# University of Global Village (UGV)
# Barishal, Bangladesh

*Lectures By*


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**Lectures On:**

# Computer Network Models


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# What is a Computer Network Model?

- **Definition:** A conceptual blueprint or "map" that defines how different computer systems and software communicate over a network.
- **Purpose:** It breaks down the complex process of data transmission into smaller, manageable tasks called **Layers**.
- **Modular Design:** Each layer performs a specific function and communicates with the layers directly above and below it.

# Advantages of layered architecture

- **Modularity**: As the tasks are divided into different sections, it makes understanding and maintenance of the system more simplified.
- **Interoperability**: Layers follow standard protocols and enable devices from different organizations to communicate efficiently.
- **Scalability**: New technologies or protocols can be integrated without affecting the entire system.
- **Troubleshooting**: Problems can be isolated to specific layers and each layer can be analyzed and tested individually.

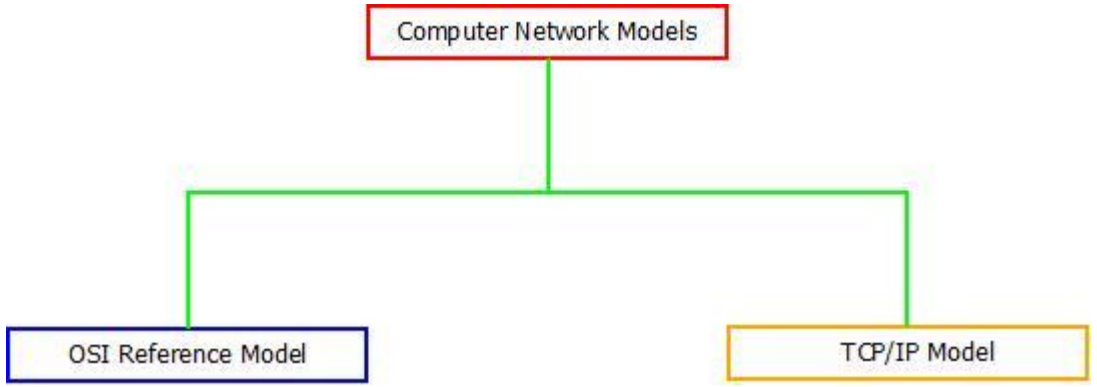
# Types of Network Models

## The Two Primary Network Models

The tech industry generally uses two main models to understand networking:

**1. The OSI Model (Open Systems Interconnection)**

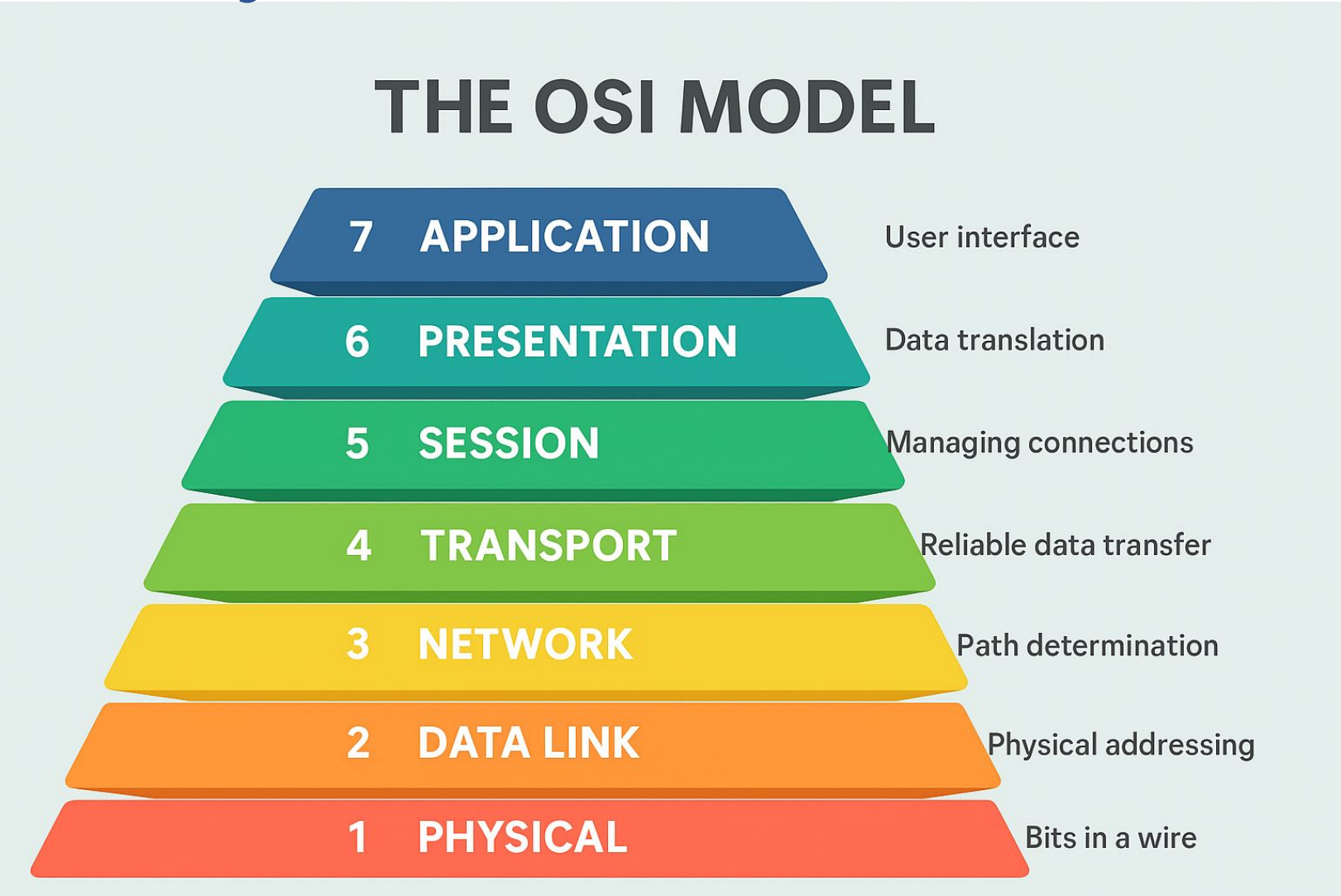
**2. The TCP/IP Model (Transmission Control Protocol)**



# What a OSI Model is?

- **The OSI Model** is a system that breaks network communication into **7 layers**, each with a specific role.
- It ensures that data moves smoothly from one device to another.

# The 7 Layers of the OSI Model



# OSI Model (7 Layers)

- **Application:** Apps like browsers, email (e.g., Protocol, HTTP, FTP).
- **Presentation:** Formats data for understanding (e.g., encryption, Compression).
- **Session:** Manages connections between devices. (Checkpoint)
- **Transport:** Ensures data is sent/received properly (e.g., Segments, Error Control, Flow Control).
- **Network:** Decides the route (e.g., IP, Packet Routing).
- **Data Link:** Rules for sending data (e.g., Ethernet).
- **Physical:** Wires, cables, signals, Bit Stream (0,1).

# The 7 Layers of the OSI Model

- **Physical Layer:** Transmits raw signals (like electrical pulses or light) over cables or wireless.
- **Data Link Layer:** Makes sure data travels without errors on a local network.
- **Network Layer:** Decides the best path to send data between devices using IP addresses.
- **Transport Layer:** Splits data into smaller pieces and ensures they arrive correctly.
- **Session Layer:** Keeps track of the connection between two devices during communication.
- **Presentation Layer:** Prepares the data for the application, handling encryption and formatting.
- **Application Layer:** Directly interacts with users through software (like email or web browsers).

# Example: Sending an Email (Alice to Bob)

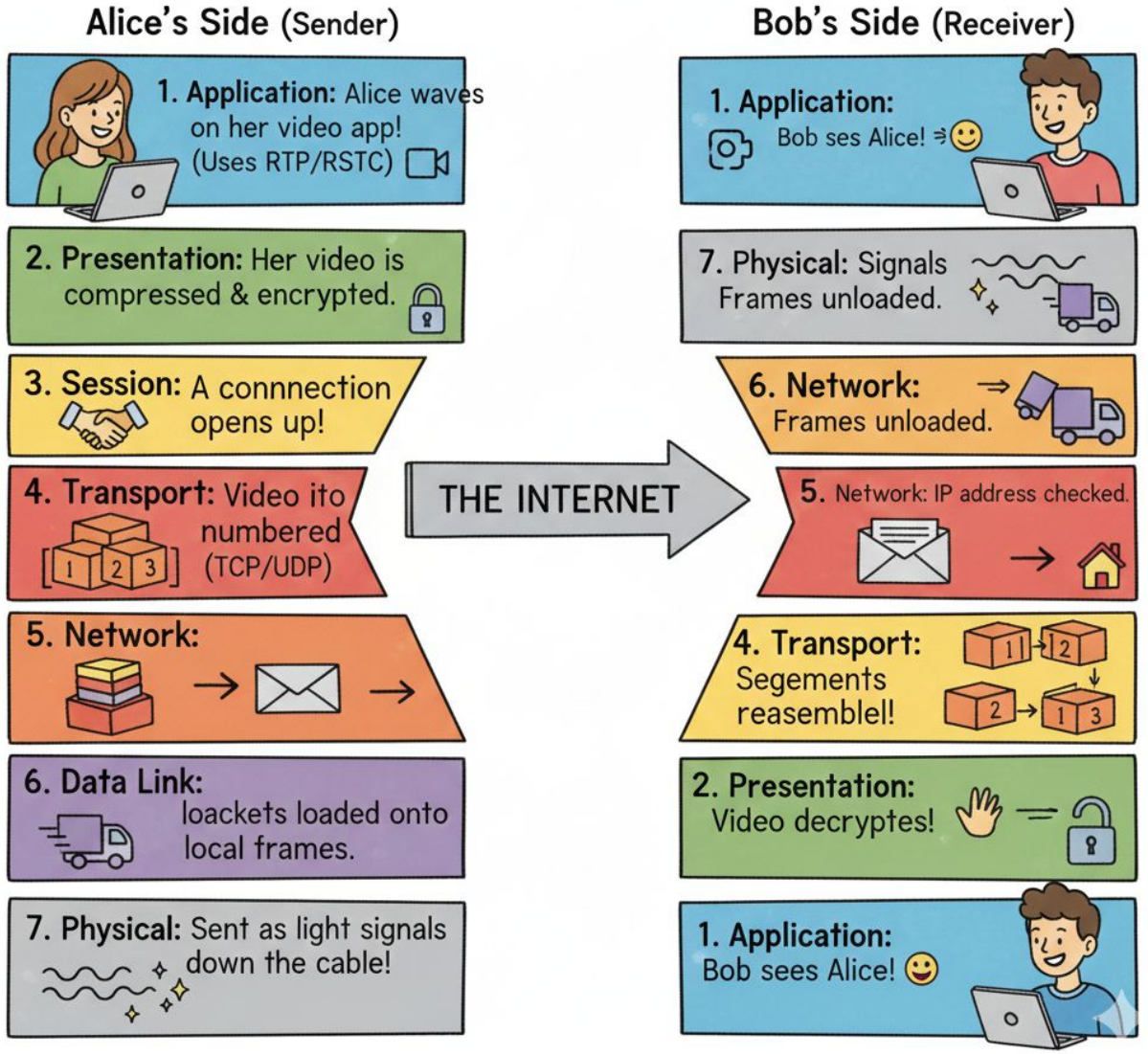
**On Alice's Side (Sender):**

- **Application Layer:** Alice writes an email in her email app; the app uses the SMTP protocol to prepare the email.
- **Presentation Layer:** The email is converted into a format that can be sent over the network and encrypted for security.
- **Session Layer:** A connection is created between Alice's device and her email server.
- **Transport Layer:** The email is broken into smaller pieces (called segments); TCP ensures they are numbered correctly for reassembly.
- **Network Layer:** Each segment is packed into a packet with Alice's and Bob's IP addresses to route it across networks.
- **Data Link Layer:** The packet is added to a frame with hardware addresses (MAC addresses) for local delivery.
- **Physical Layer:** The frame is converted into signals (electricity, light, or radio waves) and sent over the network.


**On Bob's Side (Receiver):**

- **Physical Layer:** Bob's device receives the signals and passes them to the next layer.
- **Data Link Layer:** Frames are checked for errors and unpacked to extract packets.
- **Network Layer:** Bob's device confirms the packet is for him (via the IP address) and forwards it.
- **Transport Layer:** Segments are reassembled into the original email.
- **Session Layer:** The connection between Alice's and Bob's devices remains open until the email is fully received.
- **Presentation Layer:** The email is decrypted and formatted so it's readable.
- **Application Layer:** Bob's email app (Gmail, Outlook) displays the email for him to read.

# OSI Model: The Video Call Adventure



# What Are the OSI and TCP/IP Models?

- **Both are frameworks to understand how computers communicate in a network.**
- They **break down communication into layers**, where each layer has a specific job.

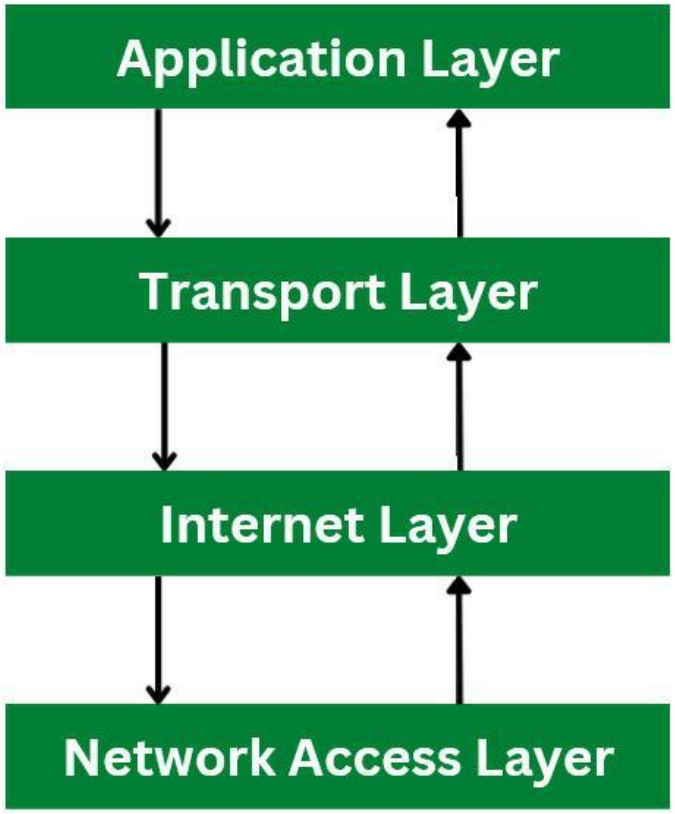
# Why Two Models?

- **OSI Model:** For learning and designing networks.
- **TCP/IP Model:** For building and running the Internet.

# Key Differences

| Feature | OSI Model | TCP/IP Model |
|---|---|---|
| **Purpose** | A guide to design new networks. | Focuses on how the Internet works. |
| **Number of Layers** | 7 layers (more detailed). | 4 layers (simpler). |
| **Use** | Mostly for learning and reference. | Used in real-world networks. |
| **Development** | Made to explain networks clearly. | Developed for the Internet. |

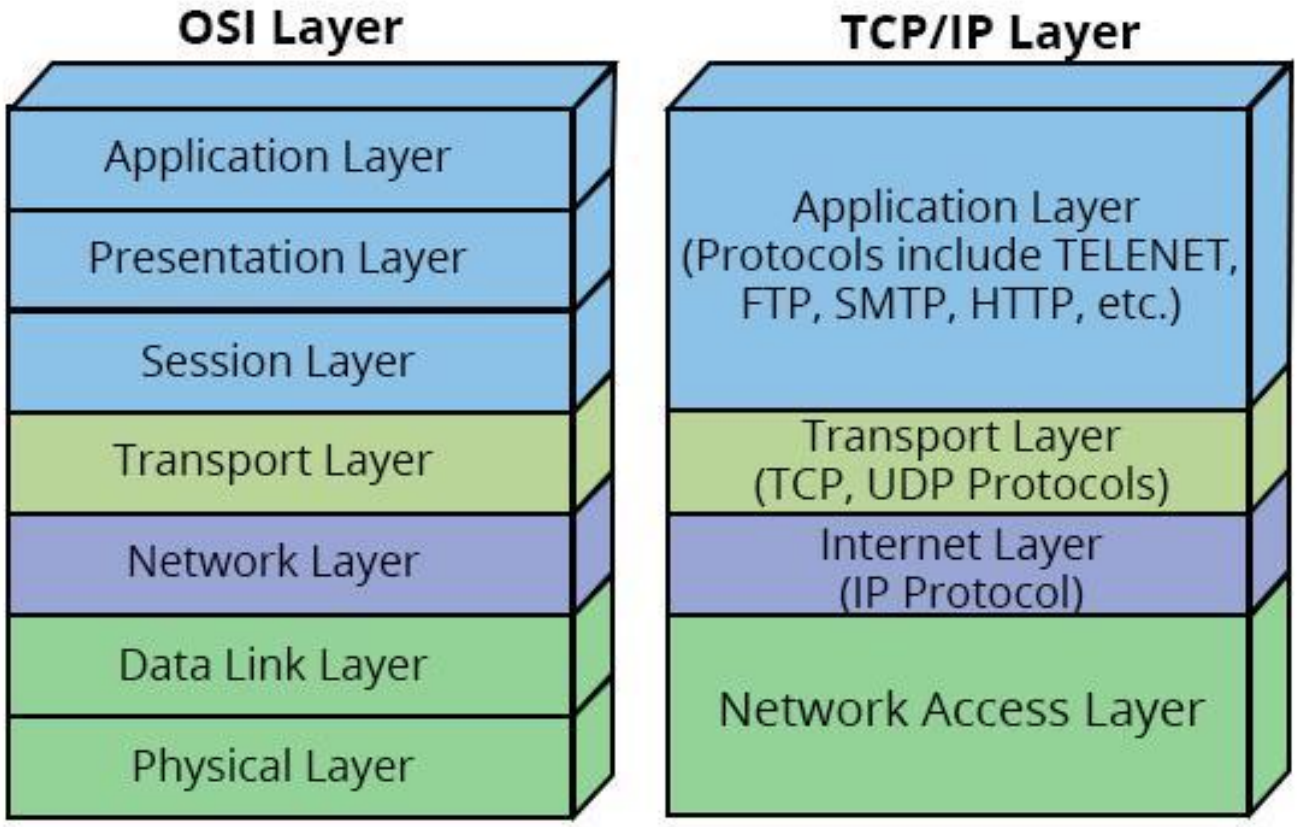
# TCP/IP Model (4 Layers)



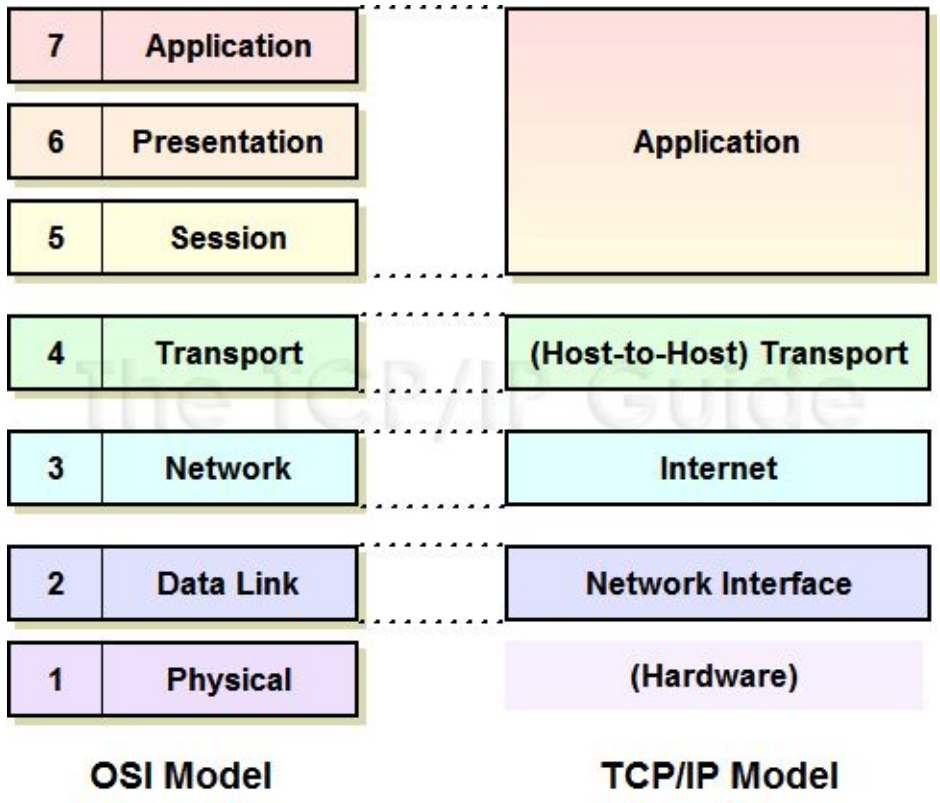
# TCP/IP Model (4 Layers)

- **Network Interface:** Combines OSI's Physical and Data Link layers.
- **Internet:** Decides the route (same as OSI's Network layer).
- **Transport:** Ensures reliable data transfer (same as OSI's Transport layer).
- **Application:** Combines OSI's Session, Presentation, and Application layers.

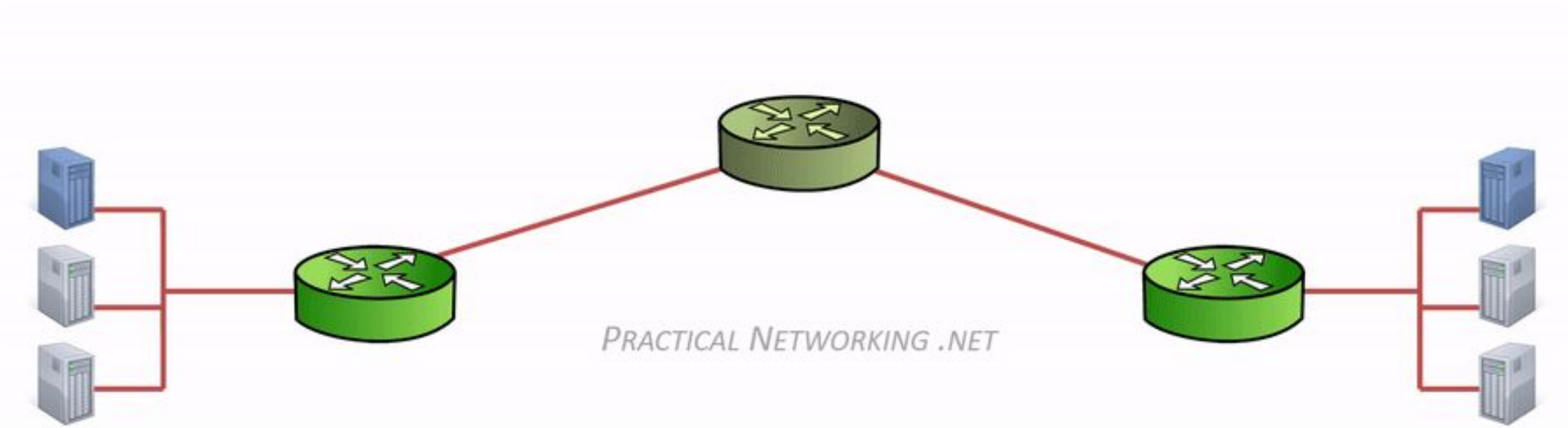
# OSI vs TCP/IP Layer Model



# OSI vs TCP/IP Layer Model



# OSI Model – Layer 2 vs. Layer 3



# Encapsulation and Decapsulation :
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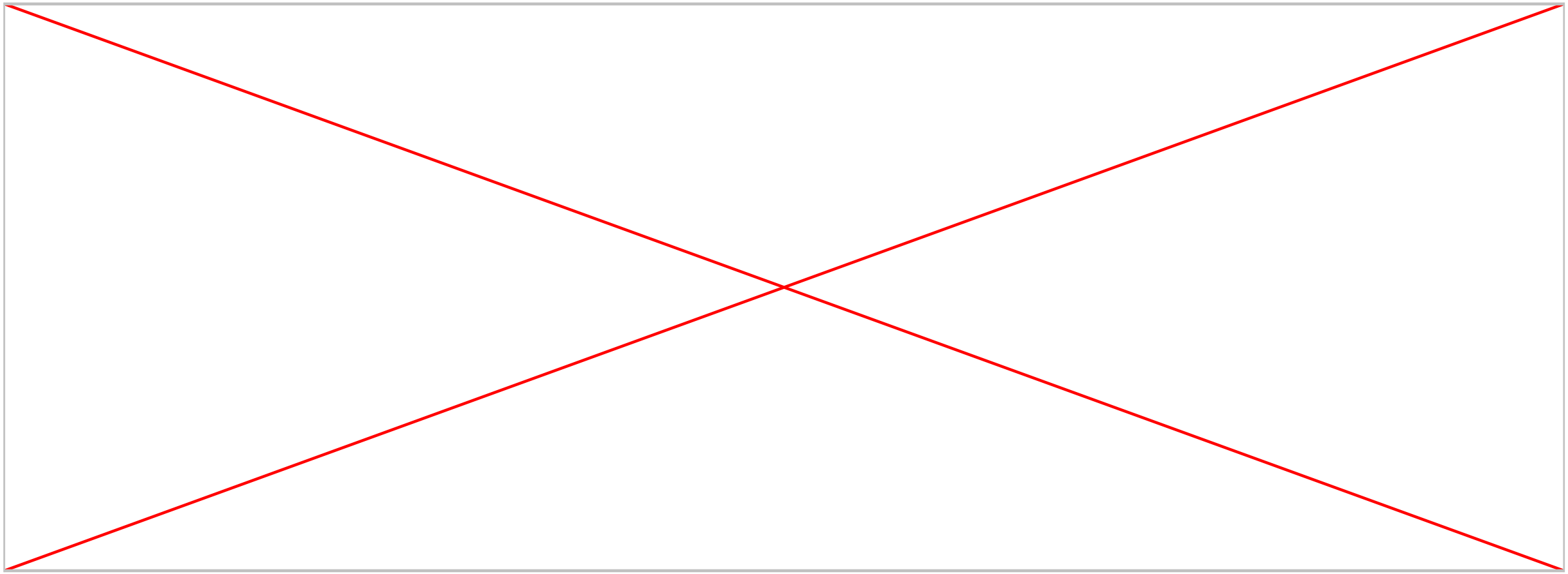

# “Thank You”