6.2.5 Network Adapter Facts

A network adapter (also called a network interface card or NIC) connects a host to the network medium.

This lesson covers the following topics:

- Function of the network adapter
- Speed of the network adapter
- Wake-on-LAN (WOL)
- MAC Address
- How Devices Communicate

Function of the Network Adapter

The network adapter is responsible for converting binary data into a format to be sent on the network medium. A transceiver is responsible for converting digital data into digital signals to be sent on the medium. The type of signal the transceiver sends depends on the type of network. A fiber optic NIC sends light signals, an Ethernet NIC sends electronic signals on a wire, and a wireless NIC sends radio signals. To receive signals, the transceiver converts digital signals from the network to digital data for the PC.

A modem converts binary data to analog waves (modulation) on the sending end and then converts the analog waves back to binary data (demodulation) on the receiving end.

Most desktop computers have motherboards with built-in network adapters. Practically all mobile devices (i.e., smart phones, tablets, laptops, etc.) have a built-in wireless NIC.

Network adapters must match the network medium of the network.

Ethernet network adapters that are connected to a switch will operate in full-duplex mode. This allows the adapter to send and receive at the same time.

Speed of the Network Adapter

The speed of an Ethernet network adapter is determined by the NIC, the network medium, and the connectivity device. The speed can be only as fast as the slowest component. For example, if the NIC runs at 1000 Mbps, but the Ethernet cable runs only at 100 Mbps, the speed to the network will be 100 Mbps.

Wake-on-LAN (WOL)

Most network adapters support Wake-on-LAN (WOL) functionality, which allows you to power on a computer system over the network through the network adapter.

MAC Address

The MAC address is a unique hexadecimal identifier burned into the ROM of every NIC.

The MAC address is a 12-digit (48-bit) hexadecimal number. Each number ranges between 0–9 or A–F. The numbers in a MAC address can be divided by dashes (00-B0-D0-06-BC-AC), periods (00B0.D006.BCAC), or colons (00:B0:D0:06:BC:AC).

The MAC address is guaranteed unique through design. The first half (first six 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 the addresses in the original assignment can apply for a new MAC address assignment.

> Some network cards allow you to change the MAC address through jumpers, switches, or software. However, there is little practical reason for doing so.

How Devices Communicate

Devices use the MAC address to send frames to other devices on the same subnet.

Before two devices can communicate, they must know the MAC address of the receiving device. They do this by using the Address Resolution Protocol (ARP):

1. The sending device sends out a broadcast frame:
   - The destination MAC address is all Fs (FFFF:FFFF:FFFF).
   - The sending MAC address is its own MAC address.
   - The destination IP address is the known IP address of the destination host.
   - The sending IP address is its own IP address.
2. All hosts on the subnet process the broadcast frame and look at the destination IP address of the packet.
3. If the destination IP address matches its own address, the host responds with a frame that includes its own MAC address as the sending MAC address.
4. The original sender then reads the MAC address from the frame and associates the IP address with the MAC address, saving it in cache.

When the sender knows the MAC address of the receiver, it sends data in frames addressed to the destination device.