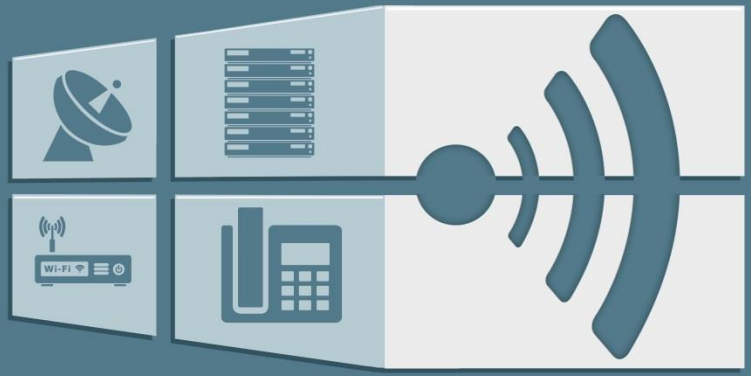


Introduction to CCNA® Routing and Switching

Lesson 18

Open Shortest Path First

By the end of this lesson, you will be able to:

- Explain the OSPFv2 protocol
- List the types of LSAs
- Explain router configuration mode used for OSPF

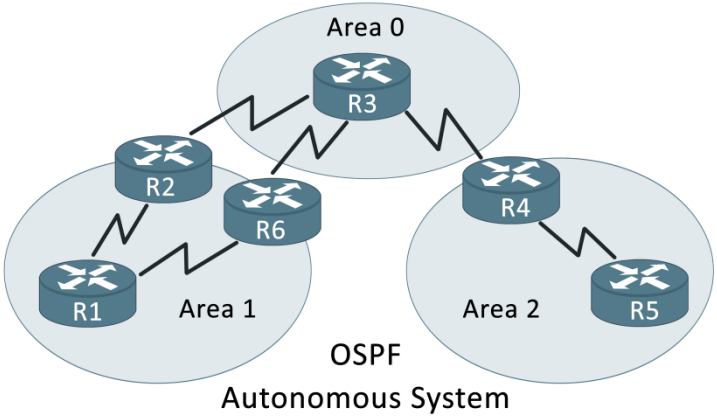
Open Shortest Path First (OSPF) was designed by the Internet Engineering Task Force (IETF) and John Moy.

Characteristics of OSPF:

- It is a link-state routing protocol
- It builds a topological map of the network
- It requires a hierarchical addressing scheme
- It uses IP protocol 89 and multicast addresses, 224.0.0.5, and 224.0.0.6

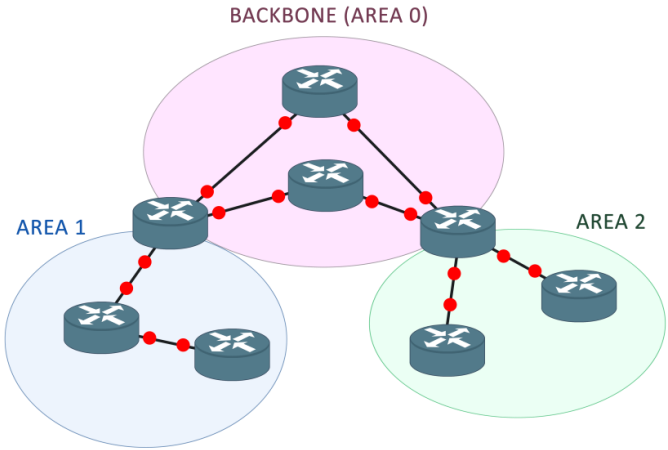
An OSPF routing domain can use multiple areas, which are groups of routers.

- The internal routing of each area can be isolated from the rest of the routing domain.
- All OSPF routing domains require an area 0.



The backbone area forms the core of an OSPF network.

- Each area must be attached to area 0 (the backbone) either physically or through a virtual link.
- By default, all traffic from other areas must cross backbone area 0 to enter another area.
- The backbone area must be contiguous.



OSPF has three tables with multiple names:

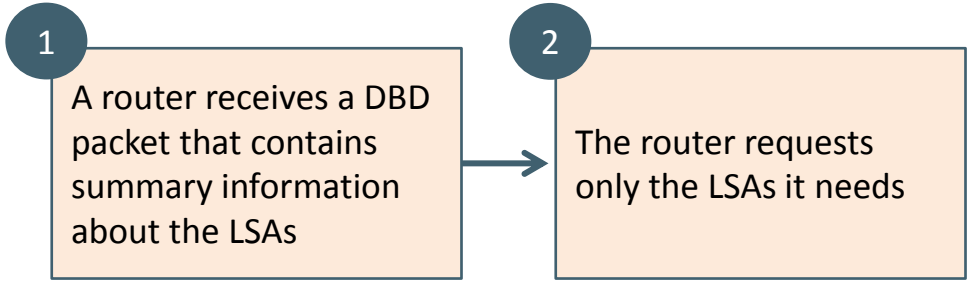
- Neighbor table or Adjacency table
- Topology table or Link State Database (LSDB)
- Routing table or Forwarding table

The Neighbor table contains information about routers with which a neighbor adjacency has been formed. The following must match between ends of a link for routers to become neighbors:

- Hello and dead intervals;
- Area ID;
- Stub area flag; and
- Authentication type and password, if applicable.

In OSPF, the word adjacency as well as neighbor are used.

Link State Updates (LSUs) contain detailed routing information. Each LSU has multiple Link State Advertisements (LSAs). Routing updates are exchanged as follows:



All LSAs have a lifetime of 30 minutes and are flooded by default every 30 minutes.

There are many types of LSAs. Each originates in a specific area and is flooded to same and helps to minimize traffic between OSPF areas:

LSA	Created By	Flooded into
Type 1 – Router LSA	All OSPF routers	All routers in the originating area
Type 2 – Network LSA	Designated Routers	All routers in the originating area
Types 3 – Net Summary LSA	Area-Border Routers	All routers in a single area

There are other types of LSAs. For the CCNA exam, you are required to know only these three types.

The Link State Database (LSDB) contains routing information by area.

- An Area Border Router (ABR) is defined as a router that has interfaces connected to at least two different OSPF areas.
- ABRs maintain separate LSDBs for each of the areas their interfaces are attached to.
- Djikstra's Shortest Path First Algorithm (SPF) is applied separately by each router against its LSDBs to find the best path.
- The best paths are then inserted into the IP routing table.

process-ID does not have to match on all routers, but it must match on both sides of a link. It should be locally significant.

router ospf *process-ID*

Each router ID must be unique in the OSPF routing domain. A router ID is configured in dotted-decimal format.

router-id *router-id*

The output of router command is shown below:

```
router ospf 22
router-id 2.2.2.2
```

The **network** command determines which interfaces will be involved in OSPF processing.

network *subnet* [*inverse-mask*] **area** *area-ID*

An inverse mask is the regular subnet mask subtracted from 255.255.255.255. The inverse mask of 255.255.240.0 is 0.0.15.255.

A mask is optional in the **network** command.

Following are the commands for hello and dead intervals.

```
Rtr1(config-if)#ip ospf hello-interval hello-interval
Rtr1(config-if)#ip ospf dead-interval dead-interval
```

- The default hello/dead interval is 10/40 seconds.
- The dead interval is the OSPF term for hold time.
- The dead interval is set to 4 times the hello interval by default.

This is an example of a completed router section.

```
router ospf 22
router-id 2.2.2.2
network 25.0.0.0 0.0.0.255 area 0
network 10.0.0.0 0.0.0.15 area 25
```

Quiz

A(n) _____ is defined as a router that has interfaces connected to at least two different OSPF areas.

a. SPF area
b. ASBR
c. ABR
d. Backbone area

A(n) _____ is defined as a router that has interfaces connected to at least two different OSPF areas.

a. SPF area
b. ASBR
c. ABR
d. Backbone area

Answer: c.

Explanation: An Area Border Router (ABR) is defined as a router that has interfaces connected to at least two different OSPF areas.

Only changes to Type _____ LSAs require an SPF recalculation.

a. 1
b. 1 and 2
c. 2 and 3
d. 1 and 3

Only changes to Type _____ LSAs require an SPF recalculation.

a. 1
b. 1 and 2
c. 2 and 3
d. 1 and 3

Answer: b.

Explanation: Only changes to Type 1 and 2 LSAs require a Shortest Path First Algorithm (SPF) recalculation.

What is the inverse mask of 255.255.240.0?

a. 0.0.15.0
b. 0.0.0.255
c. 0.0.15.255
d. 255.255.240.0

What is the inverse mask of 255.255.240.0?

a. 0.0.15.0
b. 0.0.0.255
c. 0.0.15.255
d. 255.255.240.0

Answer: c.

Explanation: The inverse mask of 255.255.240.0 is 255.255.255.255 minus 255.255.240.0, which is 0.0.15.255.

Which of the following is not a name for OSPF table?

a. Routing
b. Designated router
c. Neighbor
d. Topology

Which of the following is not a name for OSPF table?

a. Routing
b. Designated router
c. Neighbor
d. Topology

Answer: b.

Explanation: Designated router is not the name of an OSPF table.

By default, all traffic from other areas must cross _____ to enter another area.

a. The ABR
b. The LSDB
c. The backbone
d. The SPF

By default, all traffic from other areas must cross _____ to enter another area.

a. The ABR
b. The LSDB
c. The backbone
d. The SPF

Answer: c.

Explanation: By default, all traffic from other areas must cross the backbone to enter another area.

Here is a quick recap of what was covered in this lesson:

- An OSPF routing domain can use multiple areas, which are groups of routers.
- By default, all traffic from other areas must cross backbone area 0 to enter another area.
- ABRs maintain separate LSDBs for each of the areas their interfaces are attached to.
- Only changes to Type 1 and 2 LSAs require an SPF recalculation.
- The dead interval is set to 4 times the hello interval by default.