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Project Title 1: R&D Document on Working of All Layers in OSI Model

#INTRODUCTION:

The Open Systems Interconnection ([OSI](#)) model is a framework that conceptualizes how computers within a network communicate. It splits this process into seven distinct layers, each one playing a specific role within the overall operation.

#OBJECTIVE:

R&D aims to achieve that this document explores the working of each of the seven layers of the OSI Model in detail, their individual responsibilities, how they interact, and real-world examples of their use in network communication.

#Overview of the OSI Model:

Layer No.	Layer Name	Function
7	Application Layer	End-user services (e.g., HTTP, FTP)
6	Presentation Layer	Data translation, encryption, compression
5	Session Layer	Manages sessions and controls dialogues
4	Transport Layer	Ensures reliable data transfer (TCP/UDP)
3	Network Layer	Routing and IP addressing
2	Data Link Layer	Error detection, MAC addressing
1	Physical Layer	Transmission of raw bits via medium

#WORKING:

1. PHYSICAL LAYER ----- (LAYER 1)

Function:

- Deals with physical transmission of raw bits (0s and 1s) over a communication medium.
- It defines hardware specifications, voltage levels, transmission rates, and cable types.

Responsibilities:

- Bit transmission [converts digital data into electrical, optical or radio signals]
- Physical media (e.g., copper).
- Data encoding and modulation.

Devices:

- Hubs, Repeaters

Example:

When you plug an Ethernet cable into a laptop, the physical layer is responsible for sending binary data as electrical signals.

2. DATA LINK LAYER ----- (LAYER 2)

Function:

- Converts raw transmission from the physical layer into structured frames.
- Divided into two sub layer: MAC (Media Access Control) & LLC (Logical Link Control)

Responsibilities:

- Framing
- Physical addressing (MAC)
- Error detection and correction (e.g., CRC)
- Flow control

Devices:

- Switches, **Network Interface Cards (NIC)**

Example:

When a device wants to communicate in a local network, it uses the MAC address to send data. If a switch receives a frame, it checks the destination MAC and forwards it.

3. NETWORK LAYER ----- (LAYER 3)

Function:

- Manages routing of data from source to destination across networks using IP addresses.
- Handles logical addressing and path determination.

Responsibilities:

- Logical addressing (IP).
- Routing.
- Packet forwarding.

Devices:

Routers

Example:

When sending data from India to the USA, the IP packet is routed across multiple routers and networks using IP addresses.

4. TRANSPORT LAYER ----- (LAYER 4)**Function:**

- Ensures reliable data transfer between devices.
- Handles segmentation, flow control, and error recovery.

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Responsibilities:

- Port addressing.
- Segmentation and reassembly.
- Connection establishment and termination.
- Reliable (TCP) or unreliable (UDP) delivery.

Protocols:

- TCP (Transmission Control Protocol)
- UDP (User Datagram Protocol)

Example:

While reading the content, I conclude that

- TCP is used for the login and comments (reliable).
- UDP is used for streaming the video (faster, no retransmissions).

5. SESSION LAYER ----- (LAYER 5)**Function:**

- Manages sessions (communication channels) between devices.
- Responsible for starting, managing, and ending sessions.

Responsibilities:

- Session establishment
- Synchronization

- Dialog control (e.g., half-duplex, full-duplex)

Example:

When you're logged into your email, the session layer keeps your session alive so that you don't have to log in again until you close the browser or log out.

6. PRESENTATION LAYER ----- (LAYER 6)

Function:

- Translates data between the application layer and network.
- Handles data formatting, encryption, and compression.

Responsibilities:

- Data translation (e.g., ASCII, JPEG)
- Encryption/decryption (e.g., SSL/TLS)

Example:

If a secure website uses HTTPS, SSL/TLS (presentation layer) encrypts your data before it's sent over the network.

7. APPLICATION LAYER ----- (LAYER 7)

Function:

- Closest to the end-user.
- Interfaces with applications to provide network services like file transfer, web access, and email.

Responsibilities:

- Network services to applications
- Resource sharing
- Application-level protocols

Protocols:

- HTTP, FTP, SMTP, DNS.

Example:

When we use a browser to open www.google.com, our browser uses HTTP (application layer) to request the web page from Google's server.