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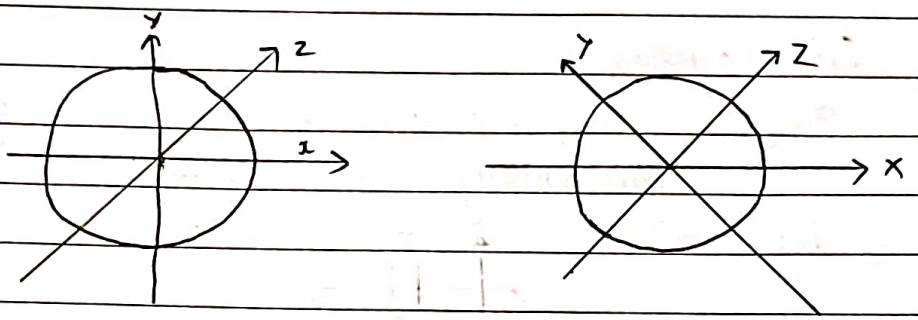
Q1 Explain various types of Antennas along with their radiation pattern.

→ Types of Antennas :

1) Isotropic Antennas :

i] An isotropic antenna is a theoretical antenna that radiates its power uniformly in all directions.

ii] It is an ideal antenna which radiates equally in all directions & has a gain of 1 (0dB), i.e zero gain & zero loss.



Radiation Pattern of Isotropic Antenna.

Note: Antennas can be broadly classified as omnidirectional & directional antennas.

2) Omnidirectional Antennas

i] Unlike isotropic antennas, dipole antennas are real antennas.

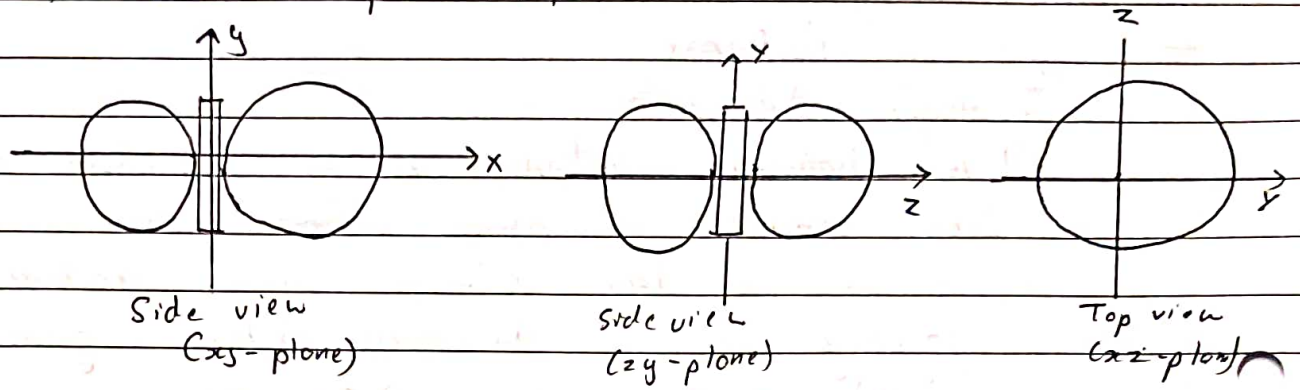
ii] The dipole radiation pattern is 360 degrees in the horizontal plane & approximately 75 degrees in vertical plane

iii] It is non-directional

iv] Dipoles:

a) The most commonly used antenna is Hertzian dipole.

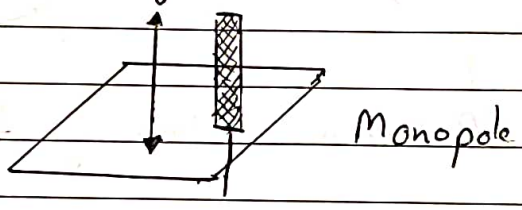
b) Radiation pattern:



2) Monopoles

a) A monopole over an infinite ground plane is theoretically the same as dipole.

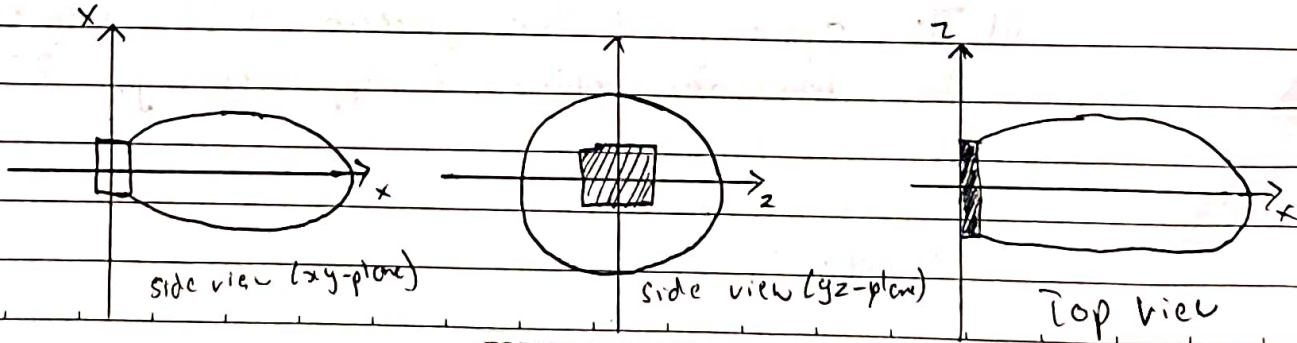
b)



c) Can be used on the roof of cars.

3) Directional Antenna

i) A directional antenna or beam antenna is an antenna which radiates or receives greater power in specific directions.



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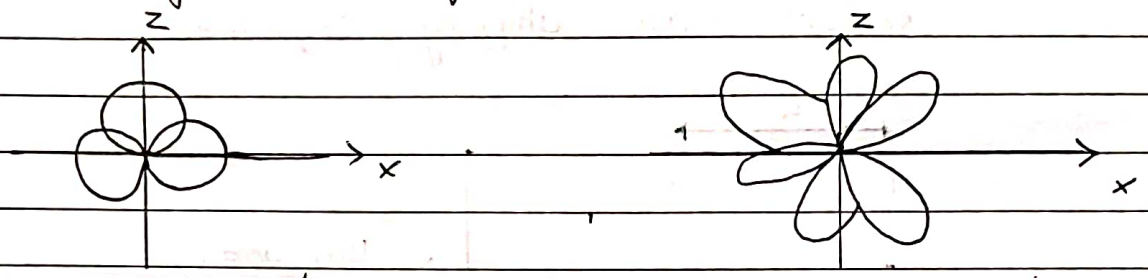
4) Sectorized Antenna

i] Several antennas can be combined on a single pole to construct a sectorized antenna.

ii] They are widely used in klephong infastructure.



Top view, 3 sector

Top view, 6 sector.

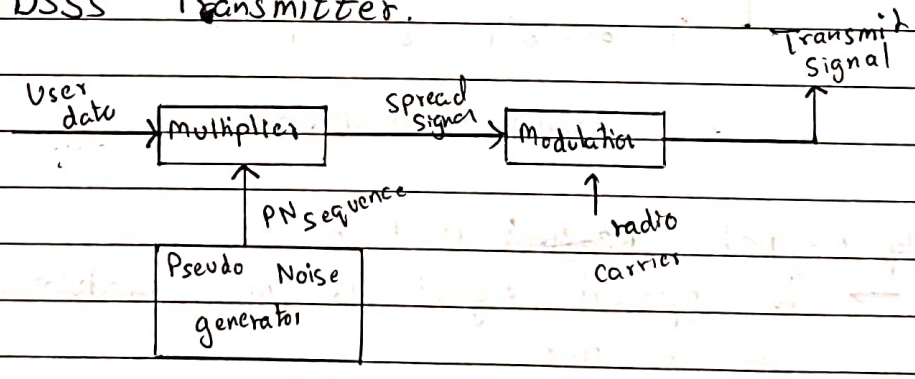
Radiation pattern of Sectorized antenna.

iii] Cell is divided into 3 or 6 sectors

Q. 2] DSSS & FHSS in detail.

→ (I) Direct Sequence Spread Spectrum (DSSS):

1] DSSS Transmitter.

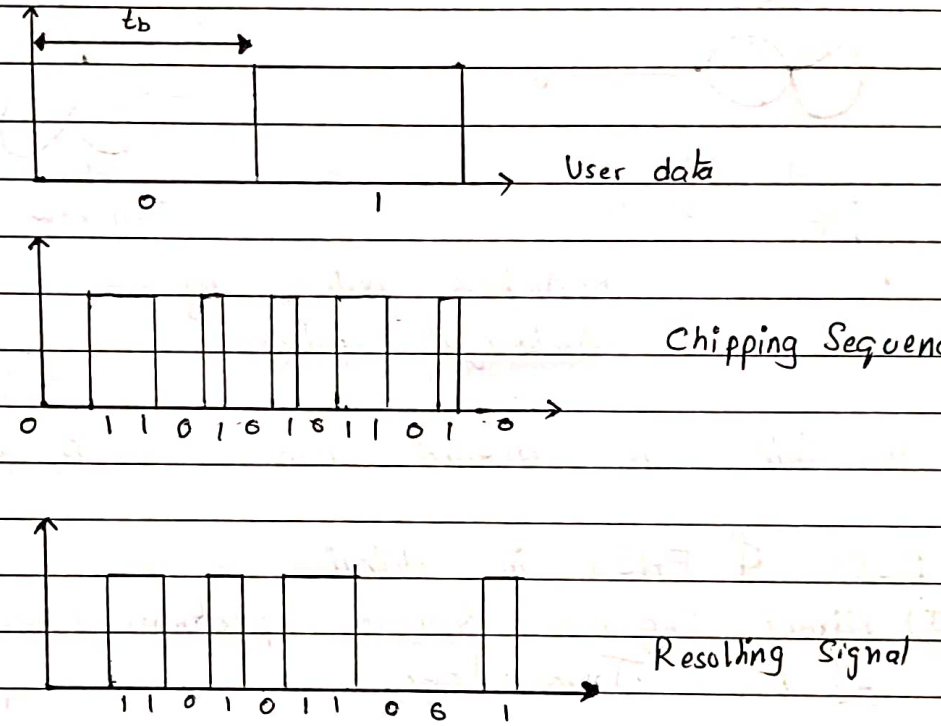


DSSS Transmitter.

Step 1: Spreading the signal

→ It is done by modulating user data with a chipping sequence (PN sequence)

→ It can be done by XORing user bit stream with chipping sequence.



Sprading with DSSS.

Step 2: Ratio ~~Receiver~~ Modulation

→ The spread signal is now modulated with a ratio carrier.

→ The radio carrier shifts the signal to the carrier frequency.

→ This signal is then transmitted

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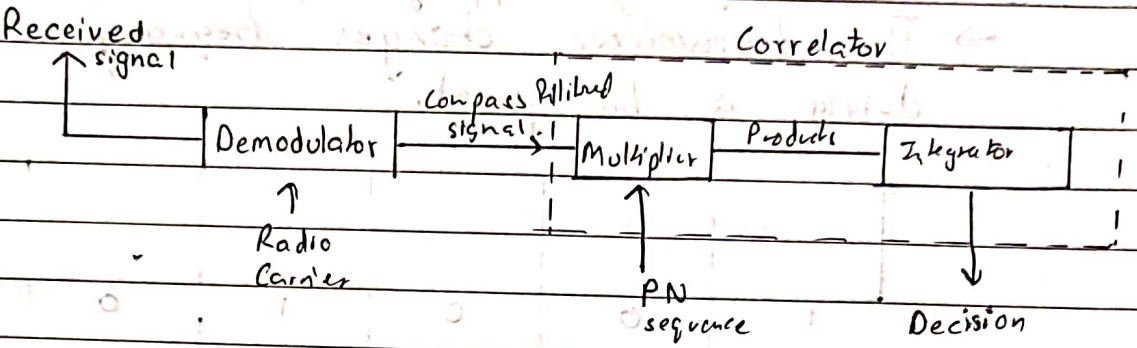
2] DSSS Receiver



DSSS Receiver. Date

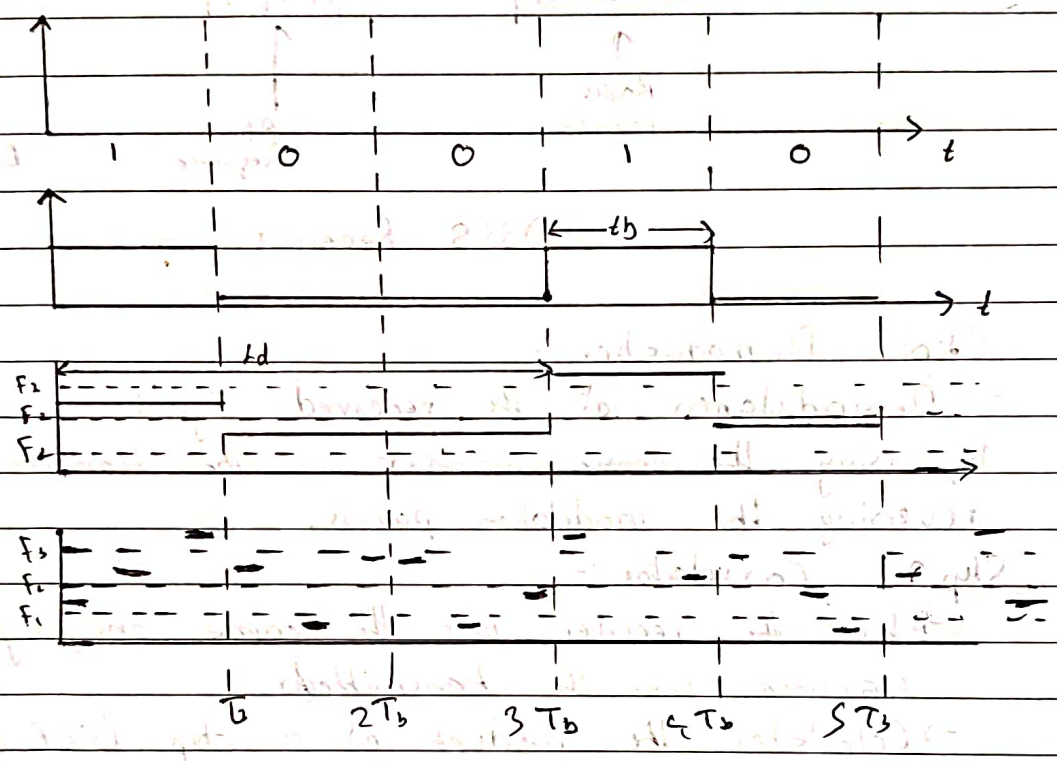
Step1 : Demodulation :-
-> Demodulation of the received signal is achieved by using the same carrier as the transmitter reversing the modulation process.

Step 2: Correlator :-
-> Here the receiver uses the same chipping sequence as the transmitter.
-> Calculates the product of a chip (XOR operation) with the incoming signal.
=> Integrator adds all these products.

Step 3: Decision Unit :-
-> It decides whether the sum represent binary 0 or 1, based on the sum provided by the integrator.

(II) (FHSS) Frequency Hopping Spread spectrum.

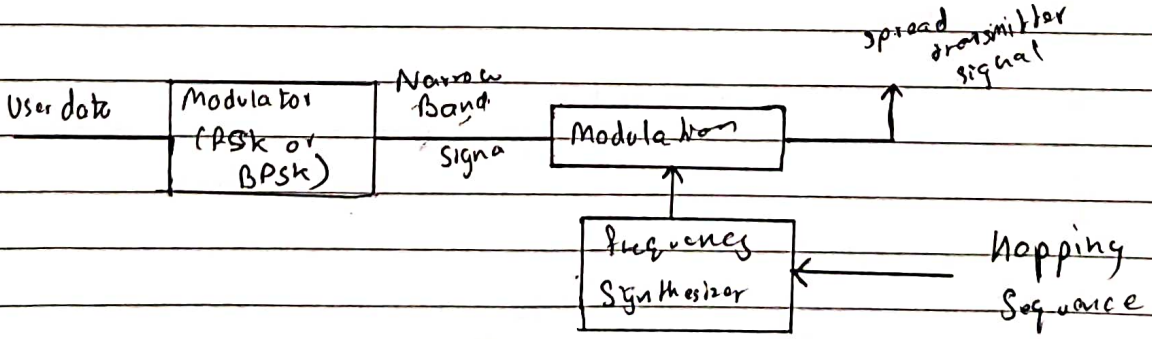
→ The transmitter changes frequency several times during a bit period.



Frequency Hopping

1] RNSS Transmitter

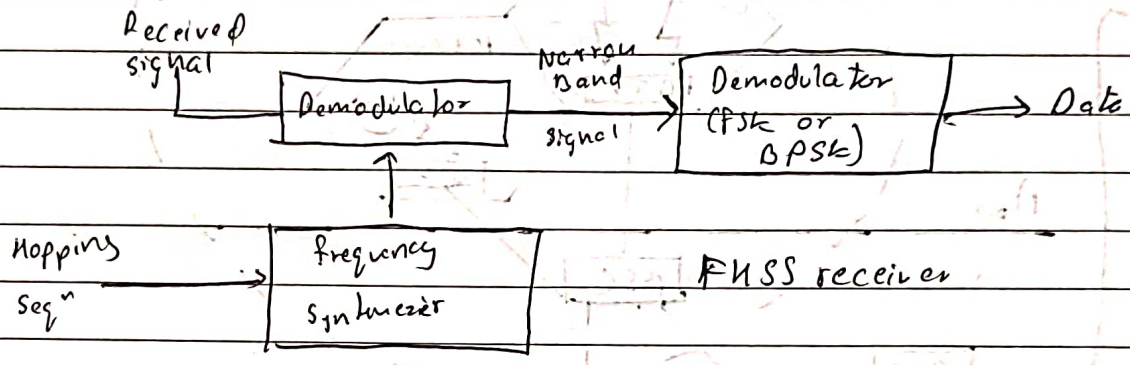
Step1 : Modulate user data using digital to analog modulation



Step 2: Frequency hopping is performed by using hopping sequence.

Step 3: Second modulation is done.

2) FHSS receiver.

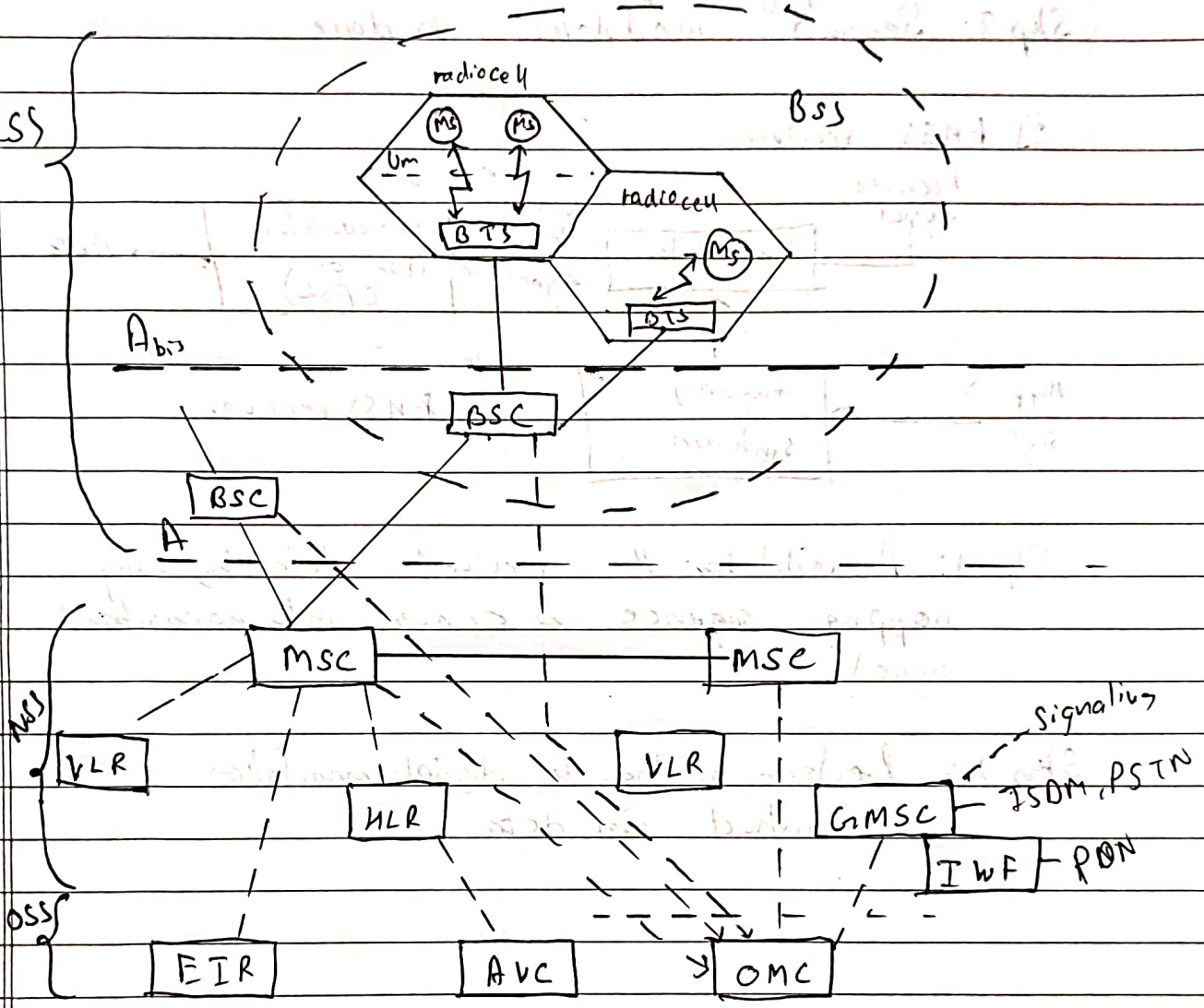


Step 1: Demodulate the received data by using hopping sequence & convert into narrowband signal

Step 2: Perform analog to digital modulation & reconstruct user data.

0.3 Explain GSM Architecture

→



GSM System Architecture

It is grouped in 3 main Subsystem.

1) Radio subsystem (RSS)
2) Network & switching Subsystem (NSS)
3) Operation Subsystem.

1. Radio Subsystem:
→ It comprises of all radio entities
(i) BSS (Base station Subsystem)
It contains radio cells each controlled by a base transreceiver station (BTS)
ii) BTS (Base Transceevier station)
It contain radio equipments like antennas signal processing & etc.
iii) BSC (Base station Controller)
It manages the radio resource for one or more BTS.
iv) Mobile Station
It is the hardware or software required for communication.

2. Network & Switching Subsystem (NSS)
→ It connects the radio network with standard public mobile networks.
(i) MSC (Mobile Switching Center)
It controls one or more BSS.
(ii) GMSC (Gateway MSC)
It is responsible for communication with external fixed networks such as PSTN & ISDN.
(iii) IWF (Internetworking function)
Connects the MSC to public Data Networks.
(iv) Home Location Register.
Stores → manages the permanent information of the Subcriber.

v) VLR (Visitor Location Register)
It is a temporary database containing records of all mobile station currently registered with the MSC

3) OSS (Operation Sub System)
→ It is the functional entity which is used to monitor and control the overall GSM network.

i) Operation & Maintainence Center (OMC)
→ It is connected to all equipment in the system & to the BSC.
→ It monitors & control all other network entities via O- interface.

ii) AUC (Authentication Center)
→ It is a protected database that stores a copy of the secret key stored in each subscriber's SIM card which is used for authentication & ciphering at the radio channel.

iii) Equipment Indentity Register (EIR)
→ It is a database that contains a list of all valid mobile equipment on the network

→ It stores International Mobile Equipment Identity (IMEI) number for each valid mobile equipment.

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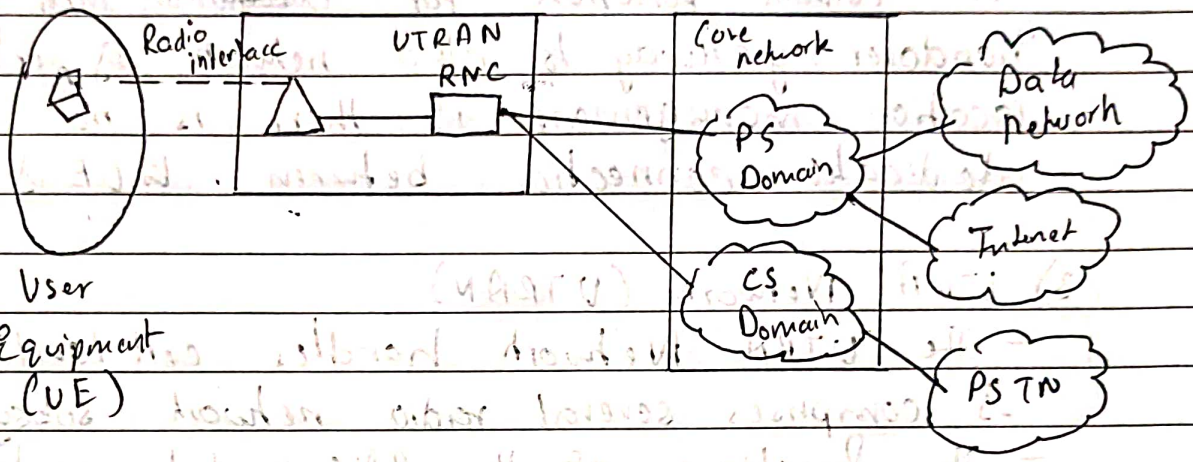
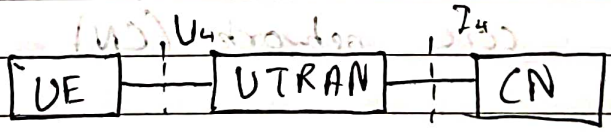
Q4 Draw UMTS block diagram & function of each block?

→



Main Component of UMTS are:

1) User Equipment (UE)
2) Core Network (CN)
3) UTRA Network (UTRAN)



1) User Equipment contains two components:
   Mobile Equipment (ME) &
   UMTS subscriber identity module (USIM)
- ME is radio terminal connected to radio interface
- USIM is smart card that contains the subscriber identity, authentication algorithm etc.

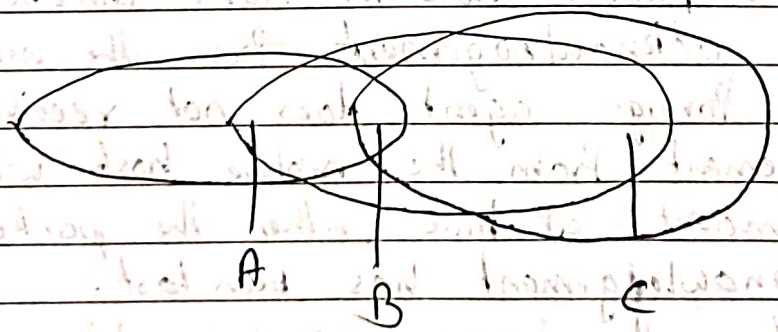
2) Core Network (CN) -
- Core Network is shared with GSM & GPRS.
- It contain function for inter-system handover, gateway to other network & perform location management - if there is no dedicated connection between UE & UTRAN

3) UTRA Network (UTRAN)
- The UTRA Network handles cell level mobility & comprises several radio network subsystem (RNI)
- The functions of the RNS include radiochannel radio resource management.
- The UTRAN is connected to UE via the radio interface Uu.
- Via the Iu interface, UTRAN communicate with the core network (CN)

Q5 What do you mean by Hidden & Exposed problem how they can be avoided?

→ Hidden Terminals =
The transmission range of C reaches B, but not A
Finally the transmission range of B reaches A & C
- A sends to B, C cannot receive A (the detection range does not reach either)
- C wants to send B, C senses a 'free' medium
- Collision at B, A cannot receive the collision
- A is 'hidden' for C

Exposed Terminals -
- B sends to A, C wants to send to another terminal (not A or B)
- C has to wait, CS signal medium in use
- but A is outside the radio range of C, therefore waiting is not necessary
- C is exposed to B



Avoid :-

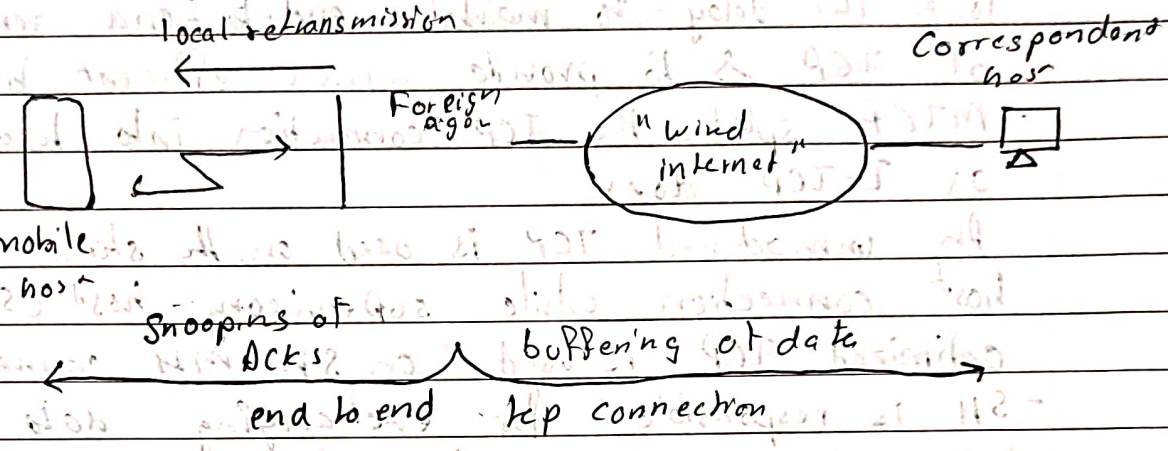
1) Comprehensive Risk Assesment :-
Conduct through risk assessments before starting any project or undertaking. Identify potential hidden & exposed problems & develop strategies to mitigate them.

2) Open Communication :-
Foster a culture of open communication where team members feels comfortable reporting issues they encounter, whether hidden or exposed.

Q6 Explain snooping TCP & Mobile TCP with their merit & demerits.

⇒ Snooping TCP -
- It enhance work completely transparently & leaves the TCP end-to-end connection intact.
- In this approach, the foreign agent buffers all packets with destination mobile host & additionally 'snoops' the packet flow in both directions to recognize acknowledgements from the mobile host.
- If the foreign agent does not receive an acknowledgement from the mobile host within a certain amount of time, either the packet or the acknowledgement has been lost.
- Alternatively, the foreign agent could receive a duplicate ACK which also shows the loss of packet.

- Now the foreign agent retransmit the packet directly from the buffer, performing a much faster retransmission compared to the corresponding host.



Merit :

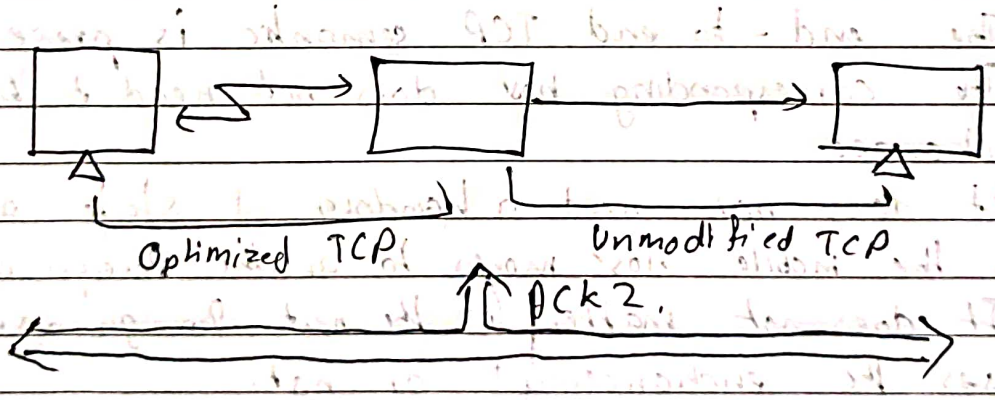
1) The end-to end TCP semantic is preserved
2) The corresponding host does not need to be changed
3) It does not need a handover of state as soon as the mobile host moves to another foreign agent
4) It does not matter if the next foreign agent uses the enchancement or not.

Demerits -

1) Snooping TCP does not isolate the wireless link as same as I-TCP
2) Using negative acknowledgement between the foreign agent & the mobile host assumes additional mechanism on the mobile host.

Mobile TCP

- MTCP approach has the some goals as I-TCP & snoopins TCP
- MTCP wants to improve overall throughput, to lower the delay, to maintain end-to-end semantics of TCP & to provide a more efficient handover
- MTCP splits the TCP connection into two parts as I-TCP does.
- An unmodified TCP is used on the standard host connection, while supervisory host (SH) an optimized TCP is used on SH-MH connection.
- SH is responsible for exchanging data between both parts similar to the party in I-TCP.



- Merit -

1) It maintains the TCP end to - end semantics The S.H does not send any Ack itself but forward the Ack from the MH.
2) If MH disconnected it avoid useless retransmission, slow start or breaking connection by simply shrinking the sender's window to 0
3) Since it does not buffer data in the SH or I-TCP does, it is not necessary to forward buffer to new SH. Lost packets will be automatically retransmitted to the new SH.

- Demerit.

1) As the SH does not act as proxy as in I-TCP, packet loss on the wireless link due to bit errors is propagated to the sender.
2) A modified TCP on the MH protocol software but also new network elements like the bandwidth manager.