Experiment No. 6

Aim: Design VPN and Configure RIP/OSPF using Packet tracer:

Resource required: Cisco Packet Tracer – Routers, Switches, End Devices, Cables

Theory:

A VPN (Virtual Private Network) in computer networking is a technology that creates a secure, encrypted connection (or "tunnel") over a less secure network such as the Internet.

A VPN (Virtual Private Network) is like a secret tunnel on the internet.

- When you use the internet normally, your data is visible to others (like letters sent without an envelope).
- With a VPN, your data goes inside a locked tunnel so no one else can see it.
- It also makes it look like you are using the internet from the VPN server's location, not your own.

👉 In short: VPN keeps your online activity private, secure, and sometimes helps you access blocked websites.

What is RIP?

RIP (Routing Information Protocol) is one of the oldest distance-vector routing protocols used in computer networks.
It helps routers automatically share information about networks they know, so data can find the best path to its destination.

- RIP (Routing Information Protocol) is a way for routers to talk to each other and share which paths they know in a network.
- It decides the best path based on hop count → how many routers (stops) data has to pass through.

- Fewer hops = better path.
- But RIP only works up to 15 hops → if a destination is 16 hops away, it's considered unreachable.
- Routers using RIP send updates every 30 seconds to keep each other informed.

OSPF (Open Shortest Path First) is a routing protocol used in computer networks. It helps routers find the best path for sending data using a method called the Shortest Path First (SPF) algorithm.

- OSPF (Open Shortest Path First) is a rule that helps routers decide the fastest way to send data.
- Instead of just counting stops (like RIP), OSPF looks at the speed of the roads (links).
- It builds a map of the whole network and then picks the shortest and quickest path.
- Routers only talk when something changes, so it's faster and smarter than RIP.
- It can also split a big network into areas to keep things organized.

👉 In short: RIP is like choosing the road with fewer stops, but OSPF is like choosing the road where you reach fastest, even if there are more stops.

In short:

- RIP is simple, slow, and limited to small networks.
- OSPF is more complex, faster, and better for large networks.

A **serial DCE (Data Communication Equipment) cable** is used primarily to connect a DTE (Data Terminal Equipment) device, like a computer or router, to a DCE device, like a modem or CSU/DSU, for data communication.

Here's a simple breakdown:

- DTE (Data Terminal Equipment): Device that generates or uses data (e.g., PC, router).

- DCE (Data Communication Equipment): Device that provides a path for data (e.g., modem, switch, CSU/DSU).

The command or phrase router ospf 30 is used in Cisco routers to configure OSPF (Open Shortest Path First) routing. Let me break it down:

1. router ospf → This starts the OSPF routing configuration mode on the router.
2. 30 → This is the OSPF process ID.

ID:

 OSPF Process ID

- Identifies the OSPF instance running on a router.
- Local to the router.
- Example: router ospf 30 → Process ID = 30

 OSPF Area ID

- Identifies a specific OSPF area in the network.
- Must match between routers in the same area.
- Example: area 0 → Area ID = 0 (backbone area)

 OSPF Router ID (RID)

- Unique identifier for a router within OSPF.
- Usually written like an IP address.
- Example: router-id 1.1.1.1 → Router ID = 1.1.1.1

In OSPF, the command:

network 10.0.0.0 0.255.255.255 area 0

can be broken down as follows:

1️⃣ network 10.0.0.0

- This specifies the IP network that you want OSPF to advertise.
- Here, it starts with 10.0.0.0.

2️⃣ 0.255.255.255 (Wildcard Mask)

- This is a wildcard mask, which is the inverse of a subnet mask.
- It tells OSPF which IP addresses in the network to include.
- How it works:
  - 0 → match exactly
  - 255 → ignore (any value allowed)
- So 0.255.255.255 means match the first octet exactly (10), and allow any value for the last three octets.
- In short, this includes all IPs from 10.0.0.0 to 10.255.255.255.

3️⃣ area 0

- Specifies that this network belongs to OSPF area 0, which is the backbone area.

☑️ In simple terms:

"Tell OSPF to advertise all networks that start with 10...* in area 0."

Here's how to calculate a wildcard mask from a normal subnet mask in OSPF:

1️⃣ **Understand Wildcard Mask**

- A wildcard mask is the inverse of a subnet mask.
- Formula:

Wildcard Mask=255.255.255.255−Subnet Mask\text{Wildcard Mask} = 255.255.255.255 - \text{Subnet Mask}Wildcard Mask=255.255.255.255−Subnet Mask

---

2️⃣ Step-by-Step Example

Suppose your network is 10.0.0.0/8:

1. Subnet mask for /8 → 255.0.0.0
2. Subtract from 255.255.255.255:

255.255.255.255

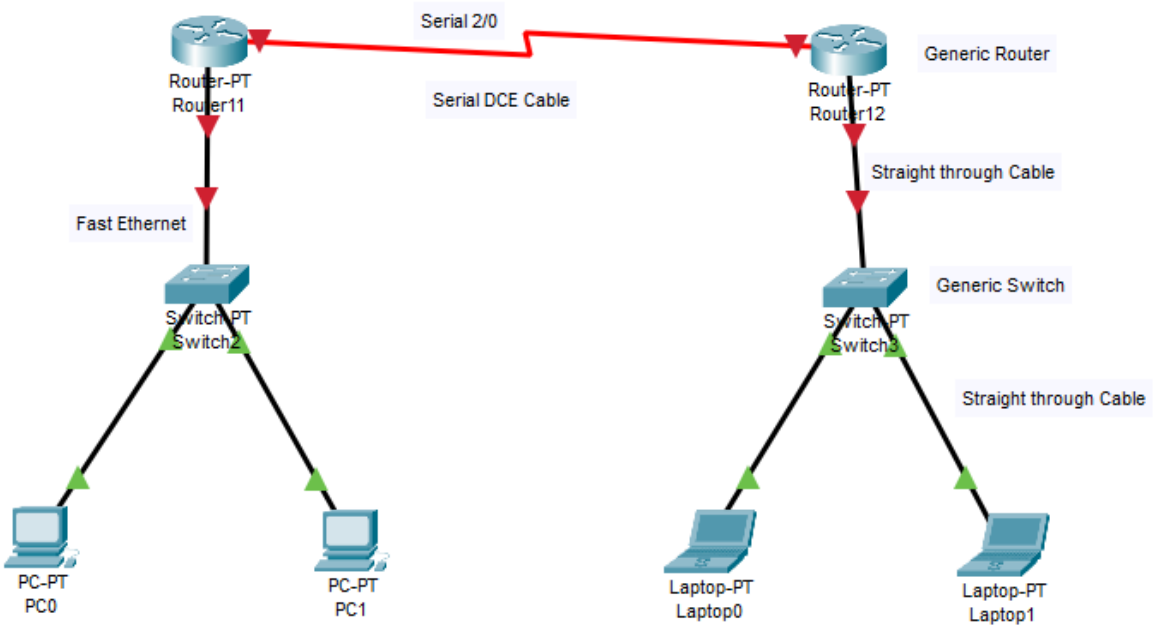
- 255.0.0.0

= 0.255.255.255

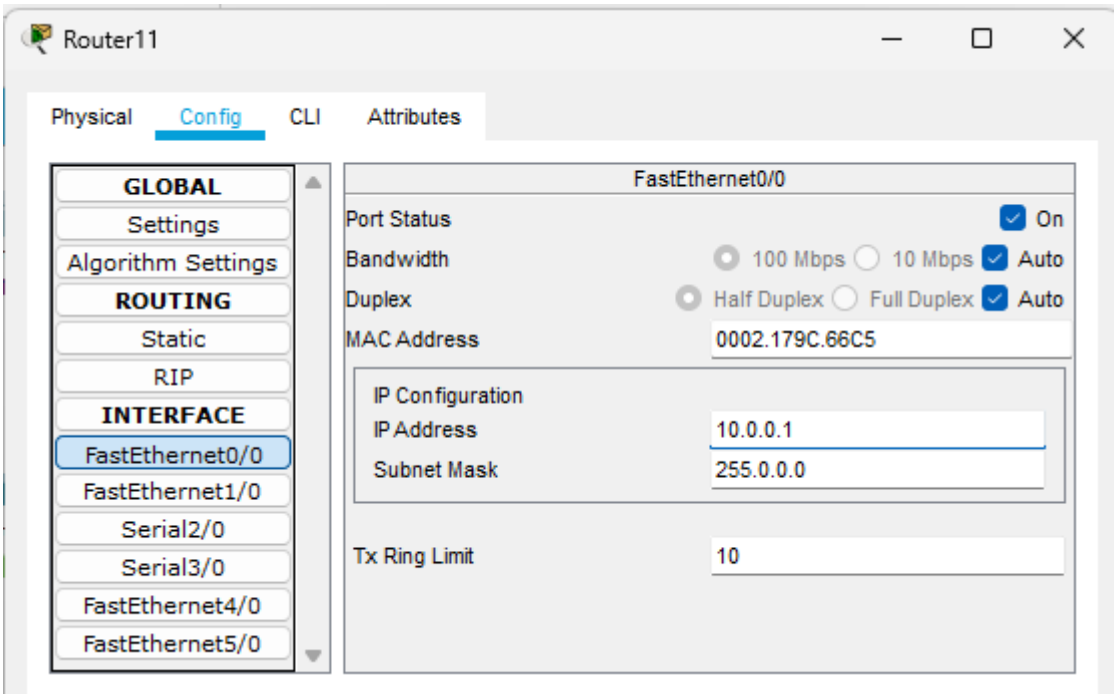
What is Area 0?

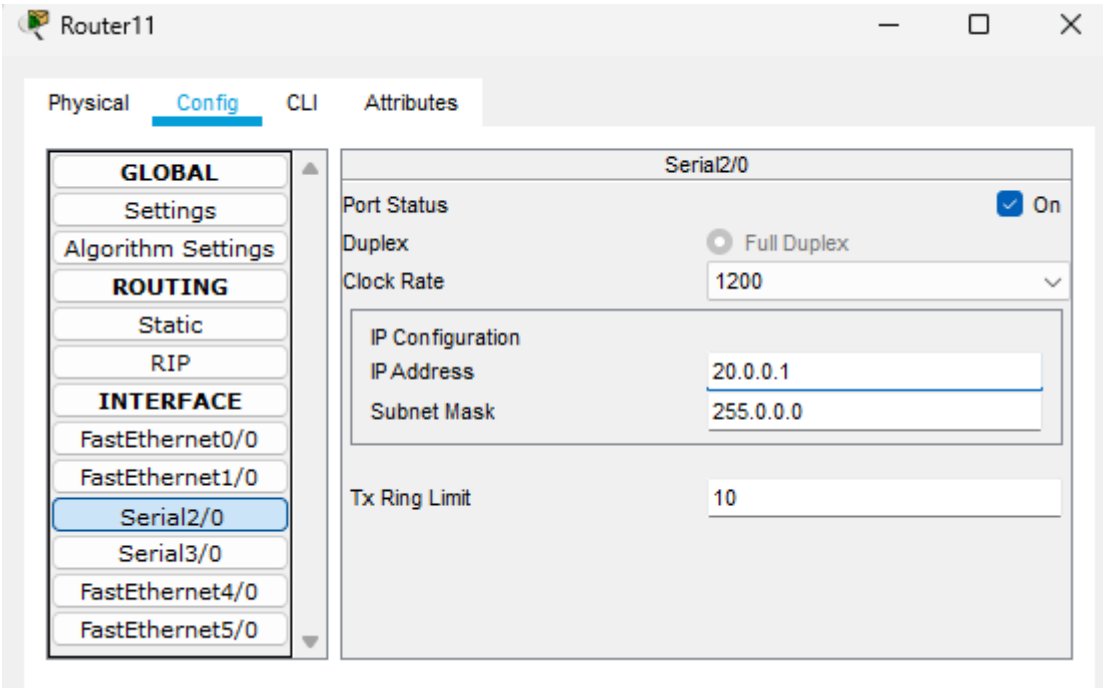
- Area 0 is called the backbone area in OSPF.
- All other OSPF areas must connect to Area 0.
- It is the central area that connects all other areas in an OSPF network.

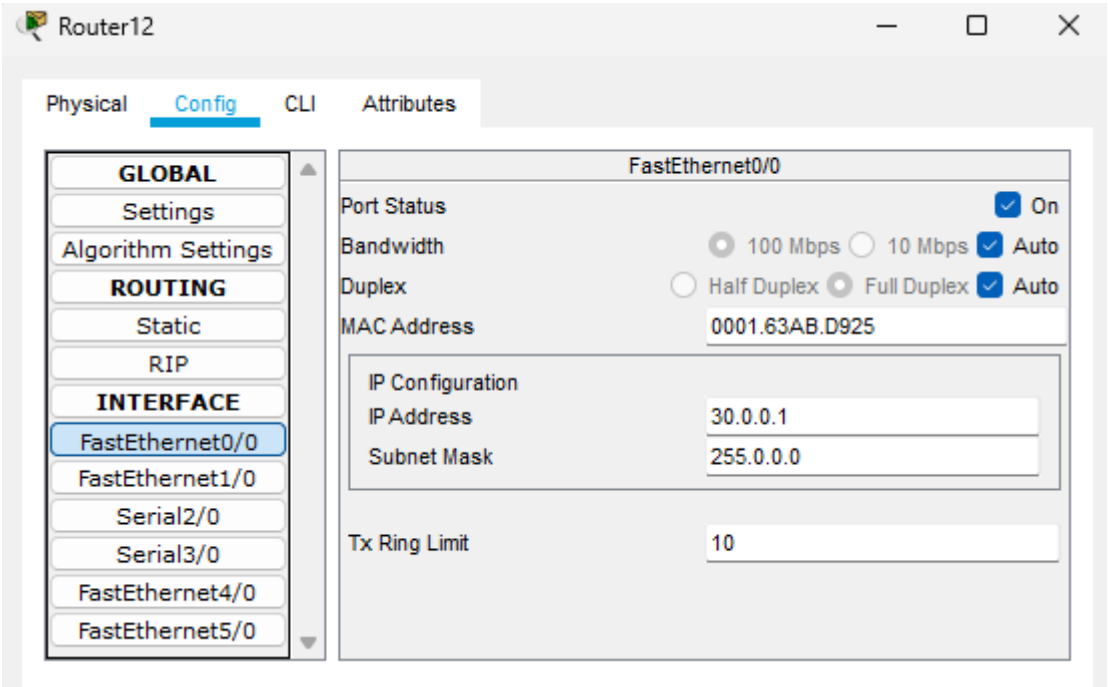
Practical Implementation:

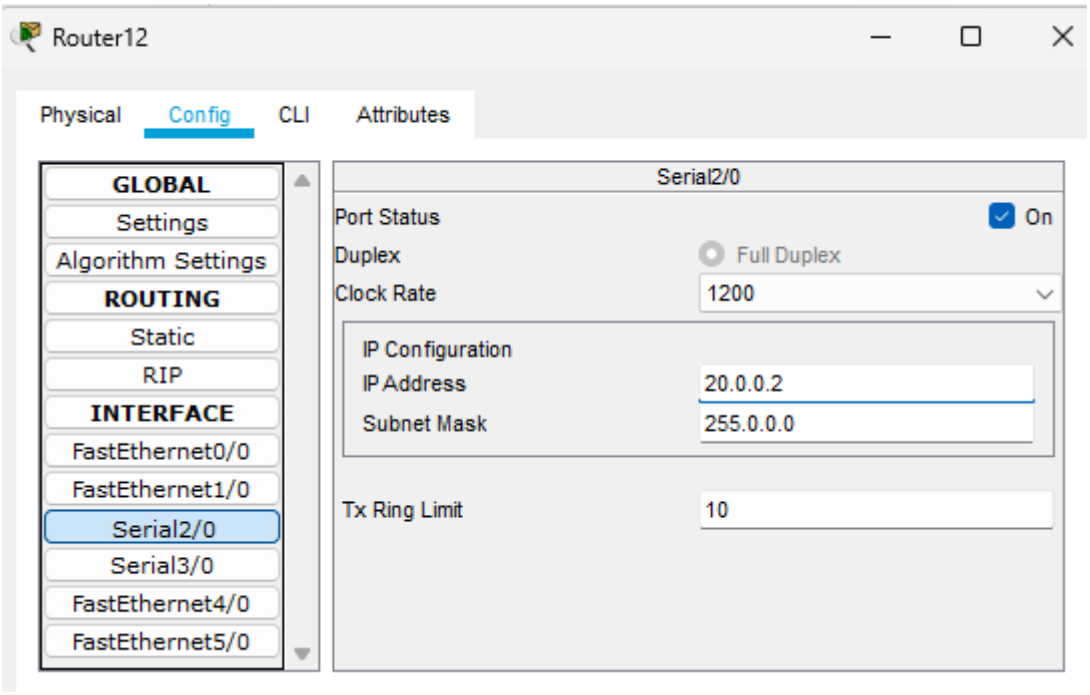


Assign IP Address, Subnet Mask and check the Port Status to ON of FastEthernet0/0 and Serial2/0 of both the routers:

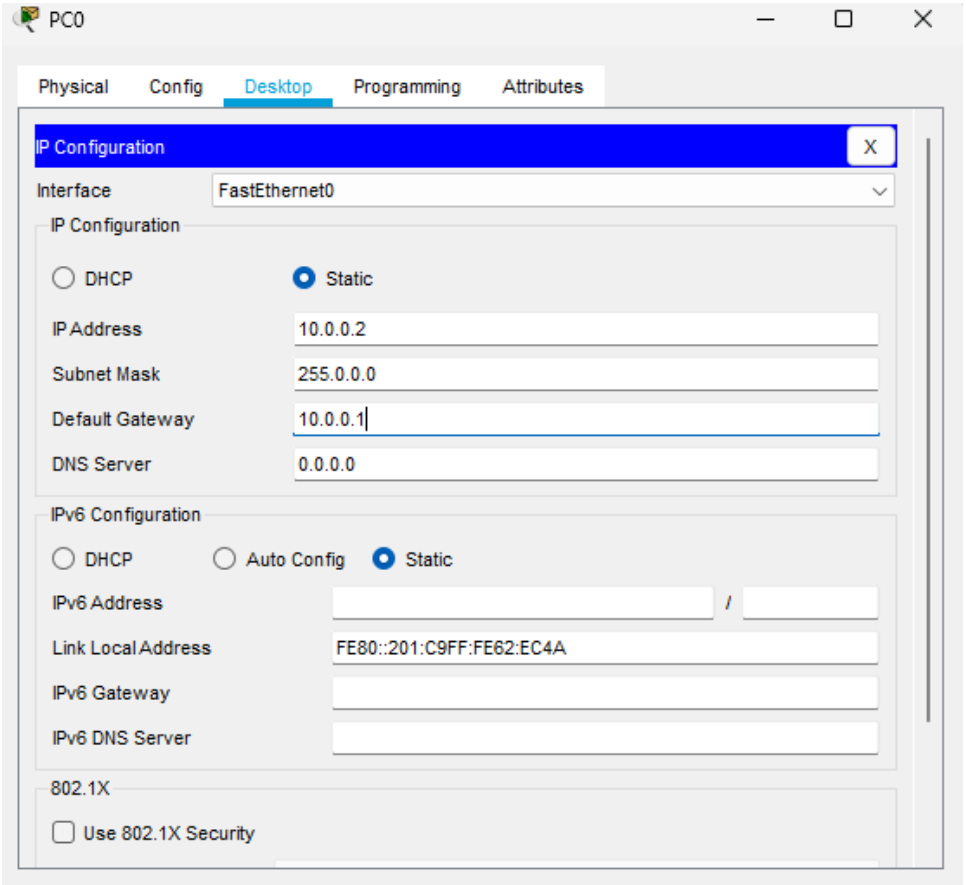


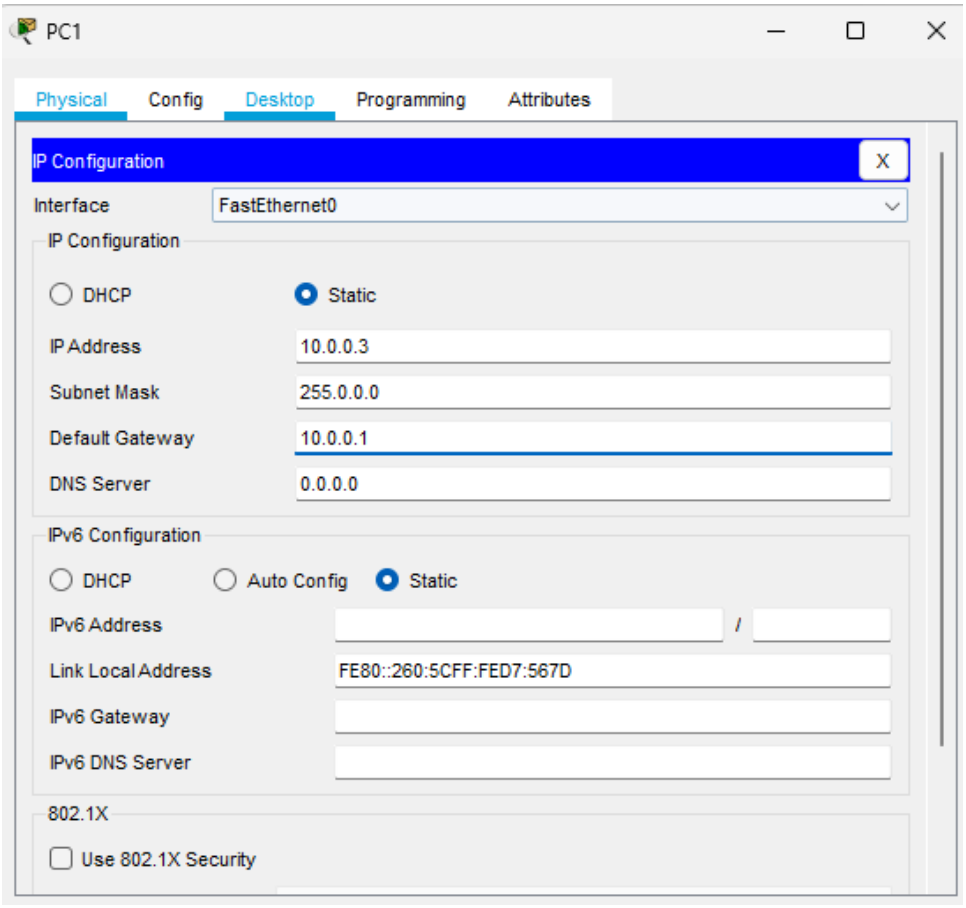

Router11
Physical
Config
CLI
Attributes
GLOBAL
Settings
Algorithm Settings
ROUTING
Static
RIP
INTERFACE
FastEthernet0/0
FastEthernet1/0
Serial2/0
Serial3/0
FastEthernet4/0
FastEthernet5/0
Serial2/0
Port Status
On
Duplex
Full Duplex
Clock Rate
1200
IP Configuration
IP Address
20.0.0.1
Subnet Mask
255.0.0.0
Tx Ring Limit
10

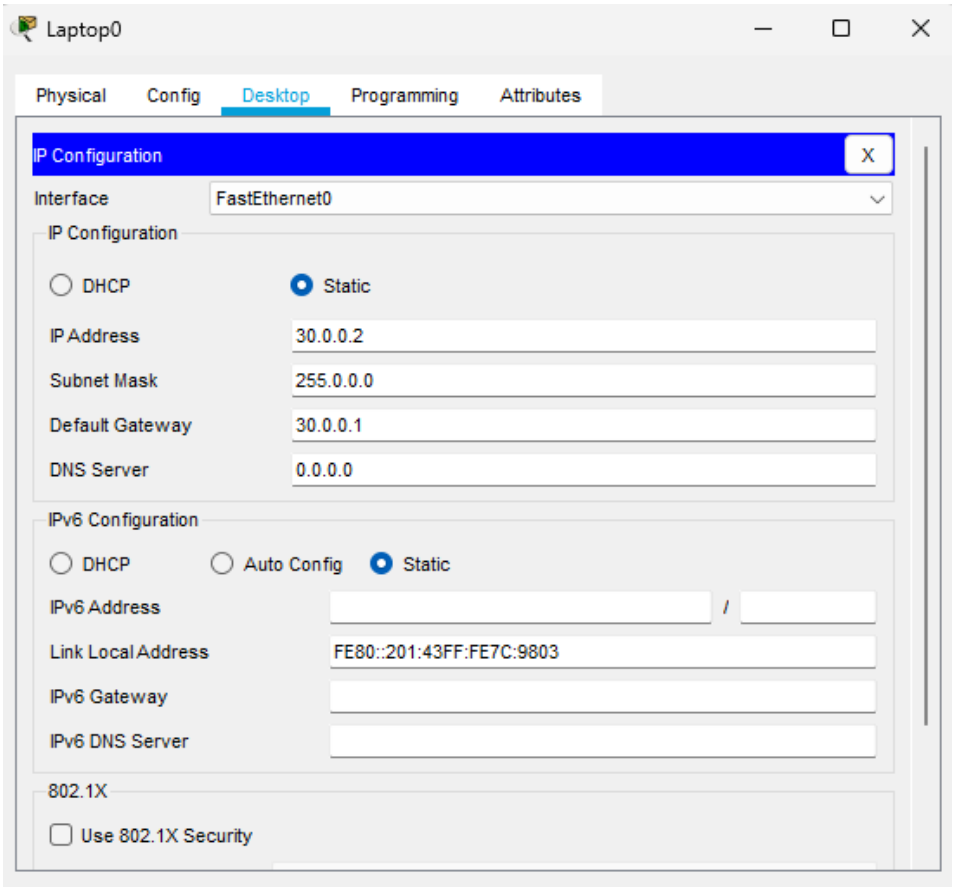

Router12
Physical
Config
CLI
Attributes
GLOBAL
Settings
Algorithm Settings
ROUTING
Static
RIP
INTERFACE
FastEthernet0/0
FastEthernet1/0
Serial2/0
Serial3/0
FastEthernet4/0
FastEthernet5/0
FastEthernet0/0
Port Status
On
Bandwidth
100 Mbps
10 Mbps
Auto
Duplex
Half Duplex
Full Duplex
Auto
MAC Address
0001.63AB.D925
IP Configuration
IP Address
30.0.0.1
Subnet Mask
255.0.0.0
Tx Ring Limit
10

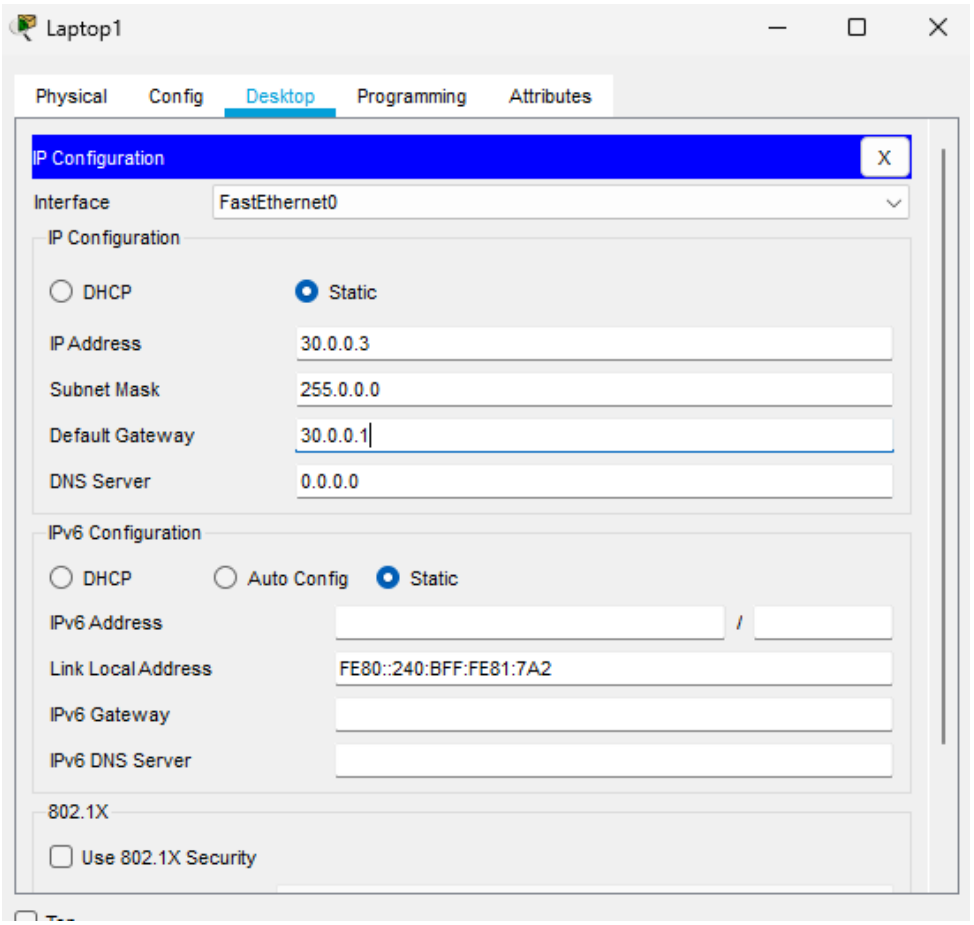


Now assign IP Address, Subnet Mask and Default Gateway of each End Device:

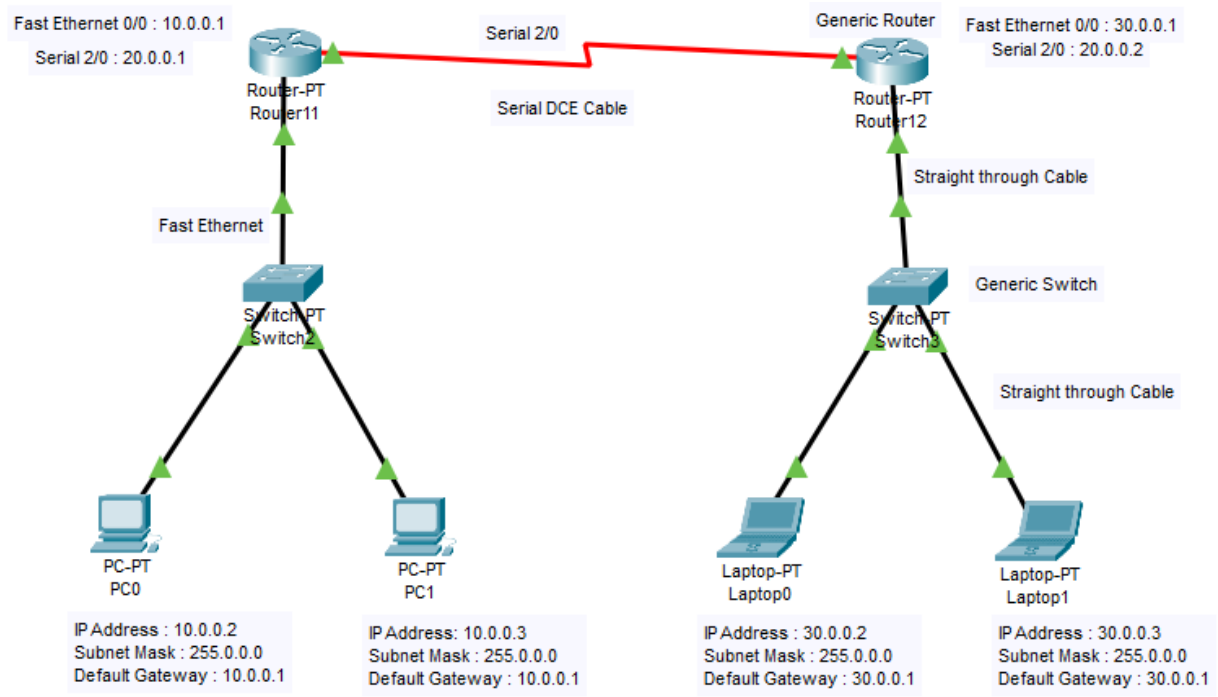



PC1
Physical
Config
Desktop
Programming
Attributes
IP Configuration
X
Interface
FastEthernet0
IP Configuration
DHCP
Static
IP Address
10.0.0.3
Subnet Mask
255.0.0.0
Default Gateway
10.0.0.1
DNS Server
0.0.0.0
IPv6 Configuration
DHCP
Auto Config
Static
IPv6 Address
/
Link Local Address
FE80::260:5CFF:FED7:567D
IPv6 Gateway
IPv6 DNS Server
802.1X
Use 802.1X Security

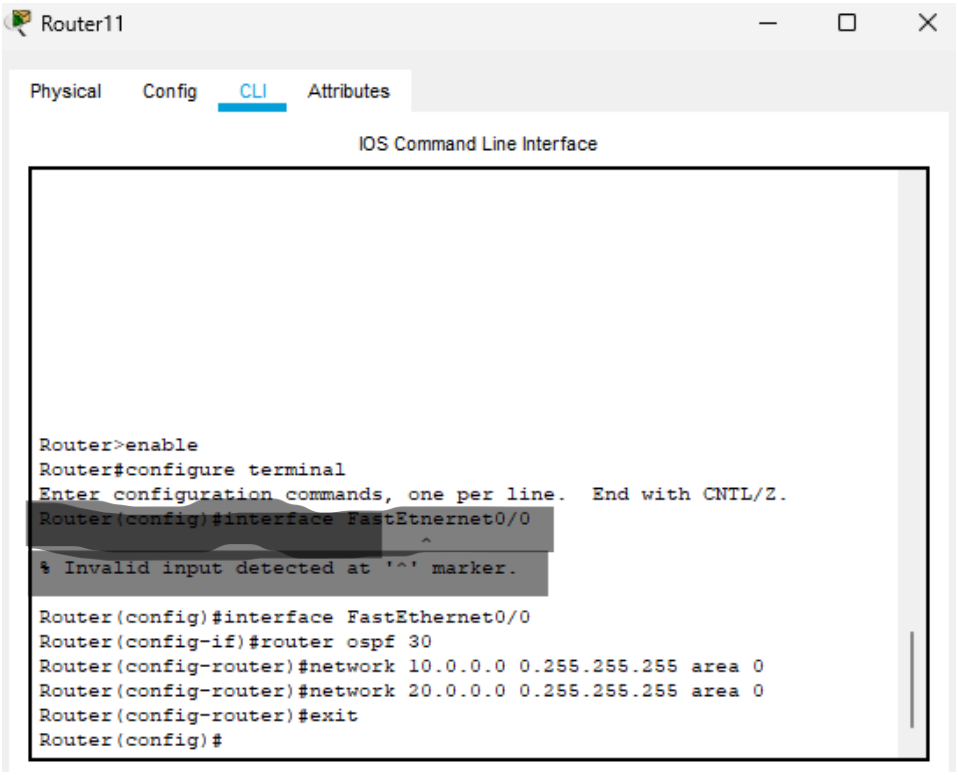

Laptop0
Physical
Config
Desktop
Programming
Attributes
IP Configuration
X
Interface
FastEthernet0
IP Configuration
DHCP
Static
IP Address
30.0.0.2
Subnet Mask
255.0.0.0
Default Gateway
30.0.0.1
DNS Server
0.0.0.0
IPv6 Configuration
DHCP
Auto Config
Static
IPv6 Address
/
Link Local Address
FE80::201:43FF:FE7C:9803
IPv6 Gateway
IPv6 DNS Server
802.1X
Use 802.1X Security

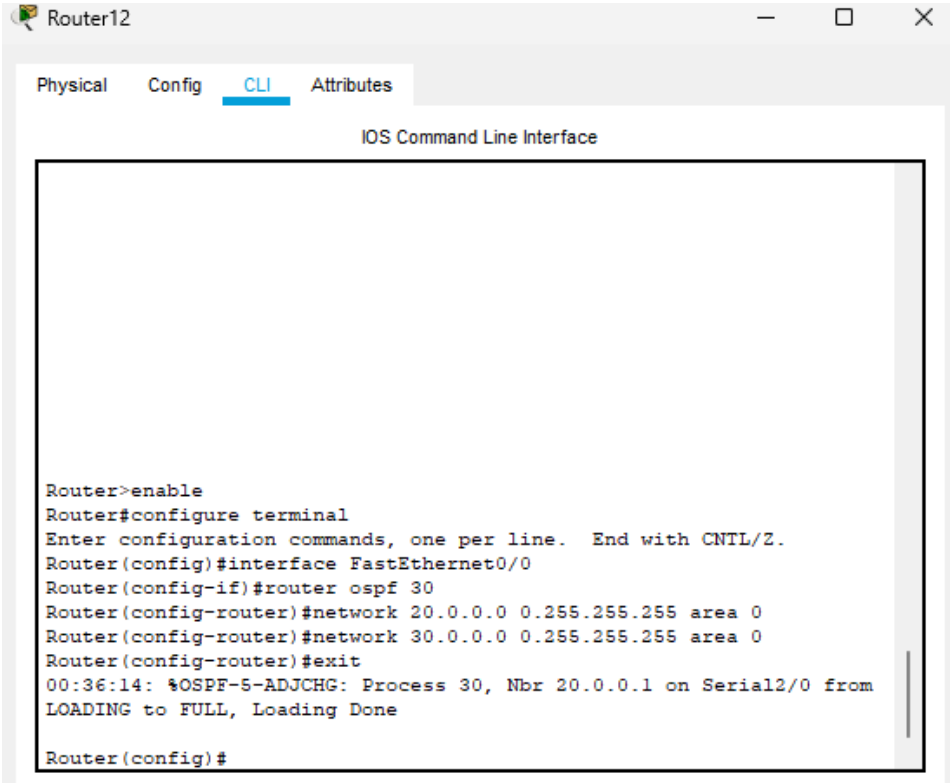


Check whether all the cable are active or not:



Now configure both the routers

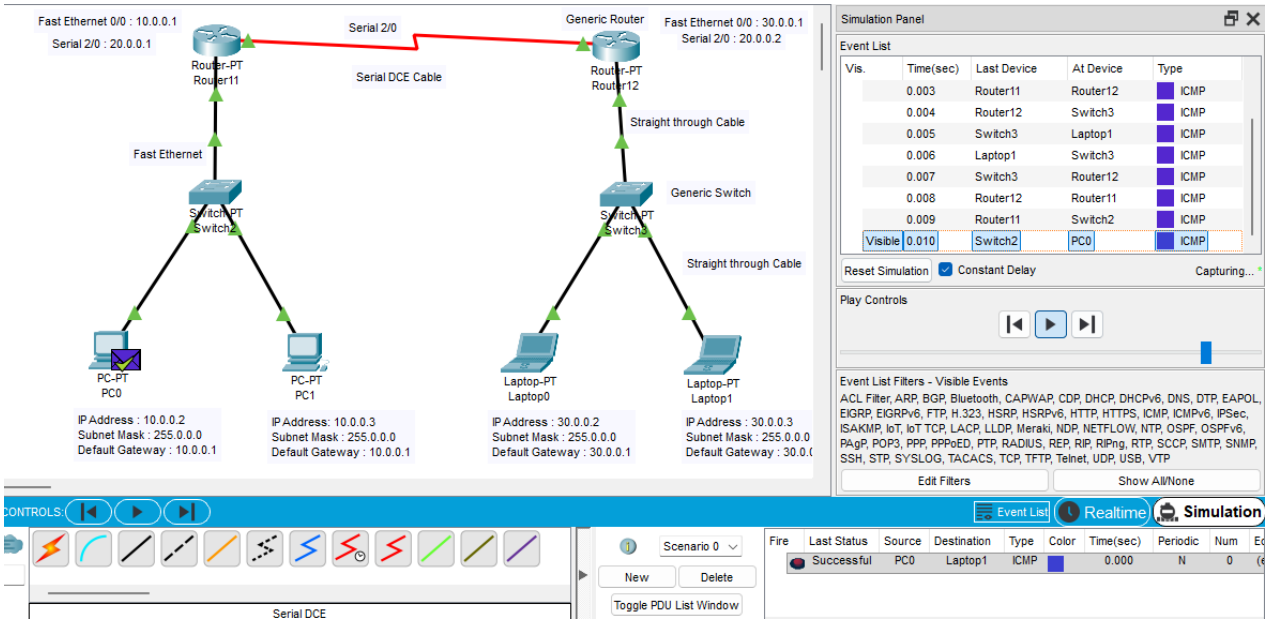




Output: Transfer the packets from One of the End Device and other End Device:

Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num
	Successful	PC0	PC1	ICMP		0.000	N	0
	Successful	Laptop0	Laptop1	ICMP		0.000	N	1
	Successful	PC0	Laptop1	ICMP		0.000	N	2

Simulation of the Packet Transfer from PC0 – Laptop1



Conclusion:

By configuring OSPF (Open Shortest Path First), we implemented a link-state routing protocol that is more efficient, scalable, and provides faster convergence compared to RIP. OSPF's hierarchical design with areas improves network performance in large-scale topologies.

The combination of VPN with OSPF ensures that data not only travels securely over the network but also follows the best possible path based on the routing protocol used.