

TCP/IP 通訊協定及應用

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<http://wmlab.csie.ncu.edu.tw/course/tcp>

We provide
無線網路多媒體實驗室
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Solution

Chapter 13:

IGMP: Internet Group

Management Protocol

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.

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.

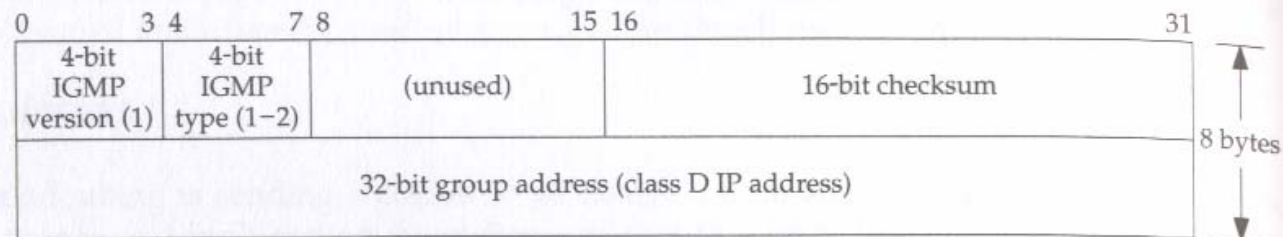


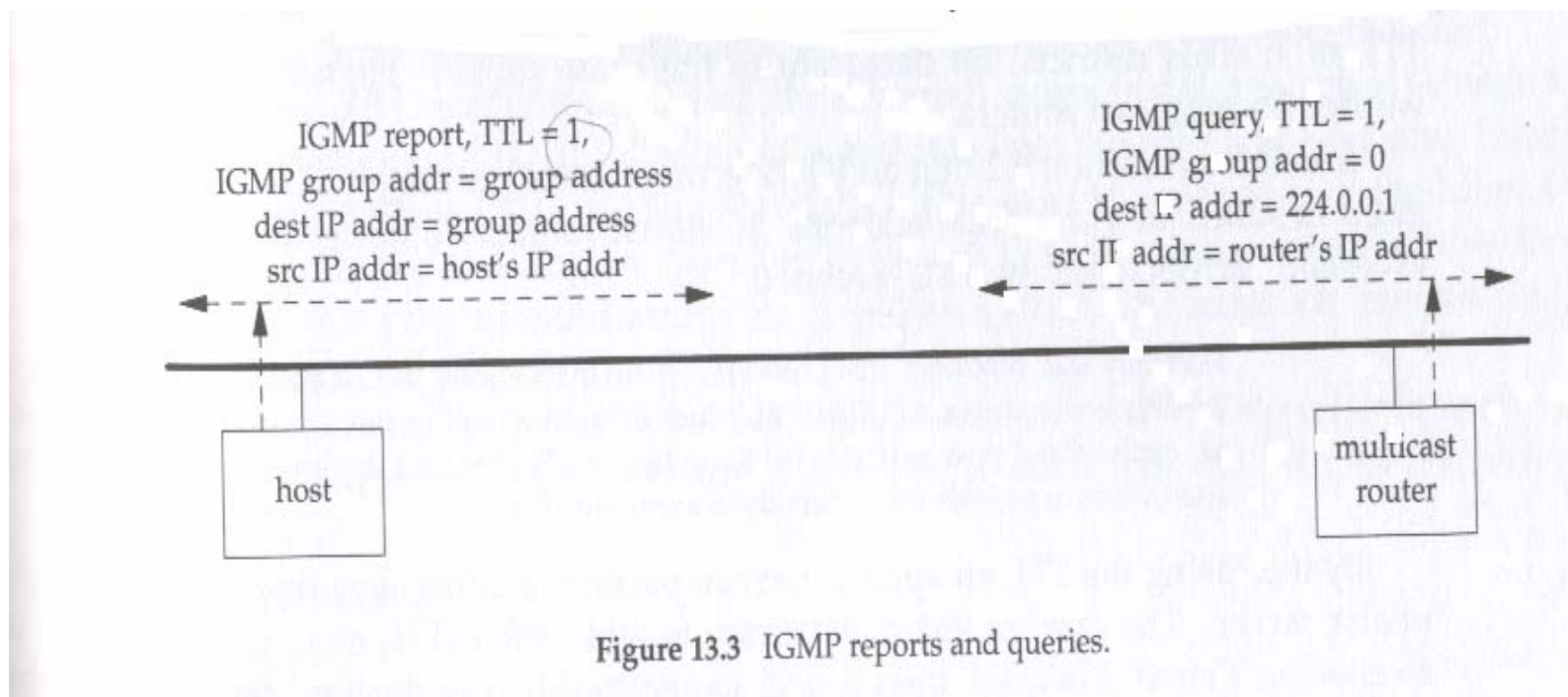
Figure 13.2 Format of fields in IGMP message.

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.

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.



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.	140.252.13.33 224.0.0.1 08:00:20:03:f6:42 01:00:5e:00:00:01	4370	0	4924	0	0
sl0	552	140.252.1	140.252.1.29 224.0.0.1	13587	0	15615	0	0
lo0	1536	127	127.0.0.1 224.0.0.1	1351	0	1351	0	0

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
slo    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.