Routing

The job of router is to forward packets through a set of networks. But, which path does it choose? The answer is the shortest. In routing the term shortest can mean the combination of many factors including shortest, cheapest, fastest, and most reliable. This is called least cost routing.

Routing is classified as:

1- Non adaptive Routing:

In some routing protocols, once a pathway to a destination has been selected, the router sends all packets for that destination along that one route. In other words, the routing decisions are not made based on the condition or topology of the networks.

2- Adaptive Routing:

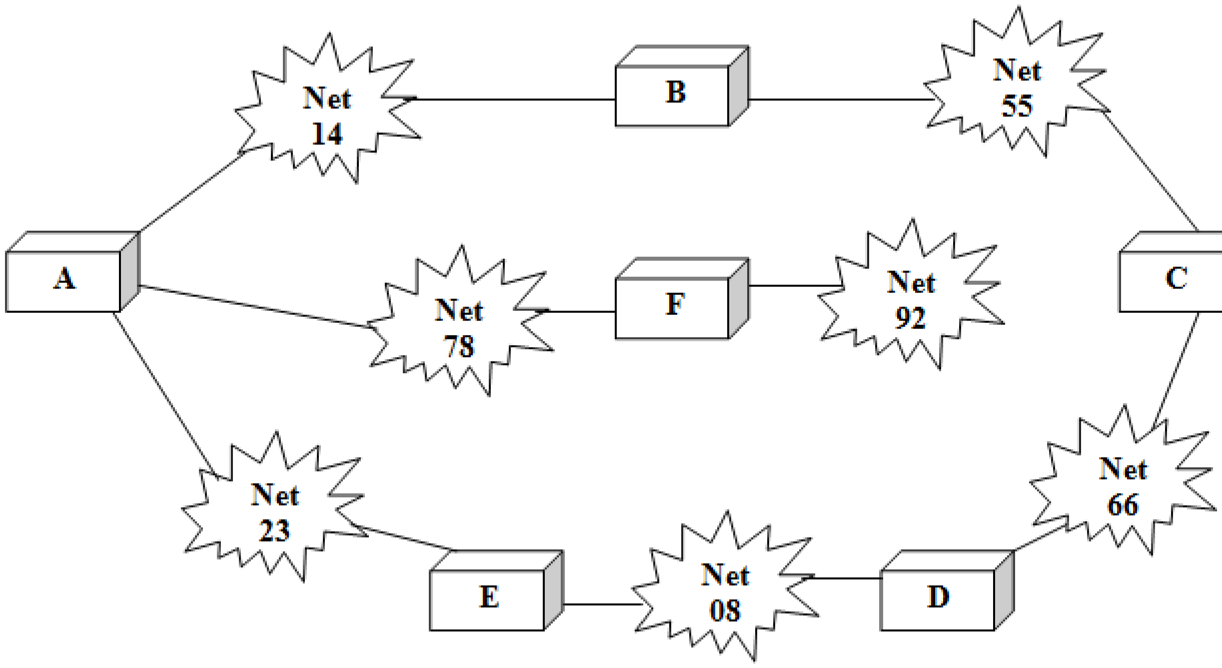
Other routing protocols employ a technique called adaptive routing, by which a router may select a new route for each packet (even packets belonging to the same transmission) in response to changes in condition and topology of the network.

Routing Algorithms:

Many algorithms are used to calculate shortest path between two routers, one of them is distance vector routing.

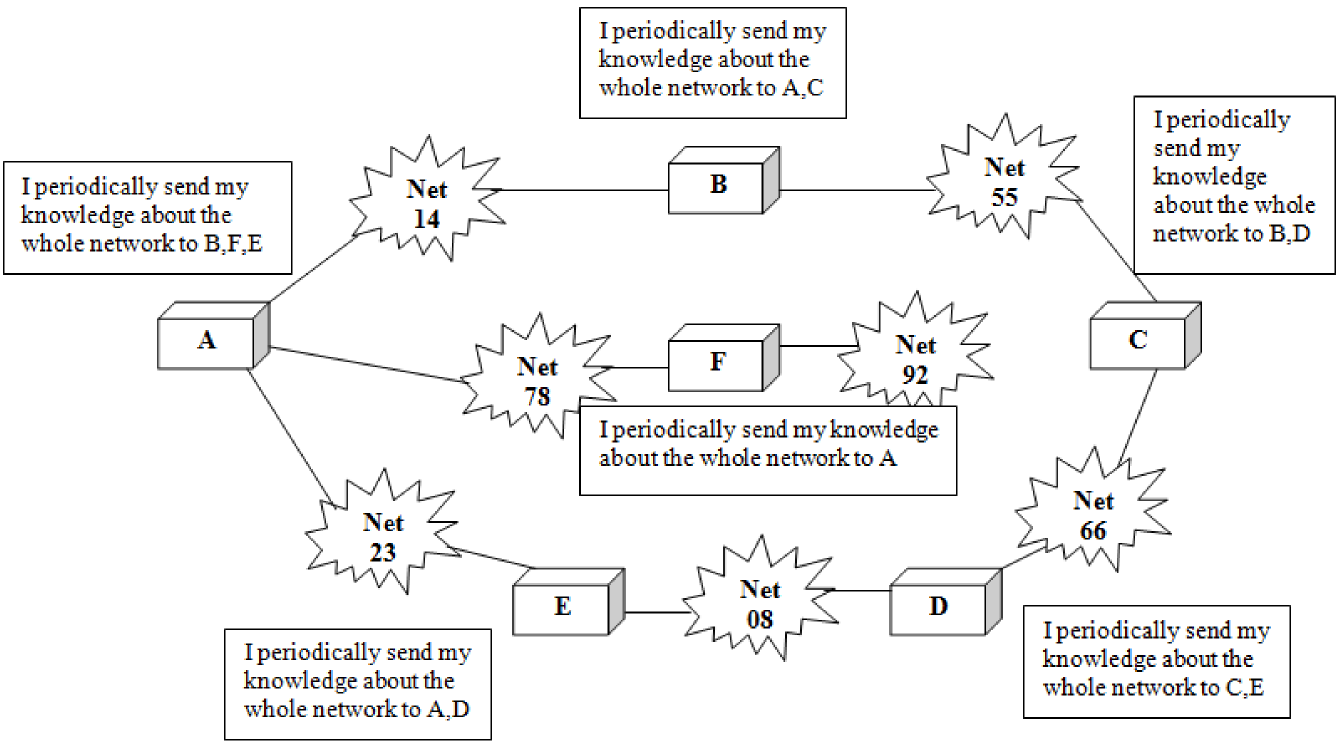
Distance Vector Routing:

In distance vector routing, each router periodically shares its knowledge about the entire network with its neighbors. To understand how distance vector routing works, examine the internet shown in figure below:



In this example, the clouds represent LANs. The number inside each cloud is that LAN's network ID. The LANs are connected by routers represented by the boxes labeled A, B, C, D, E, and F.

Distance vector routing simplifies the routing process by assuming a cost of one unit for every link; therefore the cost is based on hop count. The following figure shows the first step in the algorithm:



A router sends its knowledge to its neighbors. The neighbors add this knowledge to their own knowledge and send the whole table to their own neighbors. In this way, the first router gets its own information back plus new information about its neighbor's other neighbors. Each of these neighbors adds its knowledge and sends the updated table on to its own neighbors and so on. Eventually, every router knows about every other router in the internetwork.

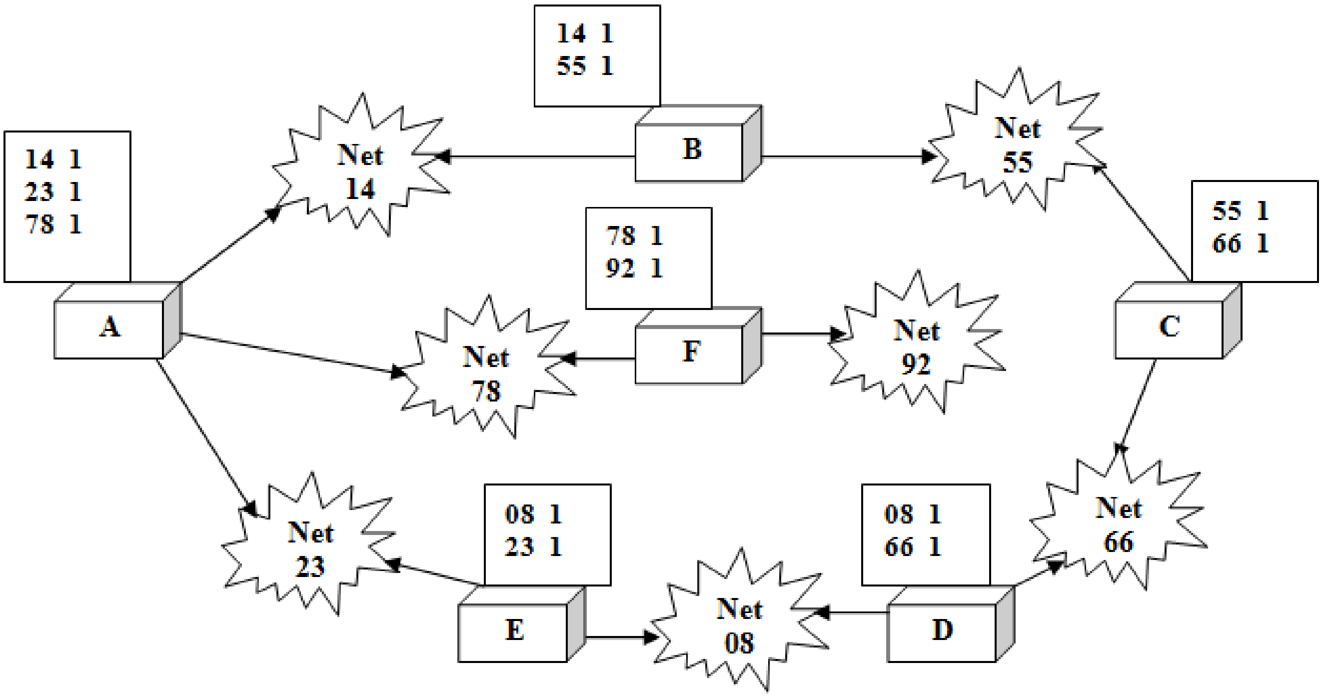
Creating Routing Table:

At start up, a router's knowledge of the internetwork is sparse. All it knows is that it is connected to some number of LANs. Because a router is a station on each of those LANs, it also knows the ID of each station. This information is enough for it to construct its original routing table as shown in table below:

Network ID	Cost	Next Hop
………..	…….	…………….
………..	……..	…………….
………..	……..	…………….
………..	……..	…………….

A routing table has columns for at least three types of information: the network ID, the cost, and the ID of the next router (next hop). The network ID is the final destination of the packet. The cost is the number of hops a packet must make to get there. And the next router is the router to which a packet must be delivered on its way to a particular destination. The table tells a router that it costs x to reach network y via router z.

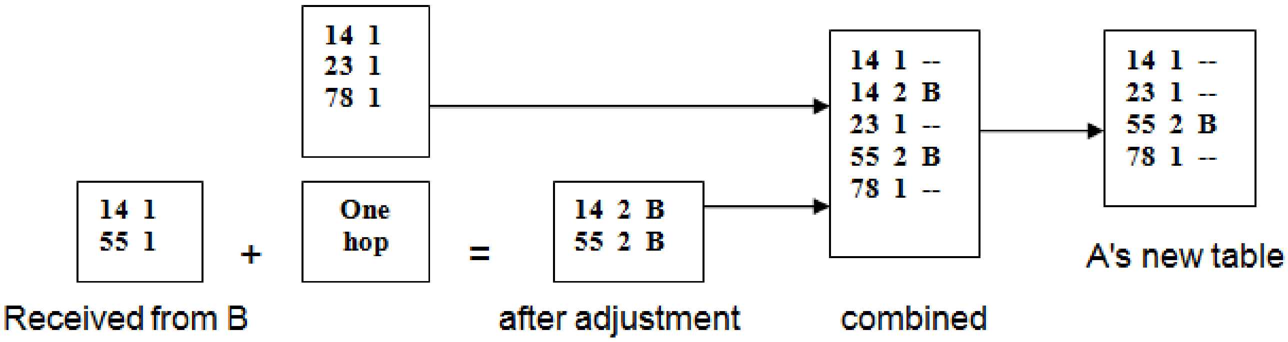
The original routing tables for our sample internetwork are shown in figure below:



At this point, the third column is empty because the only destination networks identified are those attached to the current router. No multiple-hop destinations and therefore no next routers have been identified. These basic tables are sent out to neighbors as shown at figure above.

Updating the Table:

When A receives a routing table from B, it uses the information to update its own table as shown in figure below:



Updating routing table for router (A)

The combined table may contain duplicate data for some network destination. Router A therefore finds and purges any duplications and keep whichever version shows the lowest cost.

For example, as figure above shows, router A can send a packet to network 14 in two ways. The first, which uses no next router, costs one hop. The second, via router B, requires two hops (A to B, then B to 14). The first option has the lower cost; it is kept and the second entry is dropped. This selection process is the reason for the cost column: the cost allows the router to differentiate between various routes to the same destination.

This process continues for all routers. Every router receives information from neighbors and updates its routing table as explained before with following updating algorithm:

Updating Algorithm:

The updating algorithm requires that the router first add one hop to the hop count field for each advertised route. The router should then apply the following rules to each advertised route:

1- If the advertised destination is not in the routing table, the router should add the advertised information to the table.

2- If the advertised destination is in the routing table,

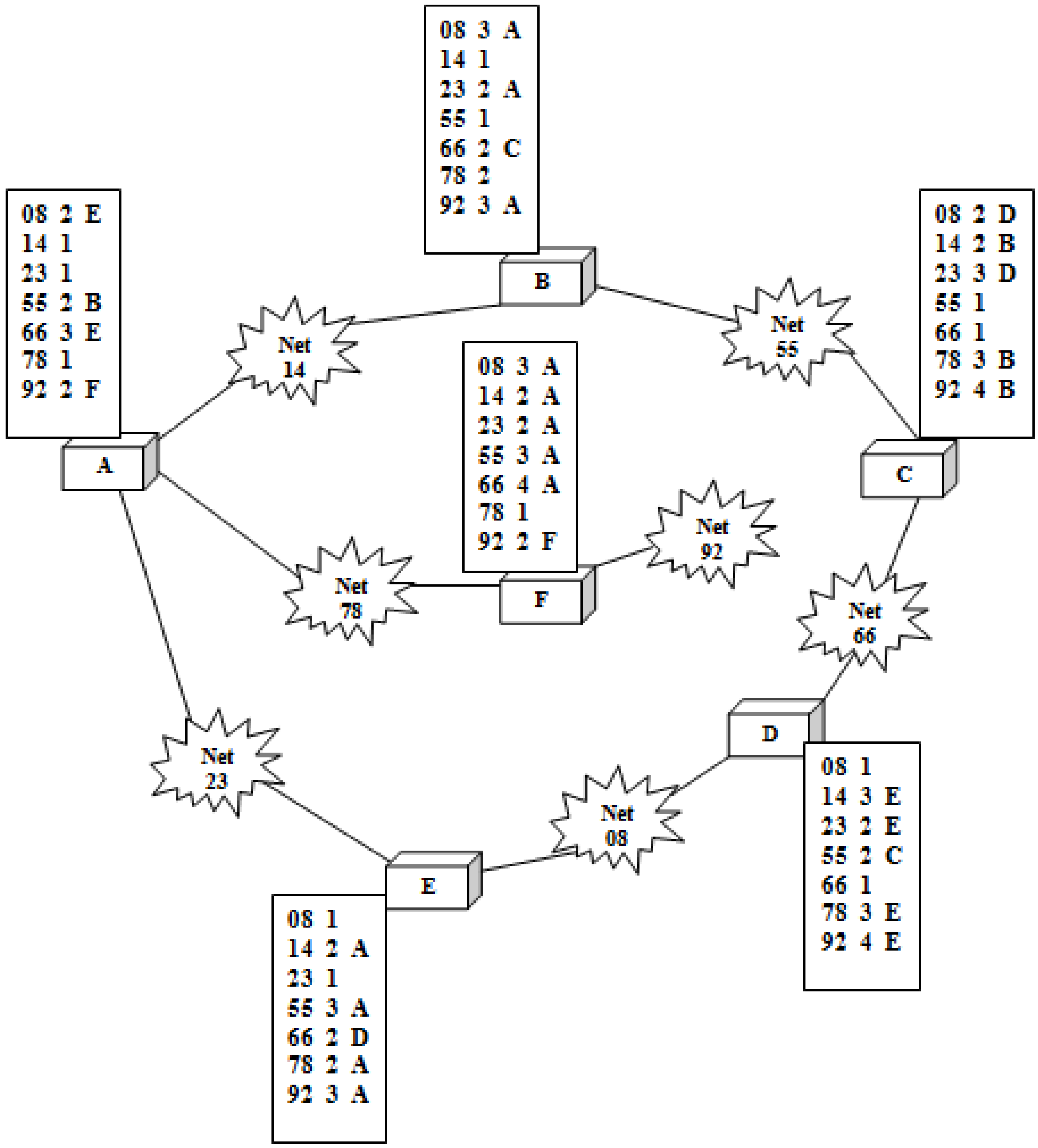
   a- If the next hop field is the same, the router should replace the entry in the table with the advertised one. Note that even if the advertised hop count is larger, the advertised entry should replace the entry in the table because the new information invalidates the old.

   b- If the next hop field is not the same,

      i- If the advertised hop count is smaller than the one in the table, the router should replace the entry in the table with the new one.

      ii- If the advertised hop count is not smaller (same or larger), the router should do nothing.

If there are no more changes, the final table may look like those in following figure:


08 3 A
14 1
23 2 A
55 1
66 2 C
78 2
92 3 A
B
08 2 E
14 1
23 1
55 2 B
66 3 E
78 1
92 2 F
A
08 2 D
14 2 B
23 3 D
55 1
66 1
78 3 B
92 4 B
C
Net 14
Net 55
08 3 A
14 2 A
23 2 A
55 3 A
66 4 A
78 1
92 2 F
F
Net 92
Net 78
Net 66
Net 23
D
08 1
14 3 E
23 2 E
55 2 C
66 1
78 3 E
92 4 E
Net 08
E
08 1
14 2 A
23 1
55 3 A
66 2 D
78 2 A
92 3 A