Lab no: 10 ***Date: 2024/09/26***

Title: Dynamic Routing Implementation using OSPF

Objectives:

- To implement OSPF for network routing
- To configure and verify OSPF routing across multiple routers

Background Theory:

Open Shortest Path First (OSPF) is a widely used dynamic routing protocol based on the link-state algorithm. It calculates the shortest path for data transmission using metrics such as cost, which is often based on bandwidth. OSPF divides the network into areas to optimize routing and reduce overhead. It is scalable and more efficient for larger networks compared to protocols like RIP, as it supports faster convergence and hierarchical design.

Process for Dynamic Routing using OSPF:

Step 1: Setup an environment with 3 routers, 3 switches and some desktops, ensuring all devices are connected properly.

Step 2: Manually assign IP addresses and subnet masks to the desktops, router interfaces, and the interface of each router.

Step 3: Access the CLI of the router and enable it using ***"en"*** command.

Step 4: Enter the global configuration mode with command ***"config t".***

Step 5: Access the OSPF configuration mode and assign a process ID using ***"router ospf [process-id]".***

Step 6: Add the connected networks with their wildcard masks and area ID using command: ***"network [network-address] [wildcard-mask] area[area-id]"***

Step 7: Follow the same steps on the other routers, ensuring that all relevant networks are added to their respective OSPF configurations.

```
Router>en
Router#config 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 0
Router(config-router)#network 192.168.4.2 0.0.0.255 area 0
Router(config-router)#exit
Router(config)#
```

Fig: OSPF Configuration of Router0

```
Router>en
Router#config t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#router ospf 2
Router(config-router)#network 192.168.3.0 0.0.0.255 area 2
Router(config-router)#network 192.168.5.0 0.0.0.255 area 2
Router(config-router)#exit
Router(config)#
```

Fig: OSPF Configuration of Router2

```
Router>en
Router#config t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#router ospf 3
Router(config-router)#network 192.168.2.0 0.0.0.255 area 1
Router(config-router)#network 192.168.4.0 0.0.0.255 area 0
Router(config-router)#
00:03:28: %OSPF-5-ADJCHG: Process 3, Nbr 192.168.4.2 on Serial0/0/0 from LOADING to FULL, Loading Done

Router(config-router)#network 192.168.5.0 0.0.0.255 area 2
Router(config-router)#exit
Router(config)#
00:04:16: %OSPF-5-ADJCHG: Process 3, Nbr 192.168.5.3 on Serial0/1/0 from LOADING to FULL, Loading Done
```

Fig: OSPF Configuration of Router1

Observation and Findings:

Implementing OPSF Protocol for dynamic routing using 3 routers, 3 switches and some desktops.

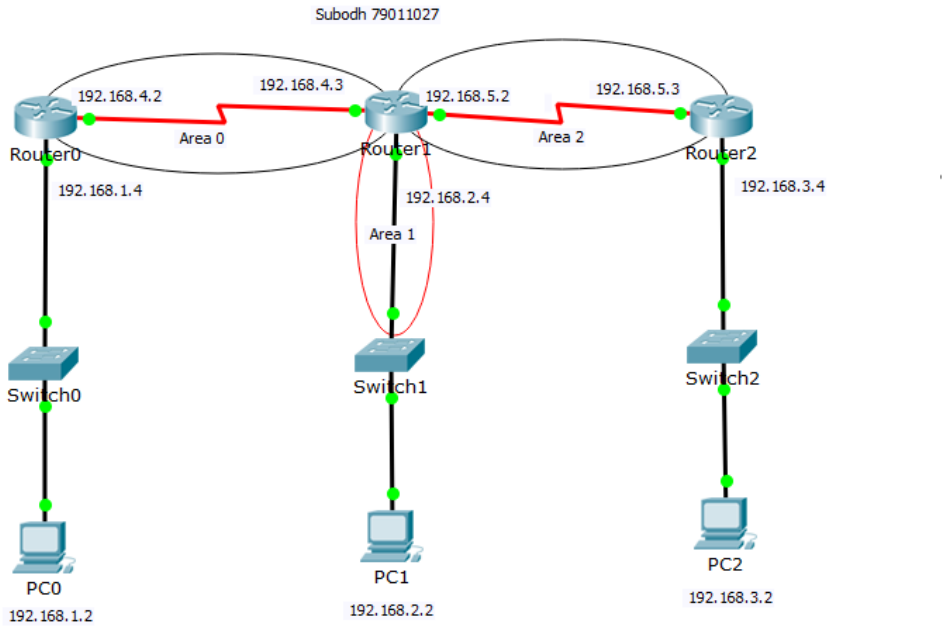

Fig: Dynamic Routing using OSPF

Output:

```
Packet Tracer PC Command Line 1.0
PC>ping 192.168.3.2

Pinging 192.168.3.2 with 32 bytes of data:

Reply from 192.168.3.2: bytes=32 time=3ms TTL=125
Reply from 192.168.3.2: bytes=32 time=2ms TTL=125
Reply from 192.168.3.2: bytes=32 time=15ms TTL=125
Reply from 192.168.3.2: bytes=32 time=2ms TTL=125

Ping statistics for 192.168.3.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 2ms, Maximum = 15ms, Average = 5ms

PC>
```

Discussions:

The routers were configured to implement dynamic routing with Open Shortest Path First (OSPF) for managing network traffic between different subnets. The process involved assigning IP addresses to router interfaces and desktops, enabling OSPF on the routers, and specifying the networks to be advertised. OSPF dynamically exchanged routing information between the routers, ensuring adaptive updates to routing tables based on the network topology. Successful ping tests between devices confirmed that the OSPF-based dynamic routes were correctly implemented, enabling seamless communication between networks. This demonstrates the efficiency, scalability, and hierarchical nature provided by OSPF in handling complex network configurations.

Conclusion:

Implementing dynamic routing using OSPF allowed for efficient and automated management of network traffic between subnets. The successful connectivity tests validated that OSPF was configured correctly, ensuring adaptive and efficient data flow across the networks while minimizing manual intervention. OSPF's hierarchical structure and fast convergence further enhanced the robustness and scalability of the network, making it well-suited for larger and more complex environment.