1. **Objective**:

- ✓ To explore the structure and functionality of the OSI and TCP/IP reference models, understand how data flows across different layers in a network, and identify their real-world applications.

- ✓ To study and compare the OSI and TCP/IP models in terms of architecture, layer functionalities, and protocol usage in order to gain a deeper understanding of modern network communication systems.

- ✓ To conduct research on the layered approach to networking, analyze the significance of each layer in both OSI and TCP/IP models, and apply this knowledge to real-world network design and troubleshooting scenarios.

2. Introduction

A network is a group of connected, communicating devices such as computers and printers. An internet is two or more networks that can communicate with each other. The most notable internet is called the "Internet" which is composed of hundreds of thousands of interconnected networks.

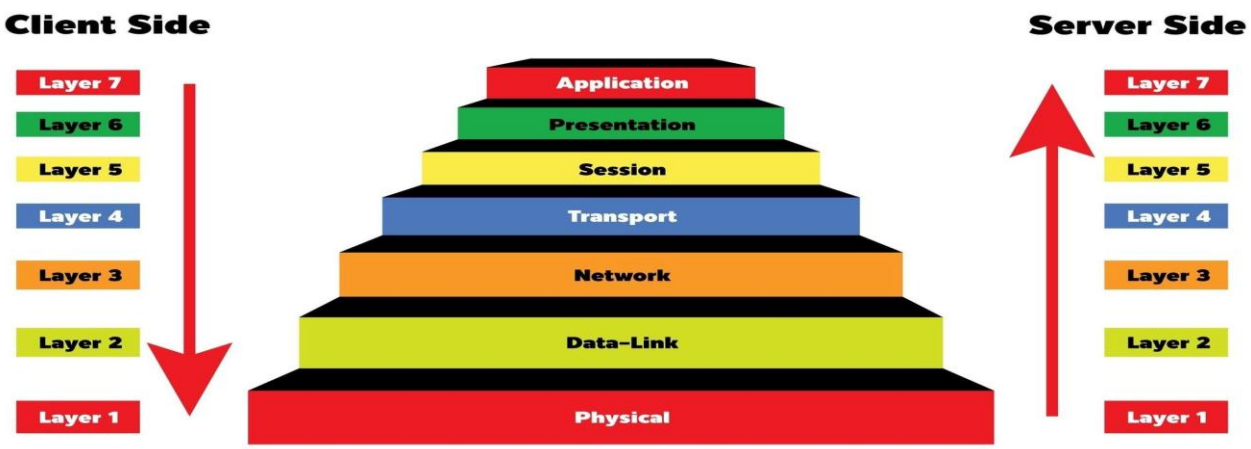
Protocols – A protocol is a set of rules that governs communication. For example, in a face-to-face communication between two persons, there is a set of implicit rules in each culture that define how two persons should start the communication, how to continue the communication, and how to end the communication.

3. OSI Model

The International Standards Organization (ISO) is a multinational body dedicated worldwide agreement on international standards. Almost three-fourths of countries in the world are represented in the ISO. ISO is the organization; OSI is the model.
The purpose of the OSI model is to show how to facilitate communication between different systems without requiring changes to the logic of the underlying hardware and software.

The OSI model divides networking up into a "vertical stack" consisting of 7 layers. Networking starts on the application layer at the top (Layer 7) and proceeds to the bottom layer (Layer 1). It is then passed back up the same hierarchy.

OSI Model:



Layer: 7 – Application Layer

Network applications use the application layer. The Application layer contains all services or protocols required by application software or operating system to communicate on the network.

Specific services provided by the application layer include the following:

- ✓ Network virtual terminal
- ✓ File transfer, access, and management (FTAM)
- ✓ E-mail services
- ✓ Directory services

Layer: 6 – Presentation Layer

The presentation layer receives data from the application layer. In this layer, the data is converted into a machine-readable format (a combination of 0 and 1) for outgoing messages, and for incoming messages, the machine-readable binary format (a combination of 0 and 1) is then converted into a human-readable format. The process of converting data is known as translation. The presentation layer handles “syntax processing”.

Specific responsibilities of the presentation layer include the following:

- ✓ Translation
- ✓ Encryption
- ✓ Compression

Layer: 5 – Session Layer

The session layer set up and manage the connection between two devices by enabling sending and receiving data, followed by the opening, and closing of the session. The session layer uses ports to initiate communication between two devices. The time between when this connection is opened and closed is known as a session.

The session layer can also set checkpoints during a data transfer. This means if the session is interrupted, devices can easily resume data transfer from the last checkpoint.

Specific responsibilities of the session layer include the following:

- ✓ Dialog control
- ✓ Synchronization

Layer: 4 – Transport Layer

The Transport Layer within the OSI model manages the transfer of data across network connections, or hosts. It takes data from the session layer and then splits it up into segments for sending the data. On the other hand, it reassembles the segments into data in the receiving device. Each segment contains a source and destination port number with a sequence number. The transport layer also manages flow control.

Other responsibilities of the transport layer include the following:

- ✓ Service-point addressing
- ✓ Segmentation and reassembly
- ✓ Connection control
- ✓ Flow control
- ✓ Error control

Layer: 3 – Network Layer

The network layer is responsible for the source-to-destination delivery of a packet, possibly across multiple networks (links). If two systems are connected to the same link, there is usually no need for a network layer. However, if the two systems are attached to different networks (links) with connecting devices between the networks (links), there is often a need for the network layer to accomplish source-to-destination delivery. Internet Protocol (IP) addressing (such as IPv4, IPv6) is done in the network layer known as logical addressing.

Other responsibilities of the network layer include the following:

- ✓ Logical addressing
- ✓ Routing

Layer: 2 – Data Link Layer

The data link layer takes packets of data from the network layer and turns the data packet into frames. A data frame is the protocol data unit. The Data Link layer is often divided into two sub layers: media access control (MAC) and the Logical Link Control (LLC) layer. The MAC sub layer controls how a computer on the network gains access to the data and permission to transmit it. The LLC layer controls frame synchronization, flow control, and error checking.

Other responsibilities of the data link layer include the following:

- ✓ Framing
- ✓ Physical addressing
- ✓ Flow control
- ✓ Error control
- ✓ Access control

Layer: 1 – Physical Layer

This layer includes all the physical equipment that is associated with data transfer. In this layer, the binary bitstreams (the combination of 0 and 1) convert into different signals on the receiving side, and reverse conversion has happened on the sending side.

The physical layer is also concerned with the following:

- ✓ Physical characteristics of interfaces and media
- ✓ Representation of bits
- ✓ Data rate
- ✓ Synchronization of bits
- ✓ Line configuration
- ✓ Physical topology
- ✓ Transmission mode

4. Conclusion

The OSI model provides a clear and structured framework for understanding how data communication happens across a network. Its 7-layer approach helps in isolating functions and troubleshooting network issues effectively. Although it’s more of a theoretical model, it’s widely used as a reference in learning, protocol design, and system architecture.

5. References

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