

## 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:**

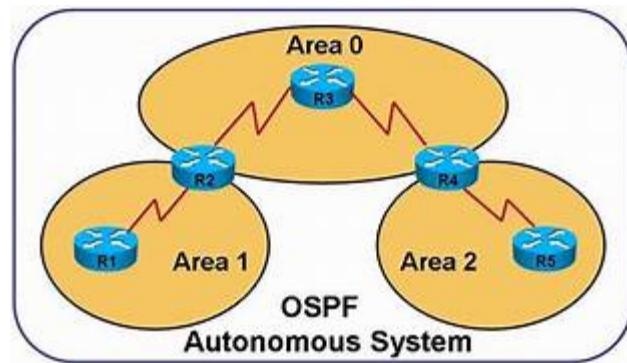
- OSPF supports large networks because it uses areas to limit the size of the LSDB.

##### **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.



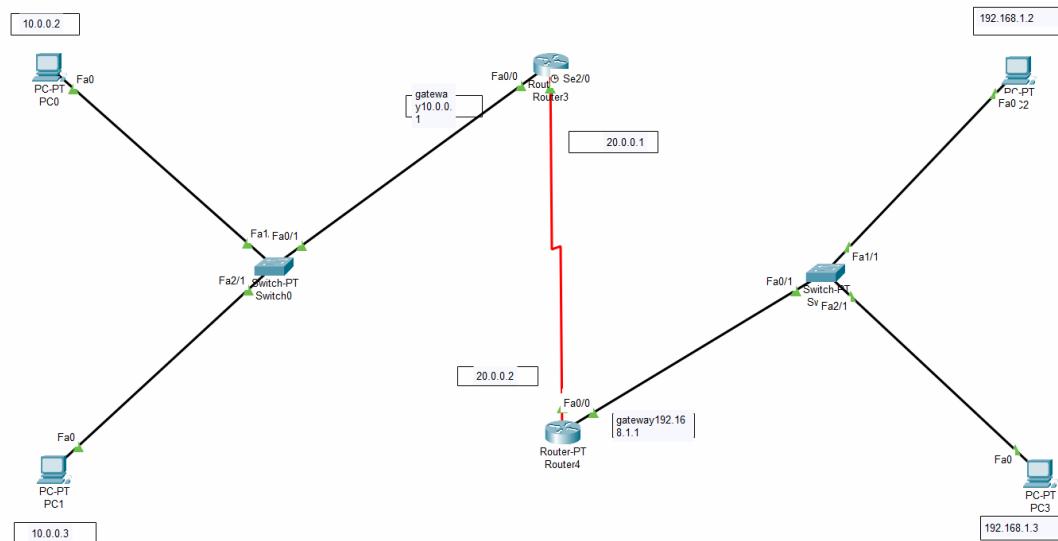
## Configure Hosts

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.

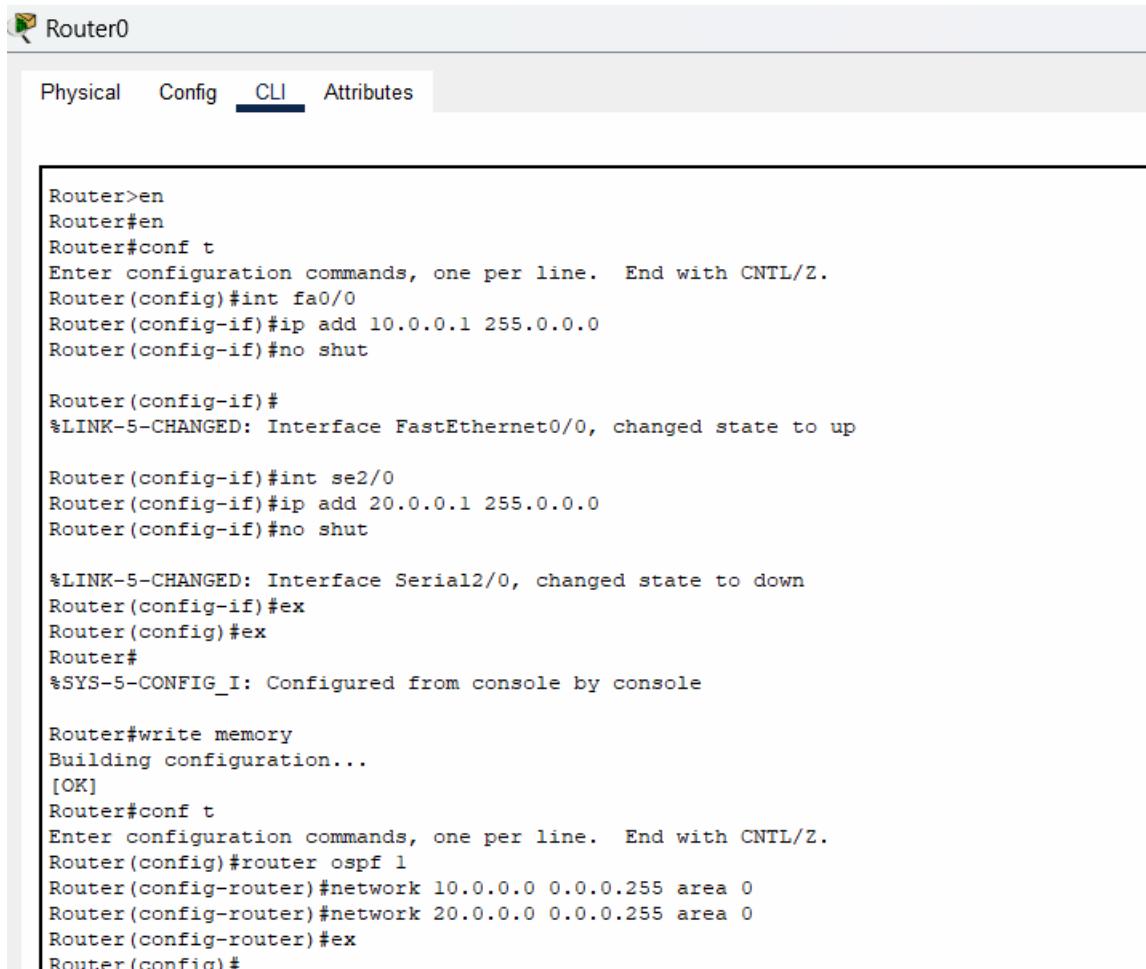
## Network Overview

- **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

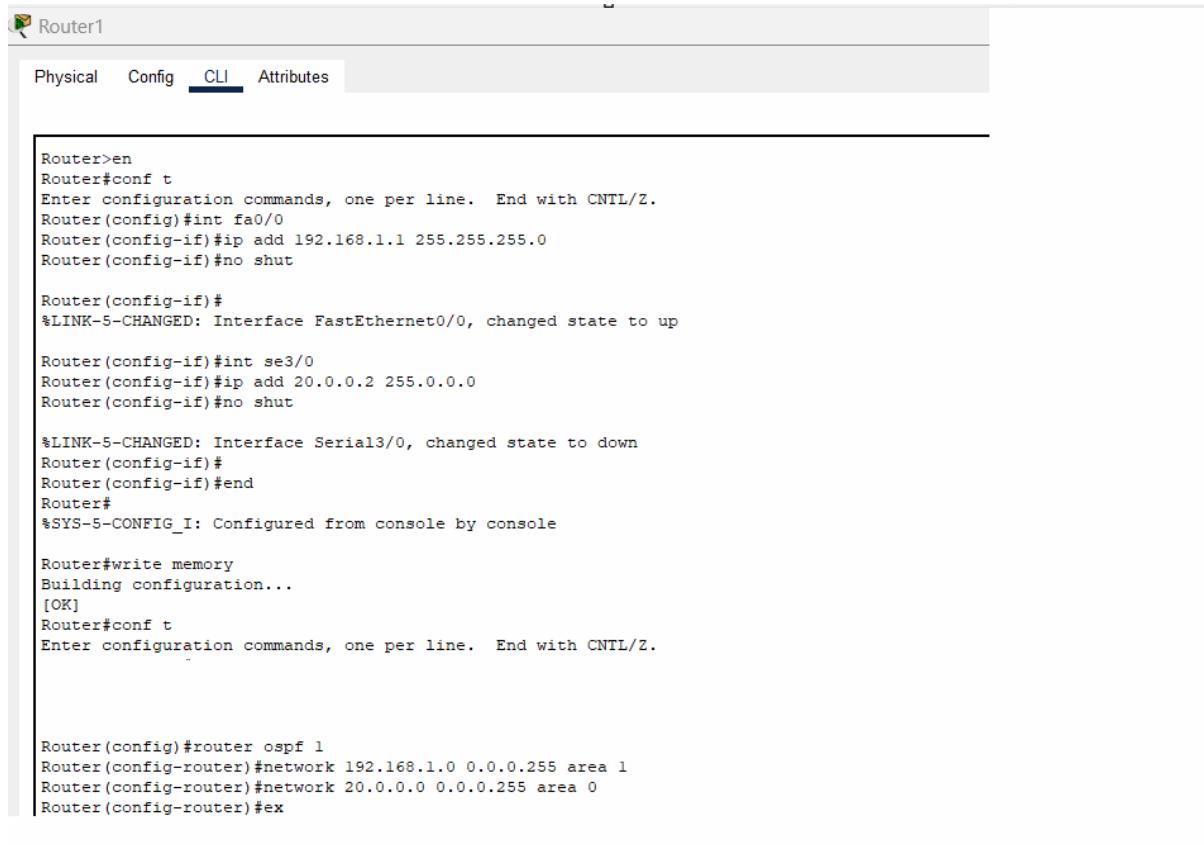
Router(config-if)#int se2/0
Router(config-if)#ip add 20.0.0.1 255.0.0.0
Router(config-if)#no shut

%LINK-5-CHANGED: Interface Serial2/0, changed state to down
Router(config-if)#ex
Router(config)#
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



The screenshot shows a software interface for managing a router named 'Router1'. The top navigation bar includes tabs for 'Physical', 'Config', 'CLI' (which is selected), and 'Attributes'. The main window displays the CLI configuration history:

```
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.

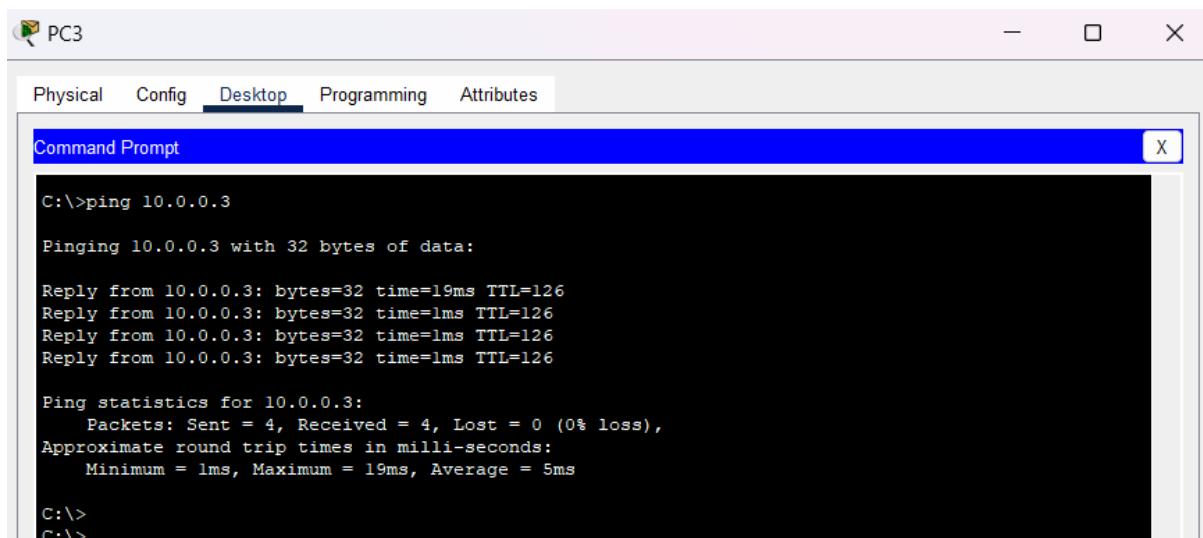
Router(config)#router ospf 1
Router(config-router)#network 192.168.1.0 0.0.0.255 area 1
Router(config-router)#network 20.0.0.0 0.0.0.255 area 0
Router(config-router)#ex
```

## Test the Configuration:

From PC3 (10.0.0.2), ping PC0 (192.168.1.3)

**Command:**

ping 10.0.0.3



The screenshot shows a Windows-style Command Prompt window titled "PC3". The window has a blue header bar with the title "PC3" and a close button (X). Below the header is a menu bar with tabs: "Physical", "Config", "Desktop" (which is selected and highlighted in blue), "Programming", and "Attributes". The main area of the window is a black terminal-like interface. It displays the command "C:\>ping 10.0.0.3" followed by its execution output. The output shows four successful replies from the target IP address 10.0.0.3, each with 32 bytes and a TTL of 126. It then provides ping statistics: 4 packets sent, 4 received, 0 lost (0% loss), and approximate round trip times (Minimum = 1ms, Maximum = 19ms, Average = 5ms). Finally, it shows two blank command prompts at the bottom: "C:\>" and "C:\>".

```
C:\>ping 10.0.0.3

Pinging 10.0.0.3 with 32 bytes of data:

Reply from 10.0.0.3: bytes=32 time=19ms TTL=126
Reply from 10.0.0.3: bytes=32 time=1ms TTL=126
Reply from 10.0.0.3: bytes=32 time=1ms TTL=126
Reply from 10.0.0.3: bytes=32 time=1ms TTL=126

Ping statistics for 10.0.0.3:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 19ms, Average = 5ms

C:\>
C:\>
```