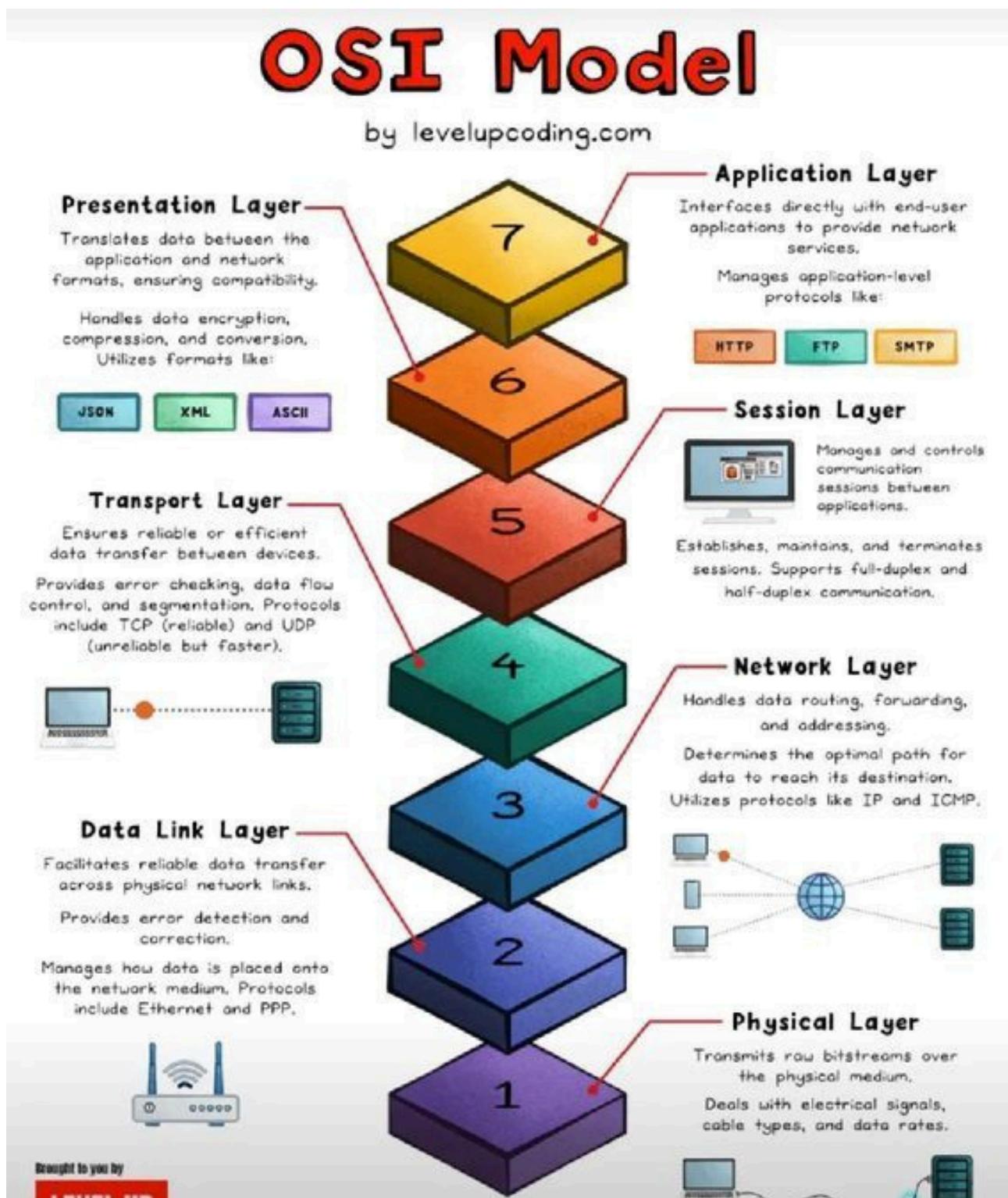


OSI MODEL : R&D DOCUMENT

OSI Model :

The OSI (Open Systems Interconnection) model is a way to understand how computer networks operate. It breaks down the complex process of sending data over the internet or local networks into seven clear steps or “layers”. Each layer has a specific role and all layers work together to make communication possible. This document explores each layer in more detail, with real-world examples and their importance.



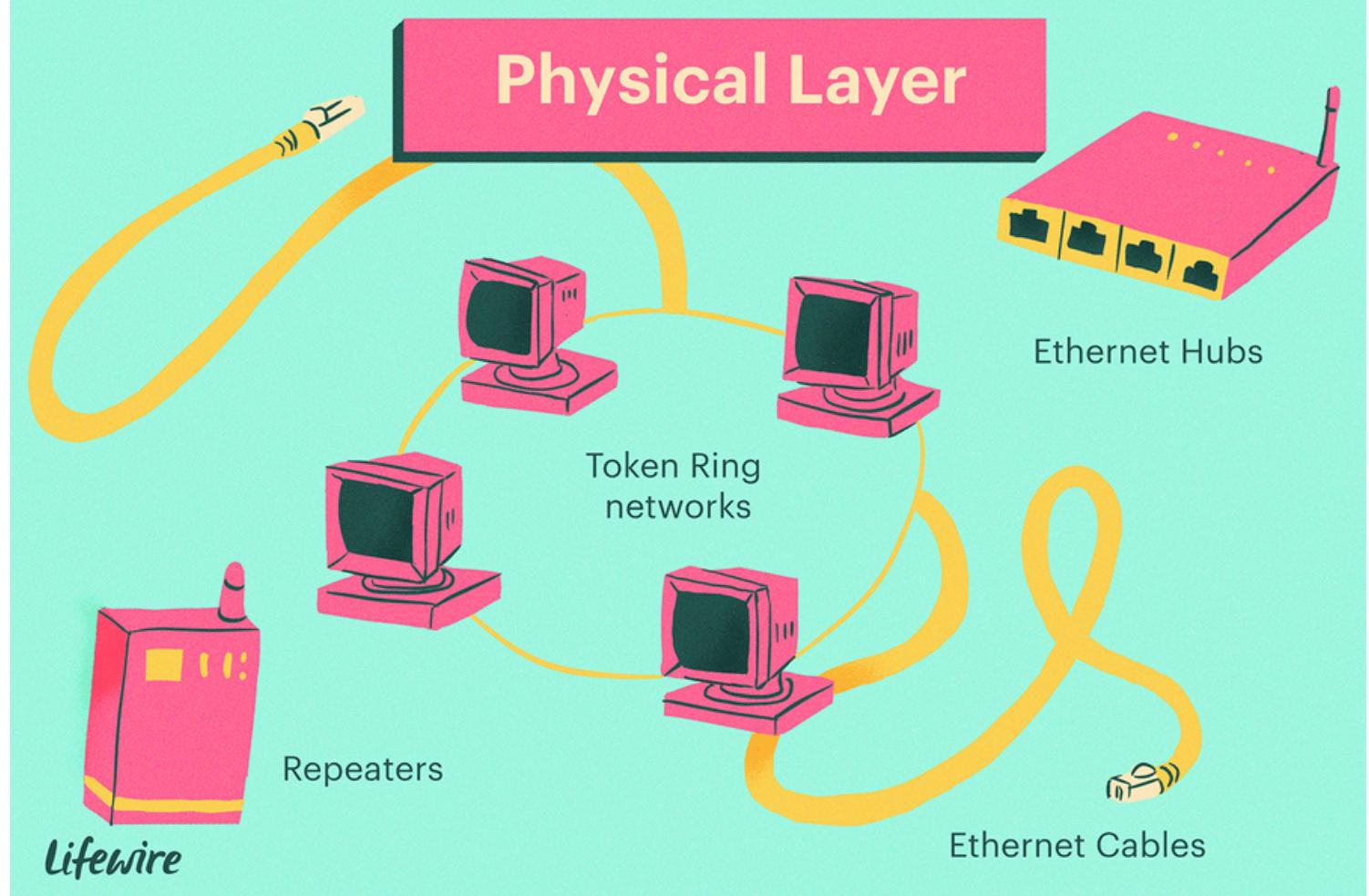
1. PHYSICAL LAYER

This is the first and lowest layer of the OSI model. It deals with the physical parts of the network-like cables, switches, and network cards. Its main job is to send raw bits (0s and 1s) over a physical medium such as copper wires, fiber optics, or even radio waves in wireless networks.

Devices: Ethernet cables, fiber optics, repeaters, hubs

Key Tasks: Bit transmission, voltage levels, timing

Why It Matters: Without this layer, there's no way to actually move data physically between machines.



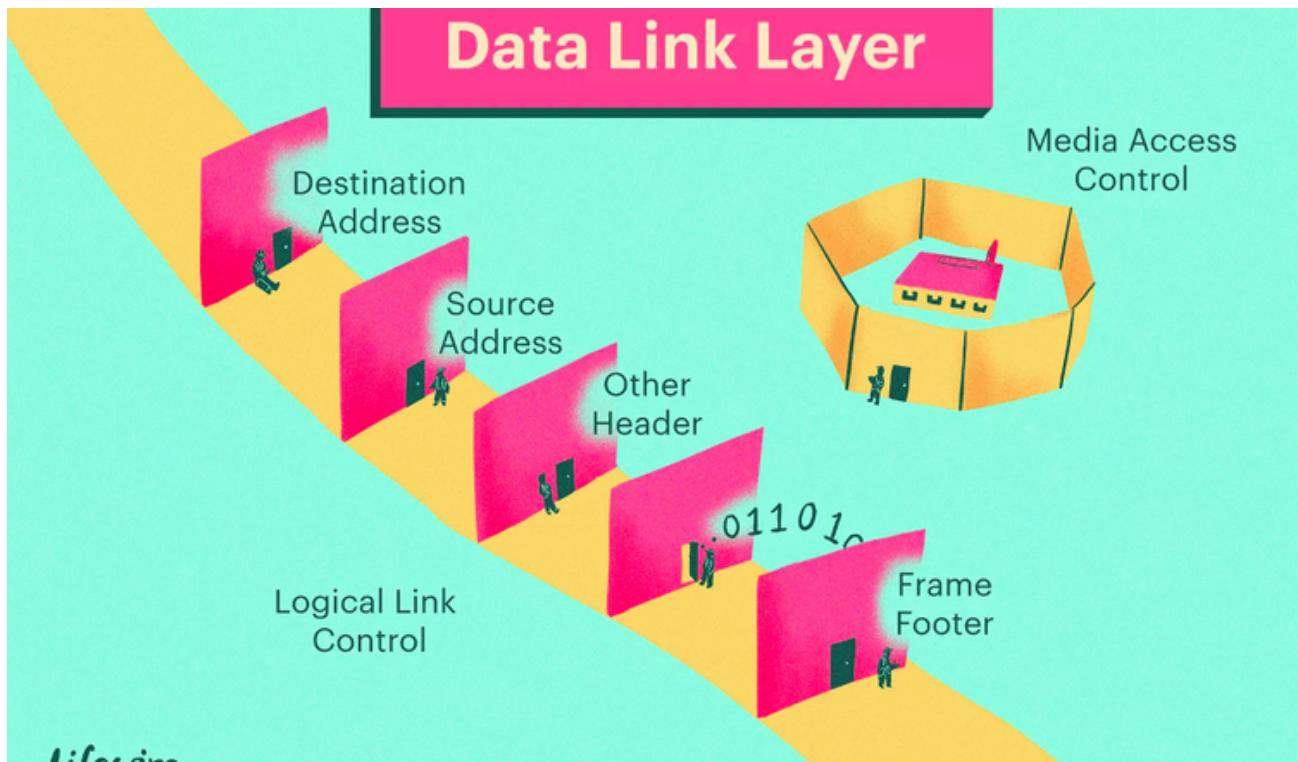
2. DATA LINK LAYER

This layer is responsible for making sure data gets from one node to another reliably over the same physical link. It packages raw bits into frames and handles error detection and correction.

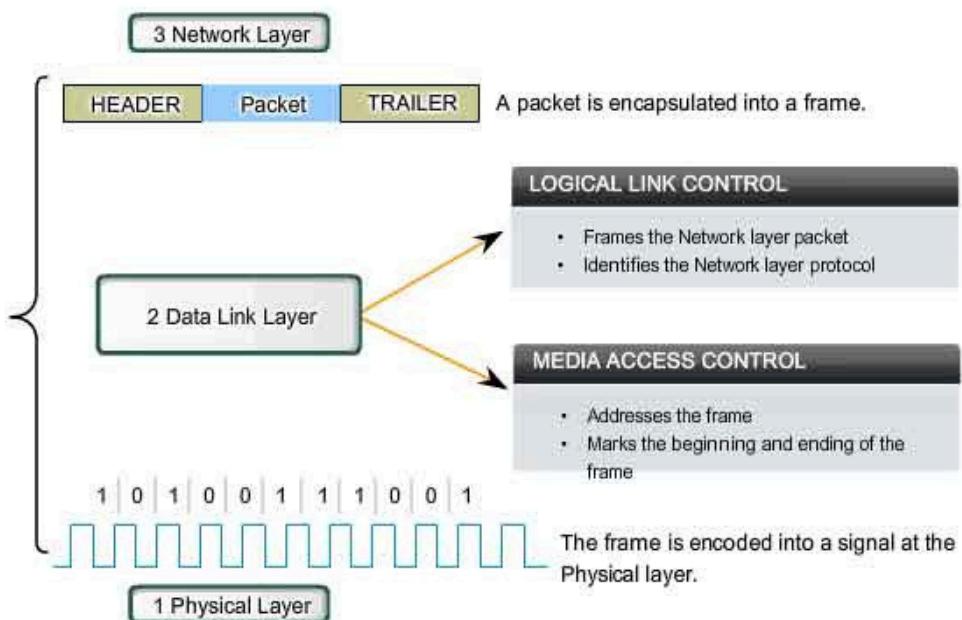
Devices: Network interface cards (NICs), switches

Key Tasks: Framing, addressing with MAC addresses, handling collisions

Example: Your Wi-Fi router uses this layer to make sure your laptop gets the data it was supposed to receive.



SUB-LAYERS OF DATA LINK LAYER



3. NETWORK LAYER

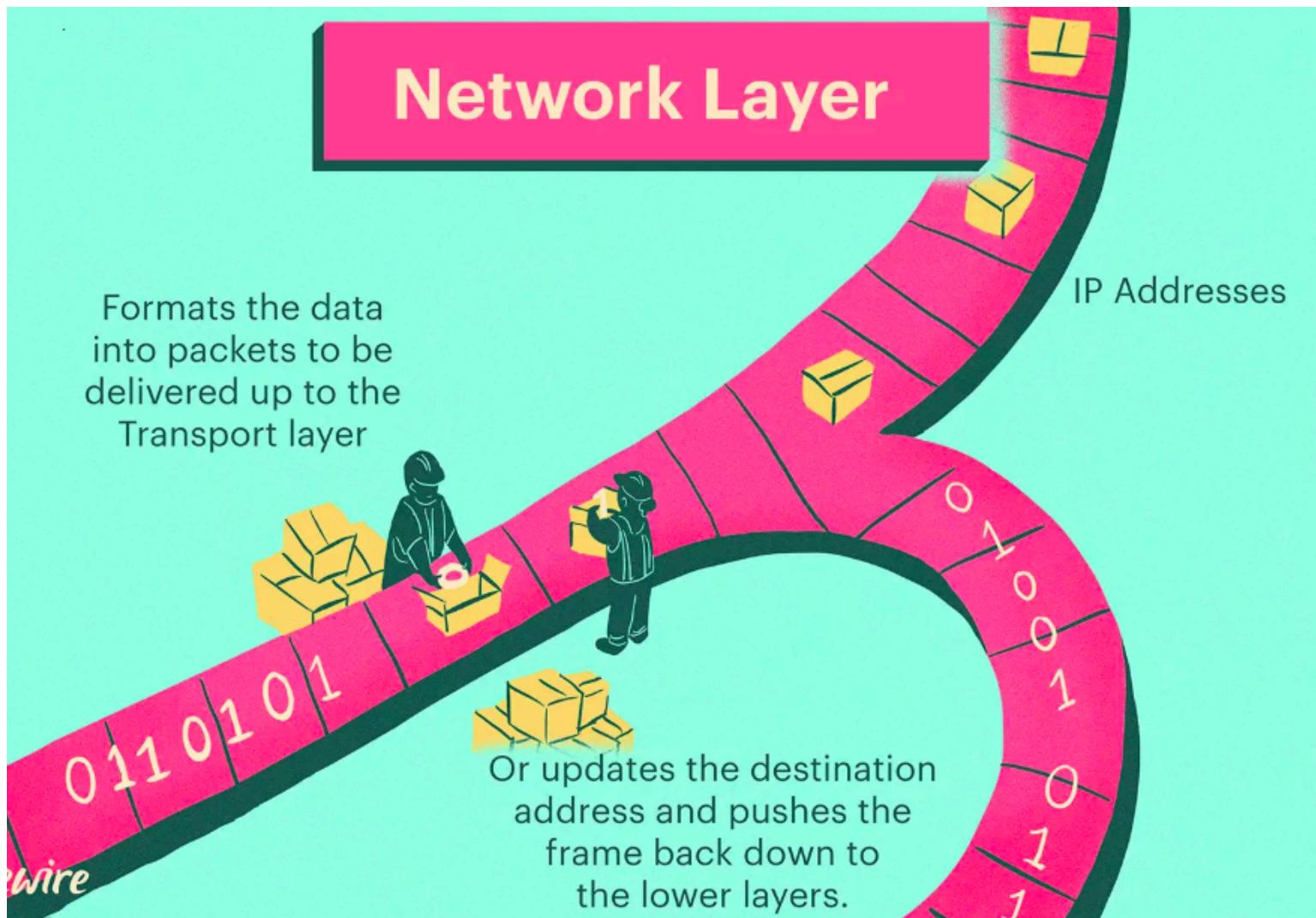
The network layer is where routing happens. It figures out how to get packets from source to destination, even if they're on different networks. This layer introduces logical addressing (like IP addresses).

Devices: Routers, Layer 3 switches

Key Tasks: Routing, addressing, fragmentation of packets

Why It Matters: Without routing, data could only travel on the same local network. This layer makes the internet work.

Protocols: IP (Internet Protocol), ICMP, IGMP



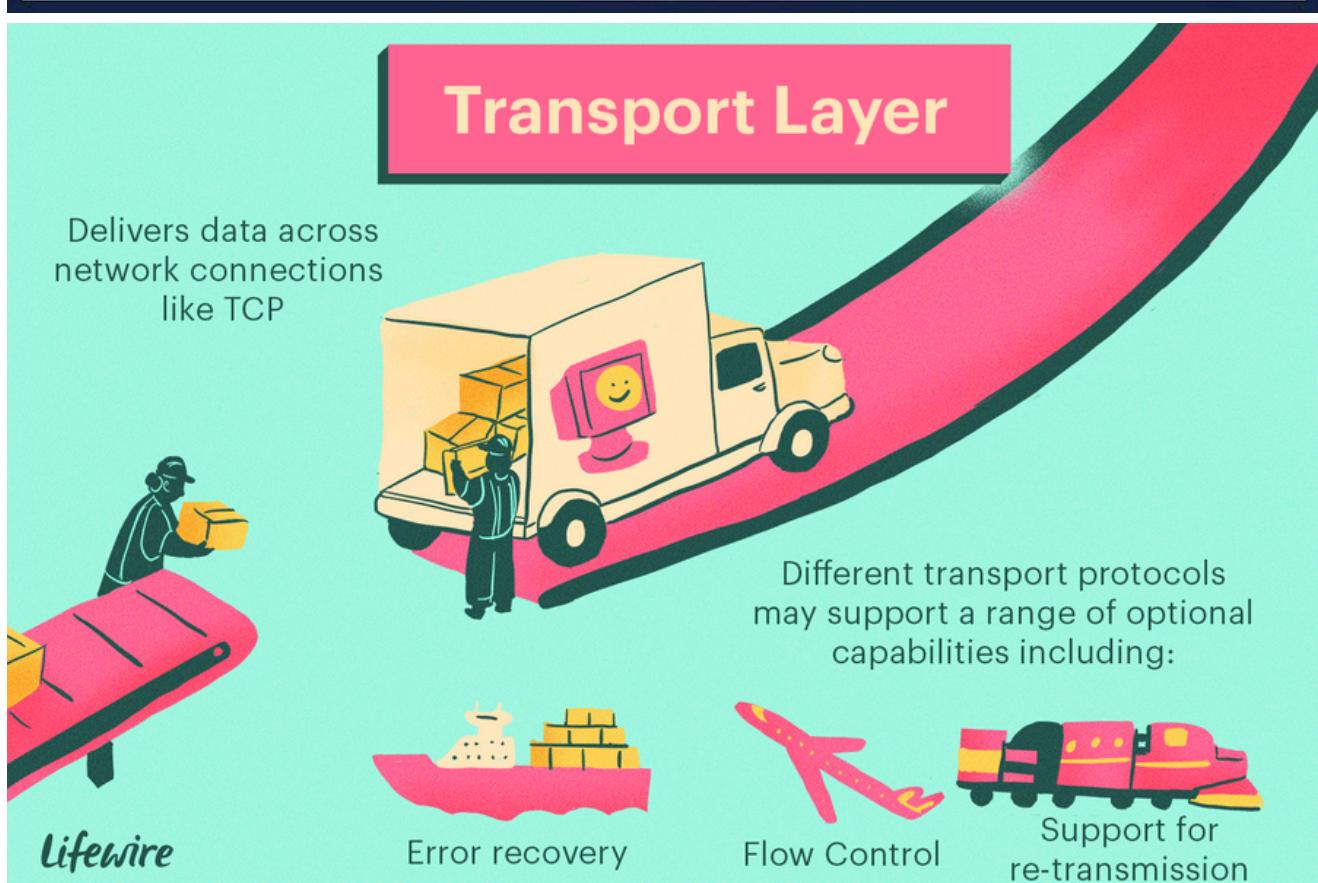
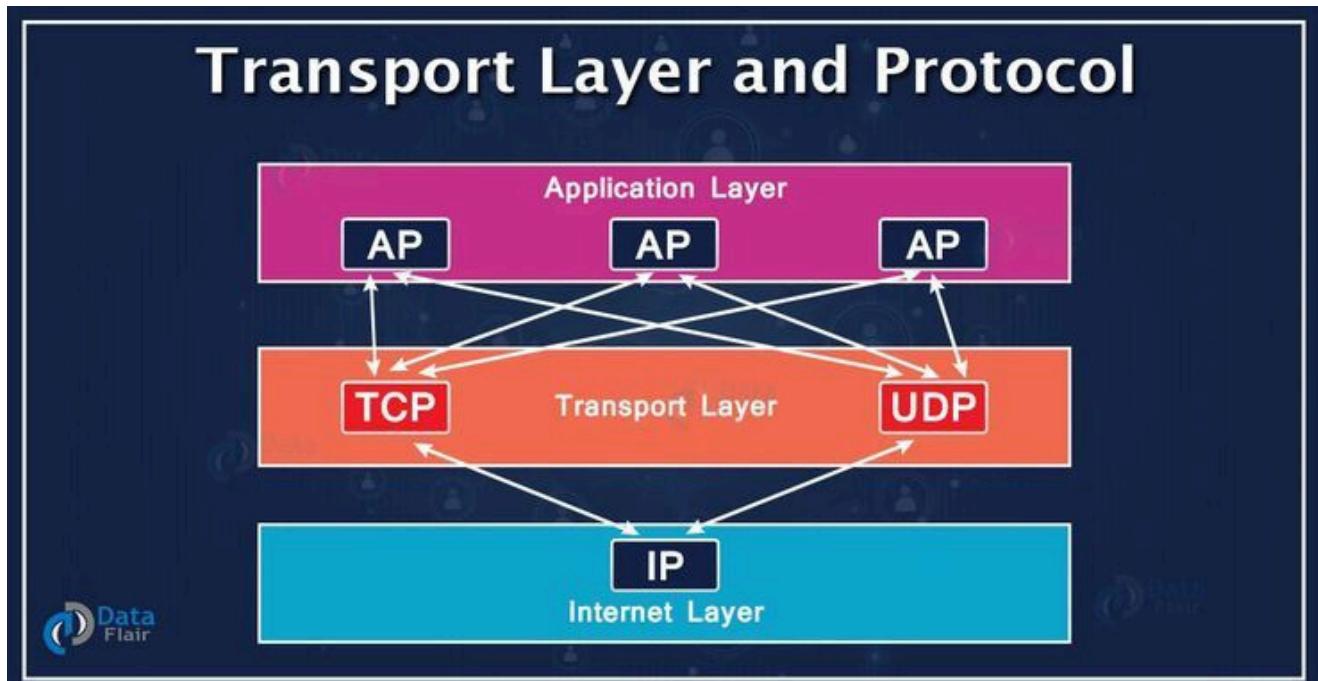
4. TRANSPORT LAYER

This layer makes sure data gets to the right application on the right device. It also ensures that large messages are broken down into chunks and reassembled correctly on the other side.

Key Tasks: End-to-end communication, error recovery, flow control

Example: When you load a website, TCP ensures the page loads completely, in order, without missing parts.

Protocols: TCP (Transmission Control Protocol), UDP (User Datagram Protocol)

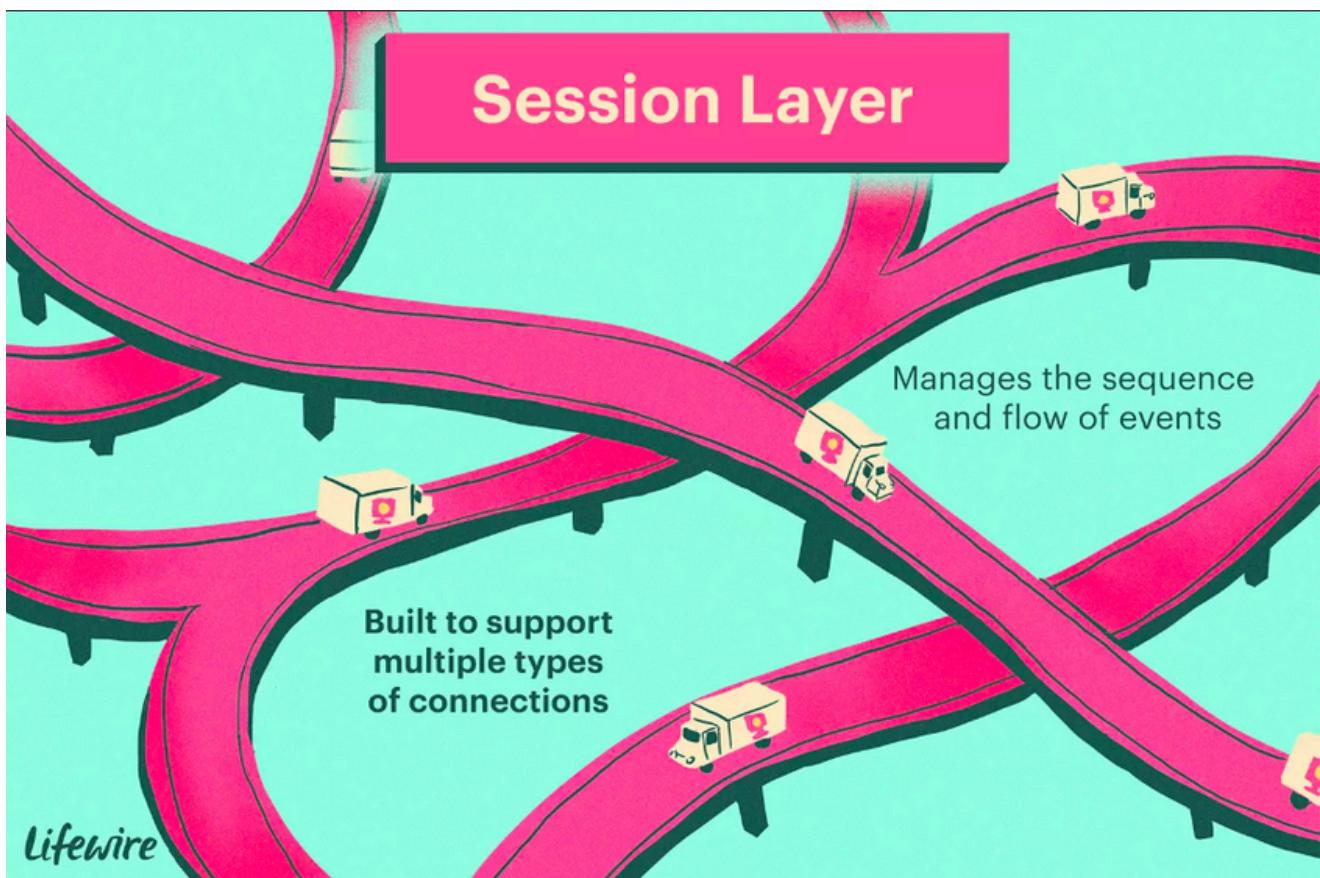
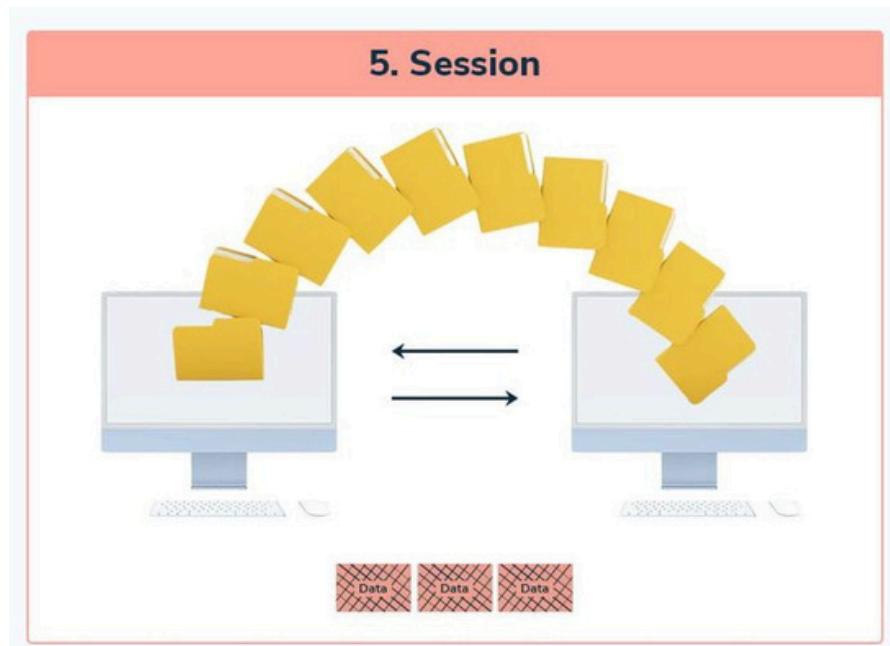


5. SESSION LAYER

This layer manages sessions—ongoing communications between two devices. Think of it as the manager of a conversation, ensuring the devices stay connected and know when to start and stop talking.

Key Tasks: Session establishment, maintenance, termination, authentication

Example: When you log into a remote server using SSH, the session layer helps keep the connection alive and secure.

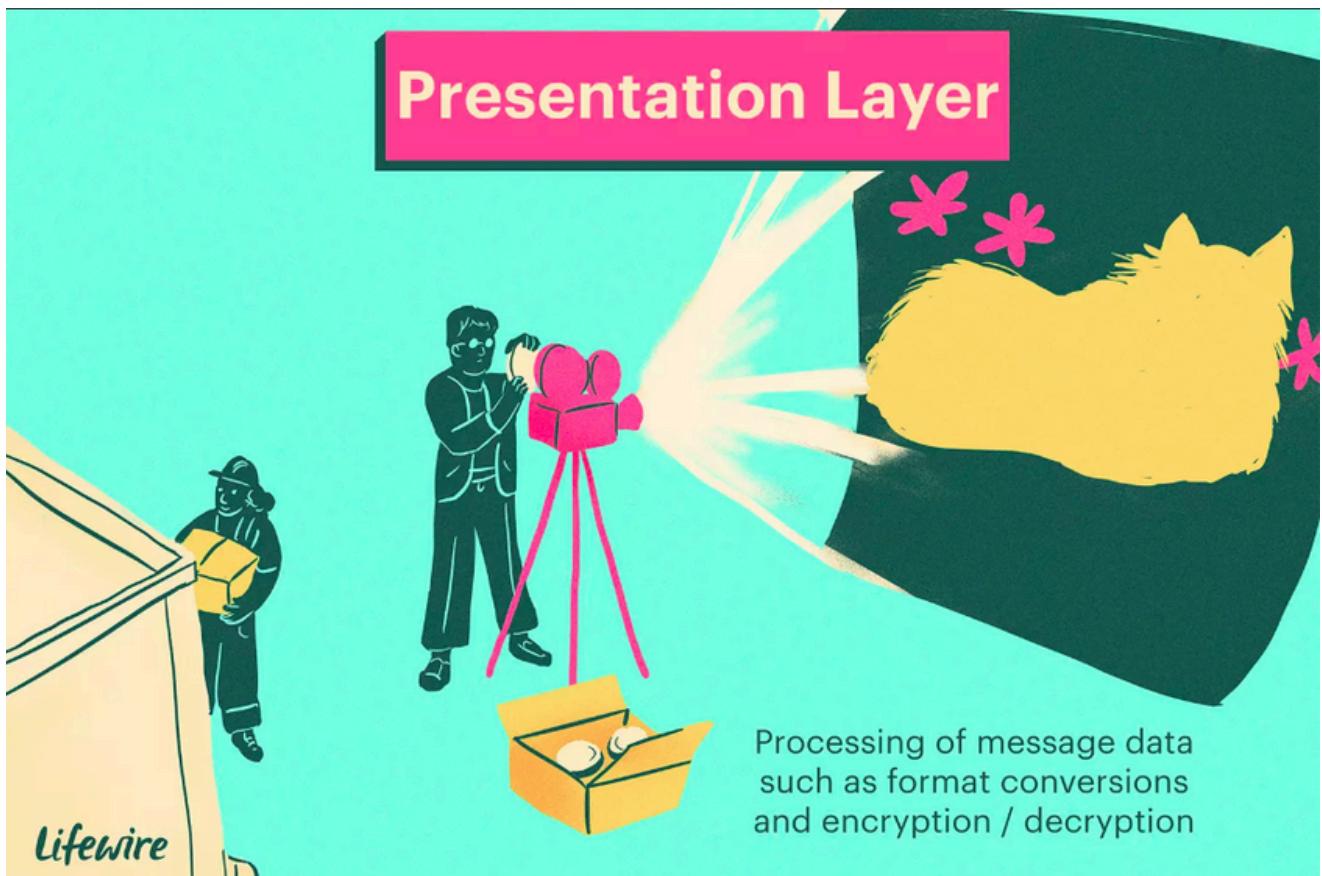
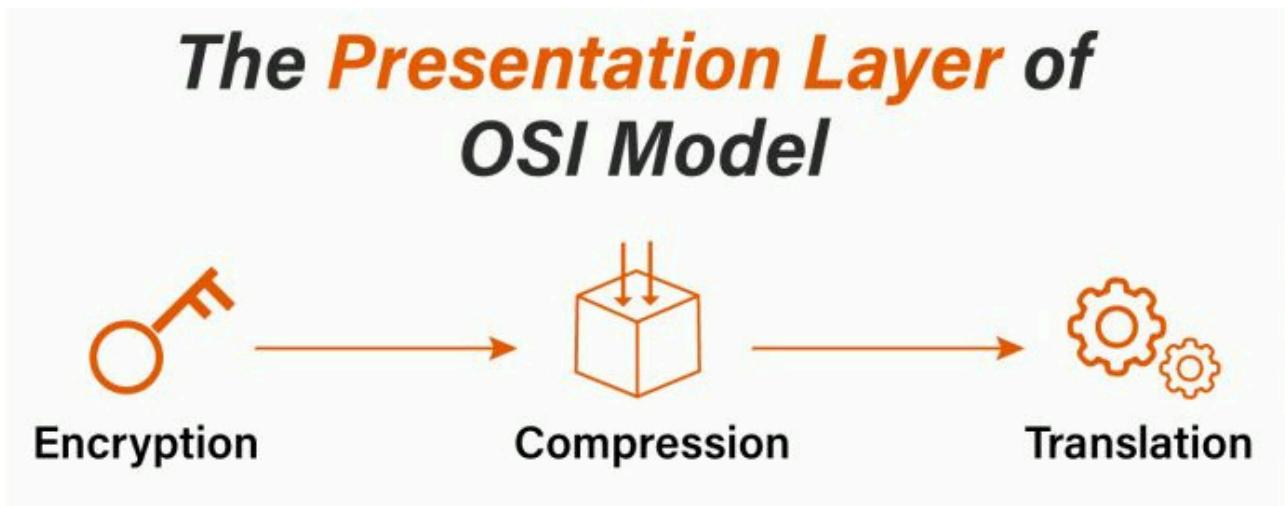


6. PRESENTATION LAYER

The presentation layer is like a translator. It converts data from one format into another so that the application layer can understand it. It also handles encryption and compression.

Key Tasks: Data format translation, character encoding, encryption, and compression

Example: Converting a JPEG image into a format your browser can display, or encrypting data using SSL/TLS before it's sent.

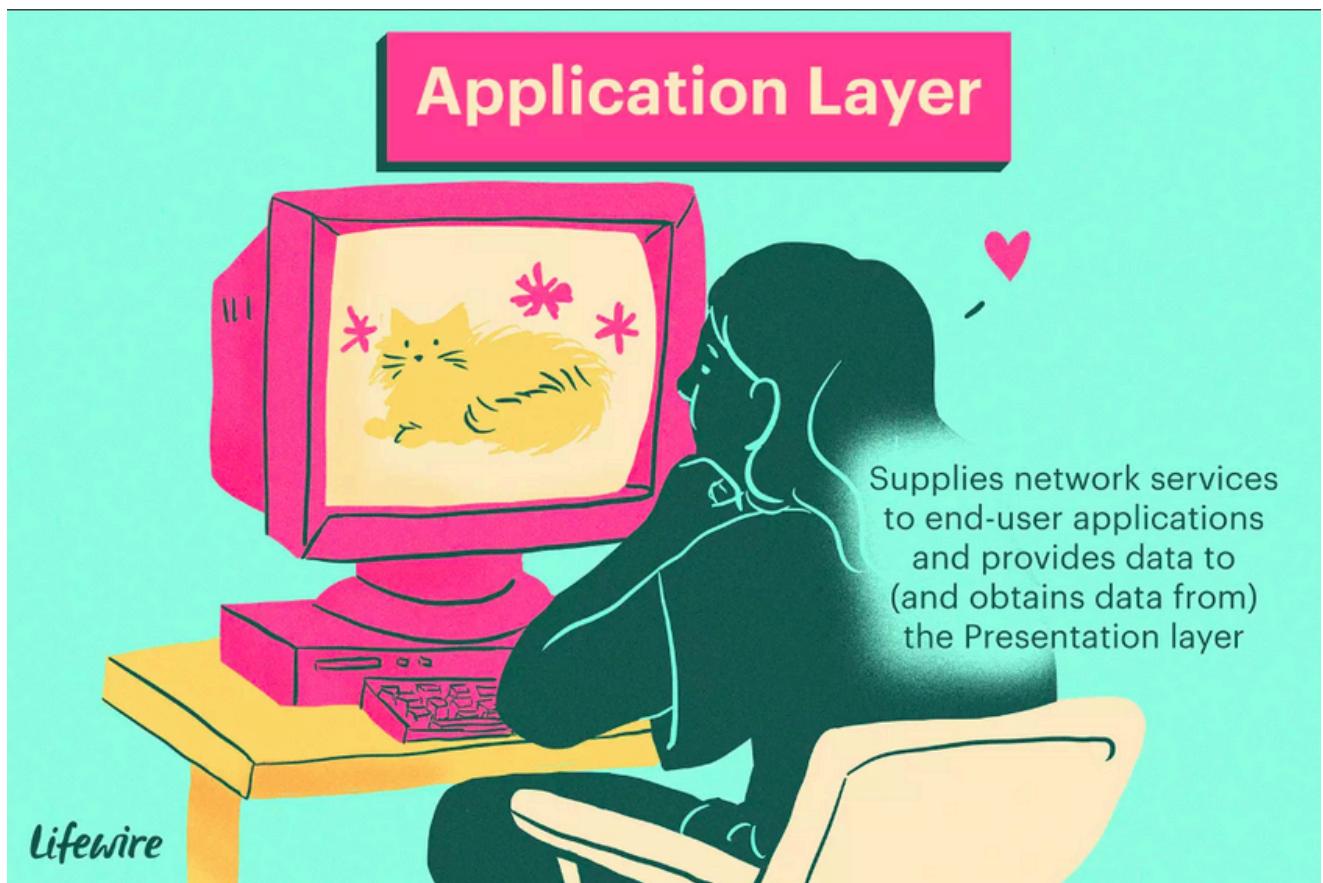
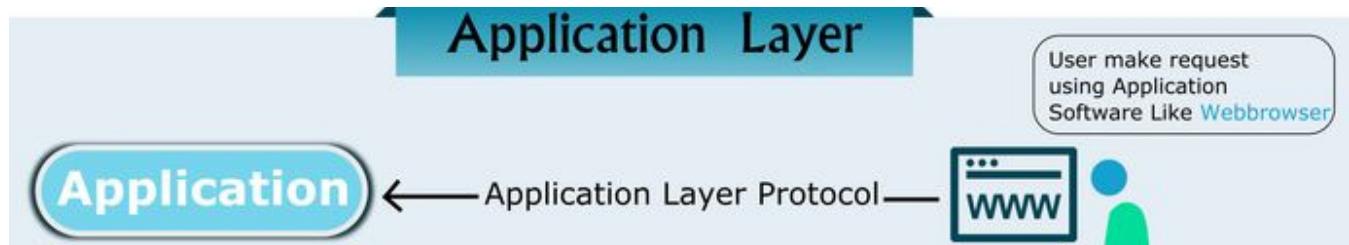


7. APPLICATION LAYER

This is the topmost layer and is what most users interact with directly. It provides services like web browsing, email, and file transfers. It's where applications access the network.

Protocols: HTTP, FTP, SMTP, DNS, POP3

Example: When you send an email or browse the internet, it's the application layer doing the heavy lifting to connect your app to the network.



CONCLUSION

The OSI model is a powerful tool for understanding how networks work. Each layer has its own responsibility, and together they ensure that data can travel from one device to another smoothly. Whether you're troubleshooting a network issue or designing a new system, knowing the OSI layers helps you pinpoint problems and build better solutions.

In this document, we explored the OSI Model and examined the specific function and significance of each layer. Understanding the OSI model not only helps in diagnosing network issues but also provides a solid foundation for designing secure, efficient network systems.

Submitted by:

Sambit Kumar Panda

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