Ethernet:-

- History
  - Developed by Bob Metcalfe and others at Xerox PARC in mid-1970s.(Palo Alto Research center, In California)

- is a family of computer networking technologies commonly used in local area networks (LAN), metropolitan area networks (MAN) and wide area networks(WAN).

- It was commercially introduced in 1980 and first standardized in 1983 as IEEE 802.3

- The original 10BASE5 Ethernet uses coaxial cable as a shared medium, while the newer Ethernet use twisted pair and fiber optic links in conjunction (Combination) with hubs or switches.

- Ethernet data transfer rates have been increased from the original 2.94 (Mb/s) to the latest 100 (Gb/s).

- The Ethernet standards several wiring and signaling variants (transformation) of the OSI physical layer in use with Ethernet.

- Systems communicating over Ethernet divide a stream of data into shorter pieces called frames.

- Each frame contains source and destination addresses, and error-checking data so that damaged frames can be detected and discarded;

Ethernet

- 10 Base 5 (Thicknet) (Bus Topology)

- 10 Base 2 (Thinnet) (Bus Topology)

- 10 Base T (UTP) (Star/Tree 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

▣ 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)

10 BASE 5:-

- 10 BASE is the original 802.3 medium specification and is directly on Ethernet .
- The 10 base 5 specifies the use of 50-ohm coaxial cable.
- The maximum length of a cable segment is set as 500m.
- The maximum length of the network can be extended by uses of the repeaters.

10Base 2:-

- To provide a lower-cost system than 10 Base5 for personal computer for LANs.

- The 10 base 5 specifies the use of 50-ohm coaxial cable.

- Difference is that 10Base 2 uses the thinner cable.

- Supports shorter distance than 10 Base 5 cable.

- Because the same data rate it is possible to combine 10Base 5 and 10 Base 2 in same network.

- By using the repeater that conforms to 10Base 5 on one side and 10 base 2 on other side

10 Base T:-

- Star shaped topology
- Number of station connected to a central point.
- The length of the cable is limited to 100m.
- As alternative an optical fiber link may be used the maximum length is 500m.
- UTP.

What is 10BaseF?

- 10Base-F is a type of standard for implementing Ethernet networks. 10BaseF is different from other 10-Mbps Ethernet technologies because it uses fiber-optic cabling instead of copper unshielded twisted-pair (UTP) cabling. 10BaseF is based on the 802.3 specifications of Project 802 developed by the Institute of Electrical and Electronic Engineers (IEEE).

- **How 10BaseF work?**

- 10BaseF is similar to 10BaseT in that each station is wired into a fiber-optic hub in a star topology to form the network. The maximum length of any segment of 10BaseF fiber-optic cabling is 2 kilometers.

- The recommended cabling type for 10BaseF networks is 62.5-micron diameter fiber-optic cabling. This cable can be terminated with either ST connectors or SMA connectors, depending on the vendor and the hub configuration. Two-strand multimode fiber-optic cabling is used, with one strand allotted for transmitting data and the other for receiving data. (62.5-micron diameter :- **the diameters of the glass or plastic core, the part of the fiber that carries** the light which encodes your data)

Fast Ethernet:-

- **DEVELOPED BY IEEE 802.3 TO provide a low cast Ethernet LAN operating at 100mbps**

- **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(high quality)
  - 100 BaseFX   - Fiber. (X is the type of Medium)

- In computer networks, Fast Ethernet is a variation of Ethernet standards that carry data traffic at 100 Mbps (Mega bits per second) in local area networks (LAN). It was launched as the IEEE 802.3u standard in 1995, and stayed the fastest network till the introduction of Gigabit Ethernet.

- Fast Ethernet is popularly named as 100-BASE-X. Here, 100 is the maximum throughput, i.e. 100 Mbps, BASE denoted use of baseband transmission, and X is the type of medium used, which is TX or FX.

- Fast Ethernet is **one of the versions of the Ethernet standard that enables the transmission of data over 100 megabits per second on local area networks (LAN)**. It was launched in 1995 and was the fastest network connection of its time.

Maximum Segment Length

- 100 Base TX - 100 m
- 100 Base FX - 2 Km (Multimode Fiber)
- 100 Base FX - 20 km (Singlemode Fiber).
- Star topology .

What is Gigabit Ethernet (GbE)?

- Gigabit Ethernet (GbE), a transmission technology based on the Ethernet frame format and protocol used in local area networks (LANs), provides a data rate of 1 billion bits per second, or 1 gigabit (Gb). Gigabit Ethernet is defined in the Institute of Electrical and Electronics Engineers (IEEE) 802.3 standard and is currently being used as the backbone in many enterprise networks.

- Gigabit Ethernet connects computers and servers in local networks. Its improvements in data transfer speed and cabling have prompted many enterprises to replace Fast Ethernet with Gigabit Ethernet for wired local networks.

- Gigabit Ethernet is carried on [optical fiber](#) or copper wire. Existing Ethernet LANs with 10 megabits per second and 100 Mbps cards can feed into a Gigabit Ethernet backbone.

- Newer standards, such as 10 GbE, a networking standard that is 10 times faster than Gigabit Ethernet, are also emerging. Today, data centers and enterprises have a myriad of options of Gigabit Ethernet speeds, including 10 GbE, 20 GbE, 40 GbE and 100 GbE for core switching.

- **How Gigabit Ethernet works**
- Gigabit Ethernet networks can function as half-duplex networks for shared media or as Ethernet switches with a switched full-duplex network.
- Gigabit Ethernet uses the same 802.3 framing structure as standard Ethernet. It supports 1 Gb per second (Gbps) speeds using Carrier Sense Multiple Access/Collision Detect (CSMA/CD). CSMA/CD handles transmissions after a collision has occurred. The transmission rate may cause data packets to intersect when two devices on the same Ethernet network attempt to transmit data at the same time. CSMA/CD detects and discards collided data packets.

- Gigabit Ethernet speeds are delivered by either copper or fiber optic cables. Fiber optic cables are needed for long-range transmissions of more than 300 meters (m). However, traditional Ethernet cables can transmit data at gigabit speeds over shorter distances -- in particular, Cat5e cables or above or the 1000Base-T cabling standard and above. Cat5e cable, for example, consists of four pairs of eight twisted wires in one cable.

- **Types of Gigabit Ethernet**
- Gigabit Ethernet is implemented in different cabling physical layer standards, including the following:
- **1000Base-CX.** This standard, which is used for connections up to 25 m, uses either balanced twinaxial cabling or shielded twisted pair (STP) cabling.
- **1000Base-SX.** This standard, which is used for connections up to 220 m, uses fiber optic cables for short-wavelength transmissions.
- **1000Base-LX.** This standard, which is used for connections up to a maximum distance of 5 kilometers (km), uses fiber optic cables.

- **1000Base-T.** This standard, which is used for connections up to 100 m, uses unshielded twisted pair ([UTP](#)) copper cables with Cat5, Cat5e, Cat6 and Cat7.

- **1000BASE-T1.** This standard, which is used for connections up to 15 m, uses STP copper cables.

- **1000BASE-TX.** This standard, which is similar to 1000Base-T, is used for connections up to 100 m. It uses UTP copper cables. But this standard does not receive much recognition due to its cost and Cat6 and Cat7 cable requirements.

- **1000BASE-KX.** This standard, which is used for connections up to 1 m, uses UTP-type cables.