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Networking

Explained

Second Edition

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Networking Explained, Second Edition

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BOX 5.1: IEEE 802.3 MAC Sublayer Addresses

Ethernet addresses, also known as hardware or MAC addresses, are installed in ROM by the manufacturers of **Ethernet** controllers (i.e., the **Ethernet** network cards). The custodian of these addresses is the IEEE, which assigns addresses on a group basis to vendors who manufacture **Ethernet** hardware devices used in a heterogeneous network environment.

Ethernet addresses consist of 48 bits, represented as 12 hexadecimal digits (0–9, A–F), and partitioned into six groups of two. An example of an **Ethernet** address is 08:00:20:01:D6:2A. Dashes are sometimes used in place of colons, and sometimes no delimiter is used to separate the byte-pairs. Also, the letters A–F are used to represent the numbers 10–15, respectively. These letters are usually written in uppercase. The higher-order three bytes (i.e., the leftmost six hexadecimal digits) correspond to the manufacturer of the **Ethernet** device, and the lower-order three bytes correspond to the serial number of the device. For example, the address 08:00:20:01:D6:2A corresponds to an **Ethernet controller** manufactured by Sun Microsystems because the leftmost three bytes, 08:00:20, have been assigned to Sun; the remaining three bytes specify a unique serial number assigned by Sun to the device. Other examples of vendor prefixes include 00:00:0c (Cisco), 00:00:1D (Cabletron), and 08:00:07 (Apple). (See Appendix A for more information about **Ethernet** vendor prefixes.)

There are three different types of destination addresses. The first is called a *unicast address*, which essentially means that data are being transmitted to only a single network interface (i.e., device). Unicast destination addresses are denoted by either a 0 or an even number (2, 4, 6, 8, A, C, E) in the second hexadecimal digit of the vendor prefix. A *multicast* or *broadcast address* enables data to be transmitted to more than one destination node at the same time. A multicast address specifies a vendor-specific group of nodes. For example, the multicast address, 09-00-87-90-FF-FF, is for Xyplex terminal servers. **Ethernet** frames that have their destination fields set to this address will be received by all Xyplex terminal servers connected to the network. If a node wants to send data to *all* network connected devices, then a broadcast address is used. This address is given as FF:FF:FF:FF:FF:FF. Multicast and broadcast **Ethernet** addresses are denoted by using an odd number (1, 3, 5, 7, 9, B, D, F) as the second hexadecimal digit.

Ethernet addresses should not be confused with Internet addresses. The former are six-byte addresses that have been “burned” into the **controller** card; the latter are logical addresses that correspond to a specific network protocol and are assigned by a network administrator and configured through software. If a device is connected to an **Ethernet** network, which in turn is connected to the Internet, then the device will have both **Ethernet** and IP addresses assigned to it. The Address Resolution Protocol (ARP), which is part of the TCP/IP protocol suite (see Chapters 2 and 3), is used to resolve IP addresses to **Ethernet** addresses. An ARP request is a network broadcast that announces the target node’s IP address and requests the node to return its MAC address. On UNIX and Windows NT systems, this protocol can be invoked on the command line by the *arp* application program. Using the “a” extension (*arp -a*) displays the contents of the current ARP table maintained by the local host.