

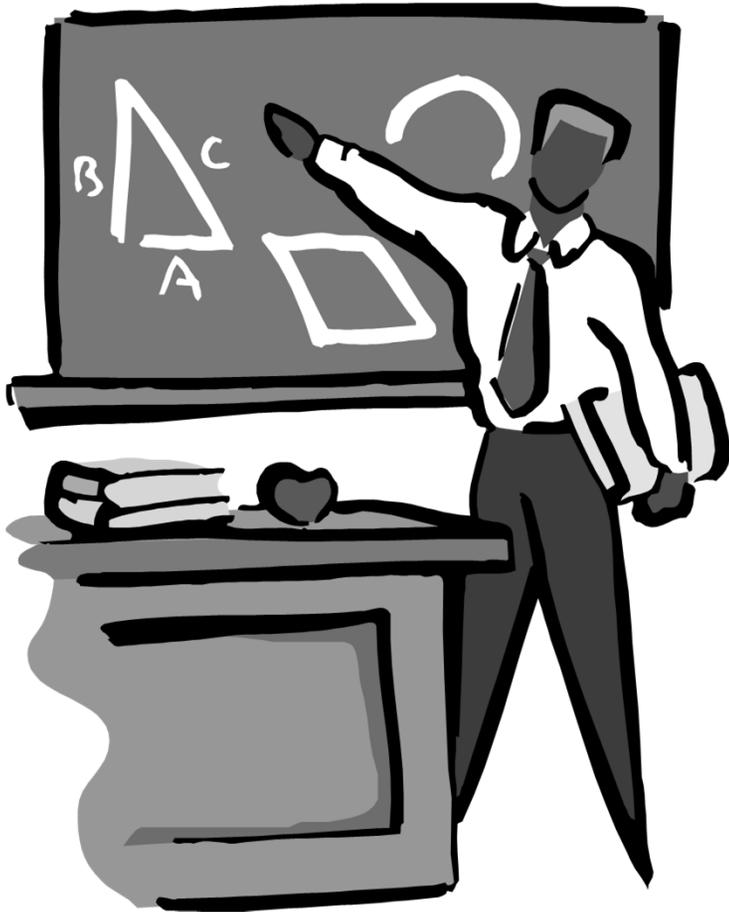


Chapter I

Layered Protocol Architectures



Layered protocol architectures



- **1 - Motivation , concepts and design issues**
- **2 - Reference models**



Motivation, concepts and design issues

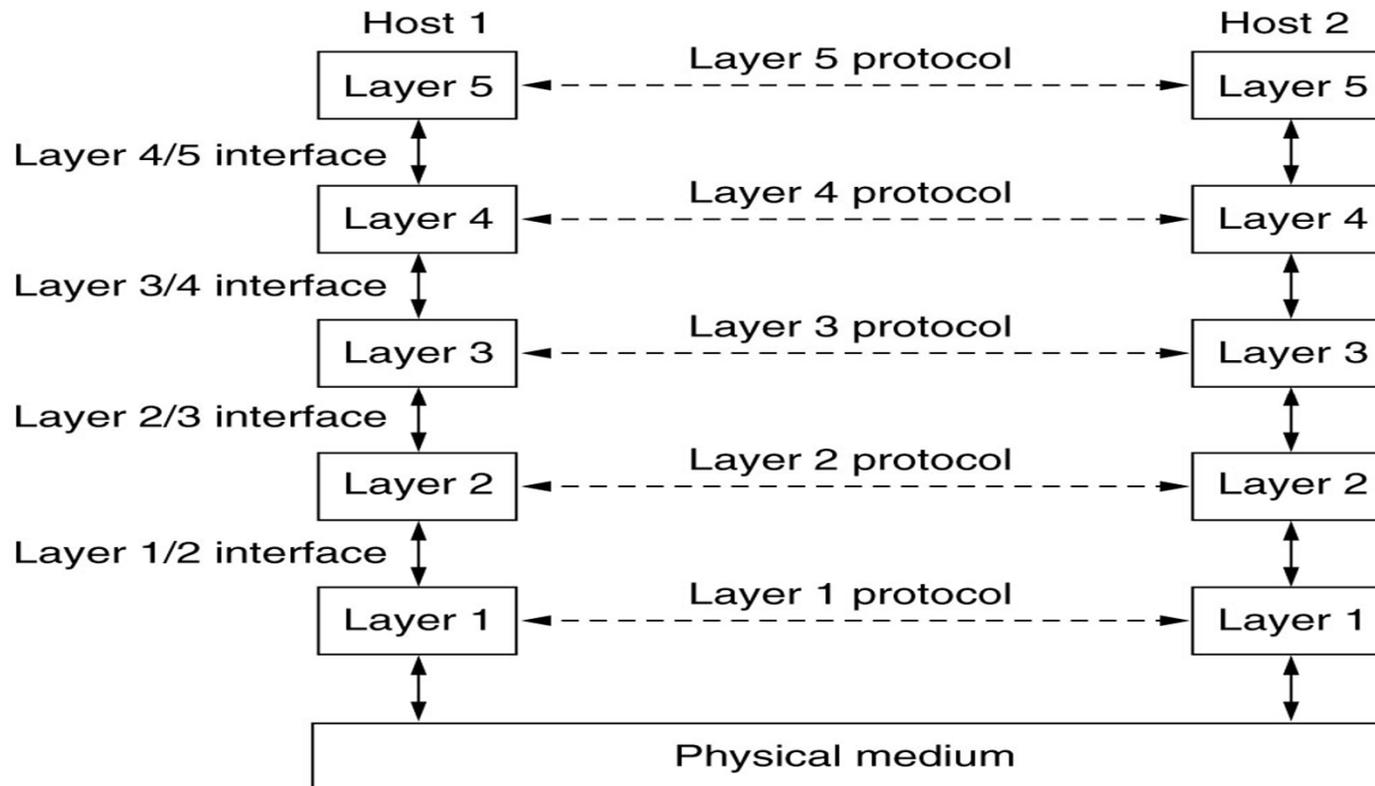


Figure 1.13 (Reference [1])



Motivation, concepts and design issues

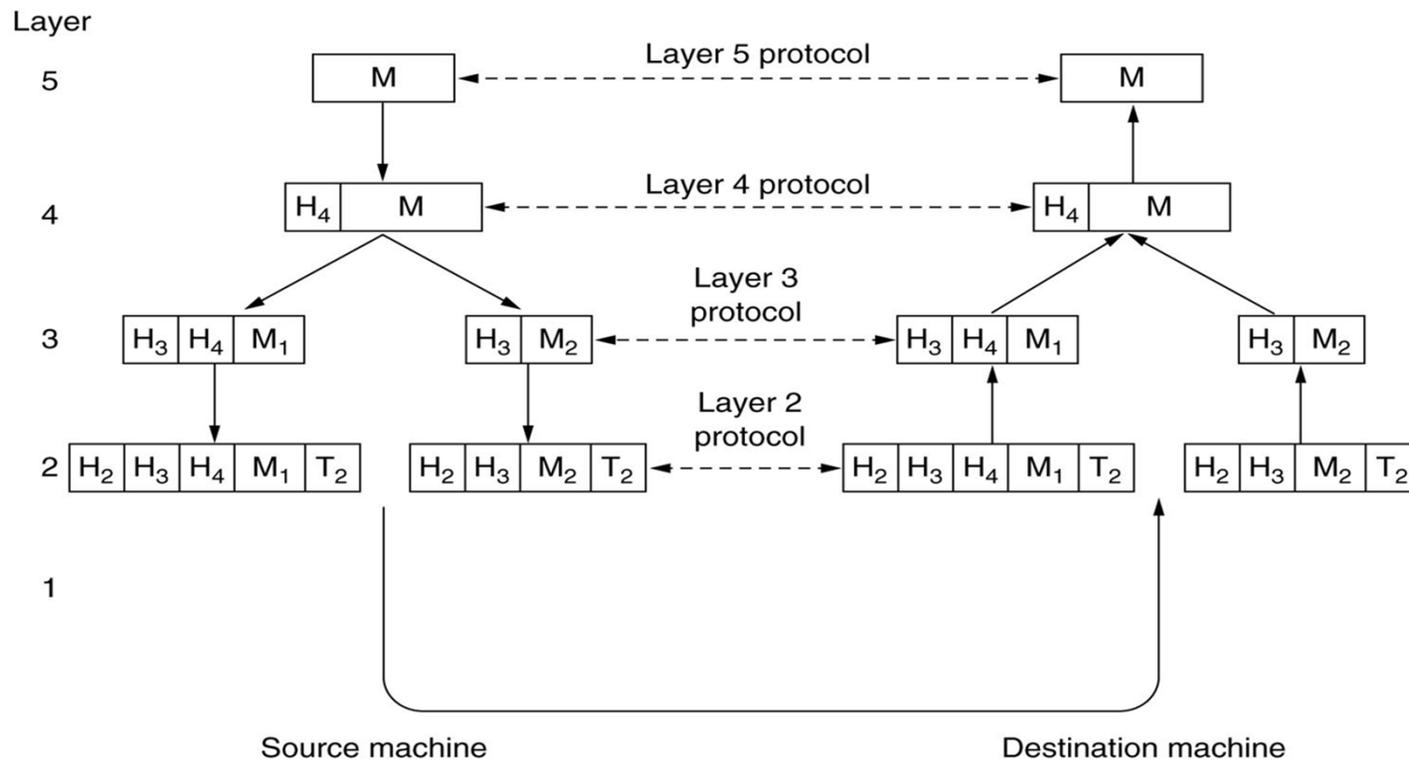


Figure 1.15 (Reference [1])



Motivation, concepts and design issues

- Why organize network software/firmware/hardware in a stack of layers?
 - A layer N provides a service to its user (Layer N+1) but keeps the details of its internal state and algorithms hidden
 - Hierarchisation
 - Modularization
 - Information hiding
 - Data encapsulation
 - Abstract data types
 - Object oriented programming



Motivation, concepts and design issues

- The key concepts
 - Protocol, protocol stack
 - Interfaces and services
 - Network architecture



Motivation, concepts and design issues

- Protocol
 - Rules governing the exchange of messages between peer layers (or entities in general)
 - Syntax
 - Semantics
 - Sequencing
- Protocol stack
 - List of protocol used by a given system, one per layer



Motivation, concepts and design issues

- Interface and services
 - Between adjacent layers
 - Primitive operations and services made available by the lower layer to the upper layer
 - Service specification
 - Set of primitives operations available to a user process to access the service
 - Connection – oriented services
 - Connection-less services



Motivation, concepts and design issues

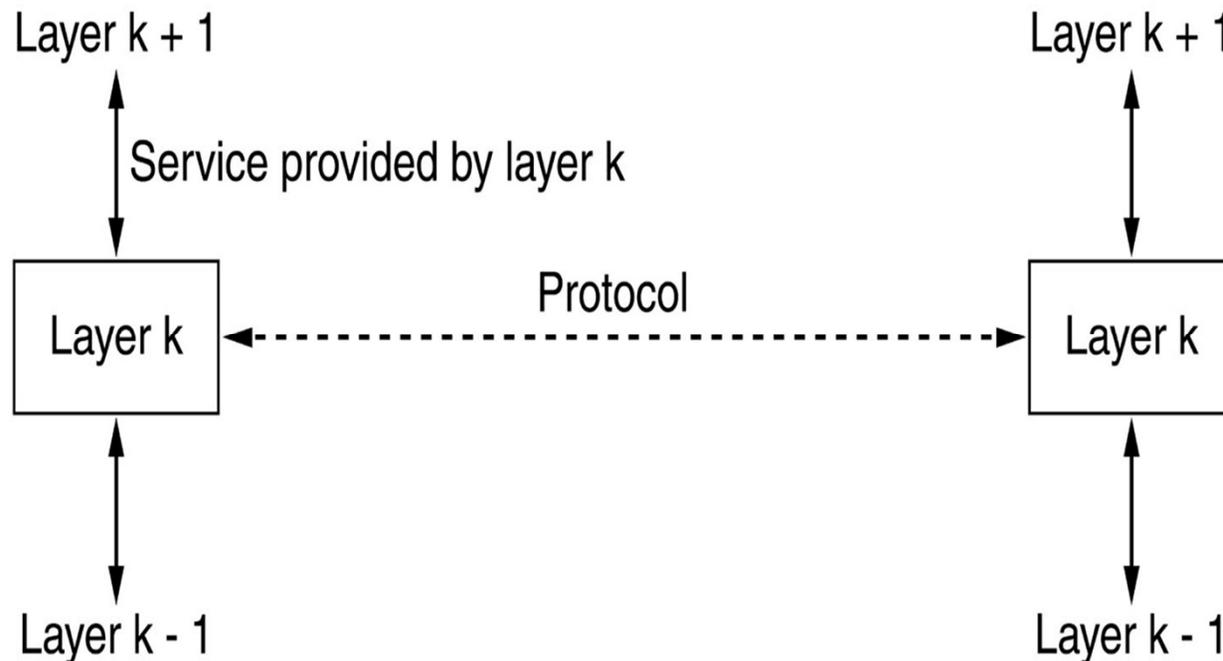
- Interfaces and services
 - Example of 5 service primitives for implementing a simple – connection oriented service (figure 1.17 – reference [1])

Primitive	Meaning
LISTEN	Block waiting for an incoming connection
CONNECT	Establish a connection with a waiting peer
RECEIVE	Block waiting for an incoming message
SEND	Send a message to the peer
DISCONNECT	Terminate a connection



Motivation, concepts and design issues

- Relationship between services and protocols
 - Figure 1.19 – reference [1]





Motivation, concepts and design issues

- Design issues for the layers
 - Addressing
 - Error control
 - Flow control
 - Routing



Motivation, concepts and design issues

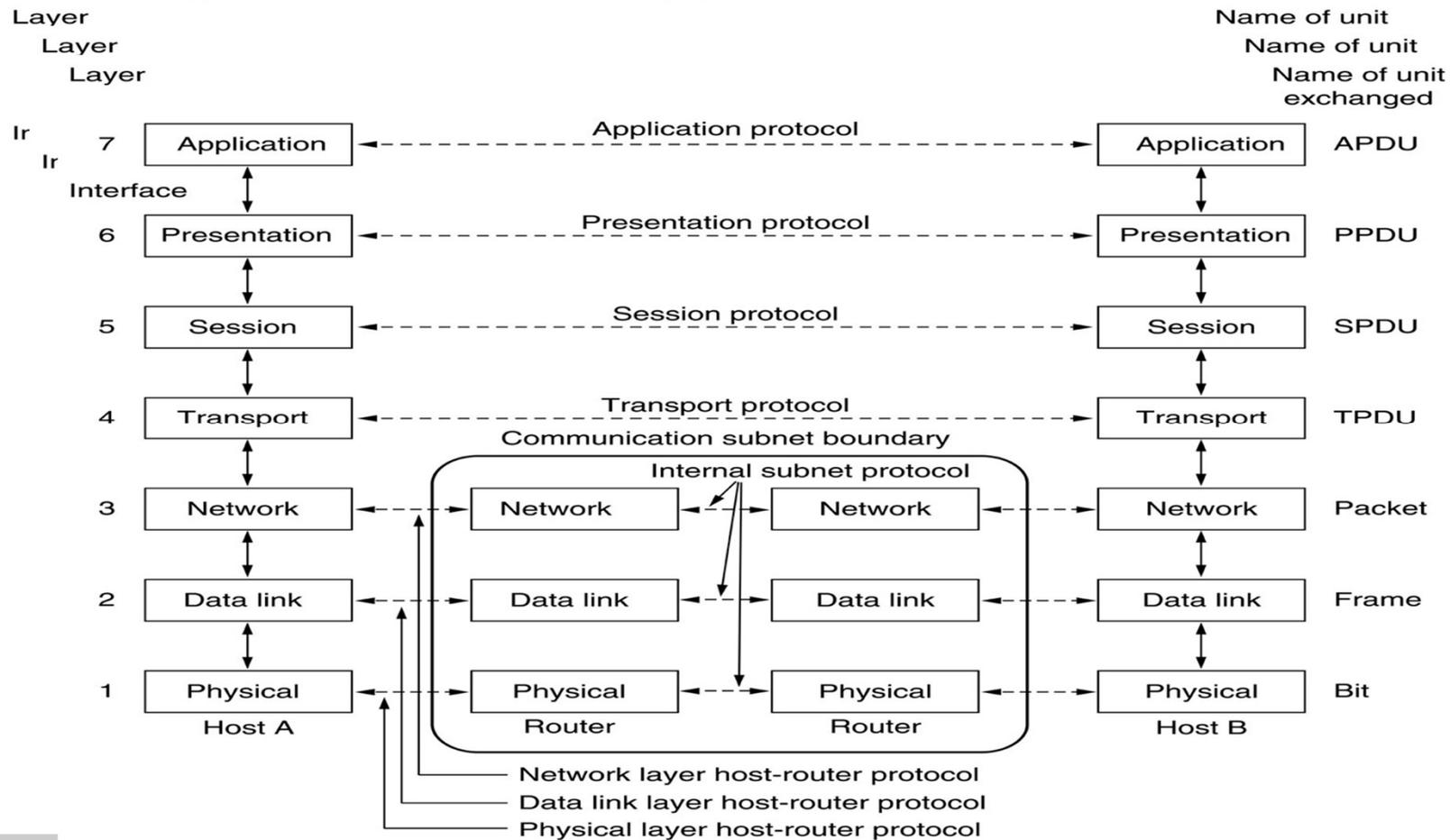
- Network architecture
 - Set of layers and protocols
 - Examples
 - OSI reference model
 - TCP/IP reference model



Reference model

OSI reference model

– Figure 1.20 – reference [1]





Reference model

- OSI Reference model
 - The 7 layers
 - Application
 - Presentation
 - Session
 - Transport
 - Network
 - Data link
 - Physical



Reference model

- OSI Reference model
 - Application Data Unit (APDU)
 - Session Data Unit (SPDU)
 - Transport Data Unit (TDU)
 - Packet
 - Frame
 - Bit



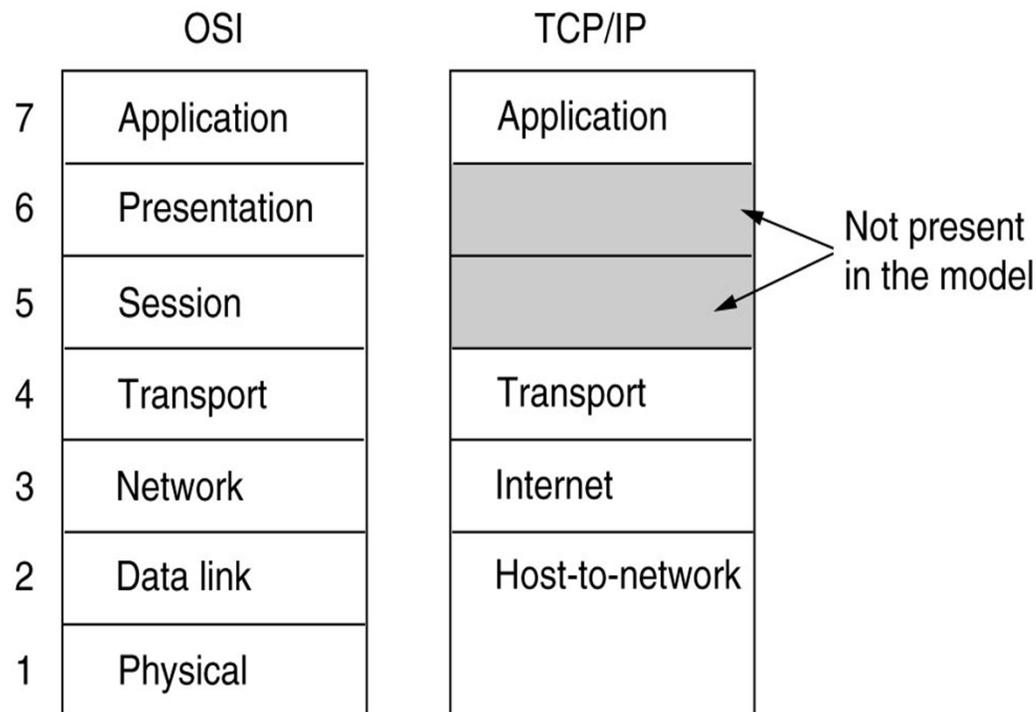
Reference model

- OSI Reference model
 - Key issues
 - Bad timing
 - Bad technology
 - Complexity leading to bad implementations



Reference model

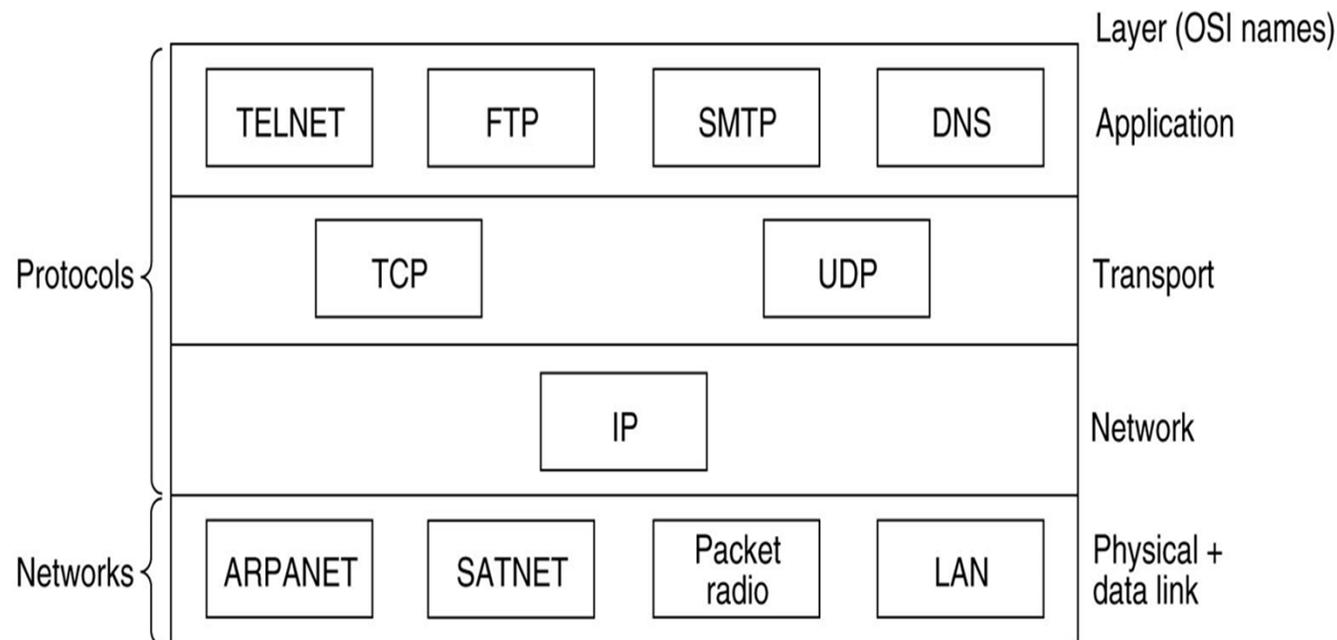
- TCP / IP reference model
 - Figure 1.21 (Reference [1])





Reference model

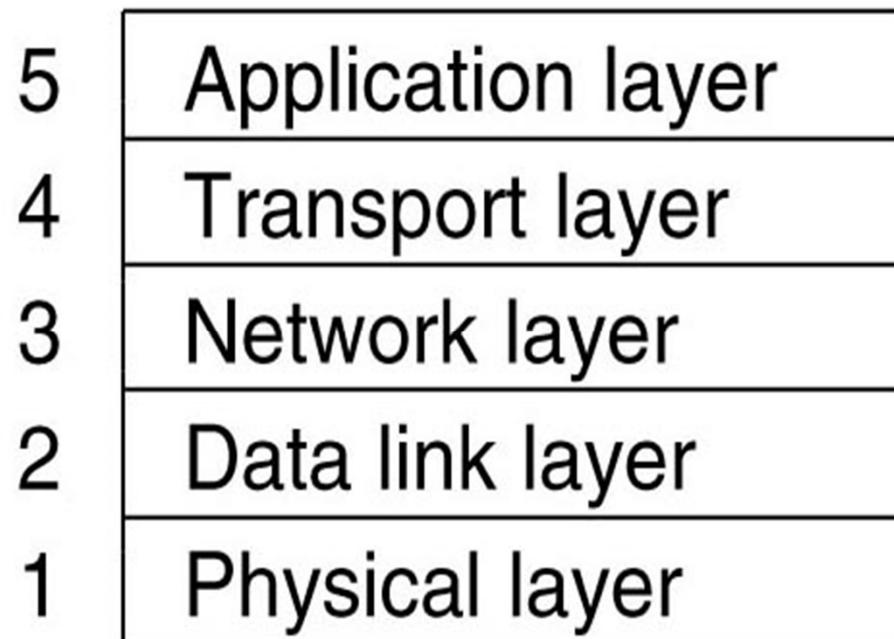
- TCP / IP reference model
 - Figure 1.22 (Reference [1]) – Protocols and networks in the TCP/IP model initially





Reference model

- Hybrid model
 - Figure 1.24 (Reference [1])





References

1. A. Tanenbaum, Computer Networks, , 5th Edition, Prentice Hall, 2010
2. Kurose and Rose, Computer Networking: A Top Down Approach, 7th Edition, Pearson, 2016