5th sem 23/07/2020 TH5 - Mobile Computing

Unit 1 Introduction to wireless networks and Mobile Computing

1.1) Networks

→ Networks are everywhere like office, business houses, institutes, research organizations, etc almost everywhere.

→ A network is a communication system that enables computer users to share computer equipments, application s/w, data/information etc. by wired or wireless (using radio waves) communication media.

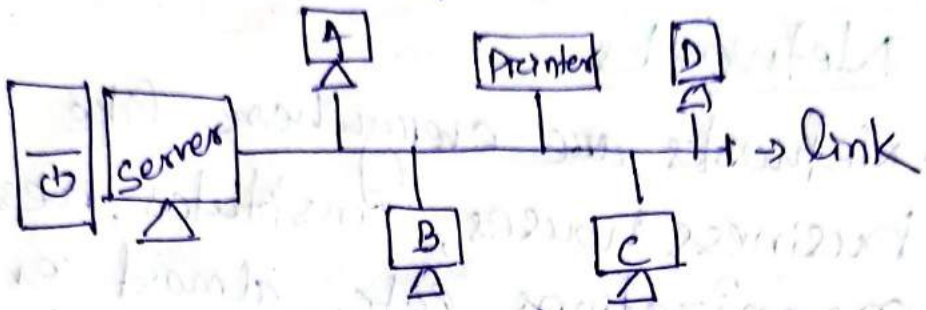
→ The wired media like coaxial, twisted and fiber optic cable.

→ Wireless network spread spectrum technology. In this network data is transmitted by high frequency radio signals.

→ the wire-based network technology. was used for connecting computers. This technology falls into three category.

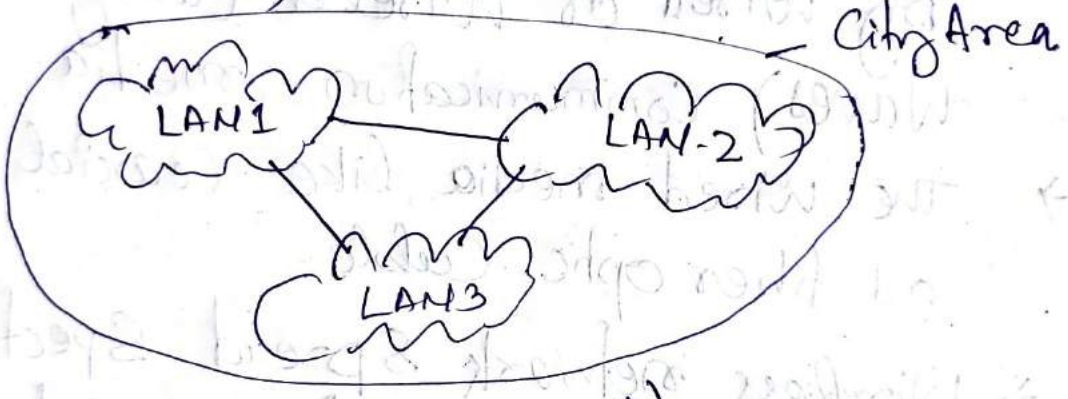
i) Local Area Network (LAN)
ii) Metropolitan Area Network (MAN)
iii) Wide Area Network (WAN)

→ LAN supports sharing of applications within a small fixed ~~boundary~~ boundary like office, bulding etc.



(LAN Network)

→ MAN :- It covers the boundary of campus or city area and connects several LAN's by optical fiber cable for data transmission



(WAN Network)

→ WAN :- It uses telephone circuits, leased lines and private circuits to communicate globally to whole world using by circuit and packet switching networks and protocols.

Internet
Intranet
Extranet

1.2) Wireless Networks

→ A wireless network is connection between network devices - computing and networking that are connected logically without wires.

→ It means it is a telecommunication network in which the devices are communicated without use of wires.

→ Wireless network are implemented with information transmission system which uses electromagnetic waves, such as radio waves.

→ The term wireless is generally used in IT equipments such as cellular telephones, Personal Digital Assistants (PDAs), smart phone etc. Other examples are GPS units, Auto door openers, Wireless mouse & keyboard etc.

Wireless Communication involves! -

* Radio frequency Communication
* Microwave Communication
  Ex:- long range line-of-sight via highly directional antennas.
* Infrared (IR) short-range communication
  Ex TV remote controls

→ In wireless communication medium electromagnetic waves carry the data signals.
Ex:- cellular phones, PDAs, GPS device, Satellite phones, Satellite television etc.

1.3) Mobile Computing

-> Mobile Computing is the computing environment over physical mobility.

-> The user of a mobile computing environment is able to access data, information or other logical objects from any device in the network while on move.

-> It allows the user to perform task from anywhere using computing device in public, corporate and personal information areas.

Dimensions of Mobile Computing

There are five dimension of mobile computing as follows! -

1) Location Awarceness
2) Quality of Service (QoS)
3) Limited Device Capability
4) Limited power Supply.
5) Support for a wide variety of user interface (UI)

WAP?

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1) Location Awareness
→ A mobile device is not be fixed in a same place.
→ Maintaining the location of the user is a big challenge for the application developers. There are various methods for collecting data of location of user and devices.

2) Quality of Service (QoS)
→ Using any type of network (wired or wireless) mobility means loss of network connectivity.
→ The quality of service is helps to take care of the mobile application so there is no connectivity issue.

3) Limited Device Storage Capability
- All mobile devices are having limited storage capacity (Now storage increses but it has limit)
→ Now a days engineers are developing more processing CPU and storage in to a small chips.

4) Limited power Supply
→ Now a days we all are seen the display size of a mobile

devices increases so batteries are the main resources of power for mobile devices.

→ So day by day battery are improving by processing unit and working purpose of device.

5) Support for a wide variety of User Interface (UI)

→ Mobile applications can also be by standalone devices like PC's with same data is shown in mobile.

→ Flexible application always needed update for adding new features in to existing user interface.

1.4) Mobile Computing Characteristics

There are six characteristics supports for mobile computing environment

1) User Mobility
2) Network Mobility
3) Bearer Mobility
4) Device Mobility
5) Session Mobility
6) Service Mobility.

1) User Mobility

→ A user should be able to move one location to another and uses the same service without any interruptions.

Ex A user is moves from Balasore to Bhadrak and uses the Internet access his application same as he uses in his office.

2) Network Mobility

→ A users should be able to move one network to another network and use the same service.

Ex:- A user moves from USA to Odisha then he uses the same GSM services to access his application by WAP.

3) Bearer Mobility

→ A user should able to move from one bearer to another and use the same service.

Ex:- Suppose a user from Hydrabad using service through WAP and he moves to Bhubaneswar where WAP not supported then he connected SMS bearer or Voice bearer to access the same service.

4) Device Mobility

→ A User should be able to move from one device to another and use the same service.

→ Ex:- A user access application through desktop/laptop etc and he is during outside by using mobile/PDA's also access same application without any problem.

5) Session Mobility

→ The users session should be moved from one environment to another.

Ex:- A user using CDMA network and another network and disconnected. then he goto his office and used that desktop for the same access. So the unfinished session moves from mobile to desktop.

6) Service Mobility

→ A user moves from one service to another.

Ex:- Suppose a user start e-mail service for writing ~~some~~ matter at that time another information comming so he switchs application and after finish again switchs back to e-mail service and send message in mobile device.

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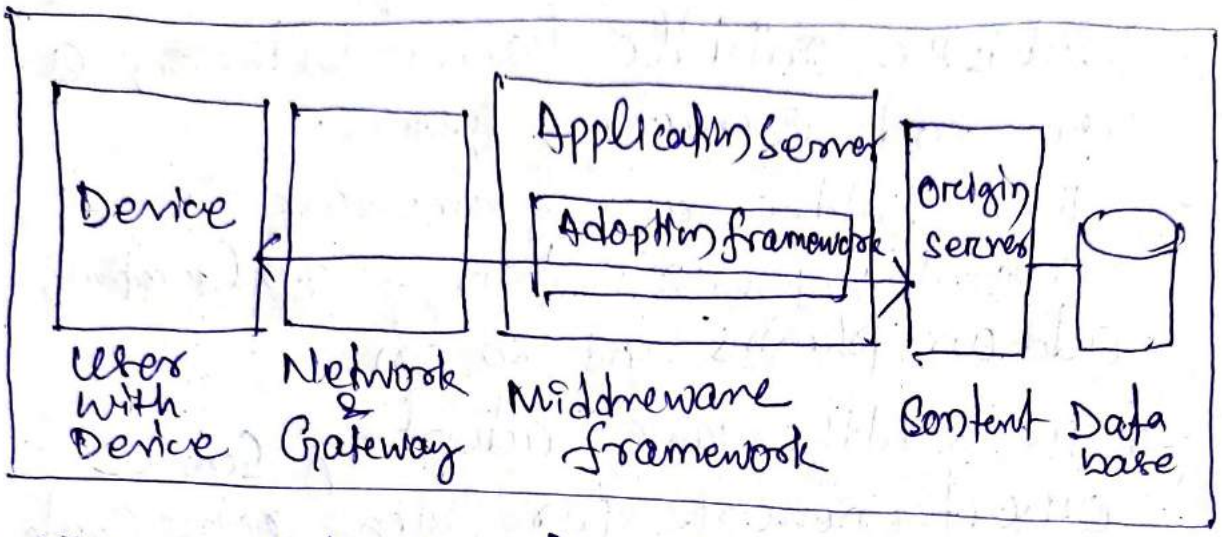
Mobile Computing functions



→ The mobile computing functions are logically divided by five segments such as:-

1) User with Device:-
   → The user can use any computing devices for access the content (request/respond) by use of mobile, desktop, PDA's etc.

2) Network
   → The user can access network which is used in diffrent, with diffrent time.
   → A mobile device can access or get the same service with diffrent networks.

3) Gateway:-
   → It is used to connect two diffrent bearers for accessing the Common content without lossing any connection.

Ex:- A person 'A' is exploring online shopping site, he/she go to the hardware section to

to buy a product, then the application redirected to payment gateways.

4) Middleware framework
→ It is the middle layer between a user and operating system.
→ The middleware framework is responsible for maintaining application, add on plugins and so on.
→ The middleware adopting some otherframework for fixing any content related issue.

5) Content
→ It is the origin server where the data are stored.
→ Without content we cannot access the information which is demand by a mobile user.
→ The content helps to store application server, data server etc.
→ The origin server is directly connected to the database.

5) Applications of mobile Computing.
→ Now a days all user (mobile users, desktop users) are using a lots of application which is very much use-full for daily needs.
→ Some of major applications are listed below! -

Ex!- Health, Retail, Marketing
Railway Inquery,
Ticket Booking Information
Lifestyle,
Game.
Industry
Online Shopping.
Mobile Banking
POS apps (point of services)

→ To our life better the Smartphone developers provided a lot of applications for daily use

→ Adroid Smartphone is an advanced application (OS), so the use interface UI, and some addition applications to better service for any Smart phone device.

→ Free and open Source Operating System Software, so the developer can easily develop application for android user and place them into playstore.

Ex!- Browsing application
Operamini, google chrome.

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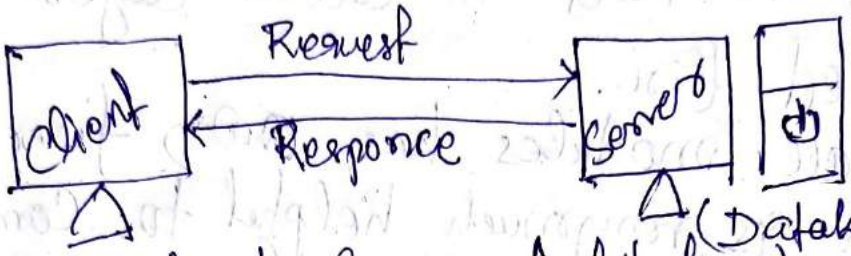
Unit-2

Introduction to Mobile Development Framework

2.1) C/S Architecture (Client-Server Architecture)



(Client-Server Architecture)

→ This architecture are simple used as web technology.

→ In this architecture a client is uses a browser to send request towards the Server.

→ The Server is responsible to take the request and provide responce to the desired client.

→ In this architecture applications are stored in different machines or same machine which is virtually connected.

→ A client request any query by html to the server and then the Server responce to that data by adding html tag with and sends to the desired client.

→ HTML language is interpreted by browser

1.2) N-tire Architecture

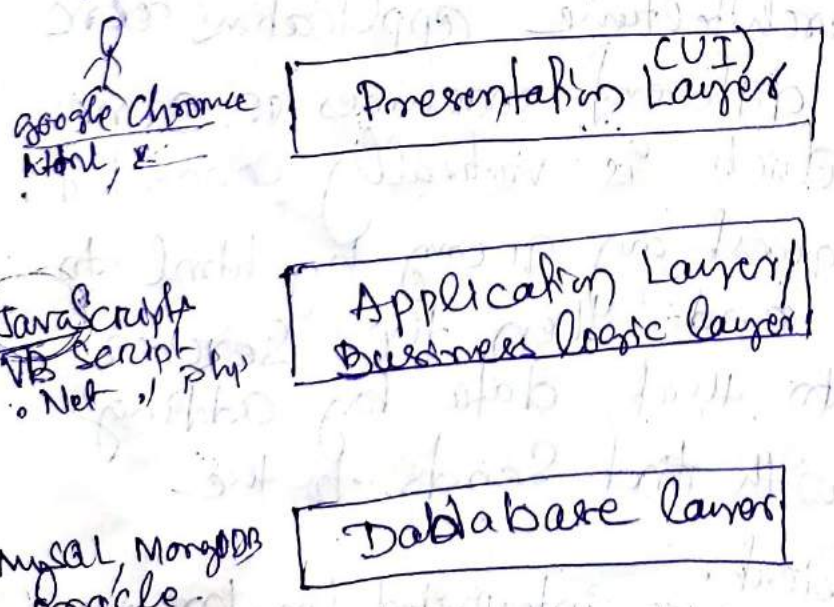
What is tire?

→ A tire is an application which is fragmented (divided) in to small & small modules is called layers or called tire.

→ So all modules has own functions which is very much helpful to communicate from one to another layers.

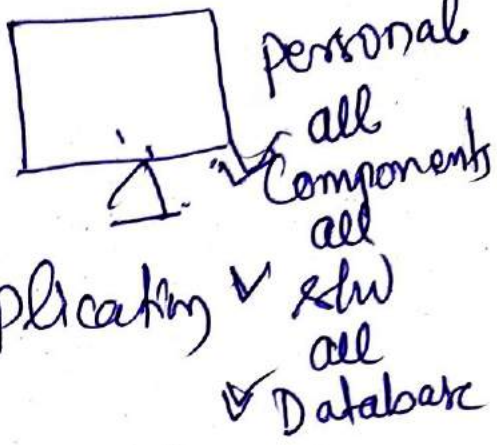
→ In today world the web communicating is rapidly going faster and faster to that the network traffic is create congestion.

→ There are various tire architecture is used that are - 1-tire, 2-tire, 3-tire and some of additional 3-tire is called n-tire architecture/model.



1-tire Architecture.

→ This is a simplest architecture for maintaining user interface, Database in to it, like a personal computer has an applicatin Software.



→ A user user has own browser, own database, he wants to run an applicatin (web apps) it in it. so all Components are installed among that Computer.

→ the scalability is not possible, not web applicatin is developed as networking is not present.

2-tire architecture

→ This architecture supply a basic network between a client and a server.
→ The best example of this architecture. Is the basic web model (client-server) is 2-tire architecture.
→ A web browser makes a request to a web server, then the request processed and responce returns to the desired client.
→ This approaches improves scalability So that it divided user interface from the data server layer.
→ So its makes difficult to update data.
→ The entire application must be updated on server because layers aren't separated.

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3-tier architecture :-

-> This architecture is used to built the web application and it more flexible as compared to 2-tier architecture.

-> In this model the browser acts like a client, middleware or application server (Business logic layer) Contains business logic and database Server handles all data functions not getting any problem of individual layers.

-> It is scalable but not as compared to n-tier architecture, which has more modules (layers) is separated to do all work into smaller functions.

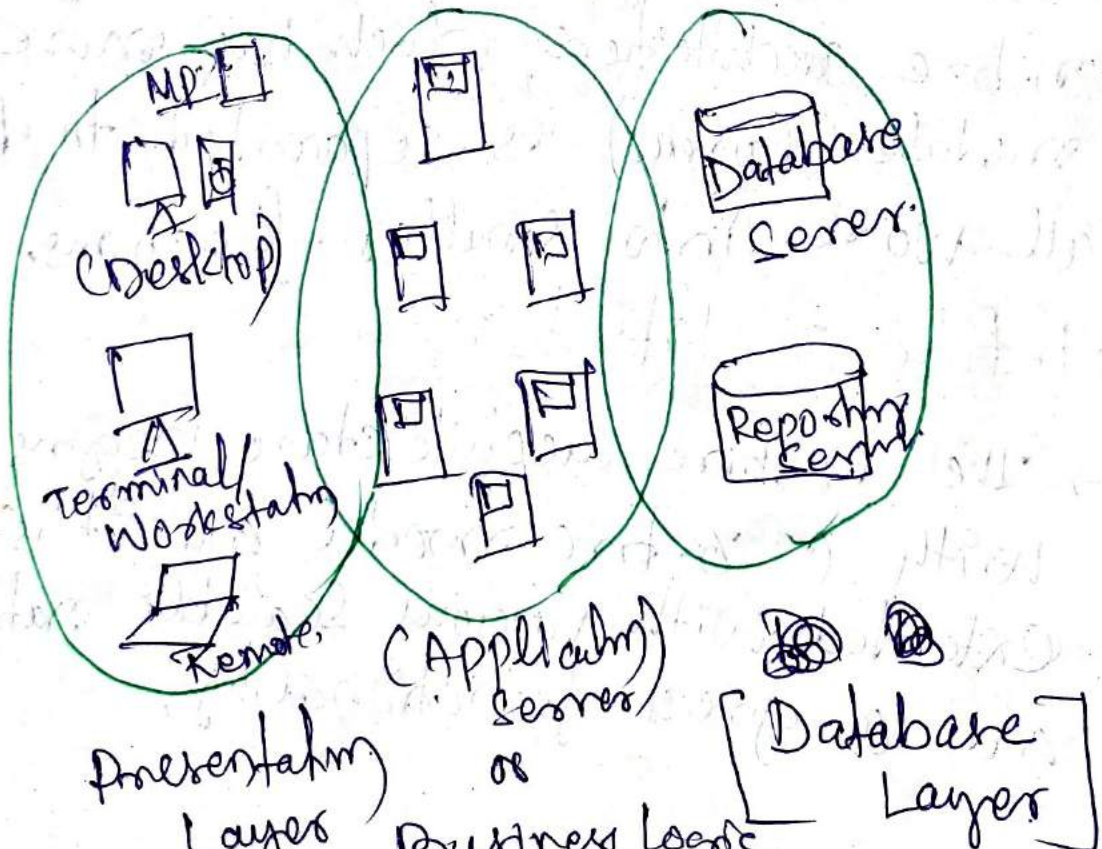
N-tier architecture

-> The n-tire architecture begins with a 3-tire model and it is extended with various scalable nature and a great functionality.

→ The n-tire is the ability for full scalling features and the greater functionality, greater flexibility of a System.

→ The workload is distributed among all layer to responce to the desired client.

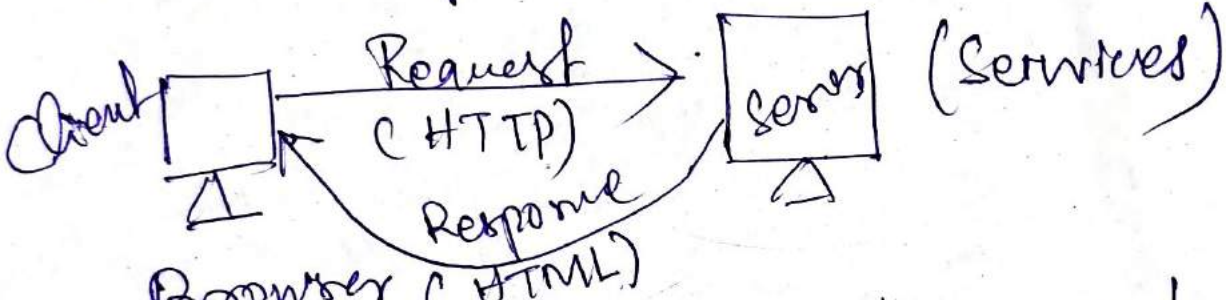
→ It also called System's modularity, So that Application Server into a Separate layer for any Updating ~~[illegible]~~ with the application without any problem.



2.3) N-tire architectures and the WWW

→ A web is actually a client-server mechanism, where the client and server communicate through HTTP (HyperText Transfer protocol).

→ The clients are the browsers which interpret the user interface in HTML and other client side scripting languages for rendering user interface.



Browser interprets HTML to Human understanding. the user used UI to display the requested data.

→ The Server are the web Server which serves the client request coming from HTTP with HTML as response

http:\\ www. ____ .com

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2.4) Peer-to-Peer Architecture

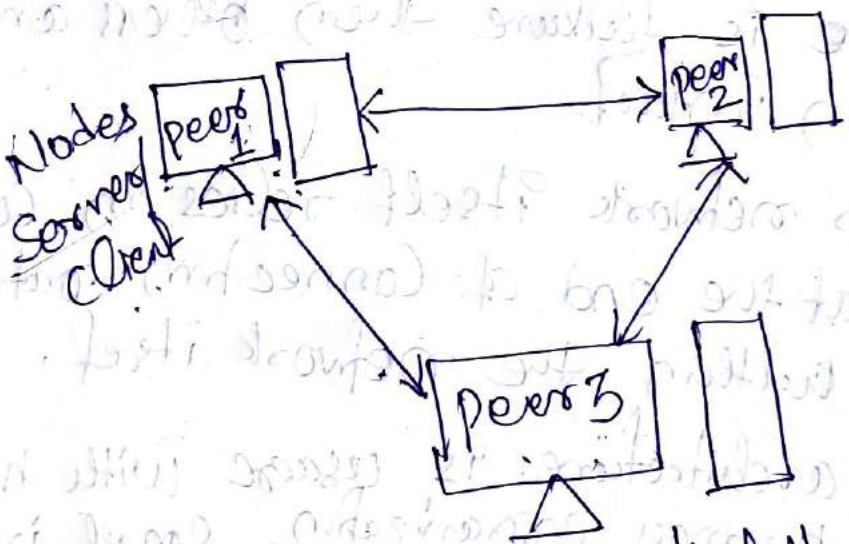
→ In the client-server architecture there are multiple clients are connected to a centeralized location (Server).

→ Always the Server needs a network to connect and "alone service" is failed.

→ The peer-to-peer architecture is very much flexible as compared to c/s architecture.

→ The peer-to-peer architecture is also called P2P network.

→



→ The P2P network is distributed communication environment and the work load is faster as compared to c/s mechanism

→ It is a simplest network where the nodes is called peer.

→ the file is transmitted through this network is very fast and the confidential message is blocked if not authorized is placed.

→ In the p2p network communicating application is installed to the peers (Nodes).
→ The applications such as Server as well as Client application is installed.

→ In p2p network all Server and all Client software installed in each node So every nodes is responsible and ability for requesting and Servicing to each and every other nodes.
→ The data is stored in every machines (local machine) it is very much advantage if one is failure then others are remain intact.

→ In p2p network itself relies on computer power at the end of Connection rather than from within the network itself.
→ The p2p architecture is usage with home users, business organization, small industries because it is Cost-effective and sharing the files very fast.

Advantages:-
→ No need for network administrator.
→ p2p network is fast or inexpensive to Setup and maintainance.
→ Each PC can make own backup copies so data flexibility is available.

→ P2P is perfect for home, small office, and small business purpose. (12)

→ SBS (own server) (P2P)

Ex:- Team viewer (P2P)
Skype (P2P)

2.5) Mobile Agent Architecture

→ The mobile user can move from one network to another one peer to another, but the service is constant.

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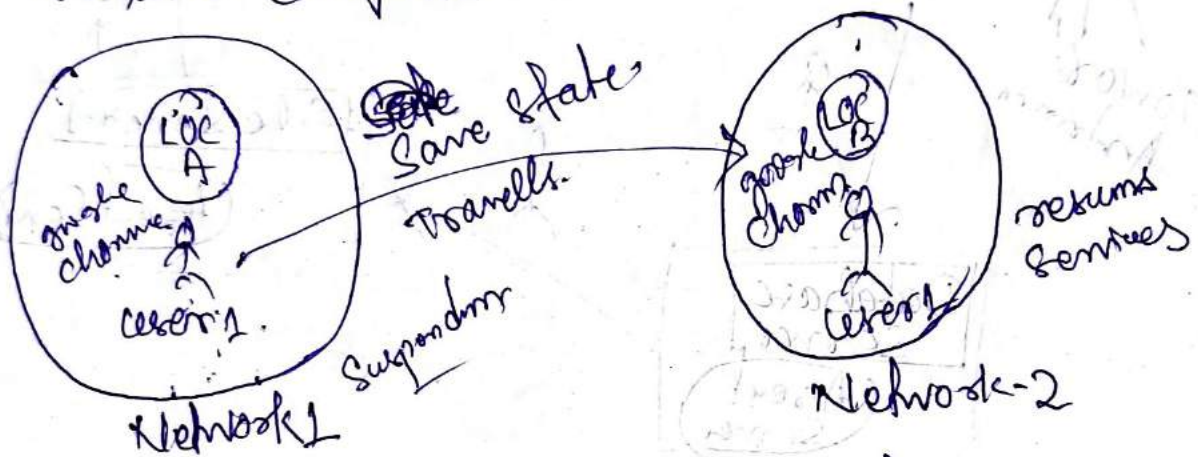
2.5) Mobile Agent Architecture

→ The mobile agent can migrates from one location to another system (host) to another and there is no service is detected.

→ A user user1 is migrated location 'A' to location 'B' and the service is remains constants.



→ An agent is an independent software program which runs on behalf of a network user.

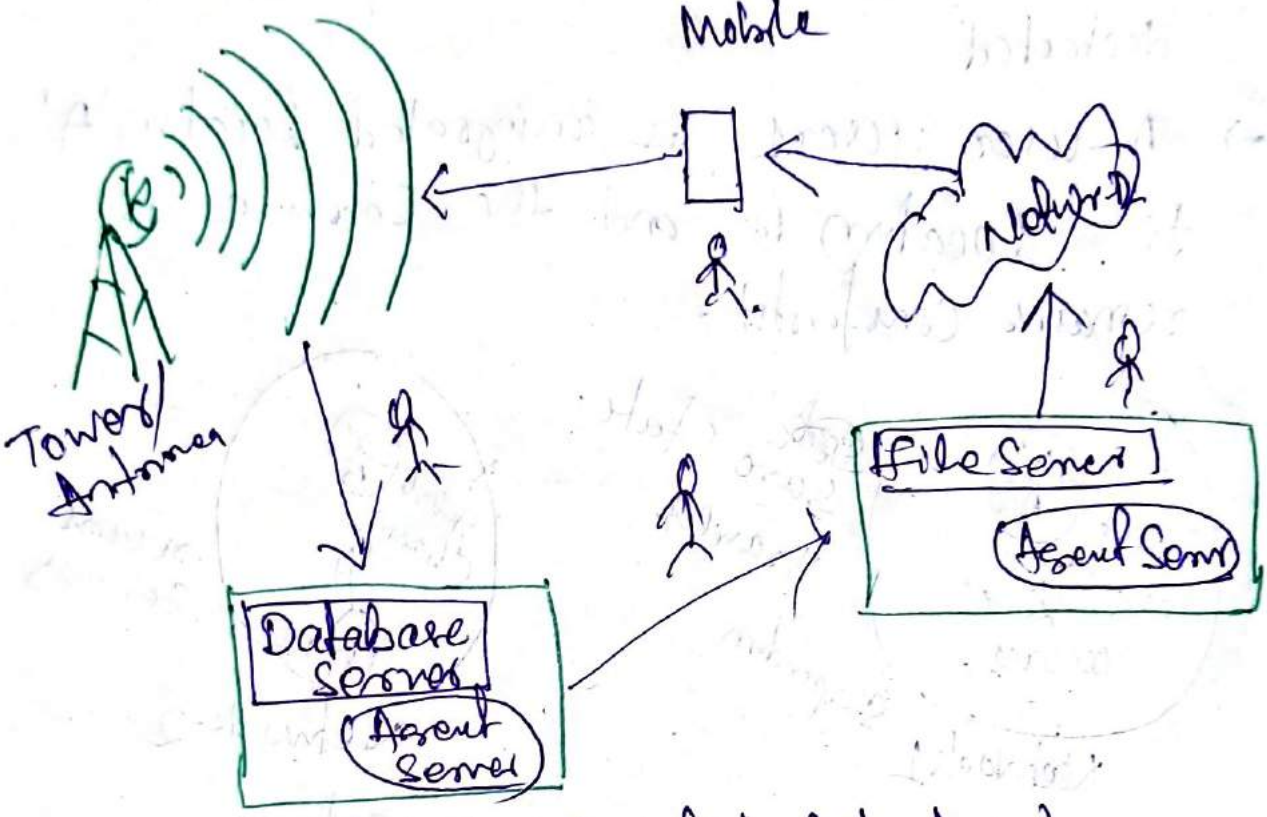
→ The Agent decides any place and when or where to move next.

→ A mobile agent is a program that, once it is lunched by the user, can travel from one node to another "autonomously" and can continue service to the user even if the user is disconnected from the network.

How does it work?

→ It working in just 3 steps.

1) Save State
2) Transport from Save state to the next node / System.
3) Resume executing of Saved state.



(Mobile-Agent Architecture)

→ Mobile agent based software system have a totally different architecture from Client-Server, N-tire architecture etc.

→ It hides data and code which are transmitted from client machine to the remote server for execution.

→ No relationship with mobile user, device or any other aspects of mobility.

→ They are Software which move from Server in a network while keeping the State of application is intact. (No loss of the service)

→ the mobile agent can manage their own life cycle, this means we can't do load or unload the application manually or store many applications on the devices.

→ Hence the usage of CPU and other resources are minimized and Simplified.

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Unit-3 Wireless Transmission

3.1) Introduction

-> DCCN — Transmission Media < Guided media (MODEM)
TCP/IP - 5 layer (physical layer) Unguided media.

→ The physical layer is deals with the data and signal.

→ At physical layer, data is moved in the form of "electromagnetic" signals, across the transmission medium.

→ The data in any physical devices is present in the form of 1's and 0's to be converted in energy in forom of electromagnetic signal.

→ These electromagnetic signal can be travel through wire in case of wired network or can be travel through open space in case of wireless network.

→ Signal are normally broadcast through free space (air) and it is available to anyone who has a device is capable of receiving received them.

Ex:- FM (frequency Modulation)

→ The electromagnetic spectrum, ranging from 3KHz to 900 THz which is used for wireless transmissions.

FM
VHF
UHF

Radio / Microwave	Infrared	Visible Light

3KHz 300 GHz 400 THz 900 THz

→ In wireless transmission the signal can travel from the source to the destination in several ways ie propagation
- there are 3 propagations such as:- (renders the ionosphere)

① Ground propagation (below 2MHz)
② Sky propagation (2 - 30MHz)
③ Line-of-Sight (LOS) propagation (above 30MHz)

→ the Radio transmission (traveling of waves through air) can take part from many different frequency bands.

→ the frequency spectrum is shared by civil, government and military users at all nations by maintaining regulations at ITU (International Telecommunication Union)

3.2) Signal

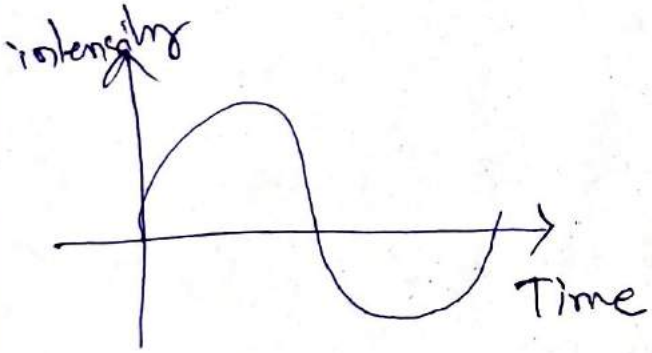
→ Signals are the physical representation of the data.

→ The data when sends over physical medium it needs to first convert into electromagnetic signals.

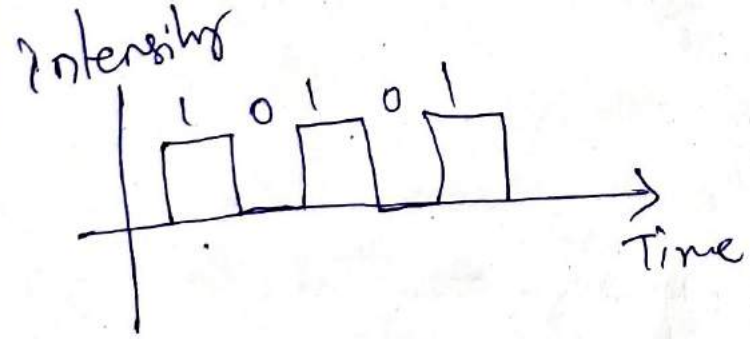
Data itself ← Analog Ex Human voice
Digital Ex) - file/data on a disk (0 & 1).

→ Signal are divided by two types
① Analog Signal
② Digital Signal.

→ The signal for radio transmission are percodic Signal.
→ That percodic signal are signals that repeat themselves after certain amount of time.
→ The signal parameters are the amplitude 'A', the frequency 'f', Period 'p', phase 'i'.
→ The sine wave is perodic signal (Analog)



Analog Signal



Digital Signal,

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3.2) Signals :-

→ Signals are the physical representation of data.

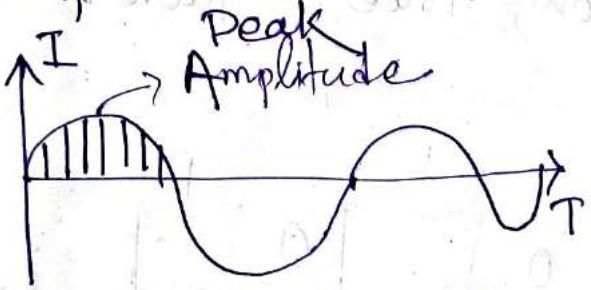
Signal
- Analog Signal (Ex Human voice)
- Digital Signal (Ex Content on disk)

1) Analog Signals

→ A simple analog signal is a sine wave.

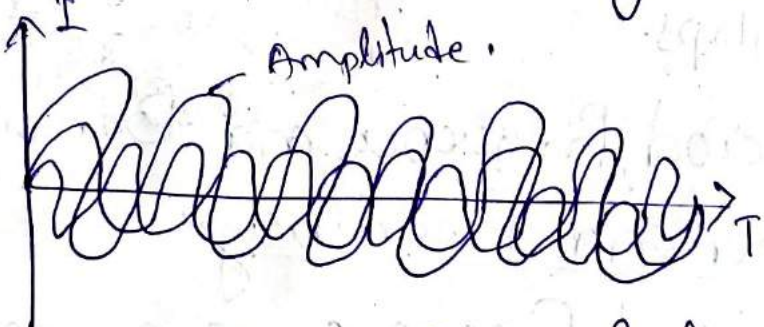
→ Analog Signal has two types

* Simple Sine wave analog signal



→ It is a collection of only a single sine wave signal.

* Composite Sine wave analog signal



→ It is collection of multiple sine wave signal.

→ An analog signal has most fundamental form of a periodic.

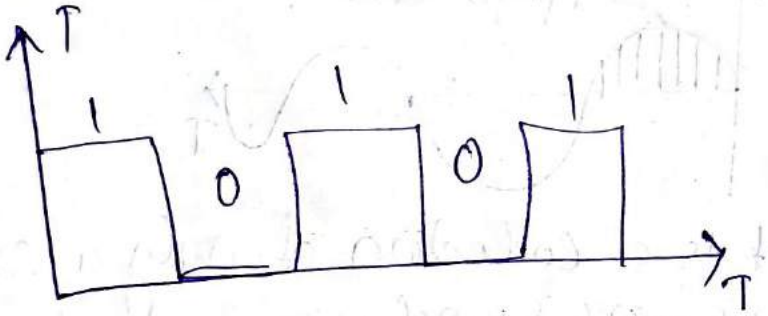
→ A periodic signal completes a pattern within a time frame called a period.

→ The completion of one full pattern is called cycle.

→ ~~Both~~ Analog signals required much less bandwidth, only about 4.5MHz with 143.5 mbps of data rate.
→ Ex:- Telephone voice signal is analog.

2) Digital Signal

→ Digital signals are transmissing signals that carry information in a discontinuous stream of on/off pulses.
→ Digital signals have two amplitude levels called nodes, the value such as 1 or 0, high or low, true or false.

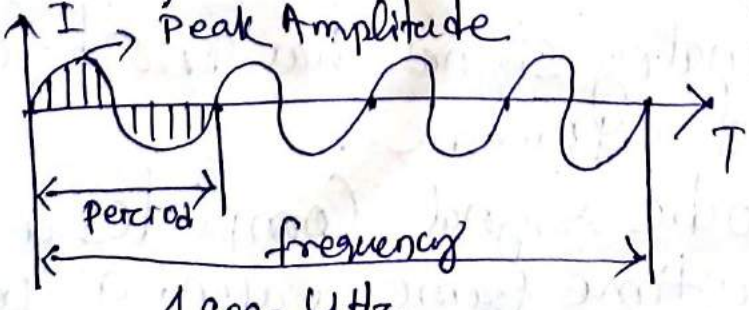


→ It require much high bandwidth as much as 74.25 MHz with data rate of 1485 mbps.

3.3) Period, frequency and Bandwidth

Period and frequency

→ Period and frequency are measured by Second (Sec) and Hertz (Hz).



→ The Period is the time was taken to complet a rotation of the Curve.

→ The total number of rotations of Curve in one Second is called its frequency.

→ frequency = $\frac{1}{\text{period}}$ and period = $\frac{1}{\text{frequency}}$.

→ So frequency and period is Inversly proporsonal to each other.

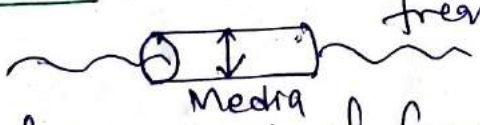
Amplitude

→ It is the value/intensity that are Carried by the Signal.

→ The maximum value of a Signal is called as peak amplitude.

→ In the electric voltage the peak amplitude is measured in "volt".

Bandwidth



→ The total number of frequency that a medium can pass is called its bandwidth.

Ex:- If a medium can pass frequency between 1000 and 5000, its bandwidth is 4000 Hz

→ So that we can say that we need a medium with bandwidth of 4000 Hz.

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3.4) Antennas


(radiates signals in air.)

→ Antennas are the metalic structures designed for transmitting and receiving electromagnetic waves or radio waves.

→ It is also called aerial.

Defination according to IEEE standard :-

"The part of transmitting or receiving system that is designed to radiate or receive electromagnetic waves/radio frequency.

→ Antennas are used in system such as radio, television, broadcasting, point-to-point radio communication, wireless LAN, radar, space communication etc.

→ Antennas are used in free space (air).

→ The waves are travel with velocity of light speed i.e 3×10^8 frequency.

- Antennas are divided in to two types :-

1) Omni-Directional (Radiates equally in all direction)

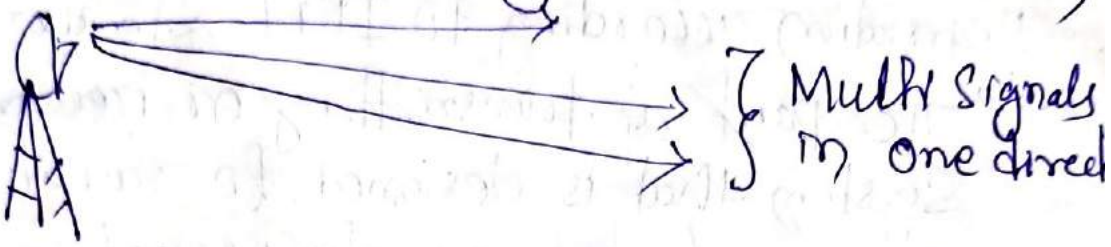
→ This antenna is radiates electromagnetic waves in all direction.

2) Directional Antenna :-

→ It radiates more than one signals in one directions.

→ It has more gain than the omni-directional antenna.

→ It is used for long distance transmission



→ So a truly omni-directional antenna trasmits its powers in all directions where directional antenna Concentrates most of its power in one direction.

3.5) Signal Propagation :-

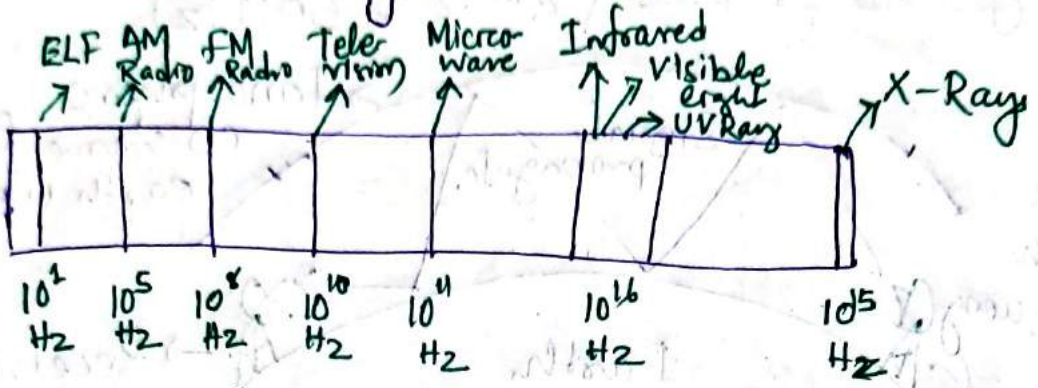
→ It nothing but travelling of signals through some medium in case of wire or wireless.

→ In Wire Communications Cables are used like Co-axial, twisted pair

→ In air signal travels from transmitter to received by three types of propagation.

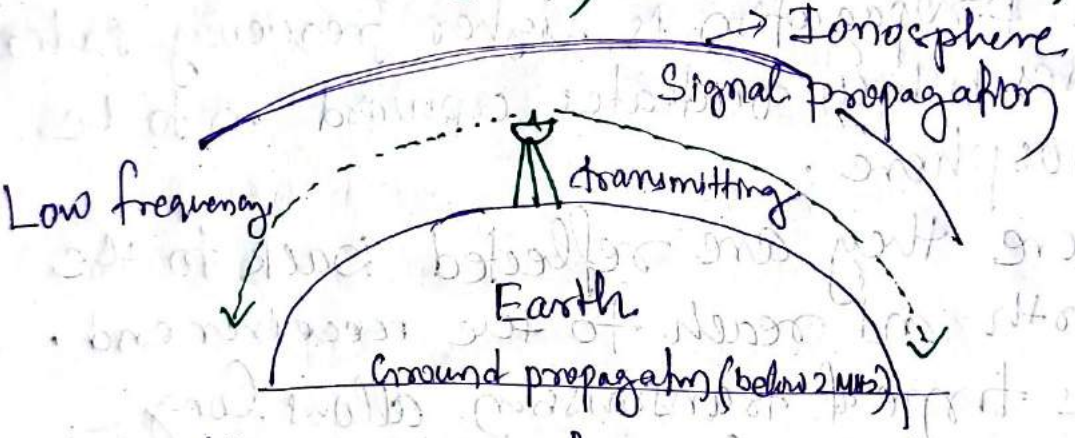
a) Ground propagation (below 2 MHz)
b) Sky propagation (2-30 MHz)
c) Line of sight (above 30 MHz)

→ the electromagnetic spectrum range from Extream Low frequency (ELF) to higher frequency such as X-Rays frequency.



[frequency Range]

1) Ground propagation (Below 2 MHz)



→ In this propagation the radio waves travels through the lowest part of the atmosphere i.e below the ionosphere, hugging to the earths.

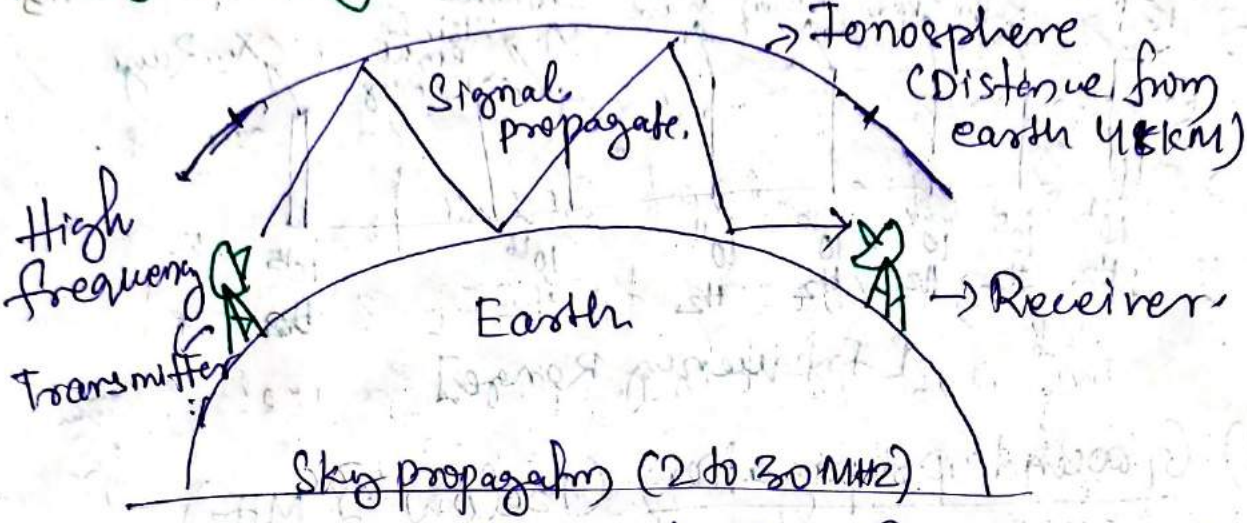
→ The low frequency signals propagate in all directional from transmitting antenna and follow the Curve path of the Planet.

→ The receiving device is anywhere on the earth for receiving signals for Communications.
Ex)- AM, FM etc

→ It can divide in to three types radio waves, micro waves and infared waves.

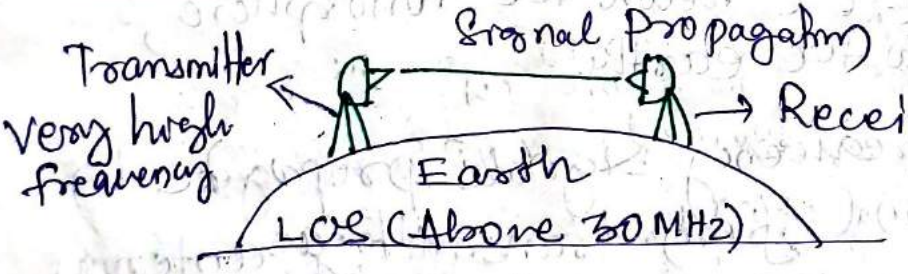
Range:- 3 KHz to 1 GHz – Radio waves
1 GHz to 300 GHz – Microwaves
300 GHz to 400 GHz → Infrared.

2) Sky Propagation (2 MHz to 30 MHz)



→ This propagation is higher frequency radio waves which radiates upword in to the ionosphere.
→ Where they are reflected back to the earth and reach to the receiver end.
→ This type of transmission allows long distance with a lower output power.

3) Line of Sight Propagation (Above 30 MHz)



→ In LOS propagation, there are very high frequency signals are transmitted in straight line directly from antenna to antenna for faster communications.

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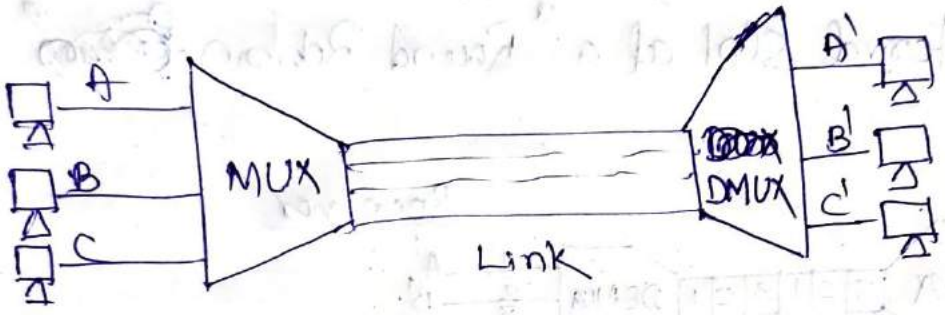
3.6) Multiplexing

→ Multiplexing is a technique for proper utilization of medium in which we can share more than one information signal at a time over a single communication path.

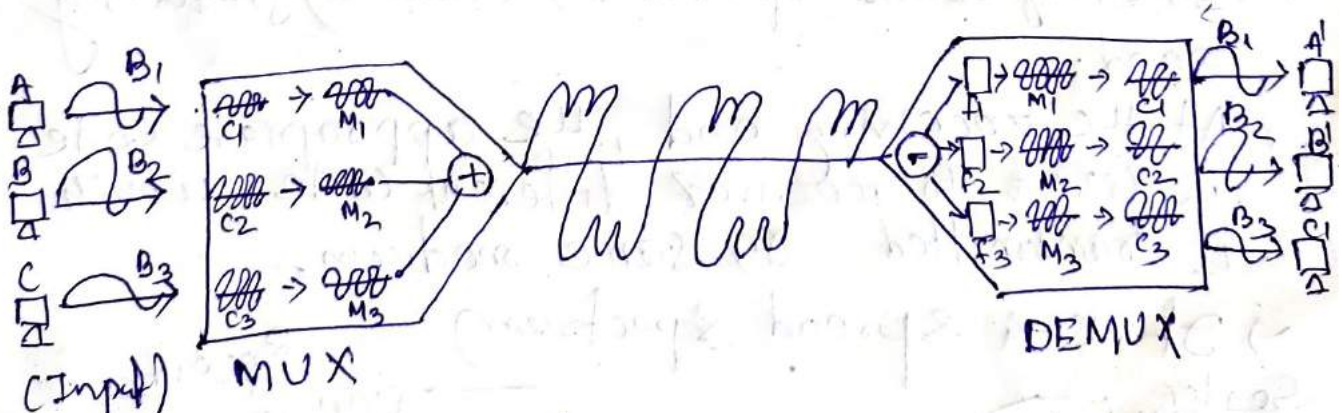
→ There are two encoders i:e MUX and DMUX used for combining and spliting the signal at sender and receiver end.



→ The link is logically divided in to number of channels.

→ Mobile Cellular System use various techniques to allow multiple users access the same radio spectrum at a same time. So Multiplexing can achive in a number of ways :-

FDM (Frequency Division Multiplexing)



→ MUX accept the input from each individual users and generate composite signal on a different frequency for the input.

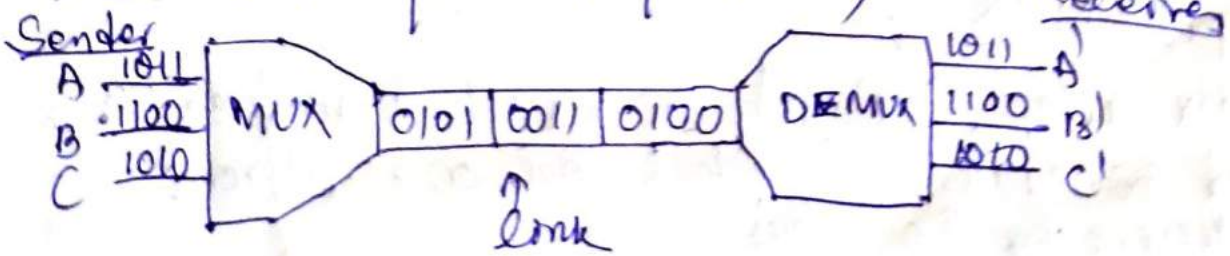
→ At the DEMUX end the Composit signal splits to single signals and received by end users.
Ex:- Old telephone network.

2) TDM (Time Division Multiplexing)

→ It is a digital multiplexing technique.
→ In this technique two or more channels of information are transmitted over the same link by allocating a different time interval. ("Slot" or "Slice").
→ The whole medium is shared in equal time interval slot at a "Round Robbin method".

3) CDM (Code Division Multiplexing)

→ In this technique each channel transmits its bits as a coded of seaquence of pulses.
→ It allows signals from individual sender and transmitted over the same frequency band.
→ So every codes spread in common frequency band.
→ At the receiving end, the appropriate code is used to recover different code, which is transmitted on same medium.
→ It is a spread spectrum



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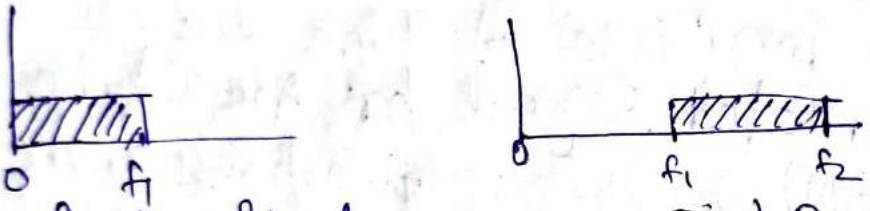
3.7) Modulation

→ Modulation is the process to send the frequency from low pass signal to band pass signal

→ Modulation is required to effective wireless transmission by increasing the compatibility of transmitted signal and the medium of transmission.



Low pass signal Band Pass Signal.

→ Signal consists of two components i.e

1) Base Signal (Information Signal)
2) Carrier Signal (High frequency wave)

→ So the base signal and the carrier signal are combined and the process is called modulation.

→ A device perform modulation is known as modulator and the reverse device is known as demodulator.

→ So MODEM can do both operation.

→ A modem accepts analog signal and converted it into digital and vice versa.

→ Modulation is two types

1) Analog Modulation ← AM, FM, PM
2) Digital Modulation ← ASK, FSK, PSK

Analog Modulation :-

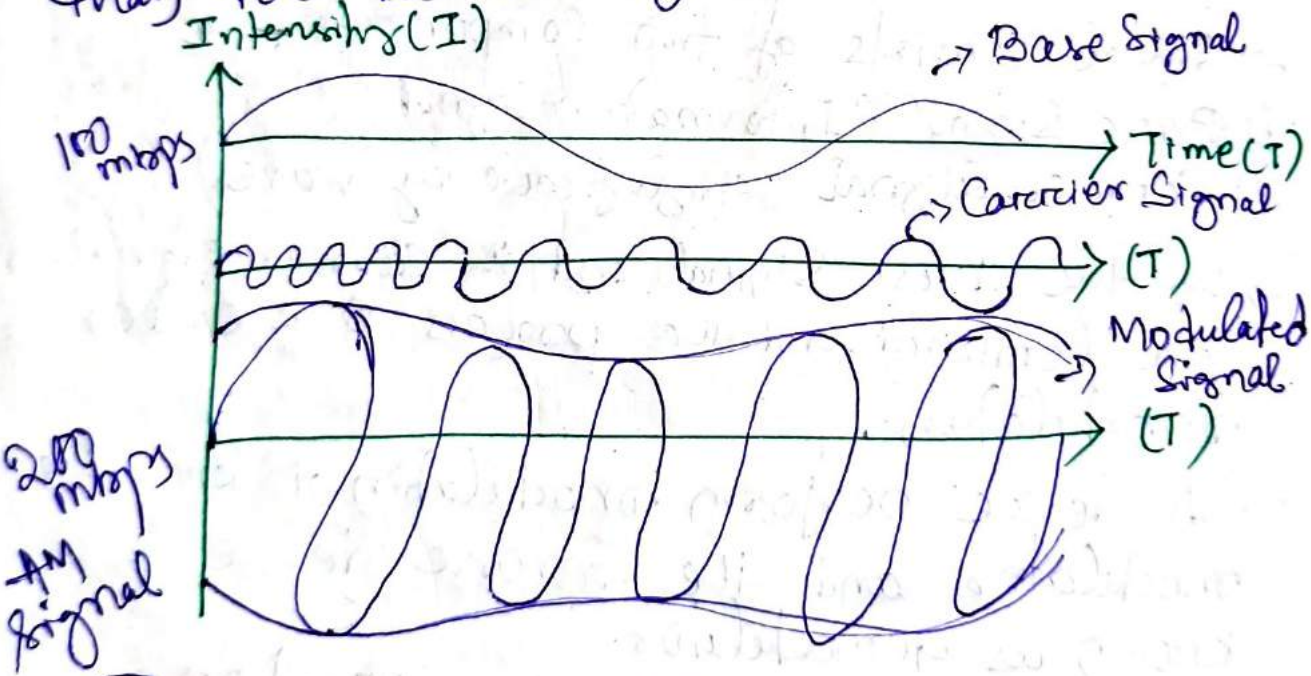
1) Amplitude Modulation (AM)

-> In this transmission the amplitude of carrier signal will be varied but frequency and phase remains constant.

-> The amplitude will derived based on base signal.

-> The base signal will be drawn in both direction (side) of time axis.

-> So the modulated signal for Amplitude Modulation (AM) signal is two times more than the base signal.

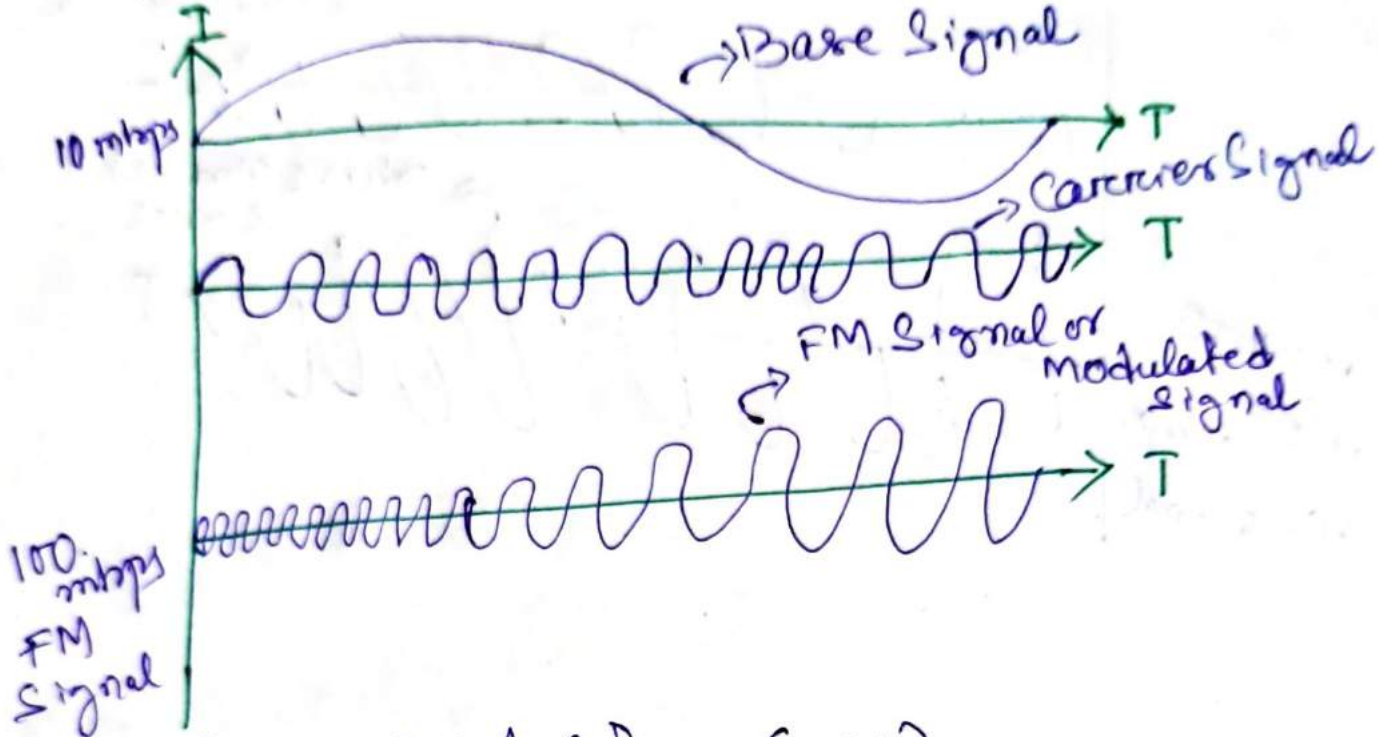


2) Frequency Modulation (FM) Hz ...

-> In this modulation the frequency of carrier signal will be varied, both amplitude and phase remains constant.

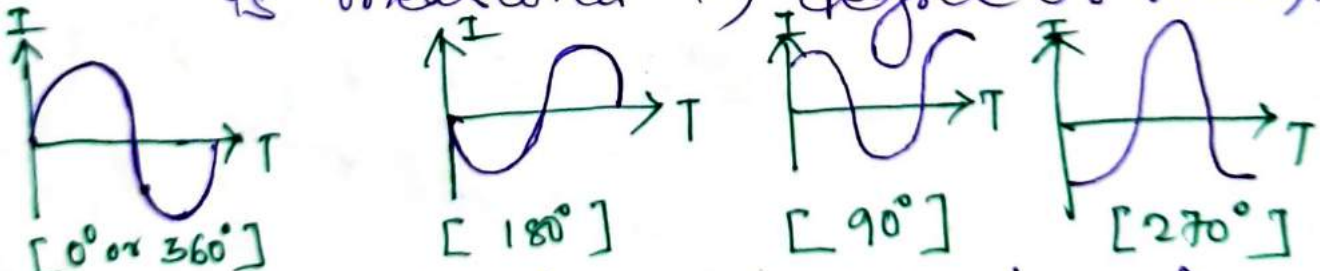
→ The base signal will be drawn in both direction of time axis.

→ The modulated signal or FM signal is 10 times more than the base signal.



3) Phase Modulation (PM)

Phase! - It is the shifting of signal which is measured in degree or radian.

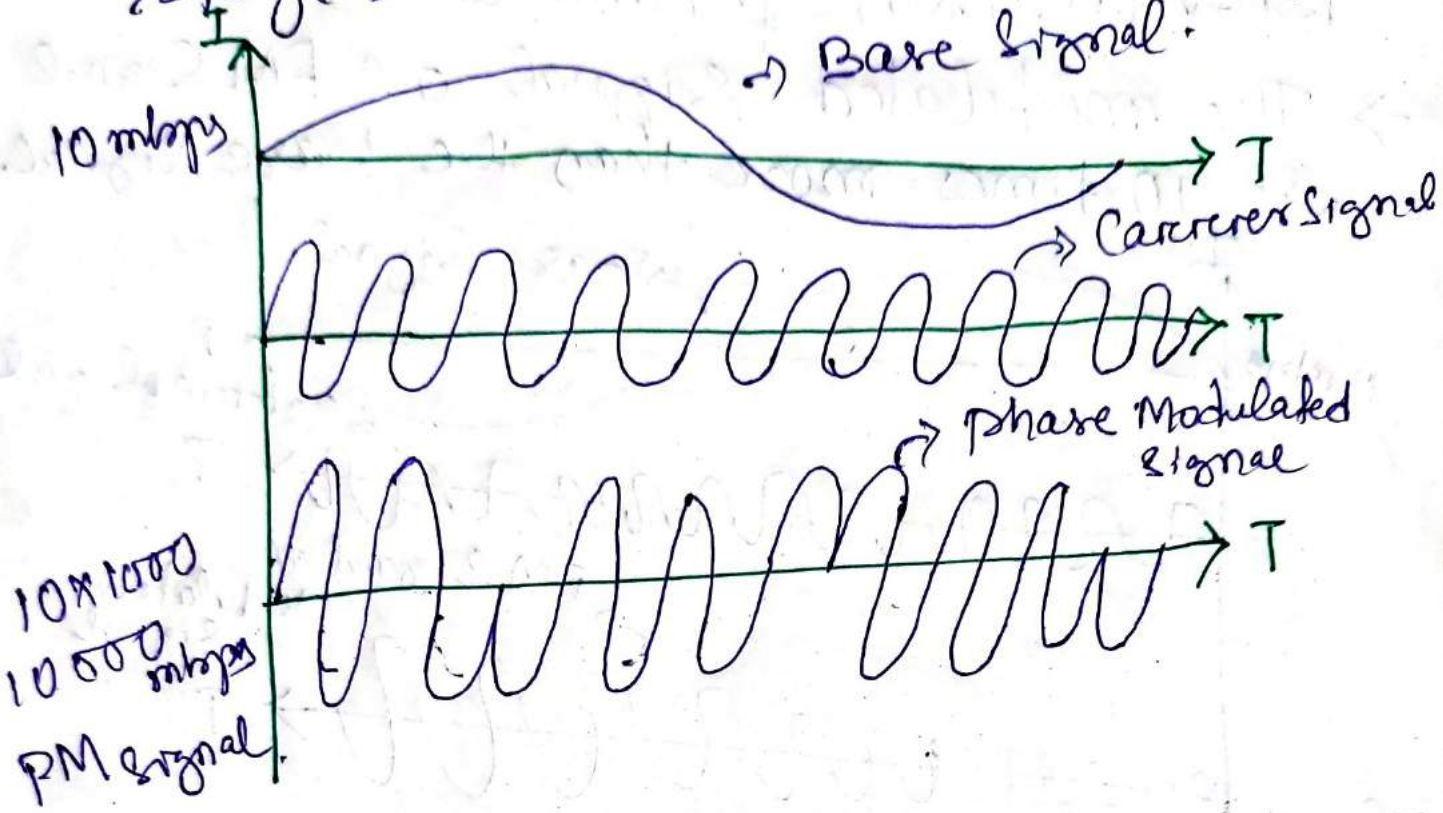


(Simple Sine Wave in degree)

→ In this modulation the phase of the Carrier Signal will be varied in degree, but both amplitude and frequency remains Constant.

→ The phase modulation is 1000 times more than the base signal.

→ This modulator is still in development staze.



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2) Digital Modulation

It has three types such as

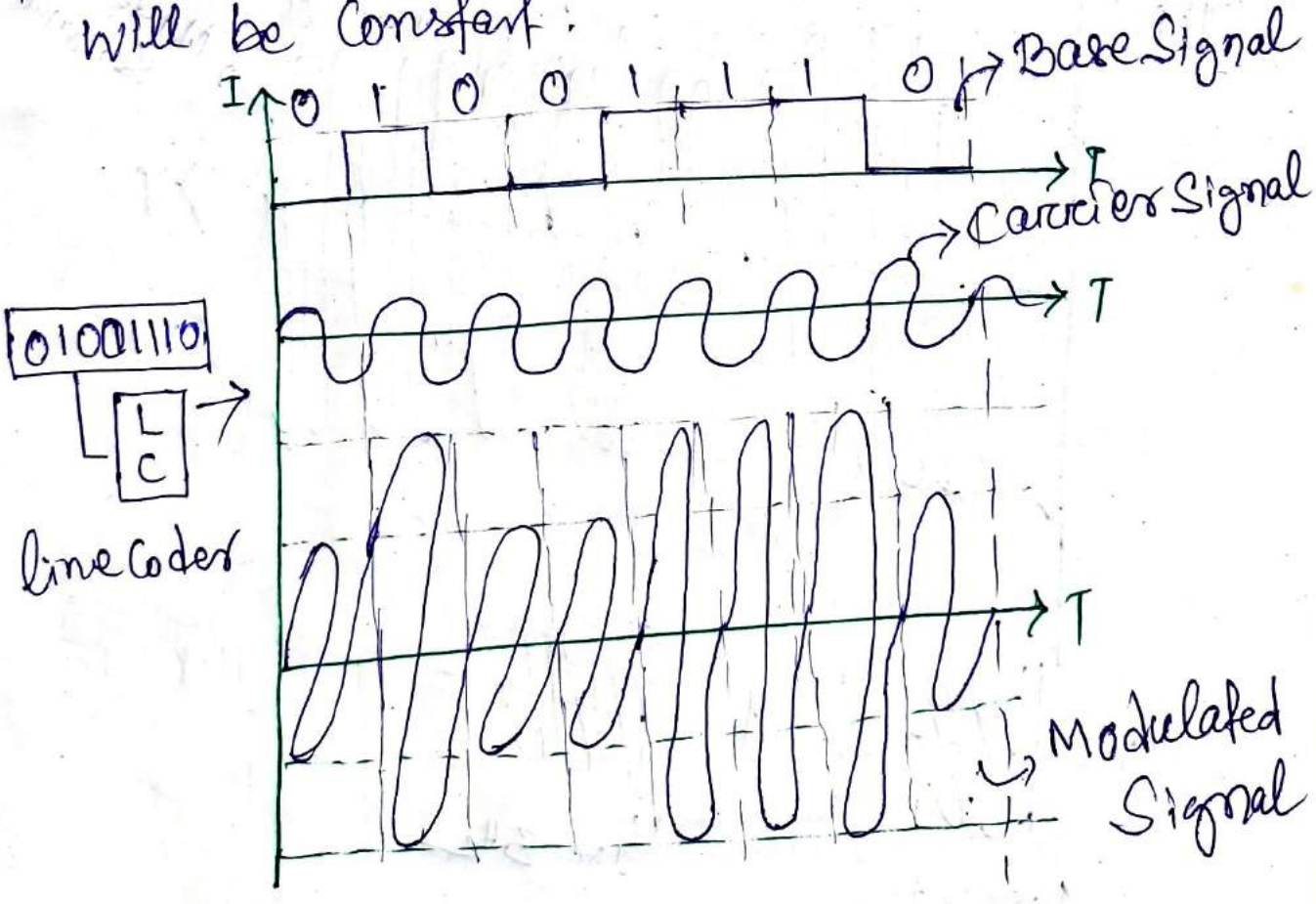
a) ASK (Amplitude Shift key)

→ ASK is the most simple digital modulation technique. Two binary values i:e 0 and 1 are represented by two different amplitude.

→ In this modulation technique the amplitude of the carrier signal is varied based on the information i:e 0 and 1.

→ Both frequency and phase will remain Constant.

→ Peak amplitude of all equals bits will be Constant.

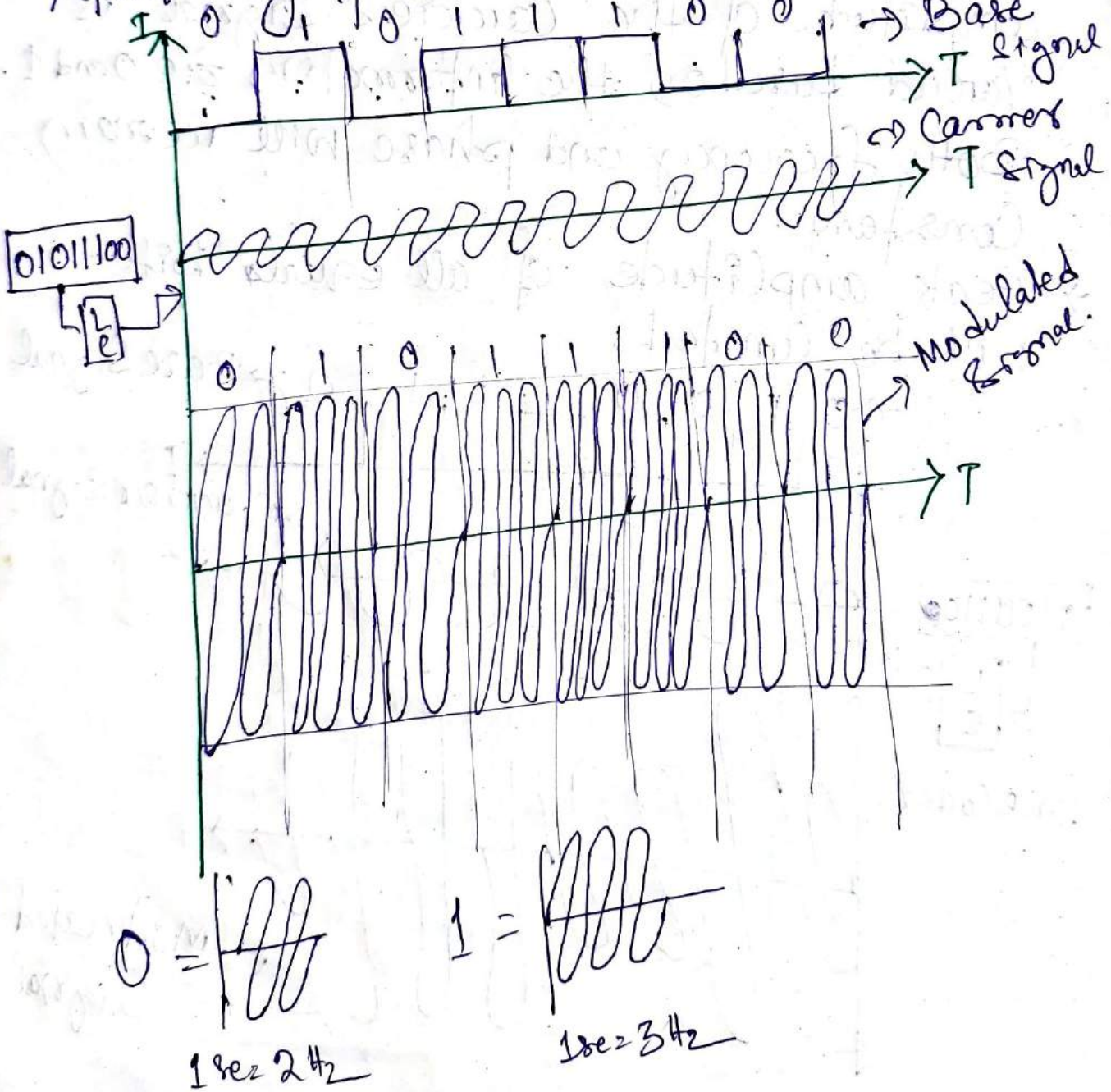


b) FSK (Frequency Shift Key)

→ In this modulation technique the frequency of the carrier signal is varied based on the information 0 and 1.

→ Both phase and amplitude remains constant.

→ frequency of all equal bits will constant



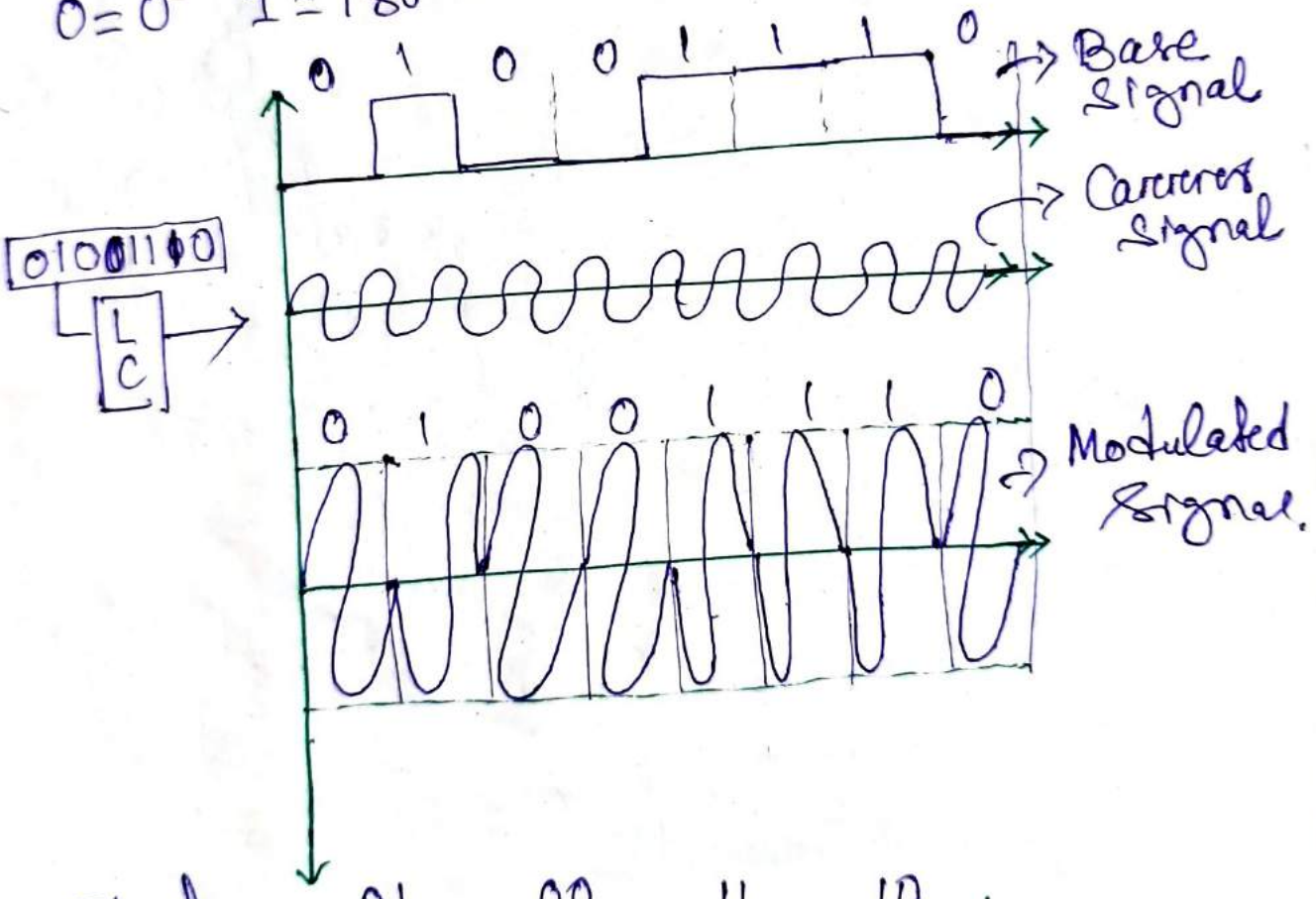
c) PSK (phase shift key)

→ In this modulation technique the phase of carrier signal is varied based on the information i.e 0 and 1

→ Both frequency and amplitude remains constant

→ Degree of equal bits are constant hence 0 bit represented as 0° or 180° and 1 bit represented 0°/180° or vice-versa.

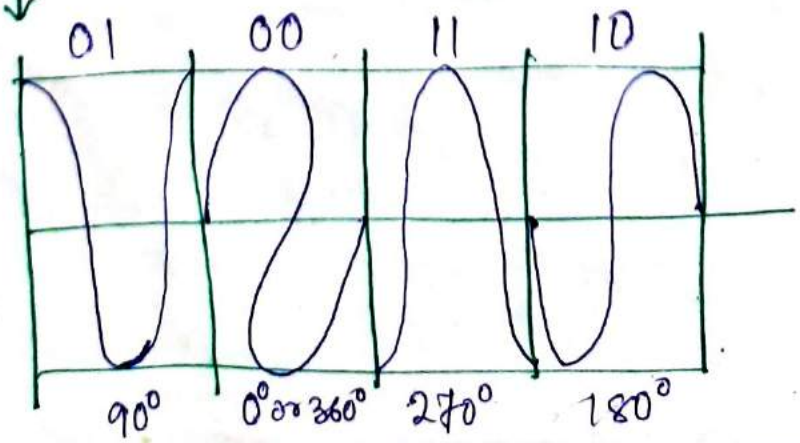
0 = 0° 1 = 180°



Digit

01001110

0° = 00
90° = 01
180° = 10
270 = 11



3.8) Spread Spectrum

→ In telecommunication, a band is called a frequency band.
→ A frequency band is a specific range of frequency in Radio frequency (RF) Spectrum.
→ The Radio frequency (RF) spectrum is divided in various ranges from Very low frequency (VLF) to Extremely High frequency (EHf)
→ Each frequency band has a upper and lower frequency limit.
→ The radio spectrum is regulated by ITU. (International Telecommunication Union)
→ Domestic use of the radio spectrum is regulated by national agencies such as federal Communications Commission (FCC).

Designation	Frequency	Users
ELf (Extremely low frequency)	3Hz to 30 Hz	-
SLf (Superlow frequency)	30Hz to 300Hz	-
ULf (Ultra low frequency)	300Hz to 3000Hz	-
VLf (very low frequency)	3kHz to 30 kHz	Time signals and Standard frequencies
Lf (low frequency)	30kHz to 300 kHz	fixed maritime mobile and navigation system, radio broadcasting.
MF (Medium frequency)	300kHz to 3000 kHz	Land, maritime mobile and radio broadcasting
HF (High frequency)	3MHz to 30MHz	fixed, mobile, aeronautical and marine mobile & radio broadcasting

Designation	Frequency	Users
VHF (Very High Frequency)	30MHz to 300MHz	Mobile, aeronautical and marine mobile radio, television and radio broadcasting, and radio navigation.
UHF (Ultra High Frequency)	300MHz to 3000MHz	mobile, aeronautical and marine mobile, radio, television, radio navigation and location, meteorological and Space Communication
SHF (Super High Frequency)	3GHz to 30GHz	fixed, mobile, radio navigation and location, and Space and Satellite Communication
EHF (Extremely High Frequency)	30GHz to 300 GHz	Amature Radio, earth and Space exploration

→ In Spread Spectrum, the transmission signal's bandwidth is much higher than the information bandwidth.
→ All spread spectrum is done through two steps modulation process.
→ First, data to be transmitted is modulated
→ Second, the carrier is modulated by spreading code, which provides spread out over a large bandwidth.

3.9) Cellular System

→ A cellular mobile communication system uses a large number of low-power wireless transmitters to create cells, the service area of a wireless communication system.

→ Increase in demand by improve the quality of service and support for more user coverage.

→ The frequency available for mobile cellular was limited, so efficient use of required frequency was needed for mobile coverage.

→ In order to work properly, a cellular system maintain the following two main conditions:-

1) The power level of transmitter within a single cell is limited, so it reduce the interference with the transmitters of neighboring cells.

2) Neighboring cells cannot share the same channels. In order to reduce the interference the frequency must be reuse only a certain pattern.

→ A cellular network is a radio network made up of a number of radio cells by a fixed transmitter is called base station.

→ Cellular networks offers a number of advantages

* Increased Capacity.
* Reduce power useage
* Better Coverage.

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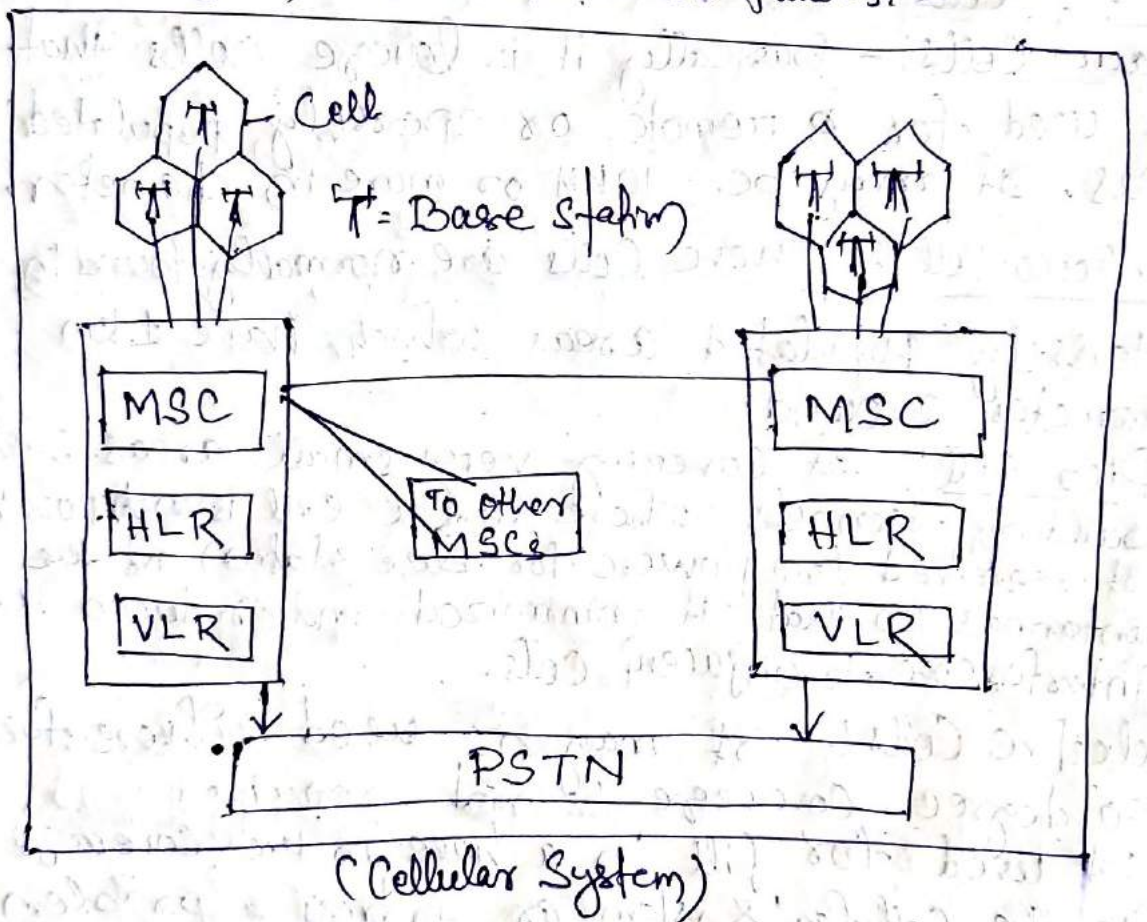
Continue from cellular system.....

→ The most common example of cellular system is a "mobile phone" (cell phone) network.

→ A mobile phone is a portable device (telephone) which receives or makes calls through a cell site (Base Station) or transmitting tower.

→ Radio frequency spectrum used to transfer signal to and from the cell phone.

Cellular System Architecture as follows:-

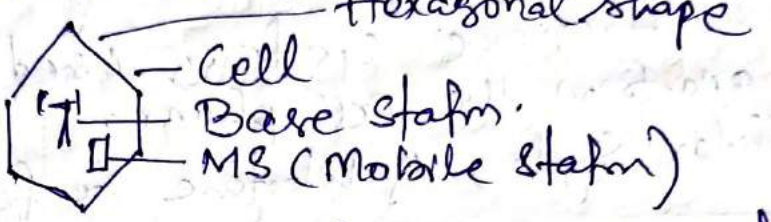


MSC:- Mobile Switching Centeres
HLR:- Home Locating Registes.
VLR:- Visitor locating Register
PSTN:- Public Switched Telephone Network.

→ The above diagram for each region is planned according to an engineering plan that includes cells, frequency reuse, cluster and handovers.

Cells

→ A Cell is the logical geographical unit of a Cellular System.
→ A Cell is represent in hexagonal shape.
→ Each Cell is varies depending on the area.
→ Within each cell a tower is must present that is called Base Station.

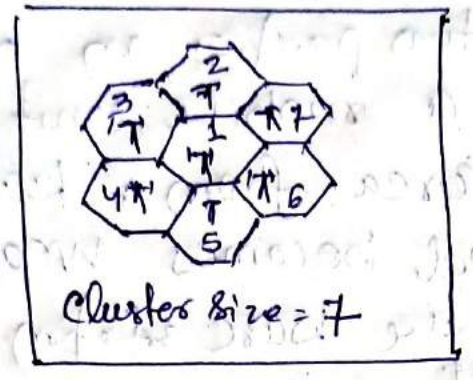


Types of Cells

1) Macro Cells:- Basically it is large cells that are used for a remote or sparsely populated areas. It may be 10KM or more in diameter.
2) Micro Cell:- There Cells are normally found in densely populated areas which have 1 km diameter around.
3) Pico Cell:- It covering very small areas such as building tunnels where large cell is not possible. It required low powerc for base station and the antennas so that it minimized and reduced the interference to adjacent cells.
4) Selective Cells:- It may be used where full 360 degree coverage is not required.
→ It used for fill in a hole in the coverage in the Cellular System or address a problem in entrance to a tunnel etc.
→ It coverage 120 degrees area.
5) Umbrella Cells:- This Cell is used where a heavily used road crosses of microcells an imporby handovers among different small neighboring cells.
→ It covers several micro cells, the power level inside an umbrella cell is different so it cominat interference to adjacent Cells.

Cluster:-

→ A cluster is a group of cells, No channels are reused within a cluster.



→ The number of cells in cluster plays very important role.
→ A smaller number of cells in cluster, then the bigger number of channels per cell which is used to avoid the interference of adjacent cells or neighboring clusters.

Frequency Reuse :- The method is used to use the same frequency by users is called frequency-reuse.

→ A small number of radio frequency range provided by cellular system provider, so frequency reuse is the technology for solving of large user can use the same frequency.
→ In this technology the cells are assigned a group of channels that completly different from adjacent cells.
→ The coverage area called foot print.

Handsoff

→ One obstacle of cellular network creates problem when a mobile user travelled from one cell to another during a call.
→ So adjacent cell not use the same frequency so Call dropped. or Call transferred.

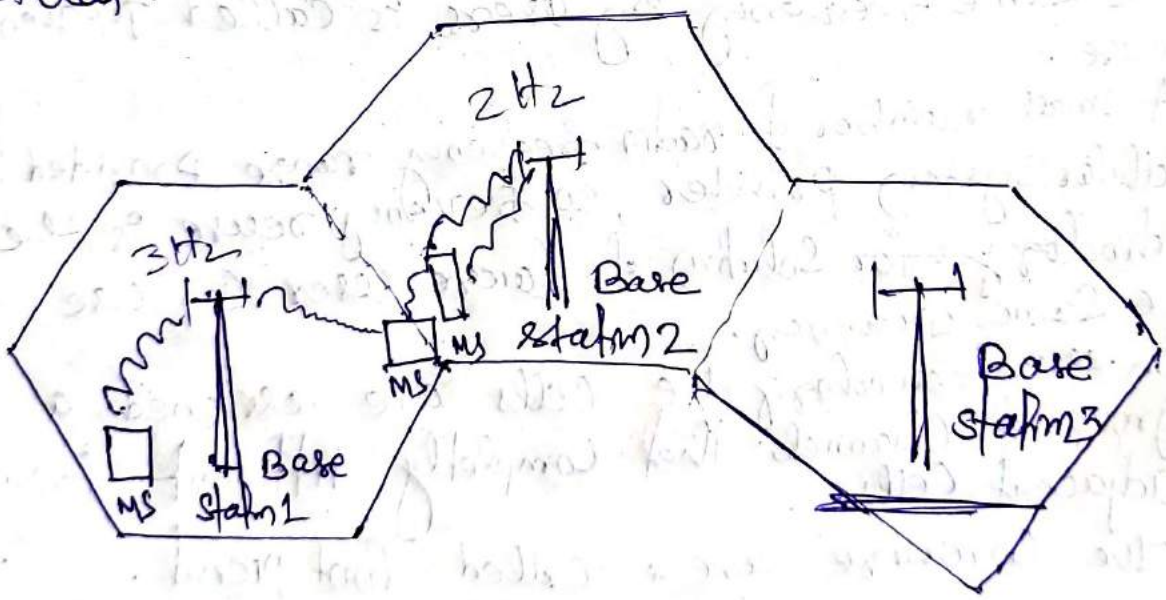
→ Handsoff used to automatically transfers call from radio channel to another radio channel as mobile crosses adjacent cells

→ During a call, two parties on one voice channel, when a mobile unit moves out of the coverage area from a base station then the signal becomes weak.

→ At this point the base station is see the request of handsoff.

→ The system switches to a stronger-frequency channel in a new base-station without interrupting the call or alerting the user.

→ The call continues as long as the user is talking and the user doesnot notice about that.



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Unit-4

Medium Access Control

4.1) Introduction:-

→ When a group of Signal Sources attempt to access a wireless medium simultaneously, then the network encounters the problem of receiving signals from each radio carrier distinctly.

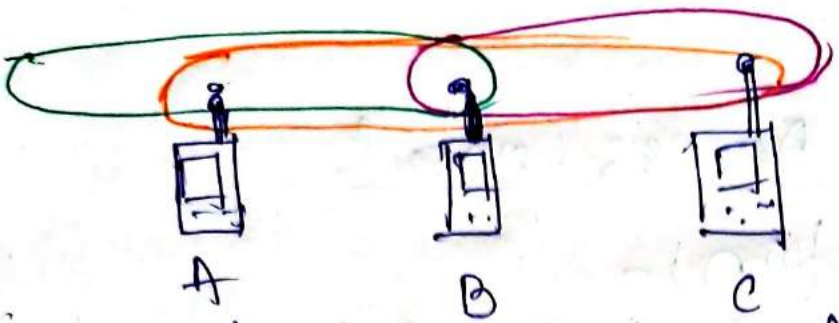
→ The signals are interference with each other when they transmitted simultaneously through the medium.

→ Also the network having the problems of Signal from hidden and exposed terminals as well as near and far terminals.

→ To Overcome these problems the Communicating system which is extract distinct signals from different cell, time slot, frequency and codes (SDMA, TDMA, fDMA and CDMA)

4.2) Hidden / Exposed Terminals

→ This problem doesnot occur on Wire LAN.



→ The transmission range of A reaches B, but to not to C.

→ Then transmission range of C reaches to B, but not to A

→ Now the transmission range of B reaches to A and C So A is directly cannot detect C and C cannot directly detect to A.

→ A start sending to B, C does not receive. Signal, Now C wants to send some data to B and Senses the medium.

→ C start Sending but causing a Collision of B

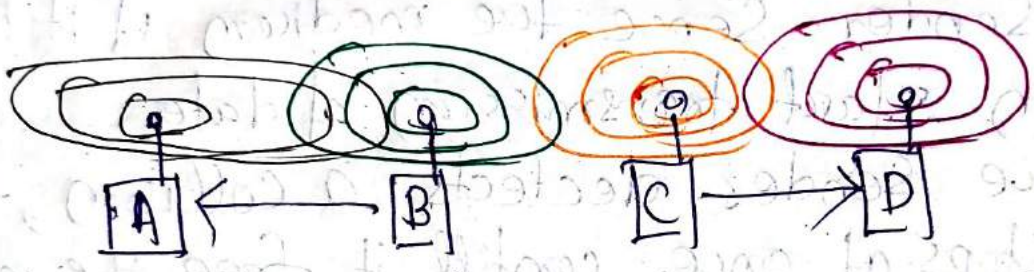
→ A cannot detect any Collision and continuous its transmission to B.

→ A is hidden for C and C is hidden for A.

→ Hidden terminal Caus Collision and consumes any delay.

(Hidden Terminal)

→ Now B sends to A and C sends to other phone outside the range of A, B and C
→ C senses the carrier and detects its busy then C postpones its transmission.
→ So this situation C is exposed terminal to B.



(Exposed Terminal)

4.3) The basic access method

→ The basic access method is CSMA (Carrier Sense Multiple Access)
→ It has two types such as CSMA/CA and CSMA/CD
→ Carrier Sense Multiple Access with Collision Avoidance.
→ Carrier Sense Multiple Access with Collision Detection.

CSMA protocol works

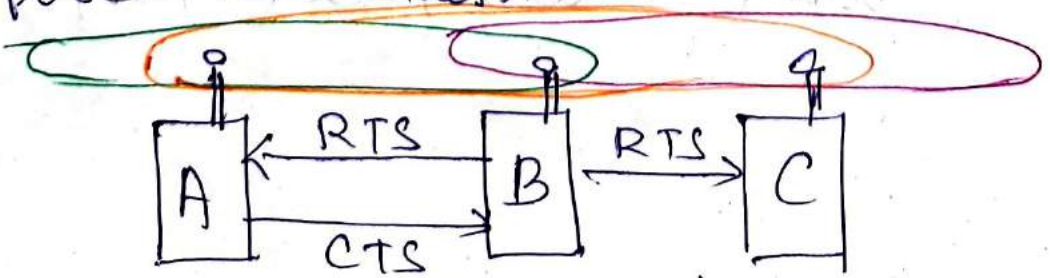
→ A station which wants to transmit the data sence the medium if the medium is busy then the station pause its transmission for some time.
→ If the medium is sensed free then the station allowed to transmission.

CSMA/CD protocol works

→ A Sender sence the medium if it is free then start transmission of data.
→ If the Sender dectects a collision, then it stops at once centill it free the medium.

CSMA/CA protocol Works

→ It uses two short Signalling packets for avoidance such as :- RTS (Request to Send) and CTS (Clear to Send)
→ The Sender requests the RTS from a receiver before it send data packet.
→ Then the receiver grants for read to receive (CTS).
→ The signaling packets contains Sender address, receiver address and packet length.
→ It avoids the problem of hidden and exposed terminals.



(CSMA/CA Architecture)

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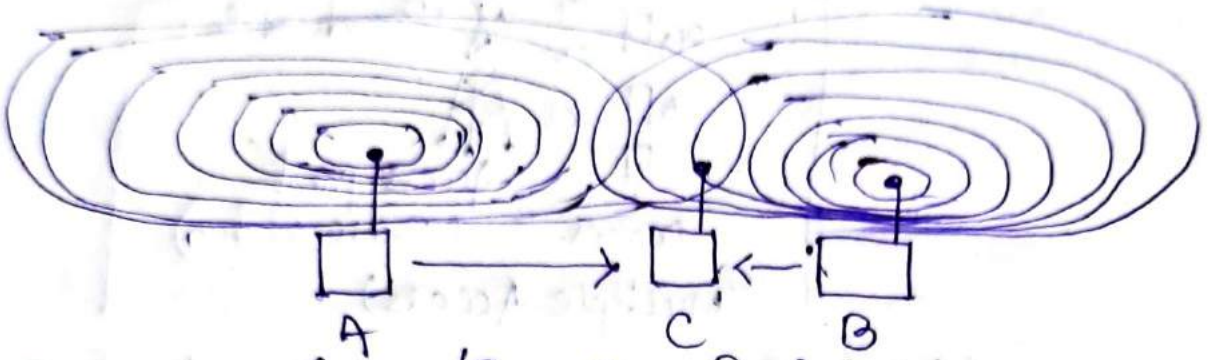
4.4) Near/far Terminal

→ let us consider three stations A, B and C as follows:-



(Near/far Terminals)

→ Here both A and B sending signals with same transmission power.

→ The signal strength decreases proportionally to the square of the distance.

→ The stronger B's signals drowns out A's signal.

→ As result C can not receive A's transmissions

→ This problem found in CDMA (Code Division Multiple Access)

→ The near/far is a sever problem of wireless network using CDM.

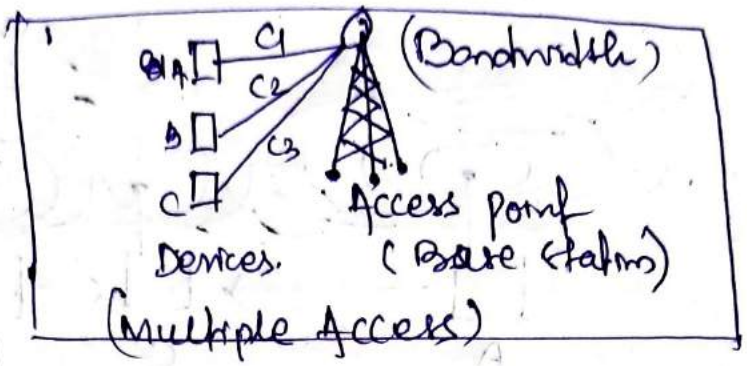
→ All signals should arrive at receiver with more or less the same strength.

→ If C is an arbiter for sending rights, B drowns out A's signal on the physical layer making C unable to hear out A.

Multiple Access Technique.

Frequency Division Multiple Access (FDMA)

→ It is one of the most common multiplexing technique.



→ The available frequency band is divided into to channels of equal bandwidth so that each communication is carried on a different frequency.

→ FDMA assigns individual channels to individual users.

→ Each user is allocated a unique frequency band of channel.

→ these channels are assigned on demand to user who request for service.

→ During the period of call, no other user can share the same channel.

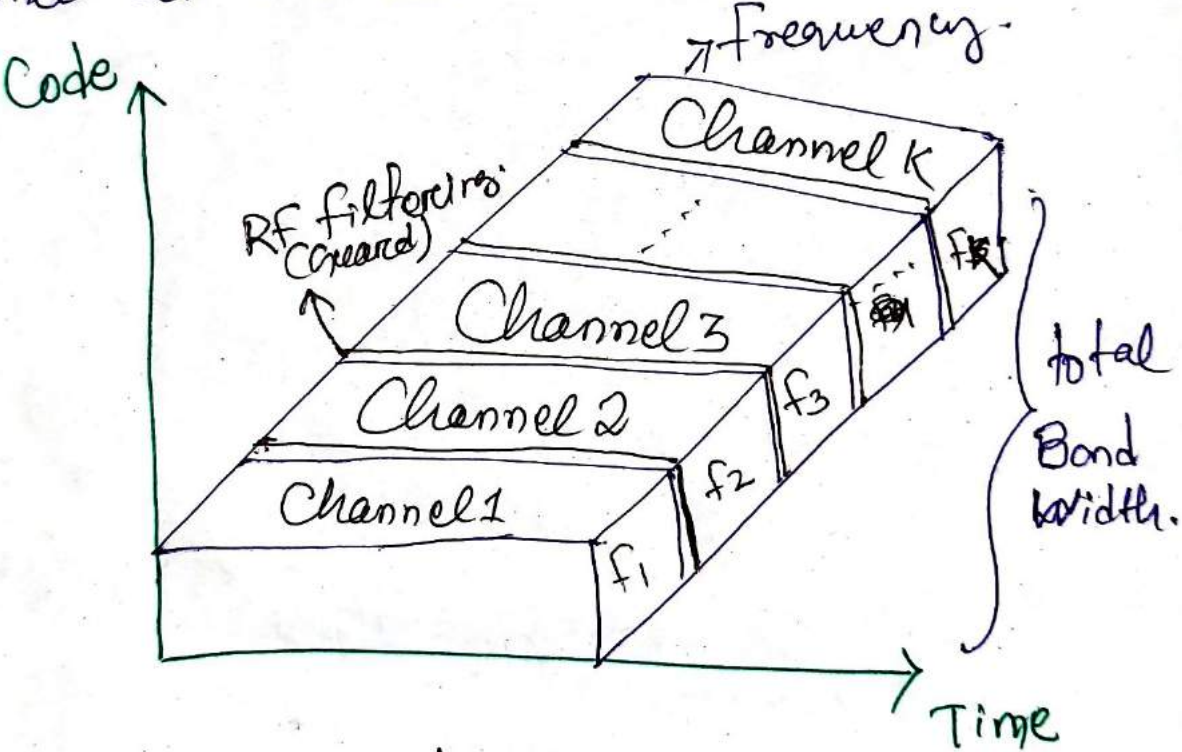
→ the FDMA channel carries only one phone circuit at a time.

→ This multiplexing technique is used in all the first generation analog mobile network.

→ If FDMA channel is not in use, then it sits idle and it can not be used by other users.

→ Each user is allocated two channels, one for uplink and another for down-link communication.

→ No other user is allocated the same channel at the same time.



→ FDMA requires tight RF filtering to minimize adjacent channel interference.

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4.5) TDMA (Time Division Multiple Access)

→ It is more expensive multiple access technique Compared to FDMA.

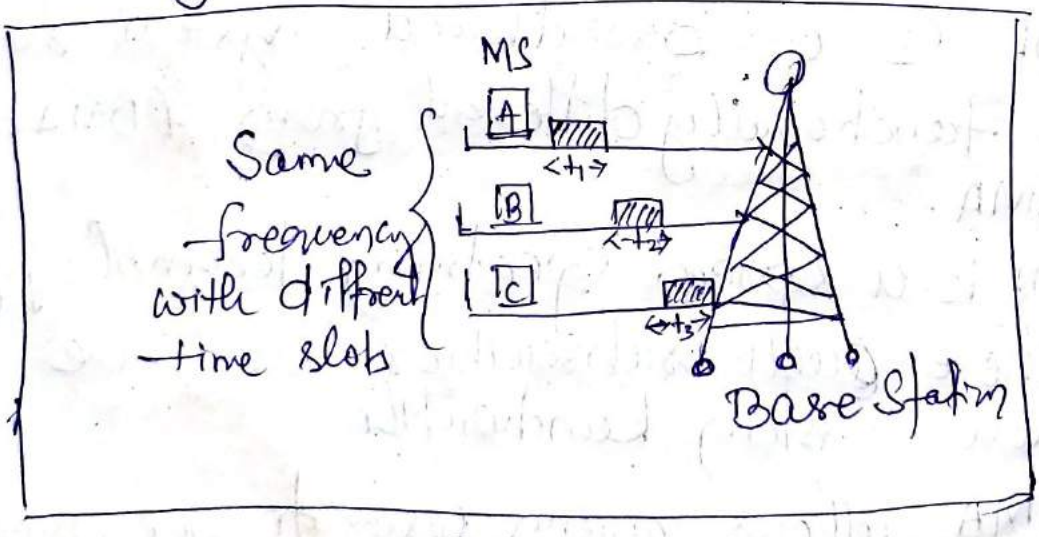
→ TDMA needs proper Synchronization between Senders and receiver.

→ TDMA System is accessed method for Shared medium by divide the radio Spectrum in to time slots.

→ It allows Several users to Share the Same frequency Channel by dividing the Signal into different time slots.

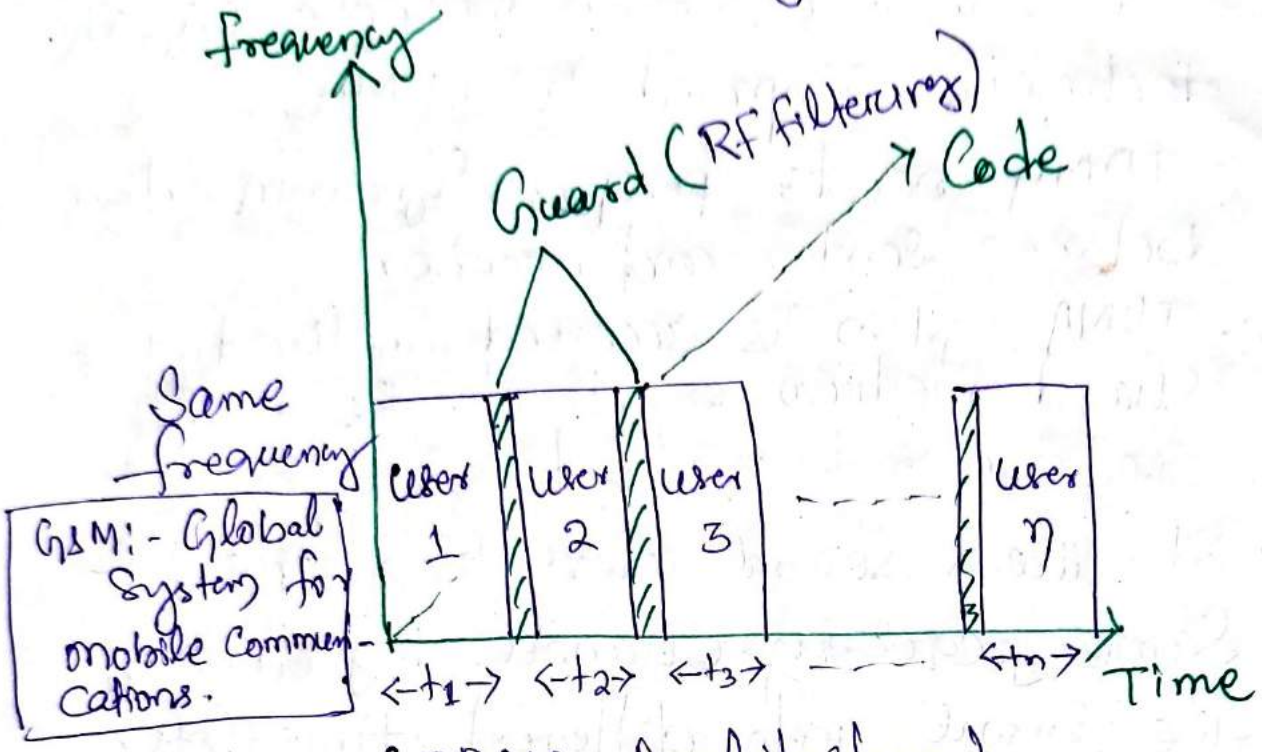
→ In each slot only one user is allowed to either transmit or receive.

→ Each User occupies a Cyclically repeating time slots.



→ Transmission for any user is non-Continuous.

→ Listening to different frequencies at same time is very difficult.



(TDMA Architecture)

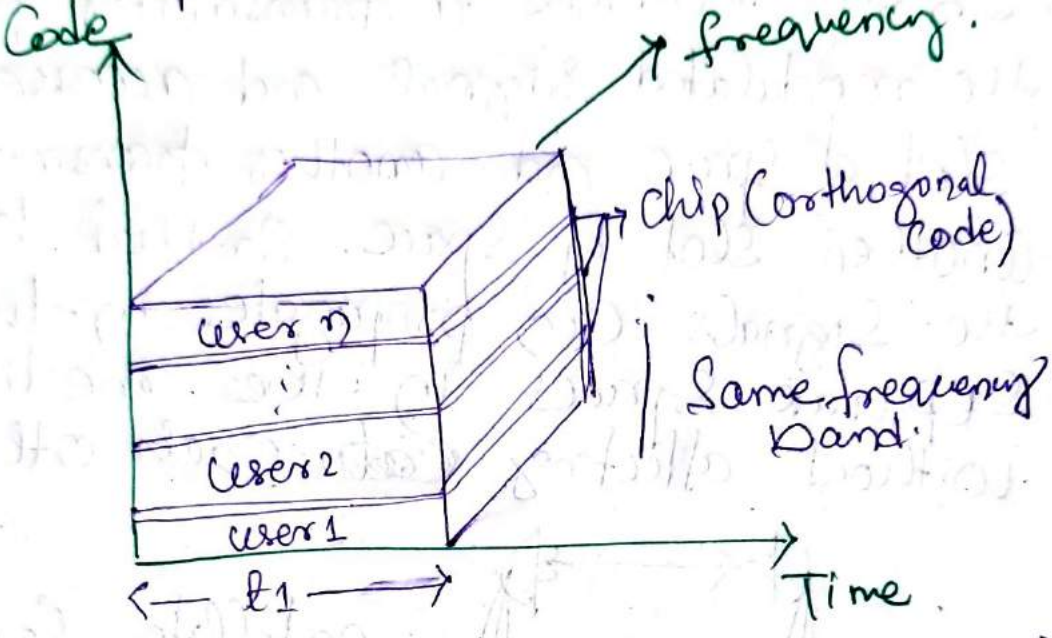
→ If used the digital 2G cellular system GSM,
→ To minimize the interference. Rf filtering used as a guard.

CDMA (Code Division Multiple Access)

→ It is a broadband system so its functionally different from fDMA and TDMA.
→ It is a spread spectrum technology. where each subscriber uses the whole system bandwidth.
→ CDMA allows many users to occupies the same time and frequency in a given band / space.

→ To separate the signals each user is assigned an orthogonal code called chip for minimizing interference.

→ It is a form of direct sequence spread spectrum communication



→ CDMA has been used in many communication and navigation systems, such as GPS, Satellite system etc.

Benefits of CDMA

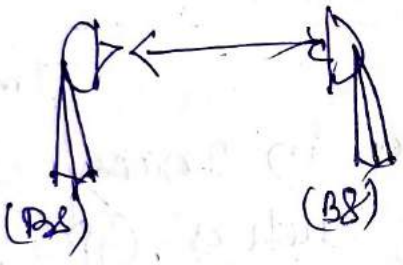
→ Outstanding voice quality
→ Greatest coverage for lower cost.
→ Package data, longer talktime, long battery life.
→ fewer dropped calls, Improved Security and Privacy.
→ Greater Capacity, reduced background voice etc.

SDMA (Space Division Multiple Access)

→ SDMA is used with CDMA, space is also used effectively.

→ In this technique where different parts of space are used for multiplexing.

→ In this technique a transmitter transmits the modulated signal and accesses a slot of space and another transmitter uses another slot of space so that both the signals can propagate in two separate spaces in the medium without affecting each other.



Satellite Communication (Directional antenna)

→ SDMA use of radio transmission by using directional antennas.

→ It allows duplicate frequencies to be used at the same time for multiple surface zones on earth.

→ SDMA is more useful in Satellite Communication.

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Assignments (20 Questions)

Unit 1:-(Introduction to wireless network and mobile Computing)

Q1) What is network? Discuss about LAN, MAN, WAN and Wireless networks.

Q2) What is mobile Computing? Explain all dimensions of mobile Computing.

Q3) Define mobile Computing characteristics.

Q4) Define applications of mobile Computing

Unit 2:- (Introduction to mobile Computing development frameworks)

Q1) Differenciate between client-Server and n-tire architecture

Q2) Differenciate between peer-to-peer and client-Server architecture.

Q3) Define mobile agent architecture.

Unit 3:- (Wireless Transmission)

Q1) What is a Signal? Explain about analog and digital signal with diagram.

Q2) Define amplitude, period and frequency with diagram

Q3) What is an antenna? Define all types of antennas.

Q4) Explain all types of signal propagation techniques.

Q5) What is multiplexing? Explain FDM and TDM

Q6) Differenciate between AM and FM modulation

Q7) Differenciate between ASK and FSK

Q8) What is Cellular System? Explain all types of Cell are used.

Unit 4:- (Medium Access Control)

Q1) Explain about hidden/exposed terminal.

Q2) Differenciate between CSMA/CA and CSMA/CD.

Q3) What is near/far problem in CDMA Service.

Q4) Differenciate between FDMA and TDMA.

Q5) What is CDMA? Define SDMA with diagram.

—x—

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Unit-5 (Wireless LAN's)

5.1) Wireless LAN and Communication

→ A Wireless Communication allows information exchange between two devices without use of wires or cables.

→ A WLAN (Wireless LAN) is a wireless local area network that uses radio waves as carriers to provide network connection to all users in its surrounding area.

→ the Coverage area may be a single room or an entire Campus for Communication.

→ The backbone of this network usually uses Cables, with one or more wireless access points which connecting wireless user.

→ WLAN provide high-speed data communications in small areas such as small building, small office etc.

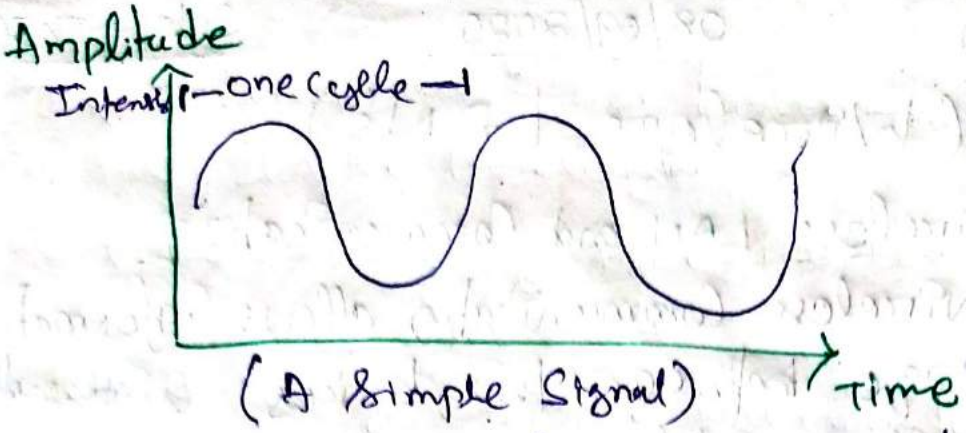
→ The user in WLAN is moved in that surrounding area without Connection fails.

→ A small transmitter is called radio transmitter used to transmit radio wave to create WLAN.

→ WLANs transmits information by three main ways such as:- microwave, radio Spectrum and infrared.

→ The electromagnetic spectrum classifies electromagnetic energy according to frequency or wavelength

→ Electromagnetic Spectrum energy waves having ELF (Extremely low frequency) to Higher frequency.
Ex:- X-Rays

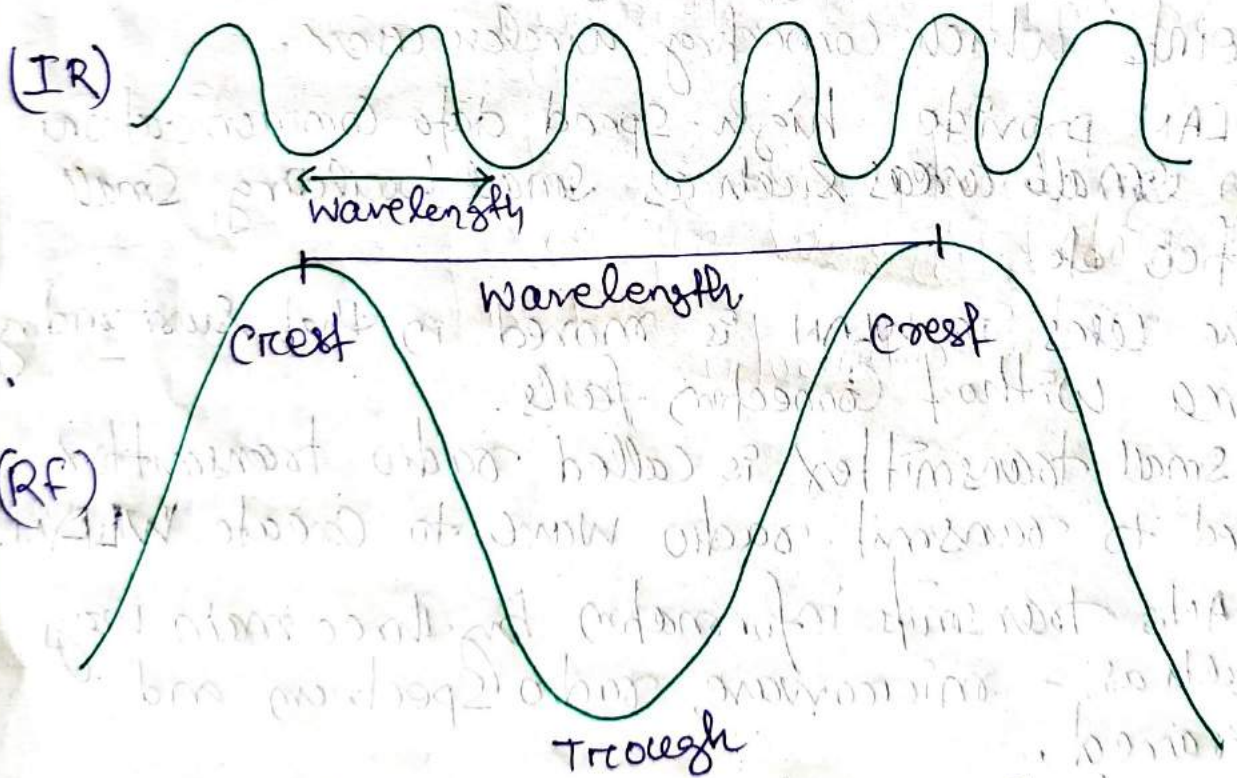


→ A simple wave signal is represented by above figure.

Frequency!-

→ The no of cycles of a waves in one seconds.
→ It is measured by Hz also KHz, MHz, GHz.
→ It is directly related to the amount of information that can transmitted on the wave.

Wavelength



→ A wavelength is the distance between two identical points (adjacent crests) of a electromagnetic wave.
→ It expressed in meter, also in km, mm, nmet
→ It is inversly proportional to frequency.

→ In IR (infrared) wave has higher frequency So it has shorter wavelength.

→ In Rf (Radio frequency) wave has lower frequency So it has longer wavelength.

→ FM radio having shorter wavelength because it is higher frequency.

→ In wireless transmission transmitter and receiver are very important devices for establish communication between them.

* Example:-

→ A radio transmitter output its energy by using an antenna.

→ An Infrared transmitter uses LED for transmitting signals.

→ The electromagnetic signal captured by the receiver and process the wave to get original output form.

→ Various communication protocols are used for transmitting and receiving information at the same time.

5.2) Infrared

→ Infrared (IR) is an electromagnetic radiation with wavelengths longer than visible light but shorter than radio waves.

→ Infrared radiation is the region of the electromagnetic spectrum between microwaves and visible light.

→ In infrared communication, LED transmits the infrared signal as non-visible light.

→ At the receiving end a photodiode detects and captures the light pulses, then it processed to retrive information they contain.

→ There are various common applications of infrared technology such as:-

* Computers - Mouse, keyboards, Printers
* Headphones
* Home Security System
* TVs, VCRs, CD Players, DVD's etc.
* Telephones
* Toys etc.

5.3) Radio frequency

→ Radio frequency (RF) refers to that portion of electromagnetic spectrum in which electromagnetic waves can be generated by alternating current, which is feed to an antenna.

FM Radio

→ When we listen to a radio station and the Radio Jockey says, "you are listening to 93.5 RED FM Bajate Raho!"

→ It means you are listening a radio station broadcasting FM signal at a frequency of 93.5 MHz (Megahertz) with Federal Communications Commission (FCC) assigned call letter of "RED FM".

→ Megahertz means millions of cycles per second so 93.5 MHz radio station send the frequency at 93,500,000 cycle per second.

→ The FM (frequency Modulator) radio station can tune in that specific frequency

→ All FM radio stations transmit the band of frequency between 88 MHz to 108 MHz.

→ This band of the radio frequency not used for other purpose, it is only used for FM radio broadcasts.

AM Radio

→ In the same way, the AM radio is provide the band from 535 KHz (Kiloherts) to 1700 KHz.

→ The Kiloherts means thousands so band range from 535,000 to 1,700 000 Cycle per second.

→ So that an AM (Amplitude Modulation) radio station says "This is 711 AM AIR Siliguri".

→ This means that radio station is broad-casting an AM radio signal at 711 KHz and it is registerd at FCC (Federal Communication Commission)

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5.4) IR Advantages and Disadvantages

Advantages:-

* Low power requirments: It is ideal for laptops, telephones, Personal Digital Assistants (PDA's)
* Low Circuitry Costs
* Simple Circuitry: No special hardware is required. It can be integrated Circuit of a product.
* Portable in nature.
* It is a Secured transmission.
* High noise Immunity: It is not any interference from any signals from other devices.

Disadvantages:-

* Line of sight is required i.e transmitters and receivers must be straight position for Communication. So longer transmission not possible.
* Blocked by Common material: people, wall, plant etc it can block transmission.
* Short range:- the performance drops off with longer distance.
* Light, weather Sensitive:- It can be affect transmission from direct Sunlight, rain fog, dust etc.
* Speed:- the rate of data transmission is lower than wired transmission.

5.5) RF Advantages and Disadvantages

Advantages:-

→ Line of Sight (LOS) is not required.

→ Not blocked by Common materials:-
It can penetrate most Solid and pass through walls.

→ It is a Spread Spectrum for long range transmission.

→ It is not light Sensitive.

→ It is not sensitive to weather/environmental conditions.

Disadvantages:-

→ Interference:- The Communicating devices using similar frequency can create interference with transmission.

→ Lack of Security: Due to Spread Spectrum of Signal transmission might be chance of break the Security.

→ It is higher Cost than IR technology.

→ FCC (Federal Communications Commission) provides licenses for the radio band.

→ Lower Speed:- In RF the rate of data transmission is lower than Wired and infrared transmission.

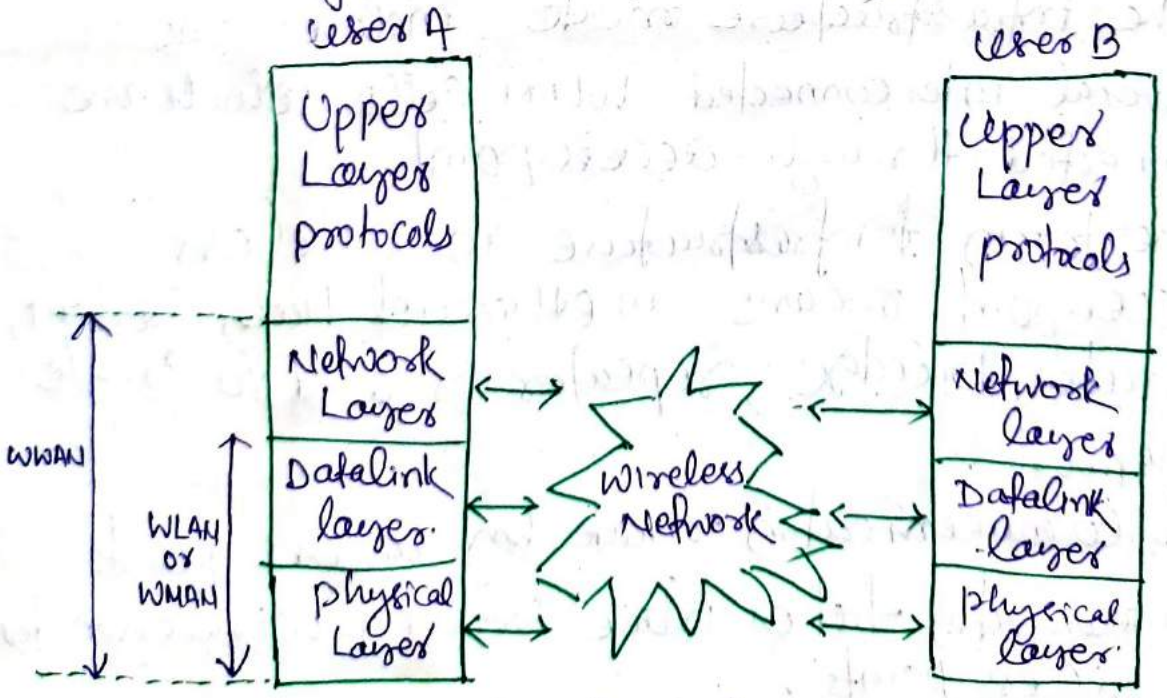
5-6) Wireless Network Architecture.

-> Network performs many functions to tranfer information from source to destination. They are as follows! -

* The medium provides path for data flow.
* Medium access control provides for sharing the common medium.
* Data Synchronization and flow and error Control mechanisms ensure for data tranfer properly.
* Routing mechanisms move the file from source to destination properly.

Logical Architecture of wireless Network

-> The wireless network do not based on 7 layers of OSI model. The function within physical and Data link layers, which provides in diagram.



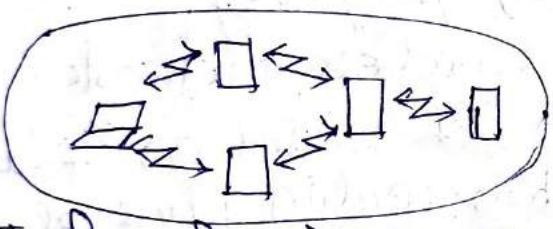
(logical architecture of wireless network)

5.7) Types of WLAN

→ There are two types of WLAN's such as:-
1) Ad-hoc Mode 2) Infrastructure Mode.

1) Ad-hoc Mode

→ The ad-hoc mode include WLAN cells interacting without connecting to wired network i:e without connecting to any access point.
→ It is a concept about peer-to-peer network and no any administrating power is involved, no setup and no cost.
→ Each node directly connected for communicate.
→ Each node is comes with wireless transmitter and receiver with proper antenna.

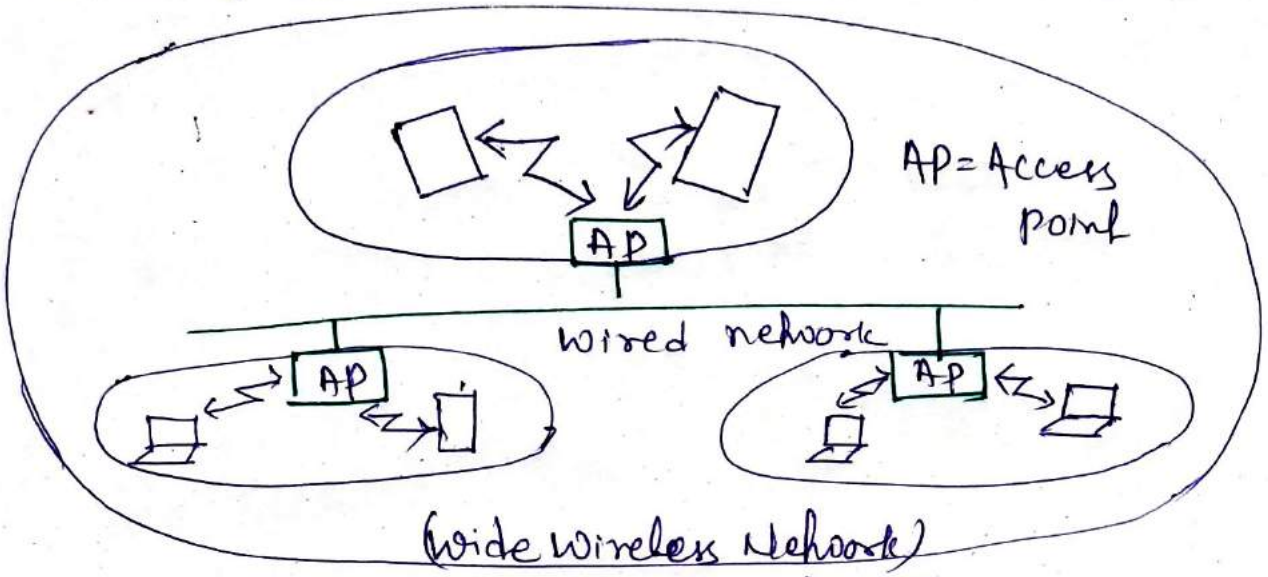


→ operate in stand-alone fashion.
(Ad-hoc network)

2) Infrastructure Mode

→ The Infrastructure mode includes one or several interconnected WLAN cells which are connected through access point.
→ The term of infrastructure in wireless accesspoint means an ethernet hubs, switches, router, bridge, repeater is used to create network.
→ All communicating made by access points.
→ Communicating takes place between wireless nodes and access points.
→ Access point acts as a bridge.

→ Access point with a fixed network can connect several wireless network to form a wide network as the actual radio coverage.



[Infrastructure Network]

→ Cellular phone & Satellite-based Cellular phone are based on Infrastructure networks.

Types of access points

There are two types of access points such as! -

1) Hardware Access Points (HAP):-

Ex!- Apple's Airport Base Station or WebGear's AviatorPRO

2) Software Access Point (SAP):- It runs on a computer by NIC.

Ex!-

Vicomsoft Internet Gateway or Software Router

5.8) IEEE 802.11

→ IEEE stands for Institute of Electrical and Electronics Engineers.

→ The IEEE adopted the first standard for WLAN's.

→ As standard number (802.11) indicates to the group of 802.11x LAN standards.

→ The standard specifies the physical and medium access layer adapted to wireless LAN's.

→ The IEEE 802 committee was formed to setup standards for LAN domain.

→ There are many standards within this family with almost all letters from a to x.

→ There specification define an over-the-air interface between wireless client and a base station (Access point) or between two or more wireless clients.

→ 802.11 standard is known as Wi-fi (Wireless fidelity).

Specifications in the 802.11 family

→ There are several specifications in the 802.11 family such as:—

* 802.11 → This standard used for wireless LANs and provide 1 or 2-Mbps transmission on the frequency of 2.4 GHz band.
→ It uses either frequency-hopping spread spectrum (FHSS) or direct-sequence spread spectrum (DSSS).

* 802.11a → This is an extension to 802.11 standard to wireless LAN's and goes as fast as 54 Mbps on the 5-GHz band.
→ It uses the orthogonal frequency division multiplexing (OFDM) encoding scheme as opposed to either FHSS or DSSS.

* 802.11b → It provides the high rate of Wi-fi an extension to 802.11 standard as fast as 11 Mbps transmission in the 2.4 GHz band.
→ It only uses DSSS and provides hard-wired ethernet connections.

* 802.11g → This standard provides 20+ Mbps transmission on the 2.4 GHz band.
→ It uses CSMA/CA access protocal.

IEEE 802.11 Architecture

→ WLANs provides high frequency radio waves instead of cables for connecting devices in LAN.

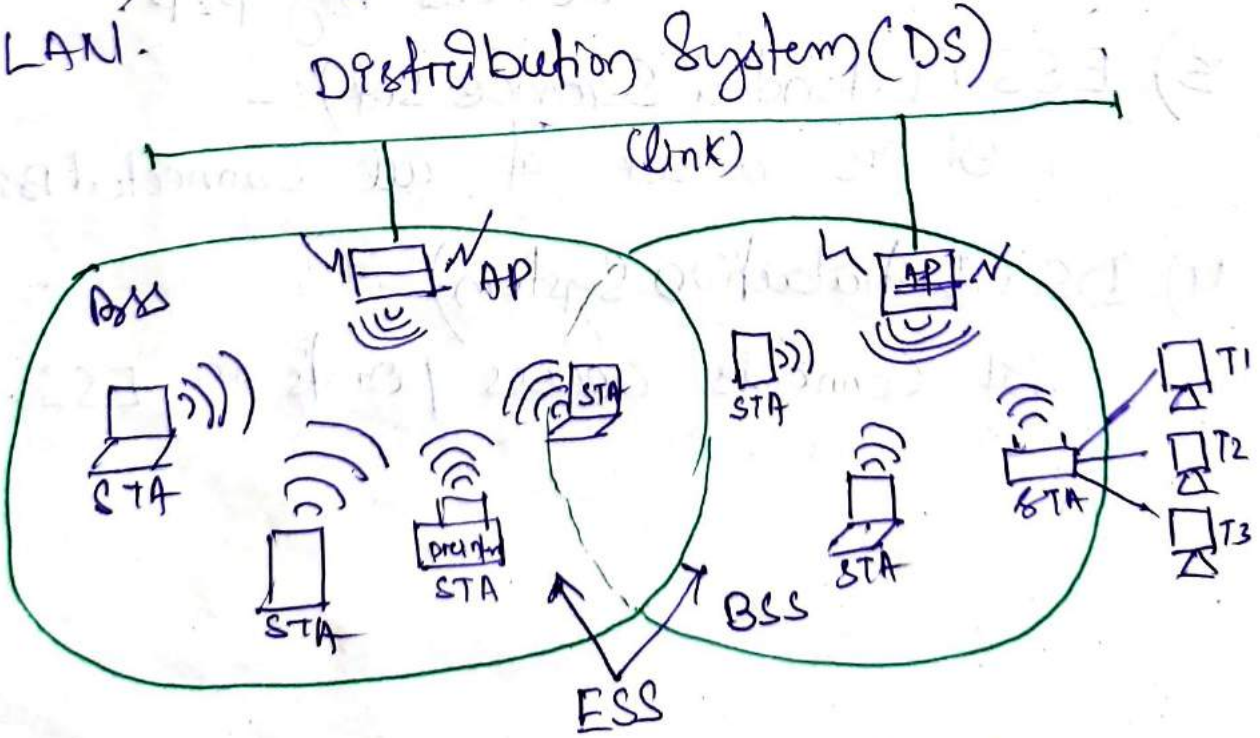
→ 802.11 architecture provides the wireless communication between access point to client or client to client communicating by air.

→ The IEEE 802.11 standard permits to establish either P2P (peer-to-peer) or network based on fixed access point (AP) which mobile nodes can communicate.

→ This standard uses both WLAN technology i.e adhoc and infrastructure network.

→ The infrastructure network is mean to extend the range of wired LAN to wireless cells.

→ A laptop or mobile station may move from cell to cell (from AP to AP) while maintaining access to the resources of the LAN.



(IEEE 802.11 Architecture)

Components of an IEEE 802.11 as follows! -

1) STA (stations) :- Stations are all devices and equipment that are connected to WLANs.
-> It is two types! -
   a) Wireless Access point (WAP) :-
      -> It is called AP (access point) are generally wireless routers.
   b) Client :- Client are workstation, computers, laptops, printers, smartphones etc.

2) BSS (Basic Service Set) :-
-> A cell area covered by an AP is called BSS. It has two category subcas! -
   a) Infrastructure BSS -> It communicates with other devices by AP.
   b) Ad-hoc BSS -> It communicates with other devices by P2P.

3) ESS (Extended Service Set) :-
-> It is a set of all connected BSS.

4) DS (Distribution System)
-> It connects access points in ESS.

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5.9) MAC Layer

→ The media access control (MAC) is a sub layer of data link layer of the OSI (open system inter-connections) model for data transmission.

→ To prevent the collision on network while sharing the common medium MAC layer is used.

→ MAC layer is responsible for flow control and multiplexing for transmission medium.

→ This layer decides who can access the network medium when multiple clients are trying to access it simultaneously.

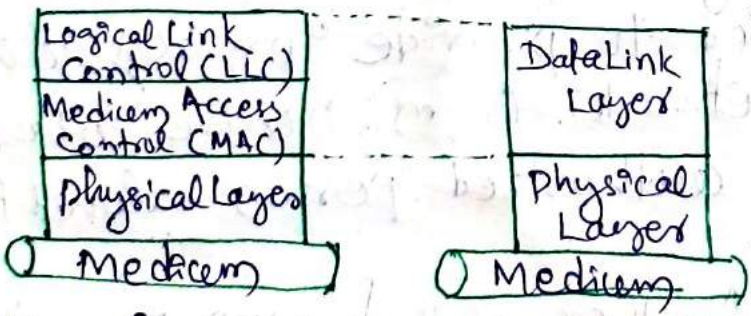
→ It establish point-to-point connections between different devices over a wireless medium.

Ex:- Token passing system or CSMA/CD for ethernet.

→ The data link layer is the second lowest layer and it is divided into two sublayers-

* Logical Link Control (LLC)
* Medium Access Control (MAC)

MAC layer diagram



* MAC layer uses 802.11 standard known as CSMA/CA.
(Carrier Sense Multiple Access/Collision Avoidance)

→ This layer is responsible for transmission of data packets from source to destination.

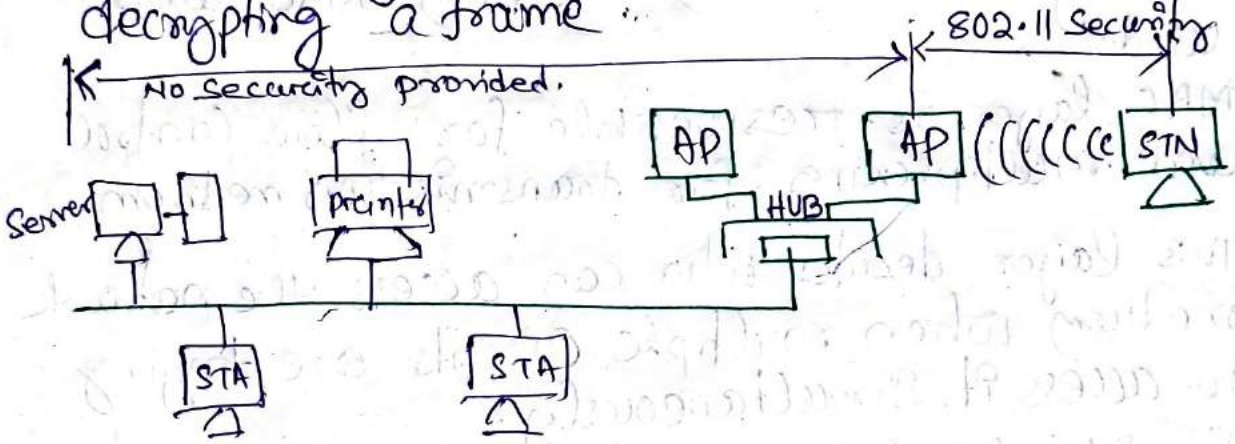
→ Every data packets successfully received send by Ack.

5.10) Security

→ Security is a major concern in wireless would because every bit is in air.

→ Bluetooth provides Security mechanism starting from key exchange to encryption.

→ IEEE 802.11 provides two mechanism to select a key for use of encrypting or decrypting a frame.



(Security Mechanism)

→ The three basic Security Services defined by IEEE for WLAN environment:-

1) Authentication:- It is a primary goal of WEP (Wired Equivalent privacy) was provide a Security Service to verify the identity of Communicating client stations.

2) Confidentiality:- Confidentiality or privacy was the second goal of WEP.

→ It was developed to provide "privacy advised by a wired network" from passive attack.

→ i.e means only authorized person allowed to view my data.

3) Integrity:- Another goal of WEP security Service developed to ensure that message not modified transmission between wireless clients and the access points in an active attack.

5.11) Synchronization

→ Synchronization is a process where the stations in BSS (Basic service set) getting step with each other for communication.

→ It provides a reliable communication.

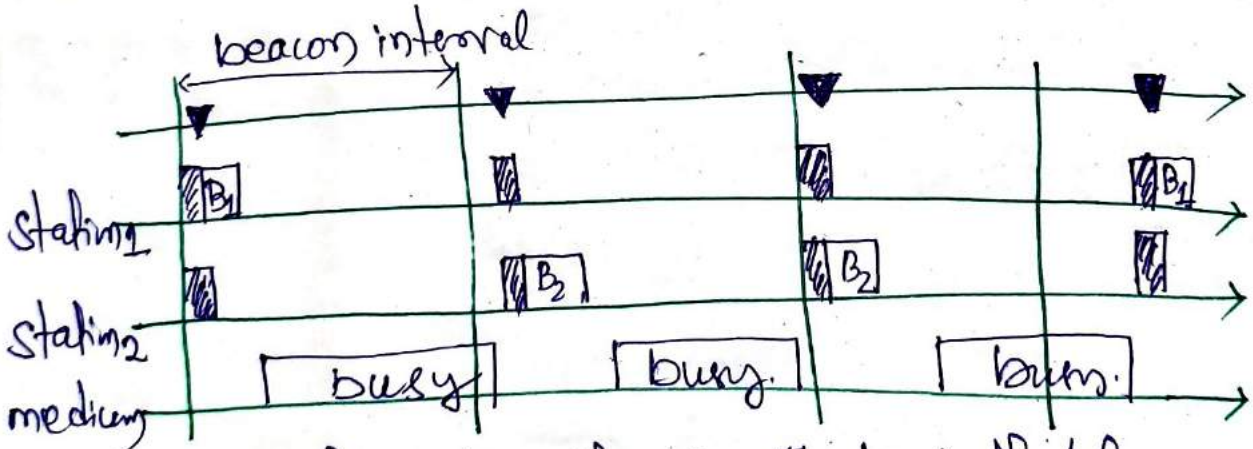
→ All Clients (Mobile) or nodes need to maintain synchronization process.

→ MAC provides the synchronization mechanism to support of physical layer.

→ MAC uses of — frequency - hopping or time based mechanism so it changes the physical layer with time.

→ It is defined by all the station updating their clocks according to access point's clock.

→ The access point transmit periodic frame called beacon. Time between two intervals is called beacon interval.



▼ value of the time stamp ▨ backoff delay.

[B] beacon frame

(Synchronization in BSS)

→ Beacon Contains the value of access point's clock at the time of transmission.

→ The packets transmission by the technique of TDMA.

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5.12) Power Management

→ Power management provides power saving modes to stations (mobile applications) of wireless LANs.

→ Power saving enables stations that to go into sleep mode without losing information.

→ The access point (AP) maintains an update record of all the stations in power saving mode.

→ Access point stored the packets for temporary period of time until the stations are requested for there packet back or the station until change their operation mode.

→ Stations must wake up periodically to receive signals and buffered data.

Power Management in an Independent BSS

→ In an independent BSS (IBSS), power management is a fully distributed process, managed by the individual mobile stations.

Power Management in an Infrastructure BSS

→ In this power management mechanism is provides to centralized in the AP.

→ This power management allows much greater power savings for mobile stations as compared to IBSS mechanism.

5.13) Roaming

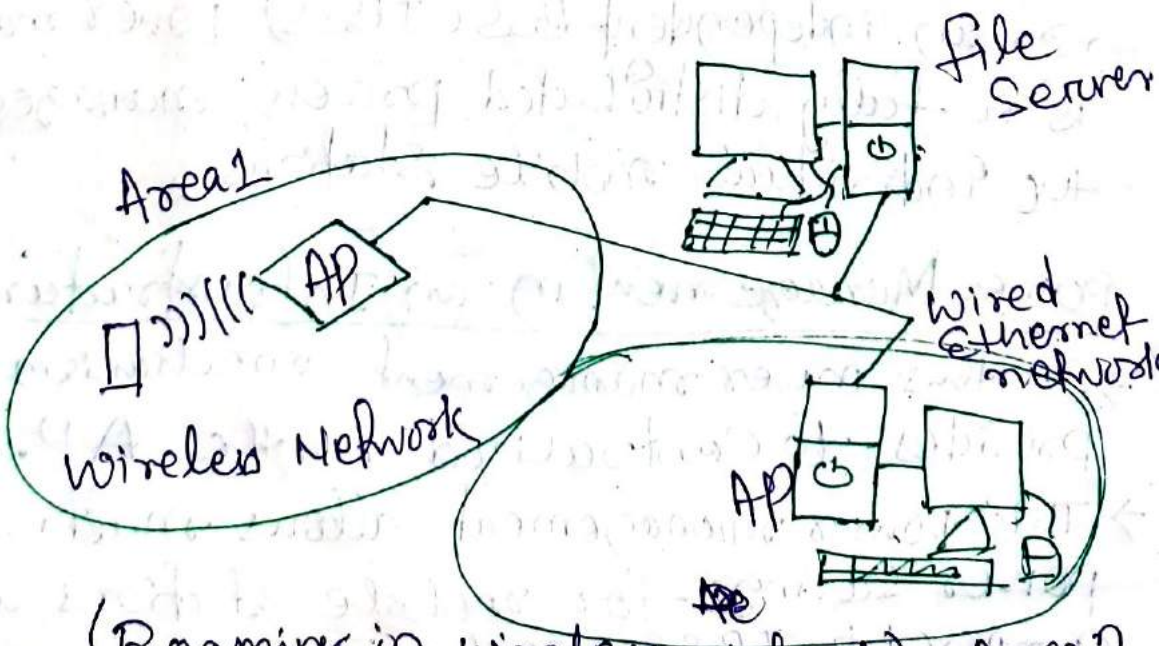
→ Roaming is the process of moving from one cell to another cell without loosing connection.

→ A client can switch between access points while physically moving and client has no restricted to being stationary.

→ Roaming is completly transparent to the user or client, they are not aware for different APs is used from area to area.

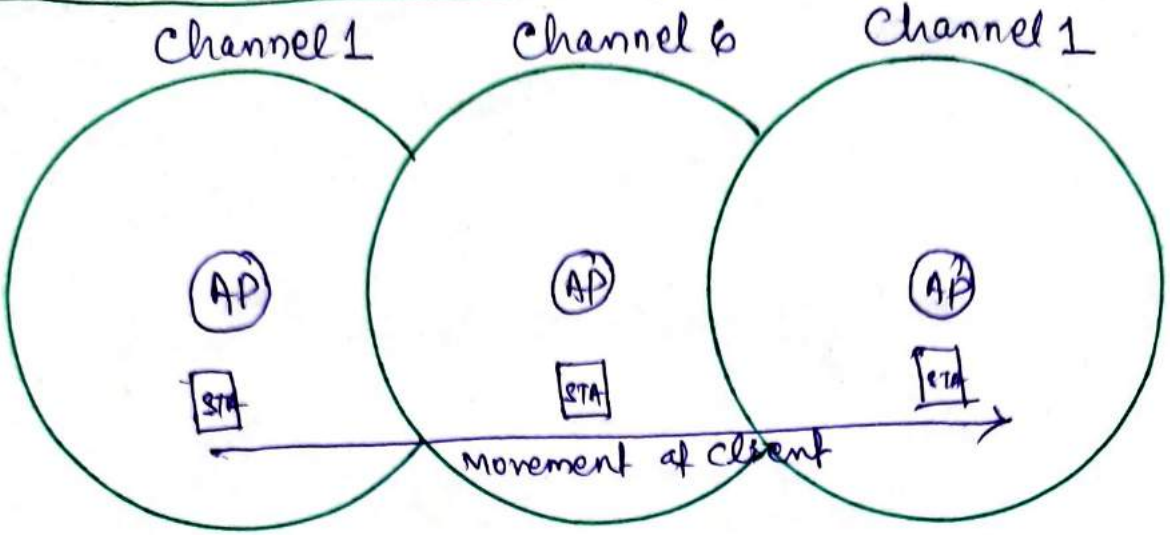
→ Some AP's required configuration for security authentication, when swapping AP., it is usally in the form of password.

→ In wireless networking hardware automatically swaps to the Access Point with the best signal provided.



(Roaming in wireless Network)

Movement of a client on a Wireless Network



→ As the client physically get closer to another access point while moving one cell to another cell.

→ The signal strength from the first (channel 1) will drop while the signal strength of others will increases

→ At one point the strengths of two will be equal and others have strongest signal and the client should roam to the next AP.

→ the clients easily roam to one are to another than the AP's maintain the followings; -

* It Connected to the same IP Subnet So Client does not Change IP address.
* It has the same SSID (Service Set identifier) to identify the wireless network
* It has same WEP (wired Equivalent protocal) key so that the client knows how to encrypt the data.

5.14) Bluetooth Overview

→ A bluetooth technology is a high speed low power wireless technology link, which is designed to connect phones or other portable devices together.

→ Bluetooth Specification standard is IEEE 802.15.1 for use of low power radio communication to link phones, computers and other devices over short distance wireless communication.

→ Wireless signal transmitted with Bluetooth technology for short distance communication upto 30 feet (or 10 meters).

→ Bluetooth transmitter has low cost and it is embedded in to devices.

→ It supports the frequency band of 2.4 GHz

→ It can connect upto eight devices at a same time

→ The bluetooth technology can adopted by Ericsson IBM, Nokia and Toshiba formed the Bluetooth Special interest Group (SIG) which published in 1999.

→ It is designed to operate in a noisy radio frequency environment.

→ Bluetooth network uses personal Area Network (PAN) or piconet which contains 2 to 8 maximum bluetooth peer devices, a single master and 7 slaves.

Unit-6 Ubiquitous Wireless Communication

6.1) Introduction

→ The idea of "anywhere, anytime, by anything and anyone" (or UAS) networking is at the core of a new technology referred as "ubiquitous networking".

→ The origin of the term "ubiquitous" is latin word, it means "being everywhere, especially at the same time".

→ The concept of ubiquitous wireless network means a number of clients can communicate when its physical movement.

→ there are four main objectives of ubiquitous networking such as! -

* freed from networking constraints capacity, location. and different links.
* freed from constraints of terminal limitation
* freed from the constraint of limited service and contents
* freed from the constraint of network risk.

6.2) Scenario of Mobile Communication

→ The mobile industry has witnessed of explosive growth in the number of subscribers in past few years.

→ As we know now a days call rates are falls due to providers are increases.

→ So the Average Revenue Per User (APRU) is shrinking. The industry having challenge in two ways; -

* By adding new Services or new user experiences for which subscribers will pay for it.
* By reducing operating expenses, where the mobile operators have to maintain regardless they own or lease lines.

→ There are two primary ecosystem in wireless industry for communication.

1) Global System for Mobile Communication. (GSM)
2) Code Division Multiple Access (CDMA)

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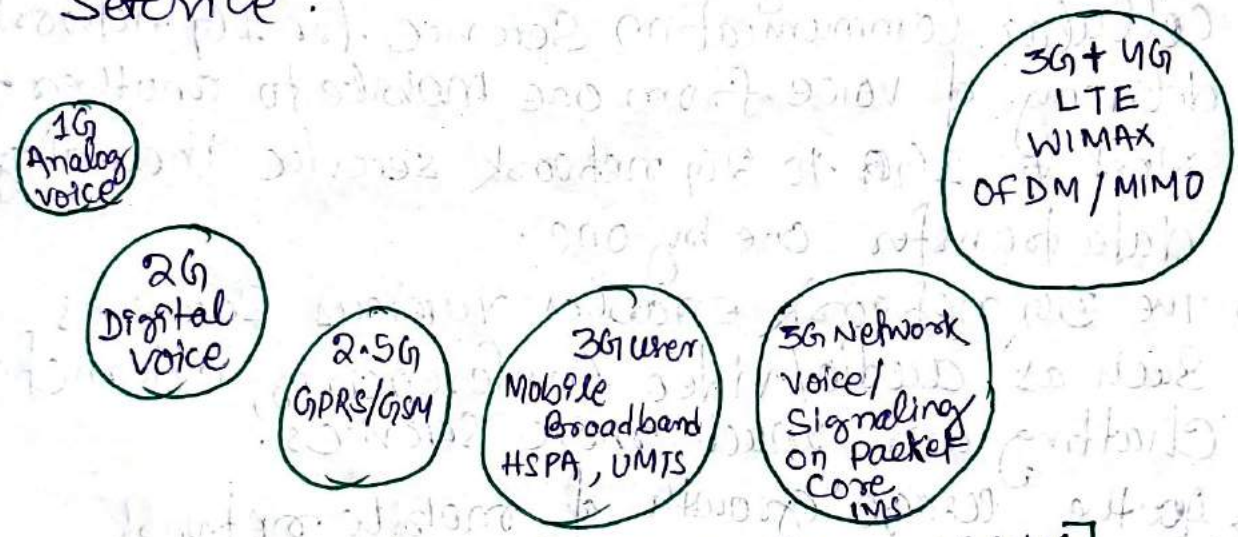
6.3) Mobile Communication Generations :- 1G to 3G

→ The standard for mobile such as GSM network and CDMA network are involved for development of a next-generation wireless System.

→ The generations have objective to create high-speed broadband and IP-based mobile System. provides network-to-network interconnection, service transparency, global roaming and independent location service.



[Cellular Network Evolution :- 1G to 4G]

→ 3G mobile System are defined by ITU (International Telecommunications Union) Specifications IMT-2000 (International Mobile Telecommunications-2000).

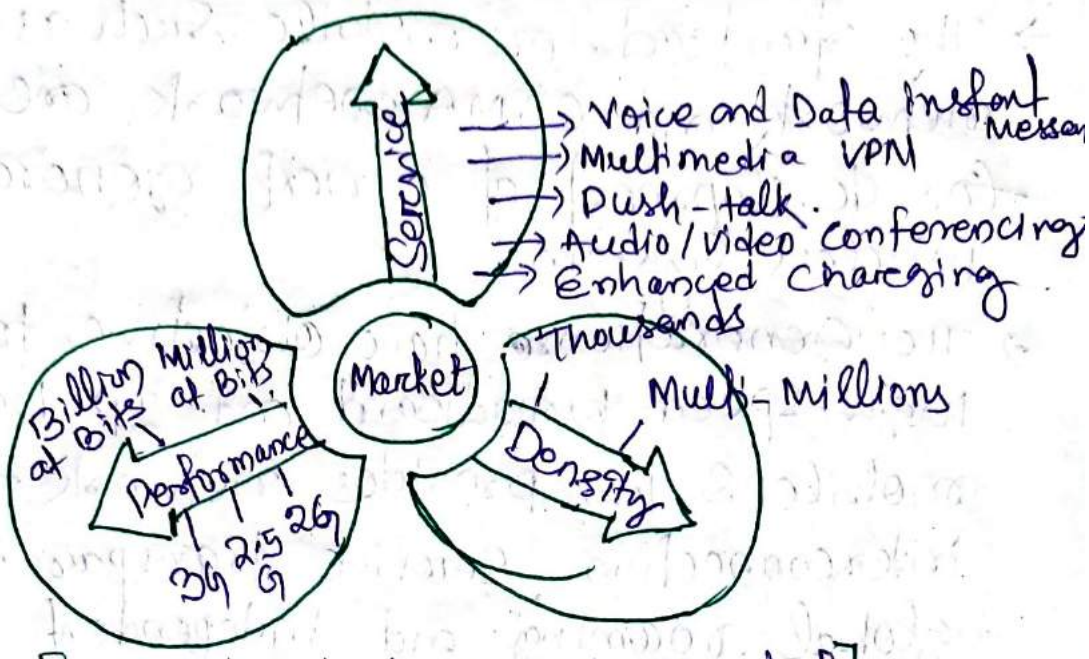
→ 3G is the Successor of 2G, it existing deployed digital mobile System.

→ 2G is the Successor of 1G, it has analog mobile System.

→ GSM is the most method choice for 2G network.

→ Voice remains same, but a new generation of wireless technology is offering high Speed data access.

6.4) 3G Generation Mobile Communication Network



[Dimension of Mobile Market]

→ Cellular communication service for 1G network delivery of voice from one mobile to another.
→ Next to 1G to 2G network service including data transfer one by one.
→ The 3G network enables various services such as audio/video conferencing, internet, chatting and much more services.
→ As the usage growth of mobile network parallel to subscribers and network usage also increases.
→ 3G push the growth of mobile market in to increase service, revenue, no of users and quality of service.
→ 3G operators provide broadband service such as internet connections, tv on smart phone.
→ These service can be attractive for young people and others for rapid growth of 3G services
→ Then 4G (LTE) introduced for high-speed internet.

6.5) Universal Mobile Telecommunication System (UMTS)

→ UMTS is a 3G mobile communication system which provides broadband services to the wireless network and mobile communication.

→ The UMTS provides low cost mobile communication at data rate upto 2 Mbps.

→ It provides global roaming feature of GSM/GPRS network.

→ UMTS used for delivery picture, graphics, video communication and other multimedia data, as well as voice to mobile wireless subscribers.

Objectives of UMTS network

* High transmission rate of data by circuit-switched or packet-switched connections.
* High frequency range and overall cost improved.
* portability of service in various environment (indoor, outdoor etc).
* It uses GSM and CDMA technology.
* GPRS supports 2G and packet-switched domain for the 3G UMTS.

UMTS Services

→ The UMTS supports for both voice and data services. The following data rates as follows:-

* 144 kbps → Satellite and rural outdoor
* 384 kbps → Urban Outdoor
* 2048 kbps → Indoor and low range (2 Mbps) → Outdoor.

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Unit-7 Mobile IP

7.1) Overview

→ Mobile IP is a part of both IPv4 and IPv6 protocol standards.

→ Mobile IP allows a host device to be identified by a single IP address even through the device may move its physical point of attachment from one network to another.

→ For data communication between two end points through TCP/IP network requires a source IP address.

→ IP address assigned to a host for communicating uniquely in a network, this structure uses for static client as desktop computer.

→ As the user moves his devices from one network to another as resulting IP address changes, this change can terminate connections.

→ The above problem is resolved by Mobile IP.

→ Mobile IP is most used in Wireless WAN environment where users need to carry their mobile devices across multiple LAN's with different IP address but get same connections.

7.2) Working of Mobile IP

→ Internet protocol is responsible for transmission of data packet from a source to destination through various routers.

→ An IP address has two parts such as network address and node address.

Ex:- a class 'C' IP address 203.197.175.123, network address (MSB 24 bits) i:e 203.197.175 and node address (LSB 8bits) i:e 123.

→ So 123 no port is receiving by host node.

→ How ever to solve the problem for moving one network to another for terminate connectn Mobile IP used.

→ To fix this problem mobile IP allows to the mobile node to use two IP address.

→ There IP address are home address and Care-of-address

→ The home address is static and known to everybody as the identity of the host.

→ The Care-of-address changes every time a new attachment is made.

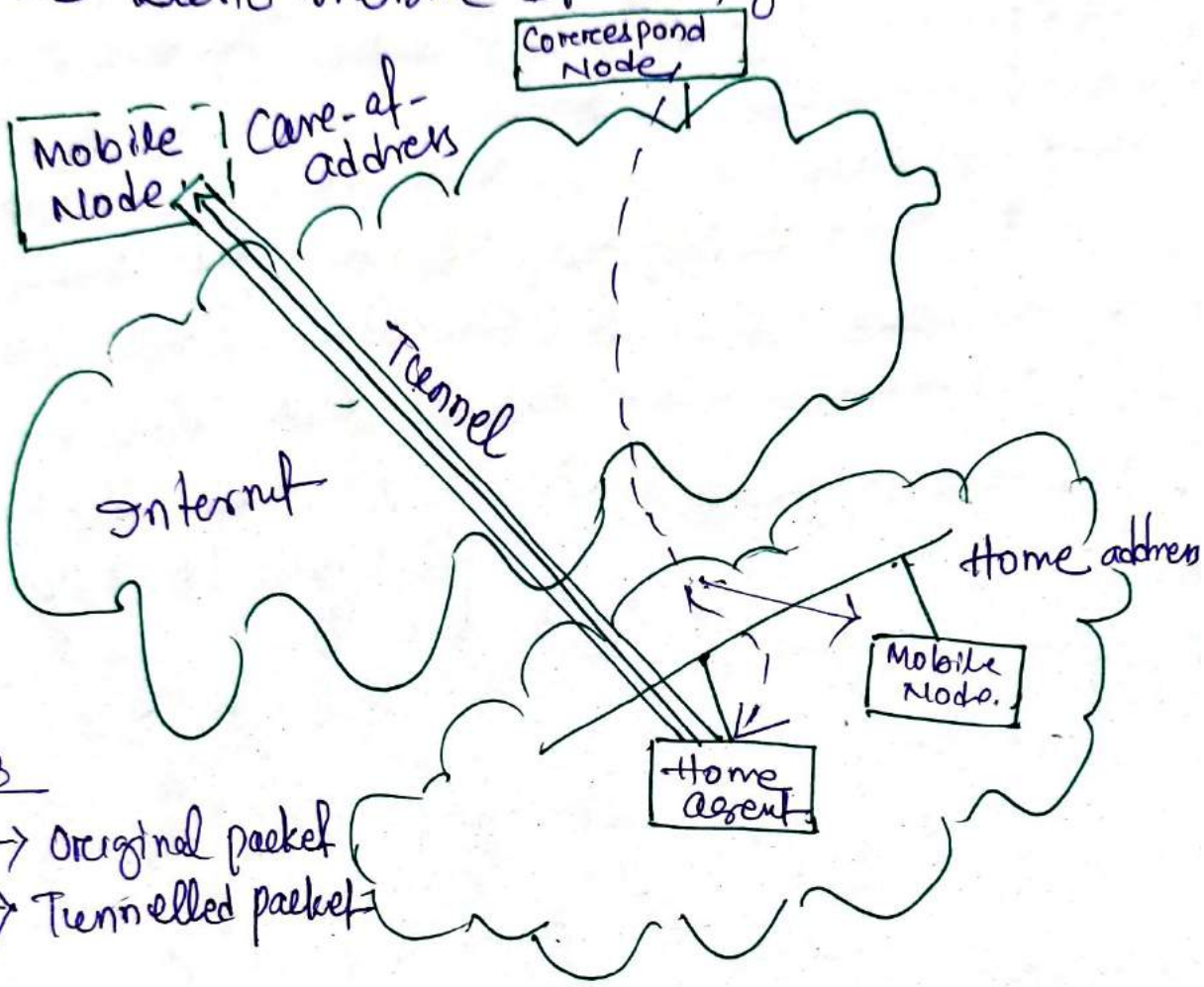
→ Mobile location is specific address while it is roaming and connect to foreign network, so home agent receives all data packets and forward them to the mobile node's current point of attachment.

→ Whenever mobile nodes moves it registred its new Care-of-address with home agent.

→ Then the home address agent forwarded data packets to the foreign network using Care-of-address becomes the destination IP address.

→ So a new header provided to original packet, that is mobile nodes home address. This concept is called Tunneling

→ the basic mobile IP figure as follows



N:B

---→ Original packet

——→ Tunnelled packet

→ IPv4 is a data-oriented protocol has 32 bit which is used on packet switched internet work.

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7.3) Mobile IP Entities

There are eight (8) entities for mobile IP such as :-

1) Mobile Node (MN):
- It is the device that can change the point of connection of the network without changing its IP address and maintain connection to its home address.

2) Home Agent (HA):
→ A router on the home link that maintains registrations of mobile nodes that away from home and the diffrent address current using.
→ It decides which tunnels data are sent to the mobile node's home address to node's current address.

3) Foreign Agent (FA):
→ It is the node's current network i.e foreign network.
→ It is a router.

4) Care-of-Address (COA):
→ It is an address by a mobile node (MN) while attached to a foreign link.
→ A mobile node can be assigned to multiple Care-of-address.

5) Correspondent Node (CN):
→ A node that communicates with a mobile node. is called CN.

→ It does not have to be Mobile IP Capable.

6) Home Address (HA)

→ Address is assigned to mobile node when it attached to home link through the IPv4 network standards.

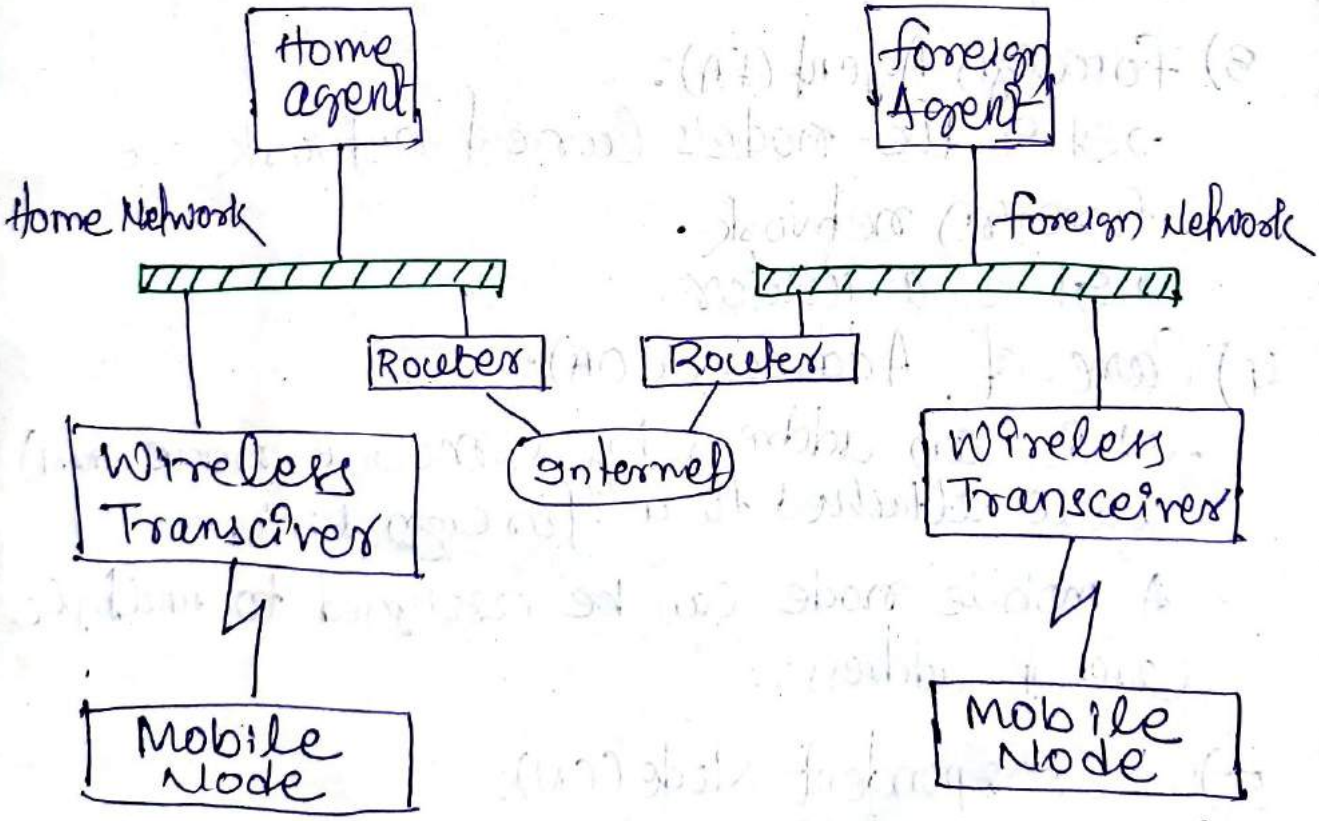
7) Home Link (HL):

- The link is assigned the home subnet from which the mobile node obtains its home address.
- → The home address resides on the home link

8) Foreign Link (FL):

→ A link that is not the mobile node's home link is called FL.

7.4) Mobility Agents



(Mobility Agents diagram)

Home Agent

-> Home agent maintain mobility on their mobility binding table.
-> The mobility binding table contains home address, Care-of-address and Lifetime (sec).

Ex:

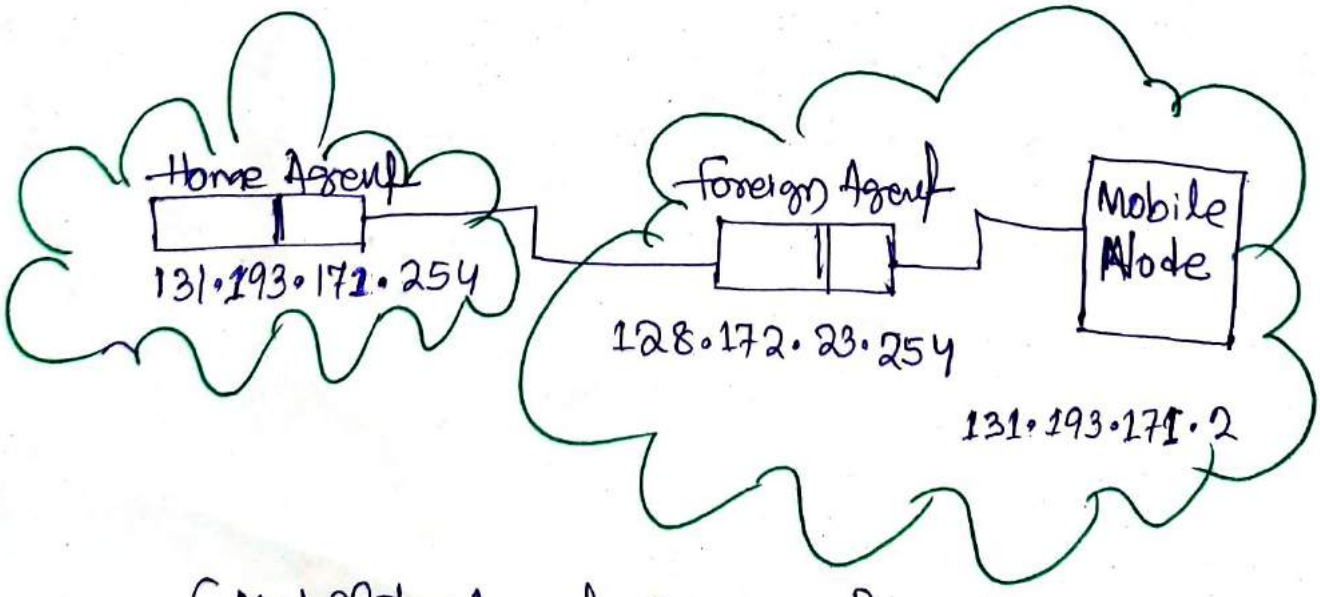
Home Address	Care-of-Address	Lifetime (sec)
131.193.171.2	128.172.23.254	200

Foreign Agent

-> It maintains visitor table which contains all mobile node currently visiting record.
-> Visitor table table contains home address, home agent address, Media address and Lifetime.

Home Address	Home Agent Address	Media Address	Lifetime (sec)
131.193.171.2	131.193.171.254	00-00-E2-30	200

Foreign Agent's address same as Care-of-address.



(Mobility Agent in a network)

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7.5) Components of Mobile IP

→ There are three main Components of Mobile IP:

* Discovering the Care-of-address:
  → A mobile node uses discovery procedure to identify prospective home and foreign agents.

* Registering the Care-of-address:
  → A mobile node uses an authenticated registration procedure to inform home agent of its Care-of-address.

* Tunneling the Care-of-address:
  → It is used to forward IP datapackets from a home address to a care-of-address.

7.6) Mobile IPv6 Features

* Larger address space: IPv6 is a unique global address for each device.
* Scalable: It runs over multiple media i.e wireless-LAN, Ethernet, 3G, 4G etc.
* Auto Configuration Capabilities: It provides auto plug-and-play Connecting network.
* Fixed header format: It has fewer fields as Compared to IPv4. It has 8 field header format and 12 for IPv6.
* Router Header: IPv6 updates are extension headers.
* Security Extension: Internet level Security in IPv6 Header.

* Encapsulation: It provides IP-layer authentication and encryption possible.
* Quality of Service and flows data: It provides efficient routing for realtime applications.
* It eliminations of "triangle routing" for mobile IP.
* All nodes can handle bindings.
* Small Overhead for distributing bindings, fixed header format.
* Option extension headers not passed by intermediate routers anymore.
* Anycast Address: Speeral type of address in IPv6.

7.7) Mobile IPv6 Address Types

There are three types of IPv6 address such as

1) Unicast (one-to-one)
2) Multicast (one-to-all)
3) Anycast (one-to-several)

1) Unicast

→ It is a communication between a single host and a single receiver.
→ A unicast address defines a single interface
→ A data packet sent to a unicast address is delivered to the specific host/node/computer.

2) Multicast

→ So this communication is establish between a single host and multiple receiver.

→ There address are used to define a set of interfaces that typically belong to different nodes instead of just one.

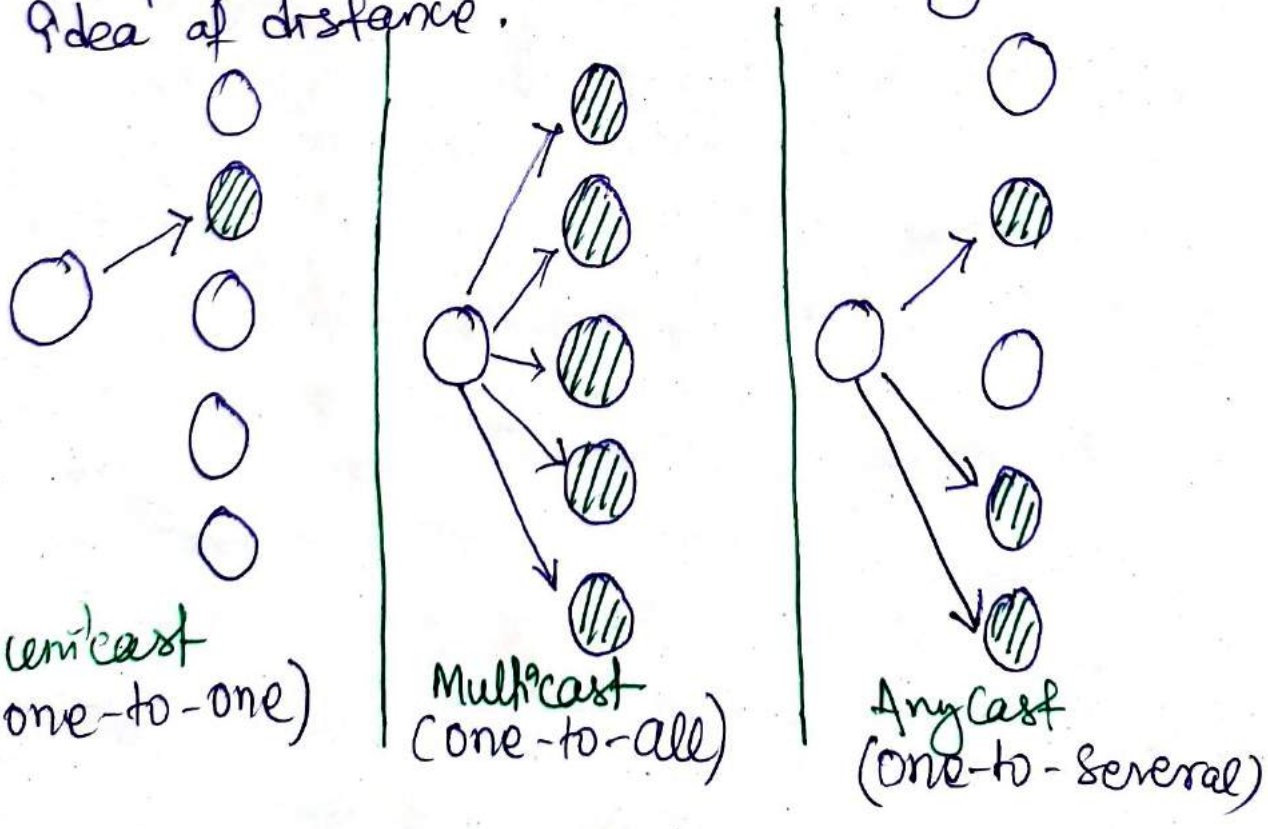
→ Sending a data packet in multicast address, then the protocol delivers the data packet to all interfaces (receivers) identified by that address.

3) Anycast

→ It is a communication between a single Sender and a list of address (receiver.)

→ there address are also assigned to more than one host belongs to different nodes.

→ A datapacket sent to anycast address which delivers of data packets to number of specific hosts, just one of host with routing protocols idea of distance.



7.8) Mobile IPv6 Address Scope

→ The mobile IPv6 address scope is divided by three types such as: -

1) Link-Local:

→ It uses on a single link.
→ The data packets with link-local from source to destination address are not forwarded to others.
→ In link-local address data transmits between the nodes in the same link or network.

2) Site-Local:

→ It used for a single site.
→ The data packets are transmitted between source or destination but not forwarded to other sites.
→ In site-local address, the data packet transmits between nodes in the same site.
→ It cannot be routed outside the site.

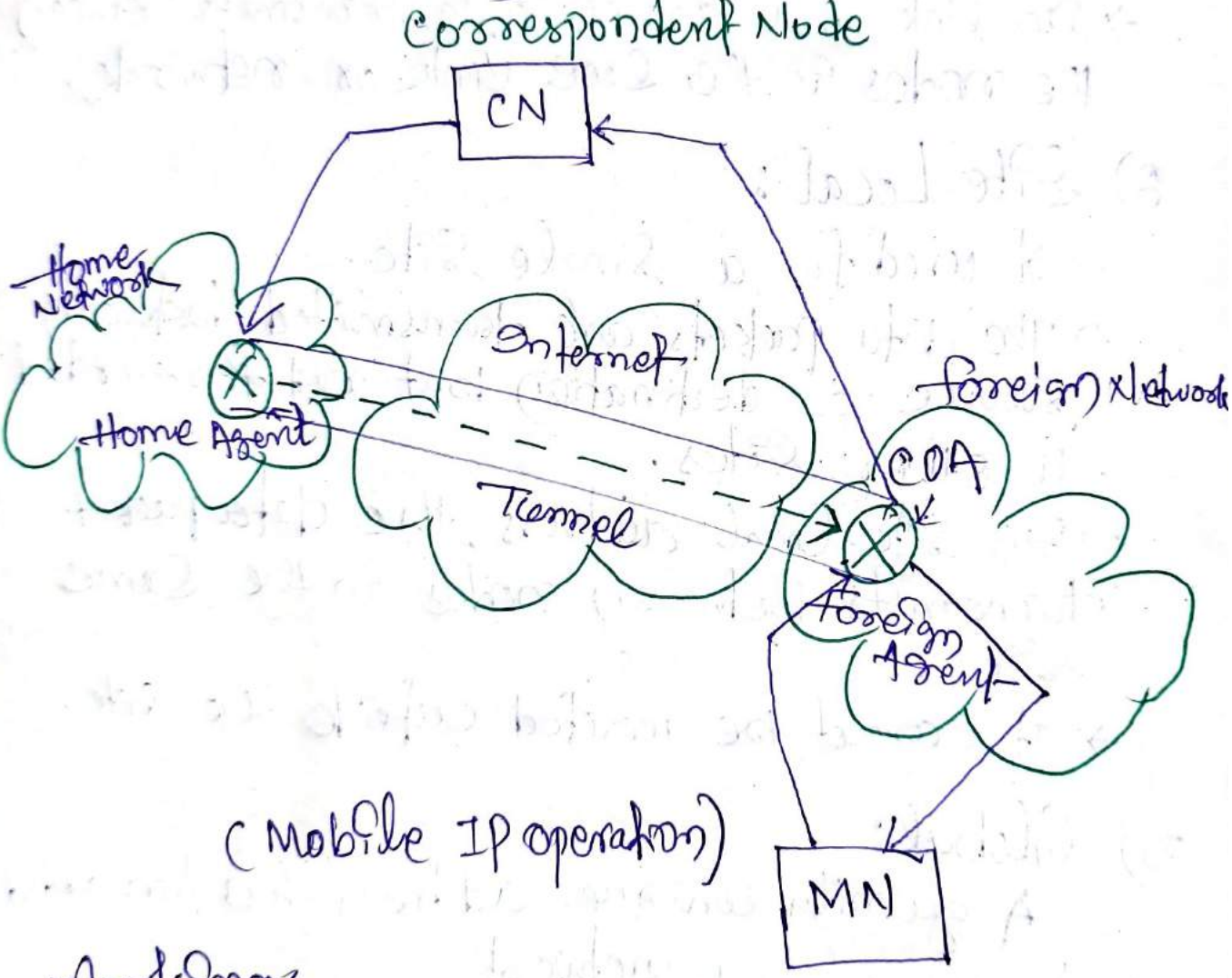
3) Global:

→ A globally unique address has forwarded to any global network.
→ The data packets with global address can be forwarded to any part of global network.

7.9) Mobile IP Operation

→ Mobile IP is a communication protocol that allows the users to move from one network to another with the same IP address.

→ Mobile IP ensure that the communication will continue without user's sessions or without connection dropped.



(Mobile IP operation)

Working

→ The correspondent node sends the data-packet to the mobile node.

→ The data packet contains CN's address (source) and home address (Destination) of MN.

→ When the data packet reaches to the home agent but that time MN is not in the home network, it is moved to foreign network.

→ Foreign agent sends the Care-of-address to the home agent for sending the data packets.

→ Now a tunnel will be establish between home agent and the foreign agent by the process of tunneling.

→ Tunneling establishes a virtual pipe for the packets available between a tunnel entry and an endpoint.

→ It is the process of sending a data packet via a tunnel this mechanism is called encapsulation.

→ Now home agent encapsulates the datapacket into new packet which has the source address is home address and destination address is the Care-of-address through the tunnel to the foreign agent.

→ At receivers side, the tunnel received data packets and decapsulates them and sends to the "mobile Node".

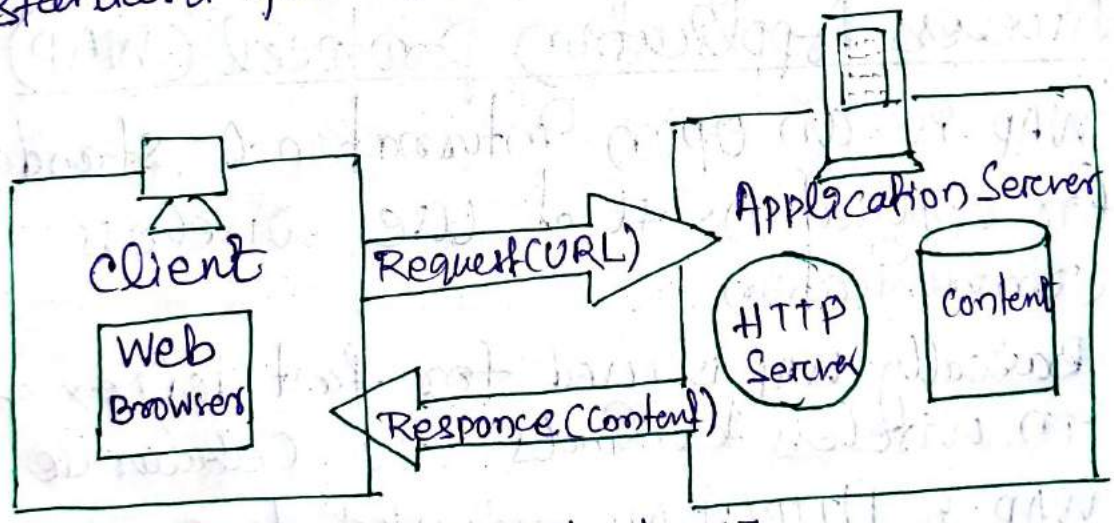
→ Mobile Node in response to the data packet as reply to foreign agent.

→ Then the foreign agent directly sends the reply to the Correspondent node.

Unit-8 Mobile Computing

8.1) WWW architecture for mobile Computing

→ The WWW architecture provides a very flexible and powerful programming model.
→ Application and Content are present in standard format of data.
→ These are browsed by an applications known as web browsers.
→ The web browser is a networked application i.e it sends requests for named data objects to a network server and the network server responds with the data encoding using the standard formats.



[WWW Architecture]

→ The WWW standards specify many mechanisms to built general-purpose application environment such as:-

* Standard naming model: All server and content on the WWW are named with an internet standard that is URL (Uniform Resource Locater).
* Content Typing: All content on the WWW has specific type allow by webbrowser for correctly

process content on its types.

* Standard Content formats: All web browsers support a set of standard content formats.
  - → There including HTML, Scripting language (JavaScript, VBscript) and a large number of other format.

* Standard protocols: It allows to any browsers to communicate with any web servers.
  - → the most commonly protocol used in www is hyper text transport protocol (HTTP).
  - → HTTP operates on top of TCP/IP protocol suite.

Wireless Application protocol (WAP)

- → WAP is an open international standard for applications that use wireless communication.
- → Basically WAP is used for fast delivery of data in wireless terminals i.e cellular devices.
- → WAP is HTTP/HTML adjusted to small devices.
- → It consists of a network architecture a protocol stack and Wireless Markup Language (WML).
- → WAP is published by the WAP forum, founded in 1997 by Ericsson, Motorola, Nokia and Unwired Planet.

→ WAP is now the protocol used for the majority of the world's mobile internet sites known as WAP site.

→ The Client/Server approach is used for the application layer here the Client's workspace is any wireless terminal.

→ The WAP Client software is called WAP browser.

→ To fit into small wireless terminal WAP uses a Micro Browser.

→ A Micro Browser is a small piece of software makes demands on hardware, memory and CPU.

→ The display information written WML (Wireless Markup language).

→ The Micro browser can interpret the version of JavaScript called WML Script.

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8.2) Need of WAP

→ WAP stands for wireless Application Protocol.

* Wireless:- Not required wire for transmission
* Application:- A computer program or a computer software that is designed to do a specific task.
* Protocol: A set of rules for transmission of data packets between sender and receiver.

→ WAP is the set of rules governing the transmission and received of data by computer applications via wireless devices like mobile phones..

→ WAP is a standardized technology for cross-platform, distributed computing very similar to Internet's combination of HTML and HTTP.

→ WAP is optimized for low-display capability, low memory, low bandwidth devices such as wireless phones, PDAs (Personal digital assistants) and pagers etc.

→ Wireless hand-held devices has less powerfull CPU, low battery life, less memory, restricted power consumption, smaller display and different input devices

→ WAP is needed for wireless hand-held devices for communication purpose only.

→ WAP is designed to scale across a broad range of wireless network like GSM, IS-95, IS-136 and PDC bend.

8.3) Benfits of WAP

* It is device independent.
* It is network independent.
* WAP utilizes standard Internet markup language technologies, XML
* Optimizing the Content and air link protocal.
* The Wireless Markup Language (WML) provides User Interface (UI) Components map well onto existing mobile phone UI.
* No re-education of the end-users.
* Eary to use.
* Access to wide variety of Serevices on a Competitive market.
* The possibility of having personalised Services.
* fast, Convenient and efficient access Services.
* WAP devices will be available in various form factors eg. pagers, hand-held PC. and Cell phones etc.

8.4) Examples of WAP Use

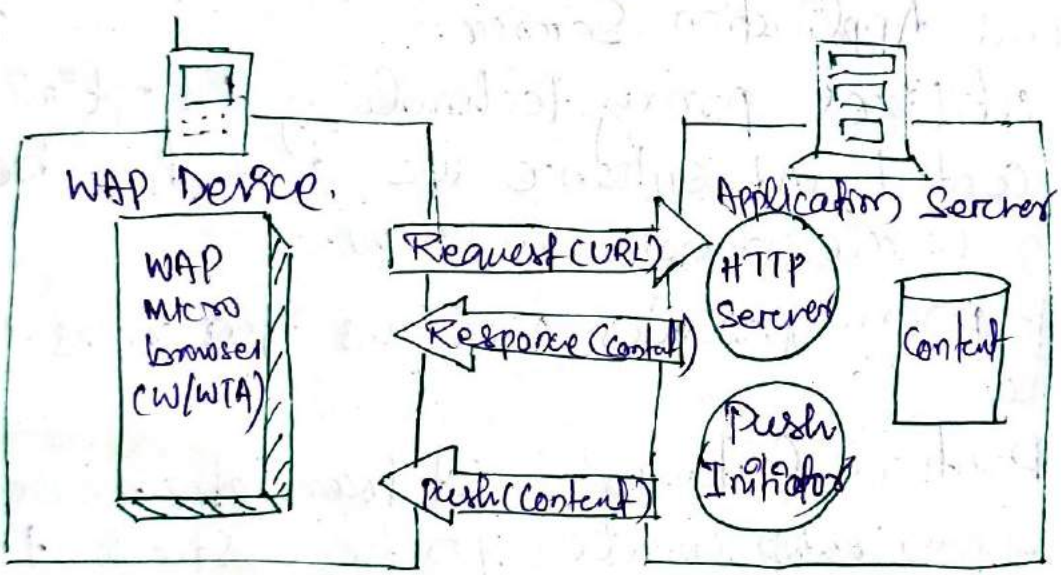
* Checking train time table information
* Ticket purchase online.
* flight Check-in
* Viewing traffic information
* Checking weather conditions
* Looking up Stock value
* Looking up phone numbers
* Looking up address
* Looking up Search results etc.

8.5) WAP Architecture

→ The WAP programming model adopting the www programming model provides several benefits to application developers community, including a familiar programming model, client-server model, and use existing tools (eg web server, XML tools etc)

→ WAP has added to the programming model are push and telephony support (WTA).

→ The classical request-response mechanism is known as pull and push mechanism.

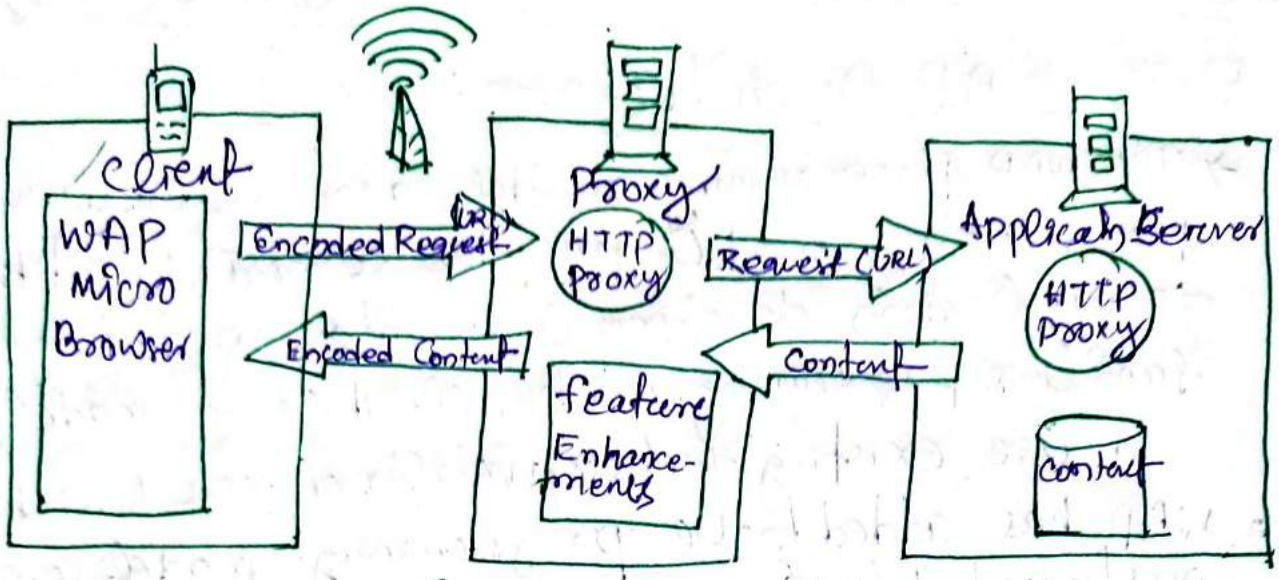


(WAP Architecture)

→ WAP Content and application are specified in a set of well-known content formats based on the familiar to WWW content formats.

→ Contents are transported using a set of standard communication protocol based on the WWW protocol.

→ The WAP micro browser in wireless devices co-ordinates the user-interface to standard web browser.



(WWW Architecture)

→ There are three components of WAP architecture are :- WAP client, WAP proxy or WAP Gateway and Application Servrer.

→ WAP utilizes proxy technology to optimize the content and enhance the connection between wireless domain and WWW.

→ WAP proxy provides various functions suchas!-

* Protocol Gateway!- It translates requests from wireless protocol stack to the WWW protocols also perform DNS look up.

* Content Encoders and Decoders!- It translate WAP content in to a compact format due to slow wireless link and viceversa.

* Usere Agent Profile Management:-
→ It enable personalization and Customization of the device.

* Caching proxy:- It improves performance and network utilization by maintaining a cache frequency accessed resources.

→ WAP client primarily included wireless phones, PDA's and pagers.

→ It allows the user to manage User interface similar to a web browser on a desktop Computer.

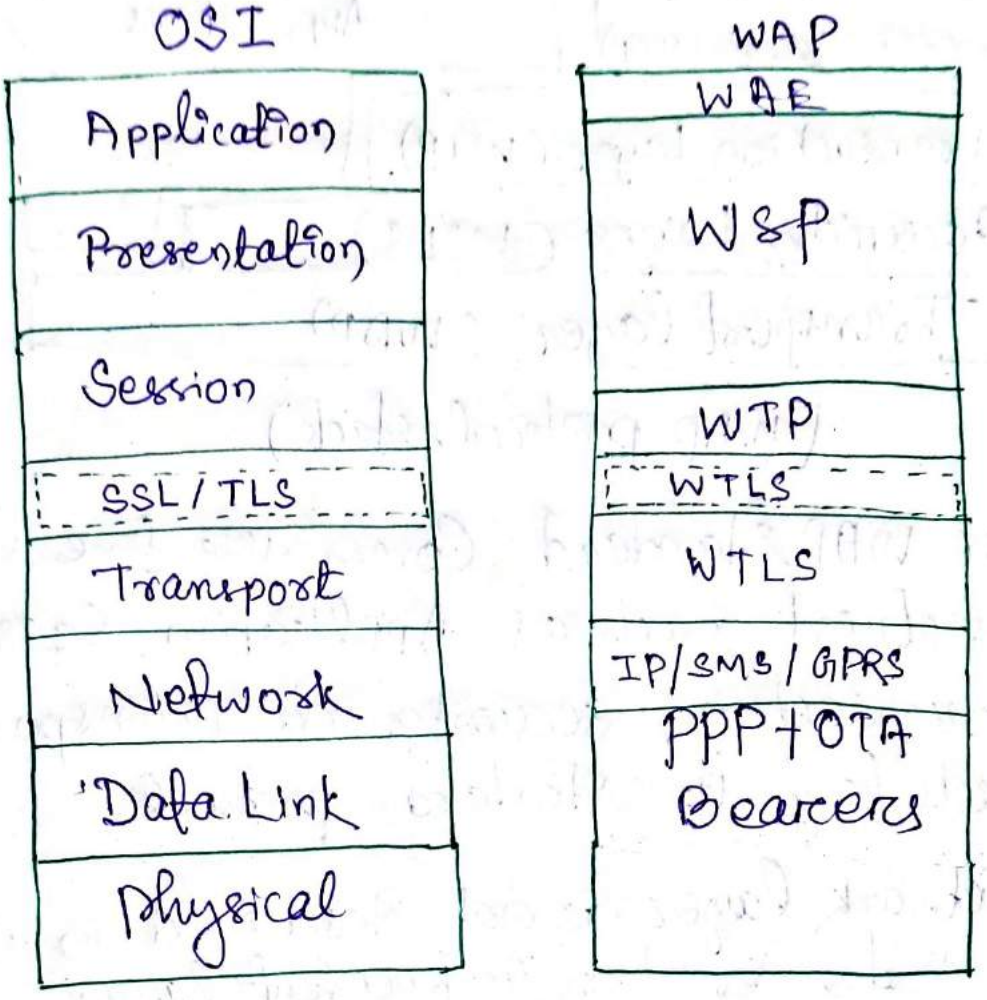
→ WAP specification determines how WML and the WML Script language are interpreted by wireless terminal and how they interact to the user by well user interface.

→ Application Servers are consists of three tires such as:-

* Web Servers:- It understands HTTP protocol and responds to HTTP requests from the clients. for eg Apache, iplanet, Microsoft IIS etc.
* Application Servers:- It encodes elements like personalization, Commerce, Securing and data storage logic. for eg Weblogic etc.
* Data Servers:- It used for persistent storage of application data. for eg Oracle, Sybase, Informix etc.

8.6) WAP Protocols

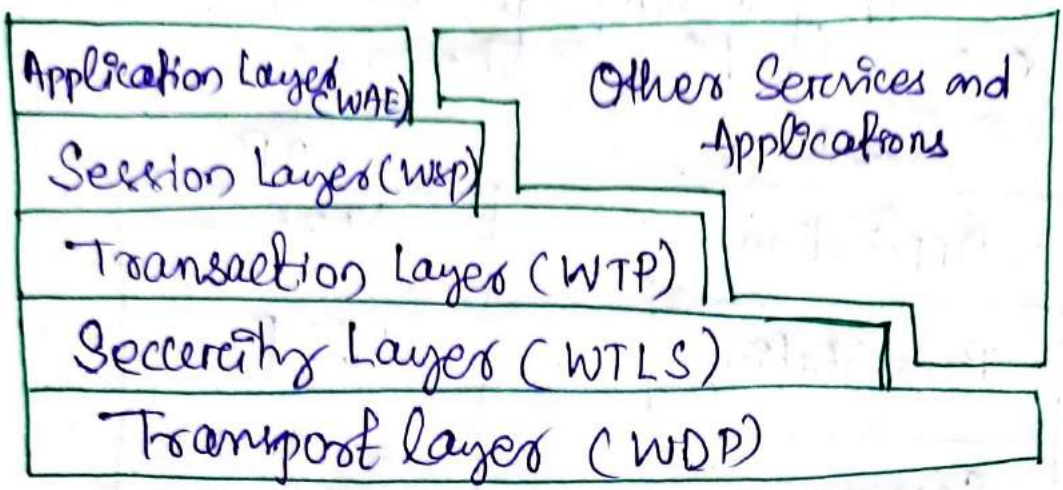
→ The mapping of WAP protocol stack to the OSI model is shown as :-



OSI Vs WAP layers

→ WAP devices Communicate with Web Servers through WAP gateway.
→ WTLS is only used between the device and the gateway SSL/TLS.
→ WAP Protocol can be used between the gateway and the web Servers on the Internet.
→ The gateway vendors have ensure that the encryption and decryption takes place in memory for the users.

→ WAP Protocol stack as follows:-



(WAP protocol stack)

→ The WAP standard covers the five layers of network such as Application, Session, Transaction, seceurity and Transport layer. each layer has standard protocal.

→ Network layer is not described in WAP Specificatn so it is independent layer.

Physical and Datalink Layer:-

- In WAP, Point-to-Point protocols (PPP) are used over one or more Over-the-Air (OTA) bearer protocal.

Network Layer:-

→ IP is the network layer of choice.

→ Not all wireless networks are capable of transmitting IP so that SMS or some other non-packet network protocal used.

Transport Layer:

→ UDP is used in this layer.

→ UDP is not feasible over non-IP network so WAP defines an additional protocol which is WDP.

→ WDP used when UDP not use.

Session Layer:

= the functionality of Session layer is partially included in WTP. others are implemented over WSP.

Presentation Layer:-

→ The functionality of this layer included in WSP

Application Layer:-

→ this layer include WSP and WAE.

N:B

WAE:- Wireless Application Environment
WSP:- Wireless Session Protocol.
WTLS:- Wireless Transport Layer Security
WTP:- Wireless Transaction Protocol
UDP:- User Datagram protocol
WDP:- Wireless Datagram protocol

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Continue from WAP protocals ...

WDP (Wireless Datagram protocol)

→ It is a transport layer protocol in the WAP architecture.

→ WDP provides a common interface to the Security, Session and Application layers.

→ The datagram service provides data transport to be routed from source to the destination.

→ UDP and WDP are two protocols used to provide data-gram transport service in the WAP architecture.

→ The data transport service provides 3-phases of working phases such as connection establishment, two-way reliable data transfer and connection release

WTLS (Wireless Transport Layer Security)

→ All communication from the mobile phone to the internet passes through the WAP gateway.

→ for providing Security the SSL/TLS protocol can't provided due to constraints of mobile phone.

→ The result is WTLS the wireless security provides alternative to SSL/TLS protocol.

→ It include different algorithm for cryptography by default.

→ WTLS operates just above of the transport layer in the OSI protocal stack.

→ WTLS establish a session between a client and a server, this is called handshake phase.

→ WTLS supports a full handshake in which the securing parameters of another session are reused.

→ Once session established then all communicatn between client and server is encrypted.

WTP (Wireless Transaction Protocol)

→ WTP specifies a set of transaction provide reliable and unreliable messaging between the client and the WAP gateway.

→ It operates either secure or non-secure wireless datagram networks.

→ It provides three different kinds of transaction service such as Unreliable one-way, reliable one-way and reliable two-way transactions.

WSP (Wireless Session Protocol)

→ WSP provides a consistent interface between two session services.

→ It establish reliable session from client and server and also close the session in proper fashion.

→ It offers both connection oriented and connection less services.

→ WSP function between WAE and WTP Protocol

→ WSP uses data exchange is performing using compact encoding method.

WAE (Wireless Application Environment)

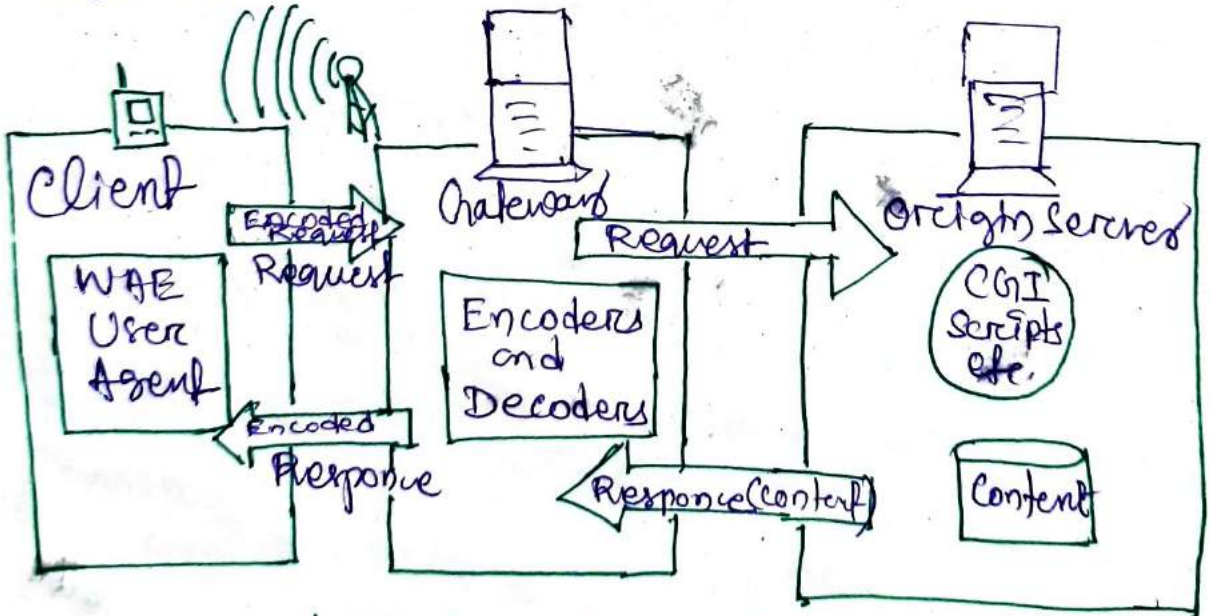
→ The WAE is the top-most level in the WAP architecture.

→ WAE based on WWW and Mobile telephony technology.

→ The aim of WAE provides the Software manufacturers, hardware vendors or Service providers on which they can build applications & services for wireless devices.

→ WAE includes the micro-browser which using WML and WML Script also use of Wireless Telephony Application (WTA).

→ The goal of WAE is to minimize air traffic and resource utilization on the wireless devices.



WAE (Wireless Application Environment)

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8.7) WML (Wireless Markup Language)

→ The WAP suite is similar to the HTTP suite that consists of many parts or components.

→ The WAP suit includes a Wireless Markup Language (WML) that used to create WAP pages is similar to HTML that used to create webpages for standard webbrowser.

→ WML is tag based document-type-definition manupulation language.

→ WML is an application of XML and HTML.

→ WML document have file extension is .wml.

→ WML represents standardized markup language defined by WML forum which promote wireless standards.

→ WML is designed for take care of the small wireless devices (mobile phone) and low bandwidth of transmission.

→ WML is the markup language defined in the WAP specification.

→ WAP sites are written in WML, while websites are written in HTML

→ It is similar to HTML, both of them use tags and written in plain text format.

→ Every line is compiled to binary by WAP gateway

→ WML supports Client-side scripting.

→ All tags are case sensitive, all tags must be closed properly.

WML deck and Card

→ Every website or webpage has a basic unit of navigation so in HTML is a page while that in WML is a card.

→ It is major difference between HTML and WML.

→ A deck is a logical representation of a document.

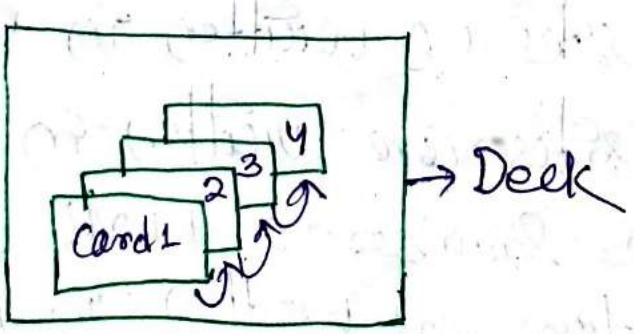
→ A deck are made up of multiple cards.

→ A WML file contains multiple cards which form a deck.

→ Each WML card in a deck performs a specific task for the user interaction.

→ WML deck can be stored in static files are fetched by JSP, ASP or CGI scripts.

→ Card within a deck can be related to each other with links.



(WML deck and Card)

→ A Card element can contain text, input fields, links, images etc.

→ When a WML page is accessed from a mobile phone, all the cards in the deck (page) downloaded from the WAP Server.

→ So if the user goes to another card of the same deck, then the mobile browser does not have to send any request to the server. due to the deck already contains all cards which is stored in that wireless device.

Basic Parts of WML Document

The structure of WML document is as follows:-

* Reference to DTD
* <wml> tag
* Document Header
* Template
* Set of Cards, each having start and end tag
* </wml> tag.

Every WML file must include XML and Document Type Declaration the structure as follows:-

A Simple WML document

```
<?xml version="1.0"?>
<!DOCTYPE wml PUBLIC "-//WAPFORUM//DTD WML 1.1
  //EN" http://www.wapforum.com/DTD/wml_1.1.xml>
<wml>
    <card> <p> Welcome to WML document </p>
    </card>
</wml>
```

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Continue from WML.

A simple WML document

```
<?xml Version = "1.0"?>
<!DOCTYPE wml PUBLIC "-// WAPFORUM// DTD WML 1.1
 //EN" http://www.wapforum.com/DTD/wml-1.1.xml>
<wml>
    <card id="one" title="First card">
        <p> Welcome to wml document </p>
    </card>
</wml>
```

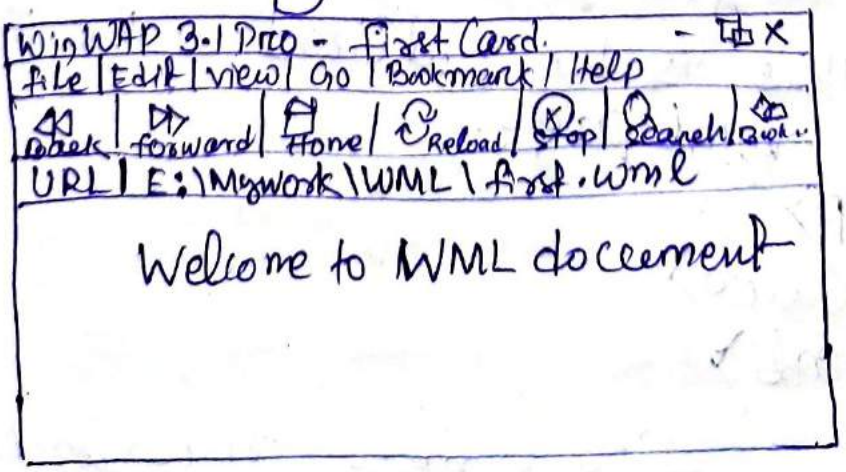
→ The first line of this text says that is an XML document and the version is 1.0.

→ The second line selects the documenttype and gives the URL of the document type definition (DTD).

→ One WML deck (i.e page) can have one or more cards is placed within <wml> and end tag of wml.

→ Within Card tag the exact Content was placed for doing specific task.

O/P

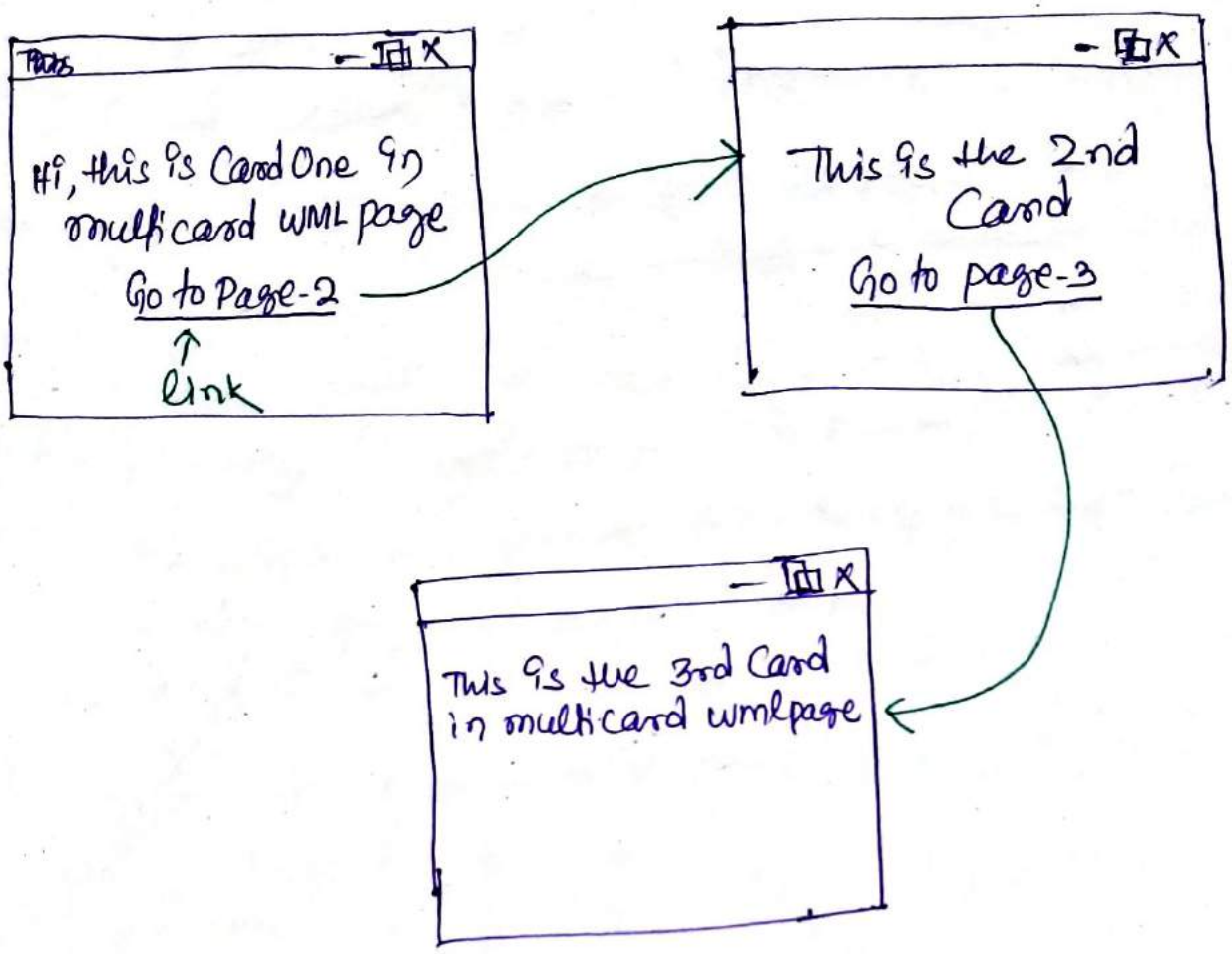


Q) Write a WML program for multi Card wml page.

```
<?xml version="1.0"?>
<!DOCTYPE wml PUBLIC "-//WAPFORUM//DTD WML 1.1//
EN" "http://www.wapforum.org/DTD/wml_1.1.xml">
<wml>
<card id="mainCard" title="This is the 1st Card">
  <p align="center">
    Hi, this is Card One in a multicard WML page
    <br/>
    <a href="#Card2"> Go to page-2. </a>
  </p>
</card>
<card id="card2" title="This is the 2nd Card">
    <p align="center">
      This is the 2nd Card
      <br/>
    <a href="#Card3"> Go to page-3 </a>
    </p>
</card>
<card id="card3" title="This is the 3rd Card">
  <p align="center">
    This is the 3rd Card in the multi card
      wml page.
  </p>
  </card>
</wml>
```

filename :- multiCard.wml

Output (all one display in same window)



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8.8) WAP Push architecture

→ The WAP push framework allows information to be sent to a client device without user action.

→ The client/server model is refferd as pull technology which means client send request and server respond that request to its client.

→ WAP push technology is also based on client/server model but there is no explicit request send by the client.

→ The server transmits its content before the client's request.

→ Pull service always made by client and push service always made by server.

→ Push technology is helpful to impliment message alert and notifications.

(Push Services)

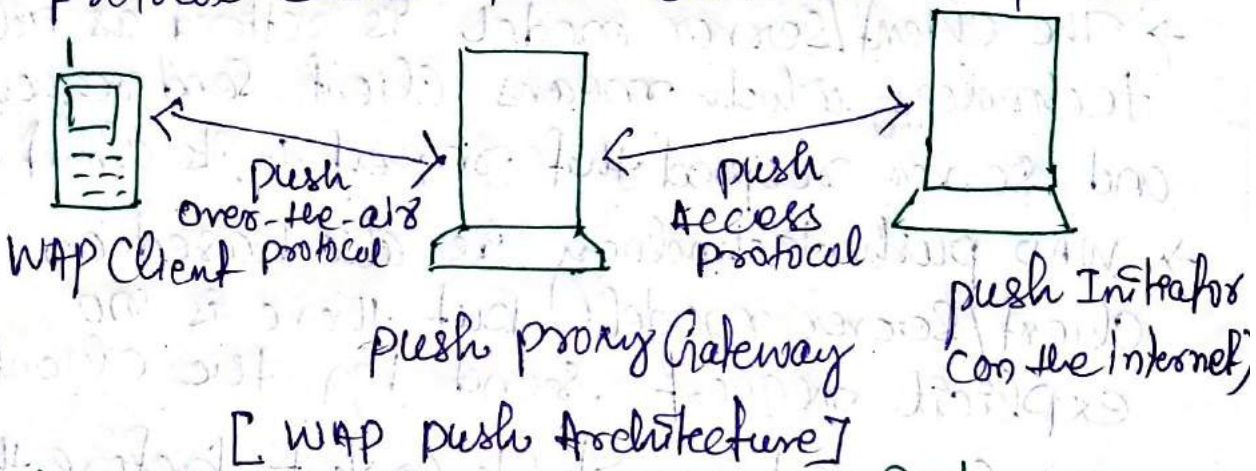
Working of push framework

→ The push content is stored in a server in the internet which needs to delivered to a mobile phone.

→ The Push Initiator (PI) contacts the push proxy Gateway (PPG) from the internet side and delivers content to the destination side.

→ then PPG forwards the Content to the mobile network to be delivered to destination Client over-the-air protocol.

→ Internet side PPG protocol is called push Access Protocol and the WAP Client side protocol called push Over-the-Air protocol.



[WAP push Architecture]

8.9) Push-Pull based data acquisition

→ there are three types of browsing Content Can be pushed to a WAP microbrowser such as!-

1) Service Indication (SI):
→ the SI push Service provides the push Content to user to notify them about e-mail retrival, news, Commercial offers etc.

2) Service Loading (SL):
→ the push SL provides service to push some content to the WAP devices without request by user. (i:e flash service msg)

3) Cache Operation (CO):
→ the push CO provides service for invalidating objects stored in the WAP devices Cache memory.

→ MMS client also in WAP device which receives push message and delivery of reports.

8.10) I-Mode

→ I-mode stands for Internet Mode is a micro-browser technology that supports text, graphics, and videos for mobile phones.
→ It offered by Japan's cellular network.
→ It uses WAP and use of HTML and WML.
→ I-Mode was the World's first Smart phone for web browsing.
→ The I-Mode wireless data Service offers color and video over many phones.
→ Its mobile Computing Service enables users to do telephone banking, airline reservations, Send and receive email and access to Internet.
→ As of early 2000, the I-Mode has 5.6 million users.

8.11) WAP 2.x

→ The WAP 1.x architecture Consists of Origin Servers, gateway and user-terminal.
→ The Servers Could be a WAP or HTTP Server. and the gateway translated the protocol layers and application information.
→ The WAP 2.x architecture Consists of four Components Such as
1) The Applicating Environment
2) Protocol framework
3) Security Services
4) Service Discovery.

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Unit-9 Wireless Telecomm Networks

Introduction

→ The 1st Generation wireless devices communicated only voice signals, so it reffered as 1G network.

→ then voice transmission carried data that is 2G network, it introduced in year 1988 and provides data rate upto 14.4 kbps.

→ 2G has variations such as 2.5G and 2.5G+ which supports data rate upto 100 kbps.

→ The 3rd generation (3G) supports much higher rates of voice and data with multimedia streams.

→ 3G supports data rate of 2Mbps for short distance and 384 kbps for long distance transmission.

→ The 4G (or 4GLTE) is around five to seven times ~~faster~~ than 3G, it offering high speed data transfer rate upto 150Mbps.

→ It improves speed, crystal-clear voice calls. VOLTE (Voice Over Long Term Evolution)

9.1) GSM (Global System for Mobile Communication)

→ GSM is a globally accepted standard for digital cellular communication network.

→ The idea of GSM was developed at Bell Laboratories in 1970, after that it is widely used mobile communication system in the world.

→ GSM is an open and digital cellular technology used for transmitting mobile voice and data services operates at the frequency of 850 MHz, 900MHz, 1800 MHz and 1900 MHz frequency bands.

→ GSM System was developed as a digital ~~Signal~~ System using time division multiple access (TDMA) technique for communication purpose.

TDMA

TDMA technique provides different time slots to each user on the same frequency. It can easily adapt to data transmission and voice communication and carry 64 kbps to 120 Mbps of data rate.

→ there are various cell sizes in a GSM system such as macro, micro, pico and Umbrella Cells.

→ the coverage area of each cell varies according to the implementation environment.

→ The security strategies standardized for the GSM system make it the most secure telecommunications standards currently accessible.

Features of GSM

* Supports International roaming
* High-quality Speech
* Support Handheld devices
* ISDN (Integrated Service Digital Network) Compatibility
* Use of Spectrum efficiency
* low Service Cost
* Use encryption to make phone calls more Secure.
* SMS (Short message Service)
* fixed dialing numbers (FDN)
* SIM Phonebook Management
* Supports for new Services

9.2) GPRS (General Packet Radio Service)

→ GPRS is a packet based communication service for mobile devices that allows data to be sent and received accross a mobile telephone network.

→ It is a step towards to 3G and it is often refered as 2.5G network for data access.

→ The GPRS network is an "always on" private network for data.

→ GPRS uses the existing GSM network for transmit and received data to and from mobile devices.

→ Ip address allocated to mobile GPRS devices so there is not accessable to outside the GPRS network.

→ GPRS offers data rate upto 171.2 kbps which is depend on the network availability.

→ To use of GPRS, a user need a mobile device which supports GPRS and a subscription to the telephone network for data supports which enable to that user.

→ GPRS technique is used to develop 3G network/ Service to the mobile world.

→ An important feature of GPRS is provides immediate connectivity and high throughput.

→ GPRS will enable Internet applications, from webbrowsing to chat, location based application, e-commerce etc over the mobile network.

9.3) IS-95 (Interim Standard 95)

→ Interim Standard 95 (IS-95) is the first CDMA-based digital cellular standard.
→ The brand name for IS-95 is CDMAONE.
→ It is a 2G mobile telecommunication standard that uses CDMA with multiple access scheme for digital radio, to send voice, data and signaling data between mobile telephones and cell sites.
→ CDMA is a digital radio system that transmits streams of bits.
→ CDMA permits several radios to share the same frequencies.
→ To use of IS-95, each user is identified by a different spreading code.

9.4) CDMA 2000

→ CDMA 2000 is the 3G version of IS-95.
→ It inherits the advantages of CDMA network and introduced (OFDM and OFDMA) such as orthogonal frequency division multiplexing.
→ CDMA2000 improves the quality of services with new antenna technique such as Multiple Input Multiple output (MIMO) and Space Division Multiple Access (SDMA) to increase data throughput and quality of service which improving network capacity and reducing delivery cost.

Attributes of CDMA

* **Soft handoff:** - All users uses the same radio frequency band, the main difference between the user channels is spreading code sequence.
  → There is no jump from one frequency to another while user moves between cells.
* **Soft Capacity:** - In CDMA all the users in all cells share one radio channel and there are separated by codes.
* **Multipath tolerance:** - As CDMA network provided code so a number of users can transmit and received with multiple path.
* **Leading performance:** - performance in terms of data-speeds, voice capacity and network-coverage is more better in CDMA2000.
* **Flexibility:** - CDMA 2000 system have been designed for urban as well as remote rural areas for fixed wireless device.
  → WLL (Wireless Local Loop) provides limited and full mobility applications in multiple spectrum bands including 450 MHz, 800 MHz, 1700 MHz, 1900 MHz and 2100 MHz.