ROUTING IN PACKET NETWORKS

A packet-switched network consists of nodes (routers or switches) intercom nected by communication links in an arbitrary meshlike fashion as shown in Figure 1.23. As suggested by the figure, a packet could take several possible paths from host A to host B. For example, three possible paths are 1-3-6, 1-4-5-6, and 1-2-5-6. However, which path is the ``best''one?

If the objective is to minimize the number of hops, then path 1-3-6 is the best. If each link incurs a certain delay and the objective function is to minimize the end-to-end delay, then the best path is the one that gives the end-to-end minimum delay. Yet a third objective function involves selecting the path with the greatest available bandwidth. The purpose of the routing algorithm is to identify the set of paths that are best in a sense defined by the network operator. Note that a routing algorithm must have global knowledge about the network state in order to perform its task.A routing algorithm should seek one or more of the following goals:

1. Rapid and accurate delivery of packets. A routing algorithm must operate correctly; that is, it must be able to find a route to the destination if it exists. In addition, the algorithm should not take an unreasonably long time to find the route to the destination.
2. Adaptability to changes in network topology resulting from node or link failures. In a real network equipment and transmission lines are subject to failures. Thus a routing algorithm must be able to adapt to this situation and reconfigure the routes automatically when equipment fails.

3. Adaptability to varying source-destination traffic loads. Traffic loads are quantities that are changing dynamically. In a period of 24 hours, traffic loads may go into cycles of heavy and light periods. An adaptive routing algorithm would be able to adjust the routes based on the current traffic loads.

4. Ability to route packets away from temporarily congested links. A routing algorithm should try to avoid heavily congested links. Often it is desirable to balance the load on each link.

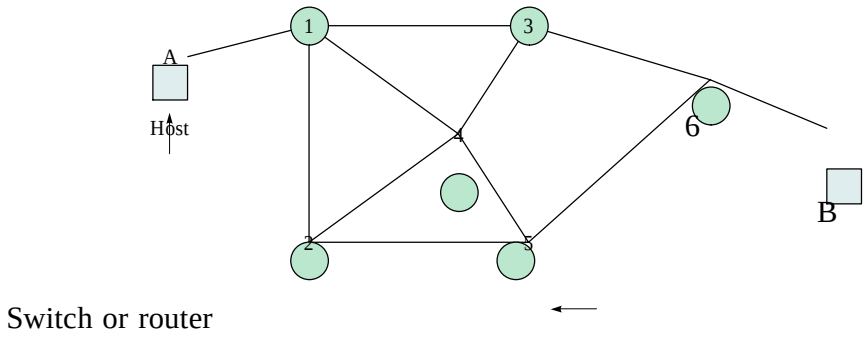

FIGURE 1.23 An example of a packet-switch network

5. Ability to determine the connectivity of the network. To find optimal routes, the routing system needs to know the connectivity or reachability information.

6. Low overhead. A routing system typically obtains the connectivity information by exchanging control messages with other routing systems. These messages represent an overhead that should be minimized.

Routing Algorithm Classification

One can classify routing algorithms in several ways. Based on their responsive ness, routing can be static or dynamic (or adaptive). In static routing the network topology determines the initial paths. The precomputed paths are then manually loaded to the routing table and remain fixed for a relatively long period of time. Static routing may suffice if the network topology is relatively fixed and the network size is small. Static routing becomes cumbersome as the network size increases. The biggest disadvantage of static routing is its inability to react rapidly to network failures. In dynamic (adaptive) routing each router continu ously learns the state of the network by communicating with its neighbors. Thus a change in a network topology is eventually propagated to all the routers. Based on the information collected, each router can compute the best paths to desired destinations. One disadvantage of dynamic routing is the added complexity in the router.

A routing decision can be made on a per packet basis or during the connec tion setup time. With virtual-circuit packet switching, the path (virtual circuit) is determined during the connection setup phase. Once the virtual circuit is established, all packets belonging to the virtual circuit follow the same route.

Datagram packet switching does not require a connection setup. The route followed by each packet is determined independently.

Source : http://elearningatria.files.wordpress.com/2013/10/cse-vi-computer-networks-ii-10cs64-notes.pdf