Chapter 7: Enhanced Interior Gateway Protocol (EIGRP)

Scaling Networks

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Chapter 7

Chapter 7: Objectives

- Describe the features and operation of EIGRP.
- Examine the different EIGRP packet formats.
- Calculate the composite metric used by the Diffusing Update Algorithm (DUAL).
- Describe the concepts and operation of DUAL.
- Examine the commands to configure and verify basic EIGRP operations for IPv4 and IPv6.

7.1 Characteristics of EIGRP

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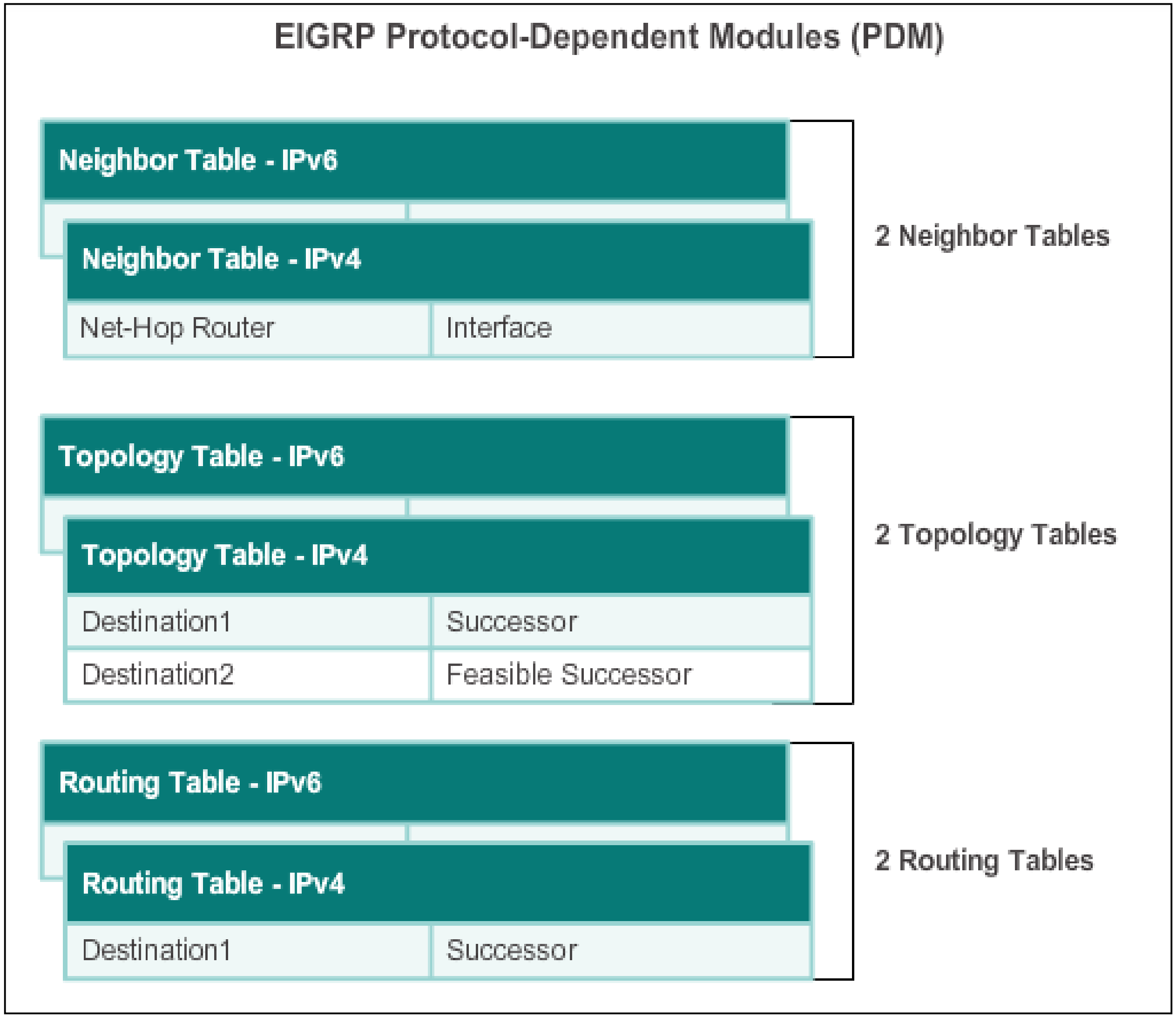
Features of EIGRP

- Released in 1992 as a Cisco proprietary protocol.
- 2013 basic functionality of EIGRP released as an open standard.
- Advanced Distance Vector routing protocol.
- Uses the Diffusing Update Algorithm (DUAL) to calculate paths and back-up paths.
- Establishes Neighbor Adjacencies.
- Uses the Reliable Transport Protocol (RTP) to provide delivery of EIGRP packets to neighbors.
- Partial and Bounded Updates. Send updates only when there is a change and only to the routers that need the information.
- Supports Equal and Unequal Cost Load Balancing.

Basic Features of EIGRP

Protocol Dependent Modules



PDM responsible for:

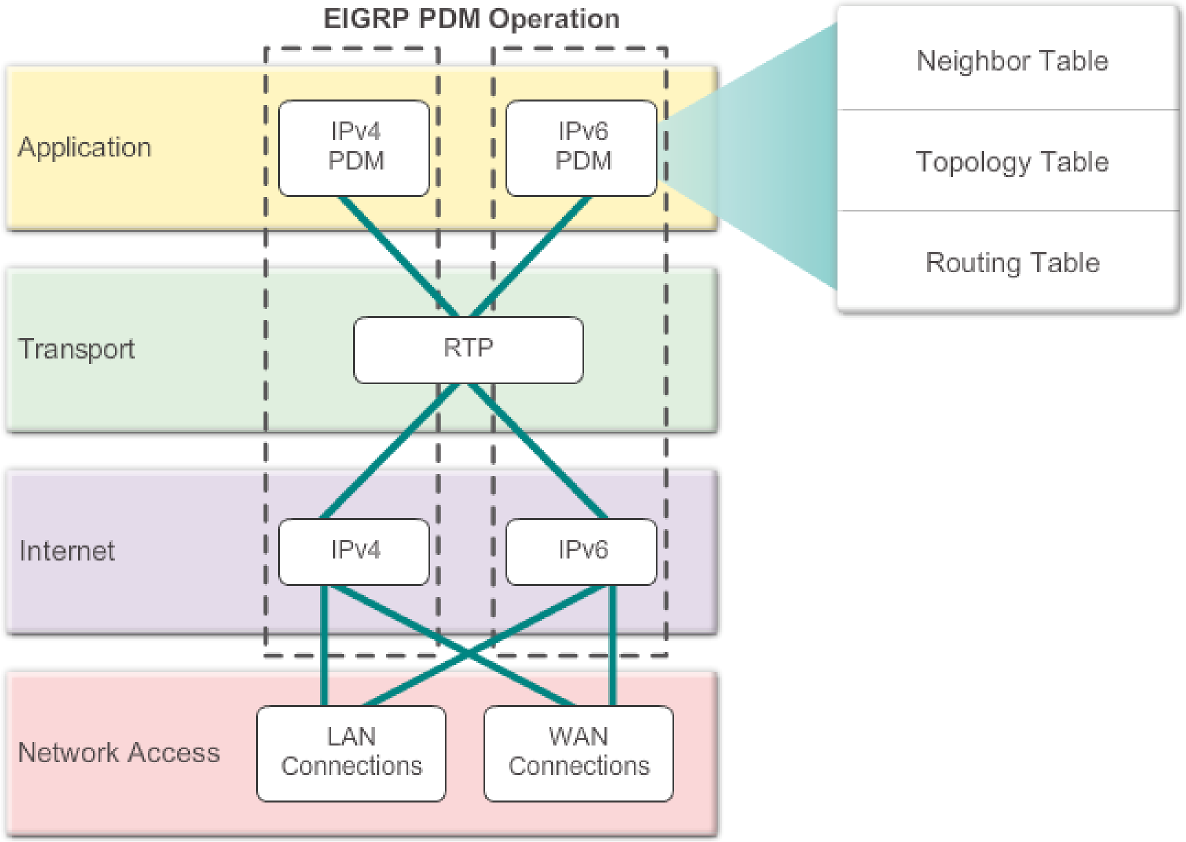
- Maintains neighbor and topology table
- Builds and translates protocol-specific packets for DUAL
- Performs redistribution functions to and from other routing protocols
- Redistribution of functions learnt from other routing protocols

One neighbor table exists for each PDM, f IPv4

Basic Features of EIGRP

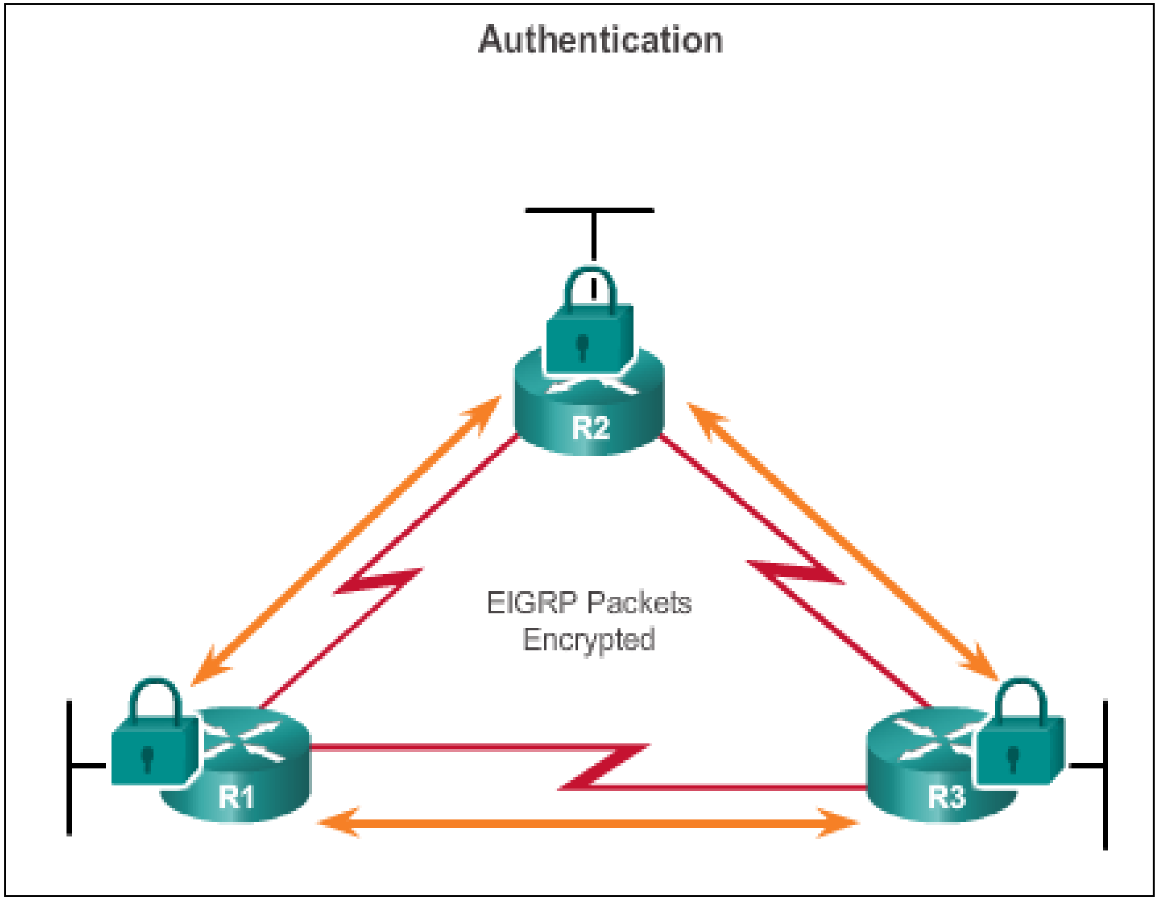
Reliable Transport Protocol

EIGRP Replaces TCP with RTP



Basic Features of EIGRP
Authentication

- EIGRP can be configured to authenticate routing information.
- Ensures routers only accept updates from routers that have been configured with the correct authentication information.



Types of EIGRP Packets

EIGRP Packet Types

Packet Type	Description
Hello	Used to discover other EIGRP routers in the network.
Acknowledgement	Used to acknowledge the receipt of any EIGRP packet.
Update	Convey routing information to known destinations.
Query	Used to request specific information from a neighbor router.
Reply	Used to respond to a query.

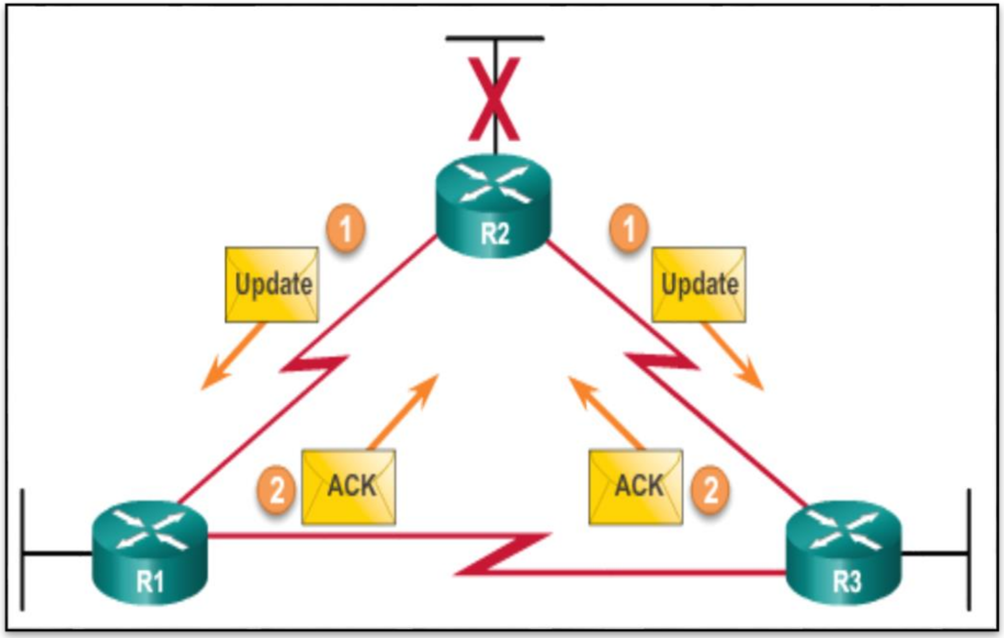
Types of EIGRP Packets

EIGRP Hello Packets

- Used to discover EIGRP neighbors.
- Used to form and maintain EIGRP neighbor adjacencies.
- Sent as IPv4 or IPv6 multicasts.
- IPv4 multicast address 224.0.0.10.
- IPv6 multicast address FF02::A.
- Unreliable delivery.
- Sent every 5 seconds (every 60 seconds on low-speed NBMA networks).
- EIGRP uses a default Hold timer of three times the Hello interval before declaring neighbor unreachable.

EIGRP Update & Acknowledgement Packets

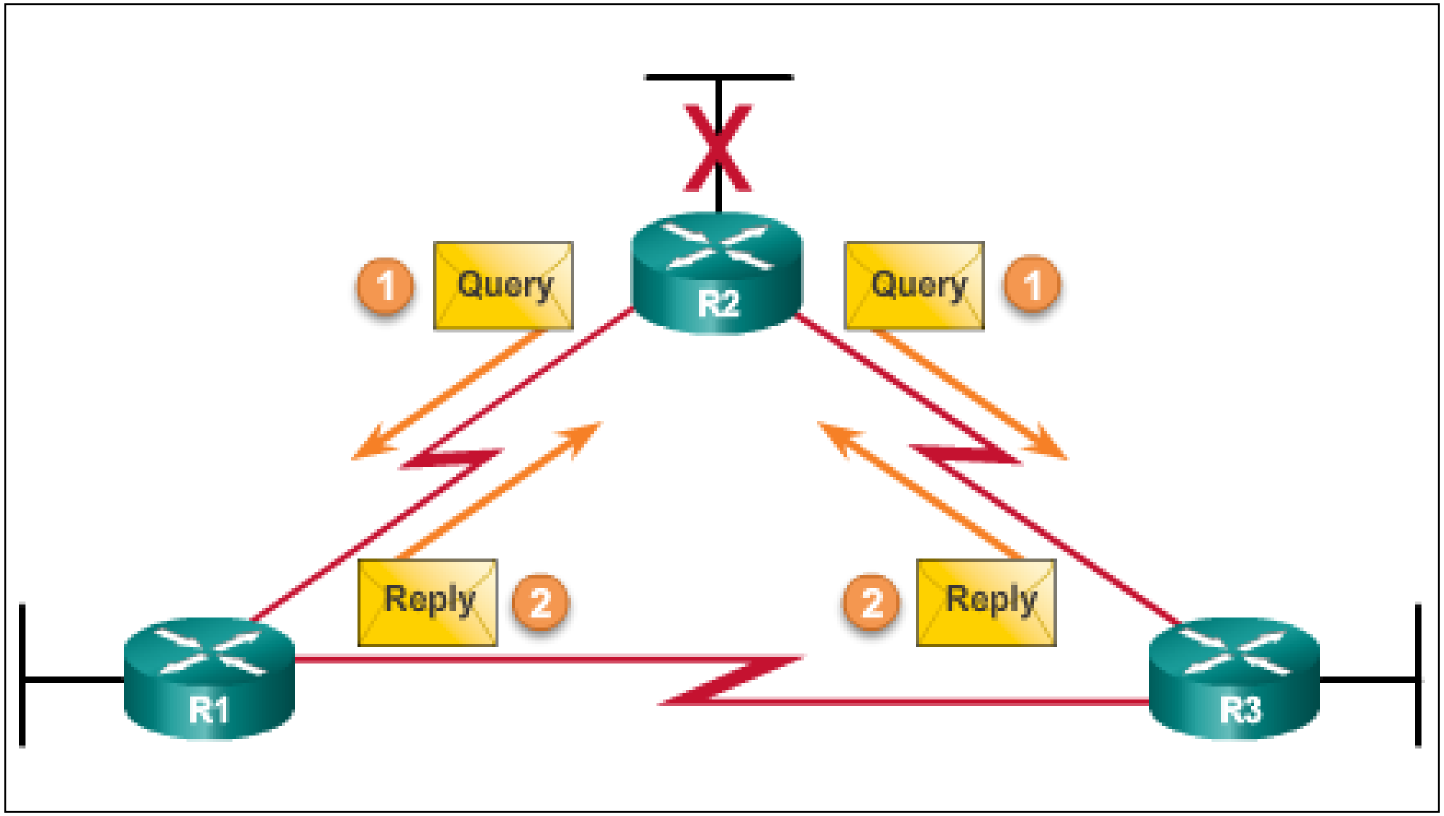
- Update packets are sent to propagate routing information, only when necessary.
- Sends **Partial** updates – only contains information about route changes.
- Sends **Bounded** updates- sent only to routers affected by the change.
- Updates use reliable delivery, therefore, require an **acknowledgement**.



Types of EIGRP Packets

EIGRP Query and Reply Packets

- Used when searching for networks.
- Queries use reliable delivery, which can be multicast or unicast.
- Replies use reliable delivery.



EIGRP Messages

Encapsulating EIGRP Messages

Type/Length/Values Types

Data Link Frame Header	IP Packet Header	EIGRP Packet Header	TLV Types

Data portion for EIGRP messege

Data Link Frame
MAC Source Address = Address of sending interface
MAC Destination Address = Multicast: 01-00-5E-00-00-0A

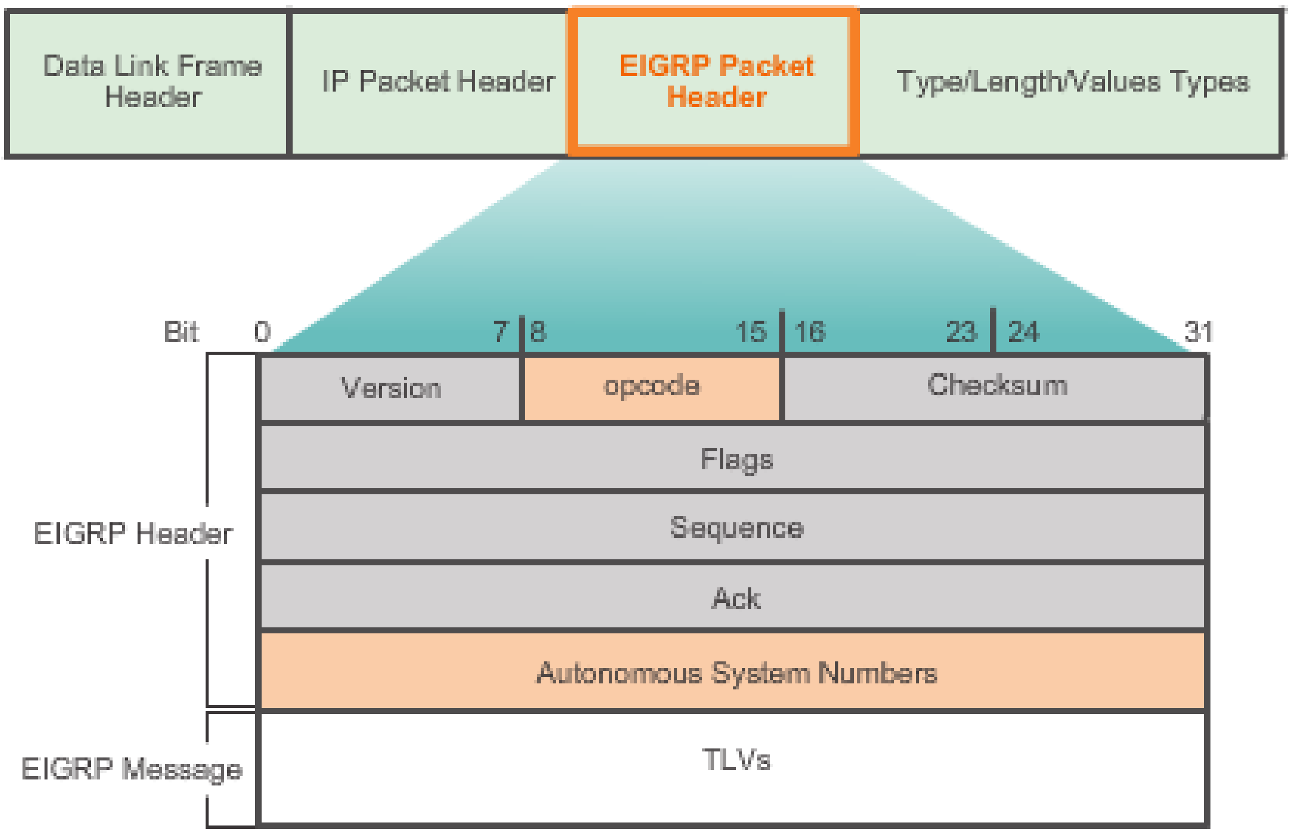
IP Packet
IPv4 Source Address = Address of sending interface
IPv4 Destination Address = Multicast: 224.0.0.10
Protocol field = 88 for EIGRP

EIGRP Packet Header
Opcode for EIGRP packet type
Autonomous System Number

TLV Types
Some types include:
0x0001 EIGRP Parameters
0x0102 IP Internal Routes
0x0103 IP External Routes

EIGRP Messages

EIGRP Packet Header and TLV



- **Opcode:** EIGRP Packet Type: Update (1), Query (3), Reply(4), Hello (5)
- **Autonomous System Number:** ID for this EIGRP routing process

7.2 Configuring EIGRP for IPv4

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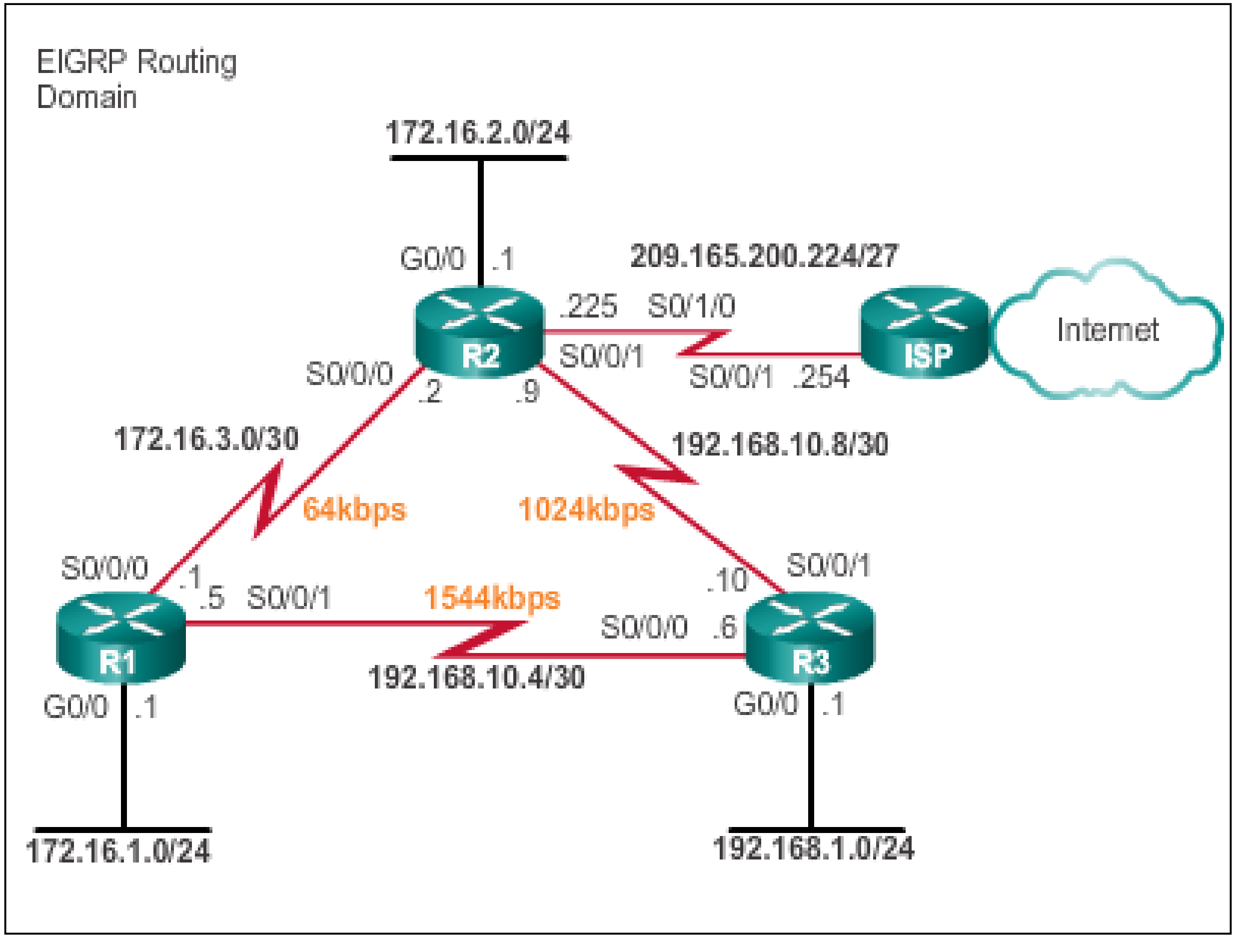
EIGRP Network Topology

This course uses the topology that configures EIGRP with IPv4.



Configuring EIGRP with IPv4

Autonomous System Numbers

- The **router eigrp** *autonomous-system* command enables the EIGRP process.
- The autonomous system number is only significant to the EIGRP routing domain.
- The EIGRP autonomous system number is not associated with the Internet Assigned Numbers Authority (IANA) globally assigned autonomous system numbers used by external routing protocols.
- Internet Service Providers (ISPs) require an autonomous system number from IANA.
- ISPs often use the Border Gateway Protocol (BGP), which does use the IANA autonomous system number in its configuration.

Configuring EIGRP with IPv4

Router EIGRP Command

Router(config)# **router eigrp** *autonomous-system*

```
R1(config)#router eigrp 1
R1(config-router)#
```

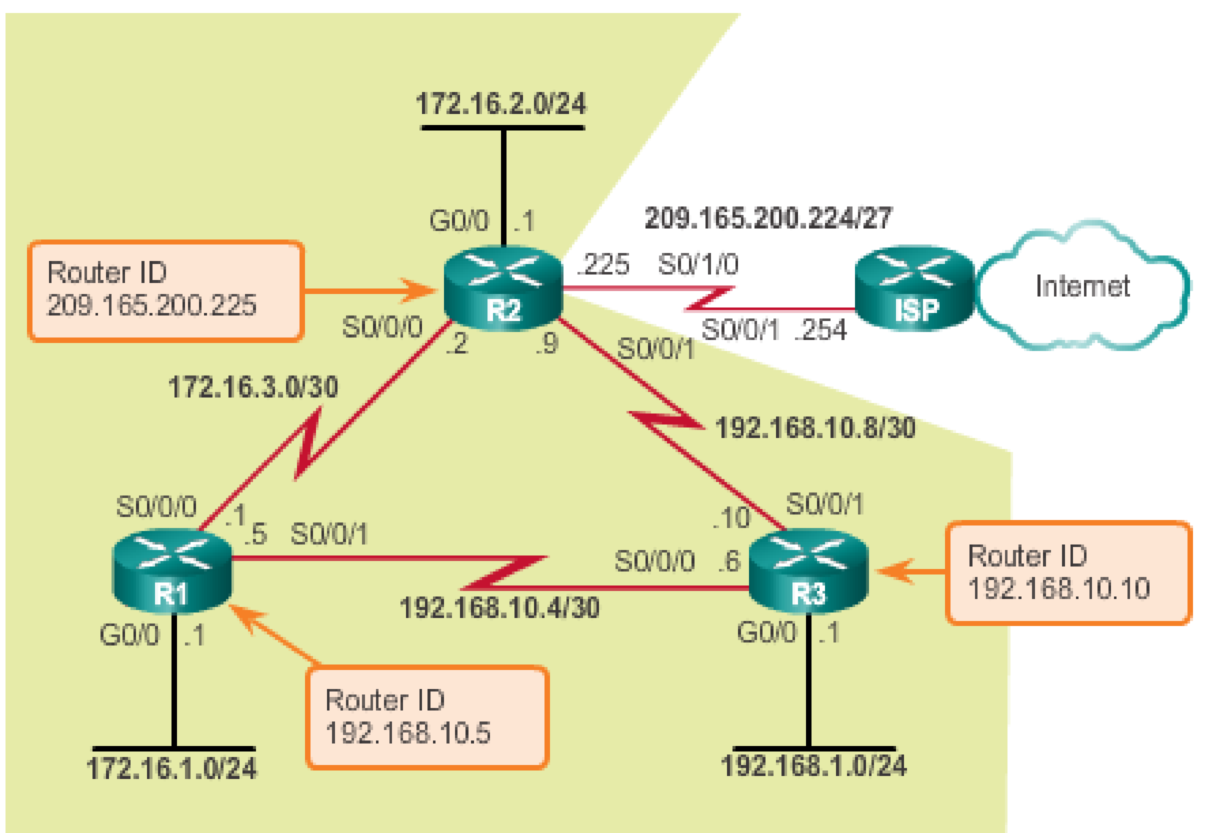
To completely remove the EIGRP routing process from a device, use the **no router eigrp** *autonomous-system* command.

Configuring EIGRP with IPv4

EIGRP Router ID

Used in both EIGRP and OSPF routing protocols, the router ID’s role is more significant in OSPF.

Topology with Default EIGRP Router IDs



Configuring EIGRP with IPv4

Configuring the EIGRP Router ID

- Configuring the EIGRP router ID

  Router(config)# **router eigrp** *autonomous-system*

  Router(config-router)# **eigrp router-id** *ipv4-address*

- The IPv4 loopback address can be used as the router ID.
- If the **eigrp** *router-id* value is NOT configured, the highest loopback address is selected as the router ID.
- Configuring a loopback interface

  Router(config)# **interface loopback** *number*

  Router(config-if)# **ip addressipv4-address** *subnet-mask*

Configuring EIGRP with IPv4

Network Command

- Enables any interface on this router that matches the network address in the **`network`** router configuration mode command to send and receive EIGRP updates.
- These networks are included in EIGRP routing updates.

Enables EIGRP for the interfaces on subnets in 172.16.1.0/24 and 172.16.3.0/30.

```
R1(config)# router eigrp 1
R1(config-router)# network 172.16.0.0
R1(config-router)# network 192.168.10.0
R1(config-router)#
```

Enables EIGRP for the interfaces on subnet 192.168.10.4/30.

Configuring EIGRP with IPv4

Network Command

The **`eigrp log-neighbor-changes`** router configuration mode

- On by default
- Displays changes in neighbor adjacencies
- Verifies neighbor adjacencies during configuration
- Indicates when any adjacencies have been removed

Configuring EIGRP with IPv4

The Network Command and Wildcard Mask

- To configure EIGRP to advertise specific subnets only, use the *wildcard-mask* option with the **`network`** command.

```
Router(config-router)# network network
address [wildcard-mask]
```

- The wildcard mask is the inverse of the subnet mask.
- To calculate the wildcard mask, subtract the subnet mask from 255.255.255.255:

```
    255.255.255.255
--  255.255.255.252
      0.  0.  0.  3   wildcard mask
```

- **Note**: Some IOS versions also let you enter the subnet mask instead of a wildcard mask.

Configuring EIGRP with IPv4

Passive Interface

- Use the **passive-interface** command to:
  - Prevent neighbor adjacencies
  - Suppress unnecessary update traffic
  - Increase security controls, such as preventing unknown rogue routing devices from receiving EIGRP updates
- To configure:

```
Router(config)# router eigrp as-number
Router(config-router)# passive-
interface interface-type interface-number
```

- To verify:

```
Router# show ip protocols
```

Configuring EIGRP with IPv4

Verifying EIGRP: Examining Neighbors

show ip eigrp neighbors Command

```
R1#show ip eigrp neighbors
EIGRP-IPv4 Neighbors for AS(1)
H    Address          Interface    Hold   Uptime     SRTT  RTO   Q    Seq
                                   (sec)             (ms)        Cnt  Num
1    192.168.10.6     Se0/0/1       11    04:57:14    27   162   0    8
0    172.16.3.2       Se0/0/0       13    07:53:46    20   120   0    10
R1#
```

- **Address**: Neighbor's IPv4 Address
- **Interface**: Local Interface receiving EIGRP Hello packets
- **Hold (sec)**: Seconds remaining before declaring neighbor down. The current hold time and is reset to the maximum hold time whenever a Hello packet is received.
- **Uptime**: Amount of time since this neighbor was added to the neighbor table.

Configuring EIGRP with IPv4

Verifying EIGRP: `show ip protocols` Command

`show ip protocols` Command

```
R1# show ip protocols
*** IP Routing is NSF aware ***

Routing Protocol is "eigrp 1"
  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-IPv4 Protocol for AS(1)
    Metric weight K1=1, K2=0, K3=1, K4=0, K5=0
    NSF-aware route hold timer is 240
    Router-ID: 1.1.1.1
    Topology : 0 (base)
      Active Timer: 3 min
      Distance: internal 90 external 170
      Maximum path: 4
      Maximum hopcount 100
      Maximum metric variance 1

  Automatic Summarization: disabled
  Maximum path: 4
  Routing for Networks:
    172.16.0.0
    192.168.10.0
  Routing Information Sources:
    Gateway         Distance      Last Update
    192.168.10.6          90      00:40:20
    172.16.3.2            90      00:40:20
  Distance: internal 90 external 170

R1#
```

1. Routing protocol and Process ID (AS Number)
2. EIGRP Router ID
3. EIGRP Administrative Distances
4. EIGRP Automatic Summarization is disabled.
5. EIGRP Routing Information Sources lists all the EIGRP routing sources the IOS uses to build its IPv4 routing table.

Configuring EIGRP with IPv4

Verifying EIGRP: Examine the IPv4 Routing Table

R1's IPv4 Routing Table

```
      172.16.0.0/16 is variably subnetted, 5 subnets, 3
masks
C        172.16.1.0/24 is directly connected,
GigabitEthernet0/0
L        172.16.1.1/32 is directly connected,
GigabitEthernet0/0
D        172.16.2.0/24 [90/2170112] via 172.16.3.2,
00:14:35, Serial0/0/0
C        172.16.3.0/30 is directly connected, Serial0/0/0
L        172.16.3.1/32 is directly connected, Serial0/0/0
D     192.168.1.0/24 [90/2170112] via 192.168.10.6,
00:13:57, Serial0/0/1
      192.168.10.0/24 is variably subnetted, 3 subnets, 2
masks
C        192.168.10.4/30 is directly connected,
Serial0/0/1
L        192.168.10.5/32 is directly connected,
Serial0/0/1
D        192.168.10.8/30 [90/2681856] via 192.168.10.6,
00:50:42, Serial0/0/1
                         [90/2681856] via 172.16.3.2,
00:50:42, Serial0/0/0
R1#
```

7.3 Operation of EIGRP

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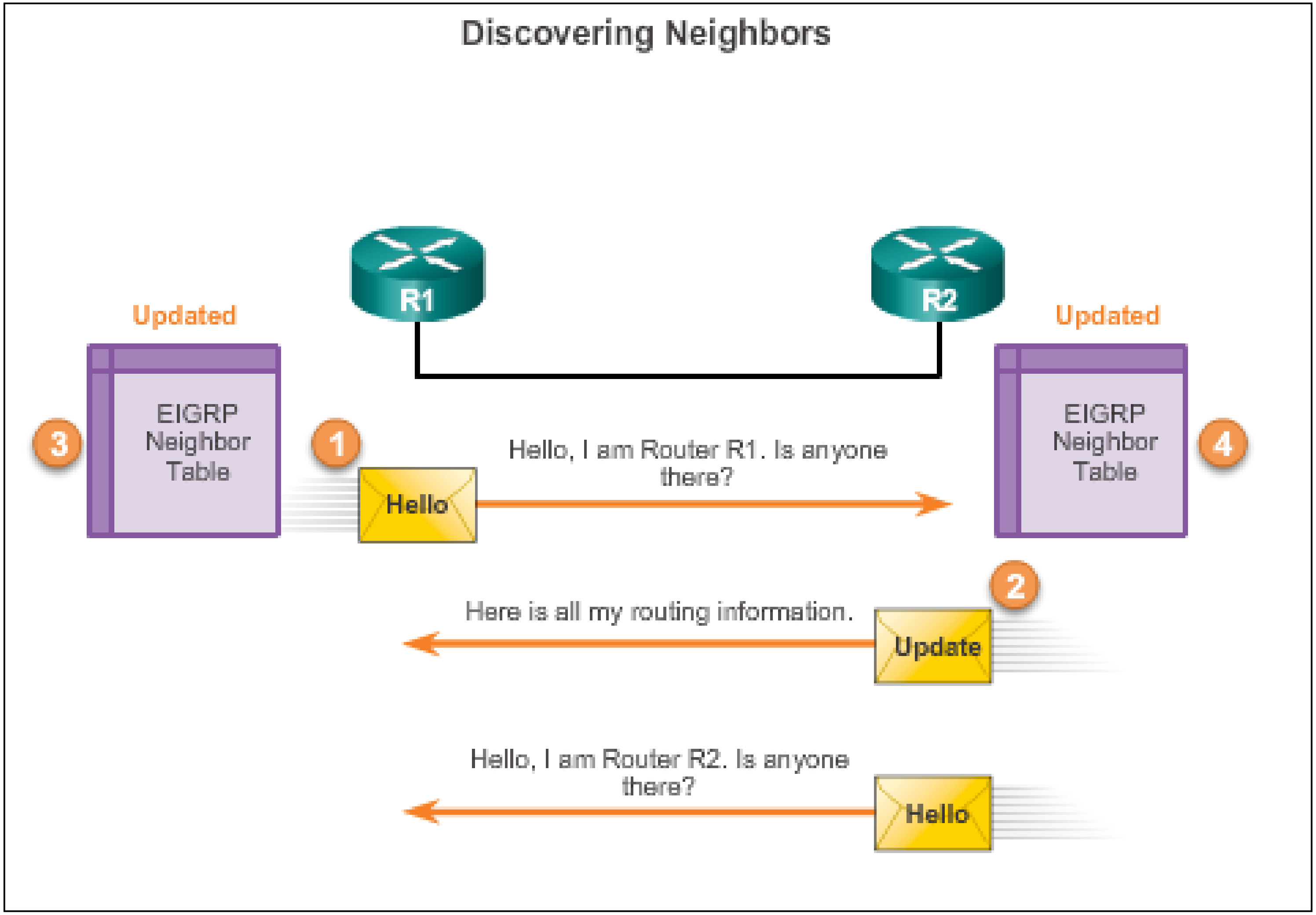
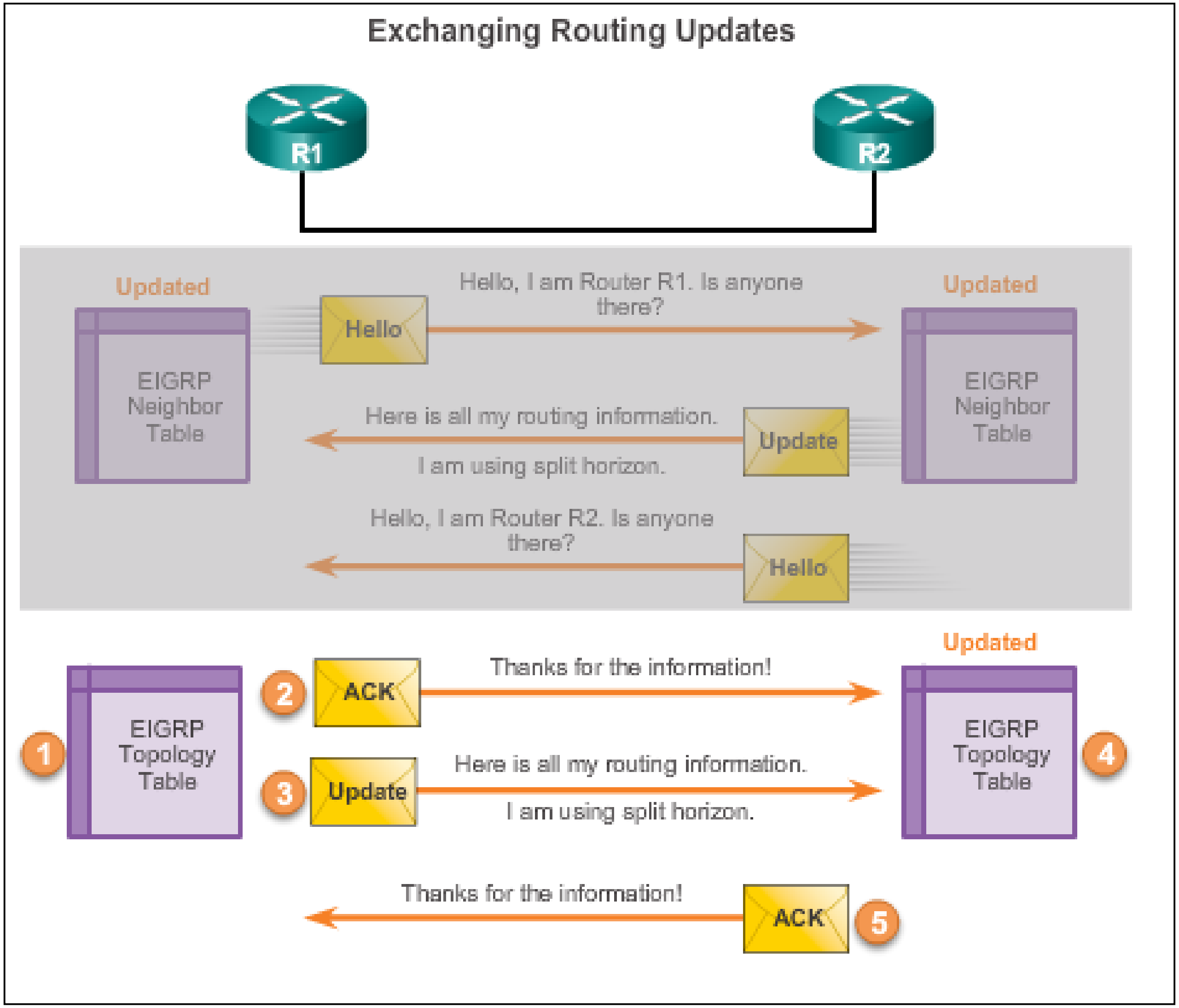
EIGRP Initial Route Discovery

EIGRP Neighbor Adjacency



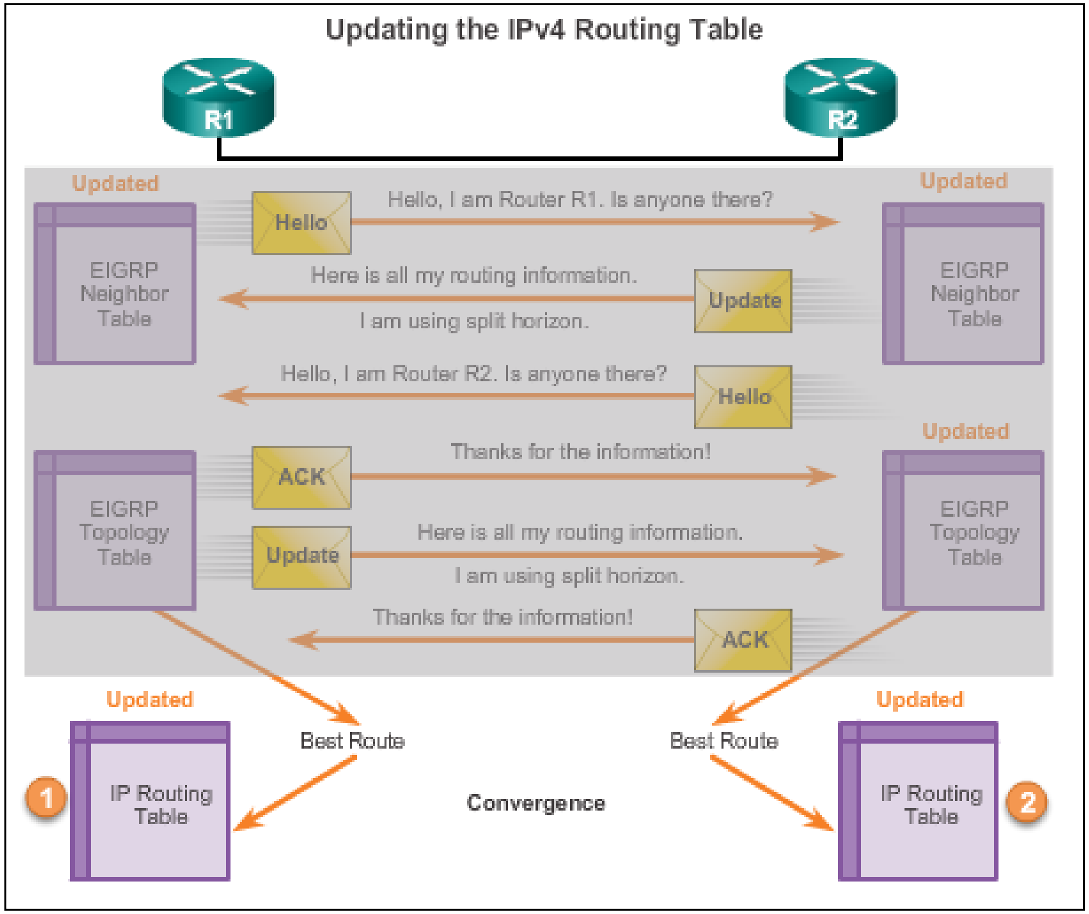
EIGRP Initial Route Discovery

EIGRP Topology Table



EIGRP Initial Route Discovery
EIGRP Convergence

Convergence – All routers have the correct, most up-to-date information about the network.



Metrics

EIGRP Composite Metric

EIGRP Composite Metric

Default Composite Formula:
metric = **[K1*bandwidth + K3*delay]**

Complete Composite Formula:
metric = **[K1*bandwidth + (K2*bandwidth)/(256 - load)+K3*delay] * [K5/(reliability + K4)]**

(Not used if "K" values are 0)

Note: This is a conditional formula. If K5 = 0, the last term is replaced by 1 and the formula becomes: Metric = [K1 * bandwidth + (K2 * bandwidth)/(256 load) + K3 * delay]

Default values:
K1 (bandwidth) = 1
K2 (load) = 0
K3 (delay) = 1
K4 (reliability) = 0
K5 (reliability) = 0

"K" values can be changed with the **metric weights** command

```
Router(config-router)# metric weights tos k1 k2 k3 k4 k5
```

Metrics

Examining Interface Values

- BW – Bandwidth of the interface (in Kilobits per second).
- DLY – Delay of the interface (microseconds).
- Reliability – Reliability of interface; by default, the value is not included in the computing metric.
- Txload, Rxload – By default, the value is not included in the computing metric.

```
R1#show interface serial 0/0/0
Serial0/0/0 is up, line protocol is up
  Hardware is WIC MBRD Serial
  Internet address is 172.16.3.1/30
  MTU 1500 bytes, BW 1544 Kbit/sec, DLY 20000 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation HDLC, loopback not set
<Output omitted>
R1#

R1#show interface gigabitethernet 0/0
GigabitEthernet0/0 is up, line protocol is up
  Hardware is CN Gigabit Ethernet, address is fc99.4775.c3e0 (bia
fc99.4775.c3e0)
  Internet address is 172.16.1.1/24
  MTU 1500 bytes, BW 100000 Kbit/sec, DLY 100 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation ARPA, loopback not set
<Output omitted>
R1#
```

Metrics
Bandwidth Metric

- Use the **`show interfaces`** command to verify bandwidth.
- Most serial bandwidths are set to 1,544 kb/s (default).
- A correct value for bandwidth is very important in order to calculate the correct metric (both sides of link must have same bandwidth).

```
R1(config)# interface s 0/0/0
R1(config-if)# bandwidth 64
```

```
R1# show interface s 0/0/0
Serial0/0/0 is up, line protocol is up
  Hardware is WIC MBRD Serial
  Internet address is 172.16.3.1/30
  MTU 1500 bytes, BW 64 Kbit/sec, DLY 20000 usec,
     reliability 255/255, txload 1/255, rxload 1/255
<Output omitted>
```

Metrics

Delay Metric

Interface Delay Values

Media	Delay
Ethernet	1,000
Fast Ethernet	100
Gigabit Ethernet	10
16M Token Ring	630
FDDI	100
T1 (Serial Default)	20,000
DS0 (64 Kbps)	20,000
1024 Kbps	20,000
56 Kbps	20,000

Metrics

Calculating the EIGRP Metric

Step 1. Determine the link with the slowest bandwidth. Use that value to calculate bandwidth (10,000,000/bandwidth).

Step 2. Determine the delay value for each outgoing interface on the way to the destination. Add the delay values and divide by 10 (sum of delay/10).

Step 3. Add the computed values for bandwidth and delay, and multiply the sum by 256 to obtain the EIGRP metric.

[K1 * bandwidth + K3 * delay] * 256 = Metric

Since K1 and K3 both equal 1, the formula simplifies to:

(Bandwidth + Delay) * 256 = Metric

((10,000,000 / bandwidth) + (sum of delay / 10)) * 256 = Metric

```
R2# show ip route

D 192.168.1.0/24 [90/3012096] via 192.168.10.10, 00:12:32, Serial0/0/1
```

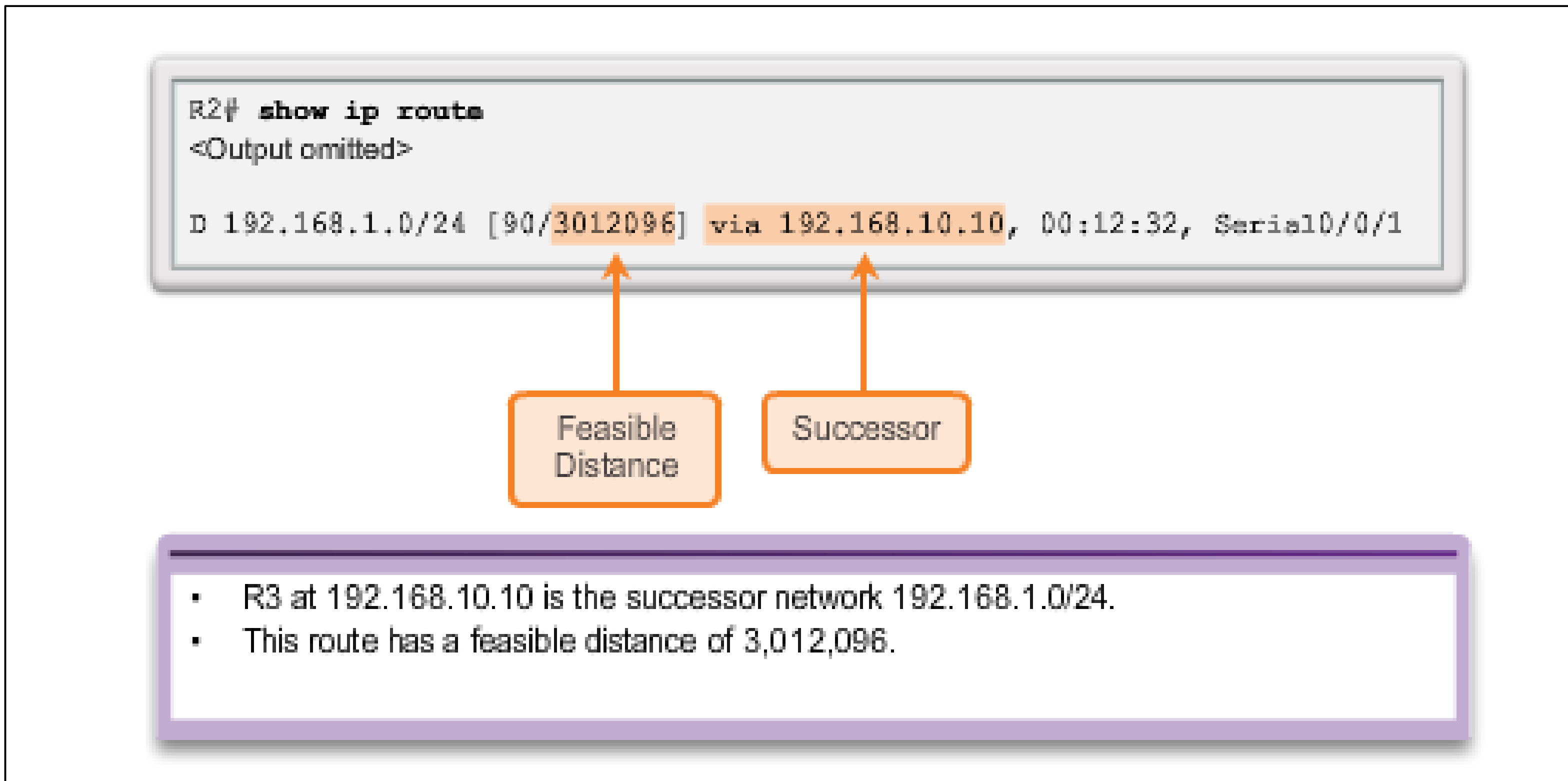
DUAL and the Topology Table

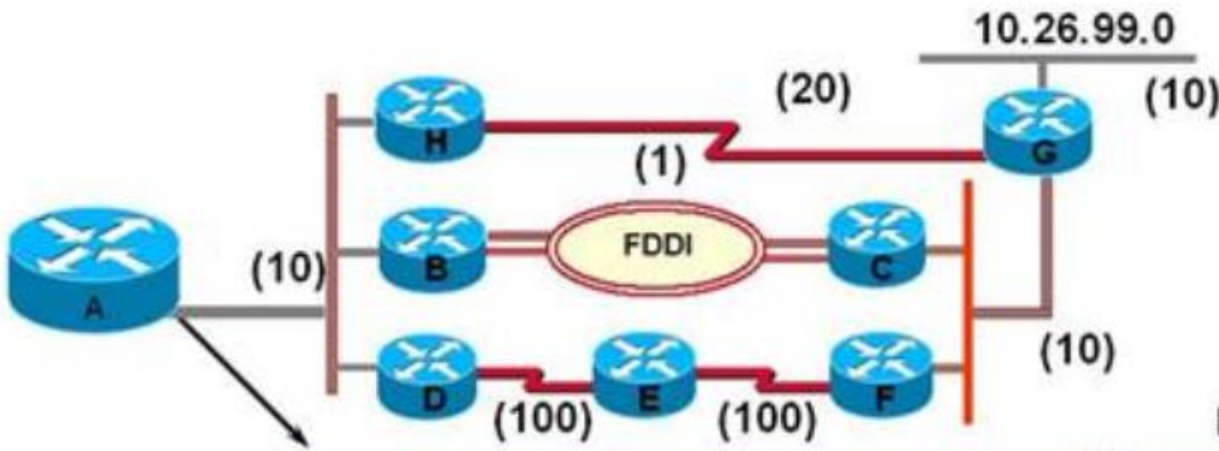
DUAL Concepts

- **Diffusing Update ALgorithm (DUAL)** provides the following:
  - Loop-free paths and loop-free backup paths
  - Fast convergence
  - Minimum bandwidth usage with bounded updates
- The decision process for all route computations is done by the **DUAL Finite State Machine (FSM)**
  - DUAL FSM tracks all routes.
  - Uses EIGRP metrics to select efficient, loop-free paths.
  - Identifies the routes with the least-cost path to be inserted into the routing table.
- EIGRP maintains a list of backup routes that DUAL has already determined that can be used immediately if the primary path fails.

Successor and Feasible Distance

- The **Successor** is the least-cost route to the destination network.
- The **Feasible Distance** (FD) is the lowest calculated metric to reach the destination network.





Router A's Routing Table

10.26.99.0|31|B

Topology Table

Destination	Feasible. Dist.	Advert. Dist.	Neighbor
10.26.99.0	40	30	H
10.26.99.0	31	21	B
10.26.99.0	230	220	D

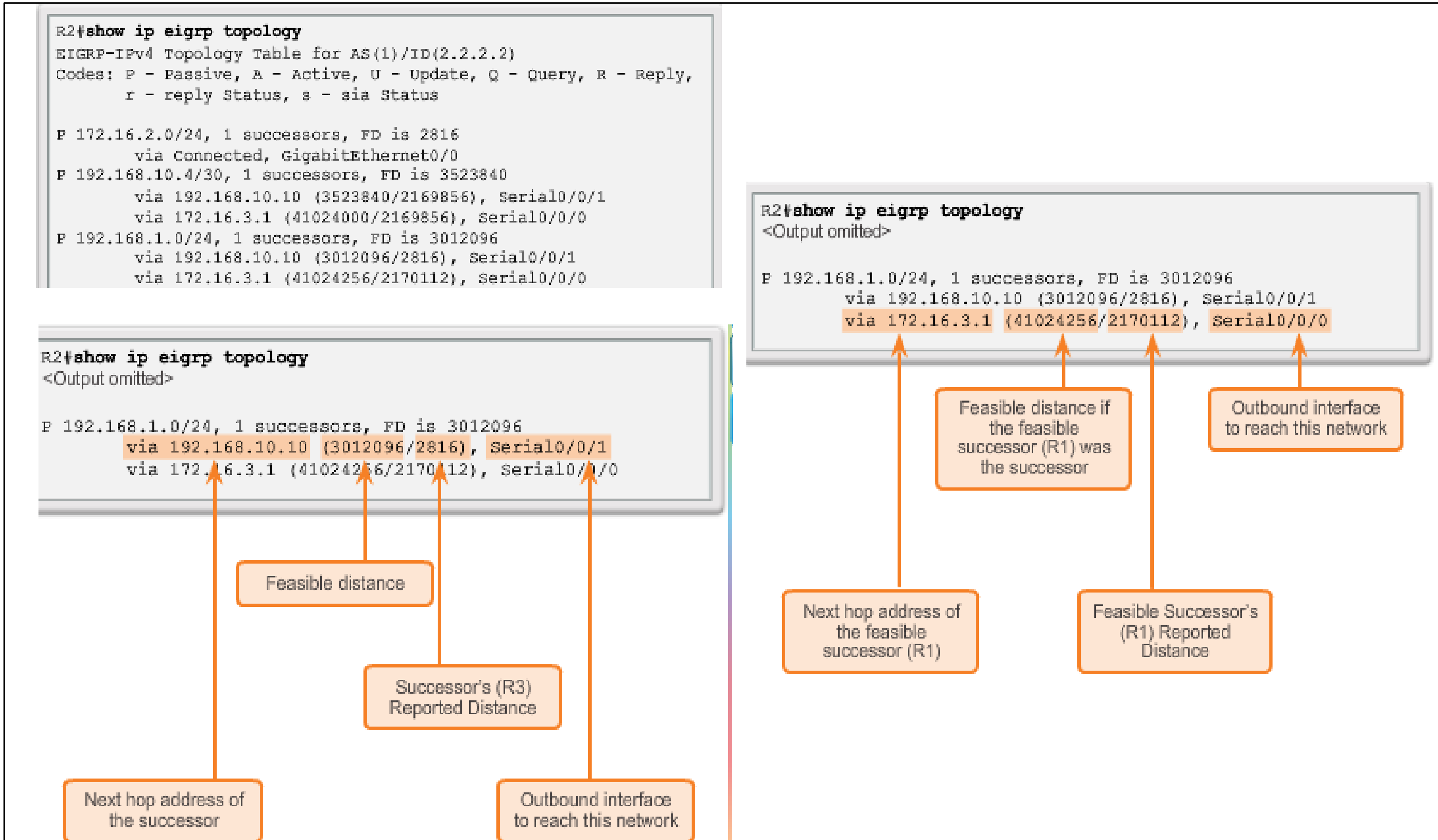
Route through B is current successor
Route through H is the feasible successor

Feasible Successors, Feasibility Condition, and Reported Distance

- **Feasible Successor** (FS) is a neighbor that has a loop-free backup path to the same network as the successor, and it satisfies the Feasibility Condition (FC).
- **Feasibility Condition** (FC) is met when a neighbor's Reported Distance (RD) to a network is less than the local router's feasible distance to the same destination network.
- **Reported Distance** (RD) is an EIGRP neighbor's feasible distance to the same destination network.

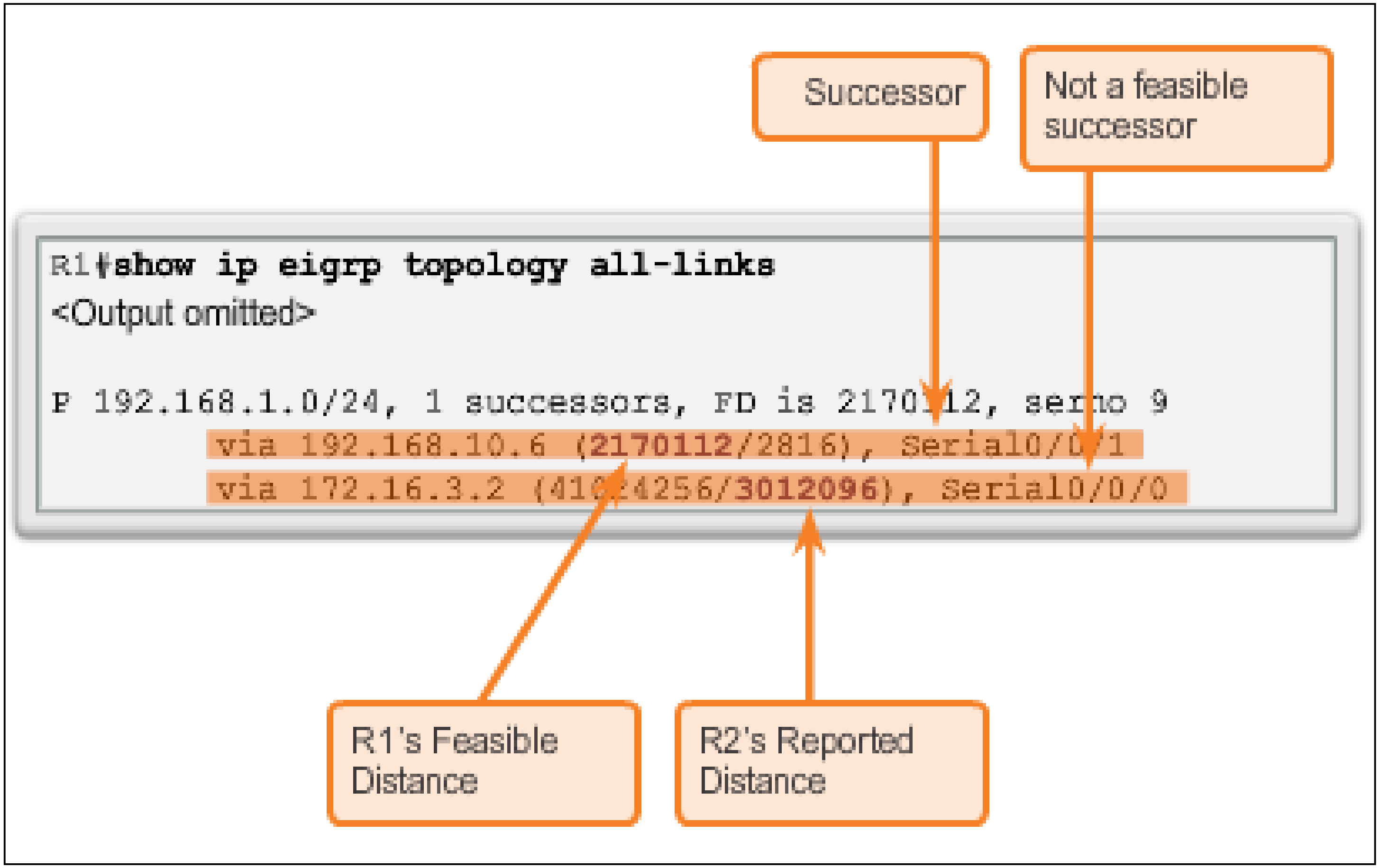
DUAL and the Topology Table

Topology Table: `show ip eigrp` Command



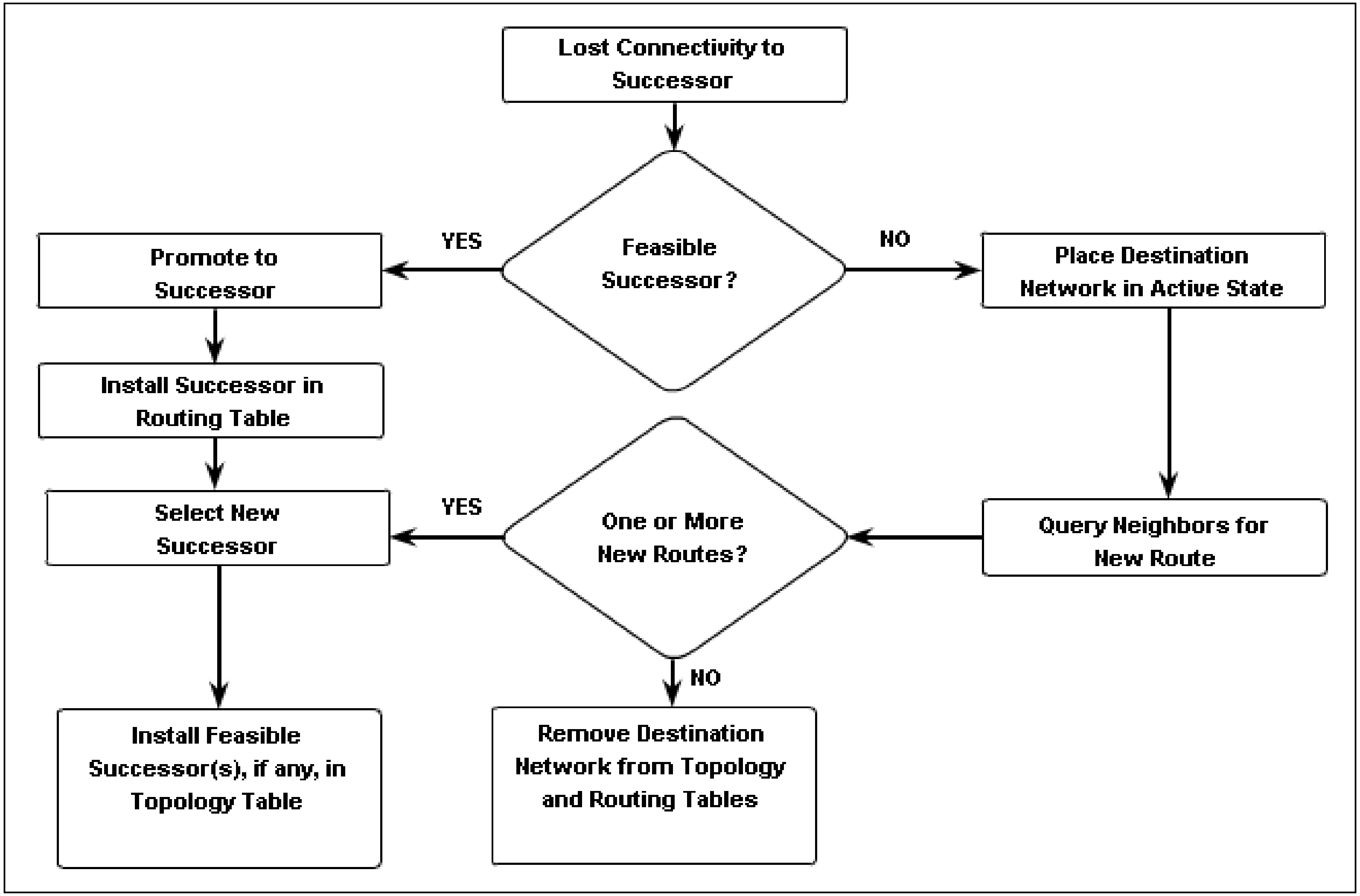
DUAL and the Topology Table

Topology Table: No Feasible Successor



DUAL and Convergence

DUAL Finite State Machine (FSM)



DUAL and Convergence

DUAL: Feasible Successor

```
R2#debug eigrp fsm
EIGRP Finite State Machine debugging is on
R2#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
R2(config)#interface s 0/0/1
R2(config-if)#shutdown
<Output omitted>
EIGRP-IPv4(1):Find FS for dest 192.168.1.0/24. FD is 3012096,
RD is 3012096 on tid 0
DUAL: AS(1) Removing dest 172.16.1.0/24, nexthop 192.168.10.10
DUAL: AS(1) RT installed 172.16.1.0/24 via 172.16.3.1
<Output omitted>
R2(config-if)#end
R2#undebug all
```

```
R2#show ip route
<Output omitted>

D 192.168.1.0/24 [90/41024256] via 172.16.3.1, 00:15:51,
Serial0/0/0
```

New Successor (R1)

DUAL and Convergence

DUAL: No Feasible Successor

```
R1#show ip eigrp topology
<Output omitted>

P 192.168.1.0/24, 1 successors, FD is 2170112
        via 192.168.10.6 (2170112/2816), Serial0/0/1
```

Successor (R3)

No feasible successor

```
R1#debug eigrp fsm
EIGRP Finite State Machine debugging is on
R1#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
R1(config)#interface s 0/0/1
R1(config-if)#shutdown
<Output omitted>
EIGRP-IPv4(1): Find FS for dest 192.168.1.0/24. FD is 2170112,
RD is 2170112
DUAL: AS(1) Dest 192.168.1.0/24 entering active state for tid
0.
EIGRP-IPv4(1): dest(192.168.1.0/24) active
EIGRP-IPv4(1): rcvreply: 192.168.1.0/24 via 172.16.3.2 metric
41024256/3012096 EIGRP-IPv4(1): reply count is 1
EIGRP-IPv4(1): Find FS for dest 192.168.1.0/24. FD is
72057594037927935, RD is 72057594037927935
DUAL: AS(1) Removing dest 192.168.1.0/24, nexthop 192.168.10.6
DUAL: AS(1) RT installed 192.168.1.0/24 via 172.16.3.2
<Output omitted>
R1(config-if)#end
R1#undebug all
```

Class Activity

- Packet tracer activity 7.3.4.4 Investigating DUAL FSM
  - Modify EIGRP metric

7.4 Configuration of EIGRP for IPv6

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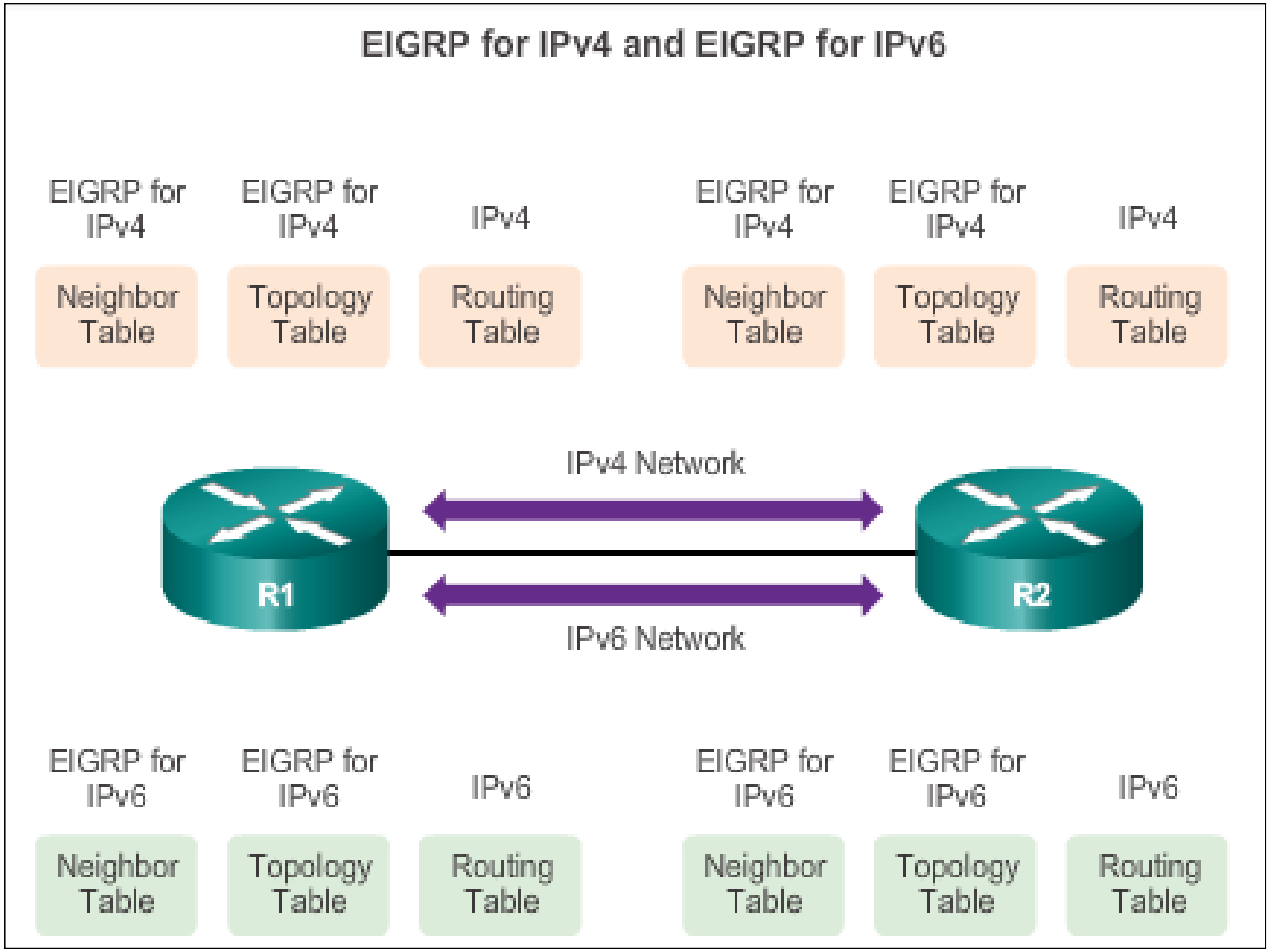
EIGRP for IPv4 vs. IPv6
EIGRP for IPv6



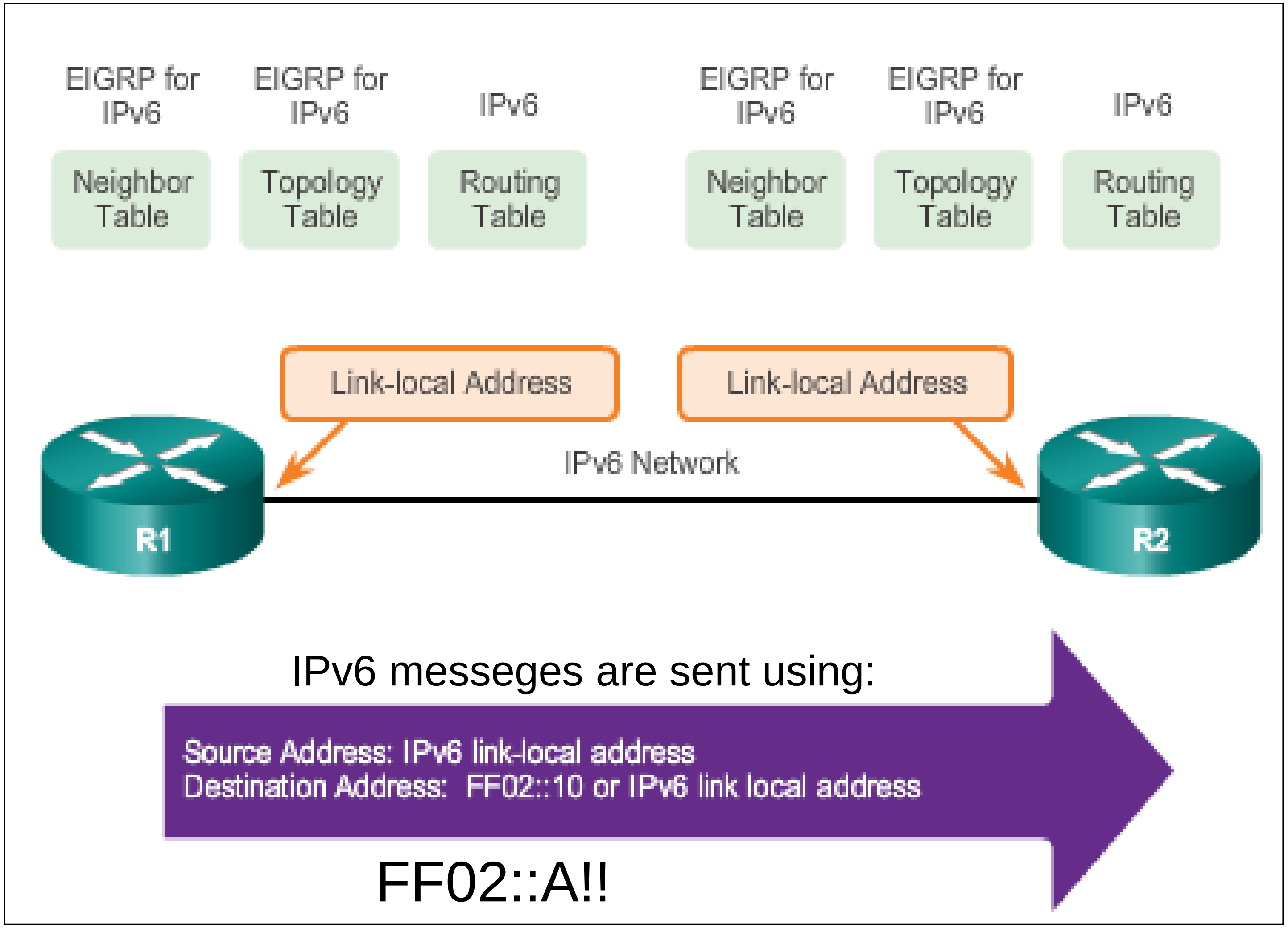
EIGRP for IPv4 vs. IPv6

Comparing EIGRP for IPv4 and IPv6

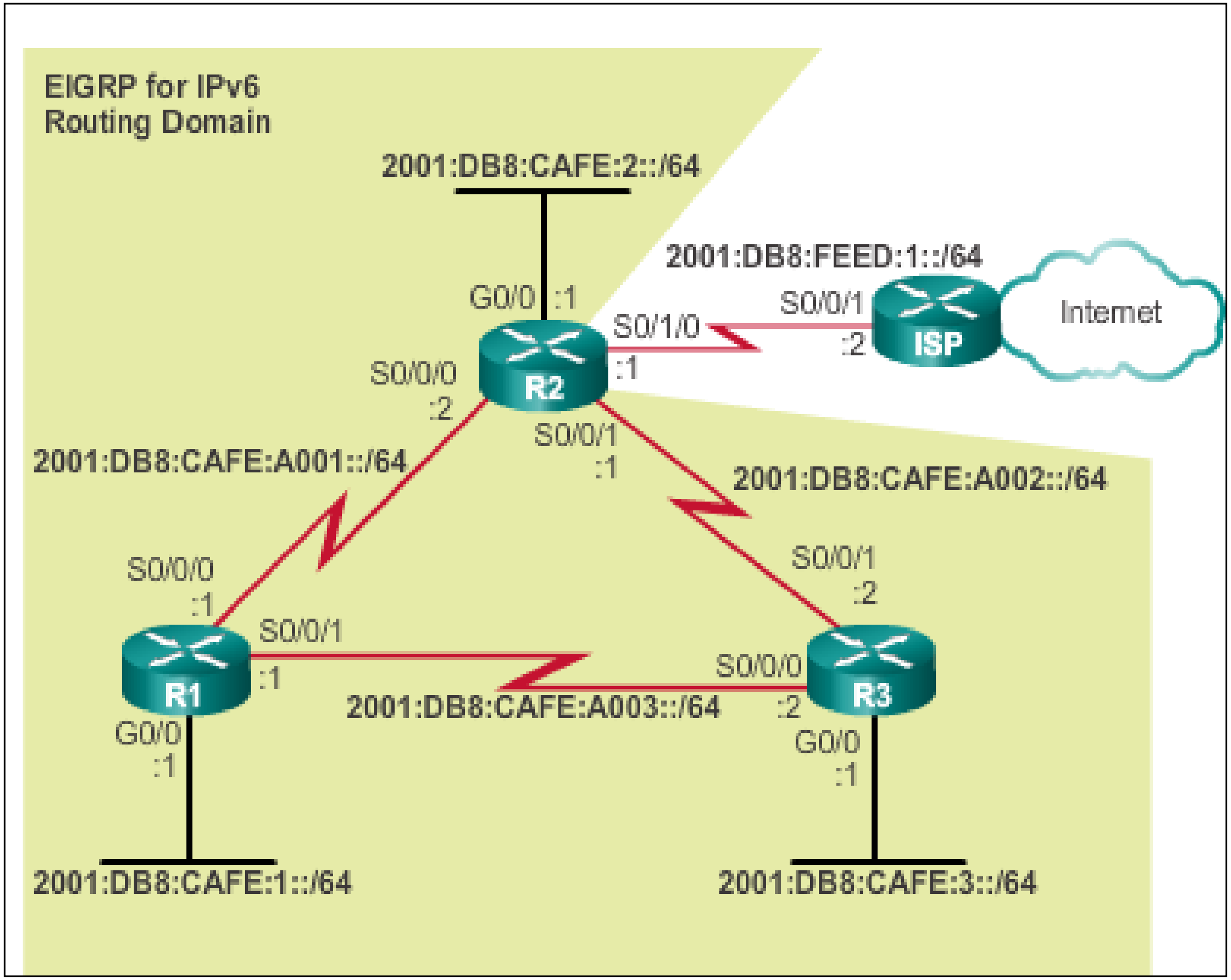
	EIGRP for IPv4	EIGRP for IPv6
Advertised routes	IPv4 networks	IPv6 prefixes
Distance vector	Yes	Yes
Convergence technology	DUAL	DUAL
Metric	Bandwidth and delay by default, reliability and load are optional	Bandwidth and delay by default, reliability and load are optional
Transport protocol	RTP	RTP
Update messages	Incremental, partial and bounded updates	Incremental, partial and bounded updates
Neighbor discovery	Hello packets	Hello packets
Source and destination addresses	IPv4 source address and 224.0.0.10 IPv4 multicast destination address	IPv6 link-local source address and FF02::10 IPv6 multicast destination address
Authentication	Plain text and MD5	MD5
Router ID	32-bit router ID	32-bit router ID

EIGRP for IPv4 vs. IPv6

IPv6 Link-local Addresses



EIGRP for IPv6 Network Topology



Configuring IPv6 Link-Local Addresses

Manually configuring link-local addresses

```
R1(config)#interface s 0/0/0
R1(config-if)#ipv6 address fe80::1 ?
  link-local  Use link-local address

R1(config-if)#ipv6 address fe80::1 link-local
R1(config-if)#exit
R1(config)#interface s 0/0/1
R1(config-if)#ipv6 address fe80::1 link-local
R1(config-if)#exit
R1(config)#interface g 0/0
R1(config-if)#ipv6 address fe80::1 link-local
R1(config-if)#
```

Verifying link-local addresses

```
R1#show ipv6 interface brief
GigabitEthernet0/0       [up/up]
    FE80::1
    2001:DB8:CAFE:1::1
Serial0/0/0              [up/up]
    FE80::1
    2001:DB8:CAFE:A001::1
Serial0/0/1              [up/up]
    FE80::1
    2001:DB8:CAFE:A003::1
R1#
```

Same IPv6 link-local address is configured on all interfaces.

Configuring EIGRP for IPv6

Configuring EIGRP for the IPv6 Routing Process

- The **ipv6 unicast-routing** global configuration mode command is required to enable any IPv6 routing protocol.
- Configuring EIGRP for IPv6

```
R2(config)#ipv6 unicast-routing
R2(config)#ipv6 router eigrp 2
R2(config-rtr)#eigrp router-id 2.0.0.0
R2(config-rtr)#no shutdown
R2(config-rtr)#
```

- The **no shutdown** command and a router ID are required for the router to form neighbor adjacencies.

Configuring EIGRP for IPv6

ipv6 eigrp interface Command

Enabling EIGRP of IPv6 on an Interface

```
R1(config)#interface g0/0
R1(config-if)#ipv6 eigrp 2
R1(config-if)#exit
R1(config)#interface s 0/0/0
R1(config-if)#ipv6 eigrp 2
R1(config-if)#exit
R1(config)#interface s 0/0/1
R1(config-if)#ipv6 eigrp 2
R1(config-if)#
```

```
R2(config)#interface g 0/0
R2(config-if)#ipv6 eigrp 2
R2(config-if)#exit
R2(config)#interface s 0/0/0
R2(config-if)#ipv6 eigrp 2
R2(config-if)#exit
%DUAL-5-NBRCHANGE: EIGRP-IPv6 2: Neighbor FE80::1
(Serial0/0/0) is up: new adjacency
R2(config)#interface s 0/0/1
R2(config-if)#ipv6 eigrp 2
R2(config-if)#
```

Verifying EIGRP for IPv6

Verifying EIGRP for IPv6: Examining Neighbors

show ipv6 eigrp neighbors Command

```
R1# show ipv6 eigrp neighbors
EIGRP-IPv6 Neighbors for AS(2)
H  Address                  Interface  Hold   Uptime    SRTT  RTO   Q   Seq
                                       (sec)            (ms)        Cnt Num
1  Link-local address:      Se0/0/1    13     00:37:17  45    270   0   8
   FE80::3
0  Link-local address:      Se0/0/0    14     00:53:16  32    2370  0   8
   FE80::2
R1#
```

- Neighbor's IPv6 Link-local Address
- Local Interface receiving EIGRP for IPv6 Hello packets
- Amount of time since this neighbor was added to the neighbor table.
- Seconds remaining before declaring neighbor down.

  The current hold time and is reset to the maximum hold time whenever a Hello packet is received.

Verifying EIGRP for IPv6: `show ip protocols` Command

```
R1# show ipv6 protocols
IPv6 Routing Protocol is "connected"
IPv6 Routing Protocol is "ND"
IPv6 Routing Protocol is "eigrp 2"
EIGRP-IPv6 Protocol for AS(2)

  Metric weight K1=1, K2=0, K3=1, K4=0, K5=0

  NSF-aware route hold timer is 240
  Router-ID: 1.0.0.0
  Topology : 0 (base)
    Active Timer: 3 min
    Distance: internal 90 external 170
    Maximum path: 16
    Maximum hopcount 100
    Maximum metric variance 1

  Interfaces:
    GigabitEthernet0/0
    Serial0/0/0
    Serial0/0/1
  Redistribution:
    None
R1#
```

1. Routing protocol and Process ID (AS Number)
2. K values used in composite metric
3. EIGRP Router ID
4. EIGRP Administrative Distances
5. Interfaces enabled for this EIGRP for IPv6.

Verifying EIGRP for IPv6

Verifying EIGRP for IPv6: Examine the Routing Table

Use the **show ipv6 route** command to examine the IPv6 routing table.

```
R1#show ipv6 route
<Output omitted>
C    2001:DB8:CAFE:1::/64 [0/0]
      via GigabitEthernet0/0, directly connected
L    2001:DB8:CAFE:1::1/128 [0/0]
      via GigabitEthernet0/0, receive
D    2001:DB8:CAFE:2::/64 [90/3524096]
      via FE80::3, Serial0/0/1
D    2001:DB8:CAFE:3::/64 [90/2170112]
      via FE80::3, Serial0/0/1
C    2001:DB8:CAFE:A001::/64 [0/0]
      via Serial0/0/0, directly connected
L    2001:DB8:CAFE:A001::1/128 [0/0]
      via Serial0/0/0, receive
D    2001:DB8:CAFE:A002::/64 [90/3523840]
      via FE80::3, Serial0/0/1
C    2001:DB8:CAFE:A003::/64 [0/0]
      via Serial0/0/1, directly connected
L    2001:DB8:CAFE:A003::1/128 [0/0]
      via Serial0/0/1, receive
L    FF00::/8 [0/0]
      via Null0, receive
R1#
```

Chapter 7: Summary

- EIGRP is a classless, advanced distance vector routing protocol.
- EIGRP uses the source code of "D" for DUAL in the routing table.
- The default administrative distance of 90 is used for internal routes and 170 for routes imported from an external source.
- Advanced features include DUAL, establishing neighbor adjacencies, RTP, partial and bounded updates, and equal and unequal cost load balancing.
- PDMs give EIGRP the capability to support different Layer 3 protocols.
- EIGRP Hello packets are used to discover neighbors.
- The **`show ip eigrp neighbors`** command is used to view neighbor table and verify adjacencies.

Chapter 7: Summary (cont.)

- EIGRP sends partial bounded updates when a change occurs on network.
- EIGRP composite metric uses bandwidth, delay, reliability and load to determine the best path (by default, only bandwidth and delay are used).
- DUAL FSM is used to determine best path; Successor and potential backup path, FS to every destination network.

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