REVERSE-PATH BROADCASTING

The easiest way to understand reverse-path multicasting is by first considering a simpler approach called reverse-path broadcasting (RPB). RPB uses the fact that the set of shortest paths to a node forms a tree that spans the network. See Figure 1.29. The operation of RPB is very simple:

Upon receipt of a multicast packet, a router records the source address of the packet and the port the packet arrives on.

If the shortest path from the router back to the source is through the port the packet arrived on, the router forwards the packet to all ports except the one the packet arrived on; otherwise, the router drops the packet. The port over which the router expects to receive multicast packets from a given source is referred to as the parent port.

The advantages of RPB are that routing loops are automatically suppressed and each packet is forwarded by a router exactly once. The basic assumption underlying the RPB algorithm is that the shortest path from the source to a given router should be the same as the shortest path from the router to the source. This assumption requires each link to be symmetric (each direction has the same cost). If links are not symmetric, then the router must compute the shortest path from the source to the router. This step is possible only if link-state protocols are used.

To see how RPB works for the network shown in Figure 8.53, assume that source S transmits a multicast packet with group G1. The parent ports for this multicast group are identifed in bold numbers, as shown in Figure 8.53.

First

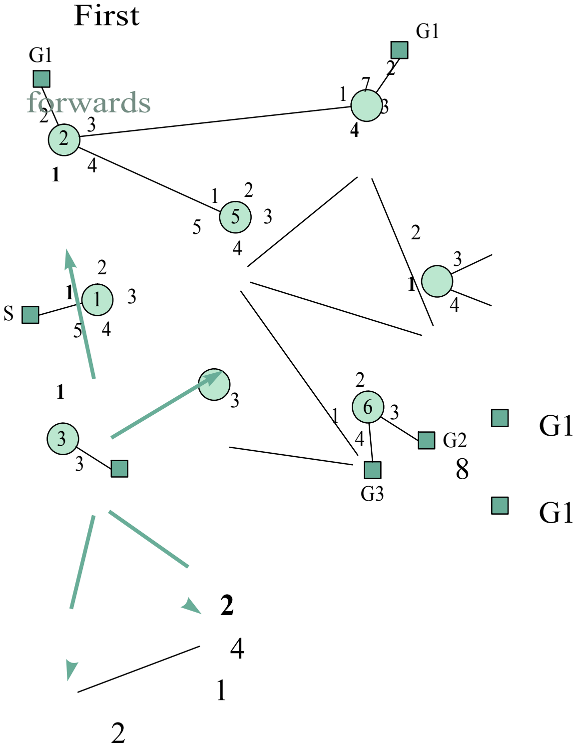

FIGURE 4.53 Router 1 forwards the packet

router 1 receives a packet on port 1 from source S. Because the packet comes from the parent port, the router forwards the packet to all other ports.

Assume that these packets reach routers 2, 3, 4, and 5 some time later. Router 2 computes the shortest path from itself to S and finds that the parent port is port 1. It then forwards the packet through all other ports. Similarly, routers 3, 4, and 5 find that the packet arrives on the parent ports. As a result, each router forwards the packet to its other ports, as shown in Figure 8.54. Note that the bidirectional link indicates that each router forwards the packet to the other.

Next assume that the packets arrive at routers 2 through 8. Because router 2 receives the packet from port 4, which is not the parent port, router 2 drops the packet. Routers 3, 4, and 5 also drop the packet for the same reason. Router 6,however, finds that the parent port is port 1, so router 6 forwards the packet coming from router 4 to its other ports. The packet that came from router 5 to router 6 is dropped. Routers 7 and 8 forward the packet that came from router 5. Figure 8.55 illustrates the process pictorially. The reader should verify that the packet will no longer be propagated after this point.

Note that although the hosts connected to routers 3 and 6 belong to different multicast groups, the packets for group G1 are still forwarded by these routers. Typically, these hosts are attached to the router via a shared medium LAN.

Therefore, unnecessary bandwidth is wasted regardless of the multicast group.

This problem can be solved by having the router truncate its transmission to the local network if none of the hosts attached to the network belong to the multicast group. This refinement is called truncated reverse-path broadcasting (TRPB).

Note that TRPB performs truncation only at the ``leaf'' routers (routers at the edge of the network). The next section describes a protocol that allows a router to determine which hosts belong to which multicast groups.