



ondia



The Ethernet Specifications

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Ethernet Basics



Ethernet

- The technology for connecting devices in a network
- Describes how network devices can format and transmit data
- Uses both Data Link and Physical layer specifications
- Electrical and Electronics Engineers (IEEE) defines Ethernet as protocol 802.3

Ethernet Basics



Ethernet

| Bandwidth | Common Name | Informal name | IEEE name | Cable Type |
|-----------|---------------------|---------------|-----------|-------------|
| 10 Mbps | Ethernet | 10Base-T | 802.3 | UTP 100m |
| 100 Mbps | Fast Ethernet | 100Base-T | 802.3u | UTP 100m |
| 1000 Mbps | Gigabit Ethernet | 1000Base-LX | 802.3z | Fiber 5000m |
| 1000 Mbps | Gigabit Ethernet | 1000Base-T | 802.3ab | UTP 100m |
| 10 Gbps | 10 Gigabit Ethernet | 10GBase-T | 802.3an | UTP 100m |

Ethernet Basics

Collision Domain

The term collision domain is used to describe a part of a network where packet collisions can occur

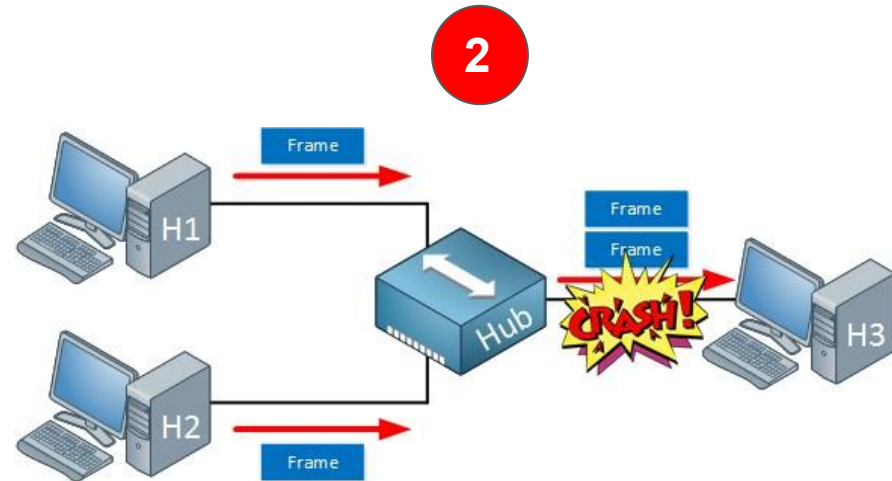
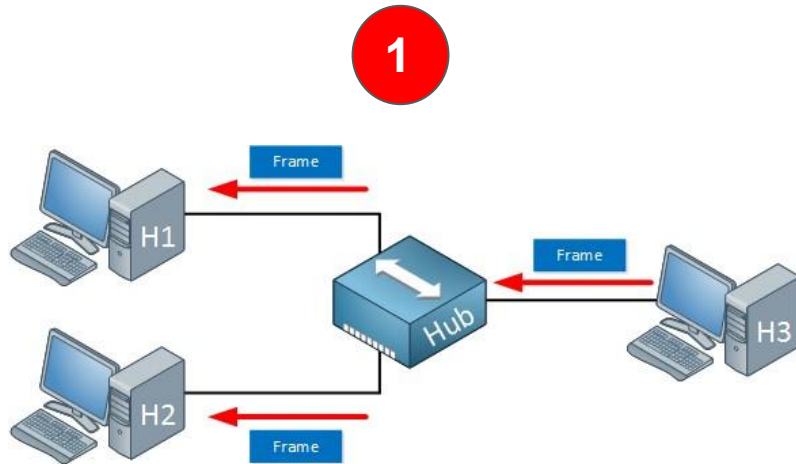
Collisions occur when two devices on a shared network segment send packets simultaneously

The colliding packets must be discarded and sent again, which reduces network efficiency

Ethernet Basics

Collision Domain

Occurs often in a hub environment

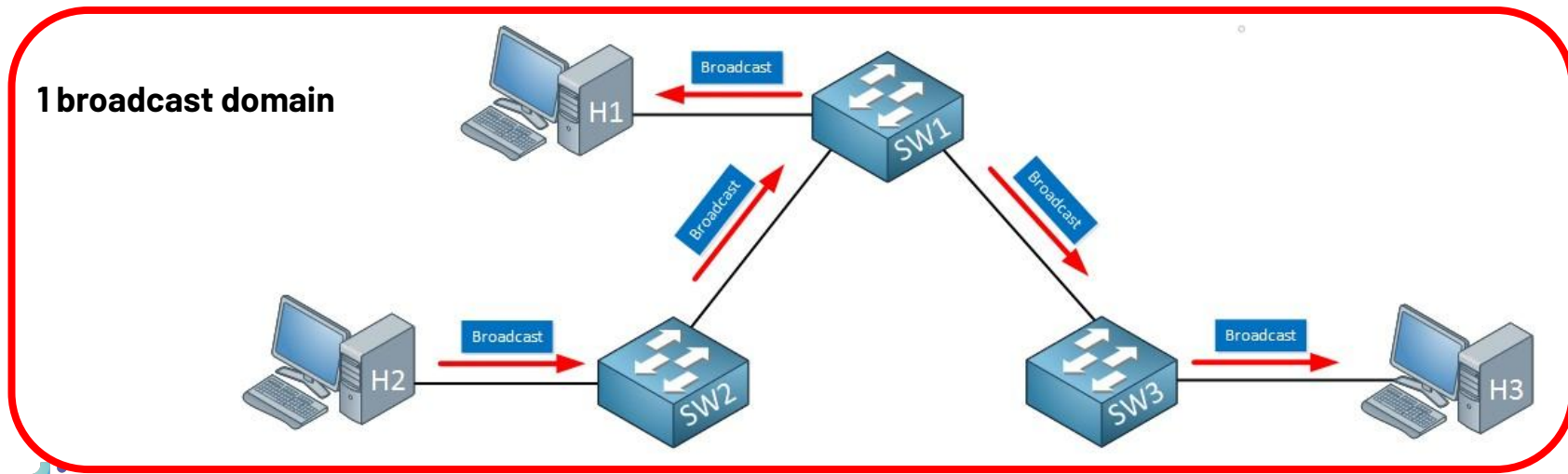


Ethernet Basics



Broadcast Domain

A broadcast domain is a collection of network devices that receive broadcast traffic from each other

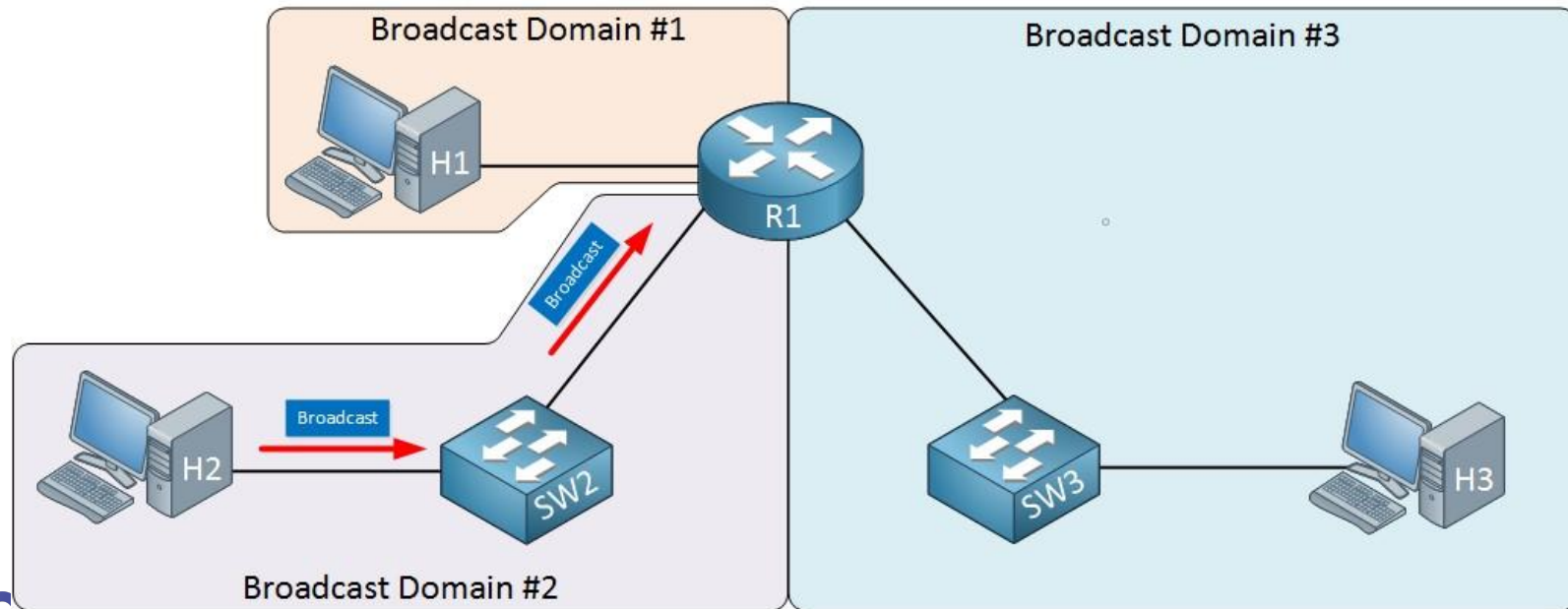


Ethernet Basics



Broadcast Domain

The more broadcast domains the more efficient network



Ethernet Basics

CSMA/CD

- Carrier Sense Multiple Access/Collision Detection is the protocol that is used to detect collisions and to re-transmit frames
- Only **bridges**, **switches**, and **routers**, but not **hubs**, can effectively prevent a transmission from propagating throughout the entire network

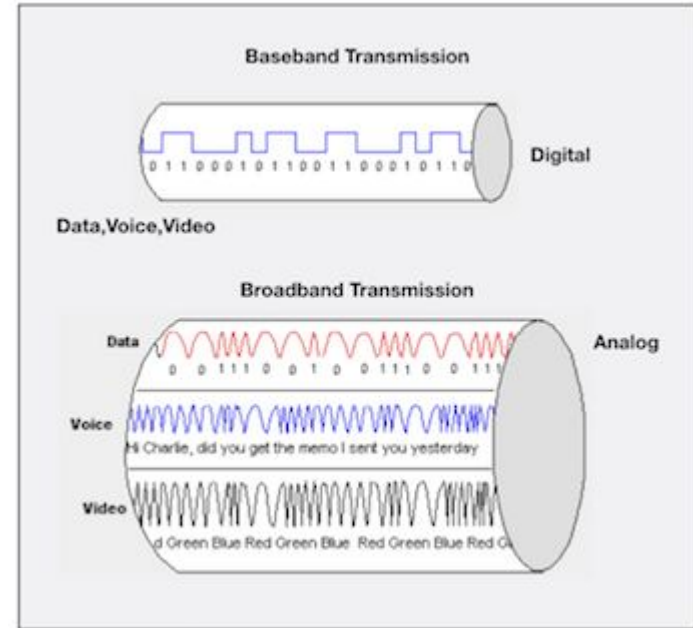


Ethernet Basics



Broadband/Baseband

- Baseband
 - Uses digital signals and single channel
 - Communication is bidirectional
 - Short distance
- Broadband
 - Uses analog signals
 - Multiple transmissions are possible
 - Communication is unidirectional
 - Long distance

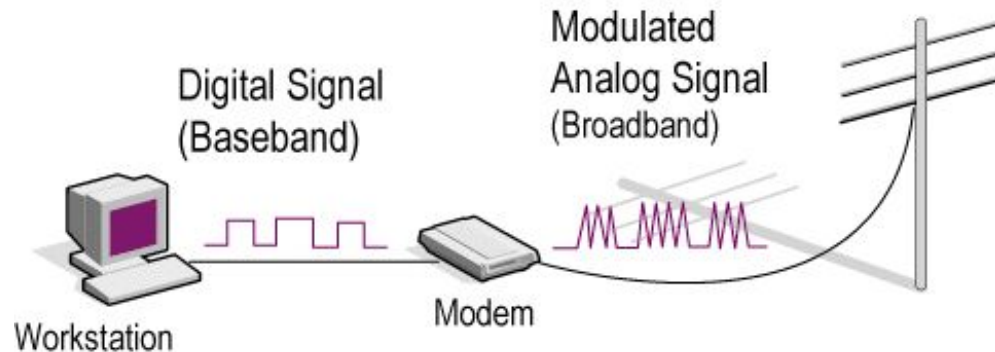


Ethernet Basics



Broadband/Baseband

If you are using a broadband internet connection for your home internet, the signals from your ISP up to your broadband router are broadband signals. But, the signals used inside your Ethernet LAN are baseband signals.





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Ethernet at the Data Link Layer



Ethernet at the Data Link Layer



Binary to Decimal and Hexadecimal Conversion

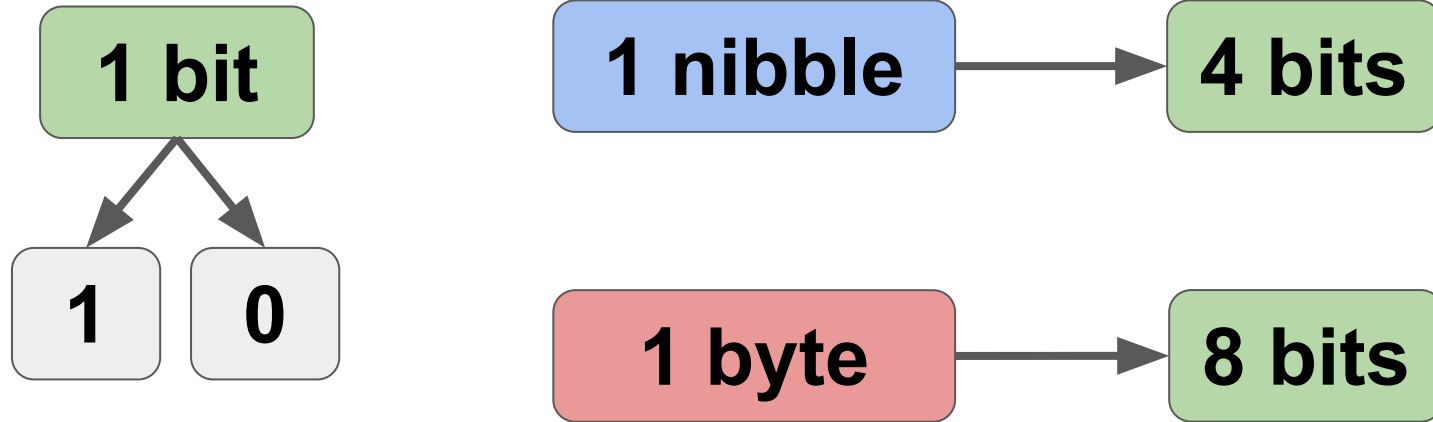
- Ethernet at the Data Link layer is responsible for:
 - **Ethernet addressing** (hardware or MAC addressing)
 - **framing packets** received from the Network layer
- Ethernet MAC addresses are made up of hexadecimal addresses



Ethernet at the Data Link Layer



Binary to Decimal and Hexadecimal Conversion





Binary to Decimal Conversion

| Binary Value | Decimal Value |
|--------------|---------------|
| 10000000 | 128 |
| 11000000 | 192 |
| 11100000 | 224 |
| 11110000 | 240 |
| 11111000 | 248 |
| 11111100 | 252 |
| 11111110 | 254 |
| 11111111 | 255 |



Ethernet at the Data Link Layer



Binary to Decimal and Hexadecimal Conversion

| Binary Value | Hexadecimal Value | Decimal Value |
|--------------|-------------------|---------------|
| 0000 | 0 | 0 |
| 0001 | 1 | 1 |
| 0010 | 2 | 2 |
| 0011 | 3 | 3 |
| 0100 | 4 | 4 |
| 0101 | 5 | 5 |
| 0110 | 6 | 6 |
| 0111 | 7 | 7 |

| Binary Value | Hexadecimal Value | Decimal Value |
|--------------|-------------------|---------------|
| 1000 | 8 | 8 |
| 1001 | 9 | 9 |
| 1010 | A | 10 |
| 1011 | B | 11 |
| 1100 | C | 12 |
| 1101 | D | 13 |
| 1110 | E | 14 |
| 1111 | F | 15 |



Ethernet at the Data Link Layer

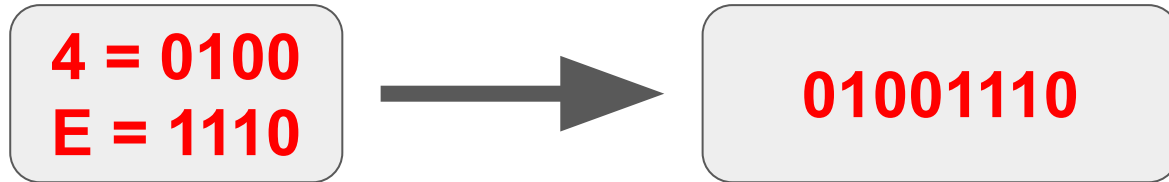


Binary to Decimal and Hexadecimal Conversion

Example:

What is the binary value of **0x4E** (or **4Eh**)?
(*0x* and *h* means that the value is hexadecimal or hex)

binary:





Ethernet at the Data Link Layer



Binary to Decimal and Hexadecimal Conversion

27h



Ethernet at the Data Link Layer



Binary to Decimal and Hexadecimal Conversion

0xF9

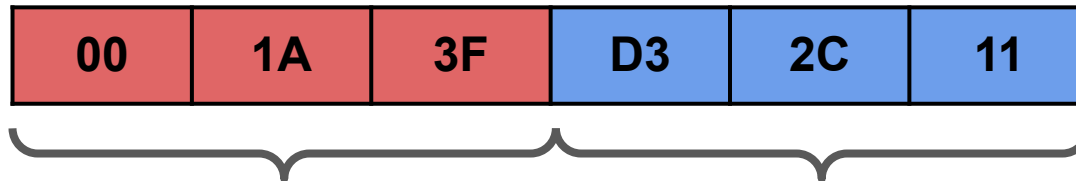


Ethernet at the Data Link Layer



Ethernet Addressing

- MAC (Media Access Control) Address
 - 48-bit (6 bytes or 12-digit hex) hardware number
 - unique
 - embedded into the network card, not changeable
 - represented as **00:1A:3F:D3:2C:11** or **00-1A-3F-D3-2C-11**



Organizationally Unique Identifier (OUI)

Network Interface Controller Specific

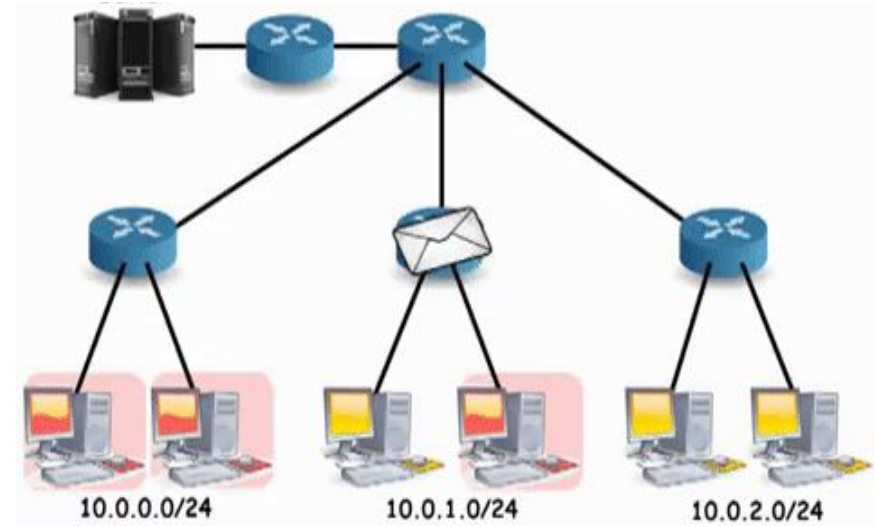
Ethernet at the Data Link Layer



Types of MAC Address

1. Unicast:

- A specific NIC on the network
- Only one sender and only one receiver



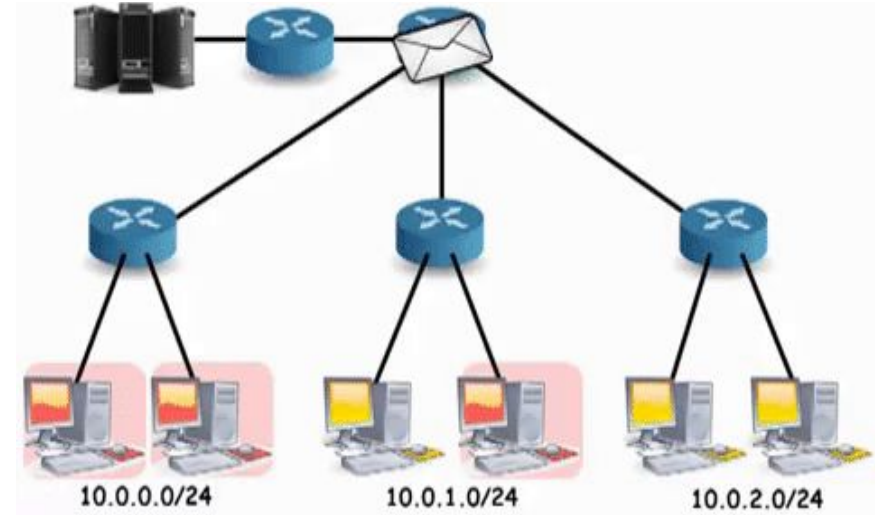
Ethernet at the Data Link Layer



Types of MAC Address

2. Multicast:

- A group of receivers
- OUI is **01:00:5E**



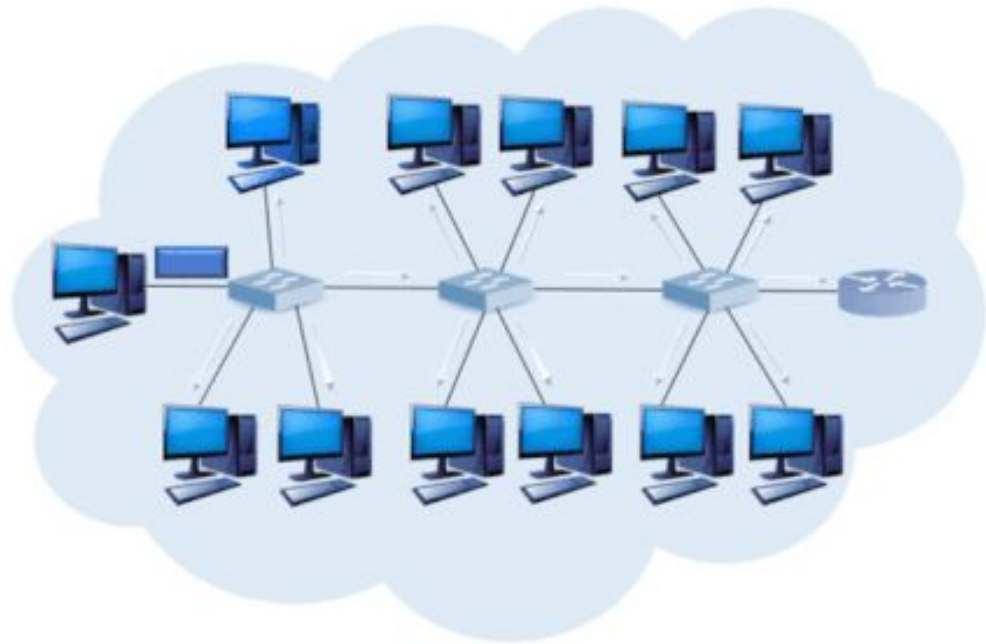
Ethernet at the Data Link Layer



Types of MAC Address

3. Broadcast:

- All devices on the network are recipients
- MAC Address is:
FF:FF:FF:FF:FF:FF



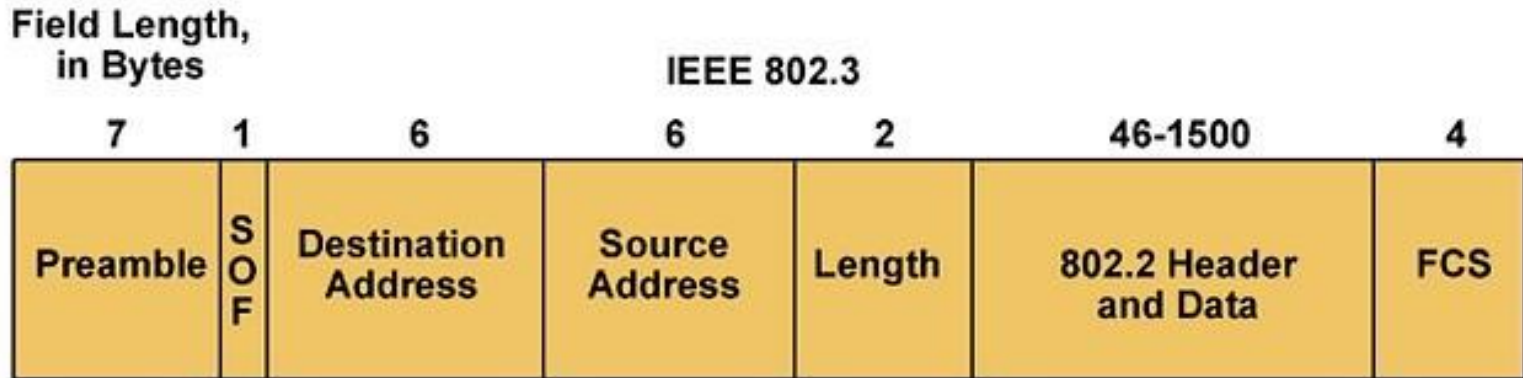


Ethernet at the Data Link Layer



Ethernet Frames

- Encapsulated data defined by the Network Access layer is called an Ethernet frame
- The Ethernet frame structure is defined in the IEEE 802.3 standard





THANKS!

Any questions?

