7a. Routing Protocols

PURPOSE

Routing Protocol—Routing protocols don't route; they learn and share route information with neighboring routers. Using its own particular algorithm, a routing protocol running on a router can choose the best route to a specific destination (network *and* mask) based on information it receives from other routers running the same routing protocol. It then offers that best route to the routing table.

The routing table may receive route offers from several sources and uses the administrative distance of the sources themselves to choose whose route to place in the routing table.

Administrative Distance (AD)—How likely a given routing protocol is to produce the best choice as compared to others. Notice that the routing table has no way to second guess the choices made by the various routing protocols. Comparing the route desirability measures (cost / distance) between different routing protocols is like comparing apples and oranges—different protocols use different metrics with no conversion available. The routing table simply chooses between protocols ("consider the source."), using the AD. The AD is expressed as an 8-bit number (0-255), lower better.

Route Source	AD
Connected	0
Static	1
BGP (External Route)	20
EIGRP (Internal Routes)	90
IGRP	100
OSPF	110
IS-IS	115
RIP	120
EIGRP (External Routes)	170
BGP (Internal Routes)	200
DHCP default route	254
Unusable	255

Routed / Routable Protocol—Things like IPv4 and IPv6 that can be routed.

The real value of a dynamic routing protocol is that it can respond to changes in the network (link failure, etc.)

AS (Autonomous System)—All the routers running the same protocol under the same management and sharing information with each other to make their decisions.

Convergence—the process of all routers in an AS agreeing on the network topology and calculating their own best routes from the information they've shared with each other. Once all this is hashed out, the steady-state is said to be "converged."

IGP (Interior Gateway Protocol)—Designed for use within a single AS. "Gateway" is an archaic term that refers to the role of a router as a gateway between a LAN and a larger inter-network

EGP (Exterior Gateway Protocol)—Designed for use between autonomous systems

ASN (Autonomous System Number)—These numbers are assigned like IP addresses and each refers to an entire AS. EGPs dynamically optimize routes to an AS and an IGP might take over within.

Most companies will run OSPF or EIGRP within their AS. CCENT also covers RIPv2.

IGP Algorithm Categories:

- Distance Vector (DV)—(e.g. RIP) Older design, slower convergence, tendency to create routing loops
- Link State (LS)—(e.g. OSPF) Require more router memory and processing. Also require more planning.
- Advanced Distance Vector—This category is a cop-out to cope with the fact that EIGRP doesn't fit neatly into either of the other two categories

Metrics—how a protocol numerically represents the cost of a route (lower better)

Classless Routing Protocols—support Variable Length Subnet Masks (VLSM) by sending the subnet mask of routes to its neighbors as part of their updates.

Protocol Comparison—Compared to RIPv1, RIPv2 added classless behavior, manual summarization and multicast updates. Hop count refers to the number of routers between a given router and the destination subnet.

	RIPv2	OSPF	EIGRP	IS-IS
Metric	Hops	Bandwidth	BW + Delay	?
Classless	•	•	•	•
Algorithm	DV	LS	Advanced DV	LS
Supports Manual Summarization	•	•	•	•
Cisco-Proprietary			(formerly)	
Multicast Updates	•	•	•	N/A
Convergence Speed	Slow	Fast	Fast	Fast

OSPF and EIGRP handle bandwidth differently. OSPF inverts bandwidth (speed) to make higher numbers slower, then adds them up across all the hops. EIGRP picks the slowest link on the path and sums the delays at each hop.