Lesson Proper for Week 1

Router

- As its name implies, it “routes” traffic between the devices and the internet.
- To forward a packet to its destination.
- The basic backbone for the Internet.

When it comes to routers, there are only two types you’ll need to consider:

a. Wireless routers. A wireless router connects directly to a modem by a cable. This allows it to receive information from and transmit information to the internet. The router then creates and communicates with your home Wi-Fi network using built-in antennas. As a result, all of the devices on your home network have internet access.

b. Wired routers. A wired router connects directly to computers through wired connections. They usually have a port that connects to the modem to communicate with the internet. Another port or ports allows the wired router to connect to computers and other devices to distribute information.

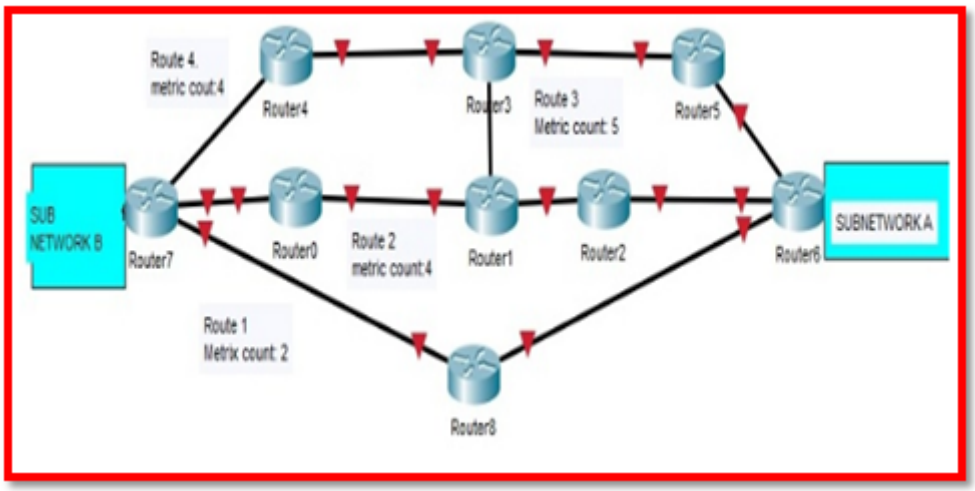
FUNCTIONS OF A ROUTER

A router uses information contained in the internet protocol header to make various decisions; these decisions include:

a. Path determination - When a router receives an IP packet through any of its interfaces, the router examines the packet's destination IP address, the optimal path to reach this destination is added to the routing table.

Common metric

1. Hop count is the number of internetworking devices, such as a router that an IP packet must pass through to reach its destination subnet. If a routing protocol uses Hop count as its metric, then the path with the least metric or number of routers is considered the best path.

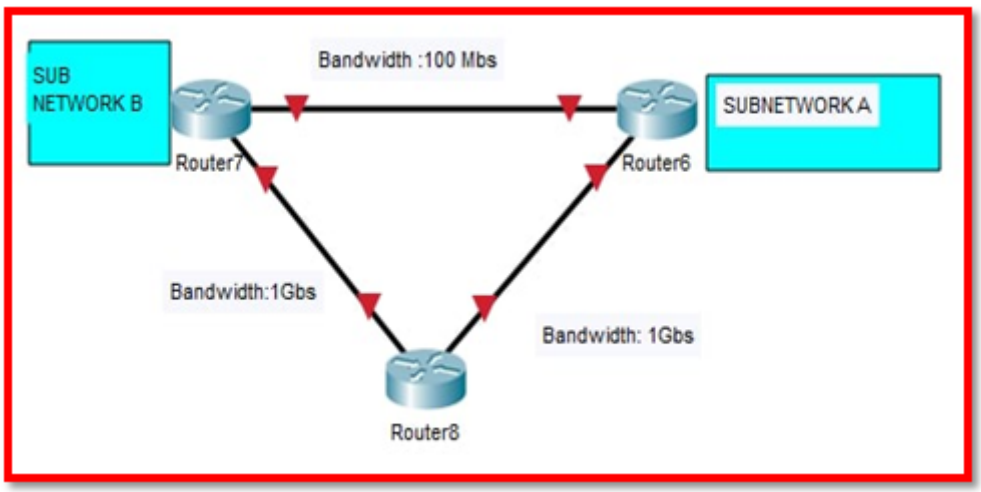


In the image above, a sub-network-A device wants to reach another in sub-network-B; using hop count as its metric; the network will use Route 1 because it has the least Hop count value (2).

2. Delay refers to the time taken to send data from source to destination; this includes the time taken by a router to process and send a datagram to the receiving interface.

3. Bandwidth is defined as the number of bits that a link between two devices can send per second.

For a protocol that uses bandwidth capacity as its metric, the protocol determines the bandwidth capacity of all possible routes to the destination subnet, and the route with a higher bandwidth capacity is considered the best path added to the routing table.



In the figure above, Router 6 will prefer to send its traffic through router 8 rather than send it through router 7 because the route through router 8 has a higher bandwidth.

b. Routing decision - The router achieves this by encapsulating the IP packet with the appropriate data link frame type of the egress port. This encapsulation happens after the router has determined the exit interface associated with the best path to forward that packet.

The path can either be:

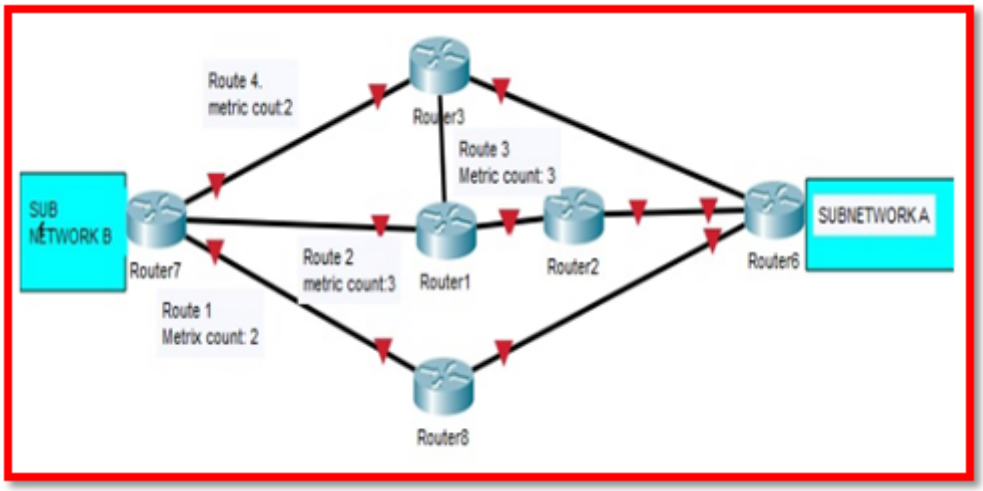
· A directly connected route (the destination address in the IP header belongs to a network connected to one of the router interfaces).

· A remote network (when the destination IP address of the packet belongs to another network).

· No route determined (when the destination address is not in the routing table).

c. Load balancing - The method of sending data to a destination sub-network using two or more paths

Load balancing is possible because a routing table can contain many paths associated with different exit interfaces of a router having an equal metric or cost path.



In the figure above, to send traffic to Sub-network B, Router 6 will distribute its traffic to Route 1 and 4 because they have an equal metric.

ROUTING PROTOCOLS

The primary responsibility of a router is to direct packets destined for local and remote networks by:

• **Determining the best path to send packets.** The router uses its routing table to determine the best path to forward the packet. When the router receives a packet, it examines its destination IP address and searches for the best match with a network address in the router's routing table.

• **Forwarding packets toward their destination.** The routing table also includes the interface to be used to forward the packet. Once a match is found, the router encapsulates the IP packet into the data link frame of the outgoing or exit interface, and the packet is then forwarded toward its destination.

ROUTING NETWORKS

A router can find remote networks using either static or dynamic routing.

1. Static routes are configured manually, network administrators must add and delete static routes to reflect any network topology changes.

When to use static Routing:

A network consists of only a few routers. Using a dynamic routing protocol in such a case does not present any substantial benefit. On the contrary, dynamic routing may add more administrative overhead.

A network is connected to the Internet only through a single ISP. There is no need to use a dynamic routing protocol across this link because the ISP represents the only exit point to the Internet.

A large network is configured in a hub-and-spoke topology. A hub-and-spoke topology consists of a central location (the hub) and multiple branch locations (spokes), with each spoke having only one connection to the hub. Using dynamic routing would be unnecessary because each branch has only one path to a given destination through the central location.

Connected Routes. Those network that are directly connected to the Router are called connected routes and are not needed to configure on the router for routing. They are automatically routed by the Router.

2. Dynamic Routes: Dynamic routing protocol uses a route that a routing protocol adjusts automatically for topology or traffic changes.

a. Non-adaptive routing algorithm - When a ROUTER uses a non-adaptive routing algorithm it consults a static table in order to determine to which computer it should send a PACKET of data. This is in contrast to an ADAPTIVE ROUTING ALGORITHM, which bases its decisions on data which reflects current traffic conditions (Also called static route)

b. Adaptive routing algorithm - When a ROUTER uses an adaptive routing algorithm to decide the next computer to which to transfer a PACKET of data, it examines the traffic conditions in order to determine a route which is as near optimal as possible. For example, it tries to pick a route which involves communication lines which have light traffic. This strategy is in contrast to a NON-ADAPTIVE ROUTING ALGORITHM. (Also called Dynamic route)

ROUTING AND ROUTING PROTOCOLS:

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1. Determining the best path to send packets.

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2. Forwarding packets toward their destination

The routing table also includes the interface to be used to forward the packet. Once a match is found, the router encapsulates the IP packet into the data link frame of the outgoing or exit interface, and the packet is then forwarded toward its destination.

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