Definition of Computer Network: A Computer Network is a system of interconnected computers and other digital devices that communicate and share resources (such as files, applications, and internet access) with each other through wired or wireless communication channels. These devices use standard communication protocols to exchange data, ensuring that information is transferred reliably and efficiently.

Goals of Computer Networks:

1. **Resource Sharing:** To allow multiple users to share resources such as printers, files, applications, and storage.
2. **Communication:** To facilitate communication between users through email, messaging, video conferencing, etc.
3. **Remote Access:** To enable users to access information and resources from remote locations (e.g., remote login, cloud services).
4. **Data Sharing:** To provide easy and fast access to shared data among multiple users or systems.
5. **Scalability:** To allow the network to grow and accommodate more devices without major changes.
6. **Reliability and Availability:** To ensure continuous access to resources with minimal downtime or disruption.
7. **Security:** To protect data and resources from unauthorized access, loss, or damage.
8. **Cost Efficiency:** To reduce operational costs by sharing expensive hardware and software resources across users.
9. **Centralized Data Management:** To enable centralized control and administration of data and services.
10. **Load Balancing:** To distribute workload across multiple systems to optimize performance and resource utilization.

Types of Computer Networks

Parameters	*PAN*	*LAN*	*CAN*	*MAN*	*WAN*
Full Name	Personal Area Network	Local Area Network	Campus Area Network	Metropolitan Area Network	Wide Area Network
Technology	Bluetooth, IrDA,Zigbee	Ethernet & Wifi	Ethernet	FDDI, CDDI, ATM	Leased Line, Dial-Up
Range	1-100 m	Upto 2km	1 – 5 km	5-50 km	Above 50 km
Transmission Speed	Very High	Very High	High	Average	Low
Ownership	Private	Private	Private	Private or Public	Private or Public
Maintenance	Very Easy	Easy	Moderate	Difficult	Very Difficult
Cost	Very Low	Low	Moderate	High	Very High

Network Models

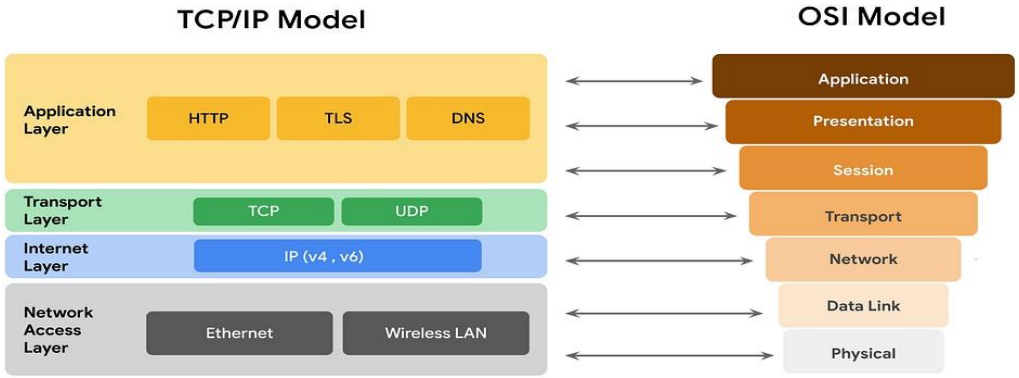
1) OSI Model:

- The **OSI Model (Open Systems Interconnection Model)** is a **conceptual framework** used to understand and standardize how different networking systems communicate with each other.
- Developed by **ISO (International Organization for Standardization)**, it divides the process of network communication into **seven distinct layers**, each with specific functions.

OSI (Open Source Interconnection) 7 Layer Model

Layer	Application/Example		Central Device/ Protocols			DOD4 Model
Application (7) Serves as the window for users and application processes to access the network services.	**End User layer** Program that opens what was sent or creates what is to be sent. Resource sharing • Remote file access • Remote printer access • Directory services • Network management		**User Applications** SMTP		GATEWAY Can be used on all layers	Process
Presentation (6) Formats the data to be presented to the Application layer. It can be viewed as the "Translator" for the network.	**Syntax layer** encrypt & decrypt (if needed). Character code translation • Data conversion • Data compression • Data encryption • **Character Set Translation**		JPEG/ASCII EBDIC/TIFF/GIF PICT			
Session (5) Allows session establishment between processes running on different stations.	**Synch & send to ports** (logical ports). Session establishment, maintenance and termination • Session support - perform security, name recognition, logging, etc.		**Logical Ports** RPC/SQL/NFS NetBIOS names			
Transport (4) Ensures that messages are delivered error-free, in sequence, and with no losses or duplications.	**TCP** Host to Host, Flow Control. Message segmentation • Message acknowledgement • Message traffic control • Session multiplexing	PACKET FILTERING	TCP/SPX/UDP			Host to Host
Network (3) Controls the operations of the subnet, deciding which physical path the data takes.	**Packets** ("letter", contains IP address). Routing • Subnet traffic control • Frame fragmentation • Logical-physical address mapping • Subnet usage accounting		**Routers** IP/IPX/ICMP			Internet
Data Link (2) Provides error-free transfer of data frames from one node to another over the Physical layer.	**Frames** ("envelopes", contains MAC address) [NIC card — Switch — NIC card] (end to end). Establishes & terminates the logical link between nodes • Frame traffic control • Frame sequencing • Frame acknowledgment • Frame delimiting • Frame error checking • Media access control		**Switch Bridge WAP** PPP/SLIP	Land Based Layers		Network
Physical (1) Concerned with the transmission and reception of the unstructured raw bit stream over the physical medium.	**Physical structure** Cables, hubs, etc. Data Encoding • Physical medium attachment • Transmission technique - Baseband or Broadband • Physical medium transmission Bits & Volts		**Hub**			

2) TCP/IP Model: The **TCP/IP Model** (Transmission Control Protocol/Internet Protocol Model) is a **real-world, practical framework** used for designing and implementing network communications. It is the foundation of the Internet and defines how data should be packaged, addressed, transmitted, routed, and received.



Differences between OSI and TCP/IP Model:

OSI Model	TCP/IP Model
It stands for **Open System Interconnection.**	It stands for **Transmission Control Protocol.**
OSI model has been developed by International Organisation for Standardization (ISO).	The TCP/IP model was developed by the United States Department of Defense (DoD). Specifically, it was created by Defense Advanced Research Projects Agency (DARPA) to support ARPANET.
It is protocol-independent.	It is protocol-dependent.
It is an independent standard and generic protocol used as a communication gateway between the network and the end user.	It consists of standard protocols that lead to the development of an internet. It is a communication protocol that provides the connection among the hosts.
In the OSI model, the transport layer provides a guarantee for the delivery of the packets.	The transport layer does not provide the surety for the delivery of packets. But still, we can say that it is a reliable model.
This model is based on a vertical approach.	This model is based on a horizontal approach.
In this model, the session and presentation layers are separated, i.e., both the layers are different.	In this model, the session and presentation layer are not different layers. Both layers are included in the application layer.
It is also known as a reference model through which various networks are built. For example, the TCP/IP model is built from the OSI model. It is also referred to as a guidance tool.	It is an implemented model of an OSI model.
In this model, the network layer provides both connection-oriented and connectionless service.	The network layer provides only connectionless service.
Protocols in the OSI model are hidden and can be easily replaced when the technology changes.	In this model, the protocol cannot be easily replaced.
It consists of **7 layers**.	It consists of **4 layers.**

OSI model defines the services, protocols, and interfaces as well as provides a proper distinction between them. It is protocol independent.	In the TCP/IP model, services, protocols, and interfaces are not properly separated. It is protocol dependent.
The usage of this model is very low.	This model is highly used.
It provides standardization to the devices like router, motherboard, switches, and other hardware devices.	It does not provide the standardization to the devices. It provides a connection between various computers.
The TCP/IP is the implementation of the OSI Model.	An OSI Model is a reference model, based on which a network is created.

Overview of some important protocols

Protocol	Full Form	Function / Use	Type	Layer
IP	Internet Protocol	Assigns addresses and routes data between devices	Connectionless	Network (Layer 3)
TCP	Transmission Control Protocol	Ensures reliable, ordered delivery of data	Connection-oriented	Transport (Layer 4)
UDP	User Datagram Protocol	Fast, unreliable data transfer (no guarantee of delivery/order)	Connectionless	Transport (Layer 4)
HTTP	HyperText Transfer Protocol	Transfers web pages from server to browser	Application Protocol	Application (Layer 7)
FTP	File Transfer Protocol	Uploading/downloading files between client and server	Application Protocol	Application (Layer 7)