

OSPF Version 2 (RFC 2328)

- Interior gateway protocol (IGP).
- Routers maintain link-state database.
 - Describes Autonomous Systems (AS) topology.
 - Propagated by flooding: Link State Advertisements (LSAs).
- Router constructs tree rooted at itself.
- Traffic distributed equally over multiple equal-cost paths to destination.

OSPF Metrics

- Internal metrics: cost associated with output side of router interfaces.
- External metrics: denote externally derived routing data.
 - Type 1: treated the same as internal metrics.
 - Type 2: always greater than cost of any internal path.
- Both external metric types can simultaneously exist in an AS.
- Ability to specify *forwarding address* in LSA to:
 - Reduce extra hops.
 - Enable some routers to acts as route servers.

OSPF Hierarchical Organization

- Autonomous System split into areas.
- Each area has its own link-state database.
- Motivation for hierarchy: scalability.
- Area border router: router connected to multiple areas.
 - Stores different link-state database for each of its areas.

Autonomous System Backbone

- Special area 0 (0.0.0.0).
- Contains all area border routers.
- Logically contiguous:
 - Employ virtual links if physical contiguity is not possible.

OSPF Classification of Routers

- Internal routers.
- Area border routers.
- Backbone routers.
- AS boundary routers.

A router may belong to multiple categories.

Every router in an AS knows the path to every *AS boundary router*.

OSPF Adjacency Determination

- Routers send and receive *OSPF Hello* packets to acquire neighbors.
- Hello packets sent to *AllSPFRouters* multicast address (224.0.0.5).
- Hello packets also used to elect *Designated Router* in broadcast and non-broadcast multi access (NBMA) networks.
- Routers form adjacencies with some newly acquired neighbors and synchronize LS database.
- In broadcast and NBMA networks, adjacencies from Designated Router and other routers, and Backup Designated Router and other routers.
- *AllIDRouters* address (224.0.0.6) used by other routers to send information to Designated and Backup Designated routers.

Intra-area Routing

- Routers flood LSAs in the area: periodically and on topology change.
- Reliable flooding through acknowledgments.
- All routers in an area have identical LS database.

Inter-area Routing

Area border router:

- Summarizes topology information of its area.
- Sends the summary to all other area border routers in the AS.
- Receives summary from other area border routers and calculates inter-area paths.
- Advertises inter-area paths to its attached area.

AS-External Routing

- AS boundary routers flood their external routing information to all routers.
- Exception: not flooded into *stub* areas.
- All routers, except those in stub areas, know the path to AS boundary routers.

Authentication

- All OSPF packets are authenticated.
- 64-bit authentication type field in OSPF packet header.
- Authentication type configurable on per-interface basis:
 - 0: null authentication.
 - 1: simple password.
 - 2: cryptographic authentication.
 - others: reserved for future use.

Simple Password Authentication

- All OSPF packets in a network use the same password.
- 64-bit clear password.
- Guards against router inadvertently joining a routing domain.
- Possible to determine password if one has physical access to network.

Cryptographic Authentication

- Shared key configured in all routers attached to a common network.
- *Message digest* generated using the key, and appended to packet.
- Implicit agreement among routers about algorithm.
- Cryptographic sequence number to prevent replay attacks:
 - Non-decreasing, 32-bit value.
 - Initialized to zero.
 - Rollover procedure not specified.
 - May be used to denote “seconds since reboot”.