Automatic Summarization in EIGRP

EIGRP is a well known routing protocol developed by Cisco Systems. EIGRP automatically summarizes at the classful boundaries by default. For example, 192.168.1.32/27 is summarized to 192.168.1.0/24 (Class C boundary) or 20.30.40.32/30 is summarized to 10.0.0.0/8 (Class A boundary).

The main objective of network summarization is to reduce routing overhead, which can be translated as reducing the routing table sizes. However, EIGRP automatic summarization does not always perform well. Let's see the following example:

When summarization is running on all router, R2 receives routing information from R1 and R3 exactly equal. Why? Networks 10.10.10.64/28 and 10.10.10.80/28 are both summarized to 10.0.0.0/8 by R1 and R3. Thus, R2 cannot make an exact determination to where route packets addressed to IPs between 10.0.0.1 and 10.255.255.254. In other words, it sees two routes to 10.0.0.0/8.

These are the truncated configurations on every router:

**R1**

```
!
hostname R1
!
! Loopback0 simulates LAN
interface Loopback0
ip address 10.10.78 255.255.255.240
!
interface FastEthernet0/0
ip address 192.168.1.1 255.255.255.0
duplex auto
```
speed auto

!

router eigrp 10

network 10.10.10.64 0.0.0.15

network 192.168.1.0

auto-summary

!

R2

!

hostname R2

!

interface FastEthernet0/0

ip address 192.168.2.254 255.255.255.0

duplex auto

speed auto

!

interface FastEthernet0/1

ip address 192.168.1.254 255.255.255.0

duplex auto

speed auto

!

router eigrp 10

network 192.168.1.0

network 192.168.2.0

auto-summary

!
R3
!
hostname R3
!
! Loopback0 simulates LAN
interface Loopback0
 ip address 10.10.10.94 255.255.255.240
!
interface FastEthernet0/0
 ip address 192.168.2.1 255.255.255.0
duplex auto
 speed auto
!
router eigrp 10
 network 10.10.10.80 0.0.0.15
 network 192.168.2.0
 auto-summary
!
Let's take a look at R2's routing table.

D 10.0.0.0/8 [90/156160] via 192.168.1.1, 00:07:34, FastEthernet0/1

 [90/156160] via 192.168.2.1, 00:06:39, FastEthernet0/0

C 192.168.1.0/24 is directly connected, FastEthernet0/1

C 192.168.2.0/24 is directly connected, FastEthernet0/0

As expected, R2 has two routes to reach 10.0.0.0/8 that includes 10.10.10.64/28 and 10.10.10.80/28. R2 cannot make a correct decision with the 10.0.0.0/8 summary route. Let's see the result when pinging 10.10.10.78 for instance.

Sending 5, 100-byte ICMP Echos to 10.10.10.76, timeout is 2 seconds:
U.U.U

Success rate is 0 percent (0/5)
"U" means unreachable. Thus, network 10.10.10.64/28 is unreachable even though it is connected.

The best solution to this problem is to turn the auto summary function off applying the no auto-summary command in router configuration mode on every router. After applying this command the routing table on R2 looks as follow:

10.0.0.0/28 is subnetted, 2 subnets

D  10.10.10.64 [90/156160] via 192.168.1.1, 00:00:25, FastEthernet0/1
D  10.10.10.80 [90/156160] via 192.168.2.1, 00:00:08, FastEthernet0/0
C   192.168.1.0/24 is directly connected, FastEthernet0/1
C   192.168.2.0/24 is directly connected, FastEthernet0/0

There are now two more specific routes to reach 10.10.10.64/28 and 10.10.10.80/28 respectively. Let's see the result when pinging 10.10.10.78.

Sending 5, 100-byte ICMP Echos to 10.10.10.78, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 1/5/10 ms

As expected, network 10.10.10.64/28 is now reachable. Let's do the same with network 10.10.10.80/28 just to double check.

Sending 5, 100-byte ICMP Echos to 10.10.10.94, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 1/5/13 ms

Reachable as well!!!