LAB #10

Routing Protocols

To Configuring OSPF (Open Shortest Path First).

Theory:

Open Shortest Path First:

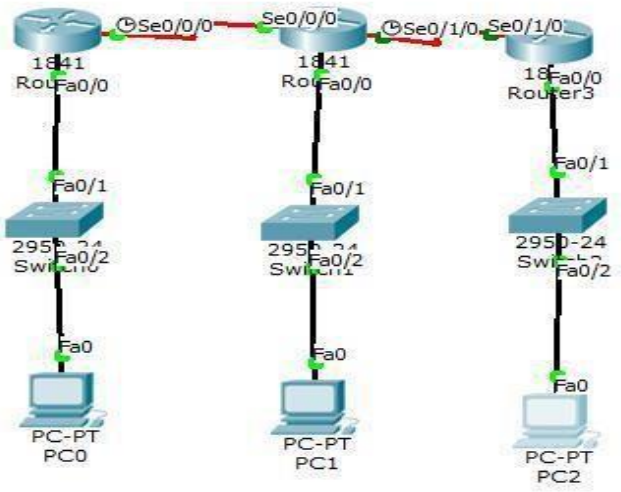
Open Shortest Path First (OSPF) is a link-state routing protocol that was developed for IP networks and is based on the Shortest Path First (SPF) algorithm. OSPF is an Interior Gateway Protocol (IGP). In an OSPF network, routers or systems within the same area maintain an identical linkstate database that describes the topology of the area. Each router or system in the area generates its linkstate database from the link-state advertisements (LSAs) that it receives from all the other routers or systems in the same area and the LSAs that itself generates. An LSA is a packet that contains information about neighbors and path costs. Based on the link-state database, each router or system calculates a shortest-path spanning tree, with itself as the root, using the SPF algorithm. OSPF has the following key advantages: Compared with distance-vector routing protocols such as the Routing Information Protocol (RIP), OSPF is more suitable for serving large, heterogeneous internetworks. OSPF can recalculate the routes in a short amount of time when the network topology changes. With OSPF, you can divide an Autonomous System (AS) into areas and keep area topologies separate to decrease the OSPF routing traffic and the size of the link-state database of each area. OSPF provides equal-cost multipath routing. You can add duplicate routes to the TCP stack using different next hops.

SPF Routing Algorithm:

The SPF algorithm accumulates costs along each path from source to destination. The accumulated costs is then used by the router to build a topology table. OSPF features include:

- Fast convergence
- Supports VLSM
- Efficient use of bandwidth - Routing changes trigger routing updates (no periodic updates)
- Supports large network size
- Routing based on best path selection
- Grouping of members into Area

LAB # 10



Procedure:

Step1:

The topology consists of 3 Cisco routers which are connected with each other and also with 3switches and switches are connected with 3PCs **Step 2:**

A WIC-1T card is placed in the slots in each router. Switch off the router and place the card in the slots and turn it on again. One end of thecable is DTE and the other is automatically DCE. **Step 3:**

We have total 5 networks , now assign ip to each network, assign first three ip in pc using default gateways: 192.168.1.1, 192.168.2.1, 192.168.3.1and remaining two on the serial interface of router. **Step 4:**

Now configure fast Ethernet and serial interface of router by using CLI. Configuration of R0 are as follow:

```
Router#conf t
Router#conf terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#int fa 0/0
Router(config-if)#ip add
Router(config-if)#ip address 192.168.1.1 255.255.255.0
Router(config-if)#no shut
Router(config-if)#no shutdown
Router(config-if)#exit

Router(config)#int s 0/0/0
Router(config-if)#ip add
Router(config-if)#ip address 10.0.0.1 255.0.0.0
Router(config-if)#clock r
Router(config-if)#clock rate 64000
Router(config-if)#no shut down
Router(config-if)#exit
Router(config)#
```

Step 5:

Enabling OSPF :

By using following Syntax:

- Router Eigrp Process id
- Network ip address , wild card mask , area 0

Enable a EIGRP routing process, which places you in router configuration mode. And associate the networks with a EIGRP routing process. Then enter the command show ip route on Ro, R1 and R2 to verify that the new route is now in the routing table.

Exercises:

Q1. What is OSPF what is the use of OSPF?

The OSPF (Open Shortest Path First) protocol is one of a family of IP Routing protocols, and is an Interior Gateway Protocol (IGP) for the Internet, used to distribute IP routing information throughout a single Autonomous System (AS) in an IP network

Each OSPF router passes along information about the routes and costs they've heard about to all of their adjacent OSPF routers, called neighbors. OSPF routers rely on cost to compute the shortest path through the network between themselves and a remote router or network destination

Q2. How do we configure OSPF?

1. **Use the command router ospf process ID to start OSPF.**
2. **Use the network command to enable the interfaces.**
3. **Identify area assignments.**
4. **(Optional) Assign the router ID. Example 3-1 displays OSPF with a process ID of 1 and places all interfaces configured with an IP address in area 0. The network command network 0.0.**

Q3 On which basis OSPF decides the best path (routing metric)?

If there are multiple routes to a network with the same route type, the OSPF metric calculated as cost based on the bandwidth is used for selecting the best route. The route with the lowest value for cost is chosen as the best route.

Q.4 What is the benefits of dividing entire network into area?

Subnetting adds order and increased performance by splitting up traffic in larger networks. When you subnet your network, you ensure that traffic destined for a particular device within that subnet stays within the subnet. This will minimize congestion in other parts of the network.

Q.5 Which algorithm OSPF use for finding best path?

The path-vector algorithm, which is used by Border Gateway Protocol (BGP) to determine the best routes to locations on the network, is based on the Bellman-Ford algorithm.
An OSPF router will not use the Diffusing Update Algorithm (DUAL) to determine the best route for packets

Q.6 In which routing protocol did OSPF lie ?

Open Shortest Path First (OSPF) is an Interior Gateway Protocol (IGP) standardized by the Internet Engineering Task Force (IETF) and commonly used in large Enterprise networks. OSPF is a link-state routing protocol providing fast convergence and excellent scalability.

Q.7 What is the router id in OSPF?

By default, when the OSPF process initializes, it selects the highest IP address on a router as the router ID for the OSPF process. The router ID uniquely identifies a router within an OSPF domain. As explained in Configuring OSPF, OSPF uses the largest IP address configured on the interfaces as its router ID.

Q.8 On a single router, if we have connected two different networks with different process id's configured, will they communicate or not. If yes, what needs to be done, to communicate with each other?

Typically, a network uses a combina- tion of both a dynamic routing protocol and static routes. In most networks, a single dynamic routing protocol is used; however, there are cases where different parts of the net- work can use different routing protocols.

Q.09 What is backbone area and what do we mean by link state in OSPF?

The backbone area (Area 0) is the core of an OSPF network. All other areas are connected to it and all traffic between areas must traverse it. All routing between areas is distributed through the backbone area. ... Routing from the stub area is performed through the default route to the backbone area.
The OSPF protocol is a link-state routing protocol, which means that the routers exchange topology information with their nearest neighbors. The topology information is flooded throughout the AS, so that every router within the AS has a complete picture of the topology of the AS

Q.10. What are the two categories of dynamic routing?

At the highest level are two main categories of dynamic routing protocol: exterior gateway protocols (EGPs) and interior gateway protocols (IGPs).

Q.11. what are the metric in OSPF, RIP, EIGRP?

Routing protocols are used to establish a path between routers. The most common routing protocols used are: Routing Information Protocol (RIP), Enhanced Interior Gateway Routing Protocol (EIGRP), Open Shortest Path First (OSPF), and Intermediate System to Intermediate System (IS-IS).