A+ Core 1 and Core 2 CertMaster Perform 15.0

5.2.1 Network Interface Cards

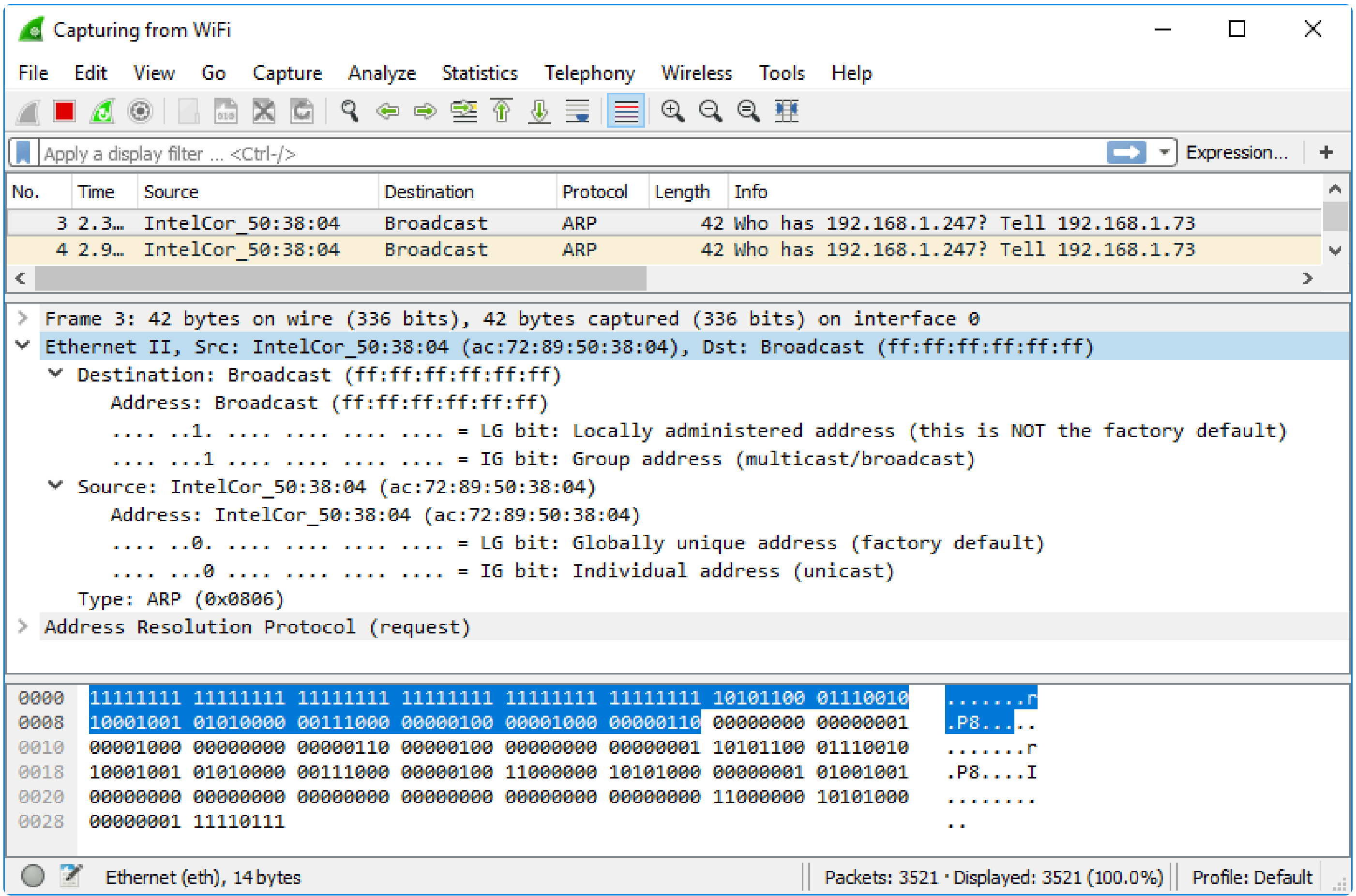
Ethernet communications are established by either electrical signaling over copper twisted pair cable or pulses of light transmitted over fiber optic cable. The physical connection to the cable is made using a transceiver port in the computer's network interface card (NIC). The majority of PC motherboards today have a built-in 1000BASE-T compatible adapter.

You might use a NIC adapter card to support other types of Ethernet, such as fiber optic. You can also purchase cards with multiple ports of the same type - two or four 1000BASE-T ports, for instance. The multiple ports can be bonded to create a higher-speed link. Four Gigabit Ethernet ports could be bonded to give a nominal link speed of 4 Gbps.

For the NIC to be able to process the electrical or light signals as digital data, the signals must be divided into regular units with a consistent format. There must also be a means for each node on the local network to address communications to other nodes. Ethernet provides a data link protocol to perform these framing and addressing functions.

Each Ethernet NIC port has a unique hardware/physical address, called the "media access control" (MAC) address. Each frame of Ethernet data identifies the source MAC address and destination MAC address in fields in a header.

Captured Ethernet frame showing the destination and source MAC addresses. The destination address is a broadcast address



Screenshot courtesy of Wireshark.

▼ Description

The interface at the top includes standard menu options like File, Edit, View, Capture, and others. Below the menu bar, there are filtering options and buttons for controlling the capture process. Th table below includes the Number, Time, Source, Destination, Protocol, Length, and Info. Few lines of code are given below.

A MAC address consists of 48 binary digits, making it six bytes in size. A MAC address is typically represented as 12 digits of hexadecimal. Hexadecimal is a numbering system often used to represent network addresses of different types. A hexadecimal digit can be one of sixteen values: 0–9 and then A, B, C, D, E, F. Each hexadecimal digit represents half a byte (or four bits aka a nibble).

A MAC address is typically written out with a colon separating every two digits. They may occasionally use a hyphen or no separator - for example, `00:60:8C:12:3A:BC` or `00608C123ABC`.

A MAC address is broken into two distinct parts:

- The first 24 bits are known as the **Organizationally Unique Identifier (OUI)**. This identifies the manufacturer of the NIC.
- The last 24 bits are known as the **Network Interface Controller (NIC) Specific**. This is a unique identifier for each NIC.

When you convert the first two hex digits of a MAC address to binary, the two right-most bits act as flags. The very last bit shows individual (0) versus group / multicast (1). The bit just to its left shows universally administered (0, factory) versus locally administered (1, set by software). Example: the address 01:13:10:6B:17:A8 starts with 01, which is 00000001 in binary. The last bit is 1, so it is multicast, and the next bit is 0, so it is globally unique.