NAME: AMEY MAHENDRA THAKUR EXAM: SEMESTER - VII SEAT NO.: 7278000

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Q1. MCQs

① B. Mapping between logical channels and transport channels, multiplexing of MAC SDUs.

② C. Link Manager Protocol

③ C. BSC

④ A. Location Registration

⑤ A. Mobile Controlled Handover

⑥ A. Access Point Controller, Access point Transceiver

⑦ C. BSs, FSs

⑧ C. ToS field

⑨ A. bits frequency

⑩ B. eNB

Amey

Q2. A]

Multiplexing Techniques

① Space Division Multiplexing
- In this technique, the entire region of transmission is divided into multiple spaces.
- For exchanging data, each use is allotted a communication channel.
- There is some space between each channel that space is called guard channel.
- This multiplexing technique can be used for FM radio stations if a simple FM station transmits in a particular region.
- It is also used in cellular system where the service area is divided into different cells.

Advantage
- Easy to implement.

Disadvantage
- If two or more channels are in the same space then it cannot be used.

Amey

(5) Frequency Division Technique
- In this, the entire frequency range is divided into frequency bands.
- Each channel gets a certain band of the spectrum.
- Different frequency bands are separated by guard spaces.
- This technique is used for radio stations within the same regions where each radio station uses its own frequency.

Advantages
- No complex coordination between sender and receiver.
- Works for analog signals as well

Disadvantages
- Bandwidth is wasted if traffic is distributed unevenly.
- It is inflexible

Amey

(3) TDM (Time Division multiplexing)

- In TDM the entire spectrum is given to a certain time interval.
- Guarded are needed in TDM as well.
- In this, all channels are the same frequency but at different time.

Advantages.

- Only comes in the medium at any time so there is a high throughput if there are many users

Disadvantages

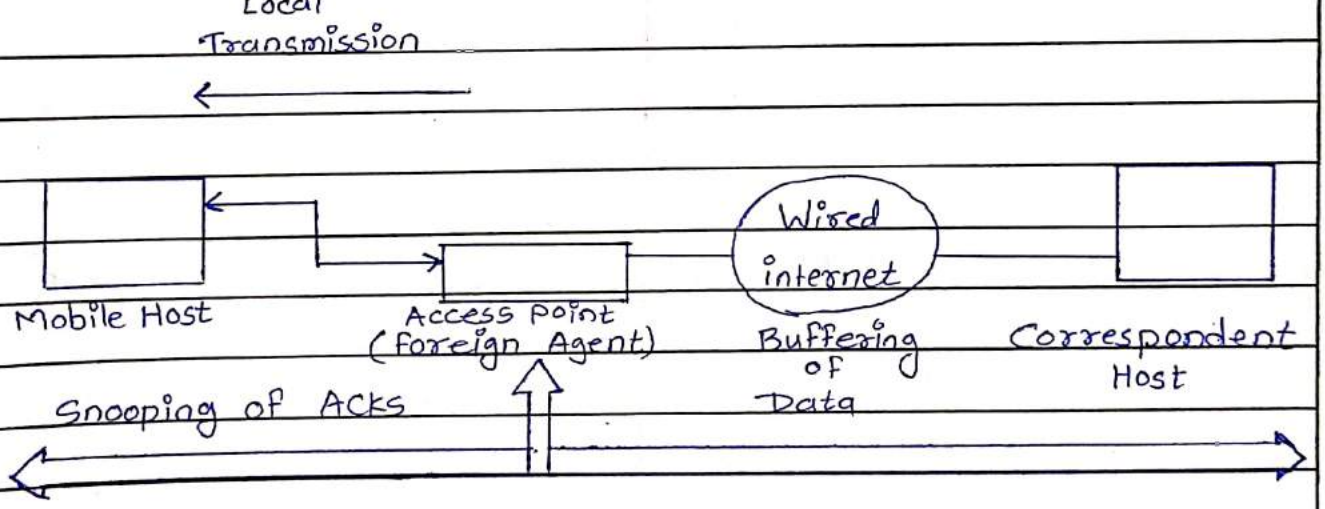
- If transmission overlap, co-channel interference may happen.
- To avoid this, it is required that different senders are precisely synchronized.

Amey.

Q2 c]

Snooping TCP.

- The main drawback of I-TCP is the segmentation of the single TCP connection into two TCP connections, which losses the original end-to-end semantics.
- This drawback is overcome using Snoop-TCP.
- It is based on End-to-End TCP semantic.
- The main function is to buffer data close to the mobile host to perform fast local retransmission in case of packet loss.
- The following figure shows a Snooping-TCP as a Transparent TCP extension.



Snooping - TCP

Amey

- In snoop TCP, foreign agent buffers all packets with destination mobile host.
- It then snoops each packet flowing in both the directions for reading acknowledgments.
- The foreign agent buffers every packet until it receives an acknowledgement 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 have been lost.

Advantages:
- The original TCP semantic ie end-to-end connection is preserved.
- No need for handoff.

Disadvantage
- If any encryption is applied at both ends, the snooping and buffering process would be a waste of time as no data can be read by FA.
- Cannot snoop encrypted datagrams

Amey.

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Q2 D]

Inter - Frame Spacing

- IEEE 802.11 offers three inter-frame spacing (IFS) between transmission of frame.
- After completion of transmission, each station having a packet waits for one of the three IFS periods depending on the type of the packet.

① Short Inter-Frame Spacing (SIFS)

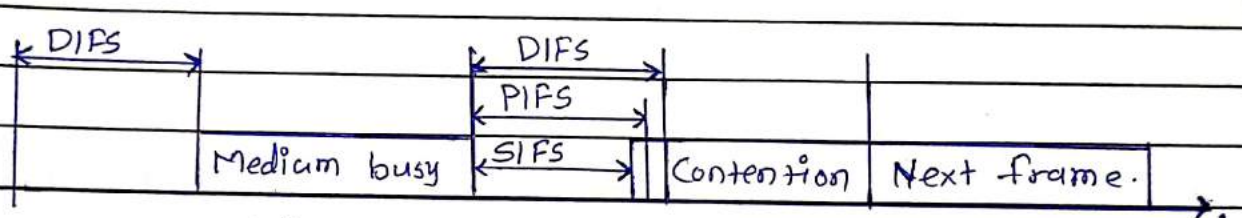
- This is the shortest waiting time for medium access.
- The higher priority packets such as short control messages, acknowledgement of data packets or polling responses have to wait for SIFS before medium access.

② Distributed Coordinating Function IFS (DIFS)

- This denotes the longest waiting time and has the lowest priority for medium access.
- Lower priority packets such as payload packets (packets containing data) have to wait for DIFS before the medium access
- DIFS is a DIFS plus two slot times.

Amey

② Point Coordinating Function IFS (PIFS)
- This is the waiting time between DIFS and SIFS.
- It is used by the access point.
- Before polling other nodes, the access point has to wait for PIFS time for medium access.



Direct access if medium is free ≥ DIFS

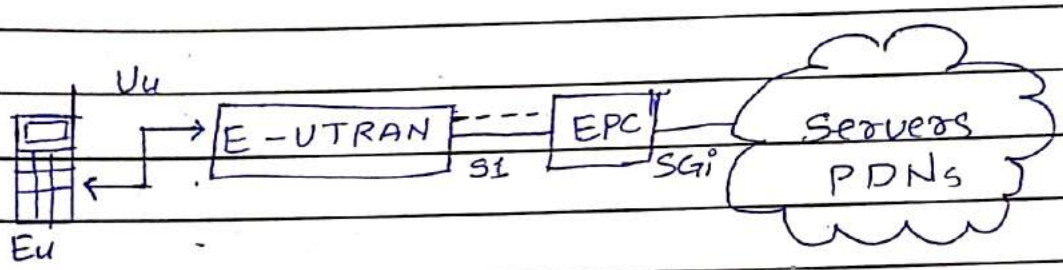
Amey.

Q2. F]

LTE

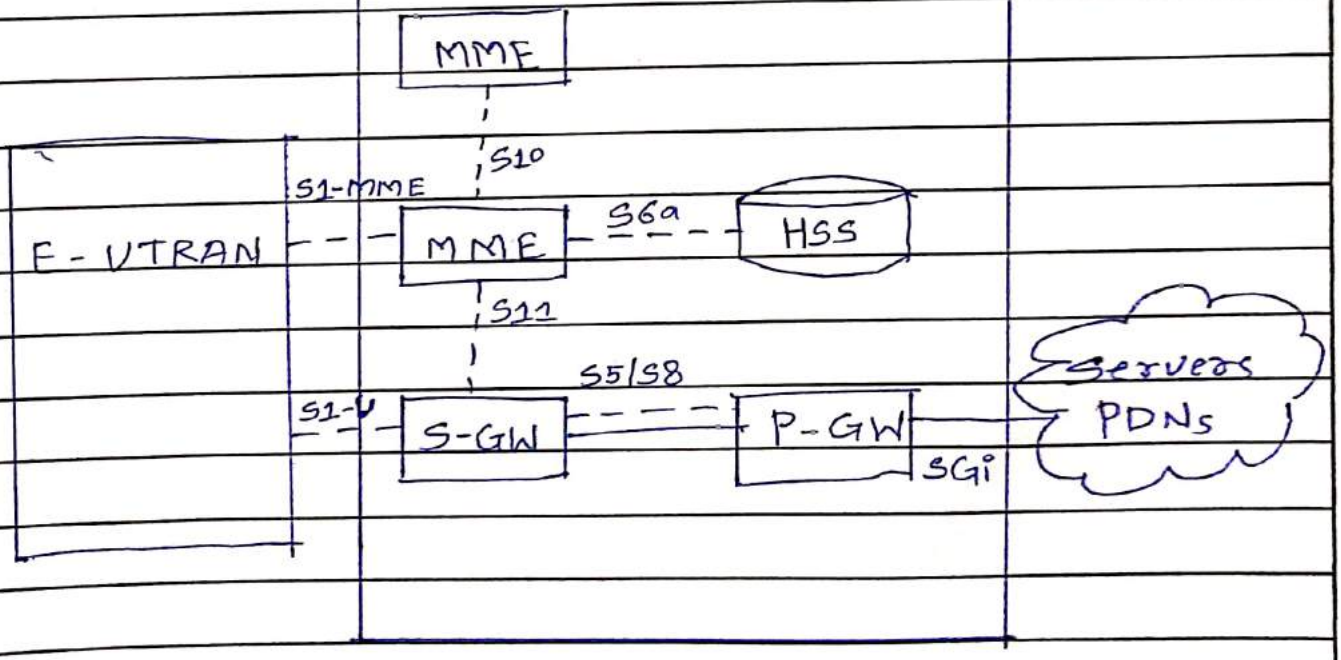
- LTE stands for Long Term Evolution.

High Level Architecture of LTE.



------ Signals
——— Traffic

The Evolved Packet Core (EPC)



Amey

EPC includes following components

(1) Home Subscriber Server (HSS)
- A central database that contains information about all the network operator's subscribers

(2) Packet Data Network (PDN) Gateway (P-GW)
- It communicates with the packet data networks PDN using SGI interface.

(3) Serving Gateway (S-GW)
- Acts as a router and forwards data between the base station and the PDN gateway.

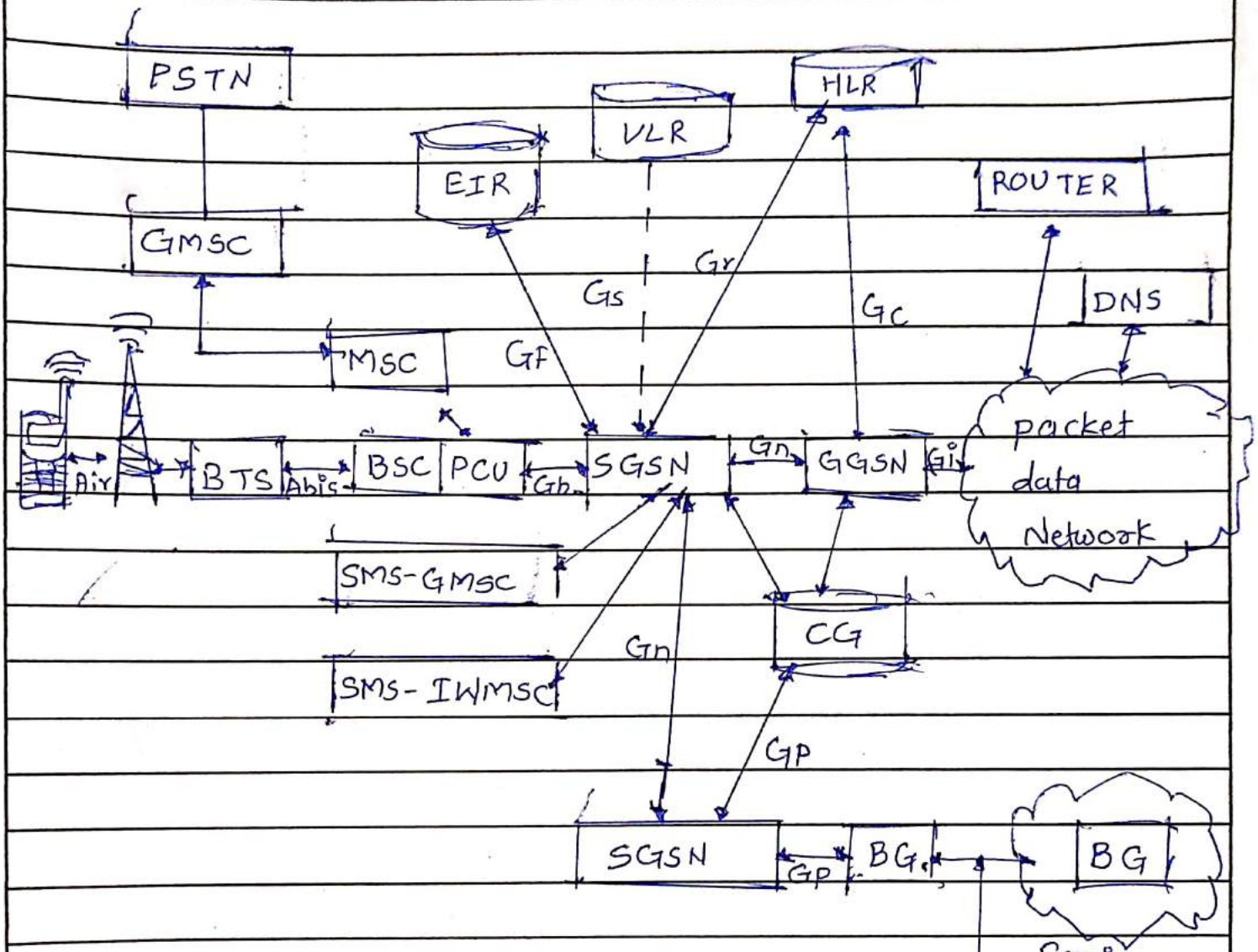
(4) Mobility Management Entity (MME)
- Controls the high level operation of the mobile by means of signaling messages and HSS.

(5) Policy control and charging Rules Function (PCRF)
- It is responsible for policy decision making, as well as controlling the flow based charging functionalities in the Policy Control Enforcement Function (PCEF) which resides in the P-GW.

Amey.

Q3. A]

System Architecture of GPRS



inter PLMN GPRS backbone

GPRS Network Architecture

Amey

SGSN

- SGSN stands for Serving GPRS support Node.
- It is equivalent to MSC of the GSM network.
- It supports the mobile station (MS) via the Gb interface.
- There must be at least one SGSN in a GPRS network
- It has following functions.
  1. Data Compression
  2. Users Authentication
  3. Mobility Management
  4. Protocol Conversion.

GR / HLR

- HLR stands for Home Location Register.
- To accommodate GPRS subscription and routing information, new fields in MS record are introduced in HLR., which are accessed by SGSN and GGSN using the IMSI as the index key.

Amey

GGSN

- GGSN stands for Gateway GPRS Support Node
- It is the gateway to external networks.
- It is considered as the internetworking unit between the GPRS network and external packet data network (PDN).
- This node contains routing information for GPRS users.
- It connects to external networks via Gi interface and transfers packet to the SGSN via Gn interface.

Amey.

Q.3 B] (ii)

FHSS - PHY

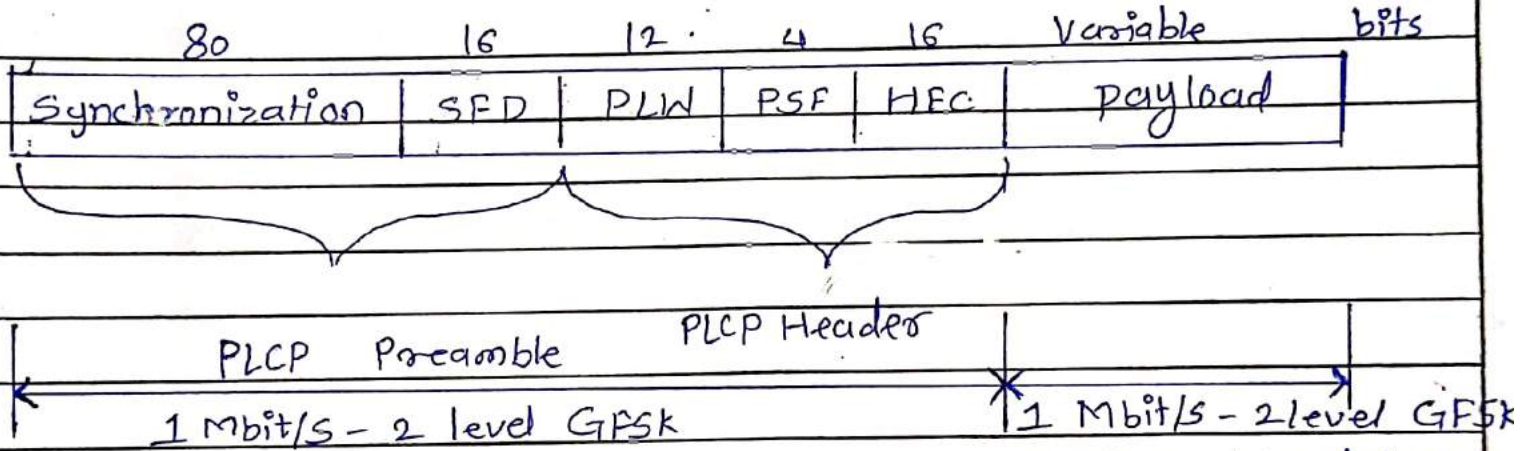
- This type of physical layer uses radio wave for transmission.
- It uses Frequency Hopping Spread Spectrum.
- Compared to DSSS physical layer, FHSS physical layer provides high distortion immunity, high system capacity, low power use and uses low cost RF component.
- It also uses the 2.4 GHz ISM band.
- Provides bandwidth of 1 MHz.
- It uses Gaussian Frequency shift keying (GFSK) for modulation
- 2-level GFSK is used for 1 Mbit/s
  4-level GFSK is used for 2 Mbit/s.
- Operation at 1 Mbit/s is mandatory while at 2 Mbits is optional.
- FHSS is easier to implement.
- Maximum Transmit power is 1 W/MHz in US, 100 mW EIRP in Europe and 10 W/MHz in Japan.

Amey.

Frame structure of FH-SS Physical layer.

- Figure shows the Frame - structure of the physical layer with FHSS PHY
- The frame consists of 3 basic parts.
  1. PLCP preamble
  2. PLCP Header
  3. Payload Part.

- IEEE 802.11 FH-SS PLCP Physical Layer Packet Format.



Amey

The fields of a frame are as follows:

① Synchronization
- This pattern is used for the synchronization of the receivers and signal detection by the CCA. (Clear Channel Assessment)
It is 80 bit field which is 0101010...

② Start Frame Delimiter (SFD):
- This is a 16 bit field indicates the start of frame and provides frame synchronization The pattern of SFD is 0000110010111101.

③ Packet Length Word. (PLW):
- The 12 bit packet length width shows the length of payload Length of packet could be up to 4K bytes.

④ PLCP Signaling field (PSF)
- 4-bit PSF field specifies the data rate of the payload following
If all bits are set to zero (0000) it means the lowest data rate (1 Mbit/s).
Maximum data rate 8.5 Mbits is represented by 1111.

⑤ Header Error Check (HEC)
- 16 bit HEC is added to protect PLCP header. It can recover error up to 2 bits. Otherwise identify whether PLCP bits are corrupted.

Amey.

Q 3. C]

Self Organizing Networks.

- The LTE SON stands for Self Organizing Networks.
- This concept of SION is introduced in LTE and LTE - advanced based networks to provide simple and fast installation and maintainance of the cellular network.
- The LTE SION features can be applied to all available types of network architectures
- LTE SON is further divided into.
  (1) Self Configuration
  (2) self Optimization
  (3) Self Healing

SION Architecture

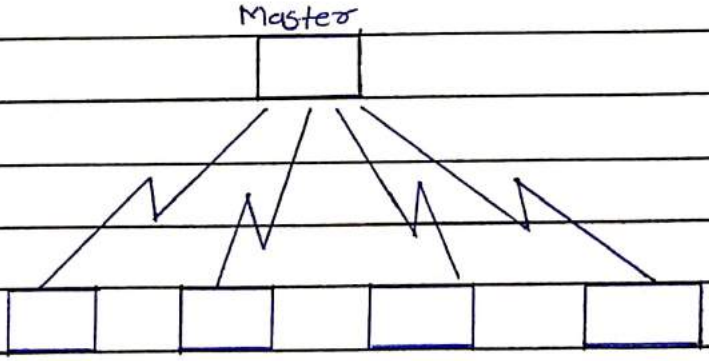
- The self organization functionality can be located at one place even split in different nodes
- Self organization algorithms can be located in OAM or eNB or both.
- SION is divided into
  (1) Centralized SION
  (2) Distributed SION
  (3) Hybrid SION

Q4. A] (:)

Bluetooth Architecture defines two types of networks

① Piconet

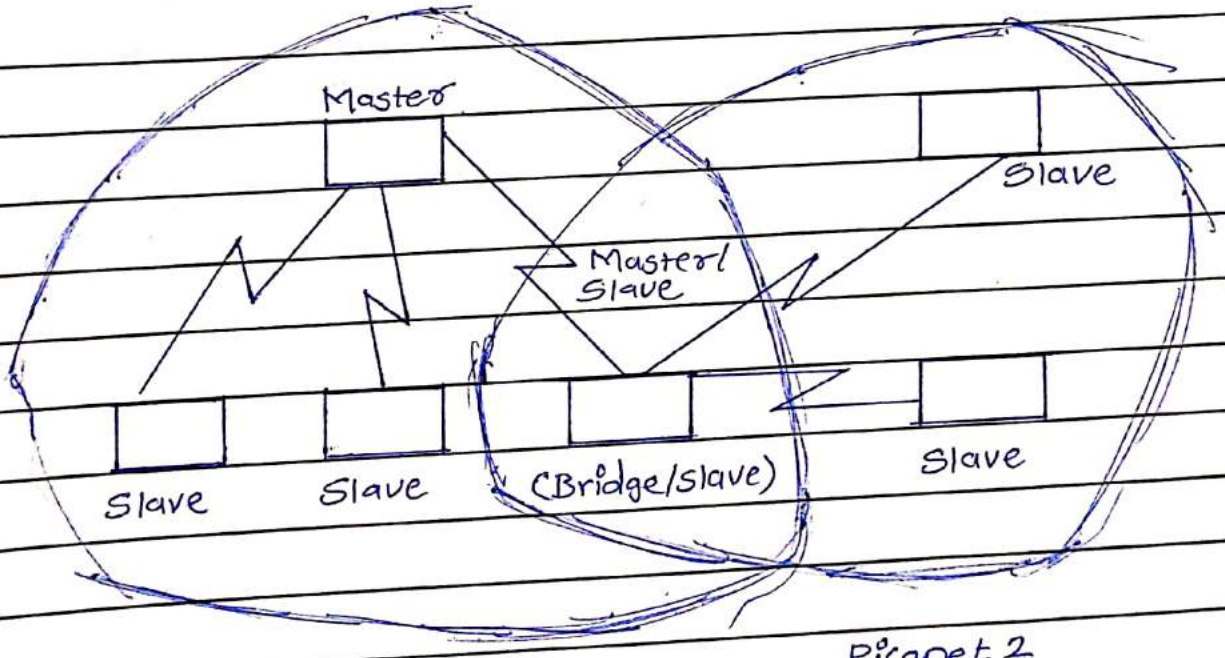
- Piconet is a bluetooth network that consists of 1 master node and 7 active slave nodes.
- Thus, piconet can have upto 8 active nodes. (1 master and 7 slaves) or stations within the distance of 10 meters
- There can be only one master station in each piconet.
- The communication between the master and slave can be one-to-one or one-to-many
- All communications is between master and a slave. Slave-slave communication is not possible.
- In addition to 7 active slave stations, a piconet can have upto 255 parked nodes.
- These parked nodes are slave stations and cannot take part in communication until it is moved from parked state to active state.



Amey

(2) Scatternet

- Scatternet is formed by combining various piconets.
- A slave in one piconet can act as a master in other piconet
- A station or node can receive messages from the master in the first piconet and delivers the message to its slaves in other piconet where it is acting as master.
- This node is also called bridge slave.
- Thus, a station can be a member of two piconets.
- A station cannot be a master in two piconets.

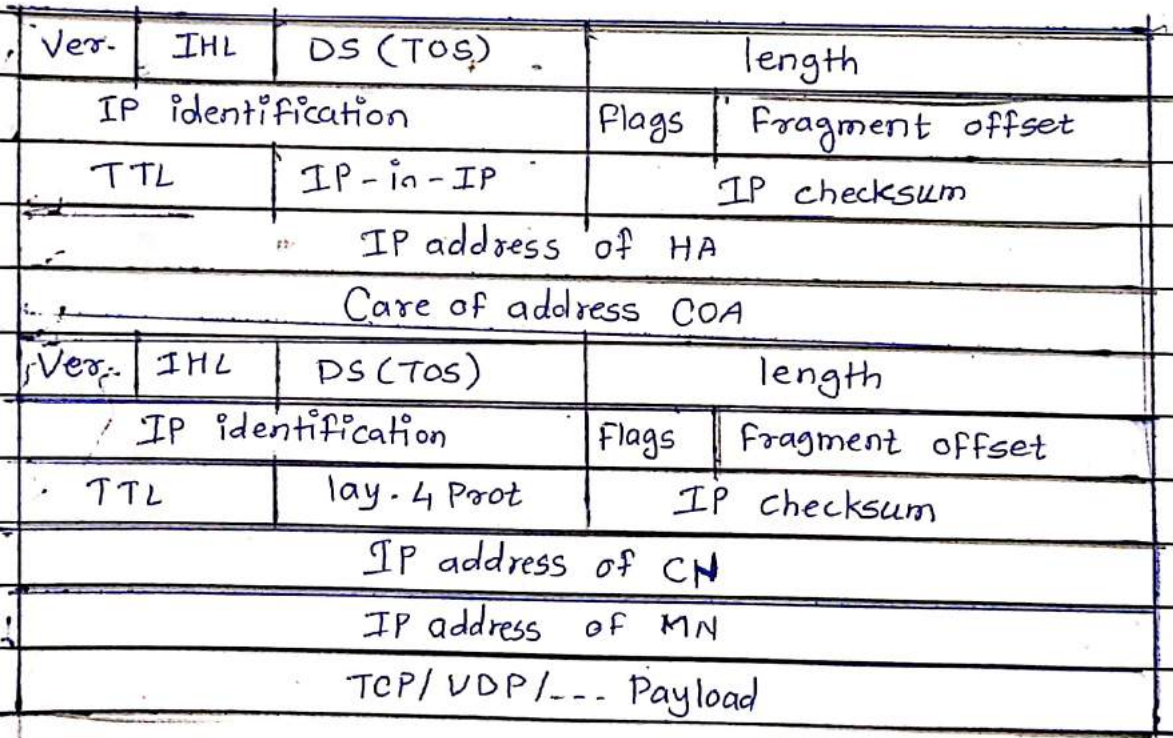


Amey.

Q4 A] (11)

· IP - in - IP Encapsulation

- IP - in - IP encapsulation is defined in RFC 2003. It is the simplest approach and router always be ~~selected~~ supported.
- In this type of encapsulation, the entire IP datagram sent by the internet host is inserted in a new - IP datagram as the payload.
- As shown in figure following, the HA encapsulates the received IP datagram within another IP datagram.



IP - in - IP Encapsulation

Amey

The various fields in the outer header are:

① Ver (version)
- Version field denotes the version number and set to 4 for IPv4.

② IHL (Internet Header Length)
- IHL indicates the length of the outer header.

③ DS (TOS):
- It is just copied from the inner header.

④ Length:
- It denotes the complete length of the encapsulated packet.

⑤ TTL (Time To Live):
- It indicates the period of validity of the packet. TTL should be high enough so the packet can reach the tunnel endpoint.

⑥ IP-in-IP
- This denotes the type of protocol used in the IP Payload

⑦ IP - Checksum:
- This is used for error detection mechanism

Amey

The fields of inner header are almost same as the outer header. The only differences are:
- The address fields consists of the address of the original sender and receivers.
- The TTL value of the inner header is decremented by 1. This means that the whole tunnel considered a single hop from the original packets point of views.
- The TCP / UDP payload contains the actual user data to be transmitted.

Advantage
- It is simple to implement
- It is default encapsulation mechanism

Disadvantage
- Most of the outer header fields are same as inner header so this method increases redundancy

Amey

Q4. A] (iii)

VoLTE (Voice Over LTE)

- VoLTE refers to voice calls that are made over a 4G LTE network instead of more traditional calls. which are made by using 'CSFB (Circuit-Switched Fall Back), a system that switches back to 2G or 3G technologies just before connecting a call.

Amey

Q4. B (i)

FHSS	DSSS
(1) Multiple frequencies are used.	(1) Single frequency is used.
(2) Hard to find the user's frequency at any instant of time.	(2) User frequency, once allotted is always the same.
(3) Frequency reuse is allowed	(3) Frequency reuse is not allowed.
(4) Sender need not wait	(4) Sender has to wait if the spectrum is busy
(5) Power strength of the signal is high	(5) Power strength of the signal is low.
(6) Stronger and penetrates through the obstacles	(6) It is weaker compared to FHSS.
(7) It is never affected by interference.	(7) It can be affected by interference
(8) It is cheaper	(8) It is expensive
(9) This is the commonly used technique	(9) The technique is not frequently used

Amey