EIGRP Wide Metric Calculation

Lo0
8.8.8.8/24

78.1.1.0/24

.7
R7 **G0/0**

.8
G0/0 **R8**

Let's configure these routers based on the above diagram.

On SW1:

```
SW1(config)#int range f0/7-8
SW1(config-if-range)#swi mode acc
SW1(config-if-range)#swi acc v 100
SW1(config-if-range)#No shut
```

On R7:

```
R7(config)#int g0/0
R7(config-if)#ip addr 78.1.1.7 255.255.255.0
R7(config-if)#No shut
```

On R8:

```
R7(config)#int g0/0
R7(config-if)#ip addr 78.1.1.8 255.255.255.0
R7(config-if)#No shut

R7(config)#int lo0
R7(config-if)#ip addr 8.8.8.8 255.255.255.0
```

To test the configuration:

On R7:

```
R7#Ping 78.1.1.8
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 78.1.1.8, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/4 ms
```

We can see that the routers have NLRI to each other's directly connected interface. Let's configure EIGRP Named mode on the G0/0 interfaces of R7 and R8 and the loopback0 interface of R8:

On R7:

```
R7(config)#router eigrp tst
R7(config-router)#address-family ipv4 unicast autonomous-system 100
R7(config-router-af)#Network 78.1.1.7 0.0.0.0
```

On R8:

```
R8(config)#router eigrp tst
R8(config-router)#address-family ipv4 unicast autonomous-system 100
R8(config-router-af)#Network 8.8.8.8 0.0.0.0
R8(config-router-af)#Network 78.1.1.8 0.0.0.0
```

We should see the following console message stating that the two routers have established an EIGRP adjacency:

```
%DUAL-5-NBRCHANGE: EIGRP-IPv4 100: Neighbor 78.1.1.7
(GigabitEthernet0/0) is up: new adjacency
```

Let's verify the routing table of R7:

On R7:

```
R7#Show ip route eigrp | B Gate
Gateway of last resort is not set

      8.0.0.0/24 is subnetted, 1 subnets
D        8.8.8.0 [90/103040] via 78.1.1.8, 00:00:25, GigabitEthernet0/0
```

We can see that the local router's cost to get to prefix 8.8.8.0/24 is "103,040", let's check the topology table for this prefix:

On R7:

```
R7#Show ip eigrp topology 8.8.8.0/24
EIGRP-IPv4 VR(tst) Topology Entry for AS(100)/ID(8.8.8.8) for
8.8.8.0/24
  State is Passive, Query origin flag is 1, 1 Successor(s), FD is
13189120, RIB is 103040
  Descriptor Blocks:
  78.1.1.8 (GigabitEthernet0/0), from 78.1.1.8, Send flag is 0x0
      Composite metric is (13189120/163840), route is Internal
      Vector metric:
        Minimum bandwidth is 100,000 Kbit
        Total delay is 101250000 picoseconds
        Reliability is 255/255
        Load is 1/255
        Minimum MTU is 1500
        Hop count is 1
        Originating router is 78.1.1.8
```

NOTE: The feasible Distance is 13,189,120 but the RIB is 103,040, what is going on?

In the EIGRP named mode configuration we can see a "Metric rib-scale" command and by default it is set to 128, therefore, if the Feasible Distance is divided by the RIB-Scale value we should see what is entered in the routing table, let's verify:

13,189,120 / 128 = 103,040

But why did Cisco do that?
The variable in the routing table that allows the composite metric to be placed is a 32 bit value and therefore, larger numbers can't be installed, therefore, the RIB-Scale command can reduce this number so it can fit in.

So how does the local router calculate the feasible distance?

EIGRP uses a number of defined constants for the calculation of the metric value and they are based on the following:

EIGRP_BANDWIDTH	**10,000,000**
EIGRP_DELAY_PICO	**1,000,000**

Now that we know the constants let's go through the calculation.

The formula for calculating the metric is:

Throughput + Latency

But let's see how these are calculated:

Throughput = EIGRP_BANDWIDTH * 65536 / Min Bandwidth

This means the following:

10,000,000 * 65536 / 100,000 = 6,553,600

The "EIGRP_BANDWIDTH" is the constant value described above and the "Min Bandwidth" is taken from the output of the "Show ip EIGRP topology 8.8.8.0/24" command.

Let's see how the latency is calculated:

Latency = Total delay (In picoseconds) * 65536 / EIGRP_DELAY_PICO

This means the following:

101,250,000 * 65536 / 1,000,000 = 6,635,520

The "Total delay" is also taken from the output of the "Show ip EIGRP topology 8.8.8.0/24" command, and the "EIGRP_DELAY_PICO" is the constant value described above.

NOW that we have calculated the latency, let's add the latency to the throughput:

6,553,600 + 6,635,520 = 13,189,120 → The Feasible Distance

I hope this was beneficial to you all.
Enjoy