7.1.2 Routing Facts

Routing is the process of moving packet from one network to another using routers. In this lesson you will learn about:

- How routing works
- Static and dynamic routing
- Interior and exterior routing

How Routing Works

A router is a device that sends packets from one network to another.

Term	Description
Packet	A *packet* is the payload of an OSI layer 2 frame. A packet has a header and a payload. ▪ The header contains source and destination IP addresses. ▪ The payload depends on the protocol that formed the packet.
Network	When used in routing, the term network can be defined as a broadcast domain where all the hosts have the same network portion in their IP address. Normally, a LAN fits this more precise definition of a network.

To perform routing, a router:

- Receives a frame
- Opens the frame's payload, which is an IP packet
- Reads the packet header to find IP addressing information
- Matches the destination network address with entries in its routing table creates a new frame using the packet as a payload
- Transmits the new frame to the next hop gateway.

The following table describes a few important routing terms:

Term	Description
Next Hop	To forward a packet, a router only needs to know next hop information, not the full path to the ultimate destination. The *next hop* is the gateway (router) that the router will to send the packet to.
Routing Table	The *routing table* is a database of entries, each with: ▪ The address of a known network ▪ The next hop gateway (router) ▪ The network interface to reach the next hop gateway ▪ A metric or cost that indicates the desirability of the route (The lower the metric, the more desirable the route.)
Default Route	The *default route* is an entry of 0.0.0.0 in a routing table. This entry matches every network. If no other entry in the routing table matches the destination IP address in a packet, the router will send the packet to the gateway found in the default route. ▪ The gateway identified in the default route is known as the default gateway. ▪ If a default route does not exist, the router will drop any packets that do not match an entry in a routing table.
Loopback Entry	Loopback entries contains loopback addresses which are used for diagnostics and for troubleshooting the TCP/IP stack. Loopback interfaces are always available. They will continue to run even if other physical interfaces in the router are down.

Static and Dynamic Routing

Routing can be classified by how entries are added to the routing table. There are three types of routing entries—default, static and dynamic.
You can use default, static and dynamic routing together.

Information about other networks can be added to the routing table using one of two methods:

Method	Description
Static	Static routing entries are manually added to the routing table.

	▪ A route entry of 0.0.0.0 identifies the default entry or default route which is special form of a static entry. ▪ Static entries remain in the routing table until they manually removed. ▪ When changes to the network occur, static entries must be modified, added, or removed. ▪ Static routing works well in smaller networks.

Dynamic	Maintaining static only routing in a large network with multiple routers would be very difficult, especially when there are multiple network paths that an IP packet can take to get to its destination. Routers can dynamically learn about networks by sharing routing information with other routers.
	
	▪ Dynamic routing is implemented by enabling a routing protocol.
	▪ A routing protocol adds dynamic entries to the routing table.
	▪ If multiple paths to a network are available, routing protocols define:
	  ▪ The algorithm used to calculate a metric.
	  ▪ How routers communicate with each other to share network path information.
	▪ Routing protocols use metric information to insert the best hop into the routing table when multiple paths are available.
	
	If needed, you can add static routes to supplement dynamic routing to identify networks that are not learned about through any routing protocol.

Interior and Exterior Routing

Dynamic routing protocols can be classified by their use, either for interior routing or exterior routing.

Routing Use	Description

Interior	Interior routing is done within an autonomous system (AS). An autonomous system is a private network that is somewhat independent of the internet. The only thing that is shared is the link to the internet.
	With interior routers:
	
	▪ You own and control the routers.
	▪ You determine where the routers are located.
	  ▪ You control the logical topology.
	  ▪ You control the physical topology.
	▪ You control the interfaces that connect the routers to your network.
	▪ You determine which interior routing protocols are enabled.

Exterior	Exterior routing is done between autonomous systems. Organizations that connect their private network to the internet are assigned a unique autonomous system number, or ASN. ▪ Exterior routing is the routing performed by the so-called internet backbone. ▪ In most organizations, exterior routing will be limited to a single router that connects the organizations network to the internet via an ISP. ▪ This router is often called a border router or an edge router. ▪ Larger organizations or organizations with a critical mission may have multiple ISPs that give them redundant internet connectivity. In this case, the edge router or routers must run an exterior routing protocol.