Protocol

Protocols

- Used for communications between entities in a system
- Must speak the same language
- Entities
  - User applications
  - e-mail facilities
  - terminals
- Systems
  - Computer
  - Terminal
  - Remote sensor

What's a protocol?

human protocols:

- "what's the time?"
- "I have a question"
- introductions

… specific msgs sent

… specific actions taken when msgs received, or other events

network protocols:

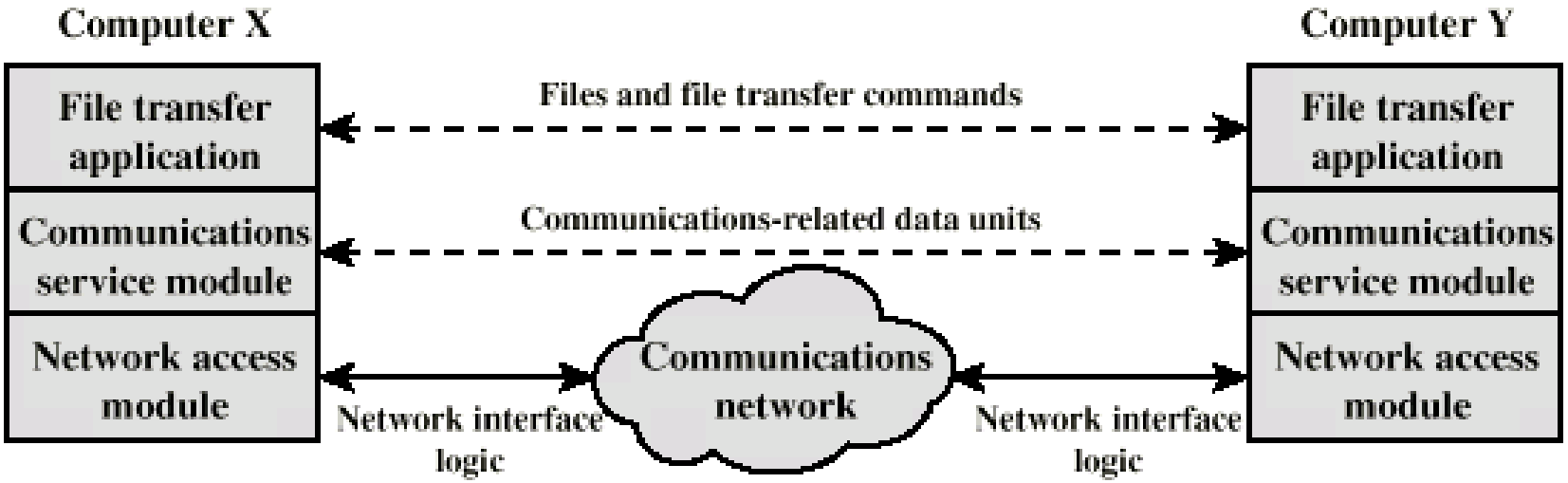
- machines rather than humans
- all communication activity in Internet governed by protocols

protocols define format, order of msgs sent and received among network entities, and actions taken on msg transmission, receipt

Protocol Architecture

- Task of communication broken up into modules
- For example file transfer could use three modules
  - File transfer application
  - Communication service module
  - Network access module

Simplified File Transfer Architecture



A Three Layer Model

- Network Access Layer
- Transport Layer
- Application Layer

Network Access Layer

- Exchange of data between the computer and the network
- Sending computer provides address of destination
- May invoke levels of service
- Dependent on type of network used (LAN, packet switched etc.)

Transport Layer

- Reliable data exchange
- Independent of network being used
- Independent of application

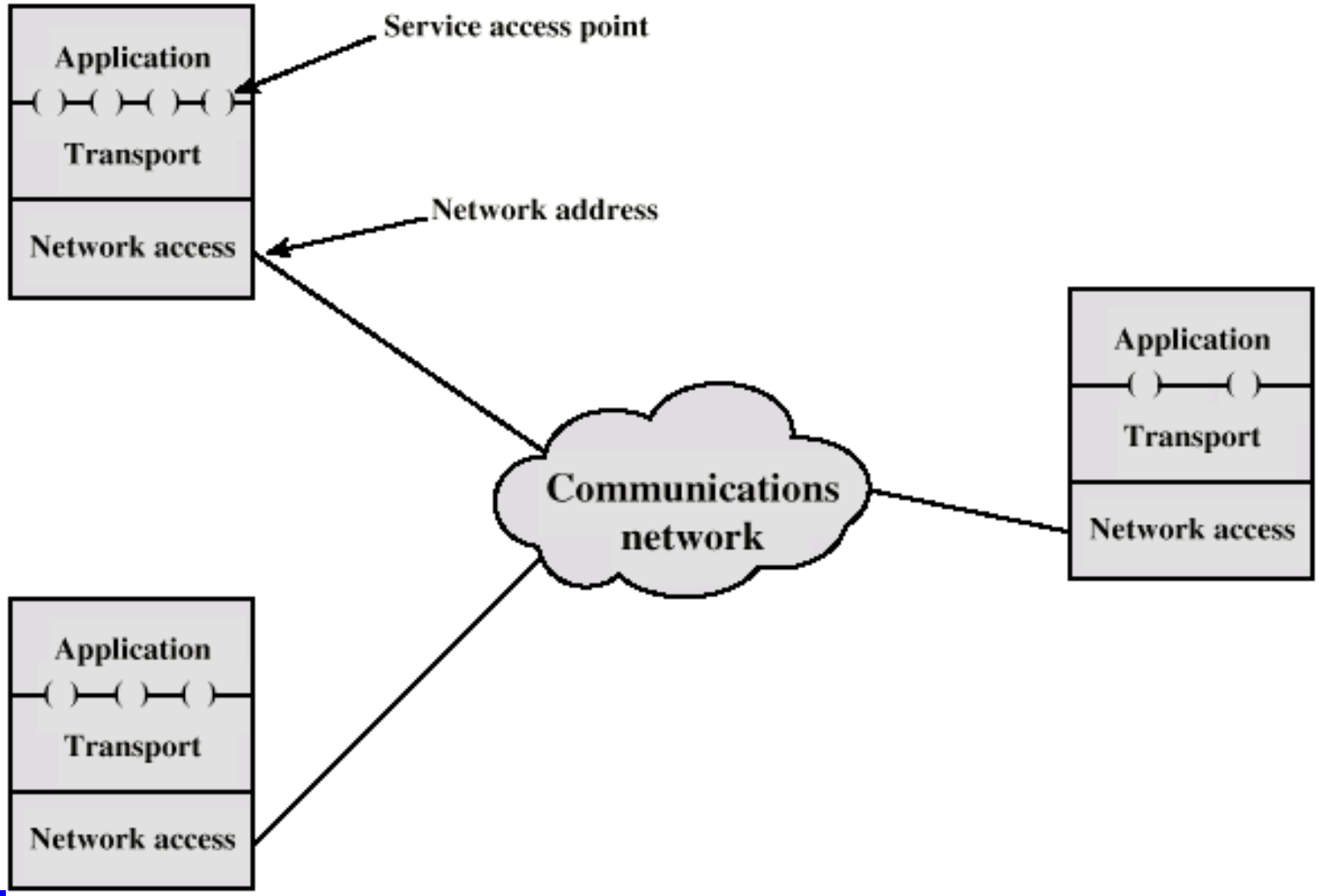
Application Layer

- Support for different user applications
- e.g. e-mail, file transfer

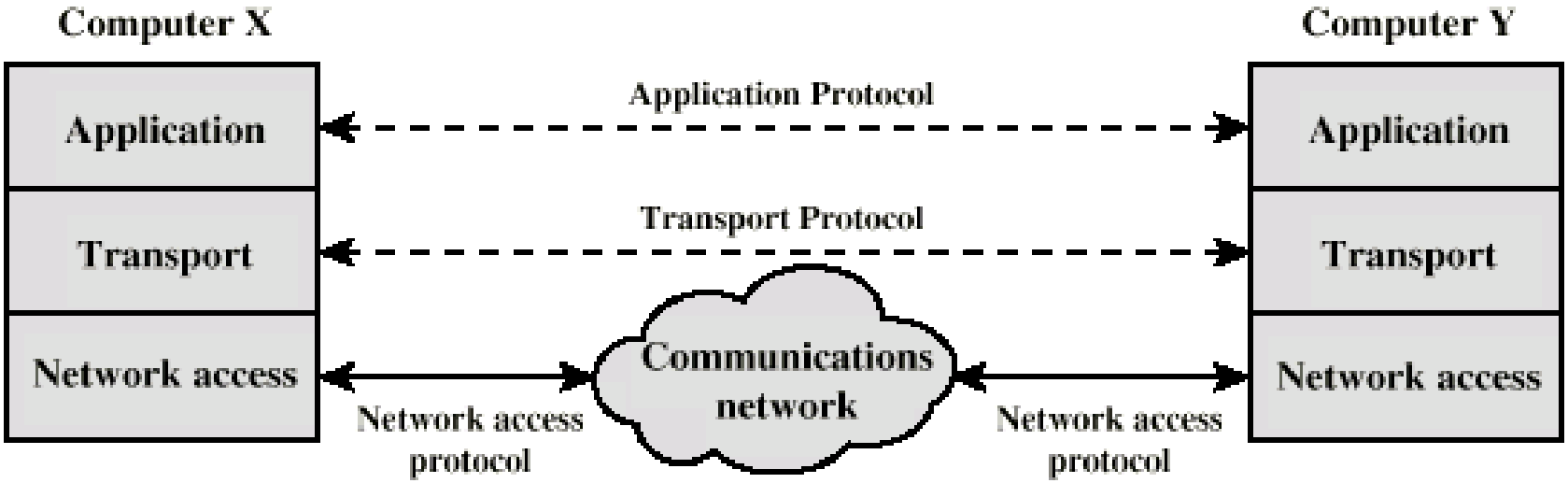
Addressing Requirements

- Two levels of addressing required
- Each computer needs unique network address
- Each application on a (multi-tasking) computer needs a unique address within the computer
  - The service access point or SAP

Protocol Architectures and Networks



Protocols in Simplified Architecture

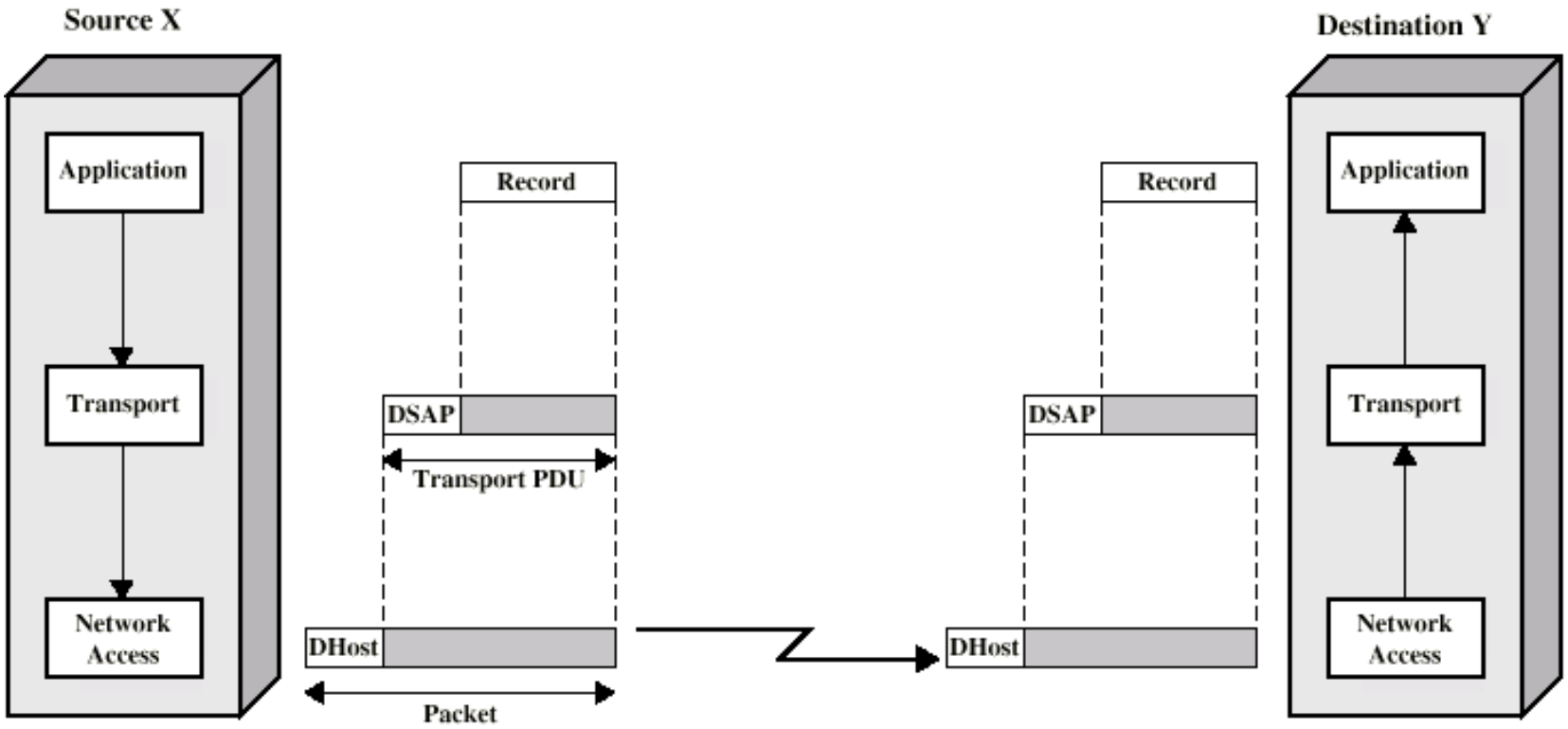


Protocol Data Units (PDU)

- At each layer, protocols are used to communicate
- Control information is added to user data at each layer
- Transport layer may fragment user data

- Each fragment has a transport header added
  - Destination SAP
  - Sequence number
  - Error detection code
- This gives a transport protocol data unit

Operation of a Protocol Architecture



OSI Model

- Open Systems Interconnection
- Developed by the International Organization for Standardization (ISO)
- Seven layers
- A theoretical system delivered too late!
- TCP/IP is the de facto standard

The OSI Model and TCP/IP Protocol Suite

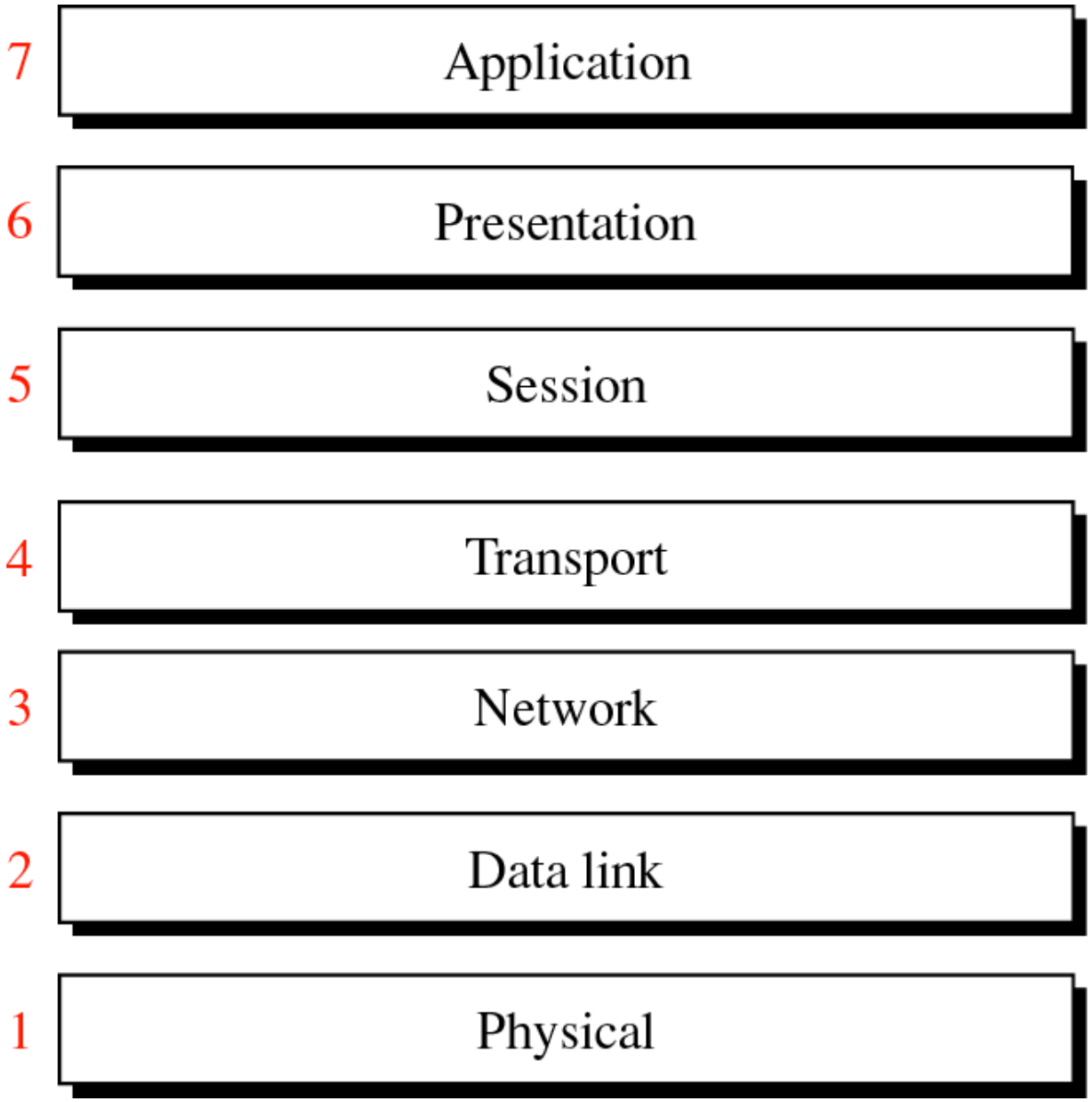
2.1

THE OSI MODEL

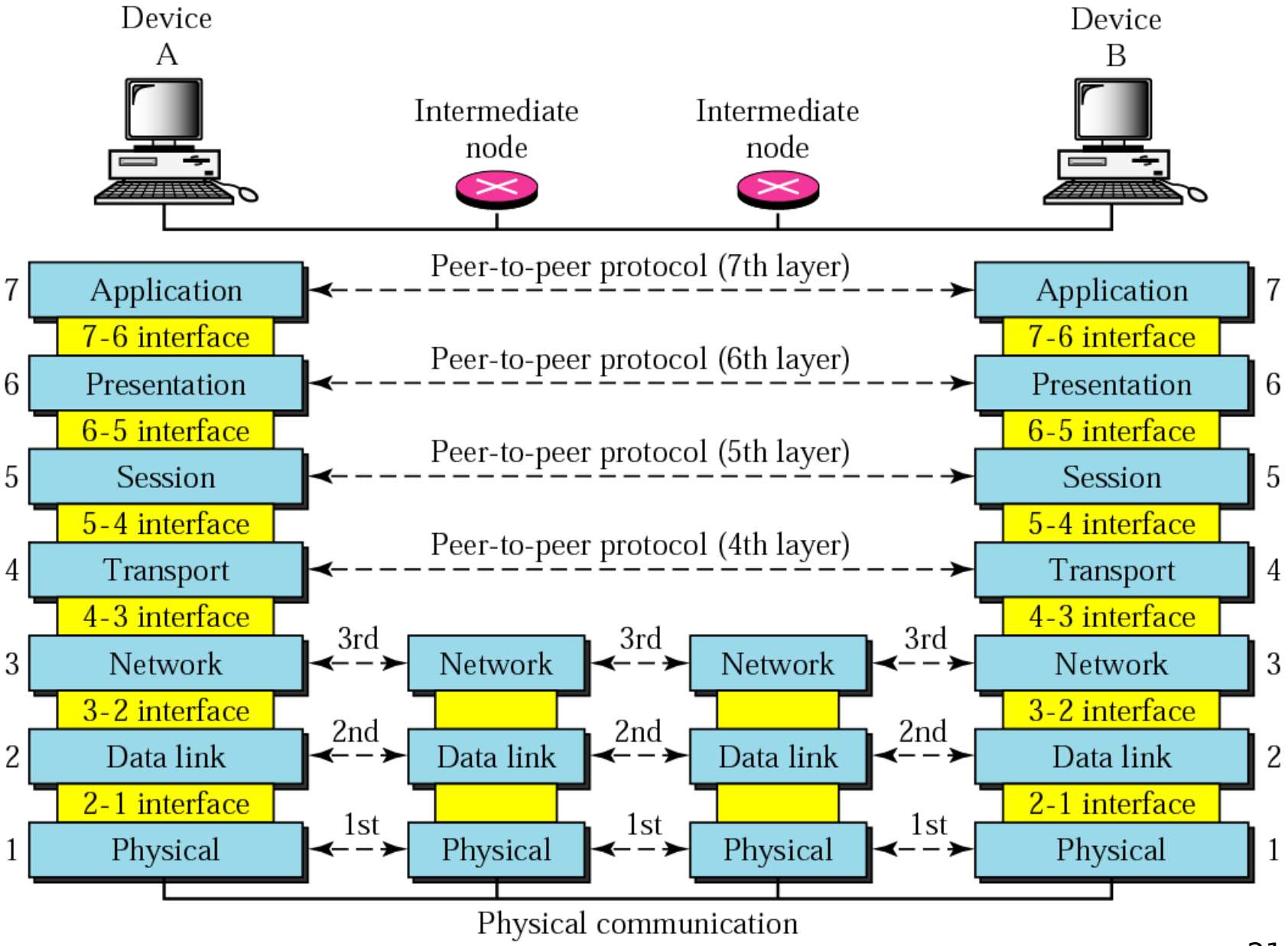
Note

ISO is the organization.
OSI is the model.

OSI Model


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

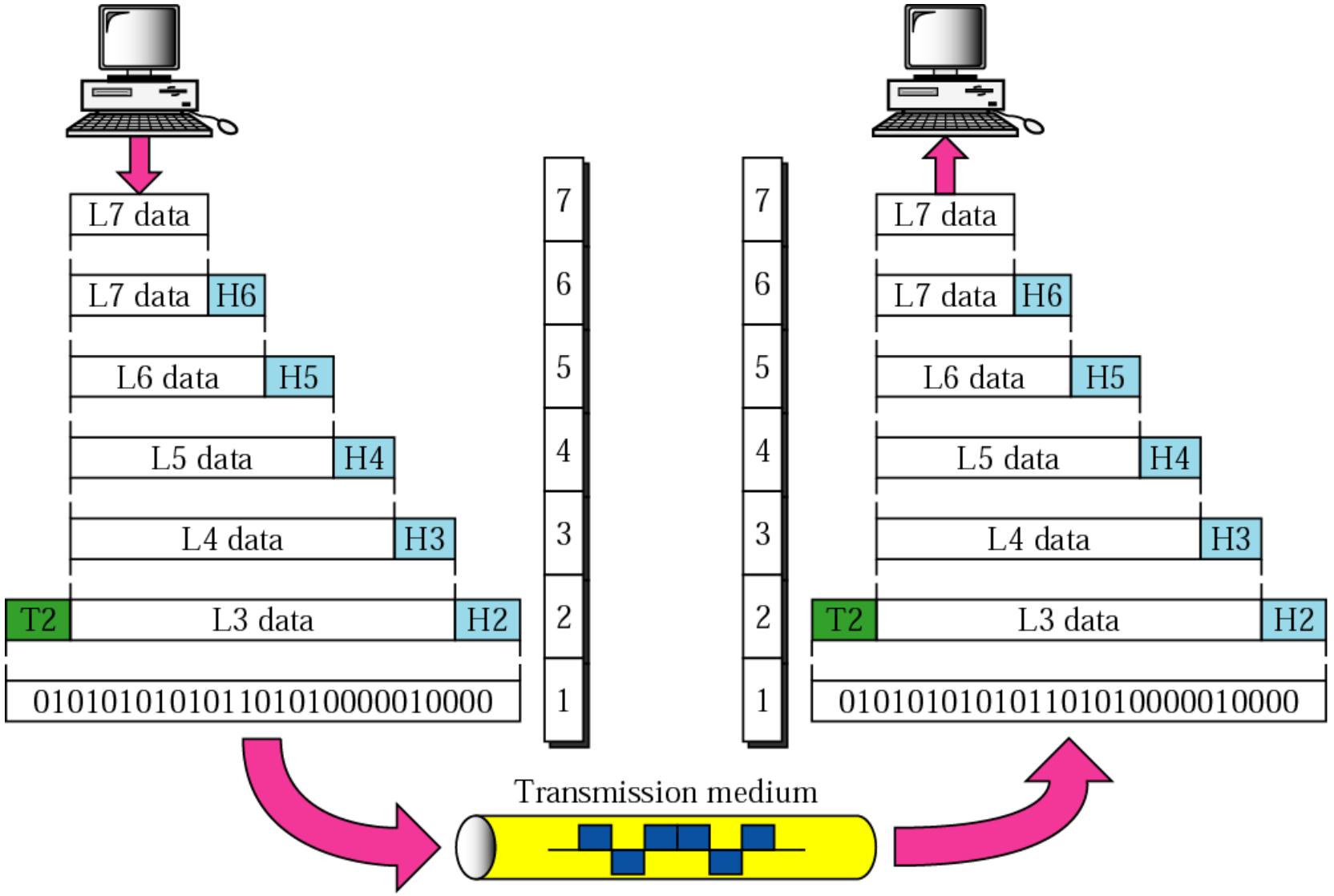
OSI layers


Device A
Device B
Intermediate node
Intermediate node
Peer-to-peer protocol (7th layer)
Peer-to-peer protocol (6th layer)
Peer-to-peer protocol (5th layer)
Peer-to-peer protocol (4th layer)
7 Application
7-6 interface
6 Presentation
6-5 interface
5 Session
5-4 interface
4 Transport
4-3 interface
3rd
3 Network
3-2 interface
2nd
2 Data link
2-1 interface
1st
1 Physical
Physical communication

Note

Headers are added to the data at layers 6, 5, 4, 3, and 2. Trailers are usually added only at layer 2.

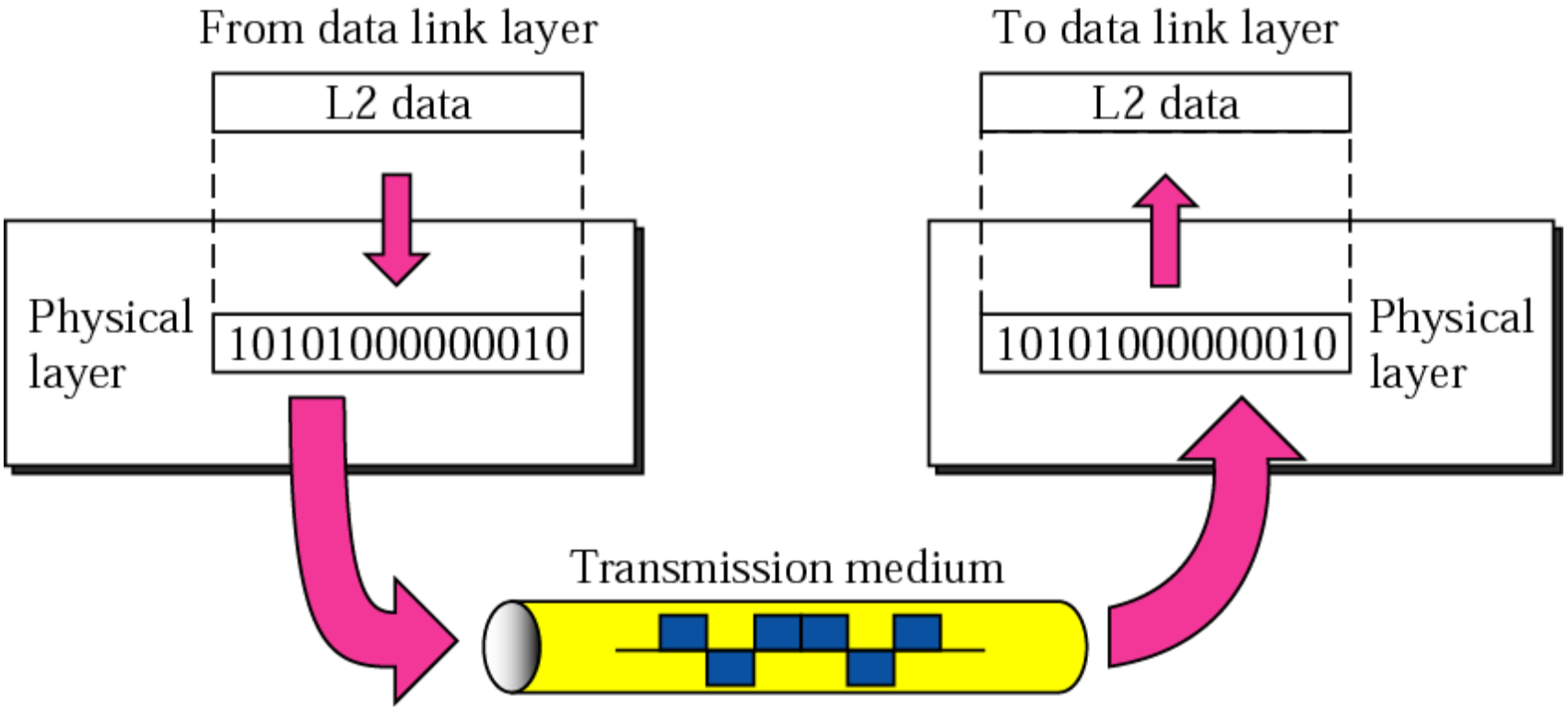
An exchange using the OSI model



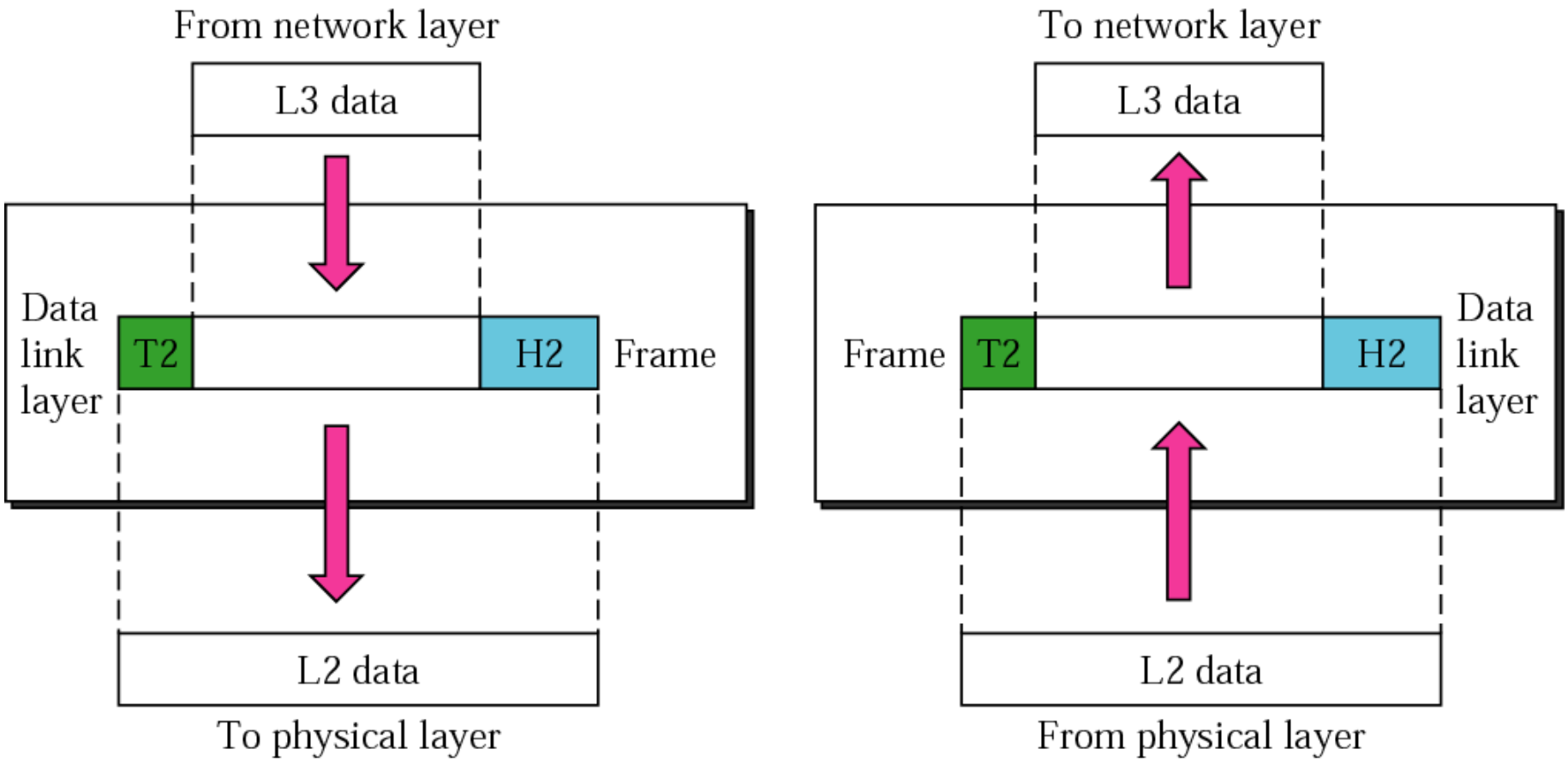
2.2

LAYERS IN THE OSI MODEL

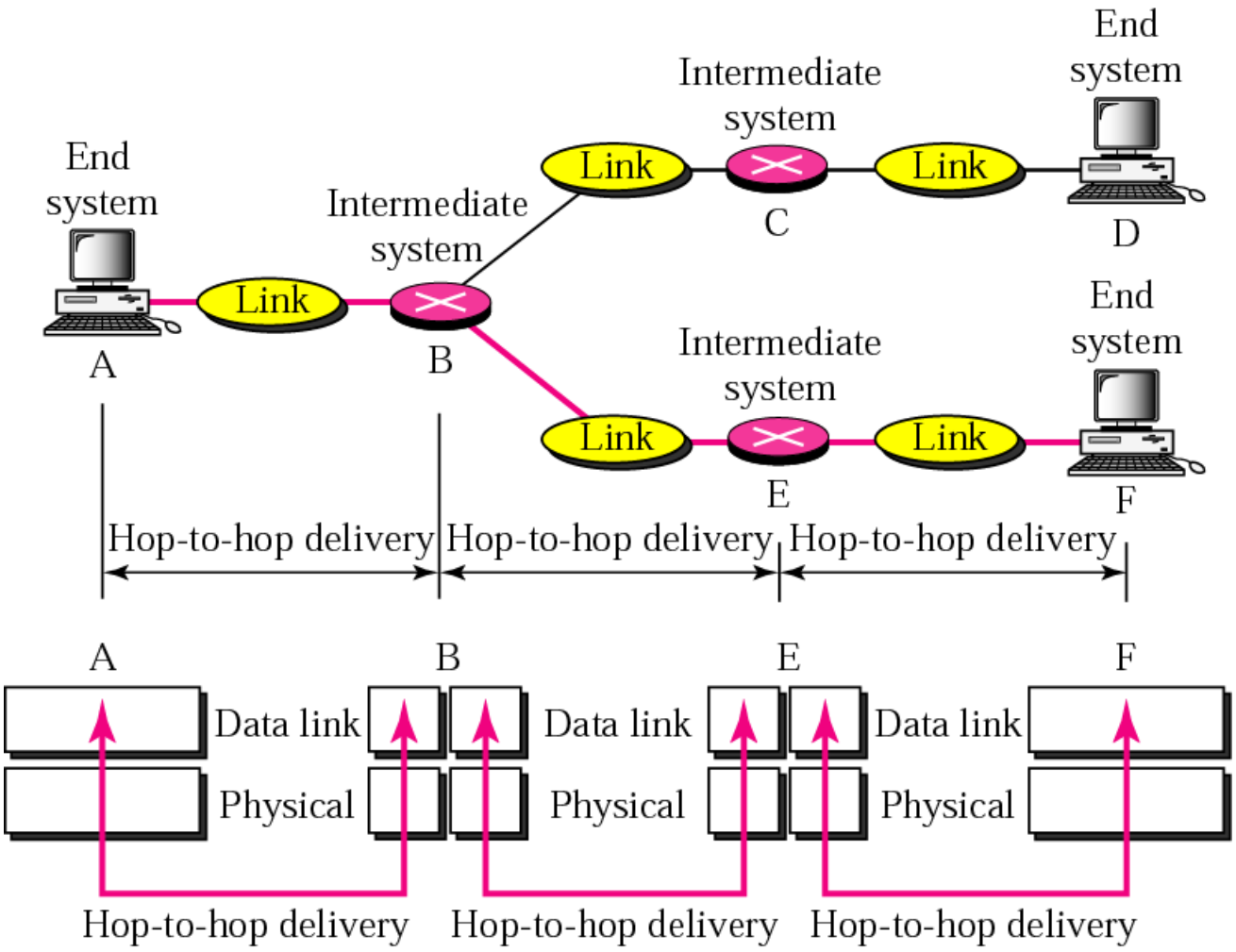
Physical Layer



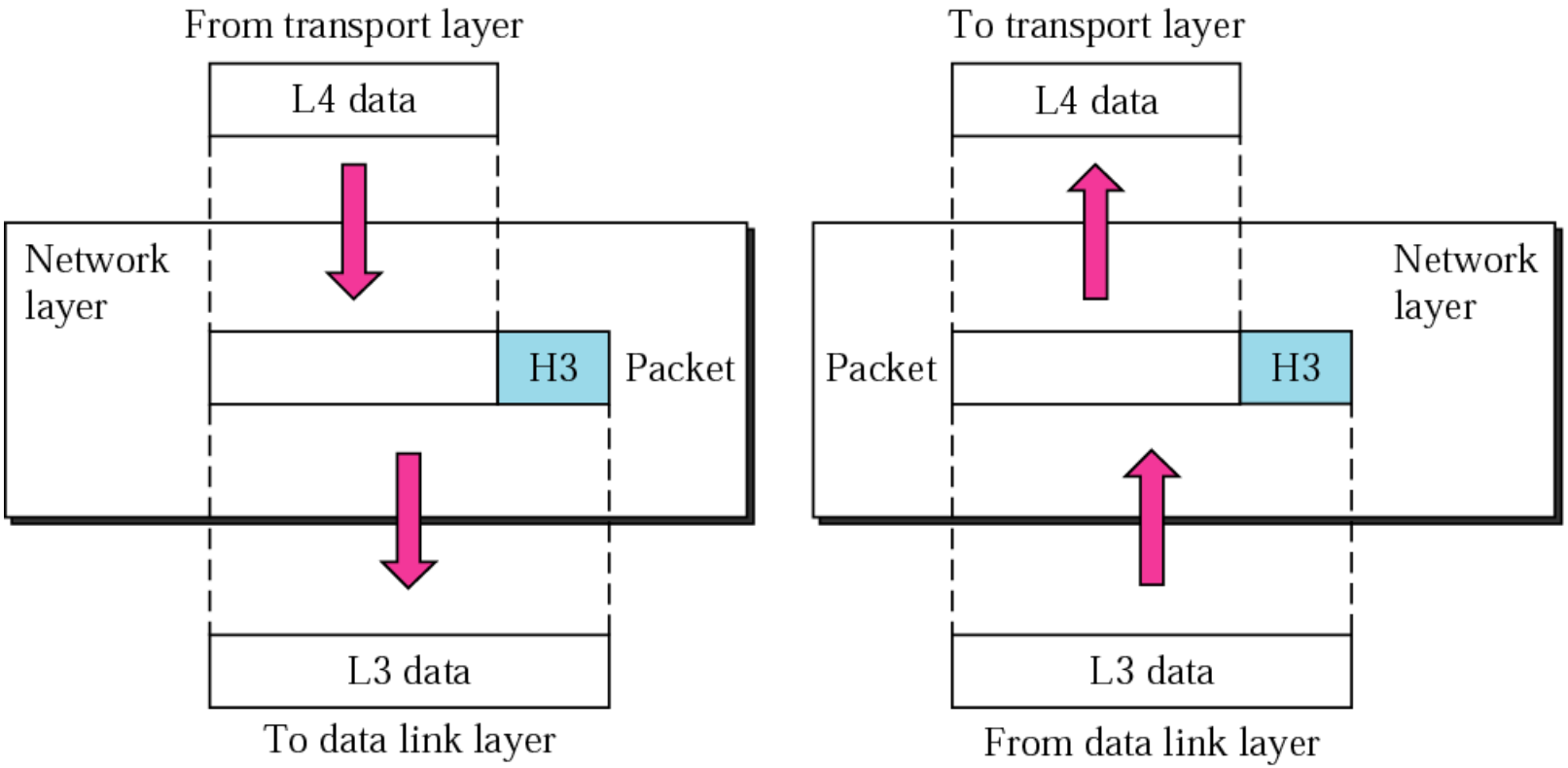
Data Link Layer



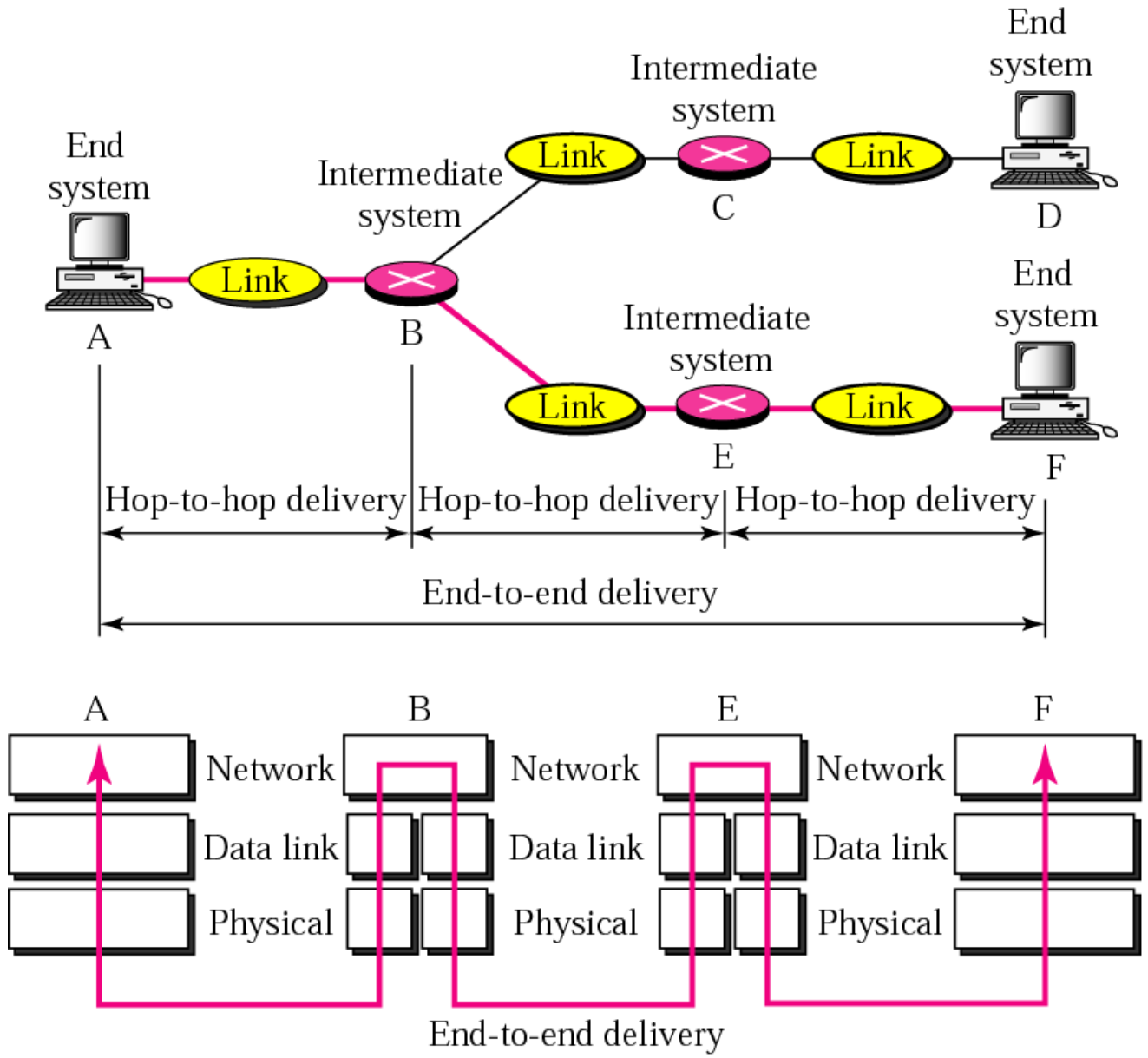
Node-to-node delivery



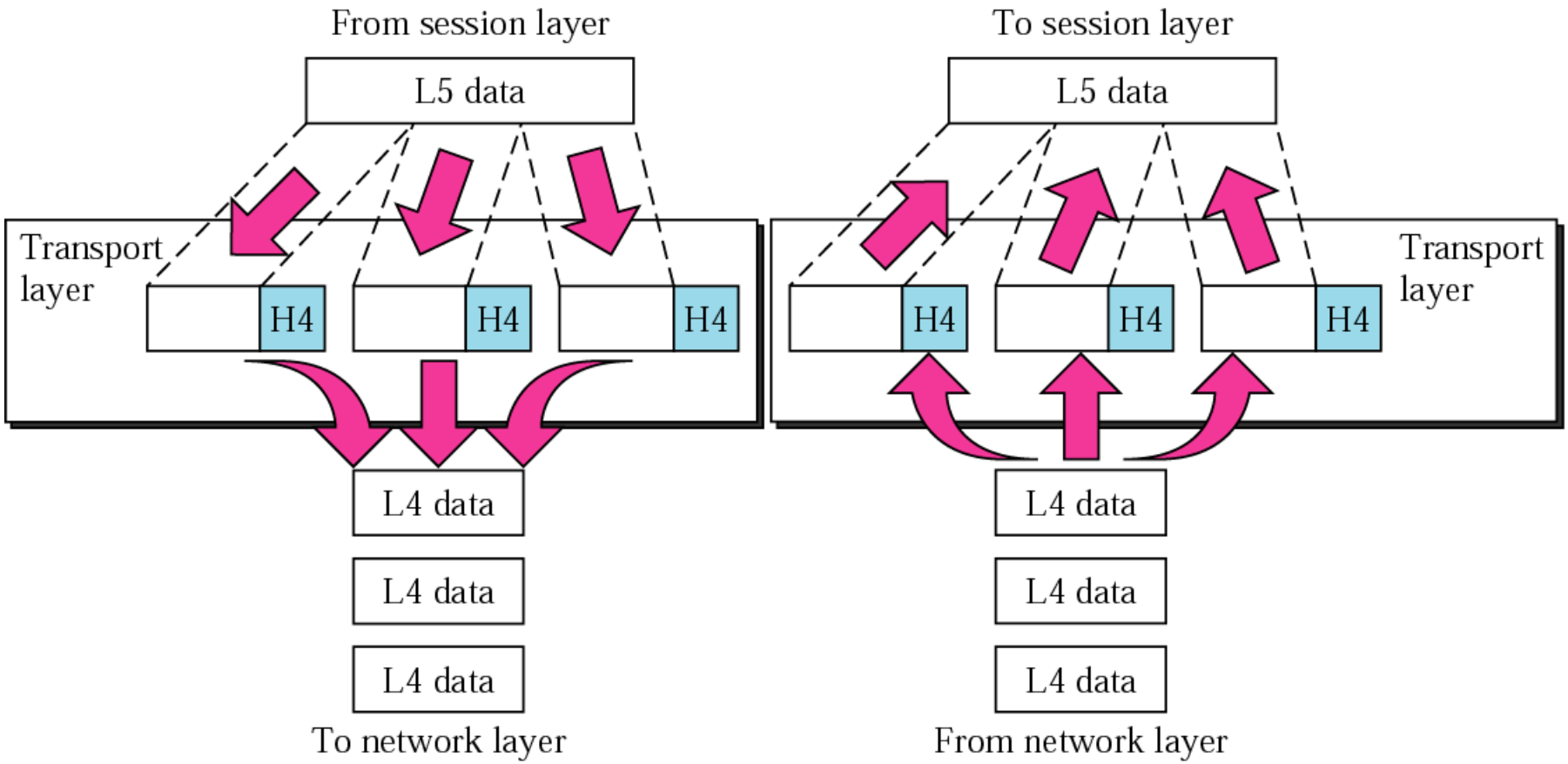
Network Layer



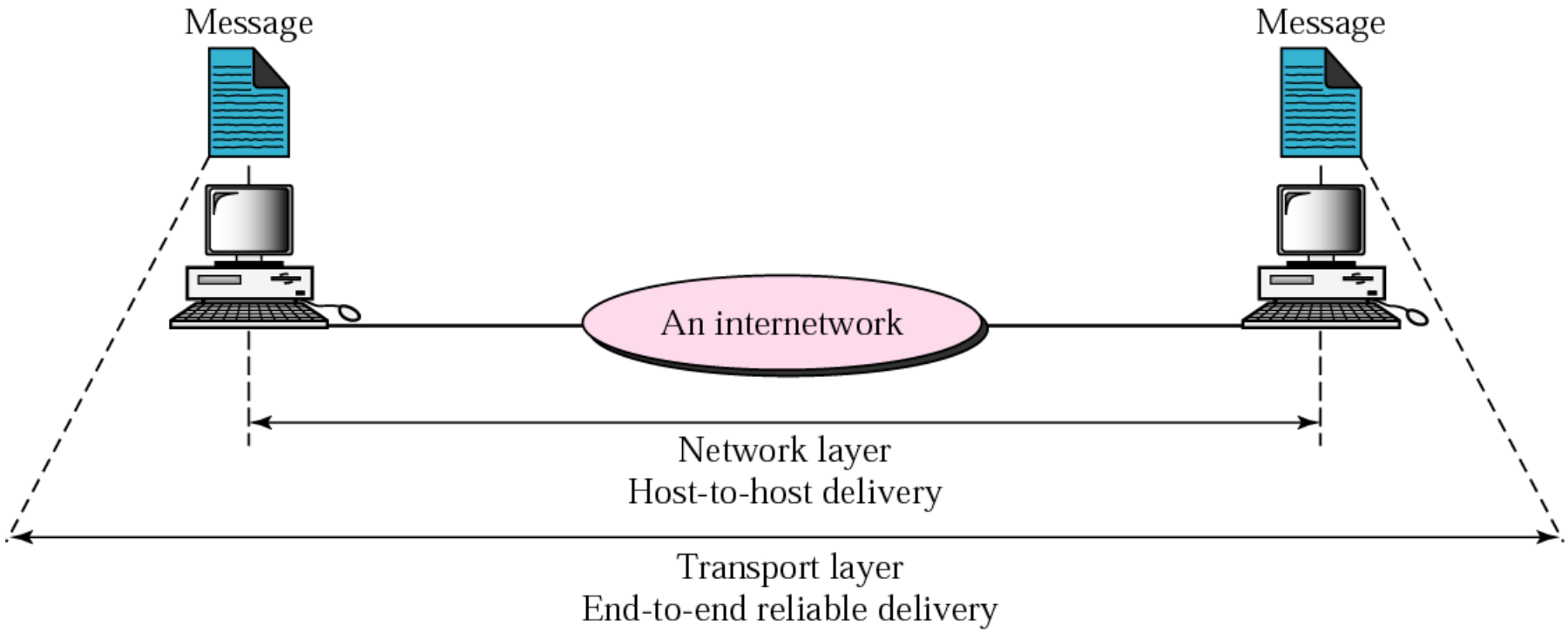
End-to-end delivery



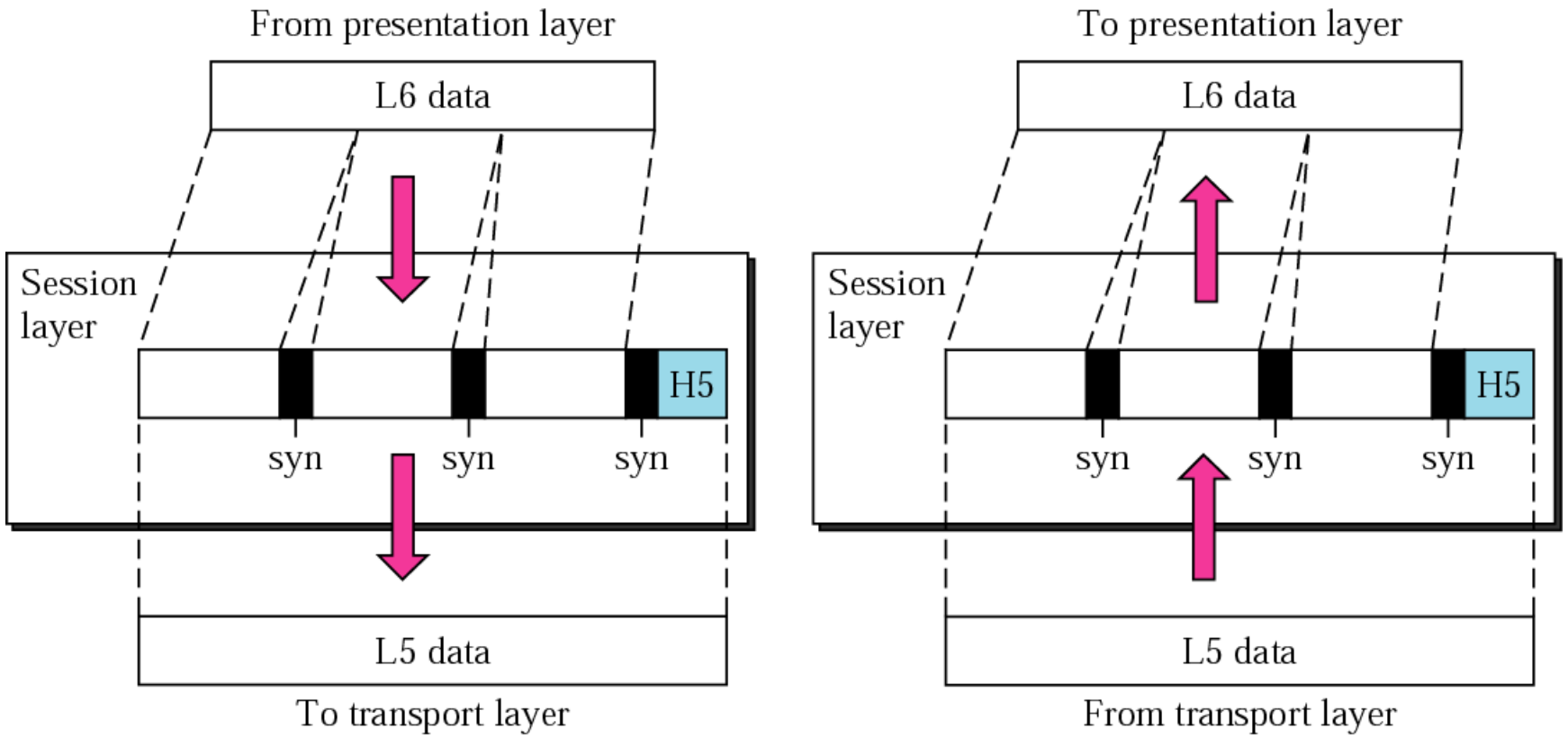
Transport Layer



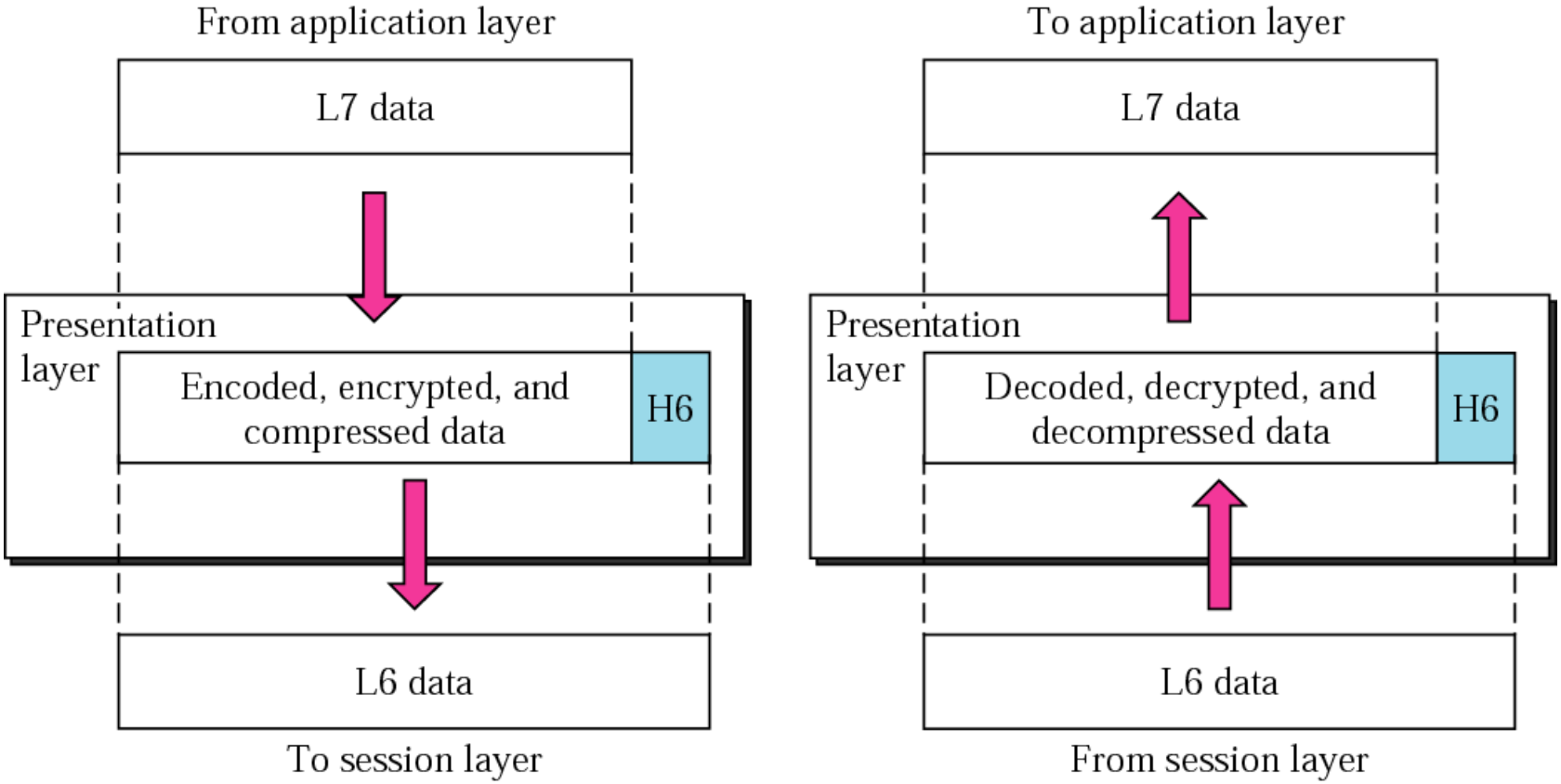
Reliable end-to-end delivery of a message



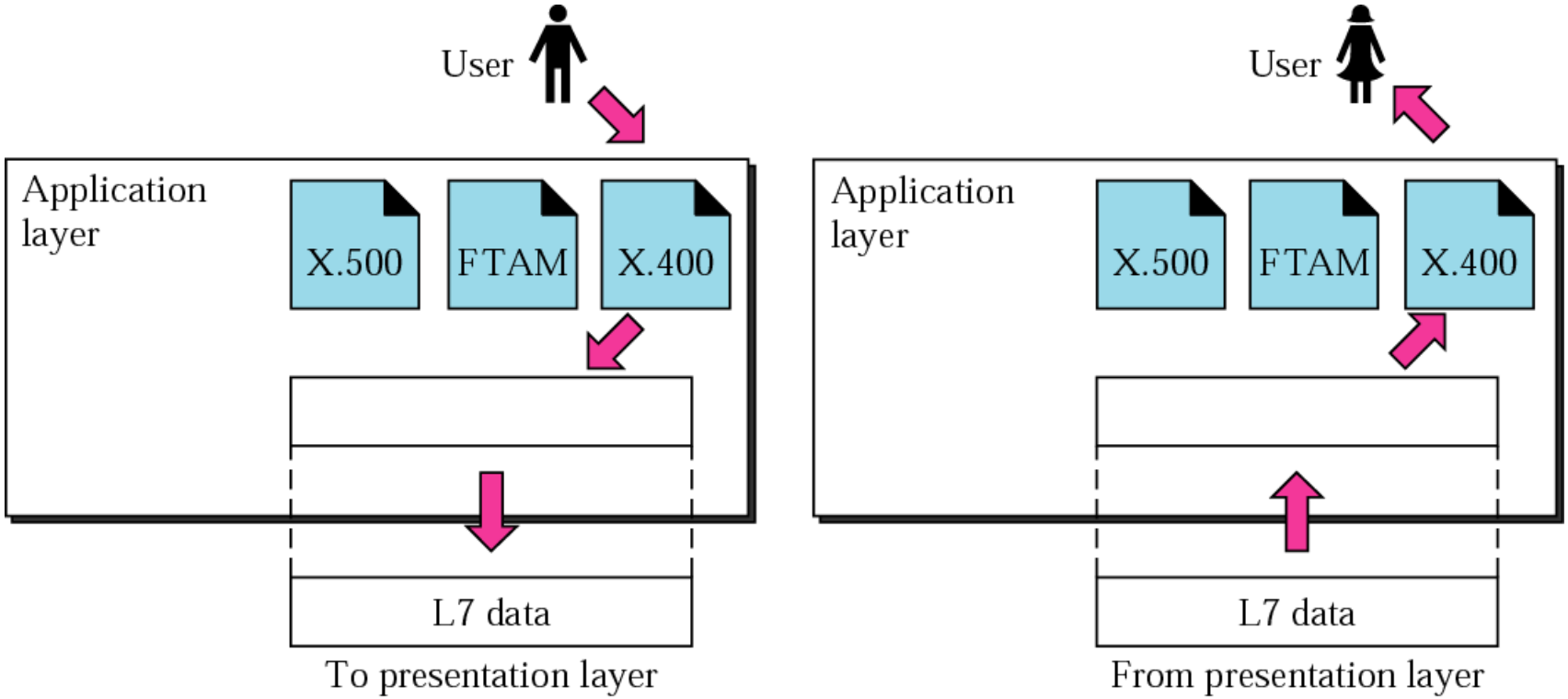
Session Layer



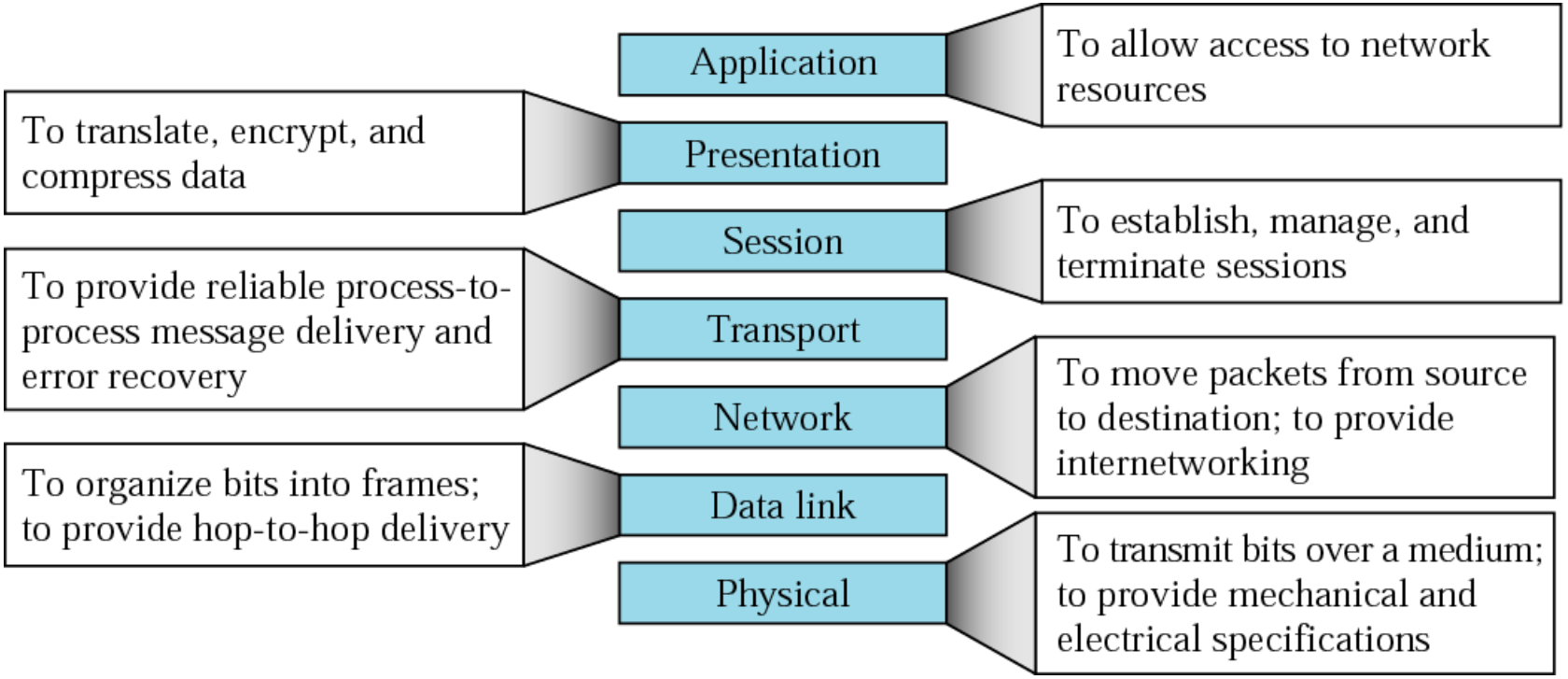
Presentation Layer



Application Layer



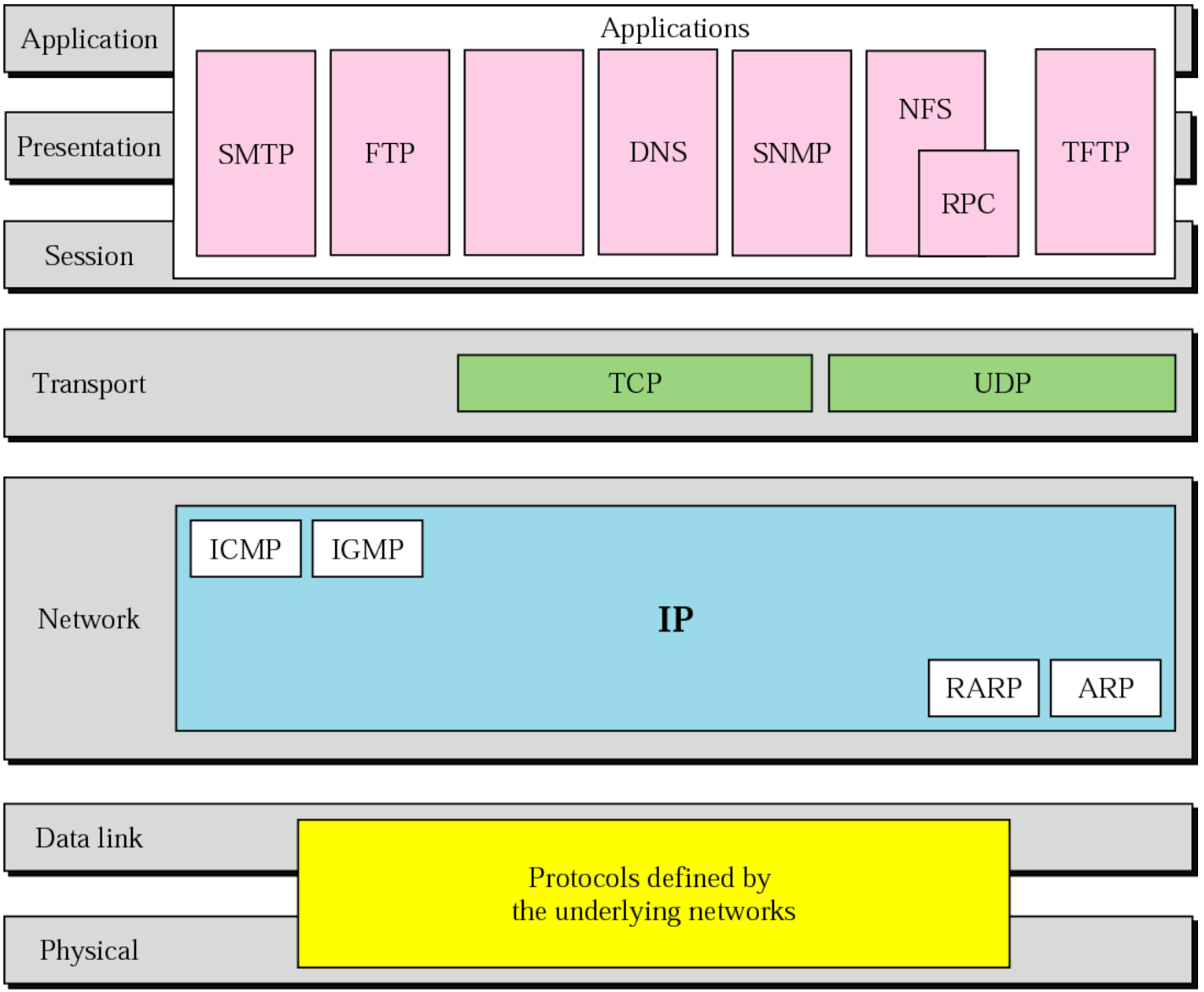
Summary of layers



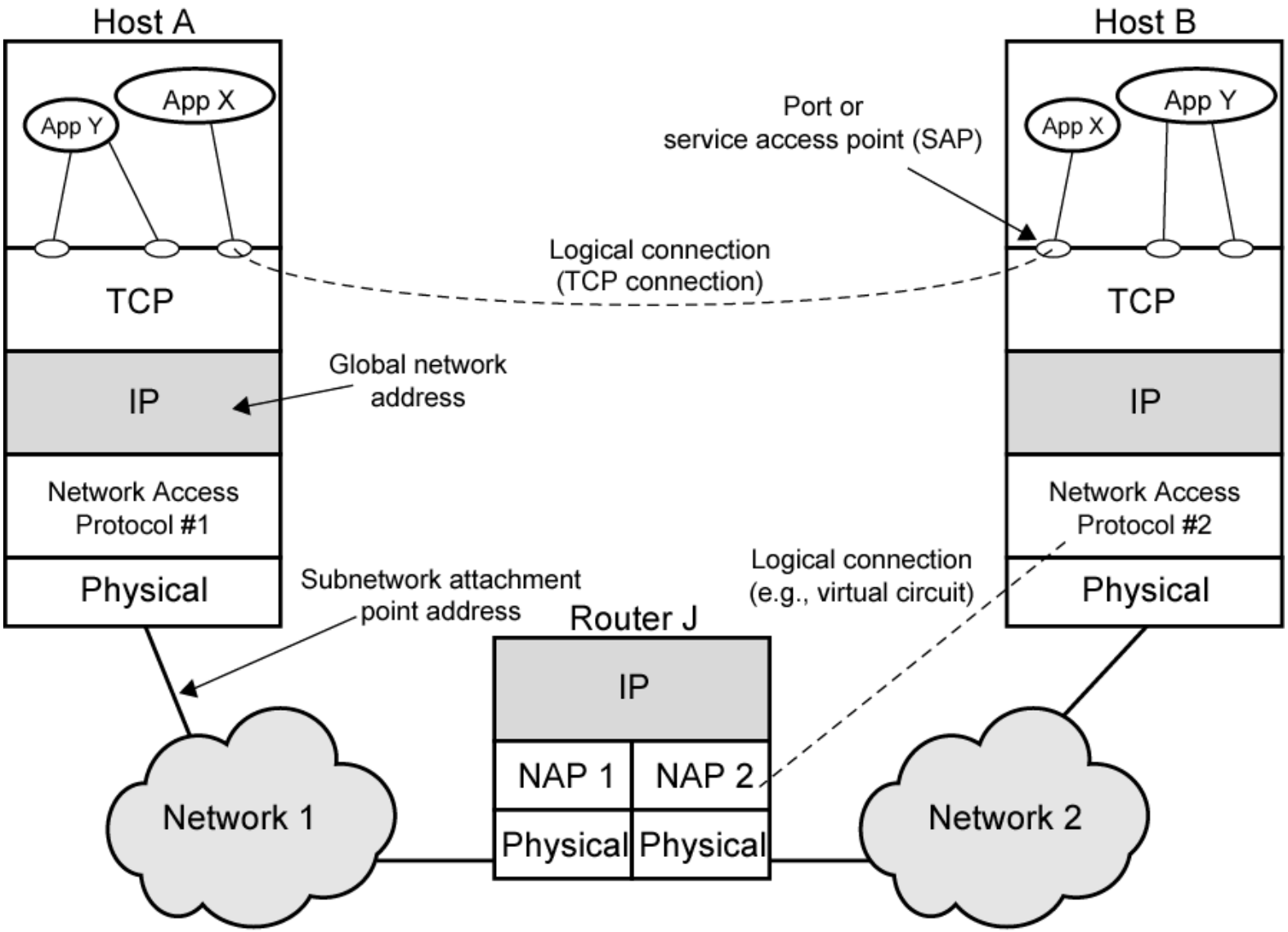
2.3

TCP/IP PROTOCOL SUITE

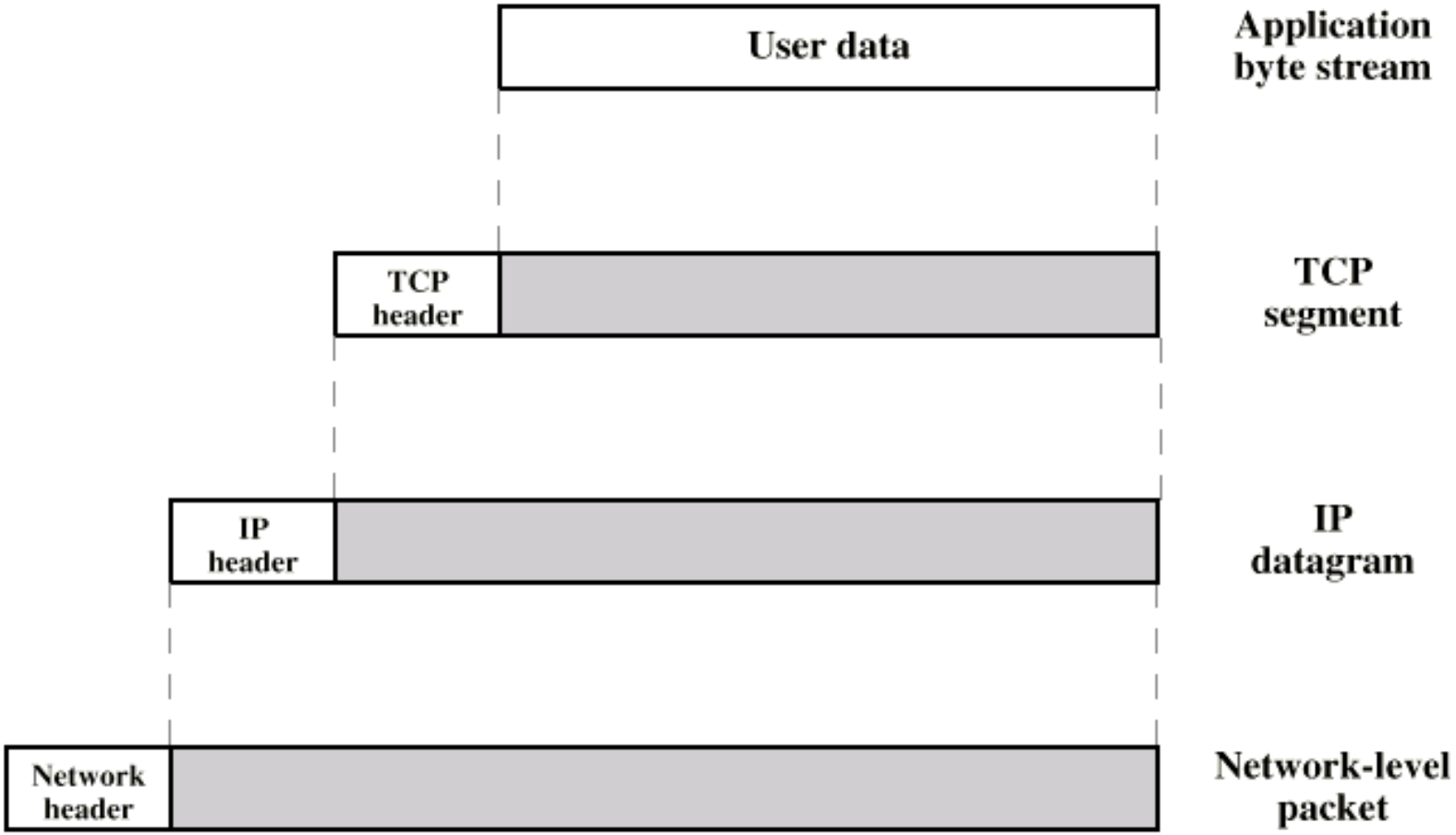
TCP/IP and OSI model



TCP/IP Concepts



PDUs in TCP/IP



Example Header Information

- Destination port
- Sequence number
- Checksum