Understanding the OSI Model: Layer-by-Layer Breakdown

Assignment 1.1 for Celebal Technologies Internship

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References

- Original Reference: *"What's the OSI model?"* (Provided by Company)
- Webopedia:Link

Introduction

The **Open Systems Interconnection (OSI) Model** is a conceptual framework developed to understand and standardize the functions of a communication system regardless of its underlying internal structure and technology. Developed by the International Organization for Standardization (ISO) in 1984, the OSI Model comprises **seven distinct layers**, each with a specific function, working collectively to enable reliable communication between systems.

1 Layer 7 — Application

The **Application Layer** is the topmost layer that interacts directly with the end user. It provides **network services** to the applications of the user like web browsers and email clients. It utilizes protocols like **HTTP, SMTP, FTP**, etc. to enable these interactions.

Key Role: Facilitates user interaction with network services.

2 Layer 6 — Presentation

The **Presentation Layer** is responsible for **data translation, encryption, and compression**. It ensures the data sent by the application layer is readable by the receiving system.

Examples: Encryption algorithms, **ASCII, JPEG, MPEG, GIF**.

Key Role: Converts data into a network-compatible format.

3 Layer 5 — Session

The **Session Layer** establishes, manages, and terminates sessions between two communicating hosts. It also offers **synchronization** and **checkpointing** to resume data transfer in case of disruptions.

Key Role: Manages sessions between applications.

4 Layer 4 — Transport

The **Transport Layer** is responsible for **end-to-end communication**, **error detection and correction**, and **flow control**. It breaks data into segments at the sender and reassembles them at the receiver.

Protocols: TCP, UDP, SPX
Key Role: Ensures reliable data transfer.

5 Layer 3 — Network

The **Network Layer** handles **packet forwarding**, including **routing through intermediate routers**, and logical addressing using **IP addresses**.

Protocols: IP, AppleTalk, IPX
Key Role: Determines the best path for data delivery.

6 Layer 2 — Data Link

The **Data Link Layer** manages the **physical addressing** and **error detection** in data frames. It is divided into two sublayers:

- **MAC (Media Access Control)** — controls device permissions for transmitting data.
- **LLC (Logical Link Control)** — handles error checking and frame synchronization.

Protocols: PPP, Ethernet (IEEE 802.3), Frame Relay, ATM
Key Role: Structures raw bits into frames.

7 Layer 1 — Physical

The **Physical Layer** is concerned with the **physical transmission** of raw bits over a communication medium. It defines the hardware elements involved in the network such as cables, switches, and NICs.

Examples: Ethernet, RS-232, RJ45, FDDI, B8ZS
Key Role: Transmits raw bitstream over the physical medium.

Advantages of the OSI Model

- **Standardization:** Enables different vendors to develop interoperable technologies.
- **Simplified Troubleshooting:** Isolates network issues layer by layer.
- **Modularity:** Each layer is independent, allowing development or replacement without affecting others.
- **Clarity:** Provides a clear model for understanding how networks operate.