

Ethernet Switching

Ethernet Frames

Ethernet : Operates in both data link and physical layer
: Family of networking technologies defined in the IEEE 802.2 and 802.3 standards

Physical + MAC \rightarrow 802.3
LLC \rightarrow 802.2

802 LAN/MAN Standards : (1) LLC Sublayer (IEEE 802.2)
(2) MAC Sublayer
(IEEE 802.3, 802.11, 802.15)

Responsibilities of MAC : Data encapsulation
Accessing the media

Encapsulation

- (1) Ethernet Frame
- (2) Ethernet Addressing
- (3) Ethernet Error detection

Ethernet Frame Fields

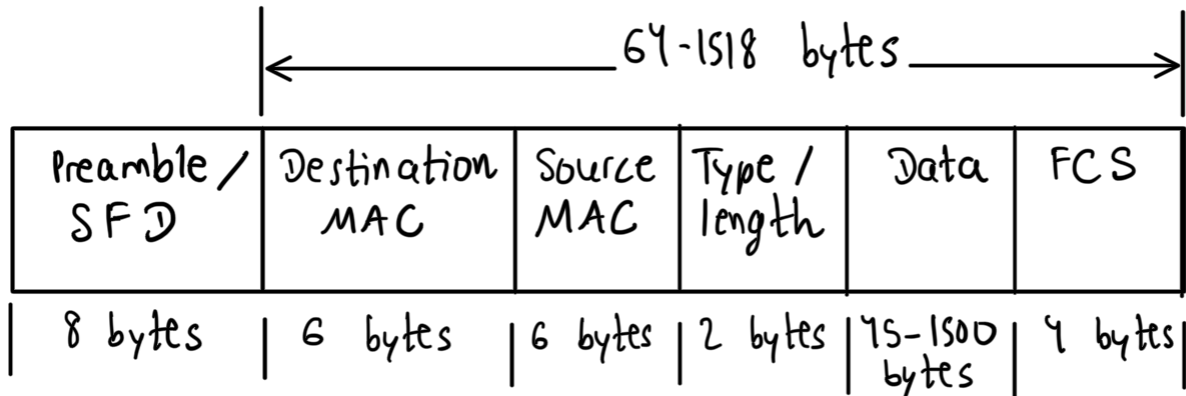
Frame size : 64 (min) - 1518 (max) bytes
[extra 18 byte is called preamble field]

< 64 bytes frame : collision fragment / runt frame
> 1500 bytes frame : jumbo / baby giant frame

If frame is < 64 or > 1500, it is dropped (invalid)

* Jumbo frames are usually supported by most Fast

Ethernet / Gigabit Ethernet switches and NICs.



Ethernet MAC address

- 48-bit address expressed using 12 hexadecimal digits (1 byte = 8 bits) → (6 bytes = 48 bits)
- 6 bytes in length
- Consists of two parts: OUI and Vendor-Assigned

3 bytes
former

3 bytes
latter

(3 bytes = 24 bits = 6 hexa)

Frame Processing

- (1) Device forwards a message to Ethernet network
[Ethernet header = Source MAC + Destination MAC]
- (2) NIC receives an Ethernet frame
Examines destination MAC and checks if it matches physical MAC stored in RAM

if check != match:
 FrameDiscard()
else:
 FramePasses()

* In ethernet, different MAC addresses are used for unicast, broadcast & multicast communications

```
while in Upper_OSI_layers :  
    De-encapsulation()  
    break
```

ARP : process used to determine destination MAC address associated with an IPv4 address

ND : process used to determine destination MAC address associated with an IPv6 address

Broadcast : FF-FF-FF-FF-FF-FF
MAC address

Multicast : 01-00-5E-xx-xx-xx

Switch fundamentals

- Ethernet switch uses MAC addresses for forwarding decisions
- When a switch is turned on, the MAC address table is empty

MAC = CAM (Content Addressable Memory)

Switch learning and forwarding

Learning: examine the source MAC address
Forwarding: find the destination MAC address
Filtering : chosen dest. MAC address frame being filtered and forwarded out a single port

Duplex and Bandwidth

Full-duplex: Both ends of the connection can send and receive simultaneously

Half-duplex: Only one connection end can send at a time

Duplex mismatch: One port full-duplex, another half-duplex

Solution: (1) both ports full-duplex
(2) enable auto negotiation

Auto-MDIX

Automatic medium-dependent interface crossover

- Configures the interfaces accordingly
- Cisco IOS 12.2 (18)SE or later
- interface configuration command: auto mdix