Ethernet Frame Format

In this lesson, we'll study the ethernet frame format.

WE'LL COVER THE FOLLOWING

Ethernet Frames

The original 10 Mbps Ethernet specification defined a simple frame format where each frame is composed of five fields.

0. The Ethernet frame starts with a **preamble** (not shown in the figure below) that's used by the physical layer of the receiver to synchronise its clock with the sender's clock.

1. The first field of the frame is the **destination address**. As this address is placed at the beginning of the frame, an Ethernet interface can quickly verify whether it's the frame recipient and if not, cancel the processing of the arriving frame.

2. The second field is the **source address**. While the destination address can be either a unicast or a multicast/broadcast address, the source address must always be a unicast address.

3. The third field is a 16 bit integer that indicates which type of network layer packet is carried inside the frame. This field is often called the **Ether Type**. Frequently used EtherType values include: 0x0800 for IPv4, 0x86DD for IPv6, and 0x806 for the Address Resolution Protocol (ARP).

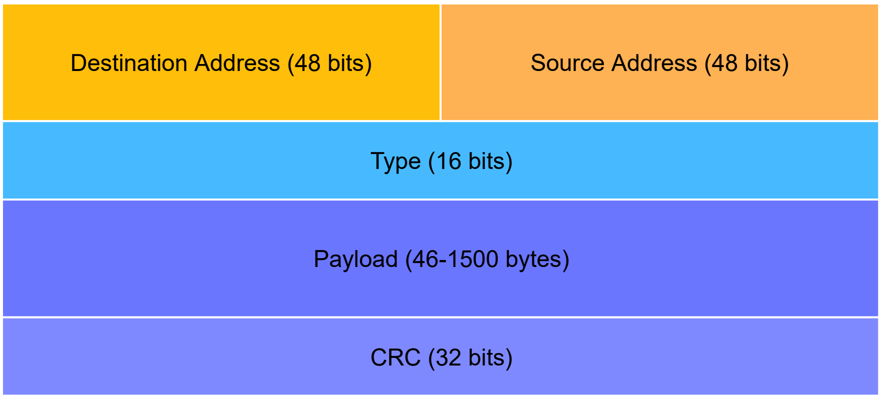
4. The fourth part of the Ethernet frame is the **payload**. The minimum

4. The fourth part of the Ethernet frame is the **payload**. The minimum length of the payload is 46 bytes to ensure a minimum frame size,

   including the header of 64 bytes. The Ethernet payload cannot be longer than 1500 bytes. This size was found reasonable when the first Ethernet specification was written. 1500 bytes was large enough without forcing the network adapters to contain overly large memories.

5. The last field of the Ethernet frame is a 32 bit **Cyclical Redundancy Check (CRC)**. This CRC is able to catch a much larger number of transmission errors than the Internet checksum used by IP, UDP and TCP.

The format of the Ethernet frame is shown below:



Ethernet DIX frame format

The Ethernet frame format shown above is highlighted in DIX, i.e., the first ethernet specification. This is the format used to send both IPv4 and IPv6 packets.

Problem: Sending Short Frames

After the publication of DIX, the Institute of Electrical and Electronic Engineers (IEEE) began to standardize several Local Area Network technologies starting with Ethernet.

- While developing its Ethernet standard, the IEEE 802.3 working group was confronted with a problem: Ethernet mandated a minimum payload size of 46 bytes, while some companies were looking for a LAN technology that could transparently transport short frames containing only a few bytes of payload.

- Such a frame can be sent by an Ethernet host by padding it to ensure that

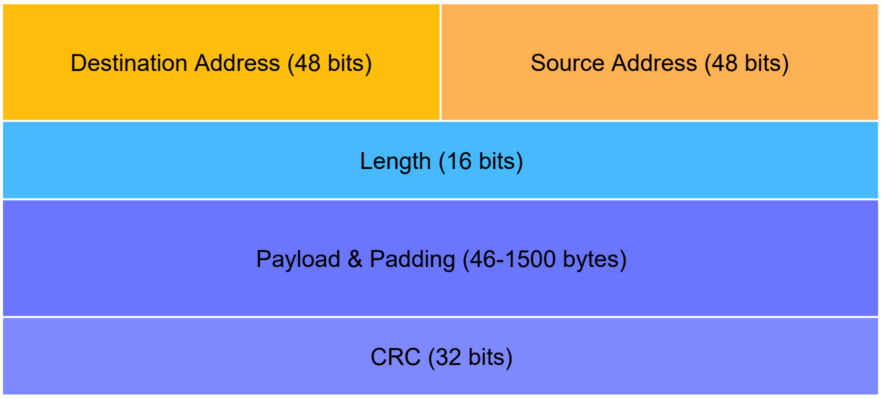
> the payload is at least 46 bytes long. However since the original Ethernet
>
> header does not contain a length field, it's impossible for the receiver to determine how many useful bytes were placed inside the payload field.

Solution: Add Length Field

To solve this problem, the IEEE decided to **replace the Type field with a length field**. This **Length field contains the number of useful bytes in the frame payload**. The payload must still contain at least 46 bytes, but padding bytes are added by the sender and removed by the receiver.

Without the type field, however, it's impossible for a receiving host to identify the type of network layer packet inside a received frame. To solve this new problem, IEEE developed a completely new sublayer called the **Logical Link Control**. Several protocols were defined in this sublayer. One of them provided a slightly different version of the Type field of the original Ethernet frame format. Another contained acknowledgments and retransmissions to provide a reliable service.

The figure below shows the official 802.3 frame format.


Destination Address (48 bits)
Source Address (48 bits)
Length (16 bits)
Payload & Padding (46-1500 bytes)
CRC (32 bits)

Ethernet 802.3 frame format

Quick Quiz!

1

What would be the total size of a minimal sized TCP packet encapsulated inside an IP packet, encapsulated inside an Ethernet frame?

COMPLETED 0%

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In the next lesson, we’ll look at physical layers that have been defined for Ethernet networks.