Chapter 12:
Broadcasting and Multicasting

Introduction

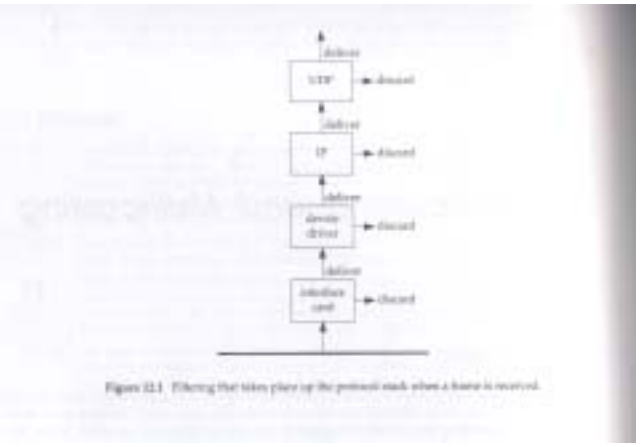
- **Three kinds of IP address:**
  - Unicast: the destination address specifies a single interface.
  - Broadcast: a host wants to send a frame to every other host on the cable.
  - Multicast: the frame should be deliverd to s set of hosts that belong to a multicast group.
- **Broadcasting and multicasting only apply to *UDP*, where it makes sense for an application to send a single message to multiple recipients.**
- **Interface card receives only those frames whose destination address is either the *hardware address* of the interface or the *broadcast address*.**

Introduction (Cont.)

- ***Promiscuous*** **mode of network interface: receiving a copy of every frame (e.g.,** *tcpdump***)**
- **A multicast address has the low-order bit of the high-order byte turned on. In hexadecimal 01:00:00:00:00:00, broadcast address is ff:ff:ff:ff:ff:ff.**
- **Problem with broadcast: processing load**
  - The intent of multicasting is to reduce this load on hosts with no interest in the application.

Introduction (Cont.)

- **Filtering:**



Broadcasting

- **Limited Broadcast :**
  - the *limited broadcasting address* is 255.255.255.255. This can be used as the destination address of an IP datagram during the host configuration process, when the host might not know its subnet mask or even its IP address.
- **Net-directed Broadcast :**
  - the *net-directed broadcast address* has a host ID of all one bits.
    - class A net-directed broadcasting is *netid*.255.255.255 , where netid is the class A network ID.

Broadcasting

- **Subnet-directed Broadcast :**
  - the *subnet-directed broadcast address* has a host ID of all one bits but a specific subnet ID.
    - A router receives a datagram destined for 128.1.2.255 , this is a subnet-directed broadcast if the class B network 128.1 has a subnet mask of 255.255.255.0 , but it is not a broadcast if the mask is 255.255.254.0 (0xfffffe00).
- **All-subnet-directed Broadcast :**
  - an *all-subnets-directed broadcast address* both the subnet ID and the host ID are all one bits.
    - The destination's subnet mask is 255.255.255.0 , the class B IP address 128.1.255.255 is an all-subnets-directed broadcast.

Broadcasting Example

```
sun % arp -a                                    ARP cache is empty

sun % ping 140.252.13.63
PING 140.252.13.63: 56 data bytes
64 bytes from sun (140.252.13.33): icmp_seq=0. time=4. ms
64 bytes from bsdi (140.252.13.35): icmp_seq=0. time=172. ms
64 bytes from svr4 (140.252.13.34): icmp_seq=0. time=192. ms

64 bytes from sun (140.252.13.33): icmp_seq=1. time=1. ms
64 bytes from bsdi (140.252.13.35): icmp_seq=1. time=52. ms
64 bytes from svr4 (140.252.13.34): icmp_seq=1. time=90. ms

^?                                              type interrupt key to stop
----140.252.13.63 PING Statistics----
2 packets transmitted, 6 packets received, -200% packet loss
round-trip (ms)  min/avg/max = 1/85/192

sun % arp -a                                    check ARP cache again
svr4 (140.252.13.34) at 0:0:c0:c2:9b:26
bsdi (140.252.13.35) at 0:0:c0:6f:2d:40
```


Broadcasting Example (Cont.)

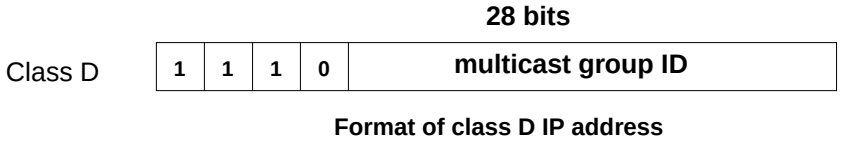
- **This type of broadcast means all the hosts on the local network, including the sender.**
- **Interaction between broadcasting and ARP**
  - The sending of these frames does not require ARP.
  - The recipients of the broadcast frames generate an ARP request. This is because the reply of *ping* is unicast.

Multicasting

- **Delivery to multiple destinations.**
  - There are many application that deliver information to multiple recipients : interactive conferencing and dissemination.
- **Solicitation of servers by clients.**
  - A diskless workstation needs to locate a bootstrap server.
  - Today this is provided using a broadcast.

Multicast Group Address

- **A multicast group address is the combination of the high-order 4 bits of 1110 and the multicast group ID. This are normally written as dotted-decimal numbers and are in the range of 224.0.0.0 through 239.255.255.255.**



Format of class D IP address

Multicasting Group Address

- **The sets of hosts listening to a particular IP multicast address is call a *host group*.**
- **Multicast group address are assigned as well-know address are called *permanent host groups*.**
  - 224.0.0.1 means “all system on this subnet “.
  - 224.0.0.2 means “all routers on this subnets”.
  - 224.0.1.1 is for NTP (the Network Time Protocol) .
  - 224.0.0.9 is for RIP-2 .
  - 224.0.1.2 is for SGI’s (silicon Graphics)

Multicast Group Address to Ethernet Address

- **The Ethernet addresses corresponding to IP multicasting are in the range 01:00:5e:00:00:00 through 01:00:5e:7f:ff:ff.**
- **This allocation allows for 23 bits in the Ethernet address to correspond to the IP multicast group ID.**
- **The mapping places the low-order 23 bits of the multicast group ID into this 23 bits of the Ethernet address.**
- **The mapping is not unique**
  - Device driver or the IP module must perform filtering
- **It is possible for multiple processes on a given host to belong to the same multicast group.**

Multicast Group Address to Ethernet Address (Cont.)

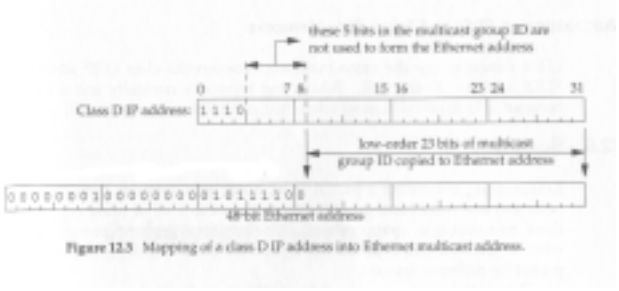


Figure 12.3 Mapping of a class D IP address into Ethernet multicast address.

Summary

- Broadcasting is sending a packet to all hosts on a network and multicasting is sending a packet to a set of hosts on a network.
- There are four types of broadcast address: limited, net-directed, subnet-directed and all-subnets-directed.
- A class D IP address is called a multicast group address. It is converted to an Ethernet address by placing its lower 23 bits into a fixed Ethernet address. The mapping is not unique, requiring additional filtering by one of the protocol modules.