

Dhabaleswar Institute of Polytechnic

Lecturer Notes

Sub - Mobile Computing
Sem - 5th.

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Dept:- Computer Science & Engineering

Introduction To Wireless Network And Mobile Computing

Network :-

- ⇒ A network is a collection of computers, servers, mainframes and network devices, peripheral or other devices connected to allow data sharing.
- ⇒ An example of a network is the internet, which connects millions of people all over the world.

Wireless Network :-

- ⇒ Wireless networking is method by which homes, telly communications networks and business installations avoid the costly process of introducing cables into a building or as a connection between various equipment locations.
- ⇒ Admin telly communication networks are generally implemented and administrated using radio communication. This implementation takes place over the physical level of the OSI model network structure.
- ⇒ Example:- Wireless network includes cellphone networks, wireless local Area Network, wireless Sensor Networks, Satellite communication networks and Terrestrial micro web networks.

Mobile Computing :-

- ⇒ It is a technology that allows transmission of data, voice and video via a computer, anywhere wireless enabled device without having to be connected to a fixed physical link.
- ⇒ The main components mobile computing are:-
 - Mobile Communication
 - Mobile Hardware
 - Mobile Software.

Characteristics Of Mobile Computing :-

Portability :-

- ⇒ The ability to move a device within a learning environment

⇒ or to different environment with social enter activity.
⇒ To ability to shared data and collaboration between users.

■ Context sensitivity:-

The ability to gather and respond to real or simulated data unique to a context, location, environment or time.

■ Connectivity:-

The ability to be digital connected for the purpose of communication of data in any environment.

■ Individual:-

The ability to use the technology to provide scaffolding on difficult activities and leason customization for individual learners.

■ Wireless Communications-

⇒ Mobile devices are typically capable of communication with other similar devices, with stationary computers and systems, with networks and portable phones.

⇒ Base mobile devices are capable of accessing the Internet through Bluetooth or WiFi networks, and many models are equipped to access cell phone and wireless data networks as well.

⇒ Email and texting are standard ways of communicating with mobile devices, although many are also capable of telephony and some specialized mobile devices, such as RFID and barcode.

■ Small size:-

Mobile devices are also known as handies, laptop, palmtop and smartphone due to there roughly phone like dimensions.

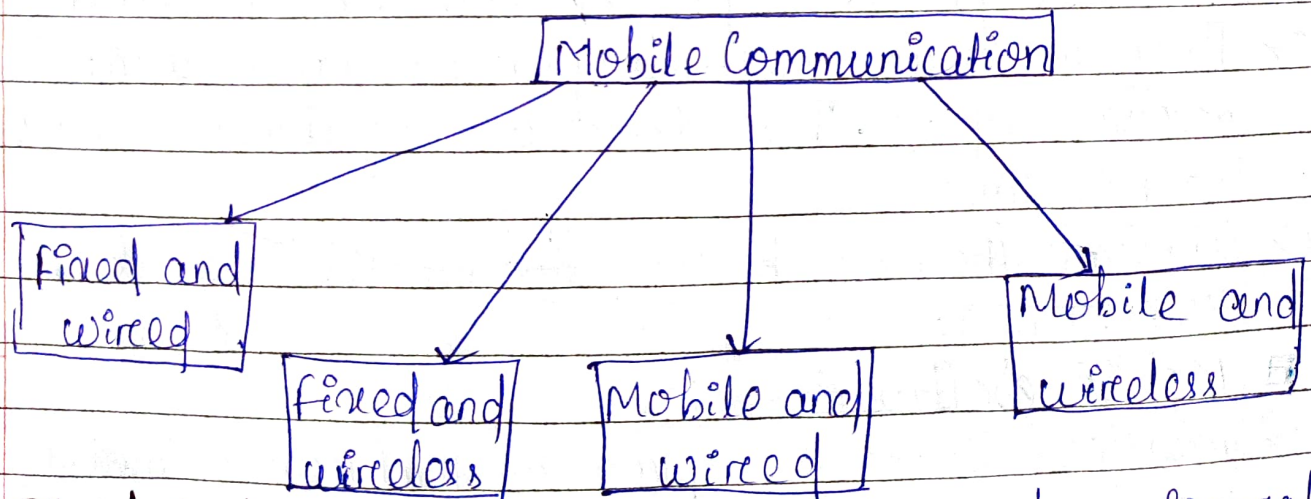
Mobile Communication:-

⇒ Mobile communication specifies a framework that is responsible for the working of mobile computing technology. Mobile communication refers to an infrastructure that ensure seamless reliable communication among wireless device.

⇒ This framework ensures the constance and ~~releability~~ reliability of communication between wireless devices. The mobile communication framework consist of communication devices such as protocol, services, bandwidth and protals necessary to fasilited and support the start services. These devices are responsible for ^{delivering} a smooth communication are process.

⇒ Mobile communication are four types:-

- (1) Fixed and wired
- (2) Fixed and wireless
- (3) Mobile and wired
- (4) Mobile and wireless



1. Fixed And Wired :- In Fixed and wired configuration the devices ~~are fixed at a position~~ and they are fixed at a position and they are connected through a physical link to communicate with the other devices.

Example - Desktop computer.

Client Server Architecture:-

Client Server architecture is a computing model in which the server host and deliver and managed most of the resources and services to be consumed by the client this type of architecture as one or more client computers ~~connect connect~~ connected to a central server over a network or internet connection client server and network.

Vocabulary For Components And Connector :-

➔ Client:- A piece of software application that send the input and send request to the server.

➔ Server:- A piece of software that receives and process request from clients.

Load Balancing:-

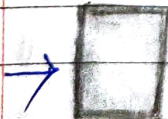
➔ It is responsible for distributing incoming network traffic ~~across are~~ across a group of backend servers to optimise resource usage. Network layer protocol such as TCP/IP.

➔ Topological Constraints:-

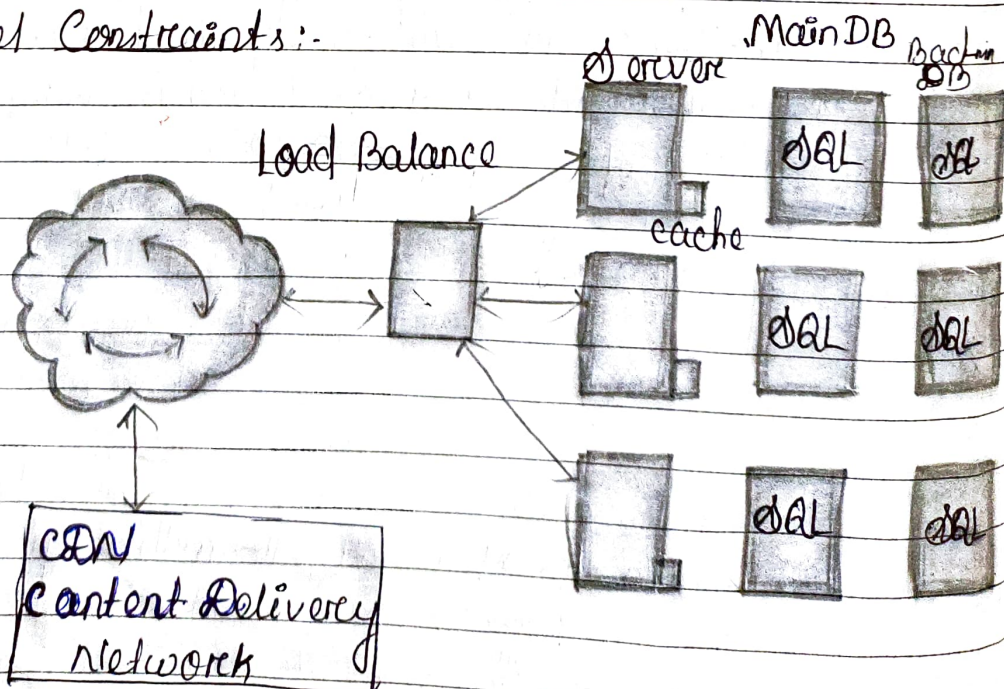
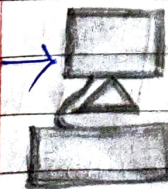
Android



MAC



PC



Advance Client - Server Diagram

⇒ The flow of data, it is unidirectional and forms a cycle of is usually initiated by client requesting some kind of data and the server processing the request and sending some kind of data back to client via a protocol client cannot directly talk to each other.

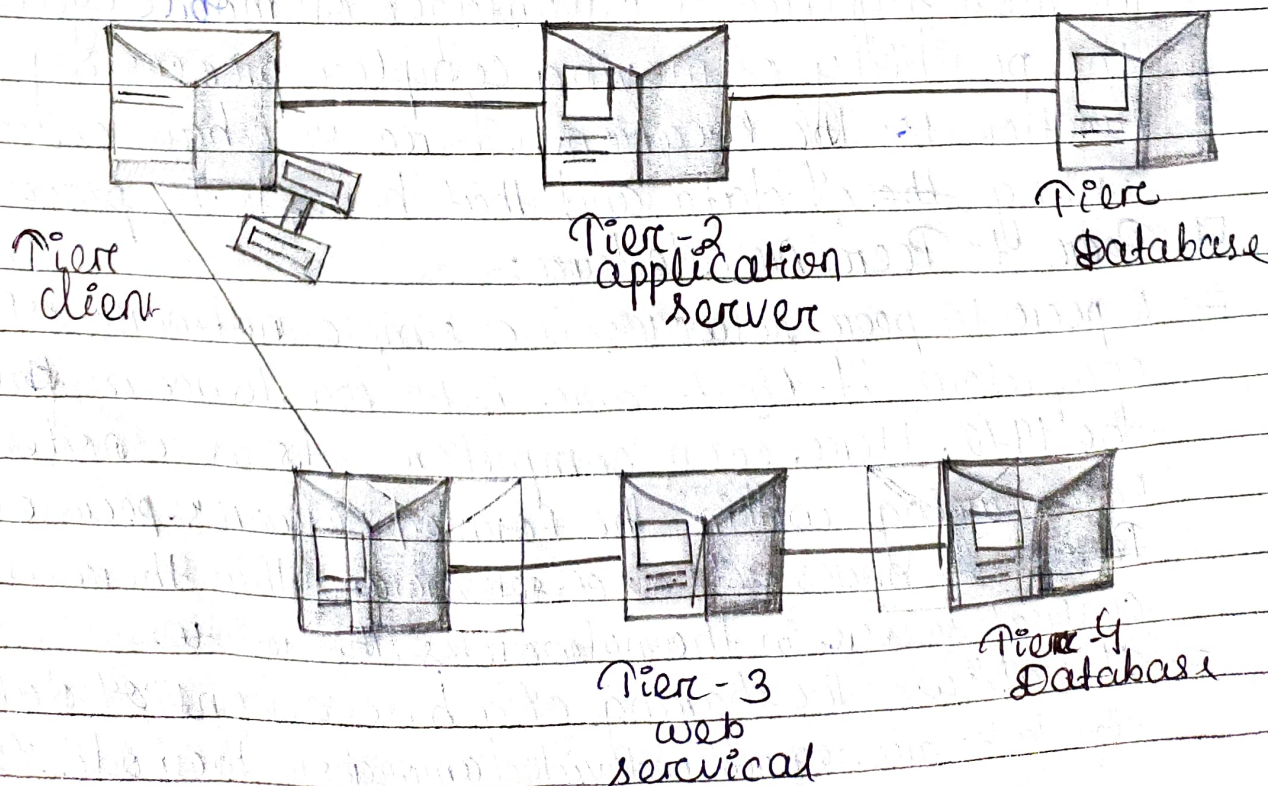
■ A typical Topological Flow:- goes as follows:-

1. Client request data from server.
2. Load Balancer routes the request to the appropriate server.
3. Server process the request ~~client~~ to client.
4. Server ~~pro~~ queries appropriate database for some data.
5. Database returns the query data back to the server.

■ N-Tier Architecture:-

This process repeats n-tier a architecture is a client server architecture. In software engineering where the presentation processing data management functional are both logically separated n-tier architecture is also known as multi-tier architecture.

■ N-Tier Architecture:-



node connected in the network shares and equal work load.
⇒ For the network to stop working, all the nodes need to individually stop working. This is because each node was independently.

■ Types Of Peer to Peer Networks:-

- 1) Unstructured peer to peer network.
- 2) Structured peer to peer network.
- 3) Hybrid peer to peer network.

1. Unstructured Peer To Peer Network:-

In this type of peer to peer network each device is able to make an equal contribution. This network is easy to build as devices can be connected randomly in the network. But being unstructured it ~~comes~~ becomes difficult to find content.

2. Structured Peer To Peer Network:-

It is designed using software that creates a virtual layer in order to put the nodes in a specific structured. These are not easy to setup but can give easy access to the users to the content.

3. Hybrid Peer To Peer Network:-

It combines the features of both peer to peer networks and client-server architecture. An example of such a network is to find a node using the central server.

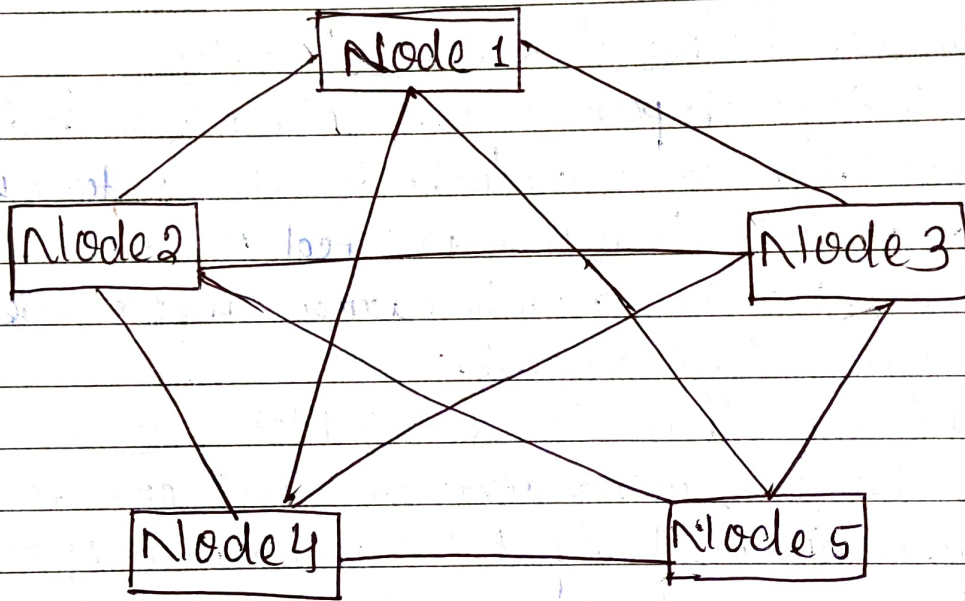
■ Peer To Peer Networks Architecture:-

In the peer to peer network architecture the computers connect with each other in a work group to share files and access to internet and printers.

⇒ Each computer in the network has the same set up responsibility and capability.

⇒ Each device in the network serves as both a client & server.

- ⇒ The architecture is useful in residential areas as, small offices or small companies where each computer act as an independent work station and stores the data on its harddrive.
- ⇒ Each computer in the network has the ability to share data with other computers in the network. The architecture is usually composed of workgroup of twelve or more computer.



P2P Architecture.

□ Definition Of N-tier Architecture:-

- ⇒ ~~N~~ N-tier architecture is also called as multitiere architecture. Multitiere architecture because the software in enginere to have to processing, data management and presentation functions physically and logically separated that means that these different functions are hosted on several machines or clusters, ensuring that services are provided without resources being shared and as such these services are delivery at top capacity. 'N' in the name n-tier architecture refers to

■ Introduction:-

⇒ Wireless communication is the fastest growing and most vibrant technological ~~area~~ areas in the communication field. Wireless communication is a method of transmitting from 1 point to another without using any connection like wires, cable or any physical medium.

⇒ Generally in a communication system information is placed over a limited distance with the help of wireless communication. The transmitter and receiver can be placed anywhere between few meters like a TV remote control to few ~~thousand km~~ 1000 kilo. (satellite communication) some of the most commonly used wireless communications systems are mobile phones, GPS, remote control, Bluetooth audio and wifi etc.

■ Signal:-

A signal is an electrical or electromagnetic current that is used for carrying data from one device or network to another. frequency is the number of radio waves that can travel during a single ~~etc~~ second and is expressed in terms of hertz (Hz). frequency is the number of radio wave that can travel during 3 single sec and expressed during high frequency is have short wave length.

■ Bandwidth v/s Frequency:-

Bandwidth	Frequency
① Bandwidth is defined as the difference between the highest and the lowest frequencies of a signal generated width a g within a given band.	① Frequency means the state of being at the rate at which an event occurs over a part particular period of time.

Bandwidth

Frequency

② It is the maximum amount of data which can be transferred over a network in a specified period of time.

③ It refers to the width of a band which carries the ~~set~~ same amount of information regardless of the location of the band in the frequency spectrum.

④ Bandwidth is expressed as a bit rate, and measured in bits per second. (bps).

② It is used to measure processing speed and is defined as the rate of radio signal to send and receive communication signal.

③ Frequency standards are often characterised as active and passive devices.

④ Frequency is measured in hertz (Hz) which represents there of cycles per second.

Antennas:-

⇒ A Antenna is a metallic structured that is used to ~~the~~ transmit radio electromagnetic waves we can defined with as the launching of waves or radio stations in space, which is efficiently accomplished with die-electronic structured called antenna.

⇒ An antenna asked as a ~~a~~ transducer that converts the electrical power into electro-magnetic waves. The electric charges are the sources of the electromagnetic waves.

⇒ The transmitting antenna carries the electric current converts it into the form of radiation, and transmits it into space.

⇒ The antenna can be used as a transmitting antenna other a receiving antenna. The antenna uses voltage and current from the source to launch ~~electron~~ ~~electron~~

electromagnetic waves into the particular medium.

⇒ There are different types of antenna. Such as:-

- (i) Omnidirectional Antenna
- (ii) Semidirectional Antenna
- (iii) Directional Antenna.

□ Signal Propagation:-

⇒ This is the movement of radio waves from a transmitter to a receiver. When the waves travel from one point to another, they are like light waves affected by different phenomena such as light reflection, observation or scattering.

Like wire networks, wireless communication networks also have senders and receivers. Signals wireless transmission propagate in three modes.

⇒ Such as:-

- (i) Ground wave propagation
- (ii) Sky wave Propagation
- (iii) Line of sight propagation

(i) Ground Wave Propagation:- Ground wave propagation are the radio waves propagating parallel to an adjacent to the surface of earth.

Following the curvature of the earth. This is also known as surface wave / ground wave.

~~Antenna:-~~

□ Sky Wave Propagation:-

Sky wave propagation is a radio wave transmission in which the electro magnetic wave spreads because of the reflection mechanism of the ionospheric layer of the atmosphere. It is also known as ~~the~~ ionospheric wave propagation since it involves the ionosphere in this mode of propagation.

electromagnetic waves emitted from an antenna and directed at work at greater angles are reflected back to earth by the ionosphere.

□ Line Of Side Propagation:-

Line of side Propagation is a characteristic of electromagnetic radiation in which two stations can only transmit and receive data signals when there is indirect view of each other with no obstacle between. Satellite and microwave transmission are common examples of Line of Side propagation.

□ Multiplexing:-

- ⇒ Multiplexing is a technique used in the area of electronic and signal processing in mobile computing.
- ⇒ Telecommunication and computer networks use multiplexing as a method that can be used to combine multiple Analog and digital signals into one signal over a shared medium.
- ⇒ The main aim of using this method is to share a scarce resource.

□ Example:-

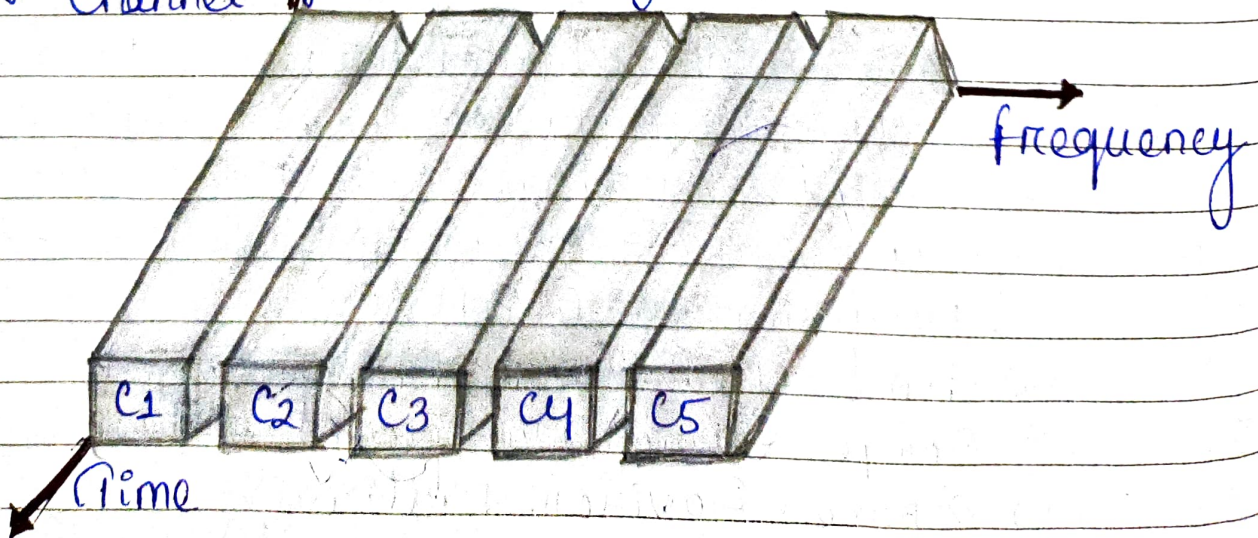
- ⇒ You can see a real life example of multiplexing in the telecommunication field where several telephone calls may be carried using one wire. Multiplexing is also called as muxing.
- ⇒ Multiplexing can be classified into 4 types:-
 - (1) Frequency Division Multiplexing
 - (2) Time Division Multiplexing
 - (3) Code Division Multiplexing
 - (4) Space Division Multiplexing.

(1) Frequency Division Multiplexing :-

⇒ Frequency division multiplexing is a ~~best~~ ~~inherently~~ and analog technology as the name specifies in frequency division multiplexing. The frequency dimension spectrum is split into smaller frequency bands. It combines several smaller distinct frequency ranges signals into one medium and sends them over a single medium. In FDM the signals are electrical signals. The most common application of FDM are a traditional radio and television broadcasting mobile and satellite stations. ~~are~~ cable television.

⇒ Example:- In cable TV you can see that only one cable which reaches to customer locality but the service provider can send multiple television channel or signal simultaneously over that cable where all customer without any interference the customers have to tune ~~for~~ of the appropriate frequency to access the required signal.

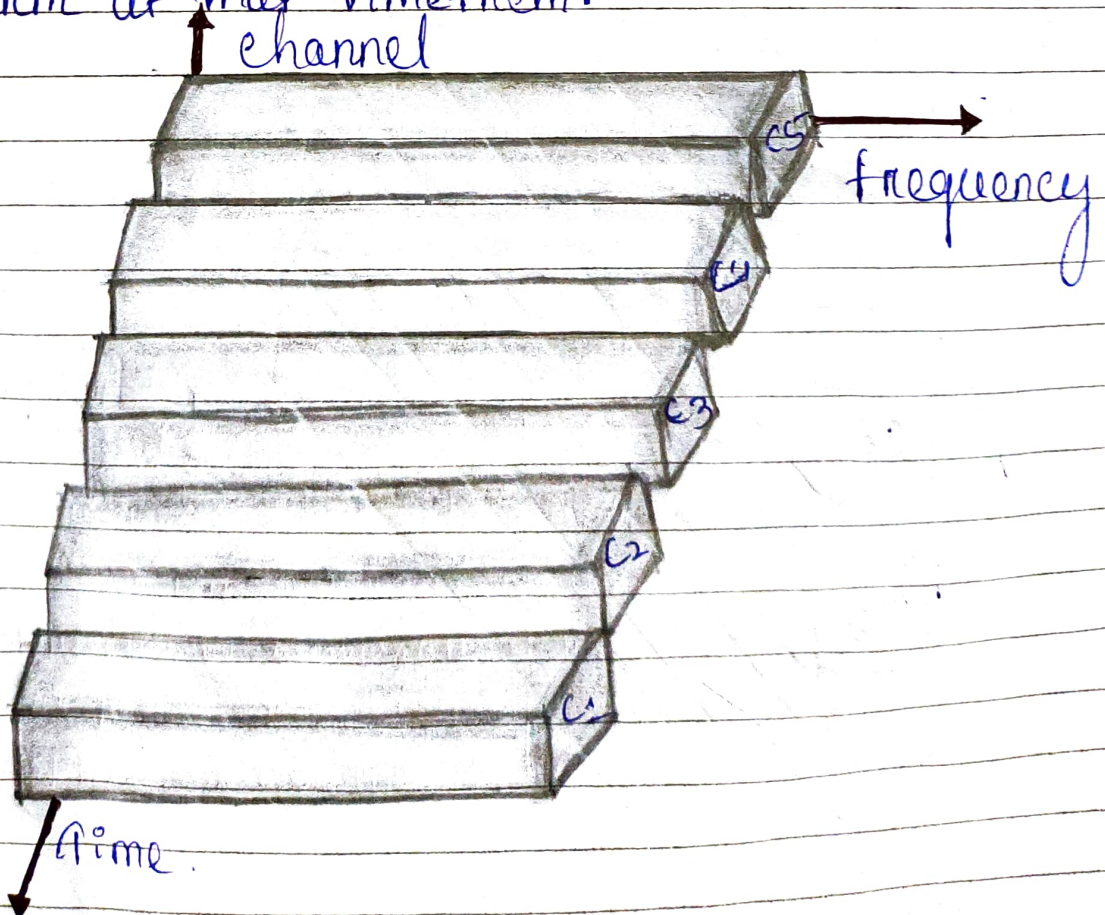
⇒ In ~~several~~ FDM several frequency bands can work simultaneously without any time constraint.



- **Advantages:-** The concept of FDM applies to both analog signals and digital signal it facilitates you to send multiple signals simultaneously within a single connection.
- **Disadvantages:-** It is less flexible. In FDM the bandwidth wastage may be high. It is used in radio and television broadcasting stations, cable TV etc.

(2) Time Division Multiplexing (TDM):-

- ⇒ The time division multiplexing is a digital or analog technology that uses time instead of space or frequency to separate the different data strings. It is used for a specific amount of time in which the whole spectrum is used.
- ⇒ The time frames of the same intervals are divided so that you can access the entire frequency spectrum at that time frame.



Advantages:-

1. It is highly efficiency.
2. It faces ~~few~~ fewer interference.

Disadvantages:-

1. The data transmission load is low.
2. It is complex.
3. It is mainly used in telephones spectrum technology such as 2G, 3G, etc.

(4) Space Division Multiplexing :-

⇒ The space Division Multiplexing (SDM) is a combination of FDM and TDM. It passes messages or data parallel with the use of specific frequency. At a specific.

⇒ It means a particular channel used against a specific frequency band for some amount of time.

Advantages:-

1. In space Division Multiplexing the data transmission rate is high.
2. It uses time and frequency band at its maximum potential.

Disadvantages:-

1. An interference may offer.
2. It faces high interference losses.

Uses:-

⇒ It is used in Global Service for Mobile (GSM) technology.

Modulation:-

⇒ Modulation is a process of mixing signals with a sinusoid to produce a new form of signals. The newly produced signals has contain benefit over all modulated signal. ~~Mixing of~~

Introduction:-

- ⇒ A medium access control is a network data transfer policy, that determines how data is transmitted between two computer terminal a network table essence of the MAC.
- ⇒ Protocol is to ensure non-collision and eases the transfer of data packets between two computer terminal.
- ⇒ MAC is a sublayer of data link layer of the OSI reference model for data transmission. It is responsible for flow control and multiplexing for transmission medium.
- ⇒ It sends data over the network interface card. The datalink layer is the second lowest layer. ~~It~~ It divided into two sublayer. There are:-

1. Logical link Control sublayer (LLC)
2. The Medium Access Control sublayer (MAC)

Functions OF MAC Layer:- It provides an abstraction of the physical layer to the logical link control sublayer & upper layers of the OSI network.

- (ii) It is responsible for encapsulating frames so that they are suitable for transmission via the physical medium.
- (iii) It resolves the addressing of source station as well as the destination station of groups of destination stations. It performs multiple access resolution when more than one data frame is to be transmitted. It determines the channel access methods for transmitted transmission. It also performs collision resolution and initiating

retransmission in case of collisions.

- (iii) It generates the frame check sequences and thus contributes to protect against transmission errors.

MAC Addresses:- MAC address or media access control is a unique identifier allotted to a network interface controller of a device. It is used on a network segment like ethernet, wifi and bluetooth. MAC address is

- ⇒ MAC address is assigned to a network adapter at the time of manufacturing. It comprises six groups of two hexadecimal digits separated by hyphens, columns or no separators. An example of MAC address is 00:0A:89:5B:F0:91.

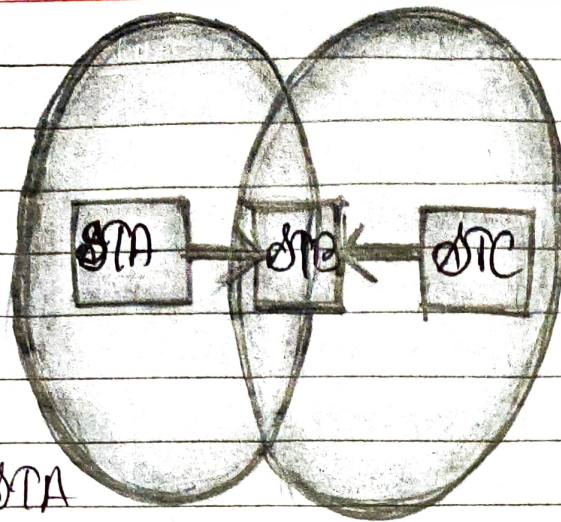
Hidden Terminals:- In wireless LAN, the hidden terminal problem is a transmission problem that arises when 2 or more stations who are out of range of each other transmit simultaneously to a common recipient.

- ⇒ This is prevalent in decentralised systems where there aren't any entity for controlling transmissions.
- ⇒ This occurs when a station is visible from a wireless access point (AP), but is hidden from other stations that communicate with the AP.

Problem Illustration:-

Suppose that there are three stations labelled STA, STB, and STC, where STA and STC are transmitting while STB is receiving. The stations are in a configuration such that the two transmitters STA and STC are not in the radio range of each other. The figure:-

Range of station STA



Range of station STC

- ⇒ The above diagram shows that station STA starts transmitting to station STB. Since station STC is out of radio range of STA, it perceives that the channel is free and starts transmitting to STB. The frames received by STC are garbled and collision occurs. The situation is known as the hidden terminal problem.

Solution:-

- ⇒ The exposed terminal problem is solved by the MAC (Medium Access Control) layer protocol IEEE 802.11 RTS/CTS, with the condition that the stations are synchronized and frames size and data speed are the same. RTS stands for Request to Send and CTS stands for Clear to Send.
- ⇒ A transmitting station sends a RTS frame to the receiving station. The receiving station replies by sending a CTS frame. On receipt of CTS frame, the transmitting station begins transmission.
- ⇒ Any station hearing the RTS is close to the transmitting station and remains silent long enough for the CTS. Any station hearing the CTS is close to the receiving station and remains silent during the data transmission.
- ⇒ In the above example, station STC hears does not hear RTS from station STA, but hears CTS frame from

Wireless LANWireless LAN :-

Introduction :- Wireless LAN stands for Wireless Local

⇒ Area Networks. It is also called LAN (Local Area Network). WLAN is one in which a mobile user can connect to a Local Area Network (LAN), through a wireless connection.

⇒ WLAN is a wireless computer network that links two or more devices using wireless communication to form a local area network within a limited area, such as a home, school, computer lab or office building. This gives users the ability to move around within the area and remain connected to the network.

Types of WLAN :-

WLAN is standardized by IEEE 802.11. Operates in two basic modes infrastructure and ad-hoc mode.

• Infrastructure Mode :-

Mobile devices and client connect to an access point (AP) that in turn connects via a bridge to LAN or internet. The client transmits frames to other clients via the access point.

Ad-Hoc Mode :-

Clients transmit frames directly to each other in a peer to peer fashion.

Advantages of WLANs :-

- They provide clutter free home, offices, and other network process.
- The LANs are scalable in nature that is devices may be added and removed from the network at greater ease than wirelans.
- The system is portable within the network coverage. Access to the network is not bounded by

the length of the cables.

- Installation and setup are much easier, ~~at~~ than wire devices.

- The equipment and setup cost are reduced.

Disadvantages of WLAN:-

- Since radio waves are used for communication the signals ~~noiser~~ with more interference from nearby system.
- Greater care is needed for a encrypting information. They are more prone to errors, so they require greater bandwidth than the wirelans.
- WLANs are slower than LANs.

Bridge:-

A bridge can be used to connect networks typically on different type. A wireless ethernet bridge allows the connection of devices on a wired ethernet network to a wireless network. The bridge acts as the connection point to the wireless LAN.

Infrared:- (IR)

IR sometimes called infrared light is electromagnetic radiation with wavelength longer than those of visible light. It is therefore invisible to the human eyes. Infrared radiation is emitted or observed by molecules when changing rotational or vibrational movements.

Radio frequency:- (RF)

Radio frequency is the oscillation rate of an alternating electric current or voltage or of a magnetic or electric or electromagnetic field, mechanical system in the frequency range from around 20 kHz to 300 GHz. This is roughly between the upper limit of audio

frequency and lower limit of ~~to~~ IR frequency.
Infrared Transmission:-

IR transmission uses the frequency range from 300GHz to 400THz to carry signal. we use transmission to transfer data between mobile phones, laptops and wireless mouse or a keyboard.

Infrared's Advantages:-

- ⇒ IR transmission required ~~men~~ minimum power to operate and can be set ~~up~~.
- ⇒ This is the secure way to transfer data between devices. as a signal can't pass beyond a room or a chamber.

Infrared's Disadvantages:-

- ⇒ The speed of data transfer in infrared is slow.
- ⇒ Infrared can be used for a small range distance.
- ⇒ Infrared signals are interpreted by object and people.
- ⇒ These signals are impacted by weather conditions.
- ⇒ Infrared waves at high power can damage eyes.

Advantages of Radio Frequency:-

- ⇒ It has different penetration through the walls of the building etc houses based on the frequency. Hence it is used for radio & TV transmission and for cellular mobile phone service.
- ⇒ Used ~~to~~ It is used in various medical application and instruments used for ~~sur~~ surgery. It is used in ~~the~~ MRI for taking images of human body. It is used for skin tightening.
- ⇒ It is used in radar for object ~~data~~ detection.

Disadvantages of Radio Frequency:-

- ⇒ Uncontrolled radiation of radio frequency affects childrens, pregnant women, elderly human, p.

paces maker, small birds and insects etc.

⇒ The areas near radio frequency cellular towers have been ~~obj~~ observed with more listening compared to other areas.

⇒ It also affects some of the fruit grown near the RF tower radius.

⇒ RF waves are available both in LOS and Non-LOS reasons of transmitter. It can be easily intercepted by the hackers and ~~executed~~ personal or official data can be decoded for malicious activities or flood activities.

Wireless Network Logical Architecture:-

The logical architecture of a network refers to the structure of standards and protocols. The enable connections to be established between physical devices or ~~know~~ nodes and which control the routing and flow of data between the nodes.

Since logical connections operate over physical links, the logical and physical architecture rely on each other but the two also have a high degree of independence as the physical configuration of a network can be changed without changing its logical architecture.

The same physical networks can in many cases support different sets of standards and protocols.

Types of WLAN:-

WLANs:- (Wireless Local Area Network):- WLANs allow users in a local area such as a university campus or library, to form a network or gain access to the internet. A temporary network can be formed by a small number of users without the need of an access point (AP). ~~Even that~~

they don't need access to network resources.

WPAN: (Wireless Personal Area Network):-

The two current technologies for wireless personal Area networks are infrared and bluetooth. These will allow the connectivity of personal devices within an area about 30 feet. However infrared requires a direct line of sites and the range is less.

WMAN (Wireless Metro Politan Area Network):-

This technology allows the connection of multiple network in a metropolitan area, such as different buildings in a city, which can be alternating or backup of laying copper or fiber cabling.

WWAN (Wireless Wide Area Network):-

These types of networks can be maintained over large areas such as cities or countries via multiple satellite systems or antenna sites looked after by an internet services provider (ISP). These types of system are referred to as second generation system (2G).

* IEEE 802.11 :-

⇒ It is a part of the IEEE 802.11 set of local area network technical standards and specifies the set of media access control and physical layer protocol for implementing wireless local Area Networks computer communication.

⇒ The stands are created and maintained by the Institute of Electrical & Electronic Eng. (IEEE). LANs and MANs standard committee IEEE, 802. The base version of the standard was released in 1997. IEEE 802.11 uses various frequency including but not limited to 2.4 GHz, 5 GHz, 6 GHz.

and 60GHz frequency bands. Although IEEE 802.11 specification lists channels that might be used the radio frequency spectrum availabilities allow varies significantly by regulatory domain.

* MAC Layer (Media Access Control Layer):-

The part of the data link control protocol that controls access to the physical transmission medium in local networks. The common MAC layer technologies are CSMA/CD (Carrier Sense Multiple Access/Collision Detection) for ethernet and ~~similar~~ CSMA/CA (Carrier Multiple Access/Collision Avoidance). For WiFi enabled MAC layers were the token passing methods in token ring, FDDI and MAP. MAC layer

⇒ MAC layer functionality is built into the network adapter, which includes a Unique ~~to~~ serial ~~no~~ number that identified the vendor and adapter to see data link protocol.

Security:-

There are three security services specified are IEEE for WLAN network such as authentication, confidentiality and integrity. Authentication takes care of ~~by~~ denying the access for the stations who don't authenticate with the access point. Confidentiality, the prevent on ~~otherised~~ ~~entry~~ entry into the WLAN network. This prevent on otherised user, forems gaining access to any particular users critical and Confidential Information. Integrity, is used to ensure that any type of on authorised modification, destruction or creation of information can't be done.

Introduction:-

Ubiquitous computing is a concept in software engineering and hardware Engg. and computer science where computing is made to appear any time and anywhere. In

In contrast to desktop computing ubiquitous computing can occur using any device, in any location and any format.

Ubiquitous networking is known as pervasive networking is the distribution of communication infrastructure and wireless technologies throughout the environment to enable continuous connectivity.

Scenario of Mobile Communication:-

Mobile communication is the use of technology, that allows us to communicate with others in different locations without the use of any physical connection. Mobile communication ~~makes our~~ makes our life easier and it saves time and efforts.

