Chapter 13:
IGMP: Internet Group Management Protocol

Introduction

- ***Internet Group Management Protocol*** **(IGMP):**
  - used by hosts and routers that support multicasting.
  - lets all the systems on a physical network know which hosts currently belong to which multicast groups.
  - is considered part of the IP layer
  - IGMP messages are transmitted in IP datagrams.
  - has a fixed-size message, with no optional data.
  - messages are specified in the IP datagram with a protocol value of 2.

IGMP Message

- The IGMP ***version*** is 1
- The ***type*** of 1 is a query, sent by a multicast router, and 2 is a response sent by a host.
- The ***checksum*** is calculated in the same manner as the ICMP checksum.
- The ***group address*** is a class D IP address. In a query the group address is set to 0, and in a report it contains the group address being report.

IGMP Protocol (Cont.)

- **Joining a Multicast Group:**
  - Membership in a group is associated with an *interface*.
  - A process can join the same group on multiple interfaces.
  - A host identifies a group by the *group address* and the *interface*.
- **IGMP Reports and Queries: IGMP message are used by multicast routers to keep track of group membership on each of the router's physically attached networks.**
  - A host sends an IGMP report when the first process joins a group
  - A host does not send a report when process leave a group, even when the last process leaves a group.
  - A multicast router sends an IGMP query at regular intervals to see if any hosts still have processes belonging to any groups.
  - A host responds to an IGMP query by sending one IGMP report for each group that still contains at least one process.

IGMP Protocol (Cont.)

- **Two IGMP messages: report sent by hosts, and queries sent by routers. The router is asking each host to identify each group on that interface.**
- **An ICMP error is never generated in response to a datagram destined to a multicast address.**

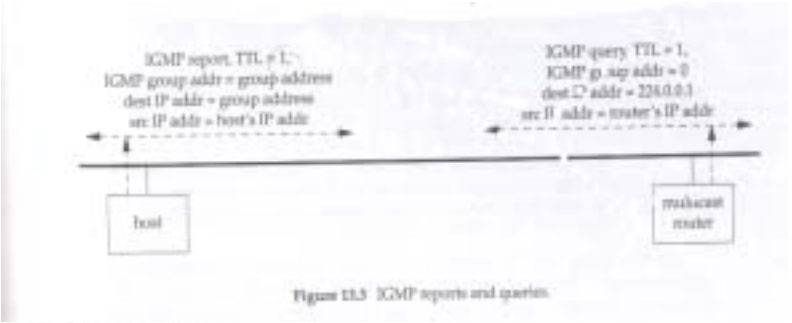

Figure 13.3 IGMP reports and queries.

IGMP Protocol (Cont.)

- **Time-to-Live Field**
  - TTL of 0 is restricted to the same host.
  - TTL of 1 (default) is restricted to the same subnet.
  - Multicast routers do not generate ICMP "time exceeded" errors when the TTL reaches 0.
  - Increasing the TTL an application can perform an expanding ring search for a particular server.
  - The special range of address 224.0.0.0 through 224.0.0.255 is intended for applications that never need to multicast further than one hop. A multicast router should never forward a datagram with one of these addresses as the destination.
- ***All-Hosts* Group Address: 224.0.0.1**
  - It refers to all the multicast-capable hosts and routers on a physical network.
  - Membership of this group is never reported (i.e., automatically join).

An Example

- **IP multicasting support to the host sun.**

```
sun % netstat -nia
Name  Mtu   Network     Address           Ipkts Ierrs   Opkts Oerrs  Coll
le0   1500  140.252.13. 140.252.13.33     4370     0    4924     0     0
                        224.0.0.1
                        08:00:20:03:f6:42
                        01:00:5e:00:00:01
sl0   552   140.252.1   140.252.1.29     13587     0   15615     0     0
                        224.0.0.1
lo0   1536  127         127.0.0.1         1351     0    1351     0     0
                        224.0.0.1
```


An Example (Cont.)

- **Join the group 224.1.2.3 on the Ethernet interface (140.252.13.33).**

```
sun % netstat -nia
Name  Mtu   Network     Address           Ipkts Ierrs   Opkts Oerrs  C
le0   1500  140.252.13. 140.252.13.33     4374     0    4929     0
                        224.1.2.3
                        224.0.0.1
                        08:00:20:03:f6:42
                        01:00:5e:01:02:03
                        01:00:5e:00:00:01
sl0   552   140.252.1   140.252.1.29     13862     0   15943     0
                        224.0.0.1
lo0   1536  127         127.0.0.1         1360     0    1360     0
                        224.0.0.1
```

Multicast Router Example

- Add group 224.9.9.9

```
 1    0.0                  sun > 224.0.0.4: igmp report 224.0.0.4
 2    0.00 (  0.00)        sun > 224.0.0.1: igmp query
 3    5.10 (  5.10)        sun > 224.9.9.9: igmp report 224.9.9.9
 4    5.22 (  0.12)        sun > 224.0.0.1: igmp query
 5    7.90 (  2.68)        sun > 224.1.2.3: igmp report 224.1.2.3
 6    8.50 (  0.60)        sun > 224.0.0.4: igmp report 224.0.0.4
 7   11.70 (  3.20)        sun > 224.9.9.9: igmp report 224.9.9.9
 8  125.51 (113.81)        sun > 224.0.0.1: igmp query
 9  125.70 (  0.19)        sun > 224.9.9.9: igmp report 224.9.9.9
10  128.50 (  2.80)        sun > 224.1.2.3: igmp report 224.1.2.3
11  129.10 (  0.60)        sun > 224.0.0.4: igmp report 224.0.0.4
12  247.82 (118.72)        sun > 224.0.0.1: igmp query
13  248.09 (  0.27)        sun > 224.1.2.3: igmp report 224.1.2.3
14  248.69 (  0.60)        sun > 224.0.0.4: igmp report 224.0.0.4
15  255.29 (  6.60)        sun > 224.9.9.9: igmp report 224.9.9.9
```

Figure 13.5 tcpdump output while multicast routing daemon is running.

Summary

- Multicasting is a way to send a message to multiple recipients.
- Broadcasting is often restricted to a single LAN, multicasting could be used instead of broadcasting for many applications that use broadcasting today.
- A problem that has not been completely solved is multicasting across wide area networks.