OSPF (Open Shortest Path First) is a routing protocol that is used as an interior gateway protocol in large enterprises.

This flow shows the message exchange that takes place when a new OSPF router comes online. You can click on any message in the flow to see full message contents.

Covered sequence: (1) OSPF hello message exchange (2) Master-slave resolution (3) Router database synchronization (4) Link state update

This sequence diagram was generated from a PCAP file with VisualEther (http://www.EventHelix.com/VisualEther/) and then modified with EventStudio ((http://www.EventHelix.com/EventStudio/) to add further design details.

OSPF periodically multicast Hello messages on the network. Routers establish neighbor relationships by listening for OSPF Hello messages from other routers.

Router 192.168.170.8 starts up.

**Down**
This is the first OSPF neighbor state. It means that no hello packets have been received from this neighbor, but hello packets can still be sent to the neighbor in this state.

Router 192.168.170.2 starts up.

**Init**
This state specifies that the router has received a hello packet from its neighbor, but the receiving router’s ID was not included in the hello packet.

The router starts up and sends out an OSPF Hello. The router is yet to learn about the designated router.

The DR sends out a periodic multicast, listing 192.168.170.2 as a neighbor.
This state is entered when bi-directional communication has been established between two routers. Bi-directional means that each router has seen the other’s hello packet (i.e. the hello packet received from another router lists this router’s ID as an active neighbor.

192.168.170.2 also reports that 192.168.170.8 is a neighbor.

After the link establishment, the neighboring routers exchange their link status database.

Exstart

At this point the Designated Router (DR) has been finalized and the routing information exchange can begin.

Master-Slave resolution for DB synchronization

The routers first establish a master-slave relationship. This is followed by the exchange of database information. Note that only link state headers will be exchanged during this phase.

Router asserts that it is the master by setting the MS option bit. The message also sets the I bit signifying that this is the initial message of the Database synchronization handshake. The more bit (M) signals that more data is going to follow.

Router asserts that it is the master by setting the MS option bit. The message also sets the I bit signifying that this is the initial message of the Database synchronization handshake. The more bit (M) signals that more data is going to follow.

Router asserts that it is the master by setting the MS option bit. The message also sets the I bit signifying that this is the initial message of the Database synchronization handshake. The more bit (M) signals that more data is going to follow.

Router removes the master assertion by resetting the MS bit. The router also starts sending its database. The more bit (M) signals that there are more database update need to be exchanged.
192.168.170.8 is greater than 192.168.170.2, so the router asserts that it is the master.
The router asserts that it is the master by setting the MS bit. The master also increments the DD sequence.

Master-slave is now settled. The routers initiate the exchange of database information.
The slave acknowledges the DD sequence.

The master again updates the DD sequence.
The slave acknowledges the changed DD sequence.

The database update has synchronized the link state headers between the routers. Routers now scan the synchronized link state headers to determine if they are missing any link state updates. This is followed by requesting the link state updates to completely synchronize the link states.

After exchanging Database Description packets with a neighboring router, "192.168.170.2" router finds that parts of its topological database are out of date. The Link State Request packet is used to request the pieces of the neighbor’s database that are more up to date.

"192.168.170.8" also requests update for its out of date database.
The routers then send out their link state updates as a multicast flood. The Link State Update packets contain a collection of link state advertisements that are one hop away from the sender.
All routers acknowledge the link state updates. The acknowledgments contain link state headers to identify the link state updates that are being acknowledged.
Once the link states are updated, routers run the Dijkstra Shortest Path First algorithm to compute the routes to all subnets. The algorithm first determines the costs to all destinations by adding up the link weights from the router to the destination.

Once all costs have been computed, the shortest path to the destination is used to select the next hop for the subnet.

The routers periodically multicast the hello message.