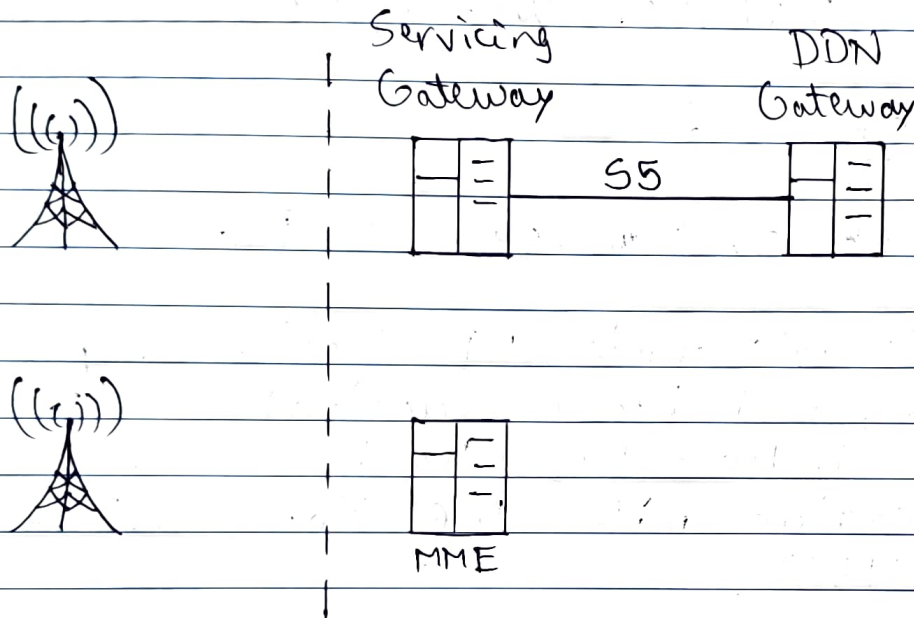


## ASSIGNMENT NO. 2

Q.1 Draw and explain SAE Architecture.

### System Architecture Evolution



System Architecture Evolution (SAE) is a new network architecture designed to simplify LTE networks and establish a flat architecture similar to the other IP-based communications networks. SAE uses an eNB and Access Gateway (aGW) and removes the RNC and SGSN from the equivalent 3G network architecture to create a simpler mobile network.

This allows the network to be built with an "All-IP" based n/w architecture. SAE also includes entities to allow full inter-working with other related wireless (WCDMA, WiMAX, WLAN, etc).

### Key components:

- MME (Mobility Management Entity)

It controls idle mode UE tracking, paging procedures, and bearer activation. It also manages intra-LTE handovers and user authentication with the Home Subscriber Server (HSS).

- SGW (Serving Gateway)

Routes and forwards user data packets, facilitates inter-eNB handovers, and supports mobility b/w LTE and other N/w's. It also terminates DL data from idle state UEs, triggering UE paging.

- PGW (PDN Gateway)

It connects UEs to external n/w's, serving as entry point for data traffic, thereby enabling UEs to access multiple PDNs.



Q.2 Describe evolution from UMTS to LTE.

LTE evolved from an earlier 3GPP system known as the Universal Mobile Telecomm. System (UMTS), which in turn evolved from the Global System for the Mobile Communications.

There was no global standard for wireless broadband until the advent of LTE. The goal with LTE was to merge a fragmented market and offer a more efficient n/w for n/w operators.

The evolution from UMTS to LTE was driven by various factors. There was a need to ensure the ongoing competitiveness of 3G systems, responding to the user demands for the higher data rates and also improved quality of service. LTE addressed these demands by offering upto 100 Mbps of downstream and 30 Mbps upstream, surpassing the capabilities of 3G. Also, there was a continuous demand for cost reduction (CAPEX and OPEX), and low complexity. Also, LTE provides reduced latency, scalable bandwidth capacity and back-ward compatibility with GSM and UMTS.

LTE successfully avoided the unnecessary fragmentation in technologies for the both paired and unpaired band operations.

Q.3 Compare Mobile Generations (1G, 2G, 3G, 4G, 5G)

	1G	2G	3G	4G	5G
Require - ments	No official reg. Analog technology	No. official reg. Digital technology	ITU's IMT 2000 reg. 144 kbps mobile, 384 kbps pedestrian, 2 Mbps indoor.	ITU's IMT Advanced reg. operates up to 40 Mhz radio channels.	Atleast 1 GB/s or more data rates - to support high definition videos.
Data bandwidth	1.9 kbps	14.4 to 384 Kbps	2 Mbps	2 Mbps to 1 Gbps	1 Gbps and higher
core N/w	PSTN	PSTN packet network	Packet network	All IP network	Flatter IP N/w and 5G NW-I (interface)
Frequency	800-900 MHz	850-1900 MHz	1.6-2.56 GHz	2-8 GHz	3-90 GHz



Q.4 what are self organizing networks?

Self Organizing Networks (SONs) are radio access networks (RANs) that automatically plan, configure, manage, optimize, and heal themselves. SONs can offer automated functions such as the self-configurations, self-optimization, self-healing, and self-protection.

SONs strive to make complicated n/w administration a thing of the past by enabling the creation of a plug-and-play environment for both simple and complex network tasks. This is in stark contrast to the traditional implementation of cellular wireless networks we see in enterprises today, most of which require teams of technicians for maintenance, management, and optimization.

SON can offer a variety of the different functions, including self-configuration, etc. These networks utilize real-time information, such as traffic load, interference and user mobility, to dynamically adjust settings like power levels, handovers, and frequency allocations.

It enhances N/w performance, reduces operational costs, and improves user experience by continuously adapting to changing conditions.

Q.5 Explain VoLTE in detail.

VoLTE stands for Voice over Long-Term Evolution or Voice over LTE.

VoLTE offers the possibility to voice call via the LTE / 4G<sup>+</sup> mobile network.

Benefits of VoLTE are as follows:

- Fast call set-up
- High voice quality and reduced background noise.
- The phone remains in the 4G / LTE network during voice calls.
- You can use 4G / LTE data services, such as web surfing and tethering, while simultaneously making and receiving calls.
- When calling over LTE, you don't use extra data but call minutes.  
You pay only for the voice call service, not the data you use.