OSPF tutorial

Computer Science Department, University of Crete

Manolis Surligas surligas@csd.uoc.gr
May 14, 2019
Open Shortest Path First (OSPF)

- OSPF is a dynamic routing protocol
- It is classified as an Interior Gateway Protocol (IGP)
- Distributes routing information between routers belonging to a single Autonomous System (AS)
- It is based on link-state technology and utilizes the Dijkstra algorithm to extract the shortest routing path
- Defined in RFC2328
OSPF Overview

• OSPF routes packets based entirely on the destination IP of the IP packet header

• It does not alter the IP packet header anyhow

• It react quickly on changes of the AS topology, utilizing a minimum amount of routing traffic

• Each router maintains a database describing the topology of the AS
**OSPF Overview**

- All routers execute the exact same algorithm in parallel
- Each router constructs a tree of shortest paths, with itself as the root
- Each shortest path gives a route to a destination in the AS
- Externally derived routing information (e.g., BGP, OSPF of other AS) appears as leaves
Advantages

- No limitation on hop count (in RIP this was 15)
- OSPF uses IP multicast to send link-state updates. Non-OSPF devices do not receive the excess traffic.
- OSPF uses the link cost, opposed to RIP that uses the hop count as metric.
- Better convergence than RIP. This is because routing changes are propagated instantaneously and not periodically.
- Better and more sophisticated load balancing capabilities.
- Routing authentication through different methods of password authentication.
Routing Areas

• An OSPF area is a set of networks and hosts within an AS that have been administratively grouped together

• It is a good practice to configure an area as a collection of contiguous IP subnetted networks

• Routers that are wholly within an area are called internal routers

• All interfaces of internal routers are directly connected to networks within the same area
Routing Areas

• The topology of an area is hidden on the rest of an AS, thus significantly reducing the routing traffic in the AS and providing a level of protection and isolation from bad routing data.

• Splitting an AS into multiple areas makes network management easier.

• Each OSPF Area has a unique ID that is described using the decimal dot notation (e.g. 10.0.0.1).

• The Area ID does not depend in any way on the IP address of any of the router interfaces.

• Area IDs need only be unique within an AS.
Routing Areas

• Area ID 0.0.0.0 is called *Backbone Area* and every AS should have one

• All other areas in the AS must be directly connected to the backbone area by a router that has interfaces in more than one area

• These routers are called *Area Border Routers (ABRs)*
Routing Areas

BACKBONE (AREA 0)

AREA 1

AREA 2
OSPF Routing Messages

• OSPF exchanges messages using directly IP packets with a protocol number 89 in the corresponding field of the IP header.

• **Hello:** allow a router to discover other adjacent routers on its local links and networks.

• **Database Description:** contain descriptions of the topology of the AS or area. If the database is large enough, multiple messages may be exchanged.
Routing Messages

- **Link State Request**: used by one router to request updated information about a portion of the Link State Database Description (LSDB) from another router.

- **Link State Update**: contain information about an updated portion of the LSDB. These messages are sent in response of a *Link State Request* message.

- **Link State Acknowledgement**: acknowledges a *Link State Update* message.
Cost Calculation

- OSPF uses a reference bandwidth divided with the actual interface bandwidth for the link cost.

- Commonly the reference bandwidth is 100 Mbps.

- E.g: the cost for a 10 Mbps link will be \( \frac{100 \text{Mbps}}{10 \text{Mbps}} = 10 \)

- Cost can be also set manually.
Vyatta useful OSPF commands

Configuration

- set protocols ospf parameters router-id x.x.x.x
- set protocols ospf area y.y.y.y network z.z.z.z/z
- set interfaces ethernet ethx ip ospf cost X
- set interfaces ethernet ethx ip ospf dead-interval Y
- set interfaces ethernet ethx ip ospf hello-interval Z
- set interfaces ethernet ethx ip ospf priority XX
- set interfaces ethernet ethx ip ospf retransmit-interval YY
- set interfaces ethernet ethx ip ospf transmit-delay ZZ
Information

- `show ip ospf`
- `show ip ospf database`
- `show ip ospf interface ethx`
- `show ip ospf`
Documentation

https://www.csd.uoc.gr/~hy435/material/Vyatta-OSPF_6.5R1_v01.pdf