

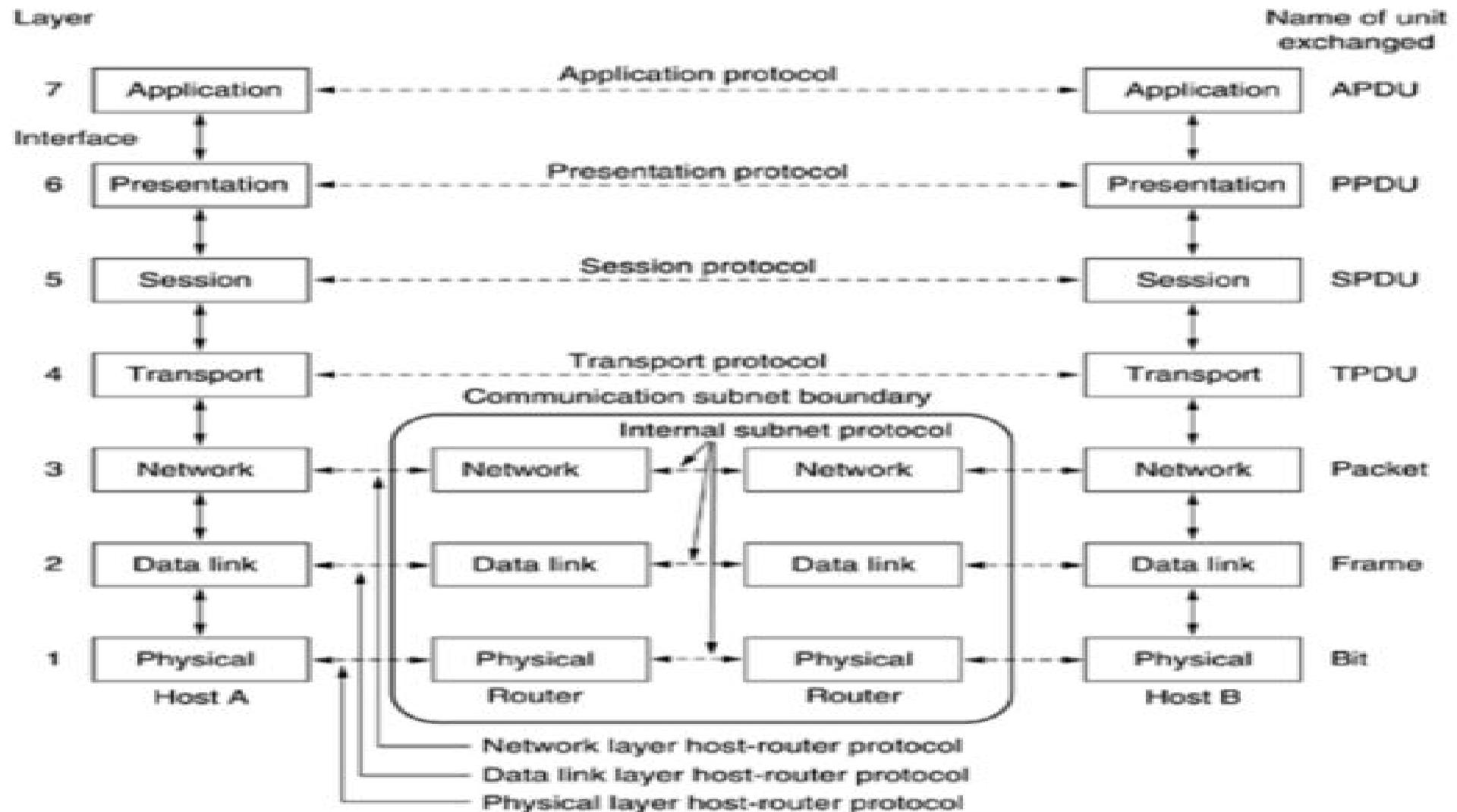
- **1 Reference Models**

- In the next two sections we will discuss two important network architectures, the OSI reference model and the TCP/IP reference model.

- **1.1 The 7 layer OSI Reference Model**

- The OSI model is based on a proposal developed by the International Standards Organization (ISO) as a first step toward international standardization of the protocols used in the various layers . It was revised in 1995 . The model is called the ISO OSI (Open Systems Interconnection) Reference Model because it deals with connecting open systems—that is, systems that are open for communication with other systems.

Figure 1-20. The OSI reference model.



- **The Physical Layer**

- The physical layer is concerned with transmitting raw bits over a communication channel.
- The physical layer deals with the physical connectivity of two different stations.
- It describes the physical characteristics of the medium being used whether transmission may proceed simultaneously in both directions, or one direction.
- The PL defines the voltage levels, how many volts should be used to represent a 1 and how many for a 0,

- **The Data Link Layer**

- The main task of Data link layer is to take a raw bits from the physical layer and it is transform into frame and transmit frames to the network layer.
- transmit the frames sequentially. If the service is reliable, the receiver confirms correct receipt of each frame by sending back an acknowledgement frame.
- The PL transmits a stream of bits without any structure and meaning. It is the responsibility of the DLL to create recognized frame boundaries by attaching the special bit patterns to binging and end of the frames.
- A noise burst on the line can destroy the frame in this case the DLL software on the source machine can retransmit the frame. If multiple retransmissions occurs it is the responsibility of DLL to solve the problem caused by damaged, lost and duplicates frames.

- Another issue that arise in DLL is how to keep a fast transmitter from a slow receiver. Some traffic regulation mechanism must be employed in order to known how much buffer space the receiver has at that moment.
- In case of broadcast network **medium access sub layer** a sublayer of data link layer provides the controlled access to the shared channel.
- **Error control** : It is the responsibility of DLL to control errors by making use of Error detection and correction.
- DLL has the two sublayers 1. Logic Link Control 2. Medium access sublayer.

- **The Network Layer**

- The network layer controls the operation of the **subnet**
- The main job of a **subnet** is to carry a message from one host machine to other host.
- The key design issue is to determine the route for packets to travel from source to destination. Two types of **routing**
- **1.static routing** : where the route is wired into the network and is rarely changes.
- **2.Dynamic routing** ,where the route is determined a new for each packet depending upon the network load.

- Congestion control is an important responsibility of NL.
- Congestion : when too many packets are present in the subnet performance degrades this situation is called Congestion.
- Factors for causing congestion:
 - slow processor can cause congestion
 - Low bandwidth line can also cause congestion

- **Transport Layer**
- The basic function of the transport layer is to accept data from above, split it up into smaller units if need be, pass these to the network layer, and ensure that the pieces all arrive correctly at the other end.
- The transport layer also determines what type of service to provide to the session layer, and, ultimately, to the users of the network.
- The most popular type of transport connection is an error-free point-to-point channel that delivers messages or bytes in the order in which they were sent
- Others include services with no guarantee about the order of messages and broadcasting.

- If the transport connection requires high throughput ,it creates multiple network connections dividing the data among the network connections.
- The transport layer might multiplex several transport connection on to the same network connections to reduce the cost.
- Another task of transport layer is flow control and error control.
- “quality of service is mainly purpose of the TL.
- Its primary duties are to transport and regulate the flow of information from source to destination reliably and accurately.

- **Session layer**
- The session layer allows users on different machines to establish sessions between them.
- Sessions offer various services, including **dialog control** (keeping track of whose turn it is to transmit), **token management** (preventing two parties from attempting the same critical operation at the same time), and **synchronization** (check pointing long transmissions to allow them to continue from where they were after a crash).

• **The Presentation Layer**

- the presentation layer is concerned with the syntax and semantics of the information transmitted.
- The presentation layer is concerned with the format and representation of data and if necessary ,this layer can translate between different data formats
- Data translation
- Data encryption
- Data compression

- **The Application Layer**

- The application layer contains a variety of protocols that are commonly needed by users.
 - One widely-used application protocol is HTTP (HyperText Transfer Protocol), which is the basis for the World Wide Web. When a browser wants a Web page, it sends the name of the page it wants to the server using HTTP. The server then sends the page back. Other application protocols are used for file transfer, electronic mail, and network news.

1.4.1 Five-Layer TCP/IP Protocol Model

The basic structure of communication networks is represented by the *Transmission Control Protocol/Internet Protocol* (TCP/IP) model. This model is structured in five layers. An end system, an intermediate network node, or each communicating user or program is equipped with devices to run all or some portions of these layers, depending on where the system operates. These five layers, shown in Figure 1.10, are as follows:

1. Physical layer
2. Link layer
3. Network layer
4. Transport layer
5. Application layer

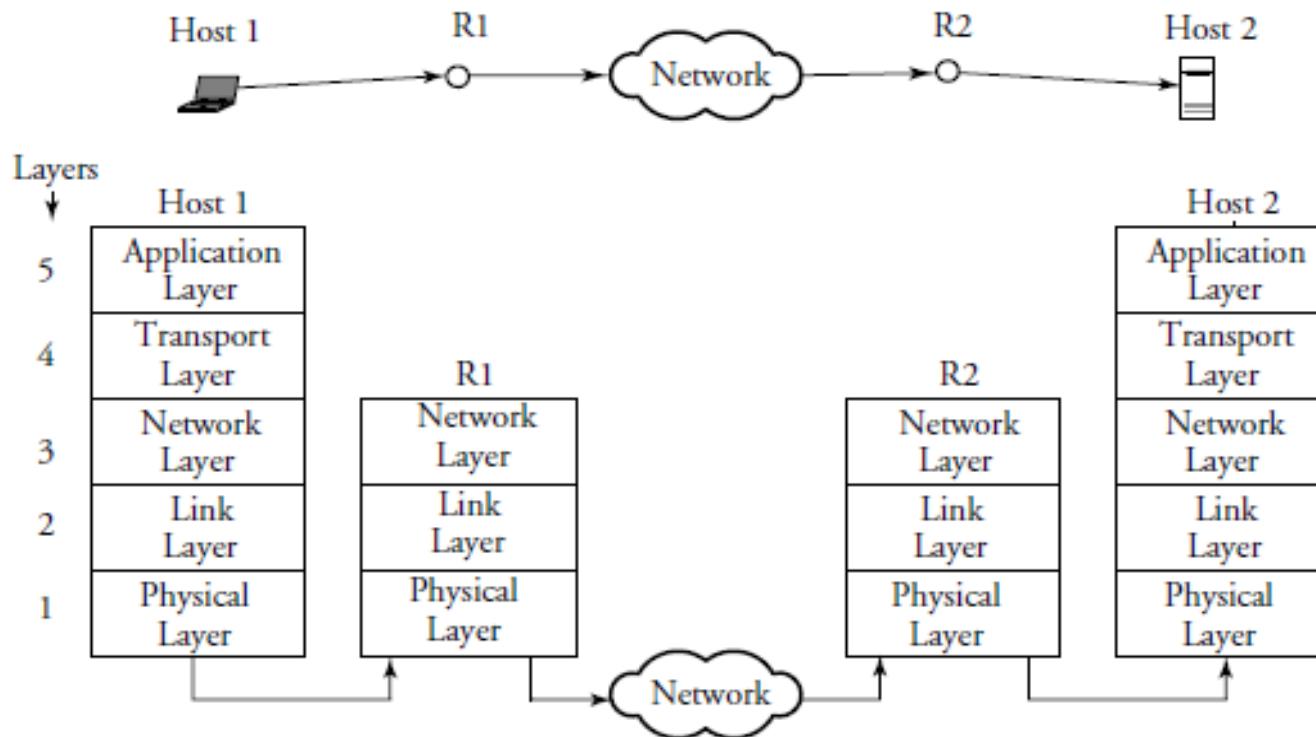


Figure 1.10 Hierarchy of the five-layer communication protocol model

• The TCP/IP Reference Model

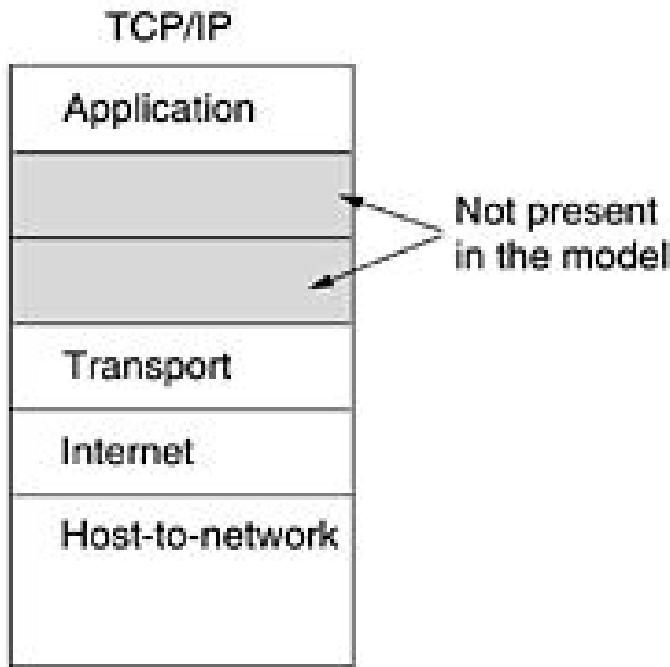
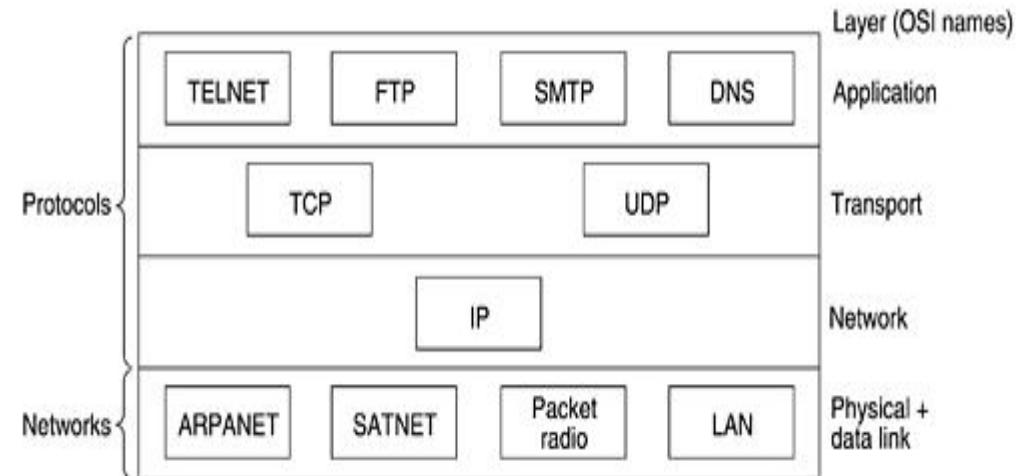


Figure 1-22. Protocols and networks in the TCP/IP model initially.



- **TCP/IP** model is practical model and is used in the Internet. TCP/IP is acronym of Transmission Control Protocol and Internet Protocol.
- The **TCP/IP** model combines the two layers (Physical and Data link layer) into one layer i.e. **Host-to-Network** layer.

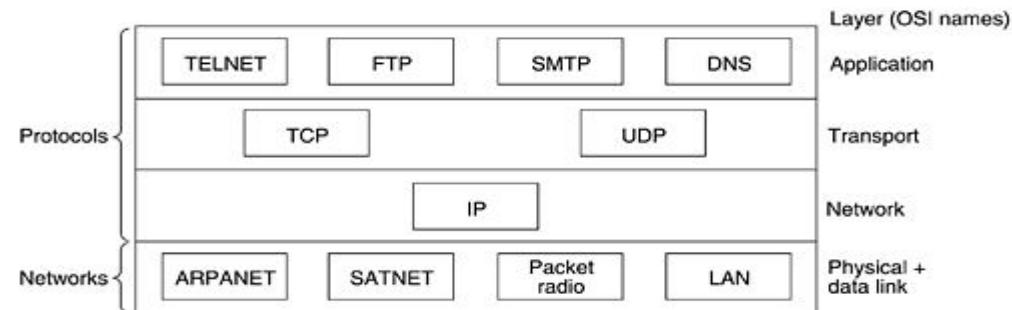
- **Application Layer**

- The TCP/IP specifications described a lot of applications that were at the top of the protocol stack. Some of them were TELNET, FTP, SMTP, DNS etc.
 1. TELNET is a two-way communication protocol which allows connecting to a remote machine and run applications on it.
 2. FTP(File Transfer Protocol) is a protocol, that allows File transfer among users connected over a network. It is reliable, simple and efficient.
 3. SMTP(Simple Mail Transport Protocol) is a protocol, which is used to transport electronic mail between a source and destination, directed via a route.
 4. DNS(Domain Name Server) resolves an IP address into a textual address for Hosts connected over a network.

- **Transport Layer**
- The layer above the internet layer in the TCP/IP model is now usually called the transport layer.
- Two end-to-end transport protocols have been defined here.
- The first one, TCP (Transmission Control Protocol), is a reliable connection-oriented protocol that allows a byte stream originating on one machine to be delivered without error on any other machine in the internet.
- It fragments the incoming byte stream into discrete messages and passes each one on to the internet layer.
- At the destination, the receiving TCP process reassembles the received messages into the output stream.
- TCP also handles flow control to make sure a fast sender cannot swamp a slow receiver with more messages than it can handle.

- The second protocol in this layer, UDP (User Datagram Protocol), is an unreliable, connectionless protocol for applications that do not want TCP's sequencing or flow control and wish to provide their own.
- The relation of IP, TCP, and UDP is shown in [Fig. 1-22](#). Since the model was developed IP has been implemented on many

Figure 1-22. Protocols and networks in the TCP/IP model initially.



- **The Internet Layer**

- All these requirements led to the choice of a packet-switching network based on a connectionless internetwork layer. This layer, called the internet layer
- Its job is to permit hosts to inject packets into any network and have them travel independently to the destination (potentially on a different network).
- They may even arrive in a different order than they were sent, in which case it is the job of higher layers to rearrange them, if in-order delivery is desired.

- The internet layer defines an official packet format and protocol called IP (Internet Protocol).
- The job of the internet layer is to deliver IP packets where they are supposed to go.
- Packet routing is clearly the major issue here, as is avoiding congestion