Task-9

9b). Configure network topology and implement dynamic routing protocol OSPF

The OSPF stands for **Open Shortest Path First**. It is a widely used and supported routing protocol. It is an intradomain protocol, which means that it is used within an area or a network.

Open Shortest Path First (OSPF) is a **dynamic routing protocol** used in IP networks. It is classified as an **Interior Gateway Protocol (IGP)**, meaning it works within a single autonomous system (AS). OSPF ensures that routers can dynamically learn and exchange routes with each other to create a loop-free, optimized routing table.

OSPF divides the autonomous systems into areas where the area is a collection of networks, hosts, and routers. Like internet service providers divide the internet into a different autonomous system for easy management and OSPF further divides the autonomous systems into Areas.

Key Features of OSPF

1. **Link-State Protocol**:

   - Unlike distance-vector protocols (e.g., RIP), OSPF considers the state of network links and builds a complete map of the network.

2. **Hierarchical Design with Areas**:

   - OSPF uses **areas** to group routers and reduce complexity.

   - **Area 0** (Backbone Area) is the central area that connects all other areas.

3. **Fast Convergence**:

   - When the network changes (e.g., a link fails), OSPF quickly recalculates routes using the updated LSDB.
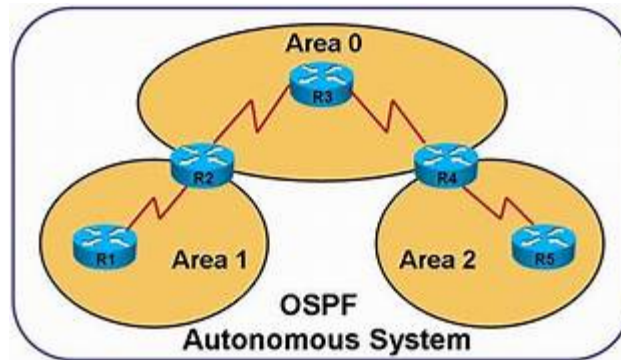
4. **Scalability**:

   - OSPF supports large networks because it uses areas to limit the size of the LSDB.

5. **Metric**:

   - OSPF uses **cost** as its routing metric. Cost is based on the bandwidth of the link:

$$\text{Cost} = \frac{\text{Reference Bandwidth}}{\text{Link Bandwidth}}$$

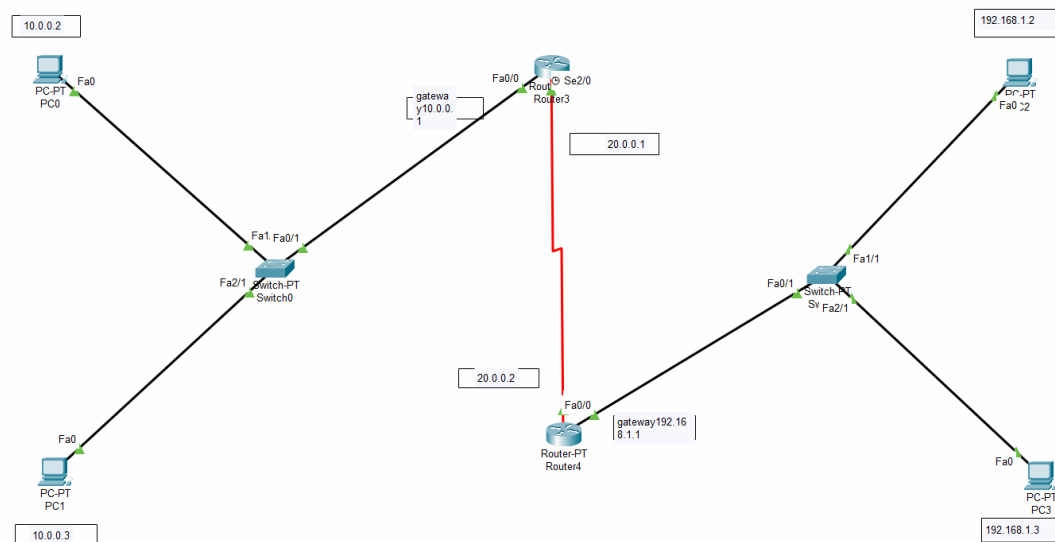- Higher bandwidth links have a lower cost.

Configure Hosts

Assign IP addresses to hosts as per the diagram:

- **PC0**: IP `10.0.0.2`, Gateway `10.0.0.1`.
- **PC1**: IP `10.0.0.3`, Gateway `10.0.0.1`.
- **PC2**: IP `192.168.1.2`, Gateway `192.168.1.1`.
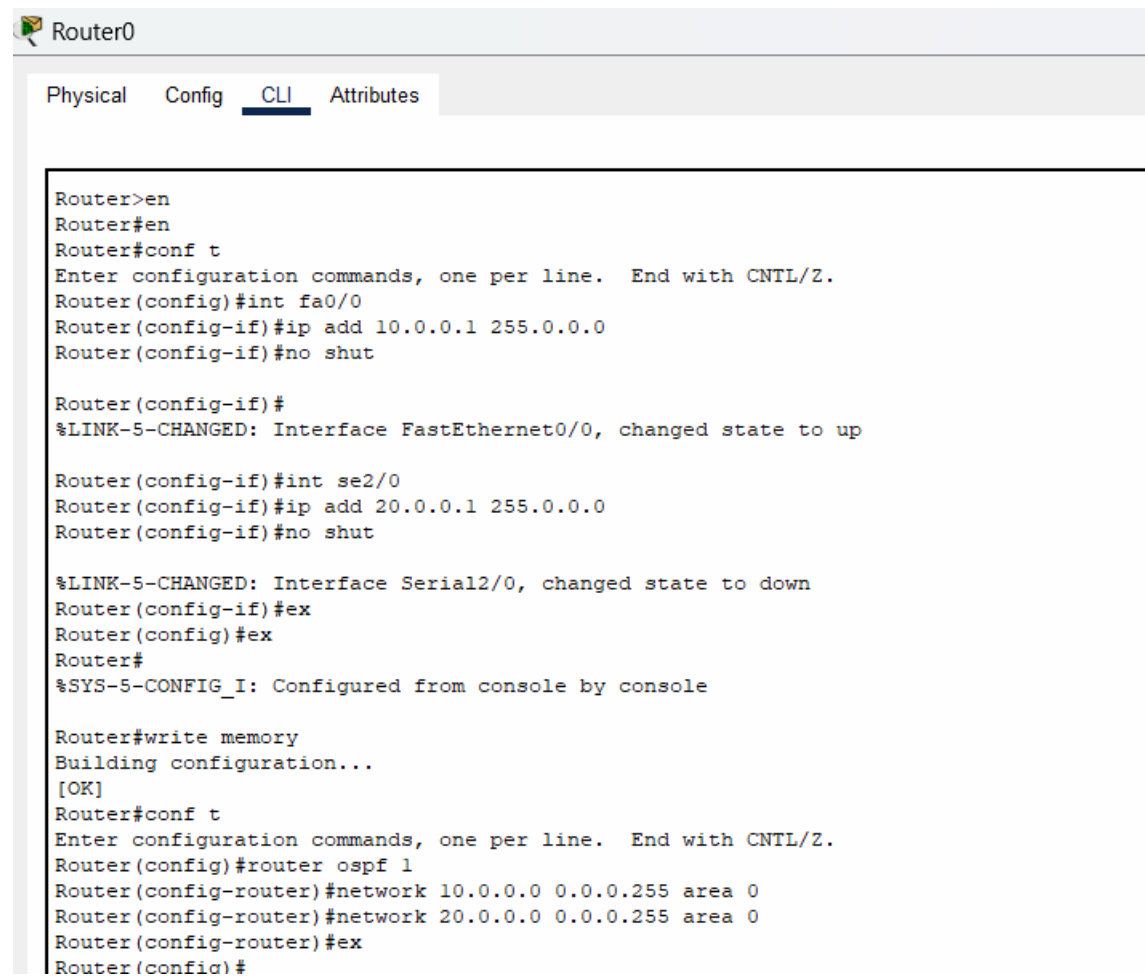- **PC3**: IP `192.168.1.3`, Gateway `192.168.1.1`.

Network Overview

- **Router1 (R1)** connects:
  - **10.0.0.0 network** on Fa0/0.
  - **20.0.0.0 network** on Se2/0.
- **Router2 (R2)** connects:
  - **20.0.0.0 network** on Se3/0.
  - **192.168.1.0 network** on Fa0/0.

Configuration Steps

1. Configure Interfaces on R1


```
Router>en
Router#en
Router#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#int fa0/0
Router(config-if)#ip add 10.0.0.1 255.0.0.0
Router(config-if)#no shut

Router(config-if)#
%LINK-5-CHANGED: Interface FastEthernet0/0, changed state to up

Router(config-if)#int se2/0
Router(config-if)#ip add 20.0.0.1 255.0.0.0
Router(config-if)#no shut

%LINK-5-CHANGED: Interface Serial2/0, changed state to down
Router(config-if)#ex
Router(config)#ex
Router#
%SYS-5-CONFIG_I: Configured from console by console

Router#write memory
Building configuration...
[OK]
Router#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#router ospf 1
Router(config-router)#network 10.0.0.0 0.0.0.255 area 0
Router(config-router)#network 20.0.0.0 0.0.0.255 area 0
Router(config-router)#ex
Router(config)#
```

2. Configure Interfaces on R2

```
Router1

Physical   Config   CLI   Attributes

Router>en
Router#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#int fa0/0
Router(config-if)#ip add 192.168.1.1 255.255.255.0
Router(config-if)#no shut

Router(config-if)#
%LINK-5-CHANGED: Interface FastEthernet0/0, changed state to up

Router(config-if)#int se3/0
Router(config-if)#ip add 20.0.0.2 255.0.0.0
Router(config-if)#no shut

%LINK-5-CHANGED: Interface Serial3/0, changed state to down
Router(config-if)#
Router(config-if)#end
Router#
%SYS-5-CONFIG_I: Configured from console by console

Router#write memory
Building configuration...
[OK]
Router#conf t
Enter configuration commands, one per line.  End with CNTL/Z.



Router(config)#router ospf 1
Router(config-router)#network 192.168.1.0 0.0.0.255 area 1
Router(config-router)#network 20.0.0.0 0.0.0.255 area 0
Router(config-router)#ex
```
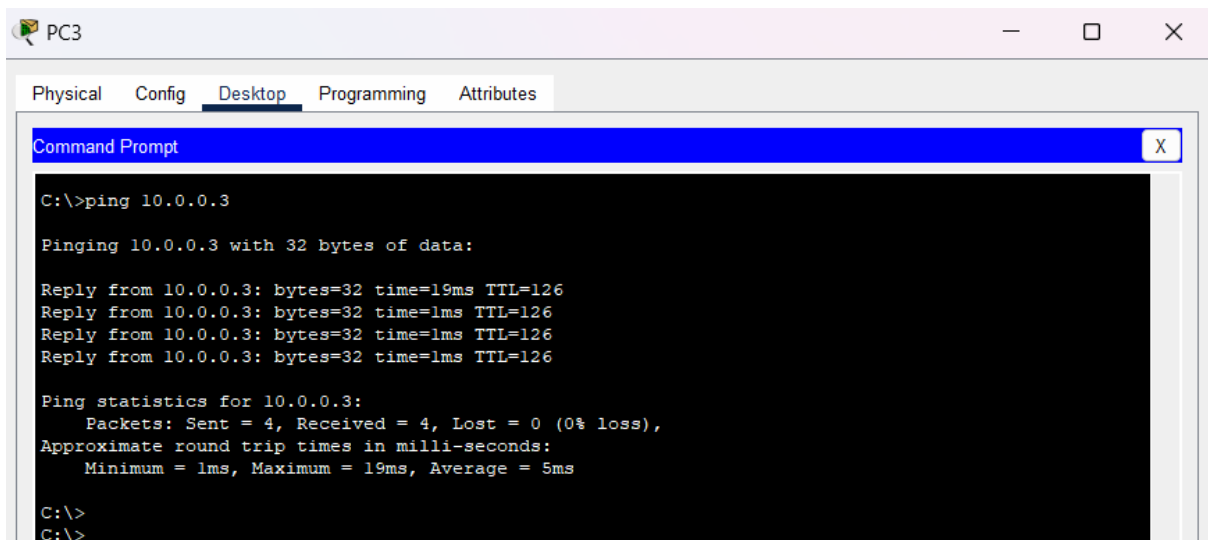
Test the Configuration:

From PC3 (10.0.0.2), ping PC0 (192.168.1.3)

Command:

ping 10.0.0.3