

## C O N T E X T

In general OSPFv2 (just called OSPF) is used for IPv4 and OSPFv3 is used for IPv6.

Double Stacking—running both IPv4 and IPv6 on the same device or interface.

Address Families—Extension to OSPFv3 for double-stacking that allows it to handle IPv4. Now, you can run a single OSPFv3 process with two address families (IPv4 and IPv6) instead of an OSPFv2 *and* an OSPFv3 process. The single OSPFv3 process would still maintain the following separate items for each address family:

- LSDB (Link State DataBase)
- SPF (Shortest Path First) Calculations
- Neighbor Relationships
- Messages between participating routers

## C O N F I G U R A T I O N

The protocol configuration is really only used for the router ID and to declare passive interfaces.

```
R2(config)# ipv6 router ospf 2
           The process ID is local-scope
R2(config-rtr)# router-id 2.2.2.2
           Without this, looks for highest IPv4 loopback, or failing that, highest IPv4 interface address.
R# clear ipv6 ospf process
           Only necessary if adjacencies had already formed with the previous router ID
R2(config-rtr)# passive-interface fa0/0
```

Interface Configurations—OSPFv3 is configured directly on interfaces rather than through network statements.

```
R2(config-if)# ipv6 ospf 2 area 23
```

Path Cost—Add all outgoing interface costs along route (outgoing = going out toward the dest.) To remember this, think of adverts coming in and each router adding its own interface cost.

Interface Cost—Normally equal the the reference bandwidth / interface bandwidth. You can set it

- Directly on the interface
 

```
R2(config-if)# ipv6 ospf cost {1...65535}
```
- Indirectly by changing the bandwidth of an interface
 

```
R2(config-if)# bandwidth <Kb/s>
```
- Indirectly by changing the reference bandwidth of an entire router.
 

```
R2(config-rtr)# auto-cost reference-bandwidth <Mb/s>
```

Equal-Cost Load Balancing—IOS will load balance across routes in its routing table. You can influence how many equal (and best) cost routes are placed in the routing table

```
R2(config-rtr)# maximum-paths 6
           The default varies by platform and version and is not mentioned in the cert guide.
```

Default Route Injection—Configured on the edge (internet-facing) router

```
R1(config-rtr)# ipv6 route ::/0 <destination>
R1(config-rtr)# default-information originate
```

## O P E R A T I O N

For CCNA purposes, there are only a few differences between IPv4 OSPFv2 and IPv6 OSPFv3.

- Addresses for hellos—FF02::5 = all OSPF routers; FF02::6 = all DR & BDR routers (easy to remember because similar to 224.0.0.5 and 224.0.0.6 in OSPFv2)
- Hellos use link-local addresses, so opposite ends of a link don't need to be in the same subnet, but that would be weird
- Type 3 LSA renamed “interarea prefix” from "summary LSA" (IPv4 OSPFv2)
- (beyond scope) New LSA types added
- (beyond scope) Details within LSA types 1, 2, and 3 changed

Neighbor Relationship Creation—routers pass through the following states (debug ipv6 ospf adj)  
2WAY → EXSTART (Starting exchange of LSAs) → EXCHANGE → FULL

Full & 2-Way are stable working states between neighbors. In links with no DR/BDR, everyone stabilizes in full state. In DR/BDR LANs, each router is

- Full with DR & BDR. “Fully Adjacent”
- 2-way with everyone else. “Adjacent”

## T R O U B L E S H O O T I N G   A D J A C E N C I E S

When routes are missing, look for adjacency problems. Verification Commands:

<code>show ipv6 protocols</code>	Interfaces grouped by area
<code>show ipv6 ospf interface [brief]</code>	Which Interfaces are in which area Which interfaces are passive (only way; not brief). After timer, “no hellos”
<code>debug ipv6 ospf adj</code>	Adjacency events

Interface Problems—Wrong area or Passive-interface

Neighbor Requirements—The process ID is local to the router and irrelevant to adjacencies.

REQUIREMENT / PROBLEM	COMMANDS TO ISOLATE PROBLEM
Interfaces up/up ( Only IPv4 OSPFv2 requires interfaces to be in same subnet )	<code>show ip interface brief</code>
ACL filtering of protocol messages	
Neighbor Authentication (optional)	<code>show ipv6 ospf interface</code>
Hello & Dead Timers match ( Ethernet defaults = 10 & 40 secs. )	<code>show ipv6 ospf interface</code>
Same Area	<code>show ipv6 ospf interface brief</code> <code>show ipv6 protocols</code>
Router ID Unique	<code>show ipv6 ospf</code>
Process ID on the Interface correct	
Passive-Interface	<code>show ipv6 ospf interface [fa0/0]</code>

## L I N K   S T A T E   A D V E R T I S E M E N T S

At our level of concern, the LSAs are the same as IPV4 OSPFV2, except for the renaming of type 3.

Types 1 & 2 define the topology, with type 3 defining a subnet outside the area.

- Type 1—One for each router in an area, including Area Border Routers (ABRs)
- Type 2 (Network)—One for each network that has a DR and 1+ neighbors (Ethernet)
- Type 3 (Inter-area Prefix)—One for each IPv6 subnet in a different area. Called a “Summary LSA” in IPV4 OSPFV2.

## T R O U B L E S H O O T I N G

Scenario—Routers become neighbors but can't exchange LSAs. They go into “exstart” (exchange start) for a few minutes, then fail to a “down” neighborhood state, where they stay. The log message as it changes to a down state may say “too many retries.” The problem can be mismatched IPV4 or IPV6 MTUs (Maximum Transmission Units). Check the MTUs on the interfaces of both neighbors (default 1500 bytes).

```
R2# show ipv6 interface
```

```
R2(config-if)# ip mtu <size>
R2(config-if)# ipv6 mtu <size>
R2# clear ipv6 ospf 1 process
```

*Cause it to take effect without a restart*

Reading the Routing Table—IPV6 OSPFV3 routes have a link-local IPV6 next hop. Given two of the three values reference-bandwidth, interface bandwidth, and interface OSPFV3 cost, you can find the other.

```
R2# show ip ospf
```

*Tells reference-bandwidth*

```
R2# show interfaces
```

*Tells interface bandwidth*

```
R2# show ipv6 ospf interface brief
```

*Tells interface cost*

Scenario—Route to a network missing

- Check that OSPFV3 is enabled on the interface of the router(s) connecting to that network
- Check neighbor chain continuity back to your router

Scenario—Suboptimal route to a network

- Check neighbor chain continuity on your preferred route
- Check OSPFV3 cost settings along the chain