SINDH MADRESSATUL ISLAM UNIVERSITY
Aiwan-e-Tijarat Rd, Seari Quarters, Karachi, Karachi City,
Sindh 74000, Pakistan.

4G & 5G Network Architecture

A mobile network architecture refers to the various components and systems that make up a mobile phone network and enable it to provide wireless communication services to mobile devices. A mobile network architecture provides the infrastructure and systems needed to support wireless communication and enable mobile devices to connect to each other and to the wider internet.

4G & 5G is the form and function of the three component architectures of the MNA, and how these components provide service to the users of an integrated mobile data network.

1. ***The Communications Architecture*** which is based upon the CCITT Open Systems Interconnection reference model, supports a layering of communications services and protocols for mobile data transport.

2. ***The Operations, Administration and Maintenance Architecture*** which is derived from the ISO OSI Management Framework, facilitates centralized management and control of a mobile network.

3. ***The Applications Architecture*** which uses a transaction-based model derived from experience with existing mobile applications, supports user applications in the harsh mobile environment.

4G Architecture

4G, also known as Long Term Evolution (LTE), is a standard for wireless communication that was developed to provide higher speeds and capacity than previous generations of mobile technology. 4G networks are capable of providing data speeds of up to 100 Mbps, which is fast enough for most applications, including streaming video, online gaming, and web browsing.

Features & Architecture:

Fully IP based Mobile System. It supports interactive multimedia, voice, streaming video, internet and other broadband service. It has better spectrum efficiency. It supports Ad-hoc and multi hop network.

Figure shows Generic Mobile Communication architecture. 4G network is an integration of all heterogeneous wireless access networks such as Ad-hoc, cellular, hotspot and satellite radio component. Technologies used in 4 G are smart antennas for multiple input and multiple output (MIMO), IPv6, VoIP, OFDM and Software defined radio (SDR) System.

IPV6 Technology:

4G uses IPV6 Technology in order to support a large number of wirelesses enable devices. It enables a number of applications with better multicast, security and route optimization capabilities.

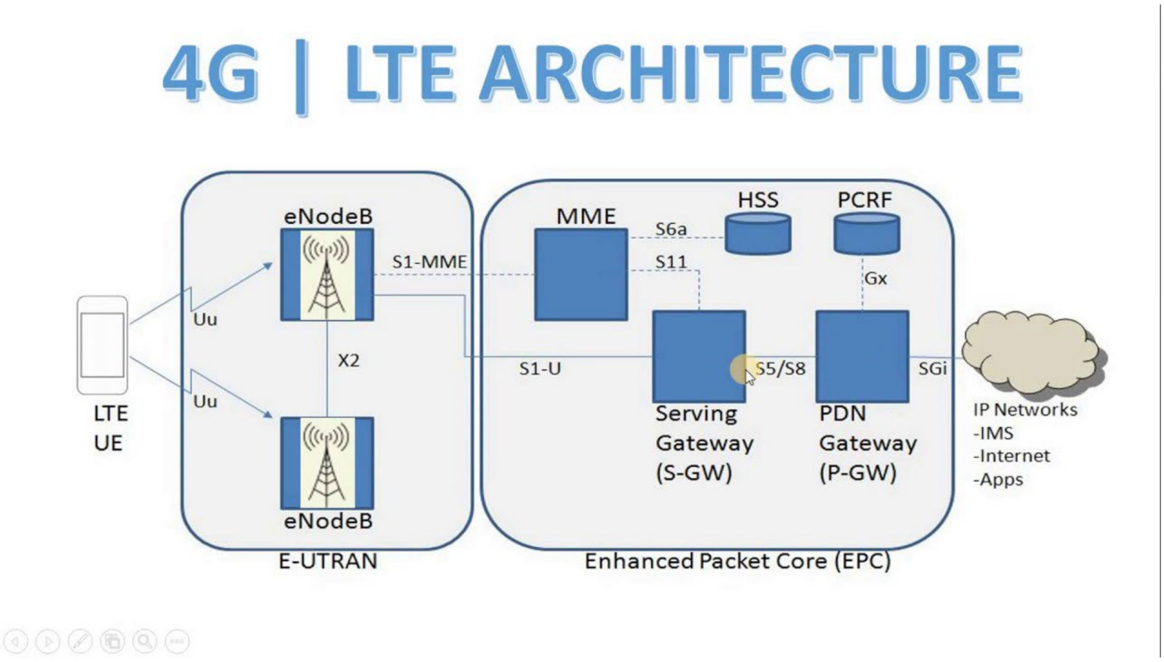
OFDM:

OFDM stands for Orthogonal Frequency Division Multiplexing. It is currently used as WiMAX and Wi-Fi.

Pros & Cons:

1. It provides better spectral efficiency.
2. It has high speed, high capacity and low cost per bit.
3. Battery usage is more.
4. Hard to implement.

4G Architecture Diagram:



5G Architecture

5G is the next generation of mobile network technology, and it is expected to offer significantly faster speeds and lower latency than 4G. 5G networks are expected to have data speeds of up to 10 Gbps and latency as low as 1 millisecond, making them suitable for a wide range of new applications and services, including virtual and augmented reality, telemedicine, and self-driving cars. In addition to faster speeds and lower latency, 5G networks are also designed to be more efficient and able to support a larger number of devices than previous generations of mobile technology. This makes 5G particularly well-suited for use in the Internet of Things (IoT), where it can support the communication needs of a wide range of connected devices and sensors.

MEC:

Multi-Access Edge Computing (MEC) is an important element of 5G architecture. MEC is an offshoot of cloud computing that brings applications from centralized data centers to the network edge, closer to end users and their devices. This essentially creates a shortcut in content delivery between the user and host, bypassing the long-distance network path that once separated them. This technology is not exclusive to 5G but is certainly integral to its efficiency.

1. Characteristics of MEC include the low latency, high bandwidth, and real time access to RAN information that distinguish 5G architecture from its predecessors.
2. Distribution of computing power enables the high volume of connected devices inherent to 5G deployment and the Internet of Things (IoT), in addition to the latency and bandwidth benefits.

NFV & 5G:

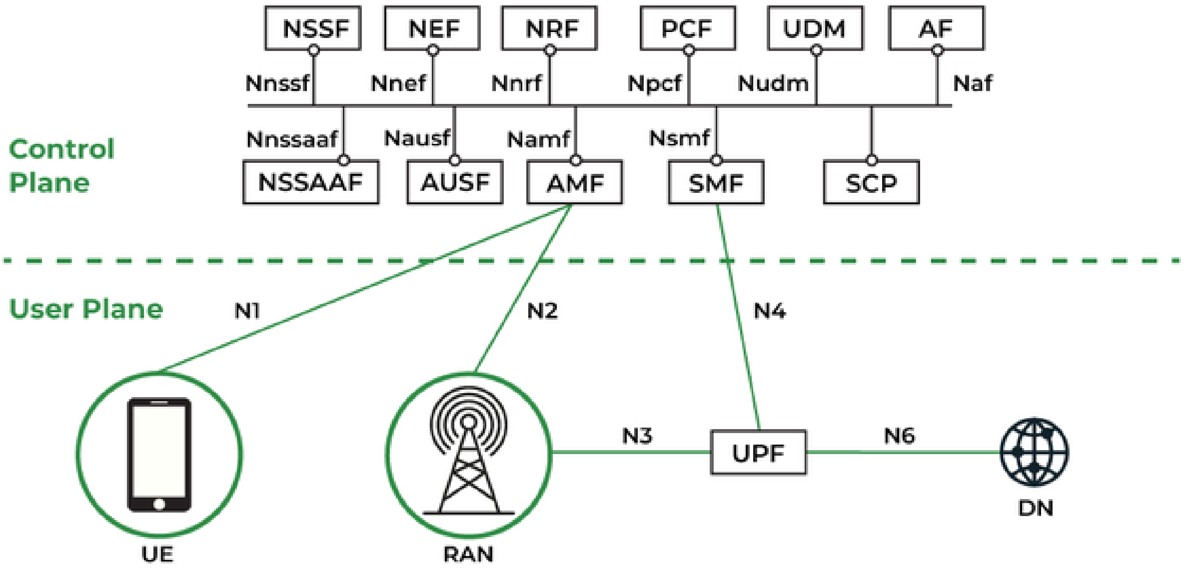
Network function virtualization (NFV) decouples software from hardware by replacing various network functions such as firewalls, load balancers, and routers with virtualized instances running as software. This eliminates the need to invest in many expensive hardware elements and can also accelerate installation times, thereby providing revenue generating services to the customer faster. NFV enables the 5G ecosystem by virtualizing appliances within the 5G network. This includes the network slicing technology that enables multiple virtual networks to run simultaneously. NFV addresses other 5G challenges through virtualized computing, storage, and network resources that are customized based on the applications and customer segments.

5G Architecture:

The 5G core network architecture is at the heart of the new 5G specification and enables the increased throughput demand that 5G must support. The new 5G core, as defined by 3GPP, utilizes cloud-aligned, service-based architecture (SBA) that spans across all 5G functions and interactions including authentication, security, session management and aggregation of traffic from end devices. The 5G core emphasizes NFV with virtualized software functions deployed using the MEC infrastructure that is central to 5G architectural principles.

SINDH MADRESSATUL ISLAM UNIVERSITY
Aiwan-e-Tijarat Rd, Seari Quarters, Karachi, Karachi City, Sindh 74000, Pakistan.

5G Architecture Diagram:



References:

- https://www.researchgate.net/publication/301789296_A_Comparative_Study_on_4G_and_5G_Technology_for_Wireless_Applications
- https://medium.com/@sarpkoksal/core-network-evolution-3g-vs-4g-vs-5g-7738267503c7
- https://www.techtarget.com/searchnetworking/feature/A-deep-dive-into-the-differences-between-4G-and-5G-networks