

• **le chit rung**

TOPIC 4

OSI Layer

Content

- Model of communication
- The OSI model
- The TCP/IP model



MODEL OF COMMUNICATION

Networking History

- **Standalone Device.**
 - Duplication of equipments and resources.
 - Inability to communicate efficiently.
 - Lack of networking management.
- **LAN.**
 - Connects devices that are close together.
- **WAN.**
 - Interconnects LANs across a large area.

Analyzing network in layers

What is flowing ?

Data

What different forms flow ?

Text, Graphic, Video ...

What rules govern flow ?

Standard, Protocol ...

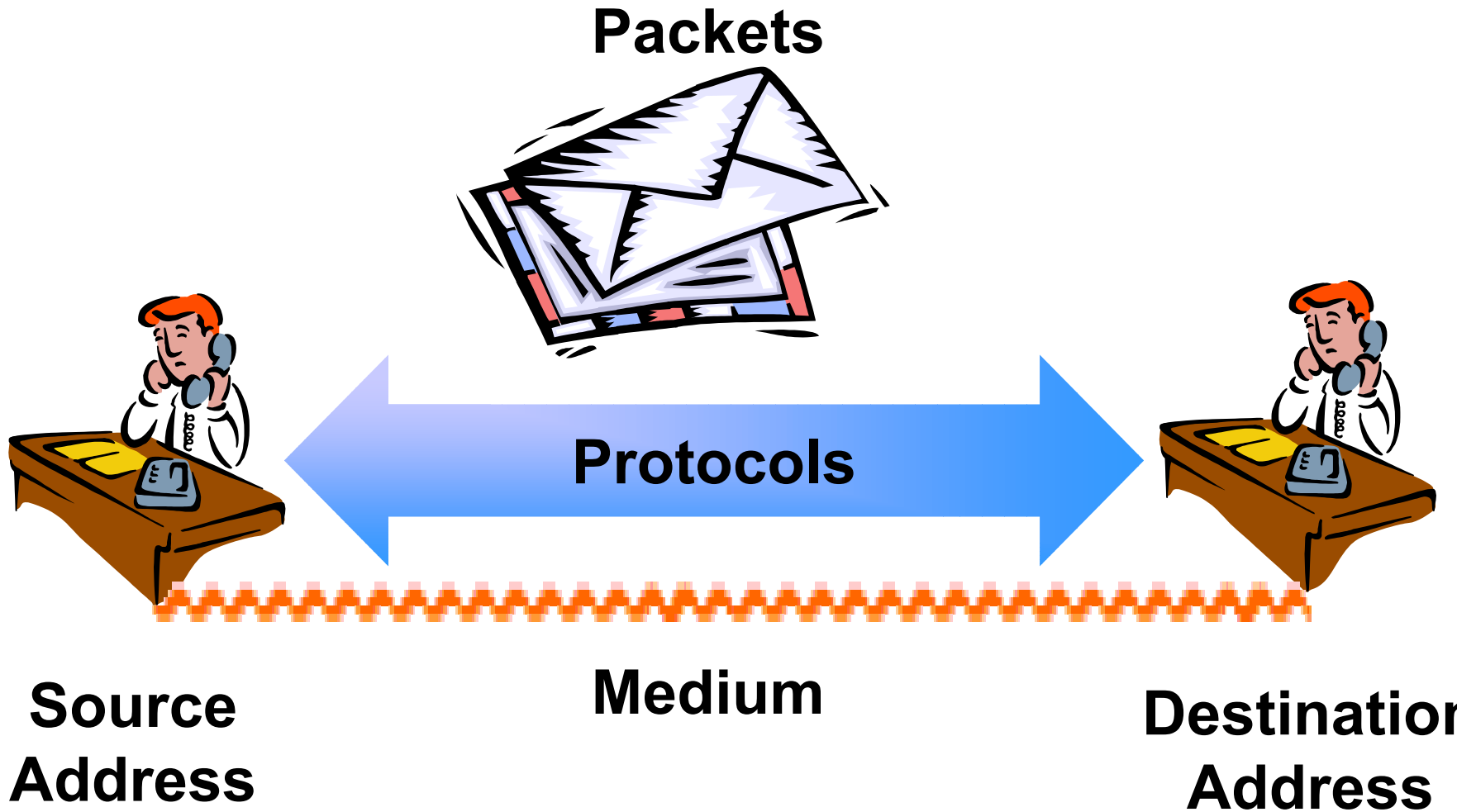
Where does the flow occur ?

Cable, Atmosphere ...

Communication

- **Transmission of information.**
- **Examples:**
 - **Speaking.**
 - **Smoke signal.**
 - **Body language.**
 - **Morse.**
 - **Telephone.**
 - **Broadcast systems (radio, television).**
 - **Internet**

Communication process



Communication characteristics

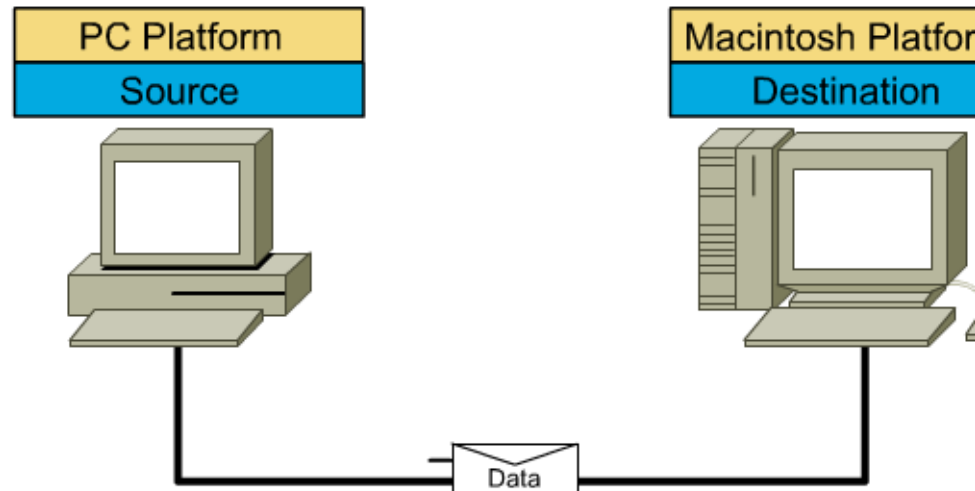
- **Addresses**
 - Who are the source and the destination of a communication process?
- **Media**
 - Where is the communication take place?
- **Protocols**
 - How to make the communication process effectively?

Communication: Human conversation

- **Address**
 - Hello Mr.A, I am B
- **Media**
 - Atmosphere
- **Protocol**
 - Language
 - Speed
 - Handshaking

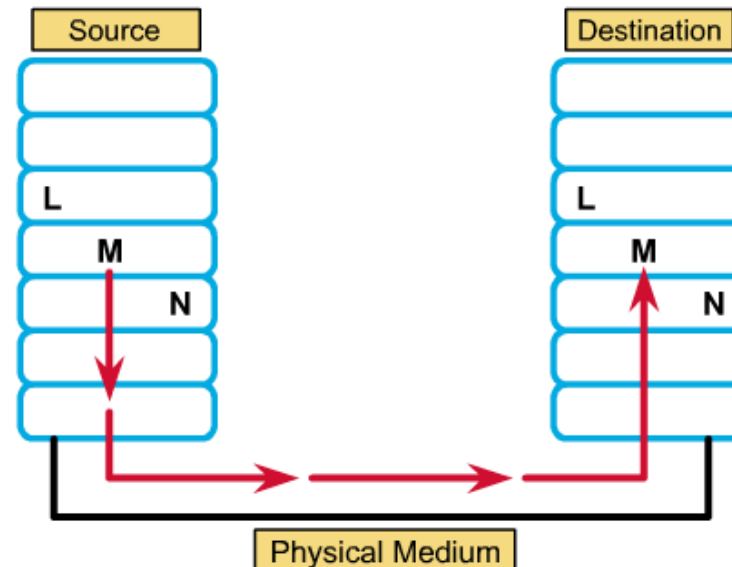
Data Communication

- **Address**
 - Source address, Destination address
- **Media**
 - Cable, Fiber, Atmosphere
- **Protocol**
 - Format
 - Procedure



Protocol

- Protocol is a set of **rules**, or an **agreement**, that determines the **format** and **transmission** of data that make communication on a network more efficient.



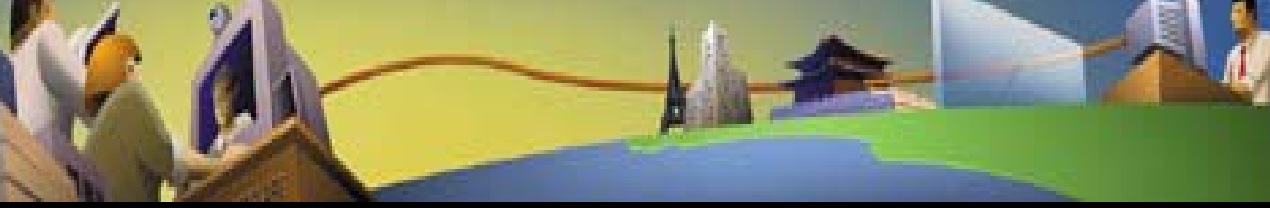
Protocol examples

- **In transportation**
- **In communication**
- **In social**

Review



- **Communication Process.**
- **What is Protocol ?**



OSI MODEL

Evolution of networking standards

SNA



Standard

- **Interconnection**
- **Development**
- **Simplification**



TCP/IP



DECNET

OSI model development

- Researched and developed by the **ISO - International Organization for Standardizations**
- **1977:** establish a subcommittee to develop a communications architecture.
- **1984:** publish ISO-7498, the **Open System Interconnection (OSI)** reference model.

OSI model

- **The OSI model:** a framework within which networking standards can be developed.
 - *It provided vendors with a set of standards that ensured greater compatibility and interoperability between the various types of network technologies that were produced by the many companies around the world.*

Proprietary vs. Open

A layered model

- The communications functions are partitioned into a hierarchical set of layers.
 - Each layer performs a related subset of the functions required to communicate.
 - Each layer relies on the next lower layer to perform more primitive functions and provides services to the next higher layer.
- *The OSI Model define a set of layers and the services performed by each layer*

Why a layered model?

- **Reduces complexity.**
- **Standardizes interfaces.**
- **Facilitates modular engineering.**
- **Ensures interoperable technology.**
- **Accelerates evolution.**
- **Simplifies teaching and learning.**

7 layers of the OSI reference model

- Layer 7 Application → Network Processes to Application
- Layer 6 Presentation → Data Representation
- Layer 5 Session → Interhost Communication
- Layer 4 Transport → End-to-end Connections
- Layer 3 Network → Address and Best Path
- Layer 2 Data Link → Access to Media
- Layer 1 Physical → Binary Transmission

• *All People Seem To Need Data Processing*

▶ **The physical layer**

- **Transmission of an unstructured bit stream over a physical link between end systems.**
 - **Electrical, mechanical, procedural and functional specifications**
 - **Physical data rate**
 - **Distances**
 - **Physical connector**

The data-link layer

- **Provides for the reliable transfer of data cross a physical link.**
 - **Frames**
 - **Physical address**
 - **Network topology**
 - **Line discipline**
 - **Synchronization**
 - **Error control**
 - **Flow control**

The network layer

- **Provides connectivity and path selection between two host systems that may be located on geographically separated networks.**
 - **Packets**
 - **Virtual circuits**
 - **Route, routing table, routing protocol**
 - **Logical address**
 - **Fragmentation**

The transport layer

- **Provides reliable, transparent transfer of data over networks.**
 - **Segments, data stream, datagram**
 - **Connection oriented and connectionless**
 - **End-to-end flow control**
 - **Error detection and recovery**
 - **Segmentation & reassembly**

▶ **The session layer**

- **Establishes, manages, and terminates sessions between two communicating hosts.**
 - **Sessions**
 - **Dialog**
 - **Conversations**
 - **Data exchange**

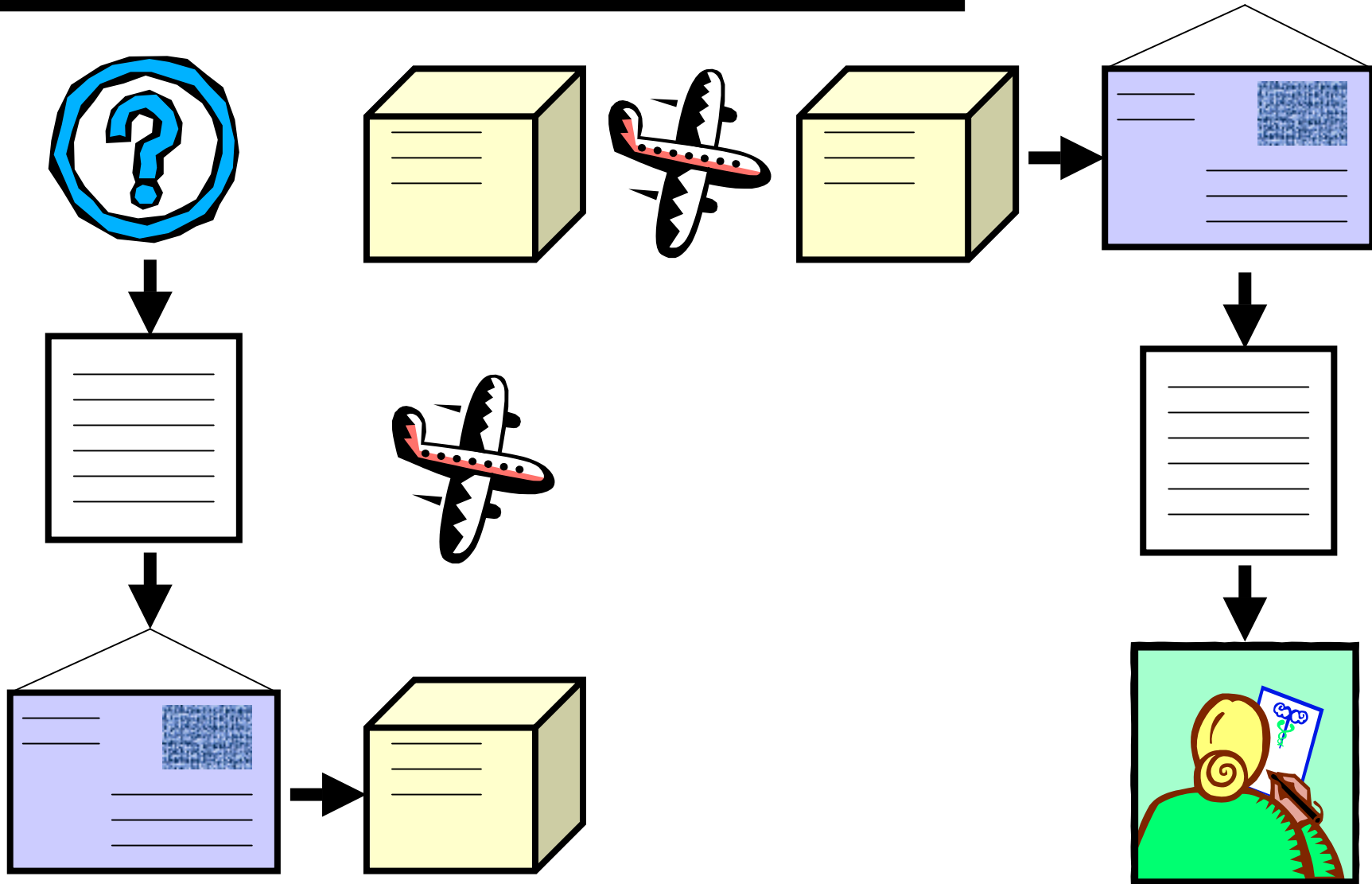
The presentation layer

- **Ensures that the information that the application layer of one system sends out is readable by the application layer of another system.**
 - **Format of data**
 - **Data structure**
 - **Data conversion**
 - **Data compression**
 - **Data encryption**

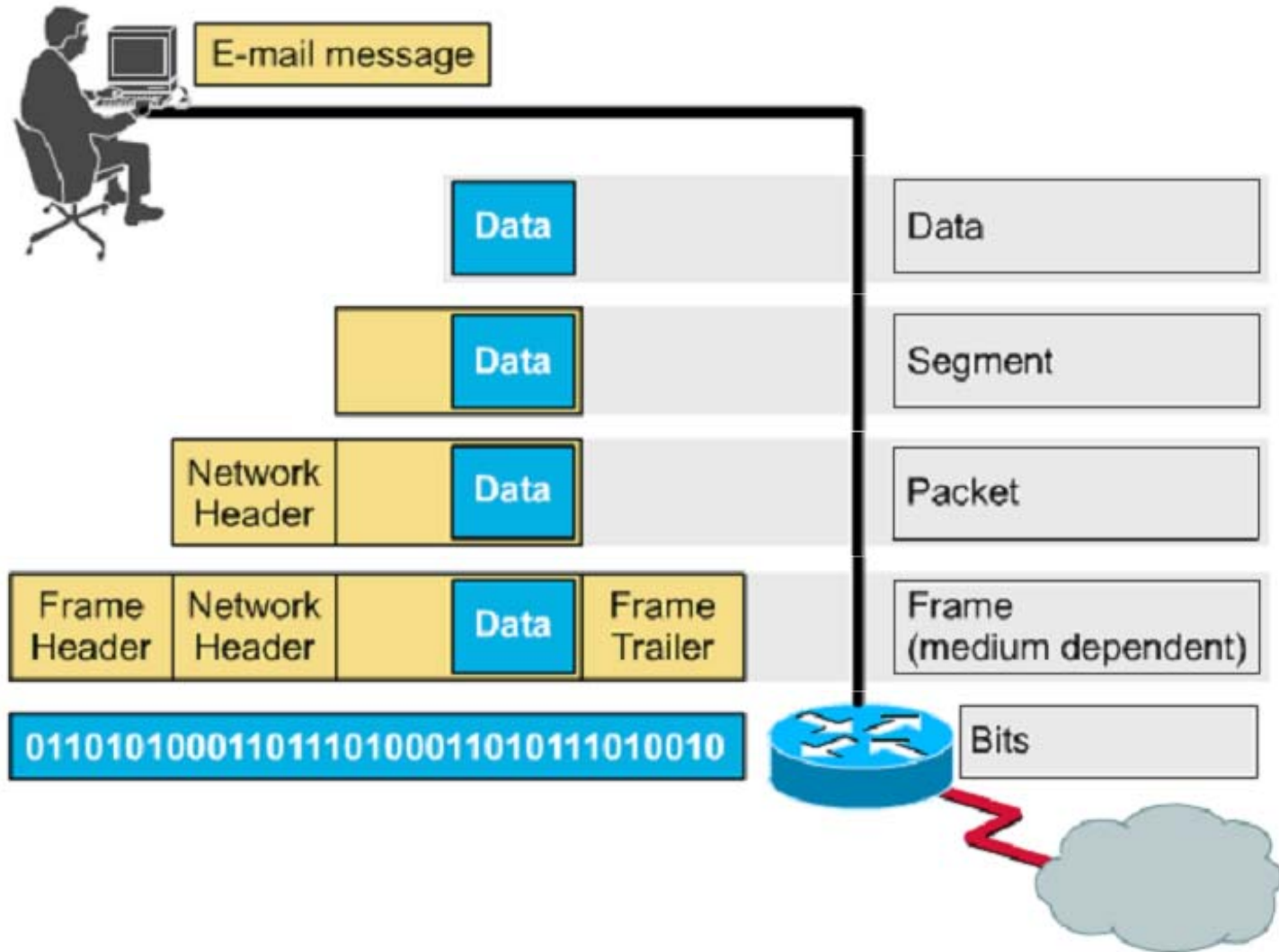
The application layer

- **Is the OSI layer that is closest to the user, it provides network services to the user's applications.**
 - **File transfer**
 - **Electronic mail**
 - **Terminal access**
 - **Word processing**
 - **Intended communication partners**

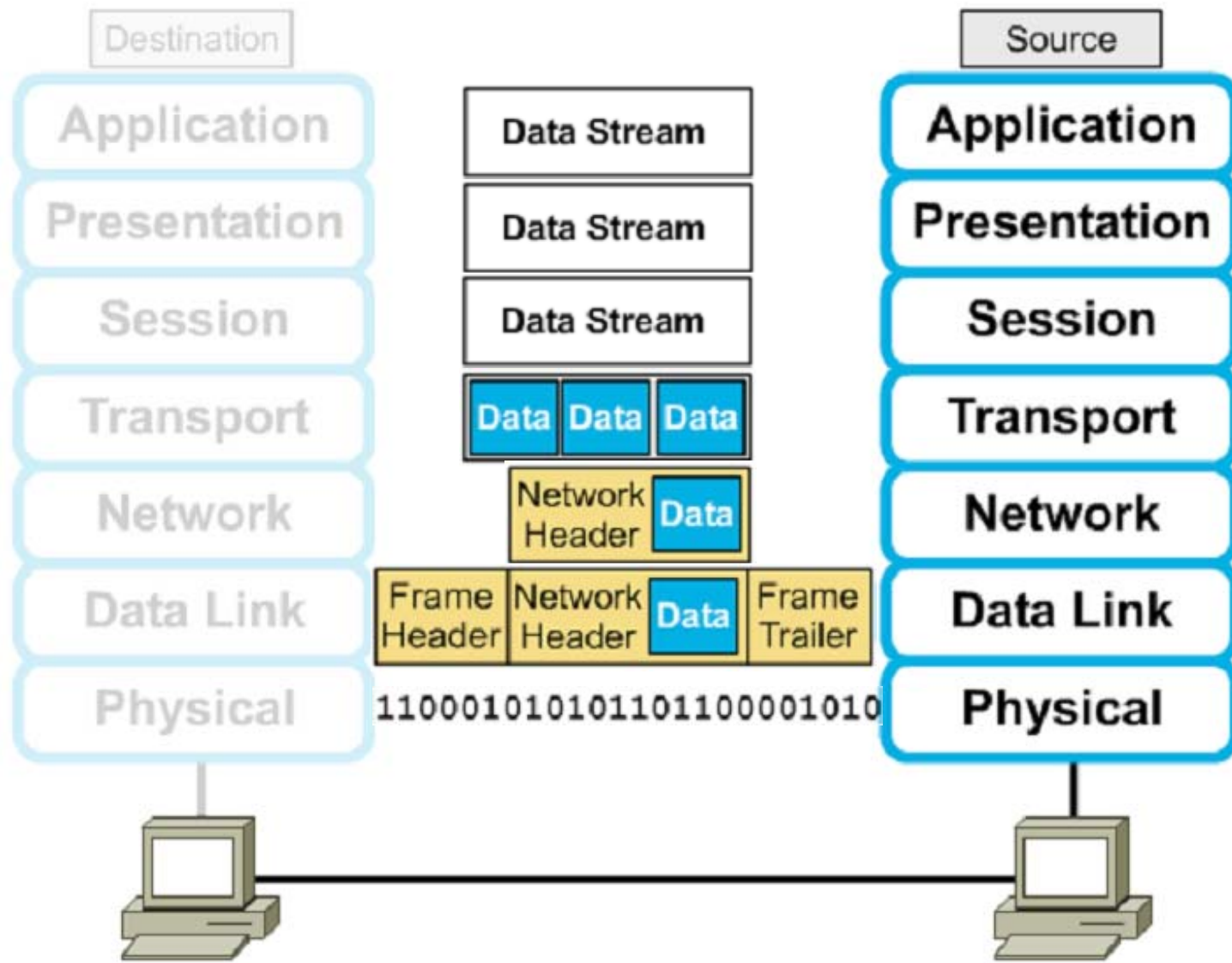
Encapsulation example: Air-mail



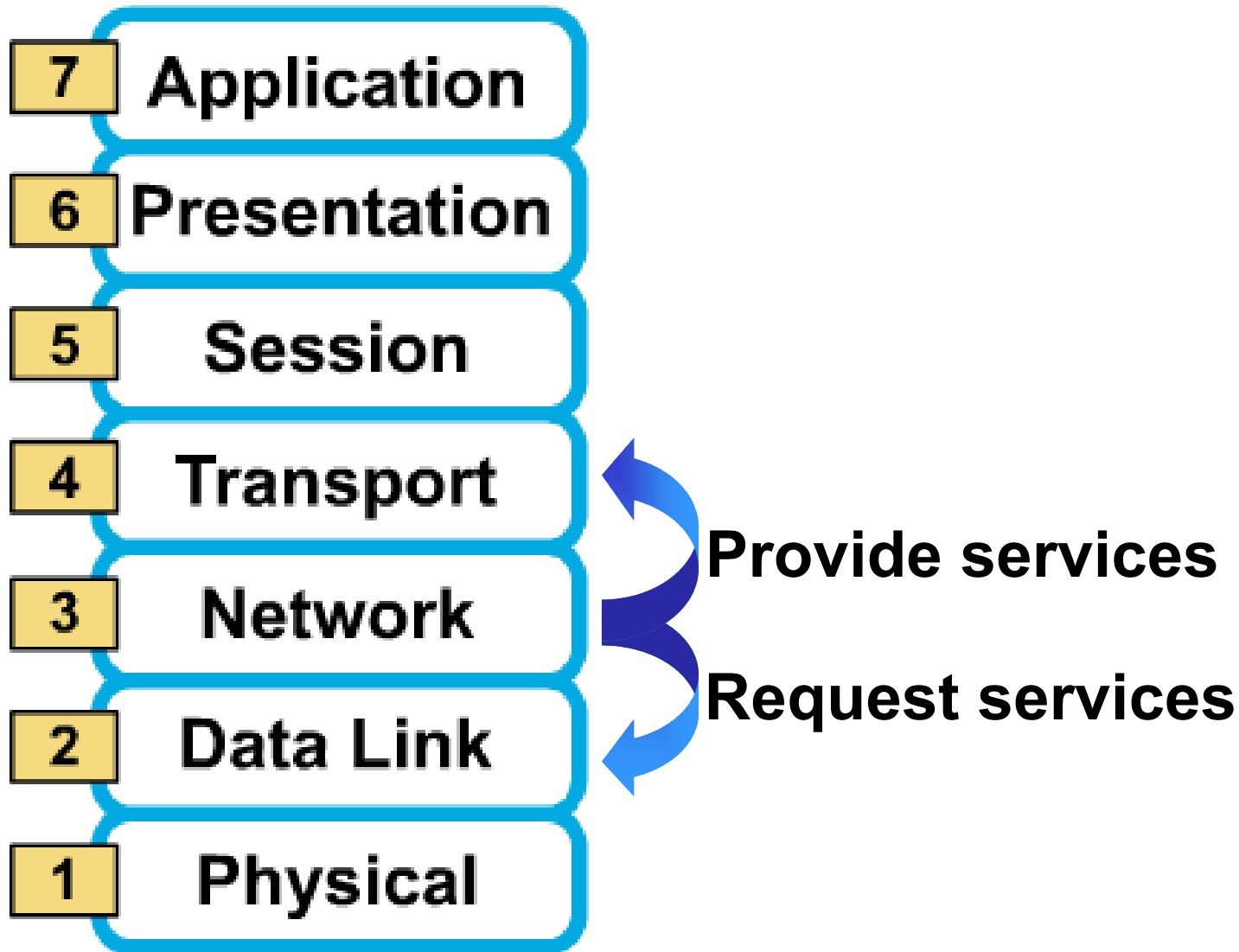
Encapsulation example: E-mail



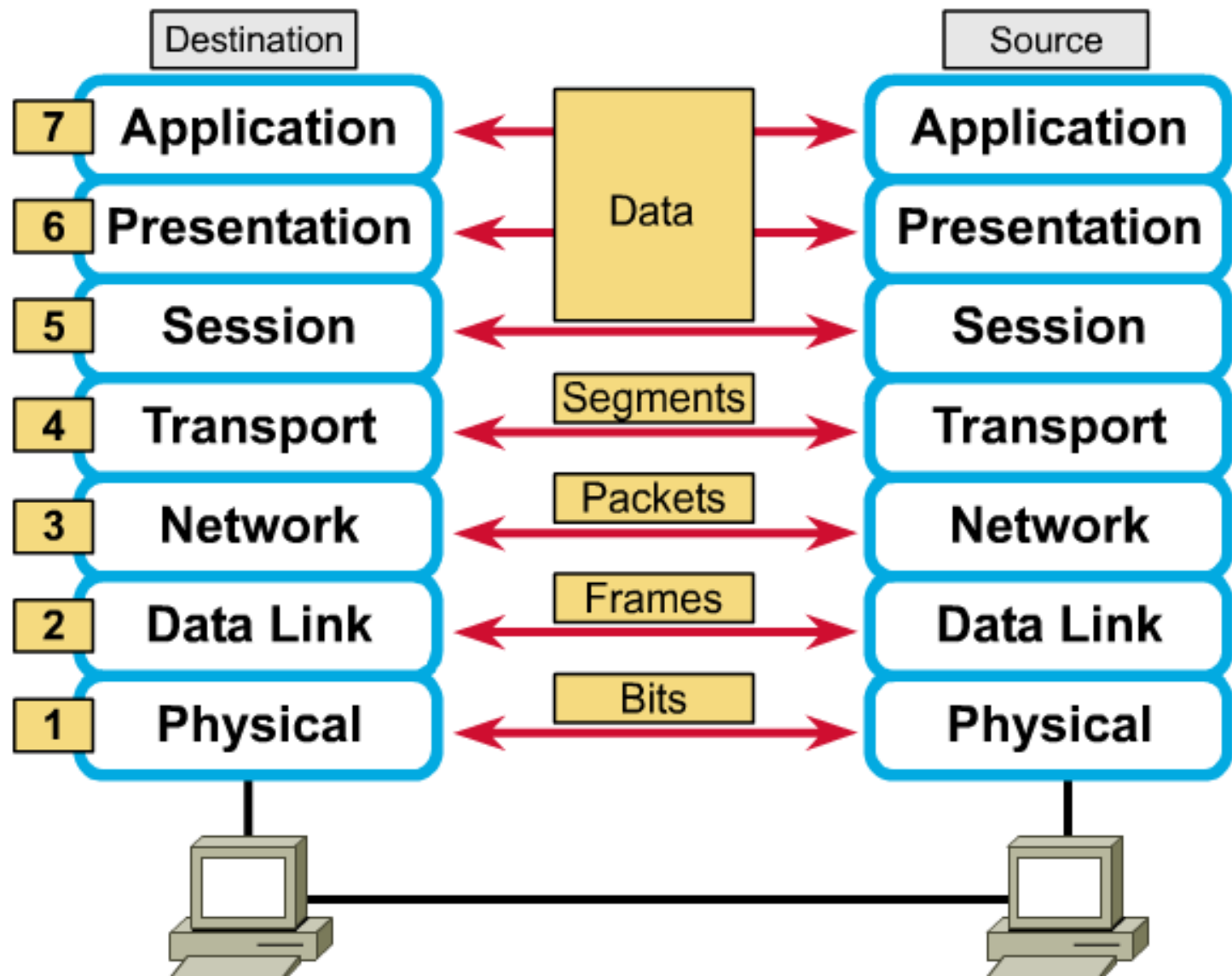
Encapsulation



Layer-to-layer communications



Peer-to-peer communications



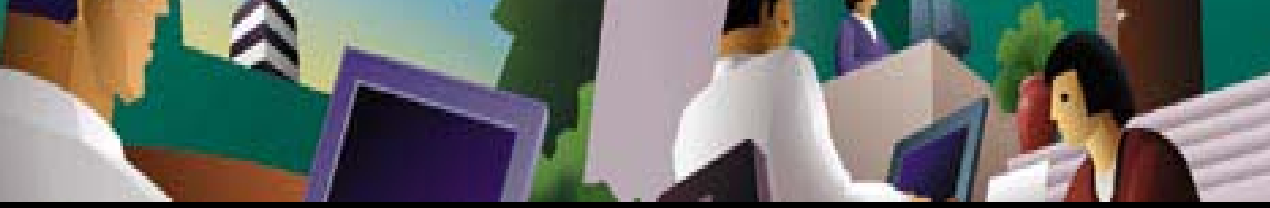
Protocols

- Is a formal set of **rules** and **conventions** that governs how computers exchange information over a network medium.
- Implements the functions of one or more of the OSI layers.
- A communication protocol is concerned with exchanging data between **two peer layers**.
- Protocol Data Units (**PDU**s) : Block of data that a protocol exchange.

Review



- **OSI Reference Model.**
- **Function of 7 layers.**
- **Encapsulation process.**
- **Peer-to-peer communications.**



TCP/IP MODEL

TCP/IP model development

- The late-60s The Defense Advance Research Projects Agency (DARPA) originally developed **Transmission Control Protocol/Internet Protocol (TCP/IP)** to interconnect various defense department computer networks.
- The Internet, an International Wide Area Network, uses TCP/IP to connect networks across the world.

4 layers of the TCP/IP model

- Layer 4: **Application**
- Layer 3: **Transport**
- Layer 2: **Internet**
- Layer 1: **Network access**

Application

Transport

Internet

Network Access

It is important to note that some of the layers in the TCP/IP model have the same name as layers in the OSI model. Do not confuse the layers of the two models.

▶ **The network access layer**

- **Concerned with all of the issues that an IP packet requires to actually make the physical link. All the details in the OSI physical and data link layers.**
 - **Electrical, mechanical, procedural and functional specifications.**
 - **Data rate, Distances, Physical connector.**
 - **Frames, physical addressing.**
 - **Synchronization, flow control, error control.**

▶ **The internet layer**

- **Send source packets from any network on the internetwork and have them arrive at the destination independent of the path and networks they took to get there.**
 - **Packets, Logical addressing.**
 - **Internet Protocol (IP).**
 - **Route , routing table, routing protocol.**

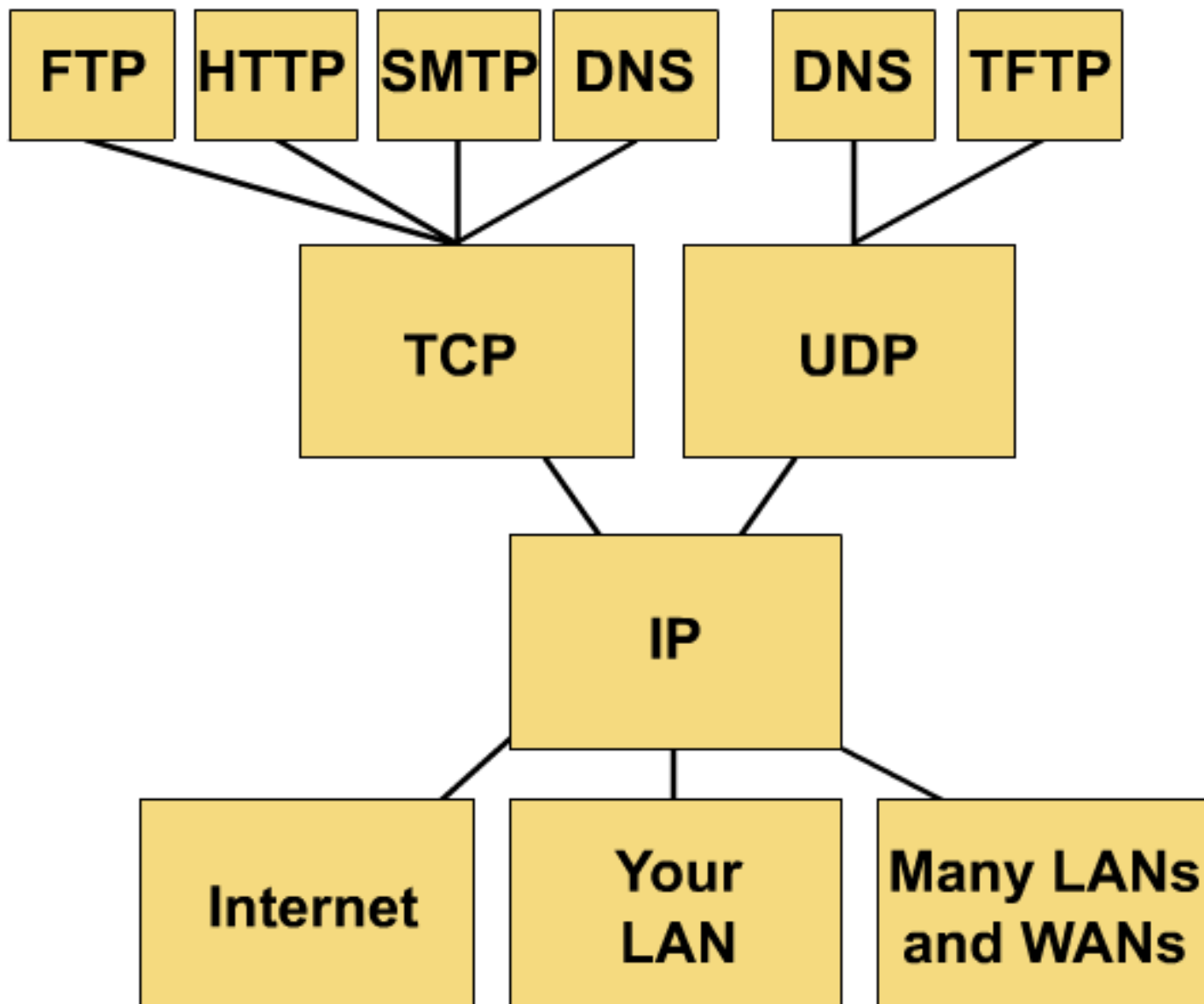
The transport layer

- **The transport layer deals with the quality-of-service issues of reliability, flow control, and error correction.**
 - **Segments, data stream, datagram.**
 - **Connection oriented and connectionless.**
 - **Transmission control protocol (TCP).**
 - **User datagram protocol (UDP).**
 - **End-to-end flow control.**
 - **Error detection and recovery.**

The application layer

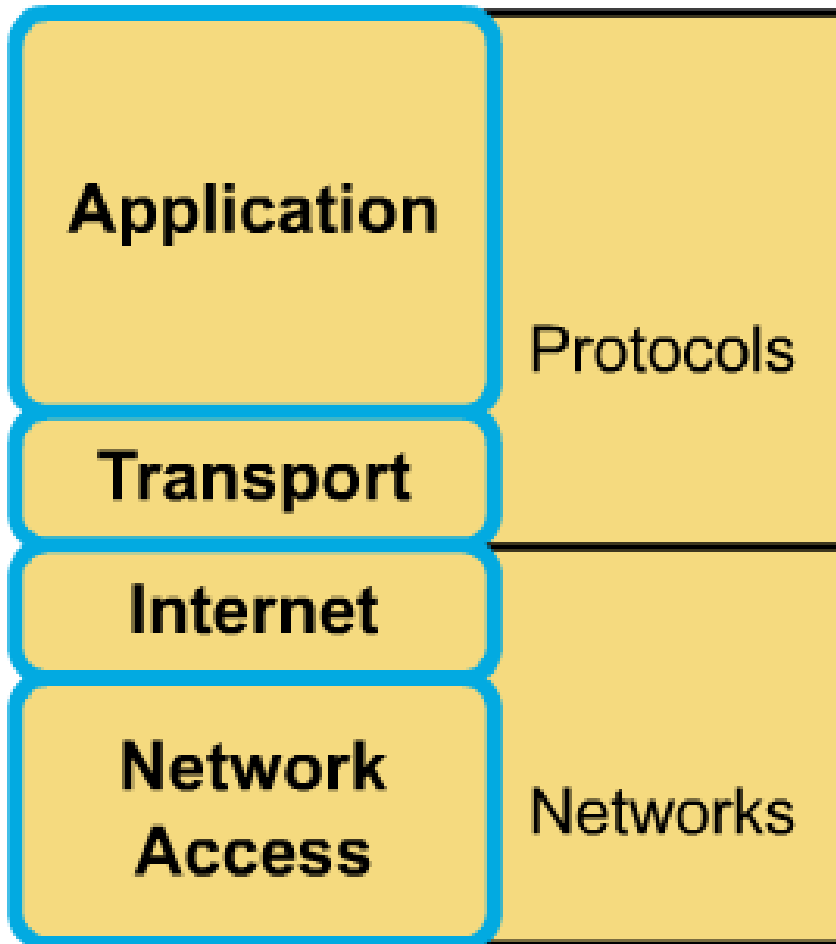
- **Handles high-level protocols, issues of representation, encoding, and dialog control.**
- **The TCP/IP combines all application-related issues into one layer, and assures this data is properly packaged for the next layer.**
 - **FTP, HTTP, SMNP, DNS ...**
 - **Format of data, data structure, encode ...**
 - **Dialog control, session management ...**

TCP/IP protocol stack

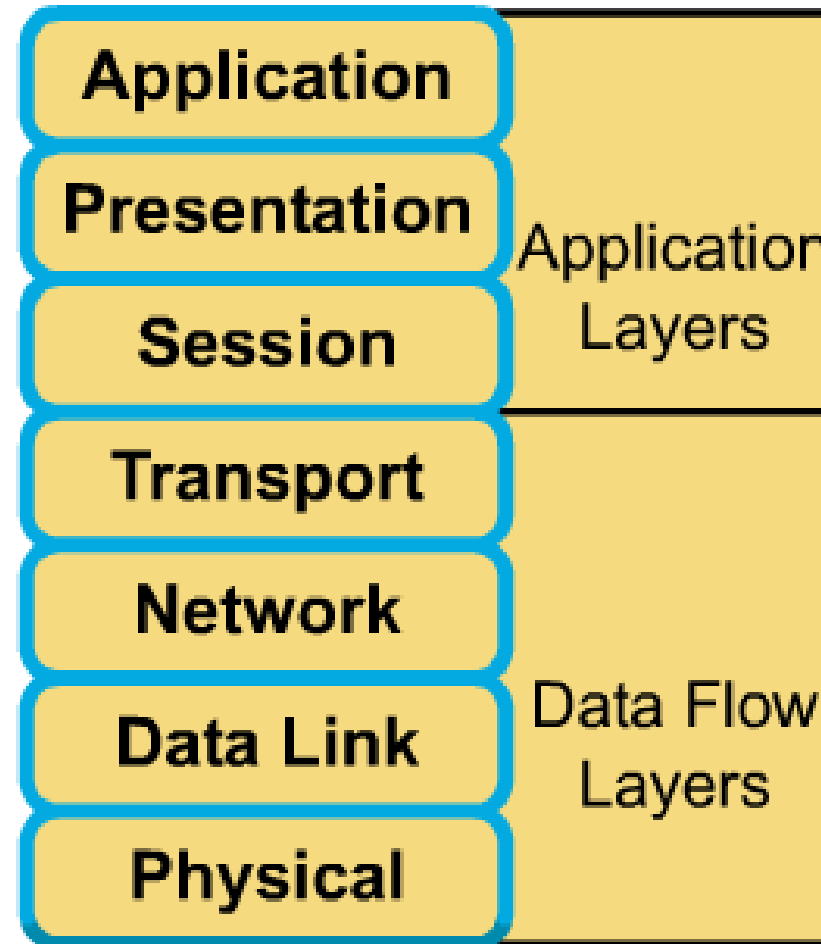


Comparing TCP/IP with OSI

TCP/IP Model



OSI Model



Comparing TCP/IP with OSI (cont.)

Similarities:

- Both have layers.
- Both have application layers, though they include very different services.
- Both have comparable transport and network layers
- Packet-switched technology is assumed.
- Networking professionals need to know both.

Comparing TCP/IP with OSI (cont.)

Differences:

- TCP/IP combines the presentation and session layer issues into its application layer.
- TCP/IP combines the OSI data link and physical layers into one layer.
- TCP/IP appears simpler because it has fewer layers.
- Typically networks aren't built on the OSI protocol, even though the OSI model is used as a guide.

Review



- **Comparing TCP/IP with OSI.**

Summary

OSI Model	OSI Model Name	Pneumonic	Equipment	Equipment Purpose	Data	Protocols	Words to Remember	TCP/IP Model
Layer 7	Application	All	Computer	Regular computer or a special gateway. Used to combine networks using different communication protocols	Data	Redirector, FTP, Telnet, SMTP, SNMP, Netware Core, NFS, SQL, RPC, X-Win	Browsers	Application
Layer 6	Presentation	People					Common Data Format	
Layer 5	Session	Seem					Dialogues Conversations	
Layer 4	Transport	To	Computer		Segment	TCP and UDP	QoS Reliability	Transport
Layer 3	Network	Need	Router	Segment Network into Smaller <i>Broadcast</i> Domains	Packet	Route able Protocols. IP, IPX, AppleTalk	Path Selection Routing Addressing	Internet
Layer 2	Data Link (LLC, MAC)	Data	Bridge Switch NIC	Segment Network into Smaller <i>Collision</i> Domains	Frame	NDIS, ODI, MAC Address, Ether Talk	Frames Media Access Control (MAC)	Network Access
Layer 1	Physical	Processing	Repeater Hub Cabling	One Collision AND One Broadcast Domain	Bit	Physical	Signals Media	