Introduction to Computer Networks

ICNE532C - Computer Networks

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History

- 1960 - Advanced Research Projects Agency (ARPA) was interested to find a way to connect computers together so that researchers could share their findings, thereby reducing costs and eliminating duplication of effort.
- 1967 - ARPA presented its ideas for ARPANET, a small network of connected computers. The idea was that each host computer would be attached to a specialized computer, called an *inteface message processor* (IMP). IMPs can communicate with each other IMPs as well as with its own attached host.
- 1969 - ARPANET was a real one to connect four nodes via IMPs to form a network. Software called the *Network Control Protocol* (NCP) provided communication between the hosts.
- 1972 - Deviced a idea *Gateway* to serve as intermediary hardware to transfer data from one network to another.

TCP/IP

- 1973 - Advanced version of NCP to achieve end-to-end delivery of data which is Transmission Control Protocol (TCP).
- 1977 - After 1977, TCP is split into two protocols: **Transmission Control Protocol (TCP) and Internet Protocol (IP)**. IP would handle datagram routing which TCP would be repsonsible for higher level functions such as segmentation, reassembly, and error dection. This combination is known as TCP/IP.
- 1981 - UC Berkeley modified the UNIX operating system to included TCP/IP.
- 1983 - ARPANET protocol is abolisehd and TCP/IP became the official protocol for the ARPANET.

History

- 1950 (SAGE) -1968 (telephone switch)
- 1969 - ARPANET
- 1972 - TCP/IP
- 1973 - Ethernet
- 1995 - Ethernet speed increased from 10Mb/s to 100Mb/s
- 1998 - Ehternet speeds of a Gigabit
- As of 2016 - 100 Gb/s

Network

- Connection of various communication devices using a communication line.
- Devices (end node) connected to network can communicate with each other through other nodes (devices) if they are not directly connected.
- Devices refers computer(desktop & laptop), mobile devices are the one connected to the network using other devices like switch, routers, etc to facilitate the connection among end node devices.
- Use - Exchange of information

Protocol

- Defines rules.
- Communication between two people or two devices needs to follow some protocol.
- Both entities should agree upon a protocol before communication starts.
- Key elements of a protocol are.
  - *Syntax*: Structure or format of the data.
  - *Semantics*: How a particular pattern to be interpreted?
  - *Timing*: When data should be sent and how fast it can be sent?

Protocol Layers (Open System Interconnection - OSI model)

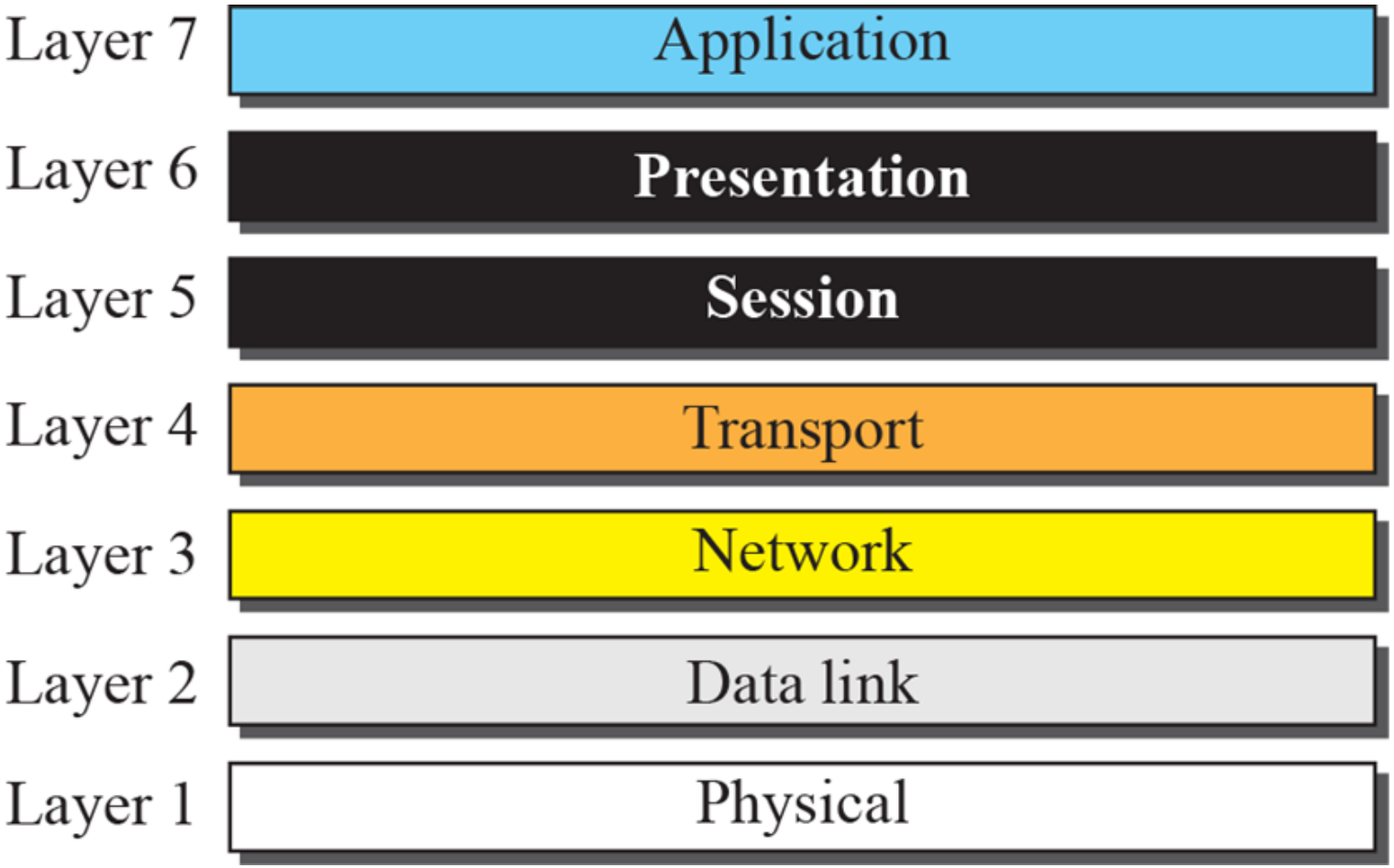


Figure: OSI Model

OSI Layers

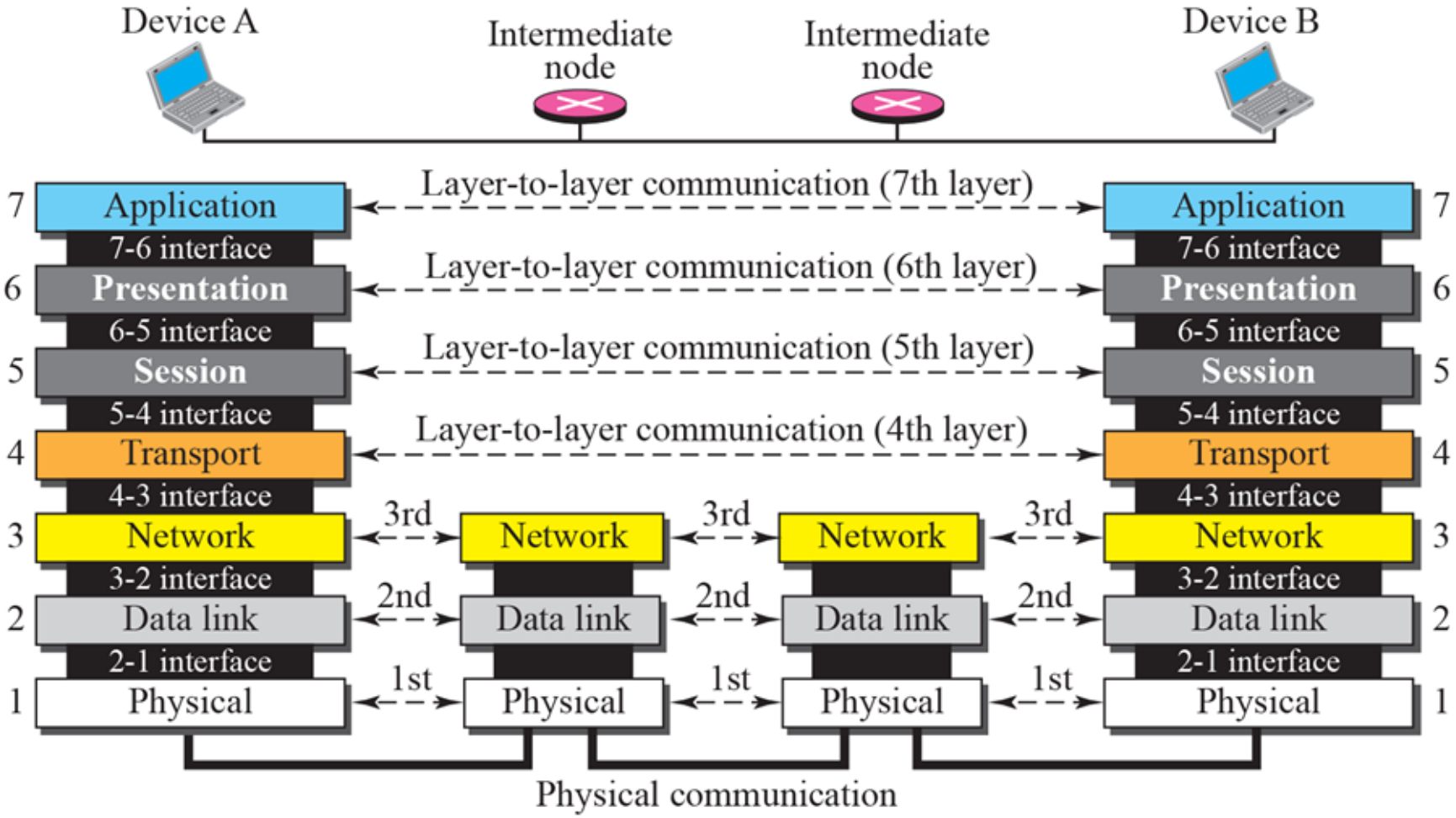


Figure: OSI Layer Representation

An exchange using OSI model

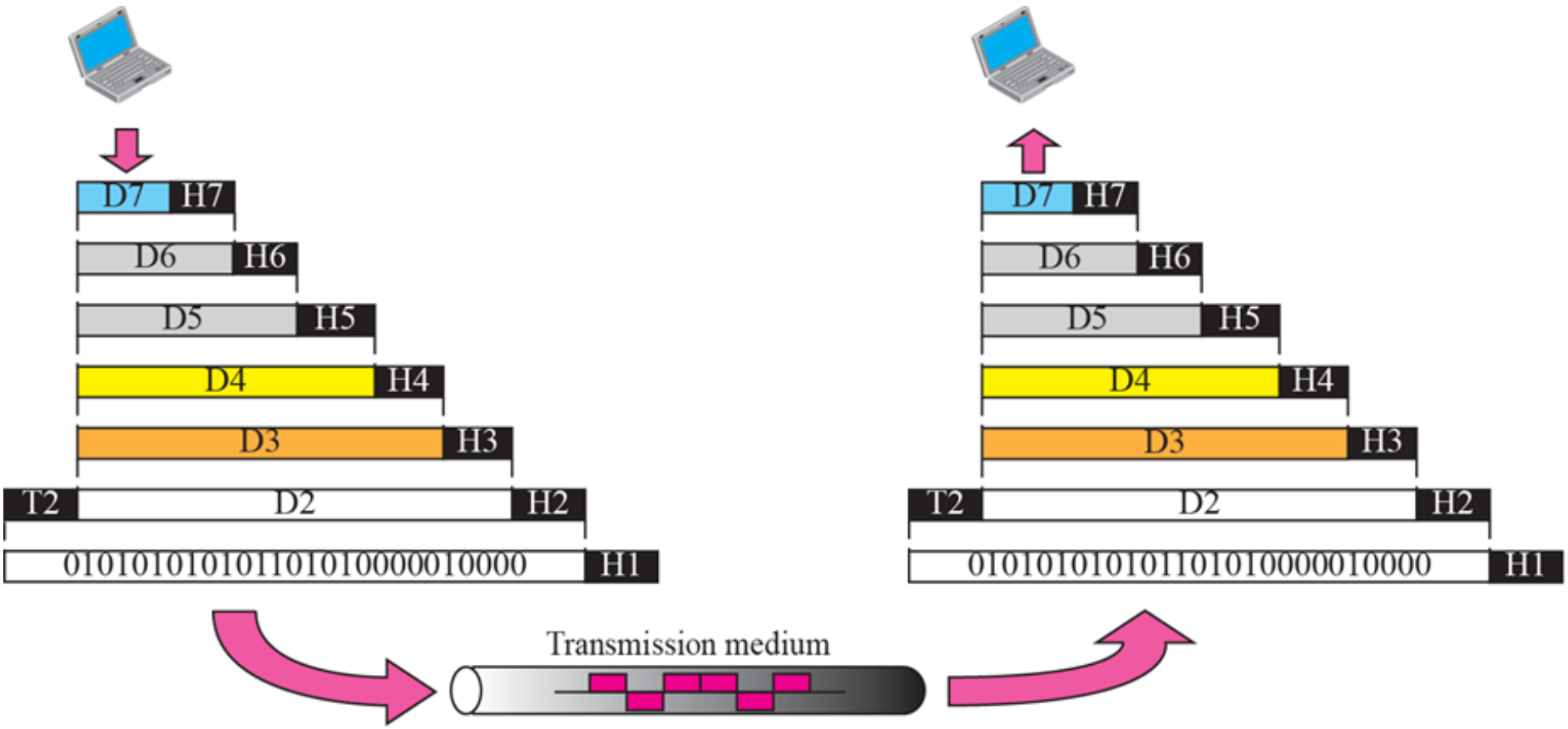


Figure: Exchange using OSI model

Physical Layer

- Physical characteristics of interfaces and media.
- Representation of bits.
- Data rate.
- Synchronization of bits.
- Line configuration.
- Physical Topology.
- Transmission mode.

Data Link Layer

- Framing
- Physical addressing
- Flow control
- Error control
- Access control

Network Layer

Responsible for source to destination delivery of packet, possibly across multiple networks (links).

- Logical addressing
- Routing

Transport Layer

It is responsible for process-to-process delivery of the entire message. A process is an application program running on the host.

- Service point addressing
- Segmentation and reassembly
- Flow control
- Error control
- Connection control

Session Layer

- Dialog control
- Synchronization

Presentation Layer

- Translation
- Encryption
- Compression

Application Layer

- Network Virtual Terminal
- File Transfer, access and management (FTAM)
- E-Mail services
- Directory services

Summary

Summarize the OSI layers

Layers in the TCP/IP suite

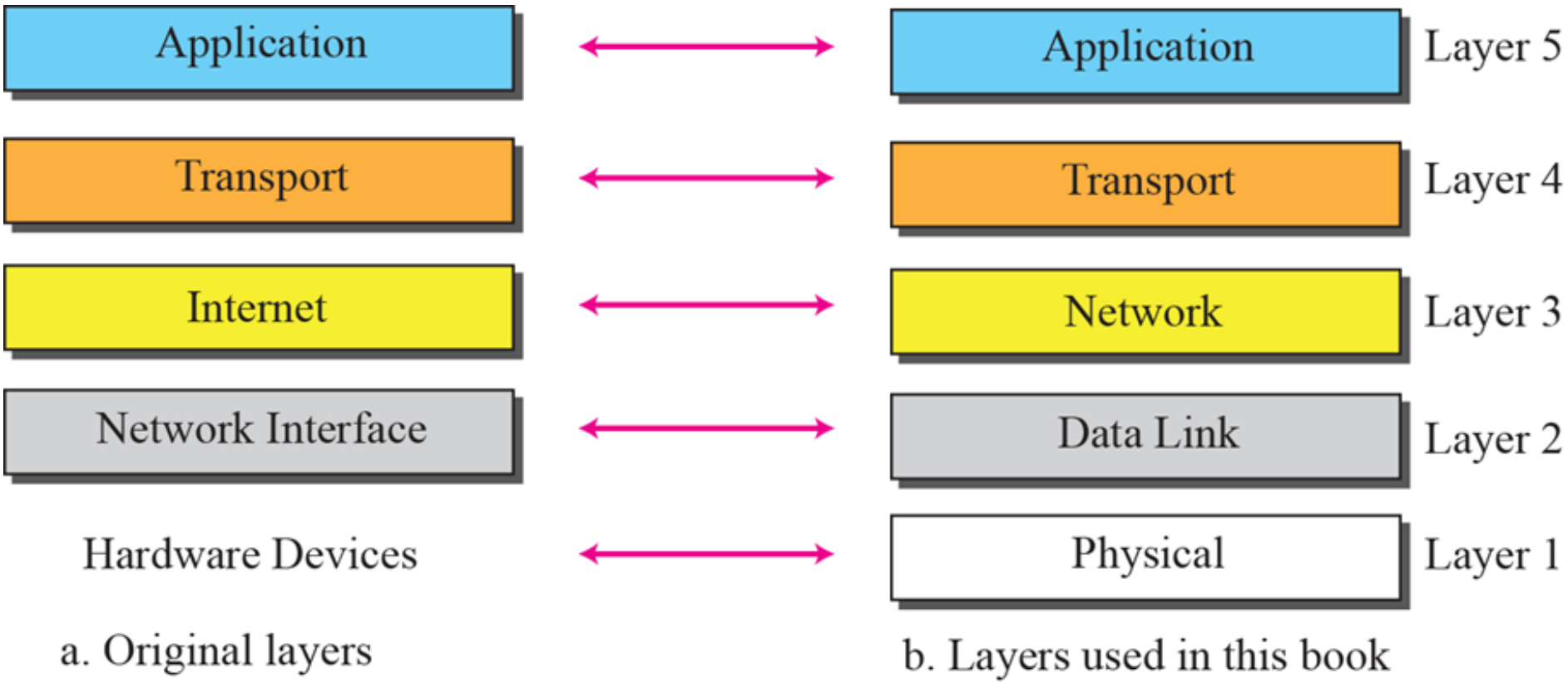


Figure: Original vs Book

TCP/IP vs OSI model

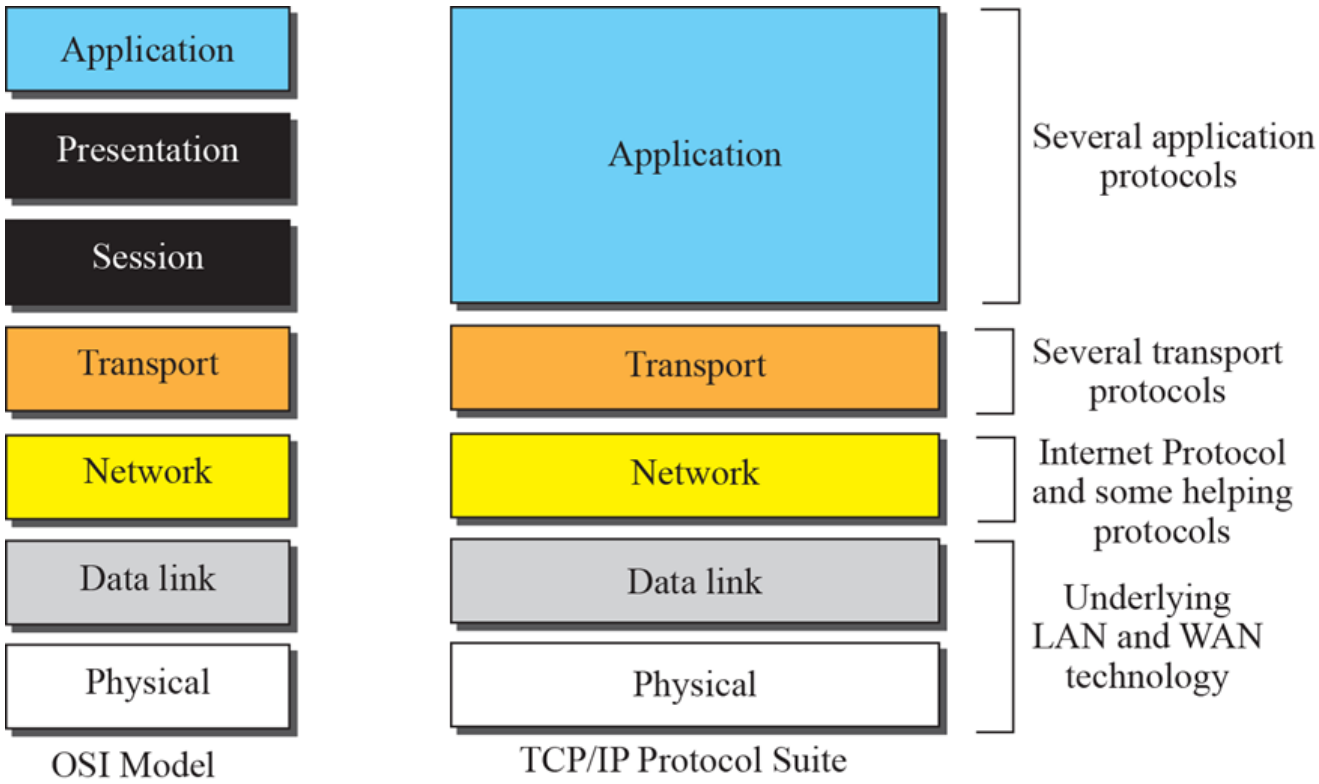


Figure: TCP/IP vs OSI

Addressing

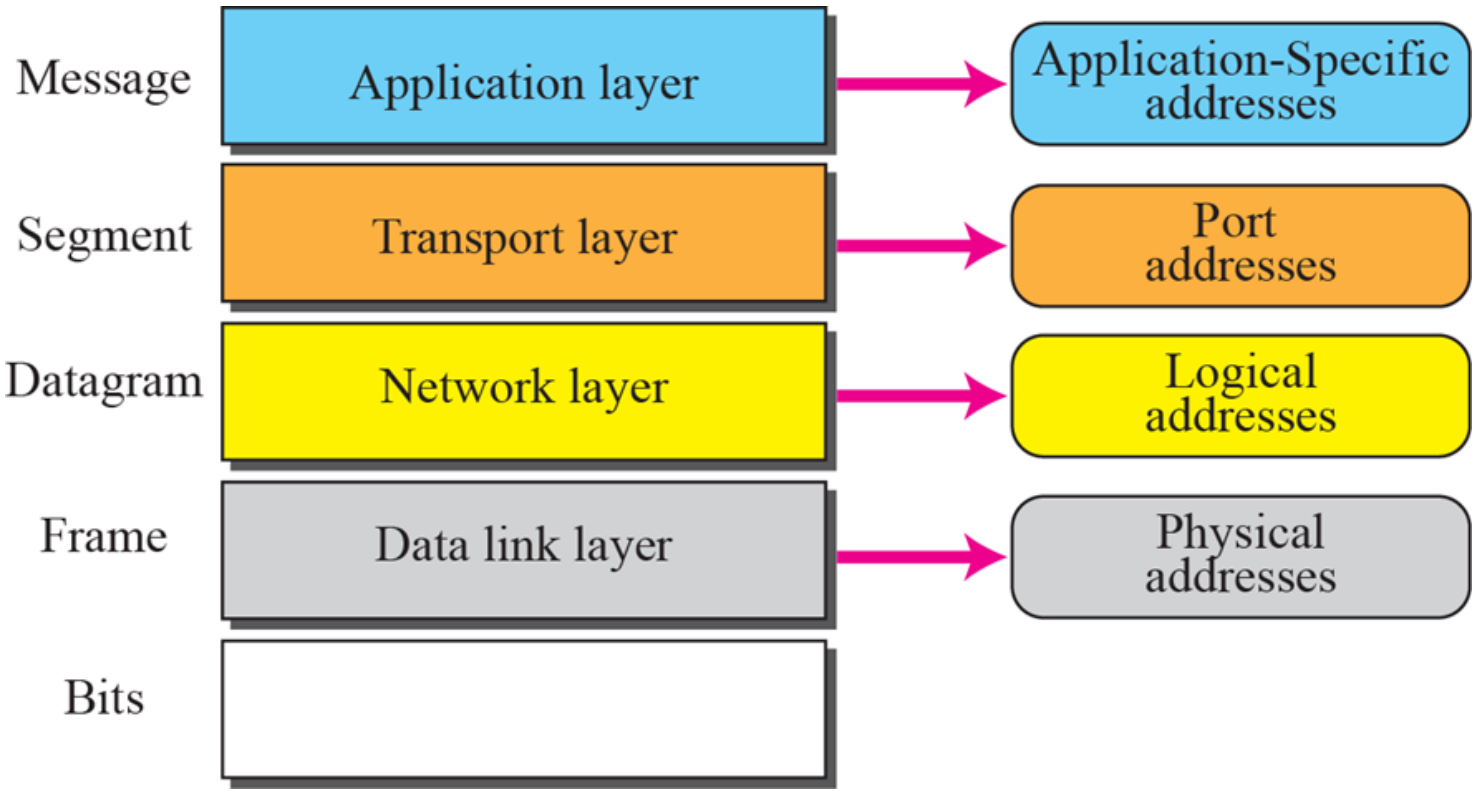


Figure: Address in the TCP/IP suite

Physical Address

- 6 Byte (48-bit) physical address
- 07:01:AB:CD:FF:02
- It can be **Unicast, multicast and broadcast**
- Some networks support all three addresses. For example, ethernet supports all. Some networks do not support the multicast or broadcast physical addresses.

Logical Address

- Physical addresses are not adequate in an internetwork environment where different networks can have different address formats.
- It is of 32 bit (4 bytes) size address
- It is the unique address
- ARP is required to get the IP address if we know only domain name.
- Eg. 214.31.1.45

Port Address

- A port address in TCP/IP is 16 bits length.
- It is represented as one single number
- Eg. 22

Application Specific Address

- E-Mail address.
- Universal Resource Locatar (URL)
- Eg. www.iiita.ac.in

References

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[3] Behrouz A. Forouzan *TCP/IP Protocol Suite*. Tata McGraw-Hill fourth edition.