

Lecture 11

Communication Fundamentals in Computer Networks

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The ISO/OSI Layer Model

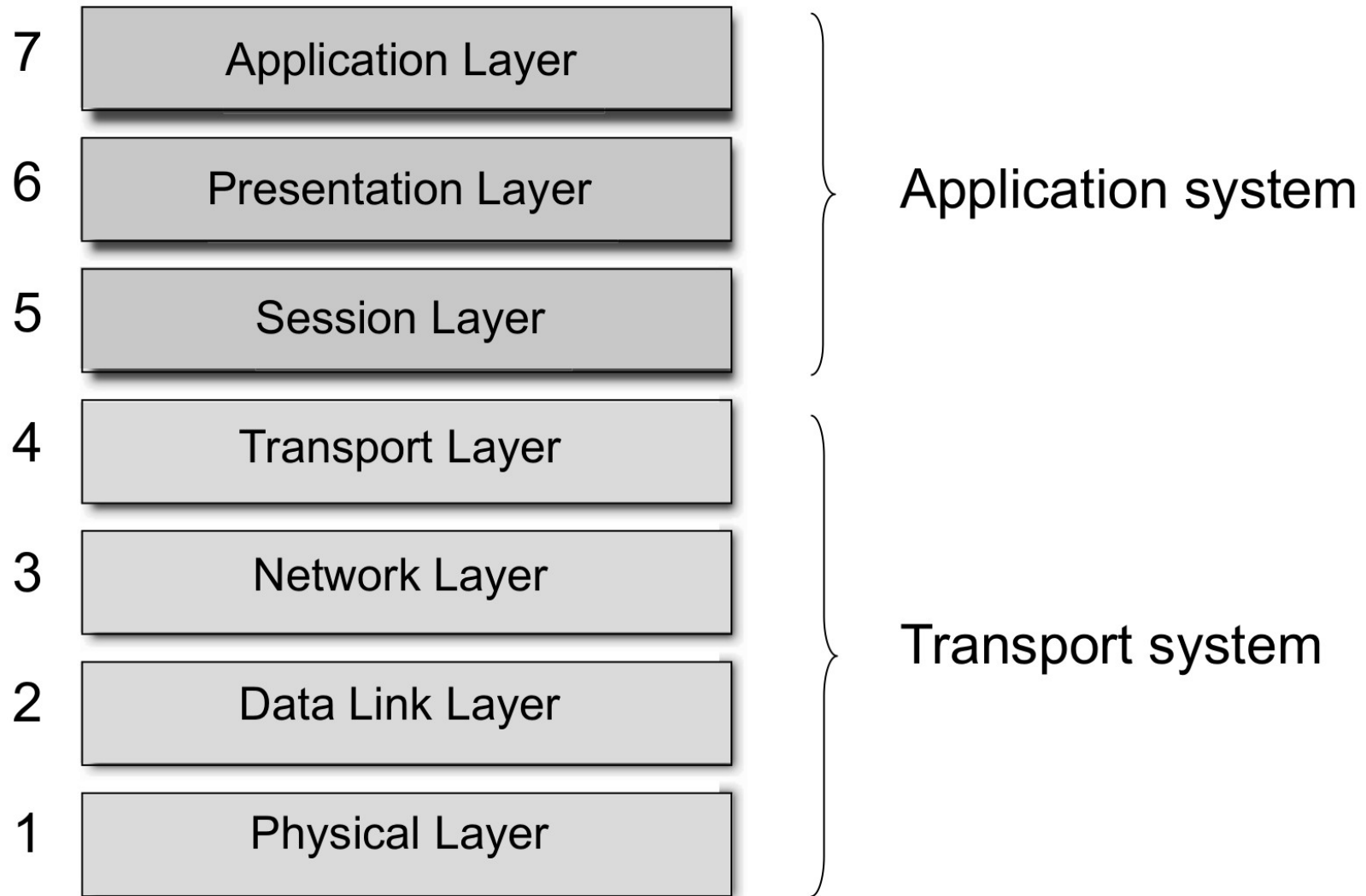
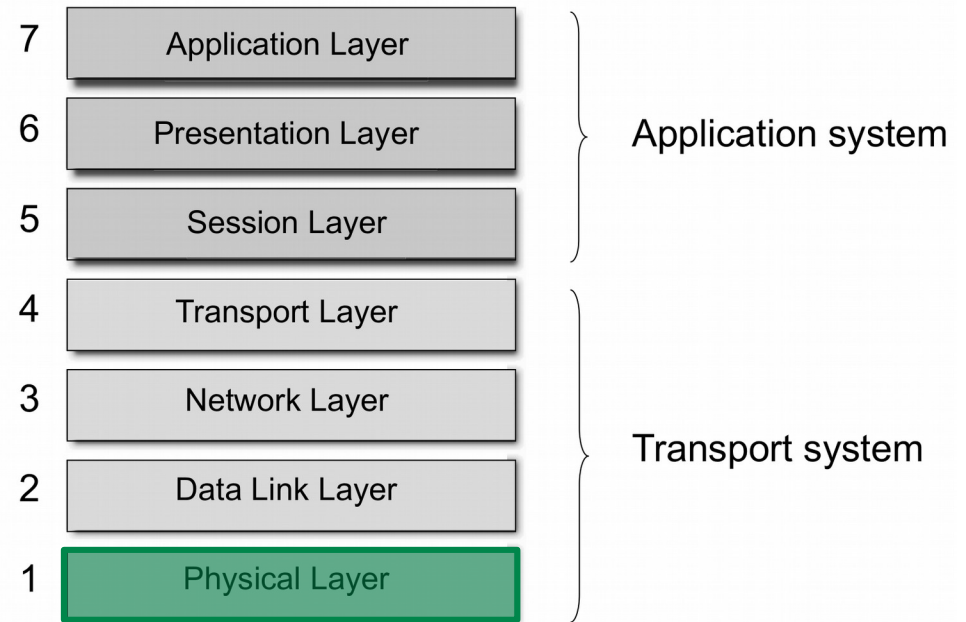


Fig. 3.20 The individual layers of the ISO/OSI Reference Model.

The ISO/OSI Layer Model

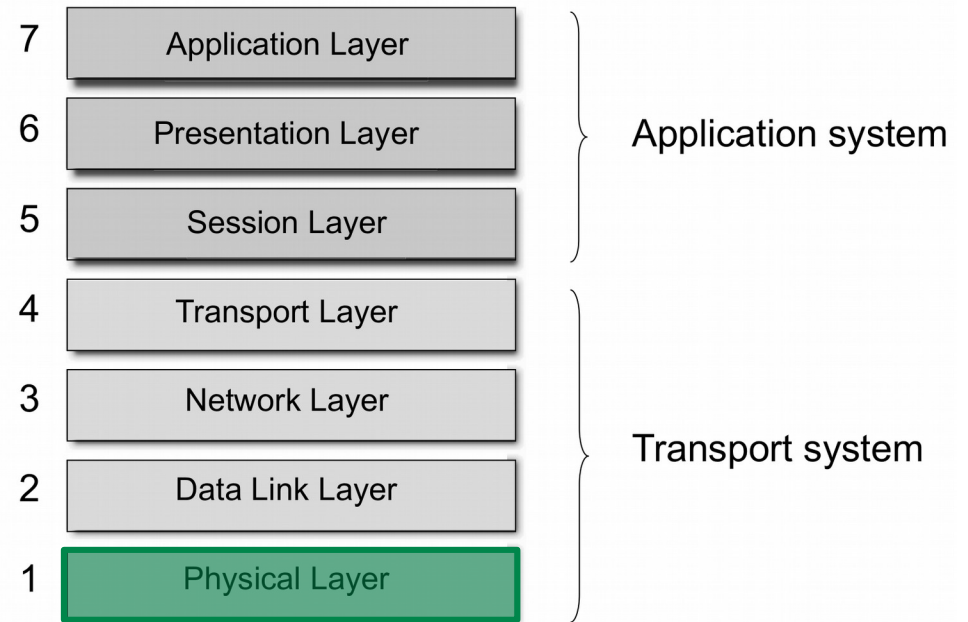
The physical layer regulates the relationships between the network hardware and the physical transmission medium.



Among the most important task at the physical layer are:

- Connection establishment and termination to a transmission medium and
- Modulation, i.e., the conversion of binary data (bit streams) into (electrical, optical or radio) signals that can be transmitted over a communication channel.

The ISO/OSI Layer Model

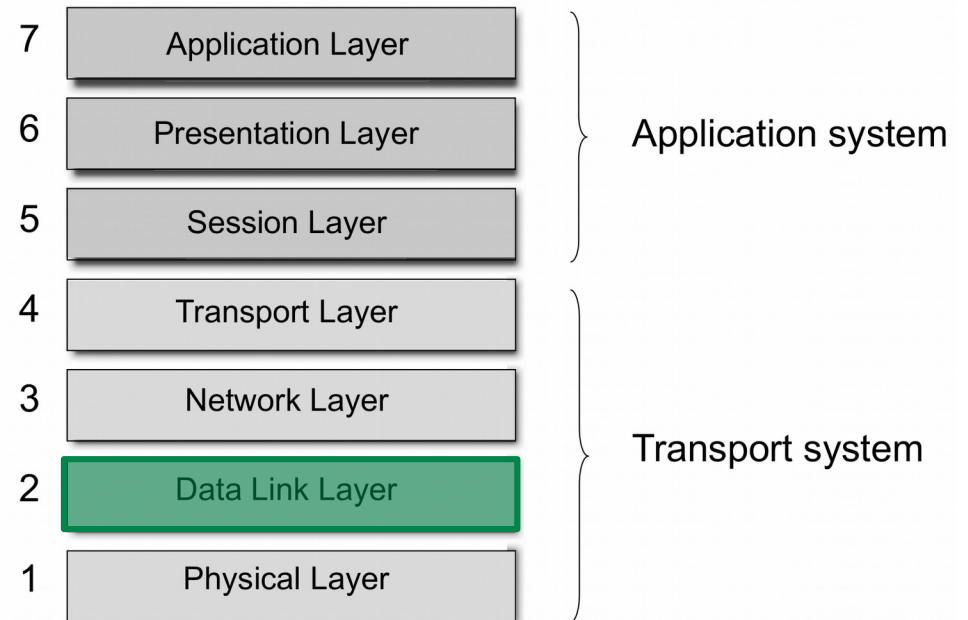


Important protocol standards at this layer are e.g.,

- ITU-T V.24, V.34, V.35
- ITU-T X.21 and X.21bis
- T1, E1
- SONET, SDH, DSL
- EIA/TIA RS-232-C
- IEEE 802.11 PHY

The ISO/OSI Layer Model

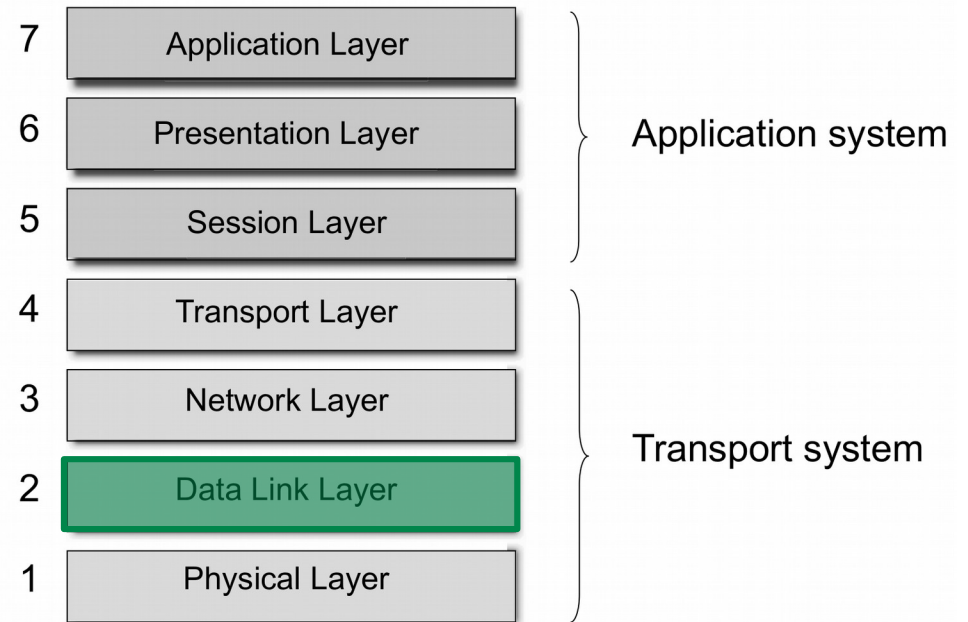
The data link layer ensures that along a point-to-point connection, in spite of occasional errors that may occur at the physical layer, reliable transmission can take place.



Among the most important task at the data link layer are:

- Organizing data into logical units referred to as frames,
- Transmitting frames between network components,
- Bit stuffing, i.e., completing frames that are not entirely filled with special padding data, and
- The reliable transmission of frames by way of simple error detection methods such as checksum calculation.

The ISO/OSI Layer Model



Important protocol standards at this layer are e.g.,

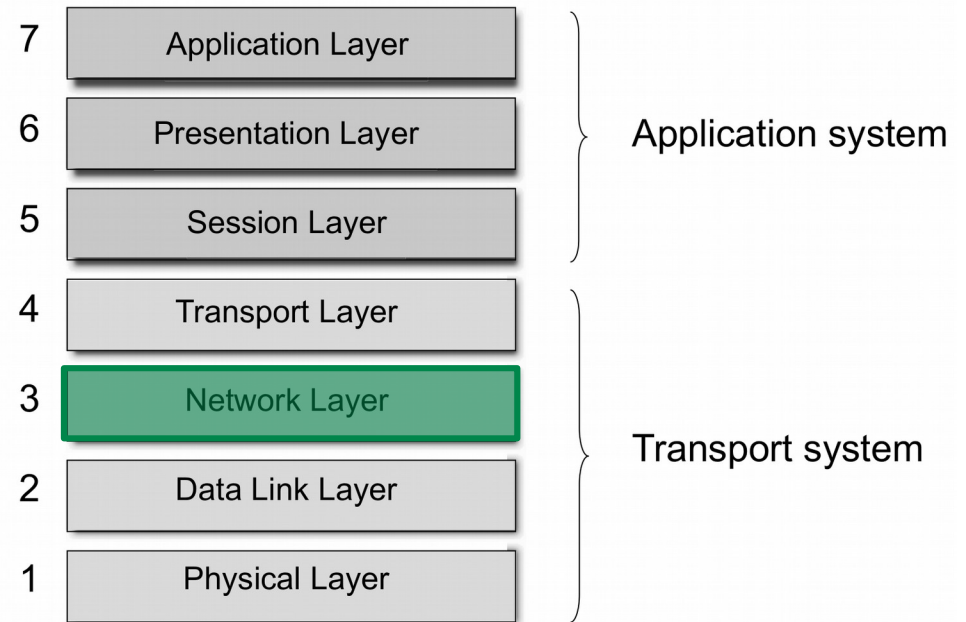
- BSC, DDCMP, PPP
- IEEE 802.3 (Ethernet)
- HDLC
- X.25 LAPB and LAPD
- IEEE 802.11 MAC /LLC
- ATM , FDDI, Frame Relay

The ISO/OSI Layer Model

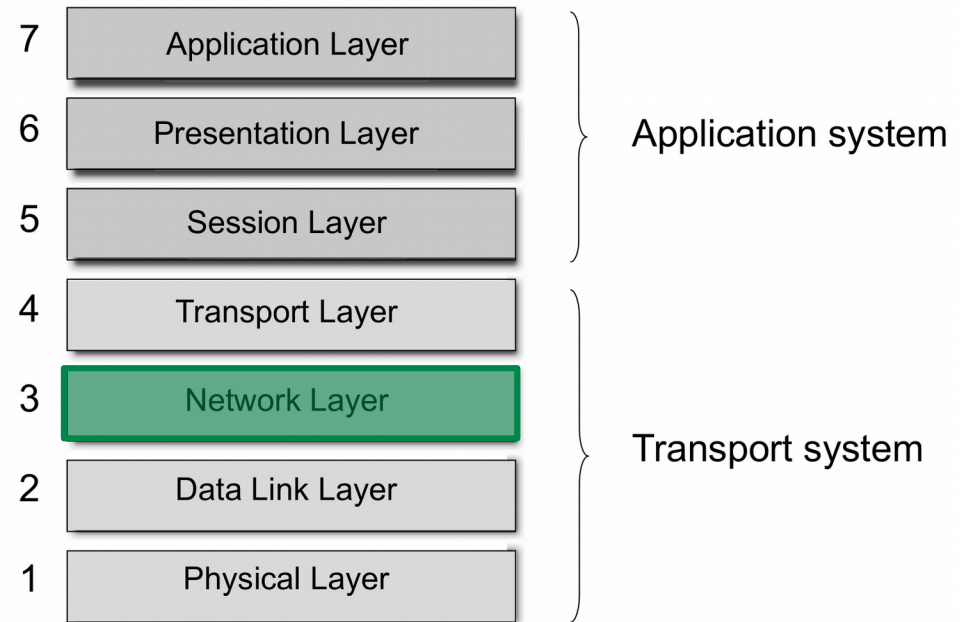
The network layer provides the functional and procedural means to enable the transfer of data packets from a sender to a receiver via one or more networks.

The tasks of the network layer include:

- Assigning addresses to end and intermediate systems,
- The targeted forwarding of data packets from one end of the network to the other (routing) and subsequently,
- Linking individual networks (internetworking),
- Fragmenting and reassembling data packets, since different network are determined by different transport parameters, and
- Forwarding error and status messages regarding the successful delivery of data packets.



The ISO/OSI Layer Model

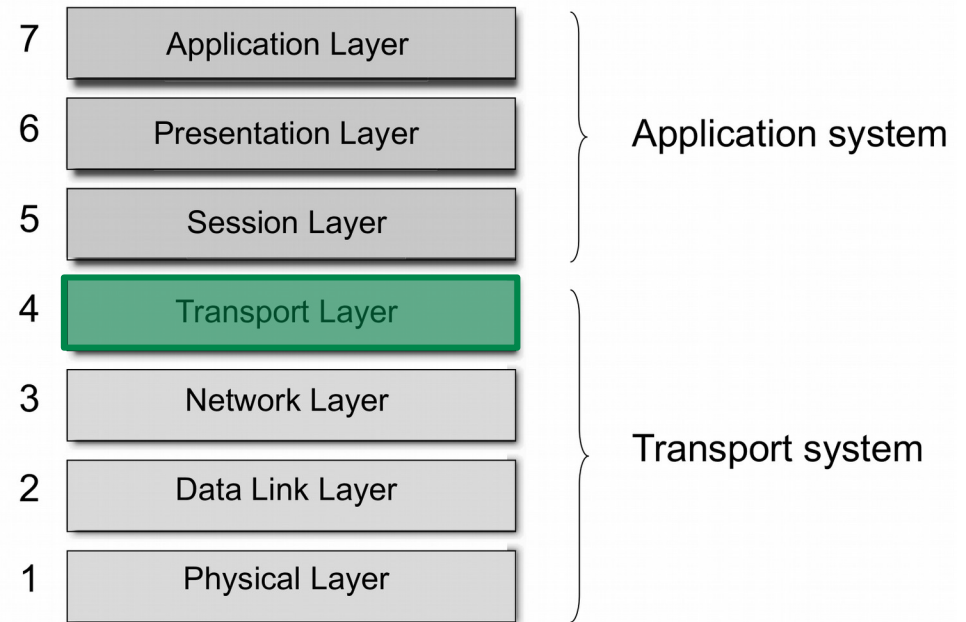


Important protocol standards at this layer are e.g.,

- ITU-T X.25 PLP (Packet Layer Protocol)
- ISO/IEC 8208, ISO/IEC 8878
- Novell IPX (Internetwork Packet Exchange)
- IP (Internet Protocol)

The ISO/OSI Layer Model

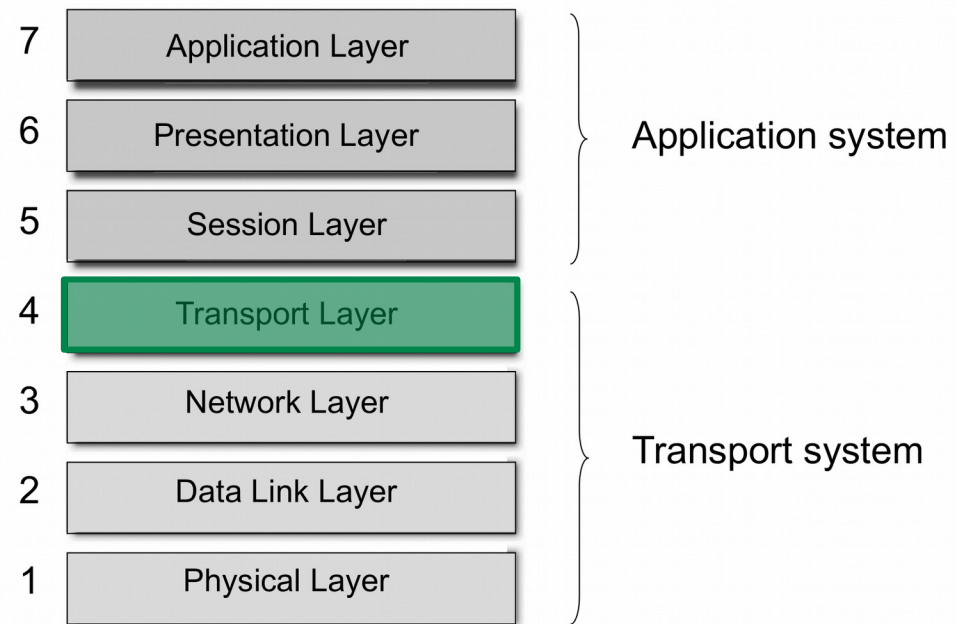
The transport layer provides transparent data transfer between end users and also provides a reliable transport service to the upper layers.



The tasks of the transport layer include:

- This layer defines the details necessary for a reliable and secure data transmission. This ensures that a sequence of data packets travels from the sender to the receiver in a form that is error-free, complete and sequentially correct.
- Also at the transport layer, the imaging of network addresses into logical names occurs. The transport layer therefore provides an end-to-end connection for the end systems involved.

The ISO/OSI Layer Model

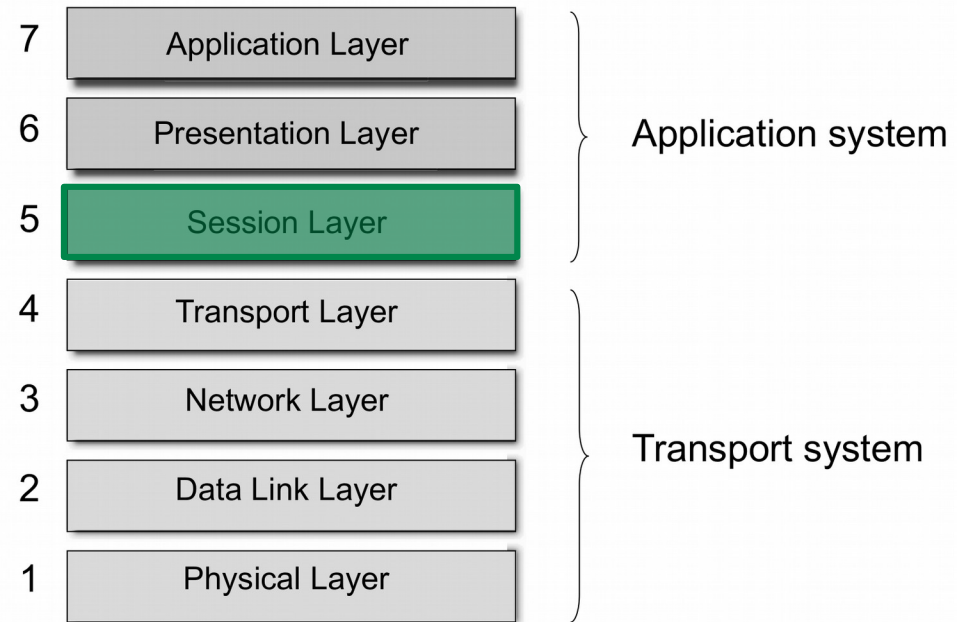


Important protocol standards at this layer are e.g.,

- ISO/IEC 8072 (Transport Service Definition)
- ISO/IEC 8073 (Connection Oriented Transport Protocol)
- ITU-T T.80 (Network-Independent Basic Transport Service for Telematic Services)
- TCP (Transmission Control Protocol), UDP (User Datagram Protocol), RTP (Real-time Transport Protocol)

The ISO/OSI Layer Model

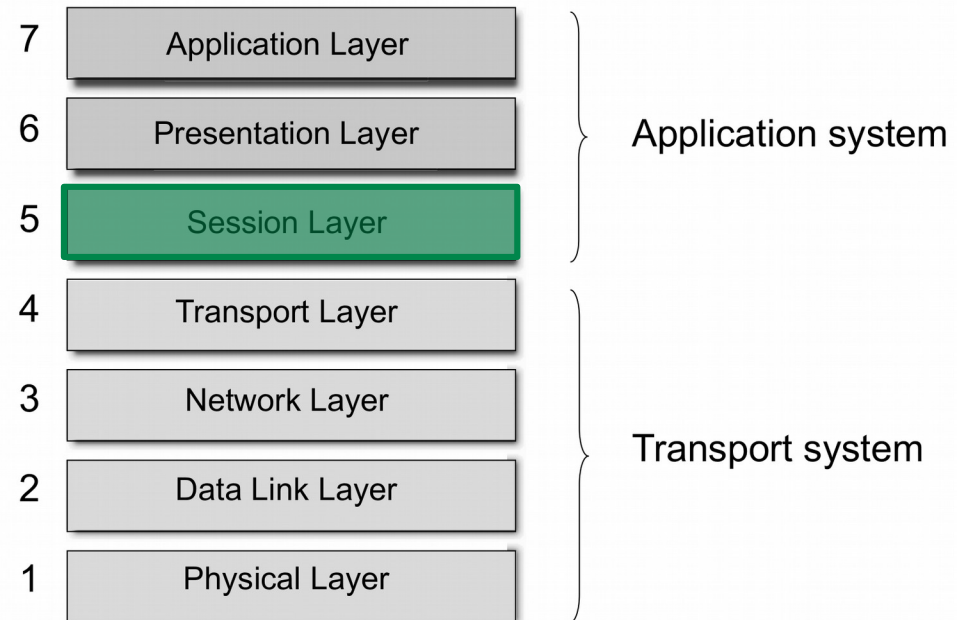
The session layer regulates the dialogue between two computer connected through the network.



The main tasks of the session layer include:

- Establishment, management and termination of connections between local and remote applications,
- Control of full-duplex, half-duplex or simplex data transport, and
- Establishment of security mechanisms, such as authentication via a password method.

The ISO/OSI Layer Model

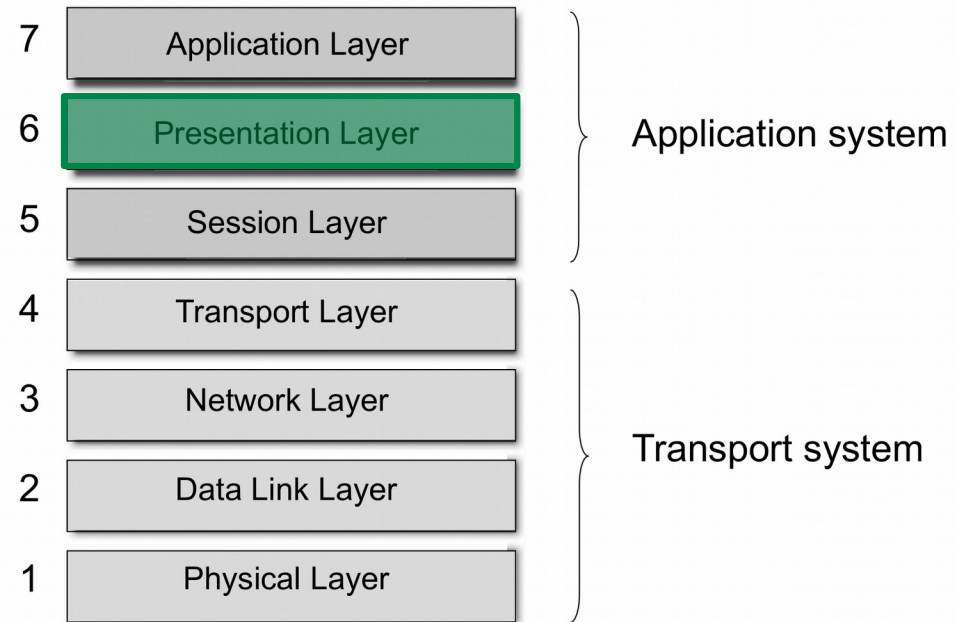


Important protocol standards at this layer are e.g.,

- SAP (Session Announcement Protocol), SIP (Session Initiation Protocol)
- NetBIOS (Network Basic Input/Output System)
- ISO 8326 (Basic Connection Oriented Session Service Definition)
- ISO 8327 (Basic Connection Oriented Session Protocol Definition)
- ITU-T T.62 (Control Procedures for Teletex and Group 4 Facsimile Services)

The ISO/OSI Layer Model

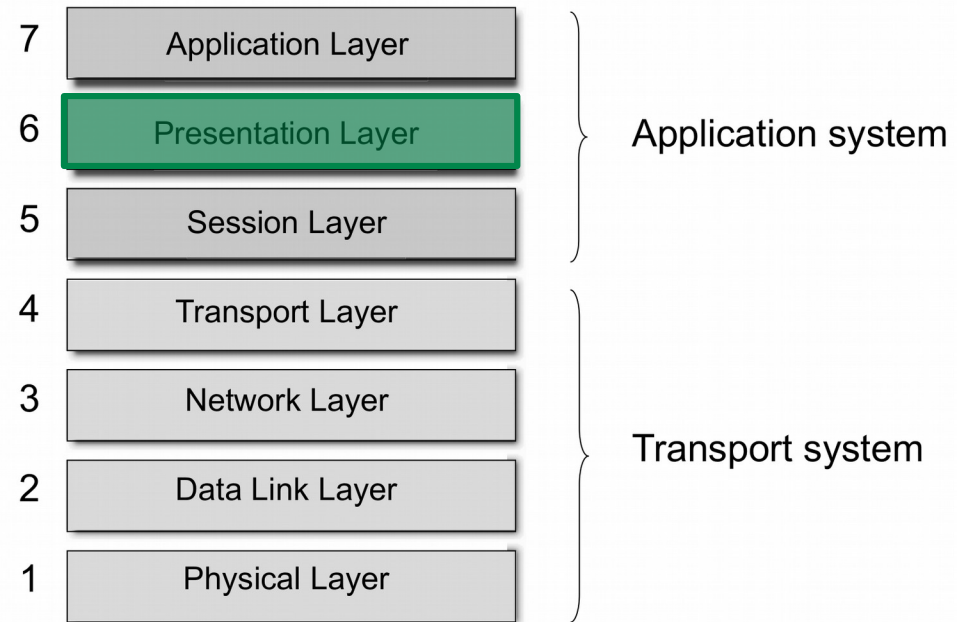
The presentation layer is responsible for correctly interpreting the transmitted data.



The main tasks of the presentation layer include:

- The presentation layer creates a context between two entities (applications) of the overlying application layer. The two applications can then use different syntax (e.g., data formats and coding) and semantics.
- The respective local data coding is converted into a special, uniform transfer coding for the presentation layer. At the receiver it is then transformed back into locally valid coding.
- Further tasks at this layer are: data compression and encryption.

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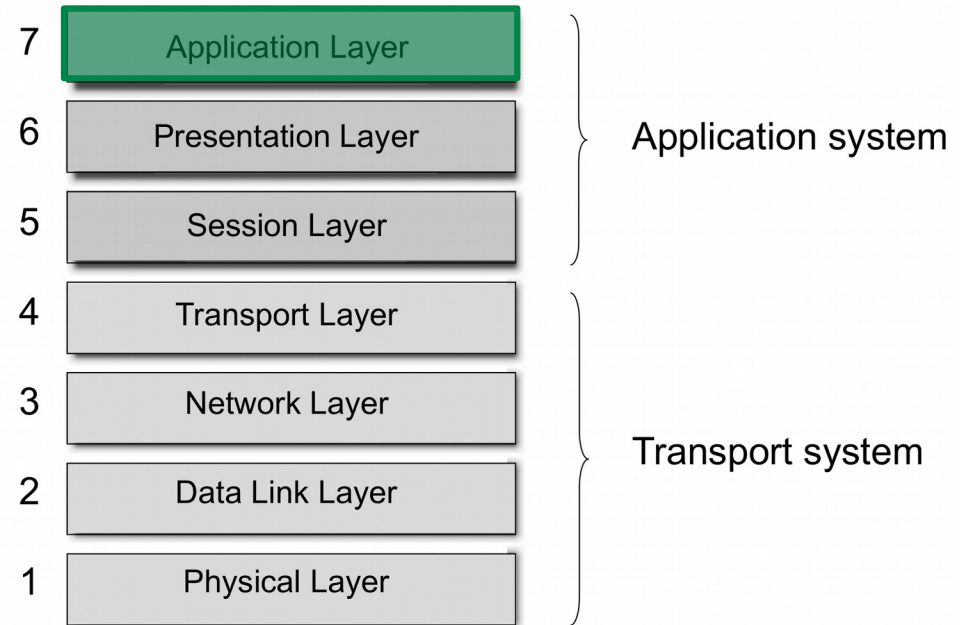


Important protocol standards at this layer are e.g.,

- ISO 8322 (Connection Oriented Session Service Definition)
- ISO 8323 (Connection Oriented Session Protocol Definition)
- ITU-T T.73 (Document Interchange Protocol for Telematic Services), ITU-T X.409 (Presentation Syntax and Notation)
- MIME (Multipurpose Internet Mail Extension), XDR (External Data Representation)
- SSL (Secure Socket Layer), TLS (Transport Layer Security)

The ISO/OSI Layer Model

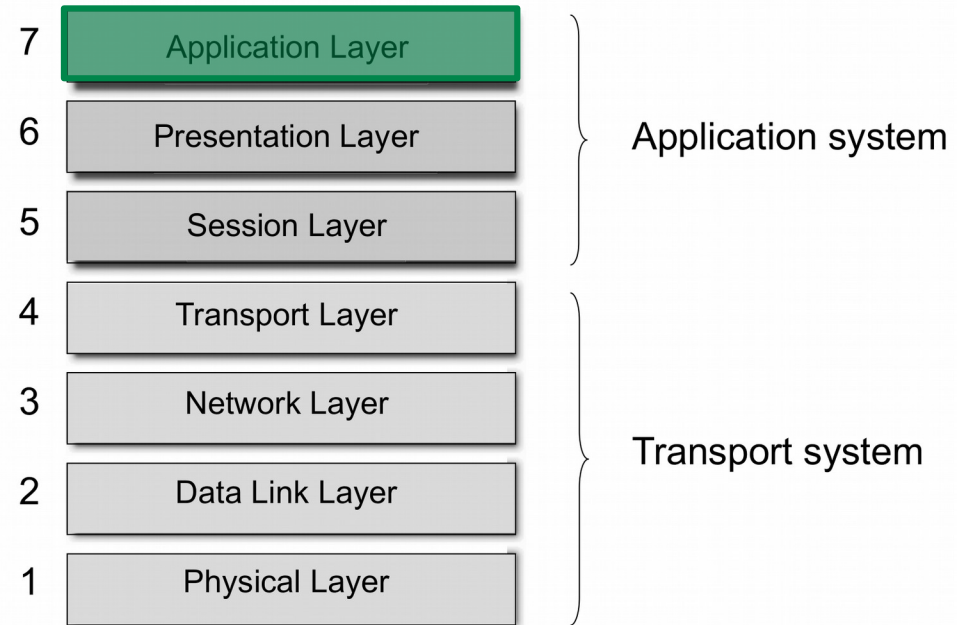
The application layer provides an interface for application programs wishing to use the network for their specific purpose.



Among the most important functions of the application layer are:

- Identifying the communication partner,
- Determining the availability of resources and
- Synchronizing communication.

The ISO/OSI Layer Model



Important protocol standards at this layer are e.g.,

- ISO 8571 (FTAM, File Transfer, Access and Management)
- ISO 8831 (JTM, Job Transfer and Manipulation)
- ISO 9040 und 9041 (VT, Virtual Terminal Protocol)
- ISO 10021 (MOTIS, Message Oriented Text Interchange System)
- FTP (File Transfer Protocol), SMTP (Simple Mail Transfer Protocol), HTTP (Hypertext Transfer Protocol), etc.
- ITU-T X.400 (Data Communication for Message Handling Systems). ITU-T X.500 (Electronic Directory Services)