



# Routing Protocols

Internal and External Routing



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- Mail to : martin.potts@martel-consulting.ch
- Or bernard.tuy@renater.fr



# Contributions

- Main authors
  - Carlos Friaças, FCCN, Portugal
  - Miguel Baptista, FCCN, Portugal
- Contributors
  - Mónica Domingues, FCCN, Portugal
  - Paulo Ferreira, FCCN, Portugal



# Prerequisites

- You must have followed previously the modules:
  - 010-IPv6 Introduction
  - 020-IPv6 Protocol
  - 030-IPv6 Addressing



# Agenda

- Internal Routing
  - RIPng
  - IS-IS
  - OSPFv3
- External Routing
  - Multiprotocol BGP



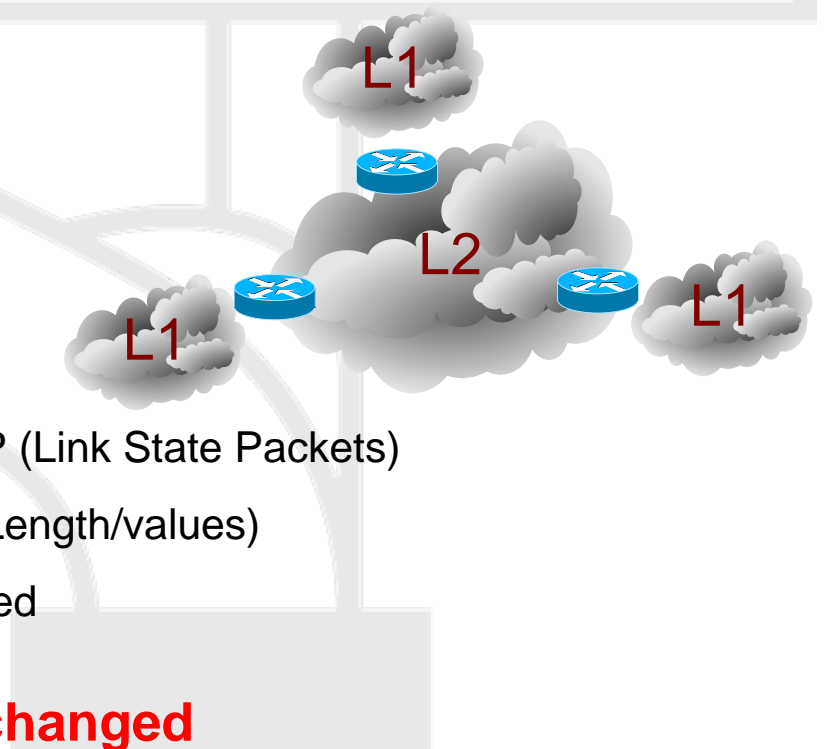
# RIPng

- Same as IPv4
  - Based on RIPv2
  - Distance vector, max. 15 hop, split-horizon, ...
- It's an IPv6 only protocol
  - In a dual-stack environment, running RIP, you'll need RIP (IPv4) and RIPng (IPv6)
- IPv6 related functionality
  - Uses IPv6 for transport
  - IPv6 prefix, next-hop IPv6 address
  - For RIP updates, uses multicast address FF02::9



# ISISv6

- OSI Protocol
- Based on two levels
  - L2 = Backbone
  - L1 = Stub
  - L2L1= interconnect L2 and L1
- Runs on top of CNLS
  - Each IS device still sends out LSP (Link State Packets)
  - Send information via TLV's (Tag/Length/values)
  - Neighborship process is unchanged
- **Major operation remains unchanged**



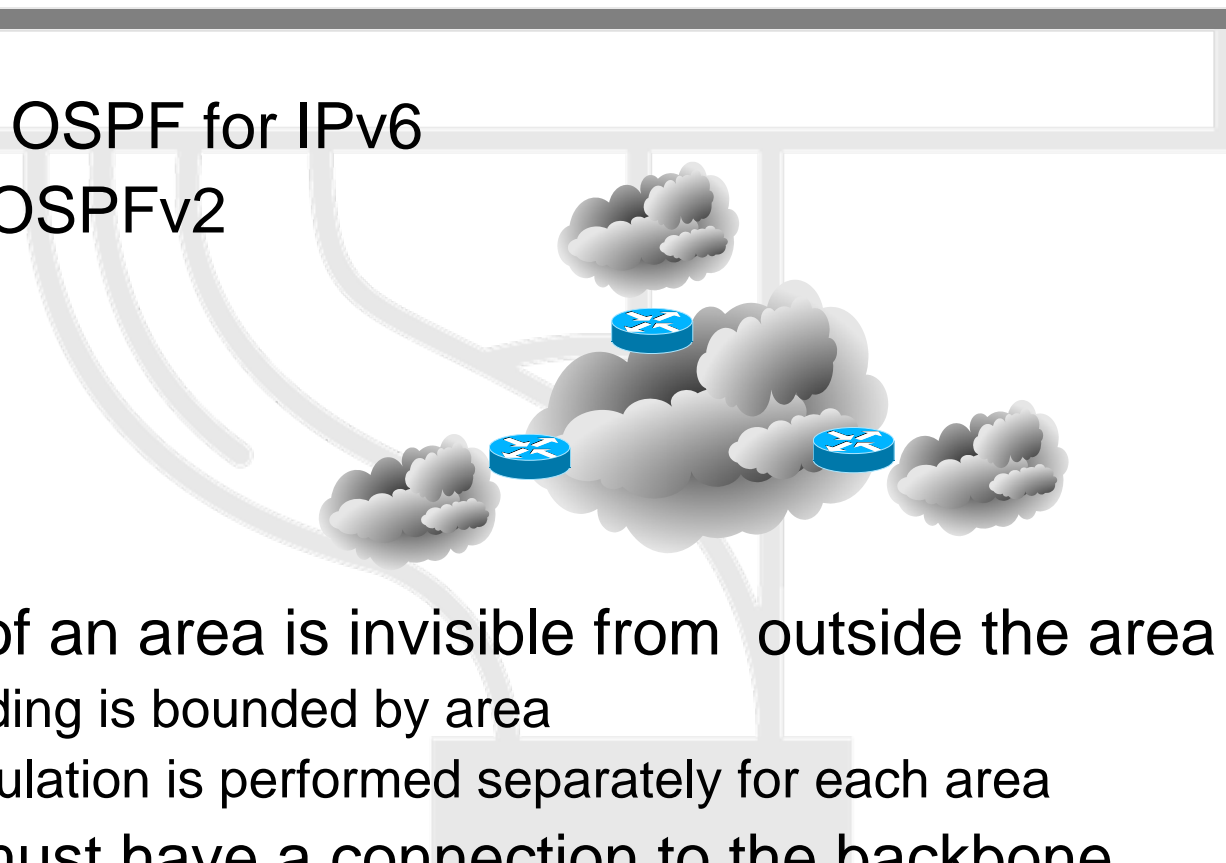
# ISISv6 #2

- Updated features:
  - Two new Tag/Length/Values (TLV) for IPv6
    - IPv6 Reachability
    - IPv6 Interface Address
  - New network Layer Identifier
    - IPv6 NLPID





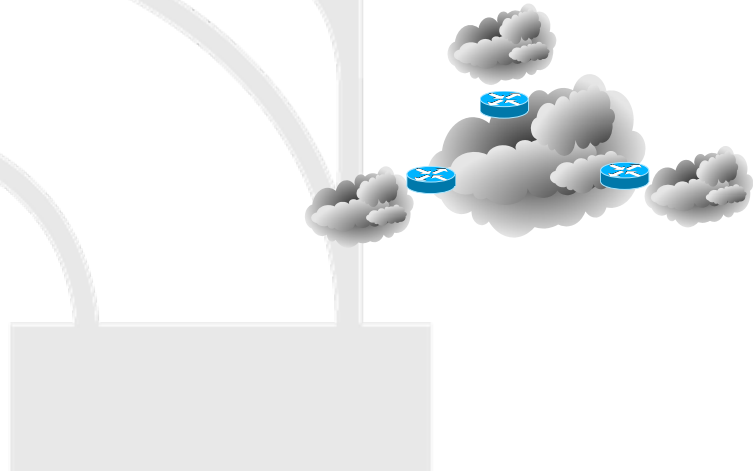
# OSPFv3

- OSPFv3 = OSPF for IPv6
  - Based on OSPFv2
- 
- The diagram illustrates a network topology for OSPFv3. It features a central backbone represented by a horizontal bar at the top. Below this backbone, several areas are shown as clouds. Three blue router icons are positioned within these clouds, connected to the backbone. The routers are arranged in a way that suggests a hierarchical or multi-area structure. The background is a light gray, and the overall style is clean and professional.
- Topology of an area is invisible from outside the area
    - LSA flooding is bounded by area
    - SPF calculation is performed separately for each area
  - All areas must have a connection to the backbone



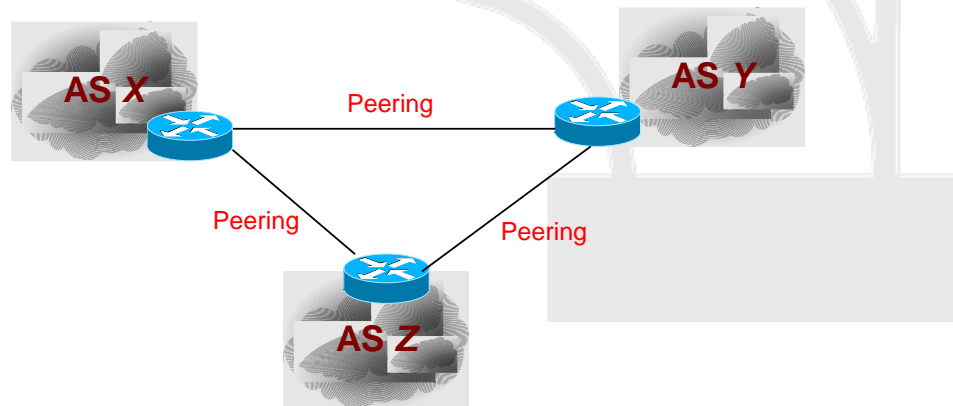
# OSPFv3

- OSPFv3 is an IPv6-only protocol
  - In a dual-stack environment, running OSPF, you'll need OSPFv2 (IPv4) and OSPFv3 (IPv6)
  - There is some work-in-progress about extensible mechanisms to enable OSPFv3 with the support for different address families
- Updated Features
  - Runs directly over IPv6
  - Distributes IPv6 prefixes
  - New LSA types
  - Uses the Multicast address
    - ALLSPFRouters (FF02::5)
    - ALLDRouters (FF02::6)



# Multiprocol BGP

- Exterior Gateway Protocol
- Connect separate routing domains that contain independent routing policies (AS)
- Carries sequences of AS numbers indicating path
- Supports the same features and functionality as IPv4 BGP
- Multiple addresses families: IPv4, IPv6, unicast, multicast



# Multiprotocol BGP

- BGP4 carries only 3 types of information which is truly IPv4 specific:
  - NLRI in the UPDATE message contains an IPv4 prefix
  - NEXT\_HOP attribute in the UPDATE message contains an IPv4 address
  - BGP ID in AGGREGATOR attribute
- RFC 2858 defines multi-protocols extensions for BGP4
  - this makes BGP4 available for other network layer protocols (IPv6, MPLS...)
  - New BGP4 attributes:
    - MP\_REACH\_NLRI
    - MP\_UNREACH\_NLRI
  - Protocol Independent NEXT\_HOP attribute
  - Protocol Independent NLRI attribute



# Conclusions

- All major routing protocols have stable IPv6 support
- And there isn't major differences with IPv4
- In a dual-stack environment, running OSPF, you'll need OSPFv2 (IPv4) and OSPFv3 (IPv6). It may change in a near future.
- In a dual-stack environment, running RIP, you'll need RIPv1/RIPv2 (IPv4) and RIPng (IPv6)

