

## Multicast trees

Multicast routing is about building forwarding trees from the sender  $S$  to the group  $G$  of receivers or listeners (in IGMP we talk about loyal members). Most efficiently is of course a Shortest Path Tree (SPT). In an SPT each path from the root to all the end nodes is the shortest possible in some sense.

The multicast routing protocol uses either source-based trees or group-shared trees. In some cases, like PIM, first a group-shared tree can be built but routing can build source-based tree later in the process if found more efficient.

## Source-based trees

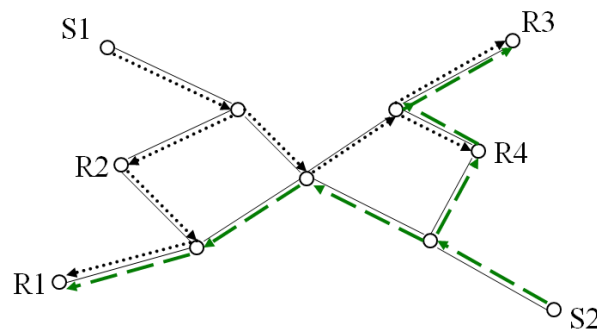


Figure 1 A multicast group using source-based trees, one per active sender

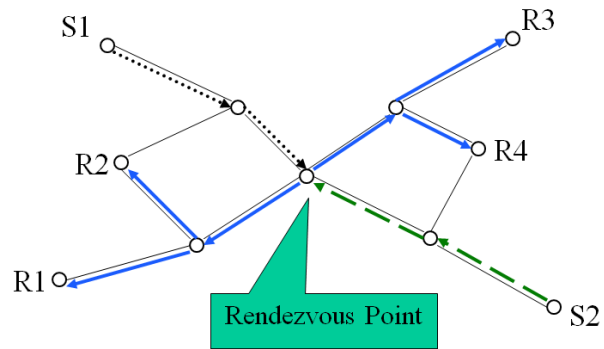
In the source based-tree approach there is one tree built per active sender in the group. Each tree can therefore be defined by the sender id and the group id, or  $(S,G)$ . All the trees are shortest path trees with the root in the multicast router closest to the sender. All other multicast routers in have to keep track of all the  $(S,G)$  trees it is involved in. Some of the trees in a group might well overlap. This is of course inefficient from the router's performance perspective, but since all trees are SPTs it is beneficial from the delivery perspective.

In Figure 1 we see a group's source-based trees. There are two trees because there are two active senders in the group. If the group's id is  $Q$  the two trees will be denoted  $(S1,Q)$  and  $(S2,Q)$ . As can be seen both trees are shortest path trees, but also that they partly overlap.

## Group-shared trees

The group-shared tree approach is more efficient from the router performance perspective. Only one tree is built for each group. The tree has its root in a designated router called rendezvous point (RP) or core router. All senders in a group forward their multicast datagrams to the RP encapsulated in unicast datagrams. The RP decapsulates the unicast and forwards the multicast datagrams along the tree. Since there are many senders in a group  $G$ , a group-shared tree is denoted  $(*,G)$ .

The RP is responsible for the shaping of a shortest path tree to all receivers with the RP as root. Other routers involved in the delivery of this group's multicast datagrams do not build any trees, but of course they have to have control over how their part of the tree is constructed.



**Figure 2** In a group-shared tree all senders in the group use the same tree. The dotted and dashed paths show how the senders send multicast datagrams to the rendezvous point encapsulated in unicast datagrams.

In Figure 2 the same group as in Figure 1 is shown, but this time a group-shared tree is formed. Senders S1 and S2 send their multicast datagrams to the RP as unicasts. The RP decapsulates and delivers the multicast datagram to the receivers along the shared tree. In this case the delivery path from S1 to R2 is not a shortest path, but the path from the RP to R2 is.