# CAREER COLLEGE BHOPAL

Session 2022-23

Subject : Introduction to Networking Protocols and Architecture

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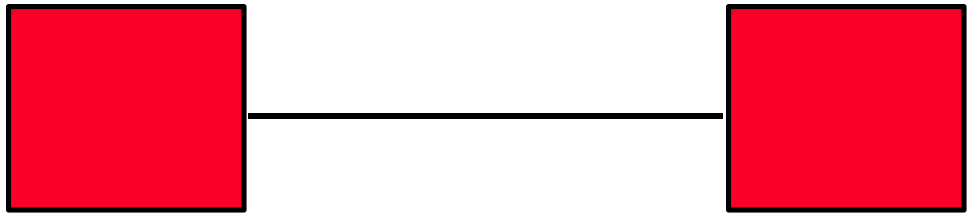
# Overview

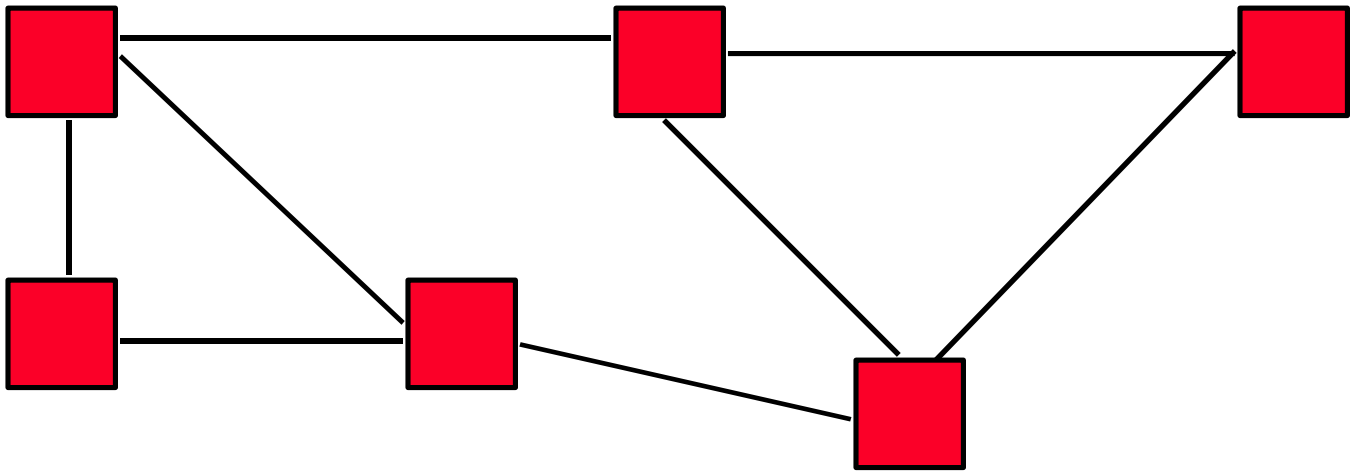
- Data Comm vs Networking vs Distributed Systems
- Types of Networks
- Protocol Layers: OSI and TCP/IP Models
- Connection-oriented vs connectionless
- Layered packet format

# Data Communication vs Networking

- Communication: Two Nodes. Mostly EE issues.

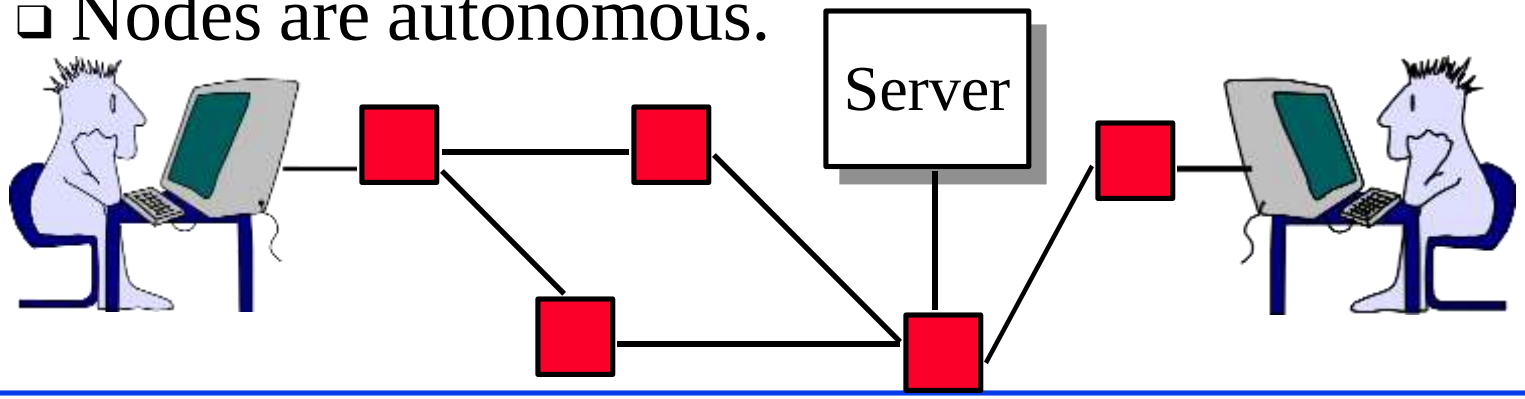


- Networking: Two or more nodes. More issues, e.g., routing



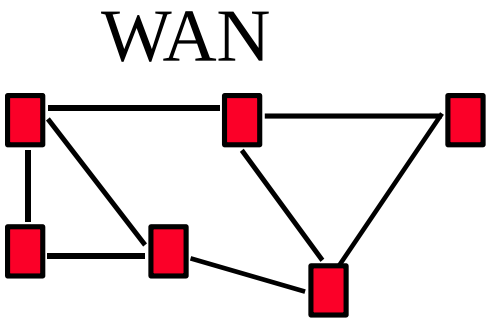
# Distributed Systems vs Networks

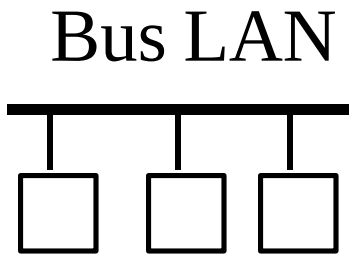
- Distributed Systems:
  - Users are unaware of underlying structure.
    E.g., trn instead of \n\bone\0\trn
  - Mostly operating systems issues.
  - Nodes are generally under one organization's control.
- Networks: Users specify the location of resources.
  - Nodes are autonomous.

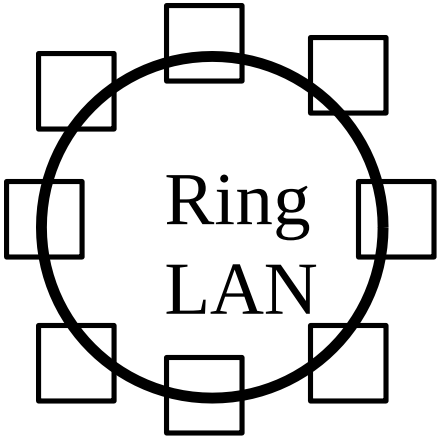


# Types of Networks

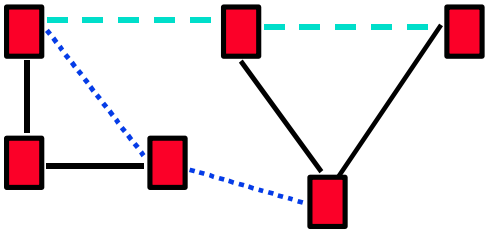
- Point to point vs Broadcast

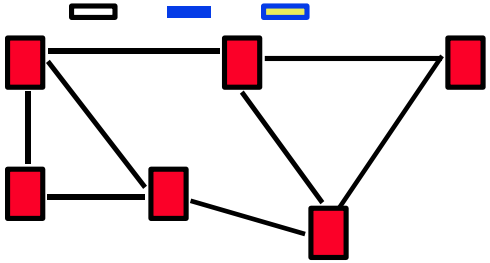



- Circuit switched vs packet switched

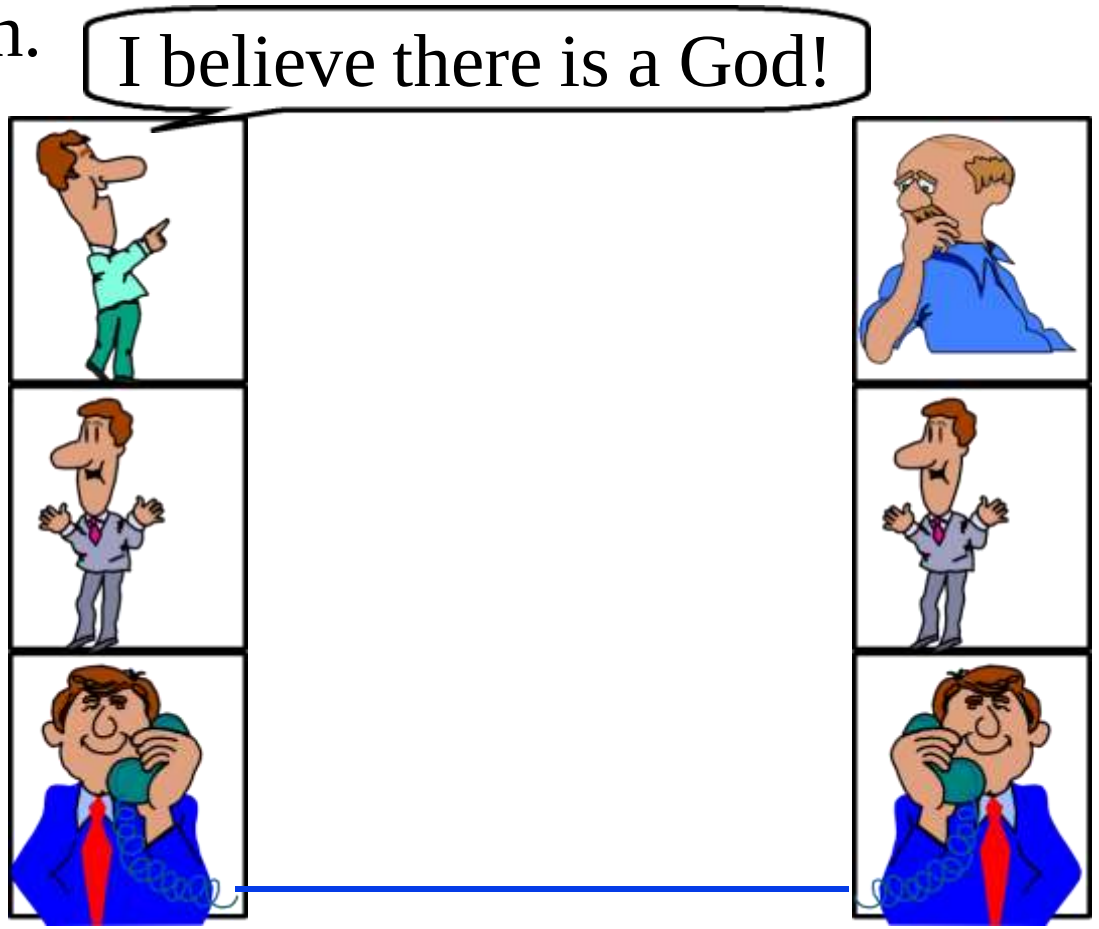




- Local Area Networks (LAN) 0-2 km,
  Metropolitan Area Networks (MAN) 2-50 km,
  Wide Area Networks (WAN) 50+ km

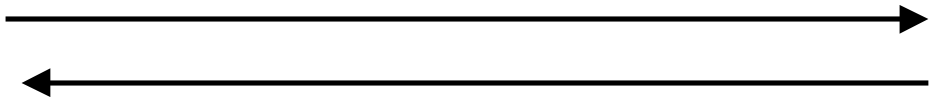
# Protocol Layers

- Problem: Philosophers in different countries speak different languages. The Telex system works only with English.



# Design Issues for Layers

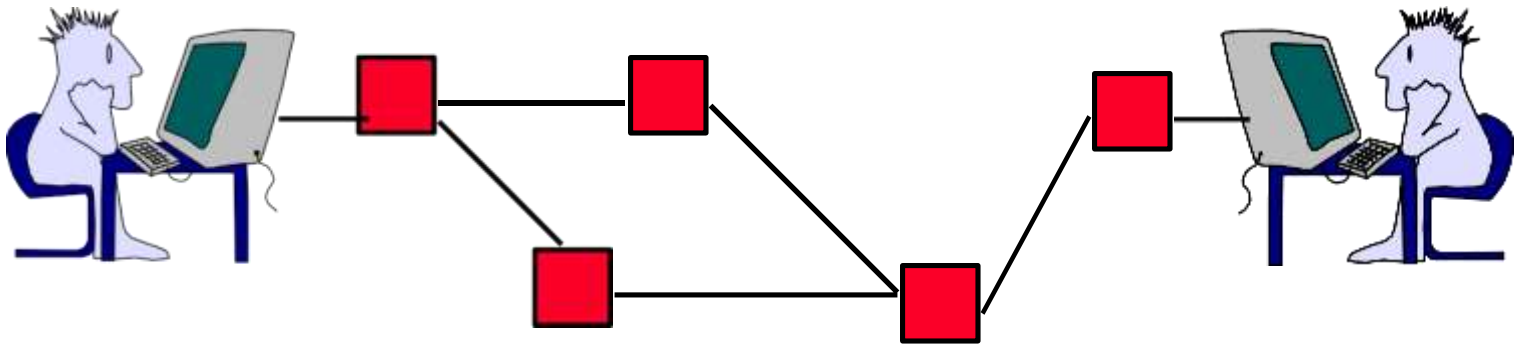
- Duplexity:
  - Simplex: Transmit or receive



  - Full Duplex: Transmit and receive simultaneously
  - Half-Duplex: Transmit and receive alternately
- Error Control: Error detection and recovery
- Flow Control: Fast sender

# ISO/OSI Reference Model

| | | |
|---|---|---|
| 3 | Application | File transfer, Email, Remote Login |
| | Presentation | ASCII Text, Sound |
| | Session | Establish/manage connection |
| 2 | Transport | End-to-end communication: TCP |
| | Network | Routing, Addressing: IP |
| 1 | Datalink | Two party communication: Ethernet |
| | Physical | How to transmit signal: Coding |



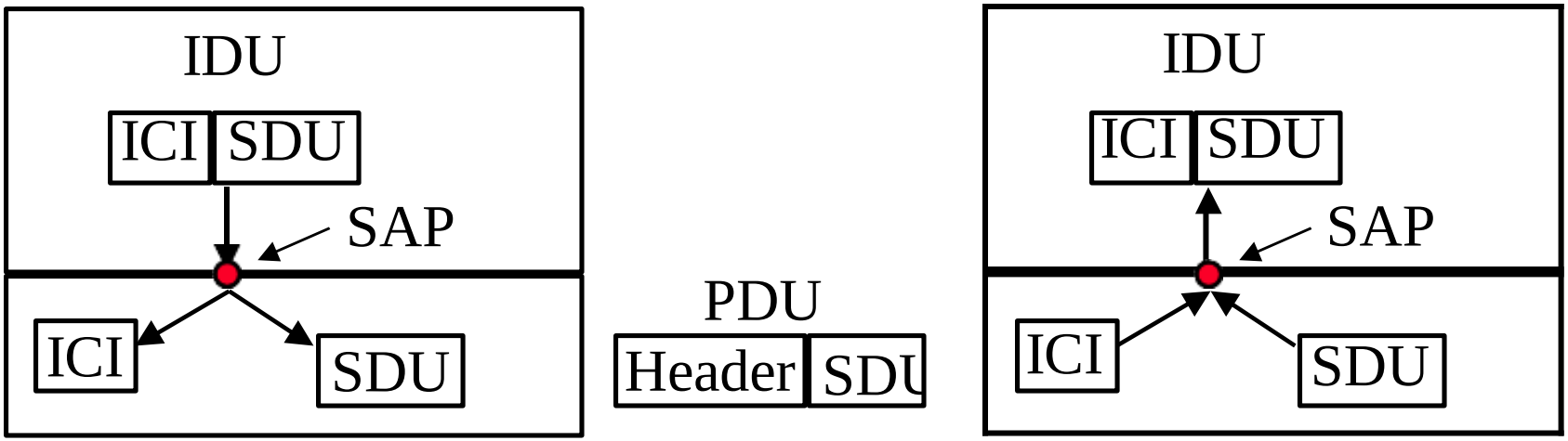
# Layering

| FTP | Telnet | Web | Email |
|---|---|---|---|
| Trans Control Prot | | User Datagram Prot | |
| Internet Protocol | | Novell Netware (IPX) | |
| Ethernet | | Token Ring | |
| Copper | | Fiber | |

← Same Interfaces

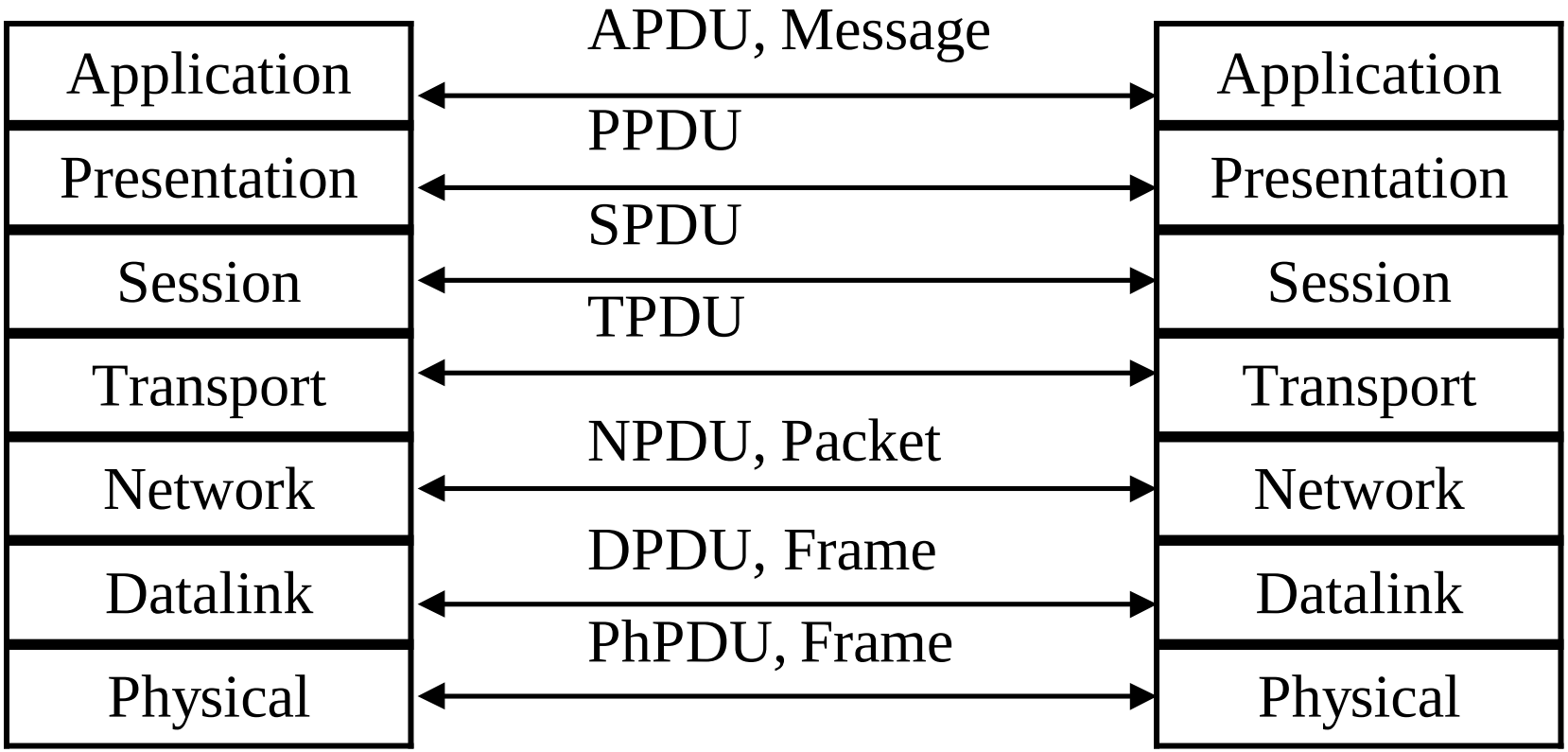
- Protocols of a layer perform a similar set of functions
- All alternatives for a row have the same interfaces
- Choice of protocols at a layer is independent of those of at other layers. E.g., IP over Ethernet or token ring
- Need one component of each layer ⇒ Null components

# Interfaces and Services

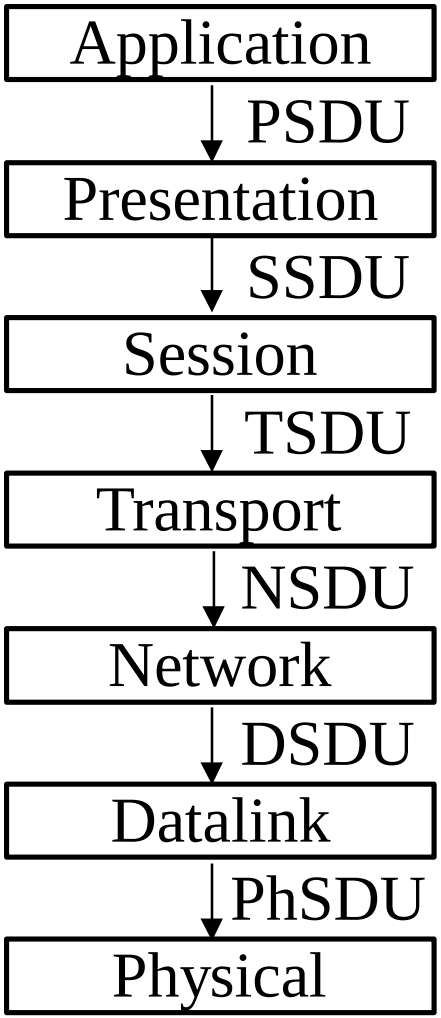



- IDU = Interface Data Unit = ICI + SDU
- ICI = Interface Control Information
- SDU = Service Data Unit
- PDU = Protocol Data Unit = Fragments of SDU + Header or Several SDUs + Header (blocking)
- SAP = Service Access Point

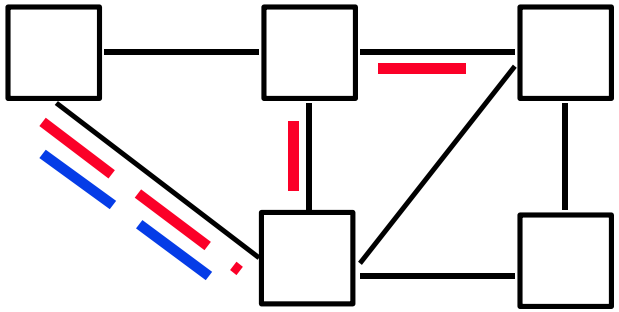
# Protocol Data Unit (PDU)



# Service Data Unit (SDU)

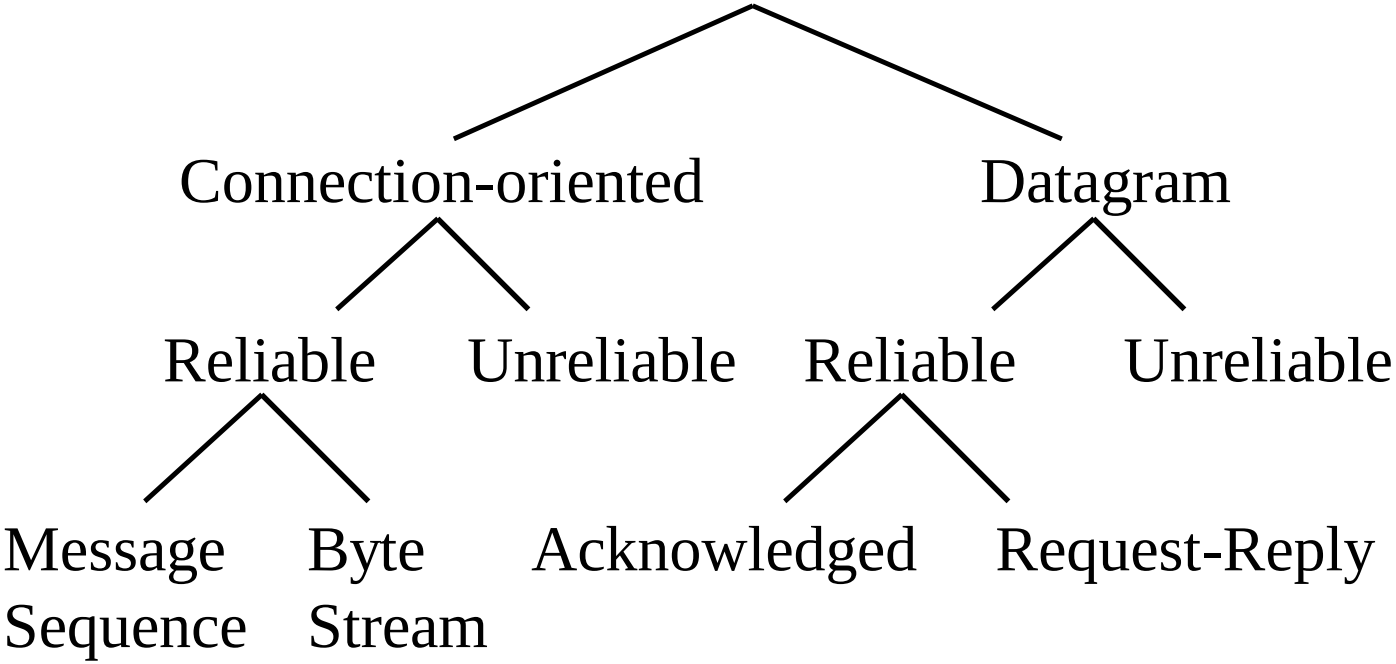


# Connection-Oriented vs Connectionless



- Connection-Oriented: Telephone System
  - Path setup before data is sent
  - Data need not have address. Circuit number is used.
  - Virtual circuits: Multiple circuits on one wire.
- Connectionless: Postal System. Also known as datagram.
  - Complete address on each packet
  - The address decides the next hop at each routing point

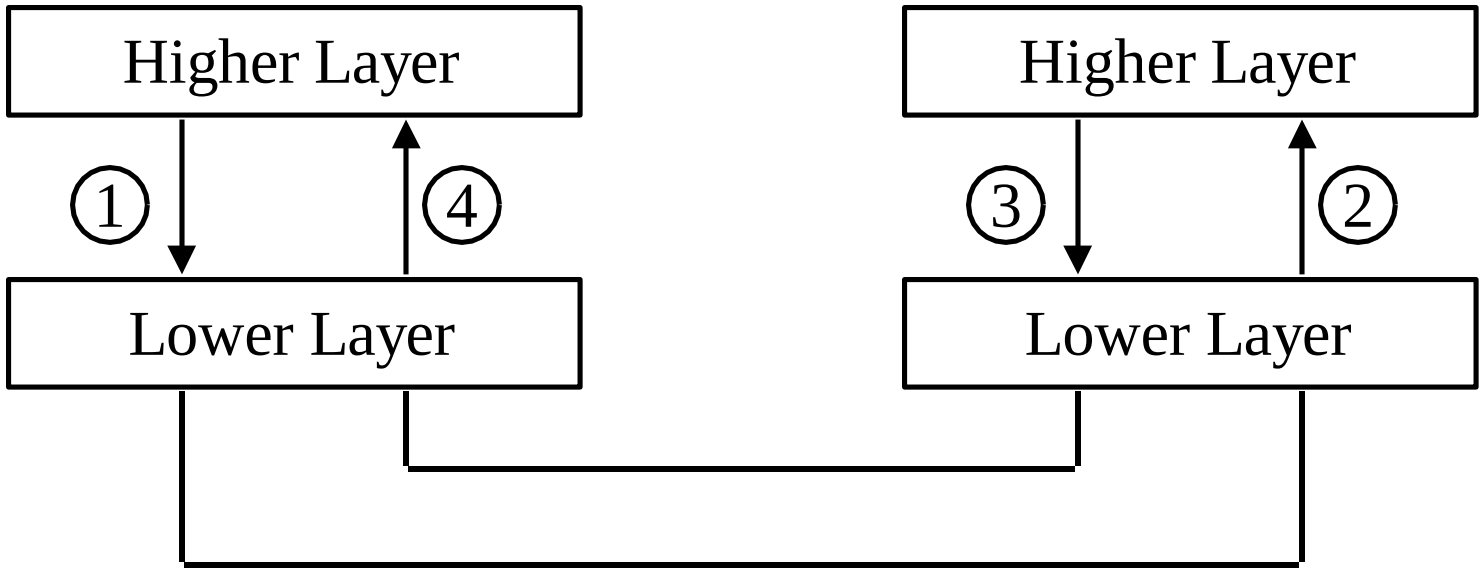
# Types of Services




- Byte streams: user message boundaries are not preserved
- Request-reply: The reply serves as an acknowledgement also
- Message oriented or byte oriented approach can be used for unreliable connection-oriented communication

# Service Primitives

- Indication = Interrupt

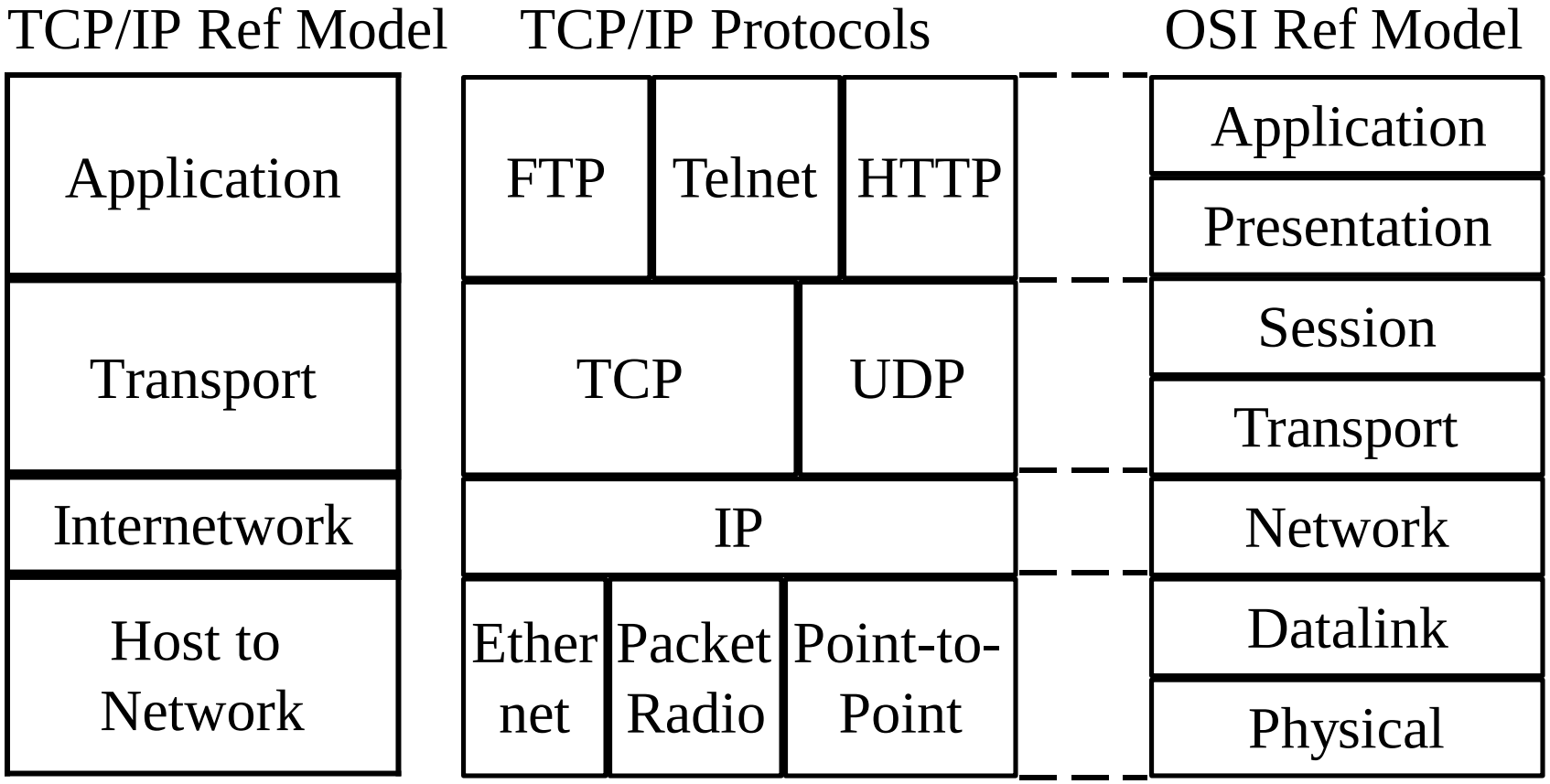



1. Request
2. Indication
3. Response
4. Confirm

Unconfirmed service: No confirmation or response

# TCP/IP Reference Model

- TCP = Transport Control Protocol
- IP = Internet Protocol (Routing)

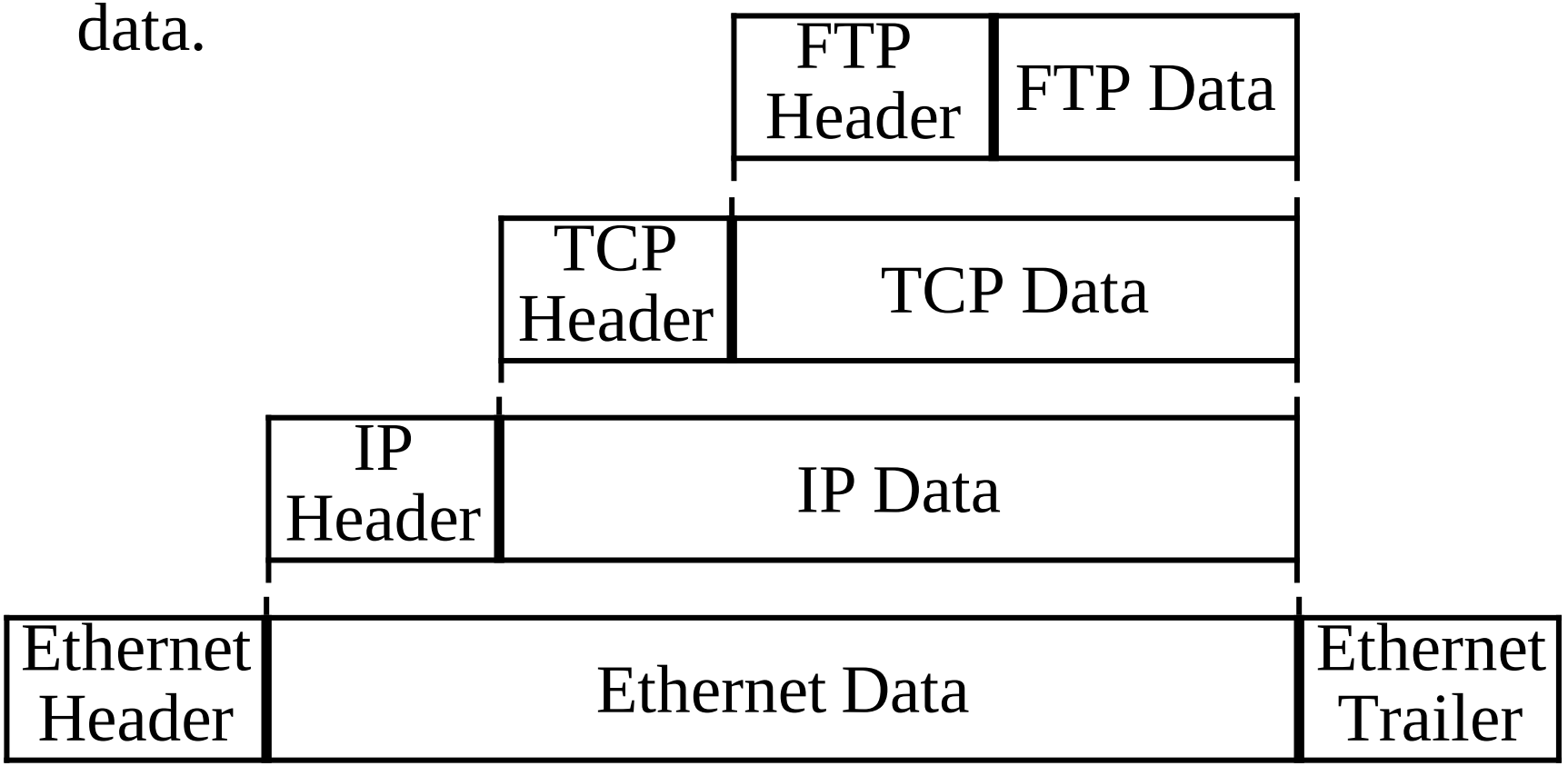


# OSI vs TCP Reference Models

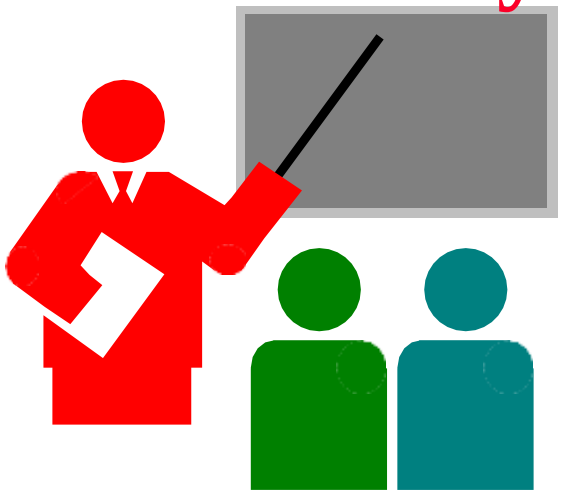
- OSI introduced concept of services, interface, protocols. These were force-fitted to TCP later
  $\Rightarrow$ It is not easy to replace protocols in TCP.
- In OSI, reference model was done before protocols. In TCP, protocols were done before the model
- OSI: Standardize first, build later
  TCP: Build first, standardize later
- OSI took too long to standardize. TCP/IP was already in wide use by the time.
- OSI become too complex.
- TCP/IP is not general. Ad hoc.

# Layered Packet Format

- Nth layer control info is passed as N-1th layer data.



# Summary



- Communication, Networks, and Distributed systems
- ISO/OSI's 7-layer reference model
- TCP/IP has a 4-layer model
- PDU, SAP, Request, Indication

# Thank You