Chapter No. 3

Transmission Media

Course Outcome

Select relevant transmission media.

Content

- **Overview of data** : (Analog & Digital), Signal (Analog & Digital), Transmission (Analog & Digital).

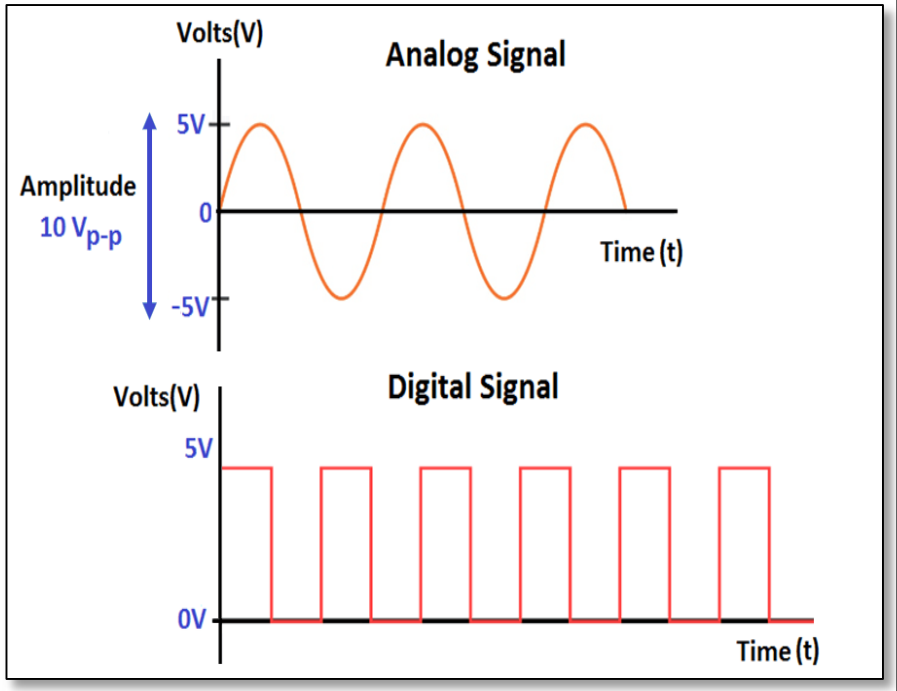
- **Transmission Media-** Need of Transmission Media, Classes of Transmission Media, Guided Media(Wired)- Coaxial Cable, Twisted Pair, Fibre Optics Cable Unguided Media (Wireless)- Electromagnetic Spectrum, Radio Waves, Infra-Red, Satellite Micro-Wave.

- **Latest Technologies in Wireless Network-** Bluetooth Architecture, Wireless Fidelity (Wi-Fi), Light Fidelity(Li-Fi), Gigabit Wireless (Gi-Fi), Wi-MAX, Applications of wireless network.

What is Data?

- **Data** can be defined as a representation of facts, concepts, or instructions in a formalized manner, which should be suitable for communication, interpretation, or processing by human or electronic machine.
- Data is represented with the help of characters such as alphabets (A-Z, a-z), digits (0-9) or special characters (+,-,/,*,<,>,= etc.)
- Computer networks are designed to transfer data from one point to another.
- During transit data is in the form of electromagnetic signals.

What is Data?

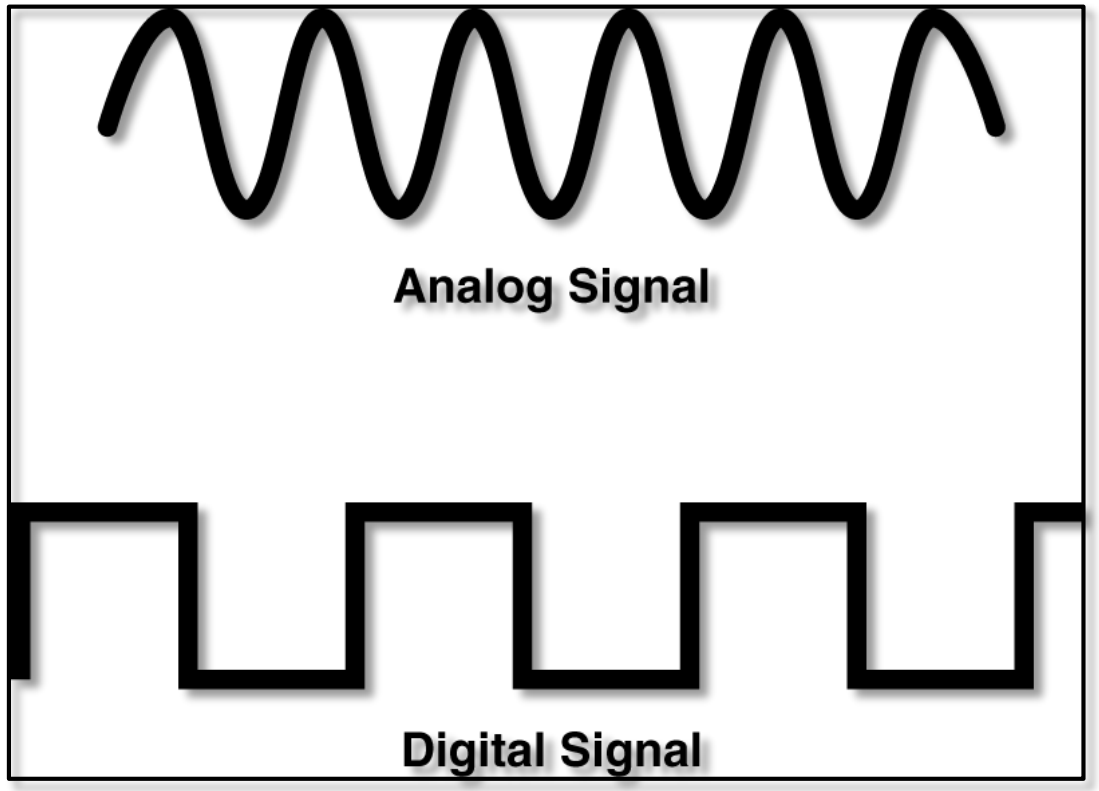


- **To be transmitted, data must be transformed to electromagnetic signals.**
- **Data can be Analog or Digital.**
  - **Analog**
    - Analog data refers to information that is continuous.
    - Ex. sounds made by a human voice.
  - **Digital**
    - Digital data refers to information that has discrete states.
    - Digital data take on discrete values.
    - For example, data are stored in computer memory in the form of 0s and 1s.

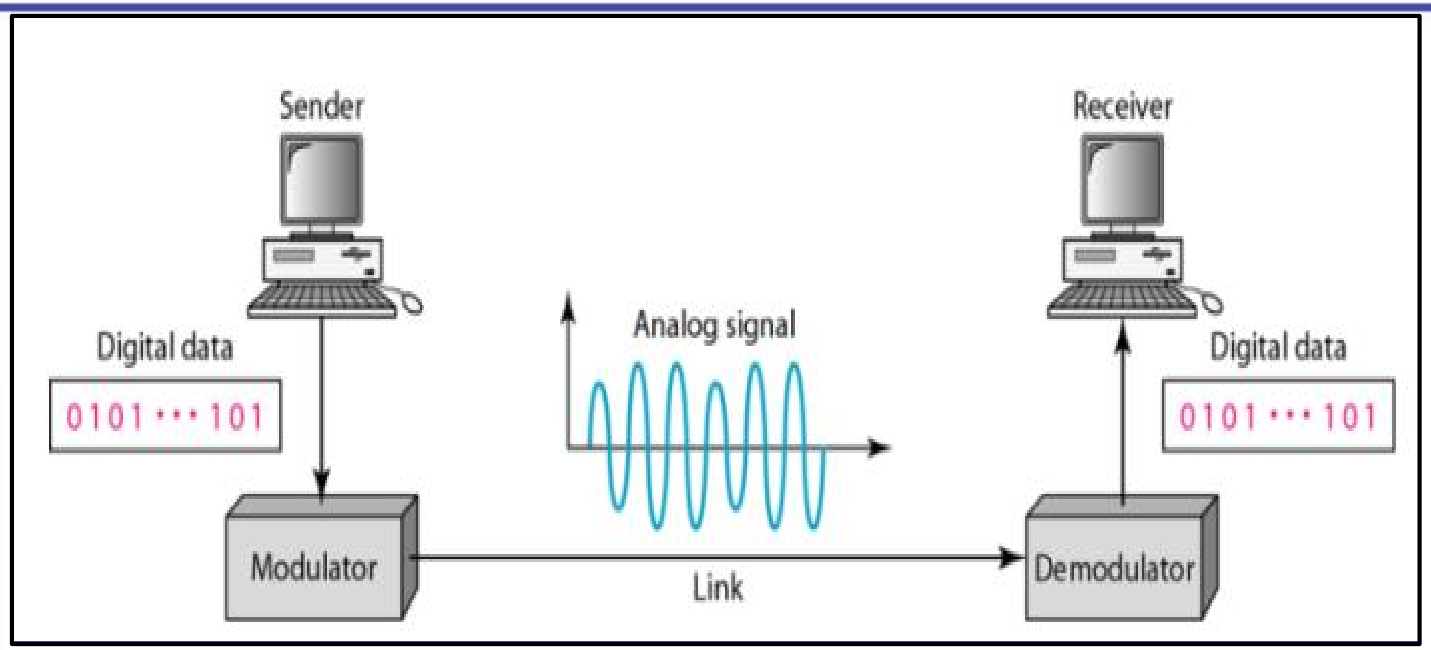
What is Signal?

- Signals are **the electric or electromagnetic impulses used to encode and transmit data.**
- Data is then transmitted through some medium, such as a cable or the airwaves.

- **Signals can be of two types:**
  1. **Analog Signal:** They have infinite values in a range.
  2. **Digital Signal:** They have limited number of defined values.

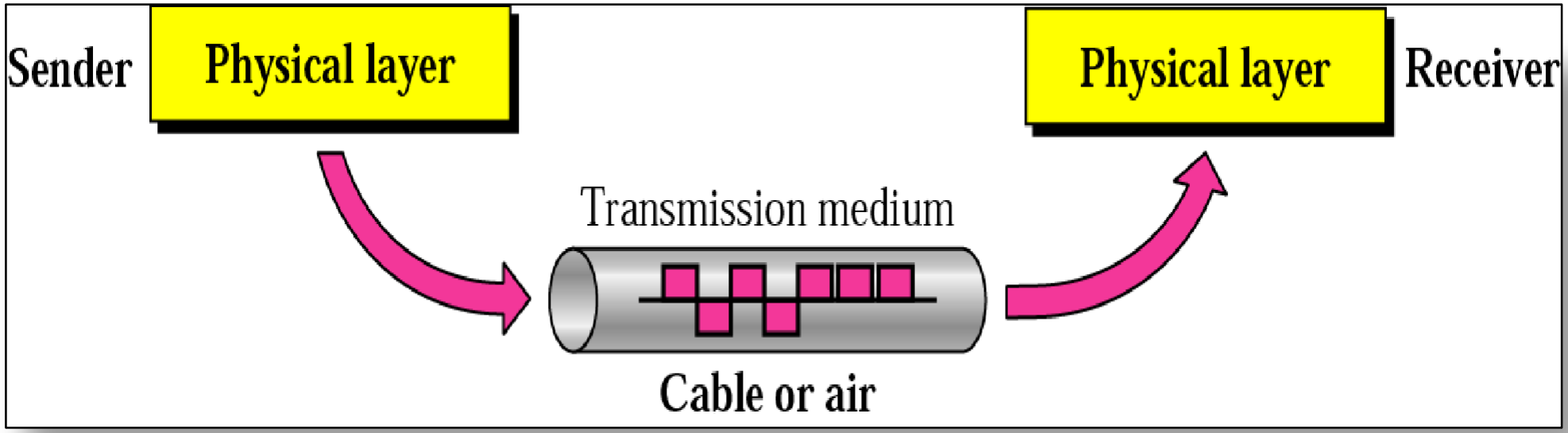


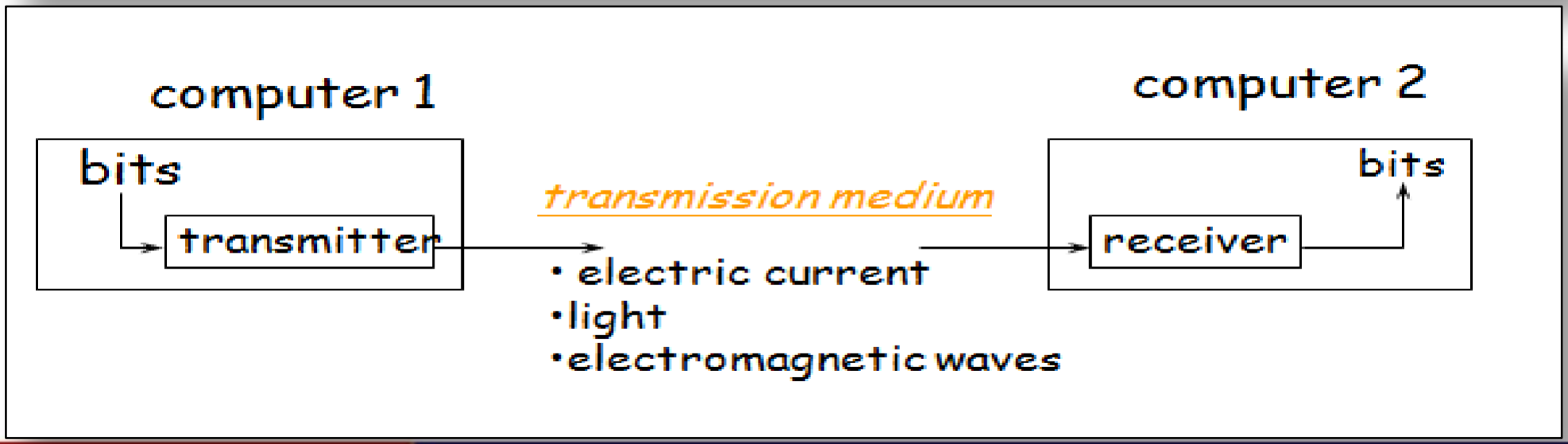
Transmission (Analog to Digital or Vice Versa)



- Transmission media is a pathway that carries the information from sender to receiver.
- We use different types of cables or waves to transmit data.
- Data is transmitted normally through electrical or electromagnetic signals.

What is Transmission Media ?





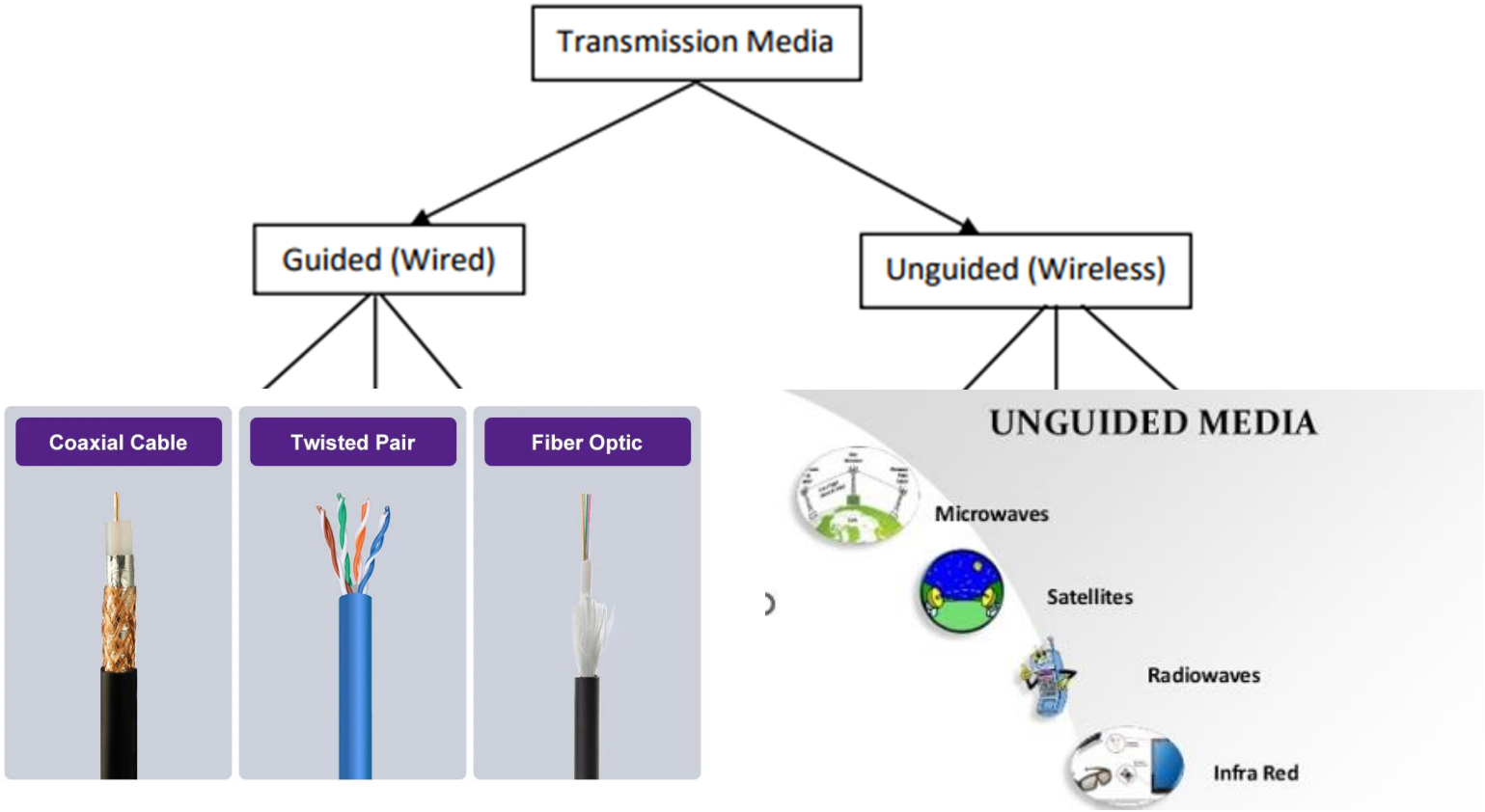
What is Transmission Media ?

- **Transmission medium:** the physical path between transmitter and receiver.
- Transmission media operates at Physical Layer of the OSI Model.
- The physical layer is responsible for movements of individual bits from one device to the another.
- Computers and other telecommunication devices use signal to represent data.
- Repeaters or amplifiers may be used to extend the length of the medium.
- For the purpose of telecoms, transmission media can be divided into two categories: Guided (twisted-pair cable, coaxial cable and fiber-optic cable) and Unguided (usually air-electromagnetic waves).

Transmission Media

- **Transmission Media Categories**

Figure: Classes of transmission media

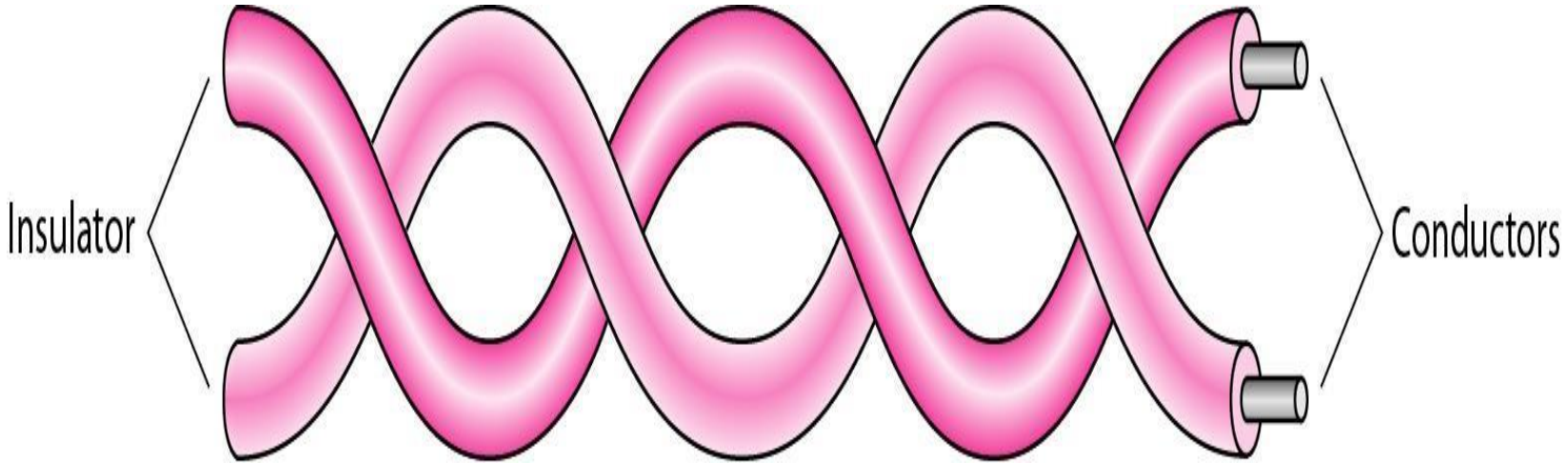


Transmission Media

Sr. No.	Guided Media	Unguided Media
1.	The signal energy propagates through wires in guided media.	The signal energy propagates through air in unguided media.
2.	Guided media is used for point to point communication.	Unguided media is generally suited for radio broadcasting in all directions.
3.	Discrete network topologies are formed by the guided media.	Continuous network topologies are formed by the unguided media.
4.	Signals are in the form of voltage, current or photons in the guided media.	Signals are in the form of electromagnetic waves in unguided media.
5.	**Examples** of guided media are twisted pair wires, coaxial cables, optical fiber cables.	**Examples** of unguided media are microwave or radio links and infrared light.

Transmission Media

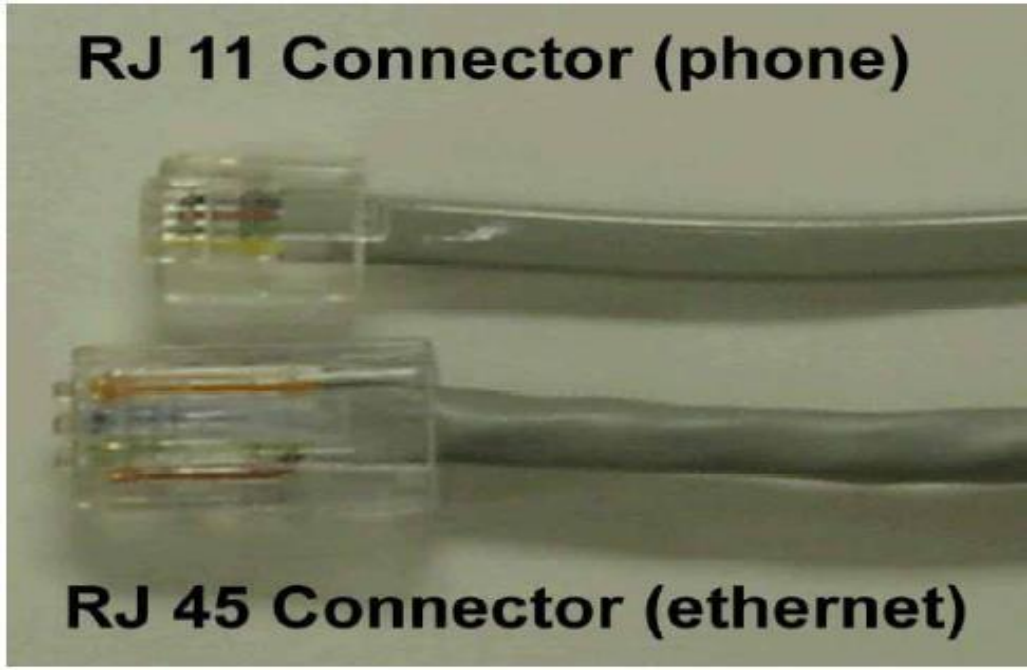
- **Twisted-pair cable**
  - Twisted-pair cable uses metallic (copper) conductors that accept and transport signals in the form of **electric current**.
  - Twisted pair cables consist of one or more pairs of insulated copper wires that are twisted together and housed in a protective jacket.

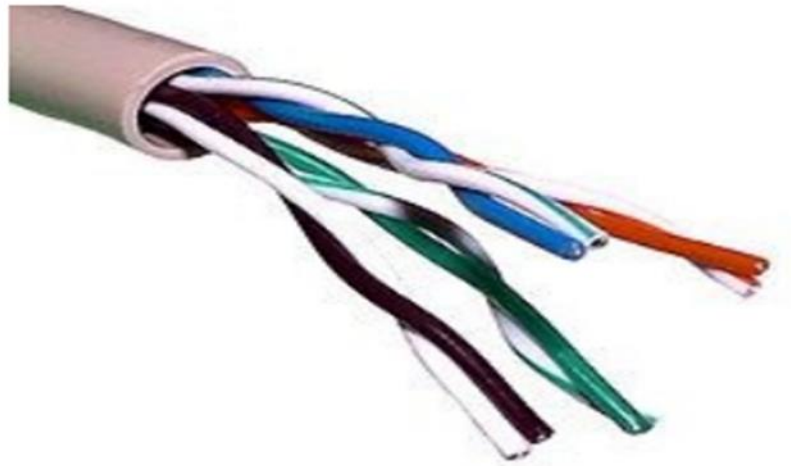


Transmission Media

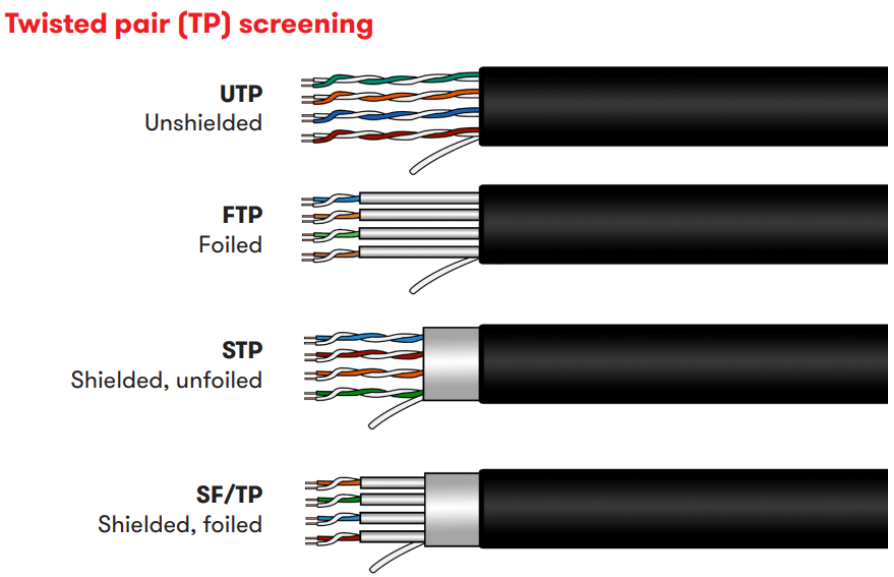
Twisted-Pair Cable

- Twisted pair cables have connectors at the end, known as RJ connectors (RJ-45, RJ-11)





Applications and Types



- The oldest and the most popular use of twisted pair are in telephony.
- In LAN it is commonly used for point-to-point short distance communication (say, 100m) within a building or a room

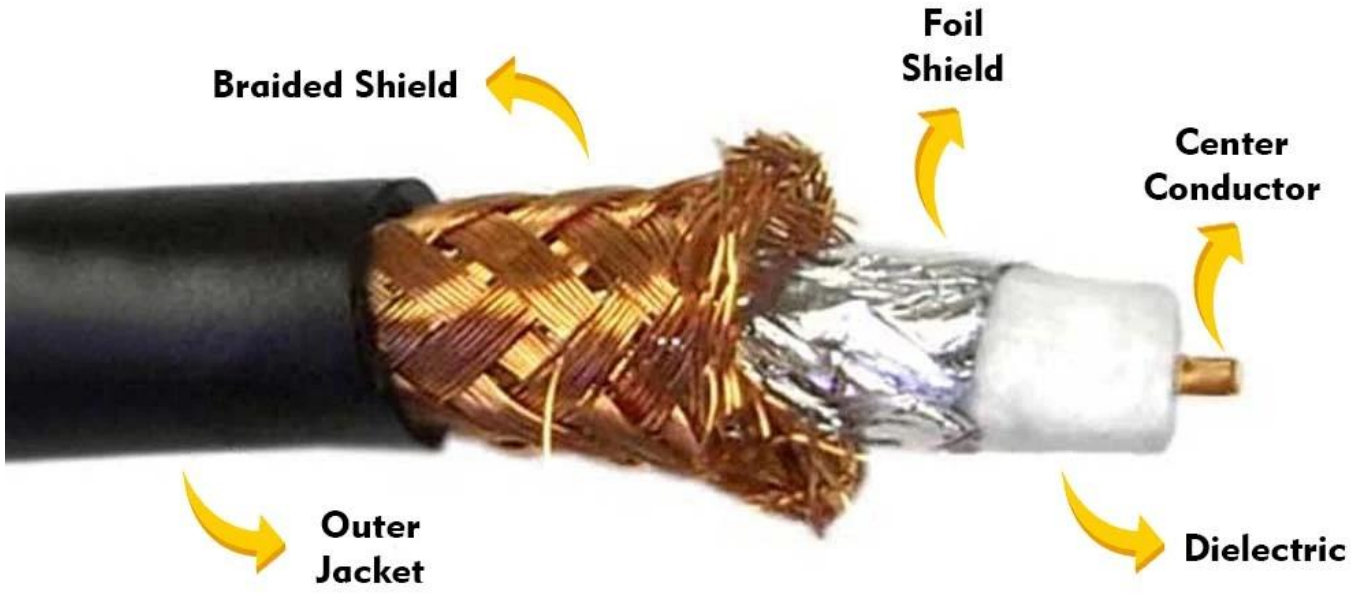
Unshielded twisted pair (UTP)
– ordinary telephone wire
– commonly used for local area networks
– subject to external electromagnetic interference
shielded twisted pair (STP)
– twisted pair shielded with a metallic braid
– more expensive

Applications and Types

UTP category	Description
Category-1	consists of cables which carry voice and not the data.
Category-2	Consists of 4 twisted pair UTP cables which can transmit data upto 4 Mbps
Category-3	Consists of 4 twisted pair UTP cables with three twists per foot which can transmit data upto 10 Mbps
Category-4	Consists of 4 twisted pair UTP cables which can transmit data upto 16 Mbps
Category-5	Consists of 4 twisted pair UTP cables which can transmit data upto 100 Mbps
Category-5e	Enhanced version of catrgory-5 for larger networks
Category-6	Used for gigabit ethernet

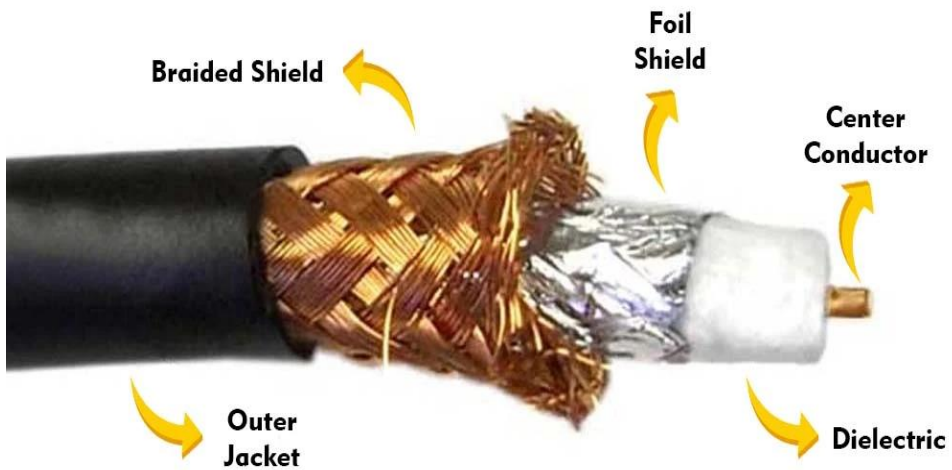
Coaxial Cable

- The construction of co-axial cable is as shown in fig.
- It is a type of electrical cable that has an inner conductor surrounded by a tubular insulating layer, surrounded by a tubular conducting shield.
- The external conductor is metallic braid and used for the purpose of shielding



- Coaxial cable received its name because it includes one physical channel that carries the signal surrounded -- after a layer of insulation -- by another concentric physical channel, both running along the same axis.
- The outer channel serves as a ground. Many of these cables or pairs of coaxial tubes can be placed in a single outer sheathing and, with repeaters, can carry information for a great distance.
- Frequency ranges of coaxial cable is 100 KHz to 500 MHz

Coaxial Cable



- Center conductor: It is heart of a coaxial cable. Typically constructed of either pure copper or copper coated steel or aluminium It is responsible for transmitting the cables signal

- Dielectric insulator: The dielectric insulator's purpose is two ways; first it acts as an insulator between the centre conductor and outer braided shielding. Second it helps physically hold the centre conductor in the centre of the cable
- **Braided shield:** Interference comes in two different ways: EMI and RFI(radio frequency interference).EMI is often caused heavy power lines, cell phone signals ,etc. A braided shield protects them from EMI.
- **Outer Jacket: It** is generally made from flexible PVC and used to hold cable together and protect it from the elements

Coaxial Cable – Advantages / Disadvantages

1. It can be used for both analog and digital transmission.
2. It offers higher bandwidth as compared to twisted pair cable and can span longer distances.
3. Because of better shielding in coaxial cable, loss of signal or attenuation is less.
4. Better shielding also offers good noise immunity.
5. It is relatively inexpensive as compared to optical fibers.
6. It has lower error rates as compared to twisted pair.
7. It is not as easy to tap as twisted pair because copper wire is contained in plastic jacket.

1. It is usually more expensive than twisted pair.
2. BNC connectors are required for connection

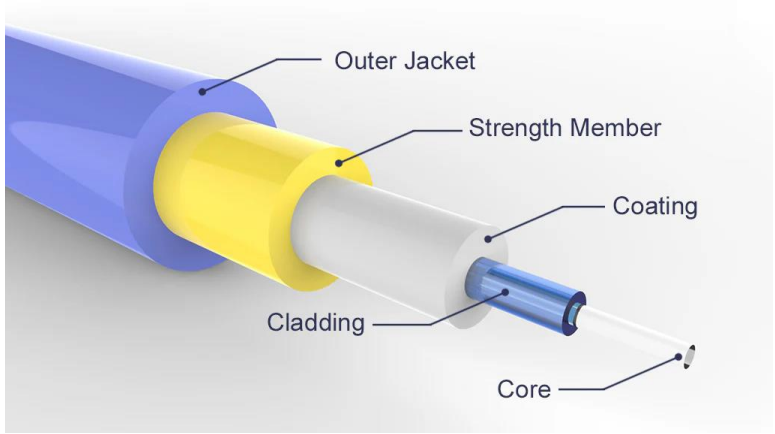
Bayonet Neill-Concelman

Coaxial Cable – Applications

- Analog telephone networks where single coaxial cable could carry 10,000 voice signals.
- Digital telephone network where single coaxial cable could carry digital data up to 600 MBPS
- Cable TV
- Traditional Ethernet LANs
- Digital transmission
- Thick Ethernet

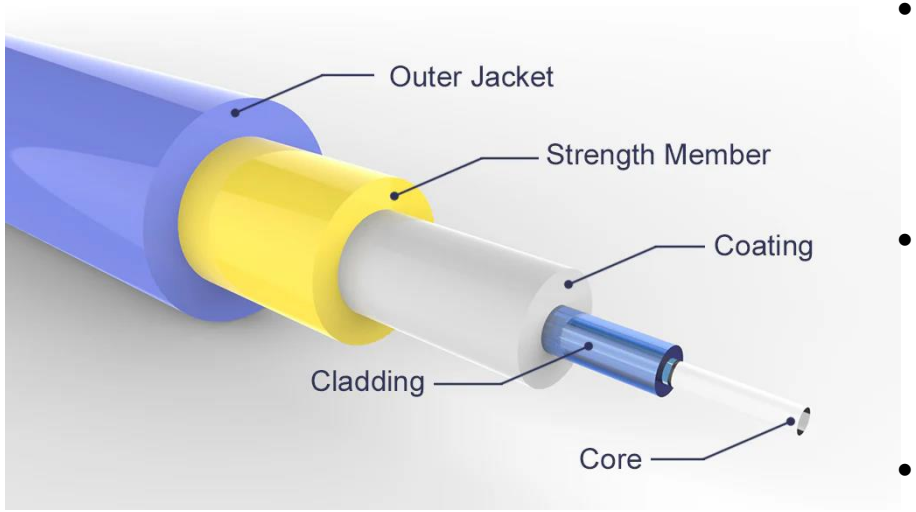
Fiber Optic Cable

- Fiber-optic is glass cabling media that send network signals using light
- Fiber optic cabling has higher bandwidth capacity than copper cabling and mainly used for high-speed network
- Light travels in a straight line if it is moving through a single uniform substance
- Light is a form of electromagnetic energy. It travels at its fastest in a vacuum; 3,00,000 Km/sec.
- The speed of light is dependent on the density of the medium through which it is traveling



Fiber Optic Cable

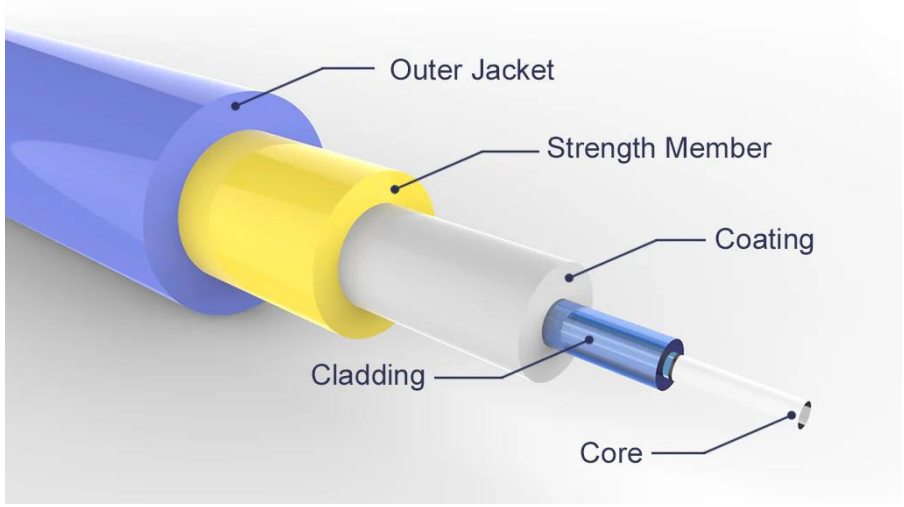
- **Core:** This is the physical medium that transports optical data signals from an attached light source to a receiving device.
- The core is a single continuous strand of glass or plastic that measured in microns (μ) by the size of its outer diameter.
- The larger the core ,the lighter the cable can carry.
- The three multimode sizes most commonly available are 50,62.5 and 100 microns.



- **Cladding:** This is the thin layer that surrounds the fibre core and serves as a boundary that contains light waves and causes the refraction, enabling data to travel throughout the length of the fibre segment.
- The function of the cladding is to provide a lower refractive index at the core interface to cause reflection within the core so that light waves are transmitted through the Fiber.

- **Coating:** This is the layer plastic that surrounds the core and cladding to protect the Fiber core .
- It measures in microns and can range from 250 to 900 microns

Fiber Optic Cable



- **Strengthening fibres:** These components help to protect the core against crushing forces and excessive tension during installation.
- **Cable jacket: This** is the outer layer of any cable .Most fibre optic cable has orange jacket.

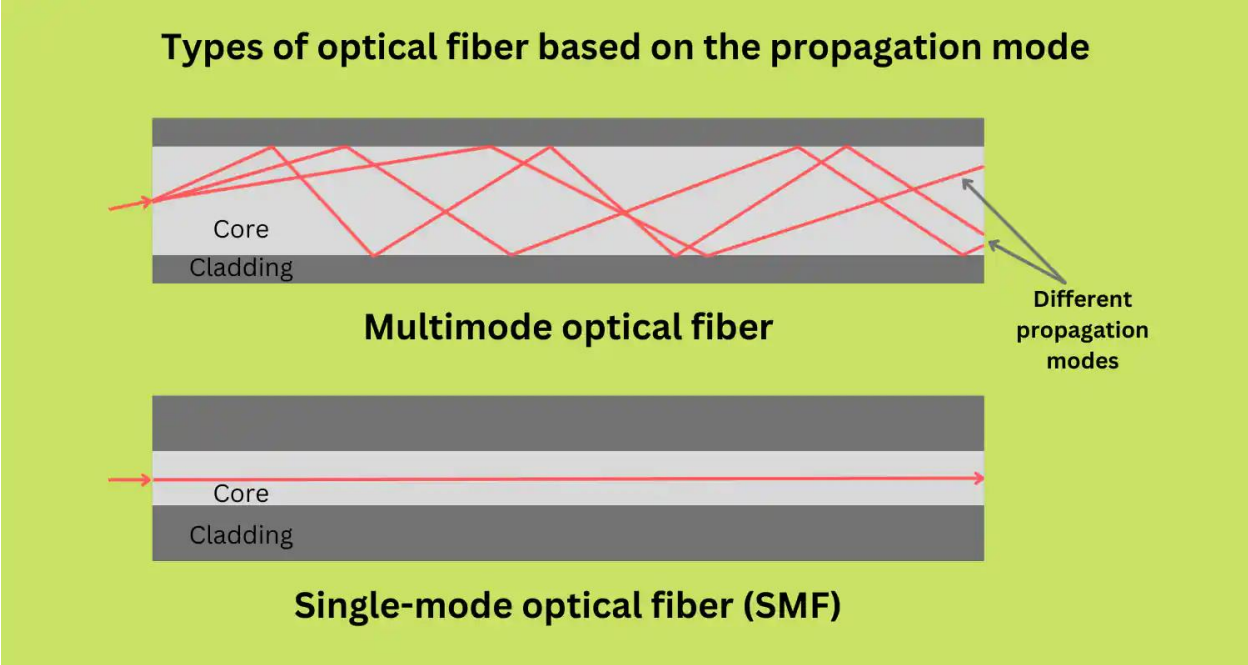
Fiber Optic – Advantages

- **Greater Bandwidth:** Fiber optic cables have a much greater bandwidth than metal cables. The amount of information that can be transmitted per unit time of fiber over other transmission media is its most significant advantage
- **Faster Speeds**
  Fiber optic cables have a core that carries light to transmit data. This allows fiber optic cables to carry signals at speeds that are only about 31 percent slower than the speed of light—faster than Cat5 or Cat6 copper cables. There is also less signal degradation with fiber cables.
- **Longer Distance**: in fiber optic transmission, optical cables can provide low power loss, which enables signals can be transmitted to a longer distance than copper cables.
- **Better Reliability**
  Fiber is immune to temperature changes, severe weather and moisture, all of which can hamper the connectivity of copper cable. Plus, Fiber does not carry electric current, so it's not bothered by electromagnetic interference (EMI) that can interrupt data transmission.
- **Thinner**– Optical fibers can be drawn to smaller diameters than copper wire.
- **Light Weight** :Fiber optic cables are much thinner and lighter than metal wires. They also occupy less space with cables of the same information capacity. Lighter weight makes fiber easier to install.
- **Security**: Optical fibers are difficult to tap. As they do not radiate electromagnetic energy, emissions cannot be intercepted. As physically tapping the fiber takes great skill to do undetected, fiber is the most secure medium available for carrying sensitive data.
- **Flexibility**: An optical fiber has greater tensile strength than copper or steel fibers of the same diameter. It is flexible, bends easily and resists most corrosive elements that attack copper cable

Fiber Optic – Disadvantages

- **Difficult to Install**: it's not easy to splice fiber optic cable. And if you bend them too much, they will break. And fiber cable is highly susceptible to becoming cut or damaged during installation or construction activities. All these make it difficult to install.
- **Attenuation & Dispersion**: as transmission distance getting longer, light will be attenuated and dispersed, which requires extra optical components like EDFA to be added.
- **Cost Is Higher Than Copper Cable**: despite the fact that fiber optic installation costs are dropping by as much as 60% a year, installing fiber optic cabling is still relatively higher than copper cables. Because copper cable installation does not need extra care like fiber cables.
- **Fragility :** The optical fibers are easily broken.
- **Fragility:** usually optical fiber cables are made of glass, which lends to they are more fragile than electrical wires. In addition, glass can be affected by various chemicals including hydrogen gas (a problem in underwater cables), making them need more cares when deployed underground.
- **Limited Application:** Can only be used on ground but cannot leave the ground or be associated with the mobile communication.

Fiber Optic – Propagation

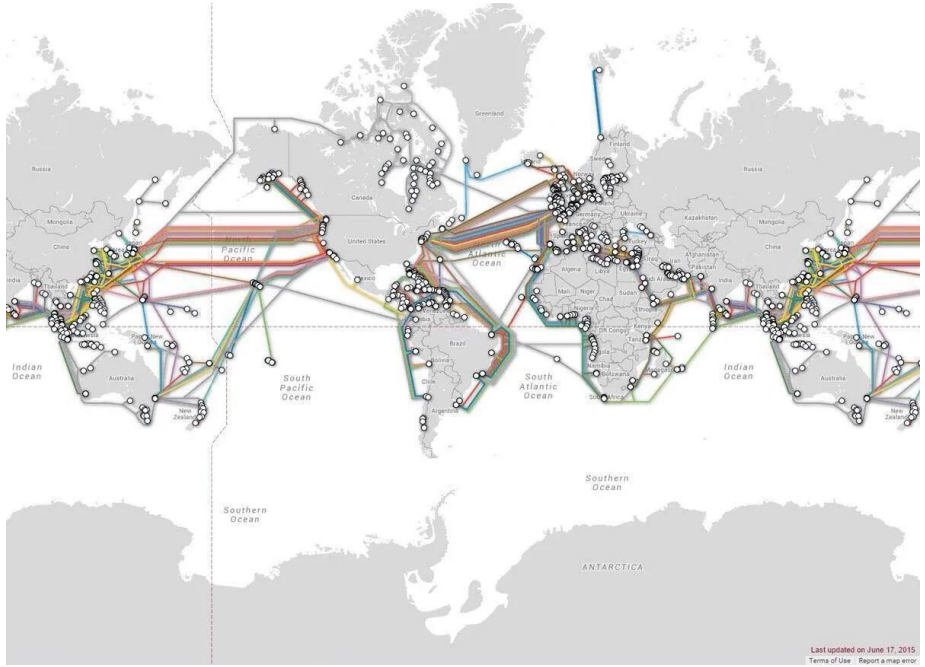


Single Mode cable is a single stand of glass fiber with a diameter of 8.3 to 10 microns that has one mode of transmission. Single Mode Fiber with a relatively narrow diameter, through which only one mode will propagate typically 1310 or 1550nm

•**Multi-Mode cable** has a little bit bigger diameter, with a common diameters in the 50-to-100-micron range.

Multimode fiber gives you high bandwidth at high speeds (10 to 100MBS - Gigabit to 275m to 2km) over medium distances. Light waves are dispersed into **numerous paths**, or modes, as they travel through the cable's core typically 850 or 1300nm

Fiber Optic – Stats



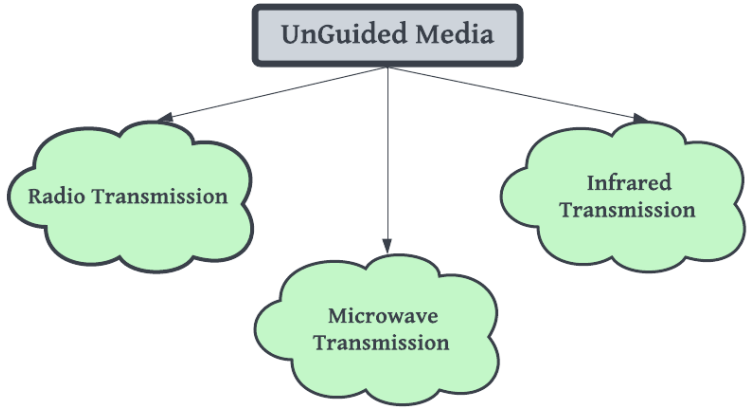
As of early 2025, the world has over 1.48 million kilometers of submarine fiber optic cables in service, with some cables being short and others, like the Asia America Gateway, being incredibly long, spanning 20,000 kilometers.

Threats:

1. Physical Attacks and Sabotage
2. Cybersecurity Threats
3. Signal Interception and Eavesdropping
4. Environmental and Natural Threats
5. Technical Failures

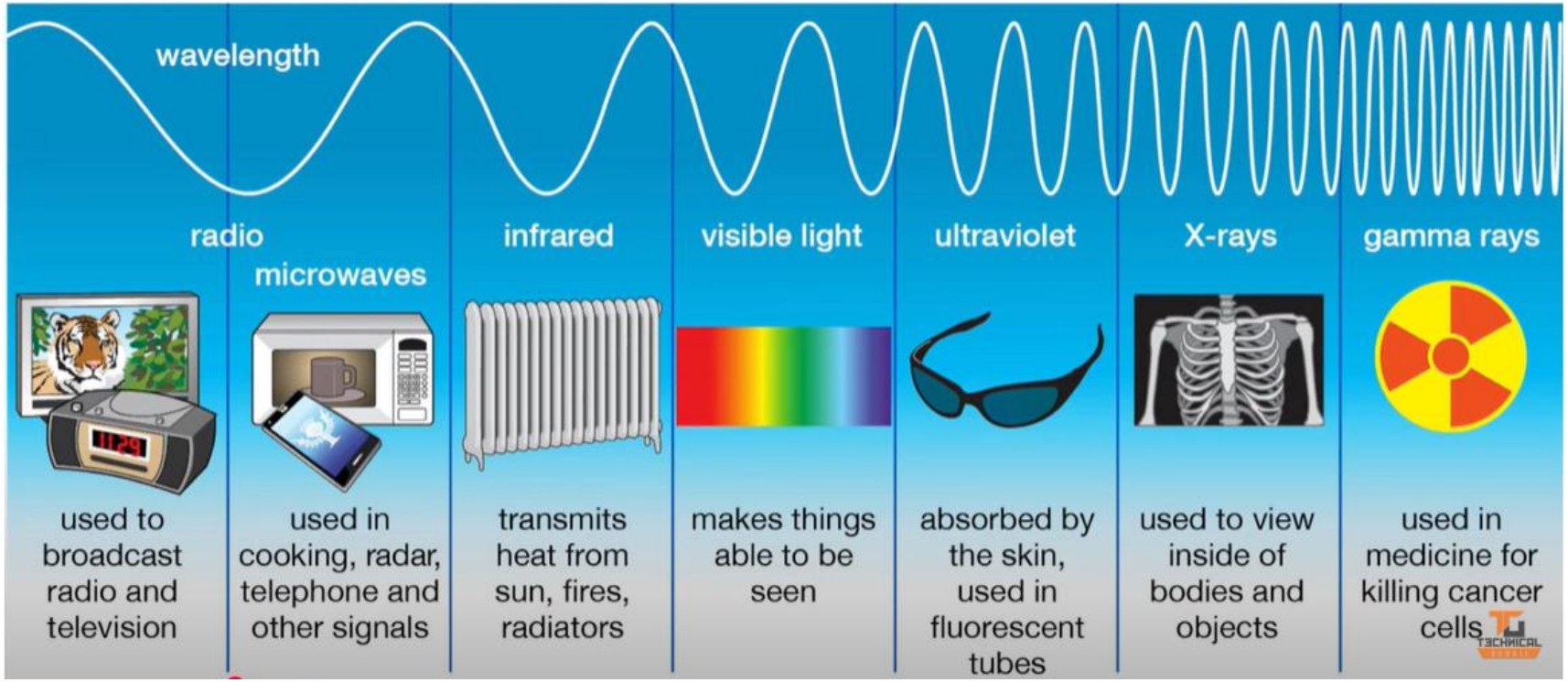
Unguided Media

- It is also called as wireless media.
- An unguided media does not use a conductor or a wire as a communication channel.
- Instead of that it uses the air or vacuum as a medium to carry the information from transmitter to receiver.
- The transmitter first converts data signals into electromagnetic waves and transmits them using suitable antenna.
- The receiver receives them using receiving them and coverts the EM waves into digital signals
- Transport electromagnetic waves without a physical conductor



Electromagnetic Spectrum

- We can use EM waves of different frequencies for different communication applications.
- The electromagnetic spectrum for wireless communication is shown in fig
- It shows the part of the electromagnetic spectrum, ranging from 3 kHz to 900 THz, used for wireless communication.



2G Spectrum Scam

LOSS TO THE NATION

₹176000000000

A Raja deprived govt of this much money in 2G spectrum allocation: CAG report

K S Narayanan | ENS
New Delhi, November 10

THE sheer enormity of the figure, when one learnt about it, was perplexing than enabling to grasp its exactness. The gravity of the offence, though, was evident on Wednesday as Telecom Minister A Raja came under stinging indictment by the Comptroller and Auditor General for arbitrarily undertaking the 2G spectrum allocation, ignoring the advice of ministries, avoiding deliberations of the Telecom Commission — and causing the exchequer a loss of ₹1.76 lakh-crore.

This the first time Raja, the DMK MP from Tamil Nadu's Nilgiris, has come under fire from a top constitutional body during the last two years. The draft report blasted the minister for squandering "a scarce finite national asset at less than its true value on flexible criteria and procedures adopted to

Unguided Media Propagation

1) Ground Propagation

➢Less than 2 MHz

2) Sky Propagation

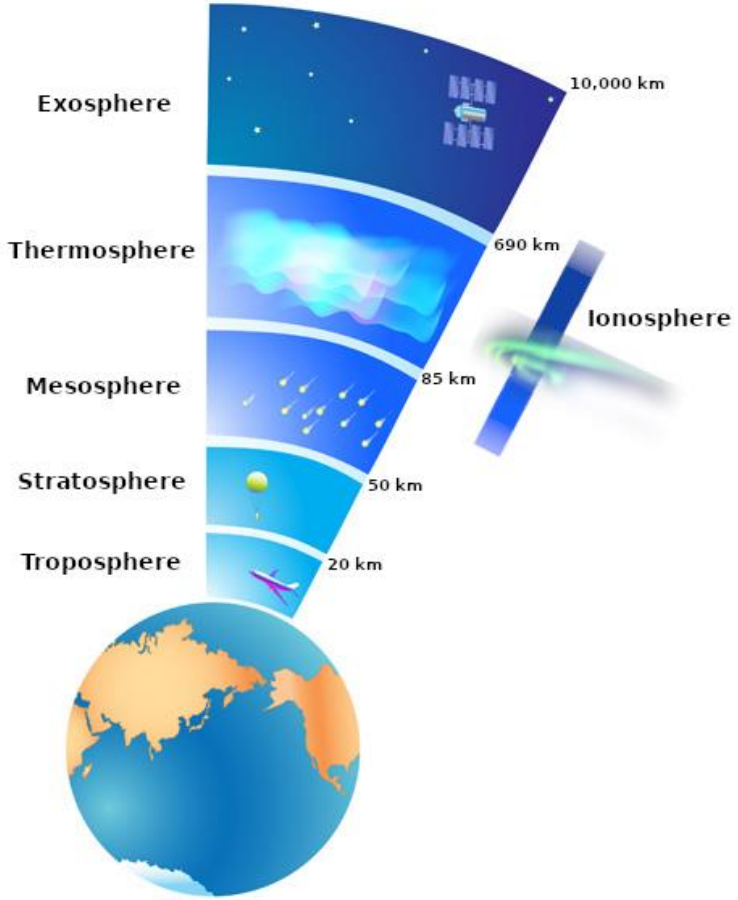
➢ 2 MHz – 30 MHz

3) Line of Sight Propagation

➢ Greater than 30 MHz

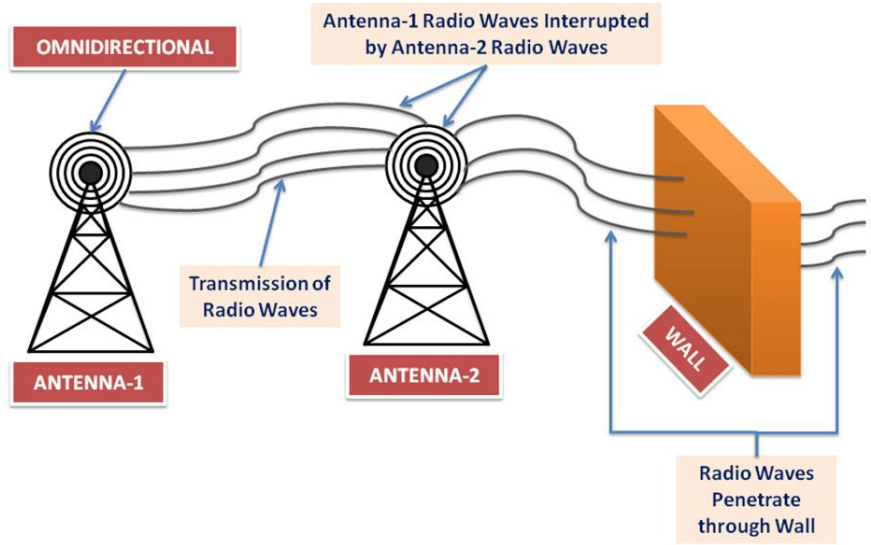
- **Ground propagation**
  - Lowest portion of the atmosphere
  - Signals follow the curvature of the earth
- **Sky propagation**
  - Higher frequency signals raise up to the ionosphere
  - Greater distance with lower output power.
- **Line-of-sight (visual) propagation**
  - Highest frequency but shorter range

Unguided Media Propagation



Unguided Media – Radio Waves

- Electromagnetic waves ranging in frequencies between 3 kHz and 1 GHz are normally called radio waves;
- Radio waves, for the most part, are omnidirectional.
- When an antenna transmits radio waves, they are propagated in all directions.
- This means that the sending and receiving antennas do not have to be aligned.
- A sending antenna sends waves that can be received by any receiving antenna.
- Radio waves, particularly those waves that propagate in the sky mode, can travel long distances. This makes radio waves a good candidate for long-distance broadcasting such as AM/FM radio.



Radio Waves - Applications

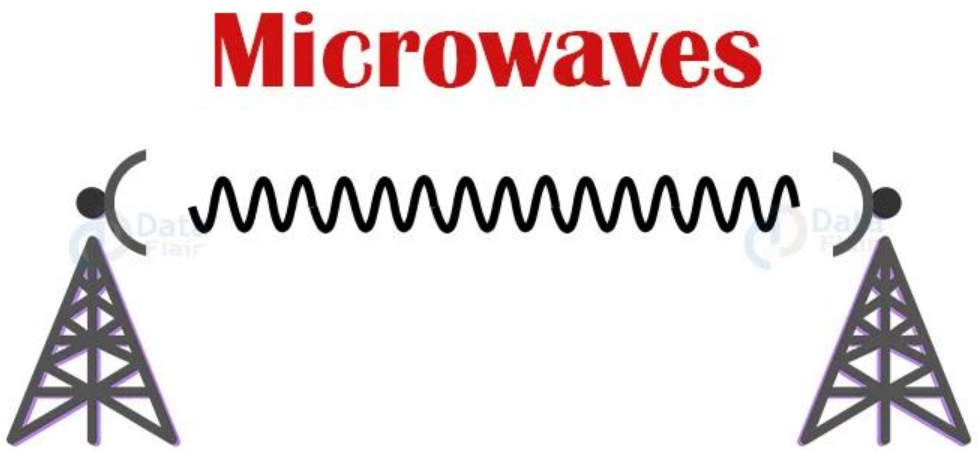
- **Radio broadcasting**: Radio waves are used to transmit audio and other signals to a large audience.
- **Cell phones and wireless networks**: Radio waves are used to transmit and receive signals for cell phones and wireless networks.
- **Radar**: Radio waves are used to detect the presence and location of objects.
- **Radio navigation**: Radio waves are used to transmit signals to radio beacons on the ground to help aircraft determine their bearings.
- **Satellite communication**: Radio waves are used to transmit information over long distances using satellites.
- **Industrial heating**: Radio waves are used to heat materials in industrial processes, such as in microwave ovens.
- **Air-to-air communication**: Radio waves are used to maintain communication between planes.

Unguided Media – Microwaves

- Electromagnetic waves having frequencies between 1 and 300 GHz are called microwaves.
- Microwaves are unidirectional.
- When an antenna transmits microwaves, they can be narrowly focused.
- This means that the sending and receiving antennas need to be aligned.
- The unidirectional property has an obvious advantage.
- A pair of antennas can be aligned without interfering with another pair of aligned antennas.

Unguided Media – Microwaves

- Microwaves propagation is line-of-sight therefore towers with mounted antennas need to be in direct sight of each other
- Due to the unidirectional property of microwaves, a pair of antennas can be placed aligned together without interfering with another pair of antennas using the same frequency.
- The microwave has a frequency higher than the radio waves. Microwave are used for telephone communication mobile phones, television distribution, etc.



Microwaves - Applications

- Microwaves, due to their unidirectional properties, are very useful when unicast(one-to-one) communication is needed between the sender and the receiver.
- They are used in
  - cellular phones
  - satellite networks
  - wireless LANs.

Microwaves - Applications

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Advantages of Microwave Transmission

- Used for long distance telephone communication
- Carries 1000's of voice channels at the same time

Disadvantages of Microwave Transmission

- It is Very costly

Unguided Media – Satellite

- Moon is a natural satellite of earth
- An artificial satellite revolves around the earth in exactly same manner as electrons revolve around nucleus of an atom.
- The path in which satellites move are called as orbits.
- The orbits are of different types such as synchronous orbit ,polar orbits and inclined orbits.

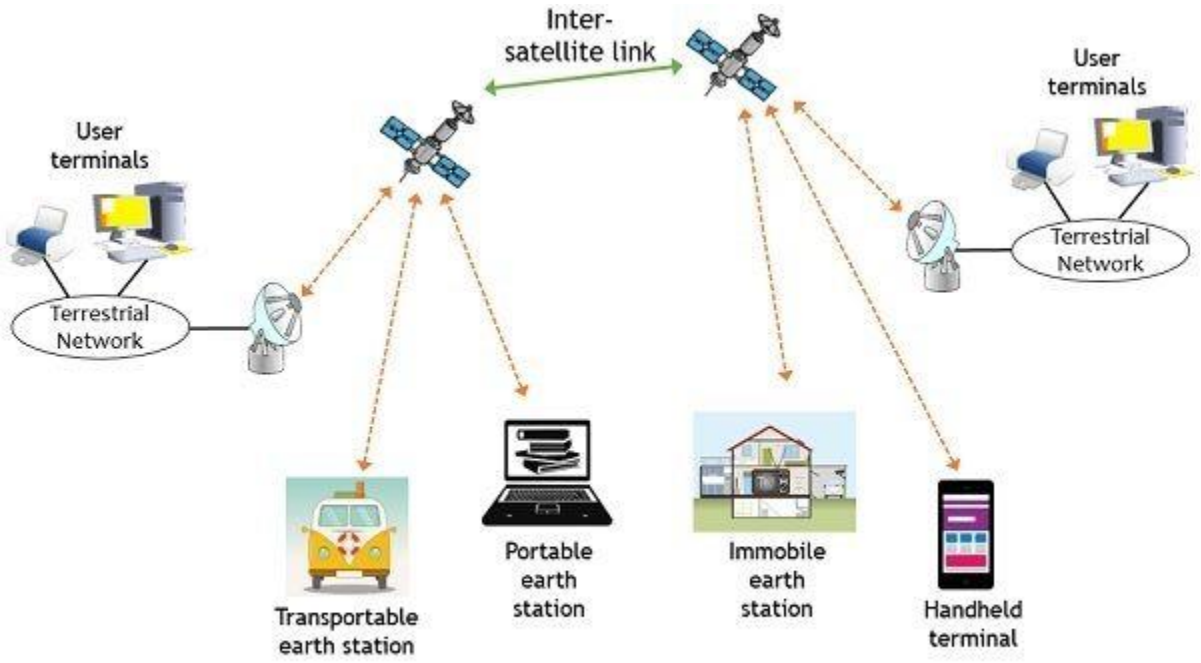
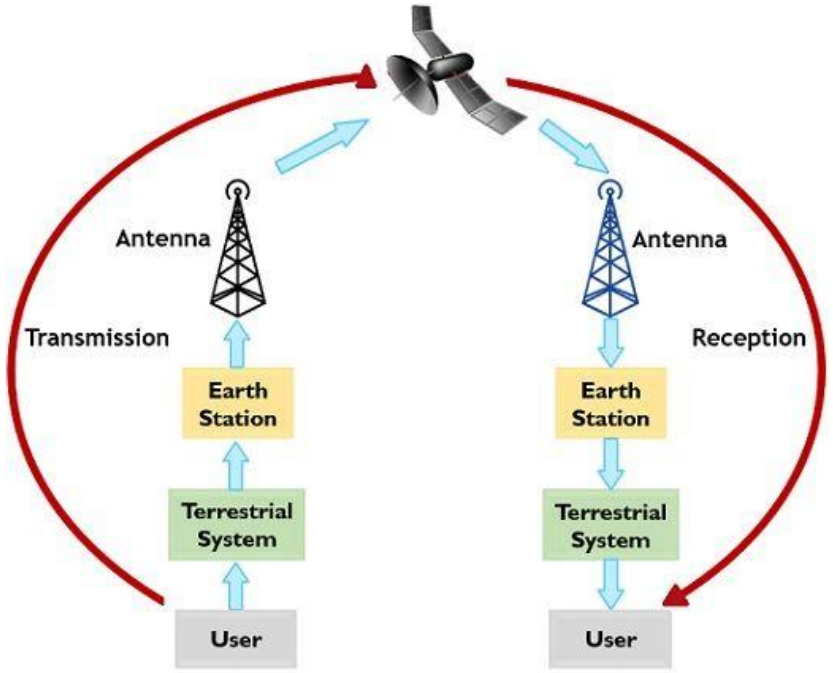


Illustration of Satellite Network

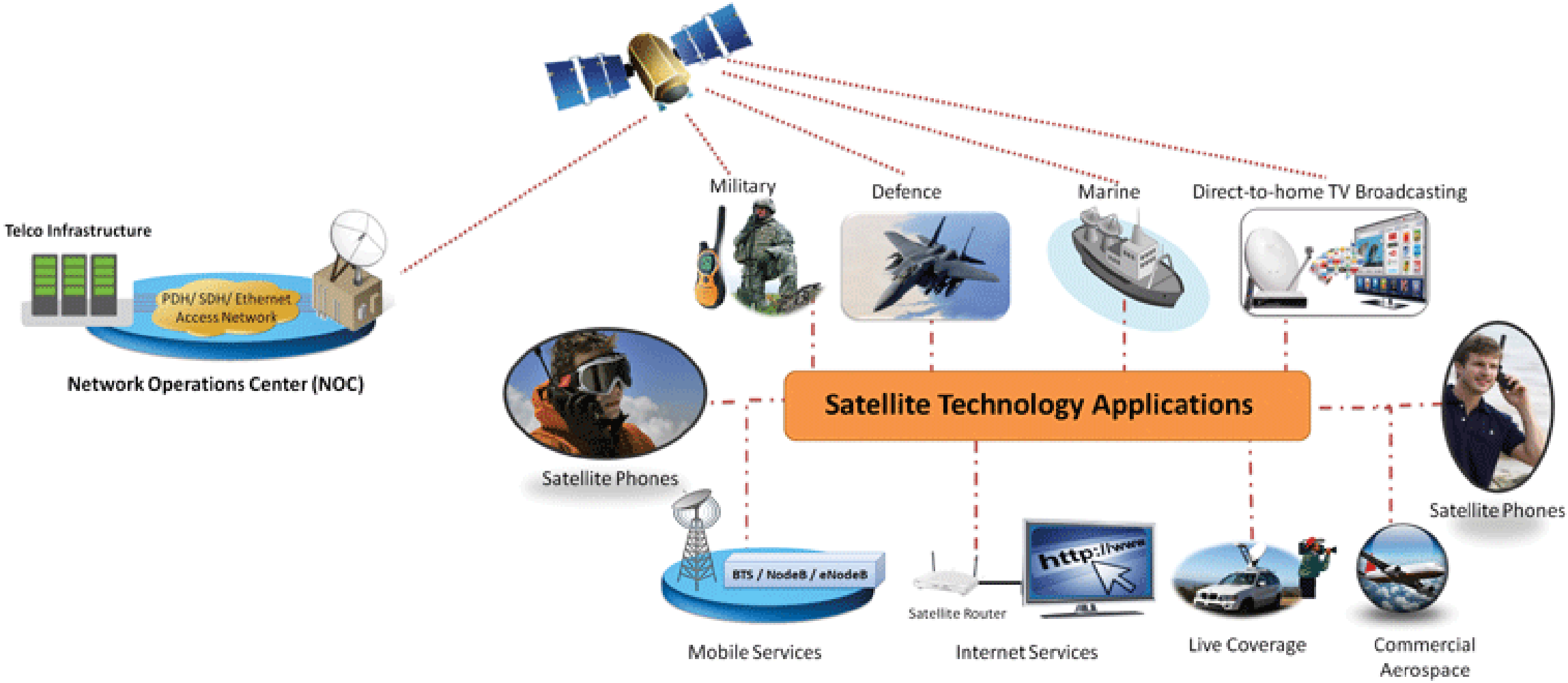
Satellite - Working

- Users are the ones who generate baseband signals, which is processed at the earth station and then transmitted to the satellite through dish antennas.
- Now the user is connected to the earth station via some telephone switch or some dedicated link.
- The satellite receives the uplink frequency, and the transponder present inside the satellite does the processing function and frequency down conversion to transmit the downlink signal at different frequency
- The earth station then receives the signal from the satellite through parabolic dish antenna and processes it to get back the baseband signal.
- This baseband signal is then transmitted to the respective user via dedicated link or other terrestrial system.



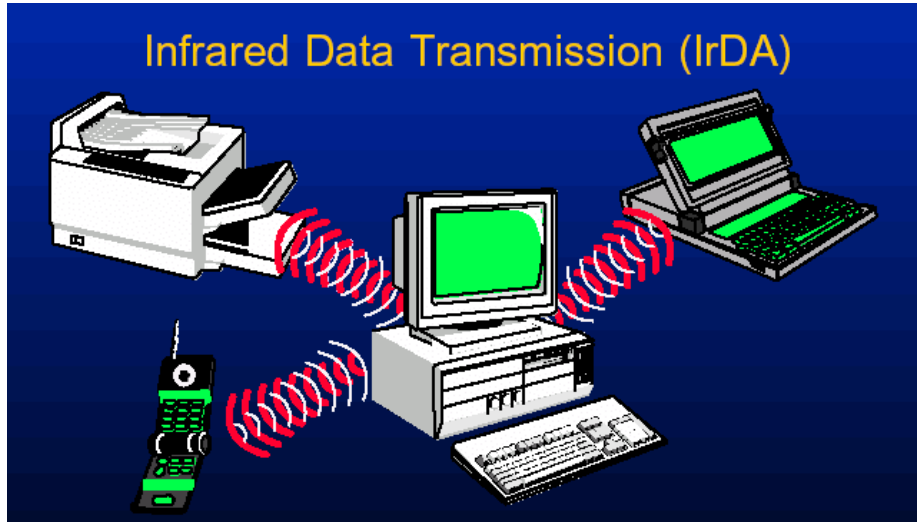
Structure of Satellite Communication

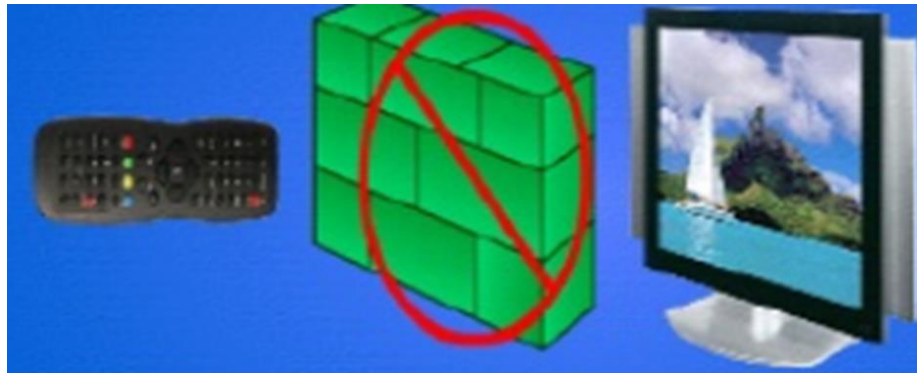
Satellite - Applications



Unguided Media - InfraRed

- Infrared is used in devices such as the wireless mouse, wireless keyboard and printers.
- Some manufacturers provide a special port called the IrDA port that allows a wireless keyboard to communicate with a PC.
- Infrared signals have frequencies between 300 GHz to 400 THz.
- They are used for short-range communication.
- Infrared signals have high frequencies and cannot penetrate walls.
- Due to its short-range communication system, the use of an infrared communication system in one room will not be affected using another system in the next room





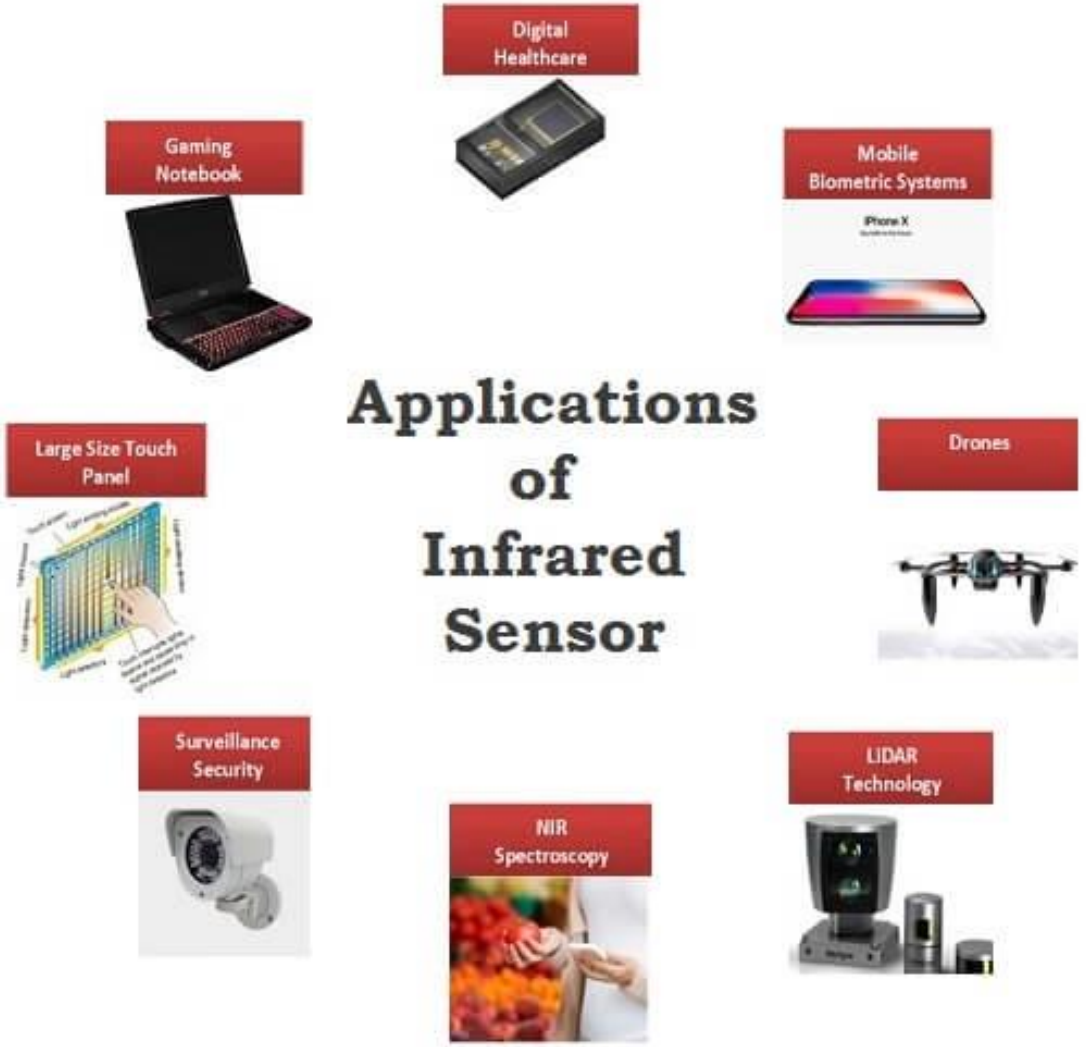
InfraRed - Advantages / Disadvantages

- This advantageous characteristic prevents interference between one system and another,
- a short-range communication system in on room cannot be affected by another system in the next room.
- Line-of-sight propagation mode is employe applications of infrared waves. That transmitter and receiver must be aligne respect to each other so that nothing obstru path of infrared wave.

- Low power requirement: therefore ideal for laptops, telephones, personal digital assistants.
- Simple circuitry: no special or proprietary hardware is required, can be incorporated into the integrated circuit of a product.
- Low circuitry cost (for the entire coding/decoding circuitry).
- security: directionality of the beam helps ensure that n't leaked to nearby devices.
- oise immunity: not as likely to have interference from from other devices.
- le.
- f sight: transmitters and receivers must be almost directly aligned (i.e. able to see each other) to communicate.
- Blocked by common materials: people, walls, plants, etc. can block transmission.
- Short range.
- Light, weather sensitive: direct sunlight, rain, fog, dust, pollution can affect transmission.
- Speed: data rate transmission is lower than typical wired transmission.

- Infrared signals cannot be used for long distance communication.
- In addition, we cannot use infrared waves outside a building because sun's rays contain infrared waves that can interfere with communication

InfraRed - Applications



Latest Technologies in Wireless Network

➢ Bluetooth Architecture:

- In 1994, the L. M. Ericsson company became interested in connecting its mobile phones to other devices (e.g., laptops) without cables.
- Together with four other companies (IBM, Intel, Nokia, and Toshiba), it formed a SIG (Special Interest Group, i.e., consortium) in 1998 to develop a wireless standard for interconnecting computing and communication devices and accessories using short-range, low-power, inexpensive wireless radios.
- Bluetooth 1.0 was released in July 1999, and since then the SIG has never looked back. All manner of consumer electronic devices now use Bluetooth, from mobile phones and laptops to headsets, printers, keyboards, mice, gameboxes, watches, music players, navigation units, and more.
- The Bluetooth protocols let these devices find and connect to each other, an act called pairing, and securely transfer data.

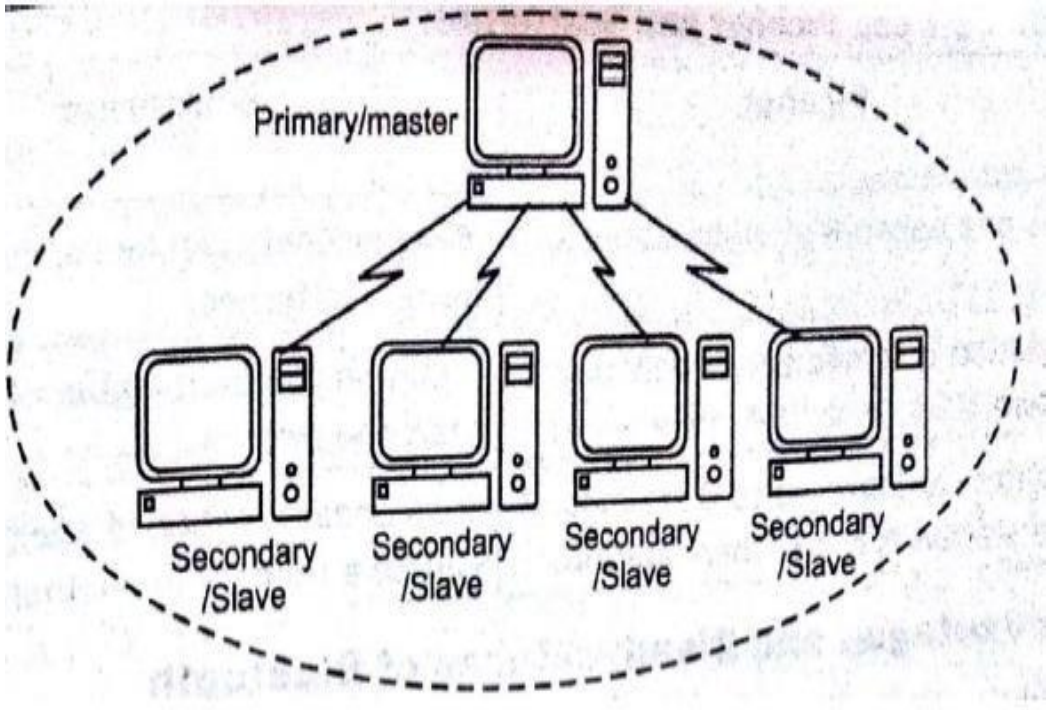
➢ Bluetooth Architecture:

- Bluetooth is low power consuming technology with transmission distances of up to 30 feet and a throughput of about 1 Mbps.
- Range: 10 meters, can be extended to 100 meters
- Bluetooth defines two types of networks:
  - 1. Piconet
  - 2. Scatternet

Bluetooth Architecture

➢ Piconet

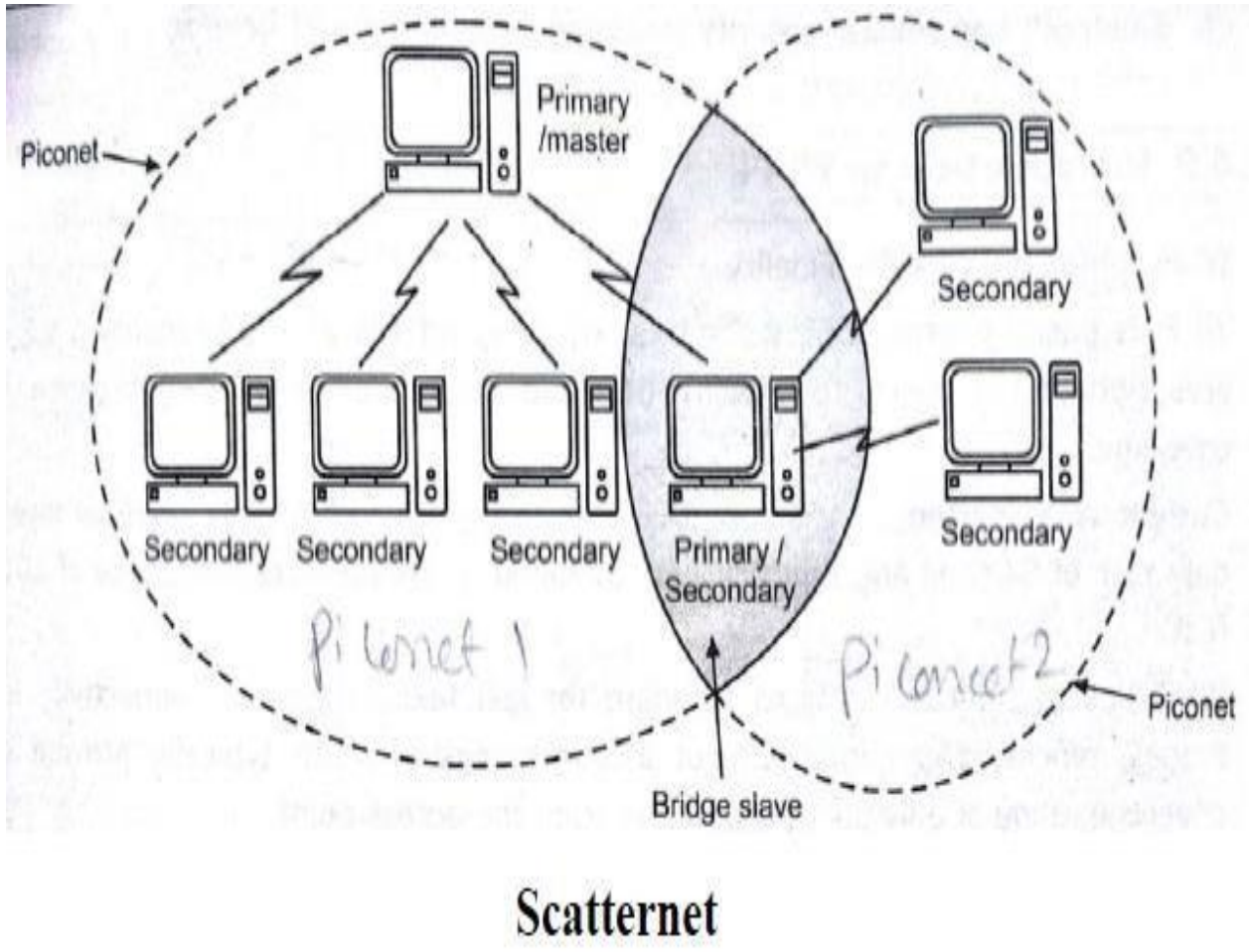
- It is a Bluetooth network that consists of one primary (master) node and seven active secondary (slave)nodes.
- It can have 8 active nodes within the distance of 10 meter.
- Communication between primary and secondary can be one-to-one or one-to-many.
- All communication is between master and slave.
- There can be only one primary or master station in each piconet.



PICONET

Bluetooth Architecture

➢ Scatternet

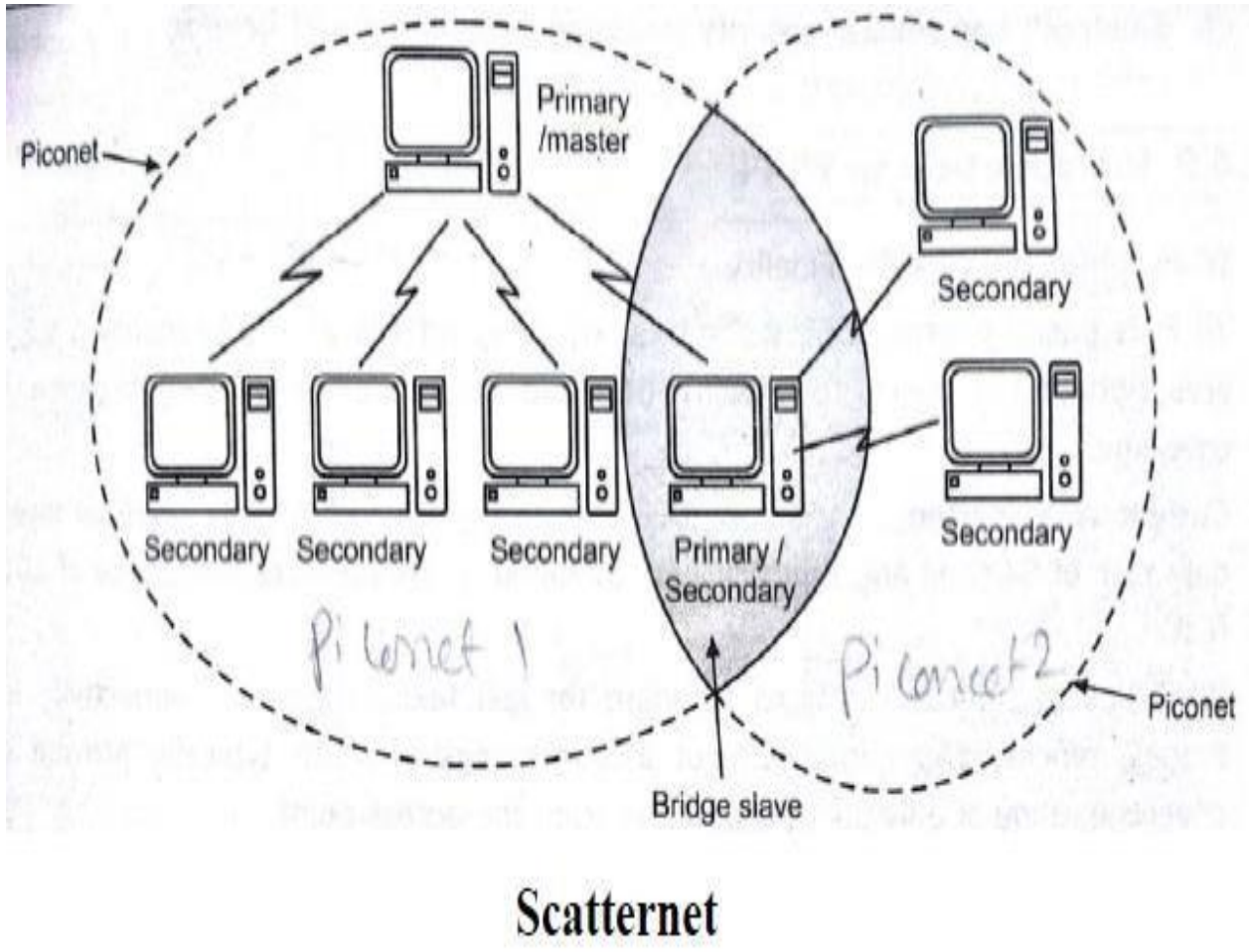


Scatternet

- Scatternet is formed by combining various piconets.
- Slave in one piconet acts as a master or primary in other piconet.
- A node can receive messages from master in first piconet and deliver the messages to its slave to other piconet where it is acting as master.
- This node is called bridge slave. This node cannot be the master of two piconets.

Bluetooth Architecture

➢ Scatternet



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Latest Technologies in Wireless Network

➢ Wireless Fidelity (Wi-Fi).

- History of Wifi
- Wi-Fi is an old concept, but its execution is a new concept. **ALOHA** System is a wireless network mechanism that was used to link **Hawaii island through a network in 1971.**
- **ALOHA protocol** was used for this, and packet transfer was used on the network in order to accomplish this task. **IEEE 802.11 protocol** is added later.
- This was followed by **Vic Hayes (known as the "Father of WiFi")** establishing **IEEE 802.11 Working Group for Wireless LANs in 1990.**
- In 1994, **Alex Hills** initiated a wireless network research project that covered seven buildings wirelessly.
- This wireless network was later renamed **IEEE 802.11a** by the Commonwealth Scientific and Industrial Research Organization **(CSIRO) in 1996.**
- After all of this, in 1997, the first version of **Wi-Fi, 802.11,** was released, which supports a maximum link speed of 2 Mb/s.
- When the link speed was increased to 11 Mb/s in 1999, it was called **11b.**

Latest Technologies in Wireless Network

➢ Wireless Fidelity (Wi-Fi).

- Wi-Fi is a wireless networking technology that allows devices such as computers (laptops and desktops), mobile devices and other equipment (printers and video cameras) to interface with the Internet.
- It allows these devices--and many more--to exchange information with one another, creating a network.
- Internet connectivity occurs through a wireless router. When you access Wi-Fi, you are connecting to a wireless router that allows your Wi-Fi-compatible devices to interface with the Internet.
- Wi-Fi networks have no physical wired connection between sender and receiver by using radio frequency (RF) technology -- a frequency within the electromagnetic spectrum associated with radio wave propagation. When an RF current is supplied to an antenna, an electromagnetic field is created that then is able to propagate through space.

Latest Technologies in Wireless Network

- **Wireless Fidelity (Wi-Fi).**

Latest Technologies in Wireless Network

- **Light Fidelity(Li-Fi)**
- **Li-Fi** (also written as **LiFi**) is a wireless communication technology which utilizes light to transmit data and position between devices.
- The term was first introduced by Harald Haas during a 2011 TEDGlobal talk in Edinburgh.
- In technical terms, Li-Fi is a light communication system that is capable of transmitting data at high speeds over the visible light, ultraviolet, and infrared spectrums.
- In its present state, only LED lamps can be used for the transmission of data in visible light.
- In terms of its end use, the technology is similar to Wi-Fi — the key technical difference being that Wi-Fi uses radio frequency to induce a voltage in an antenna to transmit data, whereas Li-Fi uses the modulation of light intensity to transmit data.
- Li-Fi can theoretically transmit at speeds of up to 100 Gbit/s.
- Li-Fi's ability to safely function in areas otherwise susceptible to electromagnetic interference (e.g. aircraft cabins, hospitals, military) is an advantage.
- The technology is being developed by several organizations across the globe.
- video link:- https://www.youtube.com/watch?v=AKvvEqm9Nv4

Latest Technologies in Wireless Network

➢ Gigabit Wireless (Gi-Fi)

- Gi-Fi or gigabit wireless refers to a wireless transmission system.
- Gi-Fi provides a data rate of more than one billion bits per second.
- It is faster version of Wi-Fi.
- In general if we will see it is ten times faster than WiFi technology.
- Gi-Fi technology is the transceiver of the world integrated on a single chip which operates at 60GHz using CMOS process.
- Gi-Fi defined in IEEE 802.15.3C standard.

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Latest Technologies in Wireless Network

➢ Wi-MAX?

- Wi- Max is a wireless internet service designed to cover wide geographical areas serving large number of uses at low cost.
- Wi-MAX is one of the hottest broadband wireless technologies around today.
- Wi-MAX systems are expected to deliver broadband access services to residential and enterprise customers in an economical way.
- Loosely, Wi-Max is a standardized wireless version of Ethernet intended primarily as an alternative to wire technologies (such as Cable Modems, DSL and T1/E1 links) to provide broadband access to customer premises.

https://www.youtube.com/watch?v=KQdc5AdJqCg

Latest Technologies in Wireless Network

➢ Wi-MAX

- Acronym for **Worldwide Interoperability for Microwave Access**.
- Based on Wireless MAN technology.
- A wireless technology optimized for the delivery of IP centric services over a wide area.
- A scalable wireless platform for constructing alternative and complementary broadband networks.
- A certification that denotes interoperability of equipment built to the IEEE 802.16 or compatible standard.
- The IEEE 802.16 Working Group develops standards that address two types of usage models −
  - A fixed usage model (IEEE 802.16-2004).
  - A portable usage model (IEEE 802.16e).

Latest Technologies in Wireless Network

➢ Why Wi-MAX?

- WiMAX can support very high bandwidth solutions where large spectrum deployments (i.e. >10 MHz) are desired using existing infrastructure keeping costs down while delivering the bandwidth needed to support a full range of high-value multimedia services.
- WiMAX can help service providers meet many of the challenges they face due to increasing customer demands without discarding their existing infrastructure investments.
- WiMAX can provide wide area coverage and quality of service.
- WiMAX, which is an IP-based wireless broadband technology, can be integrated into both wide-area third-generation (3G) mobile and wireless and wireline networks allowing it to become part of a seamless anytime, anywhere broadband access solution.

➢ Wi-MAX?

Applications:

- Video streaming
- VoIP
- Video Conference
- E-Learning

Applications of wireless network

Wireless networks are **used** into various sectors, like as -

- Satellite system
- Television remote control
- Wi-Fi
- Paging system
- Wi-Max
- Security systems
- Cellphones
- Computer interface devices
- Bluetooth
- GPS
- Garage door openers
- Baby monitors
- Certain video game consoles

- Walkie-talkies
- TV remote control
- Radios
- GPS systems
- Tablets
- Bluetooth mice
- Wireless keyboards
- Wireless mouse
- Wireless printers
- Laptop

Transmission Media

Summary

- *A guided medium provides a physical conduit from one device to another. Twisted-pair cable, coaxial cable, and optical fiber are the most popular types of guided media.*
- *Twisted-pair cable is used for voice and data communications.*
- *Coaxial cable can carry signals of higher frequency ranges than twisted-pair cable. Coaxial cable is used in cable TV networks and traditional Ethernet LANs.*
- *Fiber optic transmission is becoming increasingly popular due to its noise resistance, low attenuation, and high-bandwidth capabilities. Fiber-optic cable is used in backbone networks, cable TV networks, and Fast Ethernet networks.*
- *Unguided media (free space) transport electromagnetic waves without the use of a physical conductor.*

Transmission Media

Summary

- *Wireless data are transmitted through ground propagation, sky propagation, and line of-sight propagation.*
- *Wireless waves can be classified as radio waves, microwaves, or infrared waves.*
- *Radio waves are Omni-directional; microwaves are unidirectional.*
- *Microwaves are used for cellular phone, satellite, and wireless LAN communications.*
- *Infrared waves are used for short-range communications such as those between a PC and a peripheral device (Keyboard with PC, mouse with PC).*

Thank You !!!