→ Layers in the OSI Model :

↳ Physical Layer :→ The physical layer coordinates the functions required to carry a bit stream over a physical medium. It deals with the mechanical and electrical specifications of the interface & transmission medium. It also defines the procedures & functions that physical devices and interfaces have to perform for transmission to occur.

The physical layer is also concerned with the following:

↳ Physical Characteristics of interfaces & medium :→ The physical layer defines the characteristics of the interface b/w the devices & the transmission medium.

↳ Representation of bits :→ The physical layer data consists of a stream of bits with no interpretation. To be transmitted bits must be encoded into signals - electrical or optical. The physical layer defines the type of encoding (how 0's & 1's are changed to signals).

↳ Data rate :→ The no. of bits sent each second is also defined by the physical layer.

↳ Synchronization of bits :→ The sender & receiver not only must use the same bit rate but also must be synchronized at the bit level.

↳ Line - configuration :→ The physical layer is concerned with the connection of devices to the media.

↳ Physical - Topology :→ The physical topology defines how devices are connected to make a network.

↳ Transmission Mode :- Physical layer also defines the direction of transmission b/w two devices : simplex, half duplex or full-duplex.

(2) "Data-Link-Layer" :-

The data link layer transforms the physical layer, a raw transmission facility, to a reliable link.
It makes physical layer appear error-free to the upper layer.

Note :- The DLL is responsible for moving frames from one hop (node) to the next.

Other responsibilities of DLL are as

↳ 'Framing' :- The DLL divides the stream of bits received from the network layer into manageable data units called frames.

↳ "Physical Addressing" :- This defines how frames reach the intended recipient. (we use MAC addresses here just like IMEI nos of us cell phones)

↳ 'Flow-control" :- DLL imposes a flow control mechanism to avoid overwhelming the receiver.

↳ "Error-control" :- The DLL adds reliability to the physical layer by adding mechanisms to detect & retransmit damaged or lost frames.

Note :- Error control is normally achieved through a trailer added to the end of the frame.

↳ 'Access-control" :- When two or more devices are connected to the same link, data link layer protocols are necessary to determine

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which device has control over the link at any given time.

③ Network Layer :- The NL is responsible for the source-to-destination delivery of a packet, possibly across multiple networks (links). Whereas the data link layer oversees the delivery of the packet b/w two systems on the same network (link).
The n/w layer ensures that each packet gets from its point of origin to its final destination.

Note :- The N/w layer is responsible for the delivery of individual packets from the source host to the destination host.

Other responsibilities of the N/w layer includes :-

↳ Logical Addressing :- The physical addressing implemented by the DLL handles the addressing problem locally. If a packet passes the N/w boundary, we need another addressing system to help distinguish the source & destination systems.
(Generally IP addresses are used for this)

↳ Routing :- When independent n/ws or links are connected to create internetworks or a large network, the connecting devices (called routers or switches) route or switch the packets to their final destination. One of the functions of the N/w layer is to provide the mechanism.

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(4) 'Transport Layer' :-

It is responsible for process-to-process delivery of the entire message. A process is an application program running on a host. Whereas the N/w layer oversees source-to-destination delivery of individual packets, it does not recognize any relationship b/w those packets. It treats each one independently, as though each piece belonged to a separate msg, whether or not it does.

The transport layer, on the other hand, ensures that the whole message arrives intact & in order, overseeing both error control & flow control at the source-to-destination level.

Other responsibilities of transport layer are :-

↳ Service point addressing :- The N/w layer gets each packet to the correct computer; the transport layer gets the entire message to the correct process on that computer.

↳ Segmentation & Reassembly :- A message is divided into transmittable segments, with each segment containing a sequence number. These nos enable the transport layer to reassemble the message correctly upon arriving at the destination.

↳ Connection Control :- The transport layer can be either connectionless or connection-oriented. A connectionless transport layer treats each segment as an independent packet & delivers it to the transport layer at the destination machine. A connection-oriented transport layer makes a connection with the transport layer at the destination machine first before delivering the packets.

↳ Flow control :- Like DLL, the transport layer is responsible for flow control. However flow control at this layer is performed end-to-end rather than across a single link.

↳ Error control :- Like DLL, the transport layer is responsible for error control. However error control at this layer is performed process-to-process rather than across a single link.

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(5) "Session Layer" :-

The session layer is the n/w dialog controller. It establishes, maintains, & synchronizes the interaction among communicating systems.

Note :- "Session layer" is responsible for dialog control & synchronization.

Specific responsibilities of session layer include :-

↳ Dialog control :- The session layer allows two systems to enter into a dialog. It allows the communication b/w two processes to take place in either half-duplex or full-duplex mode.

↳ Synchronization :- The session layer allows a process to add checkpoints, or synchronization points, to a stream of data

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(6) "Presentation Layer" :⇒

This layer is concerned with the syntax & semantics of the information exchanged b/w two systems

Other responsibilities of PPT layer are :-

↳ "Translation" :- The ppt layer at the sender changes the information from its sender-dependent format into a common format. The ppt layer at the receiving machine changes the common format into its receiver-dependent format.

↳ "Encryption" :⇒ To carry sensitive information, a system must be able to ensure privacy. Encryption means that the sender transforms the original information to another form & sends the resulting message out over the network. Decryption reverses the original process to transform the message back to its original form.

↳ "Compression" :⇒ Data compression becomes particularly important in the transmission of multimedia such as text, audio & video.

(7) "Application Layer" :⇒

This layer enables the user, whether human or software to access the network. It provides user interfaces & support for services such as electronic mail, remote file access & transfer, shared database management & other types of distributed information services.

other services include:

↳ [file transfer, access & management
↳ mail services
↳ directory services]

→ Summary of Layers:

1) Application :→ To allow access to network resources.
2) Presentation :- To translate, encrypt & compress data.
3) Session :- To establish, manage & terminate sessions
4) Transport :- To provide reliable process-to-process message delivery & error recovery
5) Network :- To move packets from source to destination; to provide internetworking.
6) Data link :- To organize bits into frames; to provide hop-to-hop delivery.
7) Physical :- To transmit bits over a medium, to provide mechanical & electrical specifications.

→ TCP/IP Protocol Suite :

It is a hierarchical protocol made up of interactive modules, each of which provides a specific functionality; however the modules are not necessarily interdependent.
Whereas the OSI model specifies which functions belong to each of its layers, the layers of the TCP/IP protocol suite contain relatively independent protocols that can be mixed & matched depending on the needs of the system.
Note :→ The term hierarchical means that each upper-level protocol is supported by one or more lower level protocols

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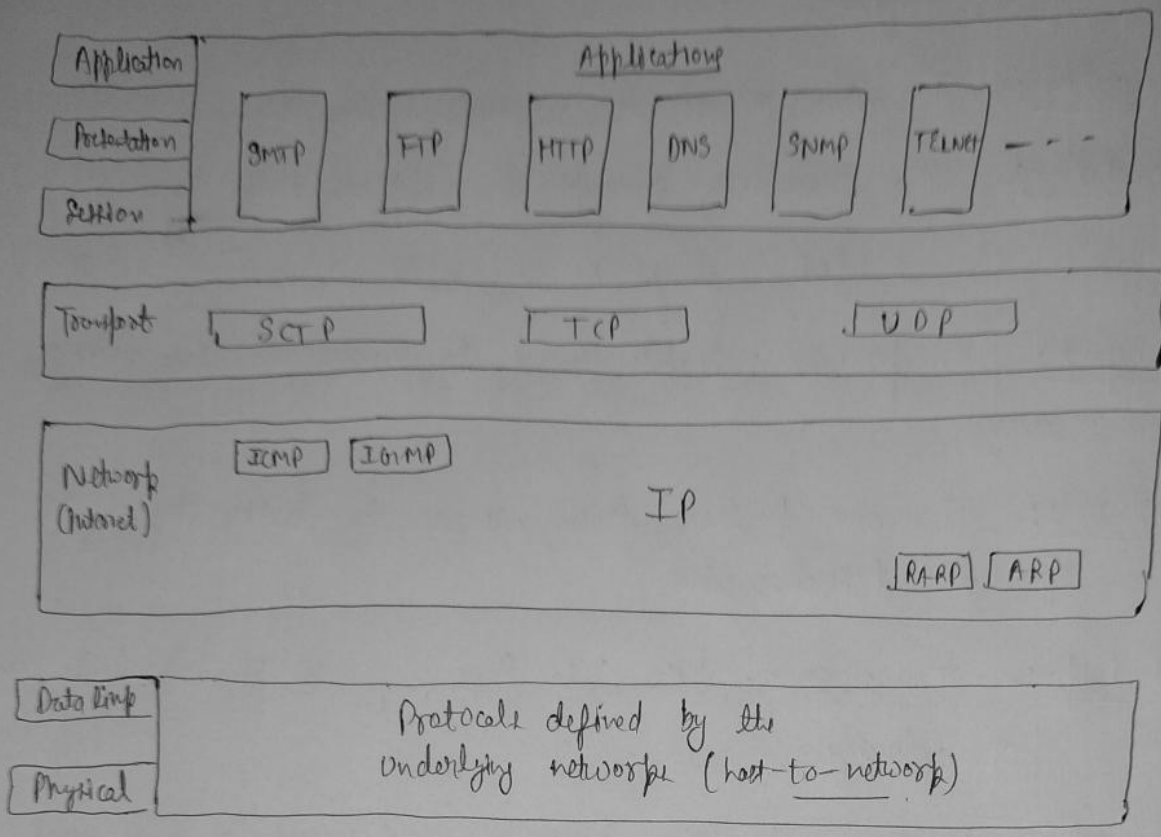

Physical & Data link layers :- At the physical & data-link layers, TCP/IP does not define any specific protocol. It supports all the standard & proprietary protocols.

Network layer :- At the N/w layer, TCP/IP supports the inter-networking protocol. IP, in turn uses four supporting protocols: ARP, RARP, ICMP & IGMP.

↳ Internetworking Protocol (IP) :- It is the transmission mechanism used by TCP/IP protocols. It is an unreliable & connectionless protocol. IP transports data in packets called "datagrams" each of which is transported separately. Datagrams can travel along diff. routes & can arrive out of sequence or be duplicated.

→ ARP (Address Resolution Protocol):→

It is used to associate a logical address with a physical address. ARP is used to find the physical address of the node when its Internet address is known.

→ RARP (Reverse ARP): It allows a host to discover its Internet address when it knows only its physical address. It is used when a computer is connected to a network for the first time or when a diskless computer is booted

→ ICMP (Internet Control Message Protocol): It is a mechanism used by hosts & gateways to send notification of datagram problems back to sender.

→ IGMP (Internet group message protocol): It is used to facilitate the simultaneous transmission of a message to a group of recipients.

↳→ Transport Layer: Transport layer in TCP/IP is represented by two protocols UDP & TCP.

→ UDP (User Datagram Protocol): It is a process to process protocol that adds only port addresses, checksum, error control & length information to the data from the upper layers.

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→ TCP (Transmission Control Protocol) :- It provides full transport layer services to applications. TCP is a reliable stream transport protocol that adds only port addresses. The term stream in this context means connection oriented: A connection must be established b/w both ends of a transmission before either can transmit data.

→ Stream Control transmission protocol (SCTP) :- Provides support for newer applications such as voice over the Internet.

→ Application layer :- The application layer in TCP/IP is equivalent to the combined session, presentation & application layers in the OSI model. Many protocols are defined at this layer.
