

3.2 LINK-STATE ROUTING

A routing algorithm that directly creates least-cost trees and forwarding tables is link state (LS) routing. This method uses the term link-state to define the characteristic of a link (an edge) that represents a network in the internet.

Link-State Database (LSDB)

To create a least-cost tree with this method, each node needs to have a complete map of the network, which means it needs to know the state of each link. The collection of states for all links is called the link-state database (LSDB) as in figure 3.2.1.

Example for LSDB

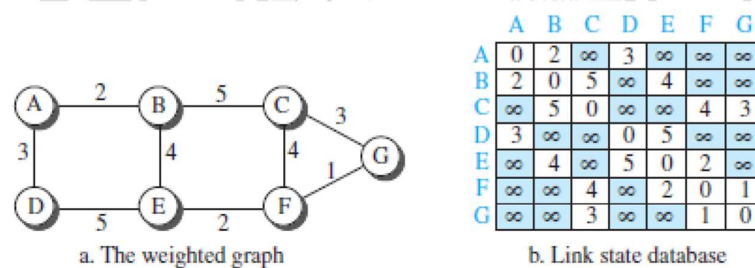


Fig3.2.1: Example Link state data base.

[Source : "Data Communications and Networking" by Behrouz A. Forouzan, Page-604]

This method is called flooding.

Each node can send some greeting messages to all its immediate neighbors (those nodes to which it is connected directly) to collect two pieces of information for each neighboring node: the identity of the node and the cost of the link.

The combination of these two pieces of information is called the LS packet (LSP); the LSP is sent out of each interface, as shown in Figure 3.2.2.

When a node receives an LSP from one of its interfaces, it compares the LSP with the copy it may already have. If the newly arrived LSP is older than the one it has (found by checking the sequence number), it discards the LSP. If it is newer or the first one received, the node discards the old LSP (if there is one) and keeps the received one. It then sends a copy of it out of each interface except the one from which the packet arrived.

This guarantees that flooding stops somewhere in the network (where a node has only one interface).

After receiving all new LSPs, each node creates the comprehensive LSDB as shown in Figure 3.2.2. This LSDB is the same for each node and shows the whole map of the internet. A node can make the whole map if it needs to, using this LSDB.

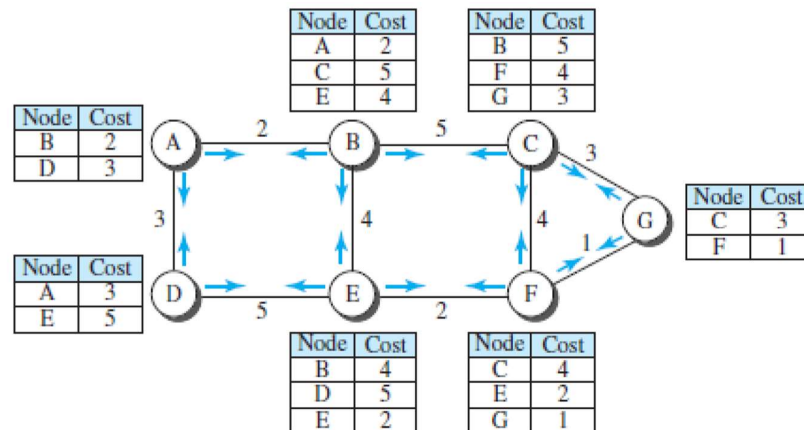


Fig3.2.2:Creation of LSP.

[Source : "Data Communications and Networking" by Behrouz A. Forouzan,Page-605]

Note:

In the distance-vector routing algorithm, each router tells its neighbors what it knows about the whole internet; in the link-state routing algorithm, each router tells the whole internet what it knows about its neighbors.

Formation of Least-Cost Trees

To create a least-cost tree for itself, using the shared LSDB, each node needs to run the famous Dijkstra Algorithm. It is illustrated in figure 3.2.3.

This algorithm uses the following steps:

- 1.The node chooses itself as the root of the tree, creating a tree with a single node, and sets the total cost of each node based on the information in the LSDB.
- 2.The node selects one node, among all nodes not in the tree, which is closest to the root, and adds this to the tree. After this node is added to the tree, the cost of all other nodes not in the tree needs to be updated because the paths may have been changed.
- 3.The node repeats step 2 until all nodes are added to the tree.

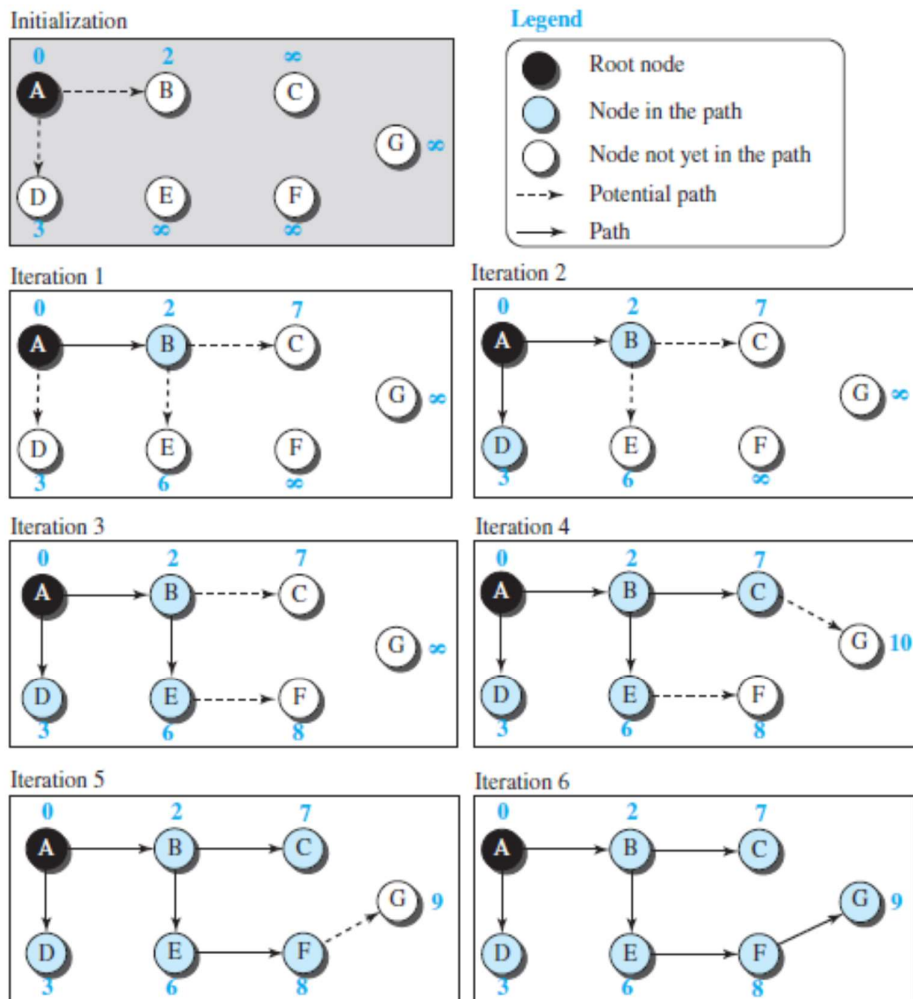


Fig3.2.3: Least Cost Tree.

[Source : "Data Communications and Networking" by Behrouz A. Forouzan, Page-607]

