CN1047 INTRODUCTION TO COMPUTER NETWORKING

CHAPTER 2
OSI MODEL

OSI Model

- **The Open Systems Interconnection model (OSI Model) is a conceptual model that characterizes and standardizes the communication functions of a telecommunication or computing system without regard of their underlying internal structure and technology.**

- **Its goal is the interoperability of diverse communication systems with standard protocols.**

- **The model partitions a communication system into abstraction layers.**

OSI Model

- The OSI model defines internetworking in terms of a vertical stack of seven layers.

- Upper layers of the OSI model represent software that implements network services like encryption and connection management.

- Lower layers of the OSI model implement more primitive, hardware-oriented functions like routing, addressing, and flow control.

OSI Model

- **The OSI Model is a way of thinking about how networks 'work'**

- **THEORY: The OSI Model is a *theoretical model***
  - **The OSI Model is not a technology.**
  - **The OSI Model is not a protocol.**
  - **The OSI Model is not a program or software.**

OSI Model Layers
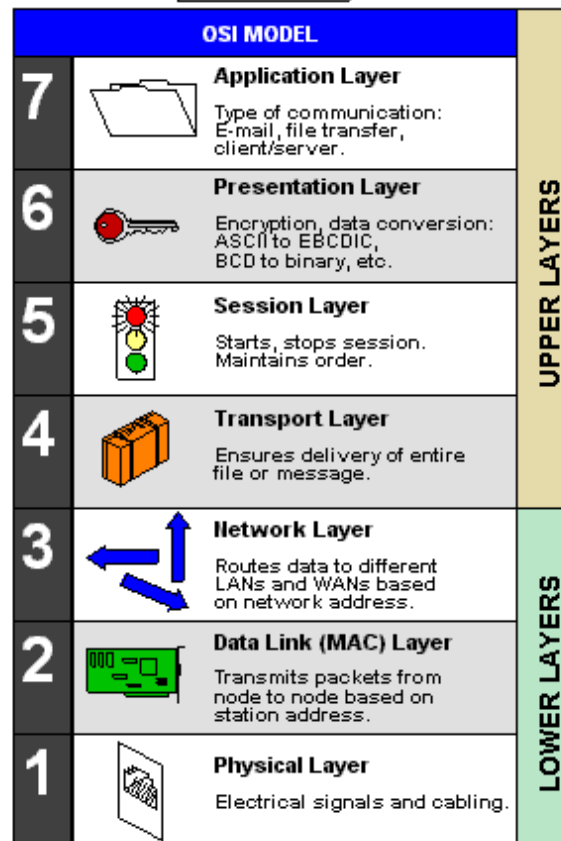
Layer 1 - Physical

- **This layer conveys the bit stream - electrical impulse, light or radio signal -- through the network at the electrical and mechanical level.**

- **It provides the hardware means of sending and receiving data on a carrier, including defining cables, cards and physical aspects.**

Layer 1 - Physical

- The *Physical Layer* receives data from the *data link* Layer, and transmits it to the wire.

- The *physical* layer controls the electrical and mechanical functions related to the transmission and receipt of a communications signal.

- It also manages the encoding and decoding of data contained within the modulated signal.

Layer 1 - Physical

- **The physical layer is responsible for:**
  - **Communication with the *data link* layer above it.**
  - **Fragmentation of data into frames**
  - **Reassembly of frames into *data link* Protocol Data Units.**
  - **Transmission to the physical media**
  - **Receiving from the physical media**

Layer 2 – Data Link

- At this layer, data packets are encoded and decoded into bits.

- It furnishes transmission protocol knowledge and management and handles errors in the physical layer, flow control and frame synchronization.

- This layer provides reliable transit of data across a physical link.

- The *data link* layer is concerned with physical addressing, network topology, physical link management, error notification, ordered delivery of frames, and flow control.

Layer 2 – Data Link

- **Four primary functions:**
    - **COMMUNICATION WITH NETWORK LAYER**
    - **SEGMENTATION & REASSEMBLY**
    - **BIT ORDERING**
    - **COMMUNICATION WITH PHYSICAL LAYER**

Layer 3 – Network

- **This layer provides switching and routing technologies, creating logical paths, known as virtual circuits, for transmitting data from node to node.**

- **Routing and forwarding are functions of this layer, as well as addressing ,internetworking , error handling, congestion control and packet sequencing.**

Layer 3 – Network

- The *network* layer is concerned with the following primary functions:
    - Communication with the Transport layer above.
    - Encapsulation of Transport data into *Network* layer Protocol Data Units.
    - Management of connectivity and routing between hosts or networks.
    - Communication with the *data link* layer below.

Layer 4 – Transport

- This layer provides transparent transfer of data between end systems, or hosts, and is responsible for end-to-end error recovery and flow control.

- It ensures complete data transfer.

- If networking software performs reliable data transfer functions, then the detection of errors, and retransmission of data to recover those errors or lost data will occur in software managing this layer.

Layer 4 – Transport

- **The *transport* layer's responsibility to recover from that error:**
  - **Communicate with the Session layer above.**
  - **Reassemble *transport* Protocol Data Units into data streams**
  - **Reliable protocols operating at this layer will**
    - **Detect errors and lost data**
    - **Recover lost data**
    - **Manage retransmission of data.**
  - **Segmentation of data streams into *transport* Protocol Data Units.**
  - **Communicate with the Network layer below.**

Layer 5 – Session

- The session layer tracks connections, also called sessions.
- This layer establishes, manages and terminates connections between applications.
- The session layer sets up, coordinates, and terminates conversations, exchanges, and dialogues between the applications at each end.
- It deals with session and connection coordination.

Layer 5 – Session

- **The *session* layer performs the following functions:**
    - **Communication with the Presentation layer above.**
    - **Organize and manage one or more connections per application, between hosts.**
    - **Communication with the Transport layer below.**

Layer 6 – Presentation

- The *presentation* layer handles the conversion of data between a Standards-based or platform independant formats to a format understood by the local machine.

- This allows for data to be transported between devices and still be understood

Layer 6 – Presentation

- **This layer provides independence from differences in data representation (e.g., encryption) by translating from application to network format, and vice versa.**

- **The presentation layer works to transform data into the form that the application layer can accept**

Layer 6 – Presentation

- **The *presentation* layer performs the folowing functions:**
    - **Communication with the *application* layer above.**
    - **Translation of data conforming to cross-platform standards into formats understood by the local machine.**
    - **Communication with the *session* layer below.**

Layer 7 – Application

- This layer supports application and end-user processes.

- Communication partners are identified, quality of service is identified, user authentication and privacy are considered, and any constraints on data syntax are identified.

- This layer provides application services for file transfers, e-mail, and other network software services.

Layer 7 – Application

- **The OSI application layer is responsible for displaying data and images to the user in a human-recognizable format and to interface with the *presentation* layer below it.**

Layer 7 – Application

- **Examples of applications that utilize the network are:**
  - Telnet
  - FTP
  - Instant Message software (AIM, MSN, ICQ, Yahoo)
  - Microsoft Windows File Shares
  - Web Browsers (Internet Explorer, Firefox, Google Chrome, Safari)
  - Network games
  - IRC (mIRC)