OSPF
(Open Shortest Path First)

Introduction

- OSPF was created in the mid-**1980s**
- It is Open Standard and widely used. As it is Open standard, it runs mostly on all platforms.
- It is a scalable protocol and can be used on very large networks.
- It uses link state for building up routing protocol.
- Has **unlimited hop count**.
- It uses the **SPF** algorithm, developed by **Dijkstra**, to provide a loop-free topology.
- It provides fast convergence with triggered, incremental updates via **Link State Advertisements** (LSAs).
- It sends data over multipaths.
- OSPF supports classless IP addressing scheme, also allows hierarchical design with VLSM and Route Summarization.
- OSPF Multicast Addresses:

For Hello Packets	-	**224.0.0.5**
For Routing Updates	-	**224.0.0.6**

Given its advantages/features, OSPF does have its share of drawbacks:

- It requires more memory to hold the adjacency (list of OSPF neighbors), topology (a link state database containing all of the routers and their routes), and routing tables.
- It requires extra CPU processing to run the SPF algorithm, which is especially true when you first turn on your routers and they are initially building the adjacency and topology tables.
- For large networks, it requires careful design to break up the network into an appropriate hierarchical design by separating routers into different areas.
- It is complex to configure and more difficult to troubleshoot.

OSPF Areas

OSPF Areas are used to impose a hierarchical structure to the flow of data over the network. A network using OSPF will always have at least one area and if there is more than one area, one of two areas must be the backbone area. Areas are used to group routers into manageable groups that exchange routing information locally, but summarize that routing information when advertising the routes externally. A standard OSPF network looks something like a big bubble (the backbone area) with a lot of smaller bubbles (stub areas) attached directly to it. Area Border Routers (ABR) is used to connect the areas. Each area will elect a Designated Router (DR) and a Backup Designated Router (BDR) to assist in flooding Link State Advertisements (LSAs) throughout the area.

OSPF Terminologies

Backbone (Area 0) - The backbone is the first area you should always build in any network using OSPF and the backbone is always Area 0 (zero). All areas are connected directly to the OSPF backbone area. When designing an OSPF backbone area, you should make sure there is little or no possibility of the backbone area being split into two or more parts by a router.
Adjacency - The situation that takes place when two OSPF routers have exchanged information that results into the two routers having identical topology tables.
Area Border Router (ABR) - This refers to those routers who exist on the border of more than one OSPF area that connects routers to the backbone.
Autonomous System - This refers a group of routers that form part of the same network management and administration, who share OSPF routing information.
Autonomous System Boundary Router (ASBR) - This refers an Autonomous system boundary (ASBR) that exists between an OSPF Autonomous System and

a non OSPF network that executes several or multiple routing protocols.
Area Border Router (ABR) - This refers to those routers who exist on the border of more than one OSPF area that connects routers to the backbone.
Backbone - This is the foremost path or route that is used for network traffic. The Backbone is that segment of the network that is most frequently resourced from.
Designated Router - This is an OSPF router that performs numerous functions is a multi-access network. A Designated Router (DR) decreases traffic, as well as the size of the topology database.
Backup Designated Router - This is a standby Designated Router (DR) that receives that same information as a DR, so that it can function when there is a DR failure.
Cost - This refers to the metric utilized by OSPF that is symbolized by a numeric value and is allocated to a particular link. Cost is based on connection output speed.
Hello Packet - This is a packet that is utilized by OSPF to create and administer relationships with neighbor devices.
Neighbor - This refers to two routers who have links on a shared network.
Link - This refers to the interface between a connected network and an OSPF router.
Link State - This refers to the circumstance or condition of a particular link between two routers that share Link State Advertisements (LSAs). A Link State can be in the full state, down, loading, init, two, exstart, or exchange condition.
Router ID - This is an exclusive number on a Cisco router. The Router ID is configured by the – ▪ Highest configured IP Address ▪ Highest configured IP Address loop-back address ▪ Manually assigned
Router Priority - This is an 8-bit number that specifies the priority of the router during the DR and BDR election method. When the need arises, the Router

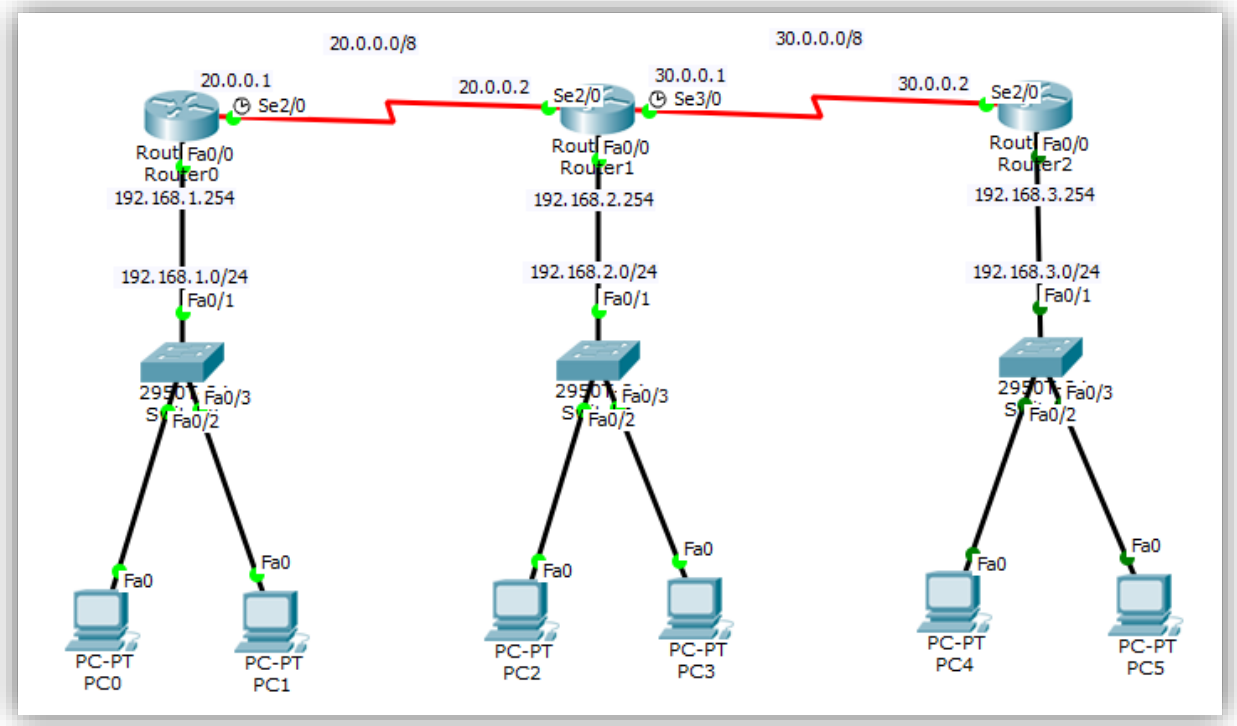
Priority can be manually reconfigured.
Routing Table/Forwarding Database - This refers to the table that is established when the SPF algorithm is performed on the link-state database.
Topology Table/Link State Database - This is that table contains each link in the whole network.

Summarization

Summarization is another key component of the OSPF feature set. Summarization can be accomplished in OSPF at ABR and ASBR boundaries advertised in summarized LSAs. Summarization of routes is usually found when hierarchical addressing is in place. The addresses must be contiguous order for protocols like OSPF to take full advantage of summarization. This ability allows OSPF to run fewer CPU cycles and reduce usage of memory and router resources. If the OSPF router can store a single route, and still be able to reach 100 different subnets from one advertisement, summarization has saved one hundred different entries to the database, and the memory to store them. CPU cycles are also spared when the SPF performs lookups to destinations and by basing its calculations on one entry that 100.

Configuration Commands Syntax

```
Router(config)# router  ospf  <ASN>
Router(config-router)# network  <network address>  <wildcard mask>  area <area no.>
```



OSPF Configuration on the basis of above diagram

Router1

```
Router(config)# do show ip route
Router(config)# router ospf 200
Router(config-router)# network 20.0.0.0 0.255.255.255 area 0
Router(config-router)# network 192.168.1.0 0.0.0.255 area 0
Router(config-router)# do show ip protocols
```

Router2

```
Router(config)# do sh ip route
Router(config)# router ospf 200
Router(config-router)# network 20.0.0.0 0.255.255.255 area 0
Router(config-router)# network 30.0.0.0 0.255.255.255 area 0
Router(config-router)# network 192.168.2.0 0.0.0.255 area 0
Router(config-router)# do show ip protocols
```

Router3

```
Router(config)# do show  ip  route
Router(config)# router  ospf  200
Router(config-router)# network  30.0.0.0  0.255.255.255  area  0
Router(config-router)# network  192.168.3.0  0.0.0.255  area  0
Router(config-router)# do  show  ip  protocols
```