

# Chapter 2

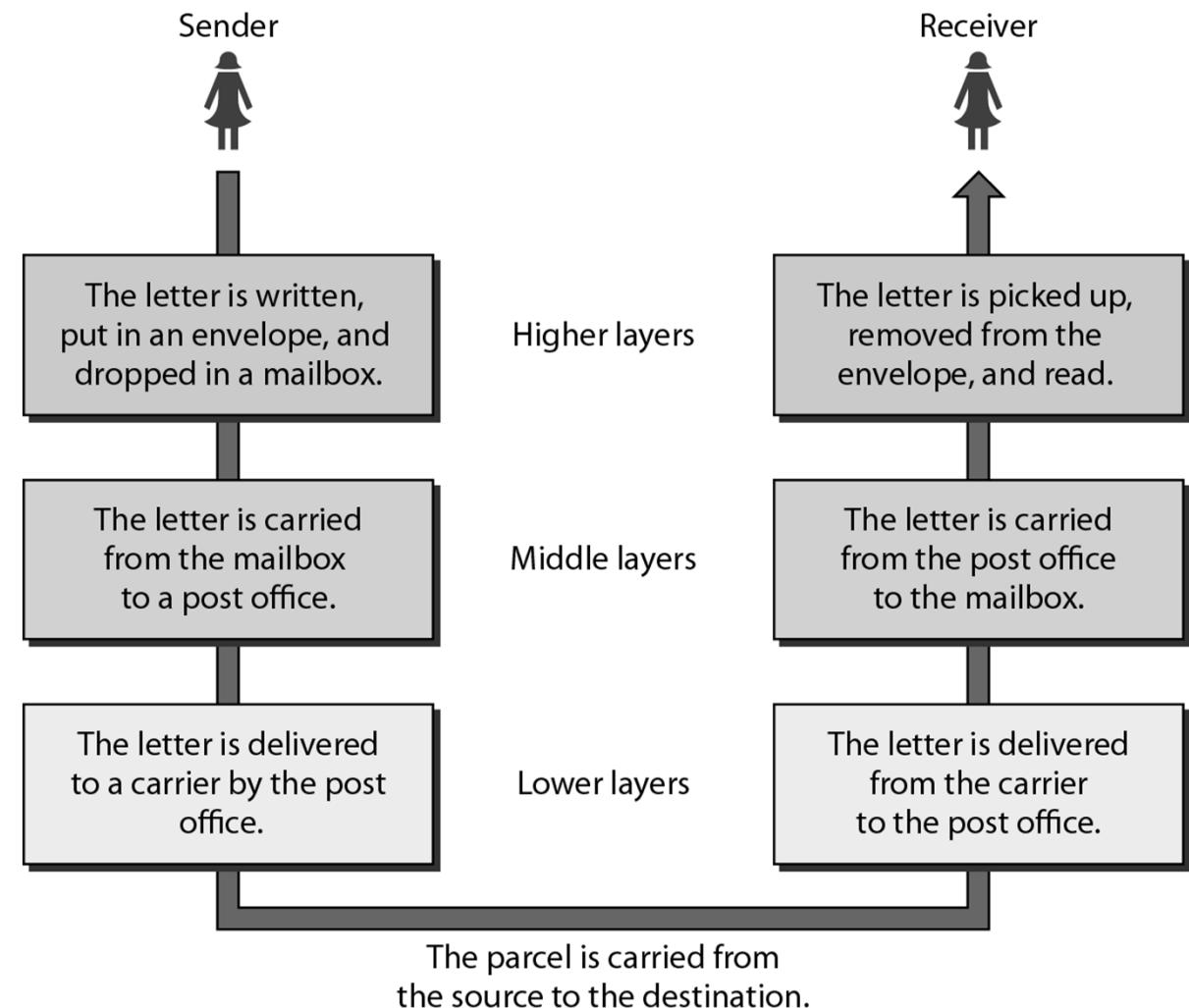
## Network Models

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King Mongkut's Institute of Technology Ladkrabang

# LAYERED TASKS

- Sender, Receiver, and Carrier
- Hierarchy



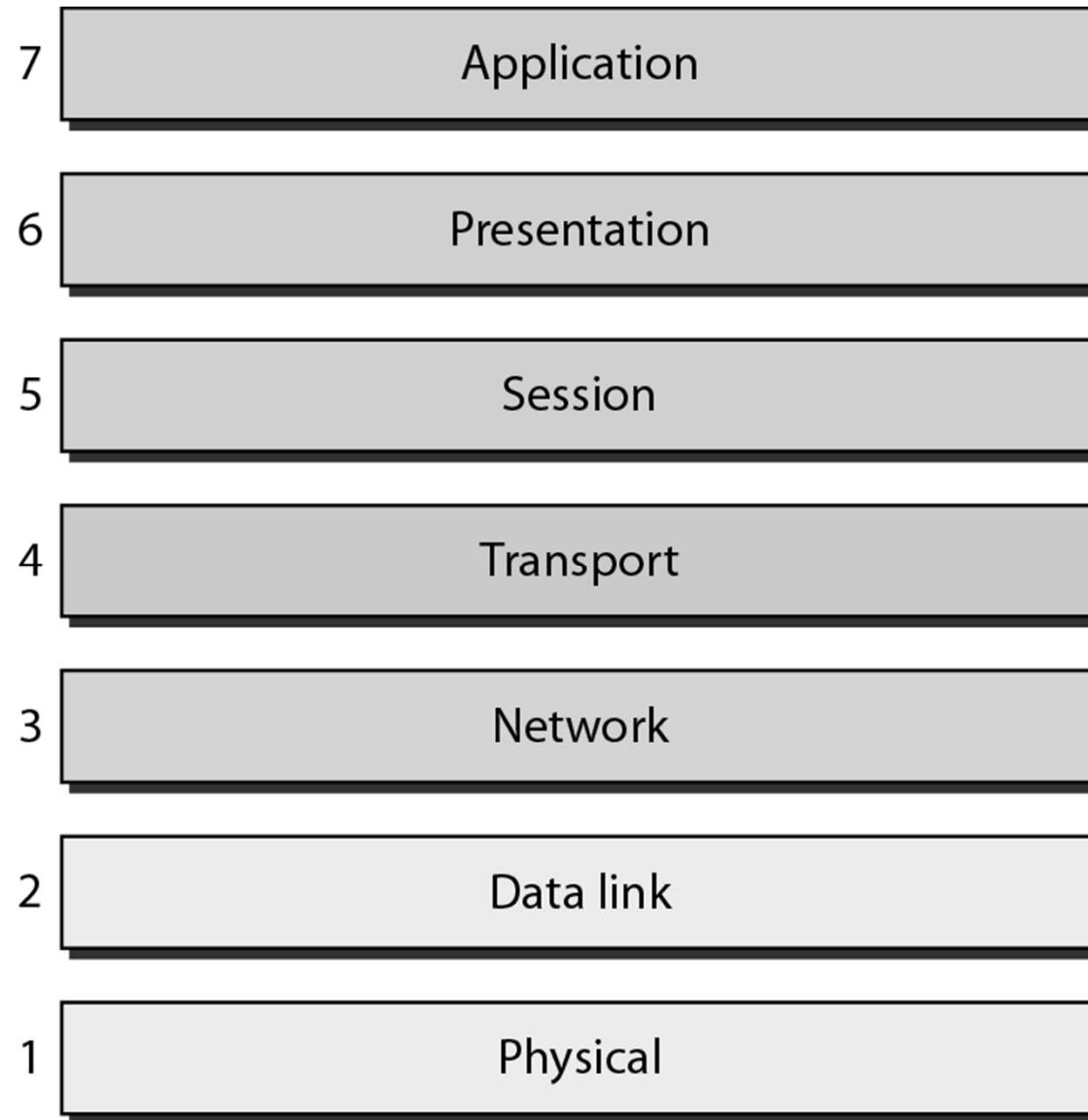
# THE OSI MODEL

- History
- Layered Architecture
- Peer-to-Peer Processes
- Encapsulation

# OSI Model

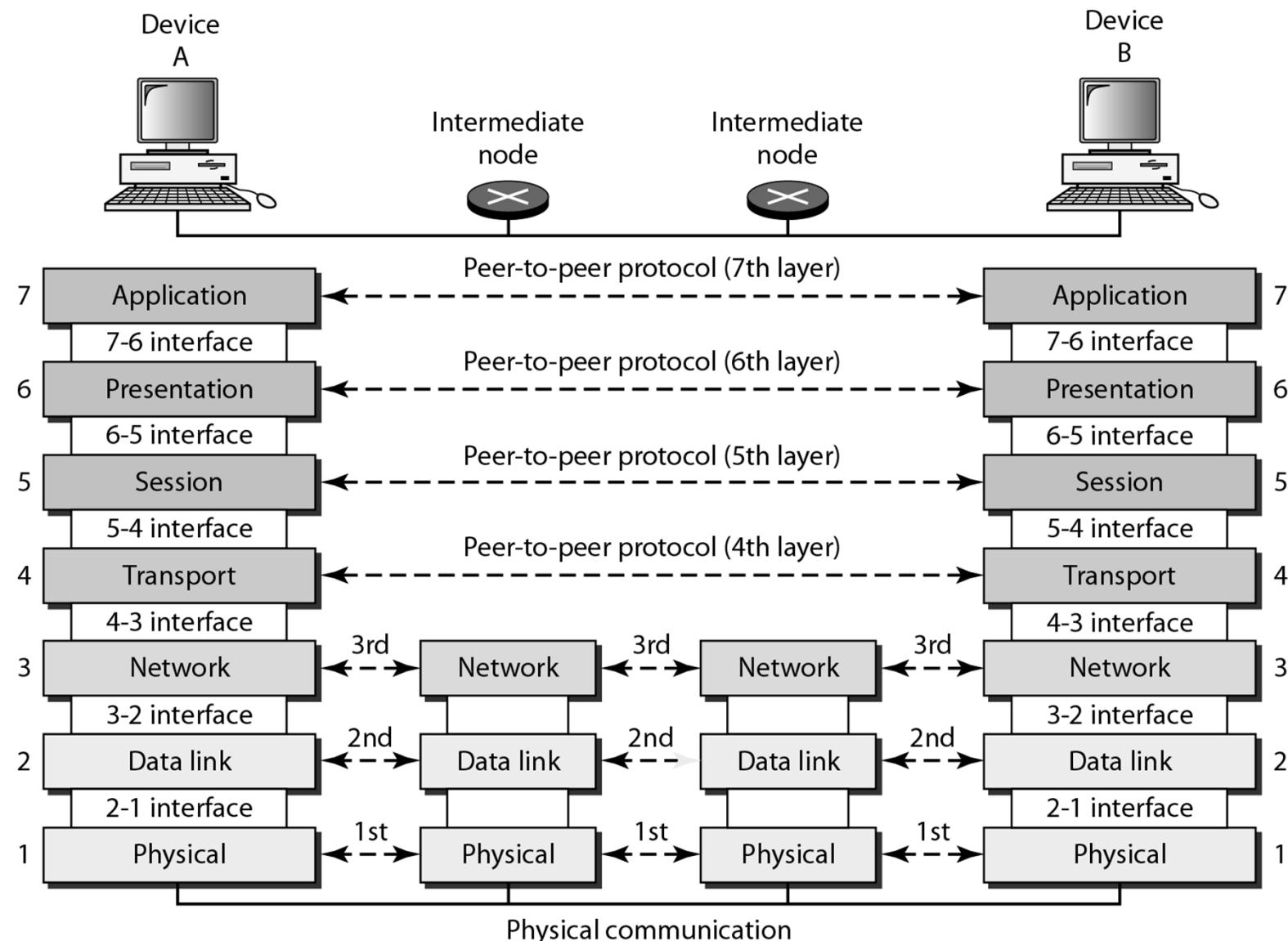
- History
  - 1970 -> ISO (International Organization for Standard)  
จัดตั้งคณะกรรมการพิจารณา architecture ที่เป็นกลางเพื่อกำหนดการเชื่อมต่อ  
ระหว่างคอมพิวเตอร์ และอุปกรณ์ต่างๆ
  - 1984 -> released in ISO 7498 document  
OSI (Open System Interconnection) -> 7 layers
- Objectives
  - Compatibility ความเข้ากันได้ของอุปกรณ์ต่างผู้ผลิตกัน
  - Flexibility มีความยืดหยุ่นต่อการเปลี่ยนแปลง เช่น การพัฒนาของเทคโนโลยี

# Layered Architecture



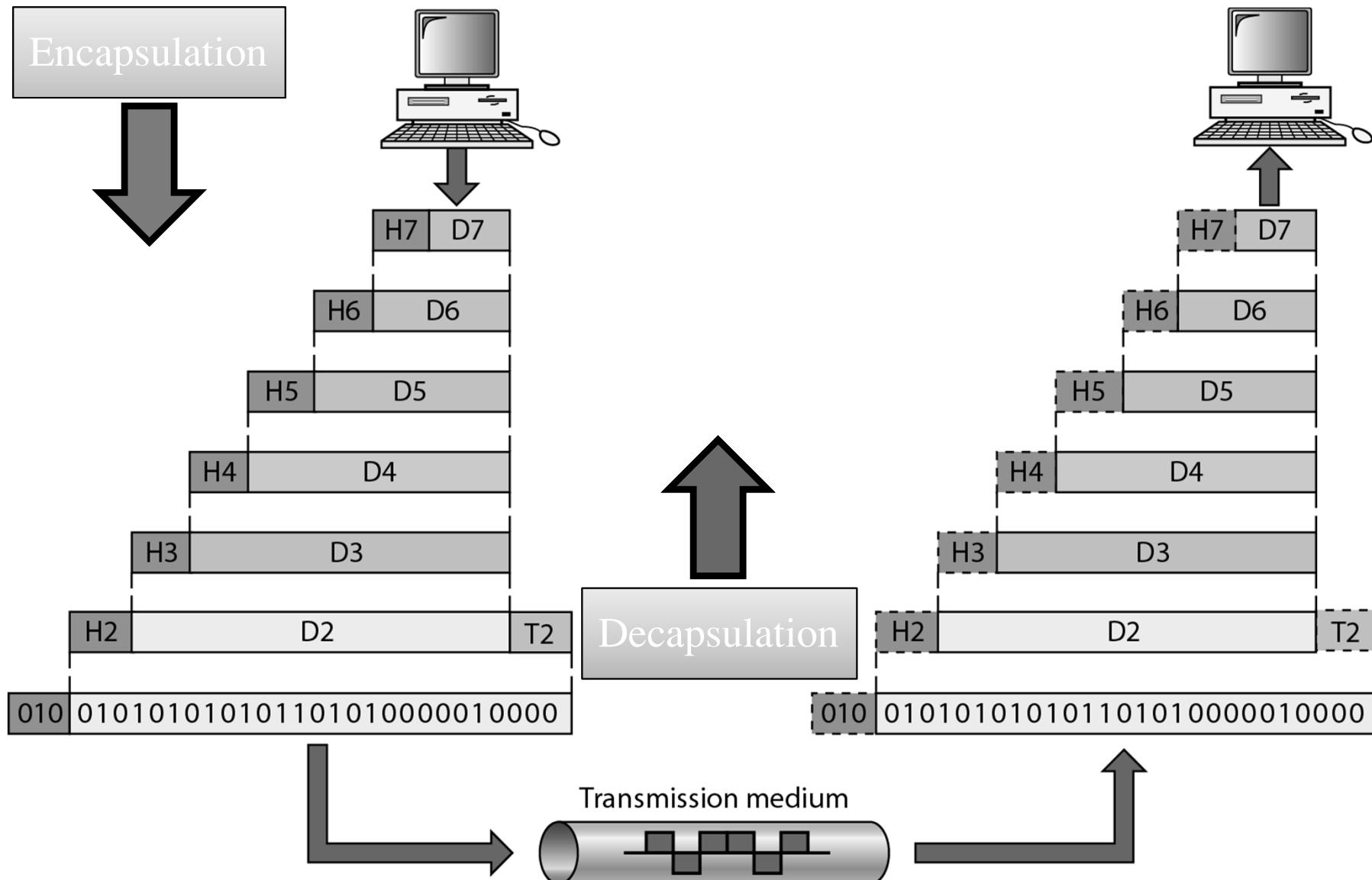
Seven layers of the OSI model (Fig. 2.2)

# Peer-to-Peer Processes



The interaction between layers in the OSI model (Fig. 2.3)

# Encapsulation

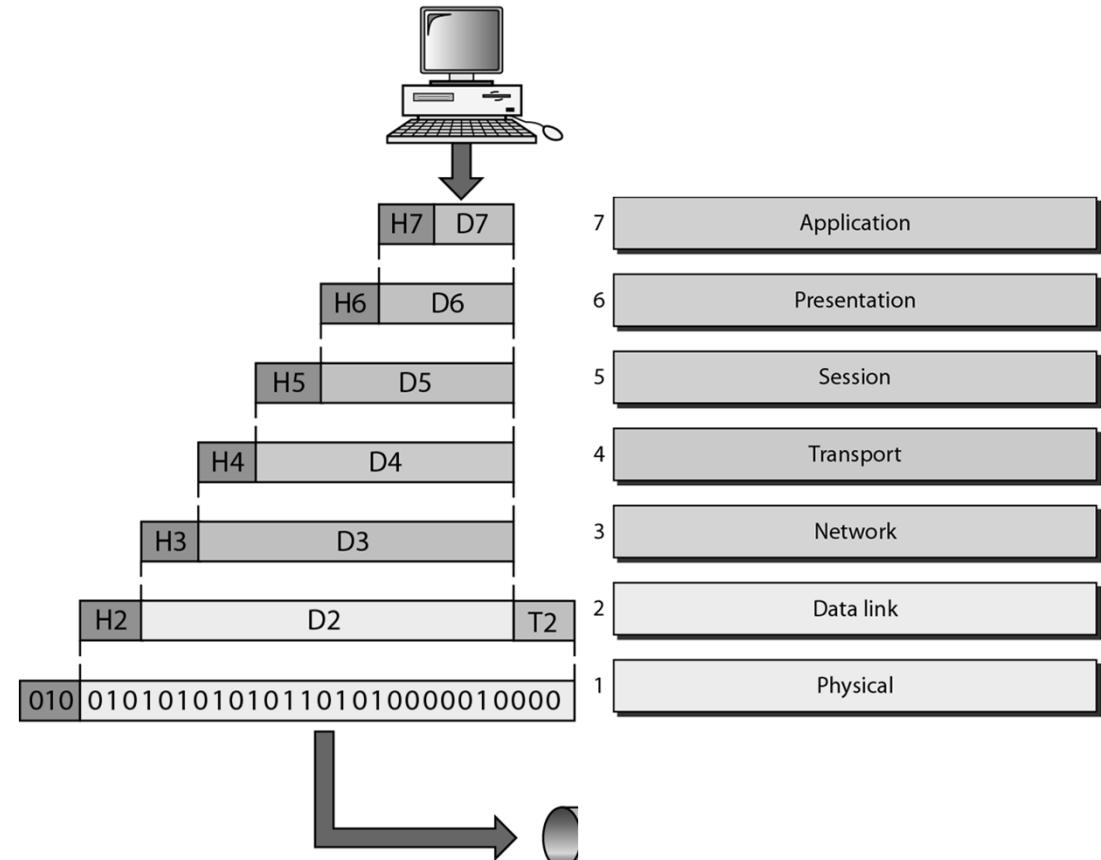


An exchange using the OSI model (Fig. 2.4)

B. A. Forouzan, Data Communications and Networking, 4th edition, McGRAW-HILL

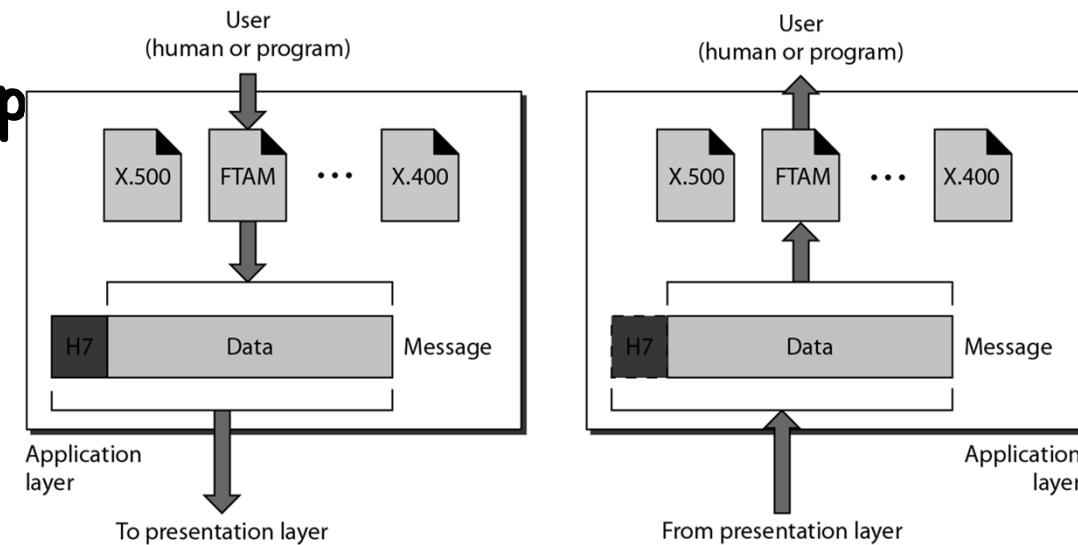
# LAYERS IN THE OSI MODEL

- Physical Layer
- Data Link Layer
- Network Layer
- Transport Layer
- Session Layer
- Presentation Layer
- Application Layer
- Summary of Layers

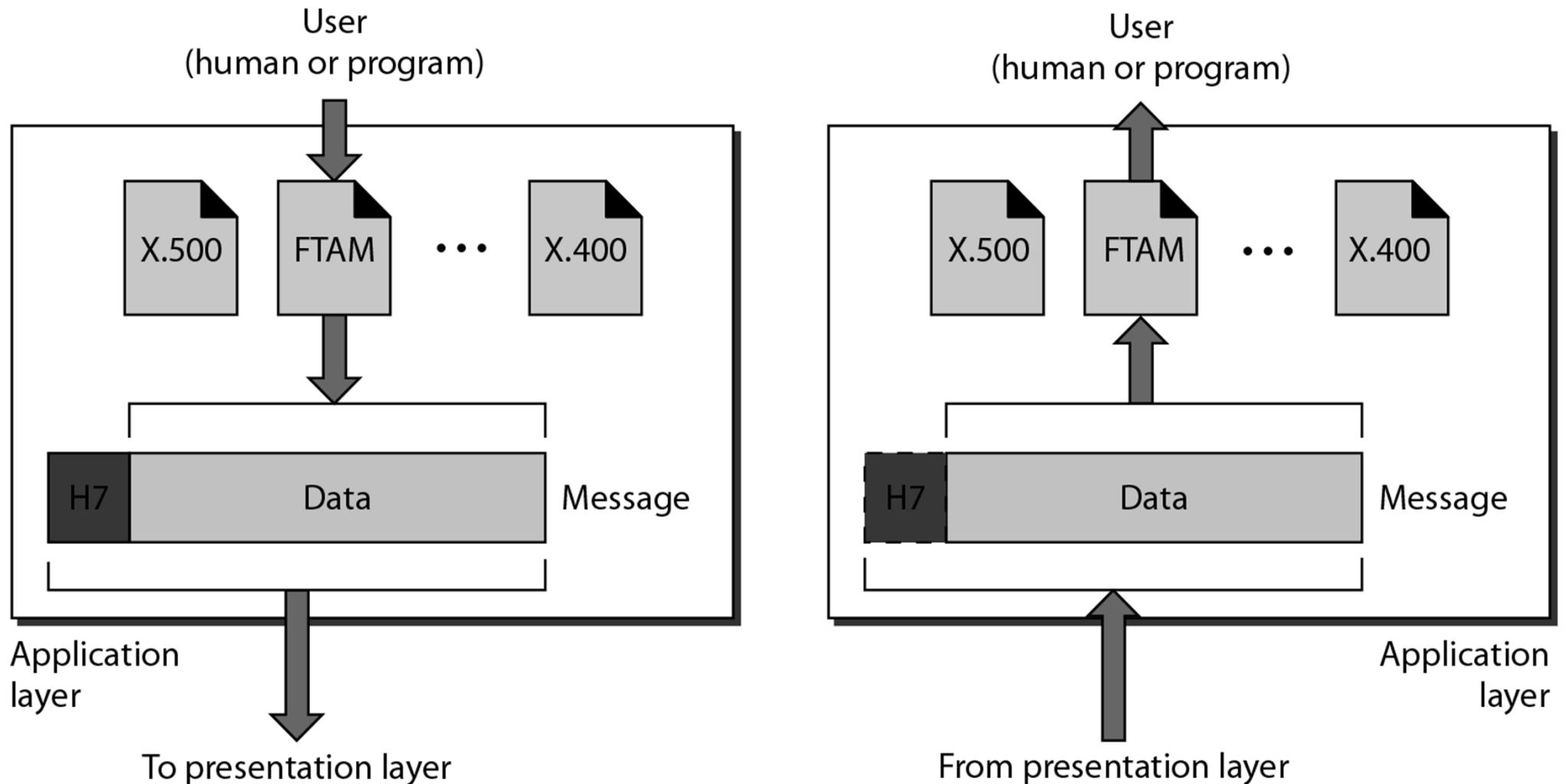


# Application layer

- Responsibility
  - providing services to the user
  - User interface (Software app)
  - No header or trailer
- Services
  - Network Virtual Terminal
  - File transfer, access, and management (FTAM)
  - Mail service
  - Accessing WWW

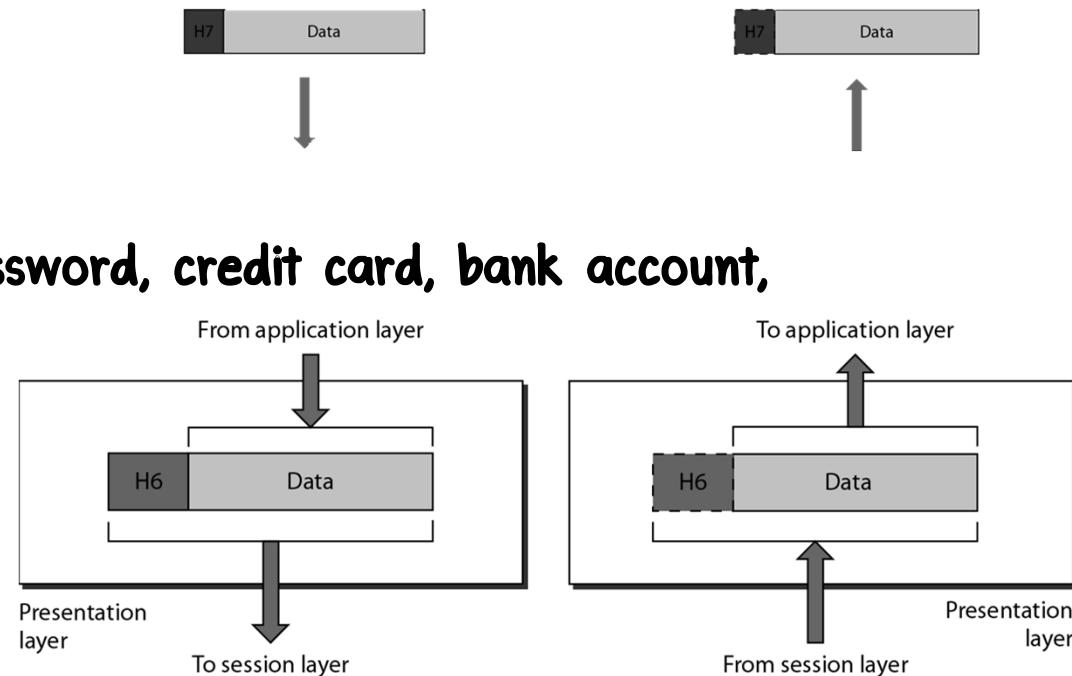


# Application layer (Fig. 2.14)

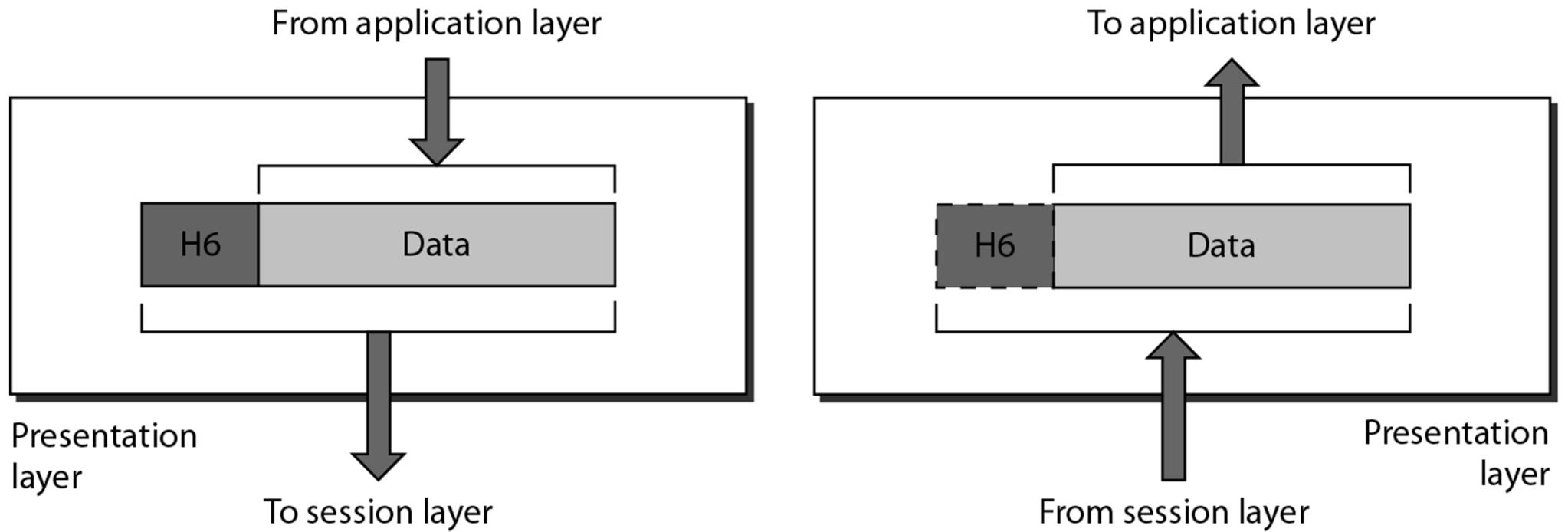


# Presentation layer

- **Responsibility**
  - translation, compression, and encryption
  - Manage syntax (format) and semantics (format understanding) of different data format between any two systems
- **Services**
  - Translation of data format
    - Ex. ASCII → non ASCII system
  - Encryption (privacy & security)
    - For sensitive information: login-password, credit card, bank account, personal information
  - Compression
    - Ex. Zip, Gif, JPEG



# Presentation layer (Fig. 2.13)



# Session layer

- **Responsibility**

- dialog control and synchronization

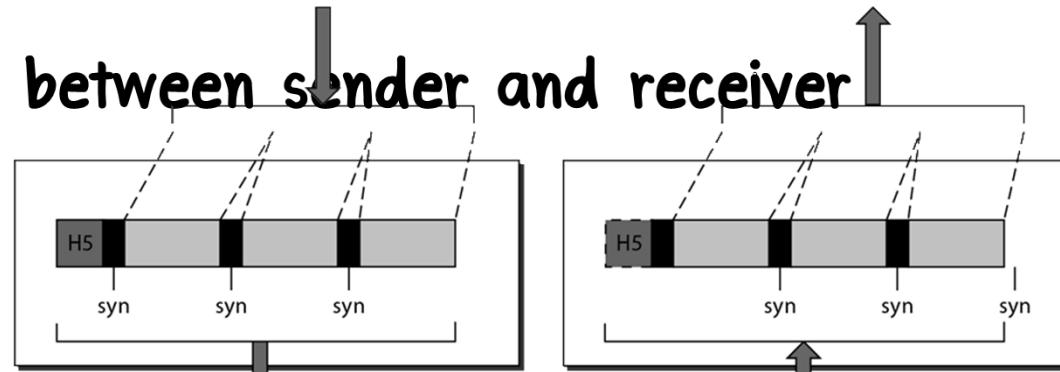


- Establish, manage, and terminate session

- Session = virtual communication between sender and receiver

- **Services**

- Dialog control

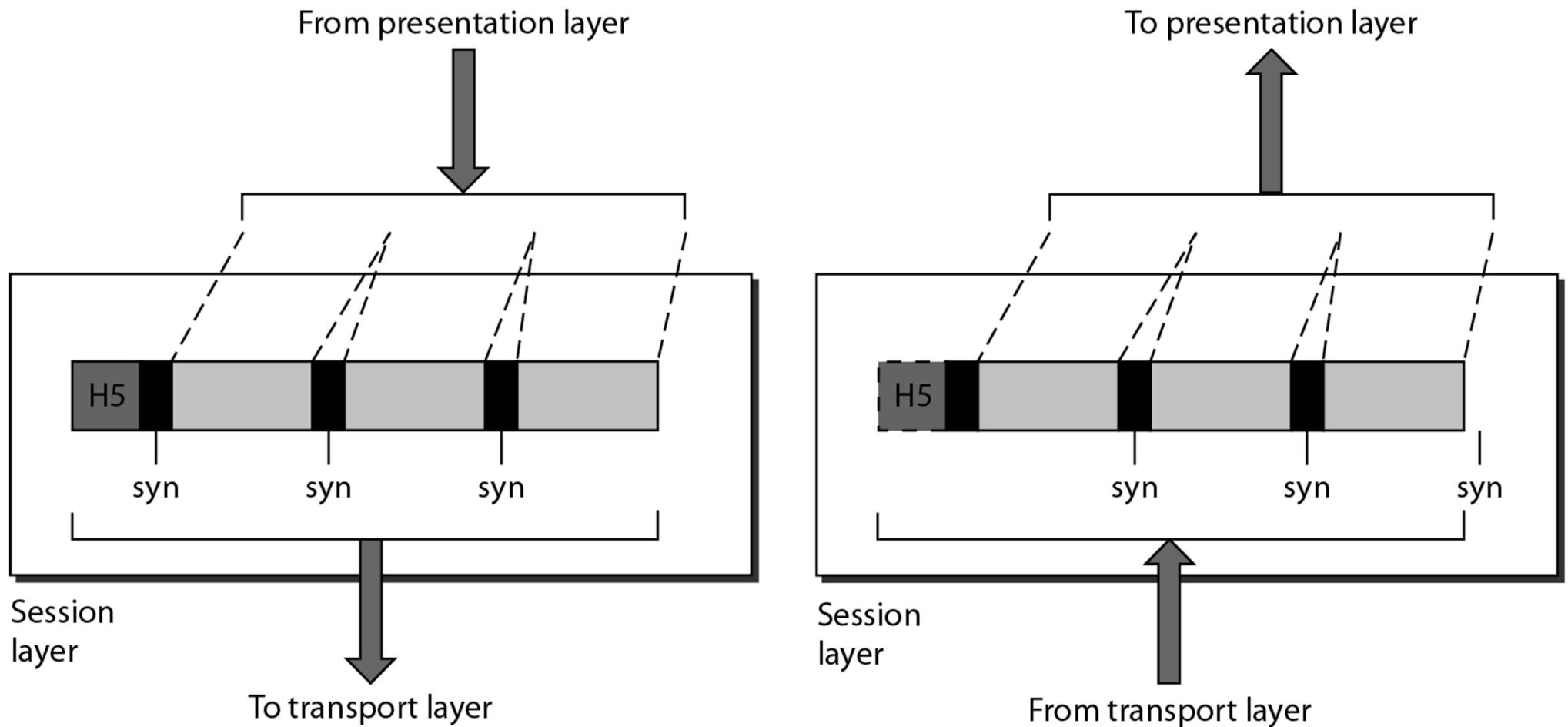


- Traffic control & direction control (Half duplex, Full duplex)

- Message synchronization

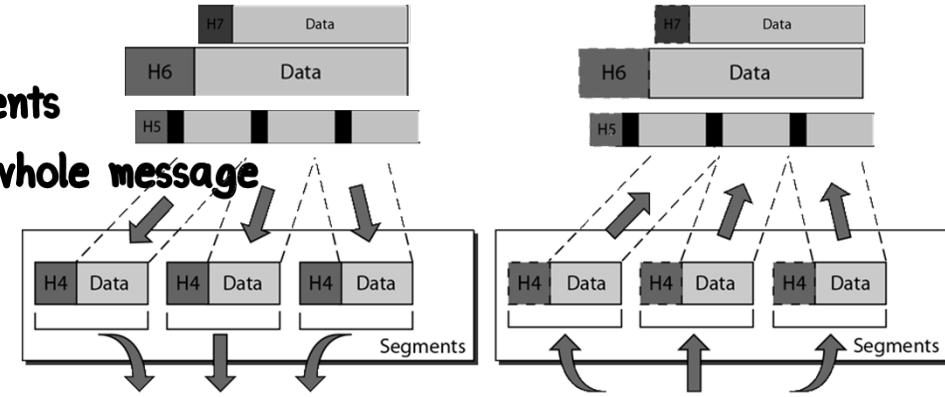
- Adding checkpoints (synchronization points) in the message stream

# Session layer (Fig. 2.12)

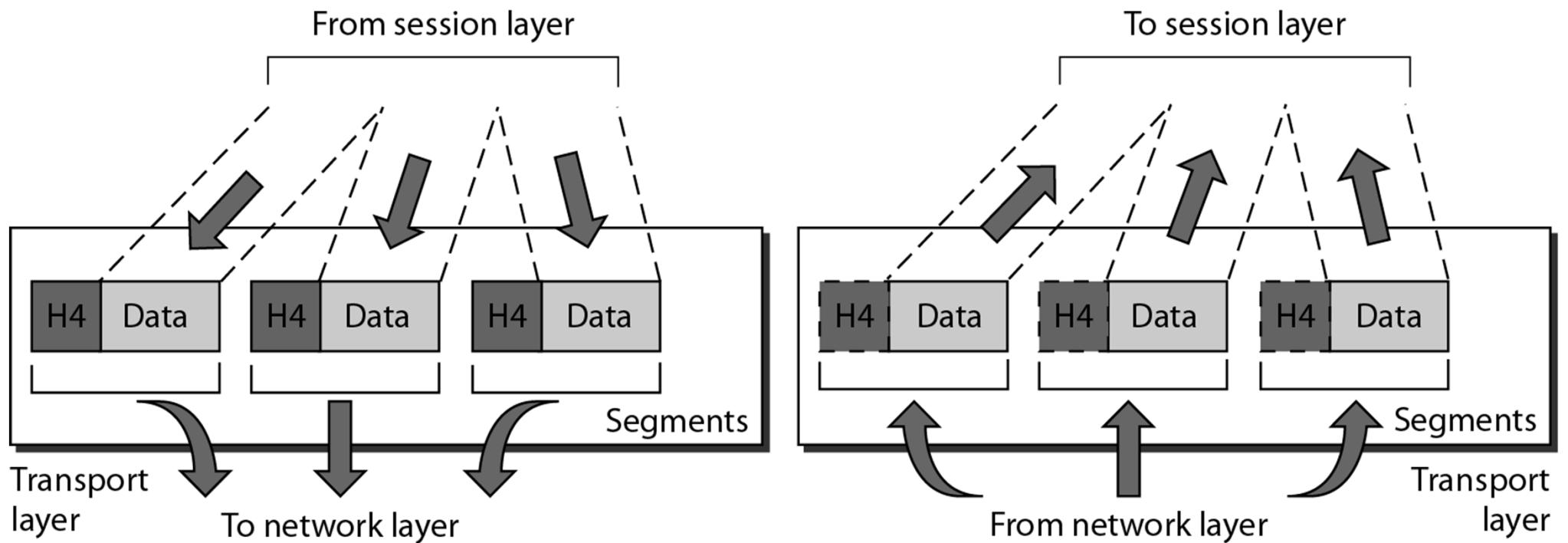


# Transport layer

- Responsibility
  - delivery of a message from one process to another
  - Guarantee whole message delivery : From source to final destination
- Service
  - Service-point addressing: Port address (16 bits: 0 - 65,535 ports)
    - Each application is assigned a specific port address
  - Segmentation and Reassembly
    - Source : segment L5 data into small segments
    - Destination : reassembly small segments into a whole message
  - Connection control
    - Connectionless
    - Connection-oriented
  - Error control : error detection and correction of the entire message
  - Flow control

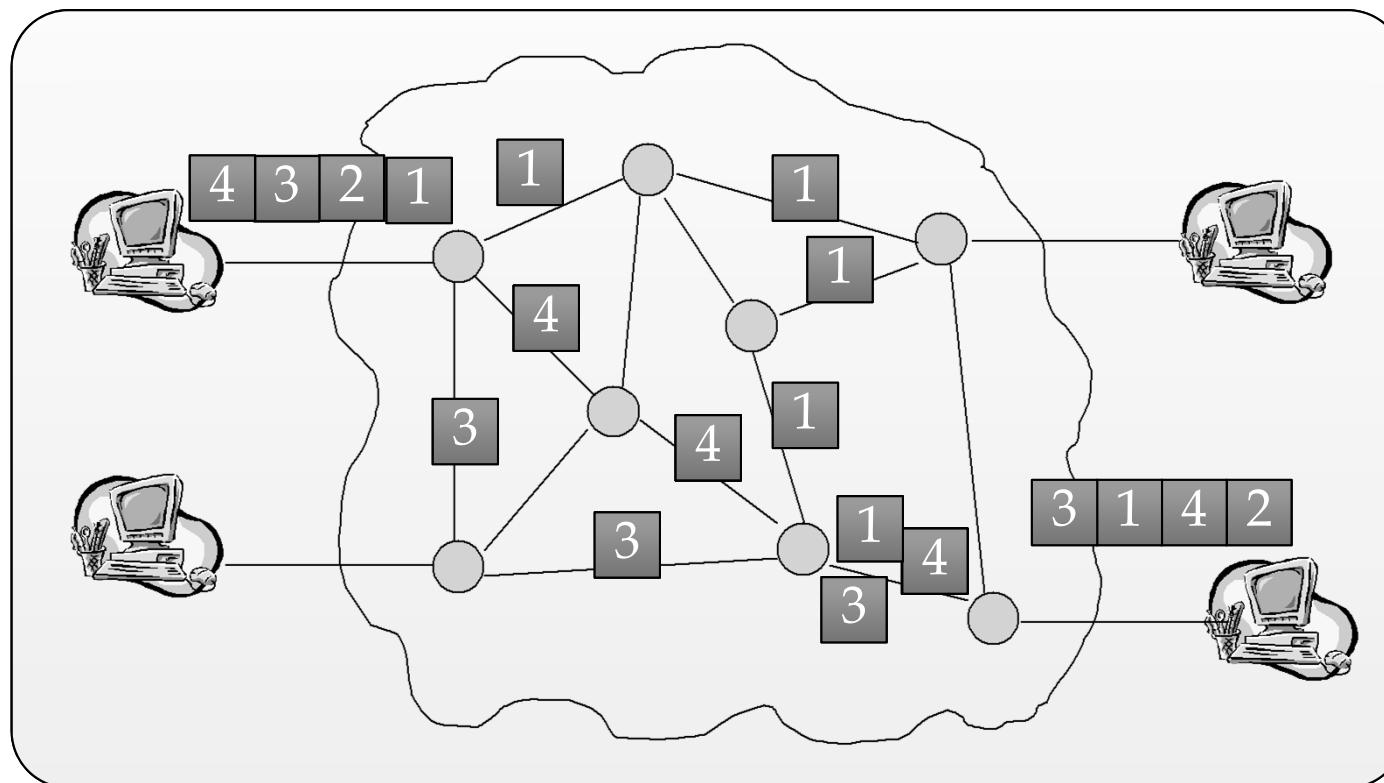


# Transport layer (Fig. 2.10)



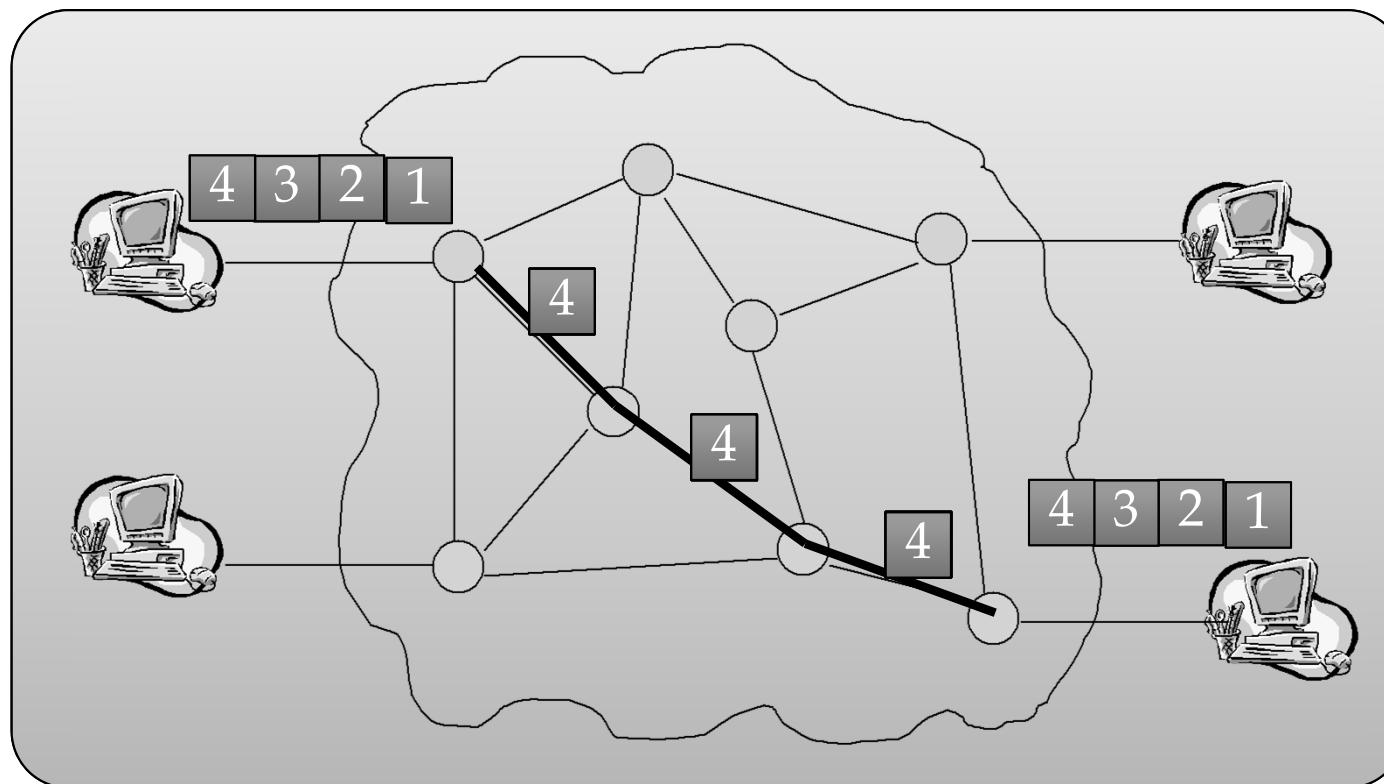
# Transport layer

- Connection Control
  - Connectionless



# Transport layer

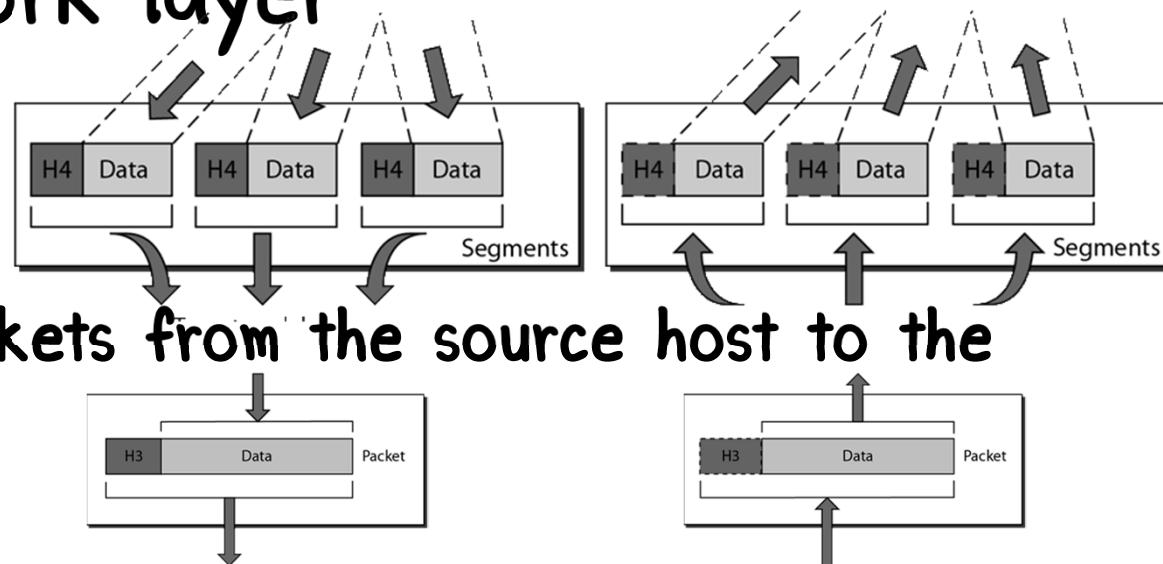
- Connection Control
  - Connection-oriented



# Network layer

- **Responsibility**

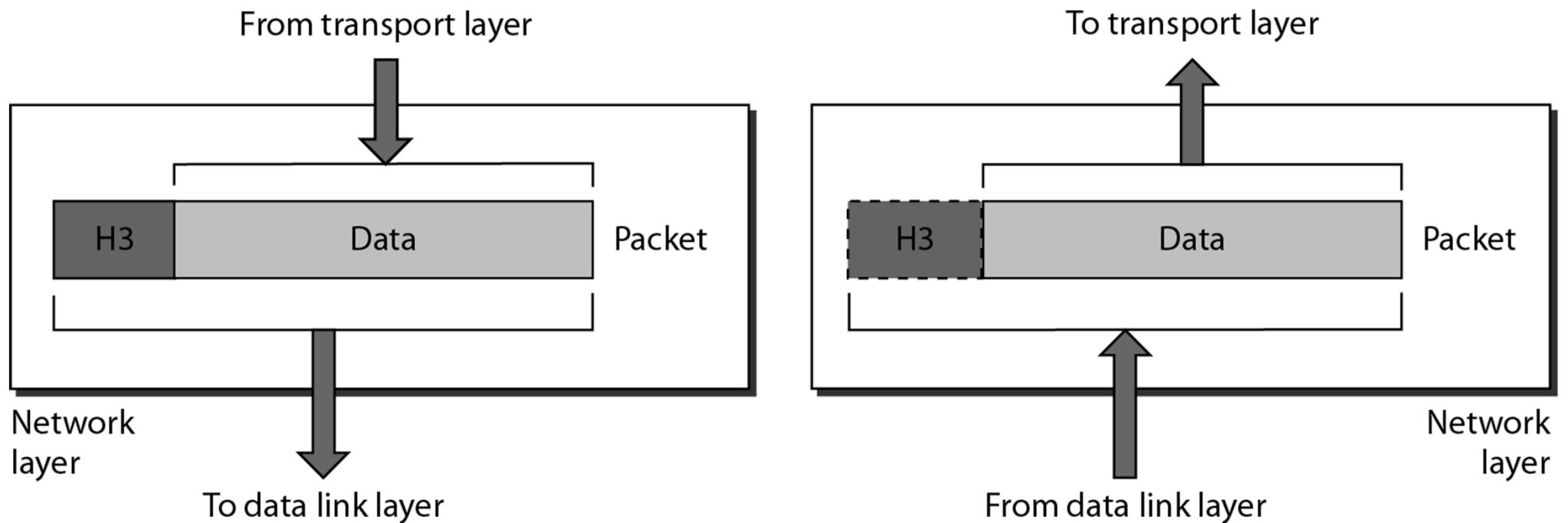
- delivery of individual packets from the source host to the destination host
  - Guarantee packet delivery



- **Service**

- Logical (Network) address (header): IP address
  - Routing packets through internetworking device
  - Router || Gateway

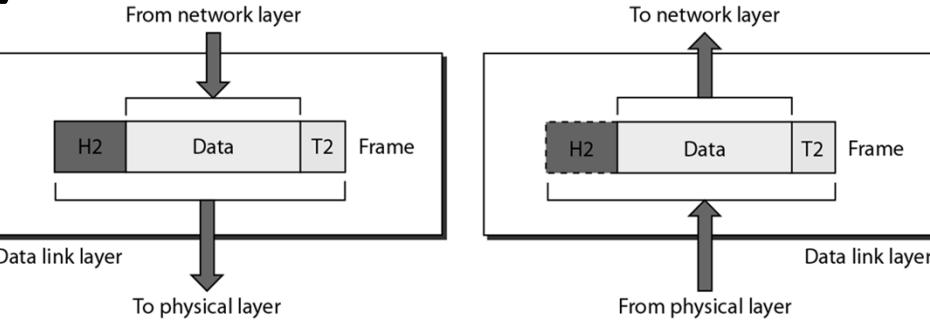
# Network layer (Fig. 2.8)



# Data link layer

- **Responsibility**

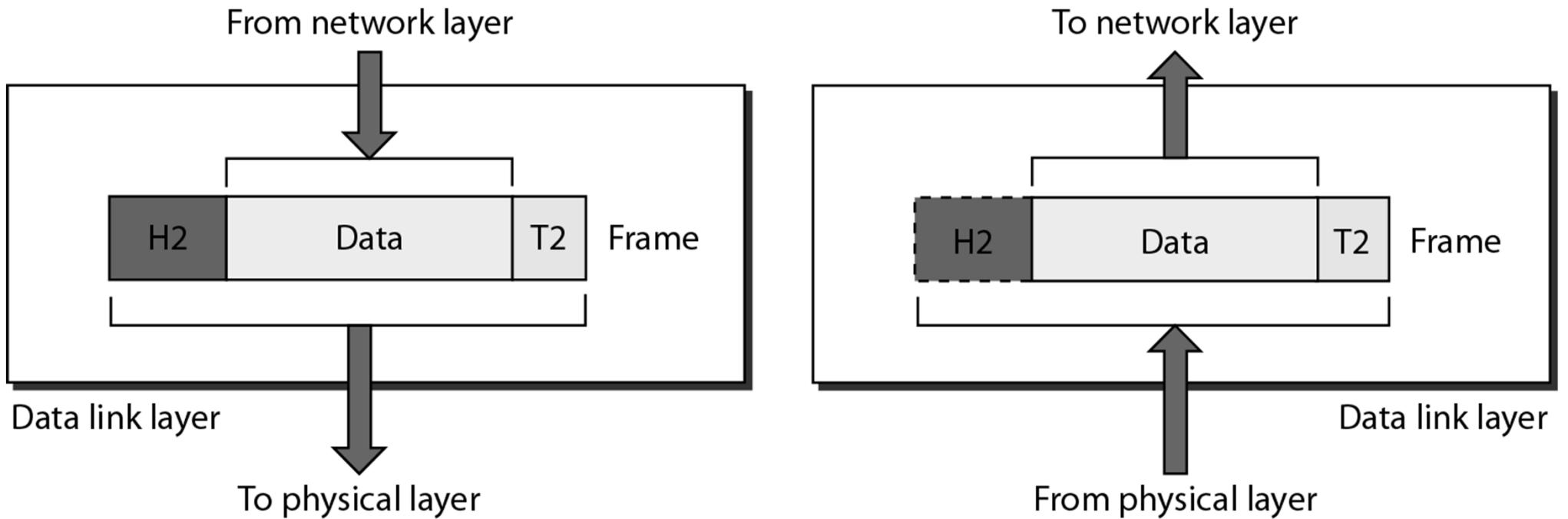
- moving frames from one hop (node) to the next
- Break L3 (Network) data into reasonable size (
- Guarantee Node-to-Node delivery (Frame Error Free)



- **Service**

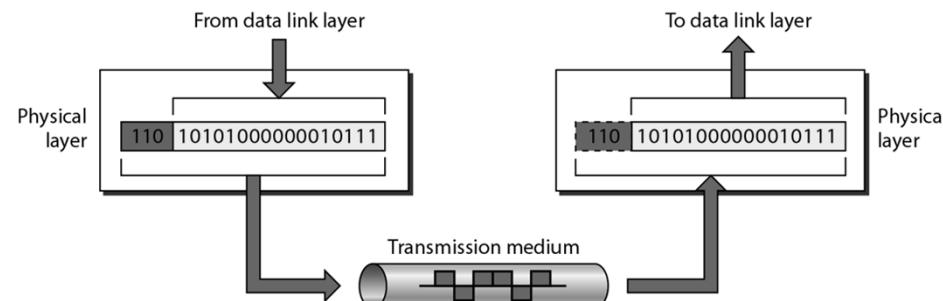
- Framing (adding header & trailer)
- Physical addressing (MAC address: 12 digit hexadecimal (e.g. 080BFOAFDC09))
  - Same sender network : source & destination address
  - Outside sender network : source & connecting devices (bridge, router, gateway) address
- Flow control: frame acknowledgement, inform buffer size, etc.
- Error control: error detection and error correction
- Access control: checking accessibility (ex. Multipoint connection)

# Data link layer (Fig. 2.6)

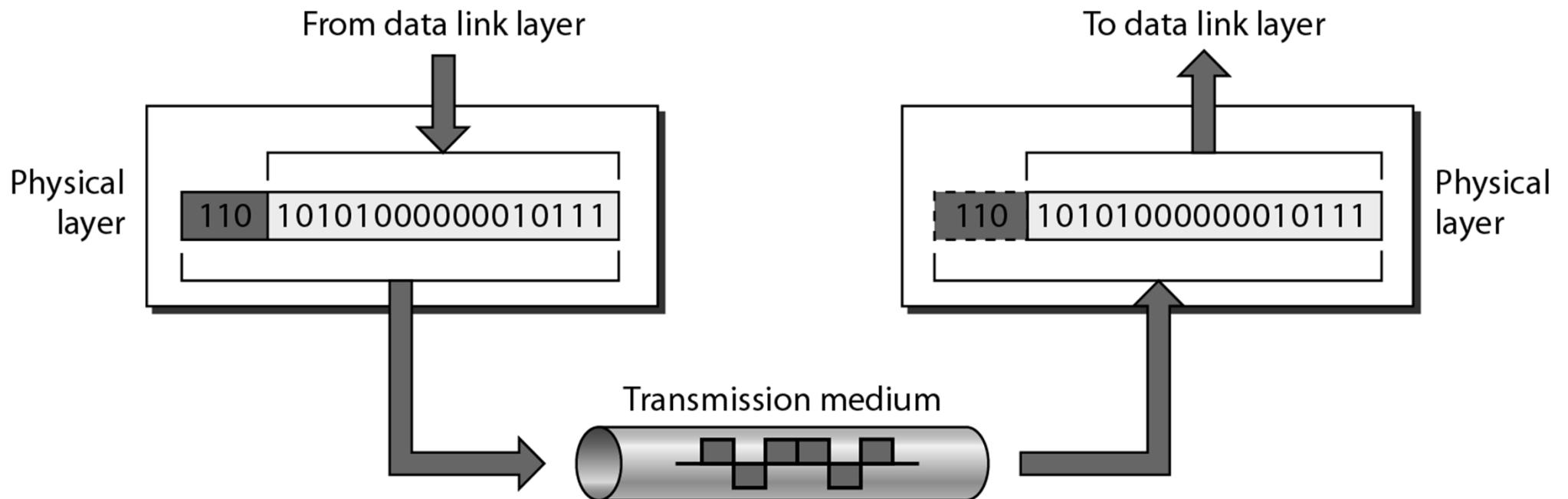


# Physical layer

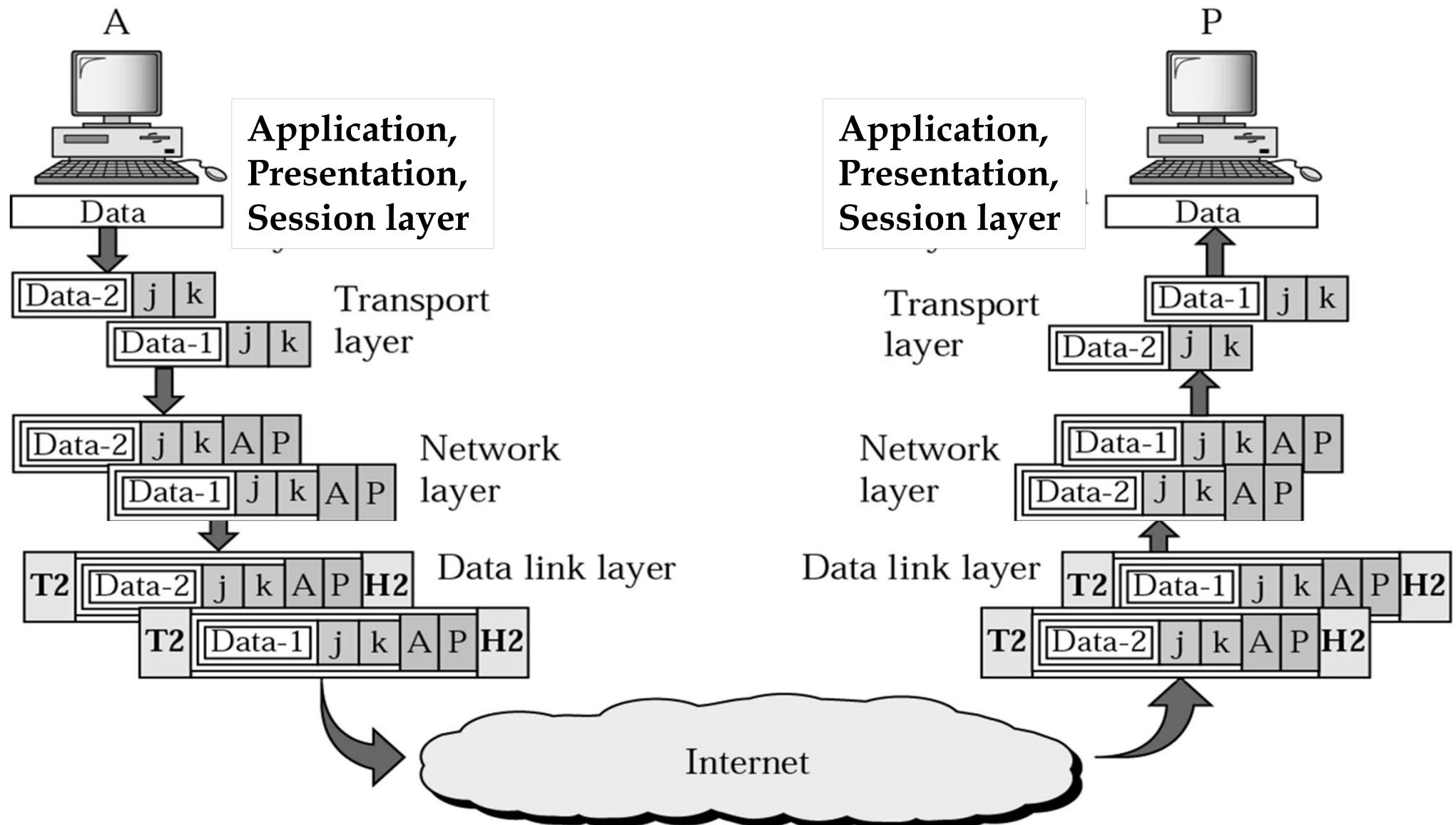
- Responsibility
  - movements of individual bits from one hop (node) to the next
  - Sending and receiving bitstream through physical medium
- Service
  - Physical characteristics of interface and medium
  - Representation of bits (encoding or modulation)
  - Data rate
  - Bit synchronization
  - Line configuration & Topology
  - Transmission mode (Simplex, Half-duplex, Full-duplex)



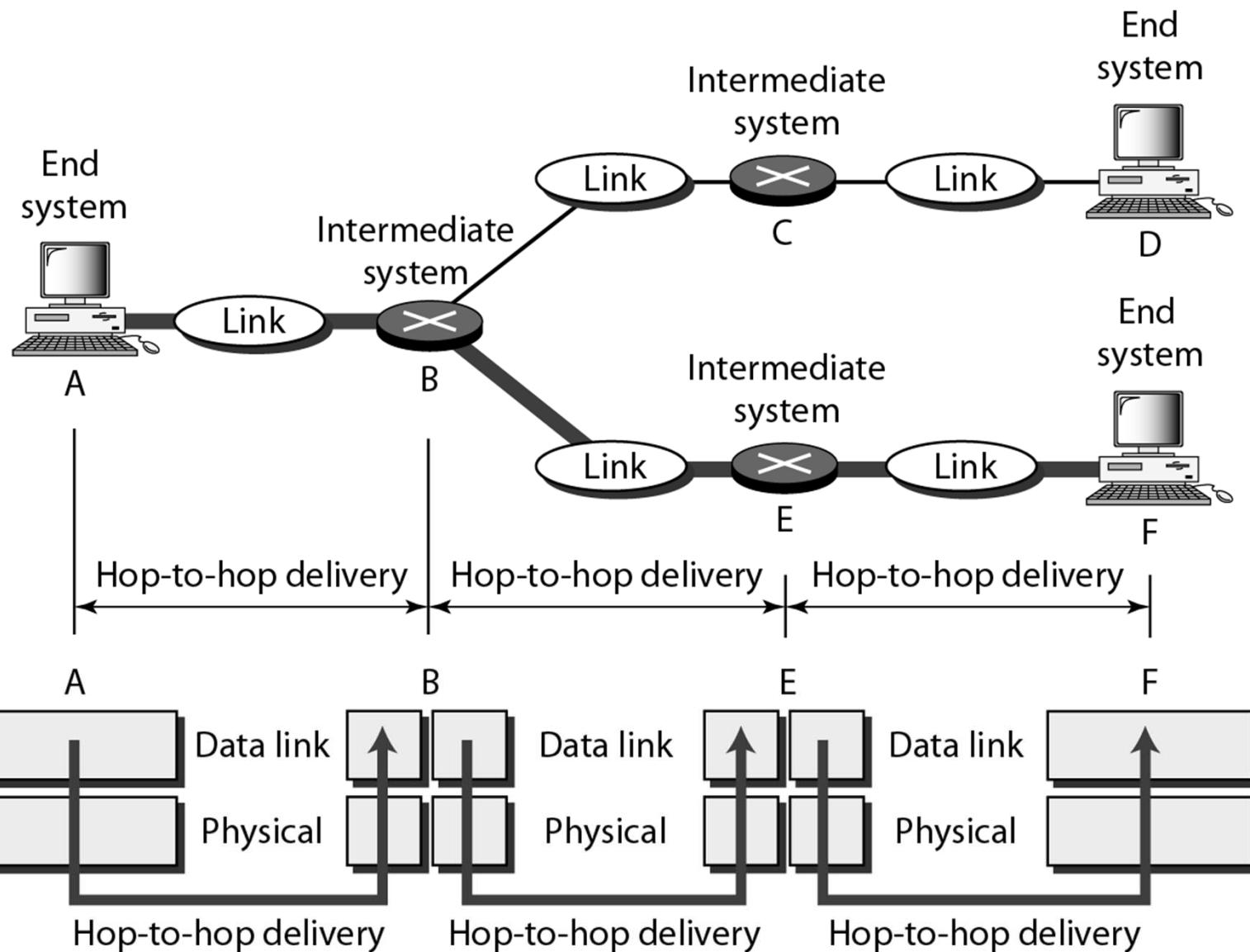
# Physical layer (Fig. 2.5)



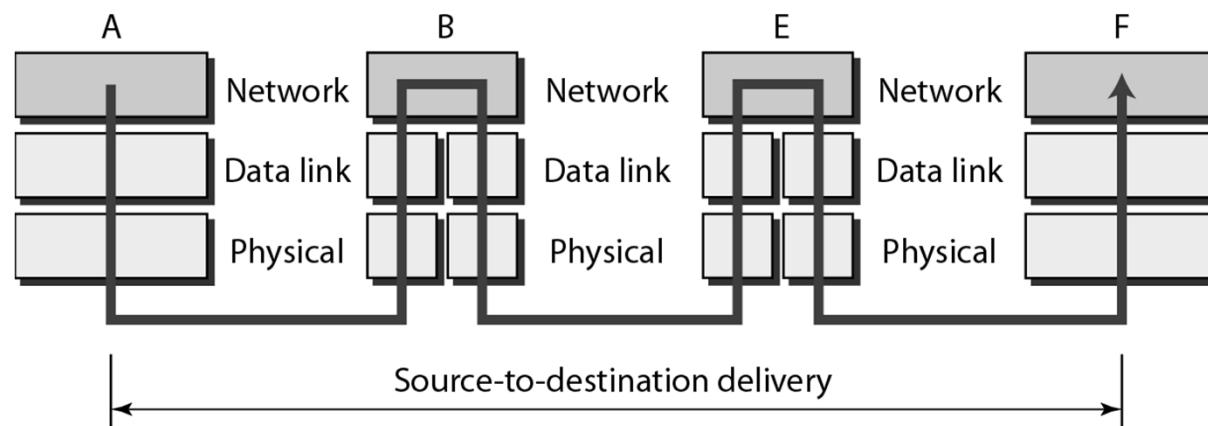
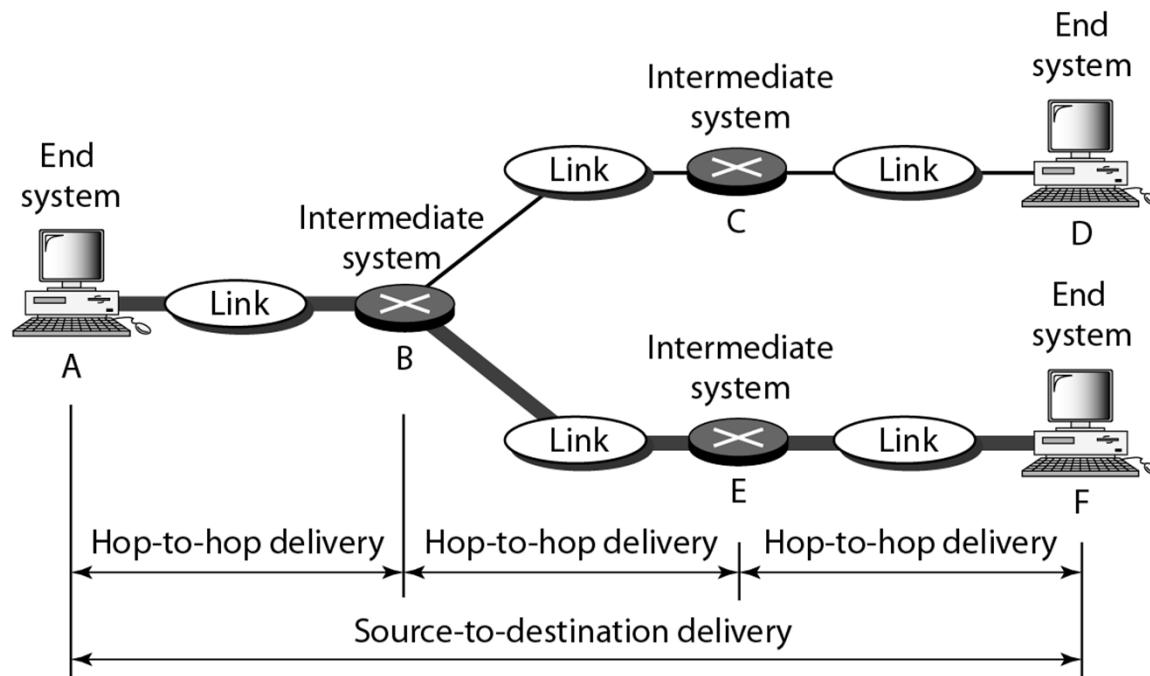
# Transport and Network Layer Example



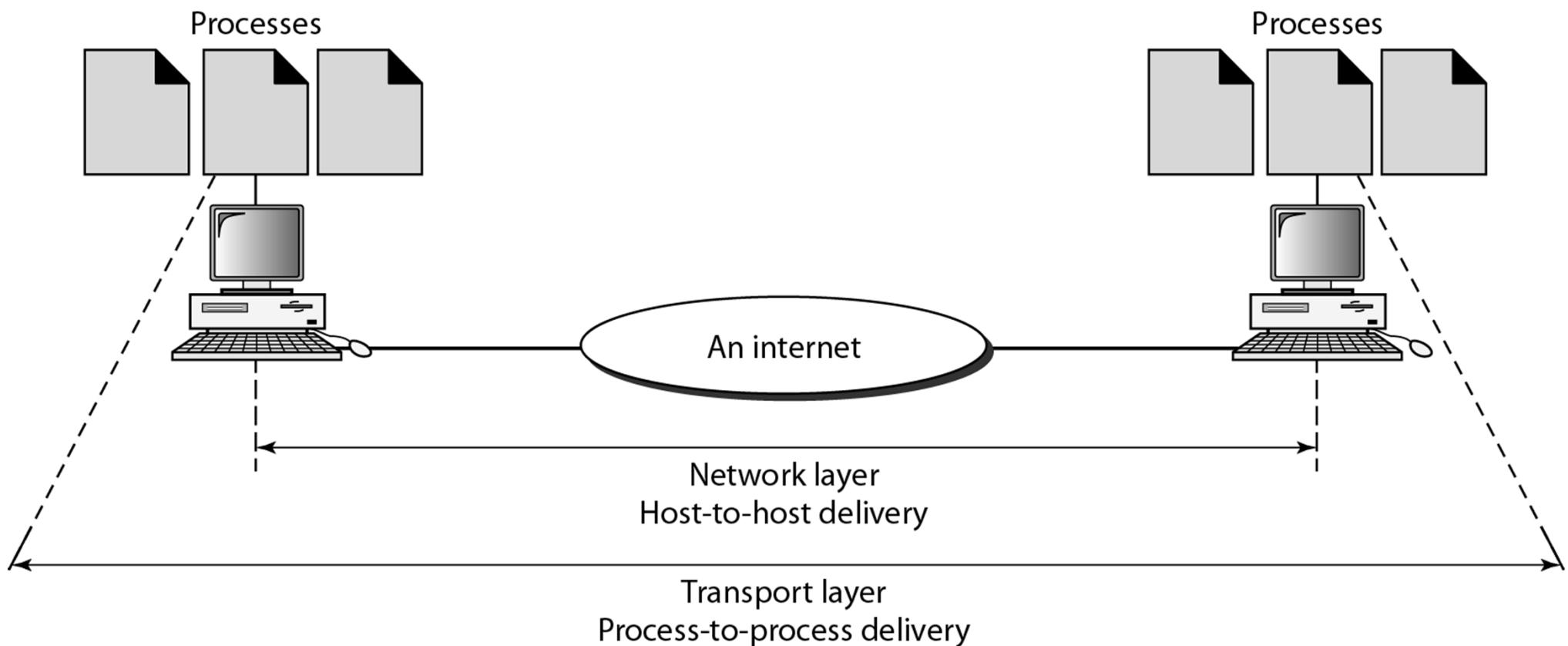
# Hop-to-hop delivery (Fig. 2.7)



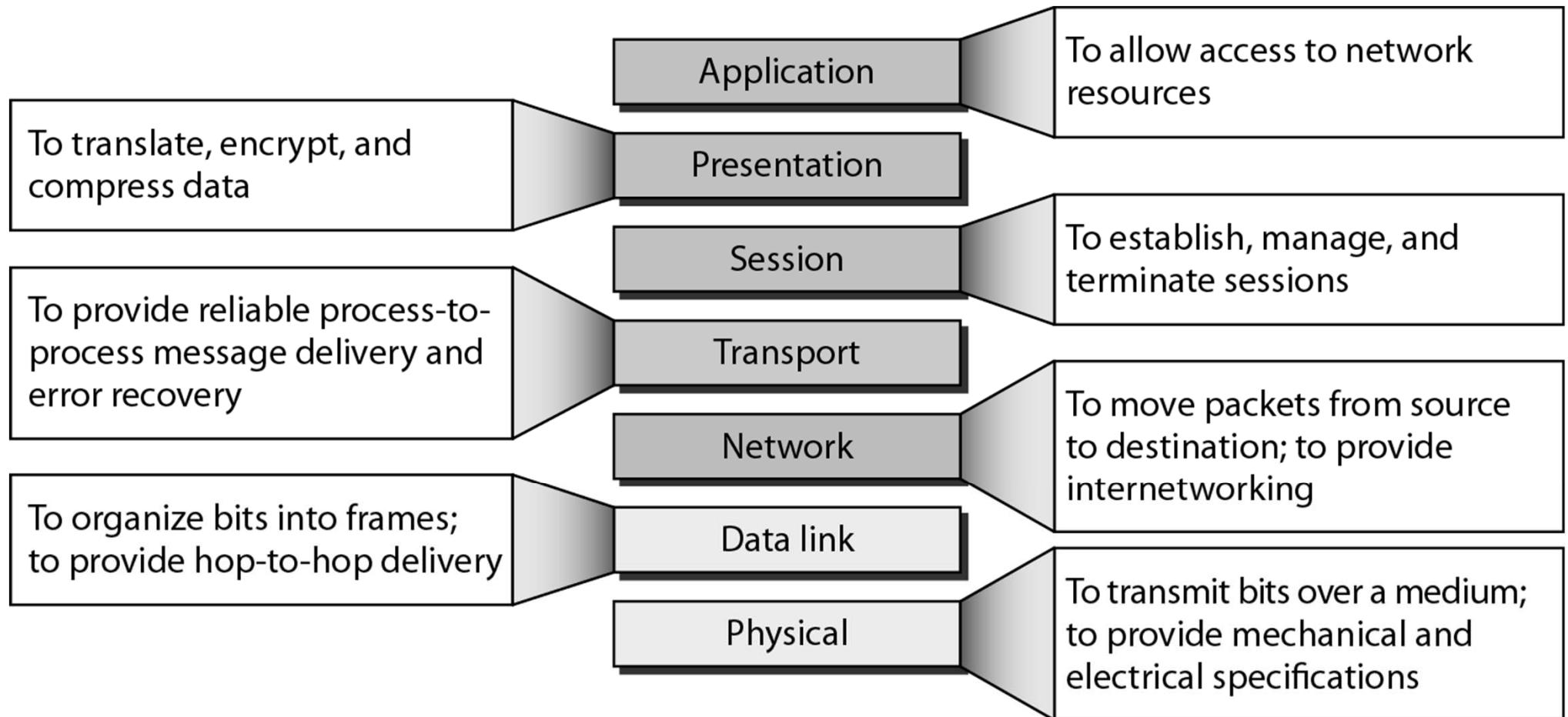
# Source-to-destination delivery (Fig. 2.9)



# Reliable process-to-process delivery of a message (Fig. 2.11)



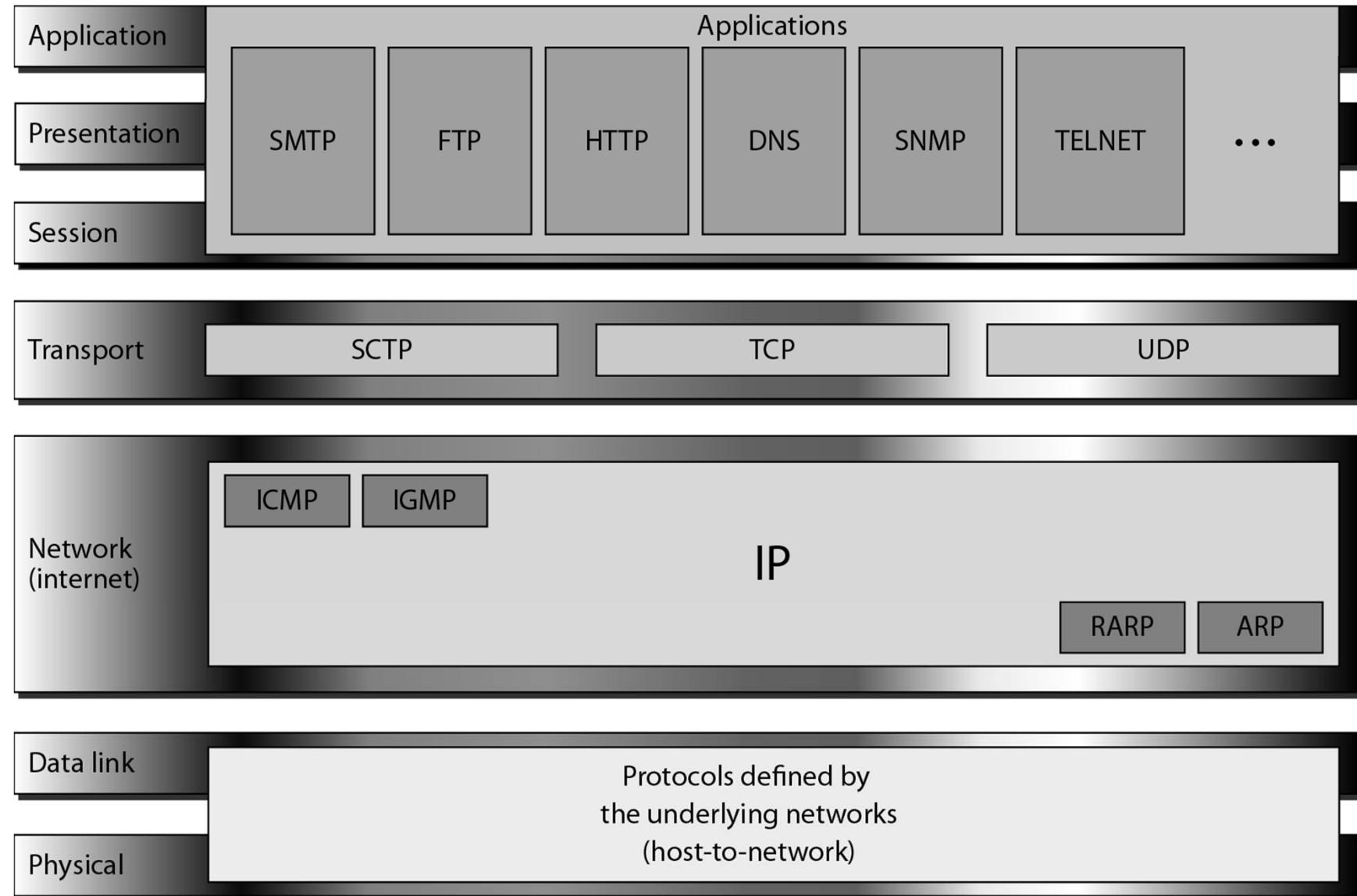
# Summary of layers (Fig. 2.15)



# TCP/IP PROTOCOL SUITE

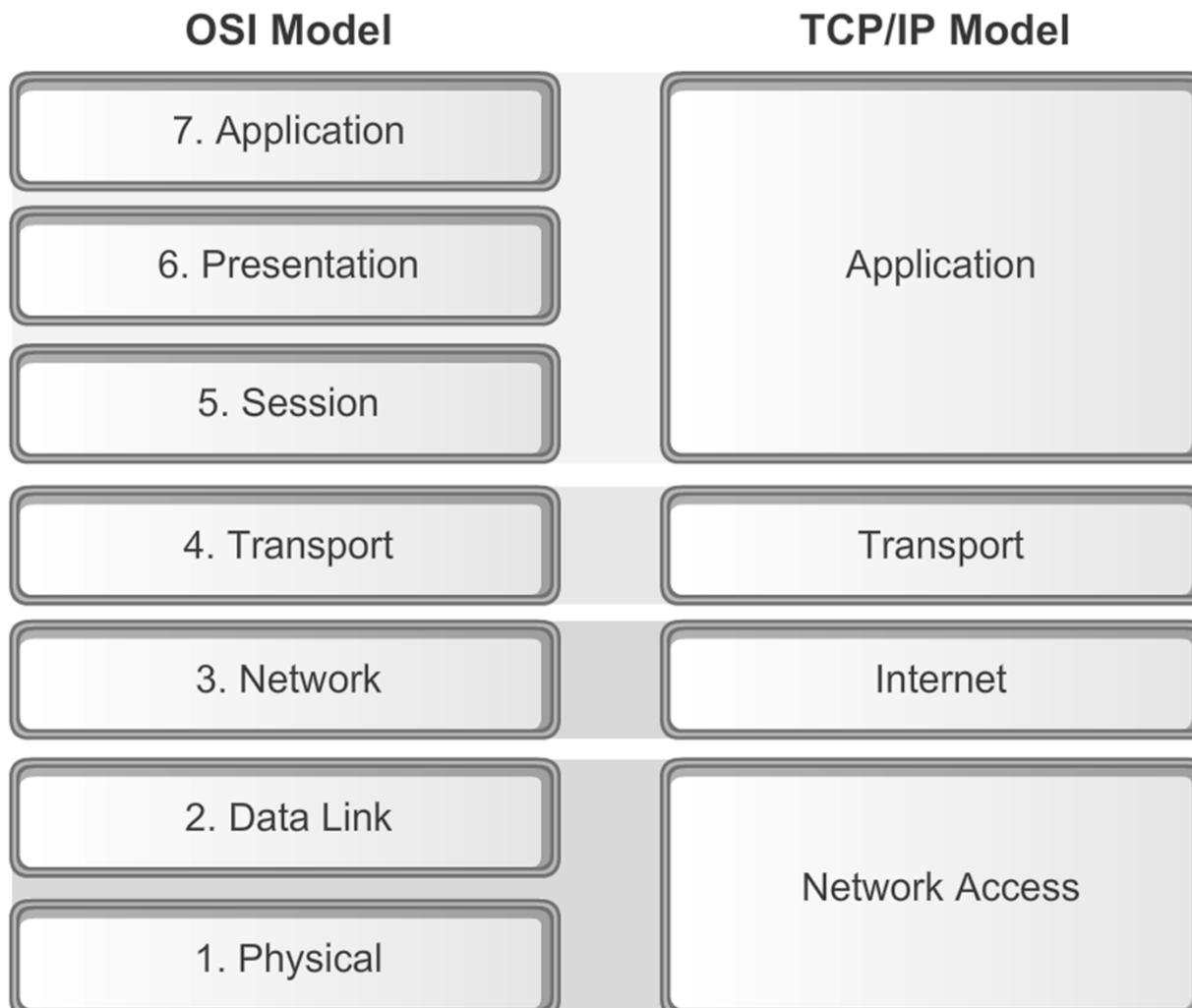
- Physical and Data Link Layers
- Network Layer
- Transport Layer
- Application Layer

# TCP/IP and OSI model (Fig. 2.16)



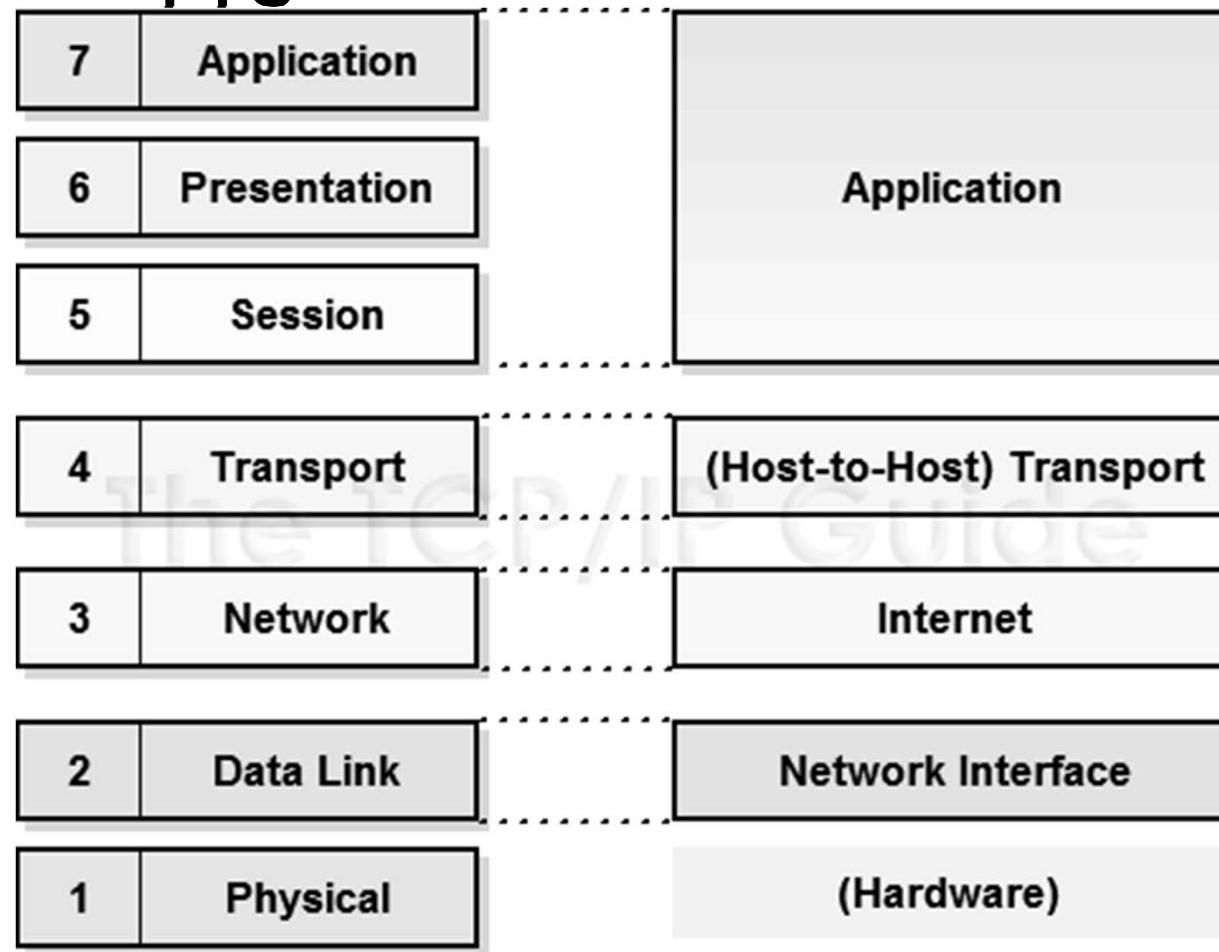
# Comparison of OSI and TCP/IP

- <https://www.netacad.com/>



# Comparison of OSI and TCP/IP

- <http://www.tcpipguide.com>



# OSI model and TCP/IP protocol

ARPA: Advanced Research Projects Agency

DOD : Department Of Defense

## OSI model

1970 (ISO, CCITT)

(International Organization of Standardization)

(Consultative Committee for International Telegraph and Telephony)

1983 (draft)

ITU-T (International Telecommunication Union-  
Telecommunication Standardization Sector)

1984 (release OSI)

1960 (ARPA in DOD)

1972 (draft)

1973 (release TCP/IP)

TCP/IP protocol