

# Information and Communication Technology (ICT)

Information and communication technology refers to the technologies used in the collection, execution, storage and transmission of information. (ICT-Information and Communication Technology). ICT mainly includes internet, wireless communication, mobile phone etc.



- In the 1800s, **Samuel Morse** invented the telegraph, which operated by Morse code in which each alphabet was written, a special code was given (.,-).
- The field of communication came in 1876, when the telephone was invented by Graham Bell.
- In 1973, "**Mobile Phone**" was invented by **Martin Cooper**.
- Charles Babbage** is considered the inventor of the computer.

## Components of Communication

**1. Transmitter** - The end of communication through which information is transmitted is called transmitter. It is an electronic device which converts one form of energy into another.

**2. Communication media** :- These are of two types -

- Wired Communication medium** - To establish communication in which Physical wires are used to connect transmitters and receivers.

**Examples**- Optical fiber, Coaxial cable etc.

- Wireless Communication medium** - Transmitter is required to establish communication in it, there is no use of physical wires between the transmitter and the receiver, the communication is done by electromagnetic waves.

**Examples** - Bluetooth, Wifi, Wifi-Lifi etc.

**3. Receiver** - In the end of the communication that receives the signals sent by the transmitter is called receiver. Transducer is also used in the receiver.

**Signal** :- Signals are mainly of two types -

- Analog signal** - Signals that regularly change from time to time, and always remain constant. These are called analog signals.

**Example**- Telephone conversation.

- Digital signal** - Such signals exist in a (digital) discrete form. It always uses the binary number (0,1).

**Note** -1. ASCII code is used for each key in the keyboard, which is 7 bits.

2. ASCII American Standard Code for information interchange.

**Methods of communication :-**

**1. Simplex communication-** In this type of communication, there is transmission of information in only one direction i.e, this is onedirectional communication.

**Examples** - RadioBroadcast, DTH ( Direct to Home) service etc.

**2. Half duplex communication-** In this type of communication, communication takes place in two directions butonly one direction at a time.The transmission of information takes place in it.

**Example** - Transmission of information over walkie talkie.

**3. Full Duplex Communication** - In this type of communication, information is transmitted in two directions simultaneously through the same channel transmission is possible.

**Examples** - Mobile Phone, Telephone Conversation etc.

**Wired Communication Technique**

**Coaxial Cable :-** It has a central solid conductor through which the signal is transmitted. There is a layer of insulator around it and around it there is a mesh-like structure called a shield, which remains connected to the earth. It is generally used in TV cable.

**Optical fibre cable** - Optical fiber is based on the principle of total internal reflection of light in which optical communication is established through energy.

- Optical fiber / silica is a thin fiber in which the inner part is called the core and the outer part is called the cladding.
- The refractive index of the core is always higher than that of the cladding because it is necessary for complete internal reflection of light.
- Before a piece of information is transmitted through an optical fiber, it is converted into energy emitted by a laser or LED, It is then converted into optical fiber and at the end of the receiver, a photodiode is used which converts optical energy into electrical energy.

**Advantages**

The optical fibre has a greater bandwidth than other media and is free from the interference of radio waves , Hence it is used to provide broadband internet facility.

- FTTH (Fibre to the home):-** Internet service reaching home or office through optical fiber is called FTTH.
- Dark Fibre:-** Such a fiber cable which has been installed but it is not currently being used is called dark fiber.
- Optical fiber system was used (first) in India in **1979 in Pune** where communication between two telephone exchanges was established
- Madhya Pradesh became the first state in which optical fiber cable was manufactured by OTL (Optical Telecommunication Limited) of Bhopal.
- In 2011, the Government of India launched the NOFN (National optical fibre network) project to connect 2.5 lakh gram panchayats, with the aim of providing broadband facilities in remote villages.
- These optical cables are being laid by BSNL& BBNL (Bharat Broad Band Network Limited).

## Wireless Communication Technique

### Bluetooth

- Bluetooth was developed by the **Ericsson company in 1994**.
- It is used to establish short distance communication.
- It operates on **2.4 GHz or 2.48 GHz frequency**.
- It is also given the meaning of WPAN (Wireless Personal Area Network).

### Wi-Fi (Wireless Fidelity)

- Weeks Hayes** is considered the **father of Wi-Fi**.
- In this the speed of transmission of information is higher than that of Bluetooth, long distance transmission (50 m) is possible to do.
- Wi-Fi works on the frequency of 2.4 GHz and 5 GHz.
- Technically, the standard of Wi-Fi is IEEE 802.11 at the international level.

### Wi-Max-Worldwide Interoperability for Microwave Access)

- Through this technology, wireless communication is established between different cities or in a big city. By this technology, a distance of at least 100 kilometers can be provided, the company uses this technology to provide internet facility in the mobile.
- This network is also known as WWAN(Wireless Wide Area Network) or WMAN (Wireless Metropolitan Areatnetwork)

### White-Fi

- The unused spectrum used in TV communication is called white space. Providing internet facilities using this unusable spectrum (white space) is called white-fi.
- This technology is being used at the International Institute of Information Technology, Bangalore as used as a pilot project.
- In 2017, Microsoft started a pilot project of this technology in Village Harisal, Maharashtra.

### Li-Fi (Light fidelity)

- The technology in which the transmission of information will be done through a light source such as a bulb. This technique uses visible light instead of radio waves.
- Development - In 2011, Professor Harald Hussein of the University of Edinburgh, UK.
- This is the optical version of Wi-Fi which uses OFDMA (Optical Frequency Division Multiple Access) technology.

## Various Techniques Related To Communication Technology

**Modulation & Demodulation :-** Generally the message signal is of low frequency. Which is not possible to transmit over long distances, so they are superimposed on high frequency carrier waves. This process is known as modulation.

- Modulation always happens at the transmitter end.
- In a modem, the digital signal generated by the computer is converted into an analog signal in the process of modulation.
- The separation of information from the modulated signal at the receiving end is called

demodulation. It always happened on the receiver end.

- In demodulation, analog signals are converted into digital signals.
- Modem speed is measured in bps (bits per second).

### Multiplexing and Demultiplexing :-

- Only one signal can be sent at a time by any communication medium but in communication many signals have to be sent simultaneously. In the end different – different Analog or Digital Signals Combined to form a carrier signal and transmit it in communication channels is called Multiplexing.
- The separation of multiplex signals (interconnected signals) at the receiver end is called demultiplexing.
- Multiplexer, is many input or One output device while demultiplexer one input is valid is an output device.

**Synchronous Communication** :- Communication in which it is necessary to establish coordination between the transmitter and the receiver before sending the information.

Ex - Telephone conversation

**Asynchronous Communication** :- In this type of communication, it is not necessary to establish coordination between the transmitter and the receiver.

Ex - Information exchange over the internet.

**Switching Technique** :- Switching in a computer is a process in which information is sent between different computer networks.

**1. Circuit Switching** :- A physical connection is established between two or more devices or once a physical connection is established, data or information is transmitted

Ex - Telephone conversation (Landline Telephone)

**2. Packet Switching** :- In this, information is broken into small packets and they are transmitted.

**3. Message Switching** :- It is based on store and forward concept. In this technique the information is stored in the nodes of the network, When the medium is empty, it is sent to the recipient.

### Internetworking Devices

- Hub** :- Hubs are used to connect different nodes together. Incoming data on one port of the hub is available to all ports. Hub only provides route for data transmission and does not monitor it. This is a passive device.
- Bridge** :- Connects the LAN of two same protocols.
- Network Gateway** :- It connects two dissimilar protocol LAN.
- Router** :- The router serves to deliver the packets of data to the destination by the fastest route. That's why it works as traffic management for the data.
- Repeater** :- When the signals travel a long distance, their energy decreases, so this problem is solved by a repeater that is used in long distance communication for settlement. Repeater amplifies the energy or power of the signal.

## Mobile Communication

- ❑ Telephone service in India was started in 1851 by the East India Company between Dimond Harbor in Calcutta.
- ❑ Telephone was first used in India in 1881 between two exchanges in Calcutta.
- ❑ The first automatic telephone exchange in India was started in Shimla.
- ❑ TRAI('TRAI'Telecom Regulatory Authority of India) was formulated in 1997 to formulate their rules for resolving telecommunication related disputes and distribution of spectrum in India.
- ❑ The International Telegraph Union was established in 1865 to make rules related to telecommunications at the international level. At present it is called InternationalTelecommunication Union.
- ❑ Mobile was invented by Martin Cooper in 1973.
- ❑ The first mobile was made by a Motorola company called Motorola Dyna Tech.
- ❑ Mobile works on UHF. (800 - 900 Mhz)

## Different Generations Of Mobile

- ❑ **1G** - Only sound signals are communicated. Analog signal is used.
- ❑ **2G** - Voice signal + data (SMS, MMS) started to be sent. Digital signal was used in place of analog. In this, GSM, CDMA technique is used.
- ❑ **2.5 G**-The Internet was started through GPRS, whose speed was very low.
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- ❑ **2.75 G** - EDGE technology was used which is called EGPRS.
- ❑ **3 G** -WCDMA technology was used, due to which the speed of the Internet increased, which made video streaming and video calls possible.
- ❑ **3.5G** - In this HSPA technique was used.
- ❑ **3.75G** - In this HSPA+ technique was used.
- ❑ **4G** - LTE technique was used. In this technique, the speed of the Internet was primitive, but there was a problem in voice calling, which was improved by VOLTE technique. In which the voice signal is also broken into small packets of information and sent to the destination address only with the help of the internet.
- ❑ Volte - HD voice calls and HD video calls are made possible by this technology.
- ❑ **5G** - The first country in the world to use 5G technology is South Korea. (2018)
- ❑ First Trail of 5G in India done by Airtel in Hyderabad.
- ❑ The normal speed in 5G will be 1 Gbps.
- ❑ According to TRAI, 5G service will start in India by 2022.
- ❑ The Paulraj Committee was constituted for 5G which presented the 'Making India 5G Report'.

<b>GPRS</b>	–	General packet Radio Service(2.5G)
<b>EDGE</b>	–	Enhanced data Rates For GSM evolution (2.75G)
<b>WCDMA</b>	–	Wide band code division multiple Access (3G)
<b>HSPA</b>	–	Higher Speed Packet Access (3.5G)
<b>LTE</b>	–	Long Term Evolution (4G)
<b>VOLTE</b>	–	Voice over long term evolution
<b>UHF</b>	–	Ultra High Frequency
<b>GSM</b>	–	Global System For Mobile.
<b>CDMA</b>	–	Code division multiple access.
<b>TDMA</b>	-	Time division multiple access
<b>FDMA</b>	-	Frequency division multiple access

**Health problems caused by mobile phones :-** Electromagnetic waves emitting from mobile phones can be cancerous, so in May 2017, the Department of Telecommunications launched the Tarang Sanchar portal, through which consumers can track the radiation level from mobile towers in their area.

### National Broadband Policy

- ❑ The first National Telecommunication Policy was launched by the Government of India in 2004.
- ❑ Presently in September 2018, the new telecom policy named as National Digital Communications Policy 2018 was announced by Telecom, Started by the department whose goals are as follows-
  - ❖ To create 400000 new jobs by 2022.
  - ❖ To provide 1 Gbps connectivity to all Gram Panchayats by 2020 and 10 Gbps connectivity by 2022.
  - ❖ Expanding public WiFi hotspots to 5 million people by 2020 and 10 million by 2022.
  - ❖ To provide 100 Mbps broadband to all educational institutions.

**Net Neutrality :-** The term was first used by Professor Tim of Columbia University. It is also known as net parity. It is a principle according to which website content and apps available on the Internet should be equally accessible to all. There is no law regarding this in India, but Chile is the first country to make a law on net neutrality.

**Mobile Number Portability (MNP) :-** MNP i.e. Mobile Number Portability is the facility by which a person can switch to another company without changing his mobile number. Mobile number portability facility was started in India from 3<sup>rd</sup> July 2015.

**Direct To Home Service (DTH) :-** It is a satellite based broadcasting service in which TV channels are broadcast through satellite. For this, there should be a set-up box and a dish antenna. DTH service for the first time in the country was launched in October 2003 by Dish TV. In India the first free DTH service in India was launched in December 2004 by Prasar Bharati named DD Free Dish India's Insat 4A Satellites provide DTH service. Currently Tata Sky, Dish TV, VideoconD2h, Airtel, Reliance Big TV etc. Digital Provides direct to home service.

## Institutes related to Information and Communication Technology in India

### 1. CDAC- Center for Development of Advanced Computing

- Established – November 1988
- Headquarters – Pune, Maharashtra
- Objective - High performance computing
- Nodal Ministry - Ministry of Electronics and Information Technology

### 2. TRAI – Telecom Regulatory Authority of India

- Established – 20 February, 1997
- Headquarters – New Delhi
- Objective - Regulating Telecom Activities in India
- Nodal Ministry - Ministry of Communications
- Statutory body–Telecom Regulatory Authority of India Act, 1997

### 3. VSNL - Videsh Sanchar Nigam Limited

- Established – 1986
- Headquarters – Pune, Maharashtra
- It was acquired by the TATA group and renamed as TATA Communications in 2008.

### 4. BSNL – Bharat Sanchar Nigam Limited

- Establishment – October 2000
- Headquarters – New Delhi
- Nodal Ministry -Ministry of Communications
- BSNL Broadband launched its services as Deta WAN from 2005.

### 5. Prasar Bharti

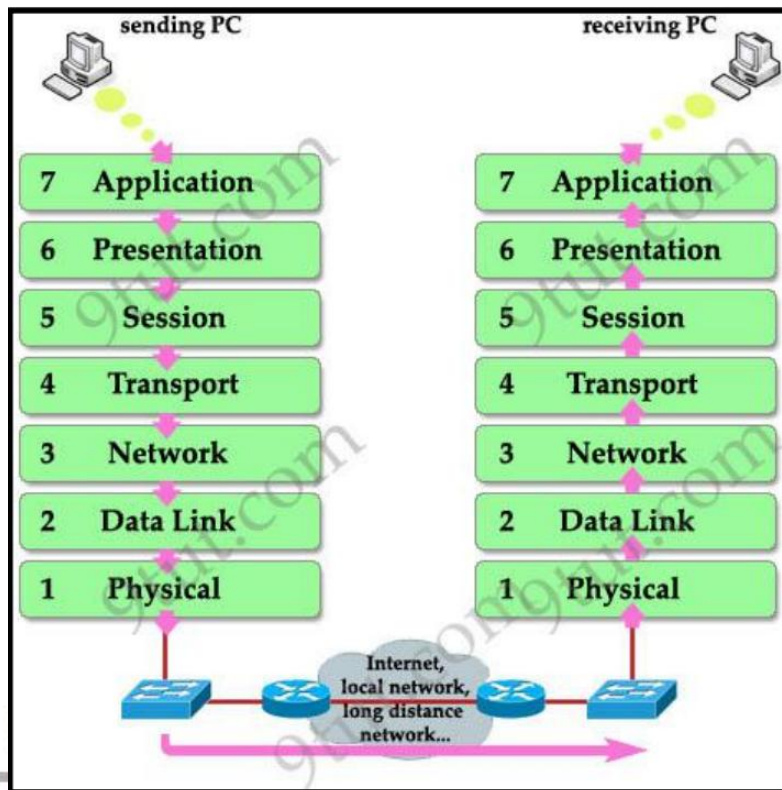
- Established – 1997
- Headquarters – New Delhi
- Agency – All India Radio (1957), Doordarshan (1959)

### 6. TDSAT – Telecom Dispute Settlement and Appellate Tribunal

- Establishment – 2000
- Headquarters – New Delhi

## OSI MODEL

**OSI (Open System Interconnection) Model** - This model was developed by ISO in 1984. A communication device manufacturer company will have to follow this model, so that there is no problem in connecting different networking devices.



**Layers of OSI model :-** It has 7 layers -

- 1.Application Layer** - This layer acts as an interface between the network and the user. Web browser, Facebook etc. come under this, in which users enter their data. Protocols like Http & Https, FTP, SMTP, POP, Telnet are used in this layer.
- 2.Presentation Layer** - This layer performs the task of translating, encrypting and compressing the data at the transmitting end, while at the receiving end it performs the task of translating, decrypting and uncompressing the data in its original form.
- 3.Session Layer** - The session layer controls the connections between multiple computers. It establishes, manages and terminates the communication session. Communication sessions set up across different network devices maintains service request and service response between applications. The session layer provides sessions for communication between two devices. That is, whenever a user opens any website, a session is created between the user's computer system and the website's server.
- 4.Transport Layer** - This layer is called the heart of the OSI model. Its main responsibility is to deliver the data without any error and in a safe form.

The following two protocols work in this-

- TCP (Transmission Control Protocol)**- This protocol is responsible for the error-free delivery of data to the destination. That's why it is called a reliable protocol.
- UDP (User Datagram Protocol)** - This protocol makes communication faster but there is no guarantee of flawless communication. That's why it is called an unreliable protocol. It is used in



video screening etc.

**5. Network Layer** - This layer is mainly responsible for routing and logical routing.

- ❑ **Logical Routing** :- The IP address of the receiver is required before the data can be sent and the packets in the layer are assigned the IP addresses of both the sender and the receiver.
- ❑ **Routing** :- This layer provides a good path to send the packet to the receiver in a short time, in the network layers the data is called packets.

**6. Data Link Layer** - It converts the data into a frame, tagging the MAC address of the sender and receiver on it and it ensures that the data is error free from one point to the other at the physical layer.

**7. Physical layer** - It is the first layer of the OSI model that is useful for the physical connection of network devices. Within this layer there is a modem, cable, NIC are included. This layer decides whether the communication will be wireless or wired.

