IEEE 802 wireless standards

IEEE stands for Institute of Electrical and Electronics Engineers. The main AIM of IEEE is to foster technological innovation and excellence for the benefit of humanity.

The IEEE standards in computer networks ensure communication between various devices; it also helps to make sure that the network service, i.e., the Internet and its related technologies, must follow a set of guidelines and practices so that all the networking devices can communicate and work smoothly

IEEE 802 is a collection of networking standards **that cover the physical and data-link layer specifications for technologies such as Ethernet and wireless**.

These specifications apply to local area networks (LAN) and metropolitan area networks (MAN).

IEEE 802 also aids in ensuring multi-vendor interoperability by promoting standards for vendors to follow.

IEEE History

Since there are various types of computer system manufacturers, the IEEE's computer society started a project in 1985 called Project 802 to enable standard communication between various devices.
Under this project, the IEEE divided the data link layer into two sub-parts, namely

- LLC or Logical Link Control and
- MAC or Media Access Control.

The standards that deal with computer networking (networking in general) are called the IEEE 802 wireless standards.
The IEEE 802 is a collection of networking standards that deals with the data link layer and physical layer technologies like ethernet and wireless communications.

IEEE 802

- Essentially, the IEEE 802 standards help to make sure internet services and technologies follow a set of recommended practices so network devices can all work together smoothly.

- IEEE 802 is divided into 22 parts that cover the physical and data-link aspects of networking. The family of standards is developed and maintained by the IEEE 802 **LAN/MAN Standards Committee,** also called the LMSC. IEEE stands for Institute of Electrical and Electronics Engineers.
- The set of standards started in 1979 with a "local network for computer interconnection" standard, which was approved a year later. The LMSC has made more than 70 standards for IEEE 802.

Why IEEE 802 standards are important

- LMSC was formed in 1980 in order to standardize network protocols and provide a path to make compatible devices across numerous industries.

- Without these standards, equipment suppliers could manufacture network hardware that would only connect to certain computers. It would be much more difficult to connect to systems not using the same set of networking equipment. Standardizing protocols help ensure that multiple types of devices can connect to multiple network types.
- IEEE 802 will also coordinate with other international standards, such as ISO, to help maintain international standards.

- In addition, the "802" in IEEE 802 does not stand for anything with high significance. 802 was just the next numbered project.

Examples of IEEE 802 uses

- The IEEE 802 specifications can be used by commercial organizations to ensure their products maintain any newly specified standards. So, for example, the 802.11 specification that applies to Wi-Fi could be used to make sure Wi-Fi devices work together under one standard. In the same way, IEEE 802 can help maintain local area network standards.
- These specifications can also define what connectivity infrastructure will be used for -- individual networks, or those at a larger organizational scale.
- The IEEE 802 specifications apply to hardware and software products. So, to ensure manufacturers don't have any input on the standards, there is a voting protocol in place. This makes sure that one organization does not influence the standards too much.

IEEE standards

- The IEEE standards in computer networks ensure communication between various devices; it also helps to make sure that the network service.
- IEEE 802 LAN/MAN Standards Committee. ...
- IEEE 802.1 Higher Layer LAN Protocols Working Group. ...
- IEEE 802.3 Ethernet Working Group. ...
- IEEE 802.11 Wireless LAN Working Group. ...
- IEEE 802.16 Wireless Metropolitan Area Networks(MAN) ...

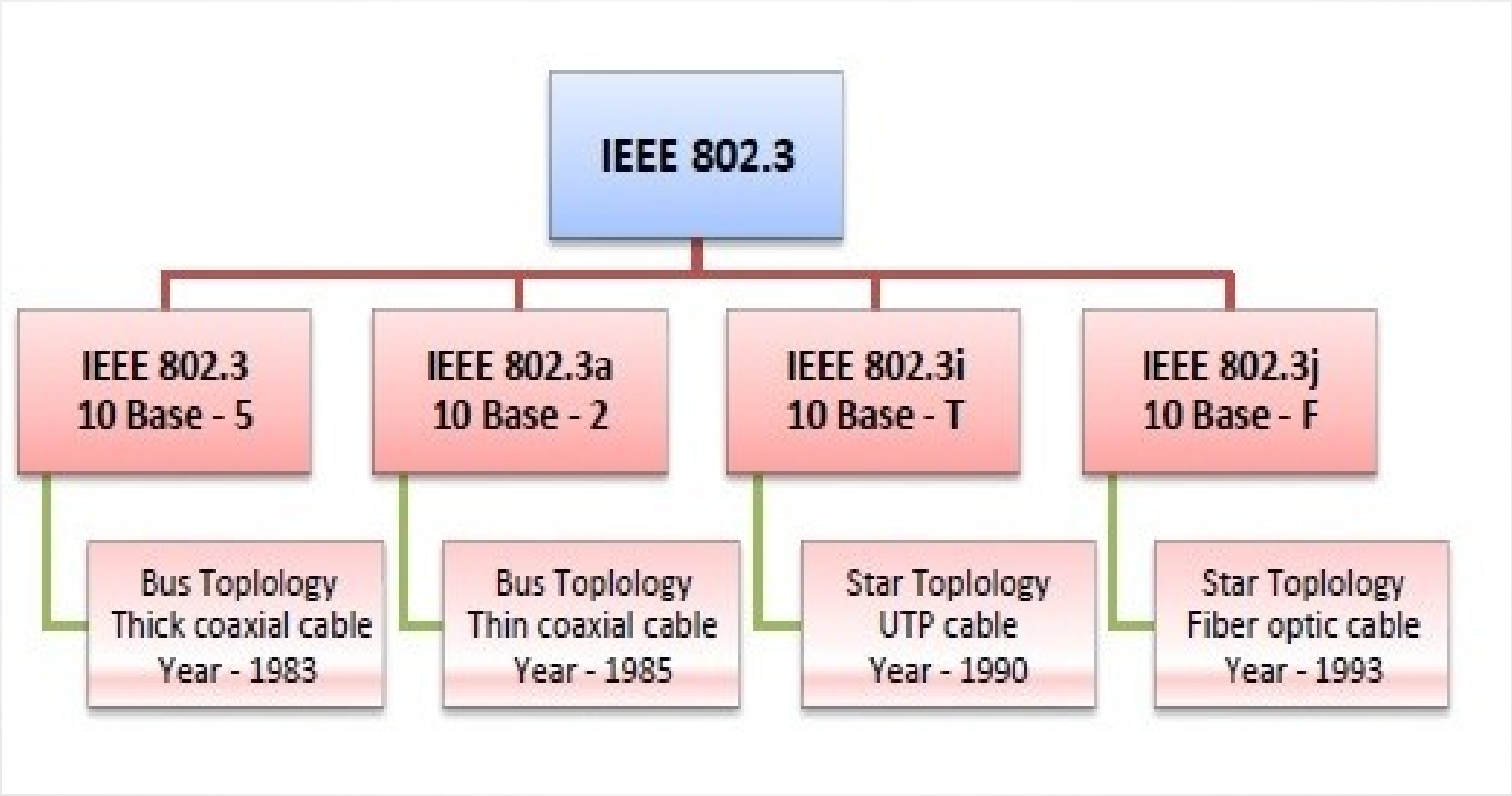
802.1

- IEEE 802.1 handles the architecture, security, management and internetworking of local area networks (LAN), metropolitan area networks (MAN) and wide area area networks (WAN) standardized by IEEE 802.
- **The following are key IEEE 802.1 tasks:**
  - Designs and implements standards that regulate network management practices
  - Provides services, including LAN/MAN management, media access control (MAC) bridging, data encryption/encoding and network traffic management.
  - IEEE 802.1 is comprised of four groups that focus on different standards and policies in the following areas:
    - Internetworking
    - Audio/video (A/V) bridging
    - Data center bridging
    - Security

802.3

- IEEE 802.3 is a set of standards and protocols that define Ethernet-based networks.
- Ethernet Technology used in LANs, MANs.
- IEEE 802.3 defines the physical layer and the medium access control (MAC) sub-layer of the data link layer for wired Ethernet networks.
- **There are a number of versions of IEEE 802.3 protocol. The most popular ones are.**
- IEEE 802.3: This was the original standard given for 10BASE-5. It used a **thick single coaxial cable** into which a connection can be tapped by drilling into the cable to the core.
- IEEE 802.3a: This gave the standard for **thin coax** (10BASE-2), which is a thinner variety where the segments of coaxial cables are connected by **BNC connectors**.
- IEEE 802.3i: 10BASE-T twisted-pair
- IEEE 802.3j: This gave the standard for Ethernet over Fiber (10BASE-F) that uses **fiber optic cables** as medium of transmission.

"Bayonet Neill–Concelman"
BNC Connector


IEEE 802.3
IEEE 802.3
10 Base - 5
IEEE 802.3a
10 Base - 2
IEEE 802.3i
10 Base - T
IEEE 802.3j
10 Base - F
Bus Toplology
Thick coaxial cable
Year - 1983
Bus Toplology
Thin coaxial cable
Year - 1985
Star Toplology
UTP cable
Year - 1990
Star Toplology
Fiber optic cable
Year - 1993

802.11

- 802.11 is an IEEE standard which defines Wireless Local Area Network (WLAN) or WiFi.
- It covers all WLAN series of products. It is optimized for nearly 100 meters.
- It does not provide the service throughout the coverage area to enable continuous connectivity.
- This 802.11 standard provides less scalability in usability point of view.

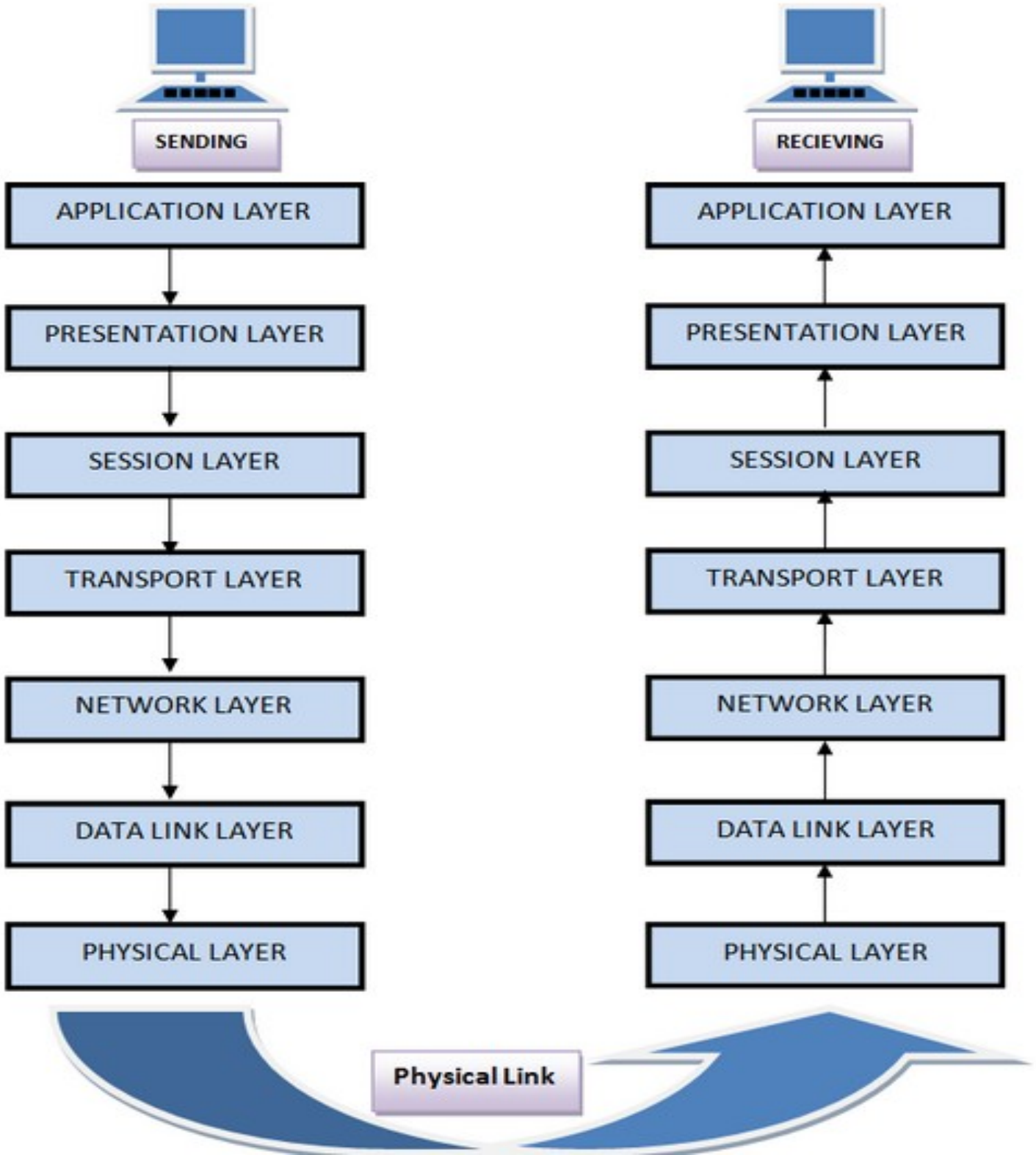
802.16

- 802.16 is an IEEE standard which defines Wireless Inter-operability for Microwave Access (WiMAX) technology products.
- It covers all WiMAX series of products. It is optimized for 50 km.
- It provides the service throughout the coverage area to enable continuous connectivity.
- This 802.16 standard provides more scalability in usability point of view.

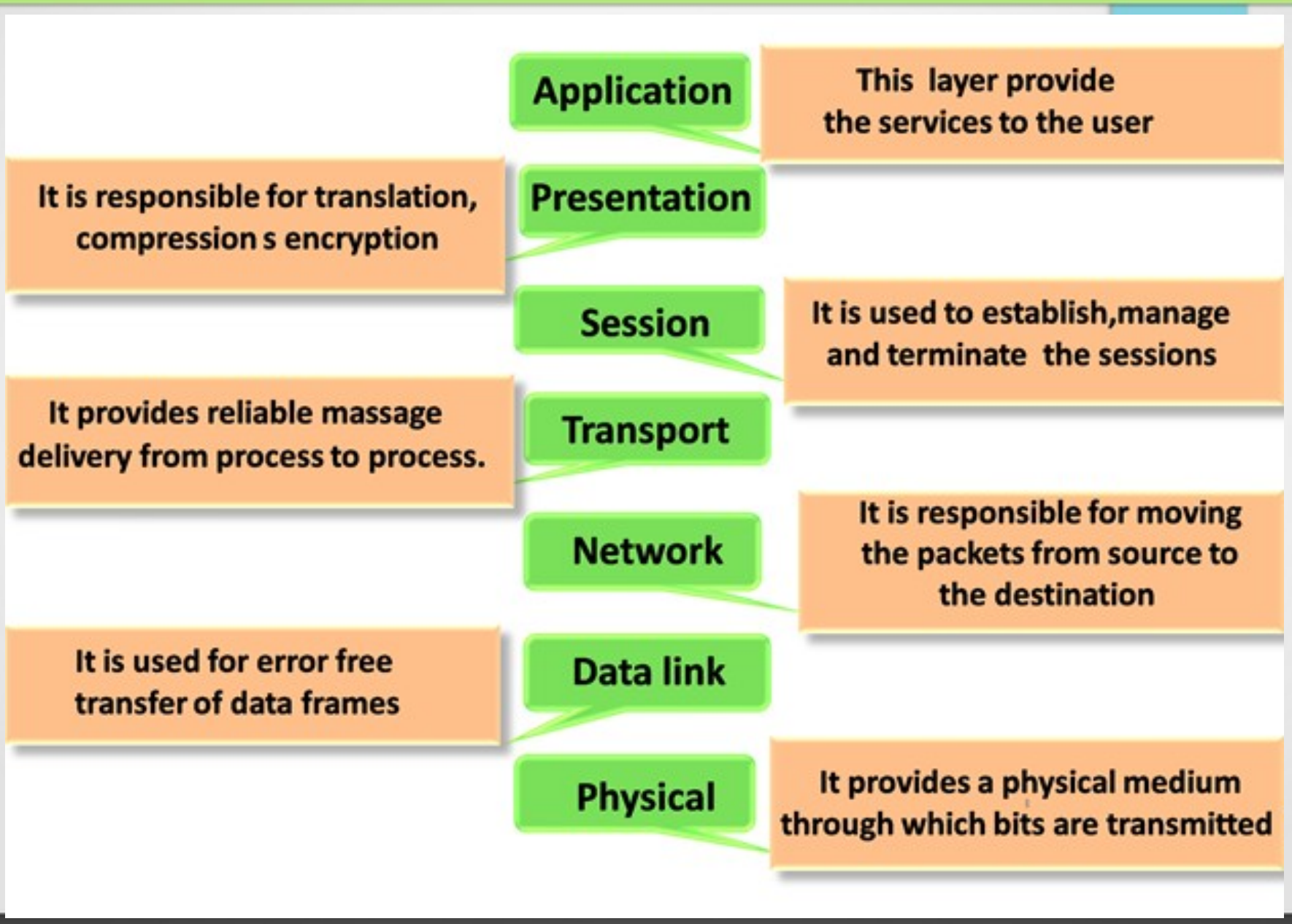
OSI Model

- ISO has developed this. ISO stands for International organization of Standardization. This is called a model for open system interconnection (OSI) and is normally called as OSI model.
- The ISO-OSI model consists of seven layer architecture. It defines seven layers or levels in a complete communication system.
- It was first introduced in the late 1970s. An open system is a set of protocols that allows any two different systems to communicate regardless of their underlying architecture.
- The OSI model is a layered framework for the design of network systems that allows communication between all types of computer systems.
- It consists of seven separate but related layers, each of which defines a part of the process of moving information across a network.

In

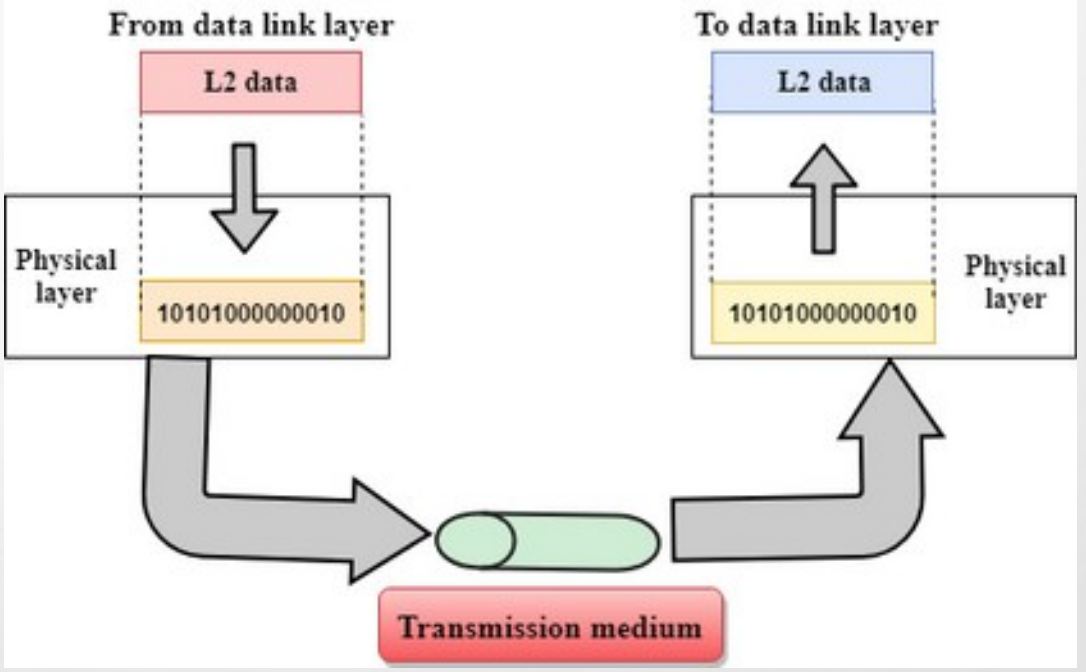

SENDING
APPLICATION LAYER
PRESENTATION LAYER
SESSION LAYER
TRANSPORT LAYER
NETWORK LAYER
DATA LINK LAYER
PHYSICAL LAYER
RECIEVING
APPLICATION LAYER
PRESENTATION LAYER
SESSION LAYER
TRANSPORT LAYER
NETWORK LAYER
DATA LINK LAYER
PHYSICAL LAYER
Physical Link

Introduction



OSI Model – Physical Layer

- The physical layer is concerned with **sending raw bits** between the source and destination nodes, coordinates the functions required to carry a bit stream over a physical medium.
- It deals with the mechanical and electrical specifications of the interface and transmission medium.
- The physical layer is responsible for movements of individual bits from one hop (node) to the next.

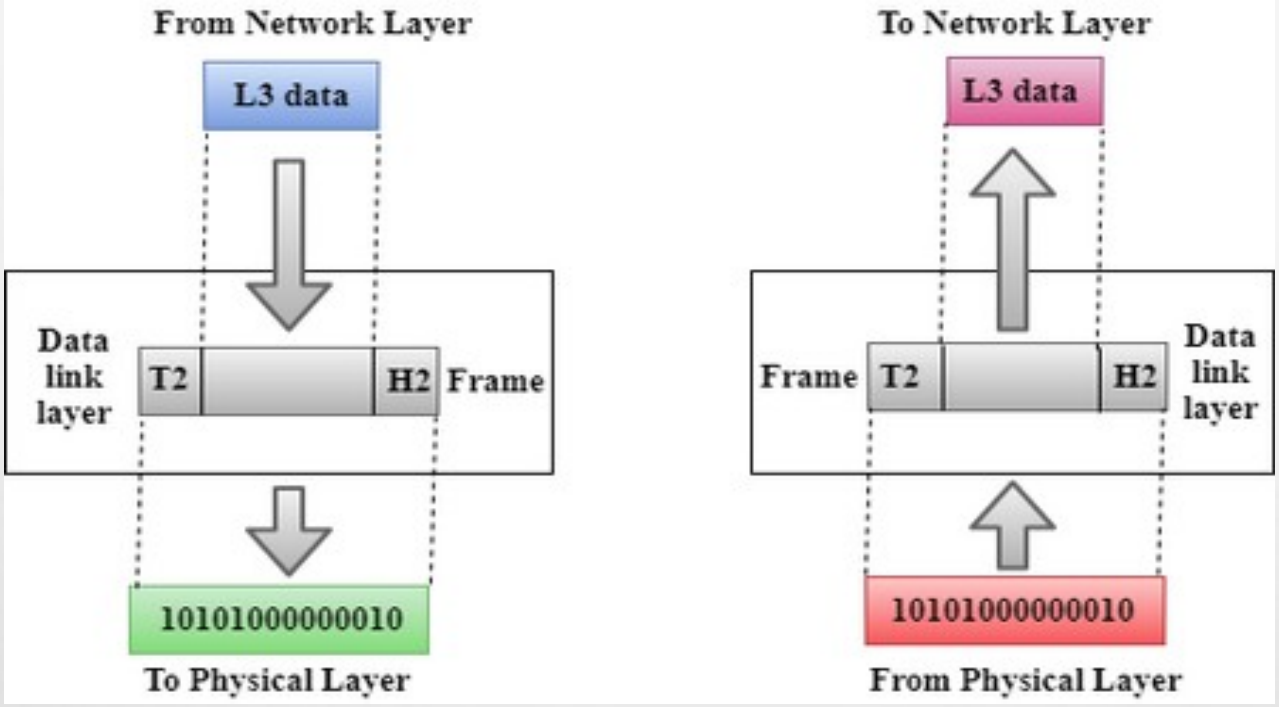


OSI Model – Physical Layer

- The physical layer is also concerned with the following:
  - **Signal Encoding:** how bits are represented 0 or 1?
  - **Medium:** Type of medium?
  - **Bit Synchronization:** Synchronuos or asynchronous?
  - **Transmission type:** Serial or parallel?
  - **Transmission mode:** simplex, half-duplex and full-duplex?
  - **Topology:** Which topology it uses – mesh, star, bus, etc.
  - **Multiplexing**: which type – FDM, TDM?
  - **Interrface**: How the devices are connected?
  - **Bandwidth**: Broadband communication is used?
  - **Signal type**: Analog or digital?

OSI Model – DataLink Layer

- The datalink layer is resposible for transmitting a group of bits between the nodes.
- The group of bits is called **frame or packet.**
- The network layer passes data to data link layer. Then **data link layer adds the header and trailer information to this data.**



OSI Model – DataLink Layer

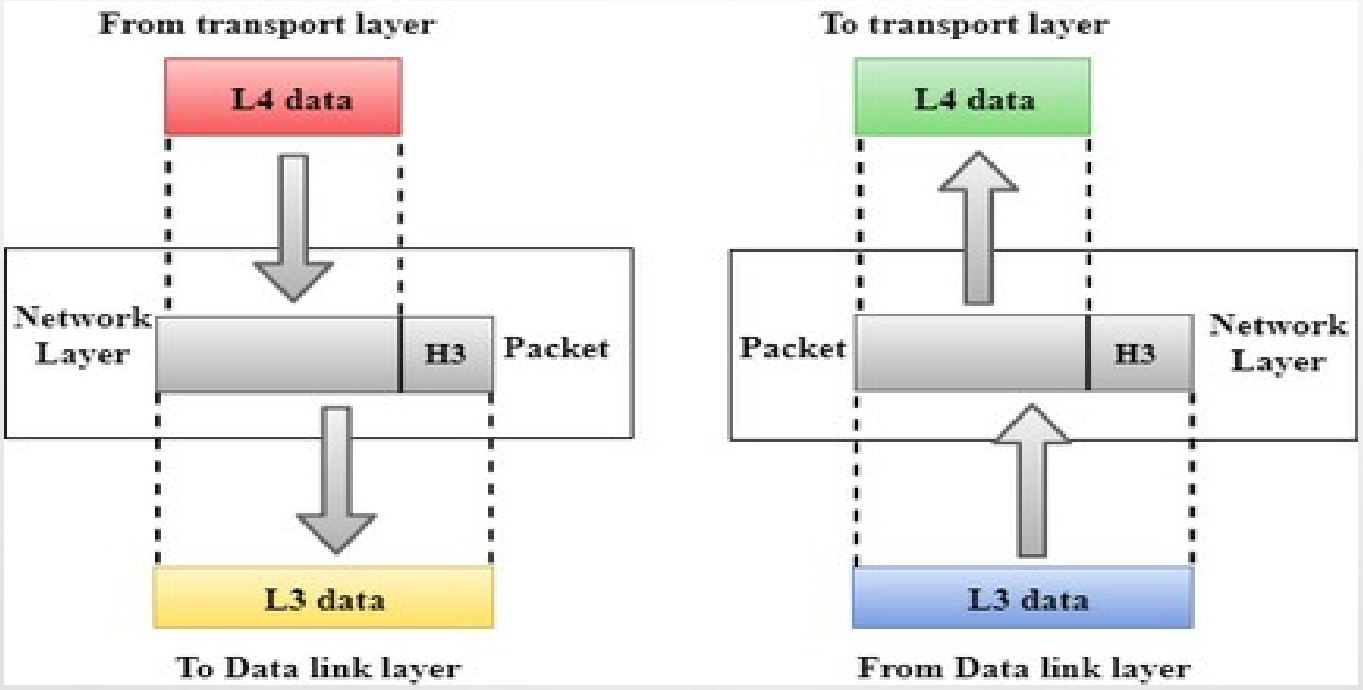
- The data link layer performs the following functions:
  - **Addressing:** Headers and trailers information are added to the packet.
  - **Flow control:** Avoids overwriting.
  - **Media Access Control (MAC):** who can send data when and how much
  - **Synchronization:** Headers tell the receiver when frame is arriving, it also contains bits to synchronize its timings.
  - **Error Control:** checks CRC to ensure correctness.
  - **Node to node delivery:** error – free delivery of entire frame.

OSI Model – Network Layer

- The Network layer is responsible for **routing and forwarding of a packet from the source to destination.**
- **This layer ensures successful delivery of a packet to the destination node.**
- It determines the best path to move data from source to the destination based on the network conditions, the priority of service, and other factors.
- Routers are the layer 3 devices, they are specified in this layer and used to provide the routing services within an internetwork.
- The protocols used to route the network traffic are known as Network layer protocols. **Examples of protocols are IP and Ipv6.**
- This layer guarantee an error-free delivery of a packet to destination. So, this layer has to carry out **accounting function** to facilitate this billing based on how many packets are routed, when they are routed, etc.

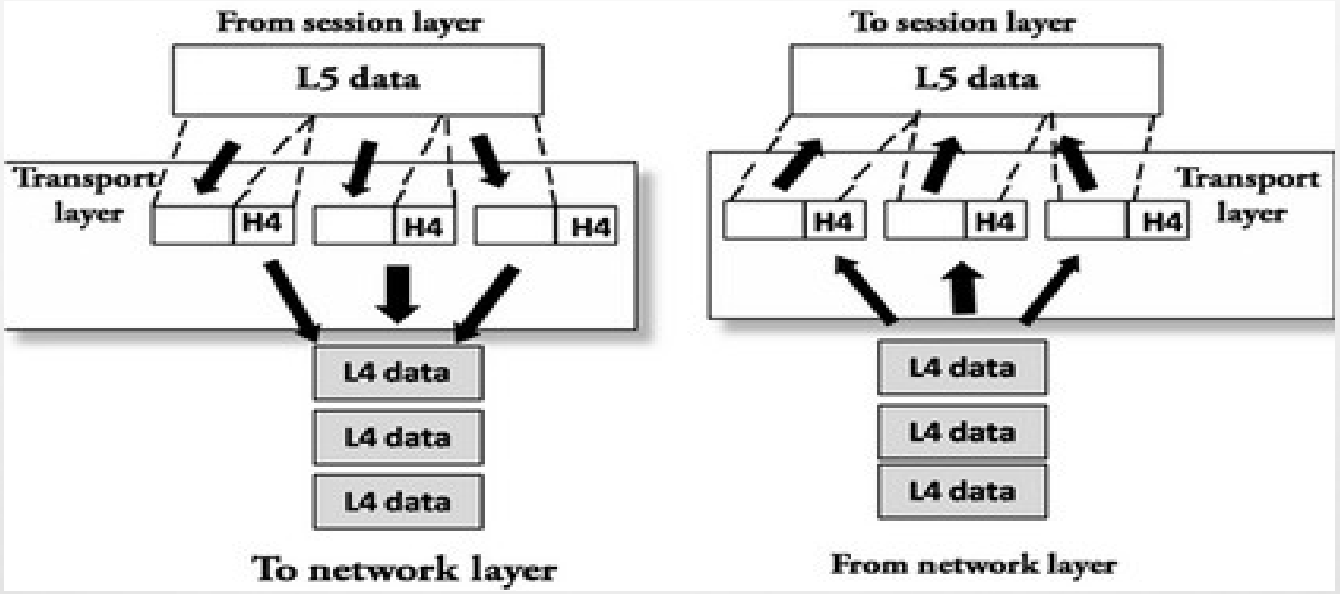
OSI Model – Network Layer

- The network layer performs the following functions:
  - **Routing:** determines the best optimal path out of the multiple paths
  - **Congestion control:** manages all route & traffic control
  - **Address Information:** interpreting logical address(discuss later)
  - **Accounting & bill:** as stated above
  - **Source to destination error free delivery:** of a packet



OSI Model – Transport Layer

- The Transport layer is a Layer 4 ensures that messages are transmitted in the order in which they are sent and there is no duplication of data.
- The main responsibility of the transport layer is to **transfer the data completely.**
- It receives the data from the upper layer and converts them into smaller units known as segments.
- This layer can be termed as an end-to-end layer as it provides a point-to-point connection between source and destination to deliver the data reliably.



OSI Model – Transport Layer

- **Example:**
- Suppose there are two computers A and B. Let us say that A hosts a file server, in which B is interested. Similarly A wants to send a message to B. As there are two different applications wants to communicate with their counterparts on remote computers at the same time it is essential that communication channel must be established not only between two computers but also between respective applications on two computers. **This is the job of transport layer.**

OSI Model – Transport Layer

- The transport layer performs the following functions:
  - **Host to host message delivery:** Ensures all the packets of a message sent by a source node to destination.
  - **Application to application communication:** enables communication between two applications running on different computers.
  - **Segmentation and re-assembly:** this layer breaks a message into packets and numbers them by adding sequence number at the source and reassemble original message at destination.
  - **Error control:** The transport layer is also responsible for Error control. Error control is performed end-to-end rather than across the single link.
  - **Connection control:** A **connectionless** service treats each segment as an individual packet, and they all travel in different routes to reach the destination. In **connection-oriented** service, all the packets travel in the single route.