decisions about **path selection and packet forwarding** across networks.

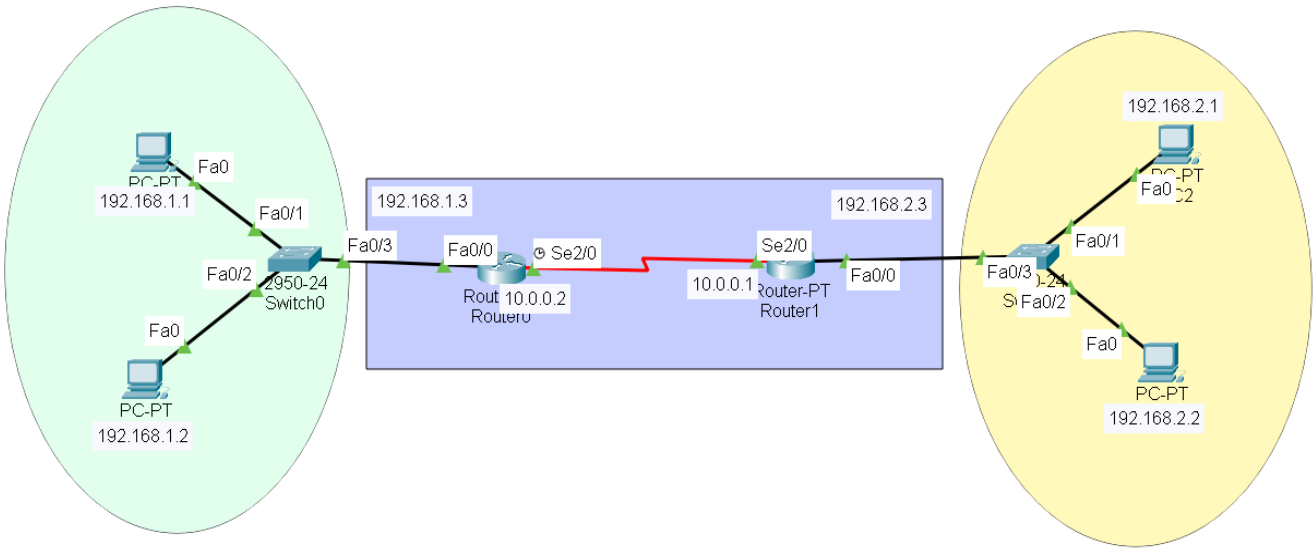
🌐 7. What is a Default Gateway?

A **default gateway** is the **access point or router** that allows devices on a local network to communicate with other networks, including the internet. It acts as the **exit path** for data leaving the local network.

✨ Summary

Routers are essential components of modern networking. They manage traffic flow, connect networks, and ensure data travels securely and efficiently between devices and the internet. 🌍💻🔗

Task 1: Creating the Topology Diagram



Objective:
Use Cisco Packet Tracer to create a simple network topology by connecting the following devices:

PC
Switch (2950-24)
Router (Generic-PT)

Basic Router configuration

1. Continue with configuration dialog? [yes/no]: no

2. Press RETURN to get started! Press enter button

3. Router>en (enable)

4. Router#config t (configure terminal)

5. Router(config)#int fa0/0 (interface FastEthernet0/0)

6. Router(config-if)#ip address 192.168.1.3 255.255.255.0

7. no shut (no shutdown)

8. Router(config-if)#exit

9. Router(config)#

10. Router#config t

11. Router(config)#int se2/0 (Interface Serial2/0)

12. Router(config-if)#ip address 10.0.0.2 255.0.0.0

13. no shut (no shutdown)

14. exit

15. exit

ANSWER:

STEPS TO DO STATIC ROUTING:

1. First enable router.
2. Then configure terminal.
3. Then assign FastEthernet Ip to LAN interface of router 1.

4. Then write no shutdown to make it step up.
5. After that assign Serial interface Ip to router1.
6. Now do again write no shutdown.

FastEthernet:

```
Router>enable
Router#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#int
Router#
%SYS-5-CONFIG_I: Configured from console by console

Router#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#interface fastEthernet0/0
Router(config-if)#ip address 192.168.1.3 255.255.255.0
Router(config-if)#no shutdown

Router(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
exit
```

Serial Interface2/0:

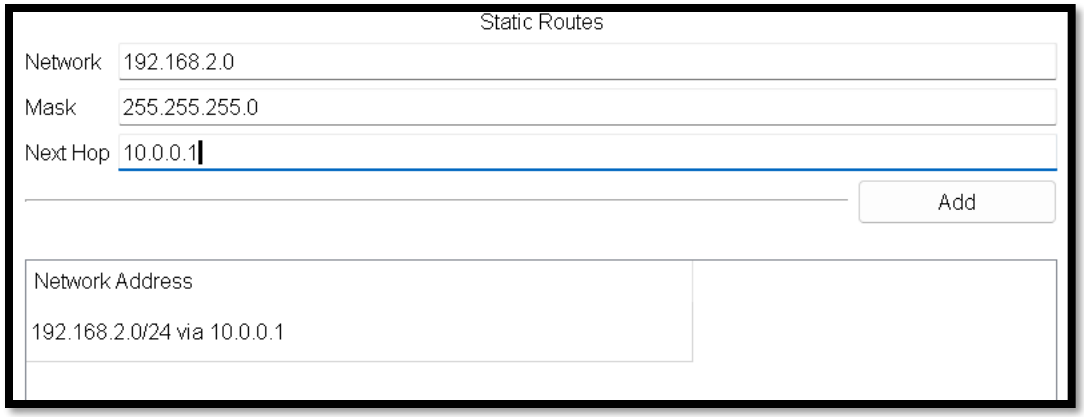
```
Router>enable
Router#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#interface Se2/0
Router(config-if)#ip address 10.0.0.2 255.255.255.252
Router(config-if)#no shutdown
Router(config-if)#exit
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console
```

Default gateway of router 1 :

CLI:

```
Router(config)#ip route 192.168.2.0 255.255.255.0 10.0.0.1
Router(config)#
```

STATIC:



Now we are going to ping LAN1 pc's to check if they are working internally:

```
Pinging 192.168.1.2 with 32 bytes of data:

Reply from 192.168.1.2: bytes=32 time=1ms TTL=128
Reply from 192.168.1.2: bytes=32 time<1ms TTL=128
Reply from 192.168.1.2: bytes=32 time<1ms TTL=128
Reply from 192.168.1.2: bytes=32 time<1ms TTL=128

Ping statistics for 192.168.1.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 1ms, Average = 0ms

C:\>
```

So yes it is working.

Router 2:

FastEthernet 0/0:

```
Router>enable
Router#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#interface fastEthernet 192.168.2.3 255.255.255.0
                                                  ^
% Invalid input detected at '^' marker.

Router(config)#interface fastEthernet0/0
Router(config-if)#ip address 192.168.2.3 255.255.255.0
Router(config-if)#no shutdown

Router(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
exit
Router(config)#exit
```

Serial Interface2/0:

```
Router#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#interface Se2/0
Router(config-if)#ip address 10.0.0.1 255.255.255.252
Router(config-if)#no shutdown
Router(config-if)#exit
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console
exit
```

Default gateway of router2:

CLI:

```
Router(config)#ip route 192.168.1.0 255.255.255.0 10.0.0.2
Router(config)#
```

STATIC by GUI:

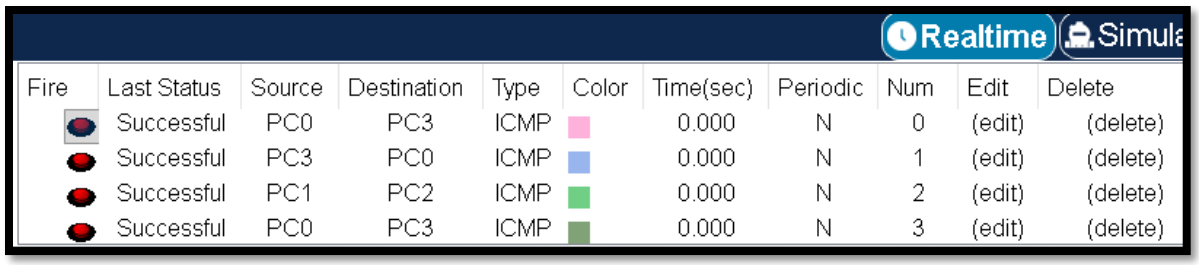
Now are going to ping pc of LAN 2 internally to verify they are working:

```
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 192.168.2.2

Pinging 192.168.2.2 with 32 bytes of data:

Reply from 192.168.2.2: bytes=32 time=12ms TTL=128
Reply from 192.168.2.2: bytes=32 time<1ms TTL=128
Reply from 192.168.2.2: bytes=32 time<1ms TTL=128
Reply from 192.168.2.2: bytes=32 time<1ms TTL=128

Ping statistics for 192.168.2.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 12ms, Average = 3ms

C:\>
```

So yes they are working internally.

Sending packet from pc 1(LAN 1) to pc 2 (LAN 2) :

Now you can see that we can route across different computers of both networks:



TASK 2

Task 2: Draw given topology diagrams and attach screen shots of Pcs communication

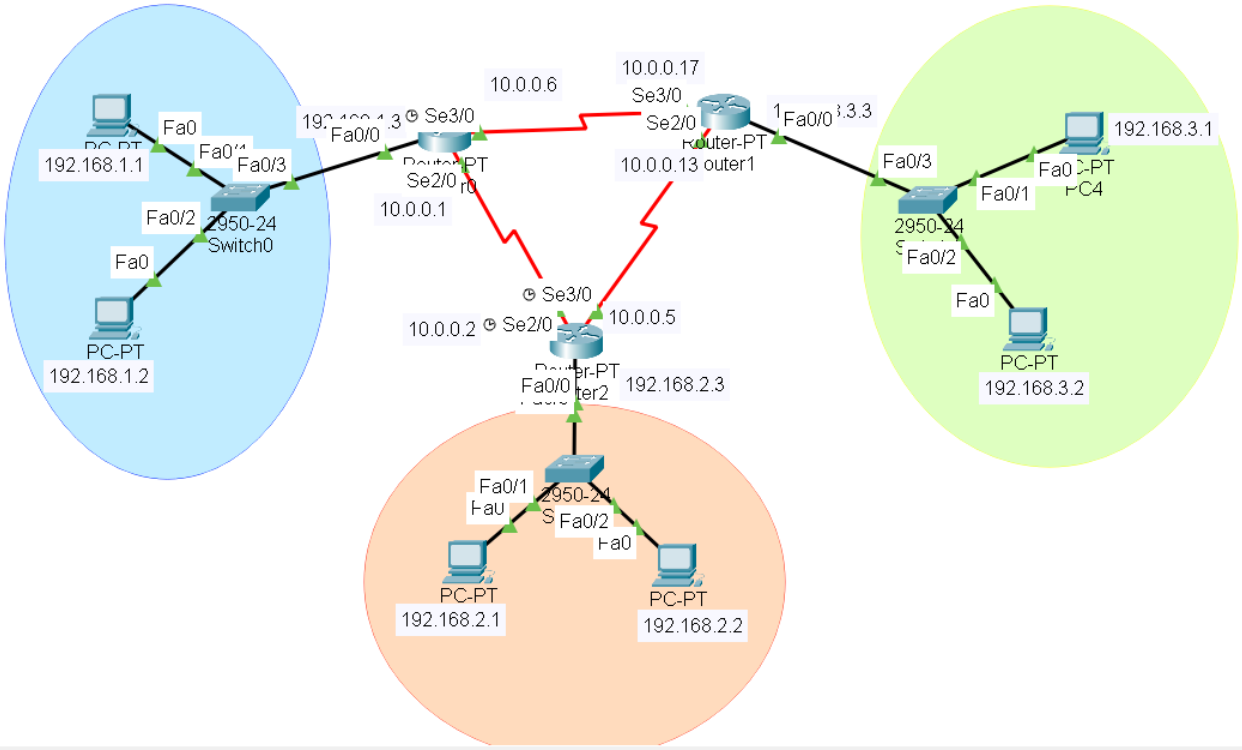
- **Label each device with a unique ip address.**
- **Highlight different sections**
- **Divide given topology in three different networks**
- **Ping one laptop to other network laptops.**
- **Send packets (Real time).**
- **Send packets(Simulation).**
- **Take screen shots of routing table of each router**

· **Take screen shots of routers configurations**

· **Assign routes through router configuration**

SOLUTION:

Task 1: Creating the Topology Diagram



Configuring Router1(Fastethernet and Serial):

```
Router>enable
Router#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#interface fastEthernet0/0
Router(config-if)#ip address 192.168.1.3 255.255.255.0
Router(config-if)#no shutdown
Router(config-if)#exit
Router(config)#interface Se2/0
Router(config-if)#ip address 10.0.0.1 255.255.255.0
% 10.0.0.0 overlaps with Serial3/0
Router(config-if)#no shutdown
Router(config-if)#exit
Router(config)#interface Se3/0
Router(config-if)#ip address 10.0.0.6 255.255.255.252
Router(config-if)#no shutdown
Router(config-if)#exit
Router(config)#interface Se2/0
Router(config-if)#ip address 10.0.0.1 255.255.255.252
Router(config-if)#no shutdown
Router(config-if)#exit
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console
```

Configuring Router 2 (Fastethernet and Serial):

```
Router>enabel
Translating "enabel"...domain server (255.255.255.255)
% Unknown command or computer name, or unable to find computer
address

Router>enable
Router#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#interface fastEthernet0/0
Router(config-if)#ip address 192.168.2.3 255.255.255.0
Router(config-if)#no shutdown
Router(config-if)#exit
Router(config)#interface Se2/0
Router(config-if)#ip address 10.0.0.2 255.255.255.252
Router(config-if)#no shutdown

Router(config-if)#
%LINK-5-CHANGED: Interface Serial2/0, changed state to up
exit
Router(config)#
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial2/0, changed
state to up

Router(config)#interface Se3/0
Router(config-if)#ip address 10.0.0.5 255.255.255.252
Router(config-if)#no shutdown

%LINK-5-CHANGED: Interface Serial3/0, changed state to down
Router(config-if)#clock rate 2000000
Router(config-if)#no shutdown
Router(config-if)#exit
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console
```

Configuring Router3 (Fastethernet and Serial):

FastEthernet0/0:

```
Router>enable
Router#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#interface fastEthernet0/0
Router(config-if)#ip address 192.168.3.3 255.255.255.0
Router(config-if)#no shutdown

Router(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
```

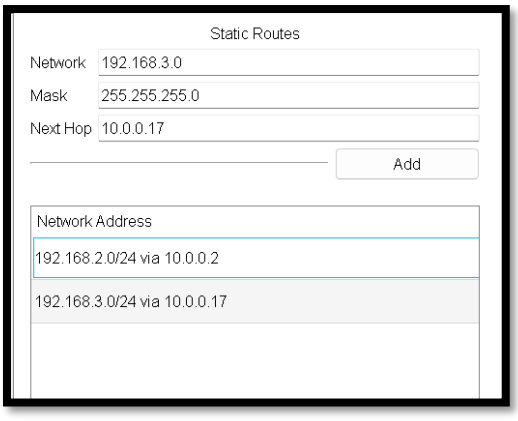
Serial Ip 10.0.0.13:

```
Router#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#interface Se2/0
Router(config-if)#ip address 10.0.0.13 255.255.255.252
Router(config-if)#no shutdown
Router(config-if)#exit
```

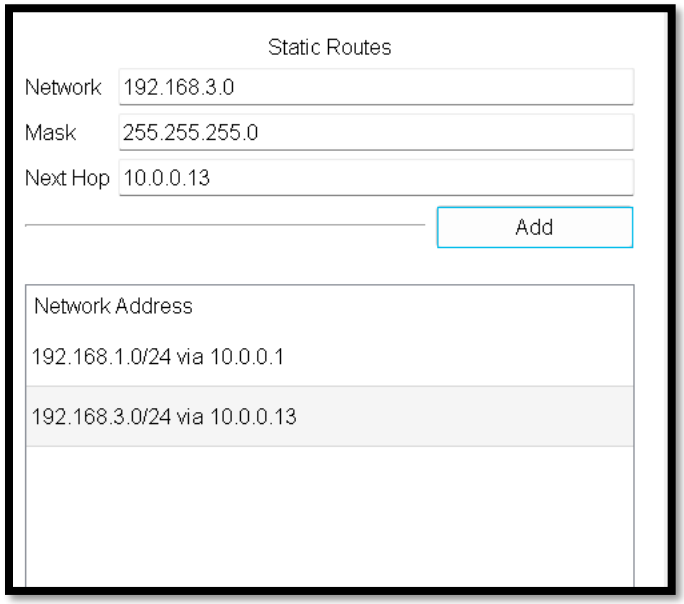
Serial Ip 10.0.0.17:

```
Router(config)#interface Se3/0
Router(config-if)#ip address 10.0.0.14 255.255.255.252
% 10.0.0.12 overlaps with Serial2/0
Router(config-if)#10.0.0.17 255.255.255.252
                  ^
% Invalid input detected at '^' marker.

Router(config-if)#ip address 10.0.0.17 255.255.255.252
Router(config-if)#no shutdown

Router(config-if)#
%LINK-5-CHANGED: Interface Serial3/0, changed state to up
exit
```

Default Gateway of Router 1:



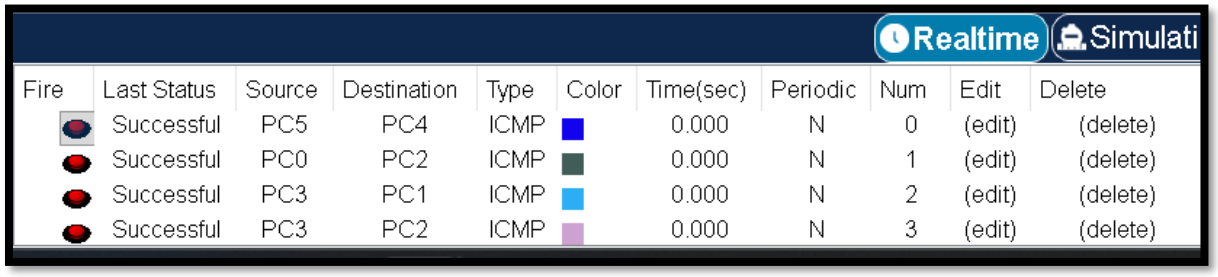
Default Gateway of Router 2:



Default Gateway of Router 3:

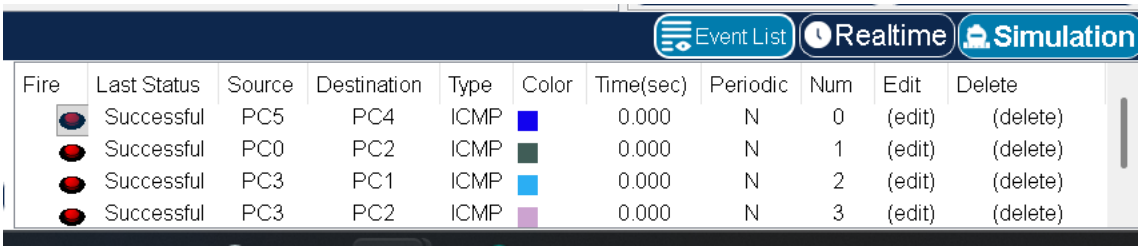
PACKET TRANSFER:

Real Time:



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

Simultation:



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

Task 3: Difference between static routing and dynamic routing

Static Routing vs. Dynamic Routing

Feature	Static Routing	Dynamic Routing
Definition	Routes are manually configured by the admin	Routes are automatically learned and updated
Adaptability	✗ No automatic updates	✓ Adapts to network changes in real-time
Protocols Used	None (manual only)	RIP, OSPF, EIGRP, BGP, etc.
Complexity	Simple to set up for small networks	Better for large, complex networks
Resource Usage	Low CPU and memory usage	Higher CPU and memory usage
Security	More secure (no route sharing)	Less secure (routes shared between routers)
Failure Recovery	Manual reconfiguration needed	Auto rerouting when links fail
Best Use Case	Small, stable networks	Large, dynamic networks