# ADVANCED COMPUTER NETWORKS

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## (1) IEEE 802.3 Frame Format

Basic frame format which is required for all MAC implementation is defined in IEEE 802.3 Ethernet standard.

46 - 1500 octets

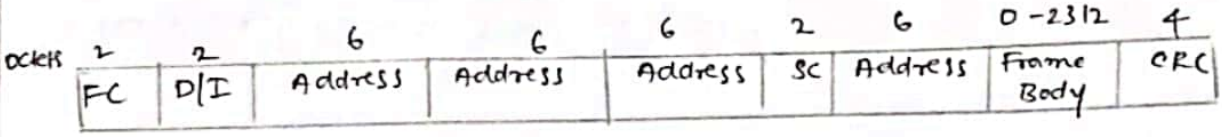
| 7 octets | 1 | 6 | 6 | 2 | 20 | 20 | 4 |
|---|---|---|---|---|---|---|---|
| Preamable | SFD | DA | SA | length | LLC data | Pad | FCS |

SFD = start of frame delimeter
DA = Destination address
SA = Source address
FCS = Frame check sequence

- Preamable: 7 octets of 10101010
- SFD: 10101011
- Length: The maximum frame size is 1518 octets, excluding preamble and SFD.
- Pad: octets added to ensure that frame is long enough for collision detection
- FCS: 32 bit CRC, based on all fields except preamble, SFD and FCS

Note: Both preamable, SFD works at physical layer.

## MAC Frame Format




FC = Frame Control
D/I = Duration / Connection ID
SC = Sequence Control

- **Frame control:** Indicates the type of frame.
  - control, management, or data
- **Control Frames:**
  - RTS, CTS, ACK (Acknowledgement), etc
- **Management Frames:**
  - To manage communications between stations and APs.
- **sequence control:**
  - 4 bit fragment number subfield used for fragmentation and reassembly
  - 12 bit sequence number used to number frames
- **Frame body:** MSDU or fragment of MSDU
- **Addresses:**
  - Number and meaning of 48 bit address fields depend on context
  - Source address, destination address, Transmitter address, Receiver address
- **Duration / connection ID:**
  - In some control frames, contains association or connection Identifier
- **Frame check sequence:** 32 bit cyclic redundancy check

(4) FAST ETHERNET & GIGA ETHERNET

| Fast Ethernet | Giga ethernet |
|---|---|
| 1. provides 100 Mbps speed | 1. provides 1 Gbps speed. |
| 2. Maximum segment length:<br>100 base TX – 100 m<br>100 base FX – 20 km (multimode Fiber)<br>100 base FX – 20 km (singlemode Fiber) | 2. Maximum segment length:<br>1000 base T: 100m (cat 5e/6)<br>1000 base SX: 275 m (multimode)<br>1000 base LX: 512 m (multimode)<br>1000 base LX: 20 km (singlemode)<br>1000 base LH: 80 km (singlemode) |
| 3. simple configured | 3. More complicated than Fast ethernet |
| 4. Generated more delay than Giga ethernet | 4. Generates less delay than Fast ethernet |
| 5. coverage is upto 10 km | 5. coverage is upto 70 km. |
| 6. Round Trip delay is 100 – 500 bit times | 6. Round trip delay is 4000 bit times. |
| 7. successor of 10 base T ethernet | 7. successor of Fast ethernet |

(3) The preamble field is 7 octet field that is used to allow the PLC circuit to reach its steady state synchronisation with the received frame's Timing.

Preamble is 7 bytes with patteon 10101010 followed by one byte with patteon 10101011

Preamble is used to synchronise receiver, sender clock rates.

Initially, preamable was introduced to allow for loss of few bits due to signal delay, but today's high speed ethernet don't need preamble to protect frame bits.

* preamble indicates receiver that frame is coming and allows receiver to lock onto data stream before the actual frame begins.

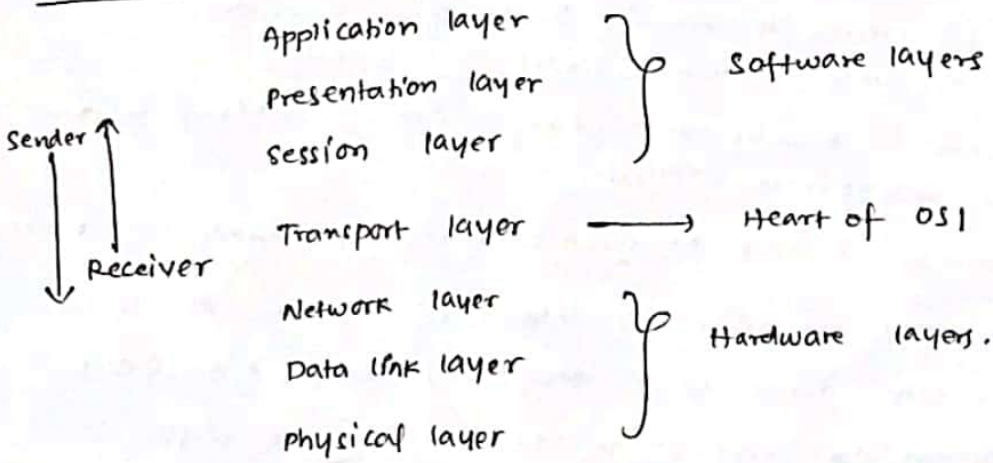
**Advantage of having FCS field in trailer of frame than in header:**

Having FCS field in trailer of frame allows stations to compute FCS value as data bits are being transmitted. Also, it allows FCS value to be computed by receiver as data bits arrive and be compared with FCS value at the end of frame.

## (5) OSI Model

* OSI is one of the first standard layering. It has been developed by ISO - International Organisation of Standardization in 1984.
* It is a 7 layer architecture with each layer having specific functionality.
* This is a reference model, a different model, TCP/IP is used in practice.
* All 7 layers work collaboratively to transmit data from one person to another across the globe.

**7 layers:**



1. Physical layer: Transmits bits

functions: (a) Bit synchronisation
(b) Bit Rate control
(c) Physical Topologies
(d) Transmission mode

2. Data link layer: collects bits into frames, Transmits frames (adapter/ device driver)

Has 2 sub layers: < LLC (Logical link control)
MAC (Media Access control)

3. Network layer: Route packets in a packet switched networks

functions: (a) Routing
(b) Logical Addressing

4. Transport layer: send messages across process end to end

functions: (a) segmentation, reassembly
(b) service point addressing

5. session layer: Tie related flows together, responsible for establishment of connection, maintains sessions security.

functions: (a) session establishment, maintenance, termination
(b) synchronisation
(c) Dialog controller.

6. presentation layer: Format of app data (byte ordering, video format)

functions: (a) Translation
(b) Encryption/ Decryption
(c) Compression

7. Application layer: Application protocols. Implemented by network protocols, produce data that has to be transferred.

Ex: Browsers, Skype.
FTP protocols.

(7) WiMAX unlike 802.11 (wifi) and Ethernet, is a connection oriented. One reason for this is to be able to offer variety of QoS guarantees regarding properties such as latency and jitter, with aim of supporting high quality telephony and high volume multimedia in addition to bursty data traffic. This is conceptually similar to some of wired last mile technologies (Ex: DSL) with which WiMAX or 802.16 is intended to complete.

∴ WiMAX would produce better foundation for packet based telephony service as it provides quality of service.

(8) As the phone begins to leave a cell, it moves into an area of overlap with one or more other cells. The current base station senses weakening signal from the phone and gives control of phone to whichever base station is receiving the strongest signal from it.

(6) Port Based VLAN

Port based VLANs group virtual local area network by #port. In this type of VLAN, a switch port can be configured manually to a member VLAN.

Devices that are connected to this port will belong to same broadcast domain that is because all other ports are configured with a similar VLAN number.

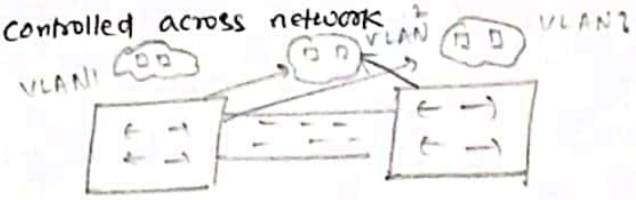
The challenge of this type of network is to know which ports are appropriate to each VLAN. The VLAN membership can't be known just by looking at physical port of switch.

You can determine it by checking configuration information.

## Advantages of membership by port

- User assigned by port association
- Requires no lookup if done in ASICs.
- Easily administered via GUIs.
- Maximise security between VLANs
- packets do not leak information to other domains
- Easily controlled across network

Diagram:




(2) WLAN deals with busty traffic way CSMA/CA using control frames such as RTS and CTS. When a station wants to send data to AP, it sends an RTS. If everything is clear, it will send CTS to all neighbours. Saying that A will be transmitting data for X unit of time, the neighbours can't Transmit during that time. A transmites CTS in this case. If there is a collision, it follows CSMA/CD where 2 parties in collision will pick 2 random numbers at each and wait for some time before they transmit. The process is repeated upto 16 times in case there is a collision.

And for Time sensitive packets, priority packets are used.