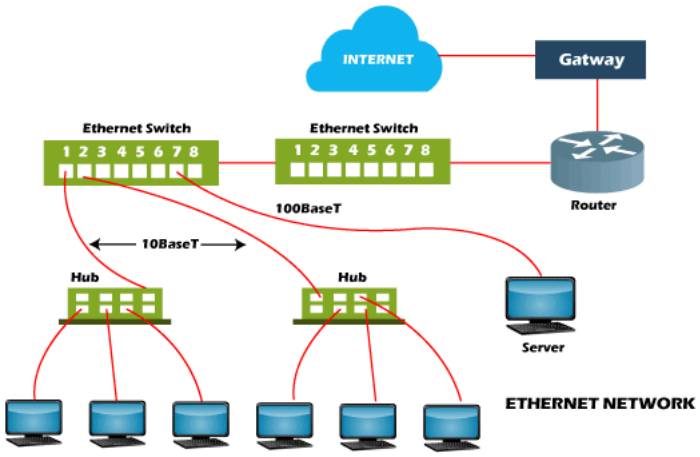
Ethernet (802.3)

Ethernet is the traditional technology for connecting devices in a wired local area network (LAN) or wide area network (WAN). It enables devices to communicate with each other via a protocol, which is a set of rules or common network language.
Ethernet is a type of communication protocol that is created at Xerox PARC in 1973 by Robert Metcalfe and others, which connects computers on a network over a wired connection. It is a widely used LAN protocol, which is also known as Alto Aloha Network. It connects computers within the local area network and wide area network. Numerous devices like printers and laptops can be connected by LAN and WAN



Different Types of Ethernet Networks

An Ethernet device with CAT5/CAT6 copper cables is connected to a fiber optic cable through fiber optic media converters. The distance covered by the network is significantly increased by this extension for fiber optic cable. There are some kinds of Ethernet networks, which are discussed below:

- Fast Ethernet: This type of Ethernet is usually supported by a twisted pair or CAT5 cable, which has the potential to transfer or receive data at around100 Mbps. They function at 100Base and 10/100Base Ethernet on the fiber side of the link if any device such as a camera, laptop, or other is connected to a network. The fiber optic cable and twisted pair cable are used by fast Ethernet to create communication. The 100BASE-TX, 100BASE-FX, and 100BASE-T4 are the three categories of Fast Ethernet.
- Gigabit Ethernet: This type of Ethernet network is an upgrade from Fast Ethernet, which uses fiber optic cable and twisted pair cable to create communication. It can transfer data at a rate of 1000 Mbps or 1Gbps. In modern times, gigabit Ethernet is more common. This network type also uses CAT5e or other advanced cables, which can transfer data at a rate of 10 Gbps.

Advantages of Ethernet

- It is not much costly to form an Ethernet network. As compared to other systems of connecting computers, it is relatively inexpensive.

- Ethernet network provides high security for data as it uses firewalls in terms of data security.
- Also, the Gigabit network allows the users to transmit data at a speed of 1-100Gbps.
- In this network, the quality of the data transfer does maintain.
- In this network, administration and maintenance are easier.
- The latest version of gigabit ethernet and wireless ethernet have the potential to transmit data at the speed of 1-100Gbps.

Disadvantages of Ethernet

- It needs deterministic service; therefore, it is not considered the best for real-time applications.
- The wired Ethernet network restricts you in terms of distances, and it is best for using in short distances.
- If you create a wired ethernet network that needs cables, hubs, switches, routers, they increase the cost of installation.
- Data needs quick transfer in an interactive application, as well as data is very small.
- In ethernet network, any acknowledge is not sent by receiver after accepting a packet.
- If you are planning to set up a wireless Ethernet network, it can be difficult if you have no experience in the network field.
- Comparing with the wired Ethernet network, wireless network is not more secure.
- The full-duplex data communication mode is not supported by the 100Base-T4 version.
- Additionally, finding a problem is very difficult in an Ethernet network (if has), as it is not easy to determine which node or cable is causing the problem.

Ethernet standards

There are different standards of Ethernet, which are discussed below with additional information about each of them.

Ethernet II / DIX / 802.3

A studied edition of Ethernet, Ethernet II, also called as DIX. The DIX stands for Digital, Intel, and Xerox. And, 802.3, which is rewritten by Digital Equipment Corp, Xerox, and Intel.

Fast Ethernet / 100BASE-T / 802.3u

Fast Ethernet (100BASE-T or 802.3u) is a communications protocol, which is usually supported by a twisted pair or CAT5 cable.

The 100BASE-T standards have two types. The 100BASE-T is the first standard that makes use of CSMA/CD.

Three different kinds of cable technologies are available with 100BASE-T.

1. 100BASE-T4: It is utilized for a network that requires a low-quality twisted-pair on a 100-Mbps Ethernet.
2. 100BASE-TX: It makes use of two-wire data grade twisted-pair wire, developed by ANSI 100BASE-TX, which is also called 100BASE-TX and 100BASE-X.
3. 100BASE-FX: It uses 2 stands of fiber cable and developed by ANSI.

Gigabit Ethernet / 1000BASE-T / 802.3z / 802.ab

Gigabit Ethernet has the potential to transmit data up to 1 Gbps, which makes use of all four copper wires in category 5, which is also called 1000BASE-T or 802.3z / 802.3ab.

10 Gigabit Ethernet / 802.3ae

10 Gigabit Ethernet (10GE or 10 GbE or 10 GigE) is a new standard that defines only full-duplex point-to-point links. It supports up to 10 Gb/s transmissions that were published in 2002, which is also known as 802.3ae. The hubs, CSMA/CD, and half-duplex operation do not exist in 10 GbE.

How to connect or plug in an Ethernet cable

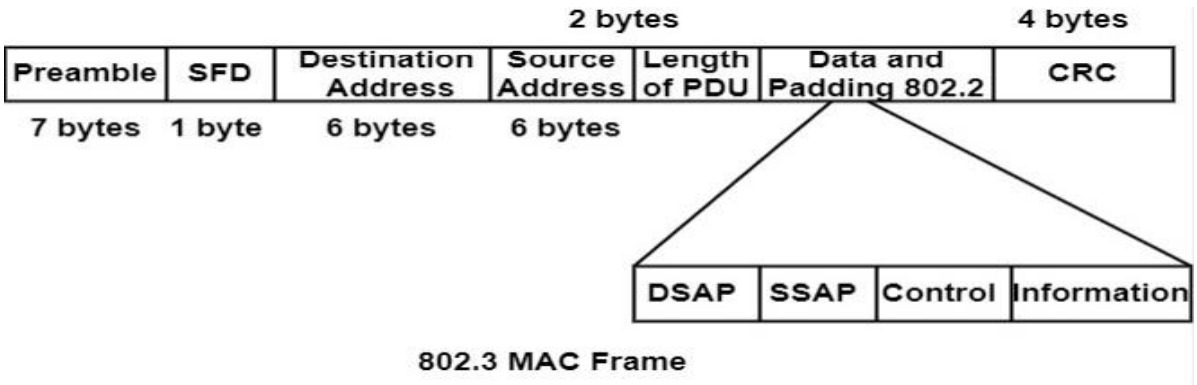
The process will be the same, whether you are connecting an Ethernet cable to your computer or setting up a home network. As the below image is representing that it appears to be a large telephone cord jack. Once you have located it, then, until you hear a click, you have to push the cable connector into the port. You will see a green light that indicates a signal is found if the connection is properly established on the other end.

Frame Format

IEEE 802.3 specifies only one type of frame format that includes seven fields. These fields are as follows−

- **Preamble** − It contains seven bytes (56 bits) and is used for synchronization.
- **Start frame delimiter (SFD)** − It is a one-byte field and is used to signal the frame's beginning.
- Destination Address and Source Address fields are six bytes' fields containing sender and receiver address as declared by the Network Interface Card.
- The next field **length/type** is a two-byte field and indicates the number of PDU bits and its type. It provides a base for other protocols.
- The **PDU** or 802.2 frames contain the entire 802.2 frames as a modular removable unit. It can start from the 46th byte and can continue up to the 1500th byte. It is generated by the LLC sublayer depending on the size and type of the PDU, and then it is linked to an 802.3 frame.
- The last field is **CRC**, which contains error detection information.

The frame format is demonstrated in the figure



802.3 MAC Frame