Enhanced Interior Gateway Routing Protocol (EIGRP): Overview and Packet Types

Introduction to EIGRP

- » Open standard
- » Hybrid IGP
- • Characteristics of both Link State and Distance Vector
- » Metric based from link bandwidth & delay
- » Supports manual and automatic summarization
- » Supports MD5 authentication
- » Supports unequal cost load-balancing

EIGRP Packets

- » Most packets sent to 224.0.0.10
- » Neighbor relationships
- • Hello packets
- » Routing Updates
- • Update (unicast initially, then multicast)
- • Acknowledgments (always unicast)
- • Query
- • Reply

EIGRP: Categories of Routes

- » EIGRP Internal
- • Route that was originated within Autonomous System with the “network” command.
- • Admin Distance = 90
- » EIGRP External
- • Route that was previously learned via some non-EIGRP method and injected into EIGRP with “redistribute” command
- • Admin Distance = 170

EIGRP: Metric Calculation and Building Neighbors

- » By Default: K1 = 1, K2 = 0, K3 = 1, K4 = K5 = 0
- » Delay is sum of all the delays of the link along the paths
- » Bandwidth is the lowest bandwidth of the link along the paths
- » Default Metric is Bandwidth + Delay

$$\text{Metric} = 256 * \left[\left[(K1 \times BW) + \frac{(K2 \times BW)}{(256 - Load)} + (K3 \times Delay) \right] \times \left[\frac{K5}{(Reliability + K4)} \right] \right]$$

This part is not used in the default formula

Forming Neighbors

- » Hello sent to 224.0.0.10
- • Required matching parameters
- Source IP Subnet
- K-Values
- Autonomous System Value
- • Hello and Hold time don’t need to match
- » Passive Interface and its effect on EIGRP

EIGRP: Diffusing Update Algorithm

- DUAL Terminology
- » Successor
- • Best route having lowest total metric (distance)
- » Feasible successor
- • Backup routes with higher metrics

DUAL Terminology

- » Feasible distance
- • Best (lowest) total distance between local router and destination prefix.
- » Reported distance
- • Distance from neighbor to destination
- » Advertised Distance
- • Distance as reported by upstream neighbor

Successor and Feasible Successor Route

- » How does EIGRP calculate the Feasible Successor?
- • Evaluate all Non-Successor Routes

- If…Evaluated Route's RD < FD

This is called the "Feasibility Condition".

- …then the neighbor can be a Feasible Successor for that path.
- If…Evaluated Route's RD ≥ FD
- …then the neighbor can NOT be a Feasible Successor for that path (possible loop).

EIGRP: Data Structures and Variance

- EIGRP Tables
- » Neighbor table
- • Neighbor information is recorded
- » Topology table
- • Backup routes are recorded
- » Routing table
- • Best routes are recorded

EIGRP Variance

- » Variance allows unequal cost load-balancing
- Router(config)# router eigrp 100
- Router(config-rtr)#variance X
- » The “X” above is simply a multiplier
- • Multiply FD of all routes in topology table by “X” = Result “YY” for each route.
- • Compare result “YY” against all Feasible Successors
- • If distance of any FS routes ≤ YY, install route in table

Implementing EIGRP

- Basic EIGRP Configuration
- » Configuration commands
- • Router(config)# router eigrp <AS-number>
- • Router(config-router)# no auto-summary
- • Router(config-router)# network <network-id>
- • Router(config-router)# end
- » AS number should match between EIGRP router

Manipulating EIGRP Routes

- » Enable Unequal Cost Load-Balancing
- • Router(config)# router eigrp <AS-number>
- • Router(config-router)# variance <multiplier>
- » Make routes more, or less, preferable to EIGRP
- • Router(config-if)# bandwidth <1-10000000> Bandwidth in kilobits
- • Router(config-if)# delay <1-16777215> Throughput delay (tens of microseconds)

Verification

- » Verification commands
- • Router# show ip eigrp neighbor
- • Router# show ip eigrp topology
- • Router# show ip route eigrp
- » Above commands display neighbor table, topology table, and routing table, respectively

Troubleshooting EIGRP

- » Troubleshooting commands
- • Router# debug ip eigrp
- • Router# debug eigrp packet
- • Router# debug ip routing
- • Router# show ip eigrp traffic

Implementing EIGRPv6

- IPv6 EIGRP
- » Similarities to IPv4 EIGRP
- • Most packets transmitted via multicast
- • Same metric formula
- • Utilizes same message types (hello, update, ack, etc)
- » IPv6 Uniqueness
- • Packets sent to FF02::A
- • Peers with Link-Local address of neighbors
- • Next-Hop address is Link-Local of pee

EIGRPv6

- » Enabling EIGRPv6
- • Router(config)# ipv6 unicast routing
- • Router(config)# ipv6 router eigrp <number>
- • Router(config)# no shutdown
- • Router(config)# router-id x.x.x.x
- • Router(config-router)# exit
- » Applying EIGRPv6
- • Router(config-if)# ipv6 eigrp <number>

Verifying EIGRPv6

- » Verification commands
- • Router# show ipv6 eigrp neighbor
- • Router# show ipv6 eigrp topology
- • Router# show ipv6 route eigrp
- • Router# show ipv6 protocols