

# CCNA Routing and Switching Study Guide

## Chapters 5 & 19: Multi-Area OSPF

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# Chapter 20 objectives

- The ICND2 topics covered in this chapter include:
- **IP Routing Technologies**
  - Configure and verify OSPF (single area)
  - Neighbor adjacencies
  - OSPF states
  - Discuss multi-area
  - Configure OSPF v2
  - Configure OSPF v3
  - Router ID
  - LSA types

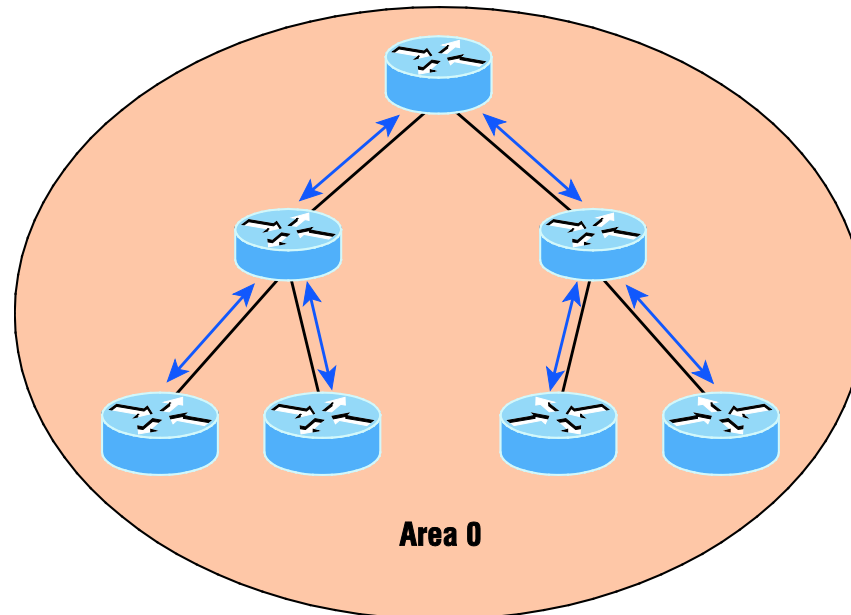
# Chapter 20 objectives (con't)

The ICND2 topics covered in this chapter include:

- **Troubleshooting**
  - **Troubleshoot and resolve routing issues**
  - **Routing is enabled**
  - **Routing table is correct**
  - **Correct path selection**
  - **Troubleshoot and resolve OSPF problems**
  - **Neighbor adjacencies**
  - **Hello and Dead timers**
  - **OSPF area**
  - **Interface MTU**
  - **Network types**
  - **Neighbor states**
  - **OSPF topology database**

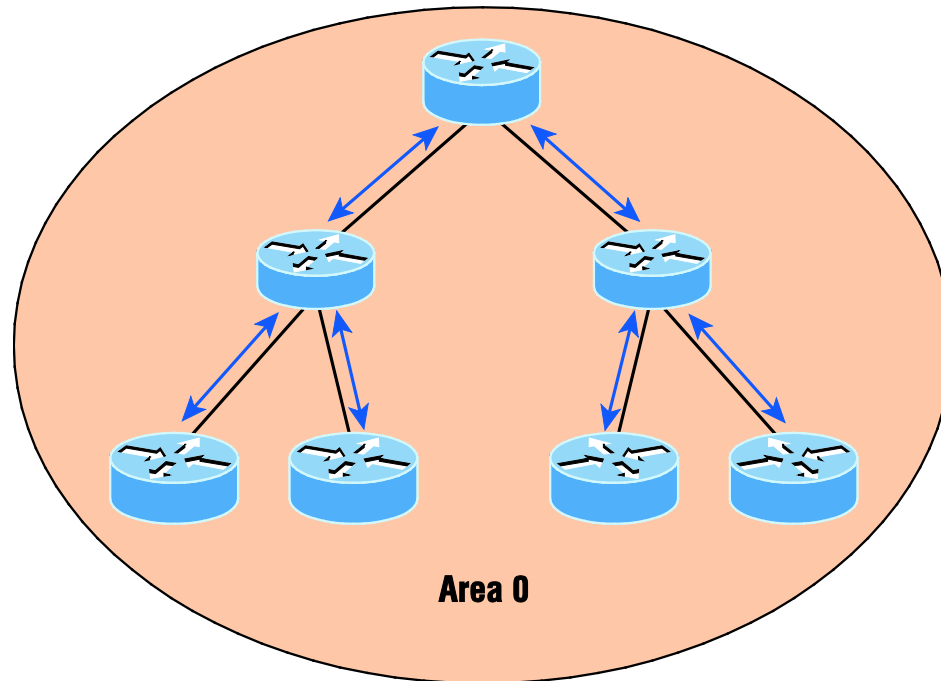
# Shortest Path First (OSPF) sample

We'll begin this chapter by focusing on the scalability constraints of an Open Shortest Path First (OSPF) network with a single area and move on from there to explore the concept of multi-area OSPF as a solution to these scalability limitations.



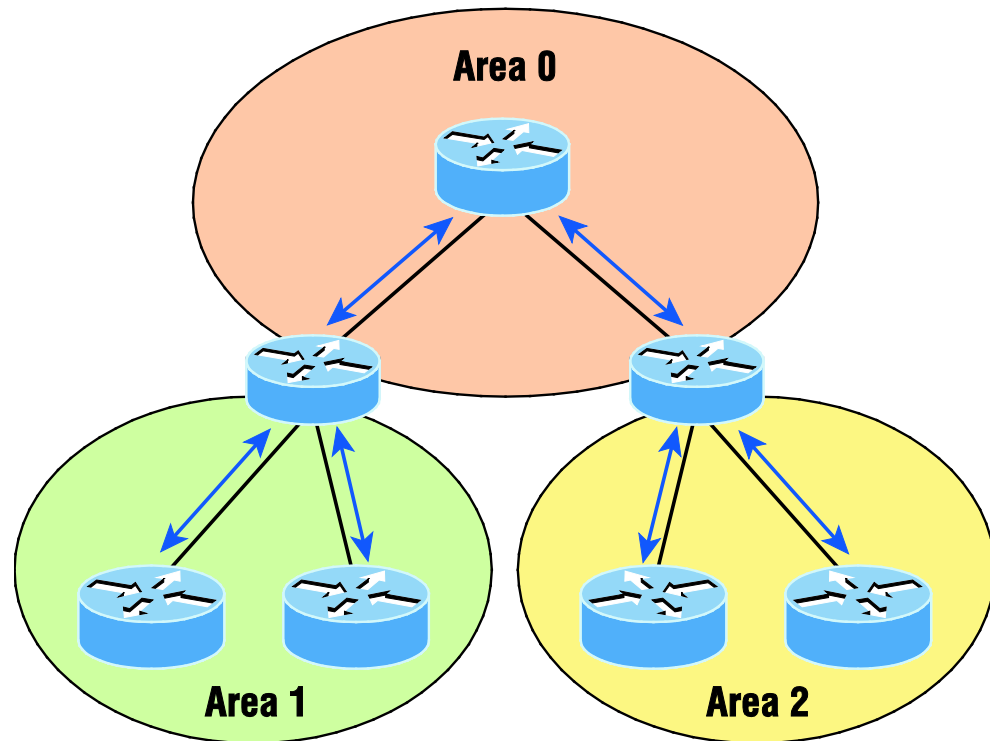
# OSPF single-area network

All routers flood the network with link-state information to all other routers within the same area.



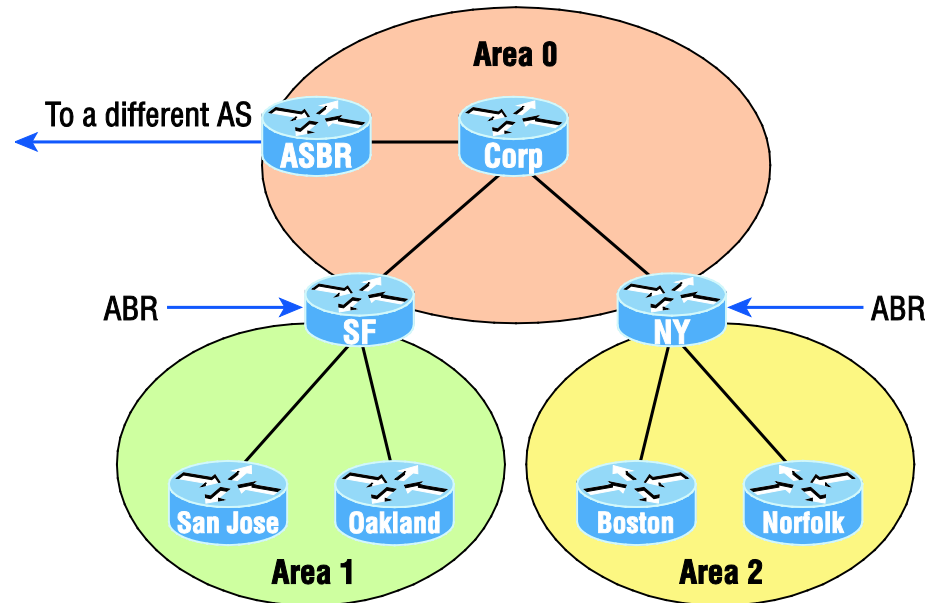
# OSPF multi-area network

All routers flood the network only within their area.



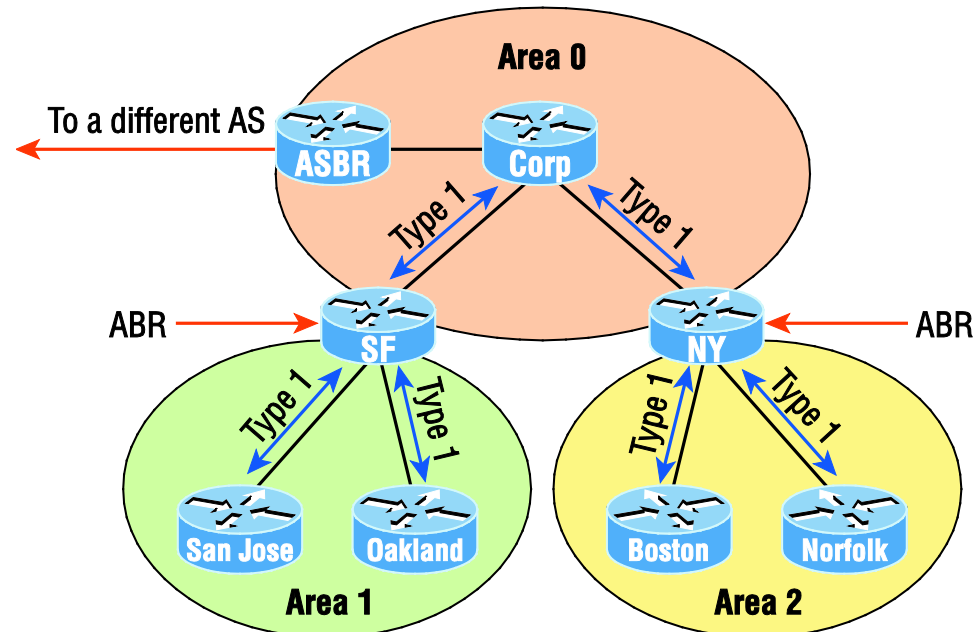
# Router roles

Routers within an area are called internal routers.



Notice that there are four routers that are part of area 0: the Corp router, SF and NY, and the autonomous system border router (ASBR). When configuring multi-area OSPF, one area must be called area 0, referred to as the *backbone area*. All other areas must connect to area 0.

# Type 1 link-state advertisements



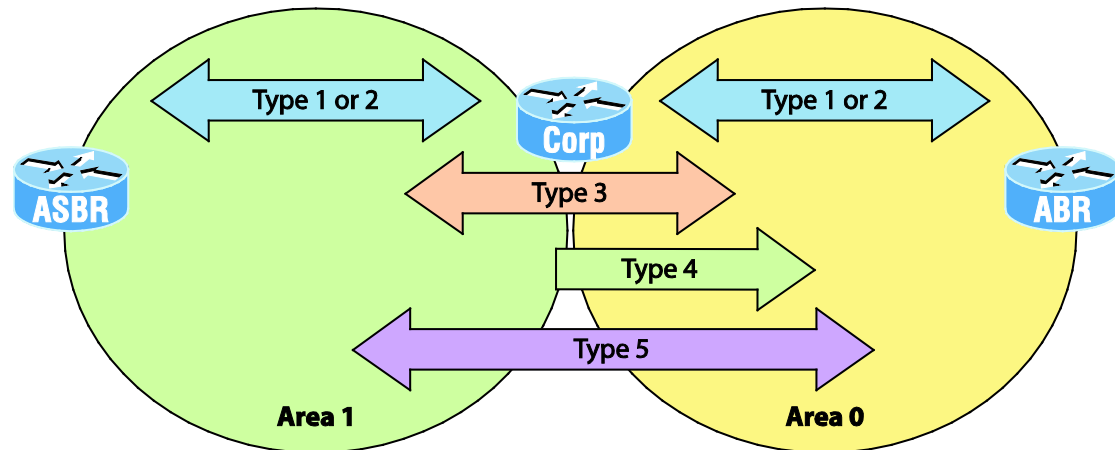
Type 1: Here is the status of my links!

Referred to as a *router link advertisement* (RLA), or just router LSA, a *Type 1 LSA* is sent by every router to other routers in its area.



# Basic LSA types

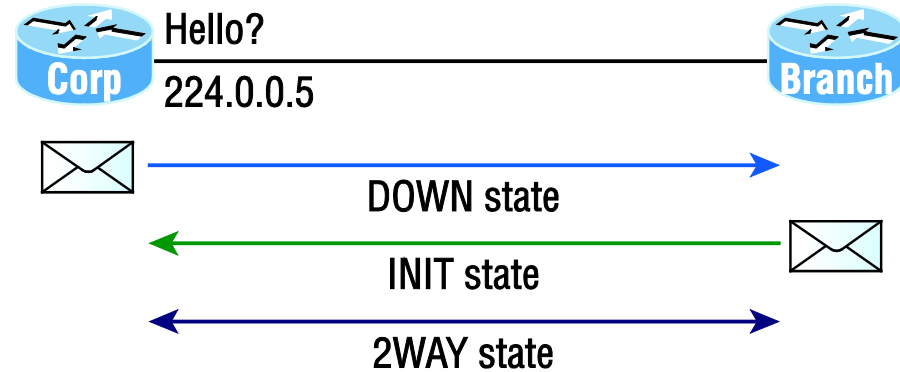
LSA Type	Description
1	Router LSA
2	Network LSA
3	Summary LSA
4	ASBR Summary LSA
5	Autonomous system LSA



Types 1 and 2 are flooded between routers in their same area, type 3 LSA's from the Corp router (which is an ABR and maintains the LSDB for each area it is connected to) will summarize information learned from area 1 into area 0, and vice versa. The ASBR will flood type 5 LSA's into area 1, and the Corp router will then flood type 4 LSA's into area 0 telling all routers how to get to the ASBR, basically becoming a proxy ASBR.

# OSPF neighbor states, part 1

Here's a definition of the eight possible relationship states:



## **DOWN**

In the *DOWN state*, no Hello packets have been received on the interface. Bear in mind that this does not imply that the interface itself is physically down.

## **ATTEMPT**

In the *ATTEMPT state*, neighbors must be configured manually. It applies only to nonbroadcast multi-access (NBMA) network connections.

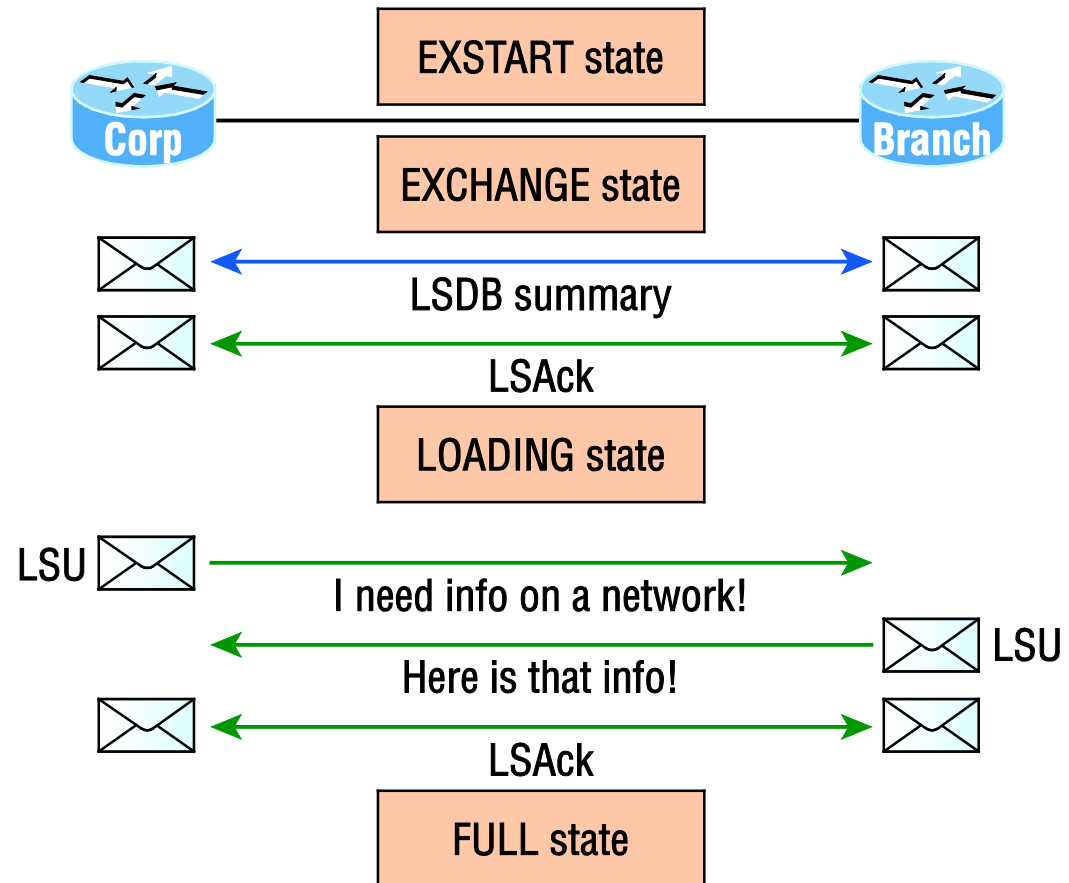
## **INIT**

In the *INIT state*, Hello packets have been received from another router. Still, the absence of the Router ID for the receiving router in the Neighbor field indicates that bidirectional communication hasn't been established yet.

## **2WAY**

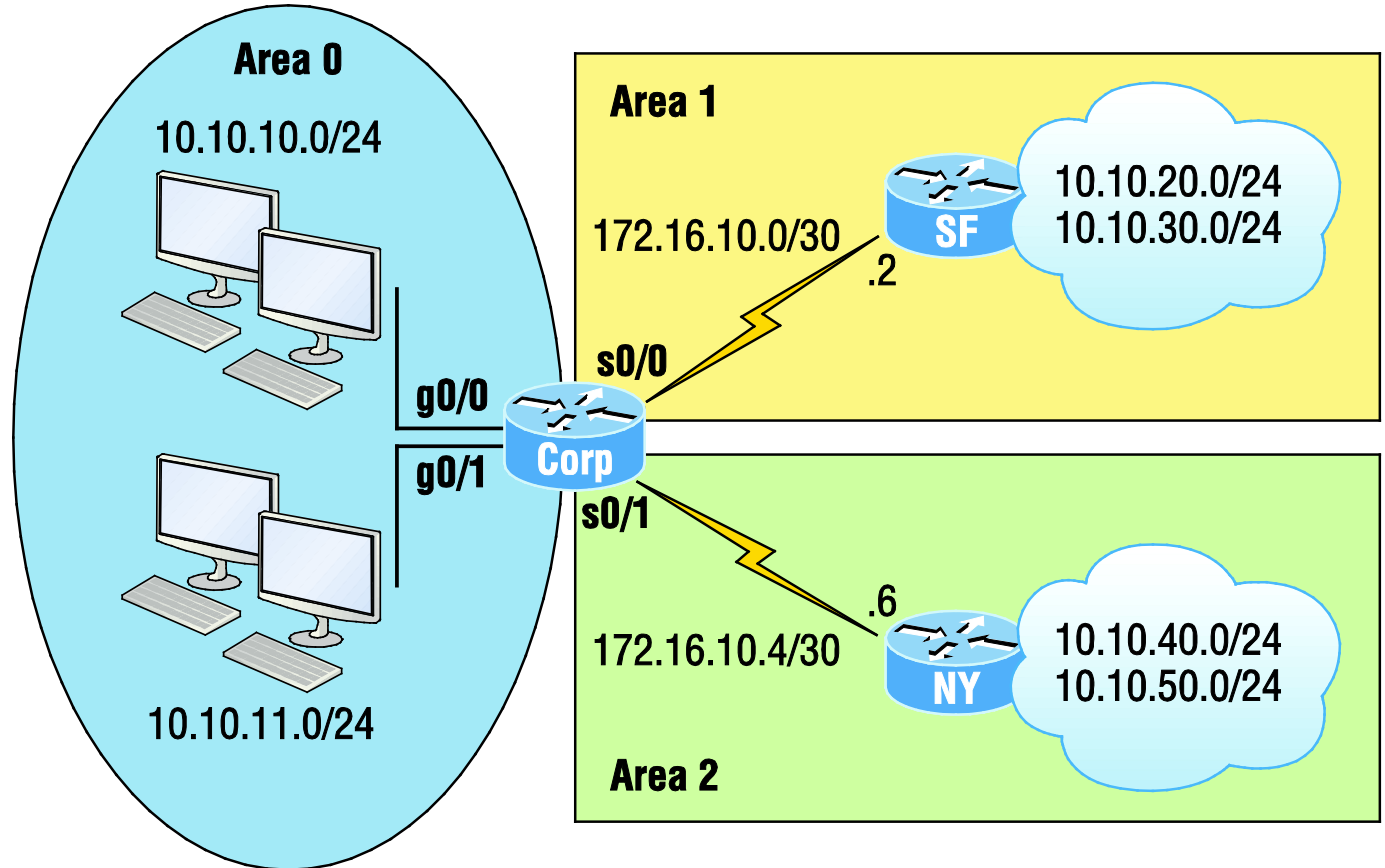
In the *2WAY state*, Hello packets that include their own router ID in the Neighbor field have been received. Bidirectional communication has been established. In broadcast multi-access networks, an election can occur after this point.

# OSPF router neighbor states, part 2



In the *FULL state*, all LSA information is synchronized among neighbors, and adjacency has been established. OSPF routing can begin only after the FULL state has been reached!

# Our internetwork



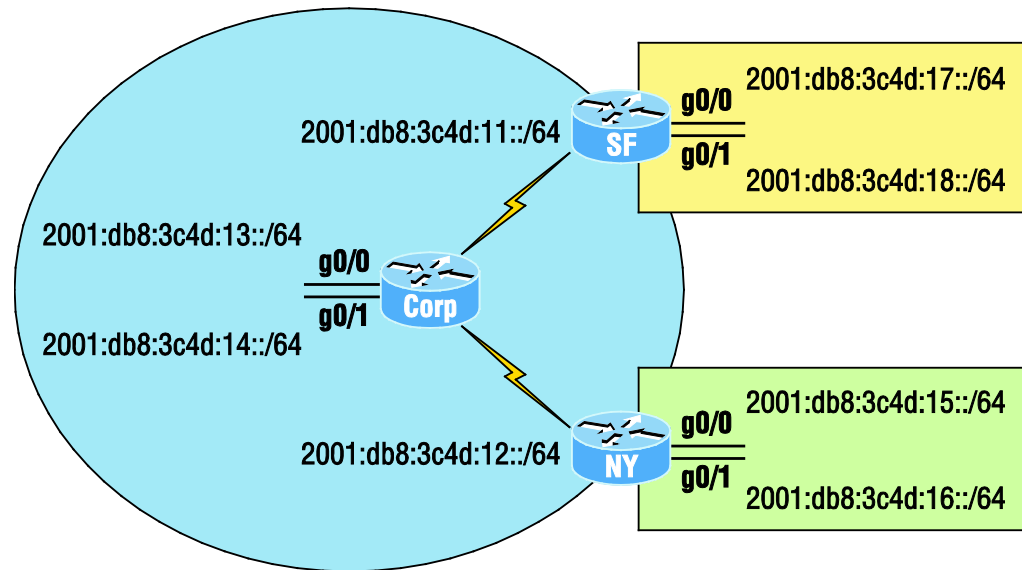
# OSPF verification commands

Command	Provides the following
<code>show ip ospf neighbor</code>	Verifies your OSPF-enabled interfaces
<code>show ip ospf interface</code>	Displays OSPF-related information on an OSPF-enabled interface
<code>show ip protocols</code>	Verifies the OSPF process ID and that OSPF is enabled on the router
<code>show ip route</code>	Verifies the routing table, and displays any OSPF injected routes
<code>show ip ospf database</code>	Lists a summary of the LSAs in the database, with one line of output per LSA, organized by type

# Troubleshooting OSPF

1. Verify your adjacency with your neighbor routers using the `show ip ospf neighbors` command. If you are not seeing your neighbor adjacencies, then you need to verify that the interfaces are operational and enabled for OSPF. If all is well with the interfaces, verify the hello and dead timers next, and establish that the interfaces are in the same area and that you don't have a passive interface configured.
2. Once you've determined that your adjacencies to all neighbors are working, use the `show ip route` to verify your layer 3 routes to all remote networks. If you see no OSPF routes in the routing table, you need to verify that you don't have another routing protocol running with a lower administrative distance. You can use `show ip protocols` to see all routing protocols running on your router. If no other protocols are running, then verify your network statements under the OSPF process. In a multi-area network, make sure all non-backbone area routers are directly connected to area 0 or they won't be able to send and receive updates.
3. If you can see all the remote networks in the routing table, move on to verify the path for each network and that each path for specific networks is correct. If not, you need to verify the cost on your interfaces with the `show ip ospf interface` command. You may need to adjust the cost on an interface either higher or lower, depending on which path you want OSPF to use for sending packets to a remote network. Remember—the path with the lowest cost is the preferred path!

# OSPFv3



```
Corp#config t
Corp(config)#int g0/0
Corp(config-if)#ipv6 ospf 1 area 0
Corp(config-if)#int g0/1
Corp(config-if)#ipv6 ospf 1 area 0
Corp(config-if)#int s0/0/0
Corp(config-if)#ipv6 ospf 1 area 0
Corp(config-if)#int s0/0/1
Corp(config-if)#ipv6 ospf 1 area 0
```

# Written Labs and Review Questions

- Read through the Exam Essentials section together in class.
- Open your books and go through all the written labs and the review questions.
- Review the answers in class.