Addressing Facts

Network devices use addresses to identify other devices. These addresses are used to send and receive packets of electronic data over the network. The addresses used depend on the physical make-up of the network as well as the protocol suite being used.

Each network device is identified using a physical address. For Ethernet networks, the physical device address is the MAC address.

- The MAC address is a unique hexadecimal identifier burned into the ROM (physically assigned address) of every network interface.
- The MAC address is a 48-bit, 12-digit hexadecimal number (each number ranges from 0-9 or A-F).
- The address is often written as 00-B0-D0-06-BC-AC or 00B0.D006.BCAC, although dashes, periods, and colons can also be used to divide the MAC address parts.
- The MAC address is guaranteed unique through design.
    - The first half (first 6 digits) of the MAC address is assigned to each manufacturer.
    - The manufacturer determines the rest of the address, assigning a unique value which identifies the host address.

    A manufacturer that uses all of the addresses in the original assignment can apply for a new MAC address assignment.

- Although some network cards allow you to change the MAC address (or specify one of your own choice), this is rarely done in practice.
- When you change the network card, the host will have a new physical device address.
- When you move a device to another network, the physical address remains the same (as long as the network card has not been changed).

In addition to the physical device address, two logical addresses are also used:

- The logical *network* address identifies a network segment (called a *subnet*). All devices on the same network segment share the same logical network address.
- The logical *host* address identifies a specific host on the network. Each device must have a unique logical host address.

The format for the logical addresses used depends on the protocol suite. With TCP/IP, the logical network and logical host addresses are combined into a single address called the IP address. An IP address:

- Is a 32-bit binary number represented as four octets (four 8-bit numbers). Each octet is separated by a period.
- IP addresses can be represented in one of two ways:
    - Decimal (for example 131.107.2.200). In decimal notation, each octet must be between 0 and 255.
    - Binary (for example 10000011.01101011.00000010.11001000). In binary notation, each octet is an 8-digit number.
- IP addresses include both the network address and the host address.
- A *subnet mask* is used to differentiate the network and host addresses.
- Each IP address has a default class that includes a default subnet mask value. The *class* defines the default network address portion of the IP address.

Address Range	Default Class	Default Subnet Mask
1.0.0.0 to 126.255.255.255	A	255.0.0.0
128.0.0.0 to 191.255.255.255	B	255.255.0.0

192.0.0.0 to 223.255.255.255	C	255.255.255.0
224.0.0.0 to 239.255.255.255	D	N/A
240.0.0.0 to 255.255.255.255	E	N/A

- **Note**: The address range from 0.0.0.0 to 0.255.255.255 is reserved for broadcast messages to the current network. The address range from 127.0.0.0 to 127.255.255.255 is reserved for loopback addresses to the local host.
- For example, an IP address of 192.168.6.11 is a Class C address and has a default mask of 255.255.255.0. The network address is 192.168.6.0 and the host address is 11.
- Instead of using the default subnet mask, you can use custom subnet masks to define different network addresses. This process is called *subnetting*.