RAM -- OS, running-config, routing table, ARP cache, packet buffer

ROM -- bootstrap instructions, diagnostic software, IOS (scaled down, basic version)

NVRAM -- startup-config (?)

Flash -- full version of IOS

Bootup -- POST (test hardware components) -> bootstrap -> load IOS -> load startup-config

Link-state vs Distance-vector -- periodic announcements, network size, topology, convergence

Metrics -- RIP uses hop count, EIGRP bandwidth and delay, OSPF bandwidth

For an entry 10.0.0.1 [90/15], 90 is administrative distance and 15 is metric

Administrative distance (AD) -- preference for routing protocols, 0 <= AD <= 255

- 0 = directly connected, 1 = static, 5 = summary route, 90 = EIGRP (internal)

- 120 = RIP, 170 = EIGRP (external), ? = OSPF

Loopback interfaces (eg: Lo0) -- software interface that emulates physical interface, localhost

Null interfaces (eg: Null0) -- always-up interface that discards received packets, doesn’t send

CIDR -- classless routing, prefix aggregation, doesn’t use address class

VLSM -- variable length subnetting, variable subnet mask, variable-size subnets

RIPv2 -- UDP port 520, up to 25 routes, distance vector, backwards compatible with RIPv1, auto summarizes routes by default

EIGRP -- distance vector protocol that uses RTP and DUAL, routing+neighbor+topology tables

- metric = bandwidth and delay, can have multiple instances

- 90 AD internal routes, 170 AD external routes, 5 AD summary routes

- Protocol=88, multicast 224.0.0.10, AS = ID for EIGRP routing process

- Hello (unreliable), Update, Query, Reply (sent in response to Query) (reliable with ACK)

- 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

OSPF -- metric = cost (bandwidth on IOS), Protocol=89, AD = 110, 224.0.0.5 and 224.0.0.6

- - Hello -- establish and maintain adjacency with other OSPF routers

- Database Description (DBD) -- list of router’s link-state database

- Link-State Request (LSR) -- request more info about an entry in the DBD

- Link-State Update (LSU) -- respond to LSR or announce new information

- Link-State Acknowledgement (LSAck) -- sent in response to LSU

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