

Routing Protocols

Internal and External Routing

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IPv6DISSemination and Exploitation

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Prerequisites

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



Agenda

- Internal Routing
 - RIPng (RFC 2080 & 2081)
 - IS-IS (ISO 10589, RFC 1195, ...)
 - <draft-ietf-isis-ipv6-06.txt> (last one known 03/2007)
 - OSPFv3 (RFC 2740)
- External Routing
 - Multiprotocol extensions for BGP (RFC 2858)



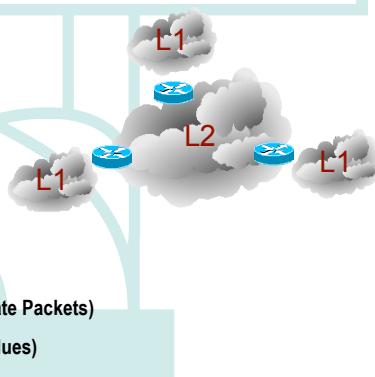
RIPng

- 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



ISIS for IPv6

- OSI Protocol
- Based on two levels
 - L1 = Stub (intra area)
 - L2 = Backbone (inter area)
- Routing is
 - L1 : intra area
 - L2 : Inter area
 - L2L1 : inter & intra area
- Runs on top of CLNS
 - 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



ISIS for IPv6 #2

- Updated features:
 - Two new Tag/Length/Values (TLVs) for IPv6
 - IPv6 Reachability
 - IPv6 Interface Address
 - New network Layer Identifier
 - IPv6 NLPID (0x8E)
- Cisco like commands :
 - Sh isis [ipv6] topo
 - Sh ip[v6] route isis



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OSPFv3

- OSPFv3 = OSPF for IPv6
 - Based on OSPFv2
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- 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 area

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OSPFv3 #2

- 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)

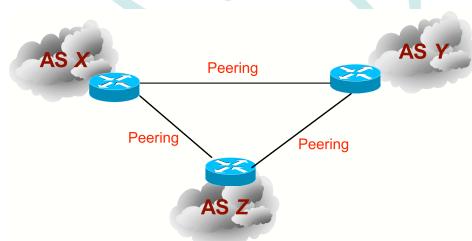


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BGP4+

- BGP4+ : Exterior Gateway Protocol (EGP)
- Connects separate routing domains that contain independent routing policies (AS)
- Carries sequences of AS numbers indicating an *AS path*
- Supports the same features and functionality as IPv4 BGP



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BGP4+ (cont'd)

- BGP4 carries only 3 types of information which is truly IPv4 specific:
 - NLRI in the UPDATE message contains an IPv4 prefix
 - *NLRI : Network Layer Reachability Information*
 - 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 creating :
 - AF (IPv4, IPv6, MPLS...) : address families
 - SAF (unicast, multicast) : sub address families
 - New BGP4 attributes:
 - MP_REACH_NLRI
 - MP_UNREACH_NLRI
 - Protocol Independent NEXT_HOP attribute
 - Protocol Independent NLRI attribute



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Conclusions

- All major routing protocols have stable IPv6 support
- And there isn't major differences with IPv4
- In a dual stack environment :
 - RIP and OSPF need 2 separate processes to handle IPv4 & IPv6 routes
 - IS-IS and BGP carry both IP versions routing information in a single process



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To go further ...

- RFC 4029
 - Scenarios and Analysis for Introducing IPv6 into ISP Networks
- BGP4+ implementation
 - http://www.cisco.com/univercd/cc/td/doc/product/software/ios123/123cgcr/ipv6_csa_bgpv6.htm



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