Lesson 27
Routing II
Objective

To explain the concept of same popular routing protocols.

8.2.1 Routing Information Protocol (RIP)

This protocol is used inside our autonomous system and is based on distance vector routing using the Bellman-Ford algorithm for calculating the distance between nodes (routers). The routing tables at every node are updated every 30 seconds by transmitting routing table updates. The distance vector metric can be number of hops or time delay. The router has a table indicating the distance to each of its neighbor. The table at a router (node) has the first column to show the distance vector metric. The third column in the table indicates the next node.

Let us consider a network as shown in Fig. 8.2.1 with distance metric (cost) shown as labels on the links. A’s table indicates cost from A to different nodes (routers). For simplicity direct one hop cost is considered. Here, thus there is no question of next node. No connection or path via another node implies the cost to be infinity. Usually the minimum cost via the next node to is entered in the table when the route is via next node to destination.

These tables are updated when a neighbor sends an update. This is shown in Fig.8.2.2. Let us consider, C sends an update to A. The table at A is modified by taking A’s old table and C’s input. For example, the cost from A to B was 4 in the old table. The cost from C to B as per information sent by C is 4. Cost from A to C in old table is 3. Thus the modified entry from A to B via C is 7 (3+4). Similarly all entries in the table are modified. Now the entries in the old table are compared with those in the modified table as shown. A new routing table at A is prepared by taking the smaller of the two costs.

This process has to be continued for every update. This is how information from neighbors is shared. The maximum number of hops in RIP in an autonomous system is limited to 15. Thus 16 hops all defined as infinity. The neighbor node or the link is considered dead if a node does not hear anything from it for 180 seconds.

Topology changes in network are also communicated to the routers using the update vectors in the same manner as explained above. RIP is slow to react when a node fails.
8.2.2 Open Shortest Path First (OSPF)

This is another interior routing protocol that is quite popular because of the drawbacks of RIP. To handle routing efficiently and in a timely manner, OSPF divides an autonomous system into areas. Area is a collection of networks within an autonomous system. Routers inside an area flood the area with routing information. At the border of an area, special routers called area border routers summarize the information about the area and send it to other areas. There is a special area within the autonomous system known as backbone. All the areas inside an autonomous system must be connected to the backbone. The routers within a backbone are known as backbone routers. A backbone router can also be an area border router. Each area has an area identification number. The area ID for the backbone is zero.
Link State Routing

Central to the operation of OSPF is the use of the link-state routing, which is used by each router to share knowledge about its neighbor. The three keys to understanding how this method works are as follows:

1. **Sharing knowledge about the neighborhood.** Each router sends the state of its neighborhood to every other router in the area.

2. **Sharing with every other router.** Each router sends the state of its neighborhood to every other router in the area by a process known as **flooding**. Each neighbor sends the packets to all its neighbors and so on. Every router that receives the packet sends copies to its neighbors. Eventually every router has received a copy of the same information.

3. **Sharing when there is no change.** Each router shares information only when there is a change. This rule contrasts with distance vector routing, where information is sent out at regular intervals regardless of change. This characteristic results in a lower traffic than required by distance vector routing.
**OSPF Overview**

In OSPF terminology, a connection is called a link. Four types of links are defined: point-to-point, transient, stub and virtual. The purpose of the link (network) is just to connect two routers.

A transient system is a network with several routers attached to it. The data can enter through any one router and leave through any router. In this case each router has many neighbors. A stub link is a network that is connected to only one router. The data packets enter the network through this single router and leave the network through this same router. The link between the router and the network is directed only from the router to the network. A point to point links connects two routers without any other host or router in between. A virtual link may be created when a link between two routers is broken.

A transient network carries data that neither originates nor terminates on an end system attached to this network.

OSPF uses Dijkstra’s link state based routing. This algorithm results in a least cost shortest path route. The algorithm is based on finding the closest node to the source node which may either be a direct path between the two nodes or it may include a path containing a source node and the closest intermediate nodes plus a direct link from the last intermediate closest node to the next closest node.

In Dijkstra’s algorithm each node must have complete topological information about the network. So each node has to know the links costs of all links in the network. In the Bellman-Ford algorithm a node has to know the link costs only from its neighbors. OSPF is used for large heterogeneous IP network.

**Questions**

1. Explain the RIP algorithm.
2. Discuss features of the OSPF algorithm
3. Compare the distance vector routing and the link state routing.
4. Compare RIP and OSPF routing techniques.