DATA COMMUNICATION

- Messages to be shared between sender and receiver
- Envelopes used to address messages
- Establish accurate and appropriate meaning to the messages
- Understood by both senders and receivers
- Standard interaction between entities

Data Communication

Communications channel
- Logical Connection
- Used to capably and reliably transport messages

Physical connection
- Independent of the messaging
- Includes signaling that represents the messages being transported

Data Communication

Transmission Control Protocol / Internet Protocol

Examples

Application Layer
- HTTP / SMTP / PPP / TFTP
- MIME Encoding / SSL

OSI Model

Application Layer
- Layer where message is created
- Includes any application that provides software that can communicate with the network layer
- Protocols are specific to purpose of application
- Web Browsing - HTTP
- File Transfer - FTP
- Mail - SMTP
- Requested data and files use URLs
- Universal Resource Locators
- URL includes protocol information

Presentation Layer
- Presents data to application in a form it can use
- Makes application independent of data representation
- Translates ASCII characters to Unicode Characters
- Encryption and decryption of messages
- Example protocols
- SSL - Secure Sockets Layer
- MIME - Multi-purpose Internet Mail Extensions
- Used to encode mail attachments
**Session Layer**
- Establishes a dialogue between two cooperating applications or processes at the ends of the communication link
- Responsible for
  - Establishing the session between the applications
  - Controlling the dialogue
  - Terminating the session
- Example
  - Sockets or ports
  - Used as an end point or connection point on the computer

**Network Layer**
- Addressing and routing of packets to proper destination
- Unreliable, connectionless, packet switching service
  - Does not guarantee delivery nor check for errors
- Communications within a local network:
  - No routing is required because nodes are directly addressable
  - Physical addresses for corresponding IP addresses are look up in a table
  - IP appends a header with the physical address and passes the datagram to the data link layer (layer 2)
- Communications sent outside of the local network
  - At each intermediate node, the network layer removes the current node address and determines the next node address
  - New address is added to the packet and passed to the data link layer (layer 2)

**Data Link Layer**
- Reliable transmission and delivery of packets between two adjacent nodes
- Packets at this layer are called frames
- Software logical link control sublayer
  - Error correction, flow control, retransmission, packet reconstruction and IP datagram/frame conversions
  - Numbers frames and reorder received frames to recreate the original message
- Hardware medium-access control sublayer
  - Defines procedures for access the channel and detecting errors
  - Responsible for services such as data encoding, collision handling, synchronization, and multiplexing

**Physical Layer**
- Layer at which communication actually takes place consisting of a bare stream of bits
- Primarily implemented in hardware by a network interface controller (NIC)
- Physical access protocol includes
  - Definition of the medium
  - Signaling method, signal parameters, carrier frequencies, lengths of pulses, synchronization and timing issues
  - Method used to physically connect the computer to the medium

**Presentation Layer**
- Responsible for
  - Data encoding, collision handling, synchronization, and multiplexing

**Application Layer**
- Responsible for
  - User Datagram Protocol (streaming video)
  - Transmission Control Protocol
  - Socket to socket communications
  - UDP - User Datagram Protocol (streaming video)
  - TCP - Transmission Control Protocol

**Data Communication**
- Message Transmission
  - User Datagram Protocol (streaming video)
  - Transmission Control Protocol
  - Socket to socket communications

**OSI Model**
- Provides services that support reliable end-to-end communications
- Generates the final address of the destination
- Responsible for all end-to-end communication facilities
- Packetization of a message,
  - breaking up of the message into packets of reasonable size
- Example protocols
  - TCP - Transmission Control Protocol
  - Socket to socket communications
  - UDP - User Datagram Protocol (streaming video)