

LAN TECHNOLOGIES

Technology Options



Ethernet



Fast Ethernet



Gigabit Ethernet



10 Gig Ethernet



WLAN

Media Access

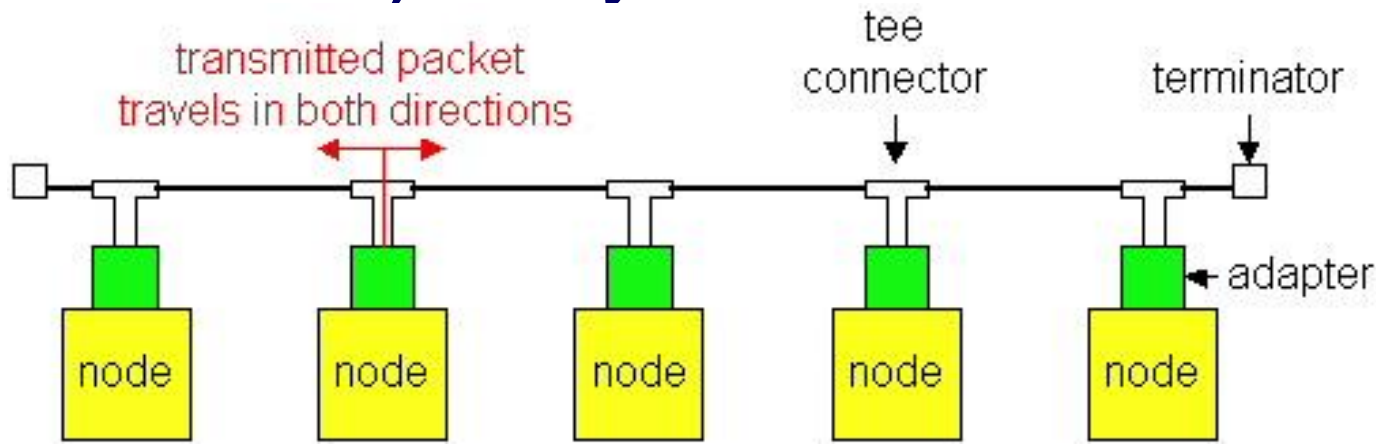
Ethernet and Wi-Fi are both “multi-access” technologies

- ❑ Broadcast medium, shared by many hosts
- ❑ Simultaneous transmissions will result in collisions

Media Access Control (MAC) protocol required

- ❑ Rules on how to share medium

The Data Link Layer is divided into two Part MAC (Media Access Control) Sublayer and LLC (Logic Link Control) Sublayer



802.3 Ethernet

 **Carrier-sense multiple access with collision detection (CSMA/CD).**

 CS = carrier sense

 MA = multiple access

 CD = collision detection






 **Base Ethernet standard is 10 Mbps.**

 100Mbps, 1Gbps, 10Gbps standards came later

Ethernet CSMA/CD



CSMA/CD (carrier sense multiple access with collision detection) media access protocol is used.

-  Data is transmitted in the form of packets.
-  Sense channel prior to actual packet transmission.
-  Transmit packet only if channel is sensed idle; else, defer the transmission until channel becomes idle.
-  After packet transmission is started, the node monitors its own transmission to see if the packet has experienced a collision.
-  If the packet is observed to be undergoing a collision, the transmission is aborted and the packet is retransmitted after a random interval of time using Binary Exponential Backoff algorithm.

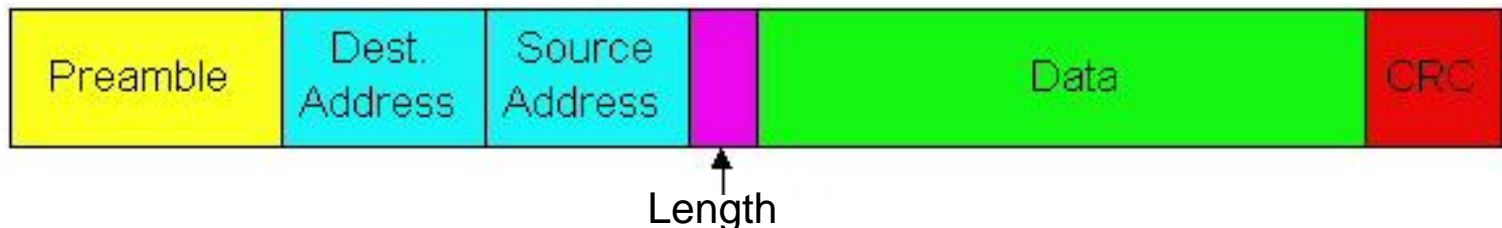
Ethernet Address

- End nodes are identified by their Ethernet Addresses (MAC Address or Hardware Address) which is a unique 6 Byte address.
- MAC Address is represented in Hexa Decimal format e.g 00:05:5D:FE:10:0A
- The first 3 bytes identify a vendor (also called prefix) and the last 3 bytes are unique for every host or device





Ethernet Frame Structure

Preamble:

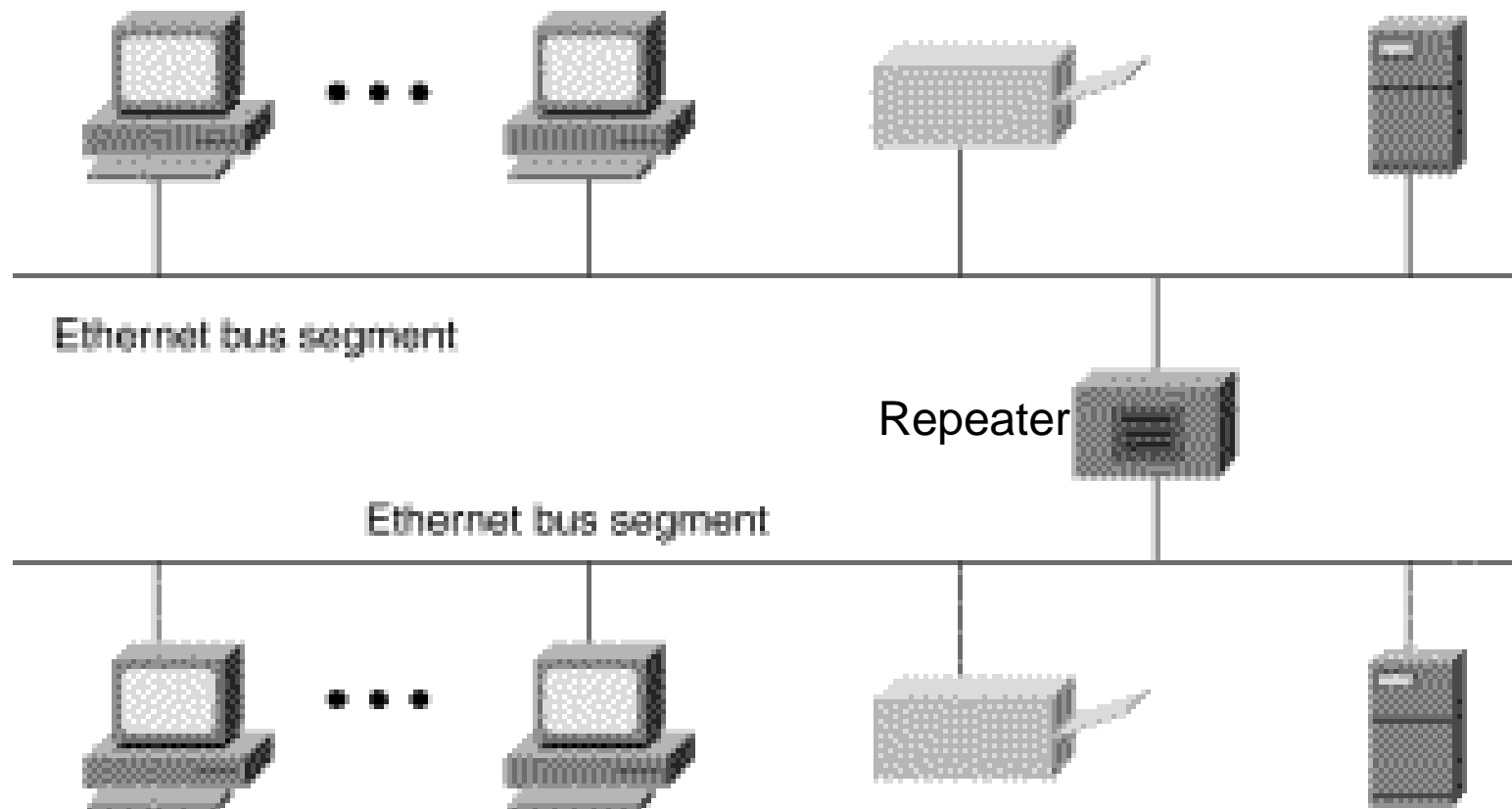
- 7 bytes with pattern 10101010 followed by one byte with pattern 10101011
- Used to synchronize receiver, sender clock rates
- Addresses:** 6 bytes, frame is received by all adapters on a LAN and dropped if address does not match
- Length:** 2 bytes, length of Data field
- CRC:** 4 bytes generated using CR-32, checked at receiver, if error is detected, the frame is simply dropped
- Data Payload:** Maximum 1500 bytes, minimum 46 bytes
 - If data is less than 46 bytes, pad with zeros to 46 bytes



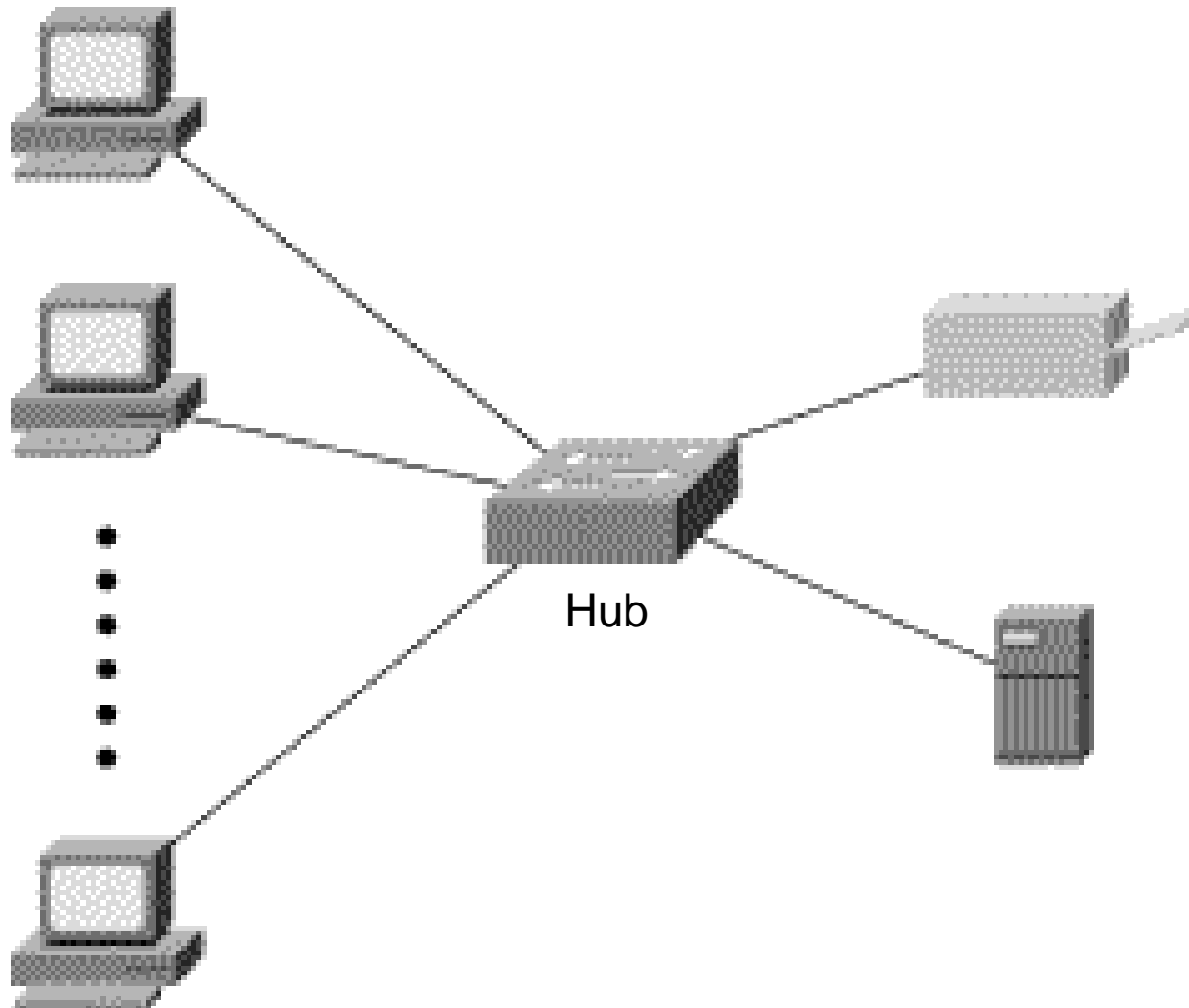
Ethernet

-  **10 Base 5 (Thicknet) (Bus Topology)**
-  **10 Base 2 (Thinnet) (Bus Topology)**
-  **10 Base T (UTP) (Star/Tree Topology)**
-  **10 Base FL (Fiber) (Star/Tree Topology)**

Ethernet BUS Topology







Ethernet STAR Topology






Ethernet

Physical Media :-

-  10 Base5 - Thick Co-axial Cable with Bus Topology
-  10 Base2 - Thin Co-axial Cable with Bus Topology
-  10 BaseT - UTP Cat 3/5 with Tree Topology
-  10 BaseFL - Multimode/Singlemode Fiber with Tree Topology

Maximum Segment Length

-  10 Base5 - 500 m with at most 4 repeaters (Use Bridge to extend the network)
-  10 Base2 - 185 m with at most 4 repeaters (Use Bridge to extend the network)
-  10 BaseT - 100 m with at most 4 hubs (Use Switch to extend the network)

Fast Ethernet

- 100 Mbps bandwidth
- Uses same CSMA/CD media access protocol and packet format as in Ethernet.
- 100BaseTX (UTP) and 100BaseFX (Fiber) standards
- Physical media :-
 - 100 BaseTX - UTP Cat 5e
 - 100 BaseFX - Multimode / Singlemode Fiber
- Full Duplex/Half Duplex operations.

Fast Ethernet



Provision for Auto-Negotiation of media speed: 10 Mbps or 100Mbps (popularly available for copper media only).








Maximum Segment Length

 **100 Base TX - 100 m**

 **100 Base FX - 2 Km (Multimode Fiber)**

 **100 Base FX - 20 km (Singlemode Fiber)**

Gigabit Ethernet

-  **1 Gbps bandwidth.**
-  **Uses same CSMA/CD media access protocol as in Ethernet and is backward compatible (10/100/100 modules are available).**
-  **1000BaseT (UTP), 1000BaseSX (Multimode Fiber) and 1000BaseLX (Multimode/Singlemode Fiber) standards.**
-  **Maximum Segment Length**
 -  1000 Base T - 100m (Cat 5e/6)
 -  1000 Base SX - 275 m (Multimode Fiber)
 -  1000 Base LX - 512 m (Multimode Fiber)
 -  1000 Base LX - 20 Km (Singlemode Fiber)
 -  1000 Base LH - 80 Km (Singlemode Fiber)

10 Gig Ethernet

- 10 Gbps bandwidth.

- Uses same CSMA/CD media access protocol as in Ethernet.

- Propositioned for Metro-Ethernet

- Maximum Segment Length

 - 1000 Base-T - Not available

 - 10GBase-LR - 10 Km (Singlemode Fiber)

 - 10GBase-ER - 40 Km (Singlemode Fiber)