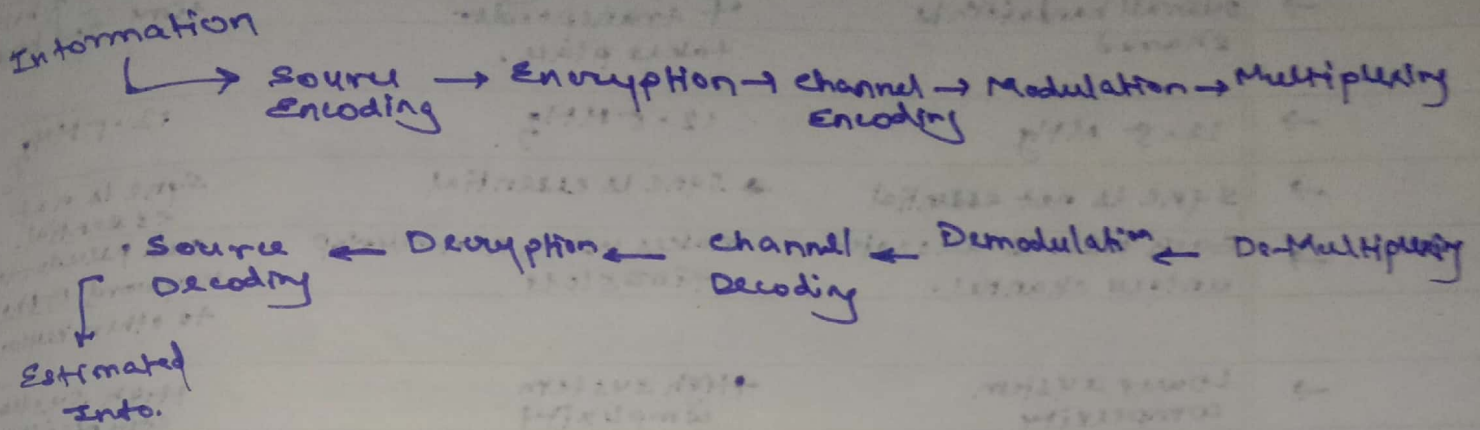


WT

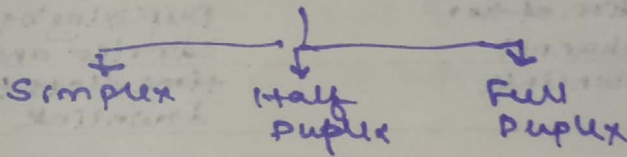
## Basic Elements of wireless communication:-



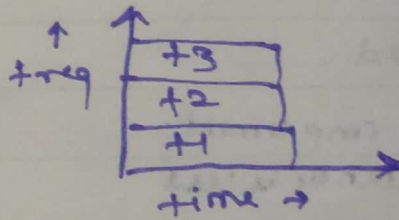
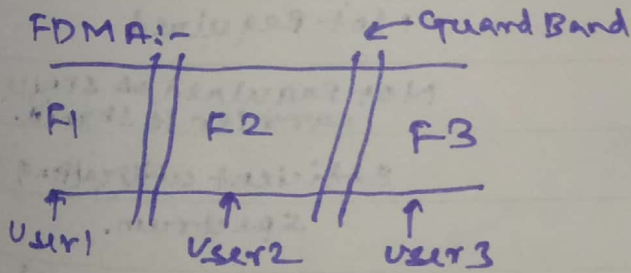
### MAT:-

The use of multiplexing technique to provide communication service to multiple users over a single channel.

### Transmission mode

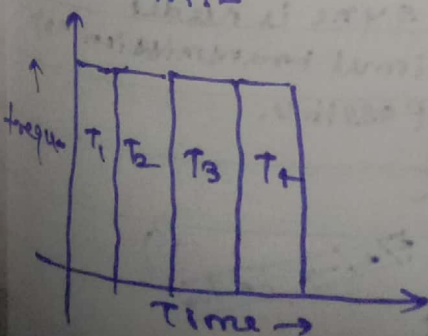


### FDMA:-

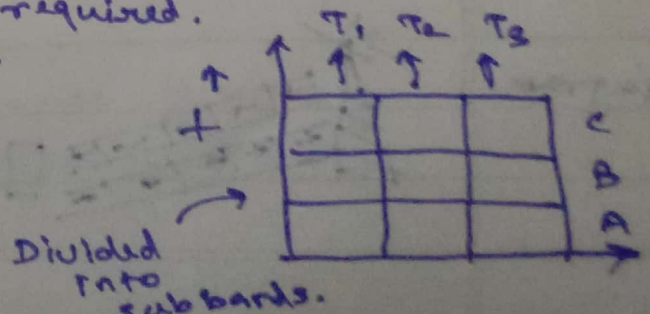


- Simple to implement
- cross talk is possible.

### TDMA:-



- Access to full length frequency of channel.
- No guard band required.
- Radio systems.



**FDMA**

→ overall bandwidth is shared

→ 12.5 MHz

→ sync is not essential

→ Each user is allocated unique channel.

→ Lower system complexity

→ simple, and

Inflexible

→ require narrowband filter

→ less susceptible to ISI

FDD

**TDMA**

time sharing of transponder takes place.

12.5 MHz

→ sync is essential

makes use of non-overlap time slots

High system complexity

Flexible

→ require accurate time to avoid overlap

→ more susceptible to ISI.

**CDMA**

Sharing of both time and band

12.5 MHz

sync is not essential.

own pseudorandom keyword orthogonal to other keywords

High system complexity.

Flexible

Working principle

Duplexing by allocation of two separate simplex channel for uplink and downlink

Impl.

Easy

Need of duplexer

Required

Guard space

Required

Advant.

Easy to implement.

Time latency is less

Simul. transmission

sync. is not needed

**TDD**

Duplexing by sharing frequency carrier and allocation of time slots for uplink and downlink

complex

Not Required

Not Required as single carrier is shared.

Efficient utilization of spectrum.

Duplexers not needed

Disadvant.

Wastage of Bandwidth

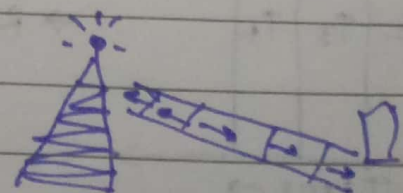
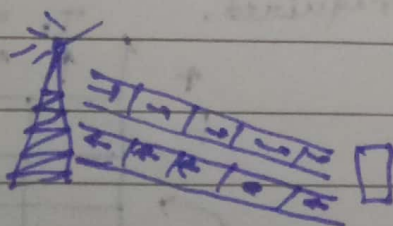
Use of Duplexer makes the hardware complex

Time latency more

sync is needed

Simul transmission not possible.

Diagram





No. of channels in FDMA:-

$$N = \frac{B_t - B_{\text{guard}}}{B_c}$$

$B_t$  = total spectrum alloc.

$B_g$  = guard band.

$B_c$  = channel bandwidth.

No. of channels in TDMA:-

$$N = \frac{m * (B_{\text{tot}} - 2 * B_{\text{guard}})}{B_c}$$

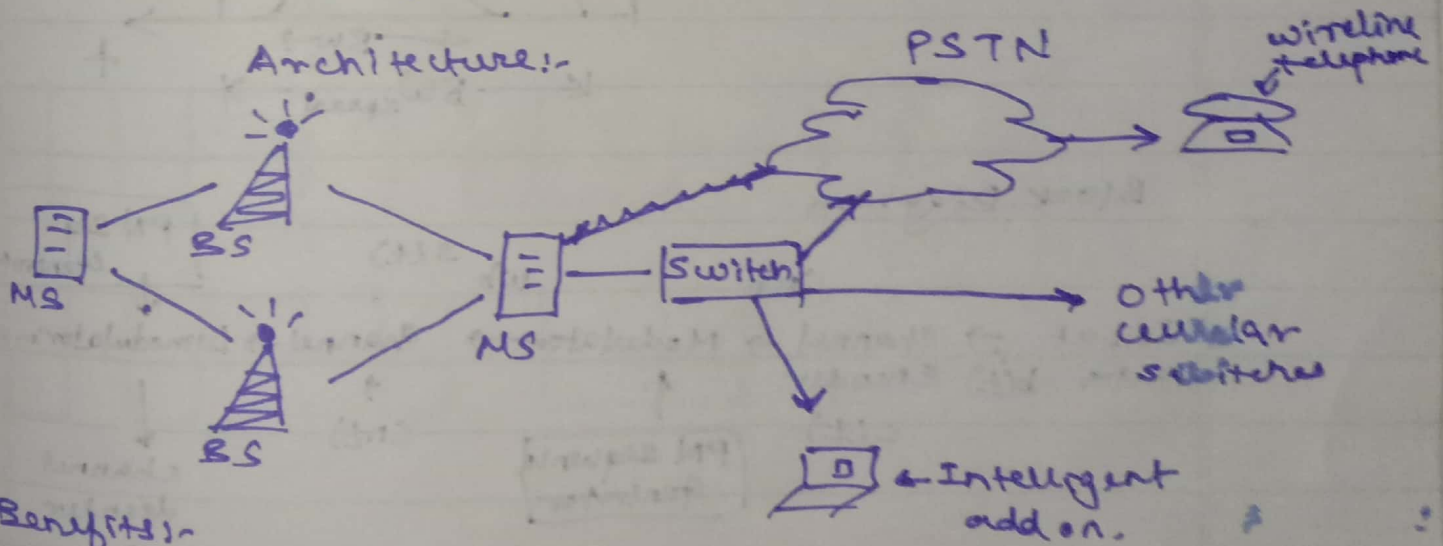
$m$  → number of TDMA users per radio channel  
rest have usual meaning.

## CDMA

↳ spread spectrum tech.

↓  
It allows many users to occupy the same time and freq. allocation in given band & space.

It is a form of direct sequence spread spectrum.



Benefits:-

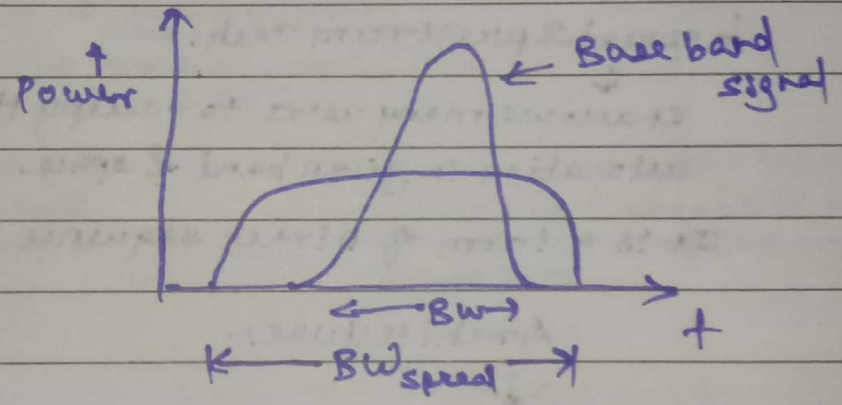
- outstanding voice call quality,
- greatest coverage for lower cost
- longer talktime, long battery life.
- fewer dropped calls, improved security & privacy
- greater capacity, reduced background noise.

# Spread Spectrum Modulation

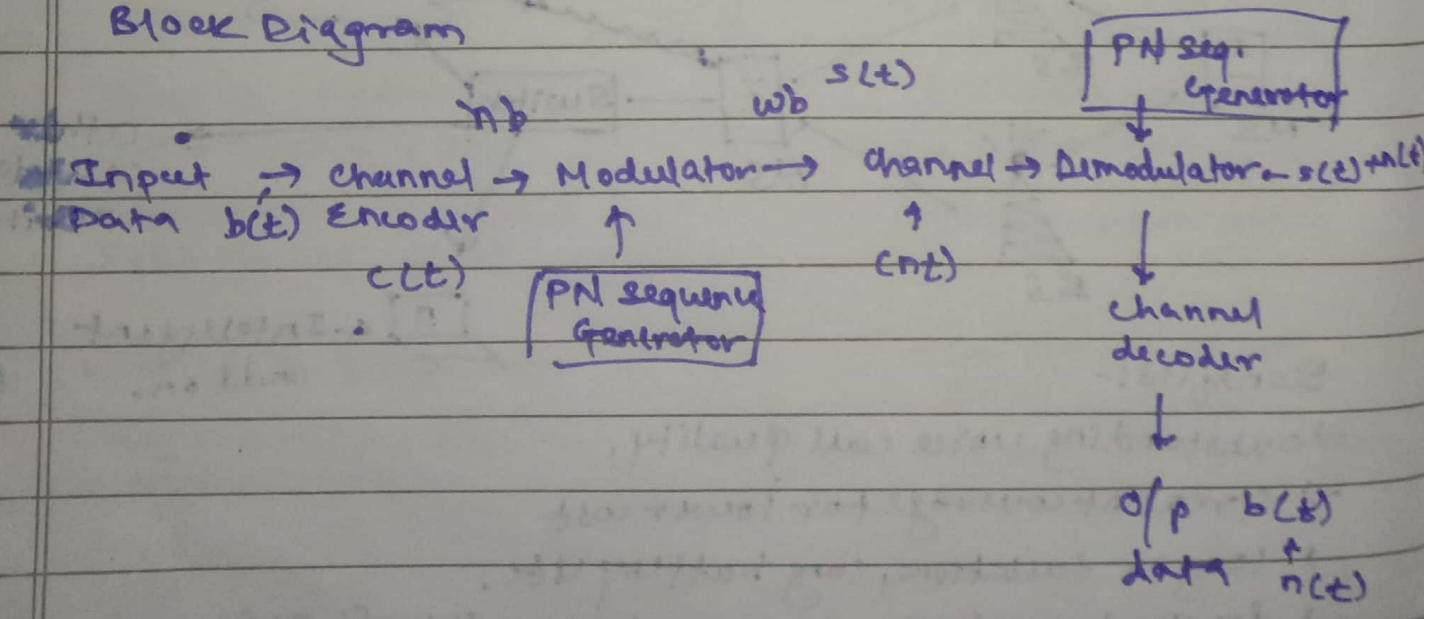
- used to enhance the BW of the baseband signal.
- In spread spectrum the data sequence occupies a BW in excess to minimum BW required to transmit sequence.
- spreading is done before transmission through use of code that is independent of data sequence.
- same code is used at receiver to despread.

## Advantages

- Ability to reject interference whenever it was intentional or unintentional.
- achieving message privacy in presence of other users.



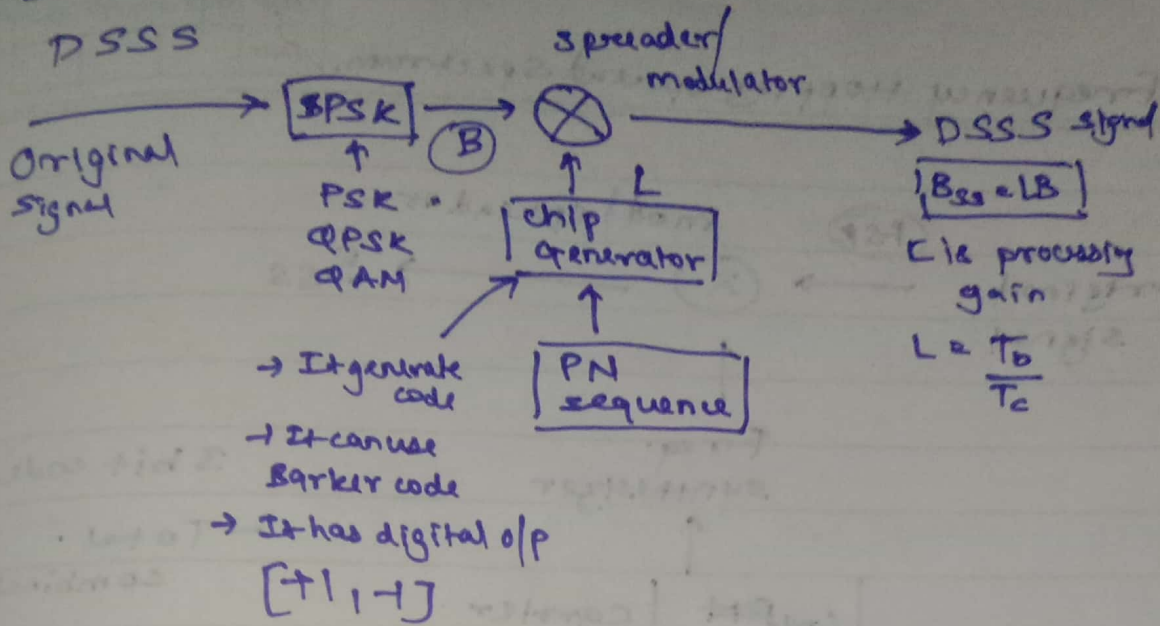
## Block Diagram



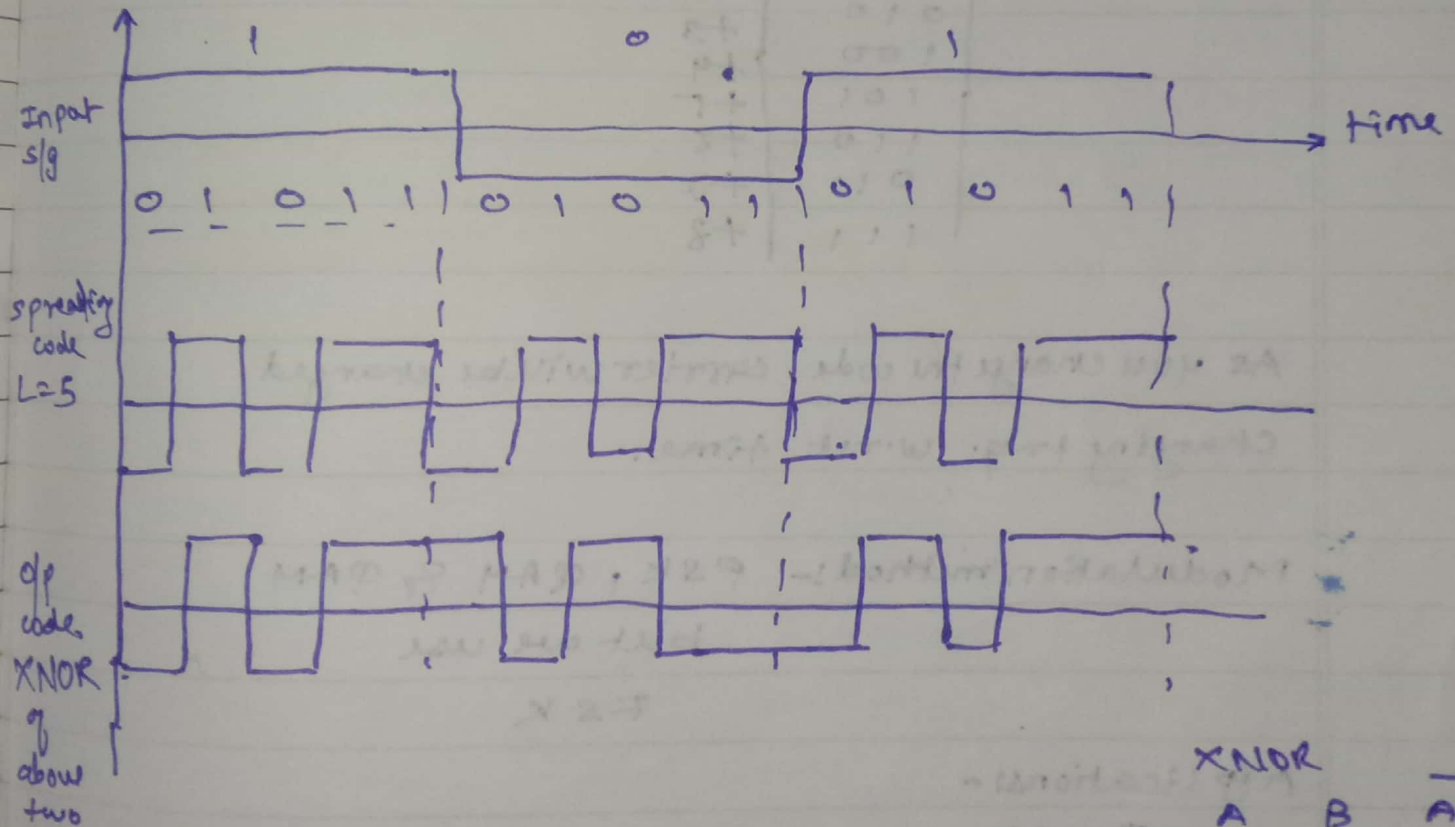


# Direct sequence spread spectrum.

DSSS



## Waveforms of DSSS

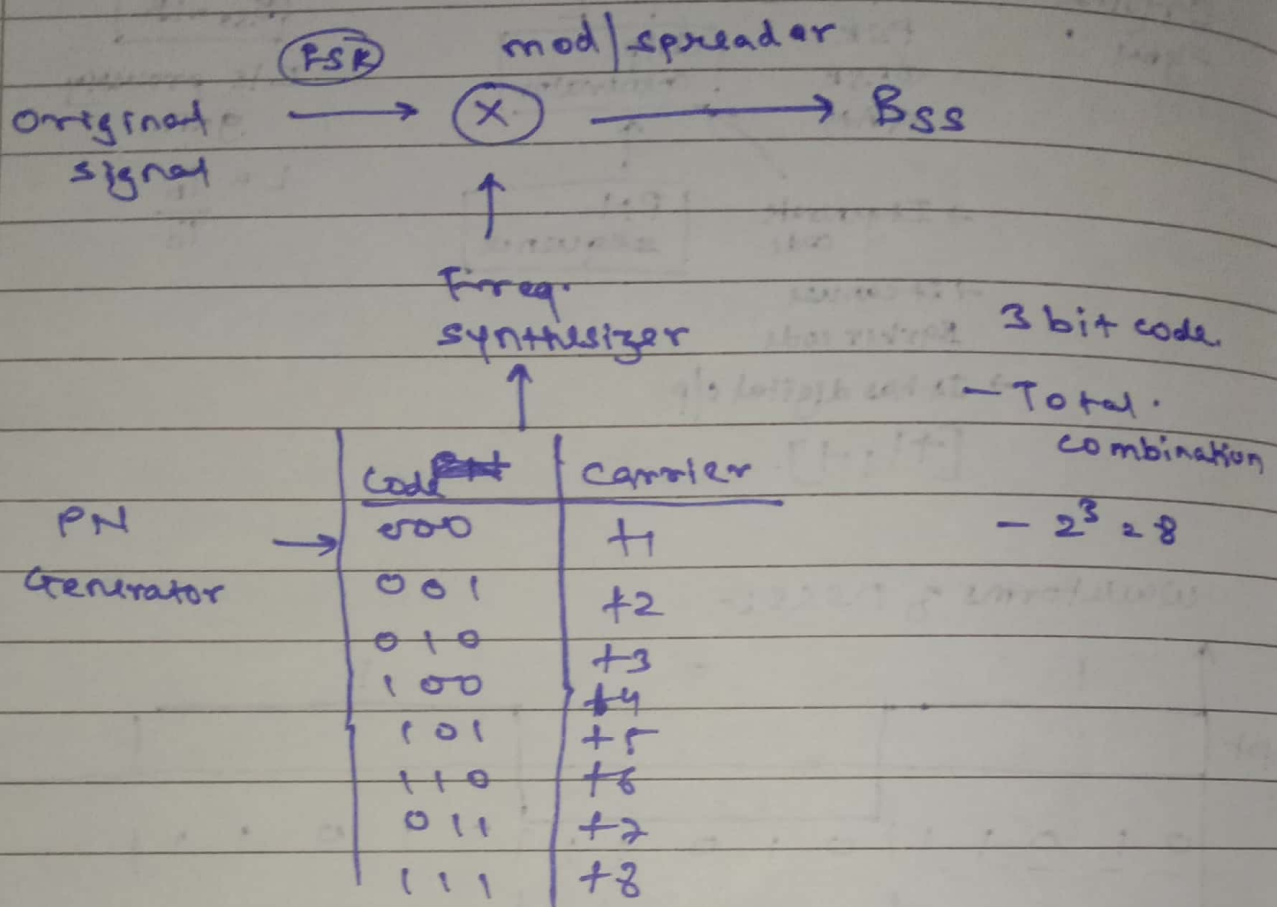


XNOR		
A	B	$\overline{A \oplus B}$
0	0	1
0	1	0
1	0	0
1	1	1

# Frequency Hopping Spread Spectrum.

Page No.

Date



As you change the code, carrier will be changed.  
Changing freq. with time.

Modulation method:- PSK, QAM & PAM  
but we use  
FSK

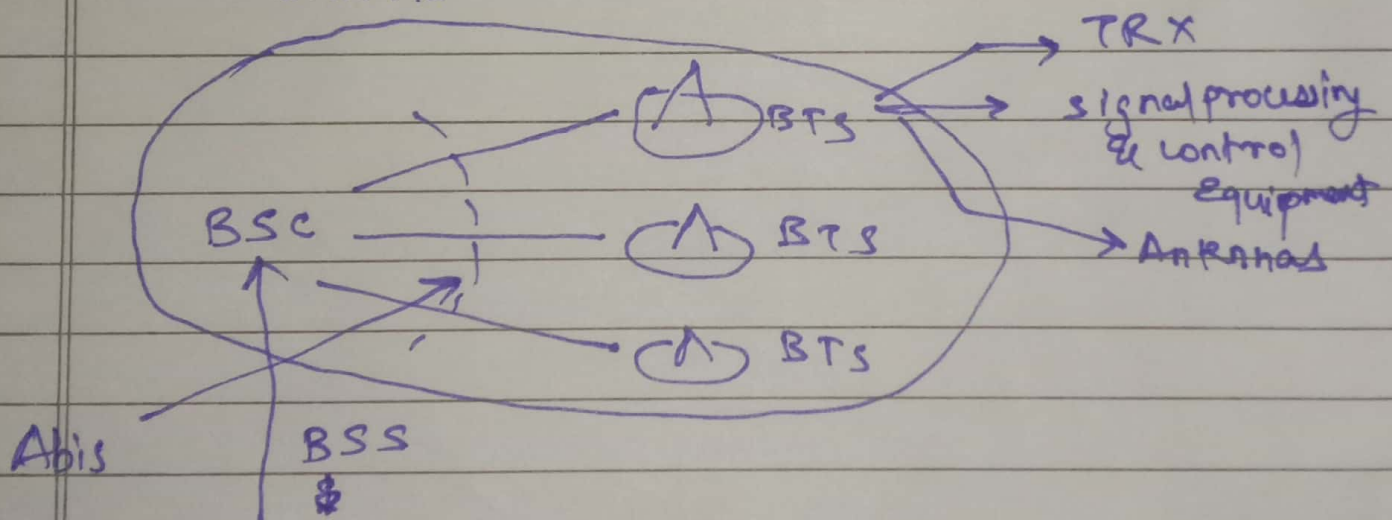
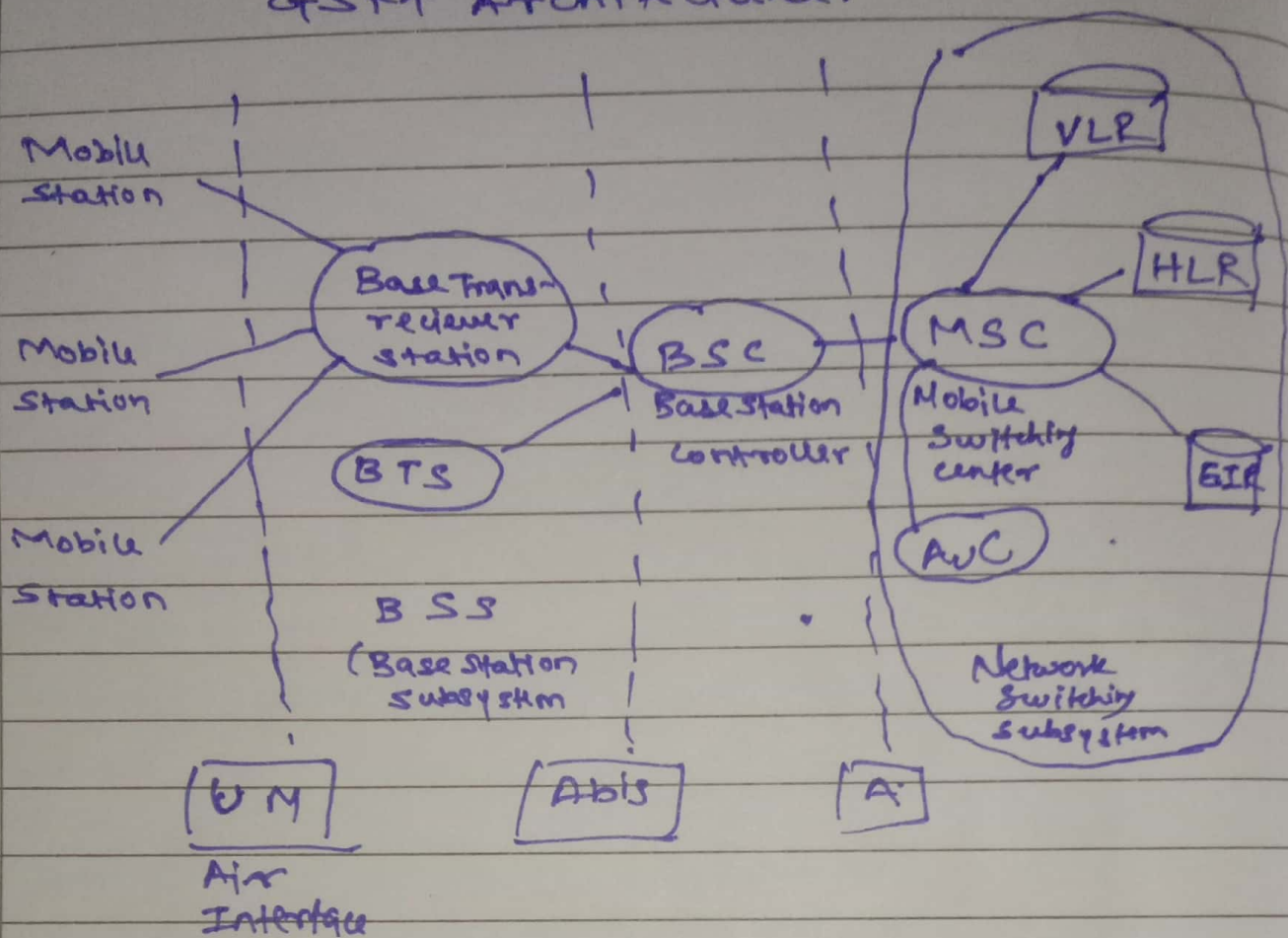
Applications:-

Bluetooth

JTRS [Joint Tactical Radio station]



# GSM Architecture.



i) Allocates channel for the duration of the call.

ii) maintains the call

- monitor the quality
- control the power transmitted by BTS or MS

iii) Handles handover

### I HLR:- (Home Location Register)

- stores permanent data about subscriber (profile, location info, status)
- subscription info. of user is stored

### II VLR (Visitor Location Register)

- stores temporary info.
- Integrated with MSC.
- works in coordination with HLR.

### III AUC (Authentication Centre):-

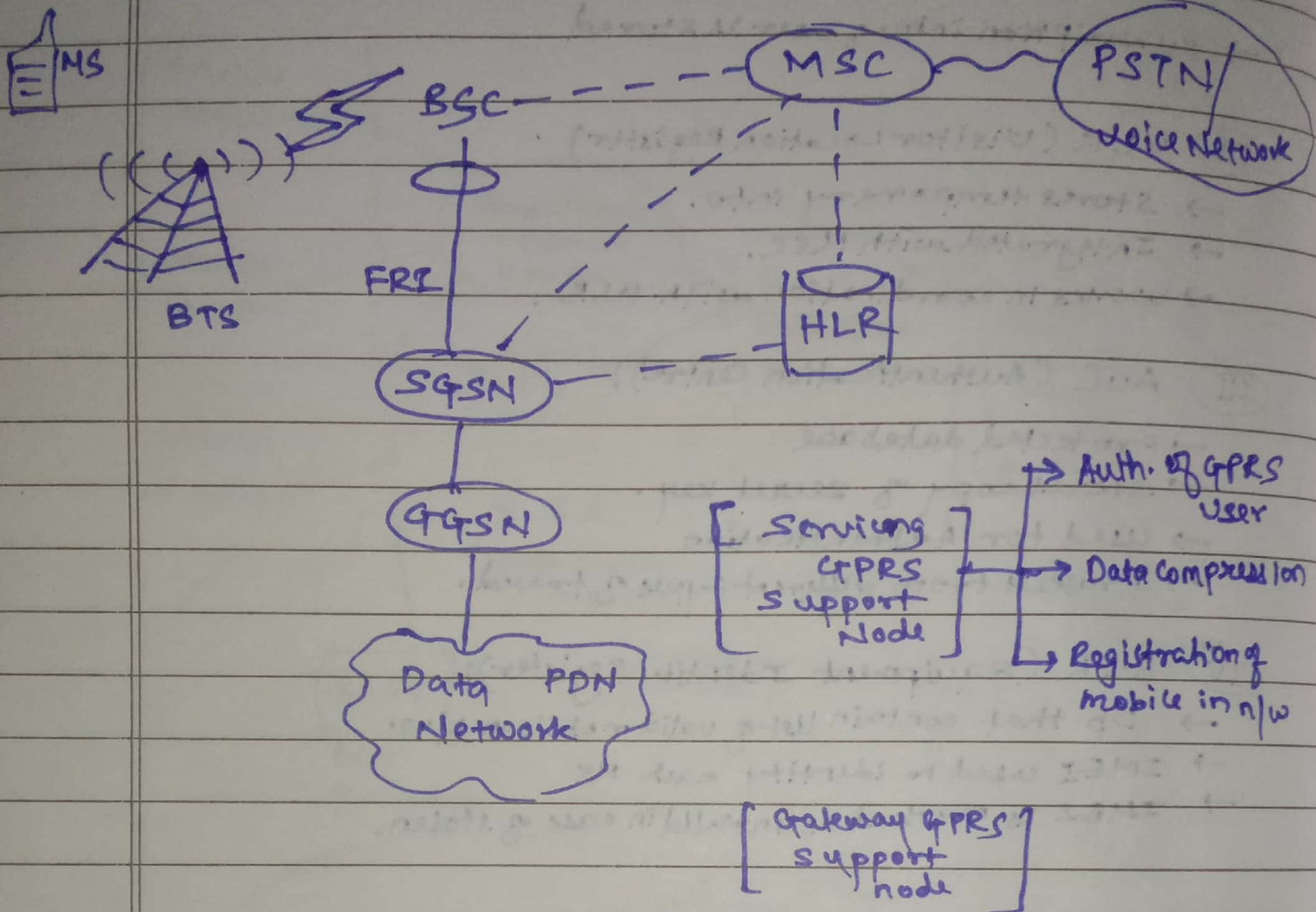
- protected database
- stores copy of secret key.
- used for Authentication
- protects from different types of fraud.

### IV EIR (Equipment Identity Register):-

- Db that contain list of valid mobile on n/w.
- IMEI used to identify each MS
- IMEI is marked as invalid in case of stolen.



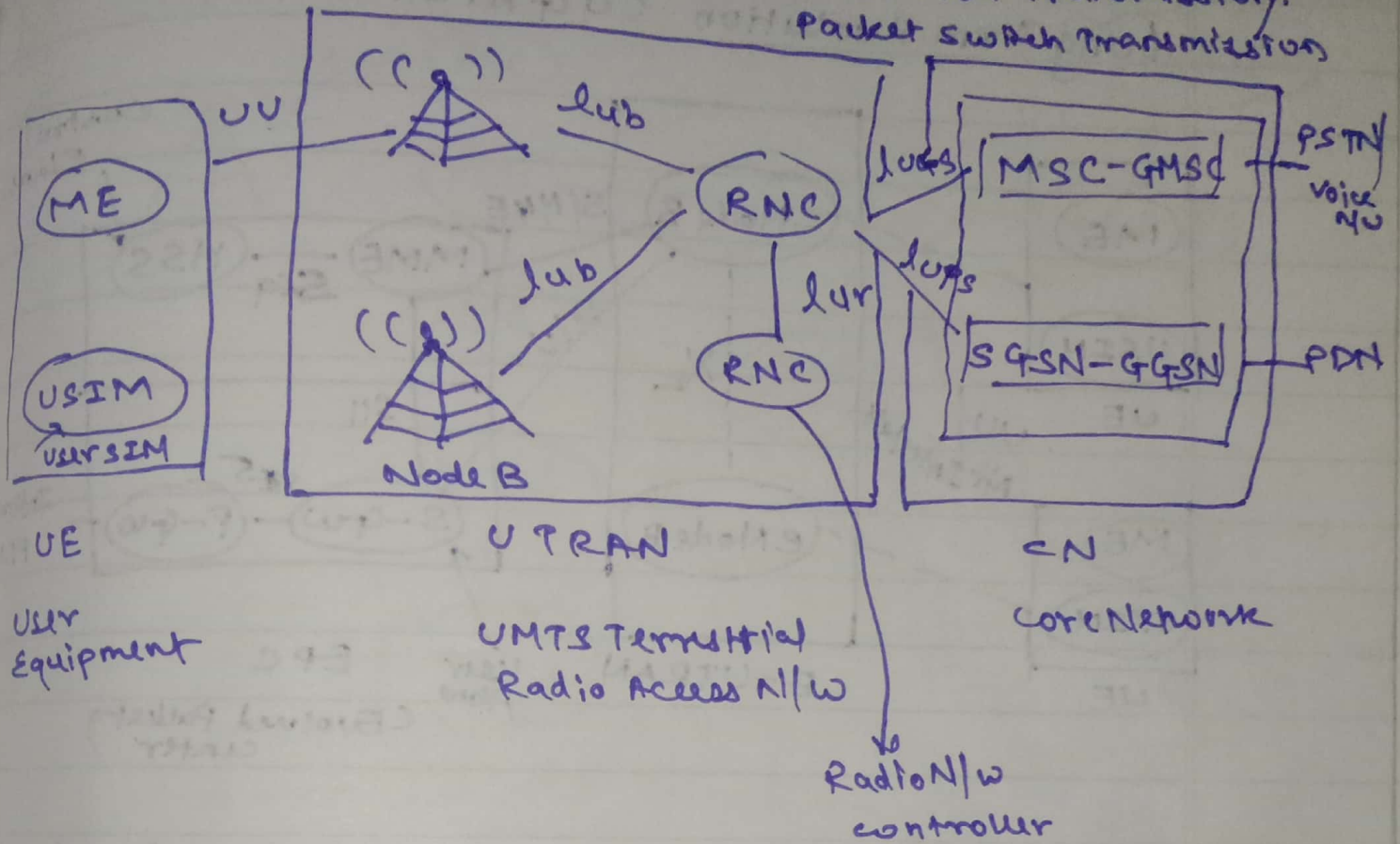
# General Packet Radio ~~System~~ <sup>Service</sup> (GPRS) :-



PCU → Packet Control Unit.

# Universal Mobile Telecommunication System. (UMTS) is-

- 3G Tech.
- Circuit Switch Transmission.  
Packet Switch Transmission

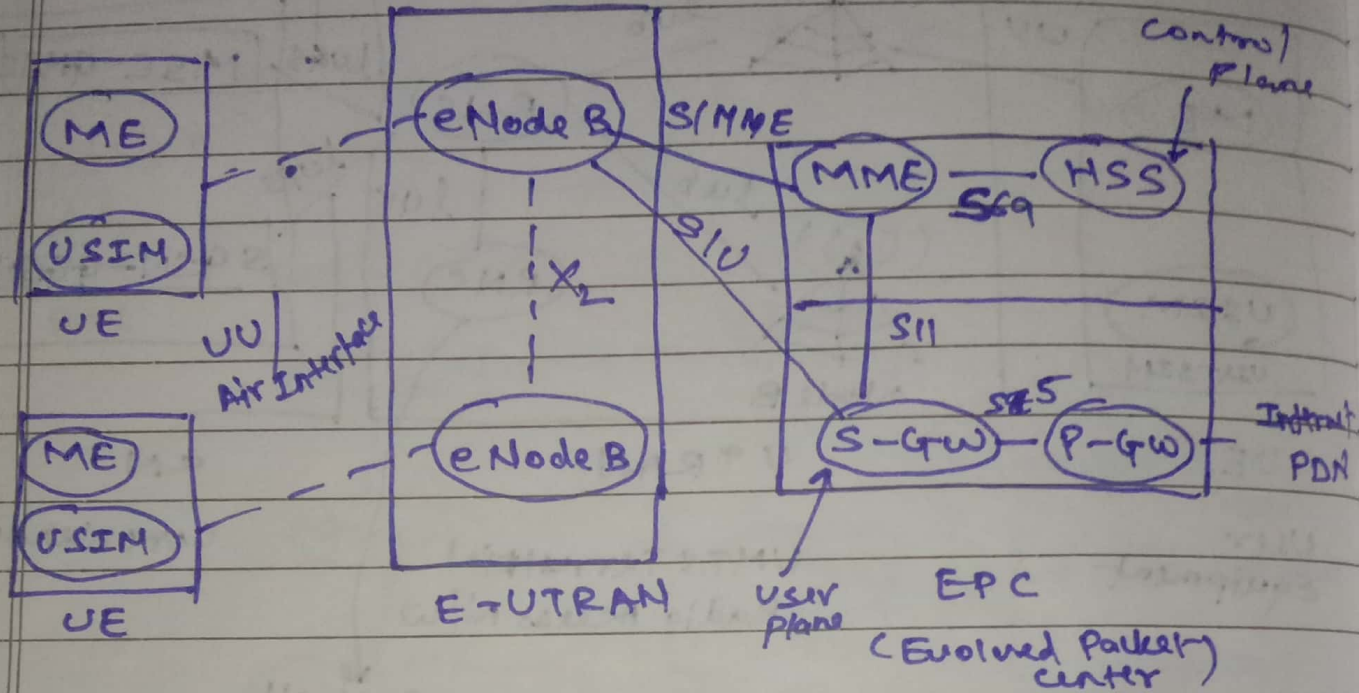




→ Only packet switching is done.

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Date	

## Long Term Evolution (4G Architecture)



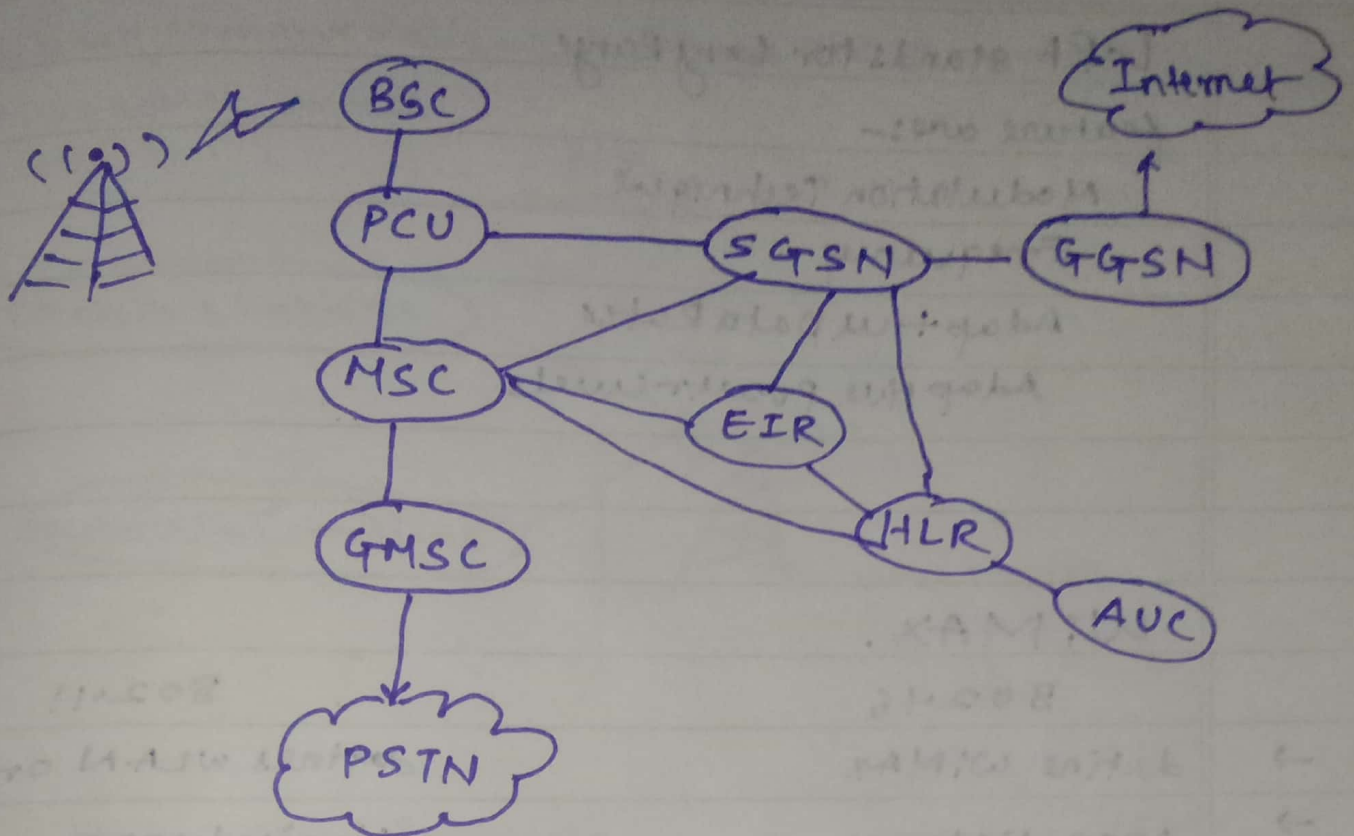
MME - mobility mgmt. entity

HSS - Home subscriber system

P-GW ← Packet data  
n/w  
Gateway

Enhancement and evolution for GSM Evolution.

## EDGE Network Architecture:-





LoRA stands for Long Range

feature are:-

Modulation Technique

Frequency

Adaptive Data Rates

Adaptive power levels

WiMAX.

802.16

- define WiMAX
- long distance
- range 7km to 50km
- used for outdoor usage
- operates on 2.4 GHz, 5 GHz
- data rate 100 Mbps
- Large no. of customers are connected
- 

802.11

defines WLAN or WiFi

Limited area

30m to 100m

indoor usage

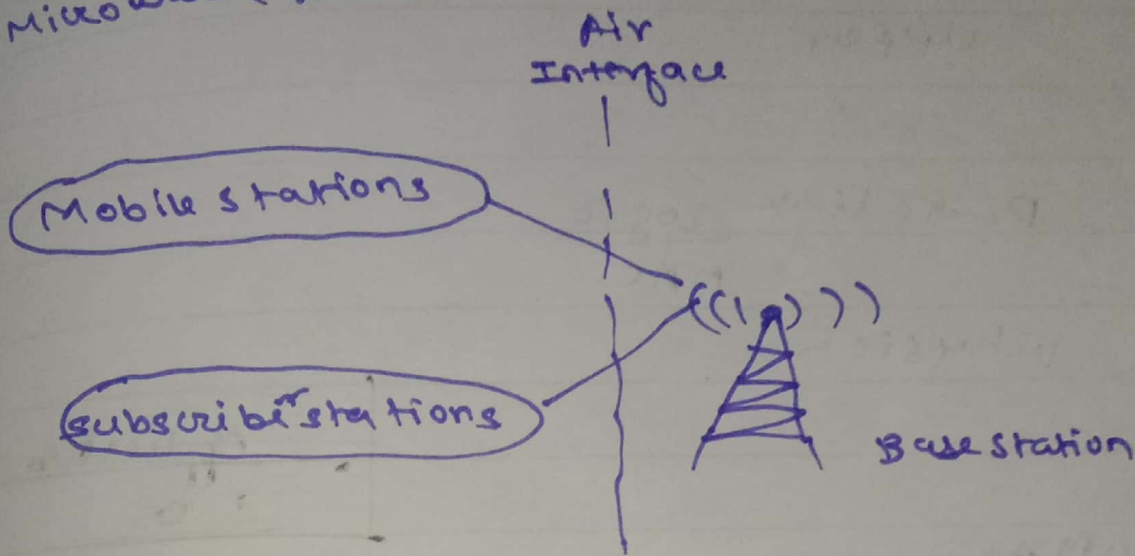
2.4 GHz, 3.5 GHz, 5.8 GHz

54 Mbps

Limited number of customers connected.

802.16

It has been commercialized as world wide interoperability  
for Microwave Access.



Higher level protocols.

} Upper Layer

Service specific convergence sublayer

MAC common sublayer

Security sublayer

} Data Link Layer

Fixed WiMAX | Mobile WiMAX  
(Scalable OFDM) (802.16e)

} Physical Layer