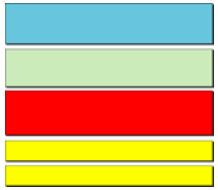


Chapter 10

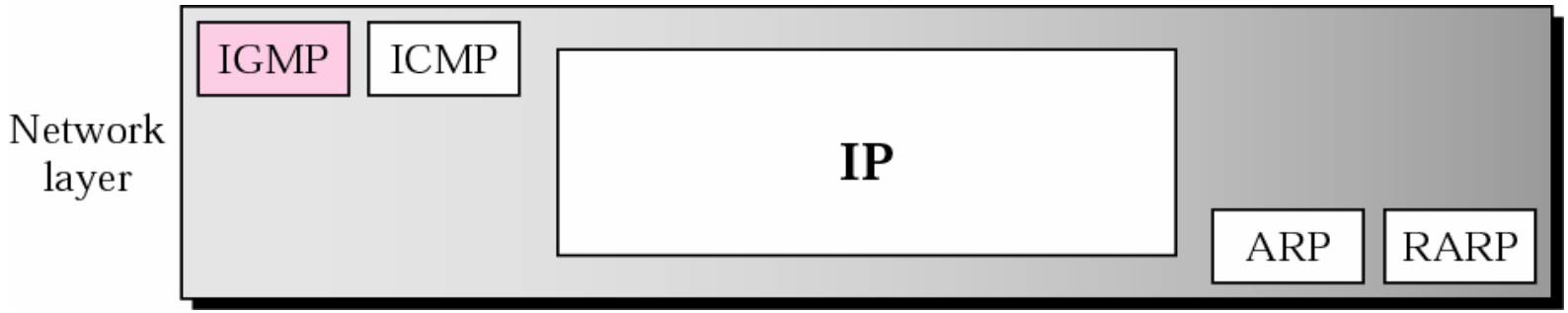
Internet Group Management Protocol

Objectives

Upon completion you will be able to:

- *Know the purpose of IGMP*
- *Know the types of IGMP messages*
- *Understand how a member joins a group and leaves a group*
- *Understand membership monitoring*
- *Understand how an IGMP message is encapsulated*
- *Understand the interactions of the modules of an IGMP package*

Figure 10.1 *Position of IGMP in the network layer*



10.1 GROUP MANAGEMENT

IGMP is a protocol that manages group membership. The IGMP protocol gives the multicast routers information about the membership status of hosts (routers) connected to the network. .

IGMP is a group management protocol. It helps a multicast router create and update a list of loyal members related to each router interface.

10.2 IGMP MESSAGES

IGMP has three types of messages: the query, the membership report, and the leave report. There are two types of query messages, general and special.

The topics discussed in this section include:

Message Format

Figure 10.2 *IGMP message types*

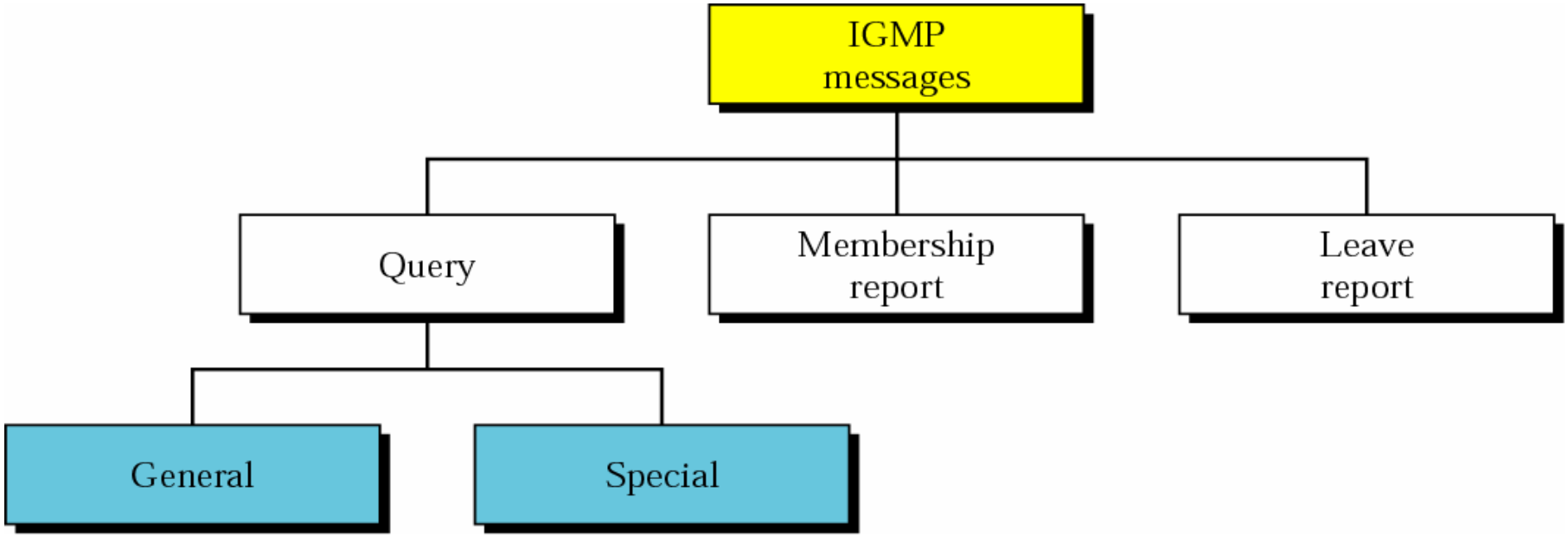


Figure 10.3 *IGMP message format*

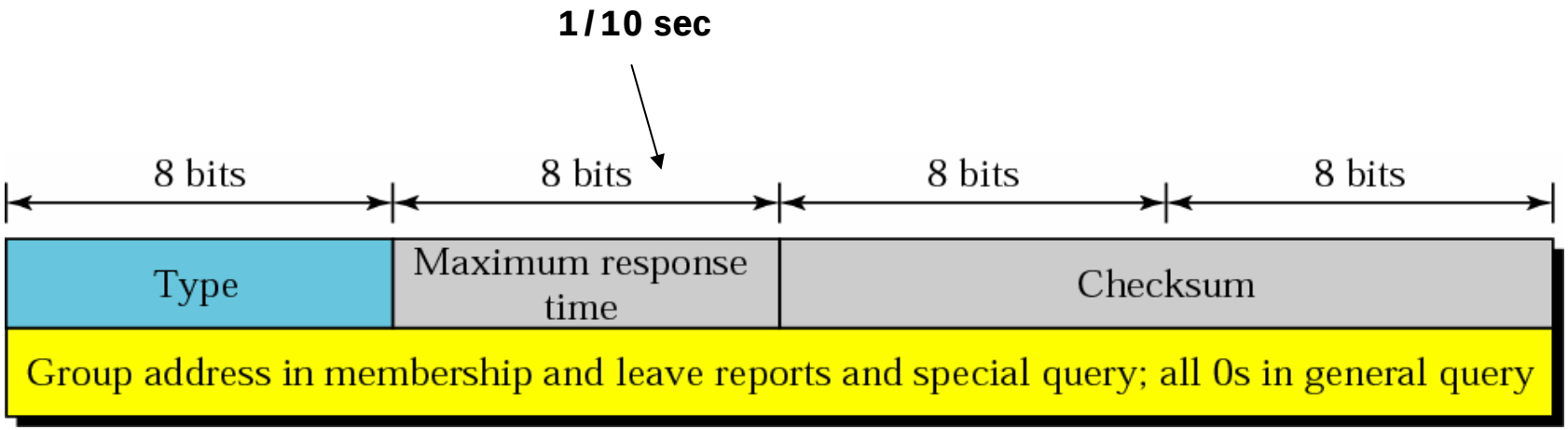


Table 10.1 IGMP type field

Type	*Value*
General or Special Query	0x11 or 00010001
Membership Report	0x16 or 00010110
Leave Report	0x17 or 00010111

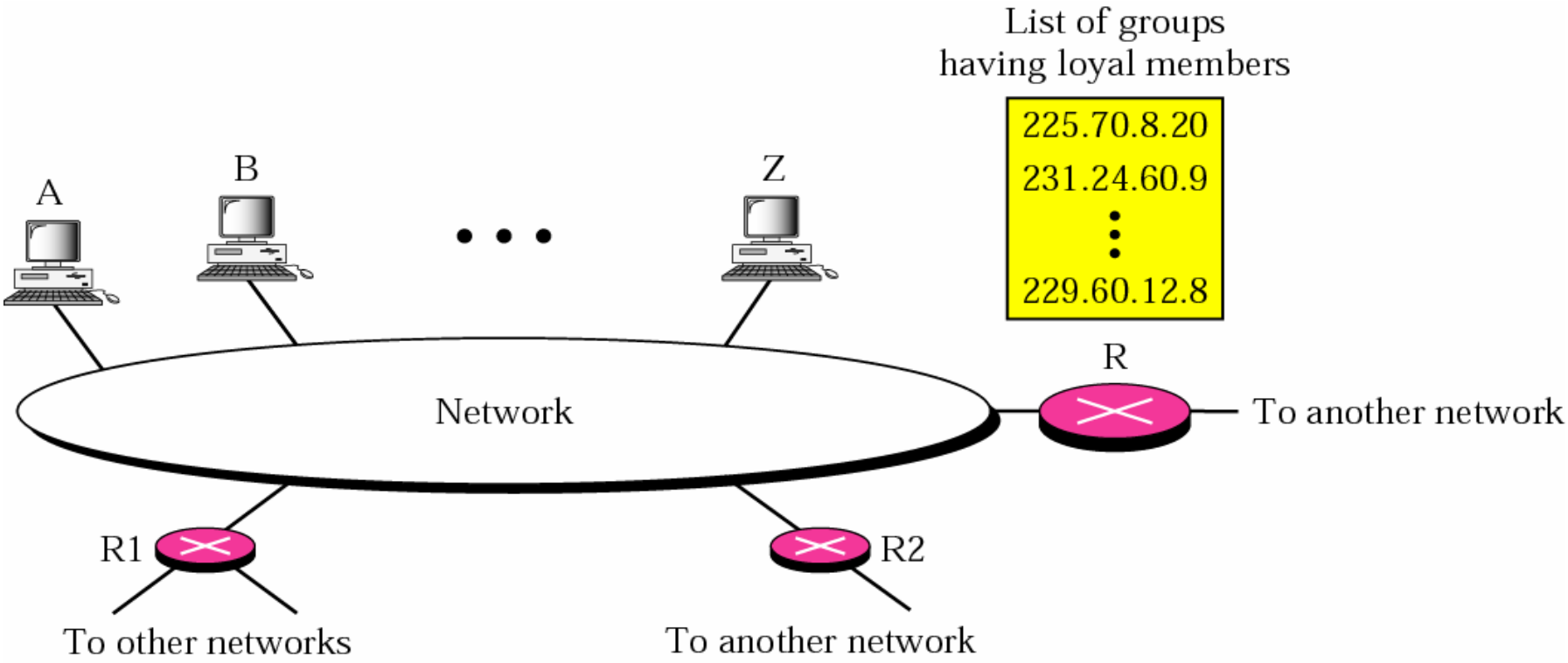
10.3 IGMP OPERATION

A multicast router connected to a network has a list of multicast addresses of the groups with at least one loyal member in that network. For each group, there is one router that has the duty of distributing the multicast packets destined for that group.

The topics discussed in this section include:

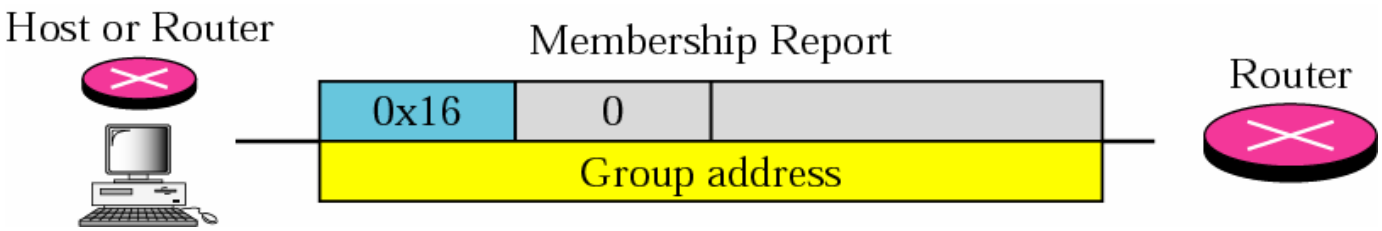
Joining a Group
Leaving a Group
Monitoring Membership

Figure 10.4 *IGMP operation*



Their (R1,R2,R3's) list of groupids are mutually exclusive.

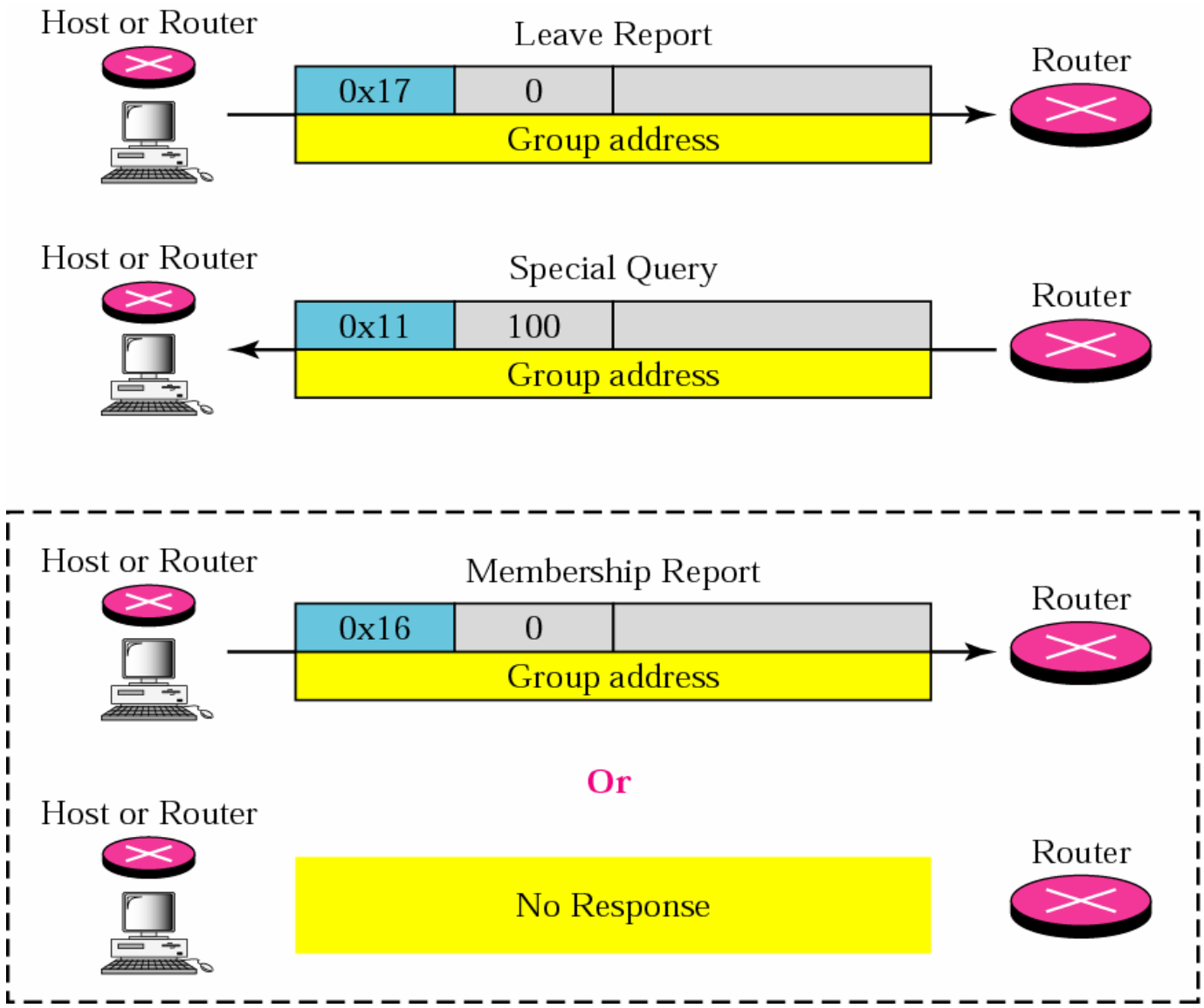
Figure 10.5 *Membership report*



Note:

In IGMP, a membership report is sent twice, one after the other.

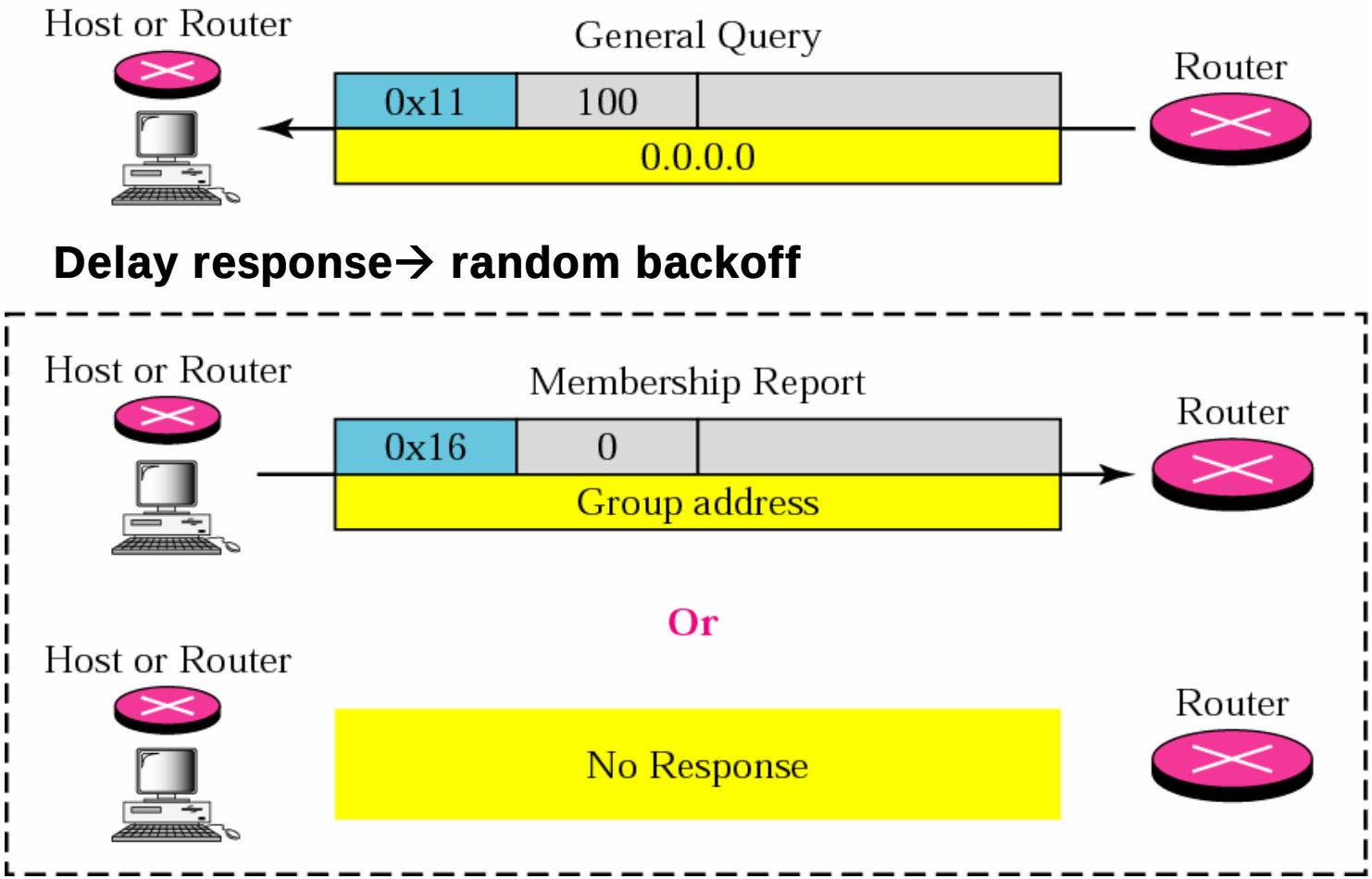
Figure 10.6 *Leave report*



Monitoring Membership: general query per 125s

The general query message does not define a particular group.

Figure 10.7 *General query message*



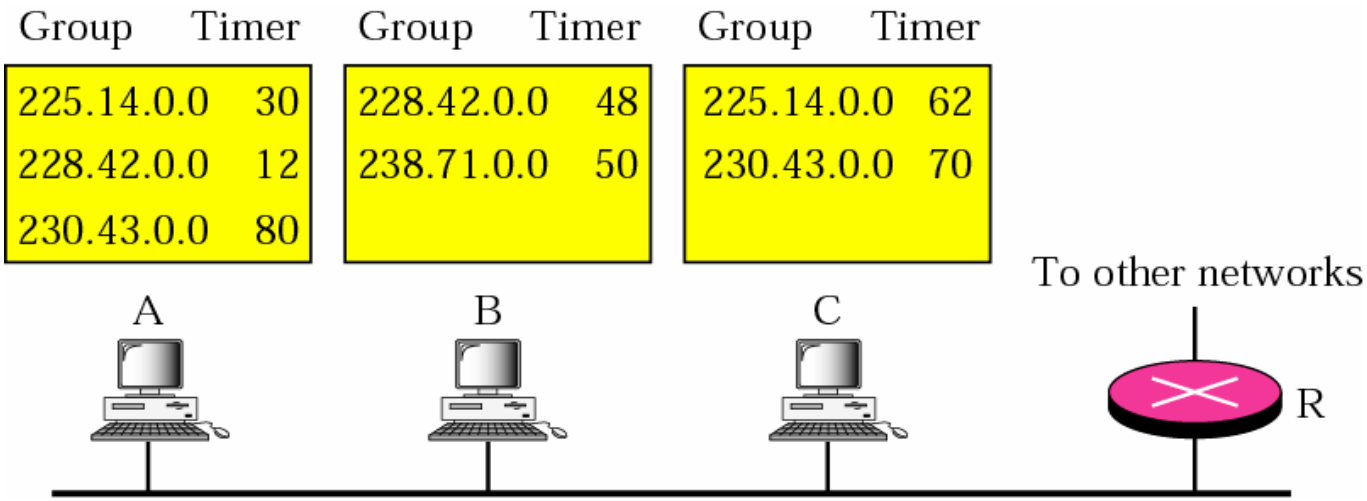
Example 1

Imagine there are three hosts in a network as shown in Figure 10.8.

A query message was received at time 0; the random delay time (in tenths of seconds) for each group is shown next to the group address. Show the sequence of report messages.

See Next Slide

Figure 10.8 *Example 1*



Example 1 (Continued)

Solution

The events occur in this sequence:

a.* Time 12: *The timer for 228.42.0.0 in host A expires and a membership report is sent, which is received by the router and every host including host B which cancels its timer for 228.42.0.0.

b.* Time 30: *The timer for 225.14.0.0 in host A expires and a membership report is sent, which is received by the router and every host including host C which cancels its timer for 225.14.0.0.

c.* Time 50: *The timer for 238.71.0.0 in host B expires and a membership report is sent, which is received by the router and every host.

See Next Slide

Example 1 (Continued)

***d.* Time 70:** *The timer for 230.43.0.0 in host C expires and a membership report is sent, which is received by the router and every host including host A which cancels its timerfor 230.43.0.0.*

Note that if each host had sent a report for every group in its list, there would have been seven reports; with this strategy only four reports are sent.

Query router that sends query message

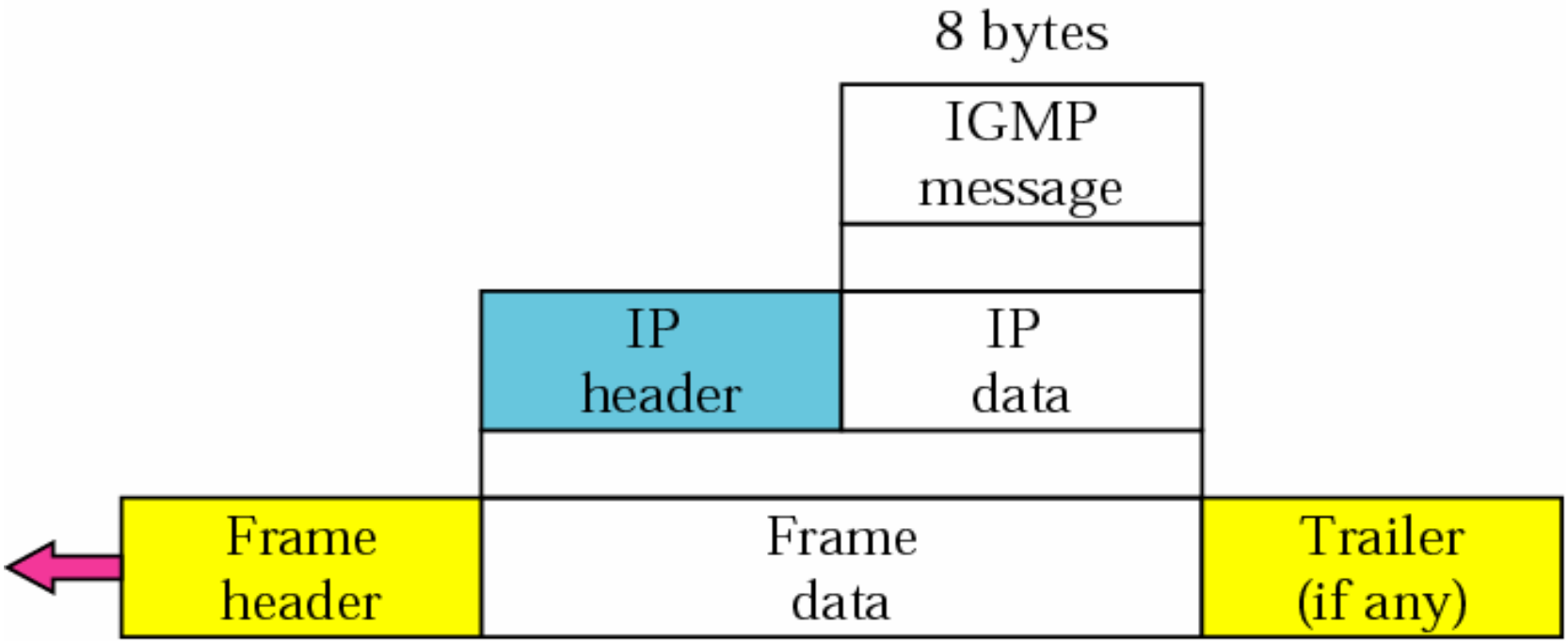
10.4 ENCAPSULATION

The IGMP message is encapsulated in an IP datagram, which is itself encapsulated in a frame.

The topics discussed in this section include:

IP Layer
Data Link Layer
Netstat Utility

Figure 10.9 *Encapsulation of IGMP packet*



Note:

The IP packet that carries an IGMP packet has a value of 2 in its protocol field.

Note:

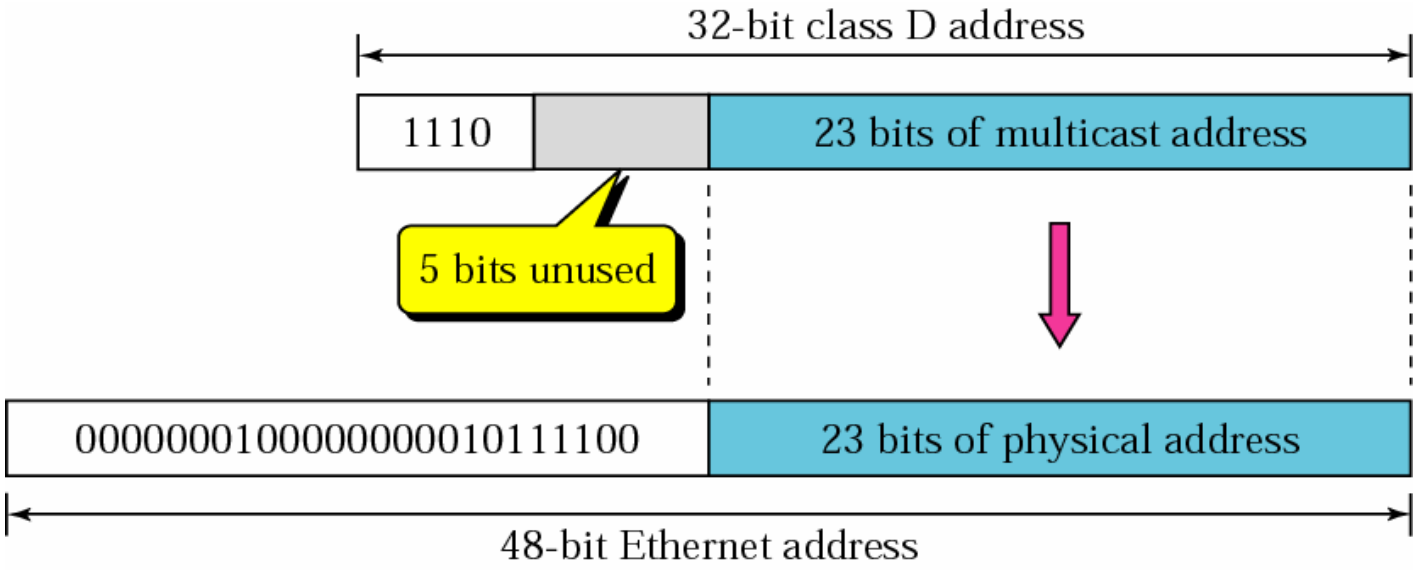
The IP packet that carries an IGMP packet has a value of 1 in its TTL field.

Destination IP addresses

Type	*IP Destination Address*
Query	224.0.0.1 All systems on this subnet
Membership Report	The multicast address of the group
Leave Report	224.0.0.2 All routers on this subnet

Figure 10.10 *Mapping class D to Ethernet physical address*

Data link layer: Ether net supports physical multicast address



Note:

An Ethernet multicast physical address is in the range

01:00:5E:00:00:00

to

01:00:5E:7F:FF:FF.

Example 2

Change the multicast IP address 230.43.14.7 to an Ethernet multicast physical

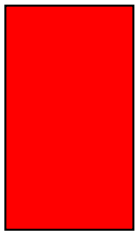
Solution

We can do this in two steps:

a. *We write the rightmost 23 bits of the IP address in hexadecimal. This can be done by changing the rightmost 3 bytes to hexadecimal and then subtracting 8 from the leftmost digit if it is greater than or equal to 8. In our example, the result is 2B:0E:07.*

b. *We add the result of part a to the starting Ethernet multicast address, which is (01:00:5E:00:00:00). The result is*

01:00:5E:2B:0E:07



Example 3

Change the multicast IP address 238.212.24.9 to an Ethernet multicast address.

Solution

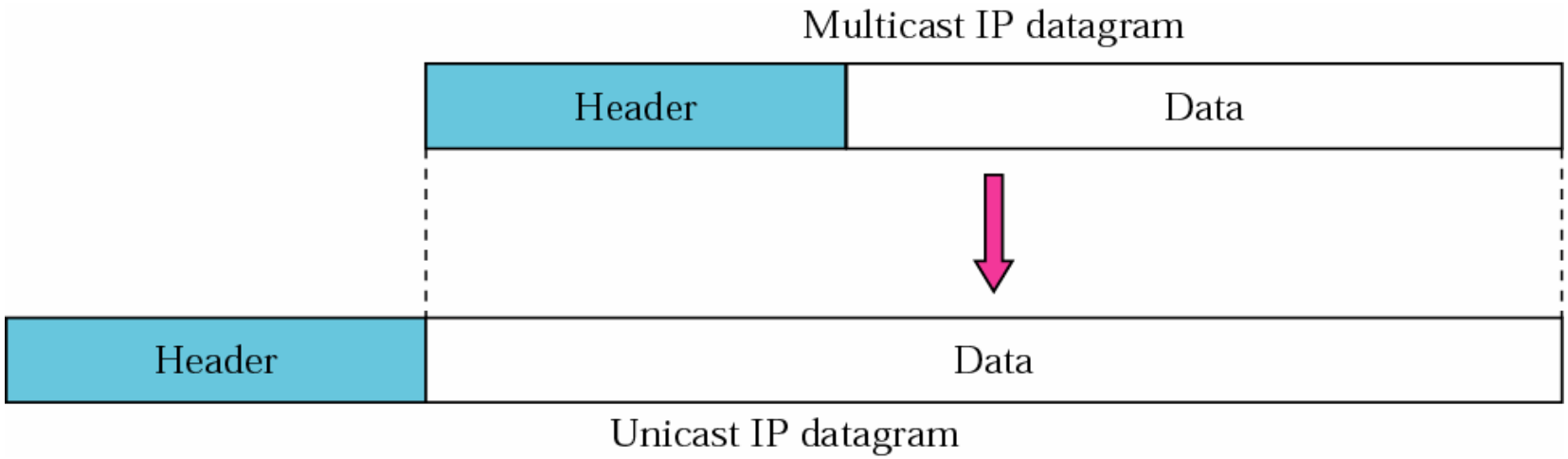
a. ***The right-most three bytes in hexadecimal are D4:18:09. We need to subtract 8 from the leftmost digit, resulting in 54:18:09..***

b. ***We add the result of part a to the Ethernet multicast starting address. The result is***

01:00:5E:54:18:09

Figure 10.11 *Tunneling*

Most WANs do not support physical multicast addressing.
We use tunneling to send the multicast datagram in a unicast method.



Example 4

We use netstat with three options, -n, -r, and -a. The -n option gives the numeric versions of IP addresses, the -r option gives the routing table, and the -a option gives all addresses (unicast and multicast). Note that we show only the fields relative to our discussion.

$ netstat -nra

Kernel IP routing table

Destination	Gateway	Mask	Flags	Iface
153.18.16.0	0.0.0.0	255.255.240.0	U	eth0
169.254.0.0	0.0.0.0	255.255.0.0	U	eth0
127.0.0.0	0.0.0.0	255.0.0.0	U	lo
224.0.0.0	0.0.0.0	224.0.0.0	U	eth0
0.0.0.0	153.18.31.254	0.0.0.0	UG	eth0

Any packet with a multicast address from 224.0.0.0 to 239.255.255.255 is masked and delivered to the Ethernet interface.

10.5 IGMP PACKAGE

We can show how IGMP can handle the sending and receiving of IGMP packets through our simplified version of an IGMP package. In our design an IGMP package involves a group table, a set of timers, and four software modules.

The topics discussed in this section include:

Group Table
Timers
Group-Joining Module
Group-Leaving Module
Input Module
Output Module

Figure 10.12 *IGMP package*

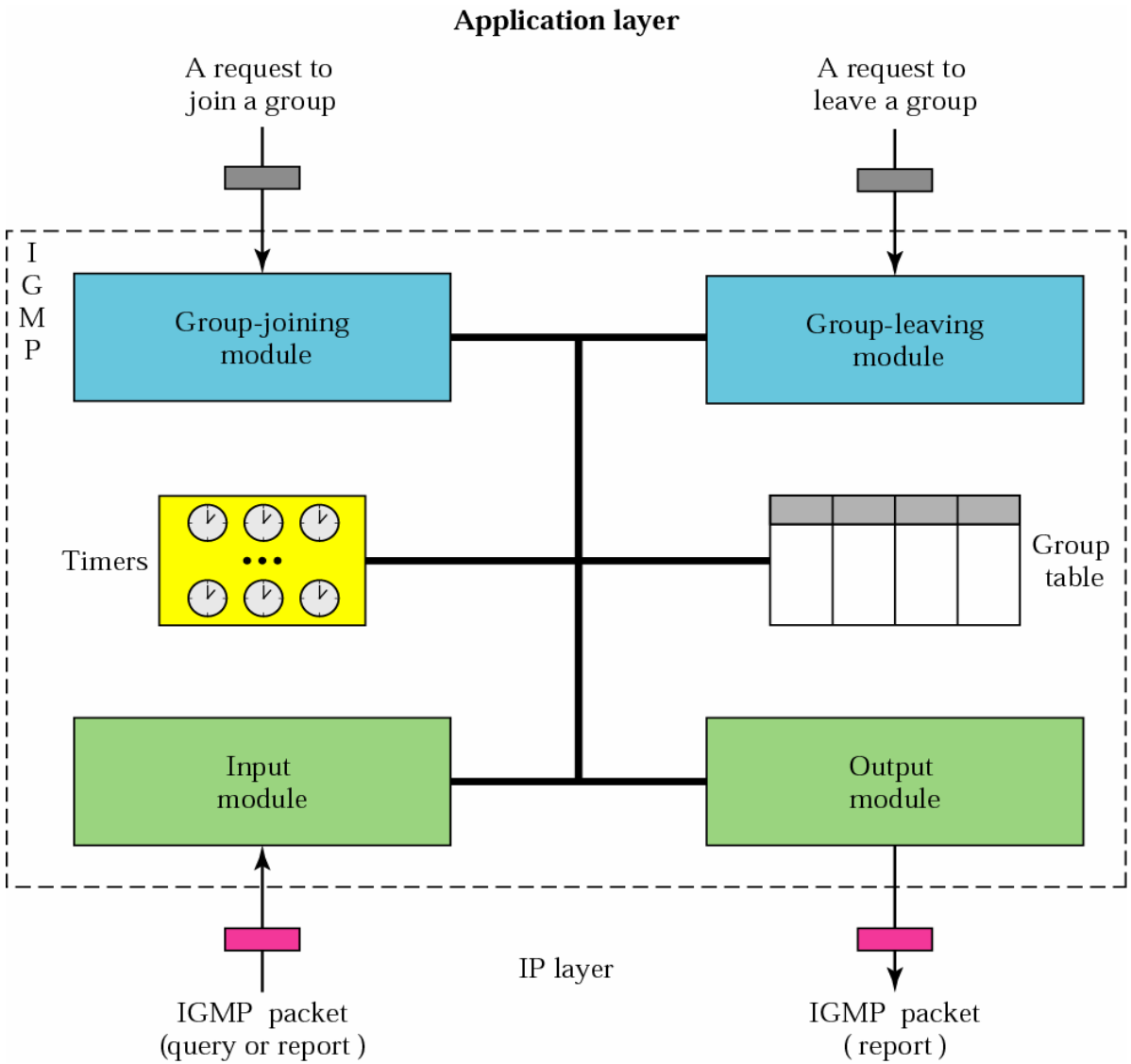


Figure 10.13 *Group table*

State	Interface No.	Group Address	Reference Count
.....	.....	.....	.....
.....	.....	.....	.....
.....	.....	.....	.....