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IP Multicast Addressing

The vast majority of traffic on IP internetworks is of the *unicast* variety: one source device sending to one destination device. IP also supports *multicasting*, where a source device can send to a group of devices. Multicasting is not used a great deal on the Internet as a whole at the present time, mainly due to lack of widespread hardware support, so most of our focus in looking at IP is on unicast. Multicast is useful in certain circumstances, however, especially as a more efficient alternative to broadcasting. I include one summary topic on multicasting for your perusal, and also want to briefly discuss here IP addressing

issues related to multicasting.

The "classful" IP addressing scheme sets aside a full one-sixteenth of the address space for multicast addresses: Class D. Multicast addresses are identified by the pattern "1110" in the first four bits, which corresponds to a first octet of 224 to 239. So, the full range of multicast addresses is from 224.0.0.0 to 239.255.255.255. Since multicast addresses represent a group of IP devices (sometimes called a *host group*) they can only be used as the destination of a datagram; never the source.

Multicast Address Types and Ranges

The 28 bits after the leading "1110" in the IP address define the *multicast group address*. The size of the Class D multicast address space is therefore 2^{28} or 268,435,456 multicast groups. There is no substructure that defines the use of these 28 bits; there is no specific concept of a network ID and host ID as in classes A, B and C. However, certain portions of the address space are set aside for specific uses. Table 48 and Figure 63 show the general allocation of the Class D address space.

Table 48: IP Multicast Address Ranges and Uses		
Range Start Address	**Range End Address**	**Description**
224.0.0.0	224.0.0.255	Reserved for special "well-known" multicast addresses.
224.0.1.0	238.255.255.255	Globally-scoped (Internet-wide) multicast addresses.

239.0.0.0	**239.255.255.255**	Administratively-scoped (local) multicast addresses.

> **Note:** As with the other IP address classes, the entire 32 bits of the address is always used; we are just only interested in the least-significant 28 bits because the upper four bits never change.

The bulk of the address space is in the middle multicast range, which are "normal" multicast addresses. They are analogous to the Class A, B and C unicast addresses and can be assigned to various groups.

The last address range is for *administratively-scoped* multicast groups. This is a fancy term for multicast groups used within a private organization; this block, representing 1/16th of the total multicast address space, is comparable to the private addresses we saw in the preceding topic. This block is also subdivided further into site-local multicast addresses, organization-local addresses and so forth.

Figure 63: IP Multicast Address Ranges and Uses

All multicast addresses begin with "1110" as shown. The "well-known" group has zeroes for the first 20 bits of the multicast group address, with 8 bits available to define 255 special multicast addresses. Multicast addresses starting with "1110 1111" are locally-scoped; all other addresses are globally-scoped (this includes addresses starting with "1110 0000" *other than* the 255 "well-known" addresses.)

Well-Known Multicast Addresses

The first block of 256 addresses is used to define special, ***well-known*** multicast address blocks. These do not represent arbitrary groups of devices and cannot be assigned in that manner. Instead, they have special meaning that allows a source to send a message to a predefined group. Table 49 shows some of the "well-known" multicast addresses:

Table 49: Well-Known IP Multicast Addresses	
Range Start Address	**Description**

224.0.0.0	Reserved; not used
224.0.0.1	All devices on the subnet
224.0.0.2	All routers on the subnet
224.0.0.3	Reserved
224.0.0.4	All routers using DVMRP
224.0.0.5	All routers using OSPF
224.0.0.6	Designated routers using OSPF
224.0.0.9	Designated routers using RIP-2
224.0.0.11	Mobile agents (for Mobile IP)
224.0.0.12	DHCP Server / Relay Agent

Note: There are some other predefined groups that also refer to routers using particular routing protocols; I didn't bother listing them all as the table would get quite large.

Delivery of IP multicast traffic is more complex than unicast traffic due to the existence of multiple recipients. Instead of the normal resolution method through the ARP protocol used for unicast datagrams, a special mapping is performed between the IP multicast group and a hardware multicast group.