EIGRP

Neighbour Table:

List of directly connected routers running EIGRP in same autonomous system

sh ip eigrp neighbours

Topology Table

List of all routes learned from its directly connected neighbors

sh ip eigrp topology

Routing Table

List of best path towards each destination

sh ip route

EIGRP metric calculation

EIGRP Metric

= [k1*BW + ((k2 * BW) / (256 – load)) + K3 * delay]

Formula with default K values

(k1 = 1, k2 = 0,k3 = 1, k4 = 0, k5 = 0)

1)Bandwidth.   - K1
2)Load.   -K2
3)Delay.   -K3
4)Reliability.   -K4
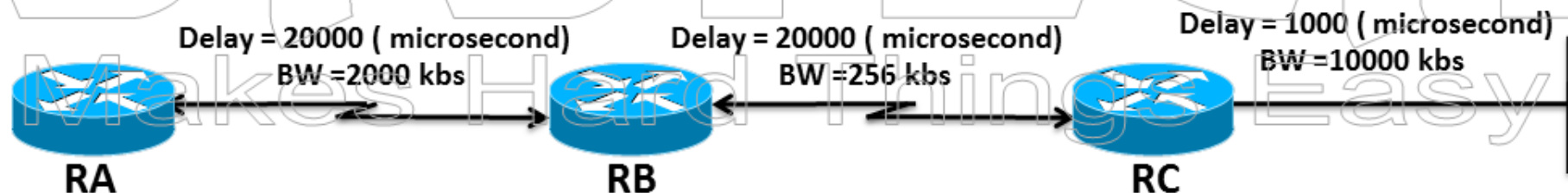5) MTU   -K5

✓ Default Bandwidth is 1.5 Mbps.

✓ MTU will not be used In metric calculation

✓ Reliability : in 9 acknowledgement if 1 fail then it is not reliable

IGRP (24 BIT)

$$\left[\frac{10^7}{\text{Least bandwidth}} \; \boldsymbol{+} \; \frac{\text{Sum of delay}}{10} \right]$$

EIGRP (32 BIT)

$$\left[\frac{10^7}{\text{Least bandwidth}} \; \boldsymbol{+} \; \frac{\text{Sum of delay}}{10} \right] \; \boldsymbol{\times} \; 256$$

Delay = 20000 (microsecond)
BW =2000 kbs

Delay = 20000 (microsecond)
BW =256 kbs

Delay = 1000 (microsecond)
BW =10000 kbs

RA   **RB**   **RC**

$$\left[\frac{10^7}{256} \; \boldsymbol{+} \; \frac{41000}{10} \right] \; \boldsymbol{\times} \; 256$$

Composite metric (CM) = 11049600   **If router has 2 CM then lowest is best path**

EIGRP Packets

1. Hello
2. Update
3. Query
4. Reply
5. ACK

Hello   : (Multicast) to discover neighbor
Update   : (Multicast) first time router will send update & when there is any changes in topology it
              will send incremental update
Query   : (Multicast) if router looses successor path it sends query to neighbour
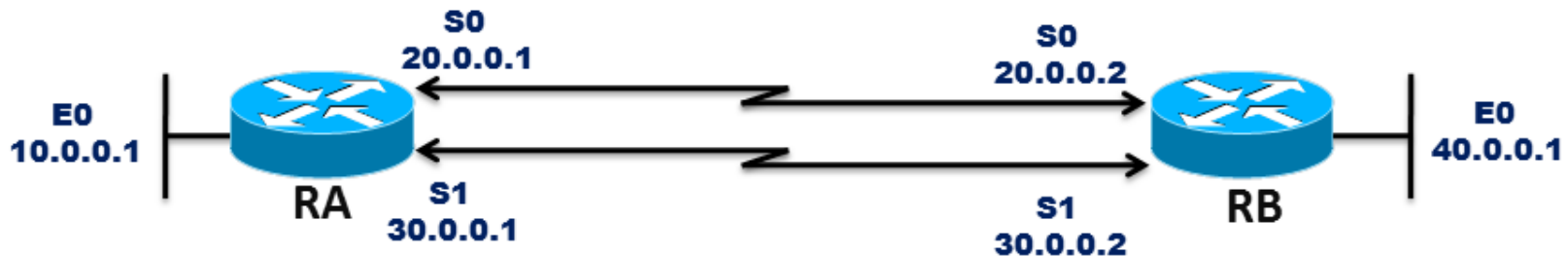Reply   : (unicast) reply from query
ACK   : (unicast)

Autonomous system number :

- 0 – 65535
- 1- 64511 (Public Range)
- 64512- 65535 (Private Range)
- APNIC (*Asia Pacific Network Information Centre*)

EIGRP
LOAD BALANCING ACROSS EQUAL COST PATH

S0
20.0.0.1

S0
20.0.0.2

E0
10.0.0.1

E0
40.0.0.1

RA

S1
30.0.0.1

RB

S1
30.0.0.2

Enable interface and configure EIGRP 100 with no auto summary

RA

sh ip eigrp topology
sh ip route

RB

sh ip eigrp topology
sh ip route

Two paths are added in topology table and routing table

RA

RB

traceroute   40.0.0.1

traceroute   10.0.0.1

10 & 40 N/W are traced through two paths, so its done by Load Balancing

EIGRP
LOAD NOT BALENCED ACROSS UNEQUAL COST PATH

Enable interface and configure EIGRP 100 with no auto summary

RA

int s0
bandwidth 64
int s1
bandwidth 128

RB

int s0
bandwidth 64
int s1
bandwidth 128

RA

sh ip route

RB

sh ip route

serial 1 alone is added

RA

int s0
bandwidth 256

RB

int s0
bandwidth 256

serial 0 alone is added

RA

traceroute   40.0.0.1

RB

traceroute   10.0.0.1

10 & 40 N/W are traced through one path, so there is no   Load Balancing

EIGRP
LOAD BALANCING ACROSS UNEQUAL COST PATH

S0
20.0.0.1

BW 2000

S0
20.0.0.2

E0
10.0.0.1

E0
40.0.0.1

RA

S1
30.0.0.1

BW 1000

S1
30.0.0.2

RB
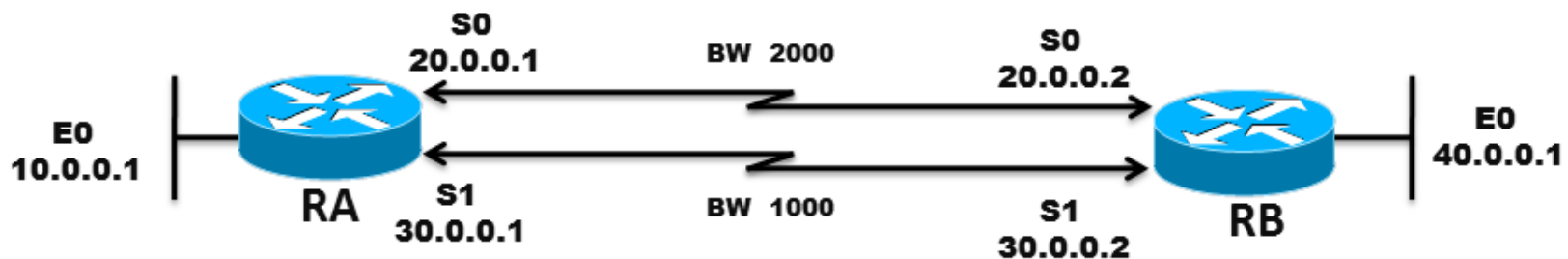
Enable interface and configure EIGRP 100 with no auto summary
Enable Bandwidth in serial 0 & serial 1

RA

RB

 # sh ip route

serial 0 alone is added

 # sh ip route

To add serial 1 to make load balancing configure variance

RA&RB

 # router eigrp 100
 # variance 2

Now serial 1 is also added and load balancing is done

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HARDWARE & NETWORKING ACADEMY

www.systechacademy.com
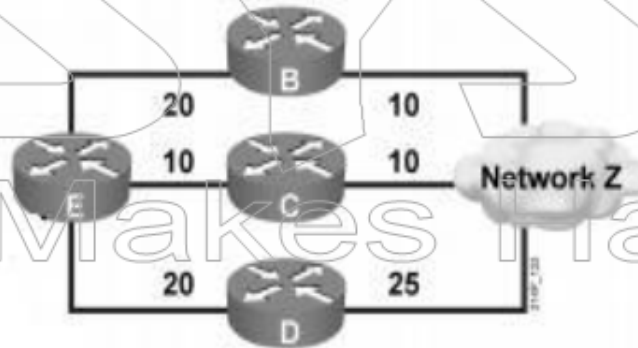www.facebook.com/systechacademy

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Variance

✓ The *variance* command is used to balance traffic across multiple routes that have different metric values.

✓ If we have one link with lower metric and as a result it is being over utilized while other connections are idle, we can load balance using the *variance* command.

✓ The multiplier value, from 1 to 128 is used for load balancing. The default is

✓ 1 and it indicates equal-cost for load balancing, as a result path is chosen by metric values.

Example :   FD values: B -> 30   C -> 20   D -> 45

✓ By default, when variance=1 the only path used is via router C, because the lowest FD is 20 and only this path have this low metric.

✓ By configuring variance 2 the required FD is 2*20 (=40) and the path via router B is now less than the requirement and can be used to load balance traffic from router E to network Z.

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EIGRP AUTHENTICATION

RA — S0 ← → S0 — **RB**

RA

```
# Configure Terminal
# key chain ccna
# key 1
#key-string  systech123
# exit
# exit
# int s0
# ip  authentication  mode eigrp 100 md5
#ip authentication  key-chain eigrp 100 ccna
```
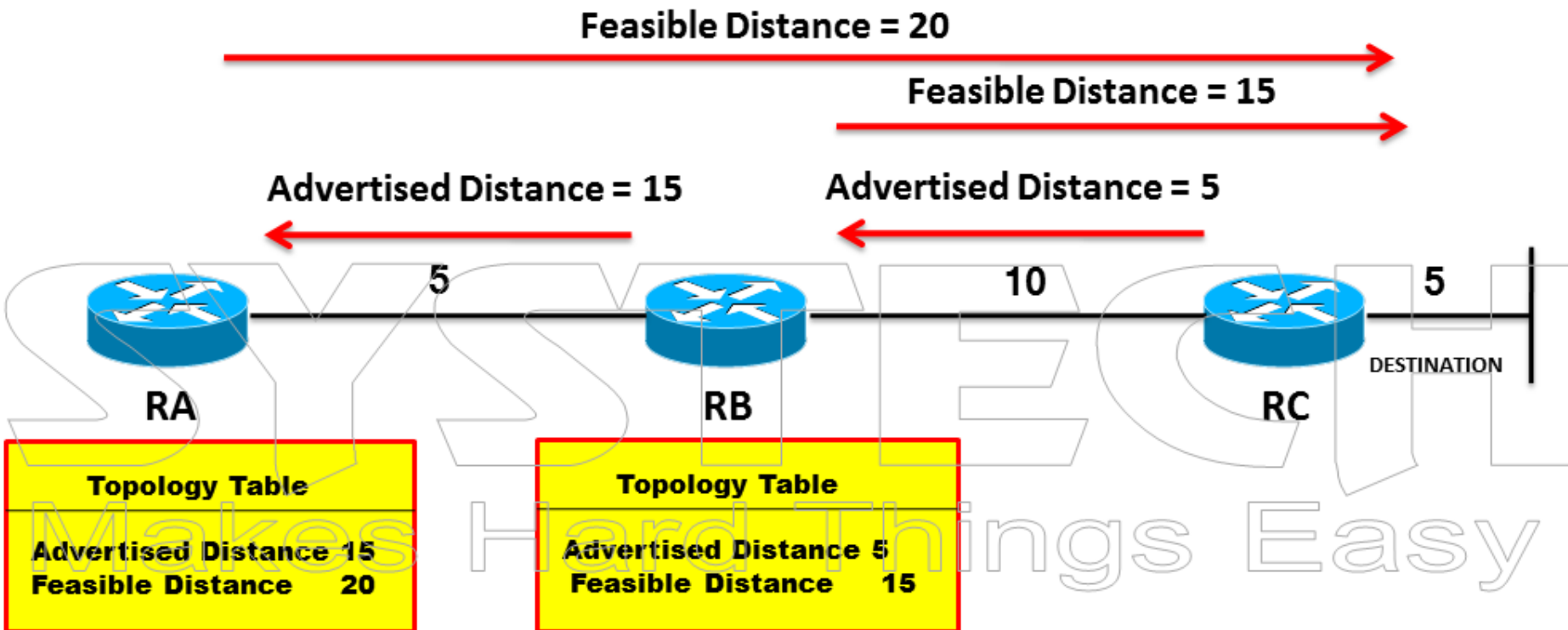
RB

```
# Configure Terminal
# key chain ccnp
# key 1
#key-string  systech123
# exit
# exit
# int s0
# ip  authentication  mode eigrp 100 md5
#ip authentication  key-chain eigrp 100 ccnp
```

RA & RB

```
# debug eigrp packets
# sh ip eigrp neighbours
```

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EIGRP

Feasible Distance = 20

Feasible Distance = 15

Advertised Distance = 15

Advertised Distance = 5

RA	5	RB	10	RC	5

DESTINATION

Topology Table

Advertised Distance   15
Feasible Distance   20

Topology Table

Advertised Distance   5
Feasible Distance   15

Advertised Distance : How far the Destination is away from neighbour
Feasible Distance   : The total distance to the destination

The best path to the destination is called SUCCESSOR
The successor will be copied from topology table to the routing table

RA

RB

SYSTECH

5

5

5

10

DESTINATION

RC

100

9
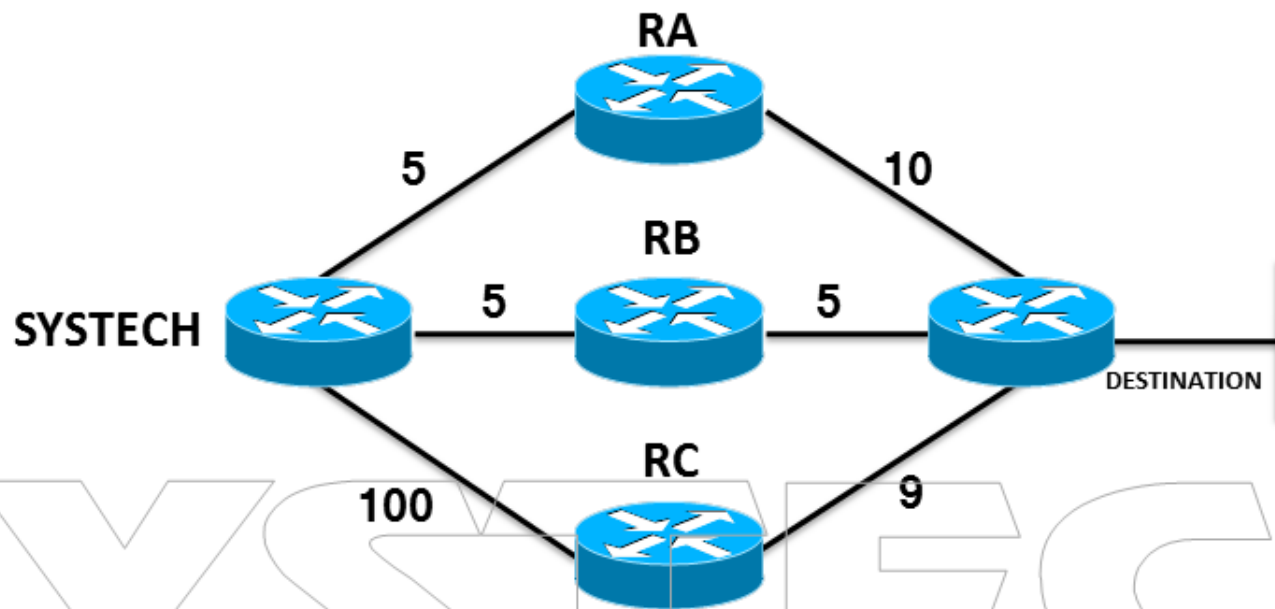
Feasible Succesor formula :

AD of Fesible succesor < feasible distance of successor

SYSTECH	Advertised Distance	Feasible Distance	
RA	10	15	
RB	5	10	Successor
RC	9	109	Feasible Successor

SYSTECH
HARDWARE & NETWORKING ACADEMY

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Go to PC settings to

SYSTECH	Advertised Distance	Feasible Distance	
RA	10	15	
RB	5	10	Successor
RC	9	109	Feasible Successor

Routing Table	Topology Table
RB	RB , RC

If successor RB's link is failed then EIGRP will copy/paste feasible successor in routing table but only if it is in topology table

If we have a feasible successor with feasible distance which is 5 times worse than the successor trafic will be shared in a 5:1 way

SYSTECH	Advertised Distance	Feasible Distance	
RA	10	15	
RB	5	10	Successor
RC	9	109	Feasible Successor

Routing Table	Topology Table
RB	RB , RC

For load balancing we have to add feasible successor (RC) in routing table. It can be done by using variance command

Our successor has a feasible distance of 10 & Our feasible succesor has feasible distance of 109

In order to loadbalance our feasible succesor must have a lower feasible distance than the successor X multiplier

If we set variance at 2 than feasible distance of successor is 10 x 2 = 20 (109 is higher than 20)
So RC will not be added in routing table and so there is no load balancing

If we set variance at 11 than feasible distance of successor is 10 x 11 = 110 (109 is lower than 110)

Routing Table
RB,RC

now RC is added in routing table and starts load balancing

SYSTECH
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EIGRP guarantee that the backup path(feasible Successor) is 100% loop free
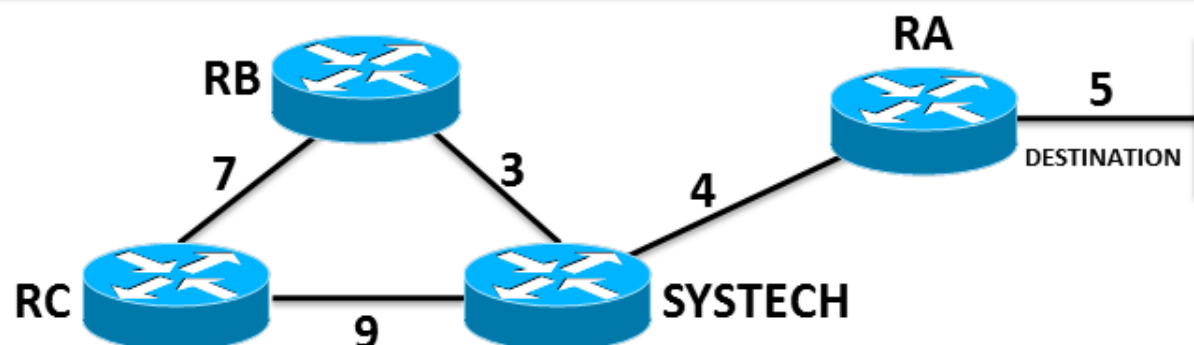
RA will advertise a distance of **5** towards SYSTECH

RB will learn destination from SYSTECH and RC , SYSTECH will advertise 5+4 =9 to RB

RC will advertise 5+4+9=18 to RB ,RB will not send information about this network back to SYSTECH because of split-horizon so RB will send 7+9+4+5=**25**

RC will advertise 7+3+4+5=**19** to SYSTECH because of split horizon

SYSTECH	Advertised Distance	Feasible Distance	
RA	5	+4 = 9	SUCCESSOR
RB	25	+3=28	FS?
RC	19	+9=28	FS?

RA has lowest FD so it is successor. But there is no backup path (FS) because 25 & 19 are higher than Feasible Distance of RA which is 9 . If RB or RA become Feasible Successors than it will lead to **LOOP!!!!!!**

EIGRP PACKETS & METRICS

EIGRP does not use broadcast packets to send information to other neighbors but will use multicast or unicast.

(MULTICAST)
HELLO
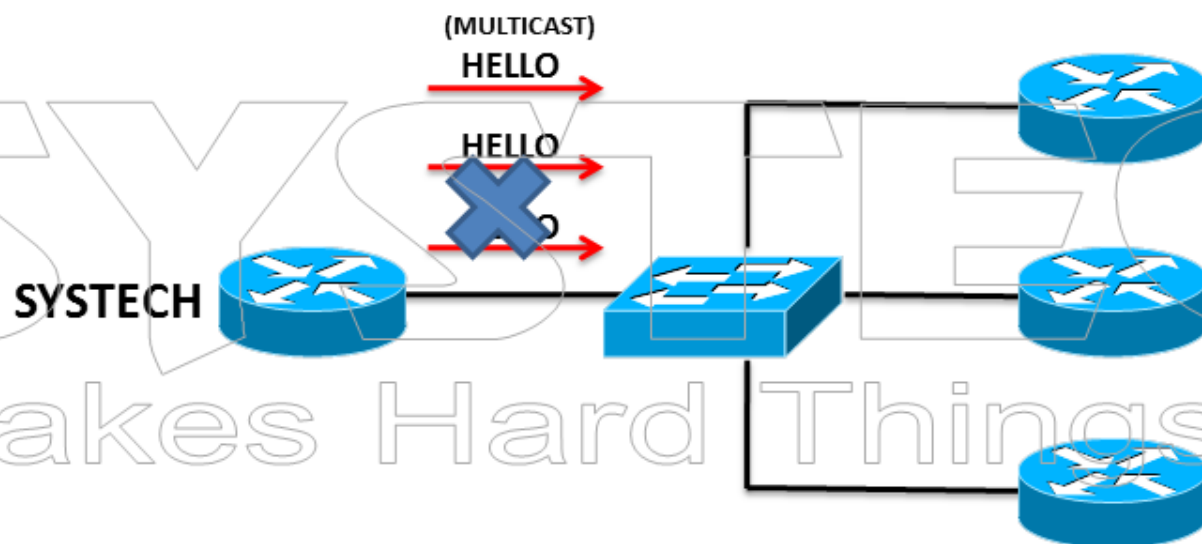
HELLO

SYSTECH

Now SYSTECH Router will not sends 3 different hello packets instead of doing this
EIGRP will Send hello packets by using multicast on a multi-access network like Ethernet

EIGRP PACKETS & METRICS

RA

RB
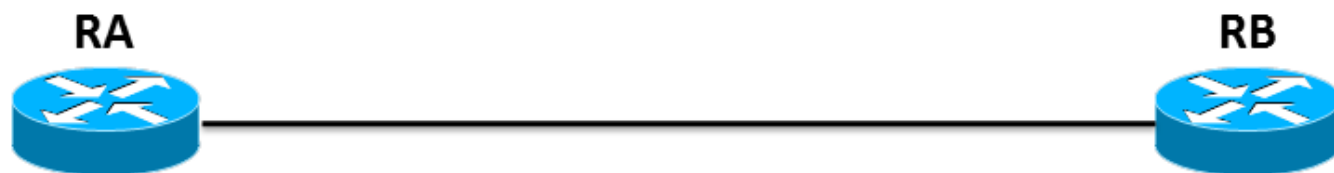
1. RA sends hello packets
2. RB sends update packets
3. RA & RB sends hello packets
4. RB sends ACK
5. RA sends update packets
6. RB sends ACK

After exchanging routing information they will select the best paths to each destination and copy those to routing table, the best path is successor.

Router# debug eigrp packets
Router# debug eigrp packets hello
Router# debug eigrp packets update
Router# debug eigrp packets ack

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EIGRP PASSIVE-INTERFACE

EIGRP network command does two things
1. Send EIGRP packets on the interface that falls within the network command range.
2. Advertise the network that is configured on the interfaces in EIGRP.

So to stop EIGRP packets going to the interfaces use passive-interface command

Router(config)# router eigrp 100
Router(config-router)# passive-interface ethernet 0/0

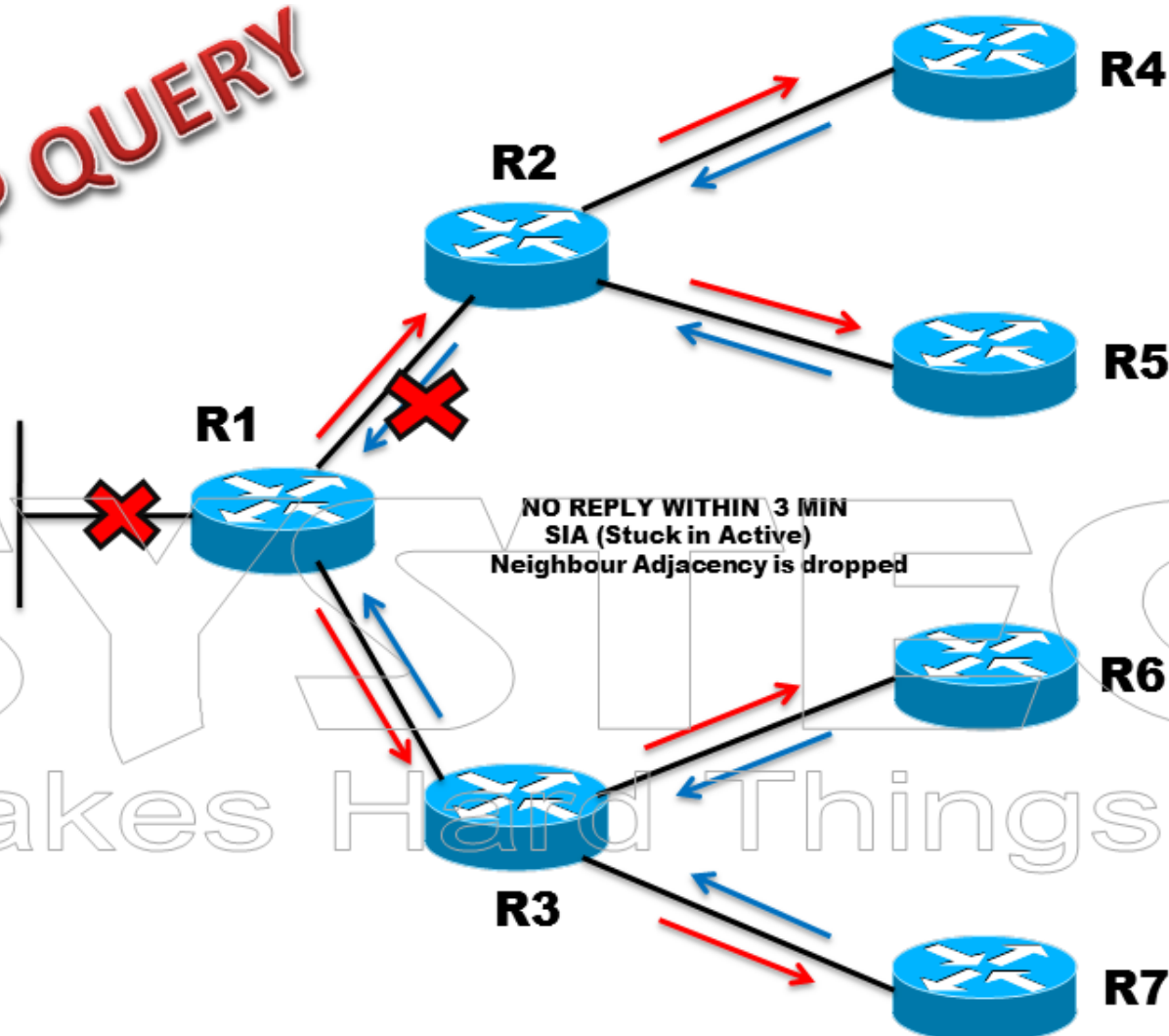This will advertise a network in ethernet 0/1 without sending
EIGRP packets to ethernet 0/0

If you have to configure in ISP router with 50+ interfaces you can use
passive-interface default
Router(config)# router eigrp 100
Router(config-router)#passive-interface default
Router(config-router)#no passive-interface fastethernet 0/0

EIGRP QUERY

R4

R2

R5

R1

NO REPLY WITHIN 3 MIN
SIA (Stuck in Active)
**Neighbour Adjacency is dropped**

R6

R3

R7

✓ In IOS 12.1 Cisco decided to change stuck in active(SIA) process to reduce the number of unwanted lost neighbour adjacency. they introduced two new packets called SIA query and SIA reply.

✓After 1.5 minute R1 will send SIA query to R2 to ask for its status than R2 will respond with SIA reply and neighbour adjacency will not be dropped. (we can also overcome this by configuring EIGRP STUB).

EIGRP STUB
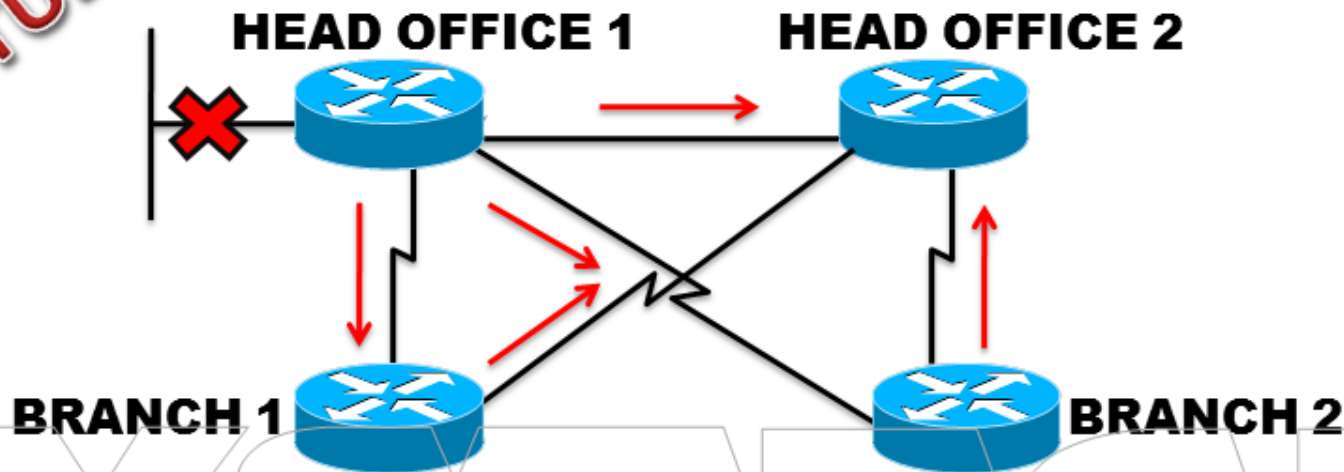
✓ To reduce QUERY packets we have to configure EIGRP STUB
✓ If we configure STUB in branch routers they will not receive queries from head office routers
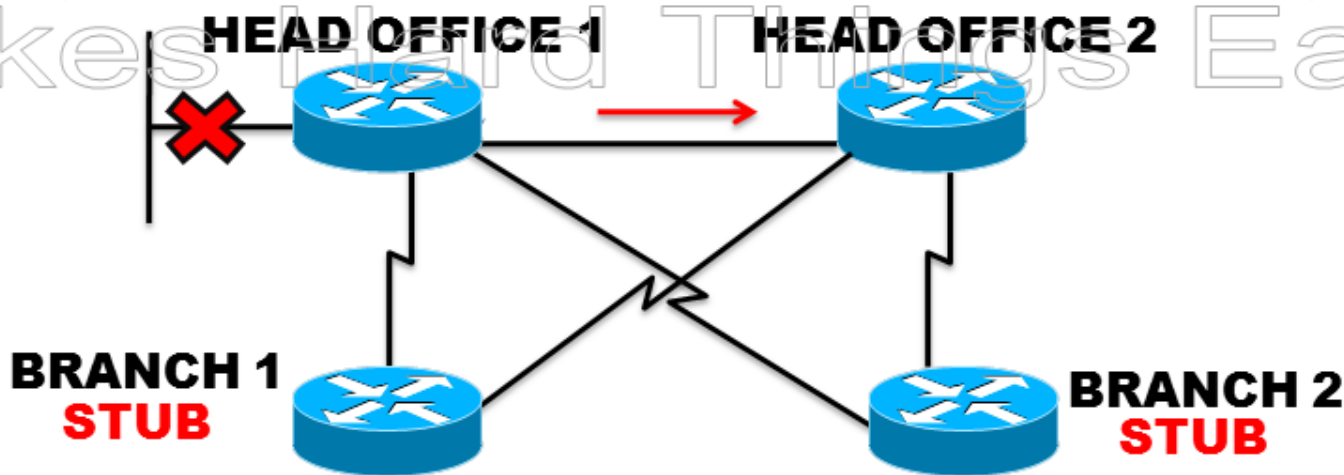
EIGRP STUB FLAVORS

Receive-only : The stub router will not advertise any route
Router(config)# router eigrp 100
Router(config-router)# eigrp stub receive-only

Connected: The stub router will advertise only directly connected routes
Router(config)# router eigrp 100
Router(config-router)# eigrp stub connected

Static : The stub router will advertise only static route
Router(config)# router eigrp 100
Router(config-router)# eigrp stub static

summary : The stub router will advertise only summary routes
Router(config)# router eigrp 100
Router(config-router)# eigrp stub summary

Redistribute : The stub router will advertise only redistributed routes
Router(config)# router eigrp 100
Router(config-router)# eigrp stub redistributed

The default is connected & summary.
Router(config)# router eigrp 100
Router(config-router)# eigrp stub