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CCNP BSCI Notes - Understanding Simple Single-Area OSPF

OSPF Fundamentals Link-state routing protocols utilize more internal resources in favor of reducing bandwidth consumption. All OSPF routers in an area share the same Link State Database (LSDB). Link State Advertisements (LSAs) are flooded to all neighboring routers. OSPF tables: Neighbor table   Topology database   Routing table **Forming adjacencies** Routers multicast hellos to 224.0.0.5 every 10 seconds on a broadcast link and every 30 seconds on a nonbroadcast link. Once hellos are exchanged, neighboring routers add one another to their neighbor tables. Contents of a hello packet: Router ID - 32-bit unique number (IP address)   Hello/dead intervals - Timers   Neighbor list - List of neighboring router IDs   Area ID   Priority - Used in electing the DR and BDR   DR and BDR   Authentication (if enabled)   Stub Area Flag - On if this is a stub area Neighbor states: Down   Attempt - Used for manually configured neighbors on an NBMA link; unicast hellos sent to neighbor from which hellos have stopped being received   Init - Hello packet received from neighbor, but without the recipient's router ID   2-Way - Bi-directional communication has been established   Exstart - The DR and BDR have been elected, link-state exchange starting   Exchange - Exchange of database descriptor (DBD) packets   Loading - Exchange of link-state information   Full - Full adjacency established Example OSPF packet capture Cisco OSPF will load balance over up to four equal-cost links; configurable up to six. **Designated Routers** Neighbors on a broadcast segment elect a designated router (DR) and backup designated router(BDR), which peer with all other routers on the segment. All non-designated routers peer only with the DR and BDR. Multicast destinations: 224.0.0.5 - All OSPF routers   224.0.0.6 - All designated OSPF routers (DR and BDR only) DRs are chosen based on priority (0 - 255). 1 is default; routers with 0 priority will never be elected. Priority ties are broken by choosing the higher router ID. DRs are elected on point-to-point Ethernet links even though this is unnecessary (Ethernet is always seen as a broadcast medium). Interfaces can be configured to operate in point-to-point mode to prevent this. (B)DRs are not preempted. New election will take place only when a current (B)DR goes offline or its OSPF process is administratively restarted. **Areas** All routers in an area maintain an identical topological database. Areas are defined to logically segment a network and reduce routing table size and complexity. All areas connect to area 0 (the backbone area). Router types: Backbone routers - Routers in area 0   Area Border Routers (ABRs) - Routers in multiple areas   Autonomous System Boundary Routers (ASBR) - Routers which redistribute information from another AS   Internal - Routers which have all interfaces in a single area Routers can fill multiple roles. **Packet Types** OSPF is IP protocol 89.   Hello - Used to establish communication with directly connected neighbors   Database Descriptor (DBD) - Lists router IDs from which the router has an LSA and its current sequence number   Link State Request (LSR) - Request for an LSA   Link State Update (LSU) - Reply to an LSR with the requested information   Link State Acknowledgment (LSAck) - Used to confirm receipt of link-state information **Packet Fields**   Version - Version of OSPF being run   Type   Length   Router ID   Area ID   Checksum   Authentication type (none/plaintext/md5)

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         Authentication data   Data Configuring OSPF in a Single Area Necessary information: OSPF process ID (locally significant)   Participating interfaces   Area ID   Router ID **Enable OSPF   **

```
Router(config)# router ospf <process number>
```

] **Configure Included Networks   **

```
Router(config-router)# network <network> <wildcard mask> area <area ID>
```

A single interface can be specified by supplying its IP address and a null wildcard mask: network 192.168.0.1 0.0.0.0 area 0 **Router ID** If no router ID has been administratively declared, a router will choose the highest loopback IP address. If no loopback addresses are present, the highest IP address of the first active interface will be used. A router ID can be manually specified: **   **

```
Router(config-router)# router-id <IP address>
```

] Best practice dictates the creation of a loopback address to be used as the router ID for stability and continuity:

```
Router(config)# interface loopback 0
Router(config-if)# ip address <IP address> <subnet mask>
```

Default Cost Link cost is a 16-bit value (0-65535); default cost is calculated as 100Mbps/interface bandwidth.(Interfaces 100Mbps and faster are assigned a cost of 1.) OSPF cost can be manually specified per interface:

```
Router(config-if)# ip ospf cost <cost>
```

An alternative to defining static costs per interface is to change the numerator bandwidth (default100Mbps):

```
Router(config-router)
```

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Router Priority Default DR election priority is 1, and a router with a priority of 0 will not become a DR. Priority range is 0 - 255.

```
Router(config-if)# ip ospf priority <priority>
```


Verifying OSPF Configuration

        show ip ospf - OSPF process details

        show ip ospf database - Contents of the topology database

        show ip ospf interface - Interfaces participating in OSPF

        show ip ospf neighbor - Neighbor information

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         show ip protocols - Displays all active routing protocols   show ip route   debug ip ospf events   debug ip packet