

Multicast Addressing (IPv4)

IPv4 Multicast Addressing

- Class D address space
- Ranges from 224.0.0.0 through 239.255.255.255 (First 4 bits are 1110 followed by a 28-bit multicast group ID)
- (224 = 11100000 and 239 = 11101111).



- Well known addresses are designated and reserved by IANA for multicast routing and group maintenance:
 - 224.0.0.0 through 224.0.0.255, e.g.,
 - 224.0.0.1 (all hosts multicast group on subnet)
 - 224.0.0.2 (all routers multicast group on subnet)
 - etc., see https://en.wikipedia.org/wiki/Multicast_address for many others.

IPv4 Multicast Addressing

- Local subnet:
 - 224.0.0.0 to 224.0.0.255
 - Multicasting on the local subnet only. Routers will not forward these outside their local subnet.
- Internetwork control block:
 - 224.0.1.0 to 224.0.1.255.
 - individually assigned by IANA for specific purposes, e.g., Network Time Protocol (224.0.1.1). These are routed through the public Internet.
- Ad Hoc block:
 - 224.0.0.2.0 to 224.0.0.255.255
 - 224.0.0.3.0 to 224.0.0.4.255.255
 - 233.252.0.0 to 233.255.255.255
 - Globally routed and are used for applications that don't fit either of the previously described purposes

IPv4 Multicast Addressing

- Source-specific multicast
 - 232.0.0.0/8
 - a method of delivering multicast packets in which the only packets delivered to a receiver are those originating from a specific source address requested by the receiver (instead of from all sources writing to the multicast address)
- GLOP addressing
 - 233.0.0.0/8
 - reserved for static multicast groups for organizations that have a reserved, registered public Autonomous System (AS) number (ASN).
- Unicast-prefix-based IPv4 multicast addresses
 - 234.0.0.0/8
 - provided to each organization that has /24 or larger globally routed unicast address space

IPv4 Multicast Addressing

- Administratively scoped IPv4 multicast addresses
 - 239.0.0.0/8
 - for private use within an organization
 - packets do not cross administratively defined organizational boundaries
 - locally assigned and do not have to be globally unique.
 - (Good for Lab 4!)

Some more IPv4 multicast address assignments:

Address	Description
224.0.0.1	All Hosts multicast group on the same subnetwork
224.0.0.2	All Routers multicast group on the same subnetwork.
224.0.0.5	The Open Shortest Path First (OSPF) AllSPFRouters address. Used to send Hello packets to all OSPF routers on a network segment
224.0.0.6	The OSPF All Routers address. Used to send OSPF routing information to OSPF designated routers on a network segment
224.0.0.9	The RIP version 2 group address. Used to send routing information using the RIP protocol to all RIP v2-aware routers on a network segment
224.0.0.13	PIM Version 2
224.0.0.22	IGMP Version 3
224.0.1.1	Network Time Protocol

Mapping IPv4 Multicast Addresses to Layer 2 Multicast Addresses

- Put the lower 23 bits of the IP multicast address into the lower 23 bits of special Ethernet multicast address 01.00.5E.00.00.00.
- e.g., 224.2.2.2 mapped to 01.00.5E.020202
- 32 multicast groups may be mapped into the same address. The probability is small, but receivers should check the datagram.
- (Recall that an IP multicast packet has a 28 bit group ID. This is mapped to 23 bits at L2, so there are $2^5 = 32$ groups that could be mapped to the same L2 multicast address.)

Mapping IPv4 Multicast Addresses to Layer 2 Multicast Addresses

- 48-bit MAC address:

xxxxxxxx1 xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx xxxxxxxx



Broadcast/multicast bit

01

00

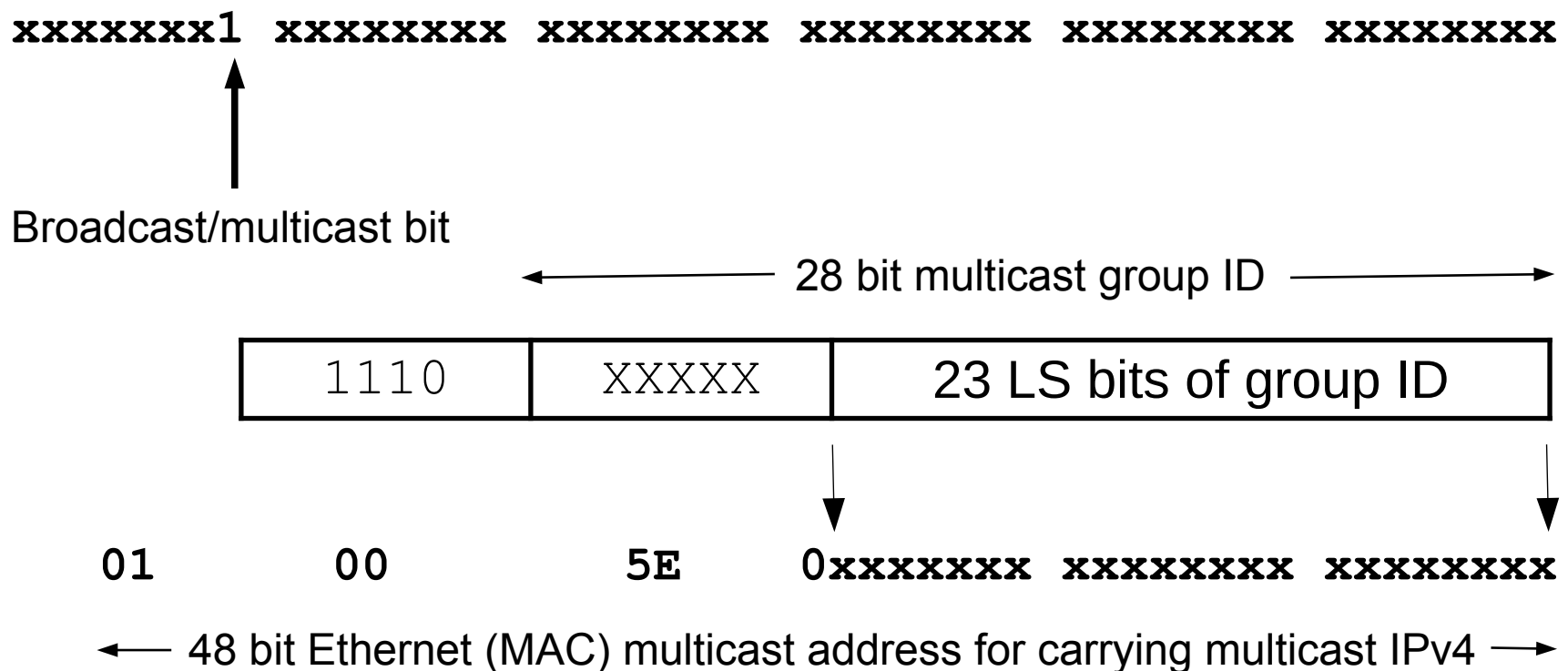
5E

0xxxxxxxx xxxxxxxx xxxxxxxx

- The first 3 octets are 01-00-5E. Only half of the remaining 24 bits are available. So the final 23 bits of the IP multicast packet are placed in the final 23 bits of the MAC address. 28 group ID bits will map to 23 bits, so there will be cases where 32 IP multicast packets are mapped to the same MAC multicast address.(i.e., the IPv4 multicast preamble is 1110.)

Mapping IPv4 Multicast Addresses to Layer 2 Multicast Addresses

- 48-bit MAC address:



Overlapped L3/L2 Address Mapping

- Because the 5 high order bits of the multicast address are dropped, up to $2^5 = 32$ multicast addresses may be mapped to the same MAC/Ethernet multicast address.
- Some example multicast groups that map to the same L2 multicast address:
 - 224.1.1.1, 224.129.1.1, 225.1.1.1, 225.129.1.1

These all map to 0x0100.5E01.0101, i.e., the above addresses all have the same least significant 23 bits.

- If you join one of these multicast groups, packets from other groups will be accepted at L2 and the packets have to be filtered out in the receiver protocol stack.

Wireshark Multicast Capture

No.	Time	Source	Destination	Protocol	Length	Info
12	6.006834040	192.168.1.10	239.0.0.10	UDP	65	36434 → 2000 Len=23

Frame 12: 65 bytes on wire (520 bits), 65 bytes captured (520 bits) on interface 0
Ethernet II, Src: AsustekC_68:bd:5c (bc:ae:c5:68:bd:5c), Dst: IPv4mcast_0a (01:00:5e:00:00:0a)
Internet Protocol Version 4, Src: 192.168.1.10, Dst: 239.0.0.10
User Datagram Protocol, Src Port: 36434, Dst Port: 2000
Data (23 bytes)

```
0000  63 72 6f 77 20 6d 75 6c 74 69 63 61 73 74 20 62   crow multicast b
0010  65 61 63 6f 6e 3a 20                               eacon:
      Data: 63726f77206d756c74696361737420626561636f6e3a20
      [Length: 23]
```