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Assignment No	Six

Assignment Number - 06

Title : Configuration of router for implementation of Open Shortest Path First (OSPF) Protocol **Problem**

Statement Using a Network Simulator (e.g. packet tracer) Configure routers for OSPF routing

Theory :

OSPF Protocol

OSPF is a complex routing protocol. It uses many terms to define its functions and operations.

Link

A link is a router's interface connected to an IP subnet. When we add an interface to the OSPF process, OSPF considers the interface as a link.

State

Since a link is an interface, it has two states: up and down. The up state shows the link (interface) is operational and OSPF can reach the IP subnet connected to the link. The down state shows the link is not operational and OSPF cannot reach the IP subnet connected to the link.

Link state protocol

OSPF is a link-state protocol. Link state protocols use the Shortest Path First (SPF) algorithm to calculate the best path to a destination. To run this algorithm, link-state protocols learn the complete topology of the network. In a big size network, this feature creates scalability problems. To solve this problem, OSPF uses two concepts: autonomous systems and areas. **An autonomous system**

An autonomous system is a group of networks under a single administrative control which can be a group of companies, a company, or a division within the company. There are two types of routing protocols: Interior Gateway Protocol (IGP) and Border Gateway Protocol (BGP). IGP routing protocols provide routing within a single AS. BGP routing protocols provide routing between different AS. OSPF is a IGP routing protocol. OSPF provides routing within a single AS.

OSPF Area

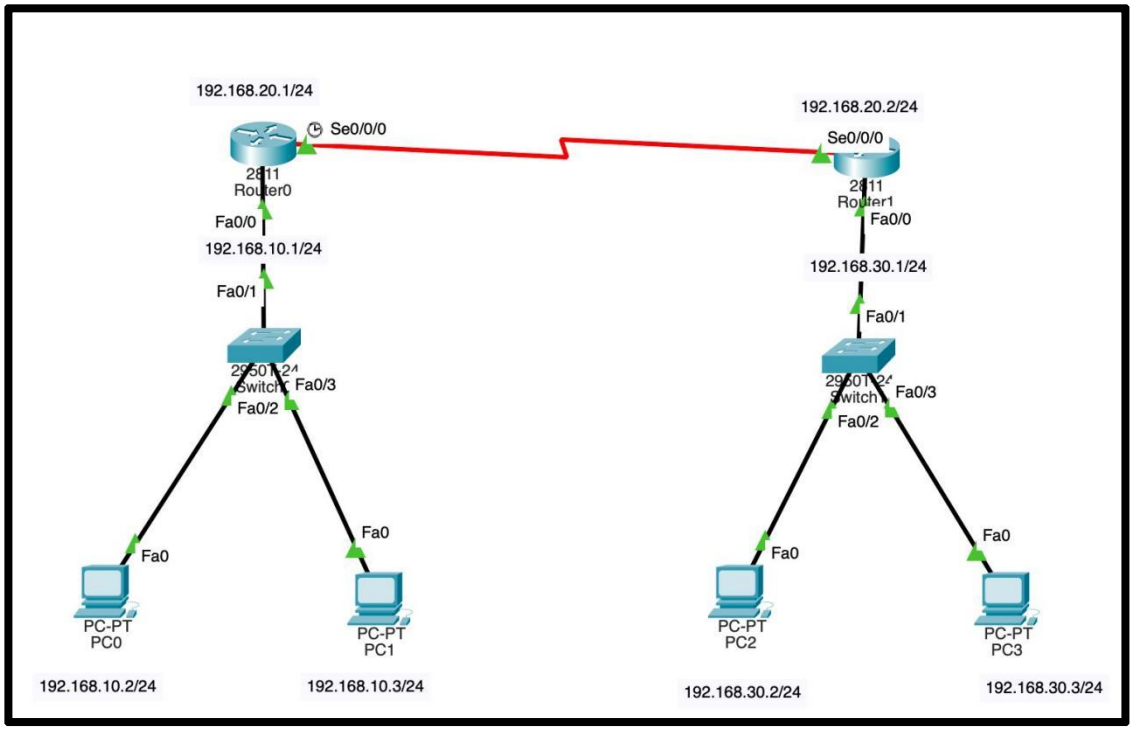
OSPF groups network together, where the topology of one group is hidden from the other. These set of groups are called Areas. An area ID is 32 bit number, which is unique identification number that differentiates each area.

Backbone area (Area 0) – Responsible for distributing routing information among other areas of the system. The backbone area is identified by the number 0.0.0.0

Off backbone area (Area 1-65535) – consist of areas other than backbone area of system.

Configuration of OSPF

The systax for configuring OSPF is:
Router(Config)#router ospf process_ID
Router(Config)#network Network_address Wildcard_mask area are_no



OSPF Implementation in Multiple Area

Code :

Router 0:

Router(config)#interface FastEthernet0/0
Router(config-if)#ip address 10.0.0.1 255.0.0.0
Router(config-if)#no shutdown
Router(config-if)#
%LINK-5-CHANGED: Interface FastEthernet0/0, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to up
Router(config)#interface Serial0/0/0
Router(config-if)#ip address 20.0.0.1 255.0.0.0
Router(config-if)#no shutdown
Router(config-if)#
%LINK-5-CHANGED: Interface Serial0/0/0, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/0, changed state to
Router(config)#router ospf 1
Router(config-router)#network 10.0.0.0 0.255.255.255 area 0 Router(config-router)#network 20.0.0.0 0.255.255.255 area 0

Router 1:

```
Router(config)#interface FastEthernet0/0
Router(config-if)#ip address 50.0.0.1 255.0.0.0
Router(config-if)#no shutdown
Router(config-if)#
%LINK-5-CHANGED: Interface FastEthernet0/0, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to up
Router(config)#interface Serial0/0/0
Router(config-if)#ip address 20.0.0.2 255.0.0.0
Router(config-if)#no shutdown
Router(config-if)#
%LINK-5-CHANGED: Interface Serial0/0/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/0, changed state to up
Router(config)#interface Serial0/0/1
Router(config-if)#ip address 30.0.0.1 255.0.0.0
Router(config-if)#no shutdown
Router(config)#router ospf 1
Router(config-router)#network 10.0.0.0 0.255.255.255 area 0
Router(config-router)#network 20.0.0.0 0.255.255.255 area 0
```

Conclusion : Implementing the OSPF (Open Shortest Path First) protocol offers valuable insights into how complex routing protocols operate within modern networks. One of the primary takeaways is the importance of link-state advertisements (LSAs), which allow routers to share topological information efficiently. Through the exchange of LSAs, each router constructs a consistent map of the network, ensuring accurate and loop-free path selection. Another key lesson is the role of Dijkstra's algorithm in calculating the shortest path tree (SPT). This highlights how routing protocols rely heavily on mathematical models to make real-time routing decisions, optimizing the network's performance. We also learn the significance of hierarchical design with areas, which makes OSPF scalable by limiting the propagation of routing updates and reducing processing overhead.