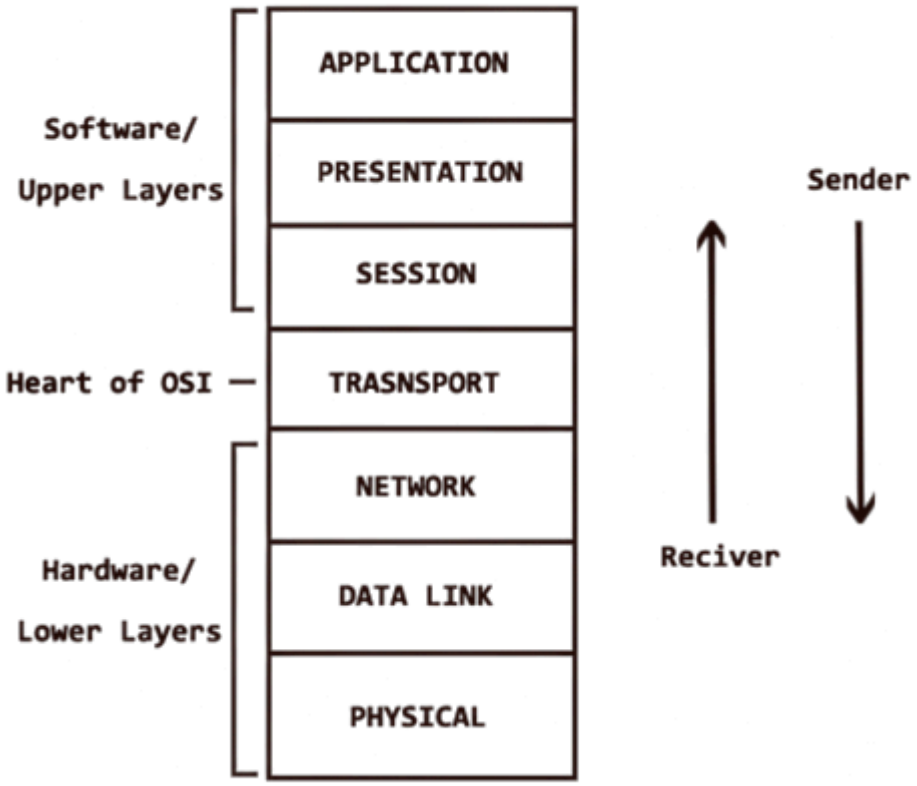
The OSI Model

The OSI (Open Systems Interconnection) model is a conceptual framework that standardises the functions of a telecommunication or computing system into seven abstraction layers. Each layer serves a specific purpose and interacts with adjacent layers, providing a systematic approach to understanding and designing a network communication.



Principles of OSI Model:

1. A layer should be created where a different abstraction is needed.
2. Each layer should perform a well-defined function.
3. The function of each layer should be chosen with an eye toward defining internationally standardised protocols.
4. The layer boundaries should be chosen to minimise the information flow across the interfaces.
5. The number of layers should be large enough that distinct functions need not be thrown together in the same layer out of necessity and small enough that architecture does not become unwieldy.

The Seven Layers of OSI:

OSI is broken down into layers. Each layer has a specific function and communicates and works with the layer below and above it. The OSI Model is conceptual, but its design enables both physical and virtual communication across a network. We'll start with layer 7, which is the uppermost layer on the stack.

Layer 7 – The Application

LayerLayer 7 is the layer most people are familiar with because it communicates directly with the user. An application that runs on a device might communicate with other OSI layers, but the interface runs on layer 7. For instance, an email client that transfers messages between client and server runs on layer 7. When a message is received on the client software, the application layer is what presents it to the user. Application protocols include SMTP (Simple Mail Transfer Protocol) and HTTP, which is the protocol for communication between browsers and web servers.

Layer 6 – The Presentation Layer

We mentioned that the application layer displays information to users, but the presentation layer of the OSI model is what prepares data so that it can be displayed to the user. It's common for two different applications to use encoding. For instance, communicating with a web server over HTTPS uses encrypted information. The presentation layer is responsible for encoding and decoding information so that it can be displayed in plaintext. The presentation layer is also responsible for compressing and decompressing data as it travels from one device to another.

Layer 5 – The Session Layer

To communicate between two devices, an application must first create a session. A session is unique to the user and identifies them on the remote server. The session must be open long enough for data to be transferred but still closed after the transfer is complete. When large volumes of data are transferred, the session is responsible for ensuring that the file is completely transferred, and retransmission is established, should the data be incomplete. For instance, if 10MB of data is transferred and only 5MB completes, the session layer ensures that only 5MB is retransferred. This transfer makes communication over a network more efficient instead of wasting resources and transferring the entire file again.

Layer 4 – The Transport Layer

The transport layer is responsible for taking data and breaking it up into smaller chunks. When data is transferred across a network, it is not transferred as one packet. To make transfers more efficient and faster, the transport layer breaks data into smaller segments. These smaller segments contain header information that can be reassembled at the target device. Segmented data also has error control to tell the session layer to reestablish a connection should packets fail to fully transfer to the target recipient.

Layer 3 – The Network Layer

The network layer is responsible for breaking up the data on the sender's device and reassembling it on the recipient's device when the transmission is across two different networks. When communicating within the same network, the network layer is unnecessary, but most users connect to other networks, such as cloud networks. When data travels across different networks, the network layer is responsible for creating small data packets routed to their destination and then rebuilt on the recipient's device.

Layer 2 – The Data Link Layer

The network layer facilitates communication across different networks, but the data link layer is responsible for transferring information on the same network. The data link layer turns packets received from the network layer into frames. Just like the network layer, the data link layer is responsible for error control and flow to ensure successful transmission.

Layer 1 – The Physical Layer

Just as the name suggests, the physical layer is responsible for the equipment that facilitates data transfer, such as cables and routers installed on the network. This layer is one aspect of network transmission, where standards are essential. Without standards, transmission across different manufacturer devices is impossible.