Expt 6. Link State Routing

Link state routing is the second family of routing protocols. While distance-vector routers use a distributed algorithm to compute their routing tables, link-state routing uses link-state routers to exchange messages that allow each router to learn the entire network topology. Based on this learned topology, each router is then able to compute its routing table by using the shortest path computation.

Link state routing is a technique in which each router shares the knowledge of its neighbourhood with every other router i.e. the internet work. The three keys to understand the link state routing algorithm.

1. **Knowledge about the neighbourhood**: Instead of sending its routing table, a router sends the information about its neighbourhood only. A router broadcast its identities and cost of the directly attached links to other routers.
2. **Flooding:** Each router sends the information to every other router on the internetwork except its neighbours. This process is known as flooding. Every router that receives the packet sends the copies to all the neighbours. Finally each and every router receives a copy of the same information.
3. **Information Sharing**: A router send the information to every other router only when the change occurs in the information.

Features of Link State Routing Protocols

- **Link State Packet:** A small packet that contains routing information.
- **Link-State Database:** A collection of information gathered from the link-state packet.
- **Shortest Path First Algorithm (Dijkstra algorithm):** A calculation performed on the database results in the shortest path
- **Routing Table:** A list of known paths and interfaces.

Calculation of Shortest Path

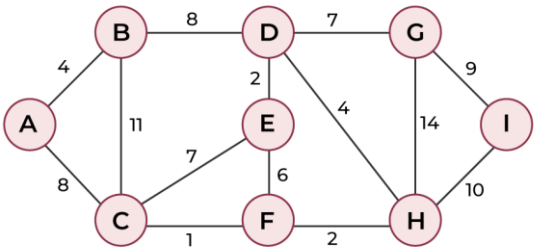
To find the shortest path, each node needs to run the famous Dijkstra algorithm. Let us understand how can we find the shortest path using an example.

Illustration

To understand the Dijkstra Algorithm, let's take a graph and find the shortest path from the source to all nodes.

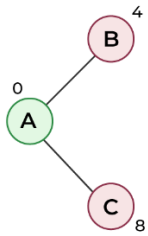
Note: We use a boolean array **sptSet[]** to represent the set of vertices included in SPT. If a value **sptSet[v]** is true, then vertex v is included in SPT, otherwise not. Array **dist[]** is used to store the shortest distance values of all vertices.

Consider the below graph and src = 0.

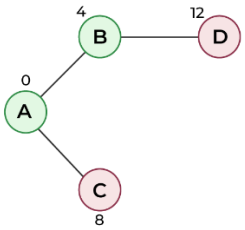


STEP 1: The set sptSet is initially empty and distances assigned to vertices are {0, INF, INF, INF, INF, INF, INF, INF} where INF indicates infinite. Now pick the vertex with a minimum distance value. The vertex 0 is picked and included in sptSet. So sptSet becomes {0}. After including 0 to sptSet, update the distance values of its adjacent vertices. Adjacent vertices of 0 are 1 and 7. The distance values of 1 and 7 are updated as 4 and 8.

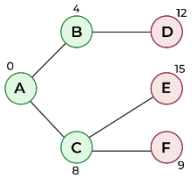
The following subgraph shows vertices and their distance values. Vertices included in SPT are included in GREEN color.



STEP 2: Pick the vertex with minimum distance value and not already included in SPT (not in sptSET). The vertex 1 is picked and added to sptSet. So sptSet now becomes {0, 1}. Update the distance values of adjacent vertices of 1. The distance value of vertex 2 becomes 12.

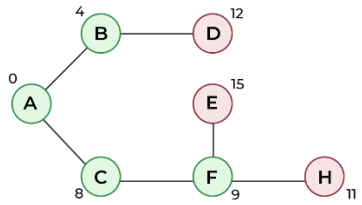


STEP 3: Pick the vertex with minimum distance value and not already included in SPT (not in sptSET). Vertex 7 is picked. So sptSet now becomes {0, 1, 7}. Update the distance values of adjacent vertices of 7. The distance value of vertex 6 and 8 becomes finite (15 and 9 respectively).

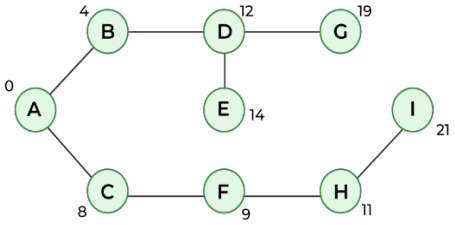


STEP 4: Pick the vertex with minimum distance value and not already included in SPT (not in sptSET). Vertex 6 is picked. So sptSet now becomes {0, 1, 7, 6}. Update the

distance values of adjacent vertices of 6. The distance value of vertex 5 and 8 are updated.



We repeat the above steps until sptSet includes all vertices of the given graph. Finally, we get the following Shortest Path Tree (SPT).



Characteristics of Link State Protocol

- It requires a large amount of memory.
- Shortest path computations require many CPU circles.
- If a network uses little bandwidth; it quickly reacts to topology changes
- All items in the database must be sent to neighbours to form link-state packets.
- All neighbours must be trusted in the topology.
- Authentication mechanisms can be used to avoid undesired adjacency and problems.
- No split horizon techniques are possible in the link-state routing.
- OSPF Protocol