COMPUTER NETWORK MODELS

ECE 422 – DATA COMMUNICATION & COMPUTER NETWORKS

Monday, 23 February 2026

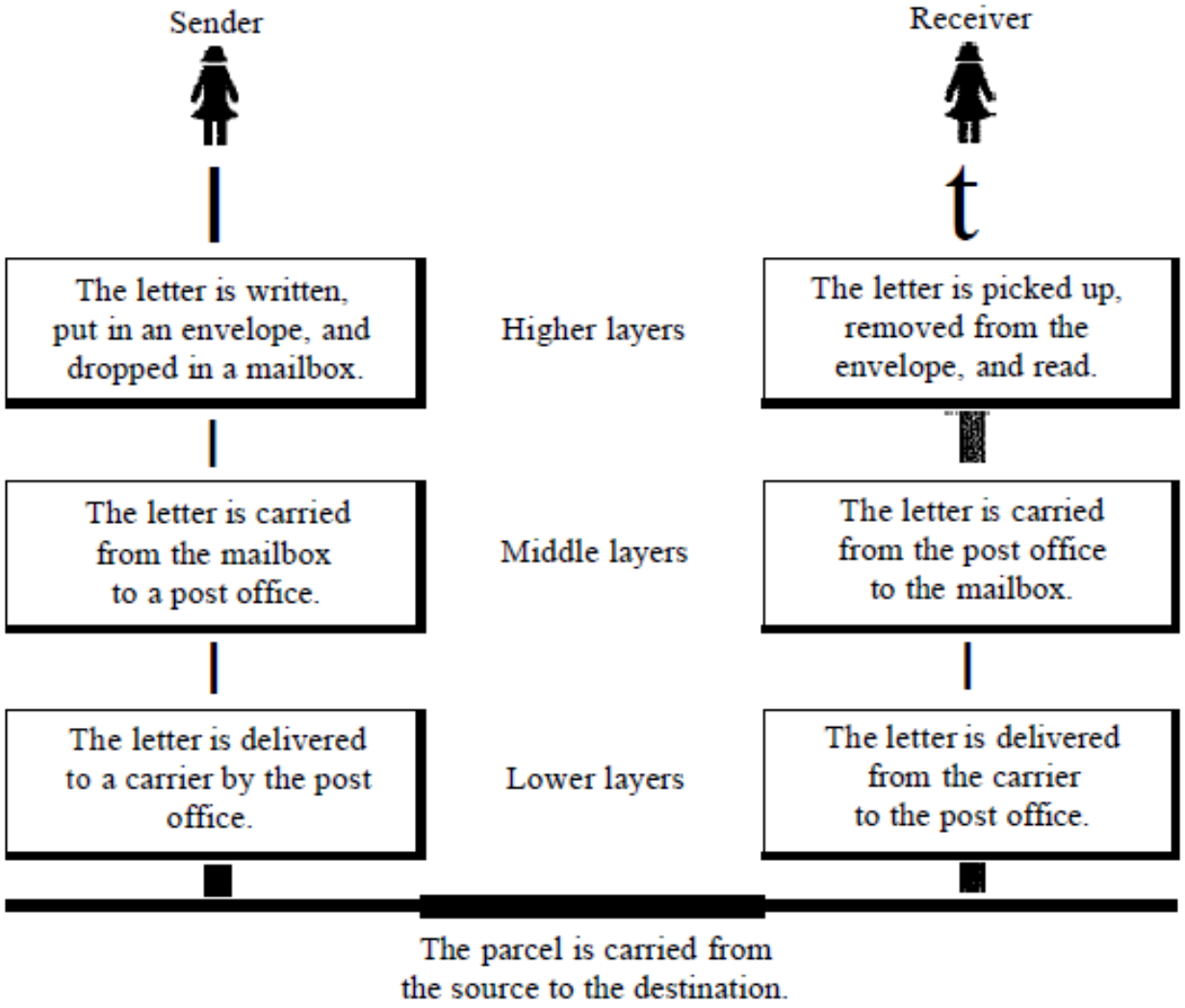
WHAT IS A COMPUTER NETWORK?

1. A **Computer network** is a combination of hardware and software that sends data from one location to another.
2. A Computer Network consists of:

   a) **Hardware**, i.e the physical equipment that carries signals from one point of the network to another.

   b) **Software** i.e a set of instructions that make possible for human beings to get services from the network.

USE OF LAYERS IN ORDINARY LIFE

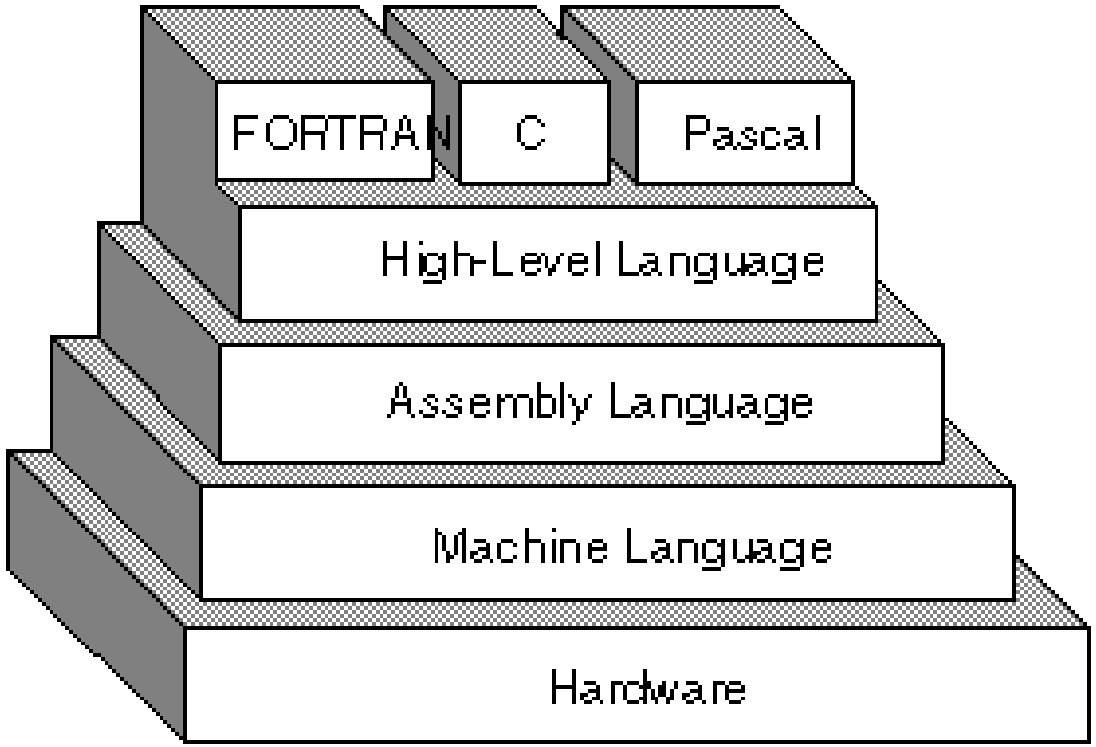


This is layer requires imagination, writing and interpretation – **Tasks which can only be done by man.**

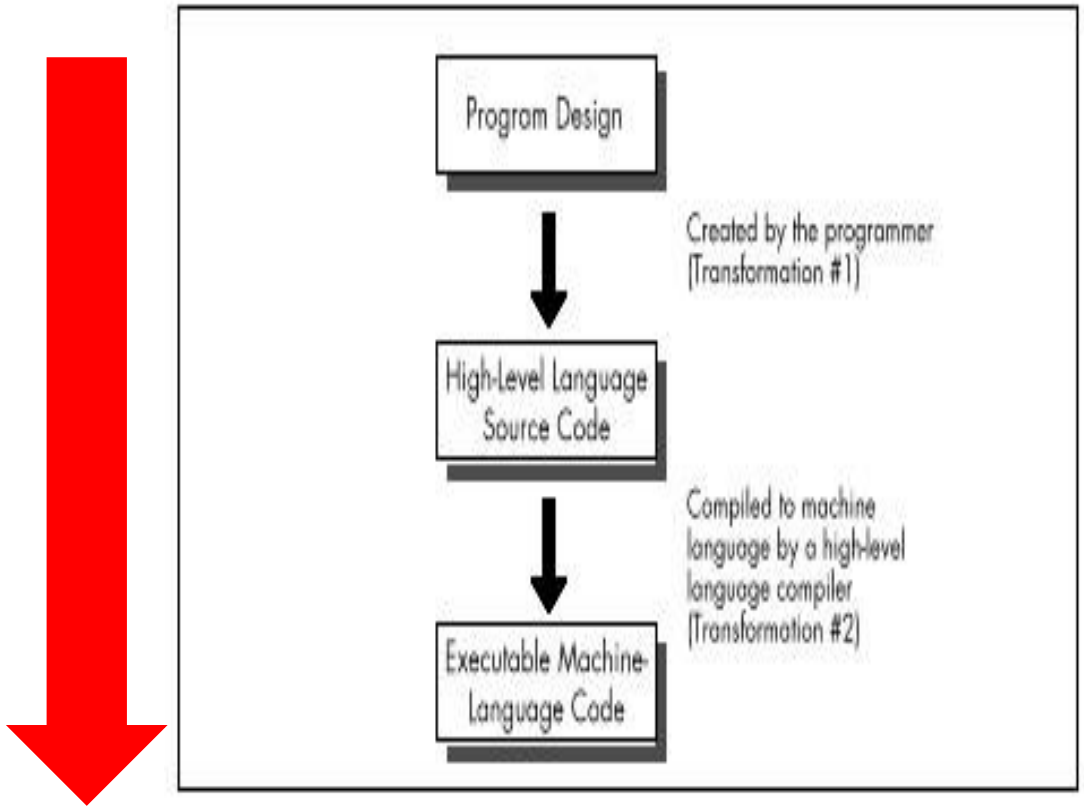
This layer carries intelligence which is wrapped up in an envelope- **Tasks which can be automated.**

LAYERS IN COMPUTER PROGRAMMING

Layers in Computer Programming



Interfaces/Systems



HISTORY OF ISO

1. **International Standards Organisation (ISO)** began in **1926** as the **International Federation of the National Standardizing Associations (ISA).**
2. In its early years, ISO focused heavily on mechanical engineering.
3. It was disbanded in 1942 during the second World War but was re-organized under the current name, ISO, in 1946.
4. The name, "ISO" is not an acronym but was **derived from the Greek word "isos" meaning "equal".**
5. The use of ISO (isos) eliminated confusion that could result from the translation of "International Organization for Standardization in many languages.

MEMBERSHIP OF ISO

1. **ISO is a voluntary organization** whose members are recognized standard authorities, each one representing one country.
2. **Kenya Bureau of Standards** is Kenya's national representative to ISO.
3. **American National Standards Institute (ANSI)** is the United States representative to ISO.
4. The bulk of the work of ISO is done by the over 2700 technical committees, subcommittees and working groups.
5. Each committee and subcommittee is headed by a Secretariat.

ISO STANDARD APPROVAL PROCESS

A standard goes through a six-stage process before being published as an ISO standard as follows:

1. **Proposal stage** during which a need for a standard is determined and members are identified who are willing to work on it.
2. **Preparatory stage** where a working draft of the standard is developed.
3. **Committee stage** where comments are elicited until a consensus is reached. The output of this stage is the **Draft International Standard (DIS).**
4. **Enquiry stage** where **DIS is circulated among all member bodies and then voted upon.** If a DIS does not receive 75% of the vote, it returns to lower stages. If it passes the enquiry stage , it becomes a **Final Draft International Standard**.
5. **Approval stage** where **Final Draft International Standard** is circulated through all member bodies for a final vote and again it must pass this stage with 75% of the vote.
6. **Publication stage** where it is sent to the ISO Central Secretariat for publication.

Health
IT & related technologies
Management & services
Security, safety & risk

Transport
Energy
Diversity & inclusion
Environmental sustainability

Food & agriculture
Materials
Building & construction
Engineering

Search our catalogue

Search

Standards All about ISO Taking part Store EN ≡ MENU

ISO

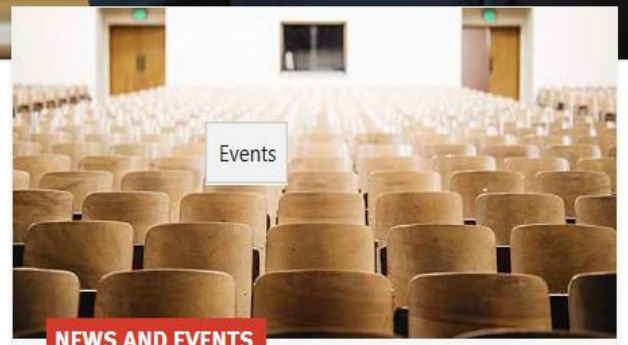
Message from the new ISO President Eddy Njoroge.

OUR FUTURE FROM NOW ON

NEW ISO PRESIDENT

January 2020 – January 2022

We're ISO, the **International Organization for Standardization.** We



NEWS AND EVENTS

EVENTS

POPULAR STANDARDS

ISO/IEC 27001 INFORMATION

https://www.iso.org/events.html

HISTORY OF OPEN SYSTEMS INTERCONNECT (OSI)

1. **The Open Systems Interconnection model (OSI)** was proposed in the late 1970s.
2. Prior to OSI, networking was mostly government-sponsored or vendor driven, by the following organizations.
   a) **ARPANET** in the US,
   b) **CYCLADES** in France
   c) IBM - **SNA** - System Network Architecture
   d) **DECnet** - Digital Equipment Corporation
3. The ISO, OSI is a set of protocols that allows any two different computer systems to communicate regardless of their underlying architecture and software.

HISTORY OF OPEN SYSTEMS INTERCONNECT

1. Two organizations began OSI standard development independently, with the same goal: to define a unifying standard for the architecture of networking systems.
2. The organisations were:
   a) International Organization for Standardization (ISO).
   b) International Telecommunication Union (ITU).
3. **In 1983**, the two standards were merged to form a standard called The Basic Reference Model for Open Systems Interconnection (OSI).
4. **In 1984** Open Systems Interconnection (OSI) was approved as International standard Number ISO 7498.

PURPOSE OF OSI MODEL

- **The purpose of the OSI model** was to show how to facilitate communication between different systems without requiring changes to the logic of the underlying hardware and software.

- **The OSI model is not a protocol**; it is a model for understanding and designing a network architecture that is flexible, robust, and interoperable.

PRINCIPLES USED TO DETERMINE THE OSI LAYERS (PAGE 29 OF THE STANDARD)

a) Do not create so many layers as to make the system engineering task of describing and integrating the layers more difficult than necessary.

b) Create a boundary at a point where the description of services can be small and the number of interactions across the boundary are minimized.

c) Create separate layers to handle functions that are manifestly different in the process performed or the technology involved.

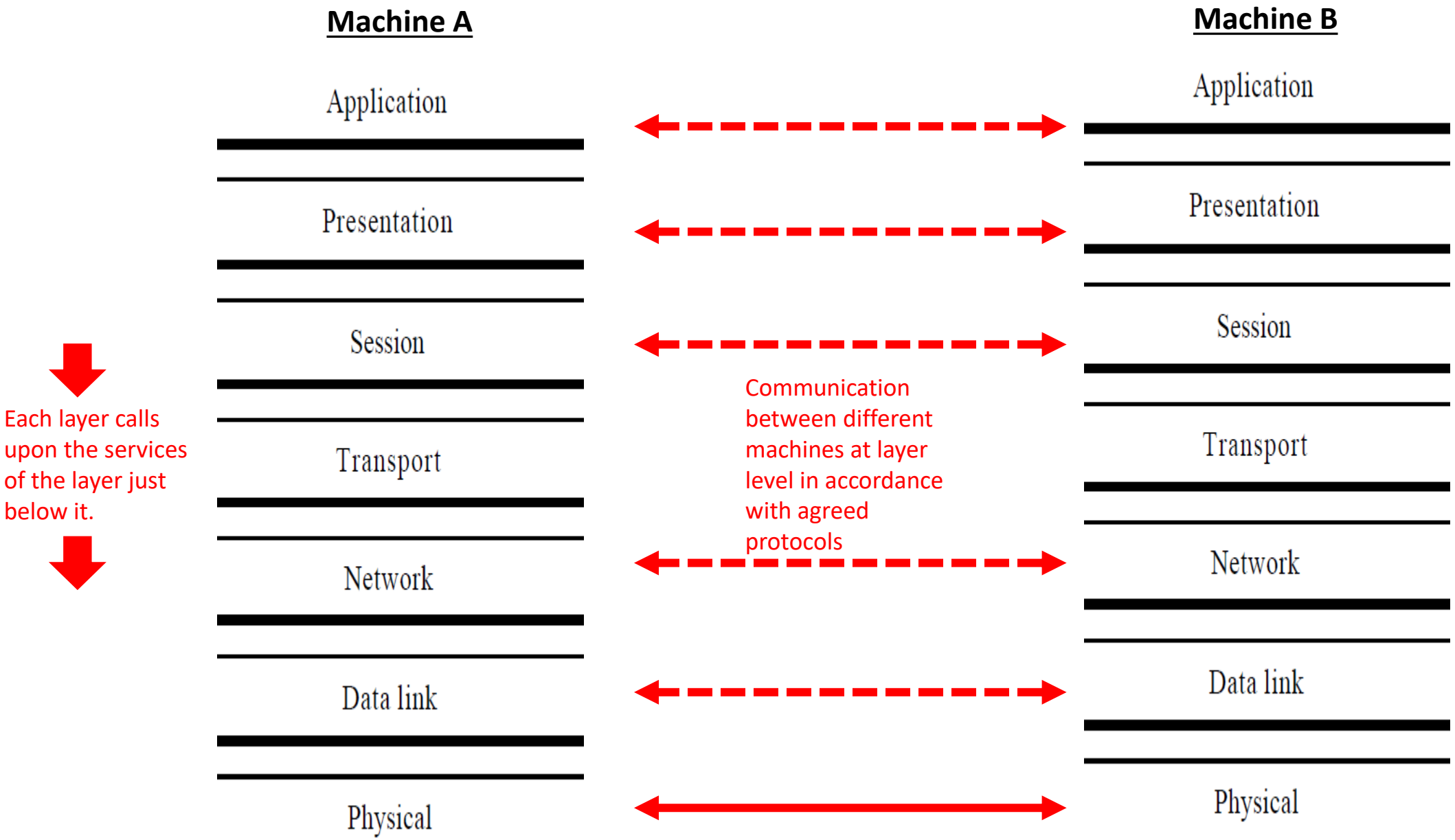
d) Collect similar functions into the same layer.

e) Select boundaries at a point which past experience has demonstrated to be successful.

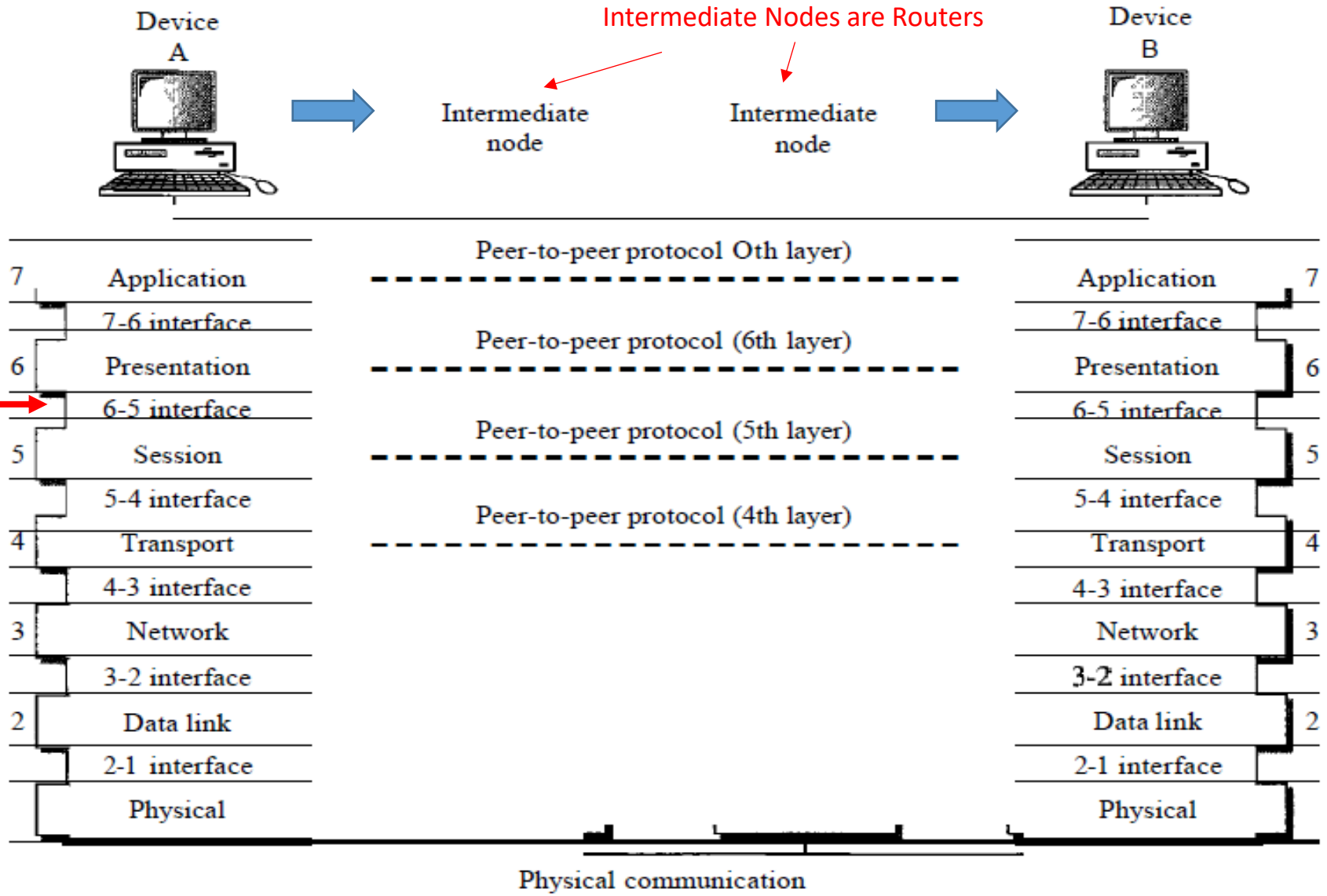
f) Create a layer of easily localized functions so that the layer could be totally redesigned and its protocols changed in a major way to take advantage of new advances in architectural, hardware or software technology without changing the services expected from and provided to the adjacent layers.

g) Create a boundary where it may be useful at some point in time to have the corresponding interface standardized.

THE OSI MODEL

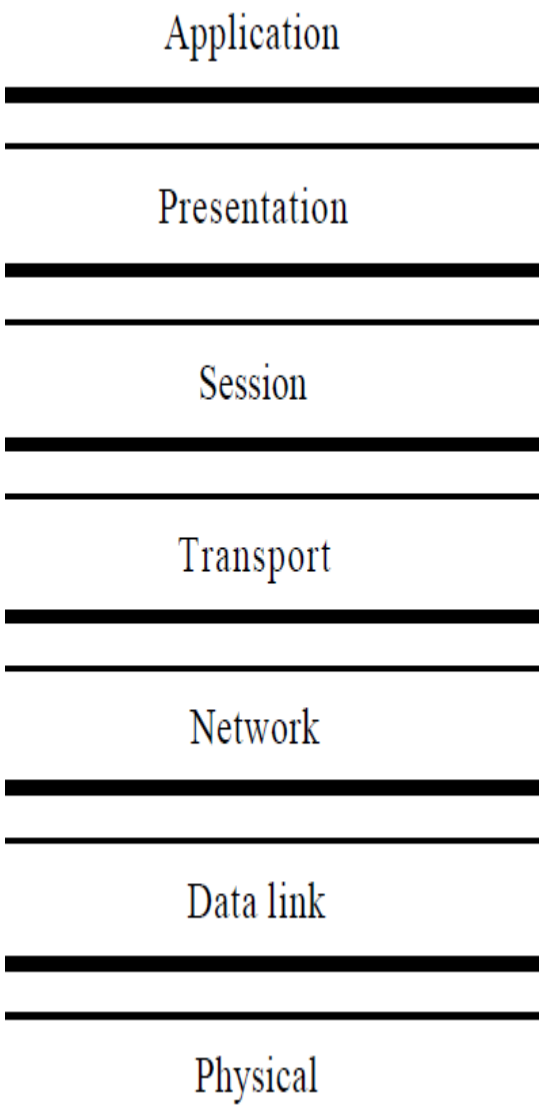


OSI COMMUNICATION MODEL (TEXTBOOK)



Interfaces define the information and services a layer must provide for the layer above it

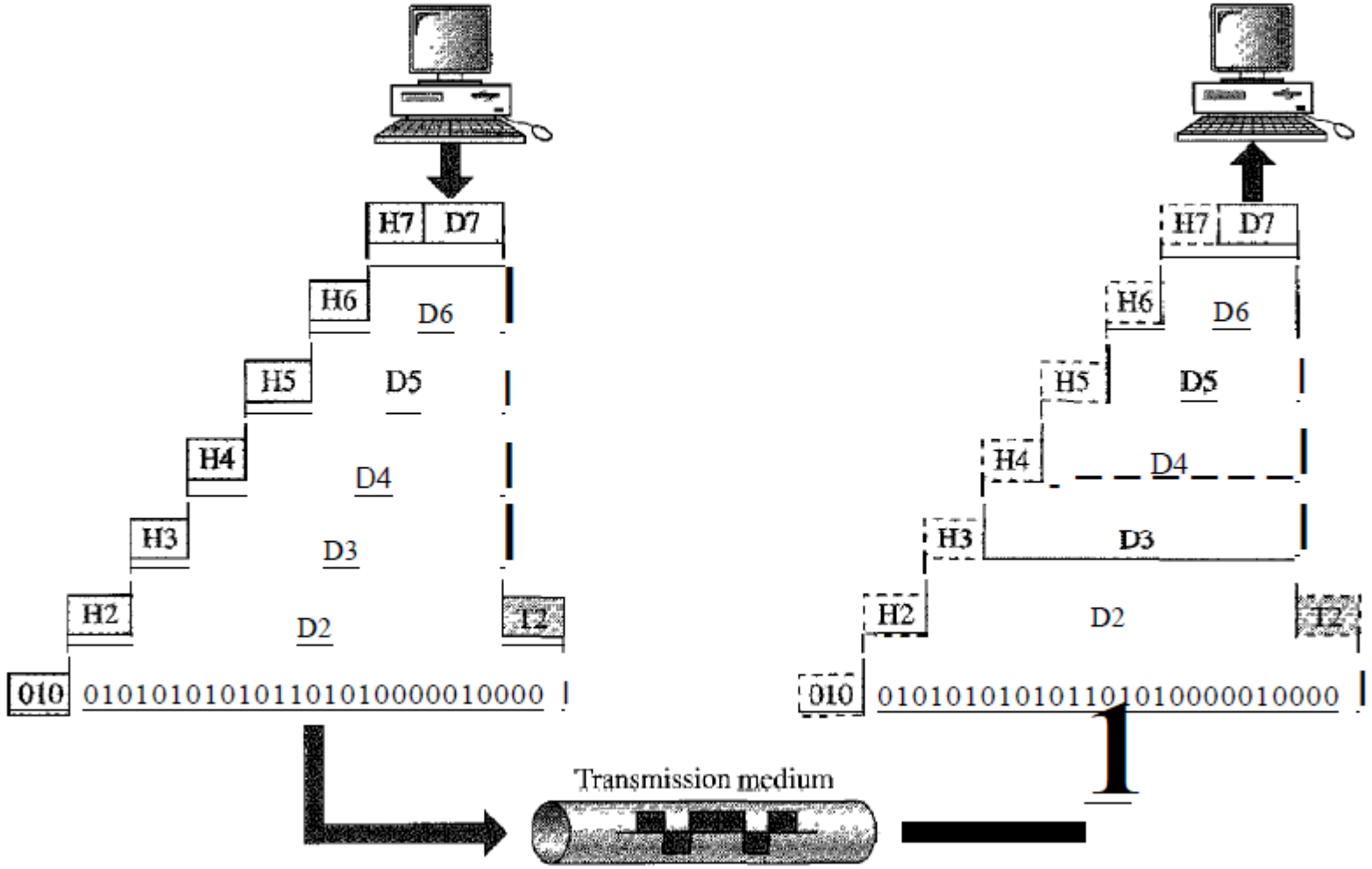
CATEGORIES OF LAYERS



User support layers:
Allow interoperability among software systems.

Network Support Layers:
Deal with physical aspects of moving data from one device to another e.g. electrical specifications, physical connections, physical addressing, and transport timing and reliability.

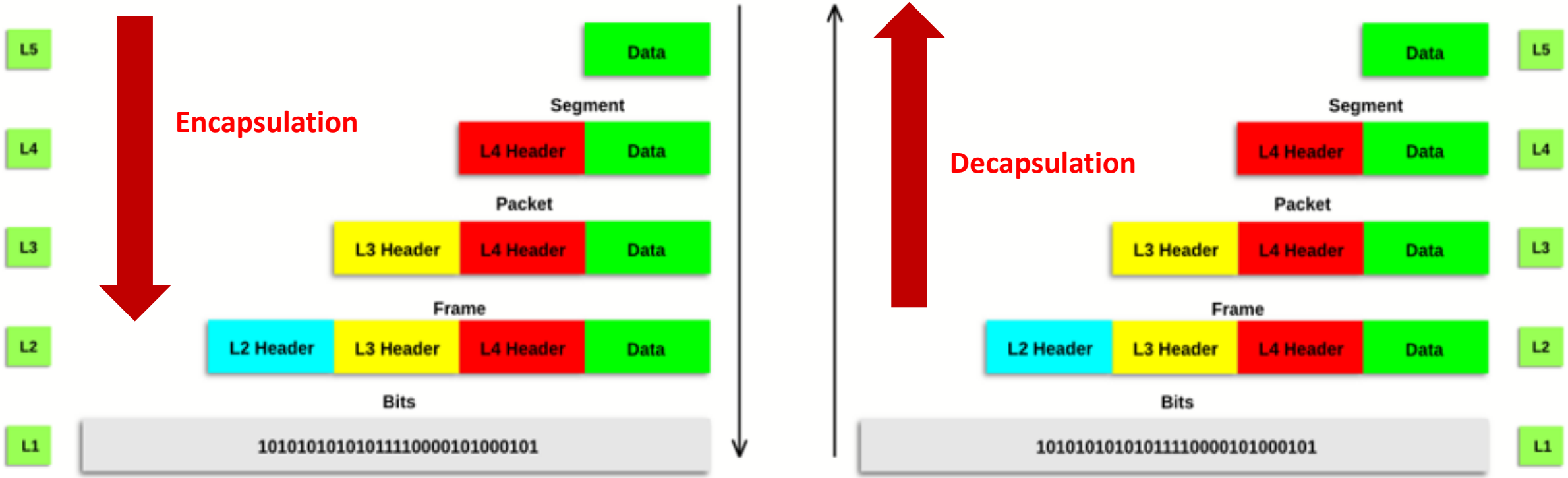
DATA EXCHANGE IN OSI MODEL



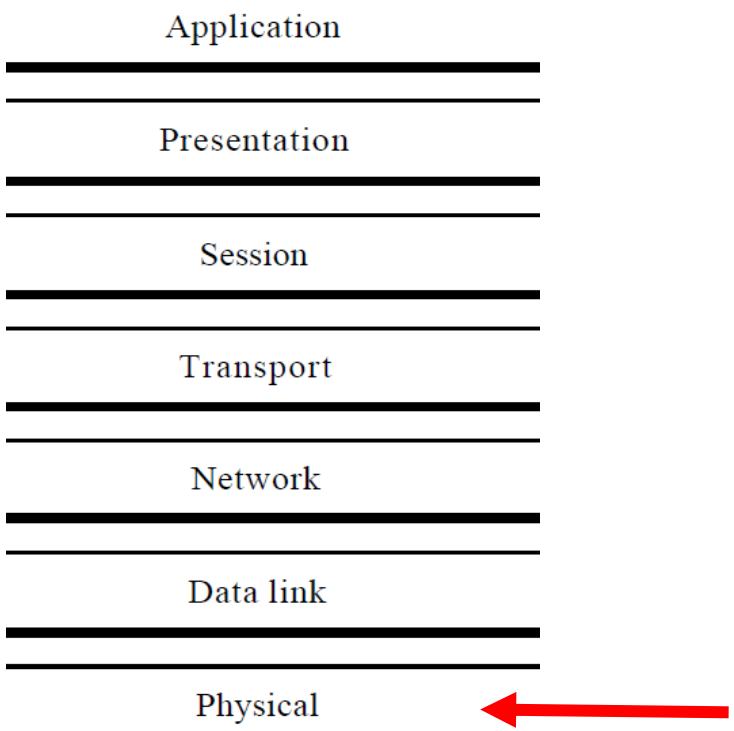
At each layer, a header, or possibly a trailer, can be added to the data unit.

ENCAPSULATION AND DECAPSULATION

1. The data which should be transmitted to a new location should go through each layer in the ISO Model.
2. When reaching each layer, the information is added to the data. This process is called **encapsulation.**
3. When the data reaches the destination, in each layer the added information is unpacked. That process is known as **decapsulation**.



FUNCTIONS OF THE PHYSICAL LAYER

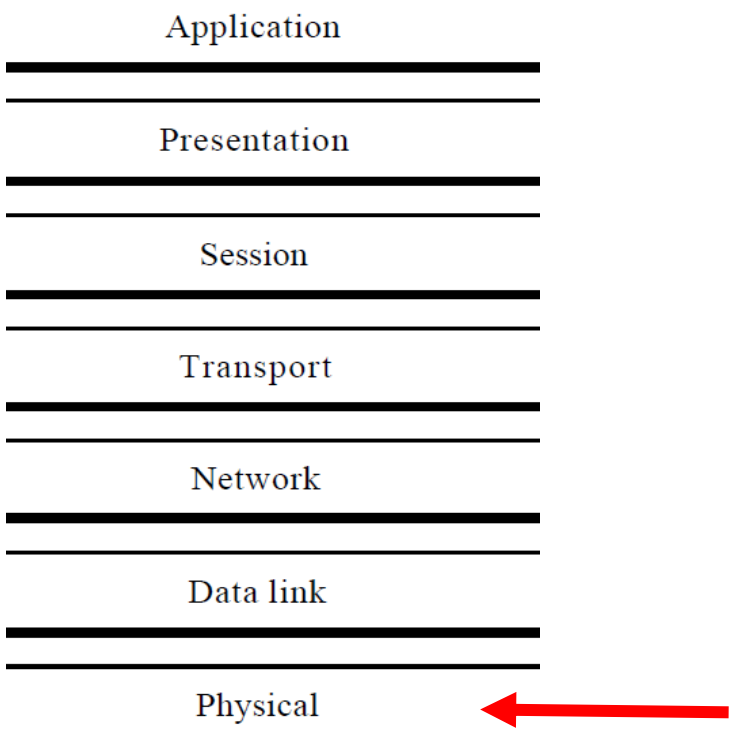


Physical Layer

Coordinates the functions required to carry a bit stream over a physical medium. Standards include:

1. Mechanical Specification of the interface
2. Electrical specifications of the interface
3. Transmission medium.
4. Definition of the procedures and functions of the physical devices

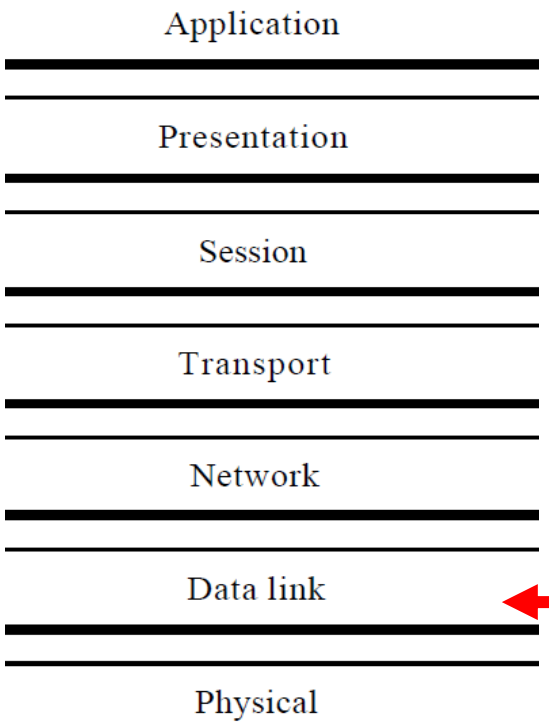
FUNCTIONS OF THE PHYSICAL LAYER



Main Issues Covered by Physical Layer:

1. Physical characteristics of interfaces and medium
2. Representation of bits
3. Data rate
4. Synchronization
5. Line configuration
6. Physical topology
7. Transmission mode (duplex, half duplex or simplex)

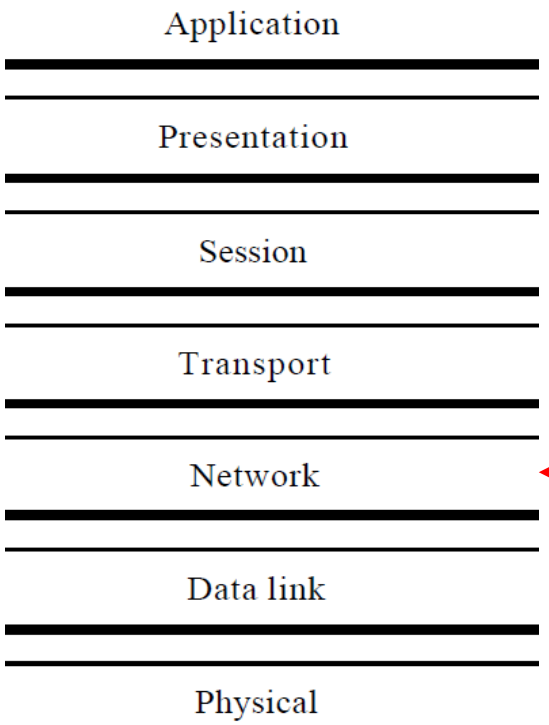
FUNCTIONS OF THE DATA LINK LAYER



The Data Link Layer

1. Makes the physical layer appear error-free to the upper layer.
2. Functions include:
   a) Physical addressing
   b) Flow-control
   c) Error Control
   d) Access Control

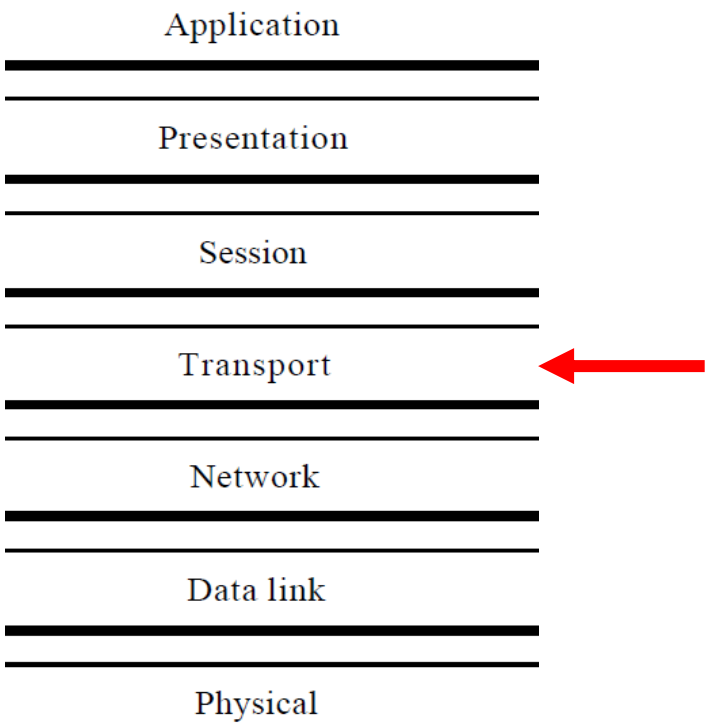
FUNCTIONS OF THE NETWORK LAYER



The Network Layer

1. Responsible for the source-to-destination delivery of a packet, sometimes across multiple networks.
2. Functions include:
   a) Logical addressing
   b) Routing of Packets

FUNCTIONS OF THE TRANSPORT LAYER



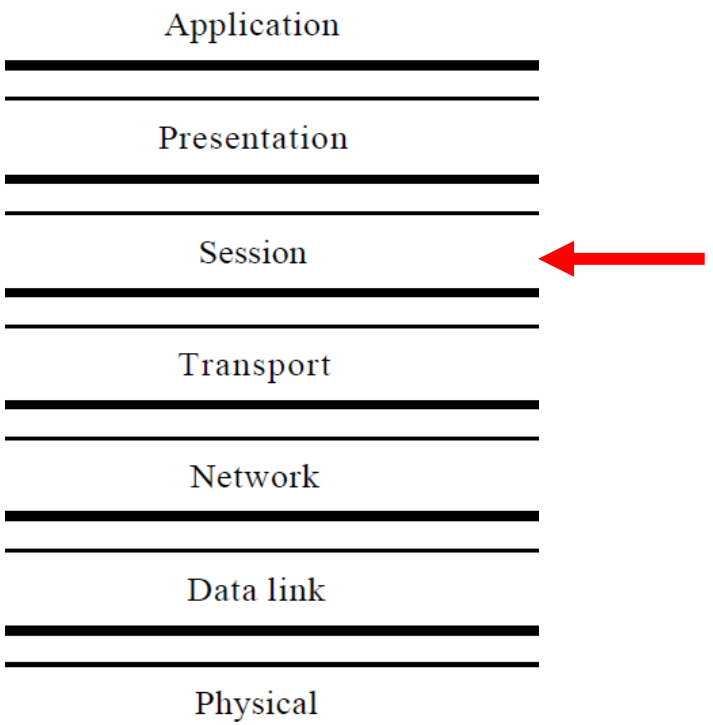
The Transport Layer

1. Responsible process-to-process delivery of the entire message.
2. A process is an application program running on a host.
3. Functions Include:
   a) Service point addressing
   b) Segmentation and assembly
   c) Connection control
   d) Flow control
   e) Error Control

TRANSPORT LAYER FACILITATES DOWNLOADING WEB PAGES/DOCUMENTS SIMULTENEOUSLY

Each Tab is downloading data from a different Server

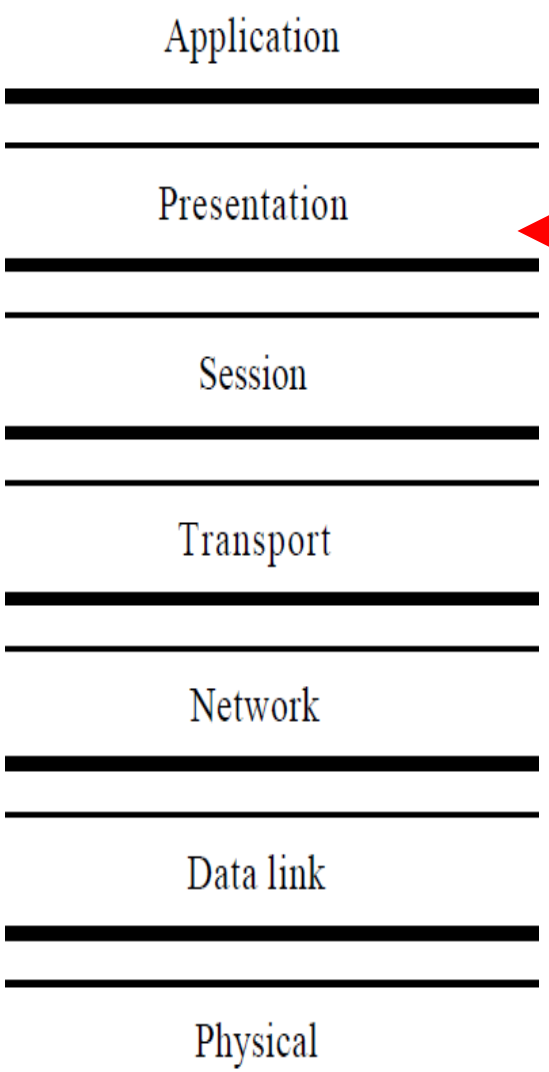
FUNCTIONS OF THE SESSION LAYER



The Session Layer

1. Responsible for establishing, maintaining, and synchronizing the interaction among communicating systems.
2. Functions include:
   a) Dialog control
   b) Synchronization of messages

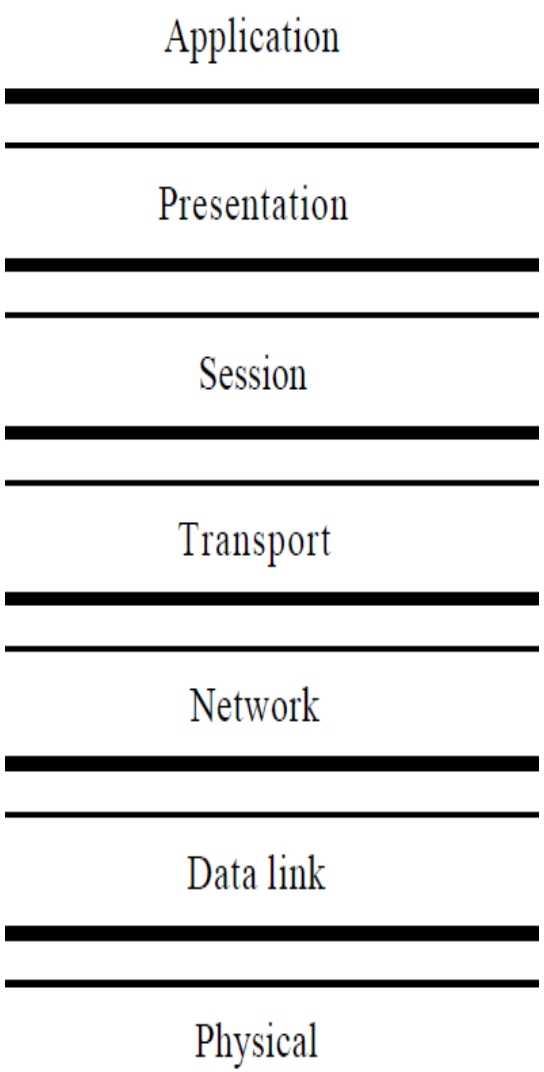
FUNCTIONS OF THE PRESENTATION LAYER



The Presentation Layer

1. Responsible for syntax and semantics of the information exchanged.
2. Functions include:
   a) Compression
   b) Encryption
   c) Translation

FUNCTIONS OF THE APPLICATION LAYER



The application layer

1. Enables the user, whether human or software, to access the network.
2. Examples include:
   a) E-mail software
   b) Web browser
   c) Video streaming
   d) Music player

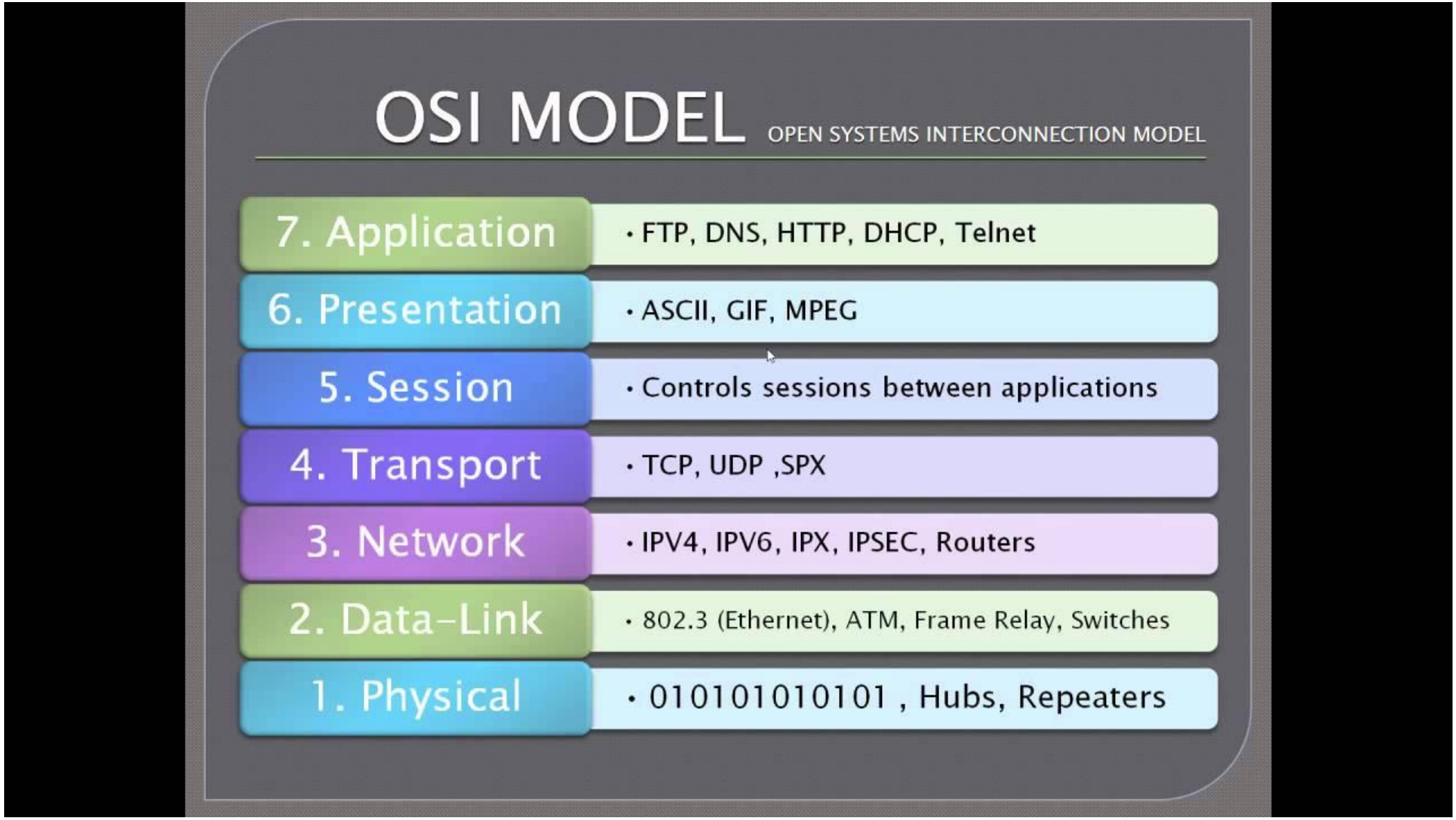
SUMMARY OF FUNCTIONS & EXAMPLES (1)

OSI Model

Layer	Function	Examples
Application (Layer 7)	User interface	Telnet, HTTP
Presentation (Layer 6)	Handles encryption & changes to syntax	ASCII/EBCDIC, JPEG/MP3
Session (Layer 5)	Manages multiple applications and maintains synchronisation points	Operating systems, scheduling
Transport (Layer 4)	Provides reliable or best-effort delivery and (optional) error and flow control	TCP, UDP
Network (Layer 3)	Provides logical end-to-end addressing used by routers and hosts	IP
Data Link (Layer 2)	Creates frames from data bits, uses MAC addresses to access endpoints, and provides error detection but no correction	802.3, 802.2, HDLC, Frame Relay
Physical (Layer 1)	Specifies voltage, wire speed, and cable pin-outs	EIA/TIA, V.35

TECHNOLOGY TRAINING LIMITED
LEARNING... FROM EXPERIENCE

SUMMARY OF FUNCTIONS & EXAMPLES (2)

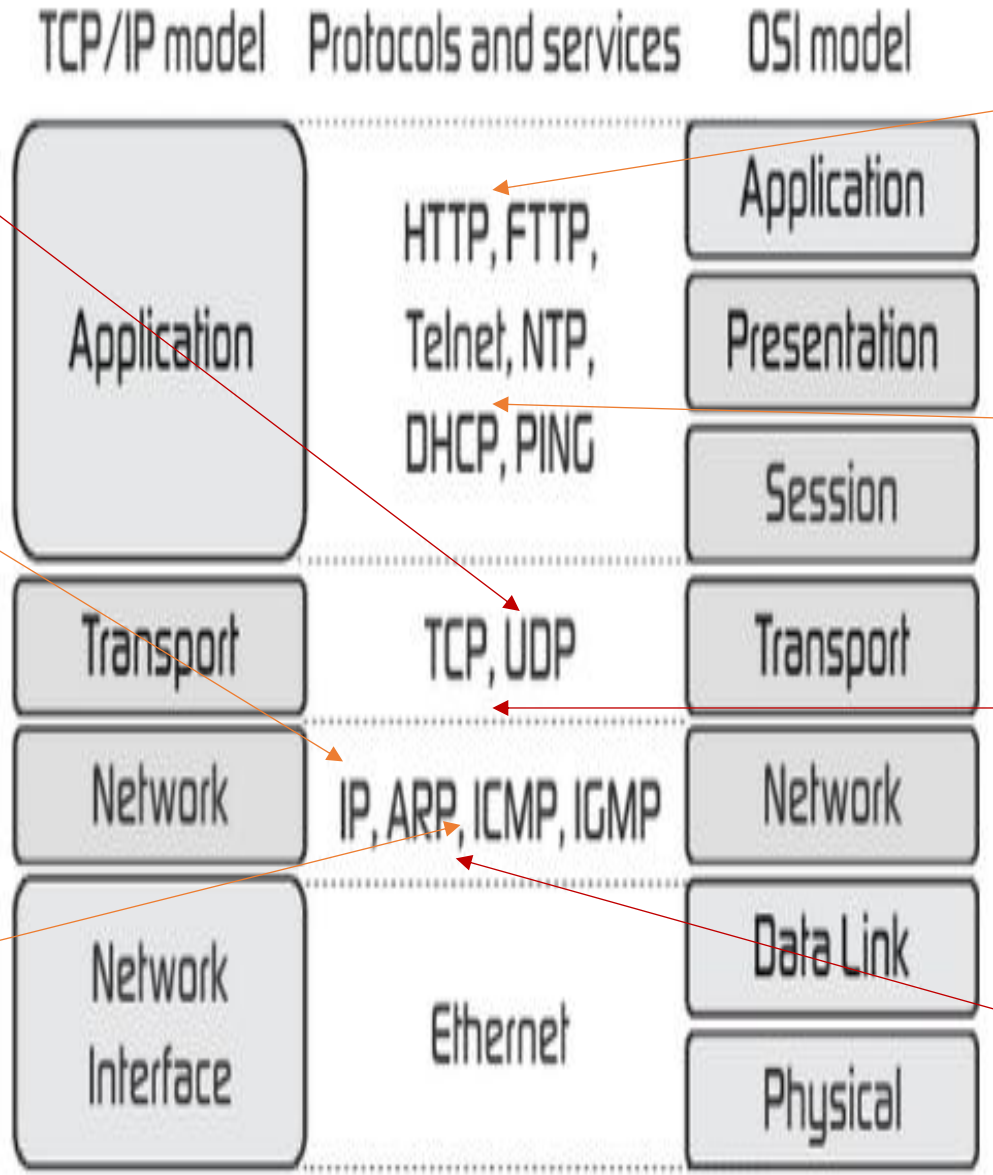


SIMILARITY BETWEEN INTERNET PROTOCOL (TCP/IP) & OSI

User Datagram Protocol (UDP) a protocol used to establish low-latency and loss-tolerating connections between applications on the internet.

Internet Protocol, or (IP) responsible for routing packets across interconnected networks

Internet Control Message Protocol (ICMP) is a supporting protocol in the Internet protocol suite used to send error messages and operational information indicating success or failure when communicating with another IP address



Hypertext Transfer Protocol (HTTP) used for transmitting hypermedia documents, such as HTML.

Dynamic Host Configuration Protocol(DHC) automatically provides an Internet Protocol (IP) host with its IP address

Transmission Control Protocol (TCP) enables application programs exchange messages.

Address Resolution Protocol (ARP) is a procedure for mapping a dynamic IP address to a permanent physical machine address