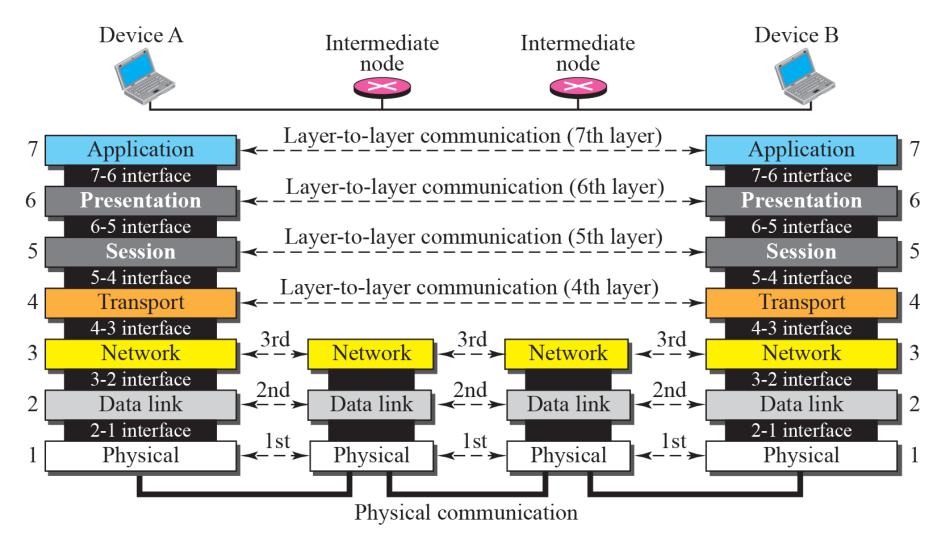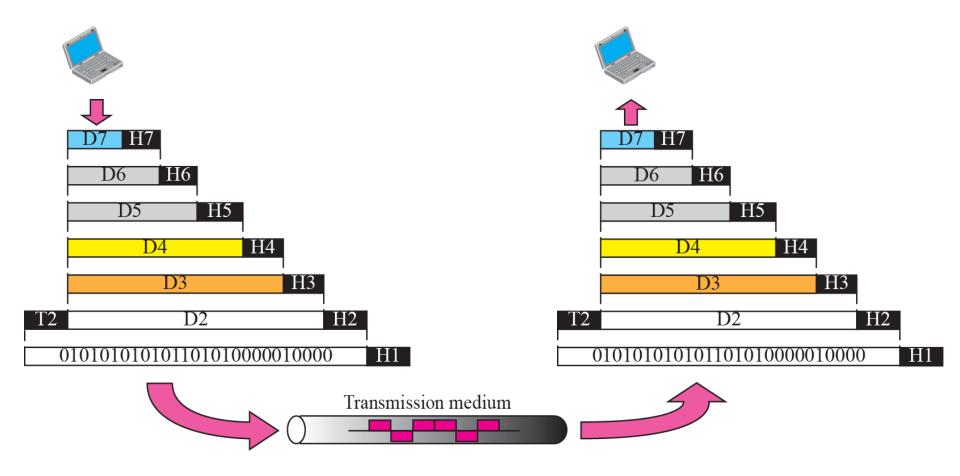# THE OSI MODEL

Established in 1947, the *International Standards Organization (ISO)* is a multinational body dedicated to worldwide agreement on international standards. Almost three-fourths of countries in the world are represented in the ISO. 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.

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

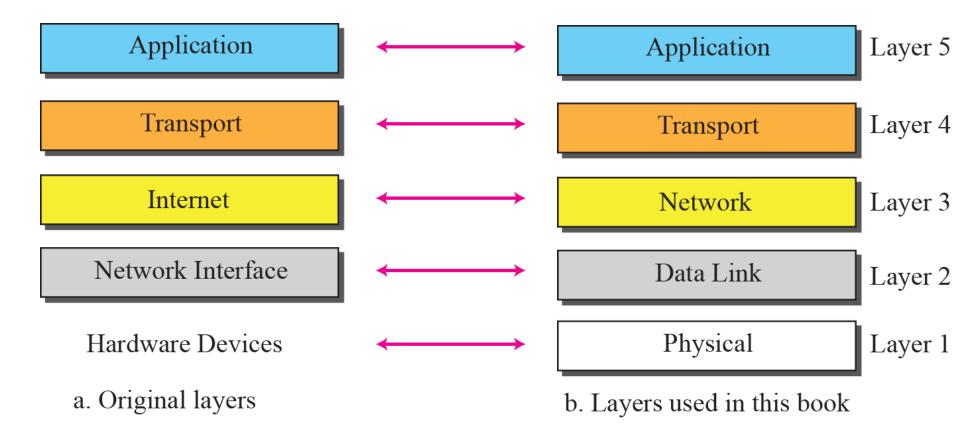Transmission medium

| Layer	Description	#
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
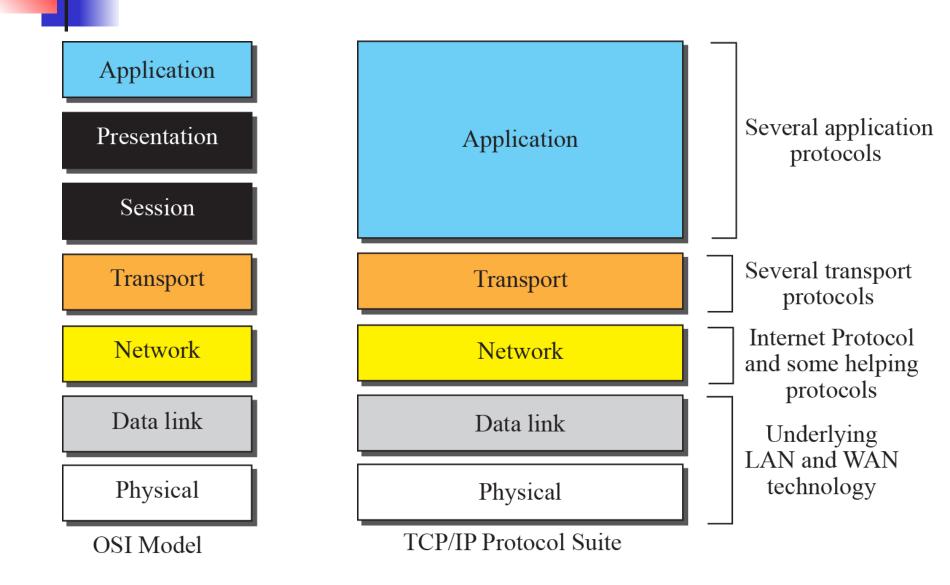
TCP/IP PROTOCOL SUITE

The TCP/IP protocol suite was developed prior to the OSI model. Therefore, the layers in the TCP/IP protocol suite do not match exactly with those in the OSI model. The original TCP/IP protocol suite was defined as four software layers built upon the hardware. Today, however, TCP/IP is thought of as a five-layer model with the layers named similarly to the ones in the OSI model.
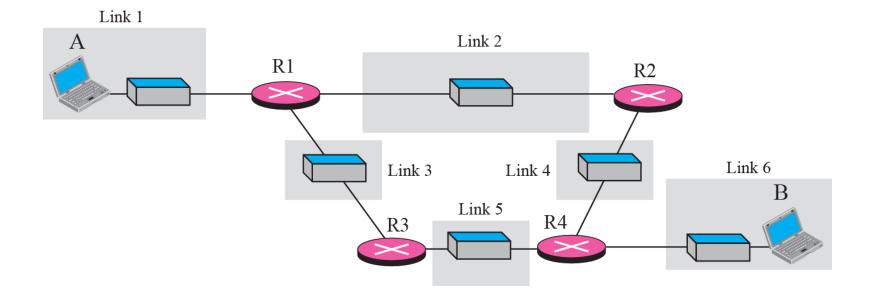
a. Original layers

b. Layers used in this book

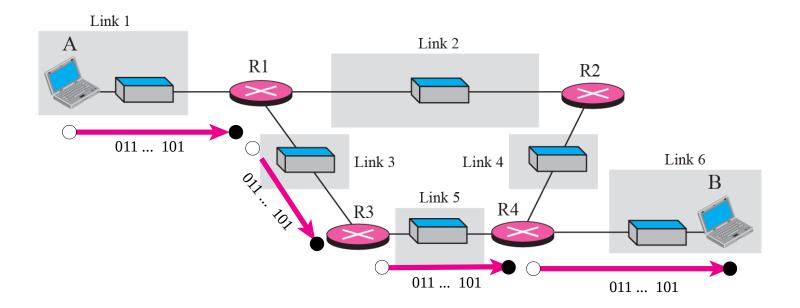| OSI Model	TCP/IP Protocol Suite	
Application	Application	Several application protocols
Presentation		
Session		
Transport	Transport	Several transport protocols
Network	Network	Internet Protocol and some helping protocols
Data link	Data link	Underlying LAN and WAN technology
Physical	Physical	

Figure 2.11   *Communication at the data link layer*

Legend: ○ Source ● Destination D Data H Header
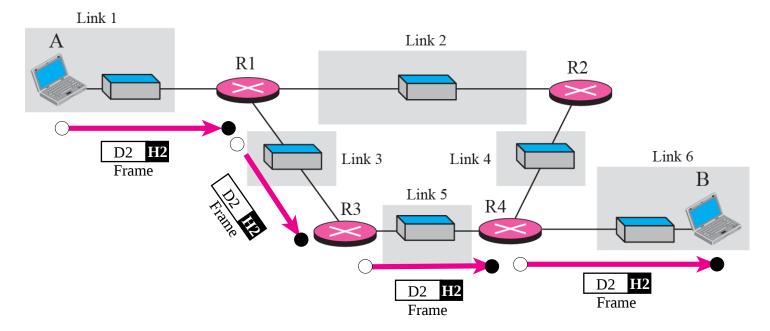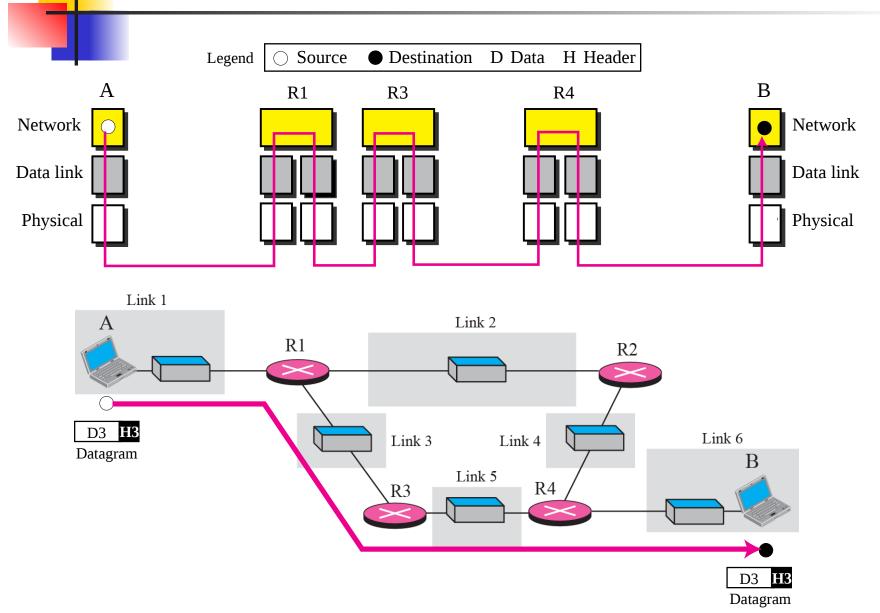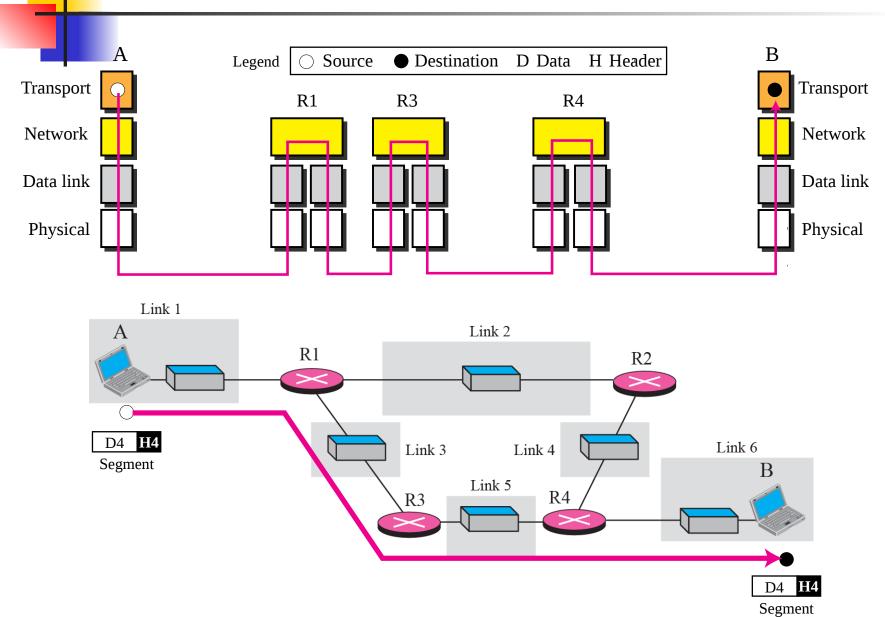
Figure 2.12 *Communication at the network layer*

Legend: ○ Source ● Destination D Data H Header

A   R1   R3   R4   B

Network   Network

Data link   Data link

Physical   Physical

Link 1

A

Link 2

R1   R2

D3 | H3
Datagram

Link 3   Link 4   Link 6

Link 5

R3   R4   B

D3 | H3
Datagram

Communication at transport layer

A

Legend | ○ Source ● Destination D Data H Header

B

Transport — Network — Data link — Physical

R1 R3 R4

Transport — Network — Data link — Physical

Link 1
A
R1
Link 2
R2

D4 H4
Segment
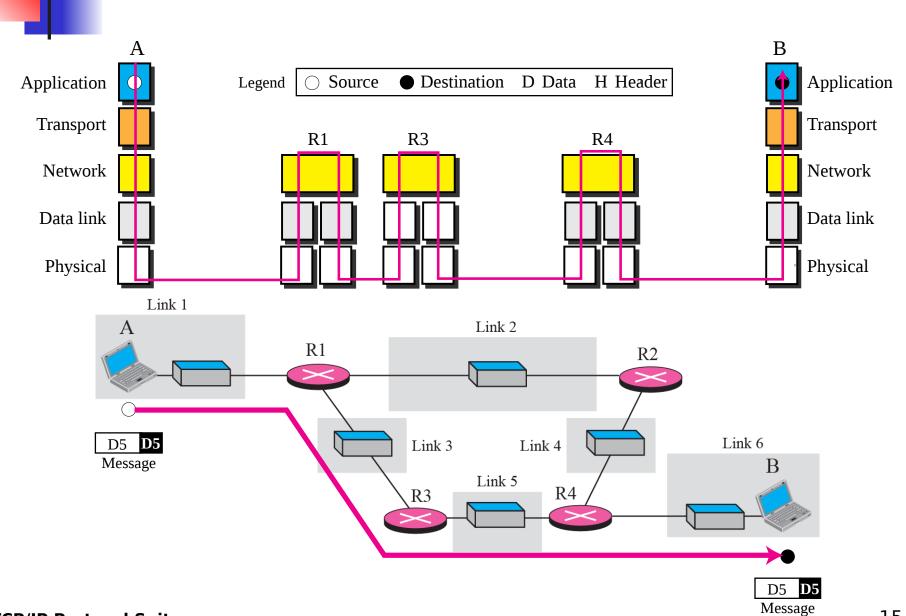
Link 3 Link 4 Link 6
B
Link 5
R3 R4

D4 H4
Segment

TCP/IP Protocol Suite 13

Note

The unit of communication at the transport layer is a segment, user datagram, or a packet, depending on the specific protocol used in this layer.

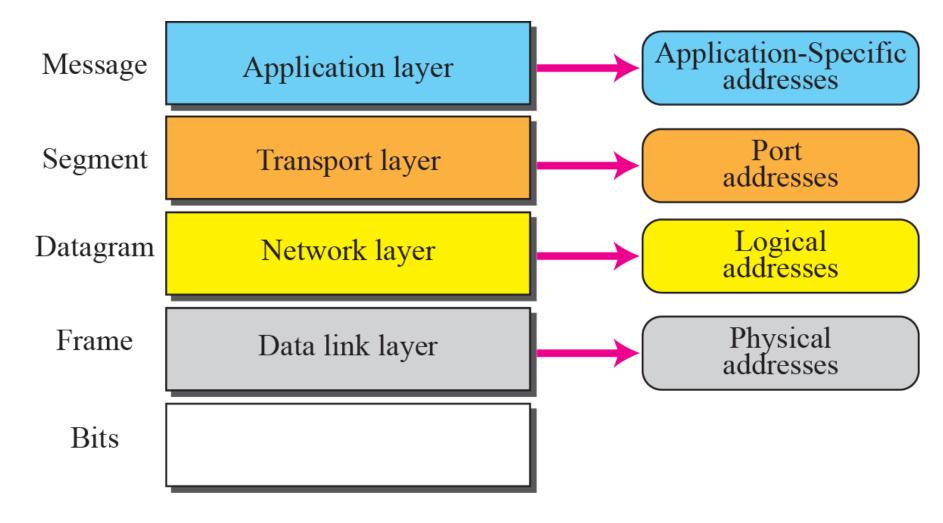Legend: ○ Source ● Destination D Data H Header

ADDRESSING

Four levels of addresses are used in an internet employing the TCP/IP protocols: physical address, logical address, port address, and application-specific address. Each address is related to a one layer in the TCP/IP architecture
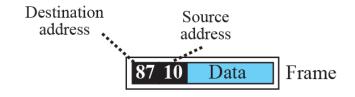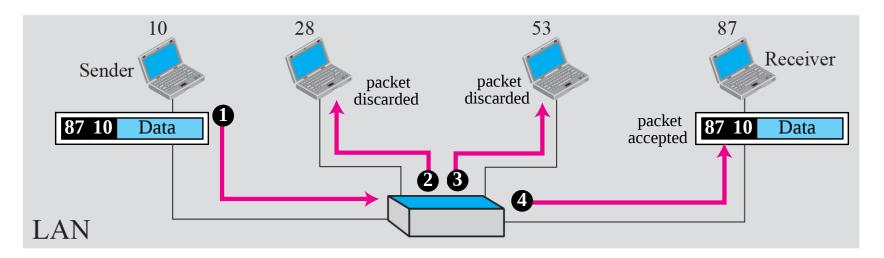
Topics Discussed in the Section

- ✓ **Physical Addresses**
- ✓ **Logical Addresses**
- ✓ **Port Addresses**
- ✓ **Application-Specific Addresses**

Bellow Figure a node with physical address 10 sends a frame to a node with physical address 87. The two nodes are connected by a link (a LAN). At the data link layer, this frame contains physical (link) addresses in the header. These are the only addresses needed. The rest of the header contains other information needed at this level. As the figure shows, the computer with physical address 10 is the sender, and the computer with physical address 87 is the receiver. The data link layer at the sender receives data from an upper layer. It encapsulates the data in a frame. The frame is propagated through the LAN. Each station with a physical address other than 87 drops the frame because the destination address in the frame does not match its own physical address. The intended destination computer, however, finds a match between the destination address in the frame and its own physical address.
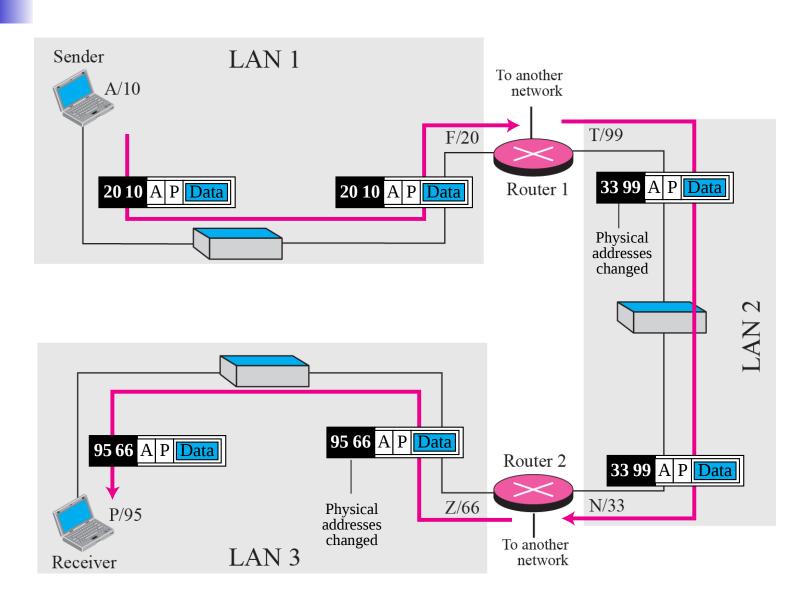
Example

Most local area networks use a 48-bit (6-byte) physical address written as 12 hexadecimal digits; every byte (2 hexadecimal digits) is separated by a colon, as shown below:

07:01:02:01:2C:4B
A 6-byte (12 hexadecimal digits) physical address

Bellow Figure shows a part of an internet with two routers connecting three LANs. Each device (computer or router) has a pair of addresses (logical and physical) for each connection. In this case, each computer is connected to only one link and therefore has only one pair of addresses. Each router, however, is connected to three networks. So each router has three pairs of addresses, one for each connection. Although it may be obvious that each router must have a separate physical address for each connection, it may not be obvious why it needs a logical address for each connection. We discuss these issues in Chapters 11 and 12 when we discuss routing. The computer with logical address A and physical address 10 needs to send a packet to the computer with logical address P and physical address 95. We use letters to show the logical addresses and numbers for physical addresses, but note that both are actually
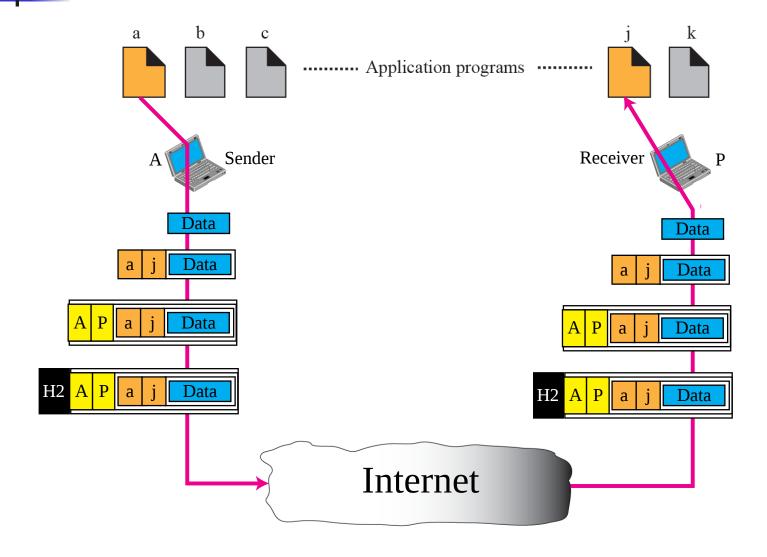
The physical addresses will change from hop to hop, but the logical addresses remain the same.

Example

Bellow Figure shows two computers communicating via the Internet. The sending computer is running three processes at this time with port addresses a, b, and c. The receiving computer is running two processes at this time with port addresses j and k. Process a in the sending computer needs to communicate with process j in the receiving computer. Note that although both computers are using the same application, FTP, for example, the port addresses are different because one is a client program and the other is a server program

Note

The physical addresses change from hop to hop, but the logical and port addresses usually remain the same.

As we will see in future chapters, a port address is a 16-bit address represented by one decimal number as shown.

753

A 16-bit port address represented as one single number