Mobile Computing notes

1. Comparison between 1G, 2G, 3G, 4G, 5G

Parameters	1G	2G	3G	4G	5G
Implementation	1984	1991	2002	2010	2015
Standards	NMT, AMRS	GSM,PDC	WCDMA	Single unified standard	Single unified standard
Technology	Analog cellular	Digital cellular	Wideband CDMA	LTE	5G-LTE
Data rates	2.4 Kbps	14.4 Kbps	1.4 Mbps	100 Mbps	More than 1 Gbps
Switching	Circuit switching	Circuit switching	Pocket switching	Pocket switching	Pocket switching
Services	Voice	Voice and SMS	High quality voice & data	Dynamic information access	Dynamic information access, wearable devices with AI.

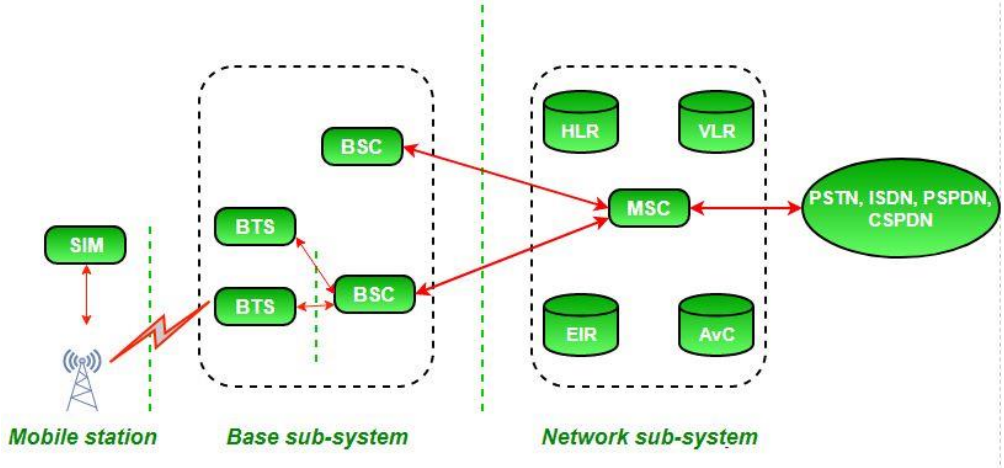
2. Explain Co-channel interference.
   - Cells using the same set of channels are called as co-channel cells.
   - The interface between signals from these cells is called as co-channel interference.
   - In order to reduce the co-channel interference, the co-channel cells are physically separated by minimum distance to provide isolation.
   - The frequency reuse distance D is
     $D = \sqrt{3N}\ R$
     where N is frequency reuse pattern
     R is radius of cell
   - It becomes a function of the radius of cell R and distance between nearest co-channel cells D. the ratio D/R is called as co-channel reuse ratio. It is expressed as $Q = D/R$.
   - Thus the co-channel interference is reduced. But transmission quality is improved.

3. Explain Antenna and its types.
   - The antenna is wire structure used to convert high frequency current into electromagnetic radiations and electromagnetic radiations into high frequency current.
   - The antenna is very important into high frequency current.
   - The antenna is very important part of the communication path.
   - An antenna acts as transducer that converts the electrical power into EM waves. The electric charges are the source of EM or electromagnetic waves.

- The spacing, length and shape of an antenna depends on wavelength of signal being radiated.
- Functions :
  i. It is capable of transmitting & receiving the electromagnetic waves.
  ii. It converts high frequency current in EM.
- Types of antenna :
  i. Isotropic radiator
  ii. Dipole antenna
  iii. Directional antenna
  iv. Sectorized antenna

4. What is GSM ?
   - GSM stands for global system for mobile.
   - It is a second generation (2G) digital cellular technology used for mobile voice and data services.
   - GSM uses time division multiple access (TDMA) for providing voice and text based services over mobile phone networks.
   - GSM mobile services :
     i. Teleservices
     ii. Data services
     iii. Supplementary services

5. Explain GSM architecture



- SIM : subscriber identity module
- ME : mobile equipment
- BTS : base transceiver station
- BSC : base station controller
- HLR : home location register
- VLR : visitor location register
- MSC : mobile switching centre

- EIR : equipment identity register
- AUC : authentication centre

1. GSM architecture shows various functional entries and three main subsystems
   i. BSS (basic station subsystem)
   ii. NSS (network switching subsystem)
   iii. OSS (operating support subsystem)
2. MS (mobile station) is also a subsystem but generally considered as an internal part of BSS.
3. The BSS is also known as radio subsystem interlinks and manages links between MS & NSS.
4. NSS controls all the switching function of the system.
5. OSS manages operation and maintenance of GSM. It also administers monitoring & controlling operations in system.

- MS :
  1. It consist of physical mobile equipment used by subscriber to access GSM network.
  2. It includes : i) MT: mobile termination
     ii) TE : terminal equipment
     iii) TA : terminal adaptor
  3. MS is divided into 2 parts : i) mobile terminal
     ii) SIM

- BSS :
  1. It manages all the signaling and traffic between MS and NSS.
  2. It includes : i) BTS (base transceiver station)
     = consist of antenna & ratio signals
     ii) BSC (base station controller)
     = consist of high quality switch
     Which control BTS's

- NSS :
  1. BSS forwards signal to NSS
  2. It consist of main switching functions, various databases and mobility management units.
  3. The main unit of NSS is MSC
  4. NSS is divided into :
     i. HLR (home location register) :
     Database of permanent subscriber information contain info like address, account status.
     ii. VLR (visitor location register) :
     Database of local subscriber when enters VLR area
     iii. EIR (equipment identity register) :
     Keeps track of valid and invalid mobile equipment
     iv. AUC (authentication centre) :

Database contain secret authentication key

- Characteristic of SIM :
  1. IMSI (international mobile subscriber identity)
  2. TMSI (temporary mobile subscriber identity)
  3. IMEI (internal mobile equipment identity).

6. Explain Handover mechanism in GSM /types of handoffs in GSM / MSC handover technique.

   There are two basic reasons of requirement of handover :

   a) The MS moves out of range of BTS and hence received signal level decreases. The error rate may increase due to increased interference.
   b) If traffic in one cell is too high then some MS may be shifted to other cell if possible. This is known as load balancing.

- Situations of handovers in GSM :
  a) Intra-cell handover
  b) Intra-cell, intra-BSC handover
  c) Intra-BSC, intra-MSC handover
  d) Inter MSC handover

  a) Intra-cell handover :
     This handover is performed to optimize the traffic load and to improve quality of connection.

  b) Intra-cell, intra-BSC handover :
     When MS moves from one cell to another cell but both cell are under BSC then this type of handover is performed.

  c) Intra-BSC, intra-MSC handover :
     This is performed when mobile moves from one cell to another which are under control of different BSC's but same MSC.

  d) Inter MSC handover :
     This is performed when MS is moving from one MSC area to another.

7. Explain GPRS architecture.
   Stands for general packet ratio service
   BTS : base transceiver station
   MS : mobile station
   BSC : base station controller
   SGSN : serving GPRS support node

SMSN : short message service centre
GGSN : gateway GPRS support node
PLMN : public land mobile network
ISDN : integrated system digital network,
ODN : packet data network
VLR : visitor location register
HLR : home location register
AUC : authentication centre

- The GPRS provides efficient pocket mode of data transfer.
- For voice calls GPRS systems uses GSM architecture. However, for pocket data transmission GPRS includes new set of network nodes called as GPRS support nodes (GSN)
- The main function of GSN is to route and deliver data pockets.
- GSN is divided into 2 parts
  i. SGSN
  ii. GGSN

1. SGSN :
   - SGSN functions similar to GSM-MSC. The functions that GSM-MSC supports for voice are supported by SGSN for pocket data.
   - Functions :
     i. Packet switching
     ii. Data transfer
     iii. Mobility management
     iv. Routing
2. GGSN :
   - A GGSN acts as an interface between the external packet data networks and GPRS **backbone network.**
   - Function :
     i. Convert GPRS to PDP
     ii. Perform authentication
     iii. Perform billing

8. GSM maintains end-to-end security by retaining the confidentiality of calls and **ano** of GSM subscriber justify statement.

Or

Authentication and privacy in GSM.

 In any digital cellular systems, security provision is easy compared to analog systems, methods like encryption, scrambling, FEC, etc can be employed to ensure security in system.

 GSM offers several security services based on information sorted in AUC and SIM.

- Security services :
  - i. Access control and authentication
  - ii. Confidentiality
  - iii. Anonymity

i. Access control and authentication :
- Access to GSM network is allowed only through user authentication process.
- User needs to have valid PIN to access SIM.

ii. Confidentiality :
- Once authentication is done all the user data, voice are encrypted to provide confidentiality.
- It exists only between MS and BTS.

iii. Anonymity :
- User's real identity is never transmitted on air every user is allocated with TMSI which is unique for each call.

These services are achieved by three algorithm in GSM n/w

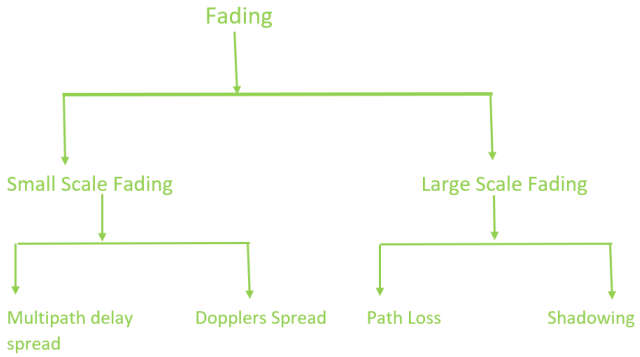
1. A3 algorithm – authentication
2. A5 algorithm – encryption
3. A8 algorithm – generation of cipher key.

9. Explain Various issues in signal propagation ?

1. Issued in signal propagation are also known as concept of fading.
2. It can be defined as fluctuation in the signal strength at receiver.
3. These are 4 types of signal propagation :

- Free space propagation
- Ground wave propagation
- Sky wave propagation
- Space wave propagation

4. Fading occurs due to interference between two waves which are transmitted by same source but travels by different paths and reaches destination differently.
5. Fading is more server in higher frequencies



Fading is divided into 2 types

1. Large scale
2. Small scale

1. Large scale :

It occurs due to signal propagation over long distances

i. Path loss :

Path loss due to distance travelled by them.

ii. Shadowing :

Blockage of signal due to large objects.

2. Small scale :

Rapid fluctuations in small distances.

- Multipath **dekey** spread :
  - i. Flat fading :
    - Signal bandwidth < channel bandwidth
    - Also known as non-selective fading.
  - ii. Frequency selective fading :
    - Signal bandwidth > channel bandwidth
    - Selective fading
- Doppler **speed** :
  - i. Fast fading :

    Rapid fluctuations in small bandwidth.
  - ii. Slow fading :

    Obstacles like building, mountains, hills, etc.

10. What is Goal of mobile IP ? how packet delivery achieved from packet node.

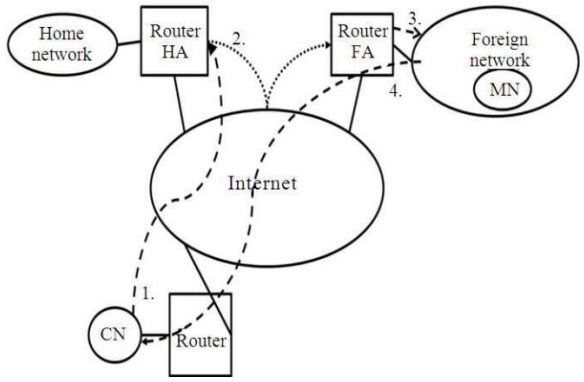
- Internet protocol is common platform for thousands of applications which runs over different network. Hence mobility at IP level in mobile phone system is supported.

- Internet is global network having millions of users. Hence mobile IP is significant technology.

- Goal of mobile IP :

The goal of mobile IP is to support end system mobility maintaing scalability, efficiency and compatibility in all respects with existing applications and internet protocols.

- IP packet delivery :



- Step 1 :
  - CN wants to send an IP packet to MN
  - In this, MN is destination address and CN is source add.
  - The if packet is sent to router belonging to the home network of MN.

- Step 2 :
  - Router receives the packet from CN.
  - The packet is **then** encapsulated and tunneled to COA.
  - COA is new destination address & HA source.

- Step 3 :
  - Router FA receives the packet from HA.
  - It decapsulates it so it so again CN becomes source add and MN is destination address.
  - Now mobility is not visible.

- Step 4 :
  - MN now sends packet with its own fixed IP address as sources and CN as destination.

11. Explain Mobile TCP
    - Goals of mobile TCP are
      i. Improvement in overall throughput
      ii. To lower the delay
      iii. To maintain end-to-end semantics of TCP
      iv. To prove more efficient handover

    - MTCP partitions the TCP connection in two parts :
      i. Unmodified TCP :
      Used on standard host-supervisory host connection.

ii. Optimized TCP :
Used on standard host-mobile host connection.

 Supervisory host monitors all packets send to the mobile host and ACKs returned from MH. If ACK is not received by SH for some time, it assumes that MH is disconnected.

 Advantages :

i. It maintains TCP end to end semantics. SH does not send any ACK itself but forwards ACK from MH.
ii. If MH is disconnected, it avoids useless retransmissions.

 Disadvantages :

i. As SH is not proxy, bit errors are propagated to sender.
ii. When number of nodes move to new SH, the bandwidth need to be
managed.

12. Explain HIPERLAN2

 Features of HIPERLAN2

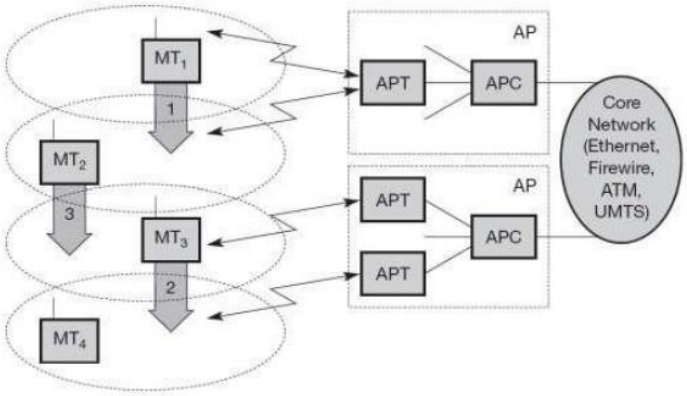
i. Operating frequency
ii. High throughput transmission
iii. Simpler QOS support
iv. Connection oriented services

i. Operating frequency :
Operating frequency is 5 GHZ for wireless networks as defined by ETSI.
ii. High throughput transmission :
If makes use of OFDM in physical layer and TDMA based MAC protocol.
iii. Simpler QOS support :
As this is connection oriented services, support for QOS is simpler.
iv. Enhanced security support :
Authentication and encryption is supported by HIPERLAN2.
v. Connection oriented services :
Logical connection is setup between sender and receiver.

 Handovers used in the system

i. Sector handover
ii. Ratio handover

ii. Networkhandover



MT : mobile terminals

APT : access point transceivers

AP : access point

APC : access point controller

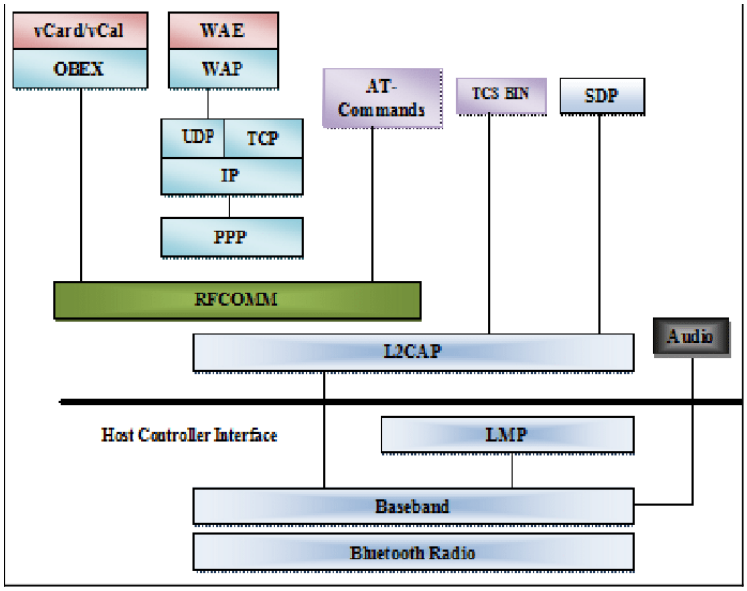
- Modes of working of HIPERLAN2

i. Centralized mode
ii. Direct mode

13. Difference between HIPERLAN1 and HIPERLAN2

	Parameters	HIPERLAN 1	HIPERLAN 2
1	Max data rate	23.5 mbps	54mbps
2	User throughput	< 20 mbps	34 mbps
3	Authentication	None	X.509
4	Connectivity	Connectionless	Connection-oriented
5	Medium access	Variant of CSMA/CA i.e. EYNPMA protocol	CSMA/CA
6	Connection	Provide multi-hop routing	Point-to-multipoint
7	Error control	FEC at physical layer	ARQ/FEC at physical layer.

14. Bluetooth protocol architecture / stack



a. Bluetooth protocol stack is combination of multiple application specific stacks.
b. Different applications :
   i. RFCOMM : radio frequency communication
   ii. TCS binary : telephony control specification
   iii. SDP : service discovery protocol.
c. Each application stack uses physical layer & data link layer.
d. Lowermost layer of stack is bluetooth radio.
e. Bluetooth protocol stack is divided into four parts :
   i. Bluetooth core protocols
   ii. Cable replacement protocols
   iii. Telephony control protocols
   iv. Adopted protocols

- Bluetooth core protocols :
  It consist of
  i. Baseband : Physical layer of Bluetooth protocol and manages physical channel.
  ii. LMP (link manager protocol) : Identify Bluetooth devices whey they come in each others radio range
  iii. L2CAP (logical link control and adaption protocol) : Provides connection less & connection oriented services.
  iv. SDP (service discovery protocol) : enable Bluetooth device to join piconet.

- Cable replacement protocols :
  RFCOMM (radio frequency communication) :
  It is serial communication protocol.
  It is based on ETSI European 07.10 specification.

- Telephony control protocols :
  It consist of

i. TCS-BIN (telephony control specification **bi**) :
It is bit oriented protocol. It is based on ITU-T recommendation.
ii. At command (attention commands)

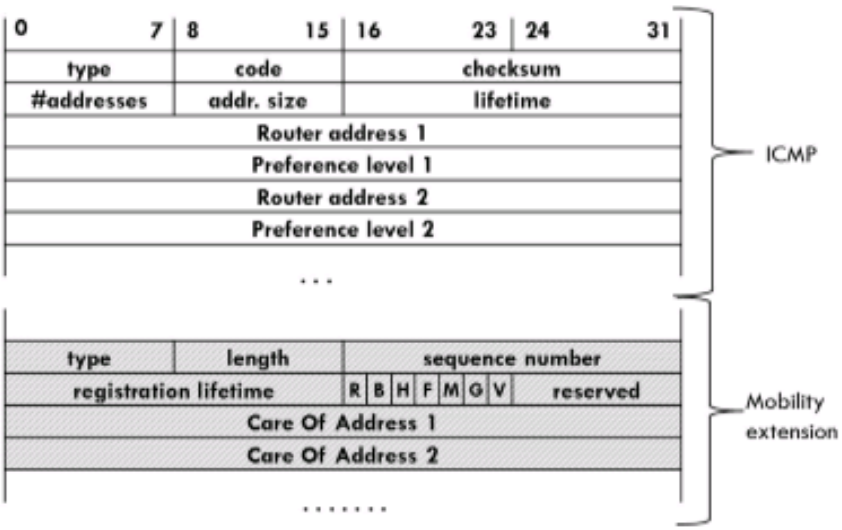
- Adopted protocols :
  i. PPP (point to point protocols) :
     - Bluetooth executes PPP over EFCOMM
     - Means taking packets and placing on LAN
  ii. TCP IP protocol :
     - Used for communication across internet
     - Used for devices like PC, Laptop, Mobile
  iii. OBEX (object exchange protocol) :
     - Used to exchange objects
     - Provides functionality of HTTP
  iv. Content formats :
     - Consist of vcalender & vcard.

15. Explain cellular IP

- Cellular IP is one of the types of MICRO mobility
- Types of micro mobility
  i. Cellular IP
  ii. Hawaii
  iii. Hierarchical mobile IPV6 (HMIPV6)

- Cellular IP is done by installing a single cellular IP gateway (CIPGW).
- Different packets which are destined for MN can be allowed to take multiple paths.
- A MN moving between cells will temporarily be able to receive packets via both old & new base station.
- Cellular IP needs changes in basic mobile IP protocol.
- The foreign network routing table are updated based on messages sent by mobile nodes,
- Advantages :
  i. Manageability
  ii. Simple
  iii. Elegant
- Disadvantages :
  i. Efficiency
  ii. Transparency
  iii. Security

16. Explain Agent advertisement & discovery



1. There two methods router discovery :
   a. Agent discovery
   b. Agent solicitation
2. As fig. there are two parts :
   a. ICMP part
   b. Extension part for mobility

   a. ICMP part :
      i. Type = It is set to 9
      ii. Code = It is set to 0 if agent routes traffic from nonmobile nodes.
      It is set to 16 if agent doesn't route anything.
      iii. #address = number of addresses advertised with packet.
      iv. Lifetime = length of time for which advertisement is valid.
      v. Preference = it is associated with address.

   b. Extension part for mobility :
      i. Type : it is set to 16
      ii. Length : depends on no of COAs provided with message.
      iii. Sequence number : gives info about total no of advertisements
      iv. Registration lifetime : specifies maximum lifetime in seconds node can requiest.