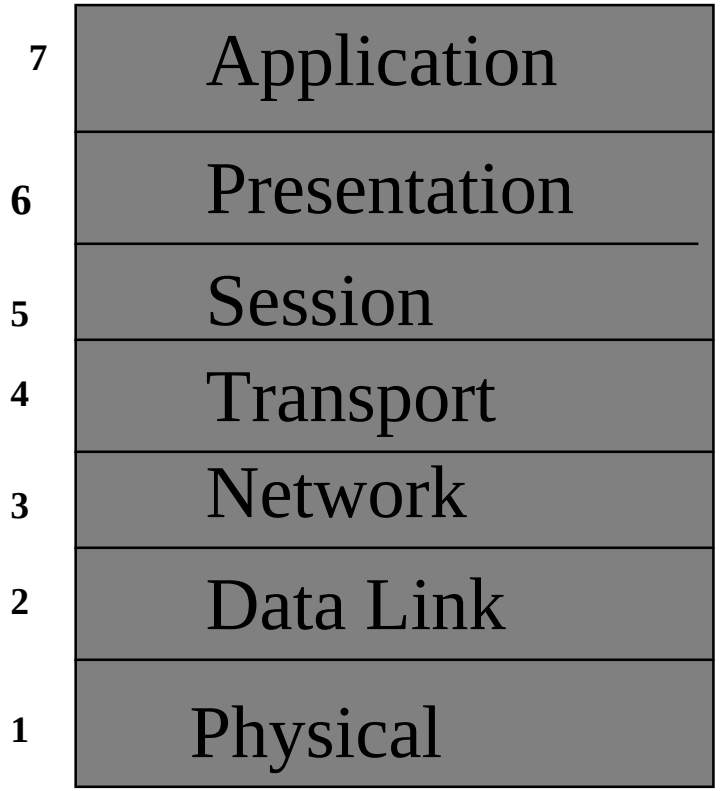
OSI Model


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

Protocols

- Define a set of rules for communication.
  - Specify the meaning and format of messages
  - Define exchange rules
  - Exception handling
    - duplicated information
    - bit corruption (chksum errors)
    - lost information
    - out of order packets

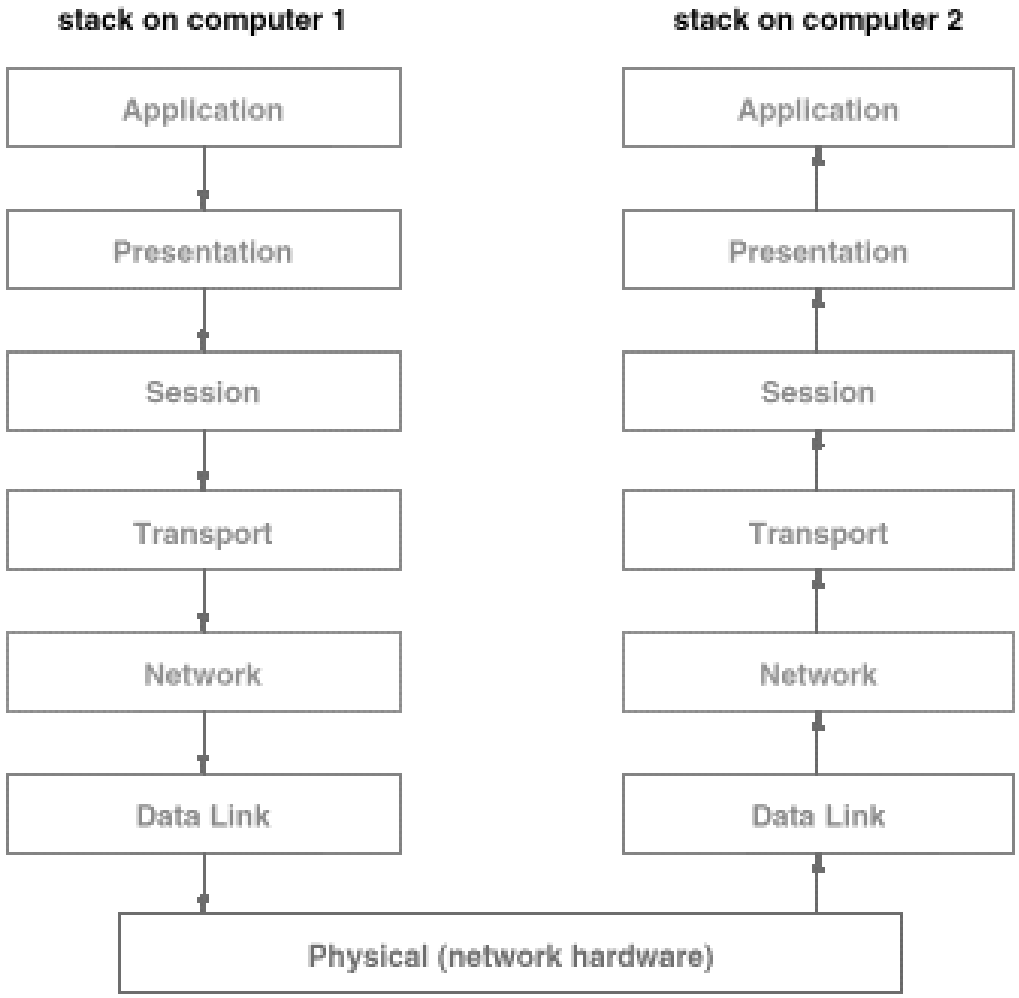
Protocols - cont.

- Other functions
  - identify different sources/destinations
  - separate applications
  - handle multiple instances of the same application on one machine
- A ***family*** of protocols shares all these tasks
  - Protocol suite/stack
  - Assign functions to different protocols (layers)

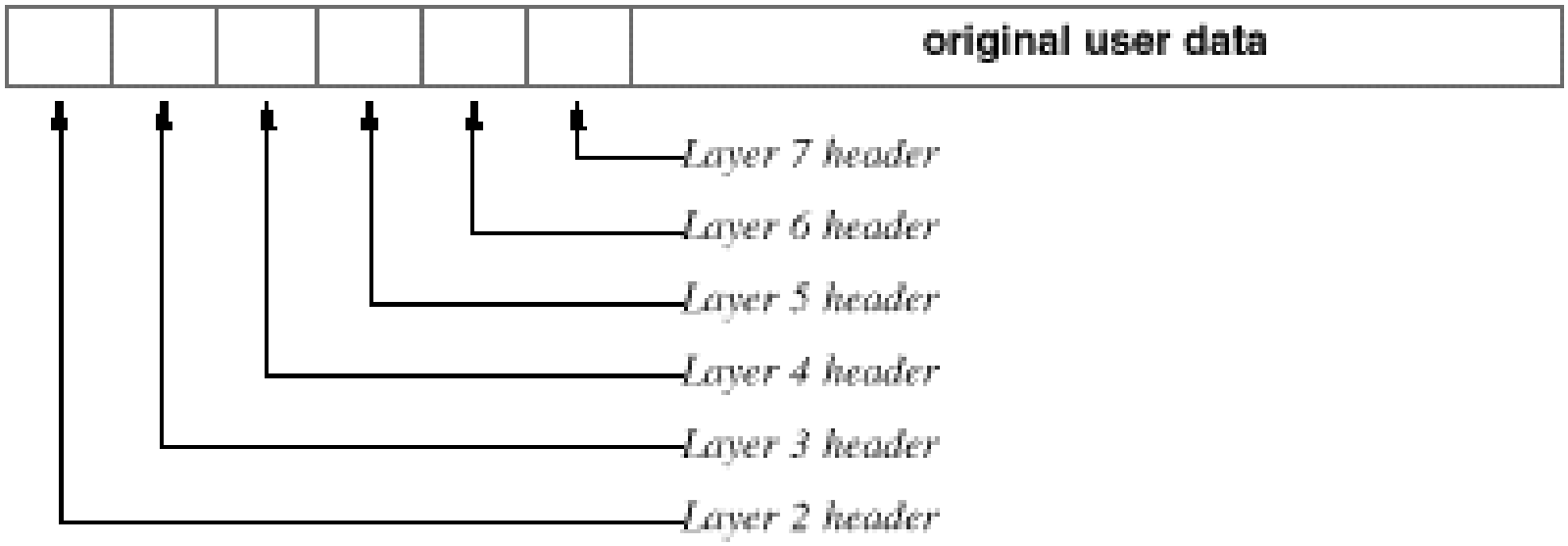
Protocol Stacks

- “Goal”: one protocol per layer
- Layers interact and cooperate with each other
  - the data is passed from one layer to the next
  - each layer adds its own information (HDR) when the data is sent, and removes it when the data is received
  - lower layers provide services for the upper layers

Protocol Stacks - cont.



Protocol Stacks - cont.



Layer 1 - Physical

- Defines the physical interfaces between devices
  - including the rules for raw bit-stream transmission (1011010110)
- **Mechanical --** physical properties
- **Electrical --** representation of bits (voltage levels) and transmission rates

Layer 1 - cont.

- **Functional --** functions performed by individual circuits
- **Procedures --** sequence of events
- Examples: EIA-232-E (RS-232 or V.24/V.28), RJ-11, RJ-45

Layer 2 - Data Link

- Physical link reliability and controls access to the media
- Error detection
  - error free transmission over the link
    - several data links may exist between endpoints
    - higher layers also have error control functions
  - use of CRC (cyclic redundancy check) to verify integrity

Layer 2 - cont.

- Error control
  - error detection
  - positive acknowledgment
  - retransmission after timeout
- Structured Frames
  - control flags
  - source/destination addresses
  - FCS (frame check sequence) for CRC

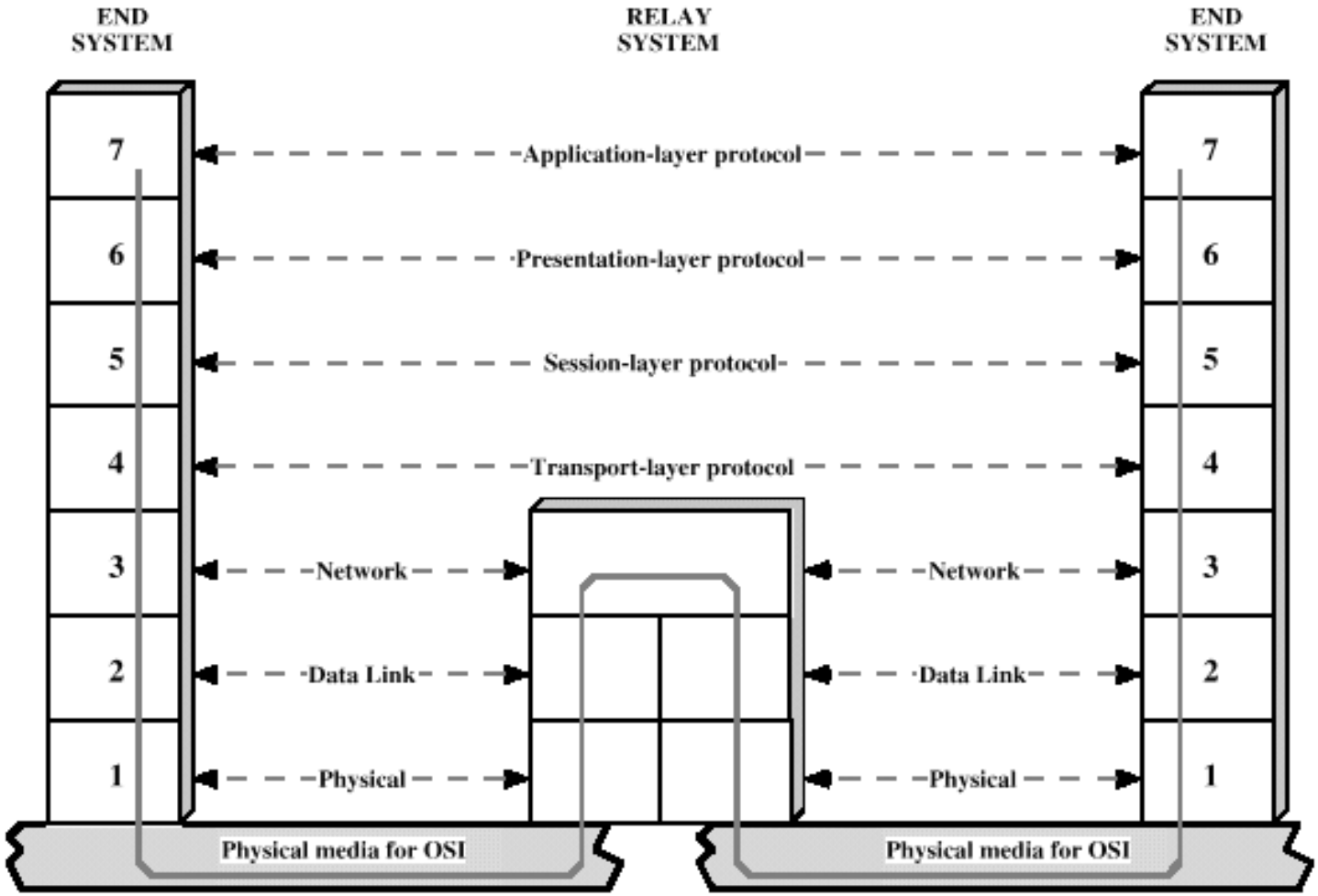
Layer 2 - cont.

- Examples:
  - HDLC: High-Level Data Link Control
  - LAPB: Link Access Procedure, Balanced
  - LAPD: Link Access Procedure, D-Channel
  - PPP: Point to Point Protocol
  - LLC: Logical Link Control

Layer 3 - Network

- Packet forwarding -- routing function
  - routed protocols: IP, IPX, AppleTalk
  - routing protocols: RIP, OSPF, NLSP
  - connectionless
- This is the highest layer at which network entities typically interact
  - higher layers use *end-to-end* protocols

Layer 3 - cont.


END SYSTEM
RELAY SYSTEM
END SYSTEM
7
6
5
4
3
2
1
Application-layer protocol
Presentation-layer protocol
Session-layer protocol
Transport-layer protocol
Network
Data Link
Physical
Network
Data Link
Physical
7
6
5
4
3
2
1
Physical media for OSI
Physical media for OSI

Layer 4 - Transport

- In general, provides for reliable exchange of information between end systems
  - connection oriented: ensures error-free, in sequence delivery with no loss or duplication
  - mechanisms for retransmission, acknowledgment, timeouts, etc.
- Examples: TCP (connection-oriented), UDP (connectionless)

Layer 5 - Session

- Controls communications between applications in end systems
  - **Dialog discipline --** full-duplex, half duplex
  - **User/application/session differentiation**
- Usually, this is not a standalone function.

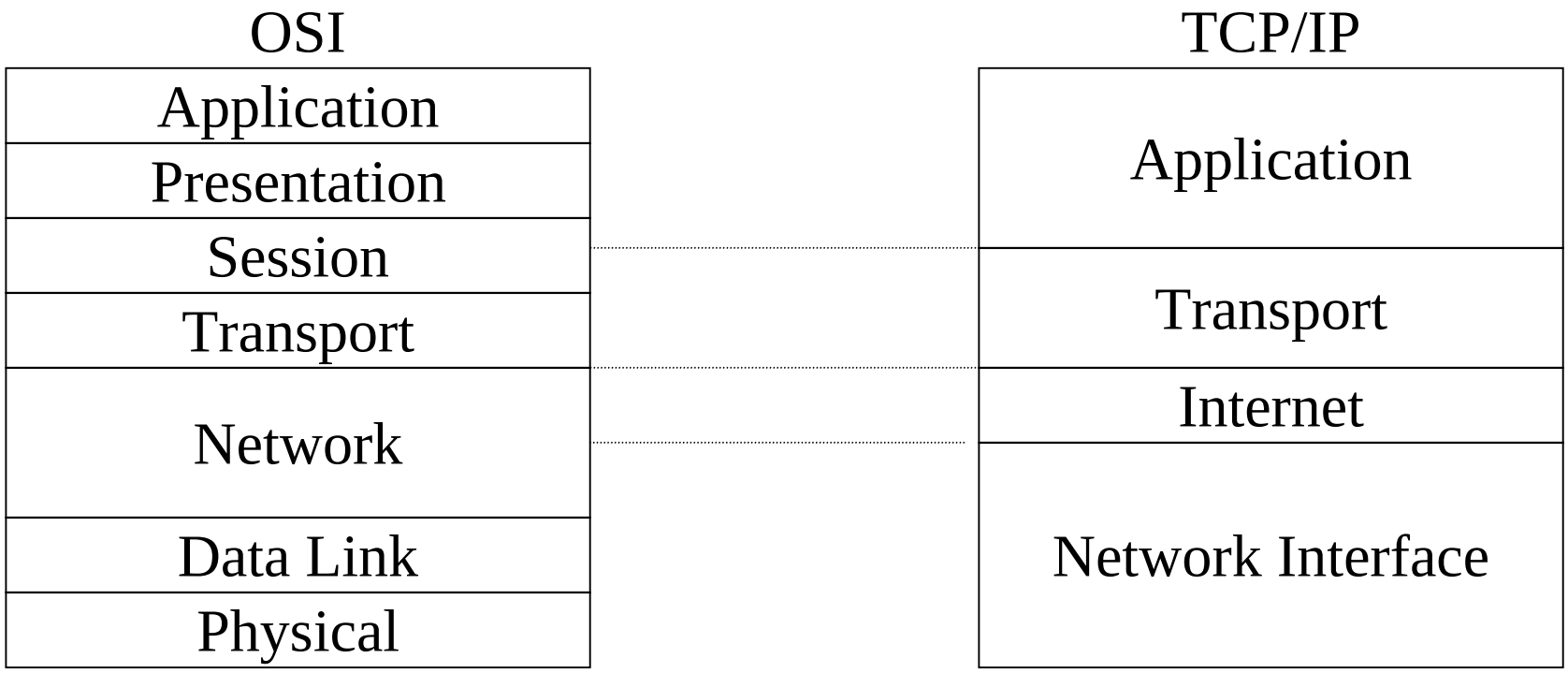
Layer 6 - Presentation

- Data representation
  - format (ASCII, for example)
  - compression
  - encryption

Layer 7 - Application

- Specific application programs
- Examples: file transfer, e-mail, telnet, etc.

OSI vs TCP/IP


OSI
Application
Presentation
Session
Transport
Network
Data Link
Physical
TCP/IP
Application
Transport
Internet
Network Interface