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LAB # 09: Routing protocol IGRP and EIGRP

Interior Gateway Routing Protocol (**IGRP**)

It is a distance vector interior gateway protocol (IGP) developed by Cisco. It is used by routers to exchange routing data within an autonomous system. IGRP was created in part to overcome the limitations of RIP (maximum hop count of only 15, and a single routing metric) when used within large networks. IGRP supports multiple metrics for each route, including bandwidth, delay, load, and reliability; to compare two routes these metrics are combined together into a single metric maximum configurable hop count of IGRP-routed packets is 255 (default 100), and routing updates are broadcast every 90 seconds (by default).

Because IGRP is a classful routing protocol, its usefulness is limited in many of today's networks. Therefore, Cisco enhanced IGRP with a new algorithm, DUAL(Diffusing Update Algorithm), and other features. EIGRP that uses the diffusing update algorithm (DUAL) , replaced the Interior Gateway Routing Protocol. Enhanced Interior Gateway Routing Protocol (EIGRP) is an advanced distance-vector routing protocol.

DUAL maintains a topology table separate from the routing table, which includes both the best path to a destination network and any backup paths.

EIGRP is used on a router to share routes with other routers within the same autonomous system. Unlike other well-known routing protocols, such as RIP, EIGRP only sends incremental updates, reducing the workload on the router and the amount of data that needs to be transmitted.

EIGRP does not use hold-down timers. Instead, loop-free paths are achieved through a system of route calculations (diffusing computations) that result is faster convergence than traditional distance vector routing protocols.

EIGRP Packet Types

EIGRP relies on different types of packets to maintain its tables and establish relationships with neighbor routers.

Hello packets: Default Hello interval depends on the bandwidth:

- ≤ 1.544 Mbps = 60 sec. Hello interval (180 hold time)
- > 1.544 Mbps = 5 sec. Hello interval (15 hold time)

Update packets: Sent (reliably/unreliably), there are 2 types:

- (Unicast) to new neighbor discovered; contains routing table
- (multicast) to all neighbors when topology changes

Query packets: Queries are (multicast) (reliably) during route recomputation, asking neighbors for a new successor to a lost route.

Reply packets: Neighbors (unicast) a reply to a query whether or not they have a route. Acknowledgment packets: "Dataless" (unicast) packets that acknowledge the receipt of packets that were sent reliably. This type is actually a Hello packet with a nonzero value in the acknowledgment field.

Basic characteristics of EIGRP are as follows:

1) Administrative distance 90

2) Uses Reliability, Load, Bandwidth and Maximum Transmission Unit (MTU.)

3) Maximum Hop Count allowed is up to 224

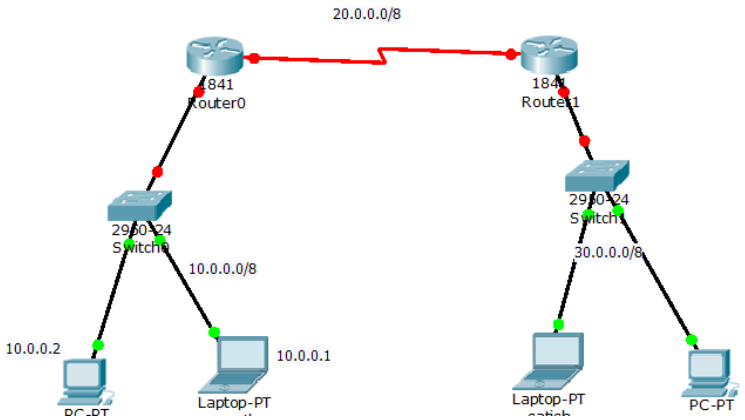
4) Supports CIDR

5) Updates route when there is change in topology and only the change value is exchanged

between neighbors

Basic EIGRP Configuration

Refer to the following topology. Using the 10.0.0.0/8 and 30.0.0.0/8 address space for LANs and the 20.0.0.0/8 address space for WANs:



By default, when using the network command and a classful network address such as 10.0.0.0, all interfaces on the router that belong to that classful network address will be enabled for EIGRP.

Following are the commands you will use to configure EIGRP on **Router0** and **Router1**:

Router0 (config)# router eigrp 1

Router0 (config-router)# network 20.0.0.0 255.0.0.0

Router0 (config-router)# network 10.0.0.0 255.0.0.0

Router1 (config)# router eigrp 1

Router1 (config-router)# network 20.0.0.0 255.0.0.0

Router1 (config-router)# network 30.0.0.0 255.0.0.0

Router(config)# router eigrp autonomous_system_#

This command will enable EIGRP routing protocol in router. We can use any ASN (Autonomous System Number) from 1 to 65,535. In order to become EIGRP neighbors this number must be same on all participates.

Router(config-router)# network IP_network_# [subnet_mask]

This command allows us to specify the local interfaces which we want to include in EIGRP. Basically we define a range of addresses and router search for these addresses in local interfaces. If match found EIGRP will be enabled on that interface. Once enabled, EIGRP will starts advertising about the connected subnets with that interface. We have two options while defining the range of addresses with network command

1. Without wildcard mask (Subnet mask is a substitute, not a replacement of wildcard mask. When we use Subnet mask, router converts them in wildcard mask before searching for associated interfaces. We can look in running configuration to know what exactly being used by router)

2. With wildcard

(in above example we used subnet mask instead of wildcard)

Verifying that EIGRP is enabled on routers by using following command:

Router0# show ip protocols

```
Router#show ip protocols

Routing Protocol is "eigrp  10 "
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Default networks flagged in outgoing updates
  Default networks accepted from incoming updates
  EIGRP metric weight K1=1, K2=0, K3=1, K4=0, K5=0
  EIGRP maximum hopcount 100
  EIGRP maximum metric variance 1
Redistributing: eigrp 10
  Automatic network summarization is in effect
  Automatic address summarization:
  Maximum path: 4
  Routing for Networks:
     20.0.0.0
     30.0.0.0
  Routing Information Sources:
    Gateway         Distance      Last Update
    30.0.0.1        90            8923
  Distance: internal 90 external 170
```

EIGRP Metric Concepts

The values EIGRP uses in its composite metric to calculate the preferred path to a network.

■ Bandwidth ■ Delay ■ Reliability ■ Load

Record the formula used to calculate the default EIGRP composite metric.

Default metric = [10^7/K1*Min bandwidth + K3*Total Sum of delay(usec)/10] * 256

By default, K_1 and K_3 have a value of 1, and K_2, K_4, and K_5 are set to 0

Following command Verifies the current EIGRP metrics used for any interface; for example, serial 0/0/0:

Router# show interface serial 0/0/0

```
Router>en
Router#show int
Router#show interfaces se2/0
Serial2/0 is up, line protocol is up (connected)
  Hardware is HD64570
  Internet address is 10.0.0.1/8
  MTU 1500 bytes, BW 128 Kbit, DLY 20000 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation HDLC, loopback not set, keepalive set (10 sec)
  Last input never, output never, output hang never
  Last clearing of "show interface" counters never
  Input queue: 0/75/0 (size/max/drops); Total output drops: 0
  Queueing strategy: weighted fair
  Output queue: 0/1000/64/0 (size/max total/threshold/drops)
     Conversations  0/0/256 (active/max active/max total)
     Reserved Conversations 0/0 (allocated/max allocated)
     Available Bandwidth 96 kilobits/sec
  5 minute input rate 104 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
     69 packets input, 4140 bytes, 0 no buffer
     Received 0 broadcasts, 0 runts, 0 giants, 0 throttles
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
     0 packets output, 0 bytes, 0 underruns
     0 output errors, 0 collisions, 1 interface resets
     0 output buffer failures, 0 output buffers swapped out
     0 carrier transitions
     DCD=up  DSR=up  DTR=up  RTS=up  CTS=up
```

Lab Task:

- Cable a network that is similar to the one in the given topology diagram.
- Configure Activate Serial and Ethernet interfaces.
- Configure EGIRP routing on all routers using 100 as Process ID (ASN) and include the connected networks in the routing updates.
- Display the routing table of each router using command "***show ip route***"
- Also manually calculate metric value for network 50.0.0.0/10 from Router0 and compare it with the value given in Routing Table. Attach handwritten solution.