In Figure 15.3, address 224.0.0.1 is permanently assigned to the *all systems group*, and address 224.0.0.2 is permanently assigned to the *all routers group*. The *all systems* group includes all hosts and routers on a network that are participating in IP multicast, whereas the *all routers* group includes only the routers that are participating. Both of these groups are used for control protocols and must be on the same local network as the sender; there are no IP multicast addresses that refer to all systems in the Internet or all routers in the Internet.

15.7.2 IPv6 Multicast Address Space

Like IPv4, IPv6 specifies the scope associated with multicast addresses. Recall that the first octet of an IPv6 multicast address contains all 1s. IPv6 uses the second octet of the address to specify the scope. Figure 15.4 lists the assignments.

Second Octet	Meaning
0x?0	Reserved
0x?1	Scope is restricted to a computer (loopback)
0x?2	Scope is restricted to the local network
0x?3	Scope is equivalent to IPv4 local scope
0x?4	Scope is administratively configured
0x?5	Scope is restricted to a single site
0x?8	Scope is restricted to a single organization
0x?E	Scope is global across the Internet

Figure 15.4 The use of the second octet in an address to specify the scope of an IPv6 multicast address.

In the figure, constants starting with *0x* are hexadecimal. The question mark denotes an arbitrary nibble. Thus, 0x?1 refers to 0x01, 0x11, 0x21... 0xF1.

Using an octet to specify the scope allows a service to be accessed with a variety of scopes. For example, the *Network Time Protocol* (*NTP*) has been assigned the multicast group ID 0x101. The scope of the assignment is unrestricted, meaning that a sender can choose the scope of a multicast. For example, it is possible to send a multicast datagram to all NTP servers on a single link (address FF02::101) or all NTP servers in an organization (address FF08::101). Only the second octet of the address differs.

Some services are assigned a specific scope or a specific set of scopes, because the IETF can foresee no reason to send a multicast to the group globally. For example, the *All Nodes* multicast group is limited — one cannot specify a multicast datagram for all nodes throughout the Internet. Most routing protocols are also limited to a single link because the intended communication is between routers on the same underlying network. Figure 15.5 lists a few examples of permanently assigned IPv6 multicast addresses.