Dynamic Routing with OSPF

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1 Introduction

Dynamic routing using OSPF (Open Shortest Path First) is a link-state routing protocol that provides efficient and scalable routing solutions for large networks. This configuration demonstrates the practical implementation of OSPF in a network with multiple routers and PCs.

2 Network Topology

Figure 1 shows the complete network topology with all routers, PCs, and their interconnections.

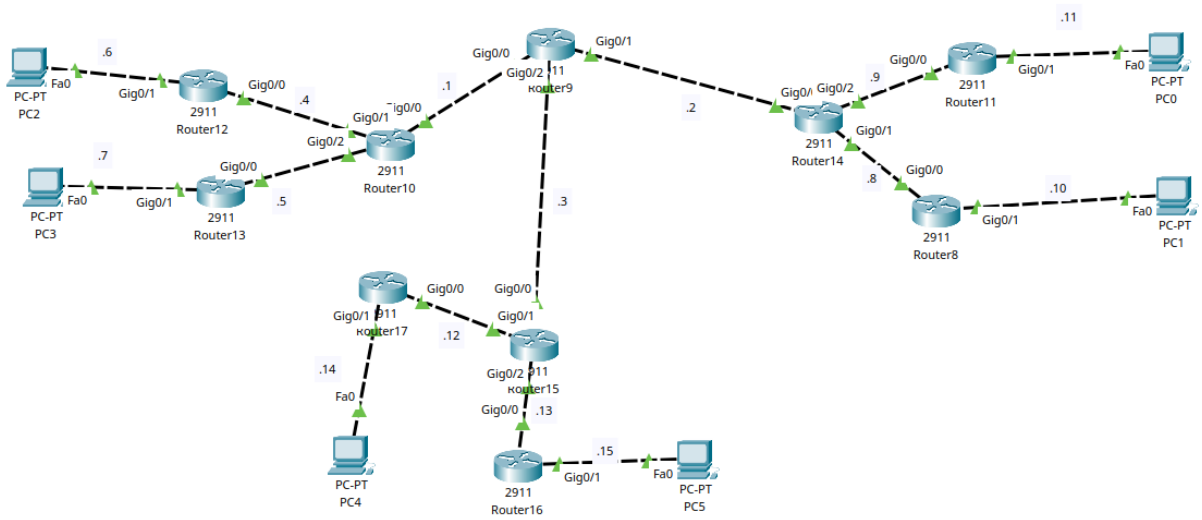

Figure 1: OSPF Network Topology

3 Objectives

The objectives of this OSPF configuration are:

- Establish communication between multiple networks (192.168.x.0/24 networks)
- Demonstrate OSPF protocol configuration in a single area
- Ensure path redundancy through multiple routers
- Enable fast convergence and optimal path selection

4 Router Configuration

4.1 Router Router9 (Center)

IP addresses and interface configuration:

Destination	Mask net	Interface
192.168.1.0	255.255.255.0	g0/0
192.168.2.0	255.255.255.0	g0/1
192.168.3.0	255.255.255.0	g0/2

Table 1: Routing Table for Router9

Configuration commands:

```
Router(config)#hostname Router9
Router9(config)#interface g0/0
Router9(config-if)#ip address 192.168.1.1 255.255.255.0
Router9(config-if)#no shutdown
Router9(config-if)#interface g0/1
Router9(config-if)#ip address 192.168.2.1 255.255.255.0
Router9(config-if)#no shutdown
Router9(config-if)#interface g0/2
Router9(config-if)#ip address 192.168.3.1 255.255.255.0
Router9(config-if)#no shutdown
```

Explanation:

- `hostname Router9`: Sets the router's name to Router9 for identification.
- `interface g0/0`: Enters interface configuration mode for Gigabit Ethernet interface 0/0.
- `ip address 192.168.1.1 255.255.255.0`: Assigns an IP address and subnet mask to the interface.
- `no shutdown`: Activates the interface, enabling it to send and receive traffic.

Destination	Mask net	Interface
192.168.1.0	255.255.255.0	g0/0
192.168.4.0	255.255.255.0	g0/1
192.168.5.0	255.255.255.0	g0/2

Table 2: Routing Table for Router10

4.2 Router Router10

IP addresses and interface configuration:

Configuration commands:

```
Router(config)#hostname Router10
Router10(config)#interface g0/0
Router10(config-if)#ip address 192.168.1.2 255.255.255.0
Router10(config-if)#no shutdown
Router10(config-if)#interface g0/1
Router10(config-if)#ip address 192.168.4.1 255.255.255.0
Router10(config-if)#no shutdown
Router10(config-if)#interface g0/2
Router10(config-if)#ip address 192.168.5.1 255.255.255.0
Router10(config-if)#no shutdown
```

4.3 Router Router11

IP addresses and interface configuration:

Destination	Mask net	Interface
192.168.9.0	255.255.255.0	g0/0
192.168.11.0	255.255.255.0	g0/1

Table 3: Routing Table for Router11

Configuration commands:

```
Router(config)#hostname Router11
Router11(config)#interface g0/0
Router11(config-if)#ip address 192.168.9.2 255.255.255.0
Router11(config-if)#no shutdown
Router11(config-if)#interface g0/1
Router11(config-if)#ip address 192.168.11.1 255.255.255.0
Router11(config-if)#no shutdown
```

Destination	Mask net	Interface
192.168.4.0	255.255.255.0	g0/0
192.168.6.0	255.255.255.0	g0/1

Table 4: Routing Table for Router12

4.4 Router Router12

IP addresses and interface configuration:
Configuration commands:

```
Router(config)#hostname Router12
Router12(config)#interface g0/0
Router12(config-if)#ip address 192.168.4.2 255.255.255.0
Router12(config-if)#no shutdown
Router12(config-if)#interface g0/1
Router12(config-if)#ip address 192.168.6.1 255.255.255.0
Router12(config-if)#no shutdown
```

5 OSPF Protocol Configuration

5.1 OSPF Configuration on Router9 (Center)

```
Router9(config)#router ospf 100
Router9(config-router)#network 192.168.1.0 0.0.0.255 area 0
Router9(config-router)#network 192.168.2.0 0.0.0.255 area 0
Router9(config-router)#network 192.168.3.0 0.0.0.255 area 0
```

Explanation:

- `router ospf 100`: Enters OSPF configuration mode with a process ID of 100.
- `network 192.168.1.0 0.0.0.255 area 0`: Defines the OSPF network by specifying the network address and wildcard mask, assigning it to area 0.

5.2 OSPF Configuration on Router10

```
Router10(config)#router ospf 100
Router10(config-router)#network 192.168.4.0 0.0.0.255 area 0
Router10(config-router)#network 192.168.1.0 0.0.0.255 area 0
Router10(config-router)#network 192.168.5.0 0.0.0.255 area 0
```

5.3 OSPF Configuration on Router11

```
Router11(config)#router ospf 100
Router11(config-router)#network 192.168.9.0 0.0.0.255 area 0
Router11(config-router)#network 192.168.11.0 0.0.0.255 area 0
```

5.4 OSPF Configuration on Router12

```
Router12(config)#router ospf 100
Router12(config-router)#network 192.168.4.0 0.0.0.255 area 0
Router12(config-router)#network 192.168.6.0 0.0.0.255 area 0
```

6 PC Configuration

IP addresses for PCs are assigned as follows:

PC Name	IP Address	Subnet Mask	Default Gateway
PC1	192.168.1.10	255.255.255.0	192.168.1.1
PC2	192.168.2.10	255.255.255.0	192.168.2.1
PC3	192.168.4.10	255.255.255.0	192.168.4.1
PC4	192.168.5.10	255.255.255.0	192.168.5.1
PC5	192.168.9.10	255.255.255.0	192.168.9.2
PC6	192.168.11.10	255.255.255.0	192.168.11.1
PC7	192.168.6.10	255.255.255.0	192.168.6.1

Table 5: PC Configuration

7 Advantages and Disadvantages of OSPF

7.1 Advantages of OSPF

- **Fast Convergence**: OSPF quickly adapts to changes in the network topology, reducing downtime and maintaining optimal routing paths.
- **Scalability**: OSPF supports large networks with thousands of routers and can be segmented into areas to improve manageability and performance.
- **Link-State Protocol**: OSPF uses link-state advertisements (LSAs) to maintain an accurate view of the network, allowing routers to make informed routing decisions.
- **Cost-Based Routing**: OSPF allows for more granular control over routing paths by assigning costs to links based on bandwidth or other metrics.

7.2 Disadvantages of OSPF

- **Complexity**: OSPF configuration and management are more complex compared to simpler protocols like RIP.
- **Resource Intensive**: OSPF requires more CPU and memory resources on routers due to its use of LSAs and maintenance of link-state databases.
- **Overhead**: Frequent updates and the need for routers to maintain state information can result in increased overhead, especially in very large networks.

8 Conclusion

The OSPF configuration presented in this document successfully enables dynamic routing across multiple networks, ensuring effective communication and redundancy. Future enhancements may include configuring additional OSPF features such as summarization and route filtering for optimized performance.