Embedded Software Trainee Project

OSI MODEL

Define:

The OSI (Open System Interconnection) Model is a conceptual framework used to understand and standardize network communication. Then the Process of data transmission is 7 layer and each layer has perform specific tasks, OSI model ensures interoperability between different systems and protocols.

OSI introduce the 7 Layers by International Organation in 1984

Each layer has package of some protocal

- Physical Layer
- Data Link Layer
- Network Layer
- Transport Layer
- Session Layer
- Presentation Layer
- Application Layer

Appllication layer

- It's used by network Application
- Netwaork Application that mean's computer application that used **Internet** (Like.,Chrome , Firefox,etc..)
- Protocols: HTTP,HTTPS, FTP, NFS, FMTP, DHCP, POP3, TELNET, IRC, These protocal used in various operations like **File Transfer, Web Surfing, Emails,**

Virtual Terminal

Presentation Layer:

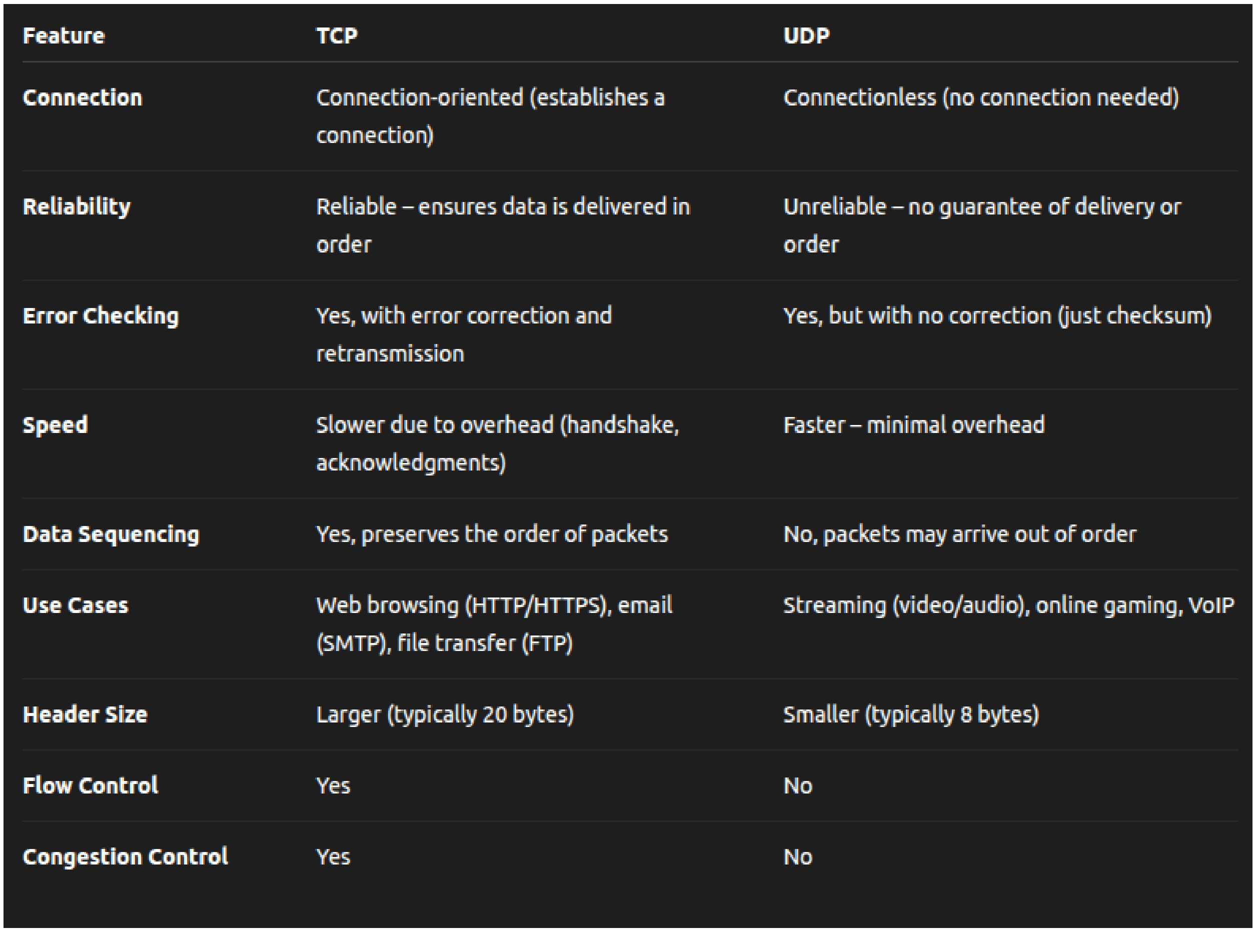
- Recive data from the Application Layer, This data contains **character and numbers** that convert in to machine understandable **binary formate** The Function of Prasentation layer Called **Translation.**
- The Presentation Layer can 3 basic function **"Translation and Data Compression and Encryption/Decryption"**
- Before the data Translation the presentation Layer has **reduce the Number of bits** the process called **Data Compression** and it can be Lossy or Lossless.
- That data compression has **reduce the File size** and it can recieved the destination in less time that is data transmission is **very fast**
- That is used in Real time video and audio streming
- Protocals: SSL(Secure Socket Layer) Protocal used to sender can encrypt the data and reciver can decrypt the data

Session Layer:

- The session Layer can **Setting and Manageing** the connections for "**Sending and Receiving data** ".
- Protocals:
  - **API** → Application Programming Interface
  - **NETBIOS** → Network Basic input output system
- Sesson can established with the Server , Server can perform the **Authendication** process
- **Authorization** : if can permision can access the File From the Server
- Sesson Layer can help in **Session Management and Authendication and Authorization**

Transport Layer:

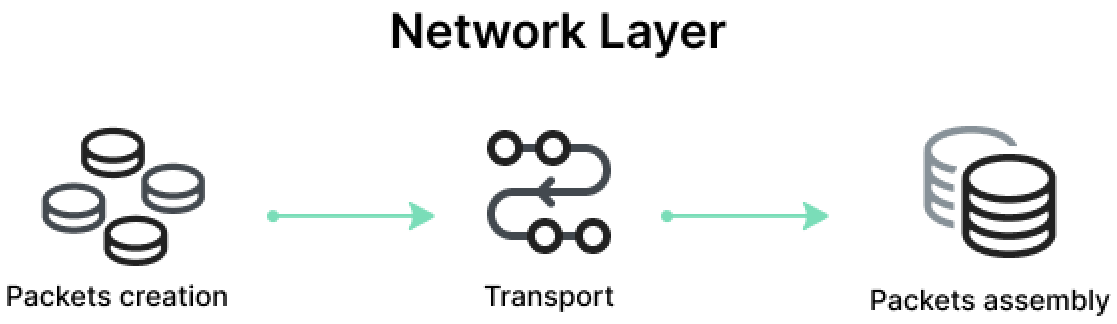
- To controle the realibility of Communication through the **Segmentation** and **Flow Control** and **Error Control**
- **Segmentation:**
  - data diveded into Small uints
  - Each uints has own **Source Port Number and Sequence Number**
  - Port number can helps the access the application directly
  - Sequence Number can helps to the reassemble the segments in Correct order to receive the data
- **Flow Control:**
  - Control the Amount of data being transmited
  - Eg: (**Mobile and Server communication) →**The Mobile can Connect the Server , Than the Server send the File to 50 Mbps, the Mobile can request through the **Transport Layer** the Flie has 50 Mbps speed then the file sending speed is decressed the 10Mbps.
- **Error Control:**
  - Some data does not arive the destination the Transport Layer
- **Protocal:**
  - **TCP→T**ransmision control Protocal
  - **UDP→** User DataGram Protocal
- **Services**
  - Connection Oriented → TCP
  - Connectionless Oriented→UDP



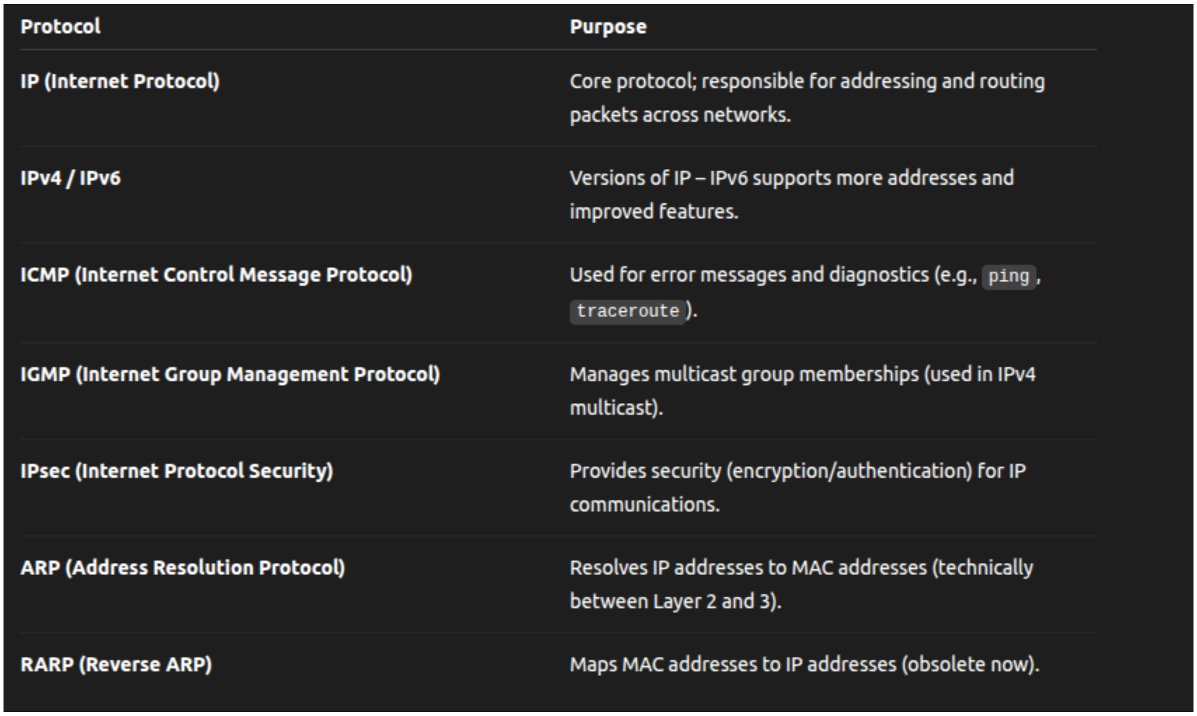
Feature	TCP	UDP
Connection	Connection-oriented (establishes a connection)	Connectionless (no connection needed)
Reliability	Reliable – ensures data is delivered in order	Unreliable – no guarantee of delivery or order
Error Checking	Yes, with error correction and retransmission	Yes, but with no correction (just checksum)
Speed	Slower due to overhead (handshake, acknowledgments)	Faster – minimal overhead
Data Sequencing	Yes, preserves the order of packets	No, packets may arrive out of order
Use Cases	Web browsing (HTTP/HTTPS), email (SMTP), file transfer (FTP)	Streaming (video/audio), online gaming, VoIP
Header Size	Larger (typically 20 bytes)	Smaller (typically 8 bytes)
Flow Control	Yes	No
Congestion Control	Yes	No

Network Layer:

- Transport Layer Pass the Data Segment Through the Network Layer
- Transmit the Recived data to Various Network



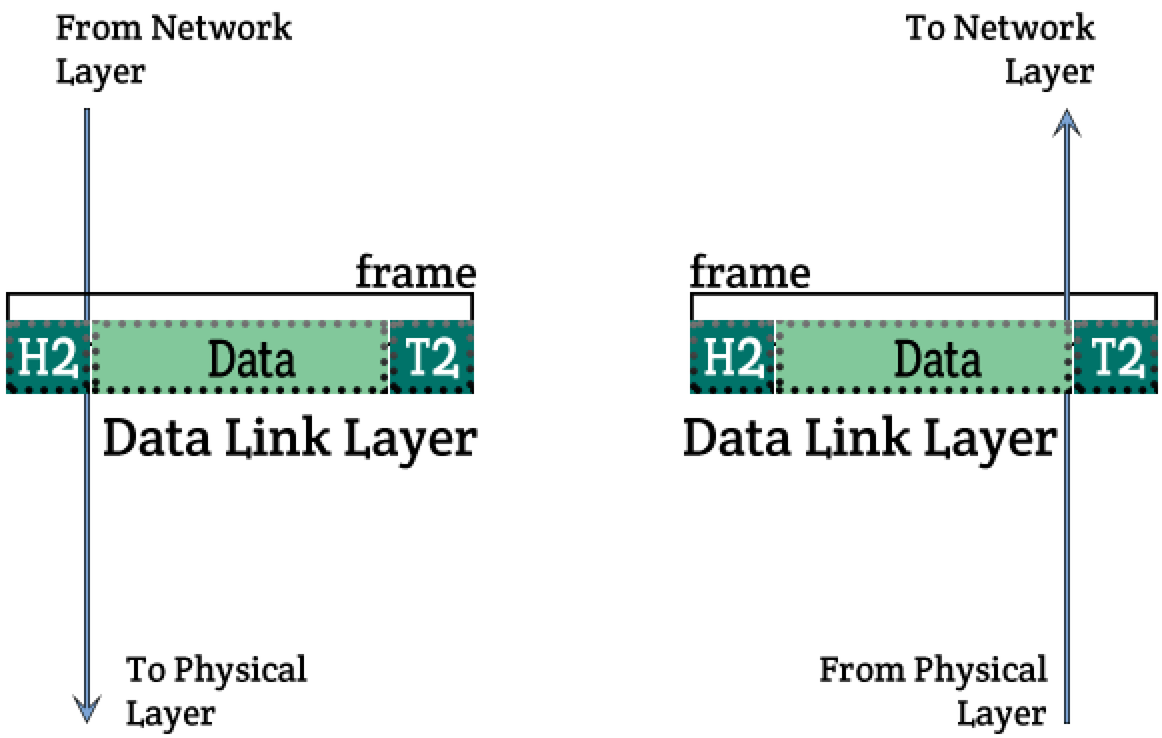
- Network Layer Function:
  - Logical Adderssing → IPv4 & IPv6
  - Routing → IPv4 & IPv6 + Mask
  - Path Determination → Best Path For Data Delivered



Protocol	Purpose
IP (Internet Protocol)	Core protocol; responsible for addressing and routing packets across networks.
IPv4 / IPv6	Versions of IP – IPv6 supports more addresses and improved features.
ICMP (Internet Control Message Protocol)	Used for error messages and diagnostics (e.g., `ping`, `traceroute`).
IGMP (Internet Group Management Protocol)	Manages multicast group memberships (used in IPv4 multicast).
IPsec (Internet Protocol Security)	Provides security (encryption/authentication) for IP communications.
ARP (Address Resolution Protocol)	Resolves IP addresses to MAC addresses (technically between Layer 2 and 3).
RARP (Reverse ARP)	Maps MAC addresses to IP addresses (obsolete now).

Data Link Layer:

- Recive data packets form the Network Layer
- Data packets contains IP Address for both sender and reciver



- It’s an Phycial Adderssing

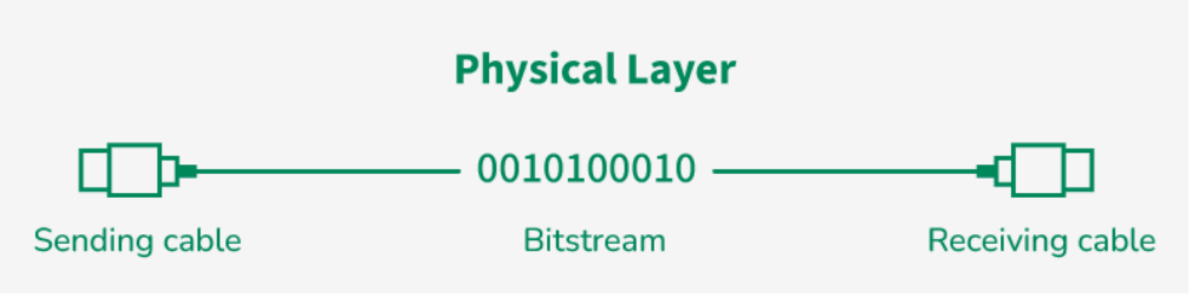
  MAC1 (Src) ──▶ Frame ──▶ MAC2 (Dest)

- **Function:**
  - **Accessing The Media**
  - Control how data is placed and received from the media (Media Access Control)

Pysical Layer

- The Physical Layer is responsible for the physical connection between devices. It defines the hardware elements involved in the network, including cables, switches, and other physical components.
- **Function:**
  - **Bit Synchronization:** The physical layer provides the synchronization of the bits by providing a clock. This clock controls both sender and receiver thus providing synchronization at the bit level.

- **Bit Rate Control:** The Physical layer also defines the transmission rate i.e. the number of bits sent per second.
- **Physical Topologies:** Physical layer specifies how the different, devices/nodes are arranged in a network i.e. **bus topology**, **star topology**, or **mesh topology**.
- **Transmission Mode:** Physical layer also defines how the data flows between the two connected devices. The various transmission modes possible are **Simplex, half-duplex and** full duplex.


Physical Layer
0010100010
Sending cable
Bitstream
Receiving cable