CO513 - Lab 04
Dynamic Routing - OSPF

OSPF - Open Shortest Path First Protocol

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. It is used to distribute IP routing information throughout a single Autonomous System (AS) in an IP network. 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. This picture is then used to calculate end-to-end paths through the AS, normally using a variant of the Dijkstra algorithm. Therefore, in a link-state routing protocol, the next hop address to which data is forwarded is determined by choosing the best end-to-end path to the eventual destination.

The main advantage of a link state routing protocol like OSPF is that the complete knowledge of topology allows routers to calculate routes that satisfy particular criteria. This can be useful for traffic engineering purposes, where routes can be constrained to meet particular quality of service requirements. The main disadvantage of a link state routing protocol is that it does not scale well as more routers are added to the routing domain. Increasing the number of routers increases the size and frequency of the topology updates, and also the length of time it takes to calculate end-to-end routes. This lack of scalability means that a link state routing protocol is unsuitable for routing across the Internet at large, which is the reason why IGPs only route traffic within a single AS. Each OSPF router distributes information about its local state (usable interfaces and reachable neighbors, and the cost of using each interface) to other routers using a Link State Advertisement (LSA) message. Each router uses the received messages to build up an identical database that describes the topology of the AS. From this database, each router calculates its own routing table using a Shortest Path First (SPF) or Dijkstra algorithm. This routing table contains all the destinations the routing protocol knows about, associated with a next hop IP address and outgoing interface.

Lab Exercise

1. Explain the terms DR and BDR. What are the criteria/parameters used during the election of DR and BDR within an OSPF network?

Follow the given steps and use [Cisco packet tracer](#) to configure the following single area OSPF network accordingly.

As indicated in Figure 1, overall there are 5 networks which have been connected via 3 routers. The network IP configurations related to each network as mentioned in the Table 01 below. On the other hand, the router ID/Loopback IP assigned to each router are mentioned in table 02.
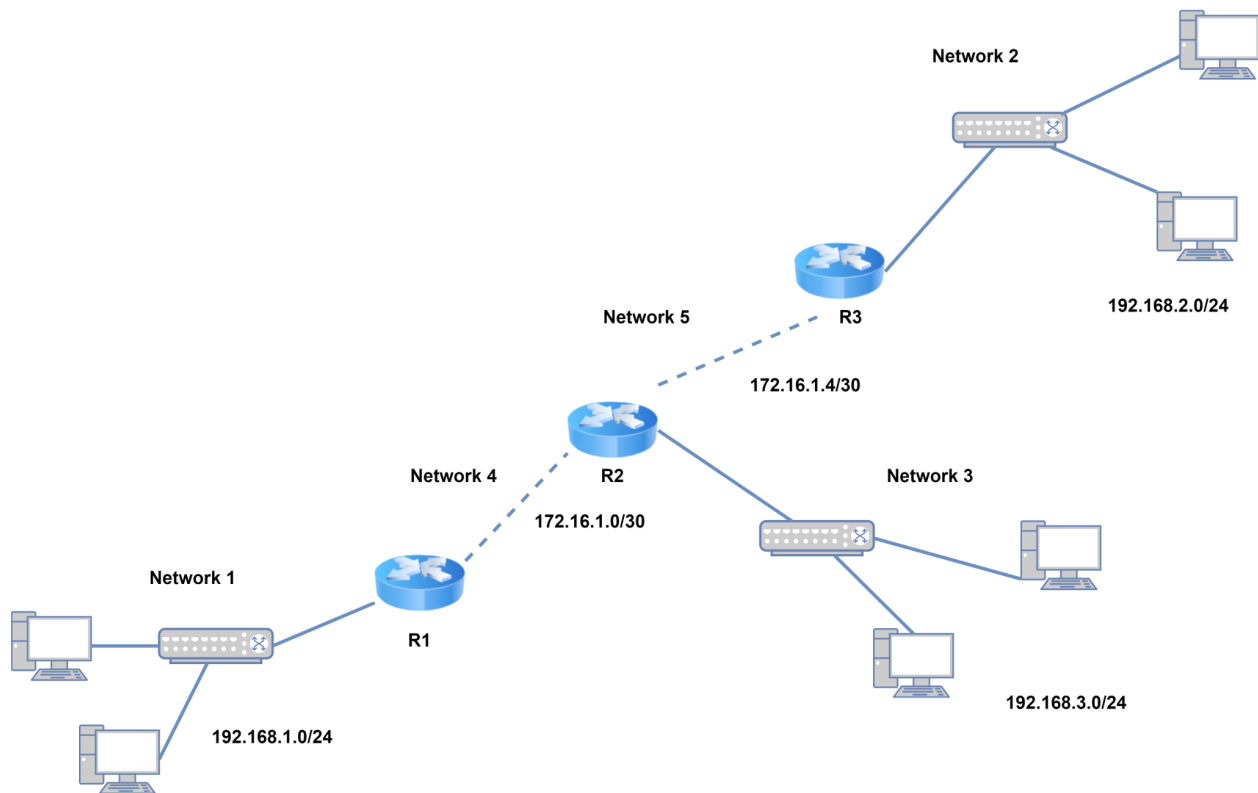
Figure 01: Network Diagram

Table 01: Ip Configurations

Network	Network Address
1	192.168.1.0/24
2	192.168.2.0/24
3	192.168.3.0/24
4	172.16.1.0/30
5	172.16.1.4/30

A. Configure OSPF
   a. Draw the topology given in Figure 01, in Packet Tracer using appropriate networking and end devices.
   b. Assign IP addresses to each PC/router ports considering Table 01.
   c. Configure OSPF in each of the routers accordingly (Configure each router with router ID or loopback IP addresses according to the data provided in Table 02).

d. Ping from one of the PCs in network 1 to another PCs in network 2 and 3.

Table 02: Router ID Assignment

Router	Router ID/Loopback ID
R1	1.1.1.1
R2	2.2.2.2
R3	3.3.3.3

B. Network Verification
   a. Use following commands to verify the implemented OSPF network. Include CLI screenshots for each command and mention what kind of information you have been retrieved via each command briefly.
      i.   #show ip ospf interfaces
      ii. #show ip protocols
      iii. #show ip ospf
      iv. #show ip ospf neighbor
      v.   #show ip ospf database

Submission

Create a report renamed as **E16XXX_report.pdf** (XXX is your E Number) including the **screenshots for your observations, simulations, CLIs (Show Command Outputs and Necessary Configurations), and answers** related to each of the steps.

- Submit a zip file **E16XXX_Lab04.zip** (XXX is your E Number) which contains the following.
   - **E16XXX_report.pdf**
   - **E16XXX.pkt** (Packet Tracer Activity File)

Note: Make sure that you have copied your running configuration to startup configurations before submitting the .pkt file (i.e. save your configurations correctly before submission).

Reference

What is Open Shortest Path First (OSPF)? (metaswitch.com)