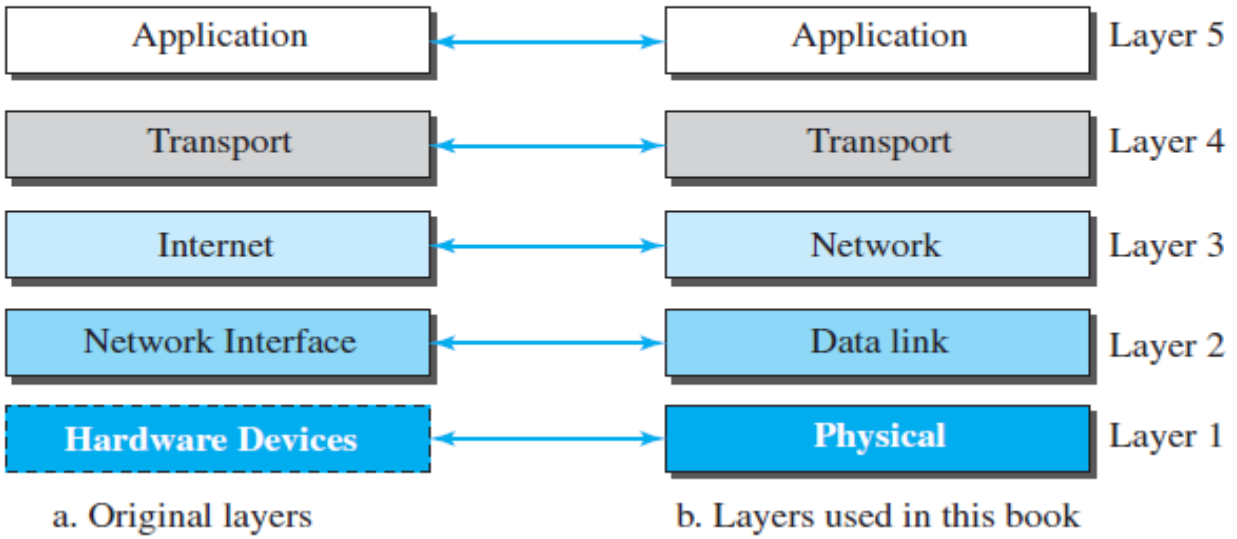
Network Models

2.2 TCP/IP PROTOCOL SUITE

- **TCP/IP (Transmission Control Protocol/Internet Protocol)** is a hierarchical protocol made up of interactive modules, each of which provides a specific functionality.

Figure 2.4 *Layers in the TCP/IP protocol suite*



Physical Layer

- physical layer is responsible for carrying individual bits in a frame across the link.
- lowest level in the TCP/IP protocol suite
- Two devices are connected by a transmission medium (cable or air).
- transmission medium carries electrical or optical signals.
- logical unit between two physical layers in two devices is a **bit**.

Data-link Layer

- when the next link to travel is determined by the router, the data-link layer is responsible for taking the datagram and moving it across the link.
- The data-link layer takes a datagram and encapsulates it in a packet called a frame.
- It provide complete error detection and correction

Network Layer

- network layer is responsible for host-to-host communication and routing the packet through possible routes.
- The network layer in the Internet includes the main protocol, Internet Protocol (IP).
- IP is a connectionless protocol that provides no flow control, no error control, and no congestion control services.
- A routing protocol does not take part in routing (it is the responsibility of IP), but it creates forwarding tables for routers to help them in the routing process.

Continue…

- The Internet Control Message Protocol (**ICMP**) helps IP to report some problems when routing a packet.
- The Internet Group Management Protocol (**IGMP**) helps IP in multitasking.
- The Dynamic Host Configuration Protocol (**DHCP**) helps IP to get the network-layer address for a host.
- The Address Resolution Protocol (**ARP**) is a protocol that helps IP to find the link-layer address of a host or a router when its network-layer address is given.

Transport Layer

- The transport layer at the source host gets the message from the application layer, encapsulates it in a transport layer packet (called a segment or a user datagram) and sends it, to the transport layer at the destination host.

Continue…

- Transmission Control Protocol (TCP), is a connection-oriented protocol that first establishes a logical connection between transport layers at two hosts before transferring data.
- TCP provides flow control, error control and congestion control
- User Datagram Protocol (UDP), is a connectionless protocol that transmits user datagrams without first creating a logical connection.
- UDP does not provide flow, error, or congestion control.

Application Layer

- Communication at the application layer is between two processes (two programs running at this layer).
- Hypertext Transfer Protocol (HTTP) to access the World Wide Web (WWW).
- The Simple Mail Transfer Protocol (SMTP) is the main protocol used in electronic mail (e-mail) service.
- The File Transfer Protocol (FTP) is used for transferring files from one host to another.

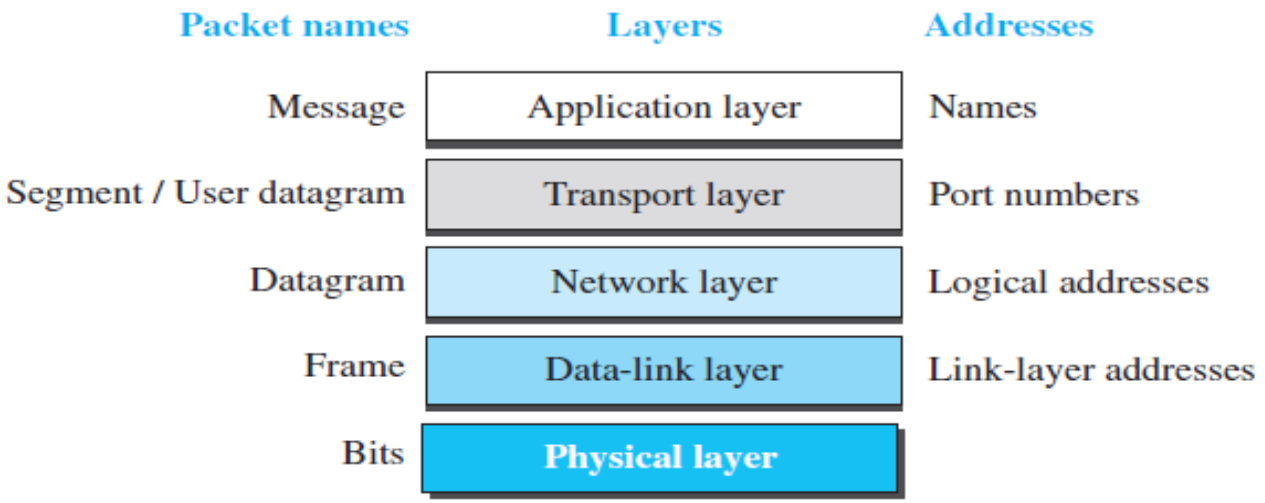
Continue…

- The Terminal Network (TELNET) and Secure Shell (SSH) are used for accessing a site remotely.
- The Simple Network Management Protocol (SNMP) is used by an administrator to manage the Internet at global and local levels.
- The Domain Name System (DNS) is used by other protocols to find the network-layer address of a computer.

Addressing

- Any communication that involves two parties needs two addresses: source address and destination address.

Figure 2.9 *Addressing in the TCP/IP protocol suite*

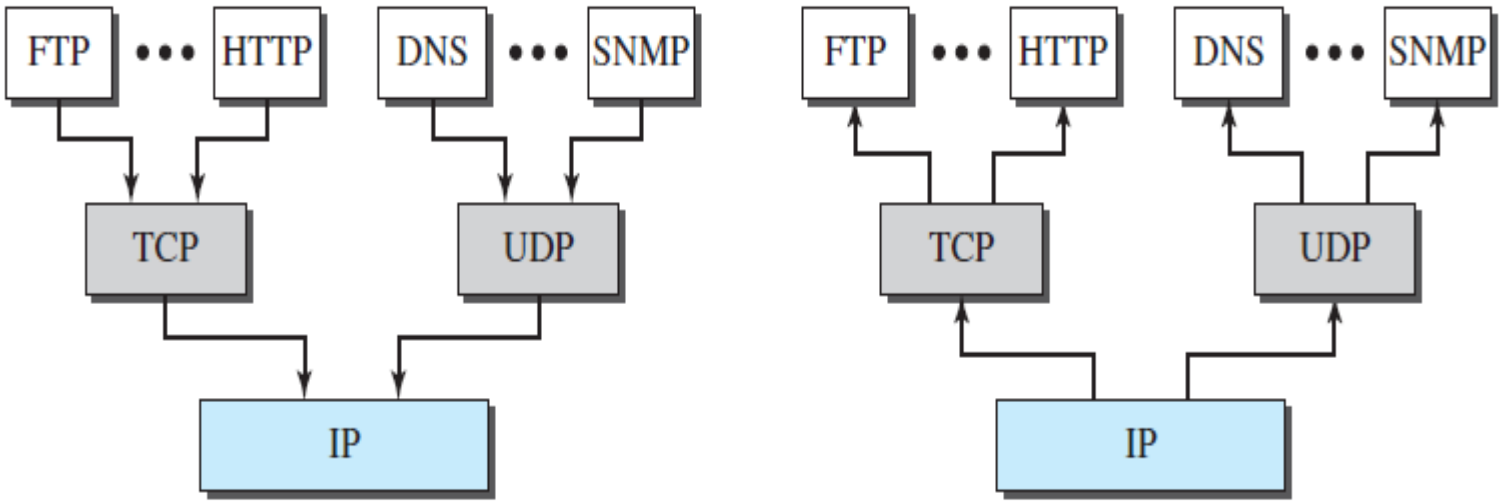


Multiplexing and Demultiplexing

- **Multiplexing** in this case means that a protocol at a layer can encapsulate a packet from several next-higher layer protocols (one at a time).
- **Demultiplexing** means that a protocol can decapsulate and deliver a packet to several next-higher layer protocols (one at a time).

Continue…

Figure 2.10 *Multiplexing and demultiplexing*



a. Multiplexing at source

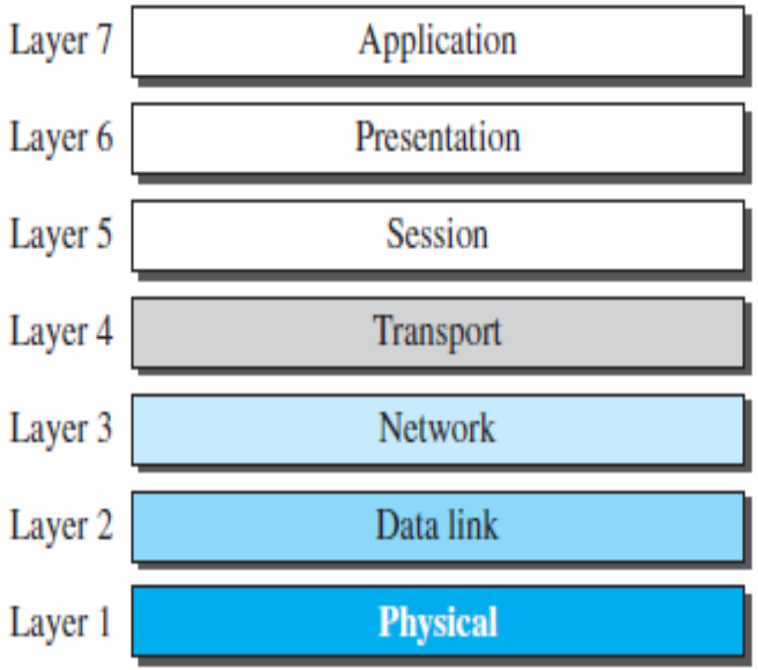
b. Demultiplexing at destination

THE OSI MODEL

- An ISO standard that covers all aspects of network communications is the **Open Systems Interconnection (OSI) model. It was first introduced in the late 1970s.**
- 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.

OSI

Figure 2.11 *The OSI model*



Continue…

Presentation Layer

- The presentation layer prepares data for the application layer. It defines how two devices should encode, encrypt, and compress data so it is received correctly on the other end. The presentation layer takes any data transmitted by the application layer and prepares it for transmission over the session layer.

Session Layer

- The session layer creates communication channels, called sessions, between devices. It is responsible for opening sessions, ensuring they remain open and functional while data is being transferred, and closing them when communication ends. The session layer can also set checkpoints during a data transfer—if the session is interrupted, devices can resume data transfer from the last checkpoint.

Reference:

- Data Communications and Networking, Behrouz A. Forouzan, Fifth Edition, TMH, 2013.