



# CCIE Enterprise Infrastructure v1.0 Bootcamp

OSPF



# OSPF

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- + Core OSPF Goals
  - + Establish routed IPv4 & IPv6 connectivity
- + First OSPF consideration
  - + OSPFv2 vs. OSPFv3

## OSPFv2 vs. OSPFv3

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- + OSPFv2
  - + IPv4 AFI only
  - + Uses IPv4 for transport
- + OSPFv3
  - + IPv4 and IPv6 AFIs
  - + Uses IPv6 for transport
- + Implies that OSPFv2 and OSPFv3 are not compatible
  - + Legacy “ipv6 ospf” and multi-af OSPFv3 are compatible

# Core OSPF Workflow

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- + Enable global OSPF process
  - + **router ospf 1**
  - + **router ospfv3 1**
- + For OSPFv3, define the AFI
  - + **address-family ipv4 unicast [vrf]**
  - + **address-family ipv6 unicast [vrf]**
- + Enable the protocol at the link level
  - + **ip ospf 1 area...**
  - + **ospfv3 1 ipv4 area...**
  - + **ospfv3 1 ipv6 area...**

## Core OSPF Workflow (cont.)

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- + Verify OSPF is enabled
  - + **show ip ospf interface brief**
  - + **show ospfv3 interface brief**
- + Verify OSPF adjacencies have formed
  - + **show ip ospf neighbors**
  - + **show ospfv3 neighbors**

## Core OSPF Workflow (cont.)

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- + How do we know neighbors are fully adjacent?
  - + On broadcast/non-broadcast network types...
    - + FULL adjacencies with DR and BDR
    - + 2-WAY adjacencies with DROthers
  - + On point-to-point/point-to-multipoint network types...
    - + FULL adjacency with no DR/BDR

## Core OSPF Workflow (cont.)

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- + Verify OSPF routing information
  - + **show ip ospf database**
  - + **show ospfv3 database**
  - + **show ip route ospf**
  - + **show ip route ospfv3**
  - + **show ipv6 route ospf**
- + Verify IPv4/IPv6 reachability
  - + **ping, traceroute, telnet, etc.**

# OSPF Transport Considerations

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- + OSPF Multicast
  - + OSPF uses protocol 89 to 224.0.0.5 and 224.0.0.6
  - + Implies transports such as DMVPN could be broken
    - + **ip nhrp map multicast...**
- + OSPF Unicast
  - + OSPF protocol 89 unicast used in non-broadcast and point-to-multipoint non-broadcast
  - + Unlike EIGRP, **neighbor** statement is only needed on one end



## OSPF Transport Considerations (cont.)

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- + OSPF transport can be verified with...
  - + **debug ip ospf packet**
  - + **debug ospfv3 packet**
  - + **debug ip ospf hello**
  - + **debug ospfv3 hello**
- + What else could break transport?
  - + Data plane (ACL) filters
  - + Control Plane (CoPP) filters

# OSPF Adjacency Considerations

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- + After transport is established, adjacency is negotiated
- + Options must match for adjacency, such as...
  - + Interface Area-ID
  - + Hello interval & dead interval
  - + Interface network address
  - + Interface MTU
  - + Network Type
  - + Authentication
  - + Stub Flags

## OSPF Adjacency Considerations (cont.)

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- + Some options must be unique for adjacency, such as...
  - + Router-ID
  - + Primary IP address in OSPFv2
  - + Link-Local IPv6 address in OSPFv3

# OSPF Network Type Considerations

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- + OSPF Network Type influences three things
  - + How are hellos sent (unicast vs. multicast)
  - + How is the next-hop calculated
  - + Is there a DR/BDR election

# OSPF Network Type Considerations (cont.)

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- + OSPF Network Type mismatches
  - + Incompatible network types can form neighbor relationships if other parameters match
  - + SPF calculation fails though, resulting in no routes being installed
  - + To be compatible, network types must agree to elect DR/BDR (use LSA 2) or not to elect (no LSA 2)

# OSPF Authentication Considerations

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- + Mode must match
  - + Clear Text
  - + MD5
  - + SHA
  - + IPsec AH (OSPFv3)
  - + IPsec ESP (OSPFv3)
- + Verified with...
  - + **show ip ospf interface**
  - + **show ospfv3 interface**

# OSPF Topology Considerations

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- + Once adjacency is established, LSAs are exchanged and SPF is calculated
  - + OSPF uses complex path selection rules that override normal metric/distance logic
- + Path selection, in general, is...
  - + Intra Area
  - + Inter Area
  - + External 1 / NSSA 1
  - + External 2 / NSSA 2
- + Some path selections result in failure to install route in table
  - + [Why Are Some OSPF Routes in the Database but Not in the Routing Table?](#)

# OSPF Filtering / Summary Considerations

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- + OSPF enforces strict hierarchy
  - + non-zero – zero – non-zero
- + Filters and summaries are only supported at SPF boundaries
  - + Between areas
  - + Between ASes
- + Virtual-links & Sham-links can be used to extend area 0 boundaries



# OSPF Scaling & Convergence Considerations

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- + OSPF hierarchy natively adds scaling
  - + Areas filter topology information, not routes
- + OSPF filtering adds more scaling
  - + Stub areas filter topology information and routes
- + Like EIGRP, OSPF supports LFAs
  - + Use BFD to quickly detect neighbor down
  - + Pre-install a backup SPT (IP FRR/LFA)

