Ministry of Higher Education and Scientific Research

Al-Mustaqbal University

College Of Engineering & Technology

Computer Techniques Engineering Department

2023 -2024

Computer Networks Fundamentals

Lecture 5:

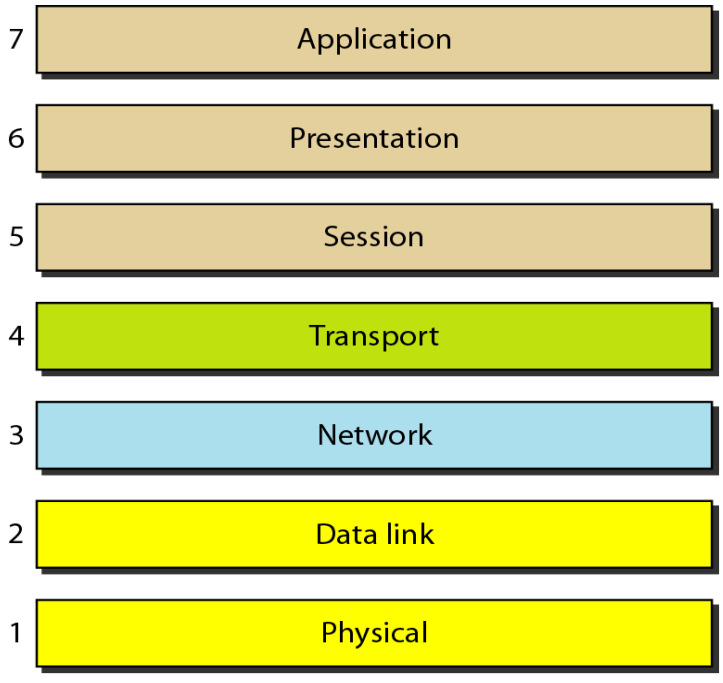
The OSI Model

The OSI Model

The International Standards Organization **(ISO)** is a multinational body dedicated to worldwide agreement on international standards (Established in 1947). An ISO standard that covers all aspects of network communications is the **O**pen **S**ystems **I**nterconnection **(OSI)** model. An ***open system*** is a set of protocols that allows any two different systems to communicate regardless of their underlying architecture. The **purpose of** the OSI model is to open communication between different systems without requiring, changes to the logic of the underlying hardware and software. The OSI is not a protocol, it is a model for understanding and designing a network architecture.

5.1- The Model

The Open Systems Interconnection model is a layered framework for the design of network system that allows for communication across all types of computer systems. It consists of *seven* separate but related layers, each of which defines a segment of the process of moving information across a network:



5.1.1- OSI Layered Architecture:

Each layer defines a family of functions distinct from those of the other layers. By defining and localizing functionality in this fashion, the designers created an architecture that is both comprehensive and flexible. Figure (2.1) shows the layers involved when a message sent from device **A** to device **B**. As the message travels from A to B, it may pass through many intermediate nodes. The intermediate nodes usually involve only the first three layers of the OSI model.

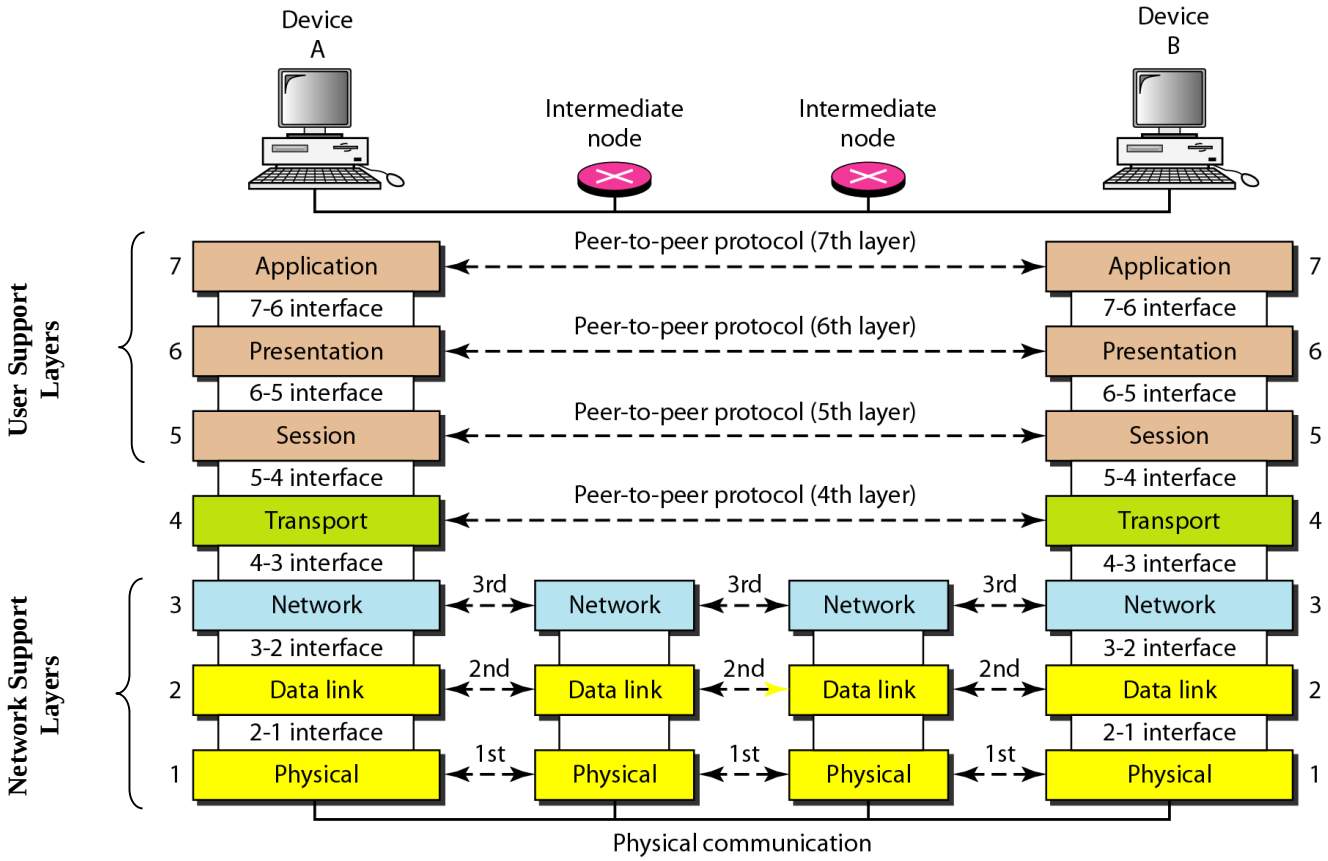


Figure (5.1) shows the layers involved when a message sent from device A to device B.

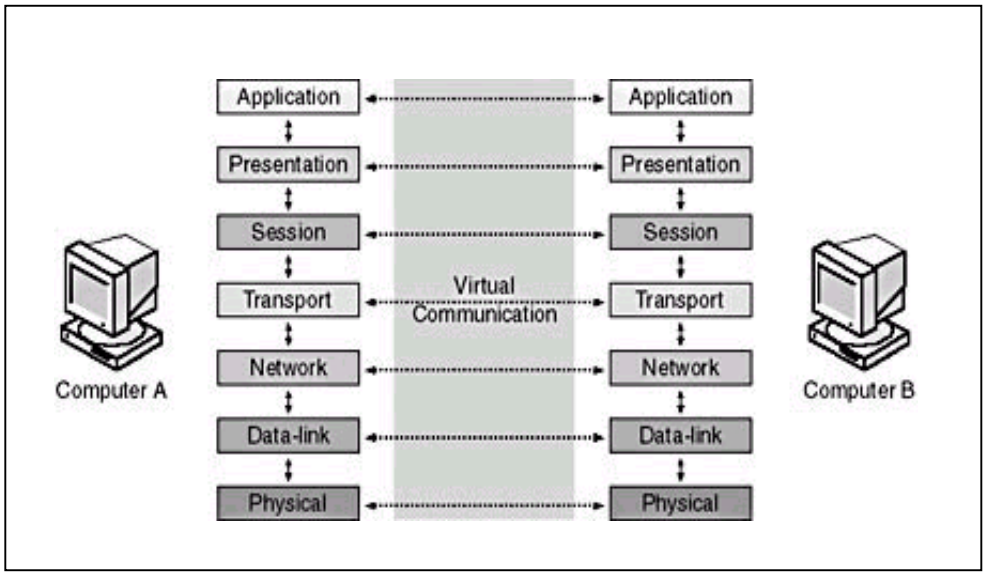
5.1.2- Interfaces between Layers

Within a single machine, the passing of the data and network information *down* through the layers of the sending machine and back *up* through the layers of the receiving machine is made possible

by an *interface* between each pair of adjacent layers. *Each interface defines what information and services a layer must provide for the layer above it*. Layer 3, for example, uses the services provided by layer 2 and provides services for layer 1

5.1.3- OSI Peer-to-Peer Processes

Between machines, layer *x* on one machine communicates with layer *x* on another machine. This communication is governed by an agreed upon series of rules and conventions called ***protocol.*** The processes on each machine that communicate at a given layer called ***peer-to-peer processes***. Each layer in the sending machine **adds** its own information to the message it receives from the layer just above it, and **passes** the whole package to the layer just below it. This information added in the form of ***headers*** or ***trailers*** (control data appended to the beginning or end of a data parcel).



5.1.4- Encapsulation and Protocol data unit (PDU)

As application data is passed down the protocol stack on its way to be transmitted across the

network media, various protocols add information to it at each level. This is commonly known as the encapsulation process.

The form that a piece of data takes at any layer is called a protocol data unit (PDU). During encapsulation, each succeeding layer encapsulates the PDU that it receives from the layer above in accordance with the protocol being used. At each stage of the process, a PDU has a different name to reflect its new functions.

- **Data -** The general term for the PDU used at the application layer
- **Segment -** Transport layer PDU
- **Packet -** Network layer PDU
- **Frame -** Data Link layer PDU
- **Bits -** A PDU used when physically transmitting data over the medium

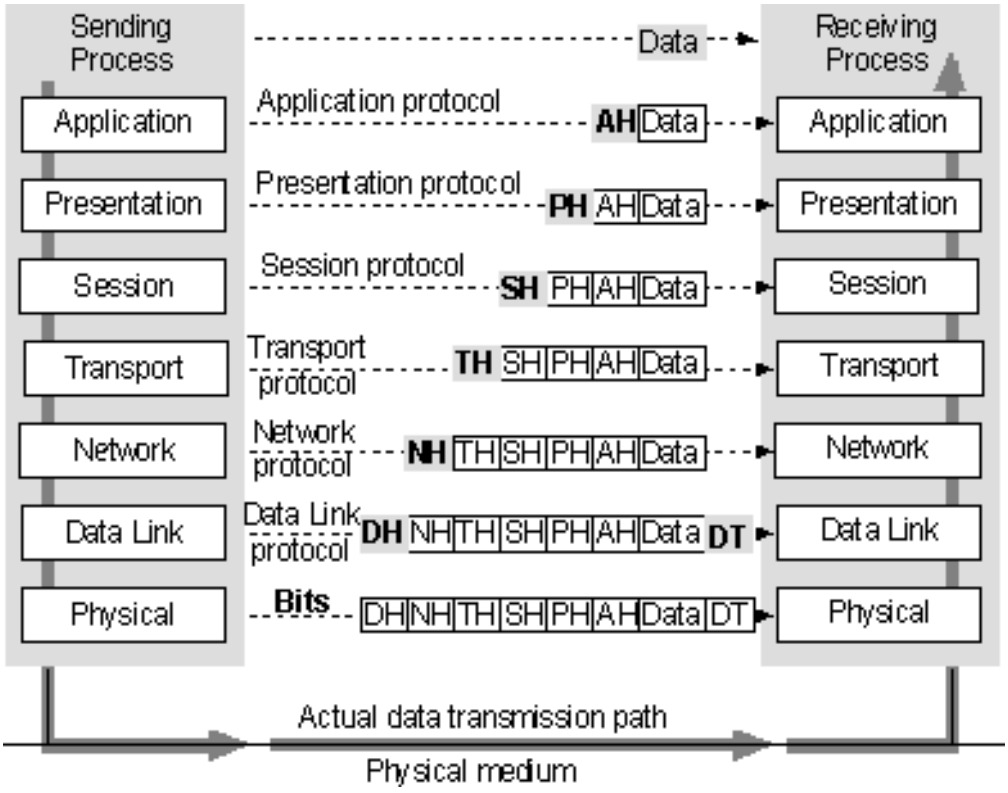


Figure (5.2): The encapsulation process

Figure (2.2), demonstrates the encapsulation process. The process starts at layer 7 (the application layer), then moves from layer to layer in descending, sequential order. At each layer, a header, or possibly a trailer, can be added to the data unit.
Commonly, the trailer is added only at layer 2. When the formatted data unit passes through the physical layer (layer 1), it is changed into an electromagnetic signal and transported along a physical link.

Upon reaching its destination, the signal passes into layer 1 and is transformed back into digital form. The data units then move back up through the OSI layers. As each block of data reaches the next higher layer, the headers and trailers attached to it at the corresponding sending layer are removed, and actions appropriate to that layer are taken. By the time it reaches layer 7, the message is again in a form appropriate to the application and is made available to the recipient.