NETWORK PROTOCOLS

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INTRODUCTION TO NETWORKING AND PROTOCOLS

LECTURE 1 PART B

2204 - 2025

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Outline

In this lecture will talk about:

- **Foundations of Networking**
  - Layered Network Models

Layered Network Models

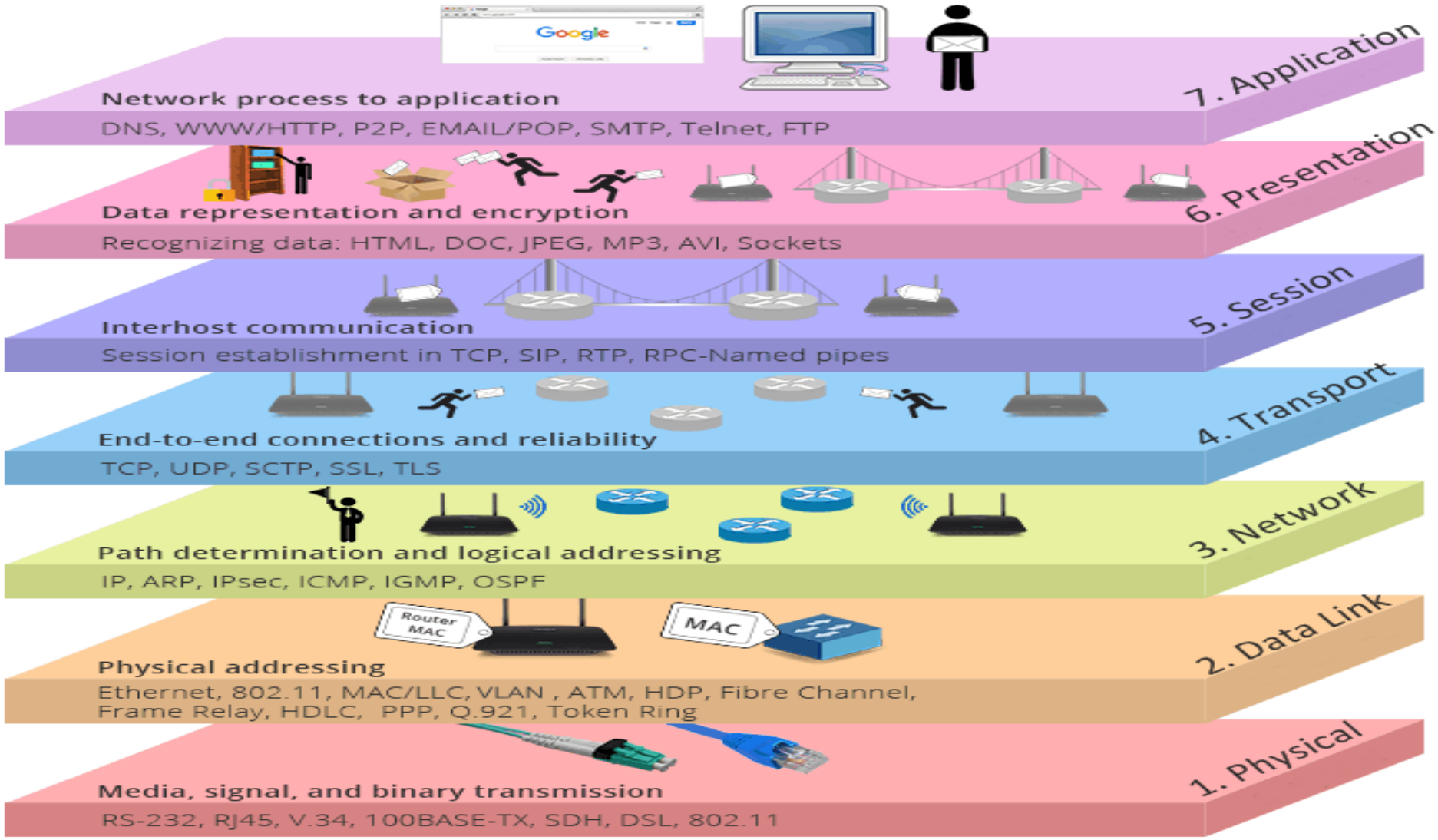
- The intercommunication between hosts in any computer network, be it a large-scale or a small-scale one is **built upon the premise** of various task-specific **layers**.

✓ يعتمد الاتصال المتبادل بين المضيفين في أي شبكة كمبيوتر، سواء كانت واسعة النطاق أو صغيرة النطاق، على فرضية وجود طبقات مختلفة خاصة بالمهام.

- Most **commonly** accepted and used **traditional** layered network models.
  - open systems interconnection (**OSI**) 7-layer model developed by the International Organization of Standardization (ISO).
  - Internet protocol suite (**TCP/IP**) 4-layer model.

Layered Network Models

- open systems interconnection (**OSI**)



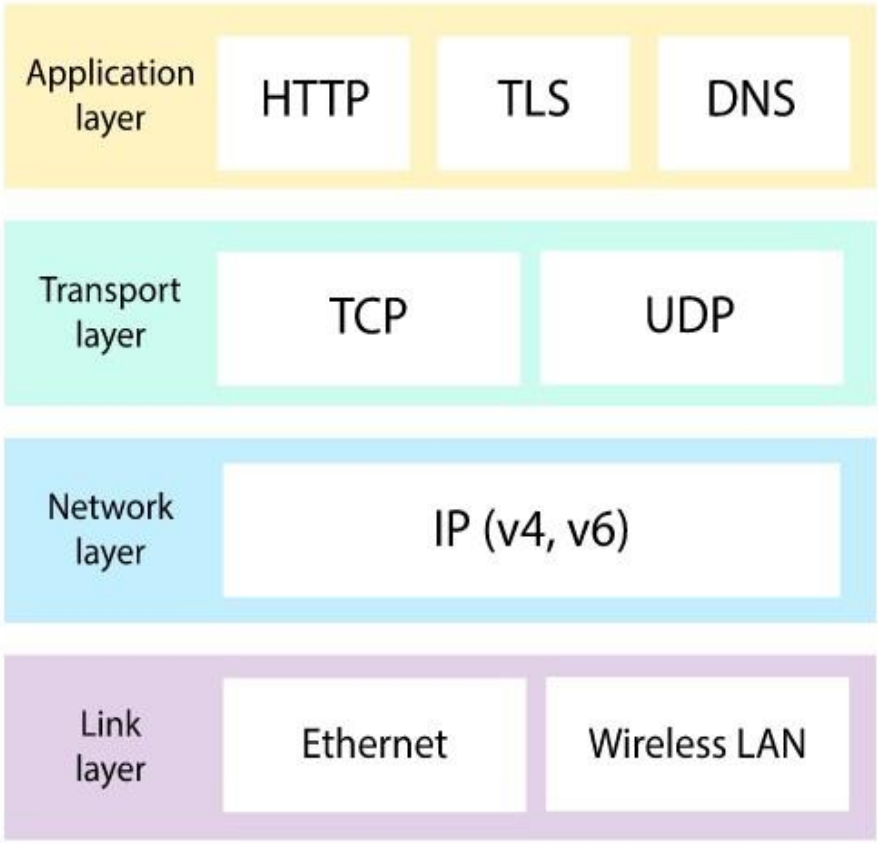
Layered Network Models

- **(ISO-OSI) reference model:**

1) **Application Layer**
2) **Presentation Layer**
3) **Session Layer**
4) **Transport Layer**
5) **Network Layer**
6) **Data Link Layer**
7) **Physical Layer**

Layered Network Models

- Internet protocol suite, transmission control protocol (TCP) and Internet protocol (IP), (**TCP/IP**).



Layered Network Models

- **Internet protocol suite (TCP/IP)**

1) **Application layer**
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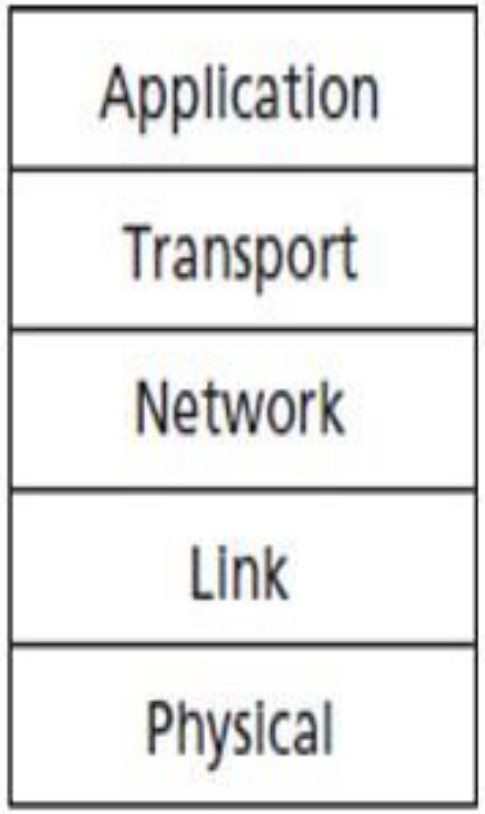

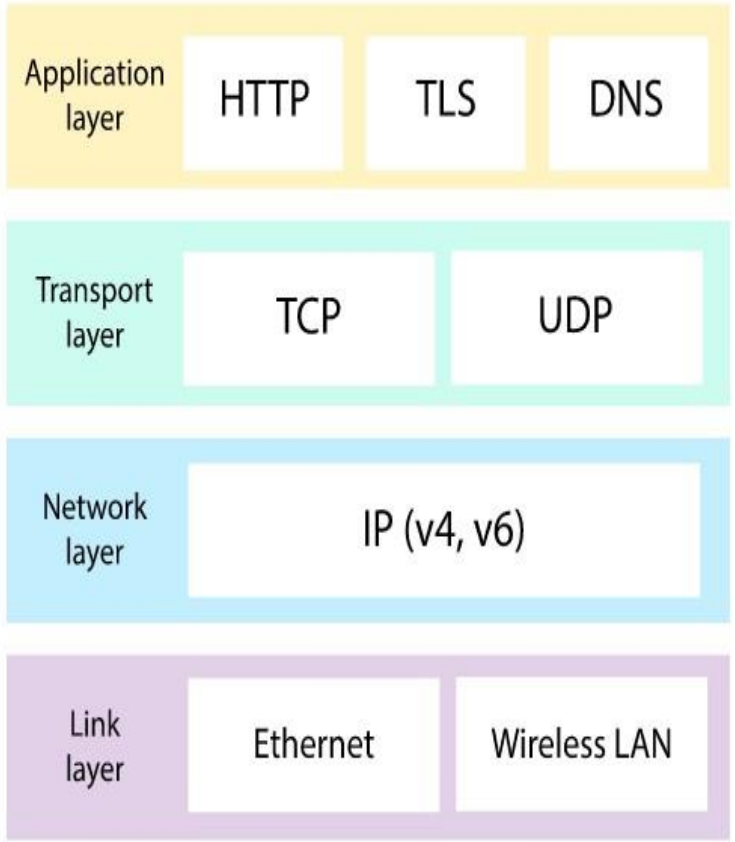

Layered Network Models

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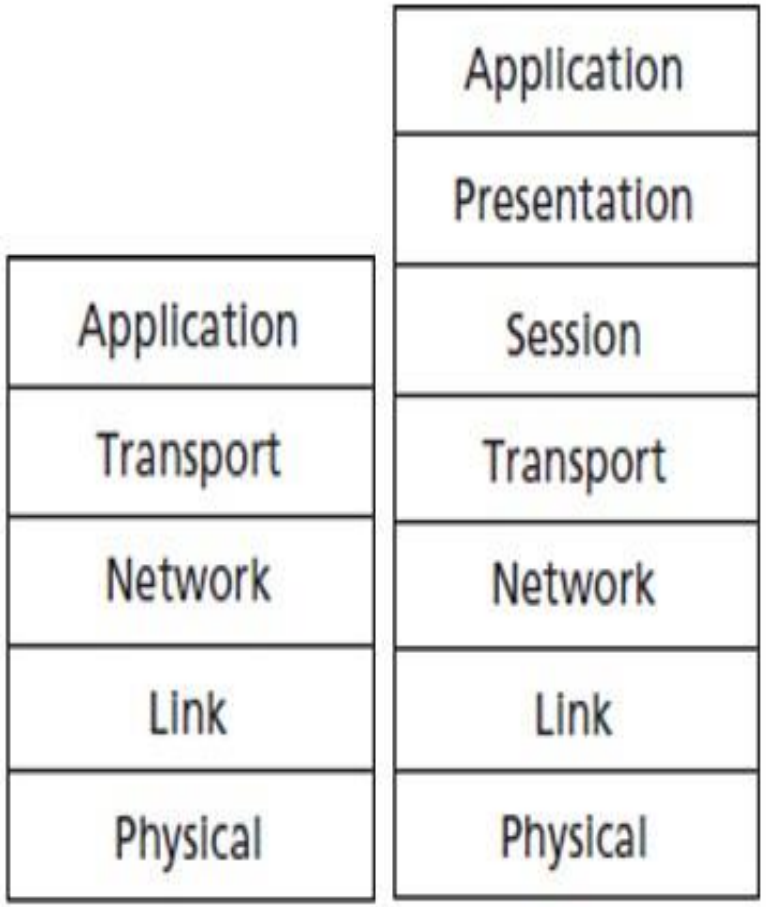

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Layered Network Models

- **(ISO-OSI) reference model**:

  It is a conceptual framework that **divides any networked communication system into seven layers**, each **performing specific tasks toward communicating with other systems**

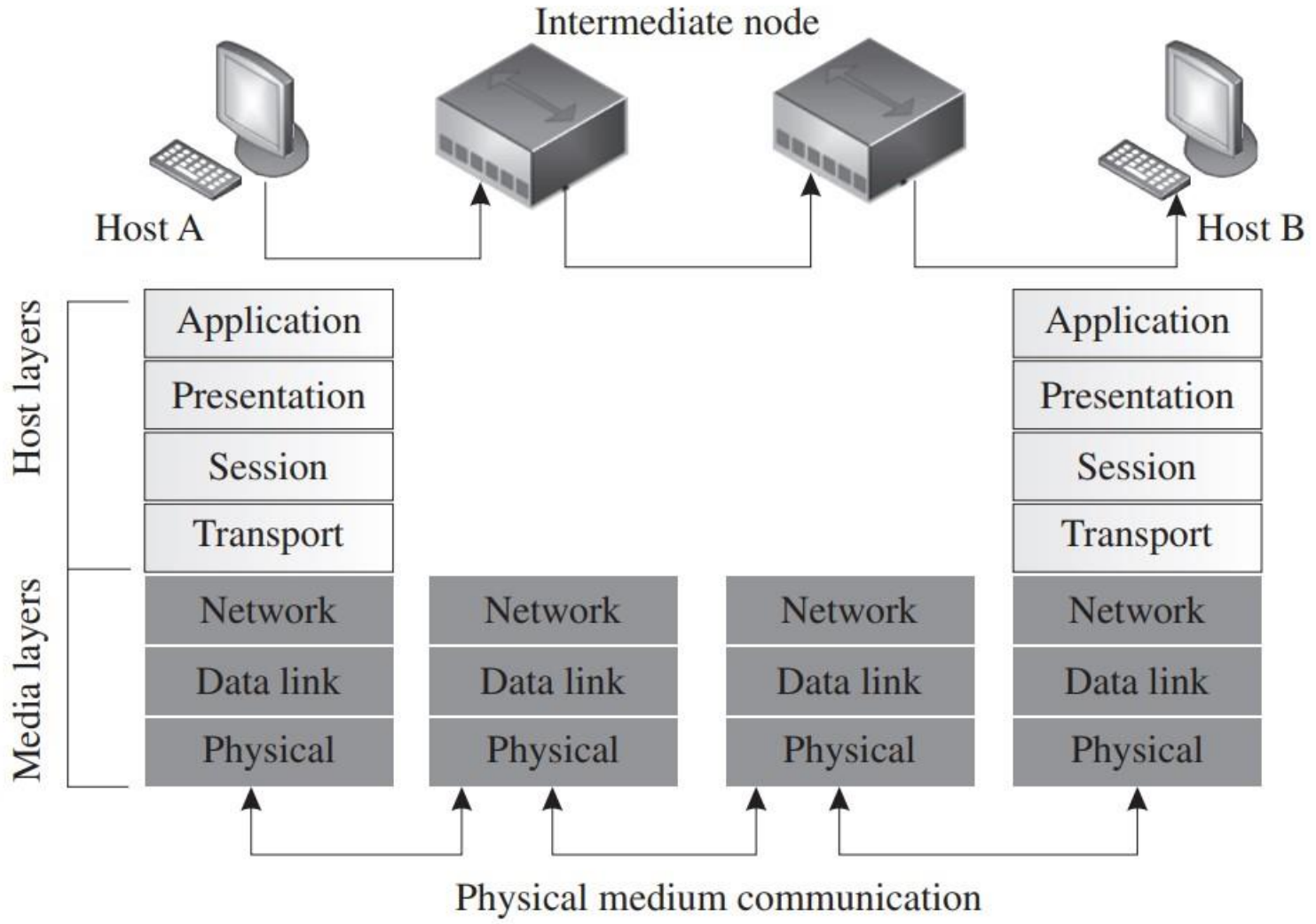
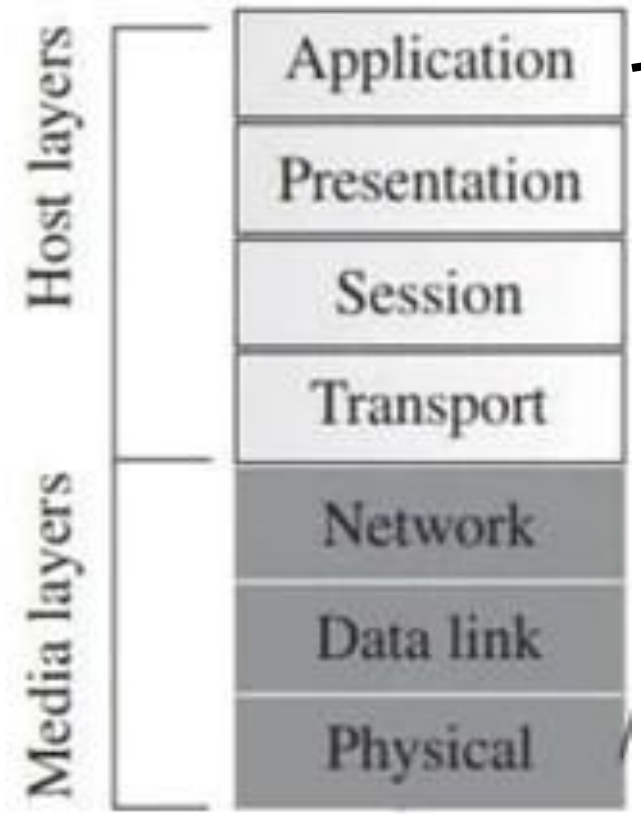


Figure: Networked communication between two hosts - OSI model

Layered Network Models

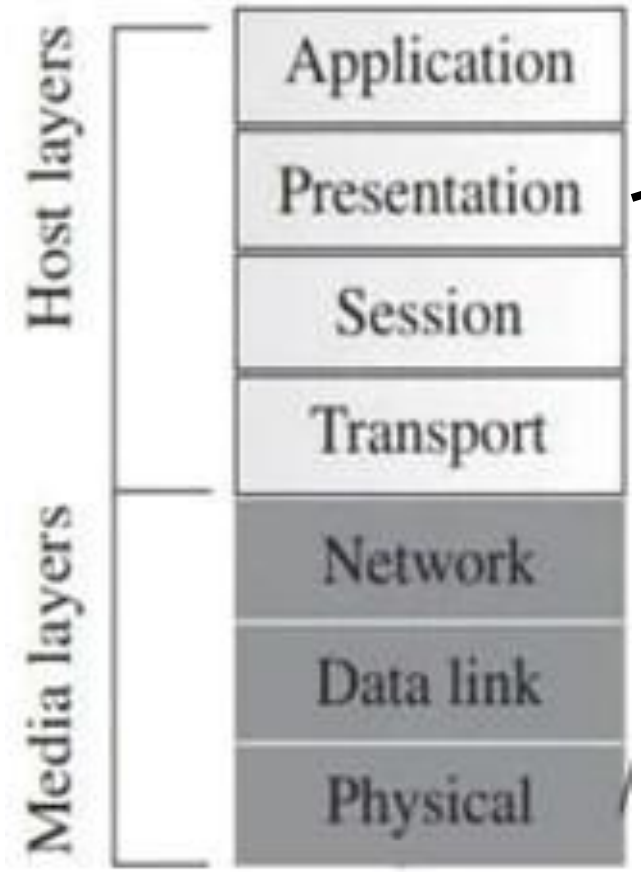
- **(ISO-OSI) reference model**:



- **Application Layer:**
  - **layer 7** of the OSI model & is a **host layer**.
  - It is select the protocol that support the action.
  - such as http for web search, file transfers, FTP (file transfer protocol) for download, SMTP for e-mails, and other such operations.
  - protocol data unit –**Data**.

Layered Network Models

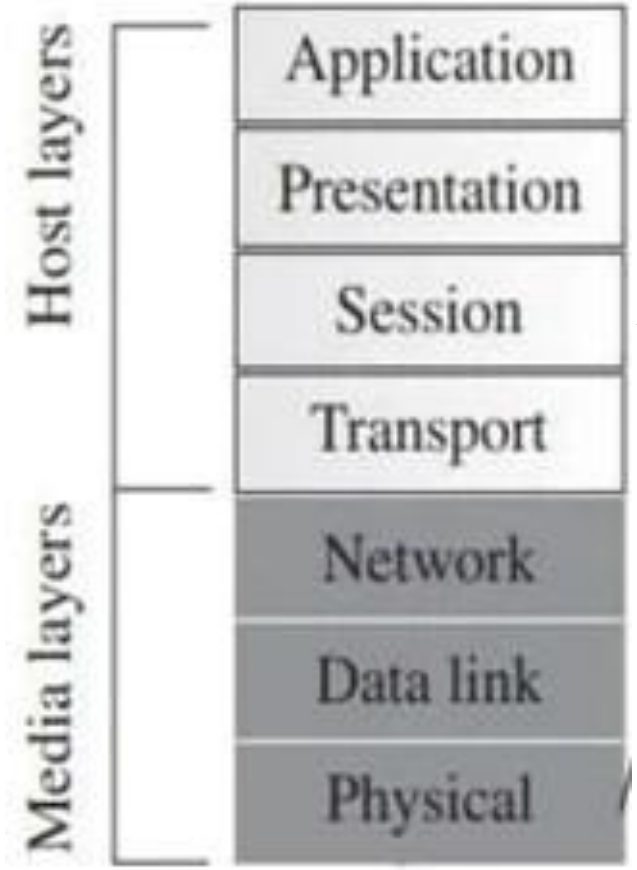
- **(ISO-OSI) reference model**:



- **Presentation Layer:**
  - **layer 6** of the OSI model & is a **host layer**.
  - Responsible for
    1- data format conversions / Translation (from high level language to binary system).
    2- Compression data.
    3- encryption tasks.
  - **syntactic compatibility** of the - also referred to as the **syntax layer**.
  - protocol data unit –**Data**.

Layered Network Models

- **(ISO-OSI) reference model**:

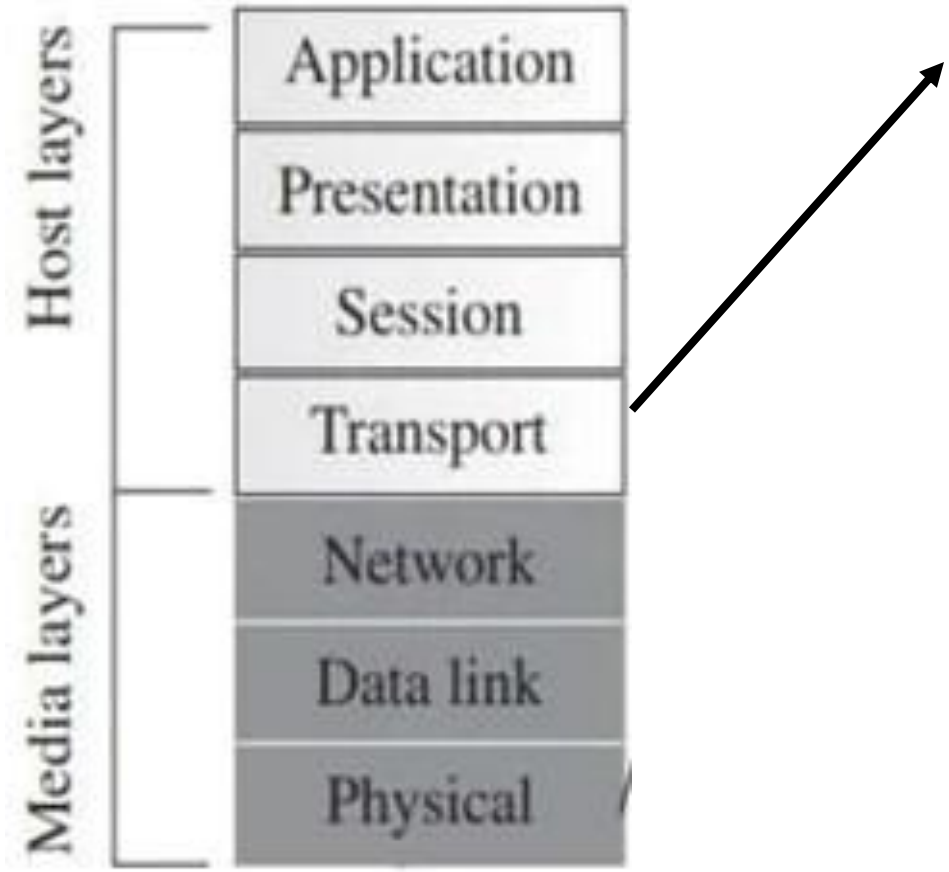


- **Session Layer:**
  - **layer 5** of the OSI model & is a **host layer.**
  - **Responsible** for
    1- transmission mode.
    - **Simplex mode.**
    - **Half-duplex.**
    - **Full-duplex mode.**

    2- Authentication (Ex. Password).
    3- Authorization.
    4- Session Management.
  - protocol data unit –**Data**.

Layered Network Models

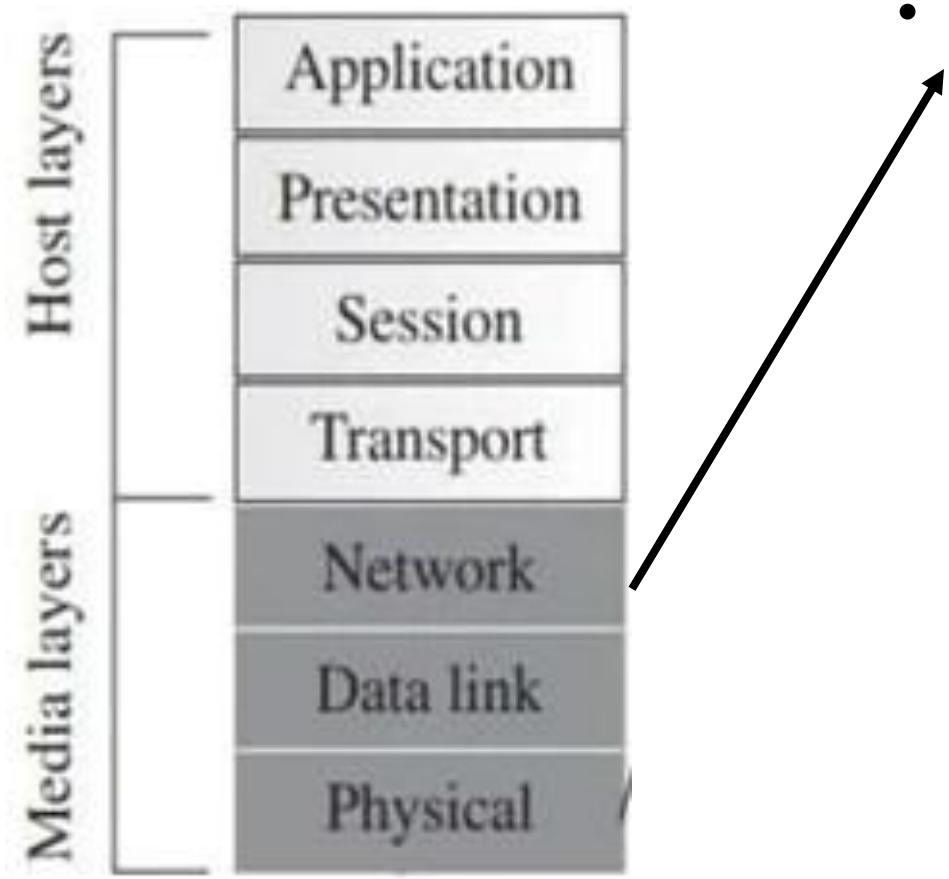
- **(ISO-OSI) reference model**:



- **Transport Layer:**
  - This is a **host layer** and is also referred to as **layer 4** of the OSI model.
  - achieve **transparent transfer** of data between hosts.
  - The transport layer is tasked with **end-to-end error recovery and flow control**.
  - keeping track of **acknowledgments** during variable-length data transfer.
  - **Determine protocol** (TCP or UDP).
  - The transport layer **ensures** that the **wrong data segment is re-sent** to the receiving host.
  - **Therefore, this layer is Responsible for**:
    1- Data transfer (transfer Data TO segment). ***Segmentation***
    2- Flow control (Transfer Rate).
    3- Determine Protocol (TCP Transmission Control Protocol *connection-oriented transmission* – UDP User Datagram Protocol *connection-**less** transmission***).***
  - protocol data unit – **Segment**.

Layered Network Models

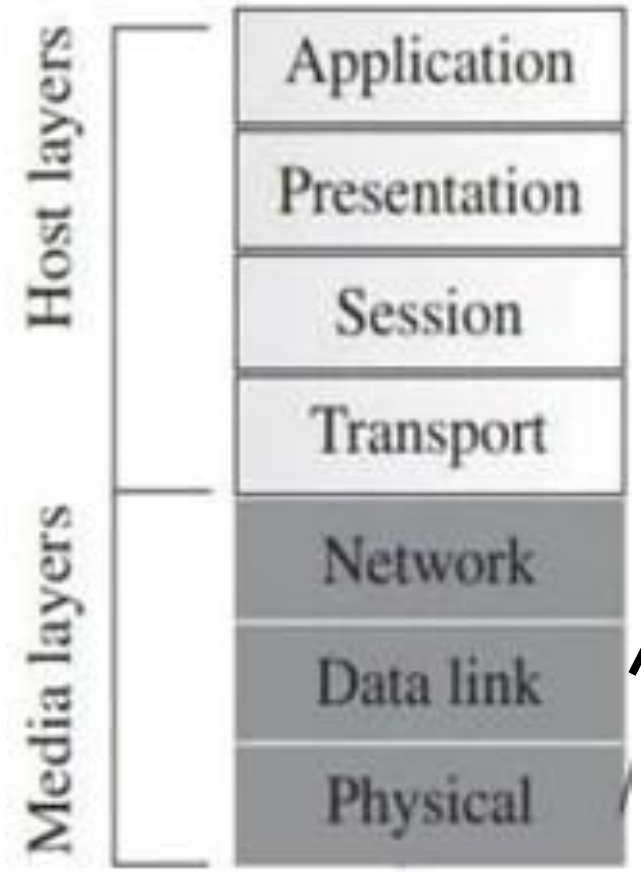
- **(ISO-OSI) reference model**:



- **Network Layer:**
  - This is a **media layer** and is also referred to as **layer 3** of the OSI model.
  - **Routing data** to various hosts connected to different networks through **logical paths** called **virtual circuits**.
  - These logical paths may pass through **other intermediate hosts (nodes)** before reaching the actual destination host.
  - The primary tasks of this layer include **addressing**, **sequencing of packets** **(add IP for Sender and Receiver)**, congestion control, and error handling.
  - **Therefore, this layer is Responsible for**:
    1- Logical Addressing (add IP to Data Segment for Sender and Receiver).
    2- Routing (routing data to the best road between the sender and receiver).
  - protocol data unit - **Packets**.

Layered Network Models

- **(ISO-OSI) reference model**:

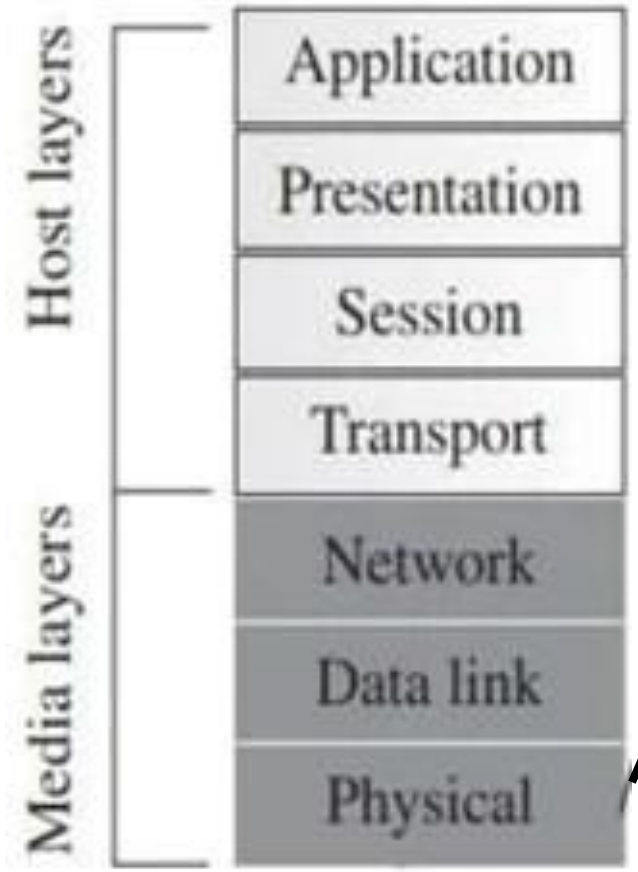


- **Data Link Layer:**
  - This is a **media layer** and is also referred to as **layer 2** of the OSI model.
  - mainly concerned with the **establishment** and **termination** of the **connection between two hosts**.
  - **detection** and **correction** of **errors** during communication between two or more connected hosts.
  - IEEE 802 divides into two sub-layers: Medium access control (**MAC**) and logical link control (**LLC**).
  - **MAC** is responsible for access control and permissions.
  - **LLC** is mainly tasked with error checking, flow control, and frame synchronization.
  - **Therefore, this layer is Responsible for**:
    1- Framing (Create Frame by adding MAC address to the Data Packet for Sender and Receiver, Which will create the header which will contain (MAC & IP) address, and add Trailer to the Frame).
    - **Frame Encapsulation** for sender.
    - **Frame Decapsulation** for receiver.

    2- Access to media for upper layers.
    3- Error Detection & Correction.
  - protocol data unit - **frame**.

Layered Network Models

- **(ISO-OSI) reference model**:



- **Physical Layer:**
  - This is a **media layer** and is also referred to as **layer 1** of the OSI model.
  - responsible for taking care of the electrical and mechanical operations.
  - deal with issues relating to **signal generation**, **signal transfer**, **voltages**, the **layout of cables**, **physical port layout,** and **signal loss**.
  - **responsible** for the **topological layout** of the network (star, mesh, bus, or ring), **communication mode** (simplex, duplex, full duplex), and **bit** rate control operations.
  - **Therefore, this layer is Responsible for**:
    1- Transferring Data Bits to signal (Transformed signal form depends on the data transmission media, Ex.:electric signal if the media is Ethernet cable, light pulses single if the media is A fiber-optic cable, and Radio signal if the media is wireless.).
  - The protocol **data unit associated** with this layer is referred to as a **symbol**.

Layered Network Models

- **Internet protocol suite (TCP/IP)**

1) **Application layer**
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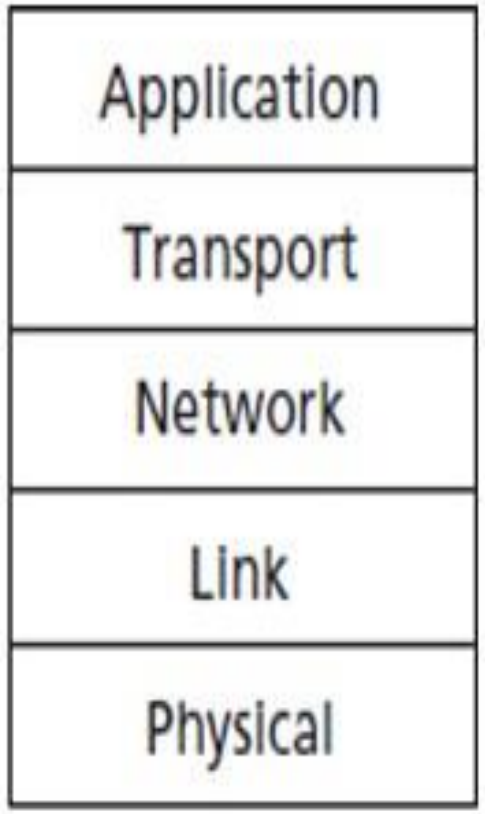
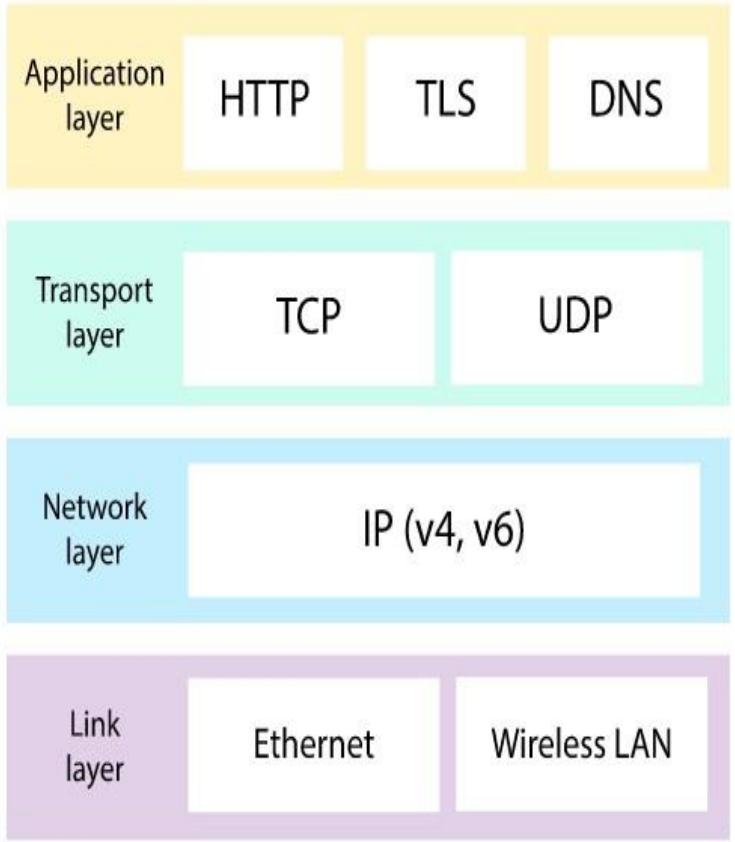


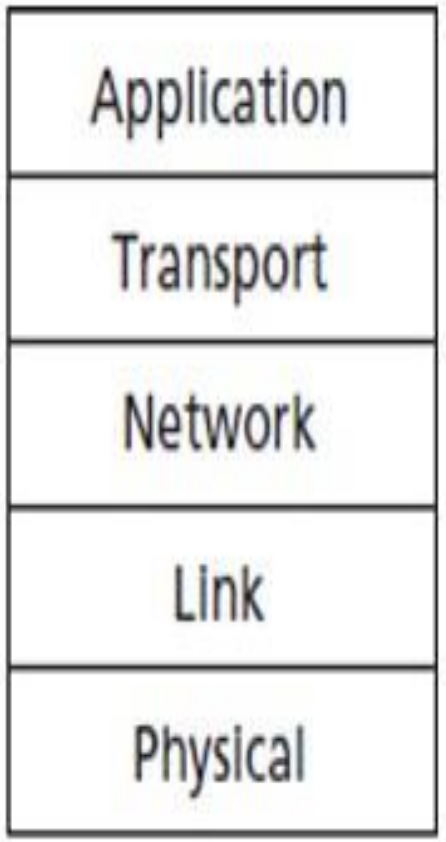


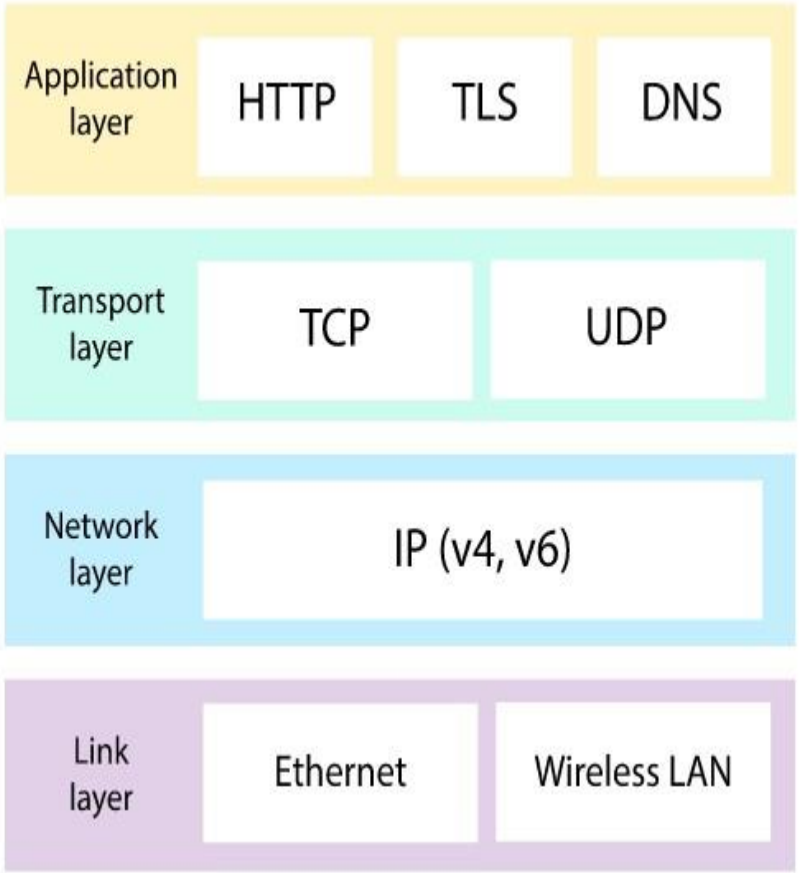
Layered Network Models

- **Internet protocol suite (TCP/IP)**

1) **Link layer.**

- The **first** and base **layer**.
- This layer is equivalent to the collective physical and data link layer of the OSI model.
- It enables the transmission of TCP/IP packets over the physical medium.
- Link layer is independent of the medium in use, frame format, and network access.
- Ethernet, wireless LAN, and the asynchronous transfer mode (ATM).



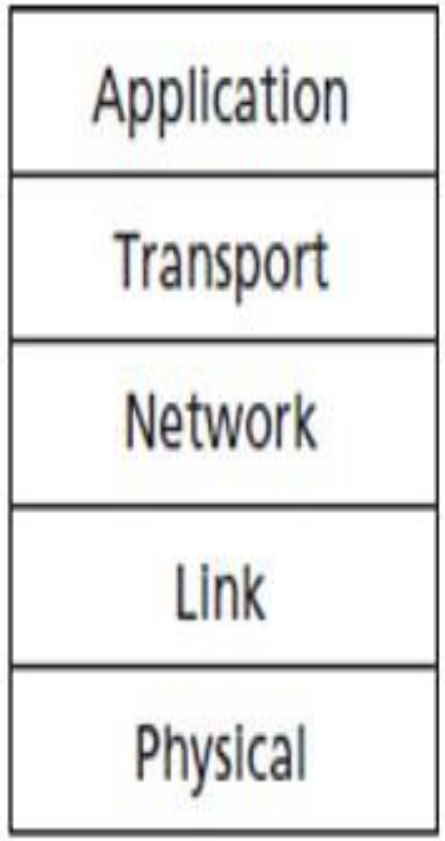


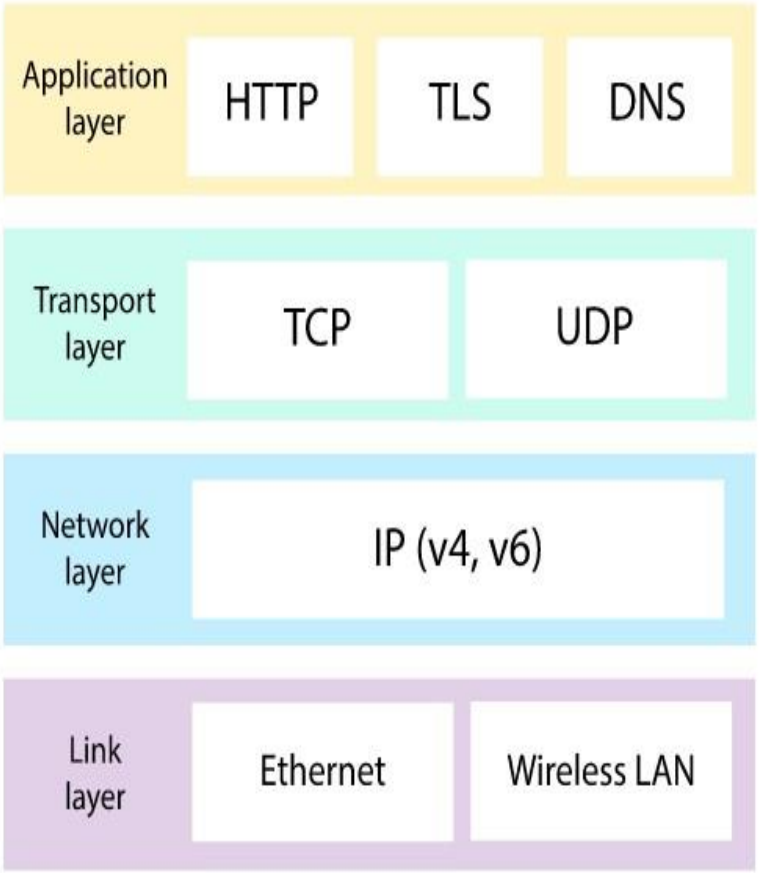
Layered Network Models

- **Internet protocol suite (TCP/IP)**

2) Internet layer:

- **Layer 2** of the TCP/IP protocol suite is somewhat equivalent to the network layer of the OSI model.
- It is responsible for addressing, address translation, data packaging, routing, and packet delivery tracking operations.
- Address resolution protocol (ARP), Internet protocol (IP), Internet control message protocol (ICMP), and Internet group management protocol (IGMP).



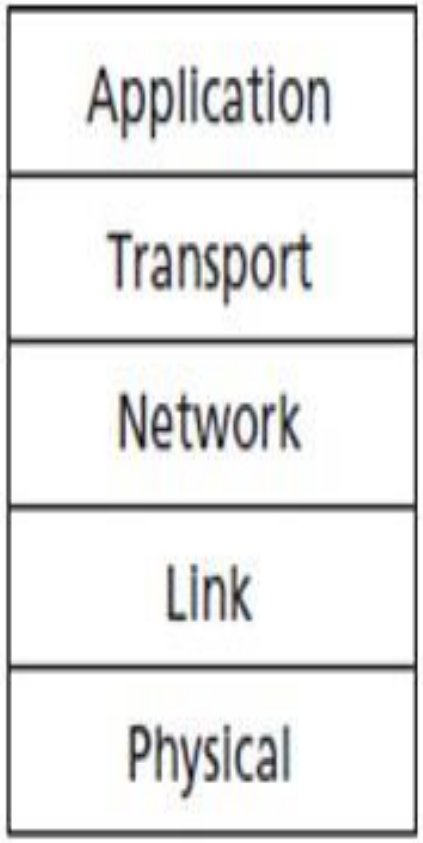


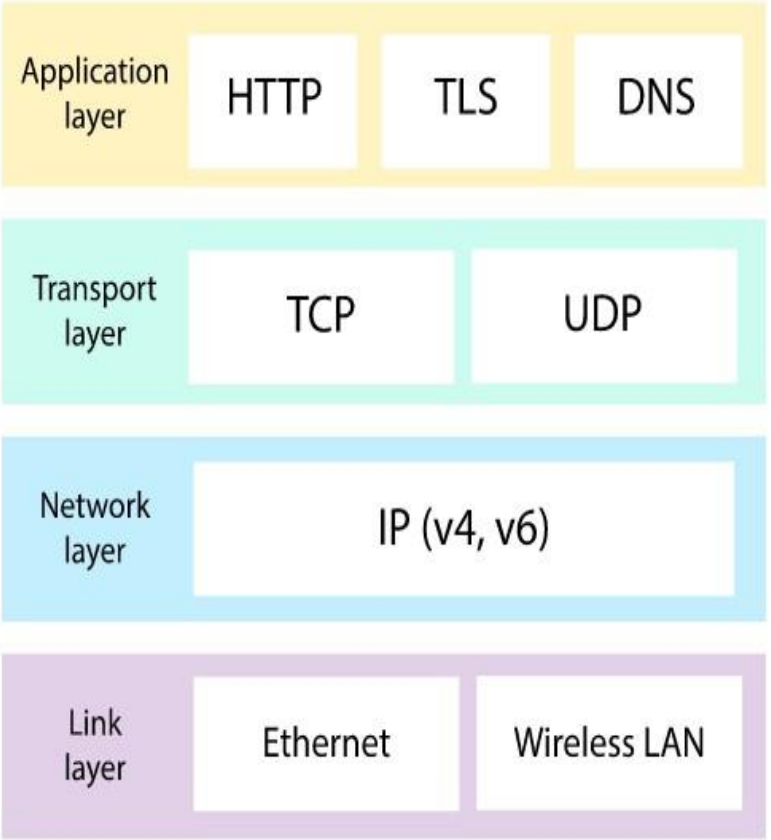
Layered Network Models

- **Internet protocol suite (TCP/IP)**

3) Transport layer:

- **Layer 3** of the TCP/IP protocol suite is functionally equivalent with the transport layer of the OSI model.
- **Tasked with** the functions of error control, flow control, congestion control, segmentation, and addressing in an **end-to-end manner**.
- Transmission control protocol (**TCP**) and user datagram protocol (**UDP**) are the core protocols.
- providing connection-oriented or connectionless services between two or more hosts or networked devices.



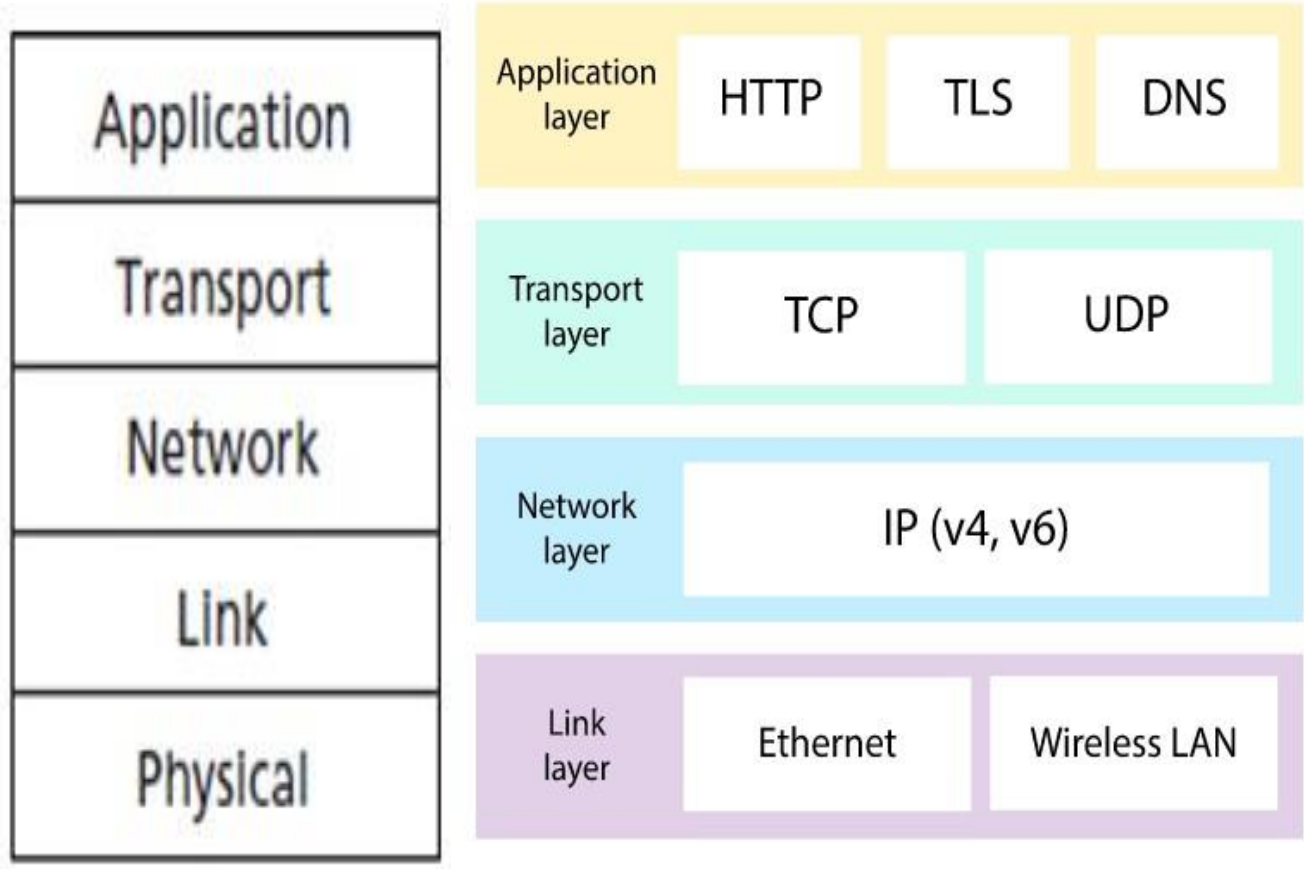


Layered Network Models

- **Internet protocol suite (TCP/IP)**

4) Application layer:

- **layer 4**, of the TCP/IP protocol suite equivalent with the collective functionalities of the OSI model's session, presentation, and application layers.
- This layer enables an end-user to access the services.
- Hypertext transfer protocol (HTTP), file transfer protocol (FTP), simple mail transfer protocol (SMTP), domain name system (DNS), routing information protocol (RIP)



Basics of Networking / Addressing

- Addressing in networked devices plays a critical role in ensuring the delivery of packets to the designated/intended receivers.
- Addressing mechanisms can be divided into two parts:

I. one focusing on **data link layer** address.

II. other focuses on **network layer** addressing.

Foundations of PROTOCOLS

❑ Definition of (PROTOCOLS)

- A protocol is a formal set of rules that govern the communication between devices on a network.

✓ البروتوكول هو مجموعة رسمية من القواعد التي تحكم الاتصال بين الأجهزة على الشبكة.

- A protocol defines the format and the order of messages exchanged between two or more communicating entities, as well as the actions taken on the transmission and/or receipt of a message or other event.

✓ يحدد البروتوكول تنسيق وترتيب الرسائل المتبادلة بين كيانين أو أكثر من الكيانات المتواصلة، بالإضافة إلى الإجراءات المتخذة عند إرسال و/أو استلام رسالة أو حدث آخر.

END OF LECTURE (1) PART B

Keep connected with the classroom

lmzcbsf

THANK YOU FOR YOUR ATTENTION