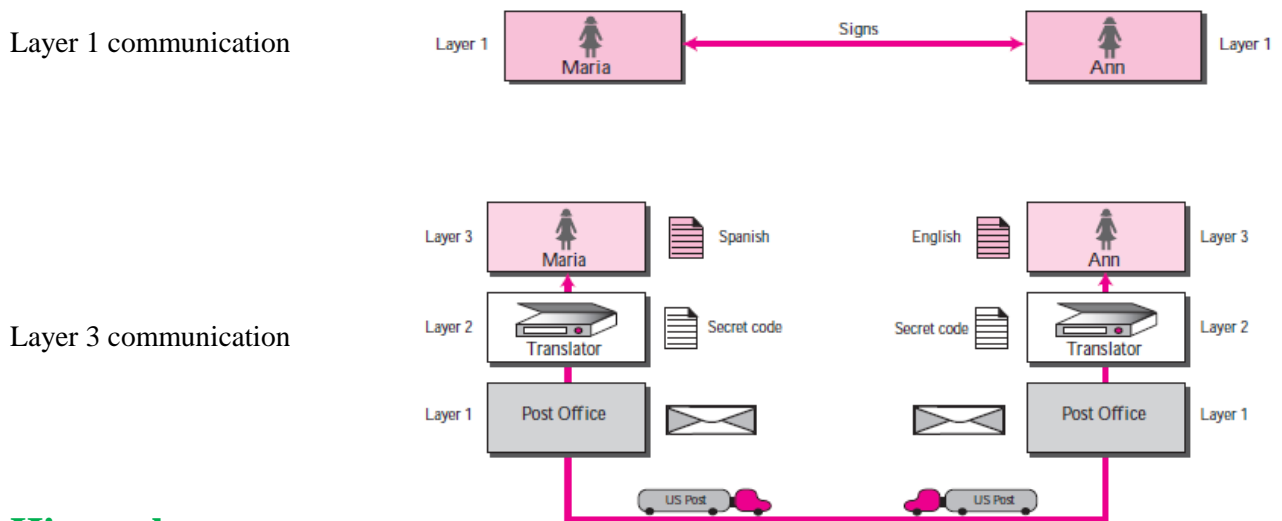


## The OSI Model and the TCP/IP Protocol Suite

- the OSI model was never fully implemented.
- The **TCP/IP protocol suite** became the dominant commercial architecture because it was used and tested extensively in the Internet.

### PROTOCOL LAYERS

The communication is not simple. we may divide the complex task of **communication** into several layers. In this case, we may need several protocols, one for each layer.



### Hierarchy

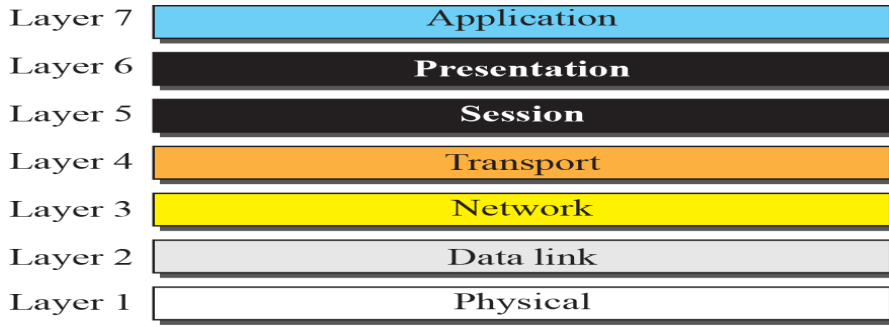
In a multilayer system, the tasks must be done in the order given in the hierarchy. At the sender site, for example, the letter must be written, translated to secret code, and dropped in the mailbox before being picked up by the letter carrier and delivered to the post office. At the receiver site, the letter must be dropped in the recipient mailbox before being picked up and read by the recipient.

### Services

Each layer at the sending site uses the services of the layer immediately below it. The sender at the higher layer uses the services of the middle layer. The middle layer uses the services of the lower layer. The lower layer uses the services of the carrier.

### THE OSI MODEL

- An ISO standard that covers all aspects of network communications is the *Open Systems Interconnection (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 show how to facilitate communication between different systems without requiring changes to the logic of the underlying hardware and software.
- The OSI model is a layered framework for the design of network systems that allows communication between all types of computer systems.

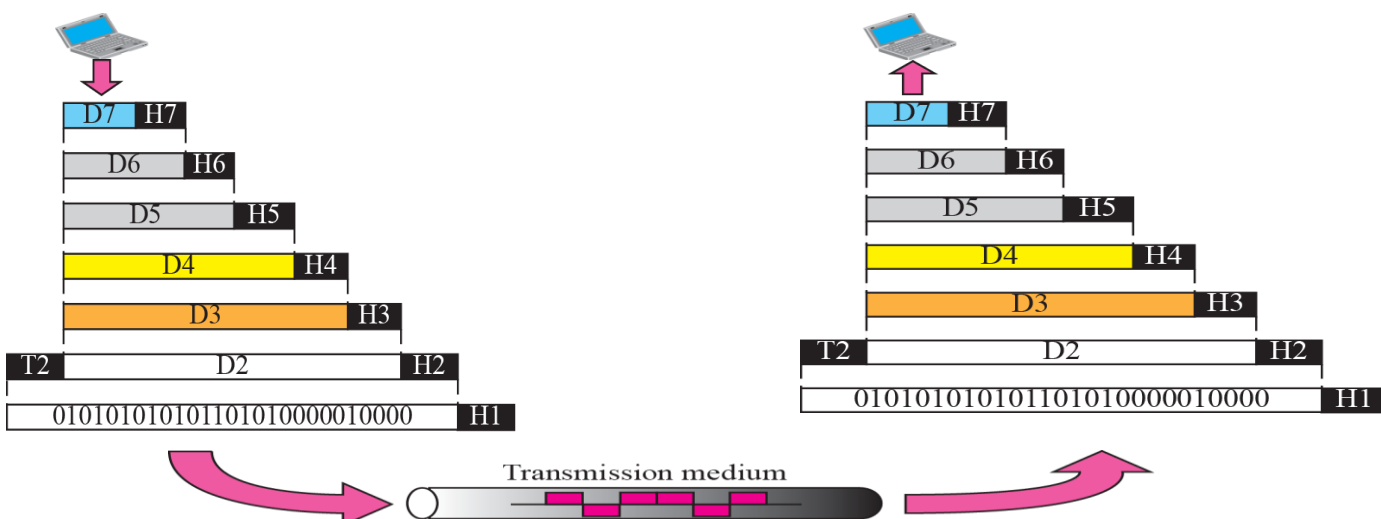
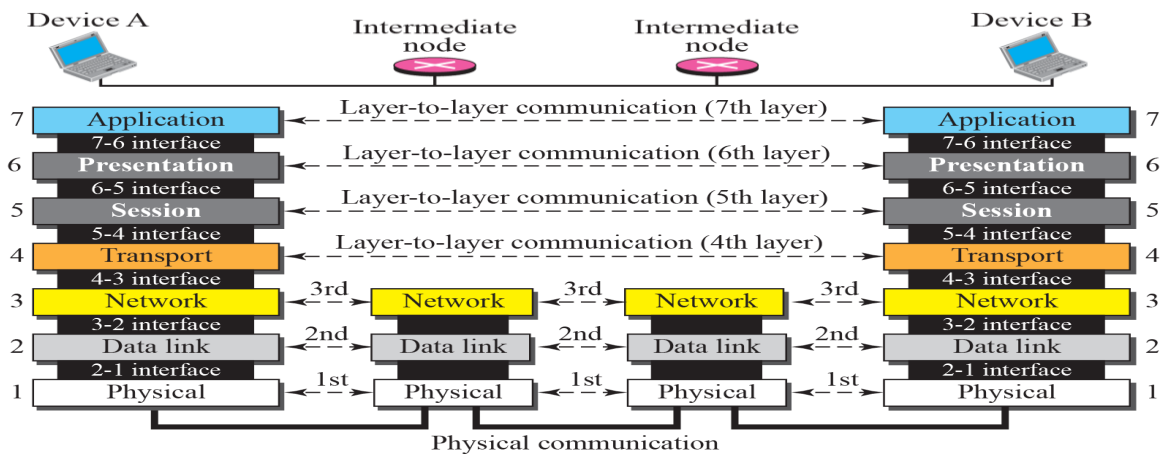


### Layer-to-Layer Communication

**Interfaces between Layers:** Each interface defines what information and services a layer must provide for the layer above it.

**Organization of the Layers:**

- :- network support layers: Layers 1, 2, and 3: they deal with the physical aspects of moving data from one device to another (such as electrical specifications, physical connections, physical addressing, and transport timing and reliability).
- :- user support layers: Layers 5, 6, and 7: they allow interoperability among unrelated software systems.
- :- Layer 4: links the two subgroups and ensures that what the lower layers have transmitted is in a form that the upper layers can use.
  - ❖ Upper layers are almost always implemented in software.
  - ❖ Lower layers are a combination of hardware and software, except for the physical layer, which is mostly hardware.



## Layers in the OSI Model :

### Application Layer

- ✓ The application layer enables the user, whether human or software, to access the network.
- ✓ Specific services provided by the application layer include the following:
  - ❑ Network virtual terminal
  - ❑ File transfer, access, and management (FTAM)
  - ❑ E-mail services.
  - ❑ Directory services.

### Presentation layer

- ✓ The presentation layer is concerned with the syntax and semantics of the information exchanged between two systems.
- ✓ Specific responsibilities of the presentation layer include the following:
  - Translation
  - Encryption
  - Compression

### Session layer

- ✓ The session layer is the network *dialog controller*.
- ✓ It establishes, maintains, and synchronizes the interaction between communicating systems.
- ✓ Specific responsibilities of the session layer include the following:
  - Dialog control
  - Synchronization (synchronization points)

### Transport layer

- ✓ The transport layer is responsible for process-to-process delivery of the entire message.
- ✓ It ensures that the whole message arrives intact and in order.
- ✓ Responsibilities of the transport layer include the following:
  - Service-point addressing.
  - Segmentation and reassembly.
  - Connection control (connectionless, connectionoriented)
  - Flow control.
  - Error control.

### Network layer

- ✓ The network layer is responsible for the source-to-destination delivery of a packet, possibly across multiple networks (links).
- ✓ If two systems are connected to the same link, there is usually no need for a network layer.
- ✓ Responsibilities of the network layer include the following:
  - Logical addressing.
  - Routing.

## data link layer

- ✓ The data link layer transforms the physical layer, a raw transmission facility, to a reliable link.
- ✓ It makes the physical layer appear error-free to the upper layer (network layer).
- ✓ Responsibilities of the data link layer include the following:
  - Framing.
  - Physical addressing.
  - Flow control.
  - Error control.
  - Access control.

## physical layer

- ✓ The physical layer coordinates the functions required to carry a bit stream over a physical medium.
- ✓ The physical layer is responsible for moving individual bits from one (node) to the next.
- ✓ The physical layer is concerned with the following:
  - Physical characteristics of interfaces and media
  - Representation of bits
  - Data rate
  - Synchronization of bits
  - Line configuration
  - Physical topology
  - Transmission mode.

### *Summary of OSI Layers*

Application	To allow access to network resources	7
Presentation	To translate, encrypt, and compress data	6
Session	To establish, manage, and terminate sessions	5
Transport	To provide reliable process-to-process message delivery and error recovery	4
Network	To move packets from source to destination; to provide internetworking	3
Data link	To organize bits into frames; to provide hop-to-hop delivery	2
Physical	To transmit bits over a medium; to provide mechanical and electrical specifications	1

**Q:** Why The application layer in the TCP/IP suite is the combination of three layers in the OSI model?

**Ans:** There are some reasons were mentioned for this decision.

- :- The TCP/IP protocol suite was developed prior to the OSI model.
- :- (TCP/IP has more than one transport-layer protocol). Some of the functionalities of the session layer are available in some of the transport layer protocols.
- :- (the application layer is not only one piece of software). If some of the functionalities mentioned in the session and presentation are needed for a particular application, it can be included in the development of that piece of software.

### Note:

- ❑ there is a main difference between the communication at the network layer and the communication at data link or physical layers. Communication at the network layer is end to end while the communication at the other two layers are node to node.
- ❑ There is a main difference between the transport layer and the network layer. Although all nodes in a network need to have the network layer, only the two end computers need to have the transport layer. The network layer is responsible for sending individual datagrams from computer A to computer B; the transport layer is responsible for delivering the whole message, which is called a segment, a user datagram, or a packet, from A to B.