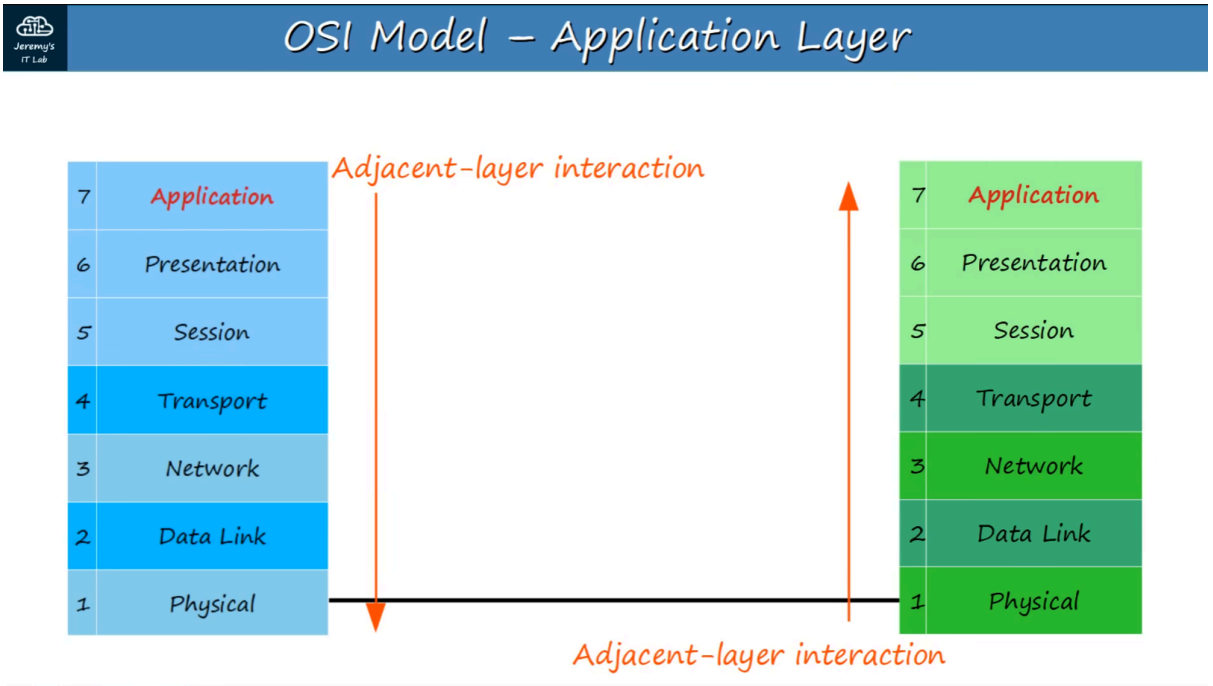
What is a Networking Model?

Networking models categorize and provide a structure for networking protocols and standards.

(Protocols are a set of logical rules defining how network devices and software should work.)

OSI MODEL

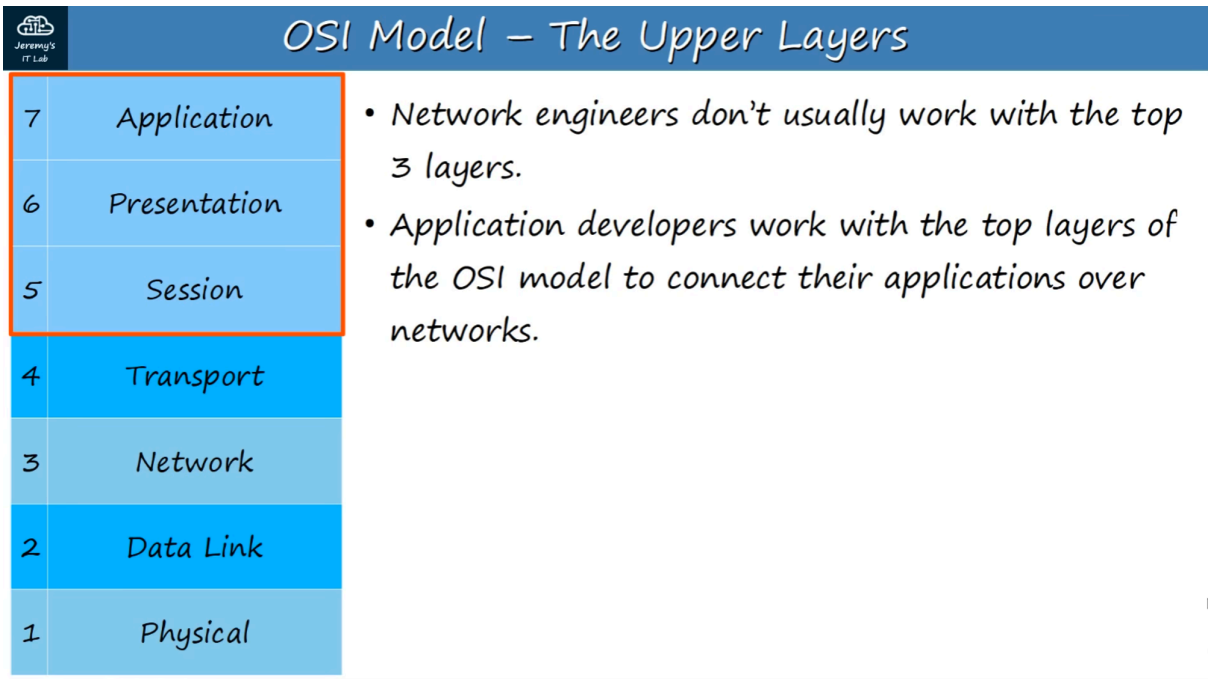
- Open Systems Interconnection Model
- Conceptual model that categorizes and standardizes the different functions in a network.
- Created by the "International Organization for Standardization" (ISO)
- Functions are divided into 7 "Layers."
- These layers work together to make the network work.



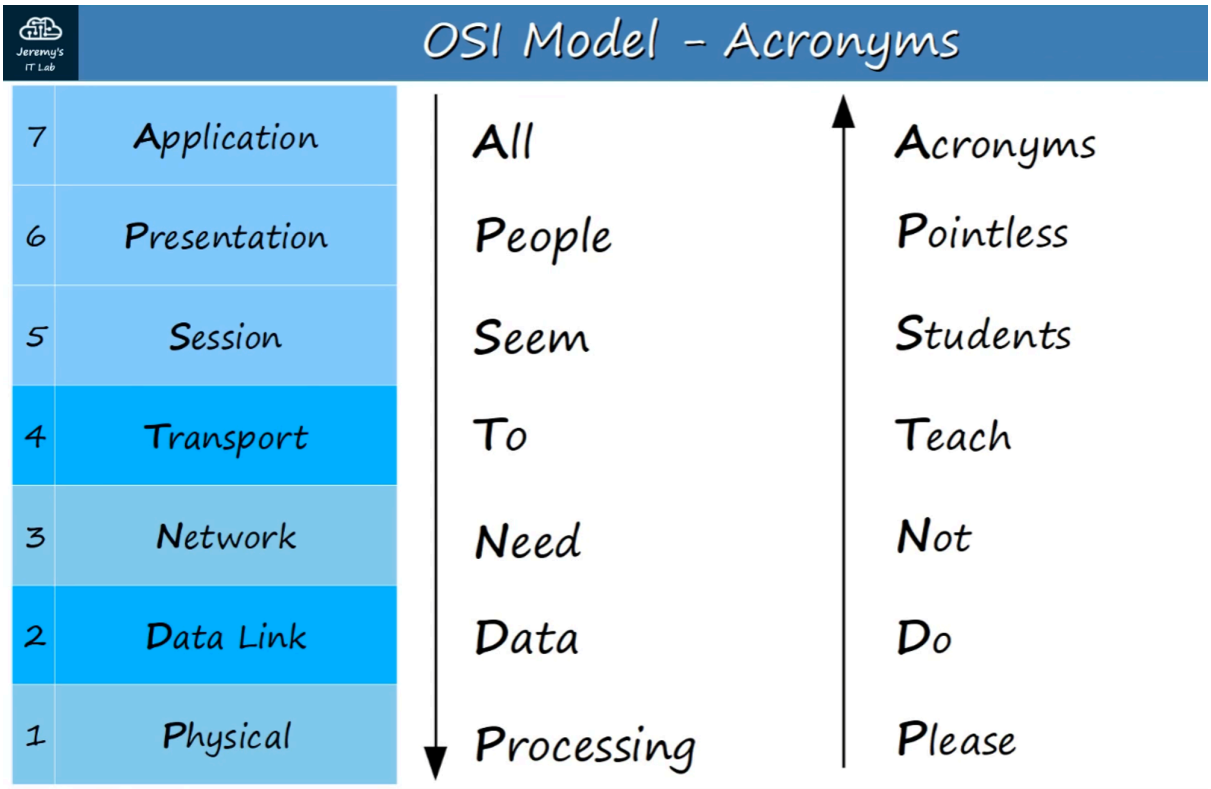
As data moves from the top layer, downward, the process is called **encapsulation.**

As data moves from the bottom layer, upward, the process is called **de-encapsulation.**

When interactions occur on the same layer, it's called **same-layer interaction.**



Mnemonic to help remember the Data Layer Names / Order:



The Layers Are:

7 - APPLICATION

- Closest layer to the end user.
- Interacts with software applications.
- HTTP and HTTPS are Layer 7 protocols.

Functions of Layer 7 include:

- Identifying communication partners
- Synchronizing communication

---

6 - PRESENTATION

- Translates data to the appropriate format (between Application and Network formats) to be sent over the network.

---

5 - SESSION

- Controls dialogues (sessions) between communicating hosts.
- Establishes, manages, and terminates connections between local application and the remote application.

Note: Network engineers don't usually work with the top three layers.
Application developers work with these top layers to connect applications over networks.

---

4 - TRANSPORT

- Segments and reassembles data for communication between end hosts.
- Breaks large data pieces into smaller segments, reducing transmission issues if errors occur.
- Provides HOST-TO-HOST (end-to-end) communication.

When Data from Layers 7-5 arrives, it receives a Layer 4 Header in the Transport layer:

```
<< DATA + L4 Header >>
```

This is called a **SEGMENT.**

---

3 - NETWORK

- Provides connectivity between end hosts on different networks (e.g., outside the LAN).

- Provides logical addressing (IP Addresses).
- Provides path selection between source and destination.
- **ROUTERS** operate at Layer 3.

When Data and the Layer 4 Header arrive in the Network Layer, it receives a Layer 3 Header:

```
<< DATA + L4 Header + L3 Header >>
```

This is called a **PACKET.**

---

2 - DATA LINK

- Provides NODE-TO-NODE connectivity and data transfer (e.g., PC to Switch, Switch to Router).
- Formats data for transmission over physical medium (e.g., copper UTP cables).
- Detects and (possibly) corrects Physical (Layer 1) errors.
- Uses Layer 2 addressing, separate from Layer 3 addressing.
- **SWITCHES** operate at Layer 2.

When the Layer 3 Packet arrives, a Layer 2 Trailer and Header are added:

```
<< L2 Trailer + DATA + L4 Header + L3 Header + L2 Header >>
```

This is called a **FRAME.**

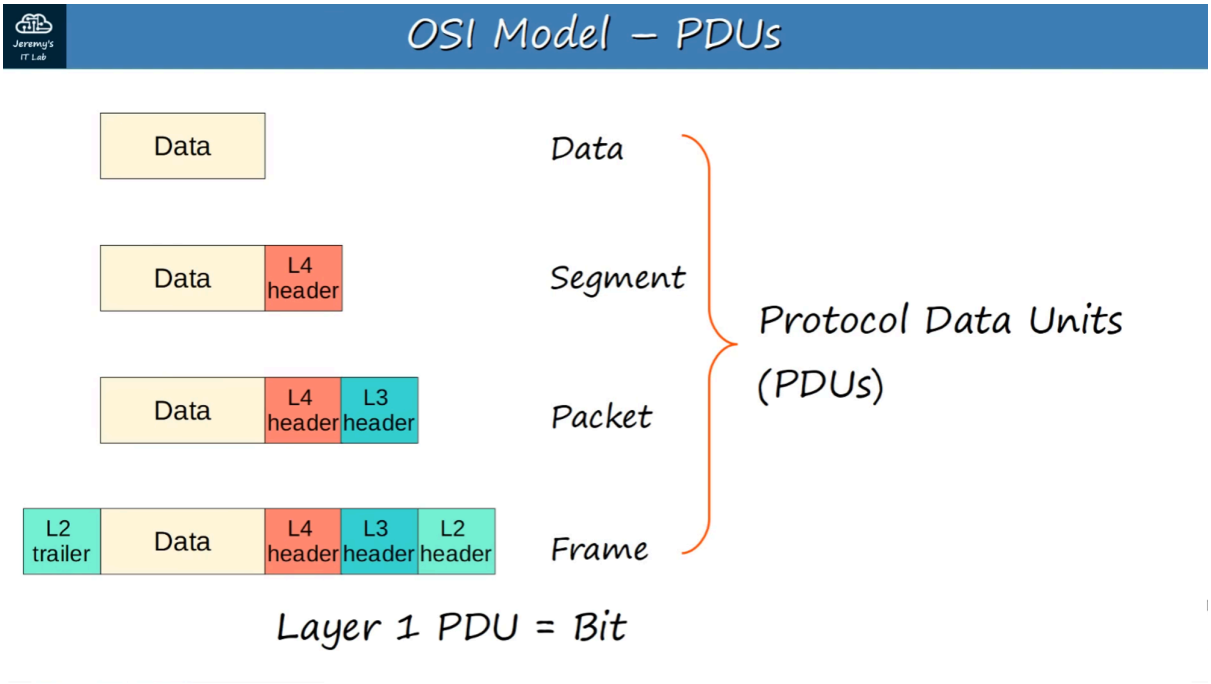
All the steps leading up to transmission are called **ENCAPSULATION.**
When the frame is sent to the receiver, it goes through **DE-ENCAPSULATION**—stripping off layers while traveling from Layer 1 to Layer 7.

---

1 - PHYSICAL

- Defines physical characteristics of the medium used to transfer data between devices (e.g., voltage levels, connectors, cable specs).
- Converts digital bits into electrical (wired) or radio (wireless) signals.
- All of the information in **Section 2 (Networking Devices)** relates to the Physical Layer.

OSI MODEL - PDUs

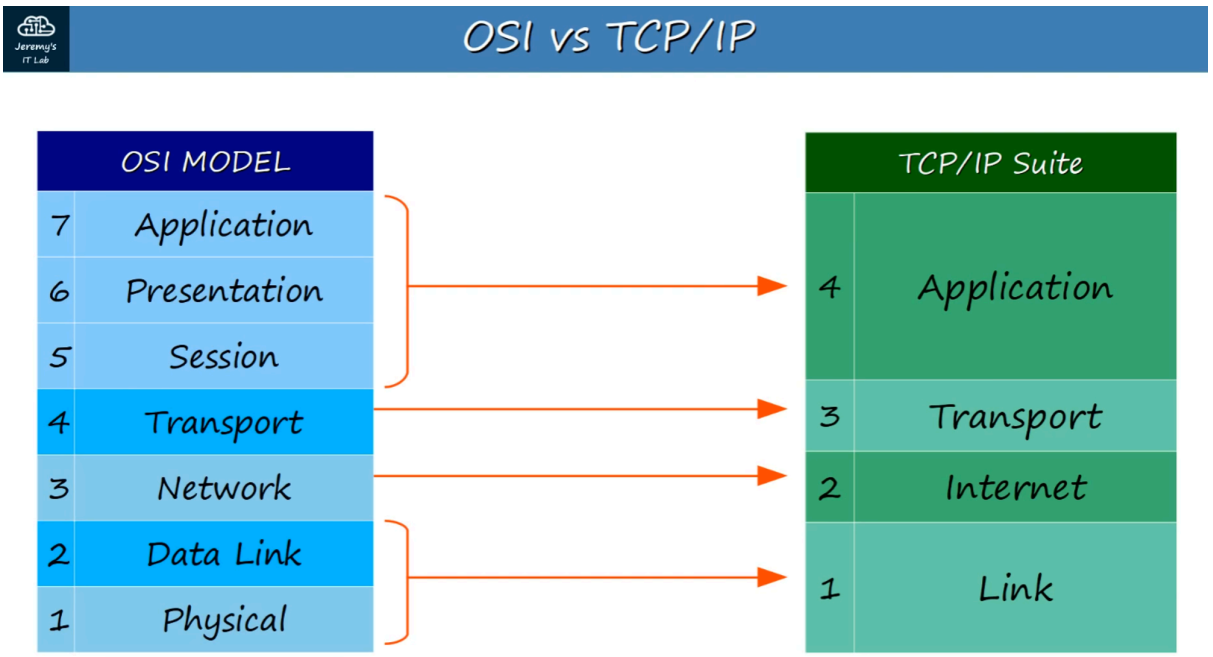


A **PDU** is a Protocol Data Unit. Each step of the process is a PDU:

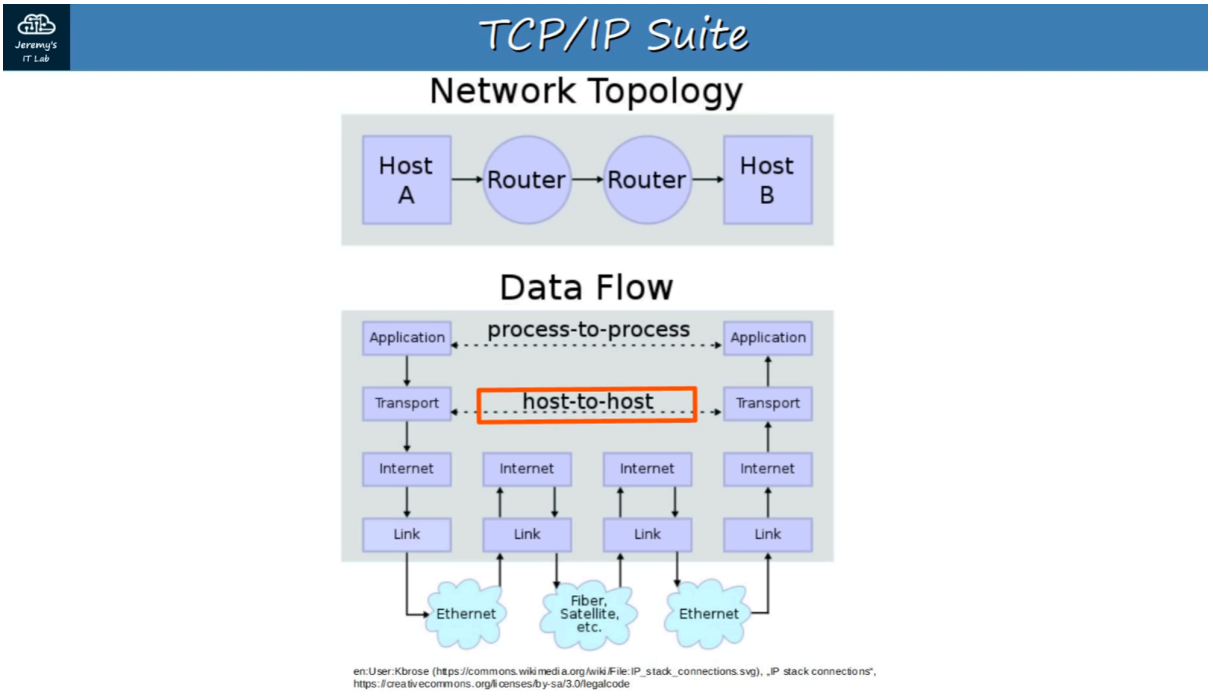
OSI Layer	PDU Name	Protocol Data Added
7-5	DATA	Data
4	SEGMENT	Layer 4 Header Added
3	PACKET	Layer 3 Header Added
2	FRAME	Layer 2 Trailer + Header
1	BIT	Transmission as 0s and 1s

TCP/IP Suite

- Conceptual model and set of communications protocols used in the Internet and other networks.
- Known as **TCP/IP** because those are two foundational protocols in the suite.
- Developed by the US Dept. of Defense via DARPA (Defense Advanced Research Projects Agency).
- Similar structure to the OSI Model, but fewer layers.
- **This is the model actually in use in modern networks.**
- *Note:* The OSI Model still influences how network engineers think and talk about networks.



Layer Interactions



en:User:Kbrose (https://commons.wikimedia.org/wiki/File:IP_stack_connections.svg), „IP stack connections", https://creativecommons.org/licenses/by-sa/3.0/legalcode

Adjacent-Layer Interactions

- Interactions between different layers of the OSI Model on the same host.

Example: Layers 5-7 sending data to Layer 4, which then adds a Layer 4 header (creating a SEGMENT).

Same-Layer Interactions

- Interactions between the same layer on different hosts.
- This allows you to focus on the interaction of a single layer across devices.

Example: The Application Layer of YouTube's web server and your PC's browser.