

A close-up, blurred image of a microscope, showing various mechanical parts and lenses. The image is used as a background for the slide.

# OSPF tutorial

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April 21, 2024

# 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 reacts 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 (eg 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



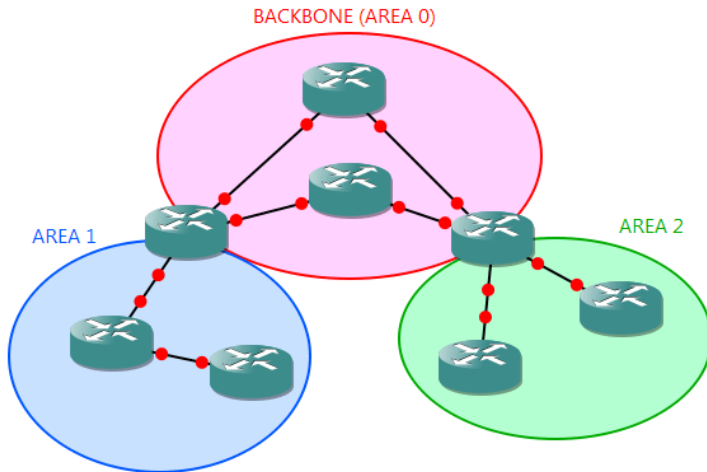
# Routing Areas

- 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



# 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  $\frac{100Mbps}{10Mbps} = 10$
- 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`



# Vyatta useful OSPF commands

## Information

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



## Documentation

- [https://docs.vyos.io/\\_/downloads/en/latest/pdf/](https://docs.vyos.io/_/downloads/en/latest/pdf/)
- [https://www.csd.uoc.gr/~hy435/material/Vyatta-OSPF\\_6.5R1\\_v01.pdf](https://www.csd.uoc.gr/~hy435/material/Vyatta-OSPF_6.5R1_v01.pdf)

