6.5.3 IP Address 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 topology of the network as well as the protocols being used.

This lesson covers the following topics:

- MAC addresses
- Logical addresses
- IP addresses

MAC Addresses

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 segments).
- 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).

Logical Addresses

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.

IP Addresses

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.
- Can be represented in one of two ways:
  - Decimal (e.g., 131.107.2.200). In decimal notation, each octet must be between 0 and 255.
  - Binary (e.g., 10000011.01101011.00000010.11001000). In binary notation, each octet is an 8-digit number.
- Includes both the network address and the host address.
- Uses a *subnet mask* to differentiate the network and host addresses.

Another way to differentiate the network and host addresses is by using CIDR block notation. With CIDR, the network address is specified by appending a slash (/) followed by the number of bits that are part of the network address. For example, the subnet mask 255.255.0.0 is written as /16 in CIDR notation (the network address consists of the first two octets, or the first 16 bits).

IP addresses use default classes that includes a default subnet mask value. The *class* defines the default network address portion of the IP address.

Address Range	Class	Default Subnet Mask	CIDR
1.0.0.0 to 126.255.255.255	A	255.0.0.0	/8
128.0.0.0 to 191.255.255.255	B	255.255.0.0	/16
192.0.0.0 to 223.255.255.255	C	255.255.255.0	/24
224.0.0.0 to 239.255.255.255	D	N/A	N/A
240.0.0.0 to 255.255.255.255	E	N/A	N/A

The IP address 192.168.6.11 is an example of a Class C address, which uses a default mask of 255.255.255.0. With this address, the network address is 192.168.6.0, and the host address is 11. Know that 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.

Instead of using the default subnet mask, it is possible to use custom subnet masks to define different network addresses. This process is called *subnetting* and typically uses CIDR notation.
