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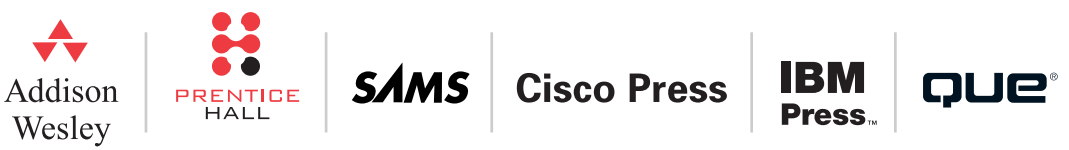


Section 11
RIP Routing

Dynamic Routing Protocol Overview

Routing protocols determine the best path packets take to reach a destination in a network. A routing protocol does this by defining rules to communicate with neighboring routings and then sending information about the router's learned routes to neighboring routers. Routing protocols are divided into two classes based on how they interact with other autonomous systems: exterior gateway protocols (EGP) and interior gateway protocols (IGP).

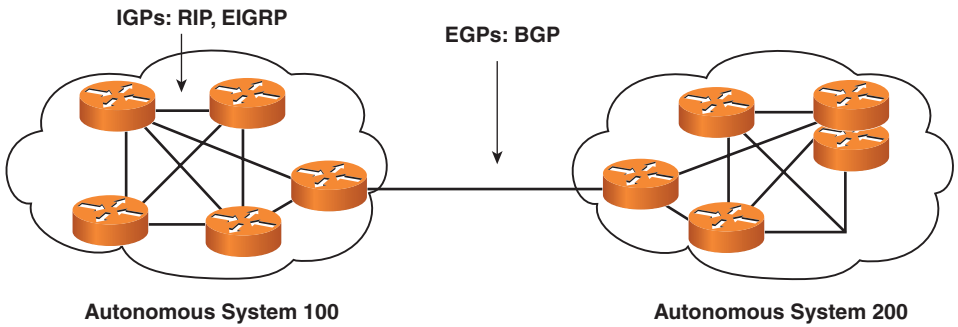
IGP and EGP

An autonomous system (AS) refers to a group of networks under a common administrative domain.

IGPs exchange information within an AS. Examples include RIP, EIGRP, OSPF, and IS-IS.

EGPs exchange information between autonomous systems. BGP is an example of an EGP.

FIGURE 11-1
IGPs and EGPs



 Please see page 172 for more details.

Classes of Routing Protocols

As mentioned in Chapter 8, "Exploring the Functions of Routing," three classes or methods of routing protocols exist:

- Distance vector
- Link-state
- Advanced distance vector (also called balanced hybrid)

Routing Ranges with Administrative Distance

Several routing protocols can be used at the same time in the same network. When more than a single source of routing information exists for the same destination prefix, the source with the lowest administrative distance value is preferred.

Table 11-1 shows the default administrative distance of learned routes.

Table 11-1 AD

Route Source	Default Distance Values
Connected interface	0
Static route	1
EIGRP	5
BGP	20
Internal EIGRP	90
IGRP	100
IS-IS	115
RIP	120
EGP	140

continues

Table 11-1 AD *continued*

Route Source	Default Distance Values
ODR	160
External EIGRP	170
Internal BGP	200
Unknown	255

Classless Versus Classful Routing

Classless routing protocols include subnet mask information in routing advertisements and support variable-length subnet mask (VLSM). In classless routing, summarization is controlled manually. RIP v2, OSPF, IS-IS, and EIGRP are classless routing protocols.

Classful routing protocols do not include the subnet mask in routing advertisements. As a result, all subnetworks of the same major network must use the same subnet mask. Routers using classful routing protocols automatically perform route summarization across network boundaries. RIPv1 is an example of a classful routing protocol.

The **ip classless** command prevents a router from dropping packets for an unknown subnetwork of a directly attached network if a default route is configured. The **ip classless** command is enabled by default.

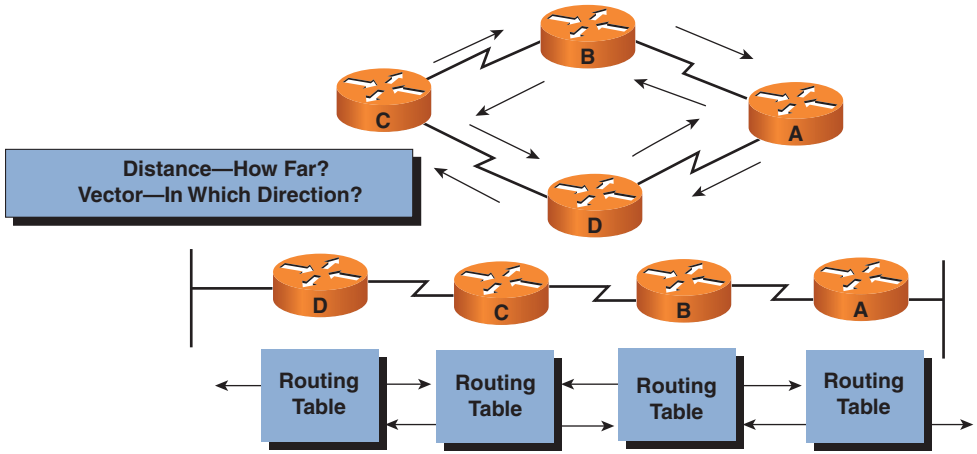
Distance Vector Route Selection

Routers using distance vector–based routing share routing table information with each other. This method of updating is called "routing by rumor." Each router receives updates from its direct neighbor. In Figure 11-2, Router B shares information with Routers A and C. Router C shares routing information with Routers B and D. In this case, the routing information

 Please see page 172 for more details.

is distance vector metrics (such as the number of hops). Each router increments the metrics as they are passed on (incrementing hop count, for example).

FIGURE 11-2
Distance Vector Routing Protocols

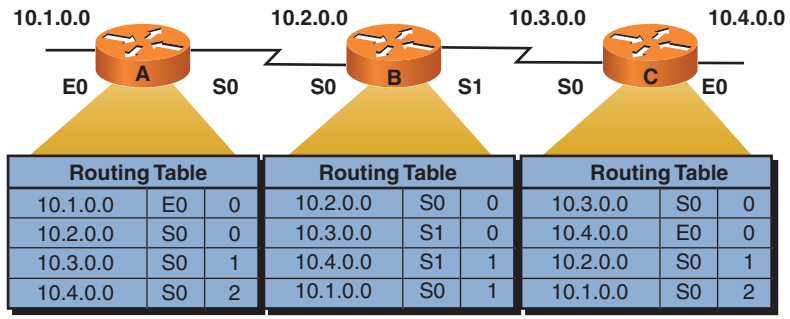


Distance accumulation keeps track of the routing distance between any two points in the network, but the routers do not know the exact topology of an internetwork.

How Information Is Discovered with Distance Vectors

Network discovery is the process of learning about nondirectly connected destinations. As the network discovery proceeds, routers accumulate metrics and learn the best paths to various destinations. In Figure 11-3, each directly connected network has a distance of 0. Router A learns about other networks based on information it receives from Router B. Router A increments the distance metric for any route learned by Router B. For example, Router B knows about the networks to Router C, which is directly connected. Router B then shares this information with Router A, which increments the distance to these networks by 1.

 Please see page 172 for more details.



Routing Table

10.1.0.0	E0	0
10.2.0.0	S0	0
10.3.0.0	S0	1
10.4.0.0	S0	2

Routing Table

10.2.0.0	S0	0
10.3.0.0	S1	0
10.4.0.0	S1	1
10.1.0.0	S0	1

Routing Table

10.3.0.0	S0	0
10.4.0.0	E0	0
10.2.0.0	S0	1
10.1.0.0	S0	2

FIGURE 11-3 Distance Vector Route-Learning Process

During updates, routing loops can occur if the network has inconsistent routing entries. Slow convergence on a new configuration is one cause of this phenomenon. The network is converged when all routers have consistent routing tables.

Routing Metrics

Routing protocols use their own rules and metrics to build and update routing tables automatically. Routing metrics are measures of path desirability. Different protocols use different metrics. Some common metrics are as follows:

- **Bandwidth:** The link's data capacity.
- **Delay:** The time required to move the packet from the current router to the destination. This depends on bandwidth, port delays, congestion, and distance.
- **Load:** The amount of activity on the interface.
- **Reliability:** The error rate of each network link.
- **Hop count:** The number of routers the packet must travel through before reaching the destination.
- **Cost:** An arbitrary value based on bandwidth, expense, and other metrics assigned by the administrator.

 Please see page 172 for more details.