Network Reference Models

Layered Models

- OSI

- TCP/IP

- IBM SNA

- DECNet

# OSI Reference Model

OSI Reference Model

- Open Systems Interconnect

  - To connect open systems

- Developed by ISO

- Has seven layers

- Just a model, does not specify any working protocol as part of the model

  - ISO has various protocol standards for each OSI layer

Basis for Layers

- Separate layer for proper abstraction

- Should perform well defined function

- Minimise information flow across the interface

- Large enough to divide distinct functions into separate layers

- Small enough to be manageable

Layers

- Physical layer

- Data Link Layer

- Network Layer

- Transport Layer

- Session Layer

- Presentation Layer

- Application Layer

| Application |
| Presentation |
| Session |
| Transport |
| Network |
| Data Link |
| Physical |
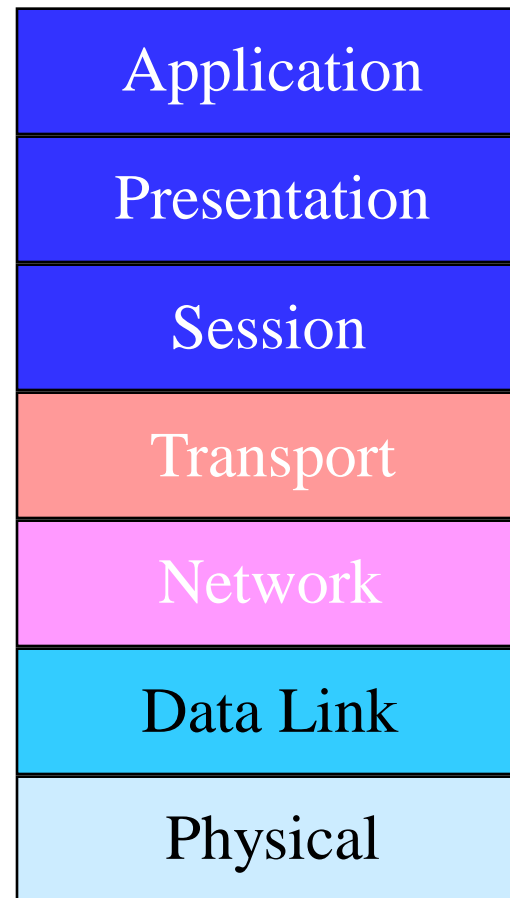
Physical Layer

- Communication channel

- Transmitting raw bits

- Voltage and current levels

- Duration of signals

- Communication mode – simplex, duplex

Physical Layer …cont.

- Connection establishment and teardown

- Type of connectors

- Definition of pins

- Mechanical, electrical, and timing issues

- Physical transmission medium

Example: RS-232 (V.24)

Data link Layer

- Transforms raw transmission channel into error free channel for higher layers

  - Convert raw bits into data *frames*

- Error handling

  - Acknowledgement or no acknowledgement

- Flow control

Data link Layer … cont.

- Control access to the shared media

  - Medium access control (MAC) sublayer

Example: Ethernet

Network Layer

- Controls a subnet

- Routing of packets

  - Fixed

  - Dynamic

- Addressing

- Packet size

Network Layer … cont.

- Congestion control

- Quality of service

  - Delay

  - Jitter

- Interconnection of heterogeneous networks

Transport Layer

- Segmentation of user data

- Ensuring the delivery of data

- Isolate upper layer from the changes in hardware technologies

- Defines the type of service for session layer

- Order of delivery

Transport Layer … cont.

- End-to-end communication

- Connection establishment

- Connection control

Session Layer

- Enable session establishment

- Dialog control

- Synchronisation at user data level

  - Recovery after crash

Presentation Layer

- Syntax of the information

- Semantics of information

- Data structures

- Encoding

- Data compression and cryptography

Application Layer

- User applications
  - HTTP
  - SMTP
  - Telnet

Reasons for failure of OSI Model

- Bad Timing

- Bad implementation

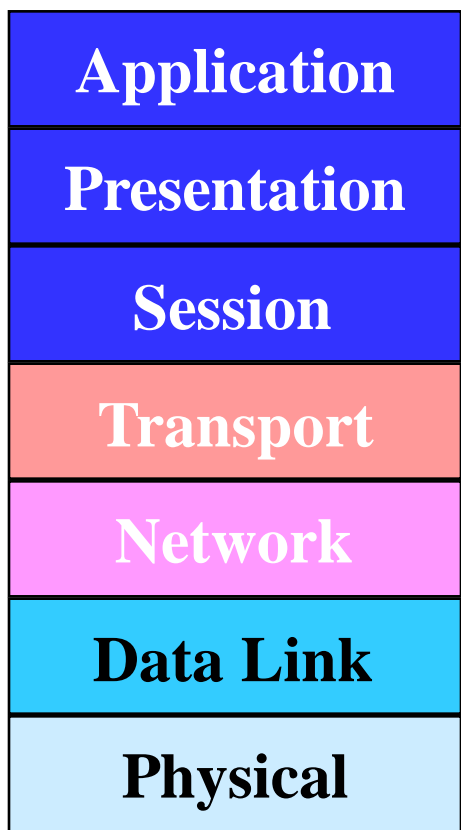- Company Politics

TCP/IP Model

TCP/IP

- Developed by Universities

  - Work of engineer volunteers

  - No standard body was involved

- First defined in 1974

- Accepted by users

- Adopted by DoD, IETF, Corporations
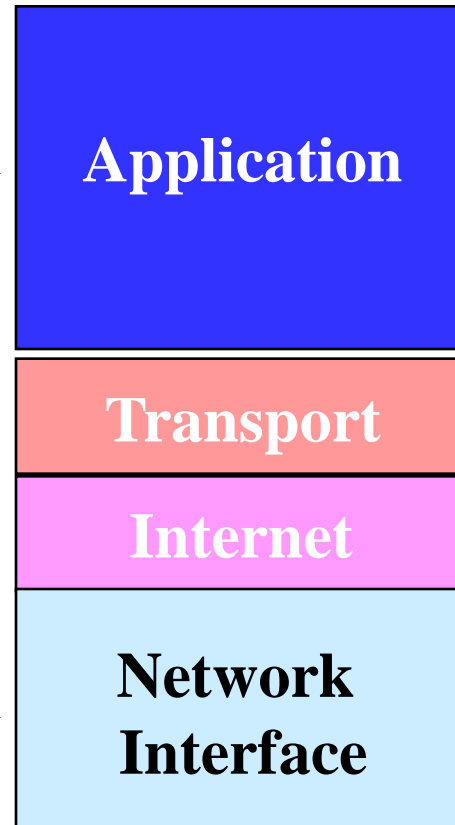
Layers

- Four Layers

  - Network Interface

    - ❖ Not defined explicitly

  - Internet layer

  - Transport layer

  - Application layer

Comparison of OSI and TCP/IP

OSI Reference Model

TCP/IP Conceptual Model

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

TCP/IP Protocol Stack
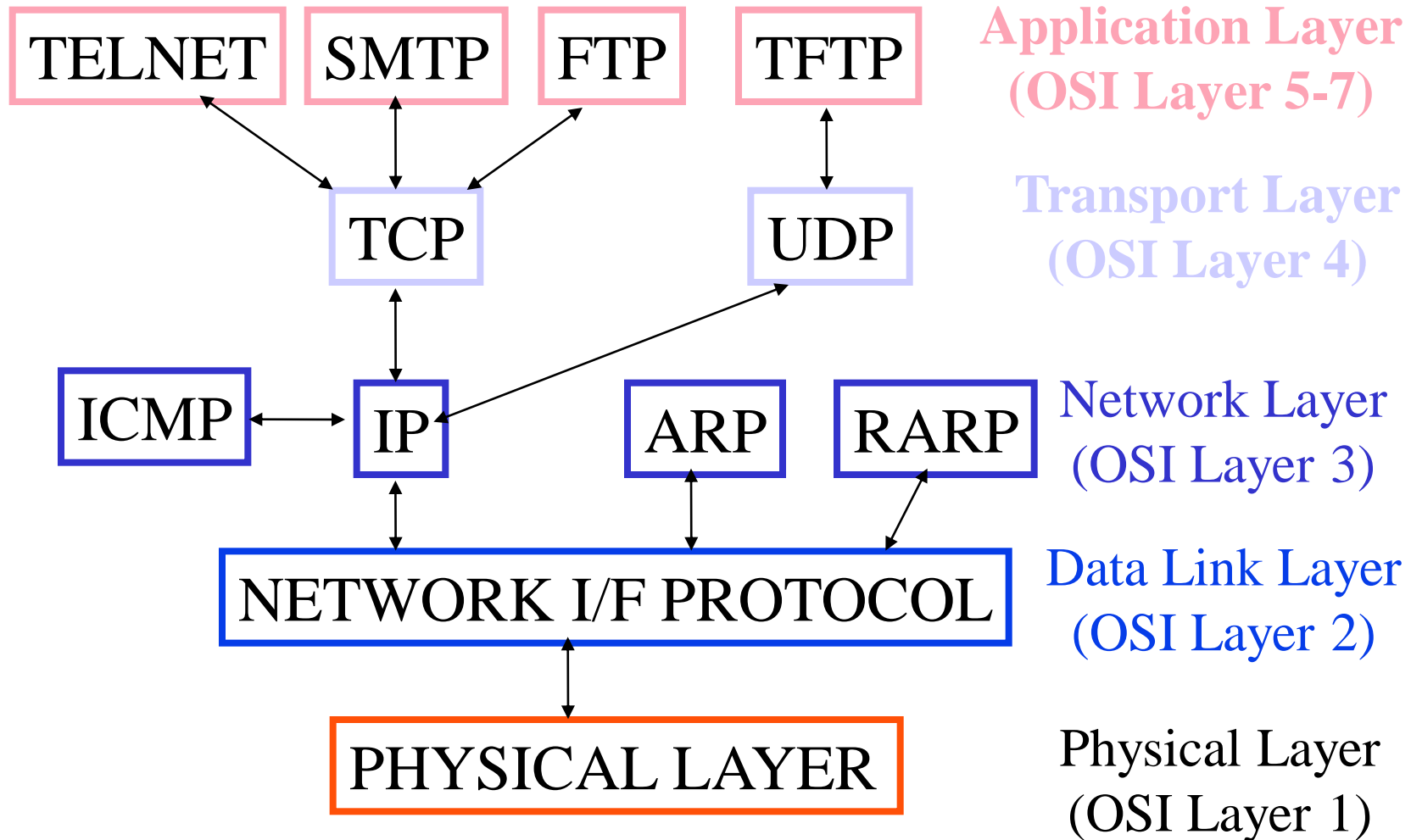
Data units at different layers

Message   **Application**

Segment / Datagram   **TCP / UDP**

Packet   **IP**

Frame   **Data Link Layer**

Bits   **Physical Layer**
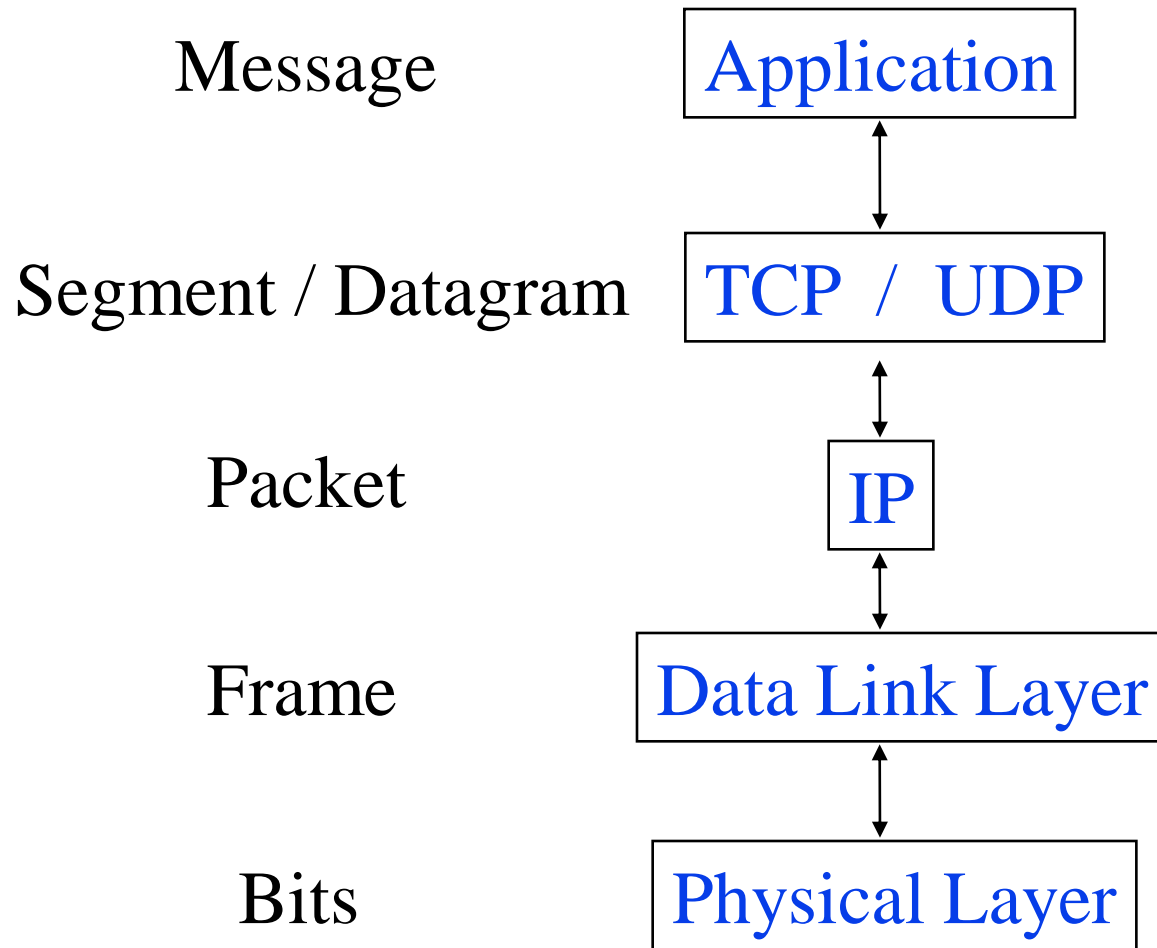
Communication between hosts

Data		Data

TCP-Hdr	Data	

Application Protocol

Transmission Control Protocol

Internet Protocol

Ethernet Protocol

Application Protocol

Transmission Control Protocol

Internet Protocol

Ethernet Protocol

TCP-Hdr	Data	

IP Hdr	TCP Hdr	Data

IP Hdr	TCP Hdr	Data

E-Hdr	IP Hdr	TCP Hdr	Data	E-Tlr

E-Hdr	IP Hdr	TCP Hdr	Data	E-Tlr

Physical Network (Media)