

# COMPUTING

## MODULE 1:

Mobile: Something that can be moved easily & quickly from one place to another

Computing: Operations of computer

Mobile computing: It is a technology that allow transmission of data, voice & video via computer or any other wireless enabled device without connecting a fix physical link.

In mobile computing a set of distributed computing system or service provider or service participate & synchronize through mobile communication protocol

Protocol: Set of guidelines frame for connectivity b/w one device to another

Eg: TCP / IP

DNS

HTTPS

## MOBILITY MANAGEMENT

Mobile Management is one of the major function of a GSM or a UMTS network that allow mobile phones to work. The aim of mobility management is to track where the subscribers are, allowing calls and other mobile service to be delivered to them.

- ii) The emerging application in censor networking, telemedicine and surveillance or expected to dominate and save the next generation of mobile communication system.
- iv) Basic mobility management operation include location update as mobile units move around and location look up as mobile units are wanted.

### • PCS (PERSONAL COMMUNICATION SERVICES)

PCS refers to a wide variety of wireless access and personal mobility services provide through a small terminal or medium with the goal of enable communications at any time, any place and in any form. Most of them are connected to PSTN

PSTN (public switching telephone Network) - It is the aggregate of world's circuit switched telephone networks that are operated by national, regional or local telephony operators providing services for public telecommunication.

Example of PCS :-

I) High type digital cellular system.

1.1 GSM (Global system for Mobile communications) is a standard developed by ETSI (European Telecommunications standards Institute) to describe the protocols for second generation digital cellular network.

1.2. DAMPS (Digital Advanced mobile phone services)

Eg - IS-54, IS-136, private no.'s

1.3. PDC (personal Digital cellular) was a 2G mobile telecommunication standard used exclusively in Japan

1.4 CDMA (code division multiple access) is a channel

access method used by various radio communication technologies. CDMA is an example of multiple access, where several transmitters can send information simultaneously over a single communication channel.

## 2. Low Telecommunication System.

2.1. CT (cordless Telephone) is a telephone in which handset is portable and communicates with the body of the phone by radio instead of being attached by a cord. Range is limited.

2.2 DECT (Digital Enhanced Cordless Telecommunications) is a standard primarily used for creating cordless telephone system.

2.3. PACS (Personal Access Communications System) is a type of wireless telephone network that is compatible with computers, fax machines, answering machine and telephone sets.

eg - Walky talky.

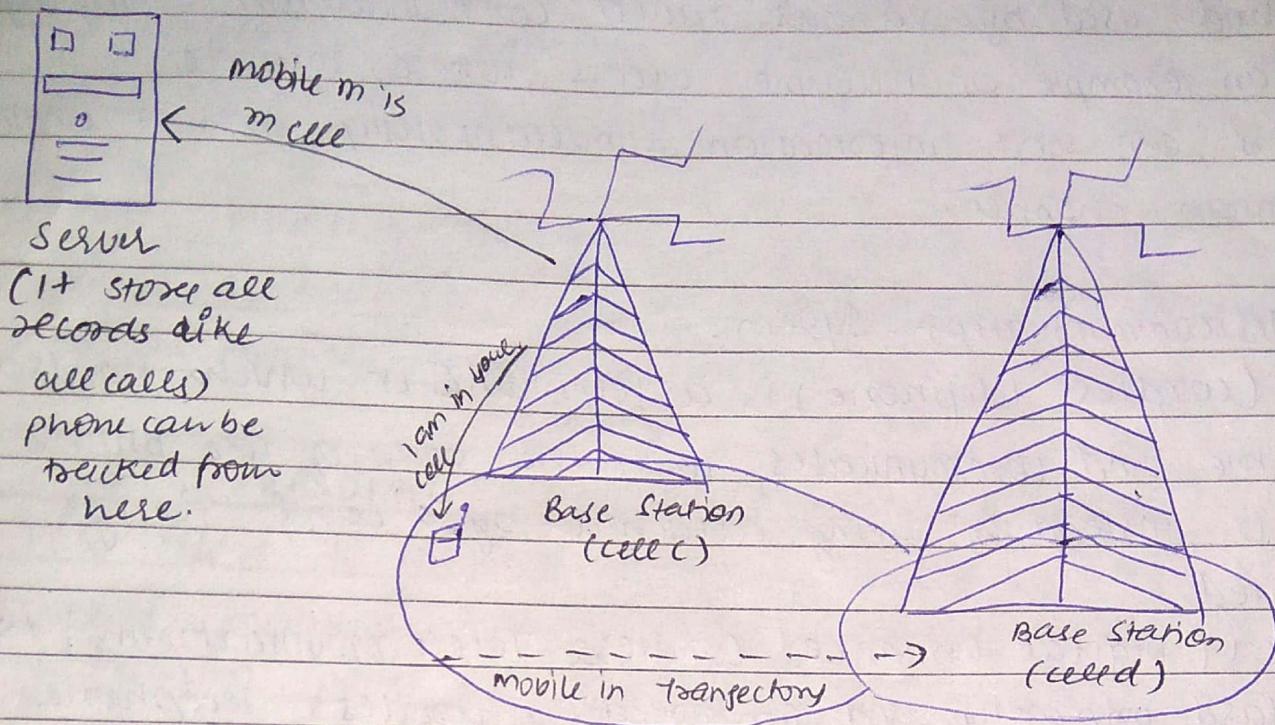
2.4 PHS (Personal Handy-phone system) eg - pager

## 3. Wide Band wireless System - developed to accommodate Internet and media services.

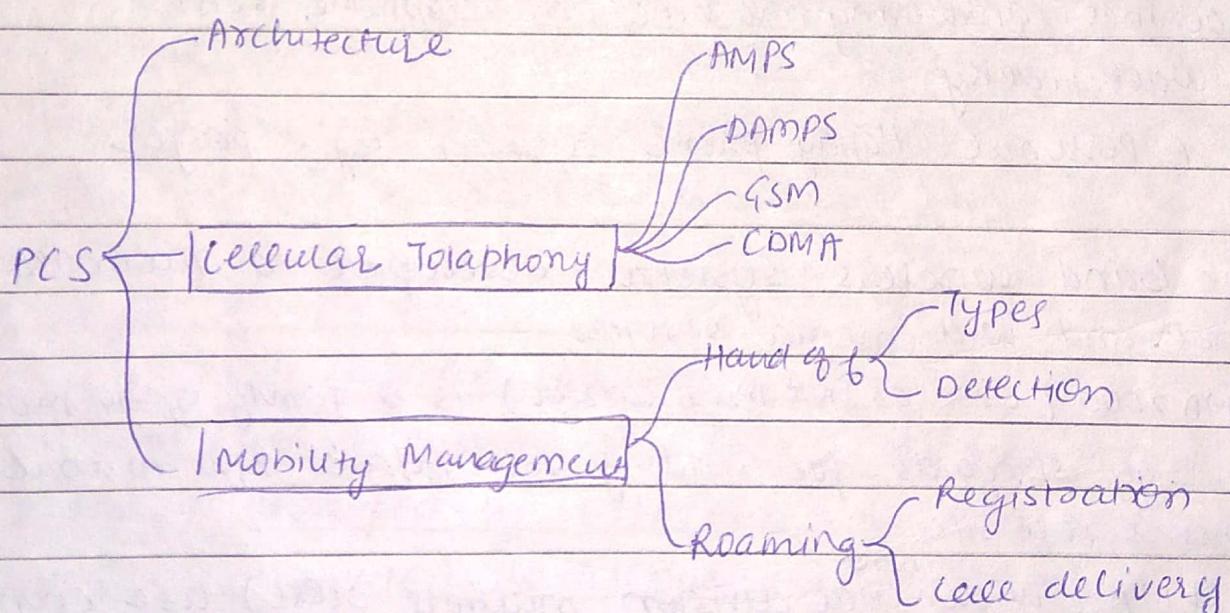
3.1. CDMA 2000 (CDMA or IMT multi carrier) is a family of 3G mobile technology standards for sending voice, data b/w mobile phones & cell sites.

3.2. W-CDMA (wide code division multiple access) use channel whose bandwidth is much greater than that of data to be transferred. most secure. used in globe

3.3. S-CDMA (synchronous code division multiple access) indicate that multiple cable modem can transmit simultaneously on same RF channel and during same DMA slot.



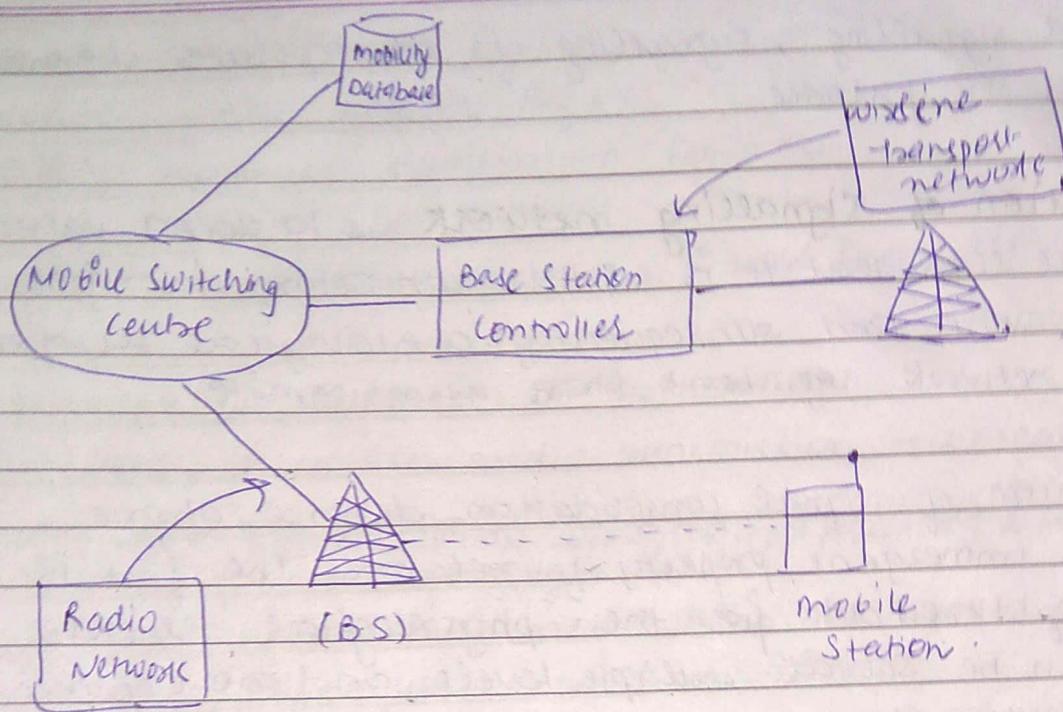
## Mobility Management



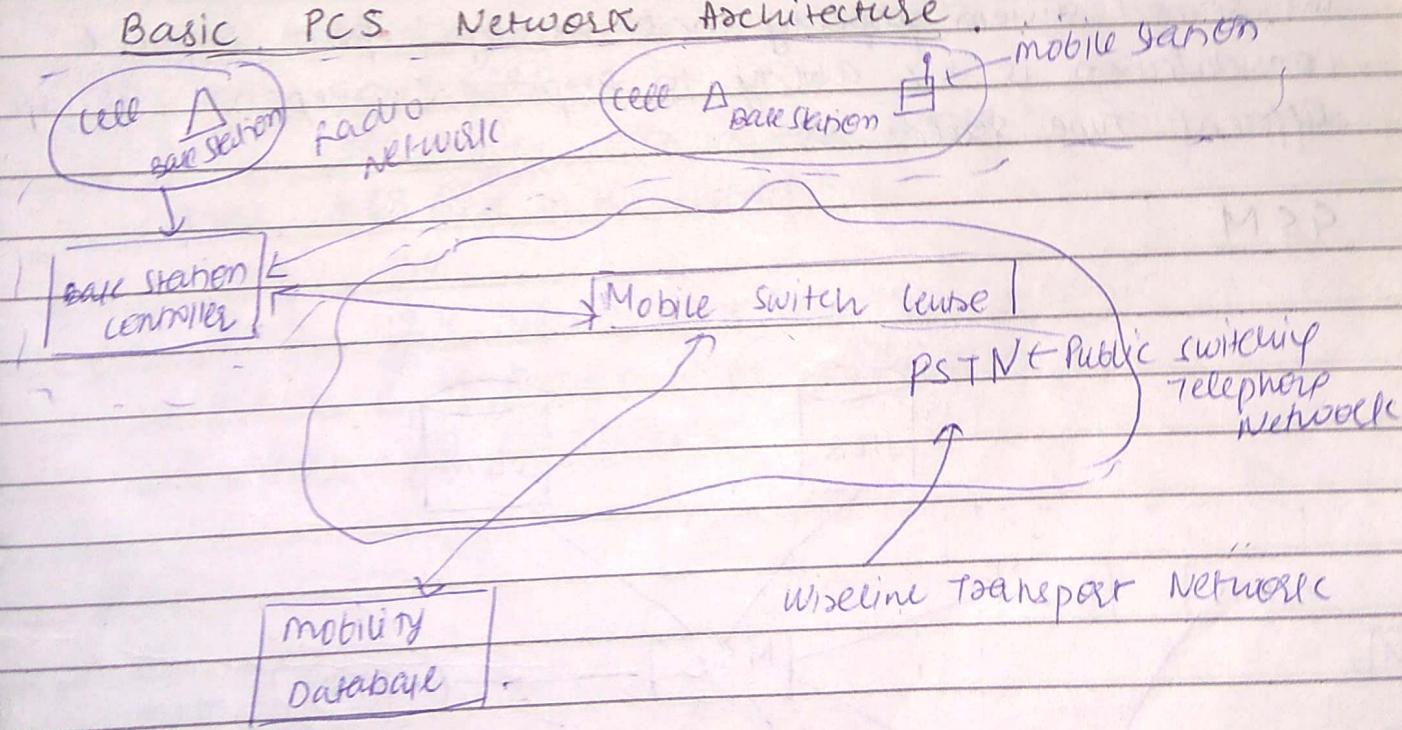
## PCS Architecture

Switching centre continuously connect the mobile with different Base Station controller situated at company's server.

CLASSTIME	Page No.
Date	/ /



### Basic PCS Network Architecture.



### Network Signalling:

In Telephony, signalling is the exchange of information b/w involve point in the network that set of controls and terminates every telephone calls. In the band signalling (band width), the signalling is on the same channel as the telephone call.

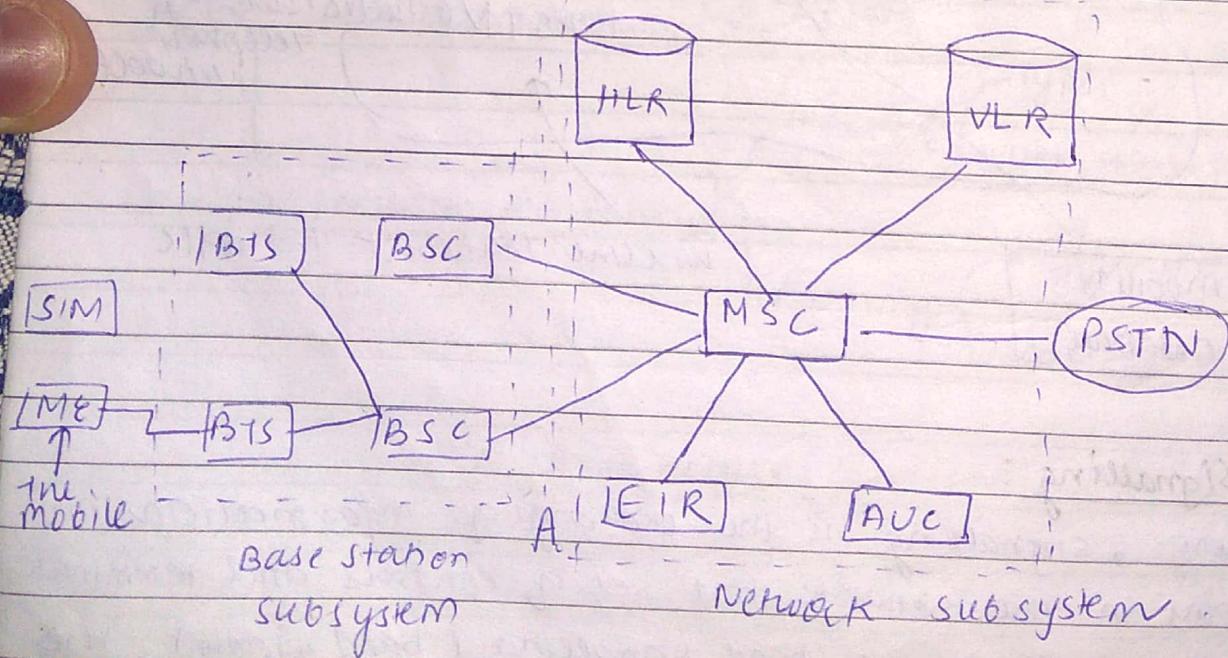
In out-band signalling, signalling is on separate channel dedicated for the purpose

Major Function of signalling network is to place a value on the signal such that it is either converted into further biochemical event and subsequently a biological response within the network. Eg- bomb blast using remote.

The mechanism of signal consolidation describe above result into emergent property of network. The first is the setting of threshold for the physiological response. Threshold can be set at multiple levels and are dependent on the signalling components.

The second system property that emerged from signal consolidation is the ability to propagate response across different type scale.

## GSM



MSC: Mobile station controller

BSC: Base station controller

HLR :- Home Locator Register

VLR :- Visitor locator Register.

EIR :- Equipment identification Register.

AUC :- Authentication centre

BTS :- Base transiver system - used for all identification

## HISTORY OF WIRELESS COMMUNICATION

In 1986, Basic gsm radio transmission techniques chosen.

In 1988, the telecommunication standard define GSM.

In 1989, FIRST GENERATION INTRODUCED call forwarding 2) Auto calls 3) answer 4) engaged 5) unanswered

In 1991, first call through GSM.

In 1992, First GSM network in the world. 6) Global Roaming

In 1994, First GSM network in Africa

In 1995, GSM network is devised in 117 countries → 2G introduced

In 1998, 120 million users in the world.

In 1999, First GPRS

In 2000, 480 million users in the world.

In 2003, 863 million users in the world.

In 2004, 34

In 2007, 2.4 billion users in the world.

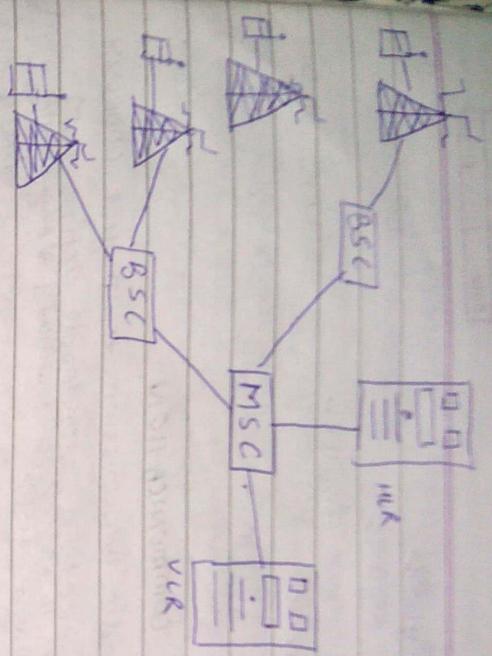
In 2010, 4.4 billion users (3G users)

In 2017, 4.77 billion users (4G users)

In 2016, 5G introduced.

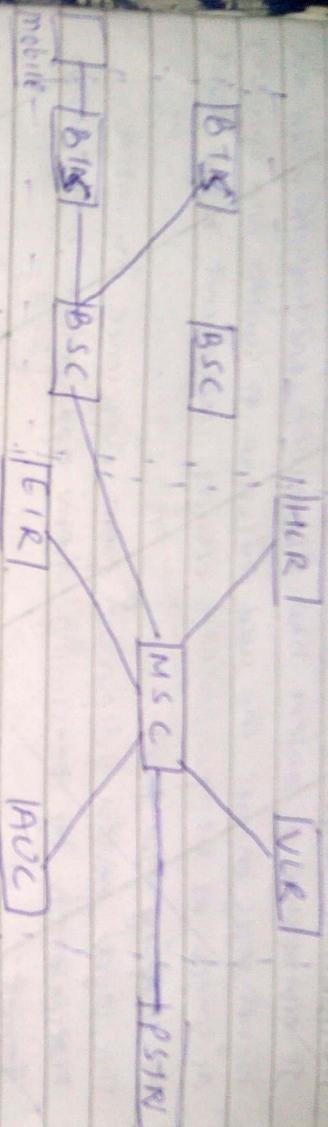
24<sup>o</sup>

- i) SMS
- ii) multi personal calling
- iii) call waiting
- iv) Hold
- v) Mobile Data Service
- vi) mobile fax services
- vii) call Broadcast



Performance characteristic of GSM :-

- i) Communication - Mobile, wireless <sup>voice, video, skype</sup> digital communication support of ~~internet~~ and data services.
- ii) Total Mobility - International areas and chip card enable use of access point of different providers.
- iii) Worldwide connectivity - one number.
- iv) High capacity - Better frequency & more customers per cell. Five is highest capacity of conference call.
- v) High transmission quality - Range, audio & video quality. Better hand off → transfer of control from one BS to another BS.
- vi) Security functions - access control, authentication where chip card and pin.



HLR = Home Location Register

VLR = Visitor Location Register

MSC = Mobile Station Controller

AUC = Authentication Center

EIR = Equipment Identification Register

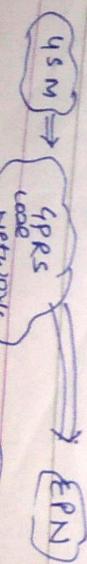
PSTN = Public Switching Telephone Network

BSC = Base Station Controller

BTS = Base Transceiver System, used for identification

## MODULE - 2 ,

GPRS (General packet Radio Services) provides mobile user access to value added web services and different external packet switch networks. These network can be (for eg - The Internet & corporate Intranet). The gsm provides the radio interface and the GPRS core network handles mobility & access to external packet network and services.



The GPRS network act in parallel with the GSM network providing packet switched connections to the external networks.

The Requirements of GPRS Network are the following -

- i) The GPRS network must use as much of the existing GSM Infrastructure with the smallest no. of modification to it.
- ii) Since a GPRS user may be on more than one data station.
- iii) GPRS should be able to support one or more packet switched connections.

iii) The GPRS network architecture has to be compatible with 3G and 4G mobile communication system.

- i) It should be able to support both point to point and point to multi point data connection.
- v) It should provide secure access to external networks.

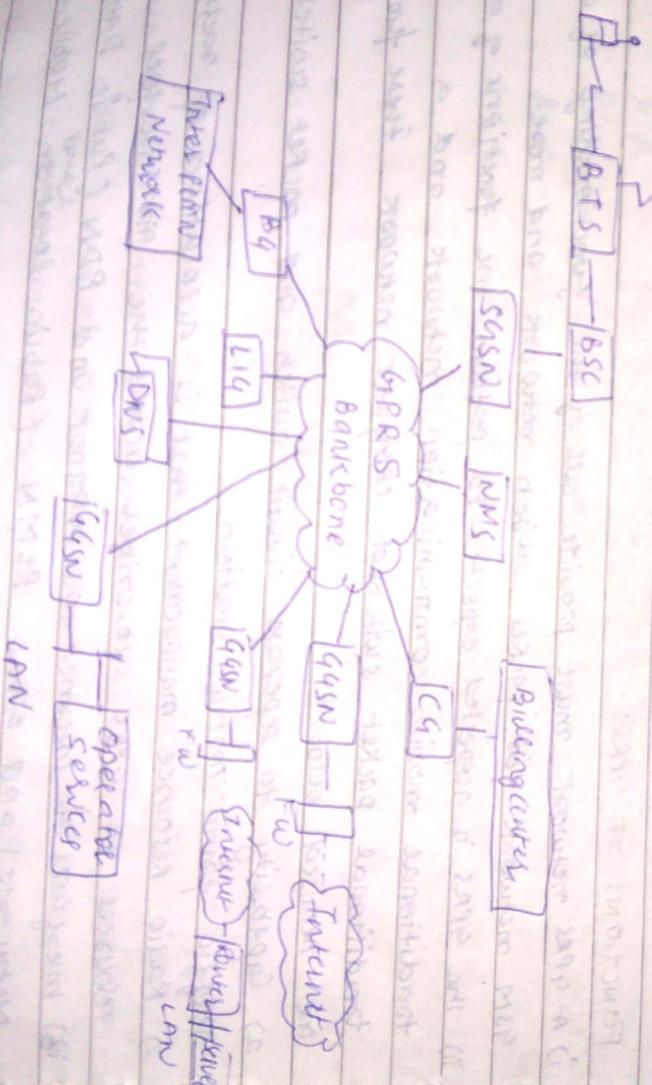
#### FUNCTIONS OF GPRS:-

- i) A GPRS network must provide all of the functionality of a GSM network for packet switched network and more.
- ii) The GPRS is expected to perform the functions of a traditional mobile communication network and a traditional packet switched computer network. These functions are itemised below -

- 1) Capability to separate circuit switch and packet switch traffic from mobile station.
- 2) Radio resource management that is allocation of radio resources to GPRS subscribers across the air interface.
- iii) Interface to Internet and Intranet and PDN (Public Data Networks) and other PLMN (Public Land Mobile Networks).
- 4) Network )
- 5) Authenticate subscriber requires for packet switched resource
- 6) Encrypt data transmission and also interface for security

- 6) Data compression for data transmitted over air after interface.
- 7) Intercept with database (HLR/VLR) containing subscriber information and security data
- 8) Hand over as a GPRS GPRS subscriber moves within a coverage area.
- 9) Protocol conversion b/w networks that may use different protocols.
- 10) Protection of the GPRS network from security threats
- 11) Capability to monitor tracer subscr bly law enforcement agencies.

### GPRS ARCHITECTURE:



SGSN

GGSN - GPRS support Note

NMS - Network Management System

LAN

operator

BG: Border gateway

CG: Charging gateway

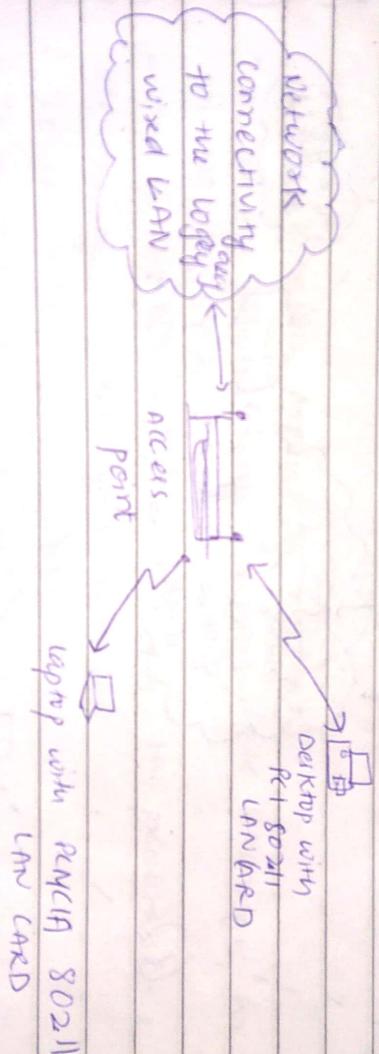
LIG: Lawful Interception gateway

FW: Fire wall

DNS: Domain Name server

### W-LAN (Wireless-LAN)

A wireless Local Area Network is a wireless computer network that links two or more device using wireless communication within a limited area, such as a home, school, computer lab, office building. This give user the ability to move around within a local coverage area and yet still be connected to the network through a gateway.



### 802.11 W-LAN:-

Range depends on distance b/w access point to W-LAN or Structural hindrance and R.F (Radio Frequency) of the objects at the access point.

To service larger areas multiple APs may be installed when a

22 to 30% overlap.

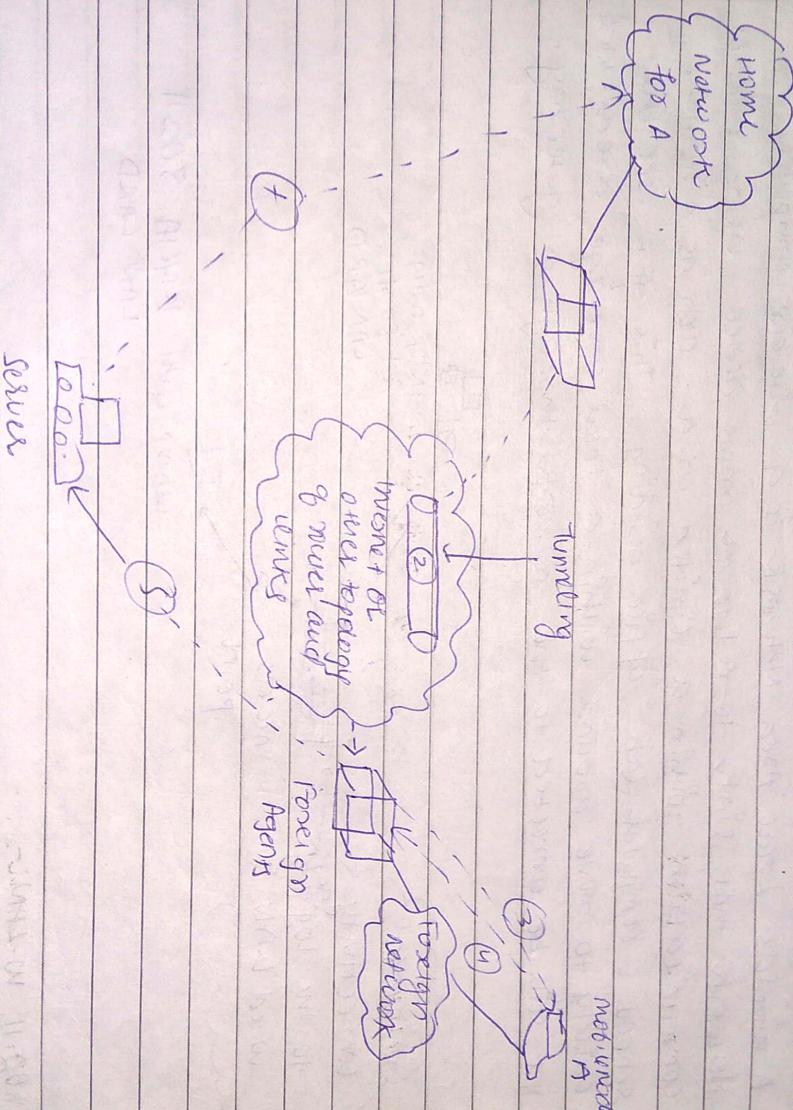
A client is always associated with one AP and when that clients moves closer to another AP it associate with the new AP. This is known as hand-off.

## MOBILE IP:

wireless device offering IP connectivity (like PDA, Digital cellular phone, laptop etc.)

- Mobile networks

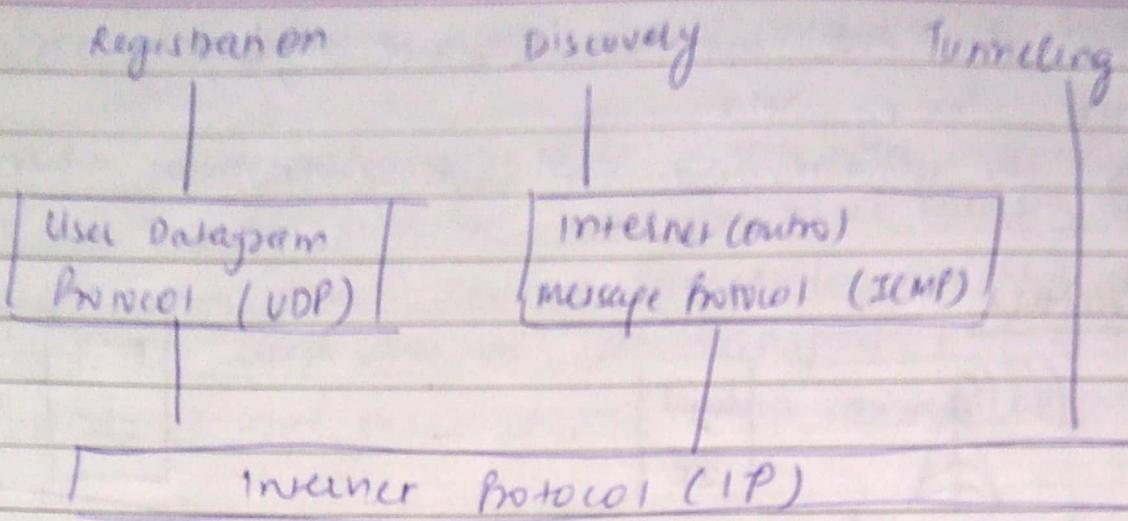
- Internet protocol routing scheme.



## Mobile IP Mechanism -

There are 3 mobile IP mechanism -

- ① Discovering
- ② Registering
- ③ Tunneling



Mobile IPV6 :-

- Mobility support in IPV6
- Route optimized
- security - IPV6 nodes are expected to implement strong authentication & encryption features.

### WAP (Wireless Application Protocol)

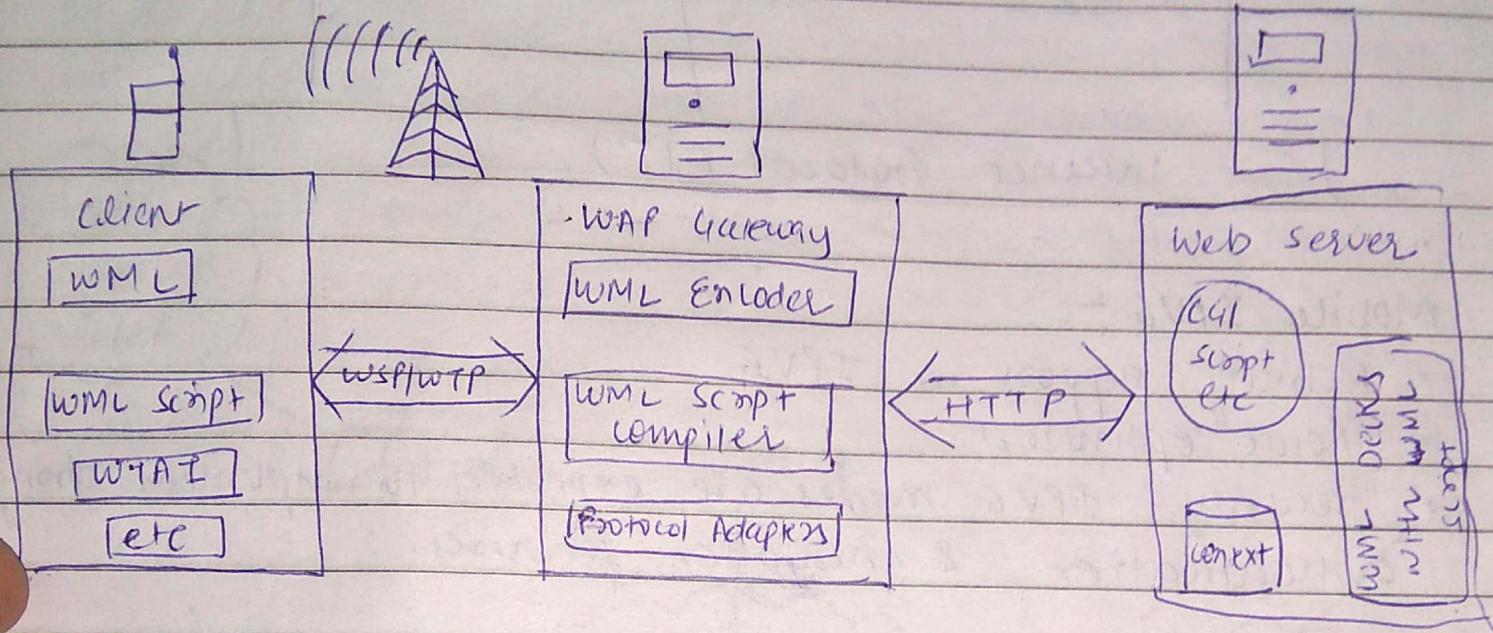
- A set of protocol which allow data exchange for mobile cellular system.
- The current world standard for the presentation & delivery of wireless information.
- It is device independent
- It is network independent

Why use WAP -

- 1) For wireless networks & phones - have specific needs & requirements not addressed by existing internet technologies.
- 2) WAP enables any data transport.
- ③ The WAP architecture - have several modular entities which together form a fully complaint internet entity. - all WMM content is accessed by a http 1.1 request

- WAP utilise standard internet markup language technology. For eg - XML
- Optimising the content and air link protocol.

## WAP Architecture



(GI = Common Gateway Interface)

WML = Wireless Markup language

WSP = Wireless session protocol

WTP = Wireless Transaction protocol

WTAI = Wireless Telephony Application Interface

## WAP PROTOCOL

- 1) WSP - provides a application layer of WAP with the consistent interface for two session services.
  - i) A connection oriented service that operates above the transaction layer protocol,
  - ii) A connection less service that operates above a secure or non-secure datagram service. (WDP)
- 2) WTP - provide efficient request or reply based transport mechanism suitable for...

resource over networks with low to medium bandwidth.

Jump

3) WTLS - wireless Transport Layer Security is a security protocol based upon the industry standard transport layer security protocol formally known as secured socket layer (SSL). WTLS is intended for use with the web transport protocol and has been optimised for use over narrow band communication channel.

4) WDP - wireless Datagram Protocol.

- 1) The transport layer protocol is the web architecture
- 2) Provides a common interface to the security, session & interface layer.
- 3) Allow these upper layer to function independently of the underlying wireless network.

## MODULE - 3

ITU  
(International  
Telecommunication  
Union)

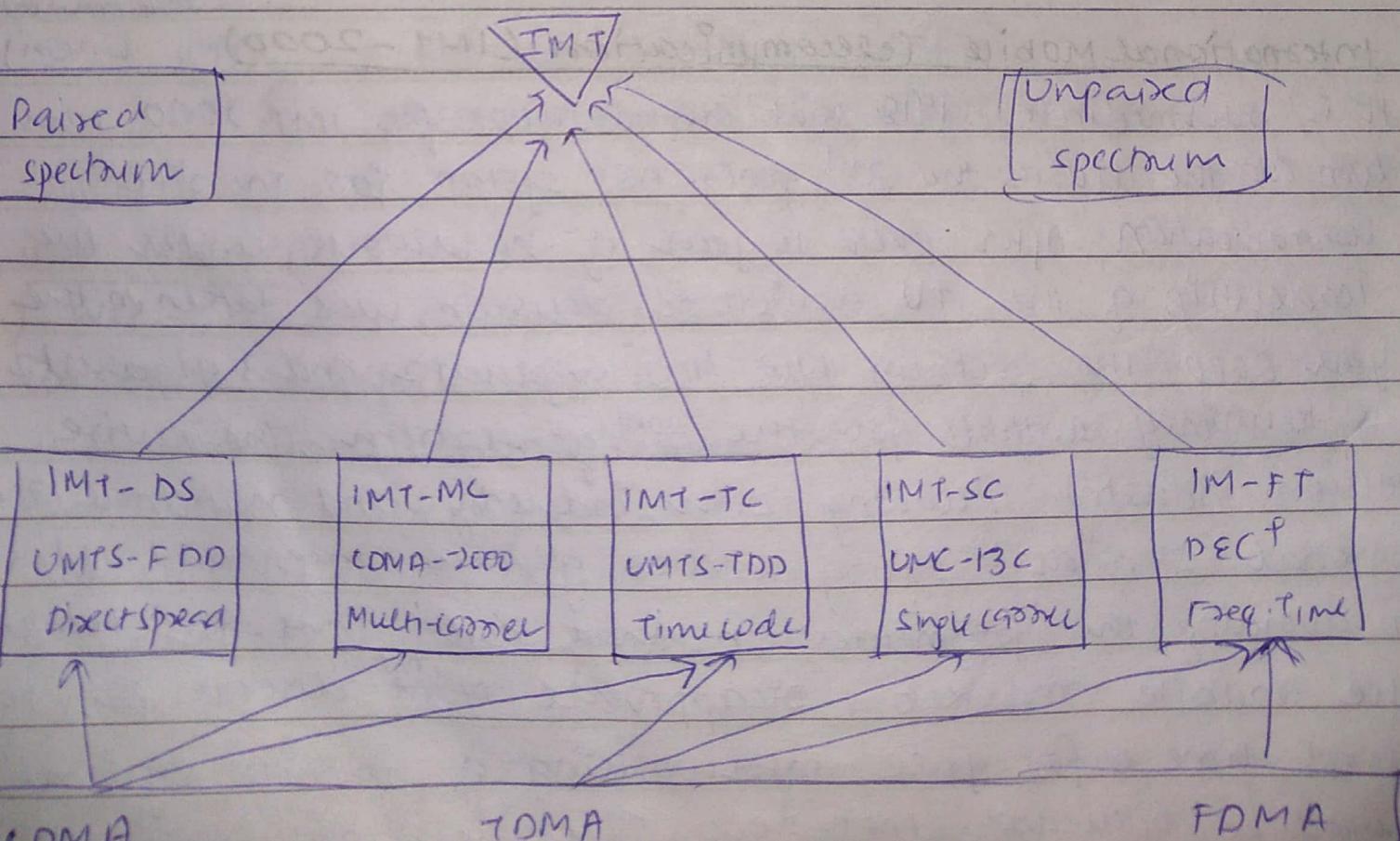
International Mobile Telecommunication (IMT-2000)

It is intermediate 1998 that our concept for IMT-2000 was born at the ITU as the 3rd generation system for mobile communication. After over 10 years of hardwork under the leadership of the ITU a historic decision was taken in the year 2000. The spectrum b/w 400 megahertz and 3 gigahertz is technically suitable for the 3rd generation. The entire telecom industry including both industry and national and regional standard setting bodies give a concentrated effort to avoiding the fragmentation that had thus far characterised the mobile market. Disapproval <sup>of IMT</sup> direct for the first time & for full interworking of mobile system could be achieved. IMT-2000 offers a capability of providing

Value-added services and applications on the basis of single standards. One of its key versions is provides global roaming enabling user to move across borders while using the same no.'s & handset. IMT-2000 also aims to provide similar delivery of services over a no. of media & standards. It is expected that IMT-2000 will provide higher transmission rate. A minimum speed of 2Mbps for stationary or walking user or 340Kbps for a moving vehicle. In addition IMT-2000 has the following key character -

- (1) Flexibility
- (2) Affordability
- (3) Compatibility with existing system
- (4) Modularity.

## IMT-2000 RADIO INTERFACE

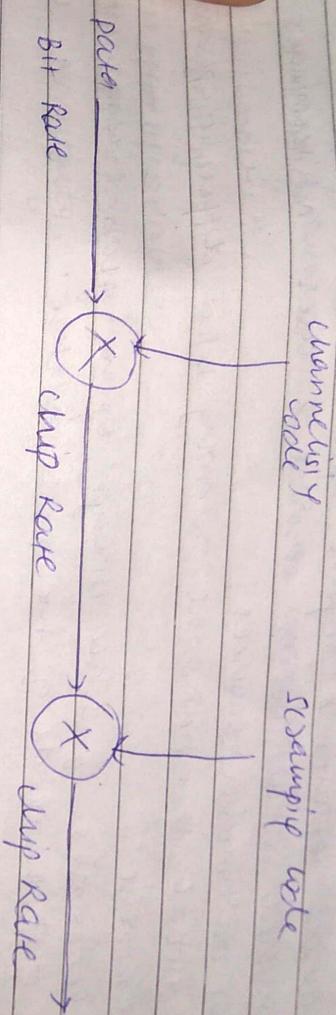


- IMT-2000 system are expected to provide support for -
- 1) High transmission data rate for indoor and outdoor operation.
  - 2) Symmetric and asymmetric data transmission.
  - 3) Circuit switched and packet switch services such as Internet protocol traffic & Real time video.
  - 4) Voice quality comparable to wireline quality.
  - 5) Greater capacity & improve spectrum efficiency.
  - 6) Several simultaneous services & user and terminals for multimedia services.
  - 7) Global, International roaming b/w different operational environment.
  - 8) Economics of scale through open global standard to meet the needs of the mass market.

### WCDMA (Wide band code division Multiple Access)

- 1) WCDMA is the most common radio interface for UMTS system (Universal Mobile Telecommunication system).
- 2) Wide bandwidth - 3.84 Mcps (Mega chip per sec.)
- 3) User share the 5 MHz frequency band per time.
- 4) High bits rates.
- 5) Fast power control.
- 6) Soft hand over.
- 7) Robust and low complexity. [rate] receiver.
- 8) Support for flexible bit range.
- 9) Multiplexing of different services on a single physical connection.
- 10) This is support for services with different QoS (Quality service requirements -)
  - i) Real time - Video & voice telephony.
  - ii) Streaming - Video & audio.
  - iii) interactive - web browsing.

- v) background - downlinks  
    i) channelized code -  
        many chips are used to separate channel a  
        single information bit & thus determine the  
        n-bit size.  
v.) same communication code in every cell & mobile



### CDMA - 2000

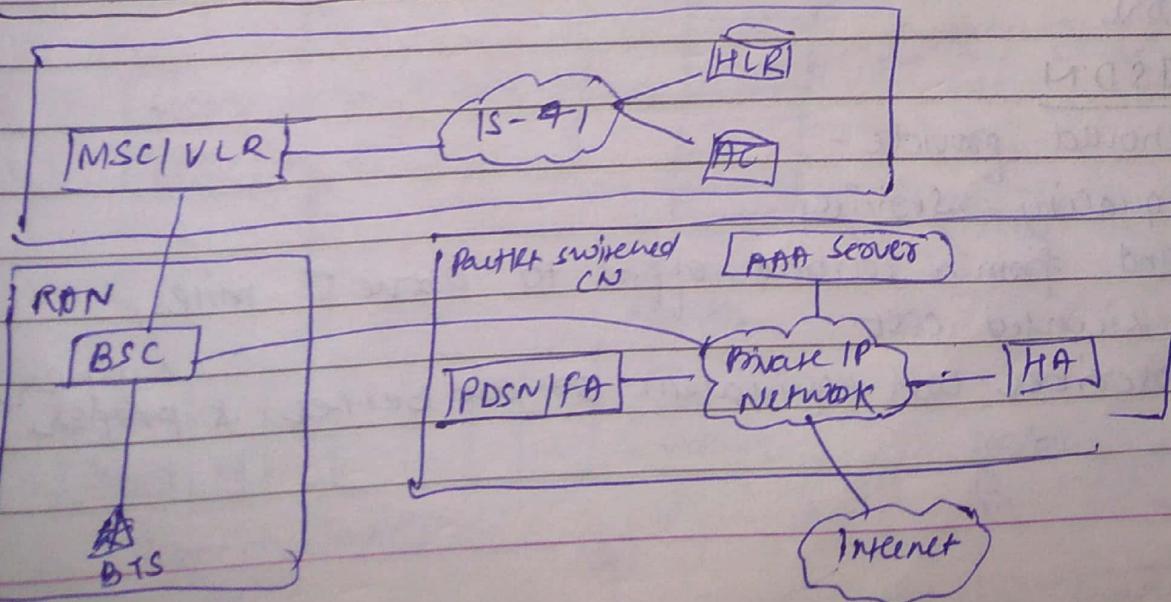
- This is also called multi-carrier mode CDMA.
- Separate spectrum technique using direct sequence.
- For eg - 1st data bit is represented by multiple width
- It supports data rates both circuit and packetized
- switched off 9.6 Kbps to mbps.
- Operates in wide range of environment
- in outdoor macrocell - cells with 35km radius signal
- ii) indoor microcells -  $R = 3.5 \text{ km}$  radius signal.
- iii) indoor picocells - 1 km radius signal.
- iv) indoor pico cells - upto 50 m radius signal.
- CDMA 2000 can be deployed in -
  - i) indoor or outdoor environment
  - ii) wireless local loops.

(iv) mixed vehicular & outdoor indoor environment.

### CDMA 2000 SERVICE SUPPORT

- i) Over configuration
- ii) Backward compatibility to signalling & network.
- iii) R upgrade from 2G, to 3G to 4G
- iv) common channels and TIA/EIA-95B system during transaction period. <sup>signalling</sup>
- v) CDMA2000 is a radio and network access system that is part of the IMT-2000. Its specification should be 3G system.
- vi) Role of IMT 2000 - Global standard.
- vii) High speed data package services -
  - i) 2Mbps for stationary use
  - ii) 384Kbps for pedestrian use
  - iii) 144Kbps for vehicle use
- viii) 3G application enable for CDMA-2000
- ix) package based service like wireless, internet, e-mail, e-commerce and multimedia & location based services
- x) longer battery life
- xi) CD

### CDMA 2000 NETWORK ARCHITECTURE



RTL Radio in the loop  
FRA - Fixed Radio Access. } they are also called WLL

CLASSTIME	Page No.
Date	/ /

AAA - Authentication Authorization Accounting.

FA - Foreign Agent

PDN - Packet Data Serving Node

HA - Home Agent

## WLL (Wireless Local Loop)

wireless local loop is the use of a wireless communication link as the last or first line connection of delivery plane own telephone system or internet access through telecommunication customers. WLL is a system that connects subscriber to the local telephone station. without wise WLL system is based on -

- i) cellular
- ii) Satellite
- iii) microcellular

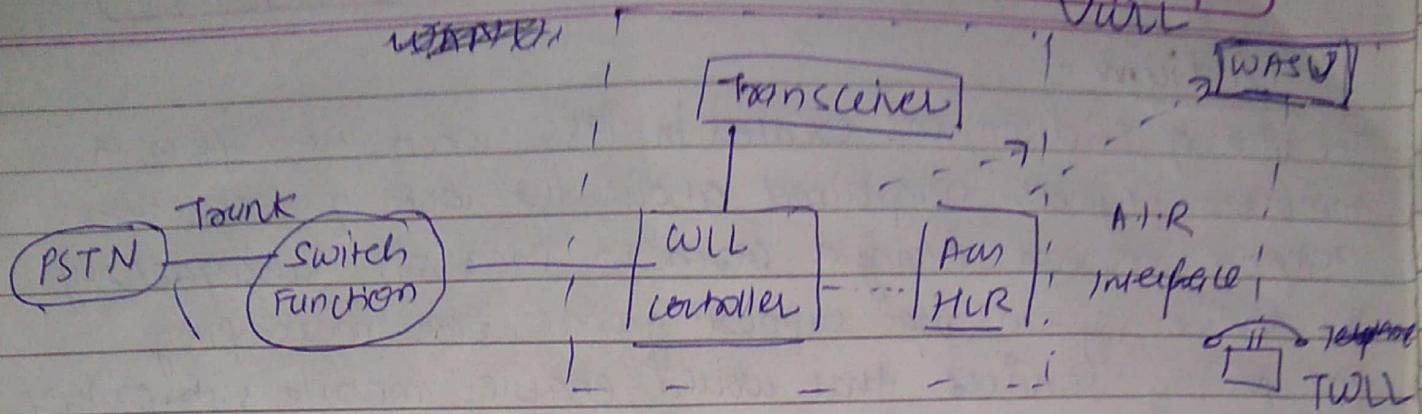
## WLL Services

- i) wireless features should be transparent.
- ii) wireline custom feature
- iii) Business related
- iv) calling card
- v) coin phone
- vi) ISDN

## ISDN

WLL should provide -

- i) toll quality services
- ii) expand from a central office to above 5 miles
- iii) low licensed cost
- iv) subscriber cost equivalent to copper & fiber



WANU : Wireless access network Unit

i) WANU

ii) WANU: Interface b/w telephone network & wireless link.

ii) BTS :-

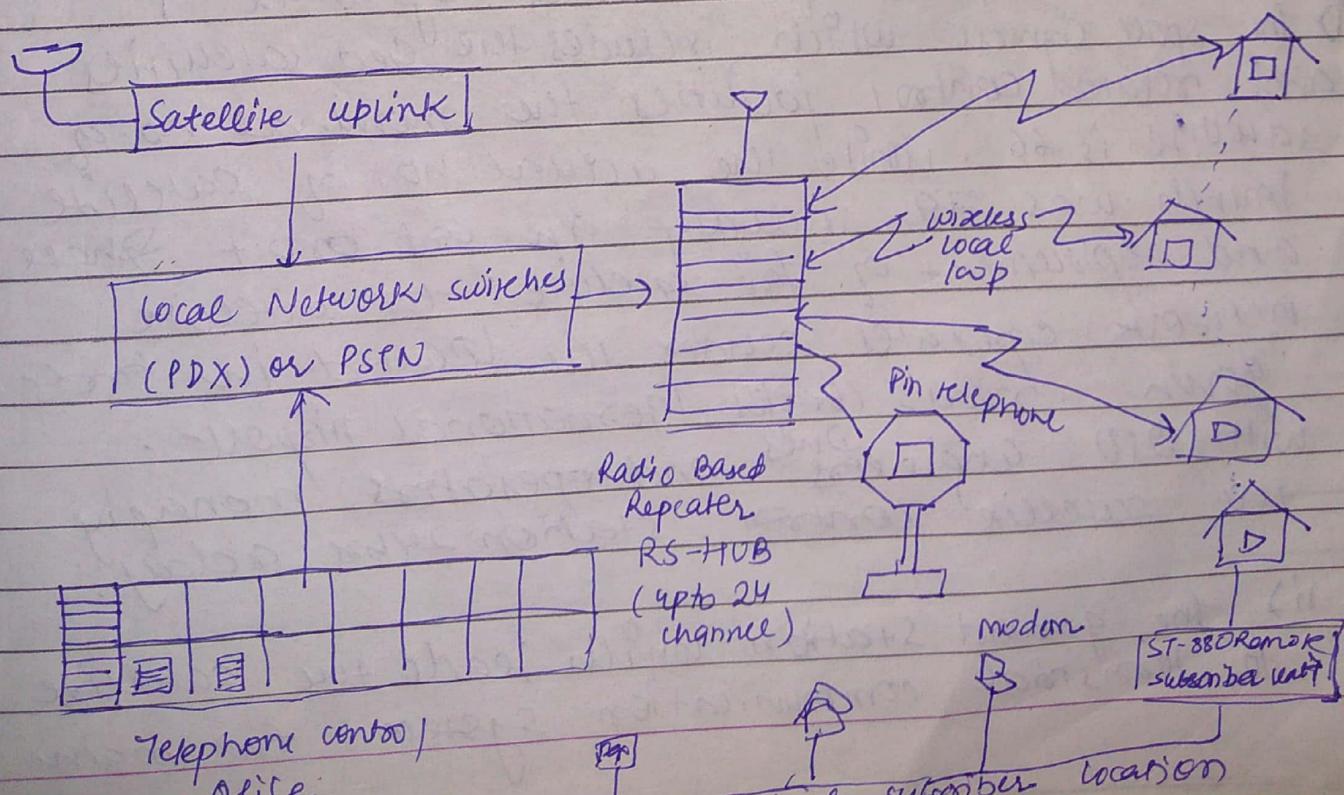
ii) AM : Access manager.

WASU : Wireless access subscriber unit.

i) Located at the subscriber.

ii) translates wireless link into a traditional telephone connection.

Architecture of WLL :-



## Iridium -

The idea of Iridium was created in 1985 when the wife of a Motorola engineer complained about the lack of cellular telephone coverage during a Caribbean vacation. Subsequently the Iridium system was supposed global wireless messaging and paging services that would enable mobile subscriber to send and receive telephone calls virtually anywhere in world all with one phone number and one customer bill. Motorola, the driving force behind Iridium announced the system as follows:

A global communication system that will allow people to communicate by telephone anywhere on earth whether on land, at sea or in the air via portable cellular radio telephones operating as part of a satellite based system. An international consortium of major communications space and construction companies include Motorola, Kyocera, Lockheed-Martin and Norden developed the Iridium system.

The main component of the Iridium system are -

① The space segment which includes the Geo-satellites and related control facilities. The nominal no. of satellites is 66. While the actual no. of satellite launch was 79. including an off orbit sphere and replacement of fail satellite. The satellite network operates sending the located in bands down near Charles International Airport. With 250 engineers and operators managing the satellite control station 24 hrs a day.

Iridium gateway is located in temple (North America) during its peak the Iridium system was operating 12 gateway in various part of the globe. This seasonal gateway is handle cell set-up procedure and interface Iridium with the <sup>existing</sup> PSTN.

- iii) The Iridium subscriber equipments (phone & pages) is provide mobile access to the satellite system and terrestrial wireless system. A dual mode that allow user to access either a compatible cellular telephone network or Iridium was added after a beamp apparent that Iridium could not operate in complete isolation of terrestrial cellular system.
- iv) The terrestrial inter protocol roaming infrastructure Iridium is design to provide cellular like service in situations where terrestrial service is unavailable or area where the PSTN not well developed.