TCP/IP 通訊協定及應用

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Chapter 13:
IGMP: Internet Group Management Protocol

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Introduction

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

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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.
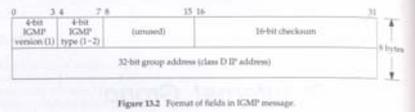

Figure 13.2 Format of fields in IGMP message.

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IGMP Protocol

- Joining a Multicast Group : 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 IMGP 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.

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IGMP Protocol

- 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.
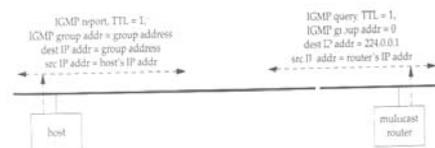
Figure 13.3 IGMP reports and queries.

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IGMP Protocol

- 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.
- All-Hosts Group: IP address of 224.0.0.1 is called the *all-hosts* group address. It refers to all the multicast-capable hosts and routers on a physical network.

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

- 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.