DEPARTMENT OF
COMPUTER SCIENCE AND ENGINEERING

Title: Configuration of OSPF

COMPUTER NETWORKING LAB
CSE 312

GREEN UNIVERSITY OF BANGLADESH

1 Objective(s)

- To build and design a network using Cisco Packet Tracer

- To learn about step-by-step configuration of OSPF using Cisco Packet Tracer

2 Problem analysis

OSPF (Open Shortest Path First) is a dynamic routing protocol used in computer networks to efficiently route data packets within a single autonomous system (AS).

For example, imagine a large corporate network with multiple departments interconnected by routers. OSPF helps these routers communicate by maintaining a database of network topology, including link-state advertisements (LSAs) that describe the state and cost of links between routers.

If a link within the network fails, OSPF quickly recalculates routes based on the remaining available paths, ensuring minimal disruption to communication. This fast convergence time is a key feature of OSPF, crucial for maintaining network efficiency and reliability.

Moreover, OSPF's hierarchical design allows administrators to divide the network into areas, each with its own routing information. This helps manage scalability and reduces routing traffic, improving overall network performance.

OSPF plays a vital role in large-scale networks, such as corporate infrastructures or internet service provider networks, by providing efficient and reliable routing capabilities. There are some roles of router in OSPF:
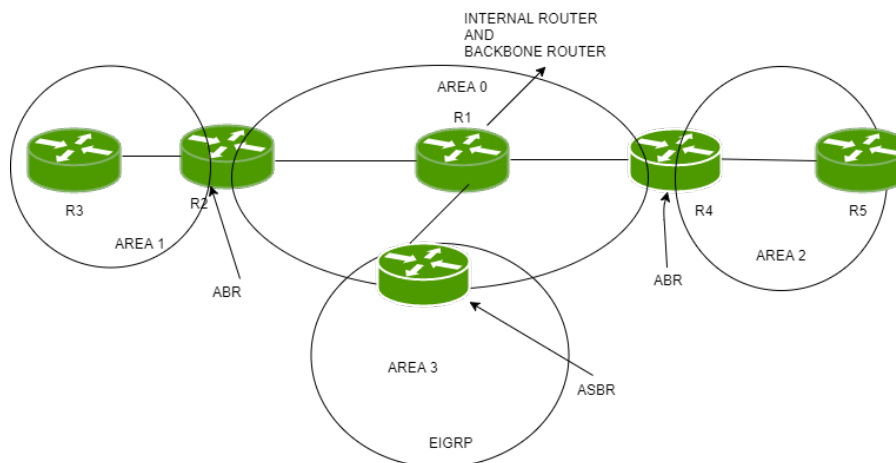

Figure 1: OSPF.

- **Backbone router**– The area 0 is known as backbone area and the routers in area 0 are known as backbone routers. If the routers exists partially in the area 0then also it is a backbone router.

- **Internal router** – An internal router is a router which have all of its interfaces in a single area.

- **Area Boundary Router (ABR)** – The router which connects backbone area with another area is called Area Boundary Router. It belongs to more than one area. The ABRs, therefore, maintain multiple link-state databases that describe both the backbone topology and the topology of the other areas.

- **Area Summary Border Router (ASBR)** – When an OSPF router is connected to a different protocol like EIGRP or Border Gateway Protocol, or any other routing protocol then it is known as AS. The router which connects two different AS (in which one of the interfaces is operating OSPF) is known as Area Summary Border Router. These routers perform redistribution. ASBRs run both OSPF and another routing protocol, such as RIP or BGP. ASBRs advertise the exchanged external routing information throughout their AS.

So, in figure 2, we are going to take four Routers where one PC is connected to each. Router 1 and Router 2 belong to Area 1 and Router 3 and Router 4 belong to Area 2. OSPF Area Configuration we are going to do while configuring the route. Now, let's add IP Address on all the devices according to the picture given above.
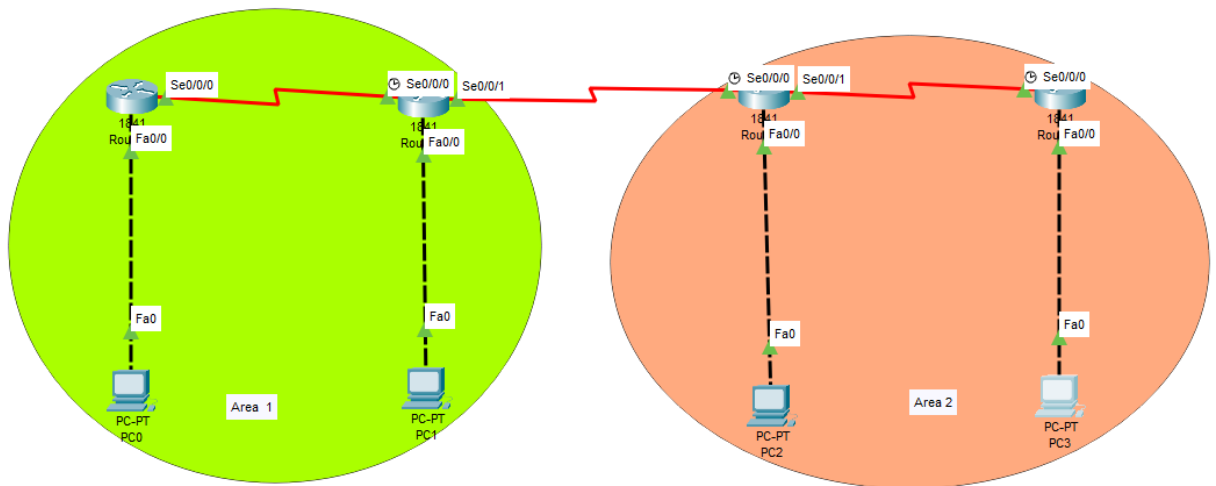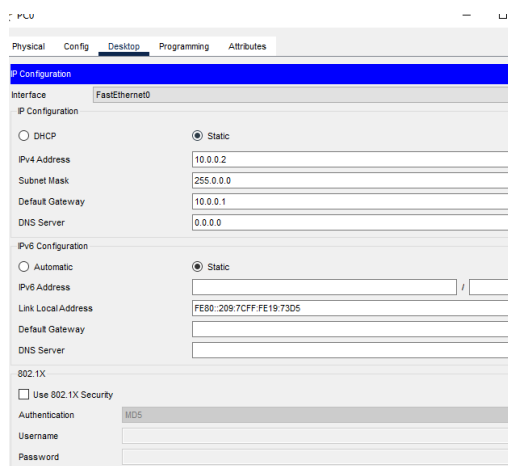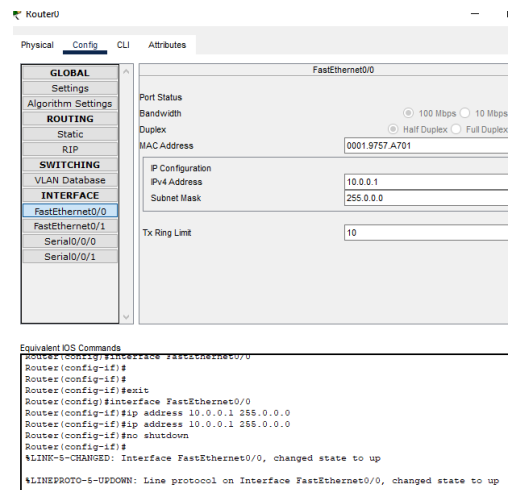
3 Configuration

1. Build the network topology

Figure 2: Build the network for OSPF Configuration.

2. Configure **IP addresses** on the PC and Router(Figure 3).
   a) Click the device and go to the **Desktop tab > IP Configuration**.
   For PC0 : IP: 10.0.0.2 Subnet Mask: 255.0.0.0 Gateway: 10.0.0.1
   For PC1: IP: 20.0.0.2 Subnet Mask: 255.0.0.0 Gateway: 20.0.0.1
   For PC2 : IP: 30.0.0.2 Subnet Mask: 255.0.0.0 Gateway: 30.0.0.1
   For PC3: IP: 40.0.0.2 Subnet Mask: 255.0.0.0 Gateway: 40.0.0.1

   b) Click the router and go to the **Config > Interface**.

3. **OSPF Routing Commands**.

   (a) **Router ospf 10**
       This command allows you enable OSPF protocol on your router and number 10 is the process ID. You can give the process ID between 1 to 65,535.

   (b) **Network 1.0.0.0 0.255.255.255 area 1**.
       This command allows you to create a route in OSPF. Where 1.0.0.0 is the Network ID to which the router is connected to. Here 0.255.255.255 is a Wildcard Mask which is the complete inverse of Subnet Mask. The best way to find the wildcard mask is, just subtract the subnet mask from 255.255.255.255. In this example, the default subnet mask for the class A IP address is 255.0.0.0. So we have subtracted it from 255.255.255.255 and got the wildcard mask as 0.255.255.255.

   (c) In the end, we have mentioned area 1. Here in OSPF, the area defines the complete different network. Two different Areas cannot communicate with each other directly.

4. OSPF Configuration Commands Step by Step.

   (a) Configure OSPF in Router 1

(a) IP Configuration of PC

(b) IP configuration of router

Figure 3: IP Configuration of End Devices and Router

```
Router # en
Router#conf t
Router(config)#router ospf 10
Router(config-router)#network 1.0.0.0 0.255.255.255 area 1
Router(config-router)#network 10.0.0.0 0.255.255.255 area 1
Router(config-router)#  Z (Use Ctrl + Z to save settings)
```

(b) Configure OSPF in Router 2

```
Router # en
Router#conf t
Router(config)#router ospf 10
Router(config-router)#network 1.0.0.0 0.255.255.255 area 1
Router(config-router)#network 2.0.0.0 0.255.255.255 area 1
Router(config-router)#network 20.0.0.0 0.255.255.255 area 1
Router(config-router)#  Z (Use Ctrl + Z to save settings)
```

(c) Configure OSPF in Router 3

```
Router # en
Router#conf t
Router(config)#router ospf 10
Router(config-router)#network 2.0.0.0 0.255.255.255 area 2
Router(config-router)#network 3.0.0.0 0.255.255.255 area 2
Router(config-router)#network 30.0.0.0 0.255.255.255 area 2
Router(config-router)#  Z (Use Ctrl + Z to save settings)
```

(d) Configure OSPF in Router 4

```
Router # en
Router#conf t
Router(config)#router ospf 10
Router(config-router)#network 3.0.0.0 0.255.255.255 area 2
Router(config-router)#network 40.0.0.0 0.255.255.255 area 2
Router(config-router)#  Z (Use Ctrl + Z to save settings)
```

4 Input/Output

After the successful compilation of ospf configuration, we simply test our configuration by ping command.

5 Discussion & Conclusion

Based on the focused objective(s) to learn the step-by-step configuration of an OSPF. This task will help students learn the principles of networking with hands-on experience as well as develop Cisco technology-specific skills. The additional lab exercise will help them to practice OSPF configuration and also help them to be confident towards the fulfillment of the objectives(s).

6 Lab Task (Please implement yourself and show the output to the instructor)

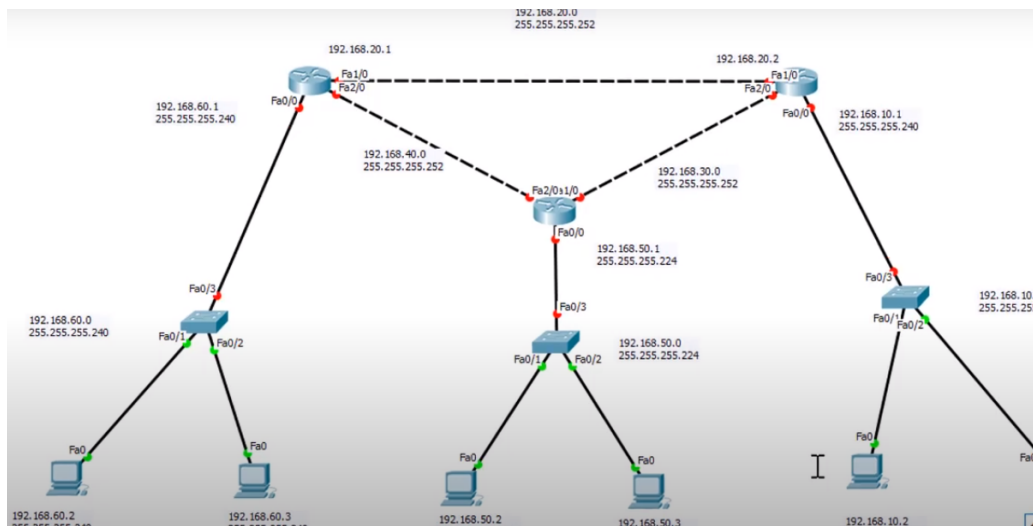Implement OSPF for the following topology

Figure 4: OSPF

7 Lab Exercise (Submit as a report)

You will work on a simple network topology consisting of:

- 4 routers (R1, R2, R3,R4)

- 3 switches (SW1, SW2, SW3)

- 6 PCs (PC1, PC2, PC3, PC4,PC5,PC6)

  Requirements:

1. Configure IP addresses on all interfaces of routers and PCs according to the provided IP addressing scheme

2. Enable OSPF routing protocol on routers and ensure full connectivity between all PCs.

3. Verify OSPF neighbor adjacencies and routing tables.

4. Troubleshoot any OSPF-related issues that may arise during the configuration.

8 Policy

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