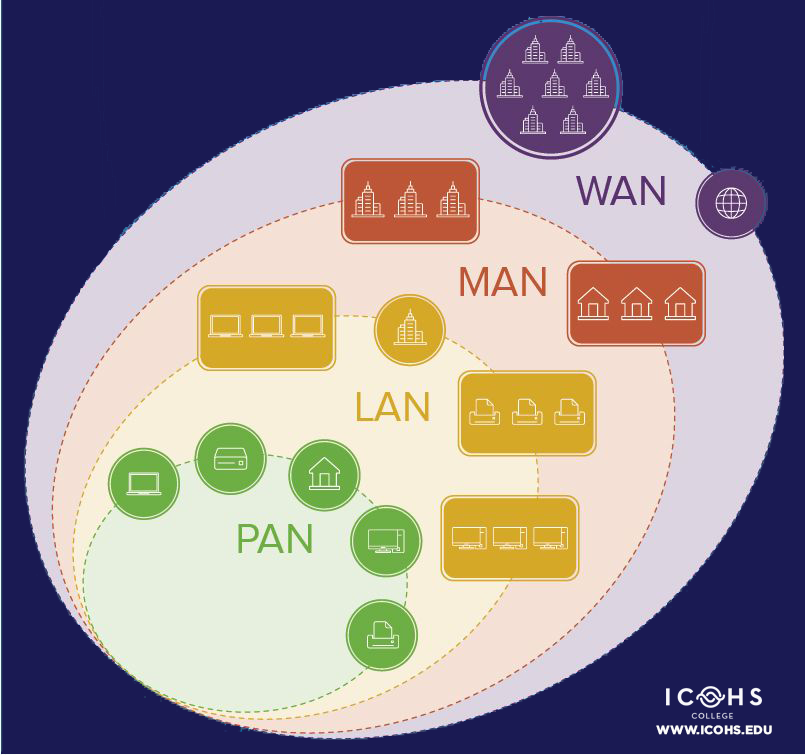
Data Networking

Data is basically any information which is in binary form. A system that transfers data between different nodes through data switching, system control and interconnection transmission lines is what we called as data network. The excahnage of data between 2 devices via a transmission medium and following some kind of a protocol is known as data communication. Data networking and communication is used to transfer data to one or more points called as multipoint. It is of two types namely: Broadcast and Point-to-Point.

Broadcast: when data is transmitted from one point to multipoint then that is known as broadcasting of data. Data broadcasting is again of two types i.e. Independent data broadcasting and linked data broadcasting. Independent data broadcasting is the one which transmits supplementary information directly onto the main television such as news, weather forecast etc. Linked data broadcasting is the one which provides information about the characters of the television drama. For example, in a sports program one can check about the athletes, their information and their progress.

ISDB- T (Integrated Services Digital Broadcasting- Terrestrial) is able to send much more and detailed data through a communication line in order to complement broadcasting of data which has only limited Bandwidth.

The figure shown below shows the basic types of data networks:



1. PAN (Personal Area Network) :- It is the smallest network which is personal to the users. It is basically involved with the personal usage of the person that’s why named as personal area network. Its range is around 10 meters. It includes Bluetooth, Zigbee , Smartphones, TV Remotes etc. It ranges generally from 10m to 100m with a speed of upto 250 Kbps in zigbee and 24Mbps in Bluetooth.

Some Standards are shown below;

Bluetooth:- Bluetooth was standardized by the IEEE with a standards

802.15.01

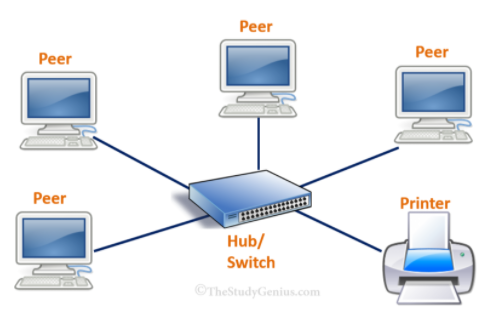
802.15.01B

802.15.1.1 Ratified as [IEEE Standard 802.15.1–2002](https://en.wikipedia.org/wiki/IEEE_802.15#Task_group_1_(WPAN/Bluetooth))

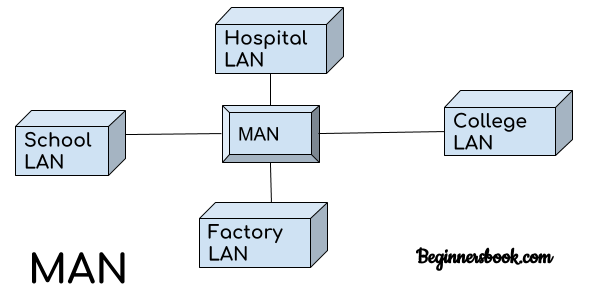
802.15.1.2 Ratified as [IEEE Standard 802.15.1–2005](https://en.wikipedia.org/wiki/IEEE_802.15#Task_group_1_(WPAN/Bluetooth))

And so on

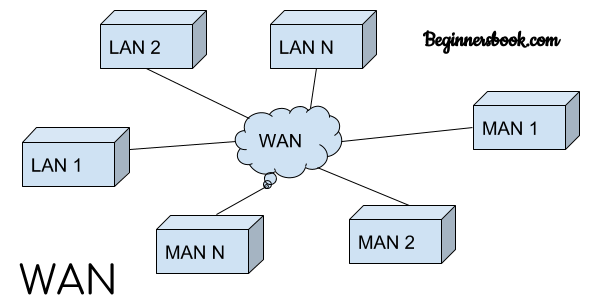
1. LAN (Local Area Network):- It is a network which is local to an area like school, college, office, building etc. It is a privately owned network which can be directly accessed by using an ethernet or a central device like switch or a hub. With Ethernet cables, the speed of data transfer can reach upto 54Mbps and with Gigabit Ethernet, it can reach upto 1Gbps. It ranges from basically 100m to 5km

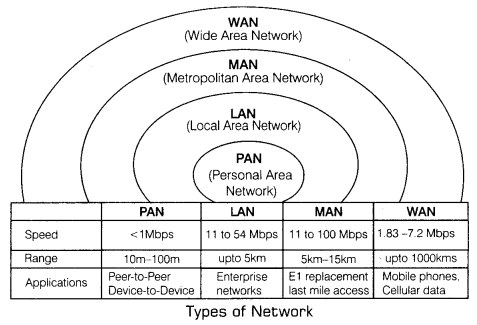


1. MAN (Metropolitan Area Network) :- When two or more LAN are interconnected then a MAN network is formed. It is bigger than LAN but smaller than WAN. For example, an organization has many branches at numerous locations which uses LAN network. So the organization can connect a telephone line over the LAN network to create a MAN network. Its speed is around 100Mbps with a range of upto 15Km.



1. WAN (Wide Area Network) :- It includes a large geographical area like a country or a continent and uses a carrier such as a telephone line or a satellite system etc. It is basically when multiple MANs and LANs are interconnected to form a network then a WAN network is formed. It Speed speed varies from 1.83 to 7.2 Mbps with a range of upto 1000km





The effectiveness of data communication system depends on 5 fundamental characteristics which includes:

Accuracy:- The accuracy of data transfer should be high i.e whatever data is transmitted must be received at the receiver site. The data that has been changed while transmission and useless.

Delivery:- The data must be delivered to the correct destination. The data transmitted, if received by some other receiver other that the intended one is useless.

Jitter:- Any abrupt change in the delay is what is known as jitter. It is basically defined as the variation in the arrival time of the packet.

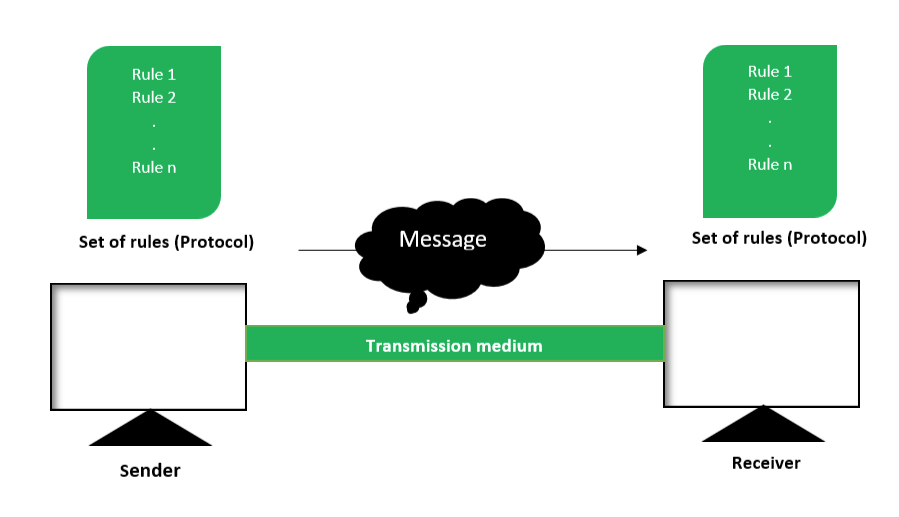
Timeliness:- It indicates that the system must deliver the data timely. Any data delivered after the allotted time is useless. Such kind of D=delivery is known as rea-time transmission.

Latency:- It is the delay between the transmission time and the reception time. It is less than 10ms in 4G.

Data Communication system has five components namely:

1. Message: Any piece of data which needs to be communicated is a message. It is the most useful asset of a communication system.
2. Sender: Any device which is responsible for sending the data from transmitter is known as sender.
3. Receiver: It is the destination which receives the data send by the transmitter.
4. Tranmission medium: The bridge between transmitter and receiver is known as medium. It could be through twisted pair cable, microwaves, fibre optic cable, radio waves, etc. . It can be simplex, half duplex or full duplex
5. Protocols: These are the set of rules which governs the transmission of data from transmitter to receiver.

Lets take an example of data communication system in sending an email. Here the user who sends an email acts as a sender, the receiver of email is the reciver and message is the data. Email is an example of application layer where SMTP protocol is used. However there are many protocols involved in the whole process. Below is the explainationof whole OSI action in sending an email.



OSI Model: **. Data (Packet) transmission over the internet :-**

Data is transmitted over the internet not in its actual form but rather they are subdivided into smaller packets and the transmission between computers (or server) across the internet is featured by TCP/IP protocol [7]. It is a five layered model consisting of physical, data link, internet (network), transport and application layer.

**Physical layer :-**

* It coordinates function required to carry a bit stream over physical layer.
* It provides physical and electrical specification for device and medium.
* It is responsible for representation of bits and synchronization of sender and receivers clock.

**Data link layer:-**

* It makes the unliable physical layer to a reliable link.
* It converts bit streams into manageable units called frames.
* It provides physical addressing to the frames and responsible for node-to-node delivery.
* It is also responsible for error control and detection of damaged, duplicate or lost frames.

**Network layer:-**

* It is responsible for host to host delivery i.e source to destination delivery of the packets across multiple networks.
* It is responsible for providing logical address and also performs the function of routing.

**Transport Layer:-**

* It is responsible for process to process delivery of the packets.
* It is also responsible for segmentation, sequencing and service-point addressing known as port address wich is used to achieve multiplexing.

**Application Layer:-**

* It is a combination of session, presentation and application layer and it enables user to access the network.
* For example :- E-mail services, file transfer etc.