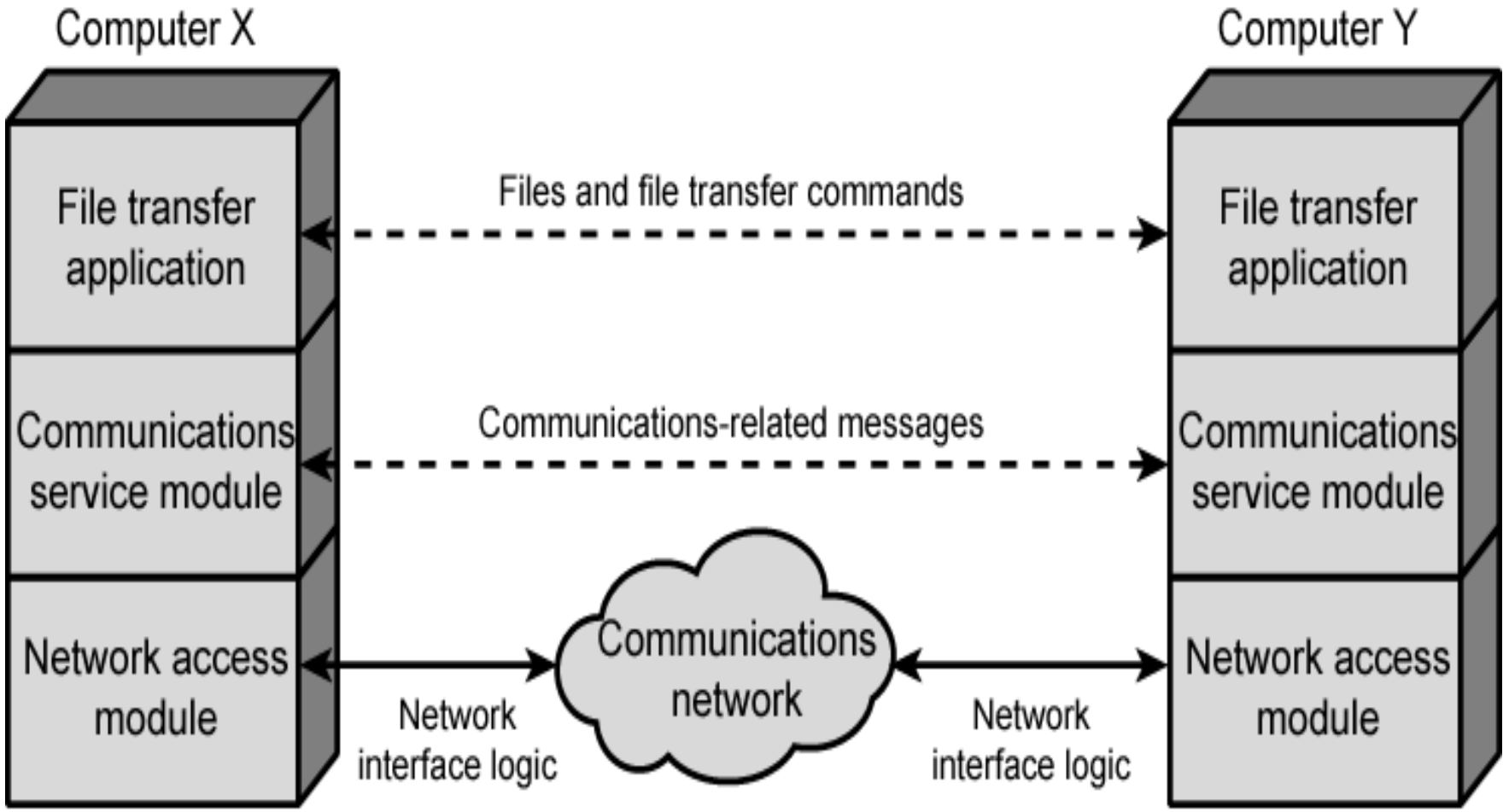
Data Communication

LAYER ARCHITECTURE

OSI

TCP/IP

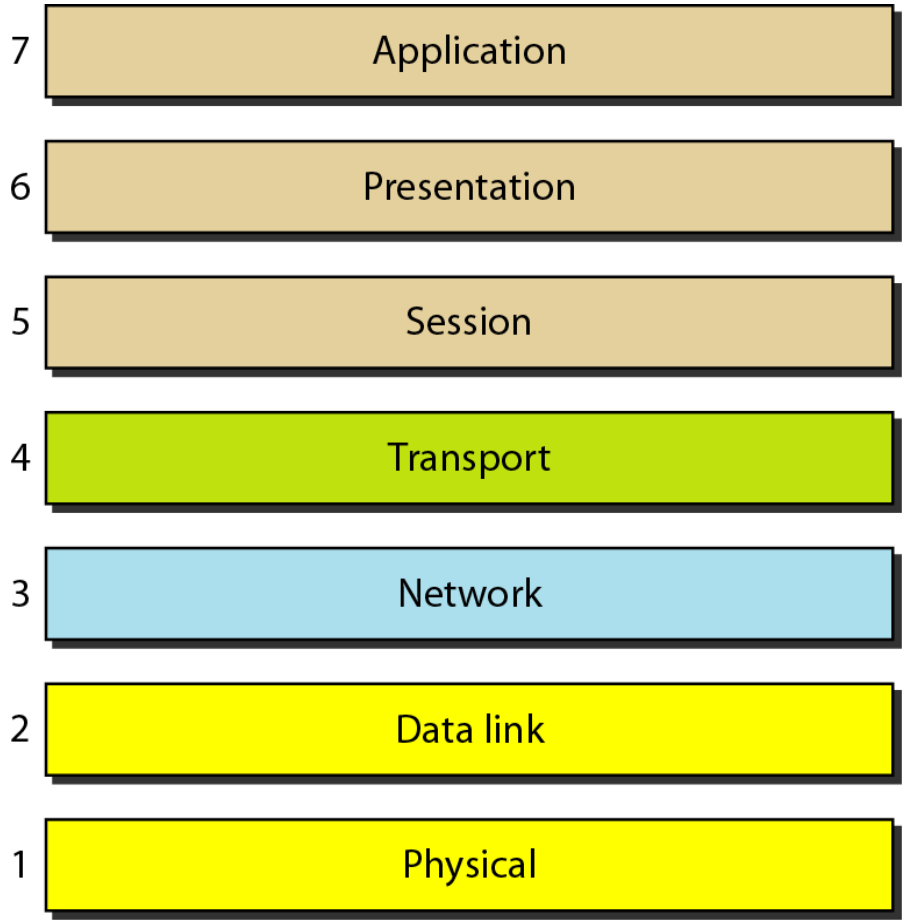
Simplified Network Architecture



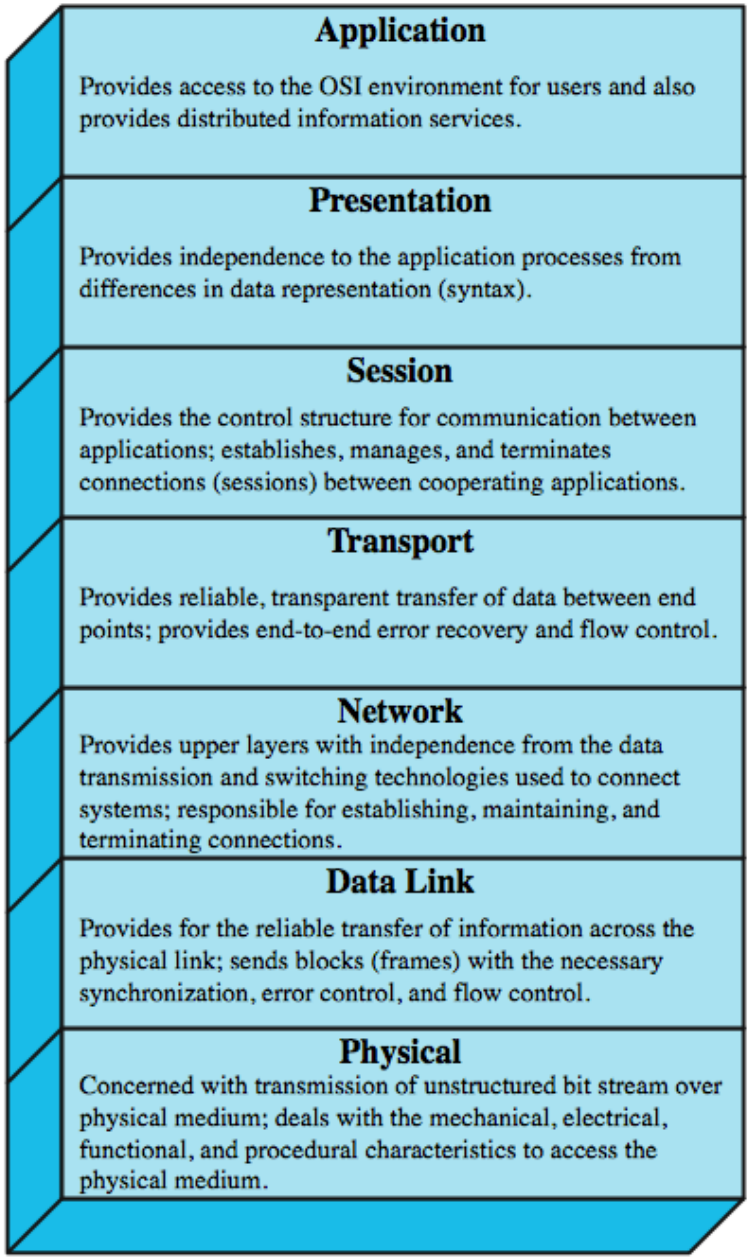
OSI

- Open Systems Interconnection
- developed by the International Organization for Standardization (ISO)
- has seven layers
- is a theoretical system delivered too late!
- TCP/IP is the de facto standard

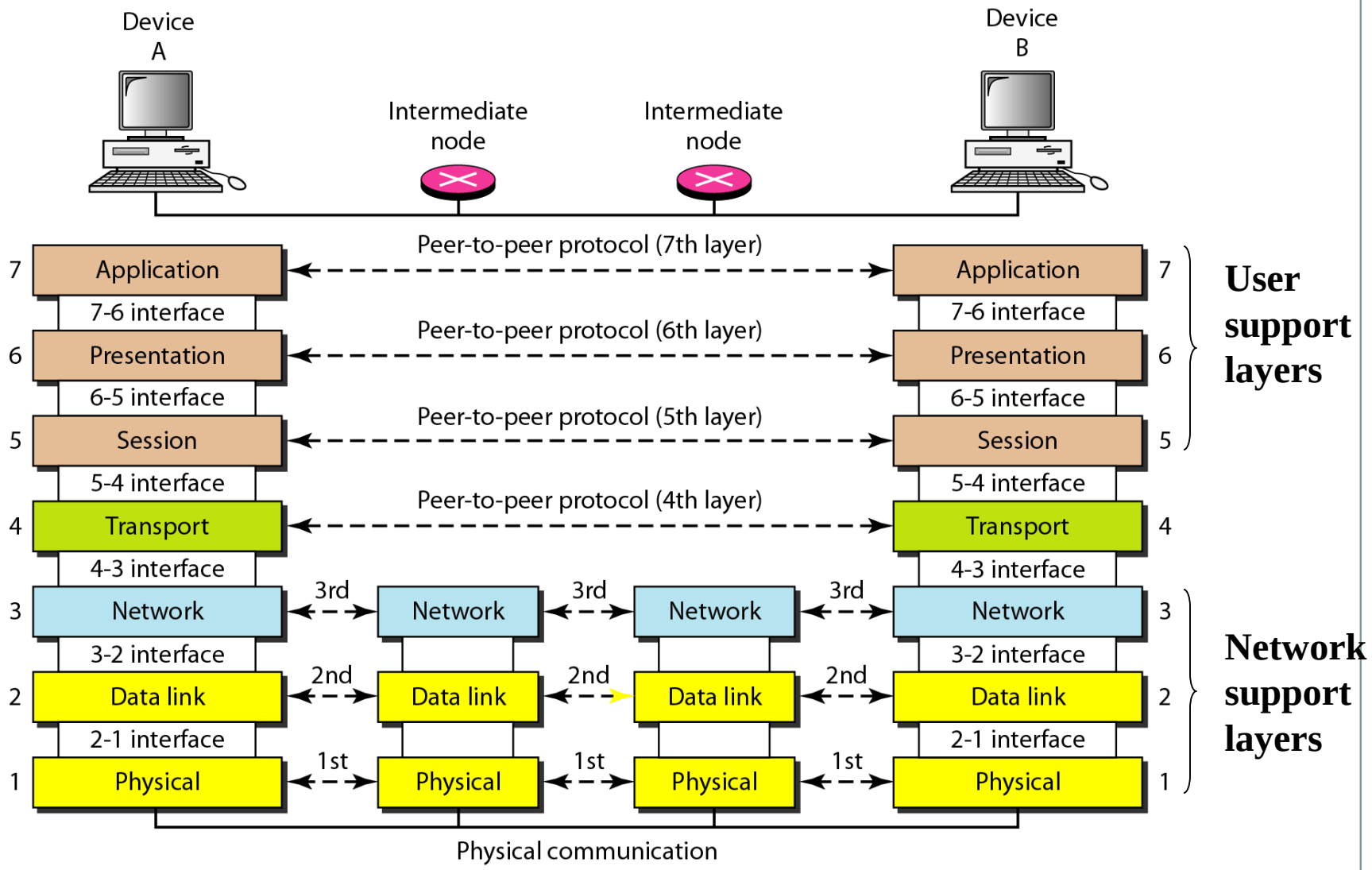
Seven layers of the OSI model



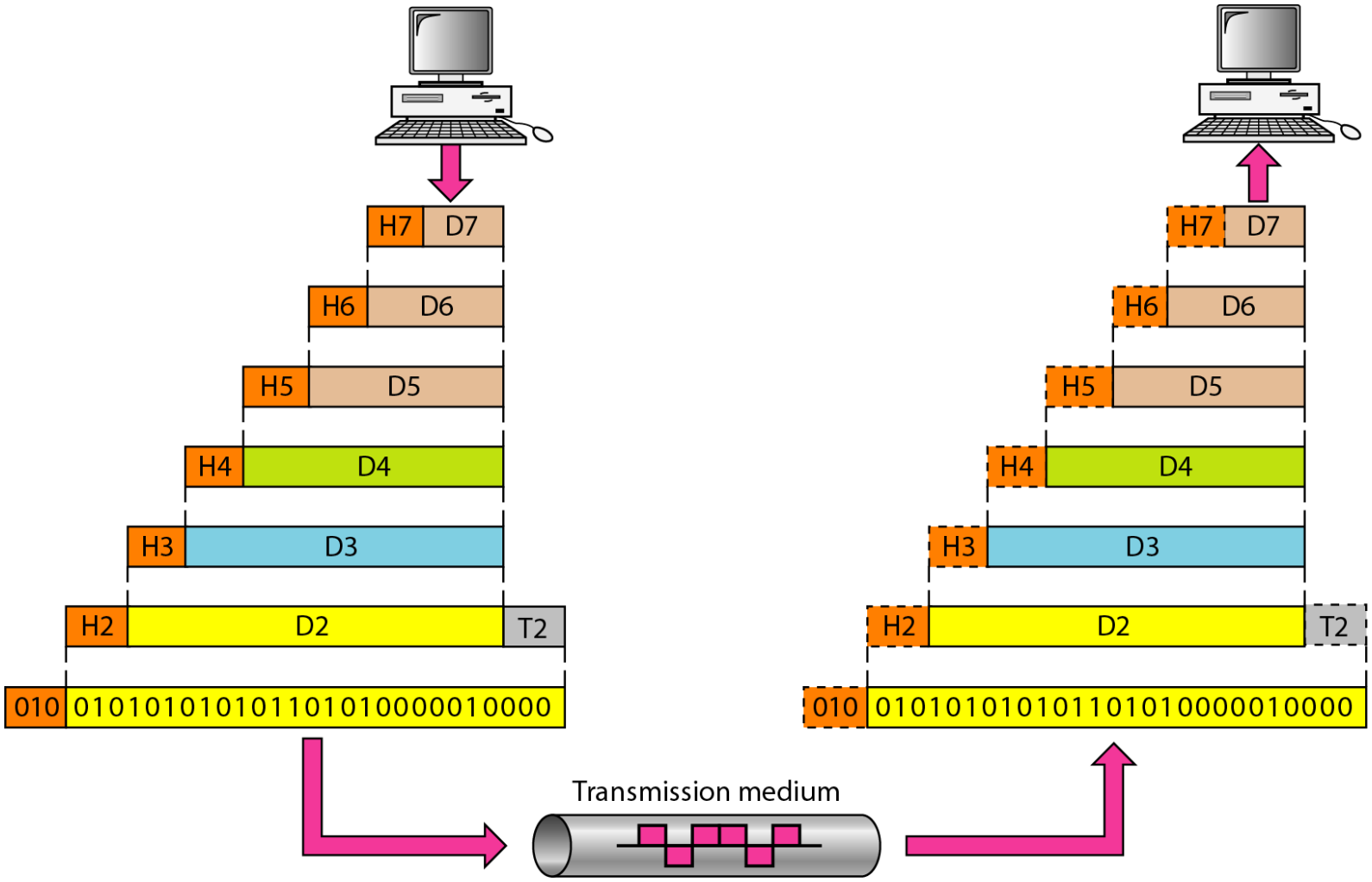
OSI Layers


Application
Provides access to the OSI environment for users and also provides distributed information services.
Presentation
Provides independence to the application processes from differences in data representation (syntax).
Session
Provides the control structure for communication between applications; establishes, manages, and terminates connections (sessions) between cooperating applications.
Transport
Provides reliable, transparent transfer of data between end points; provides end-to-end error recovery and flow control.
Network
Provides upper layers with independence from the data transmission and switching technologies used to connect systems; responsible for establishing, maintaining, and terminating connections.
Data Link
Provides for the reliable transfer of information across the physical link; sends blocks (frames) with the necessary synchronization, error control, and flow control.
Physical
Concerned with transmission of unstructured bit stream over physical medium; deals with the mechanical, electrical, functional, and procedural characteristics to access the physical medium.

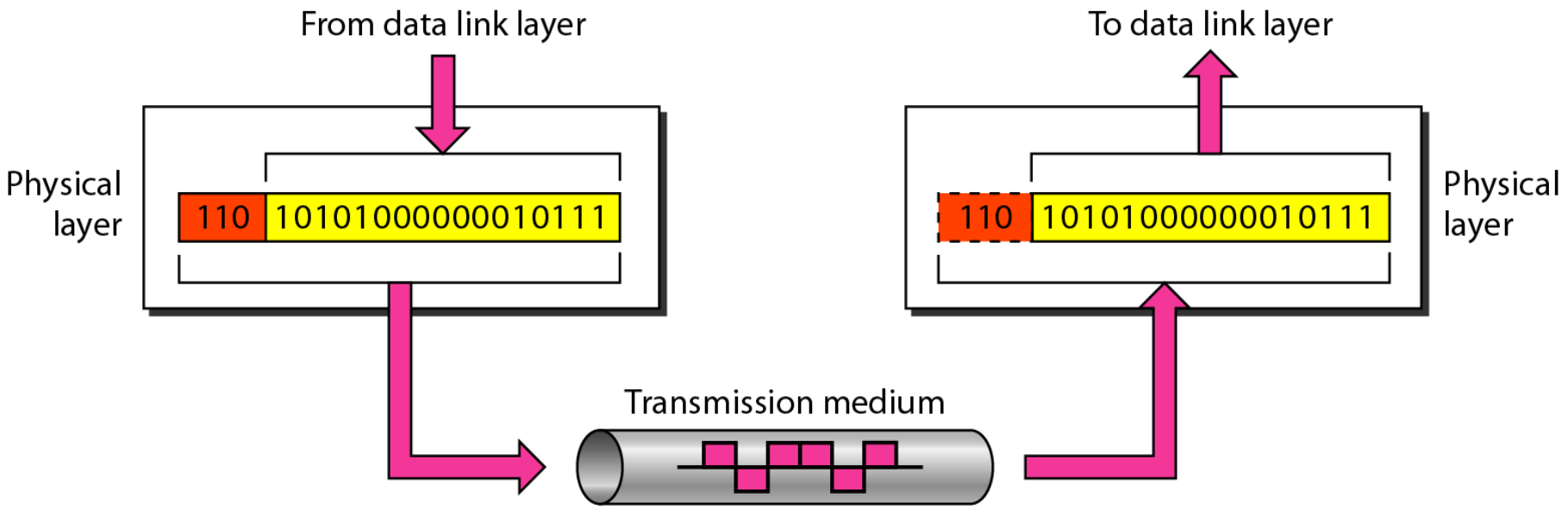
The interaction between layers in the OSI model



An exchange using the OSI model



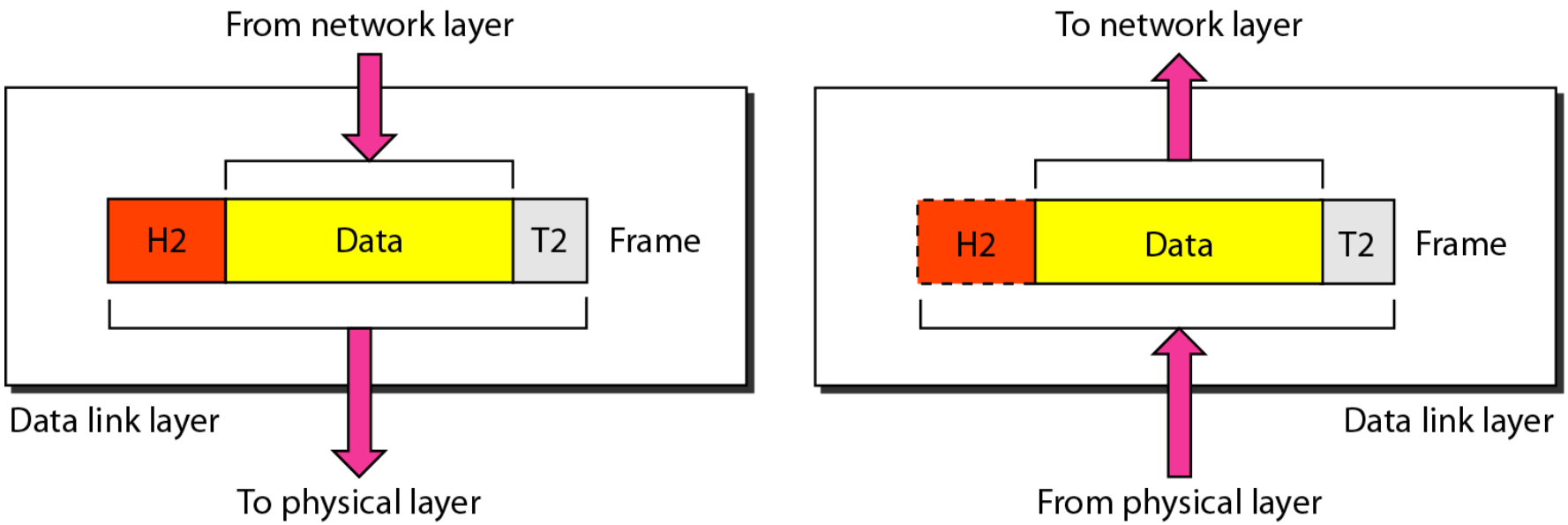
LAYERS IN THE OSI MODEL



Physical layer

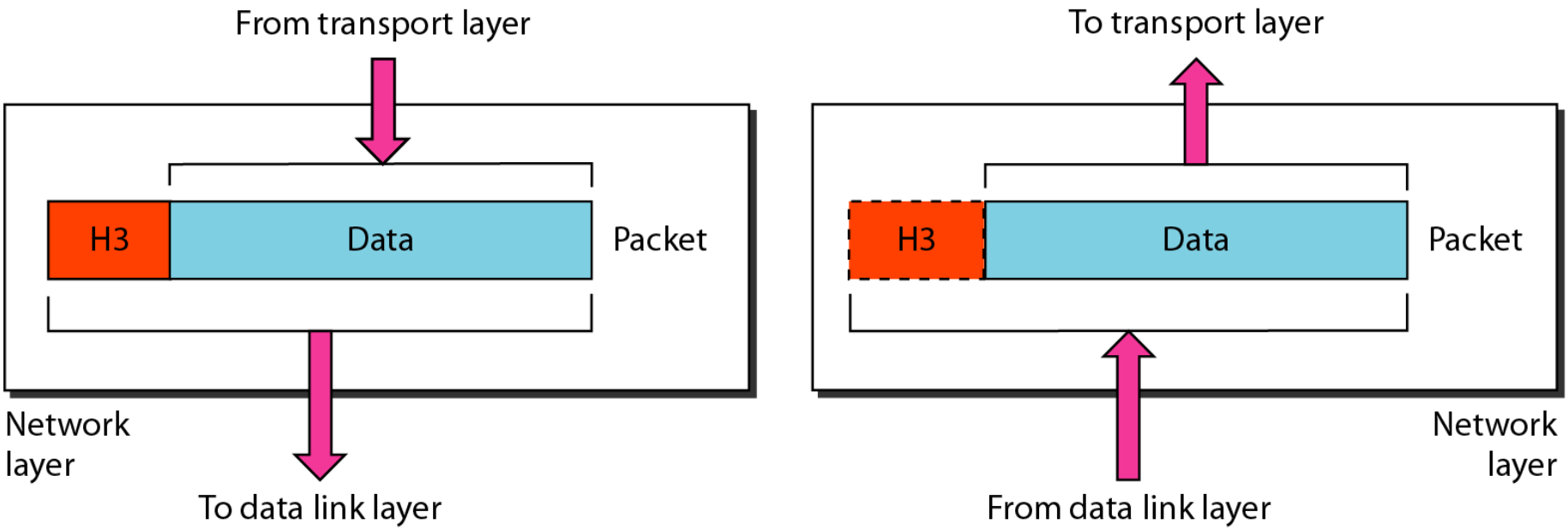
The physical layer is responsible for movements of individual bits from one hop (node) to the next.

Data link layer



The data link layer is responsible for moving frames from one hop (node) to the next.
Provides for error detection, "framing," and flow control
It divides the stream of bits into frames (data units)
Detect and retransmit damaged or lost frames.
Recognize duplicate frames. Using trailor
Determine which device has control over the link at any given time

Network layer

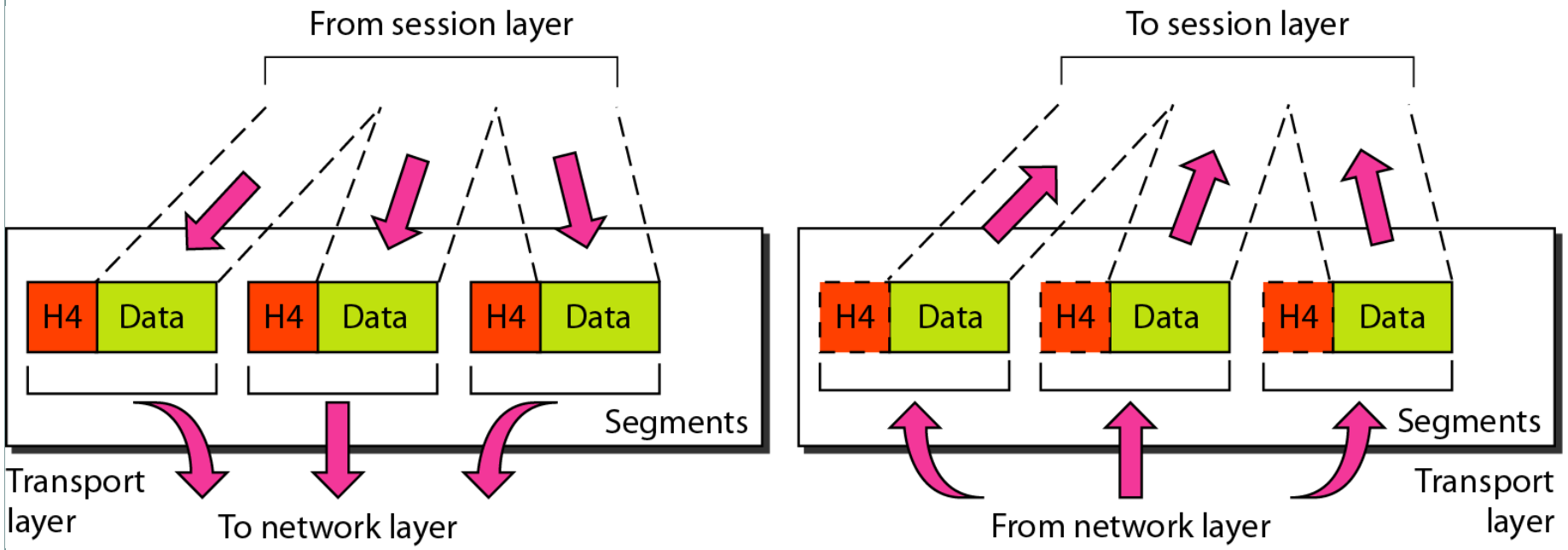


The network layer is responsible for the delivery of individual packets from the source host to the destination host.

Network layer adds logical addresses of the sender and receiver

Routing: routers/switchers route or switch the packets to their final destination.

Transport layer

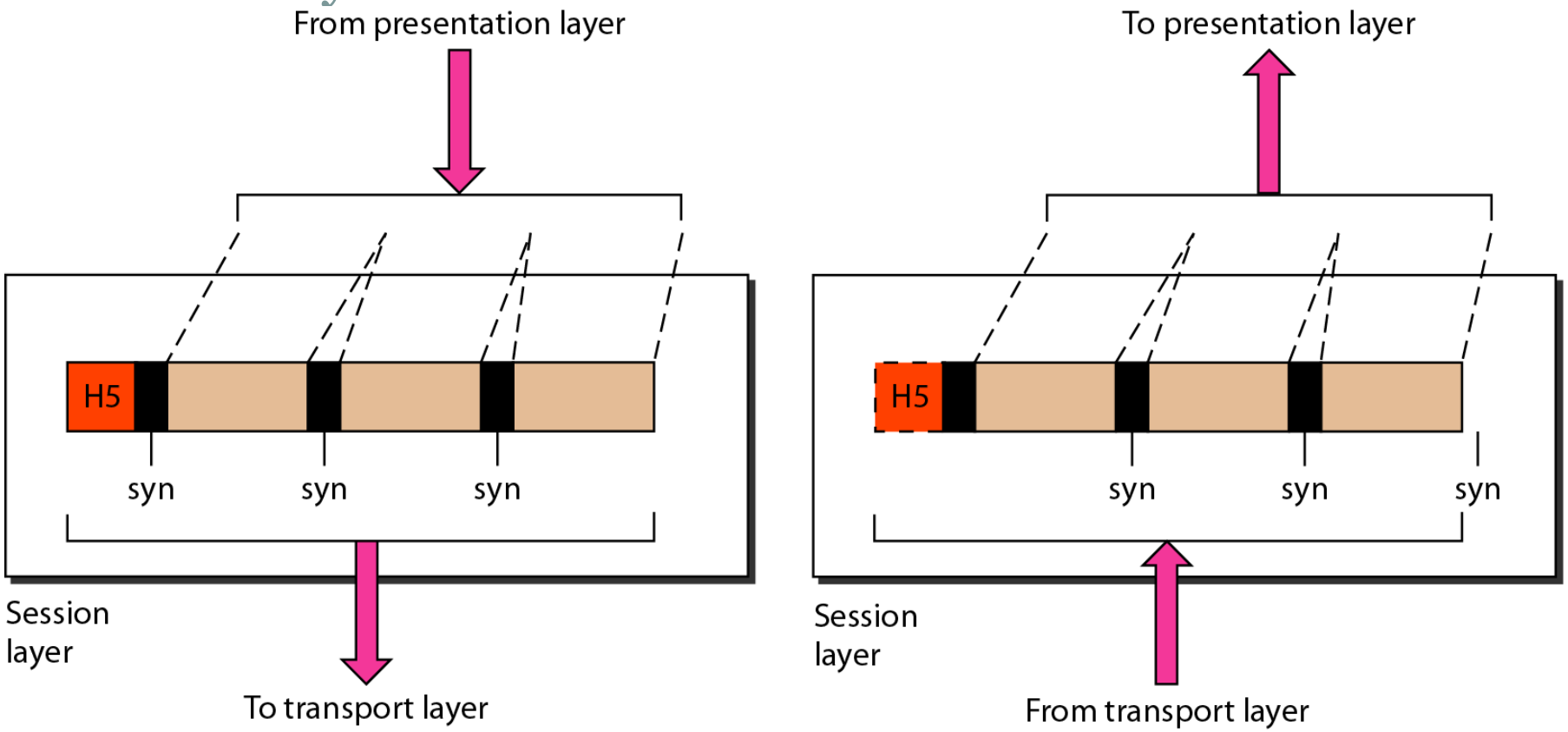


The transport layer is responsible for the delivery of a message from one process to another.

Adds service-point address (port address), gets the message to the correct process on the computer

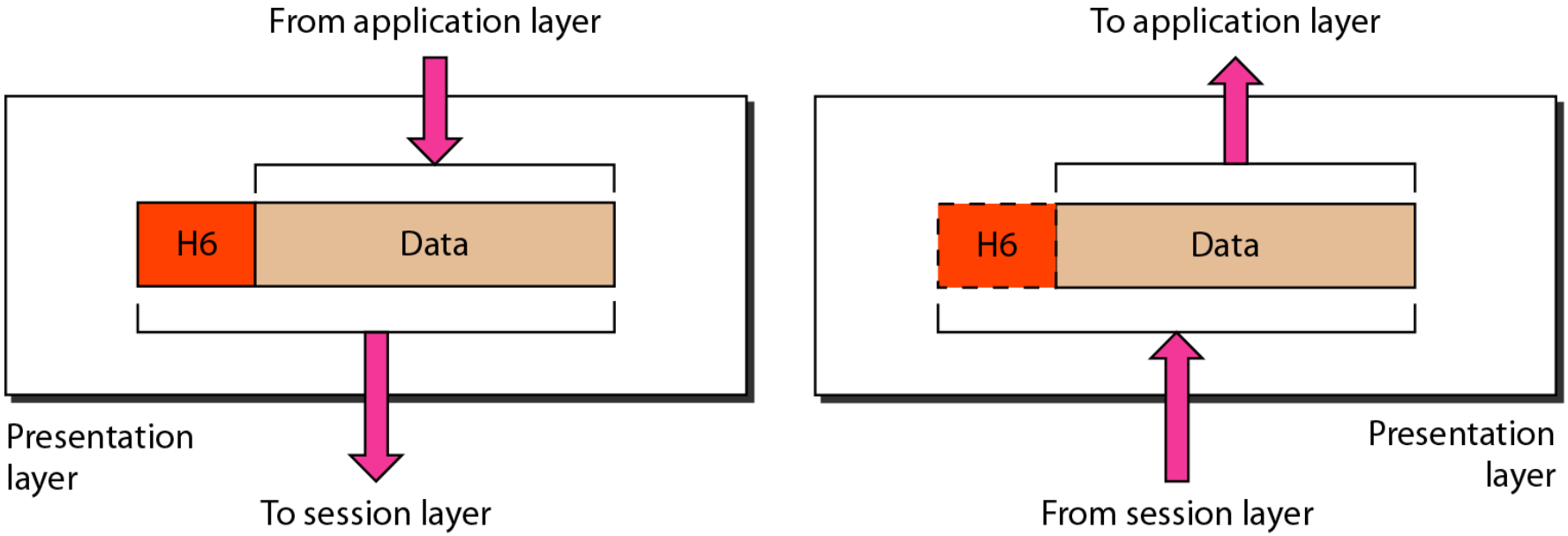
Flow control, error control and correcting,

Session layer



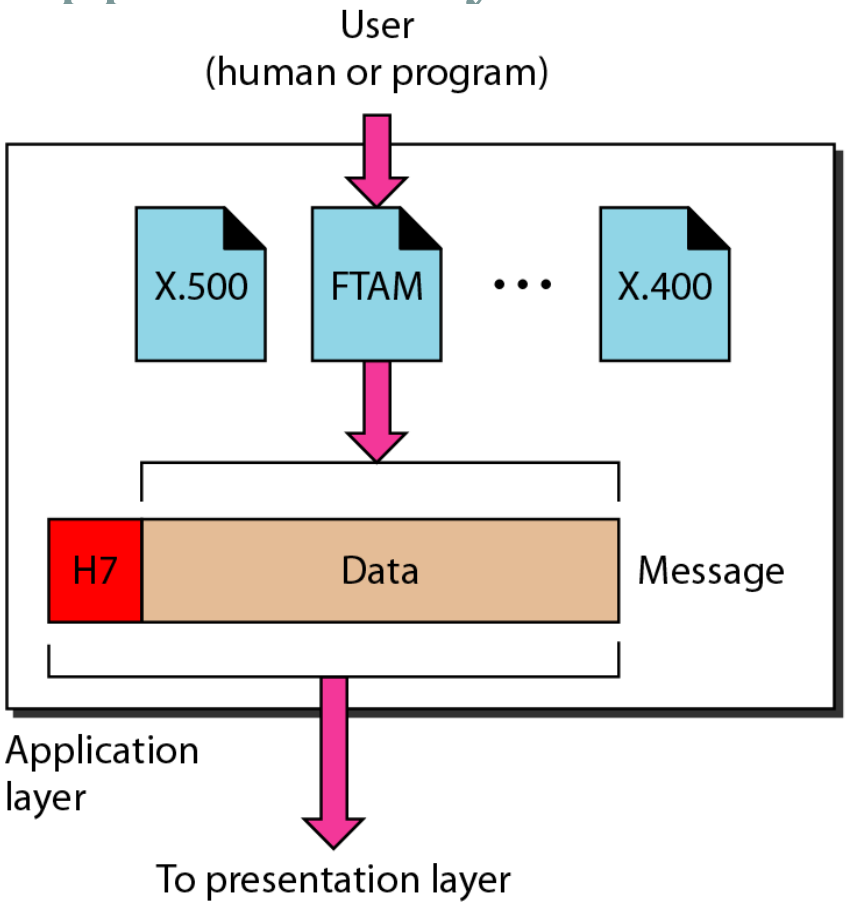
The session layer is responsible for dialog control and synchronization.
Provides for coordination between communicating processes between nodes

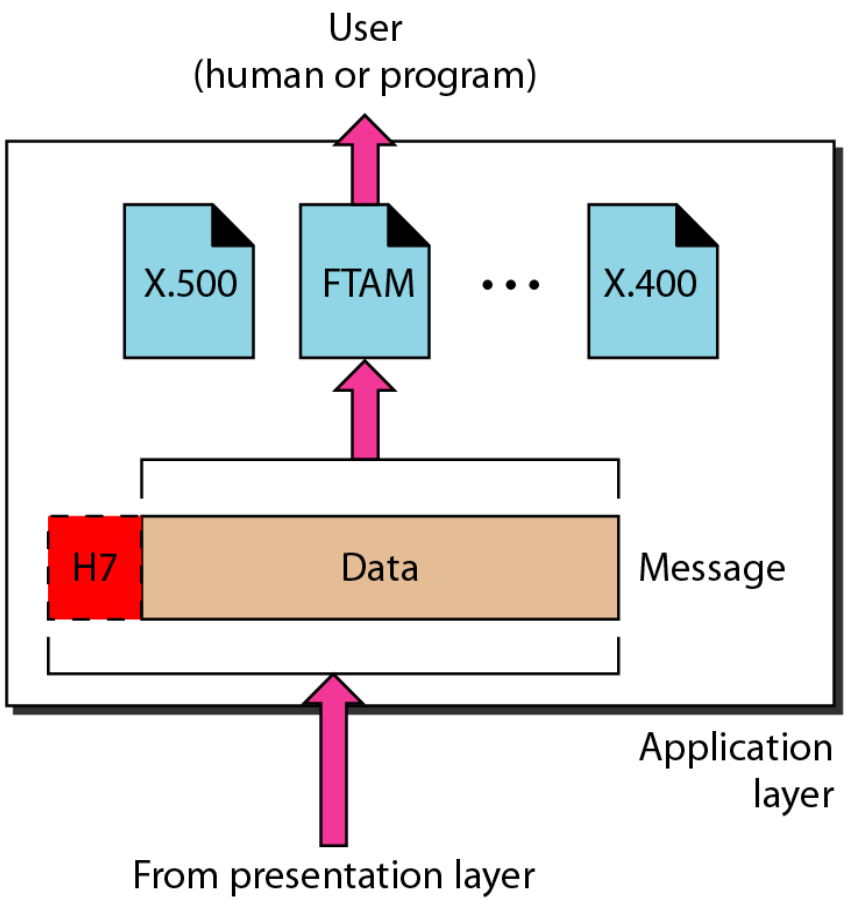
Presentation layer



The presentation layer is responsible for translation, compression, and encryption.
Concerned with the syntax and semantics of the information exchanged between two sytems.
Compression: reduces the number of bits contained (text, audio, video)
Receives message from application layer, formats it, and passes it to the session layer.

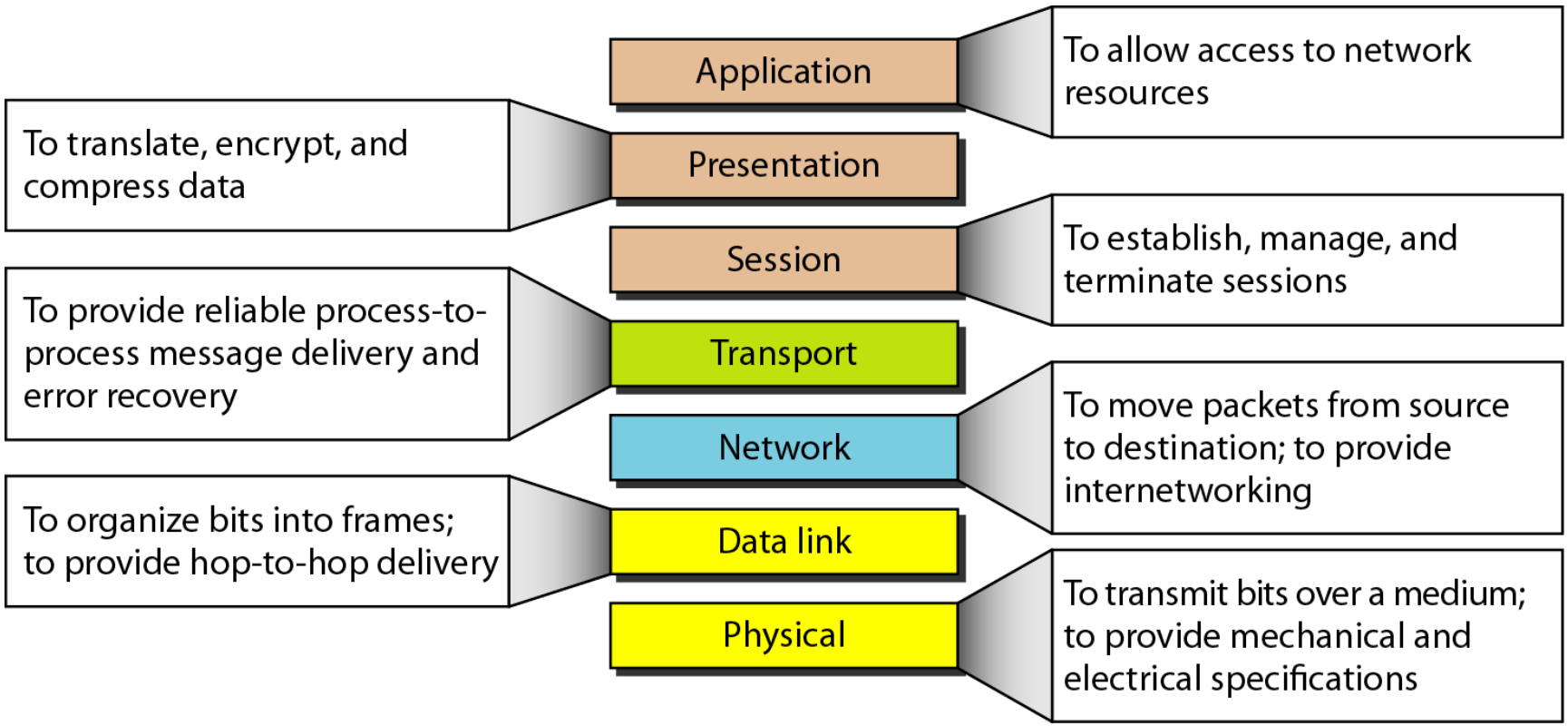
Application layer





The application layer is responsible for providing services to the user.
Provides user interfaces and support for services such as email
Network virtual terminal: software version of a physical terminal. Allows users to log on to a remote host

Summary of layers



TCP/IP Protocol Architecture

- developed by US Defense Advanced Research Project Agency (DARPA)
- for ARPANET packet switched network
- used by the global Internet
- protocol suite comprises a large collection of standardized protocols

TCP/IP PROTOCOL SUITE

- The layers in the TCP/IP protocol suite do not exactly match those in the OSI model. The original TCP/IP protocol suite was defined as having four layers: host-to-network, internet, transport, and application.
- However, when TCP/IP is compared to OSI, we can say that the TCP/IP protocol suite is made of five layers: physical, data link, network, transport, and application.
- Topics covered:
  - Physical and Data Link Layers
  - Network Layer
  - Transport Layer
  - Application Layer

TCP/IP Layers

- no official model but a working one
  - Application layer
  - Host-to-host, or transport layer
  - Internet layer
  - Network access layer
  - Physical layer

Physical Layer

- concerned with physical interface between computer and network
- concerned with issues like:
  - characteristics of transmission medium
  - signal levels
  - data rates
  - other related matters

Network Access Layer

- exchange of data between an end system and attached network
- concerned with issues like :
  - destination address provision
  - invoking specific services like priority
  - access to & routing data across a network link between two attached systems
- allows layers above to ignore link specifics

Internet Layer (IP)

- routing functions across multiple networks
- for systems attached to different networks
- using IP protocol
- implemented in end systems and routers
- routers connect two networks and relays data between them

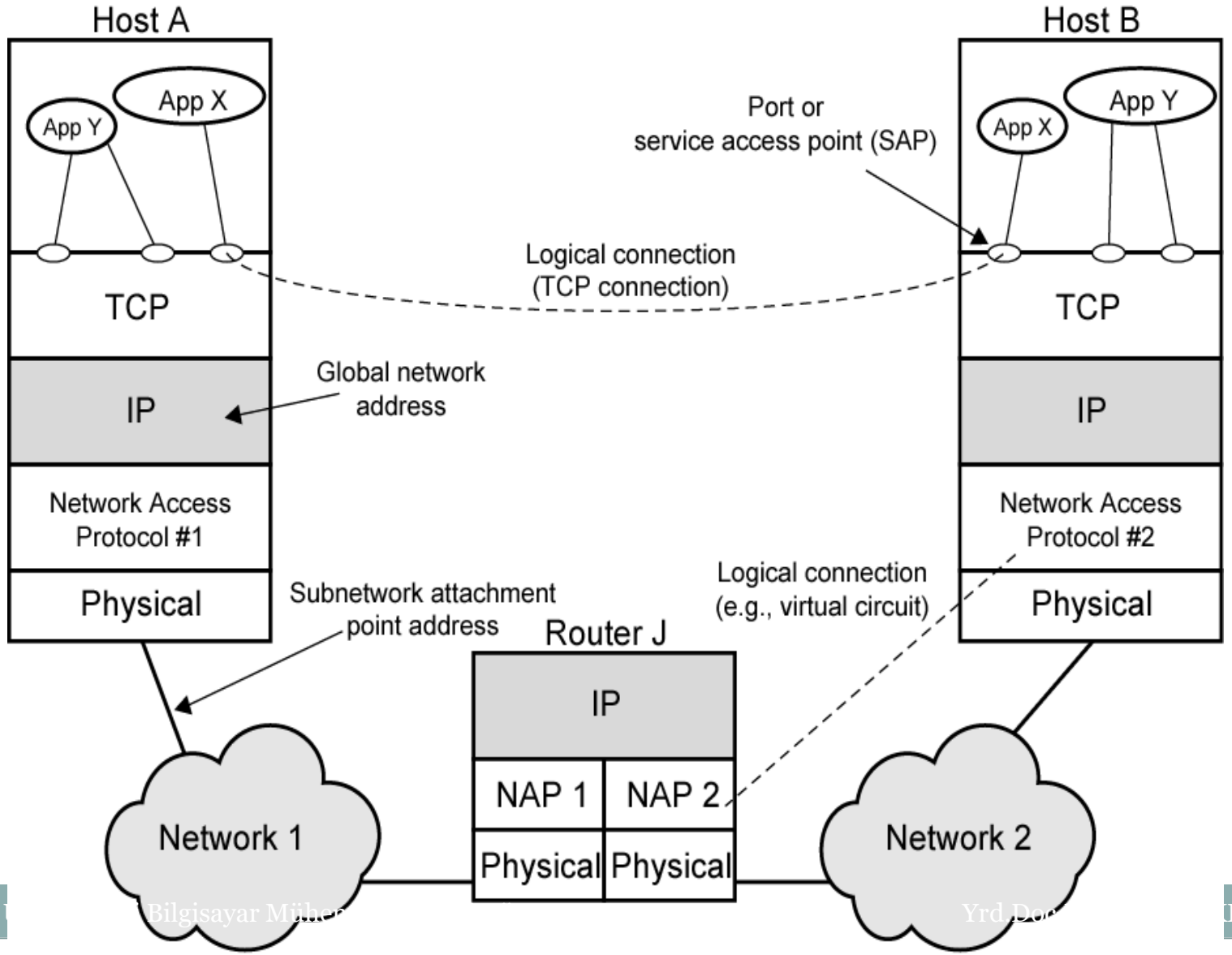
Transport Layer (TCP)

- common layer shared by all applications
- provides reliable delivery of data
- in same order as sent
- commonly uses TCP

Application Layer

- provide support for user applications
- need a separate module for each type of application

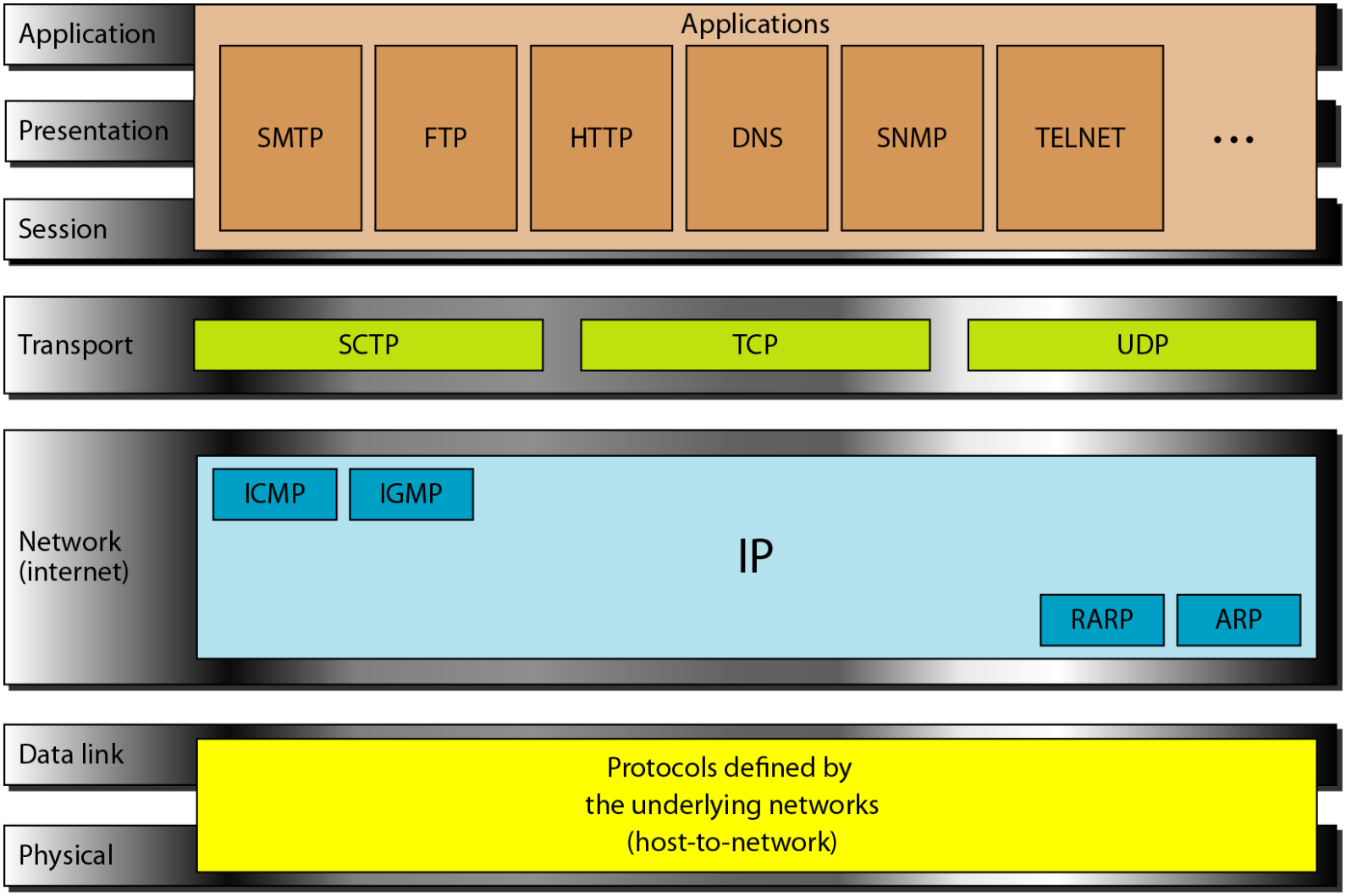
Operation of TCP and IP



Addressing Requirements

- two levels of addressing required
- each host on a subnet needs a unique global network address
  - its IP address
- each application on a (multi-tasking) host needs a unique address within the host
  - known as a port

TCP/IP and OSI model



Relationship of layers and addresses in TCP/IP