Shri Vile ParleKelvani Mandal's

DWARKADAS J. SANGHVI COLLEGE OF ENGINEERING

Approved by AICTE and Affiliated to the University of Mumbai

Department of Electronics & Telecommunication Engineering

Mini Project Report

On

OSPF using Cisco Packet Tracer

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CERTIFICATE

This is to certify that Mr _____of TE EXTC-1, SAP ID: _____ has submitted the Computer Communication Networks Mini Project Report for the Academic Year 2018-2019.

Guide

Examiner

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1.1 Aim:

To design a network in Cisco Packet Tracer Software using various components, and to find the shortest path from one node to another.

1.2 Introduction:

Open Shortest Path First (**OSPF**) is a routing protocol for Internet Protocol (IP) networks. It uses a link state routing (LSR) algorithm and falls into the group of interior gateway protocols (IGPs), operating within a single autonomous system (AS). It is defined as OSPF Version 2 in RFC 2328 (1998) for IPv4.

The OSPF routing protocol has largely replaced the older Routing Information Protocol (RIP) in corporate networks. Using OSPF, a router that learns of a change to a routing table (when it is reconfigured by network staff, for example) or detects a change in the network immediately multicasts the information to all other OSPF hosts in the network so they will all have the same routing table information.

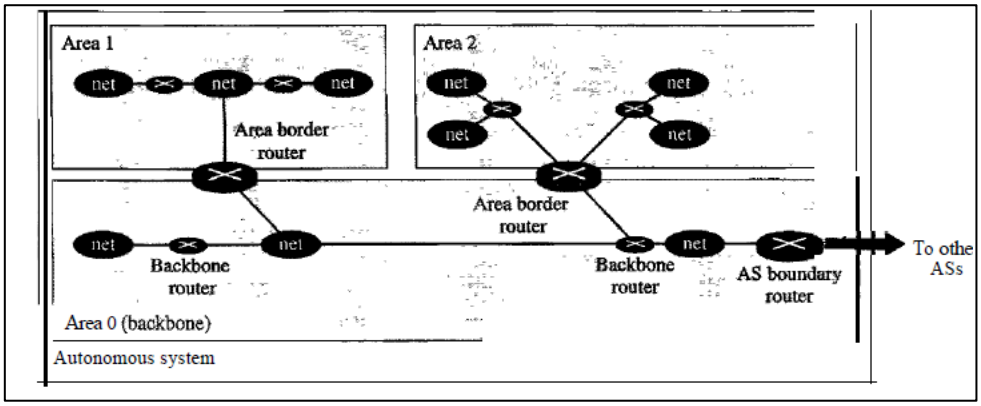
1.3 Theory:

- Unlike RIP, which requires routers to send the entire routing table to neighbours every 30 seconds, OSPF sends only the part that has changed and only when a change has taken place. When routes change -- sometimes due to equipment failure -- the time it takes OSPF routers to find a new path between endpoints with no loops (which is called "open") and that minimizes the length of the path is called the *convergence time*.
- Rather than simply counting the number of router hops between hosts on a network, as RIP does, OSPF bases its path choices on "link states" that take into account additional network information, including IT-assigned cost metrics that give some paths higher assigned costs. For example, a satellite link may be assigned higher cost than a wireless WAN link, which in turn may be assigned higher cost than a metro Ethernet link.
- OSPF is developed by Internet Engineering Task Force (IETF) as one of the Interior Gateway Protocol (IGP), i.e. the protocol which aims at moving the packet within a large autonomous system or routing domain. It is a network layer protocol which works on the protocol number 89 and uses AD value 110. OSPF uses multicast address 224.0.0.5 for

normal communication and 224.0.0.6 for update to designated router (DR)/Backup Designated Router (BDR).

Areas:

- To handle routing efficiently and in a timely manner, OSPF divides an autonomous system into areas. An area is a collection of networks, hosts, and routers all contained within an autonomous system. An autonomous system can be divided into many different areas.
- All networks inside an area must be connected. Routers inside an area flood the area with routing information. At the border of an area, special routers called area border routers summarize the information about the area and send it to other areas.
- Among the areas inside an autonomous system is a special area called the *backbone;* all the areas inside an autonomous system must be connected to the backbone. In other words, the backbone serves as a primary area and the other areas as secondary areas. This does not mean that the routers within areas cannot be connected to each other, however.
- The routers inside the backbone are called the backbone routers. Note that a backbone router can also be an area border router. If, because of some problem, the connectivity between a backbone and an area is broken, a virtual link between routers must be created by an administrator to allow continuity of the functions of the backbone as the primary area.
- Each area has an area identification. The area identification of the backbone is zero. The figure below shows an autonomous system and its areas.

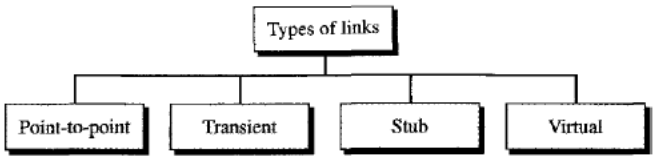


Metric:

- The OSPF protocol allows the administrator to assign a cost, called the metric, to each route. The metric can be based on a type of service (minimum delay, maximum throughput, and so on). As a matter of fact, a router can have multiple routing tables, each based on a different type of service.

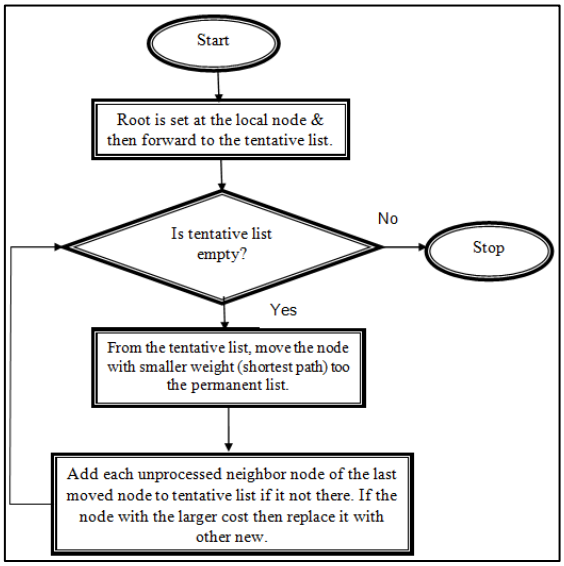
Types of Links:

Figure 22.25 *Types of links*



- In OSPF terminology, a connection is called a *link.* Four types of links have been defined: point-to-point, transient, stub, and virtual. A point-to-point link connects two routers without any other host or router in between. In other words, the purpose of the link (network) is just to connect the two routers. An example of this type of link is two routers connected by a telephone line or a T line. There is no need to assign a network address to this type of link.
- Graphically, the routers are represented by nodes, and the link is represented by a bidirectional edge connecting the nodes. The metrics, which are usually the same, are shown at the two ends, one for each direction. In other words, each router has only one neighbour at the other side of the link.
- A transient link is a network with several routers attached to it. The data can enter through any of the routers and leave through any router. All LANs and some WANs with two or more routers are of this type.

Algorithm (Dijkstra's Algorithm for open shortest path)



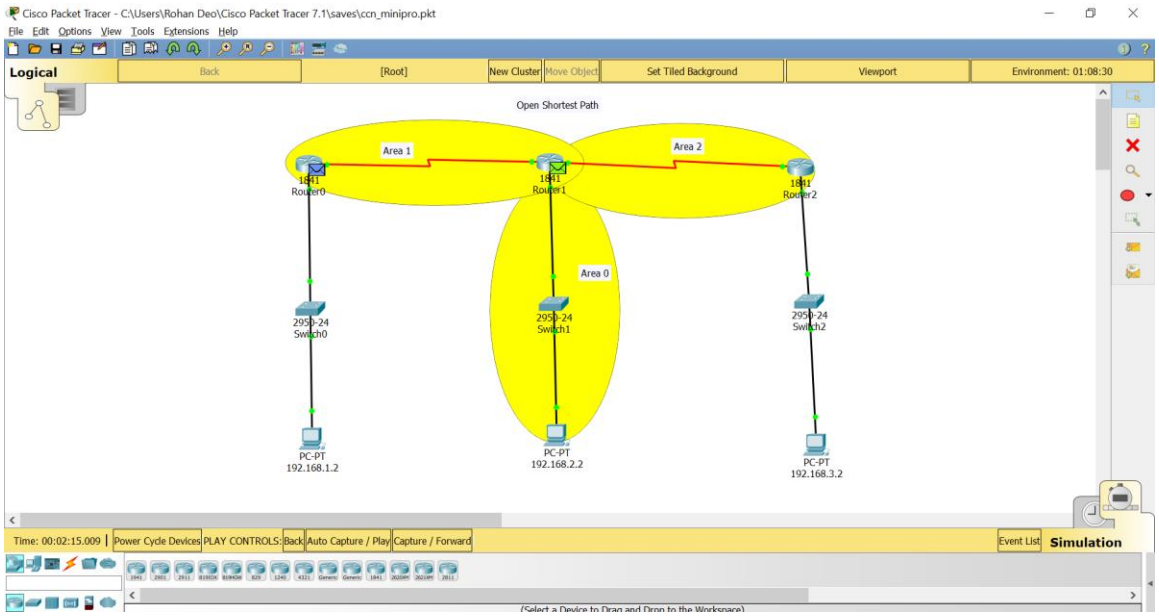
1.4 Components Used

Software Used: Cisco Packet Tracer

Components:

1. **Router:** They are used to connect different LANs or a LAN with a WAN (e.g. the internet). Routers control both collision domains and broadcast domains. If the packet's destination is on a different network, a router is used to pass it the right way, so without routers the internet could not functions. They use NAT (Network Address Translation) in conjunction with IP Masquerading to provide the internet to multiple nodes in the LAN under a single IP address. Now a day, routers come with hub or switch technology to connect computers directly. They work on the network layer so they can filter data based on IP addresses. They have route tables to store network addresses and forward packets to the right port.
2. **Switch:** Switches on the other hand are more advanced. Instead of broadcasting the frames everywhere, a switch actually checks for the destination MAC address and forward it to the relevant port to reach that computer only. This way, switches reduce traffic and divide the collision domain into segments, this is very sufficient for busy LANs and it also protects frames from being sniffed by other computers sharing the same segment. They build a table of which MAC address belongs to which segment. If a destination MAC address is not in the table it forwards to all segments except the source segment. If the destination is same as the source, frame is discarded.
3. **End Devices:** PC's

1.5 Implementation/Result



Commands for Router 0:

```
Router1(config-if)#exit
Router1(config)#router ospf 1
Router1(config-router)#network 10.0.0.0 0.255.255.255 area 1
Router1(config-router)#network 192.168.1.0 0.0.0.255 area 1
Router1(config-router)#exit
```

Commands for Router 1:

```
Router1(config-if)#exit
Router1(config)#router ospf 2
Router1(config-router)#network 10.0.0.0 0.255.255.255 area 1
Router1(config-router)#network 192.168.2.0 0.0.0.255 area 0
Router1(config-router)#network 11.0.0.0 0.255.255.255 area 2
Router1(config-router)#exit
```

Commands for Router 2:

```
Router1(config-if)#exit
Router1(config)#router ospf 1
Router1(config-router)#network 192.168.3.0 0.0.0.255 area 2
Router1(config-router)#network 11.0.0.0 0.255.255.255 area 2
Router1(config-router)#exit
```

1.6 Conclusion:

We have concluded the following after performing the project: -

- As a link state routing protocol, OSPF maintains link state databases, which are really network topology maps, on every router on which it is implemented. The *state* of a given route in the network is the cost, and OSPF algorithm allows every router to calculate the cost of the routes to any given reachable destination.
- OSPF is much faster as compared to RIP protocol, hence its operation is more efficient and time saving
- An OSPF network can be structured, or subdivided, into routing *areas* to simplify administration and optimize traffic and resource utilization.

1.7 References:

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2. https://protechgurus.com/ospf-configuration-commands-examples/

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4. B. A. Farouzan, "Data and Computer Communication", Tata McGraw Hill