OSI model :

- Stands for open system interconnection.
- It is a conceptual framework which helps in understanding the working of network protocols.
- It contains 7 layers namely : Physical, Data link, Network, Transport, Session, Presentation, Application .
- It was developed by ISO in 1970s.
- Each layer serves specific functions identical to them only.
- The data is passed down and up in layers.
- Common protocols associated with each layer include Ethernet, IP, TCP, HTTP, and more.

Each layer and its working :

1. Physical layer:
    - It transmits raw bits over physical medium .
    - It also converts electrical, optical signals to digital signals and vice versa.
    - Ethernet is a protocol used for setting up LAN.
    - Wi-fi is a wireless communication standard that enables devices to connect to a network without physical cables.
    - Physical layer also performs multiplexing
    - Also performs error detection and correction.
    - Devices: NIC Card, Hubs, Repeater.
    - Physical media types used are Twisted Pair, Fiber Optic, Coaxial Cable, Wireless.

2. Data Link Layer:
    - Responsible for error-free transmission of data frames over a physical link.
    - Provides logical addressing through MAC (Media Access Control) addresses.
    - Performs framing, flow control, and error detection.
    - Protocols: Ethernet (IEEE 802.3), Point-to-Point Protocol (PPP).
    - Techniques: Media access control, framing, error detection.
    - Devices: Network Interface Card (NIC), switches, bridges.

3. Network Layer:
   - Handles logical addressing and routing of data packets across different networks.
   - Translates logical IP addresses to physical MAC addresses.
   - Determines the best path for data delivery using routing algorithms.
   - Protocols: Internet Protocol (IP), Internet Control Message Protocol (ICMP).
   - Techniques: Logical addressing, routing.
   - Devices: Routers, Layer 3 switches.

4. Transport Layer:
   - Ensures reliable, end-to-end data delivery and error recovery.
   - Divides data into smaller segments and reassembles them at the destination.
   - Manages flow control and congestion control.
   - Protocols: Transmission Control Protocol (TCP), User Datagram Protocol (UDP).
   - Techniques: Segmentation, error recovery, flow control.
   - Devices: Gateways, firewalls.

5. Session Layer:
   - Establishes, manages, and terminates communication sessions between applications.
   - Synchronizes dialogue and supports session checkpointing and recovery.
   - Handles session establishment, authentication, and termination.
   - Protocols: Remote Procedure Call (RPC), NetBIOS.
   - Techniques: Session establishment, synchronization.
   - Devices: Not applicable (software layer).

6. Presentation Layer:
   - Focuses on data representation and encryption for application-layer compatibility.
   - Translates data formats between different systems.
   - Handles data compression and decompression.
   - Protocols: JPEG (image compression), MPEG (video compression), SSL/TLS.
   - Techniques: Data representation, encryption, compression.
   - Devices: Not applicable (software layer).

7. Application Layer:

- Interacts directly with user applications and provides network services.
- Offers a wide range of services such as file transfer (FTP), email (SMTP, POP3, IMAP), and web browsing (HTTP).
- Supports application-specific protocols and data formats.
- Protocols: HTTP, SMTP, FTP, DNS.
- Techniques: Application-specific protocols, data formats.
- Devices: Not applicable (software layer).

These bullet points provide an overview of the remaining layers of the OSI model, their functions, associated protocols, techniques, and devices used.

Encapsulation:

- Encapsulation is the process of enclosing data and related information within a protocol-specific wrapper or
container for transmission over a network.

Protocol Data Unit(PDU):

- unit of data at each layer of the protocol (OSI & TCP/IP)

Encapsulation at layer's

1. Application Layer
   – Add application-specific data and headers.
   – Encapsulate the data into a message.
2. Transport Layer
   – Add transport layer header with source and destination port numbers.
   – Encapsulate the message into a segment or datagram.
3. Network Layer
   – Add network layer header with source and destination IP addresses.
   – Encapsulate the segment or datagram into a packet.
4. Data Link Layer
   – Add data link layer header and trailer with source and destination MAC addresses.
   – Encapsulate the packet into a frame.
5. Physical Layer
   – Convert the frame into a stream of bits.
   – Transmit the bits over the physical medium.

Benefits:

- Standardization: Ensures interoperability between different vendors' products.
- Modularity: Allows for easy development and modification of specific layers.
- Troubleshooting: Simplifies problem isolation and resolution.
- Protocol Development: Facilitates the creation of new protocols.
- Education and Understanding: Aids in comprehending network protocols and technologies.
- Comparison with TCP/IP: OSI model provides a comprehensive framework, better interoperability, modularity, troubleshooting, and protocol development support.