



SNS College of Engineering Coimbatore - 641107



UNIT II

LINK LAYER

Services, ARP, DLC Protocols, HDLC, PPP, Media Access Control, Wired LANs: Ethernet, Wireless LANs: IEEE 802.11, Bluetooth, Connecting devices: Hubs, Routers, Switches.

27.09.2023

1

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Ethernet

- Ethernet is a widely used networking technology that allows devices to communicate and share data over a local area network (LAN).
- It uses a set of protocols and standards to establish a reliable and efficient connection between devices.



Key Components of Ethernet



- There are four types:
 - The Ethernet protocol
 - The Ethernet port
 - Ethernet network adopter
 - Ethernet cable



The Ethernet Protocol



- This protocol was developed in the 1970s by Xerox.
- It is a series of standards that governs how data is sent between Ethernet components as explained before



The Ethernet Port

- Ethernet ports commonly known as jacks or sockets
- It supports cables with RJ-45 connectors
- The Ethernet port of a computer is linked to an Ethernet network adapter, also known as an Ethernet card, mounted on the motherboard.



Ethernet network Adapter



- An Ethernet adapter is a chip or card that fits into a slot on the motherboard and allows a computer to connect to a local area network (LAN).



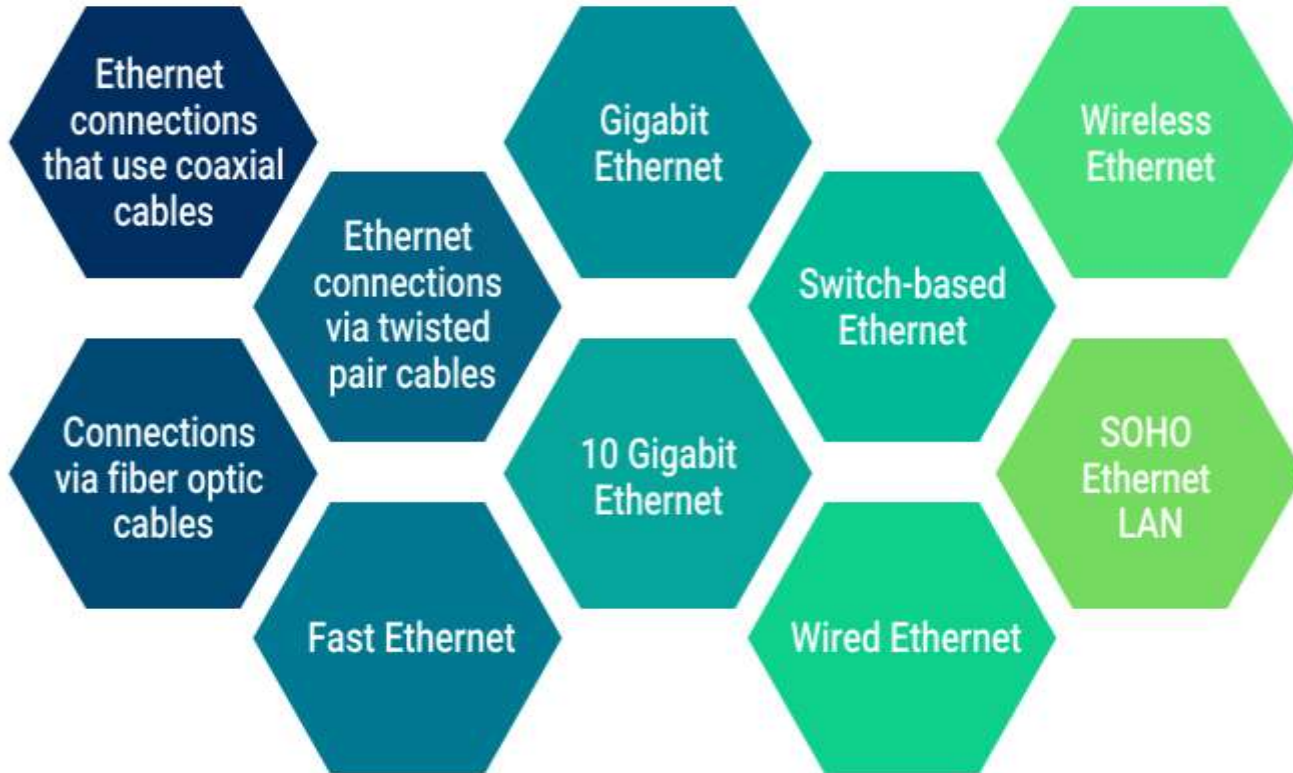
An Ethernet cable



- Ethernet cable, often known as a network cable
- The Ethernet cable consists of the RJ45 connection, the internal cabling, and a plastic jacket.



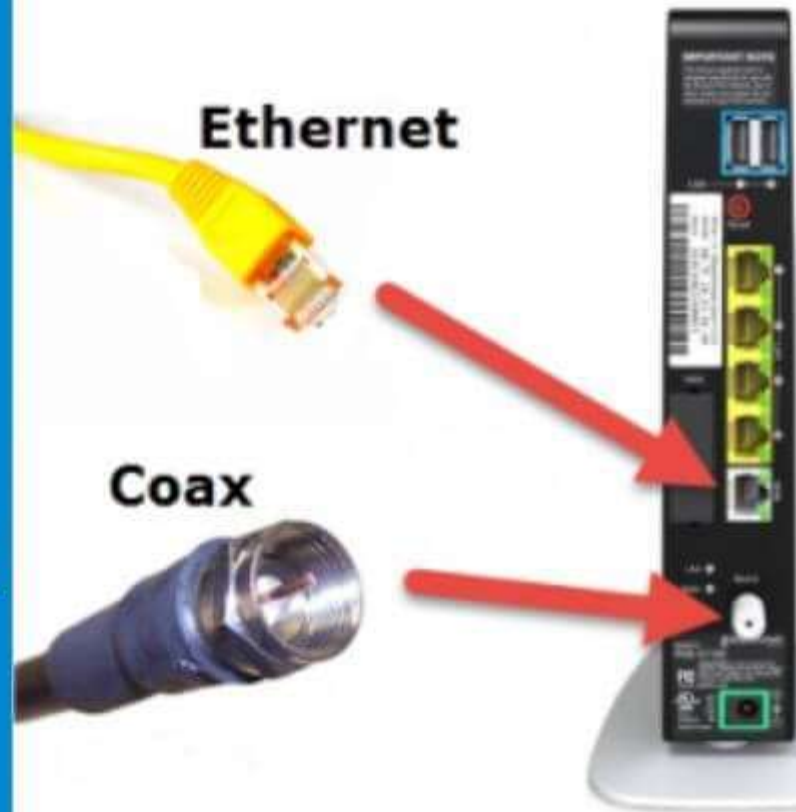
Types of Ethernet





1. Ethernet that uses Coaxial

Coax
VS
Ethernet





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- Coaxial cable transmits electrical signals at high frequencies with minimal loss.
- Ethernet types 10Base2 and 10Base5 are now used.



Types

- This Ethernet type can be further classified into networks that use one of the following cable types:
- **Tri-axial:** Using an extra copper braid shield. It is often used to link cameras and cable televisions.



Tri-axial



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11

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RG-6

It includes a thicker dielectric insulator and are employed in wireless broadband, cable television, etc.





Hardline

This cable variant is utilized in Ethernet networks that demand a strong signal.

They are employed in telephone and internet connections.



2. Connections via fiber optic cables

- These connections employ optical fibers with glass cores wrapped by several sheets of cladding material, often PVC or Teflon.



Types

- **Single-mode fiber (SMF):** It is utilized for long-distance communication and employs a single beam of light to deliver data.
- **Multi-mode fiber (MMF):** It utilizes numerous light beams to convey data and is less expensive than other alternatives.



3. Ethernet connections via twisted pair cables

- Twisted pair is a copper wire cable consisting of two insulated copper wires wrapped around to prevent interference and crosstalk.
- It utilizes RJ-45 plugs.



Types

Ethernets that use shielded twisted pair (STP)

cables: This foil shield offers protection against interference flowing into or out of the cable.

Ethernets that use unshielded twisted pair (UTP)

cables: UTP comprises two twisted, insulated copper wires; twisting cables help limit interference.



4. Fast Ethernet

- It is an Ethernet network capable of 100 Mbit/s data transmission. It may use twisted pairs or fiber optic cables.
- Cat-5 cable is the type of twisted pair cable which enables Fast Ethernet.



5. Gigabit Ethernet

- Gigabit Ethernet, which might alternatively be based on twisted pair or fiber optic cable, provides a data transfer rate of one gigabit per second.
- Cat-5e is the kind of twisted pair cable that enables Gigabit Ethernet, in which all four types of twisted wires are used to accomplish high data speeds.



6. 10 Gigabit Ethernet

- The newest iteration of Ethernet, 10 Gigabit Ethernet, offers a data throughput of 10 Gbit/s (10,000 Mbit/s) via an optic fiber or twisted pair connection.
- The twisted pair option requires a cable of exceptional quality (Cat-6a or Cat-7)



7. Switch-based Ethernet

- It includes a hub or a switch
- In addition, a standard network cable is employed as opposed to a twisted pair cable.
- This form of Ethernet network has a star topology centered on a switch.



8. Wired Ethernet, which uses cables

- A modem is directly attached to an Ethernet cable, and the cable's opposite end is linked to a machine (laptop or desktop)
- This cable needs to be at least Cat5 or above
- It can load and transmit large amounts of data, such as films and audio, and live stream them without interruption.



9. Wireless Ethernet – i.e., without cables

- A wireless network relies on high-frequency radio signals and does not require cables to connect a receiving device, such as a laptop, to the network
- If a modem and a router are present, one must connect the modem to the router via a category 5 (Cat5) or category 6 (Cat6) Ethernet connection.



10. SOHO Ethernet LAN

- SOHO refers to a tiny office or home office. This is the simplest Ethernet LAN configuration
- These devices typically contain four-eight LAN access points. Additionally, specific variants have wireless LAN entry (or access) points.



Key Uses of Ethernet



Improves consumer internet experiences



Offers high bandwidth connections



Provides different speed options



Strikes a balance between cost and performance



Amplifies the capabilities of the Wi-Fi network



Enforces greater security



Supports direct current (DC) power transmission



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24

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Working of Ethernet Network

- The Ethernet network is designed to work in the 1st layer (physical layer) and 2nd layer (Data Link Layer) of the OSI model.

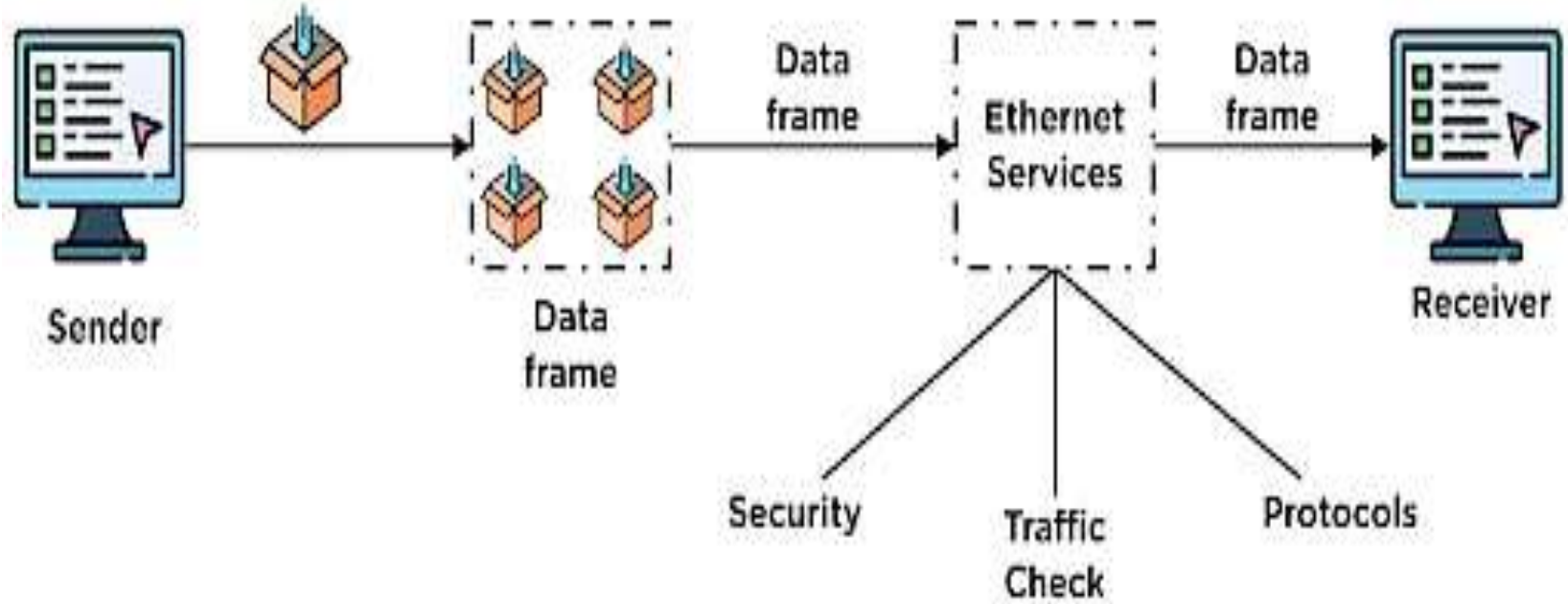
Ethernet divides the transmission of data into two parts: packets and frames.



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- Packet—Refers to a unit of data in the network.
- Frame—Refers to the collection of data packets being transmitted.

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How does Ethernet differ from Wi-Fi?

- Ethernet uses physical cables to establish a wired connection between devices, while Wi-Fi uses wireless signals for communication.
- Ethernet generally offers faster and more stable connections compared to Wi-Fi, but it requires physical cable connections to each device.



Advantages

- The cost of installing an Ethernet connection is affordable
- Provides high-speed data transmission for data in the network.
- It maintains data quality and also provides a secure channel for data transmission



Disadvantages

- Ethernet networks are more suited for short-distance connections.
- Troubleshooting faults in the ethernet connection is difficult.
- Increased cases of network traffic in the network channel.