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Q1 (a):

Ans: Five ways of increasing the capacity of a cellular system:

1 → Adding new channels.

2 → Frequency borrowing:

taken from adjacent cells by congested cells. frequencies are

3 → Cell splitting:

Cells in high areas of high usage can be split into smaller cells.

4 → Cell sectoring: Cells are divided into a number of wedge-shape sectors, each with their own set of channels.

5 → Microcells:

= = antennas move to buildings, hills & lamp posts.

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Q1: b)

Ans: Diff between 3G, 4G & 5G:

3G:

This is the 3rd generation of wireless technology, it is called UMTS (universal mobile terrestrial system). It give us the data rate of 384 kbps. It has the feature of video calling.

4G:

4G is the 4th & current generation of wireless technology. It is 500 times faster than 3G. It has been able to support HD mobile TV, video conferencing & much more. Its data rate for stationary users are 1 gbps & for high mobility users is 100 mbps.

5G:

The 5th generation of wireless tech with the data rate of 5 Gbps.

The main difference between 5G & 4G is 5G will have the data rate in Gbps as compared to 4G in mbps & other difference is 5G will have wider bandwidth.

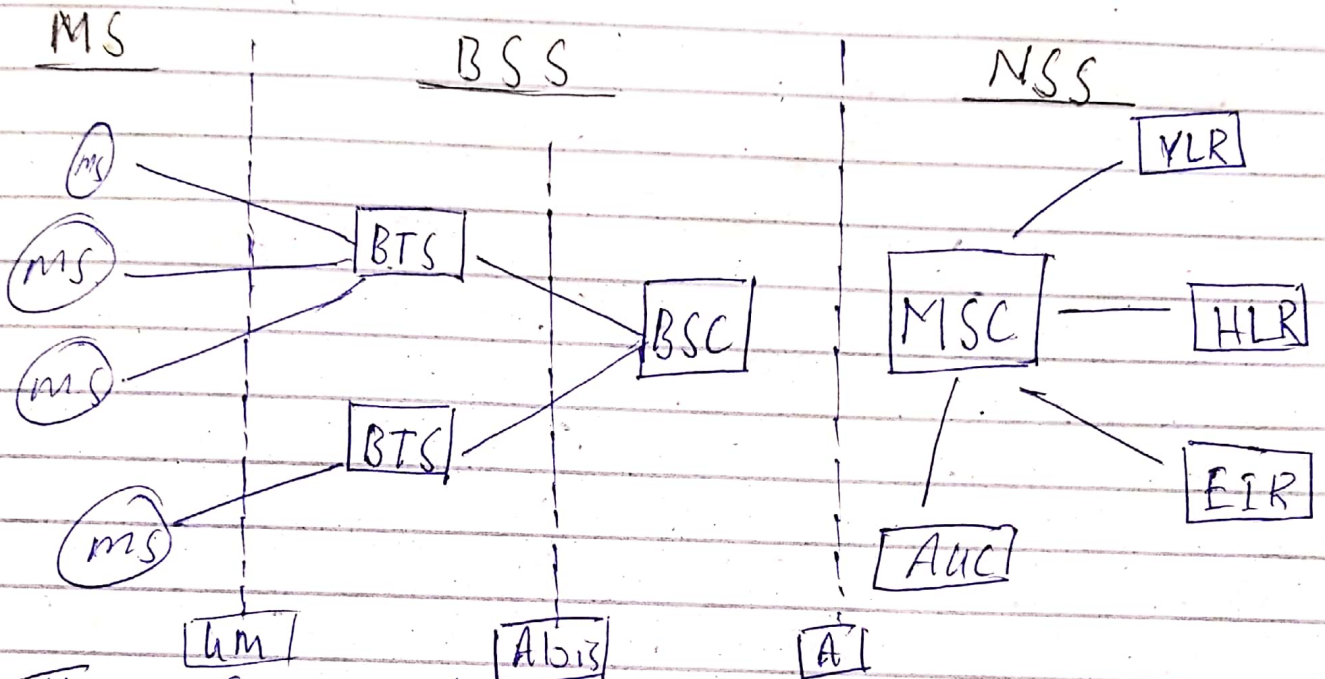
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Q4 (c):

Ans: GSM Architecture:

Diagram:



The GSM network is made up of three subsystems:

→ "The Mobile Station (MS)": The user equipments, the devices we use.

→ "The Base Station Sub-system (BSS)": comprising a BSC & several BTSs.

→ "The Network & Switching Sub-system (NSS)": comprising an MSC & associated registers.

The Interfaces

- "A" interface b/w NSS & BSS
- "Abis" interface b/w BSC & BTS (within BSS)
- "UM" interface b/w BSS & the MS.

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Q1 (d):

Ans.

Minutes of traffic in the hour = number of caller  $\times$  duration.

Minutes of traffic in the hour =  $1 \times 35$

" " " " " = 35

Hours of traff in the hour =  $35 / 60$

" " " " " = 0.5

So traffic figure = 0.5 Erlangs.

Ans.

Q1 (c)

Answer: Issues & Challenges for cellular Networks:

Issues:

→ Security:

Security is a big concern in cellular networks.

→ Wireless LAN Security:

The most serious challenges in securing wireless networks is protecting your data from the access of unauthorized users.

Challenges:

→ Enhancing data rate.

→ Low power design.

→ Improving performance.

Q2 (f)

Ans: Capabilities of Mobile IP:→ Discovery:

Mobile node uses discovery procedure to identify prospective home & foreign agents.

→ Registration:

Mobile node uses an authenticated registration procedure to inform home agent of its care-of address.

→ Tunneling:

Used to forward IP datagrams from a home address to a care-of address.

Q2: (h):

Ans: Tunneling:

In computer networks, a tunneling protocol is a communications protocol that allows for the movement of data from one network to another.

It involves allowing private networks communications to be sent across a public network through a process called encapsulation.

Q2 (i)

Ans WAP protocol stack:WAE protocol:

WAE specifies an application framework for wireless devices. It defines the following functions.

- ↳ WML:
- ↳ WML Script
- ↳ Wireless telephony application (WTA, WTAI)
- ↳ Content format.

WSP protocol:

The wireless session protocol (WSP) implements an interface for connection-oriented & connectionless session layer services.

The connection-oriented session service operate using the protocol of the transaction layer. However the connectionless uses a secure or non-secure datagram service.

WTP:

The wireless transaction protocol (WTP) is a transaction-oriented protocol, executed using a datagram service.

WTLS:

= The ~~WIRELESS~~ Wireless Transaction Layer Security (WTLS) layer implements a security protocol based on the TLS industry standards.

WTLS is intended for use with the WAP transport protocols. & has \$

WDP:

= Wireless Datagram protocol (WDP) layer operates on various bears that depends on the used network type.

WCMP:

= The wireless control message protocol defines the error reporting mechanism for WDP datagrams as well as the protocol elements that can be used for diagnosis & informational purposes.



Farhan

Q3 (a)

Ans. The IEEE 802 protocol layers:

The services & protocols specified in IEEE 802 map to the lower two layers of the seven layer OSI networking reference model.

In fact IEEE 802 splits the OSI Data Link layer into two sub-layers named logical link control (LLC) & media access control (MAC), so the layers can be listed like this:

→ Data link layer:

↳ LLC sublayer

↳ MAC sublayer.

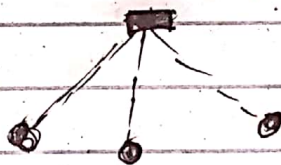
→ Physical layer.

Qn 4 (b)  
Answer

→ Piconets:

It is the type of connection that is formed between two or more Bluetooth-enabled devices such as modems, cell phones or PDAs.

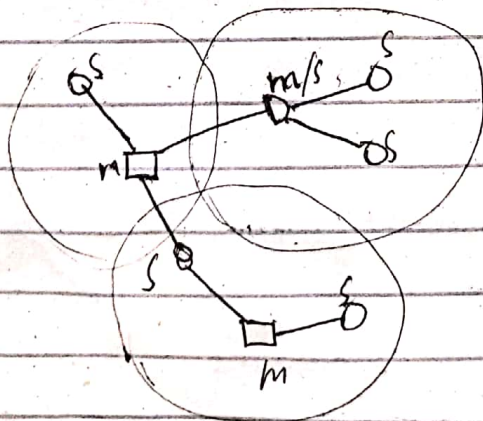
→ Scatternet: is a number of interconnected piconets that supports communication between more than 8 devices.



□ master  
○ slave

Single slave  
Piconet

Multi-slave  
Piconet



Scatternet.

Piconet: In this, device can function either as master or slave  
→ It serves smaller coverage area  
→ It supports maximum 8 nodes

Scatternet: It serves larger coverage area.  
→ It support more than 8 nodes.

Q2 (g):

Areas:

They are:

- ① Home address
- ② Care-of address.

→ Home address:

In mobile IP a home address is the relatively permanent IP address given to a mobile node.

→ Care of address:

Care-of means through someone or by way of someone. This phrase indicates that something is to be delivered to an address where they don't normally receive correspondence.

Q 4 (a)

Ans: Bluetooth Low Energy

Bluetooth low energy is now available in our gateway. It is the perfect wireless protocol for IoT devices that run on battery & that need to last for long.

Low Energy Protocol:

BLE is a personal area network developed to meet the increasing demand in the market for internet of things products. BLE is a suitable protocol to use with devices that run on batteries & that need last for a long time.

With the increasing demand for IoT devices to carry on us & to install in homes, the question of security becomes extremely important.

BLE is a secure protocol that can protect the user's data & identity.

Q4 (c):

Ans:

### L2CAP:

The "Logical Link Control & Adaptation Layer Protocol" (L2CAP) is layered over the baseband Protocol & resides in the data link layer.

L2CAP provides connection-oriented & connectionless data services to upper-layer protocols with protocol multiplexing capability, segmentation & reassembly operation, and group abstractions.

L2CAP permits higher level protocols & applications to transmit & receive L2CAP data packets upto 64 Kilobytes in length.

Q 3 (b):

Ans:

IEEE 802.11n:

Published in 2009, the aim of the IEEE 802.11n is to increase the MAC layer throughput from the previous standards.

It build upon previous 802.11 standards by adding multiple input multiple-output.

IEEE 802.11o:

Similar to the IEEE 802.11n, no task group was named as IEEE 802.11o to avoid confusion.

IEEE 802.11p:

To provide for wireless access in ~~the~~ vehicular environments (WAVE), IEEE 802.11p is an approved amendment to the IEEE 802.11 standard. It defines enhancements to main 802.11 required to support intelligent Transportation Systems (ITS) applications.

IEEE 802.11r:

Published in the year 2008, IEEE 802.11r or Fast BSS Transition (FT) enabled wireless connectivity with secure & fast handoffs between STAs. This standard provided fast roaming, even for vehicles in motion.

It reduced the roaming delay between two basic service sets (BSS) to less than 50 ms.

IEEE 802.11s:

IEEE 13 is an IEEE 802.11 Standard for mesh networking. It defines how wireless devices can be interconnected to create a WLAN mesh network, which may be used for static topologies as well as for adhoc networks.

IEEE 802.11t:

The IEEE 802.11t standard regroups recommend<sup>ed</sup> practices to test and measure performance in wireless networks. It was also known as WAPP. However as on date, the standard has been cancelled from the IEEE 802 project.

IEEE 802.11u:

Published in the year 2011 the IEEE 802.11u was developed to improve inter networking with external non-802.11 networks.

This was achieved through network discovery & selection & QoS map distribution.

IEEE 802.11v:

The IEEE 802.11v was introduced in 2011, to enable configuring clients while they are connected to the network.