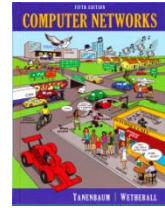# Solutions – Ethernet

The solutions below are based on our capture and use of tools. Your answers will necessarily differ in the details because they are based on your capture and use of tools in a different network setting. Nonetheless, we expect our solutions to help you understand whether your answers are correct.

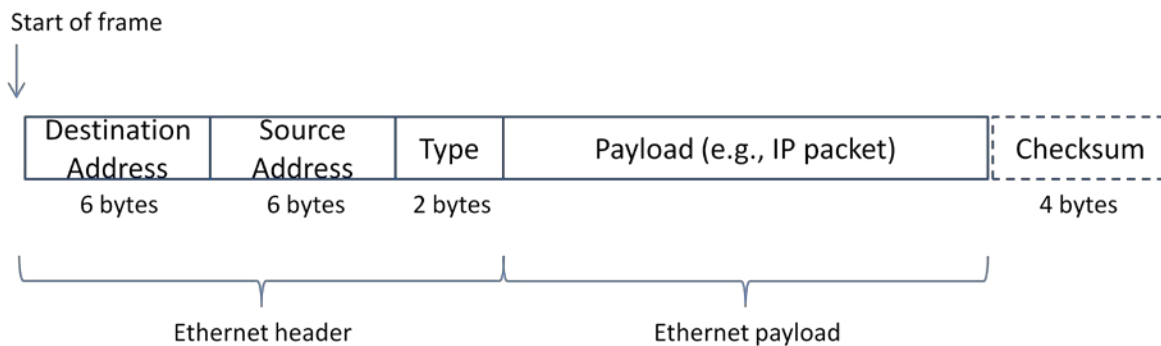## Step 3: Ethernet Frame Structure

Figure 1: Structure of an Ethernet frame

There are several features to note:

- The destination address comes before the source address.
- The pad is not shown because the packets we examined (ping) are large enough that no pad is needed.
- Unlike many protocols, Ethernet has a trailer (the checksum, and pad if present) as well as a header. The checksum is handled by the hardware and not visible to Wireshark.
- The Ethernet header is 14 bytes long.
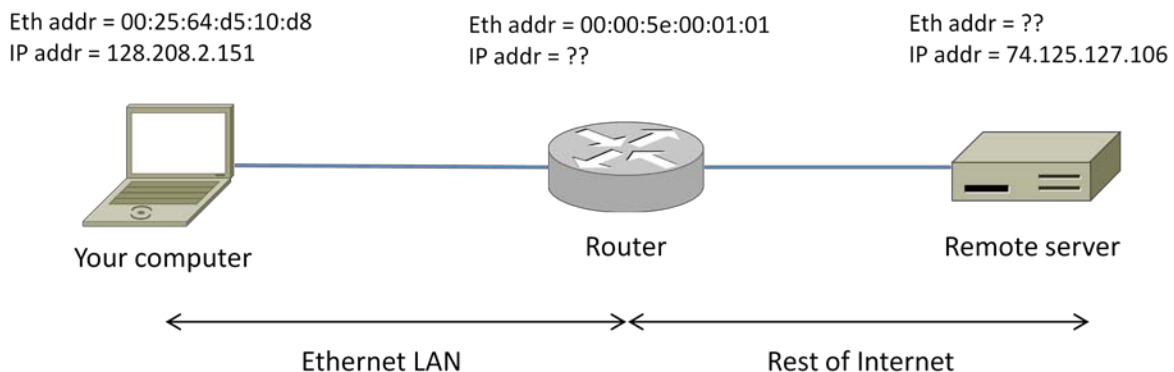
Step 4: Scope of Ethernet Addresses

Figure 2: Ethernet and IP addresses of network devices

There are several features to note:

- The Ethernet and IP addresses will vary for your trace because different computers are involved, but they will have the same form, e.g. 6 bytes in hexadecimal format or 4 "dotted" bytes.
- The Ethernet addresses correspond to your computer and the router.
- The IP addresses correspond to your computer and the remote server.
- Some Ethernet addresses and IP addresses are not known from the trace alone. They are shown as "??".

Step 5: Broadcast Addresses

Answers to the questions:

1. The broadcast address is ff:ff:ff:ff:ff:ff. This is 48 bits of "all 1s"written in standard form.
2. The broadcast/multicast or "group" bit is shown by Wireshark as "…. …1 …. …. …. …." or a one in the low-order bit of the first address byte. We could also write this 01:00:00:00:00:00. This bit is actually the bit that is transmitted on the wire first because Ethernet defines the transmission order to be the "least significant bit of each byte first".

Explore on your own (IEEE 802.3)

Answers to the questions:

1. The IEEE 802.3 header is 14 bytes, the same as DIX Ethernet. (Both also have a trailer with a checksum and padding if needed.) LLC adds another 3 bytes of headers for a total of 17 bytes of headers.
2. The DIX Ethernet Type field and IEEE 802.3 Length field are in the same position. If the value is less than 0x600 (1536) then it is interpreted as a frame length. If the value is larger than 0x600 (1536) then it is interpreted as a Type value.
3. IEEE 802.3 adds the LLC header immediately after the IEEE 802.3 header to conveys the next higher layer protocol. LLC uses a single initial byte called the DSAP (destination service access point) rather than the two bytes in the Type field.

[END]