7.2.2 Routing Protocol Characteristics Facts

Routers use a routing protocol to exchange information about known routes with other routers. The following table describes general characteristics of a routing protocol:

Characteristic	Description
Scope	Each organization that has been assigned a network address from an ISP is considered an Autonomous System (AS). The organization is then free to create one large network or divide the network into subnets. Each autonomous system is identified by an AS number (ASN). This number can be locally administered (private ASN) or publicly registered (public ASN) if the AS is connected to the Internet. Routing protocols can be classified based on their *scope*, or whether traffic is routed within or between an autonomous system. ▪ An Interior Gateway Protocol (IGP) routes traffic within an autonomous system. ▪ An Exterior Gateway Protocol (EGP) routes traffic between autonomous systems.
Metric	The *metric* is a value assigned to each route that identifies the distance or cost to the destination network. The metric is used by the routing protocol to identify and select the best route to the destination when multiple routes exist. A lower metric identifies a more preferred route. The metric can be calculated based on the following criteria: ▪ *Hop count* is the number of routers between the current router and the destination network. ▪ *Bandwidth*, or time, is an actual measure of how long it takes to reach the destination network (delay). For example, high-speed links might be associated with a lower metric cost. ▪ *Link cost* is a relative number that represents the cost for using the route. For example, it could relate to the actual cost of using a link, such as an expensive WAN link, or it might identify the desirability of using a specific link. Be aware that comparing route metrics used by different routing protocols is not useful. For example, a metric of 10 for a routing protocol that uses bandwidth might indicate a better route than a metric of 4 for a protocol that uses hop count.
Routing update method	Routing protocols use different methods for sharing routing information and discovering networks. The following are common sharing methods: ▪ With the *distance vector* method, a router shares its entire routing table with its immediate neighbors. Routes learned from neighboring routers are added to the routing table and are shared with its neighbors. Most distant vector routing protocols use a technique called *split horizon* to prevent routing loops. Split horizon does this by making sure that a router cannot send network information backwards. ▪ With the *link-state* method, routers share only their directly connected routes using special packets called link-state advertisements (LSAs) and link-state packets (LSPs). These route advertisements are *flooded* (forwarded) throughout the network. Routers use this information to build a topology database of the network. ▪ A *hybrid* method combines characteristics of the distance vector and link-state methods. A router shares its full routing table at startup, followed by partial updates when changes occur. ▪ *Route redistribution* is a way of exchanging routing information between two different routing protocols. Route redistribution involves placing the routes learned from one routing domain, such as RIP, into another routing domain, such as EIGRP. When this occurs, you have to address several issues. ▪ Metrics. Each routing protocol has its own way of determining the best path to a network. RIP uses hops, and EIGRP and IGRP both use a composite metric of bandwidth, delay, reliability, load, and MTU size. Because of the differences in metric calculations, when redistributing routes, you lose all metrics and must manually specify the cost metric for each routing domain. This is because RIP has no way of translating bandwidth, delay, reliability, load, and MTU size into hops, and vice versa. ▪ Classful vs. classless. Some routing protocols are classful and do not send subnet mask information in the routing updates (e.g., RIP and IGRP), and some protocols are classless and do send subnet mask information in the routing updates (e.g., EIGRP). This causes problems when VLSM and CIDR routes need to be redistributed from a classless routing protocol into a classful routing protocol. In general, the different routing protocol methods have the following characteristics: ▪ The distance vector method is simpler and requires less processing power for routers. It is best suited for small networks. ▪ The link-state method uses less network traffic for sending routing information, converges faster, and is less prone to errors. It is the best choice for large networks or for sharing routes over WAN links. ▪ A hybrid method reduces the negative effects of the distance vector method while gaining many of the benefits of the link-state method.
Classful or classless	Early routing protocols were not capable of variable-length subnet masks (VLSM) and used only the default subnet masks to identify destination networks. Routing protocols can be identified based on their support for Classless Inter-Domain Routing (CIDR) features. ▪ A *classful* protocol uses the IP address class and the default subnet mask to identify network addresses. Classful protocols do not support CIDR or VLSM.

	▪ A *classless* protocol ignores the IP address class and requires that a subnet mask value be included in all route advertisements. Classless protocols support CIDR and VLSM.