**EIGRP**

Routing Table:

- Route entries can come from multiple sources, including directly connected devices, static routes, and dynamic routing protocols

- Level 1 routes -- subnet mask is less than the classful mask (A, B, C, etc)

- Default routes -- static route with address 0.0.0.0

- Supernet routes -- network address with mask less than classful mask

- Network routes -- network address with mask equal to classful mask

- Level 2 routes --route that is a subnet of a classful network address

- All child routes are level 2 routes, as they are a subnet of a classful address

- When a child route is added, a parent route is automatically created in the table

- Ultimate routes are routes that include either a next-hop address or an exit interface

- Parent routes are routes that do not contain a next-hop or exit interface, and they indicate the presence of child routes

- Best route is chosen by the longest match, or most similar left-most bits

Route Lookup Process:

- Router examines level 1 routes to find the best match for the destination address

- If the route is an ultimate route, then forward it, otherwise check the child routes

- If a child route in the parent route is found, then forward the packet using that route

- If not, then look for a lesser matching route or a level 1 supernet route, or default route

- If one of the above routes is found, then forward the packet to the next-hop or interface

- If the packet is forwarded, a recursive lookup is down until it resolves to an interface

- If no route is found, then drop the packet

Classful and Classless Routing Behaviors:

- Different types of routing behaviors affect how the routing table is populated

- “ip classless” and “no ip classless” are used to change routing behaviors

- Classful routing -- if the router searches through the child routes of a parent route and finds no match, then it will not look for lesser matches and drop the packet

- Classless routing -- search beyond the child routes of a parent route and look for other, less matching level 1 supernets, and also consider the default route

- By default, classless routing is used, however this behavior can easily be changed

**(Book 2) Chapter 9:**

Enhanced IGRP (EIGRP):

- Distance-vector classless routing protocol, with support for:

- Reliable Transport Protocol (RTP)

- Diffusing Update Algorithm (DUAL)

- Bounded updates, neighbor and topology tables

- Uses bandwidth and delay as metric for routing decisions

- AD of 90 for internal routes, 170 for external routes, and 5 for summary routes

- Unlike RIP, there can be multiple instances of EIGRP (multiple processes)

- No periodic updates or old entries, only routing updates on topology change

- DUAL uses separate topology table that contains best paths and backup loop-free paths

- Faster network convergence because of lack of holddown timers and route calculations

- Uses protocol=88 in IP headers and multicast address 224.0.0.10

- Components of an EIGRP message (routing update):

- Opcode -- message type (Update, Query, Reply, Hello)

- Autonomous System -- ID for the EIGRP routing process

- Hold Down Time -- maximum time to wait for next Hello message

- Protocol Dependent Modules (PDM) -- routing for multiple types of protocols

- Example: IP-EIGRP, IPX-EIGRP, etc.

- Types of EIGRP packets:

- Hello -- discover neighboring routers and form adjacencies, unreliable, multicast

- Update -- sent on topology update, reliable delivery with ACKs, uni or multicast

- Query -- used for searching other networks, reliable delivery, multicast

- Reply -- sent in response to a query message,reliable delivery and multicast

Diffusing Update Algorithm (DUAL):

- Algorithm used for network convergence, ensures loop-free paths

- DUAL FSM tracks all routes and uses the metric to select loop-free paths

IOS Commands:

- router eigrp [PID] -- configures EIGRP for a specified 16-bit process ID

- network [IPADDR] -- allows the specified network to run EIGRP instances

- network [IPADDR] [WILDCARD\_MASK] -- used to allow EIGRP for certain interfaces

- show ip eigrp neighbor -- shows neighbor table in EIGRP protocol

- no auto-summary -- disables auto-summarization for the protocol

- show ip eigrp topology -- shows the topology table in EIGRP protocol

- ip bandwidth-percent eigrp [PERCENT] -- bandwidth limit in percent form for interface

- ip hold-time eigrp [SECONDS] -- set hold time for an EIGRP instance

- ip hello-interval eigrp [SECONDS] -- set hello interval for an EIGRP instance

- redistribute static -- includes static routes in EIGRP routing updates

EIGRP Composite Metric and K Values:

- metric = (K1 \* bandwidth) + (K2 \* bandwidth)/(256 - load) + (K3 \* delay) …

- K1 to K5 are metric weights, K1-K3 default are one, K4 and K5 are default zero

- If a K value is zero, then it is excluded from the metric calculation

- Command: “metric weights tos k1 k2 k3 k4 k5”, where tos is always set to zero

- Types of metrics used:

- Bandwidth -- speed of the link, cannot be changed

- Delay -- time involved to travel a given route

- Reliability -- probability of link failing or having errors

- Load -- amount of traffic using a link, measured as a fraction of 255 (eg: 50/255)

- When viewing with “show ip protocols”, for each entry there will be a [A / B]

- A is the administrative distance, and B is the metric

DUAL Concepts:

- Successor -- Neighboring router that is the least-cost route to the destination network

- Feasible distance (FD) -- lowest calculated metric to reach the destination network

- Successor is usually the next-hop router, and FD is the metric in [A / B]

- Feasible successor (FS) -- neighboring router with a loop-free backup path to dest.

- Reported distance (RD) -- neighboring router’s FD to the same destination network

- Feasibility condition (FC) -- happens when neighbor’s RD < local router’s FD