🚀R&D DOCUMENT ON THE WORKING OF ALL THE LAYERS IN THE OSI MODEL

TITLE :

In-depth study and analysis of the OSI model layers in Network Communication

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PURPOSE :

To explore and document the roles and functioning of all the layers in the OSI model.

🔎OVERVIEW OF OSI MODEL

- OSI is short for **Open Systems Interconnection.**
- It was the first standardized model for network communications.
- Developed by **ISO (International Organisation for Standardization)**, and was later adopted as an international standard in **1984**.
- It is a framework that conceptualises how computers communicate with each other within a network. The process is divided into **seven abstract layers**, with each one playing a significant role in the overall operation.

👍ADVANTAGES OF OSI MODEL

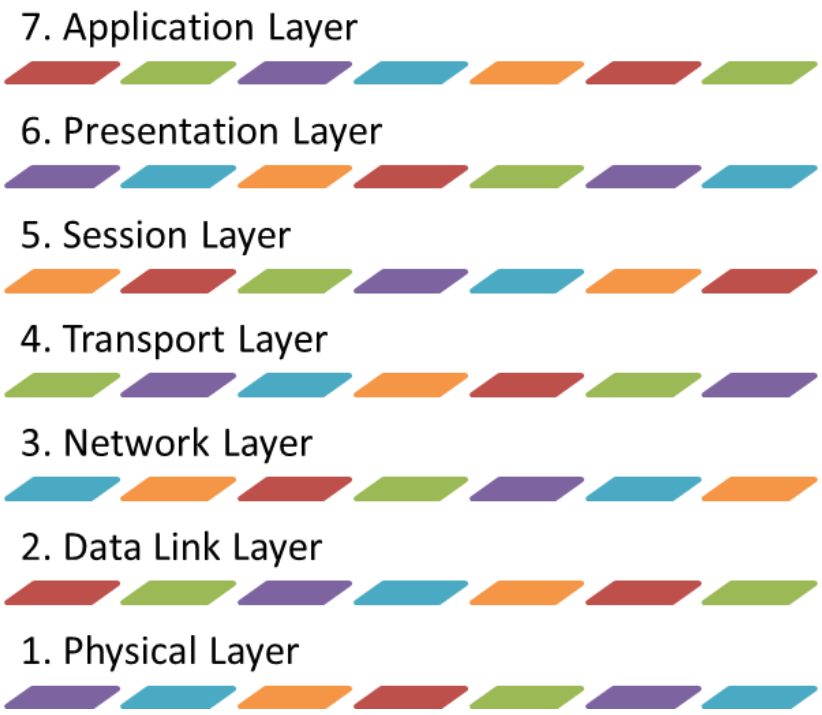
- Helps technicians determine **necessary components and software for network setup**.
- **Simplifies visualization** of roles and communication between network components.
- **Assists in troubleshooting** by isolating issues to specific network layers.
- Promotes **interoperability** between devices and software from different vendors.
- Clearly defines **component responsibilities** within the network architecture.
- Enables **vendors** to specify which network layers their products interact with.

👎LIMITATIONS OF OSI MODEL

- **Theoretical Model only**, not practically implemented as-is in real networks.
- Some functions are duplicated across layers, leading to **inefficiency** (e.g., error handling at multiple layers).
- Unnecessarily **complicated** for simple systems.
- Slow Adoption.
- In some cases, the distinction between layers (e.g., Session and Transport) is ambiguous.
- Layered architecture can add **latency** due to performance overhead.
- Not all vendors strictly follow OSI standards, leading to **compatibility issues.**

🪜 LAYERS OF OSI MODEL

The OSI model has seven layers, each describing a different function of data travelling through a network. The OSI model consists of the following 7 layers :



🔎DETAILED WORKING OF EACH LAYER

Layer 1: Physical Layer

Function: Transmits bits of data in the form of electrical impulses, light or radio signals through the network over hardware media such as cables, Network Interface Cards, fibre optics, or other physical aspects.

Protocols: Fast Ethernet, RS232, ATM, DSL

Examples: Ethernet, FDDI, B8ZS

Layer 2: Data Link Layer

Function: Establishes node-to-node transfer of bits of information into data frames to the physical layer. (*Data Frame represents a group of information*).

Sub layers :

- MAC (Media Access Control) - controls how computers gain access to data and its transmission throughout the network.

- LLC (Logical Link Control) - Controls frame synchronisation, flow control and error checking.

Protocols: Ethernet, PPP, HDLC

Responsibilities: Create and recognise frame boundaries, flow and error control.

Layer 3: Network Layer

Function: Handles data delivery across multiple networks; responsible for managing routing of data.

Protocols: IP (IPv4, IPv6), ICMP, IGMP

Examples: AppleTalk

Responsibilties: Creates logical paths known as virtual circuits, mapping between IP addresses, packet forwarding.

Layer 4: Transport Layer

Function: Ensures complete and reliable delivery of data segments across network connections by breaking data into segments.

Protocols: TCP, UDP

Responsibilities: Flow control, error control, segmentation and reassembly, port addressing

Layer 5: Session Layer

Function: Manages sessions (establishing, maintaining, terminating) between different devices in the network.

Protocols: NetBIOS, RPC

Responsibilities: Session establishment and termination, set checkpoints during large data transfer.

Layer 6: Presentation Layer

Function: Translates data between the application layer and the network into network-compatible language.

Protocols: ASCII, JPEG, MPEG

Responsibilties: Data encryption and decryption, Data compression.

Layer 7: Application Layer

Function: Closest to the end user. Interfaces directly with applications and sends data to and receives data from presentation layer.

Protocols: HTTP, FTP, SMTP

Responsibilities: Interaction with software applications, file transfers, emails, network management.

📌CONCLUSION

The OSI Model is essential for understanding networking, troubleshooting and designing protocols for every layer. Each layer has a well-defined function, and together they ensure smooth data communication between devices globally.