Link State Routing Protocol (LSR)

Draw back with DVR protocol

-Slow convergence

-Count to infinity Problem

The idea behind link state routing is fairly simple and can be stated as five parts. Each router must do the following things to make it work-

1. Discover its neighbors and learn their network addresses.
2. Set the distance or cost metric to each of its neighbors.
3. Construct a packet telling all it has just learned.
4. Send this packet to and receive packets from all other routers.
5. Compute the shortest path to every other router.

So, the complete topology is distributed to every router. Once the topology is known, then Dijkstra's algorithm can be run at each router to find the shortest path to every other router.

Learning about the Neighbors

- Every router sends a special HELLO packet on each point-to-point line. The router on the other end is expected to send back a reply giving its name.

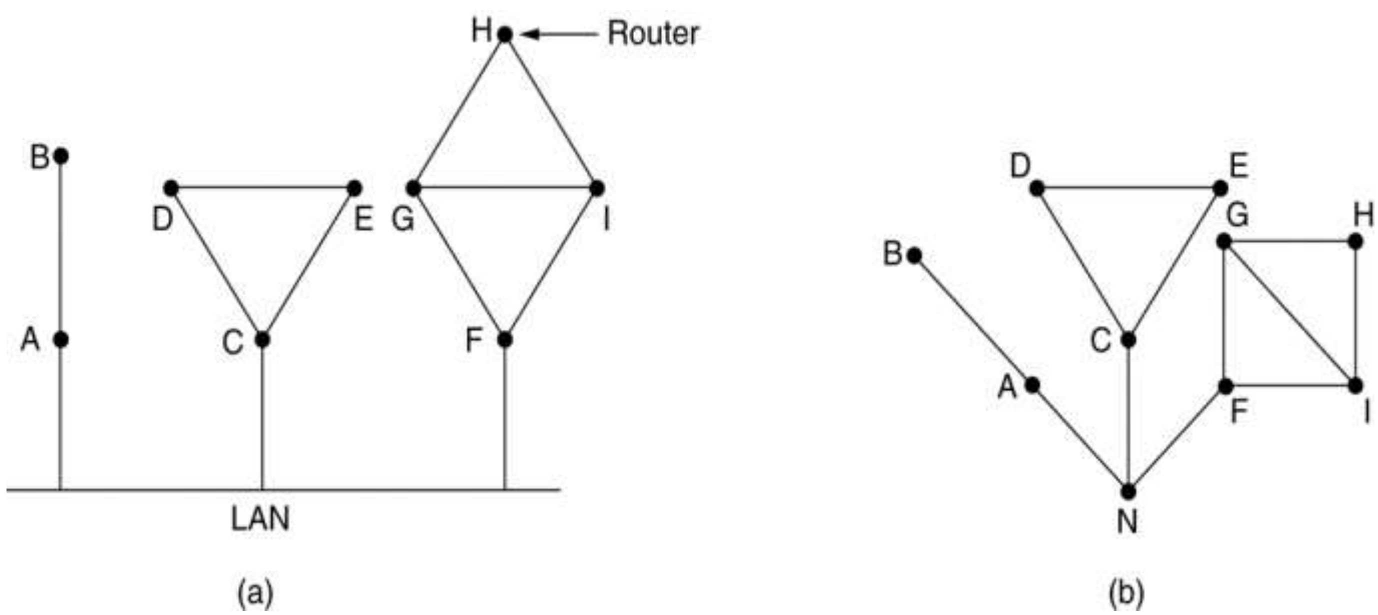

Figure1: (a) A broadcast LAN. (b) A graph model of (a) [1]

Setting Link Costs

- The link state routing algorithm requires each link to have a distance or cost metric for finding shortest paths.
- A common choice is to make the cost inversely proportional to the bandwidth of the link.
- If the network is geographically spread out, the delay of the links may be factored into the cost so that paths over shorter links are better choices.
- The most direct way to determine this delay is to send over the line a special ECHO packet that the other side is required to send back immediately. By measuring the round-trip time and dividing it by two, the sending router can get a reasonable estimate of the delay.

Building Link State Packets

- Once the information needed for the exchange has been collected, each router builds a packet containing all the data.
- The Packet contains the following information

  -Identity of the router

  -Sequence no

  -Age

  -List of neighbors and costs

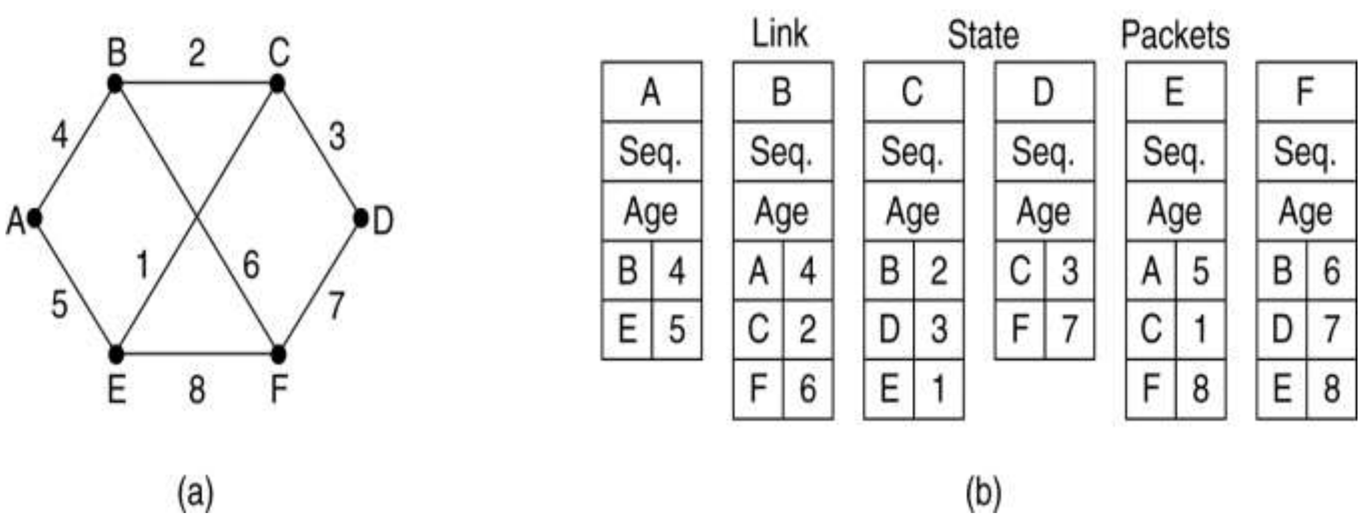

Figure2: (a) A subnet. (b) The link state packets for this subnet [1]

When to build link state packet-

-Periodically

-When some significant event occurs such as –link failure, node failure

Distributing the Link State Packets

Source	Seq.	Age	Send flags A	Send flags C	Send flags F	ACK flags A	ACK flags C	ACK flags F	Data
A	21	60	0	1	1	1	0	0	
F	21	60	1	1	0	0	0	1	
E	21	59	0	1	0	1	0	1	
C	20	60	1	0	1	0	1	0	
D	21	59	1	0	0	0	1	1	

Figure3: The packet buffer for router B in Figure 2(a).

The data structure used by router B for the network shown in Figure 2(a) is depicted in Figure 3. Each row here corresponds to a recently arrived, but as yet not fully processed, link state packet. The table records where the packet originated, its sequence number and age, and the data. In addition, there are send and acknowledgement flags for each of B's three links (to A, C, and F, respectively).

- The send flags mean that the packet must be sent on the indicated link.
- The acknowledgement flags mean that it must be acknowledged there.

In Figure3, the link state packet from A arrives directly, so it must be sent to C and F and acknowledged to A, as indicated by the flag bits. Similarly, the packet from F has to be forwarded to A and C and acknowledged to F.

However, the situation with the third packet, from E, is different. It arrives twice, once via EAB and once via EFB. Consequently, it has to be sent only to C but must be acknowledged to both A and F, as indicated by the bits.

If a duplicate arrives while the original is still in the buffer, bits have to be changed. For example, if a copy of C's state arrives from F before the fourth entry in the table has been forwarded, the six bits will be changed to **100011** to indicate that the packet must be acknowledged to F but not sent there.

Computing the New Routes

Once a router has accumulated a full set of link state packets, it can construct the entire network graph because every link is represented.

Every link is, in fact, represented twice, once for each direction. The different directions may even have different costs. The shortest-path computations may then find different paths rom router A to B than from router B to A.

Now Dijkstra’s algorithm can be run locally to construct the shortest paths to all possible destinations. The results of this algorithm tell the router which link to use to reach each destination. This information is installed in the routing tables, and normal operation is resumed.

Comparison with DVR:

-Requires more memory and computation intensive.

-However, it does not suffer from slow convergence problem

Assignments:

1. Explain the working principle of RIP protocol. Mention the drawbacks.
2. What is OSPF protocol? Explain how routing takes place in OSPF.

Reference

1. A.S. Tanenbaum & D.J. Wetherall, “Computer Networks”, Pearson