

**CSCI 251**  
**Systems and Networks**

**Network Protocols and  
Reference Models**

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# Outline

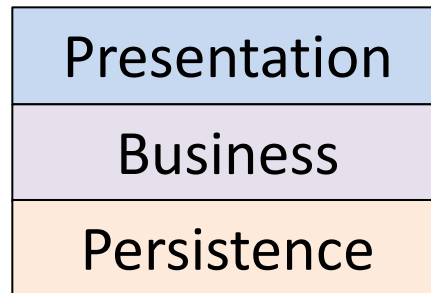
- Network Protocols and Layers
- Network Reference Models
  - OSI Reference Model
  - TCP/IP Reference Model

# Protocol

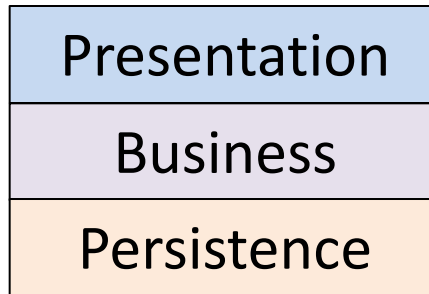
- **Protocol:** Set of agreed **rules** between the two parties engaged in a communication.
- Rules dictate what are **allowed** to do and what are **not allowed** to do in that communication.
- Rules also, dictate what are expected from the peer against what in that communication.

# Layers

- **Layers:** A system architectural design pattern that **organizes a system into multiple horizontal and functional layers separating individual concerns**. For example, presentation, business, and persistence layers in a software system.



# Layers



- Each layer **deals** with **specific concerns** and **takes services** from the layer just below it through **specific interfaces**.
- **Presentation Layer**: Manages user interface (UI) and browser communication, acting as the entry point for user interaction.
- **Business Layer**: Executes core business rules, logic, and transaction management.
- **Persistence Layer**: Handles data retrieval and storage operations, serving as a bridge to the database.

# Layers

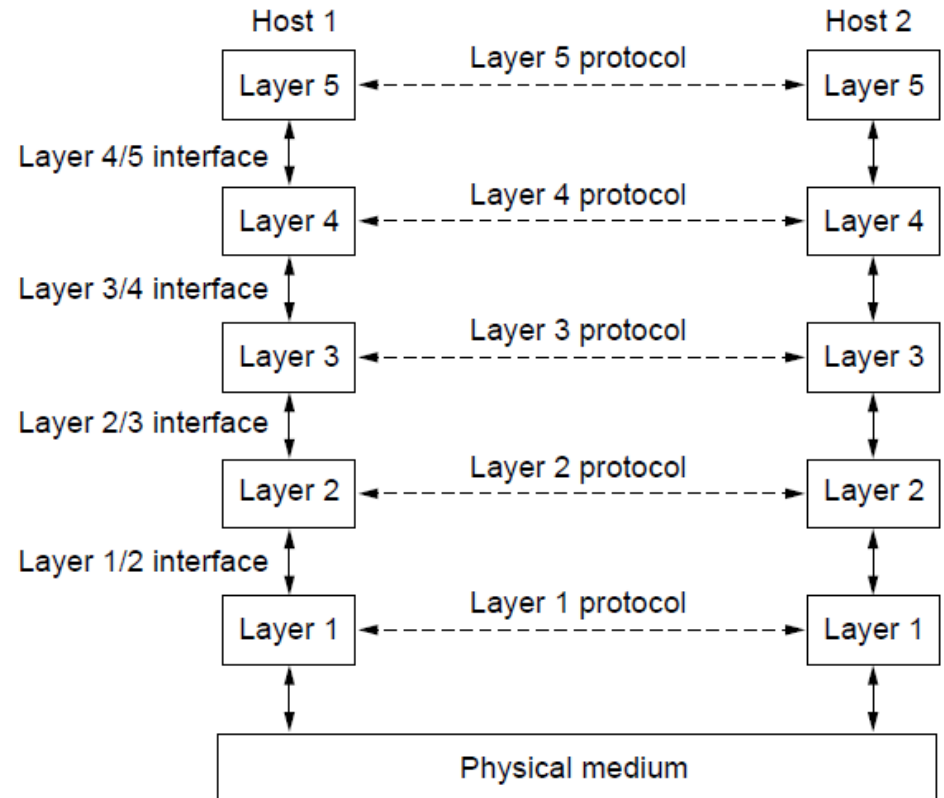
## Characteristics and Benefits

- **Separation of Concerns:** Each layer has a specific, isolated role, simplifying debugging and updates.
- **Maintainability:** Changes in one layer (e.g., updating the UI) generally do not affect others.
- **Layer Isolation:** Typically, components in one layer only interact with the layer directly below them.

# Protocol Layers

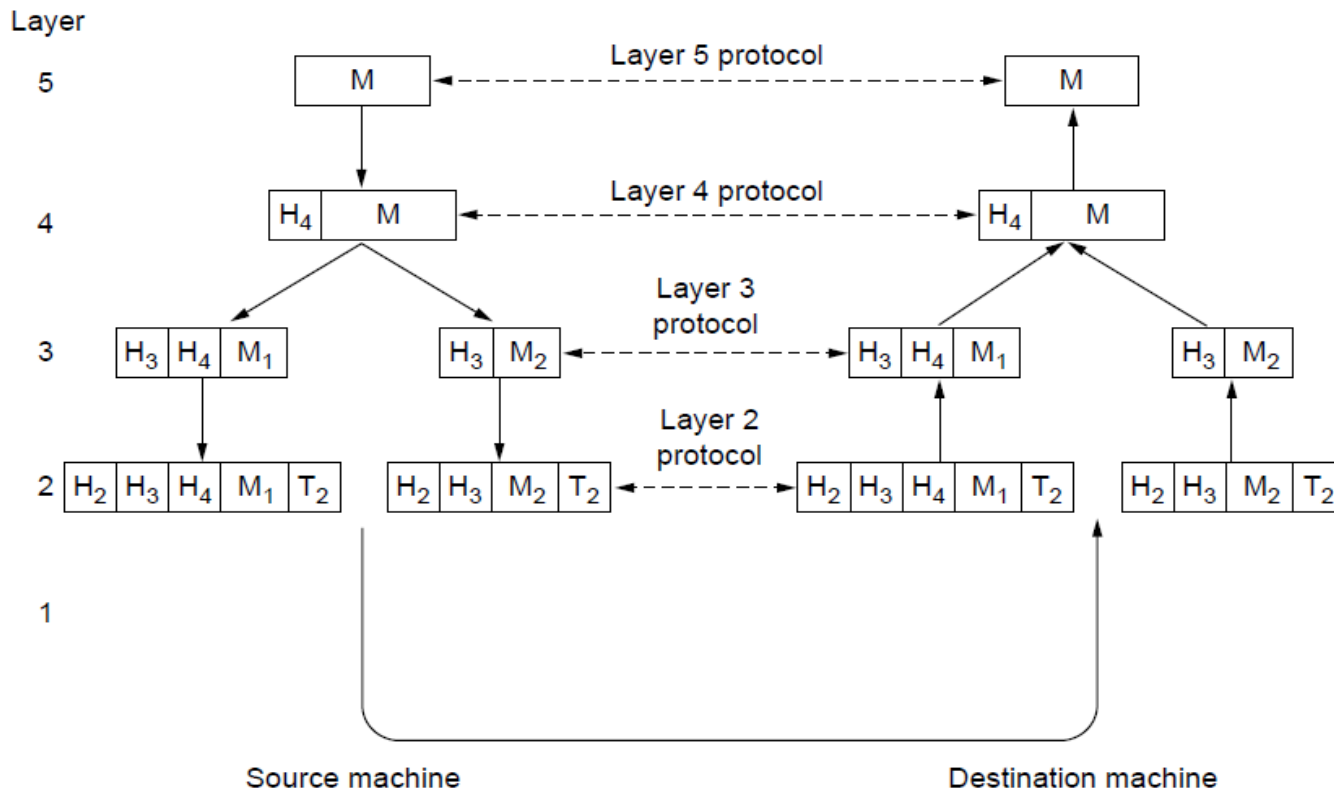
Protocol layering is the main structuring method used to divide up network functionality.

- Each protocol layer has a specific role.
- Each protocol instance talks virtually to its peer
- Each layer communicates only by using the one below
- Lower layer services are accessed by an interface
- At bottom, messages are carried by the medium



# Protocol Layers

- Each layer adds its own header (with control information) to the message to transmit and removes it on receive
- Layers may also split and join messages, etc.

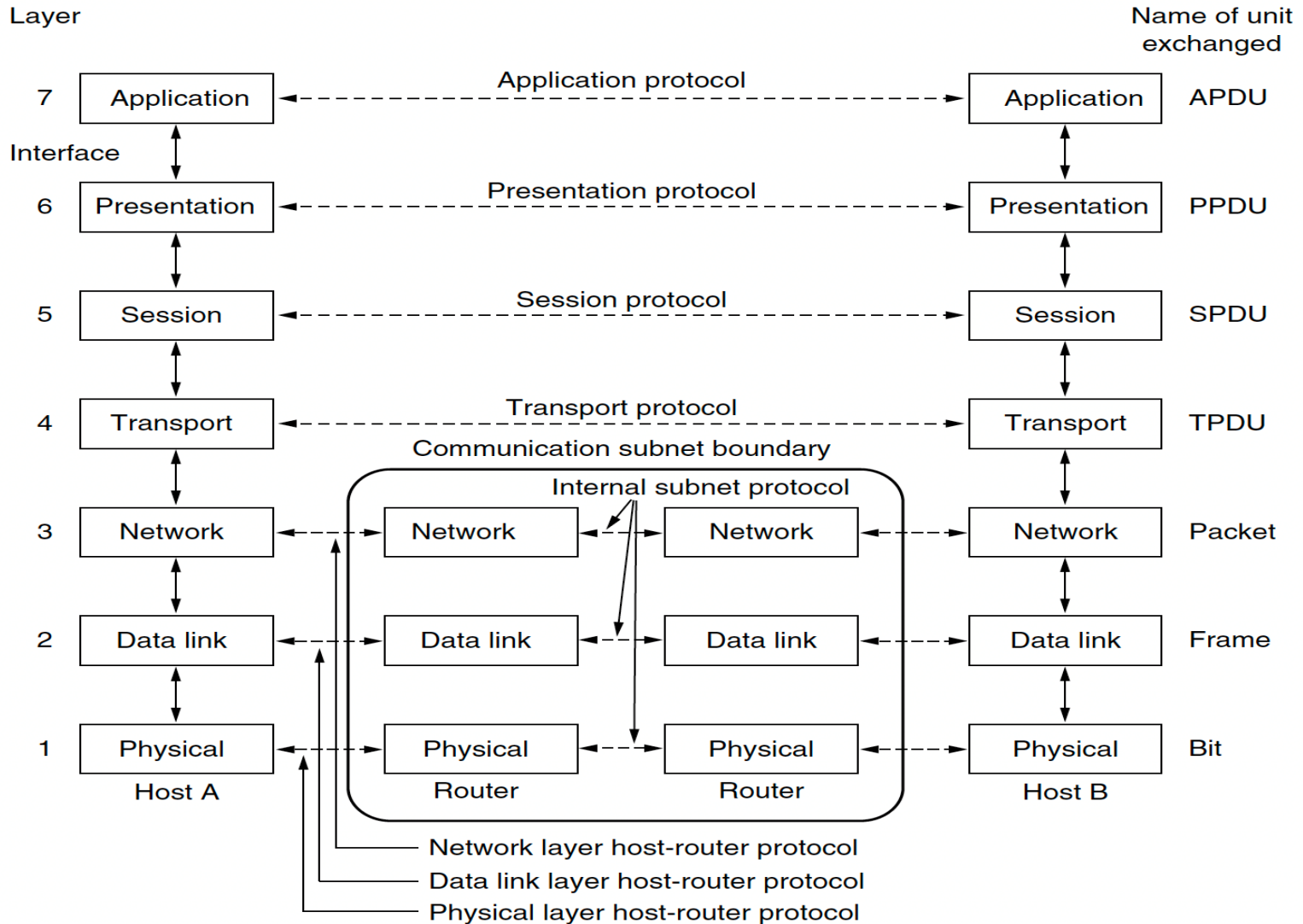


# OSI Reference Model

A principled, international standard, seven-layer model to connect different systems

7	Application	– Provides functions needed by users
6	Presentation	– Converts different representations
5	Session	– Manages task dialogs (multiple messages)
4	Transport	– Provides host-to-host delivery of a message
3	Network	– Routes datagrams over multiple networks
2	Data link	– Sends frames of information in a single network
1	Physical	– Sends bits as signals over physical media

# OSI Reference Model



# OSI Reference Model

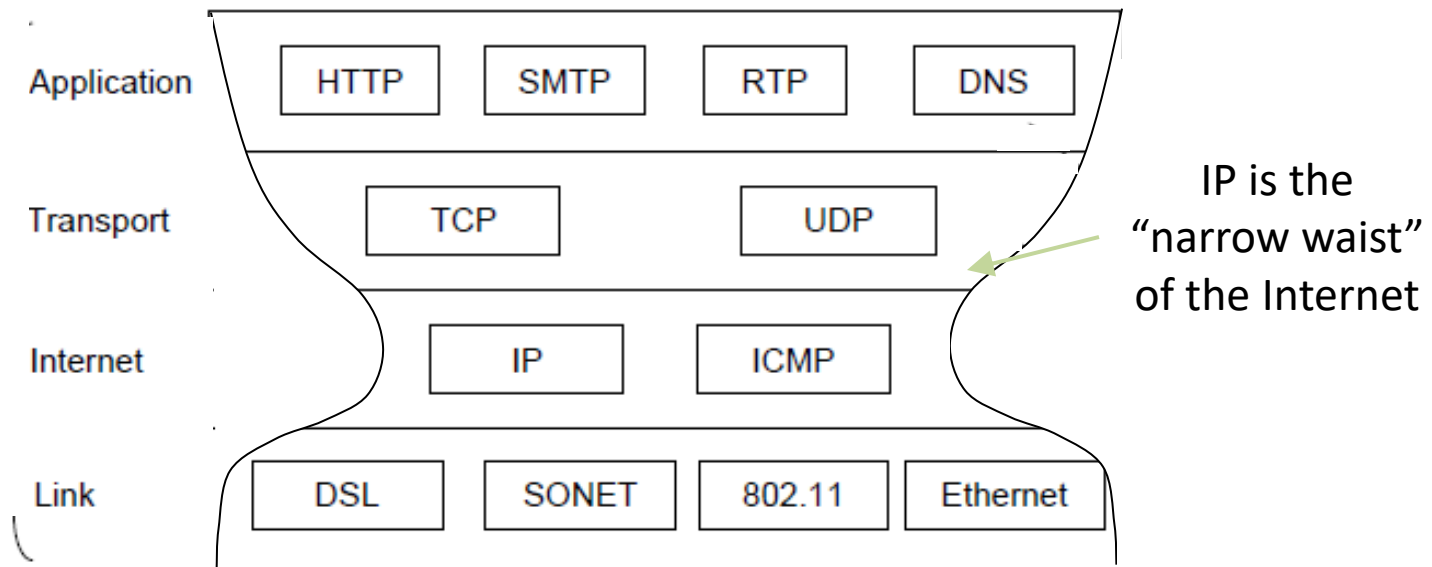
- **Application Layer:** Sends and receives message specific to an application. For example, GET message in a web application.
- **Presentation Layer:** Formats application message for presentation purpose. For example, formatting a webpage in HTML format to present it in a browser.
- **Session Layer:** Establishes, manages, and terminates a session to send and receive multiple related messages in that session. For example, user, password, get, and quit messages of a user session in a file transfer application.
- **Transport Layer:** Establishes, manages, and terminates transport connection between two end hosts to provide end-to-end messaging with error and flow control.

# OSI Reference Model

- **Network Layer:** Routes datagrams over multiple networks by estimating the shortest path between the source and the destination networks.
- **Datalink Layer:** Sends and receives data frames in a single network with medium access, error, and flow controls.
- **Physical Layer:** Transmits and receives raw bit streams (0 or 1) over physical medium by transforming and retransforming digital bit streams into appropriate signals that can be transmitted over the medium.

# TCP/IP Reference Model

A four-layer model derived from experimentation; omits some OSI layers and uses the IP as the network layer.



Protocols are shown in their respective layers

# Summary

- Network Protocols and Layers
- Network Reference Models
  - OSI Reference Model
  - TCP/IP Reference Model