EXAM 642-901

BSCI

Mega Guide

Prepare With Confidence

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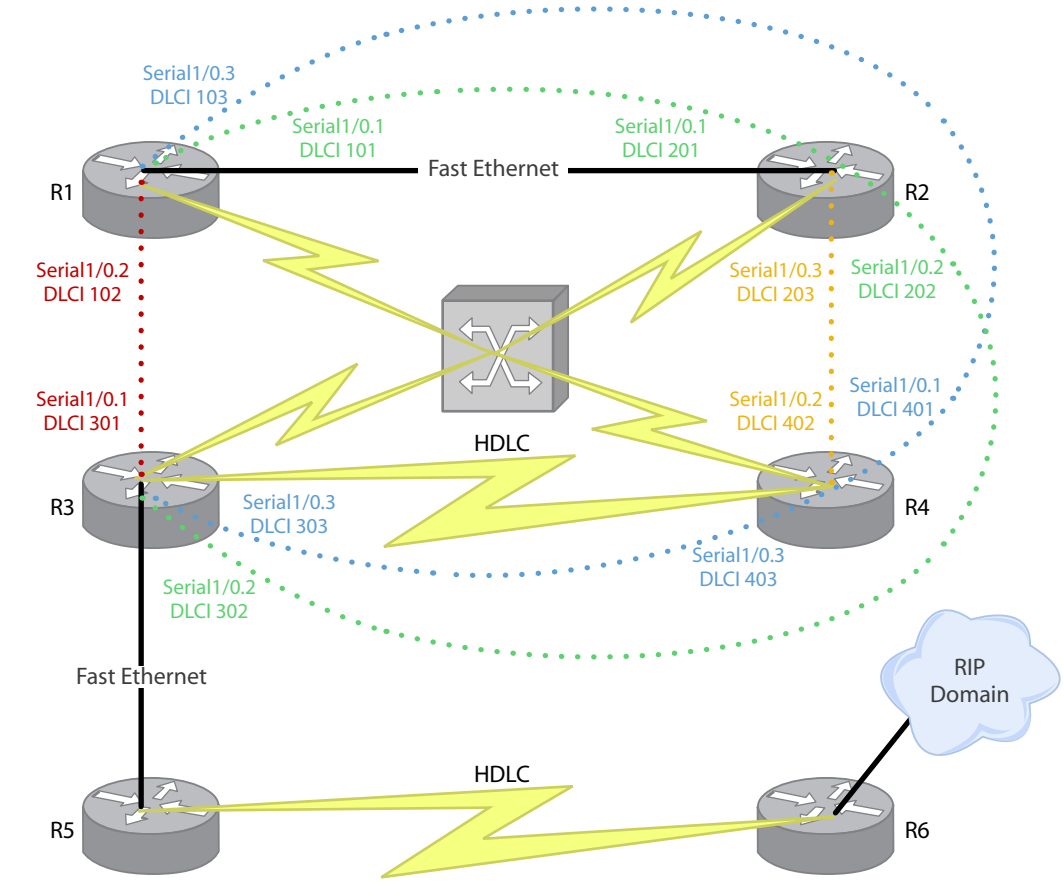
R1
Serial 1/0.1 - 10.0.0.1/30
Serial 1/0.2 - 10.0.0.5/30
Serial 1/0.3 - 10.0.0.9/30
FastEthernet3/0 - 10.0.1.1/24
LoopBack0 - 172.16.1.1/32

R2
Serial 1/0.1 - 10.0.0.2/30
Serial 1/0.2 - 10.0.0.13/30
Serial 1/0.3 - 10.0.0.17/30
FastEthernet3/0 - 10.0.1.2/24
LoopBack0 - 172.16.2.1/32

R3
Serial 1/0.1 - 10.0.0.6/30
Serial 1/0.2 - 10.0.0.14/30
Serial 1/0.3 - 10.0.0.21/30
FastEthernet3/0 - 10.0.3.1/24
LoopBack0 - 172.16.3.1/32

R4
Serial 1/0.1 - 10.0.0.10/30
Serial 1/0.2 - 10.0.0.18/30
Serial 1/0.3 - 10.0.0.22/30
FastEthernet3/0 - 10.0.4.1/24
LoopBack0 - 172.16.4.1/32



R5
Serial 1/0 - 10.0.0.25/30
FastEthernet3/0 - 10.0.3.2/24
LoopBack0 - 172.16.5.1/32

R6
Serial 1/0 - 10.0.0.26/30
LoopBack0 - 172.16.6.1/32

Figure 2 - Lab Layout (Multiple Routing Protocol)

Domain 1 - Implement EIGRP Operations

EIGRP Overview

EIGRP (Enhanced Interior Gateway Routing Protocol) is a Cisco proprietary routing protocol. EIGRP has advantages of both distance vector and link state routing protocols. It does this though the use of the Diffusing Update Algorithm (DUAL). EIGRP has very low network overhead. On startup EIGRP uses *hello* packets to communicate with neighbors and to exchange full topological information. This is the only time EIGRP exchanges full topology tables. All EIGRP updates are only sent when there is a network change and only the changes are sent over the network, which additionally reduces the overhead. EIGRP keeps two different routing tables. One, the *routing table* holds the current primary routing information to all known networks, and two, the *topology table* holds the information in the routing table and information related to all potential backup routes. This enables almost instantaneous switchover upon failure should multiple paths exist. EIGRP also provides classful boundary summarization by default.

Another main advantage of EIGRP is that its design works around protocol dependent modules, which enables it to be used with a number of different protocols. In the past this was good because it could be used for not only IPv4 but also IPX (Novell) and AppleTalk (Apple). In today's world these last two protocols are rather obsolete. Another protocol that can utilize EIGRP isIPv6. EIGRP also utilizes Reliable Transport Protocol (RTP) for communications to make sure that all communications are reliable. This traffic is transported via IP protocol 88. Protocol 88 is reserved exclusively for EIGRP traffic.

Within the Cisco world, internal EIGRP routes have an administrative distance of 90, while external EIGRP routes have an administrative distance of 170 and summary EIGRP routes have an administrative distance of 5.

EIGRP Routing and DUAL Basics

Within EIGRP there are a number of terms that must be explained:

Advertised Distance (reported distance)	The Advertised Distance (AD) is the distance from a given neighbor to the destination router.
Feasible Distance	The Feasible Distance (FD) is the distance from the current router to a destination network.
Feasibility Requirement	Within EIGRP there is a requirement that must be met for a route to be considered feasible and loop-free. This requirement states that in order for a route to be feasible the Advertised Distance of the alternate route must be lower than that of the Feasible distance of the current route. (See Example)
Feasible Successor	If an alternate route exists and it meets the requirements of the Feasibility Requirement then it is considered a Feasible Successor.
Neighbor Table	The neighbor table contains all information related to the neighbors within EIGRP. An independent copy of the neighbor table is kept per protocol (IPv4 and/or IPv6).
Topology Table	The topology table within EIGRP differs from the routing table. The topology table keeps track of all routes that have been learned and meet requirements. An independent copy of the topology table is kept per protocol.

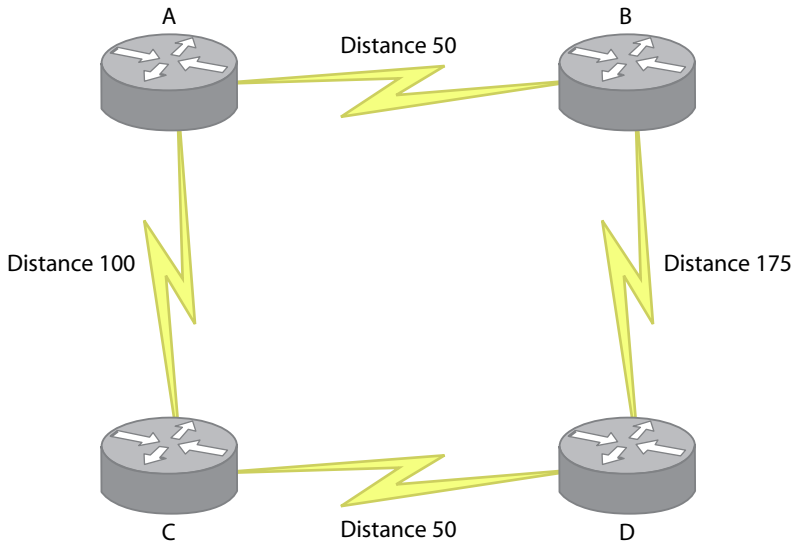


Figure 3 - EIGRP Distance Example

In the above figure a route from A to D can be accomplished in two ways: from A to B to D or from A to C to D. Now if we do the math, a route from A to B equals 50 and the route from B to D equals 175, so this route's total feasible distance is 225. The route from A to C equals 100 and the route from C to D equals 50, so this route's feasible distance is 150. So here is what we have in the tables:

Router	FD	AD
A to B to D	225	175
A to C to D	150	50

So, according to these tables, the main route would be from A to C to D with an FD of 150. At this point, we must verify that the potential alternate route (A to B to D) meets the feasibility requirement. The FD of the current route is 150 and the advertised distance of the alternate route is 175. In this case, FD < AD, so the route from A to B to D would not be considered feasible. Because the only alternate route is not considered feasible, there is only one path considered by router A to router D (A to C to D). Only if this path goes down would router A query router B to check for a new route to Router D. If the alternate route would have passed the feasibility requirement then both routes would have existed in the topology table on router A and any failure would have an almost instantaneous failover to the alternate route.

Packet Types

Hello	*Hello* packets are used for neighbor discovery and communications. *Hello* packets do not require acknowledgement. *Hello* packets are sent via multicast on 224.0.0.10.
Update	*Update* packets are used to exchange the reachability information of destinations. When new neighbors are discovered, packets are sent via unicast during initial exchanges. All updates other than this are sent via multicast on 224.0.0.10. All updates are transmitted reliably and acknowledged.
Acknowledgement	*Acknowledgement* packets are used to verify reception of *update* packets. *Acknowledgement* packets are always sent via unicast.
Query	*Query* packets are sent out when a router has topology change and has no feasible successors. *Query* packet are sent via multicast on 224.0.0.10
Reply	*Reply* packets are sent out in response to *query* packets. *Reply* packets are sent via unicast.

Neighbor Discovery and Communications

EIGRP uses a *hello* packet mechanism in order to communicate with its neighbors and establish adjacencies. This is done via multicast on 224.0.0.10. When each router sets up adjacency, the neighbors are added to a neighbor table. Unlike some other routing protocols, EIGRP keeps track of all routes advertised to it by neighbors. This is used so that faster convergence can be achieved when alternate routes (feasible routes) exist. All of these routes are added to the topology table. All routes that are calculated to have the smallest cost are installed into the routing table. Adjacencies stay active through the use of *hello* packets which are exchanged between each EIGRP router. The interval at which *hello* packets are sent is determined by two things: the type of interface and the speed of that interface.

A 5-second interval is used for the following:

Ethernet
Token Ring
FDDI
Point-to-Point Serial interfaces and subinterfaces
Point-to-Multipoint interfaces and subinterfaces above T1 speeds (1.544 Mbps)

A 60-second interval is used for the following:

Point-to-Multipoint interfaces and subinterfaces below T1 speeds (1.544 Mbps)
ATM switched Virtual Circuits (VC)
ISDN BRI

All routes are considered active and valid unless 3 consecutive *hello* packets are missed. This is considered the *hold time*. The *hello* interval and the *hold time* can be changed with the **ip hello-interval eigrp** and **ip hold-time eigrp** interface commands. When changing the *hello* interval, the *hold time* needs also to be changed.

If you are setting up EIGRP on a network which uses secondary IP addresses on the interfaces EIGRP will only setup adjacencies on the primary addresses. Another thing that must be configured to establish adjacencies when using frame-relay map command is the optional broadcast option. If this option is not used in this configuration then adjacencies will not be established.

EIGRP, in recent releases, has also implemented a "Goodbye" message which is sent to all neighbors when an EIGRP router process is shutting down. This informs the neighbors of the impending topology change, thus allowing the neighbors to more efficiently recalculate topology change.

Split Horizon and Poison Reverse

In addition to the feasibility requirement, EIGRP uses two other techniques for preventing loops: Split Horizon and Poison Reverse. These two techniques are used under different circumstances. Split Horizon is a rule which states that once a route is learned from one interface it should not be advertised back to the same interface on which it was learned on. Poison Reverse is a rule which states that once a route is learned through an interface then that route should be advertised out to that interface as unreachable. Under normal operating conditions, Split Horizon is turned on and Poison Reverse is turned off.

Within EIGRP these two rules are used in two different situations: on startup, when there is a topology change, and when queries are sent. On startup, an EIGRP router sends out *hello* packets to discover the network topology, while in this state EIGRP utilizes Poison Reverse by sending out an unreachable advertisement for every table entry received. On topology changes, it is typical for all routers to utilizeSplit Horizon to prevent routing loops. However, when there is a topology change, which changes the interface through which the router reaches a network, then the router will turn off Split Horizon and poisons the old routes out all interfaces.

EIGRP Route States

Within EIGRP routes can be in one of two states, active and passive. Routes considered active are currently being computed; routes in a passive state have been computed and are in the topology and routing tables.

Stuck-In-Active (SIA) Routes

Within EIGRP there is an error message that shows a route as Stuck-In-Active (SIA). What this means is that a route has gone down on the current router and there is no feasible successor. Because of this it queries its neighbors. If the router does not get a response back from this query within the time allotted (around three minutes), then the neighbor will be cleared and the route will be considered SIA.