The Internet Group Management Protocol (IGMP) allows a host to signal its multicast group membership to its attached router. IGMP runs directly on IP using protocol type 2. However, IGMP is usually considered as part of IP. The IGMP message format is very simple, as can be seen from Figure 8.56.

A description of each field follows.

Version: This field identifies the version number.

Type: This field identifies the message type. There are two message types:

Type 1 indicates a query message sent by a router, and type 2 indicates a report sent by a host.

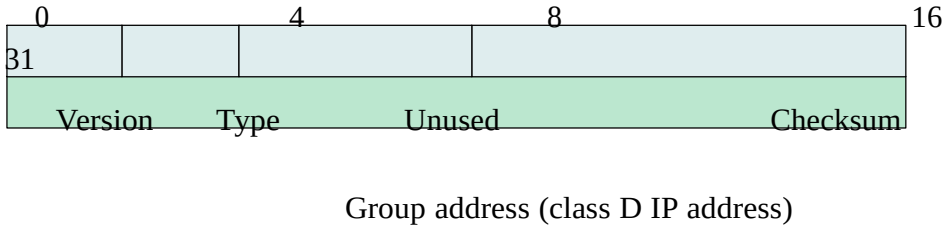

FIGURE 4.56 IGMP message format

Unused: This field must be set to zero.

Checksum: This field contains a checksum for all eight bytes of the IGMP message.

Group Address: This address is the class D IPv4 address. This field is set to zero in a query message, and is set to a valid group address in the response.

When a host wants to join a new multicast group, the host sends an IGMP report specifying the group address to join. The host needs to issue only one IGMP report, even though multiple

applications are joining the same group. The host does not issue a report if it wants to leave the group.

To make sure that multiple hosts do not send a report at the same time when receiving a query that would lead to a collision, the scheduled transmission time should be randomized. Because the router only has to know that at least one host belongs to a particular group, efficiency can be improved by having a host monitor if another host sends the same report earlier than its scheduled transmission. If another host has already sent the same report, the first host cancels its report.

Reverse-Path Multicasting:

As section 8.8.2 just explained IGMP allows hosts to indicate their group members. We now continue with selective multicast routing called reverse-path multicasting (RPM), which is an enhancement of TRPB. Unlike TRPB, RPM forwards a multicast packet only to a router that will lead to a leaf router with group members. Each router forwards the first packet for a given (source, group) according to TRPB. All leaf routers receive at least the first multicast packet. If a leaf router does not find a member for this group on any of its ports, the leaf router will send a prune message to its upstream router instructing the upstream router not to forward subsequent packets belonging to this (source, group). If the upstream router receives the prune messages from all of its downstream neighbors, it will in turn generate a prune message to its further upstream router.

A host may later decide to join a multicast group after a prune message has been sent by its leaf router. In this case the leaf router would send a graft message to its upstream router to cancel its earlier prune message. Upon receiving the graft message, the first

upstream router will forward subsequent multicast pack- ets to this leaf router. If the first upstream router has also sent a prune message earlier, the first upstream router will send a graft message to the second upstream router. Eventually, a router in the multicast tree will reactivate its affected port so that the multicast packets will travel downstream toward the host. Figure 8.57 shows the grafting message flow when a host attached to router 6 wants to join the group. Subsequently, router 1 will forward the multicast packets to router 4, which will forward the multicast packets to router 6. Eventually, the multicast packets arrive at the host.