

Analysis of 4G and 5G Communication System

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ABSTRACT--5G wireless technology is the modification and upgrade version of 4G technology. Currently 4G is lacking qualities in many areas which needed to be fixed . The comparative analysis between 4G and 5G is mainly in areas like speed, frequency, band switching design basis and forward error correction is studied. 5G mainly solves the problem of poor coverage, bad interconnectivity, poor quality of service. 5G technology will be proficient of providing an omnipresent Gpbs experience to customers who subscribe from anywhere in the country and provides data transmission speed up to tens of Gpbs per base station. The importance of the comparative study is estimated for a speed and effective connection and communication of devices like wireless devices and other hardware. The importance of the comparative study is estimated for a speed and effective connection and communication of devices like wireless devices and other hardware.

KEYWORDS-- ITU.WiMAX, OFDMA, RAT, TDMA, PDC, LTE.

INTRODUCTION

Mobile network technology is moving very fast .The current 4G technology is modified to next level 5G technology. A cellular network or mobile network is a communication network. The first commercial cellular network, The 1G generation. This 1G was followed by the first commercial digital cellular network, the 2G generation. 2G introduced data services for mobile, starting with SMS plain text-based messages.3G technology provides an information transfer rate of at least 144 kbit/s. Each generation is characterized by new frequency bands, higher data rates and non-backward-compatible transmission

technology. 4G provides, in addition to the usual voice and other services of 3G, devices. LTE(Long Term Evolution) is commonly marketed as 4G LTE. 5G is a generation currently under development. It denotes the next major phase of mobile telecommunications standards beyond the current 4G/IMT Advanced standards mobile broadband Internet access, for example to laptops with wireless modems, to smart-phones and to other mobile

EVOLUTION OF MOBILE CELLULAR NETWORKS

First Generation (1G) mobile networks were reliant upon analog radio systems which meant that users could only make phone calls, they couldn't send or receive text messages. The 1G network was first introduced in Japan in 1979 before it was rolled out in other countries such as the USA in 1980. The 1G network was not perfect, but it remained until remained until 1991 when it was replaced with 2G. Third generation mobile networks are still in use today, but normally when the superior 4G signal fails.

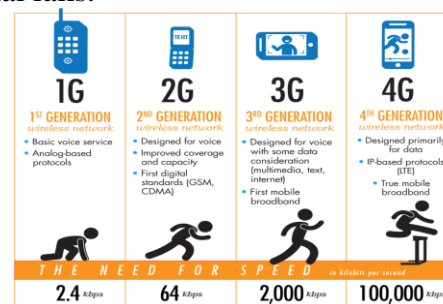


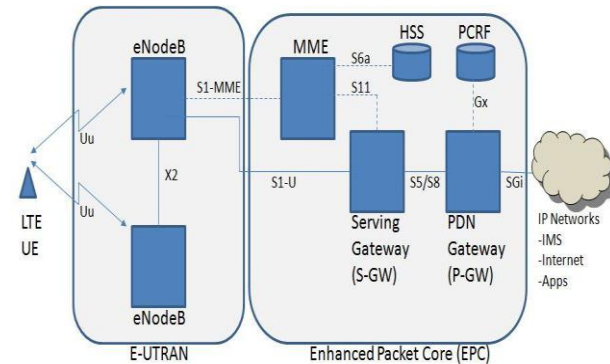
Figure-1 Evolution of generation

4G COMMUNICATION SYSTEM

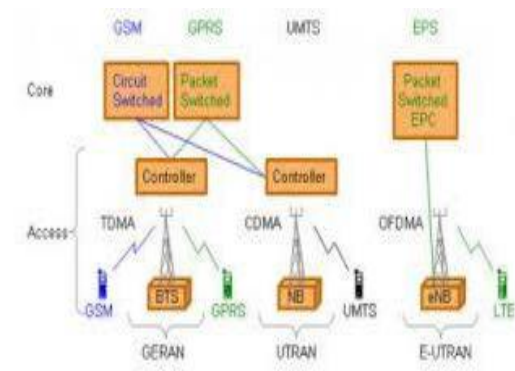
4G is a collection of fourth generation cellular data technologies. It succeeds 3G and is also called "IMT-Advanced," or "International Mobile Telecommunications Advanced." 4G was made available as early as 2005 in South Korea under the name WiMAX and was rolled out in several European countries over the next few years. It became available in the United States in 2009, with Sprint being the first carrier to offer a 4G cellular network. All 4G standards must conform to a set of specifications created by the International Telecommunications Union. For example, all 4G technologies are required to provide peak data transfer rates of at least 100 Mbps. While actual download and upload speeds may vary based on signal strength and wireless interference, 4G data transfer rates can actually surpass those of cable modem and DSL connections.



ARCHITECTURE OF 4G



Technologies used in 4G are smart antennas for multiple input and multiple output (MIMO), IPv6, VoIP, OFDM and Software defined radio (SDR) System. 4G is evaluation of 3G to meet the forecasted rising demand. It is an integration of various technologies including GSM, CDMA, GPRS, IMT-2000, Wireless LAN. 4G network is an integration of all heterogeneous wireless access networks such as Ad-hoc, cellular, hotspot and satellite radio component. OFDM stands for Orthogonal Frequency Division Multiplexing which is currently used as WiMax and WiFi.



FEATURES OF 4G

The following are some possible features of the 4G systems :

1. Support interactive multimedia, voice, video, wireless internet and other broadband services.
2. High speed, high capacity and low cost per bit.
3. Global mobility, service portability, scalable mobile networks.
4. Seamless switching, variety of services based on Quality of Service (QoS) requirements.
5. Better scheduling and call admission control techniques.
6. Ad hoc networks and multi-hop networks.

1) LTE-Long Term Evolution

LTE has been marketed both as "4G LTE" and as Advanced 4G but it does not meet the technical criteria of a 4G wireless service, as specified in the 3GPP Release 8 and 9 document series for LTE Advanced. LTE is also commonly known as **3.95G**. The requirements were originally set forth by the ITU-R organization in the IMT Advanced specification. However, due to marketing pressures and the significant advancements that WiMAX, Evolved High Speed Packet Access, and LTE bring to the original 3G technologies, ITU later decided that LTE together with the aforementioned technologies can be called 4G technologies.

2) WiMAX

WiMax stands for "Worldwide Interoperability for Microwave Access." It is an ITU-approved, fourth-generation mobile broadband technology that attempts

to mimic the abilities of Wi-Fi wireless internet, but over a mobile phone network using an open protocol (802.16m). Think of it as a patchwork of Wi-Fi hotspots that, instead of reaching for a few hundred feet, can stretch for miles and overlap, eliminating coverage gaps. It provides fixed and mobile internet access for compatible devices with less interference than traditional Wi-Fi. Theoretically, a WiMax tower could provide broadband wireless internet over a 30-mile range, though most stations currently achieve much less. Current WiMax users can realistically expect about 3Mbps to 6Mbps download speeds.

3) CDMA

Stands for Code Division Multiple Access. CDMA uses a multiple access mode of communication. This is where several transmissions are made over the same channel simultaneously. Using a speed spectrum, each transmission is assigned a unique code that corresponds to the source and destination of the signal.

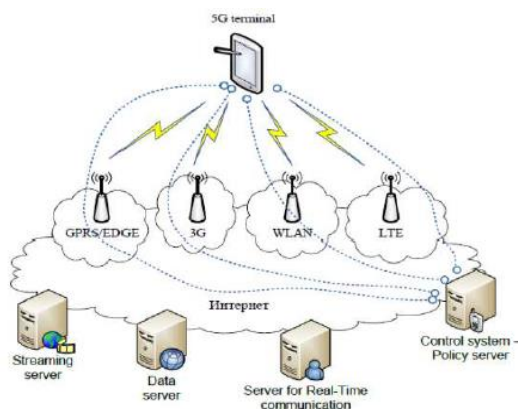
5G COMMUNICATION SYSTEM

5G Technology stands for 5th Generation Mobile technology. 5G technology has changed the means to use cell phones within very high bandwidth. The 5G network is yet to be released but is widely anticipated by the mobile industry. Many experts claim that the network will change not just how we use our mobiles, but how we connect our devices to the internet. The improved speed and capacity of the network will signal new IoT trends, such as connected cars, smart cities and IoT in the home and office. Mobile network operators claim that 5G will be available by 2020 but nothing is certain just yet. For more information on 5G and the IoT, check out our video interview of Dr Hamid Falaki, Technical Architect at Digital Catapult on how 5G will enhance the IoT. 5G is a packet switched wireless system with wide area coverage and high

throughput. 5G wireless uses OFDM. The primary technologies behind 5G include 26, 28, 38 & 60GHz millimeter wave bands. These 5G frequency bands offer speeds as high as 20Gbps Massive Multiple-Input-Multiple-Output (MIMO) 64-256 antennas offer performance speeds that are ten times better than the current 4G networks. Low-band and mid-band 5G use frequencies ranging from 600MHz – 6GHz (especially 3.5 – 4.2 GHz). 5G wireless frequency bands in the USA that are available and ready for use include; 3100 – 3550 MHz and 3700 – 4200 MHz. In Asia, they include; 3300 – 3600 MHz, 4400 – 4500 MHz and 4800 – 4990 MHz in China, 3600 – 4200 MHz and 4400– 4900 MHz in Japan and 3400 – 3700 MHz in Korea. 3400 – 3800 MHz is available in Europe. America has already begun pre-commercial deployment for very high 5G MMW frequency bands 27.5 – 28.35GHz & 37 – 40GHz. .

ARCHITECTURE OF 5G

As shown in the following image, the system model of 5G is entirely IP based model designed for the wireless and mobile networks.



The system comprising of a main user terminal and then a number of independent and autonomous radio access technologies. Each of the radio technologies is considered as the IP link for the outside internet world. The IP technology is designed exclusively to ensure sufficient control data for appropriate routing of IP

packets related to a certain application connections i.e. sessions between client applications and servers somewhere on the Internet. The 3rd Generation Partnership Project (3GPP) covers telecommunication technologies including radio access, core transport networks and service capabilities. 3GPP has provided complete system specifications for 5G network architecture which is much more service oriented than previous generations. Multiple frequency ranges are now being dedicated to 5G new radio (NR). The portion of the radio spectrum with frequencies between 30 GHz and 300 GHz is known as the millimeter wave, since wavelengths range from 1-10 mm. Frequencies between 24 GHz and 100 GHz are now being allocated to 5G in multiple regions worldwide.

FEATURES OF 5G

A new revolution of 5G technology is about to begin because 5G technology going to give tough completion to normal computer and laptops whose marketplace value will be effected. There are lots of improvements from 1G, 2G, 3G, and 4G to 5G in the world of telecommunications. The new coming 5G technology is available in the market in affordable rates, high peak future and much reliability than its preceding technologies. Features that are getting embedded in such a small piece of electronics are huge. Today you will hardly witness a cell phone without an mp3 player with huge storage memory and a camera. We can use the cell phone as a Walkman. Some of the features of 5G are as follows-

- The advanced billing interfaces of 5G technology makes it more speed.
- The 5G technology also support virtual private network.

- The new 5G technology will take all delivery service out of business prospect attractive and effective.
- 5G technology also providing subscriber supervision tools for fast action.
- The uploading and downloading speed of 5G technology touching the peak.
- The 5G technology network offering enhanced and available quality services of 5G technology based on Policy to avoid error.
- 5G technology is providing large broadcasting of data in Gigabit which supporting almost 65,000 connections.
- 5G technology offer transporter class gateway with unparalleled consistency.
- The traffic statistics by 5G technology makes it more accurate.

CONCLUSION

While the future is becoming more difficult to predict with each passing year, we should expect an accelerating pace of technological change. 5G is not a term officially used for any particular specification or in any official document yet made public by telecommunication companies. To address 5G applications, there are many developments to be considered above the introductory model. In order to handle higher data rates, the operating frequency has to be increased to a millimeter range from which we can achieve a wider bandwidth. This will result in higher path loss between transmitters and receivers, so antennas need to provide higher gain to reach a longer distance. However, this will

significantly reduce the covering range in terms of angle because the radiation pattern will be very sharp. Consequently, phased array antennas are required to get over the limit of angular dependency of high-gain antennas using the ability to steer a radiation beam toward wanted directions. By optimizing the design and performance of mobile device antennas, including those just mentioned, the ideal Internet of Things will be here before we know it, and we will be ready to embrace the new technology 4G and 5G techniques provide efficient user services with lower battery consumption, lower outage probability (better coverage), high bit rates in larger portions of the coverage area, cheaper or no traffic fees due to low infrastructure deployment costs, or higher aggregate capacity for many simultaneous users.

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