

5G: A FUTURE WIRELESS MOBILE TECHNOLOGY

VISION

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ABSTRACT

In this paper our ultimate goal is to communicate with any type of information with anyone, at anytime, from anywhere. This is possible with the aid of wireless technology. As We all are aware of wireless and mobile networks which have made extraordinary development in the past twenty years. At present, 3G mobile phone systems are sustaining IP connections Worldwide for all real and non-real time operations. Mobile wireless technology is developing in rapid speed with advanced techniques. In 5G research is being made on development of World Wide Wireless Web (WWWW), Dynamic Adhoc Wireless Networks (DAWN) and Real Wireless World. In addition, the main purpose of the fifth generation wireless networks (5G Wireless networks) is planned to design the best wireless world that is free from limitations and hindrance of the previous generations. 5G technologies will change the way most high bandwidth users access their Mobile Radio Communication (MRC). So, this paper represents, great evolution of 1G (First Generation) to 4G yield 5G, introduction to 5G technologies, why there is a need for 5G, advantages of 5G networks technology, applications in various field, Quality of Service (QoS).

Keywords : *1G, 2G, 3G, 4G, 5G Network Architecture, Need of 5G, AMPS, GSM, GPRS, IP, Mobile Networks.*

I. INTRODUCTION

During the last few decades, the world has seen a lot of changes in the telecommunications industry due to science and technology. We have different mobile and wireless communication technologies, which are mass deployed, such as WiMAX (IEEE 802.16 wireless and mobile networks) , Wi-Fi (IEEE 802.11 wireless networks), LTE (Long Term Evolution), 3G mobile networks (UMTS, cdma2000) and 4G as well as accompanying networks, such as personal area networks (e.g., Bluetooth, ZigBee) or sensor networks. Mobile terminals include variety of interfaces, such as GSM is one, which are based on old-fashioned circuit switching, the technology that is going into its last decade of existence. These technologies (mainly cellular generations) differ from each other based on four main aspects: radio access, data rates, bandwidth and switching schemes. 5G Technology stands for 5th Generation Mobile Technology. 5G technology has changed to use cell phones within very high bandwidth. 5G is a packet switched wireless system with wide area coverage and high throughput. 5G technologies use CDMA and BDMA and millimeter wireless that enables speed is greater than 100Mbps at full mobility and higher than 1Gbps at low mobility. The 5G technologies include all types of advanced features which make 5G technology most powerful and in huge demand in the near future. 5G is based

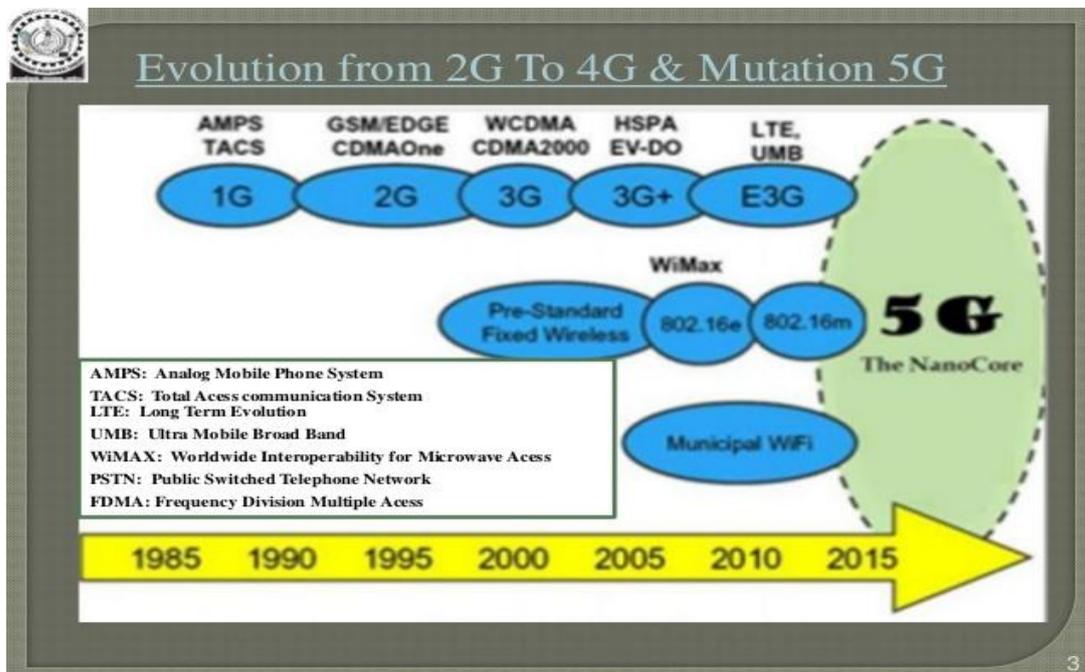
on 4G technologies. The 5G wireless mobile internet networks are real wireless world which shall be supported by LAS-CDMA (Large Area Synchronized Code-Division Multiple Access), OFDM (Orthogonal frequency-division multiplexing), MCCDMA (Multi-Carrier Code Division Multiple Access), UWB (Ultra wideband), Network-LMDS (Local Multipoint Distribution Service), and IPv6.

II. EVOLUTION OF WIRELESS TECHNOLOGIES

Mobile communication has become more popular in last few years due to fast advancement in mobile technology. This advancement is due to very high increase in telecoms customers. This revolution is from 1G- the first generation, 2G the second generation, 3G- the third generation, and then the 4G- the fourth generation, 5G-the fifth second generation.



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2.1 First Generation System (1G)

1G mobile network used analog system for communication of speech services. Mobile telecommunication in 1G first introduced in 1980s and continued till 1990. Analog Mobile Phone Systems (AMPS) was first established in USA in mobile networks. It allows end users to make voice calls only within 1 country. It has simple voice only cellular telephone parameters. The first generation of analog mobile phones has speed up to 2.4 Kbps. 1G had limited advantages but major drawbacks such as poor voice quality, handoff reliability, and battery life, large size of phones, no security mechanism alike many more. It uses analog radio signal which have frequency 150 MHz, Voice call modulation is done using a technique called frequency division multiple access (FDMA) [1].

2.2 Second Generation System (2G)

The 2nd generation was accomplished in later 1990's. The 2G mobile communication system is a digital cellular system. This system is still mostly used in different parts of the world. Planned for voice transmission with digital signal and provides speed up to 64kbps. This generation mainly used for voice & data transmission also offered additional services such as SMS, GPRS & E-mail. In this generation, two digital modulation schemes are used; one is time division multiple access (TDMA) and the 2nd is code division multiple access (CDMA) and frequency band is 850-1900 MHz's In 2G, GSM technology uses eight channels per carrier with a gross data rate of 22.8 kbps (a net rate of 13 kbps) in the full rate channel and a frame of 4.6 milliseconds (ms) duration [2].

2.2.1 Second Generation System (2.5G)

For that last reason (13kbps doesn't allow you to browse the Net or up/download an image), Telco operators came up with the GPRS (remember all the hype around the Wap) which could enable much faster communications (115Kbytes.sec). But the market decided it was still not enough compared to what they had at home. [5]

2.2.2 Second Generation System (2.75G)

EDGE, which is a pretty recent standard, allows for downloading faster. Since mobile devices have become both a TV and a „walkman“ or music player, people needed to be able to watch streaming video and download mp3 files faster – that's precisely what EDGE allows for and that's for the good news. The bad news is that if EDGE rocks at downloading, its protocol is asymmetrical hence making EDGE suck at uploading i.e. broadcasting videos of yours for instance. Still an interesting achievement thanks to which data packets can effectively reach 180kbytes/sec. EDGE is now widely being used.

2.3 Third Generation System (3G)

3G was developed in 2002 with large capacity and broadband capabilities. Allows the transmission of 384kbps for mobile systems and up to 2Mbps. Increased spectrum efficiency 5 MHz. In 2005, 3G is ready to live up to its performance in computer networking WCDMA, WLAN and Bluetooth and mobile devices area (cell phone and GPS). 3G technology is intended for true multimedia cell phone typically called smart phones and features increased bandwidth and transfer rates to accommodate web-based applications and phone-based audio and video files. 3G systems offer high data rates up to 2 Mbps. It provides data rates 384 kbps while moving 2mbps when stationary at specific locations.

2.4 Fourth Generation System (4G)

It was developed in 2010 .It offer both cellular and broadband multimedia services everywhere. 4G offers a downloading speed of 100Mbps.4G provides same feature as 3G and additional services like Multi- Media Newspapers, to watch T.V programs with more clarity and send Data much faster than previous generations [3]. LTE (Long Term Evolution) is considered as 4G technology. 4G is being developed to accommodate the QoS and rate requirements set by forthcoming applications like wireless broadband access, Multimedia Messaging Service (MMS), video chat, mobile TV, HDTV content, Digital Video Broadcasting (DVB), minimal services like voice and data, and other services that utilize bandwidth. [3]

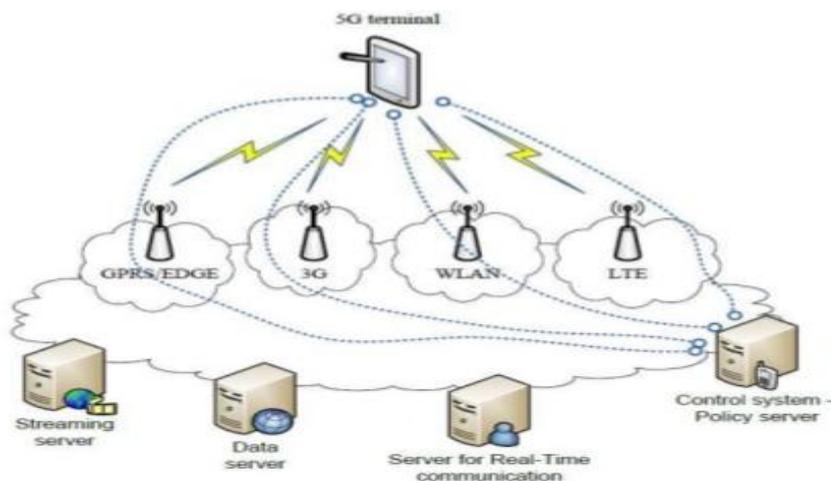
2.5 Fifth Generation System (5G)

5G is next major phase of mobile telecommunications standards beyond the 4G. 5G is a packet switched wireless system with wide area coverage and high throughput. 5G wireless uses OFDM and millimeter wireless that enables data rate of 20 mbps and frequency band of 2-8 GHz. 5G network is very fast and reliable. The concept of handheld devices is going to be revolutionized with the advent of 5G. Now all the services and applications are going to be accessed by single IP as telephony, gaming and many other multimedia applications. As it is not a new thing or gadget in market and there are millions of users all over the world who have experienced the wireless services and till now they are obsessed to this wireless technology. It is not easy for them to shrink from using this new 5G network technology. There is only need to make it accessible so that a common man can easily afford the profitable packs offered by the companies so that 5G network could hold the authentic place. There is need to win the customer trust to build fair long term relation to make a reliable position in the telecommunication field. To compete with the preceding wireless technologies in the market 5G network has to tender something reliable something more pioneering. All the features like telephony, camera, mp3 player, are coming in new mobile phone models. 4G is providing all these utility in mobile phone. By seeing the features of 4G one can gets a rough idea about what 5G Network could offer. There is messenger, photo gallery, and multimedia applications that are also going to be the part of 5G. There would be no difference between a PC and a mobile phone rather both would act vice versa. 5G technology going to be a new mobile revolution in mobile market. Through 5G technology now you can use worldwide cellular phones and this technology also strike the china mobile market and a user being proficient to get access to Germany phone as a local phone. [4]

Technology / Features	1G	2/2.5G	3G	4G	5G
Start/ Deployment	1970/ 1984	1980/ 1999	1990/ 2002	2000/ 2010	2010/ 2015
Data Bandwidth	2 kbps	14.4-64 kbps	2 Mbps	200 Mbps to 1 Gbps for low mobility	1 Gbps and Higher
Standards	AMPS	2G: TDMA, CDMA, GSM 2.5G: GPRS, EDGE, 1xRTT	WCDMA, CDMA-2000	Single unified standard	Single unified standard
Technology	Analog cellular technology	Digital cellular Technology	Broad bandwidth CDMA, IP technology	Unified IP and seamless combination of broadband, LAN/WAN/PAN and WLAN	Unified IP and seamless combination of broadband, LAN/WAN/PAN /WLAN and WWW
Service	Mobile telephony (voice)	2G: Digital voice, short messaging 2.5G: Higher capacity packetized	Integrated high quality audio, video and data	Dynamic information access, wearable devices with AI capabilities	Dynamic information access, wearable devices with AI capabilities
Multiplexing	FDMA	TDMA, CDMA	CDMA	CDMA	CDMA
Switching	Circuit	2G: Circuit for access network & air interface; Packet for core network and data	Packet except circuit for air interface	All packet	All packet
Core Network	PSTN	PSTN	Packet network	Internet	Internet

IV. FUNCTIONAL ARCHITECTURE FOR 5G MOBILE NETWORKS

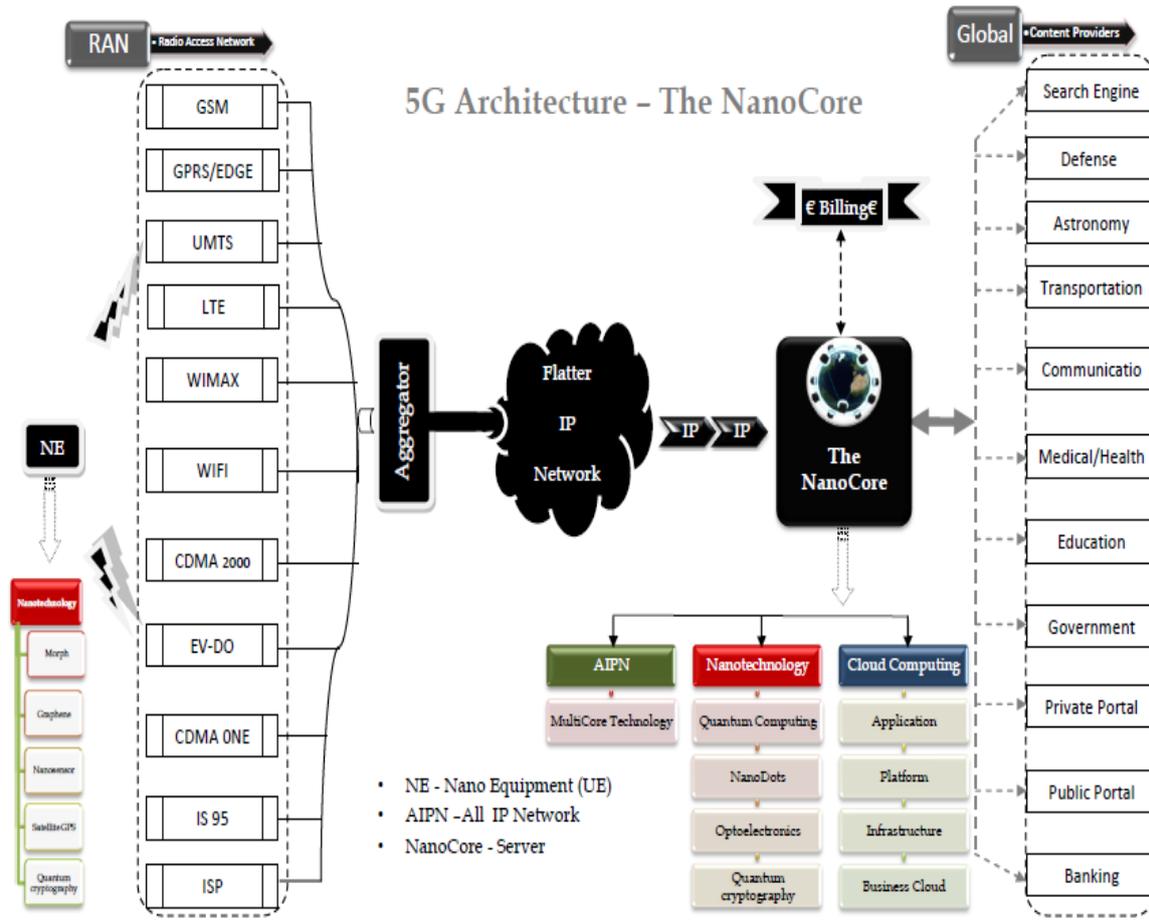
Below figure shows the system model that proposes design of network architecture for 5G mobile systems, which is all-IP based model for wireless and mobile networks interoperability. The system consists of a user terminal (which has a crucial role in the new architecture) and a number of independent, autonomous radio access technologies. Within each of the terminals, each of the radio access technologies is seen as the IP link to the outside Internet world.



The 5G architecture uses Noncore which is an association of Nanotechnology, Cloud Computing and IP Platform technologies. These technologies have their own influence on exiting wireless network which prepares them as 5G. Data sharing in 5G network is very easy. It omits the condition of putting both mobile face to face so that data could be shared. But 5G Bluetooth technology removes this condition and data could be transferred if it is shared in the range of 50m. It is not far away when we see the global mobiles all over the world. A user can move everywhere in the world by holding just 5G mobile network. All the roaming would be exempt from the tariff plans. The rates of the call would not be different area to area. 5G enabled smart phones will be a great challenge to laptops due to the extraordinary features offered. With thousands of mobile applications a user will do on his laptop with improve facilities. The tables I, II, III describes the comparison of each generation's technology and the changes which has come up for improvements.

Nanotechnology is an application of nanoscience to control process on nanometer scale (0.1 to 100nm).The term 'nanotechnology' was introduced by Nori Taniguchi in 1974 at the Tokyo international conference on production engineering Nanotechnology has shown its impact on both mobile as well as the core network. Powerful computation and communication are ready to serve the users in an intelligent way. With nanotechnology, mobile phones can act as an intelligent sensors that have applications in many industries like in transportation, medicine, safety and communications. NanoEquipment (NE): In 5G Nancore, the mobiles are known as NanoEquipment as they are stimulated with nanotechnology. Mobile devices along with intelligence, lodged in the human environment, create a new platform that enables ubiquitous sensing, and communication. The main tasks of the NanoEquipments are[9]

- Self-Cleaning – the phone cleans by itself.
- Self-powered – the phone derives its energy/power from the sun, water, or air.
- Sense the environment – A phone will tell you about the weather, the amount of air pollution present, etc.
- Flexible – bend but not break.
- Transparent – “see through” phones.



V. FEATURES OF 5G TECHNOLOGY

- Bi-directional large bandwidth.
- Large broadcasting & less traffic.
- 25 Mbps connectivity speed.
- Connectivity just about the world.
- Uploading and downloading speed of 5G technology touching the peak. (up to 1GBPS).
- Better and fast solution.
- Based on Policy to avoid error.
- Support virtual private network.
- More attractive and effective.
- 5G technology offer transporter class gateway with unparalleled consistency
- Through remote management offered by 5G technology a user can get better and fast solution.
- Every mobile in a 5G network will have an IP address (IPV6) according to the location and network being used.
- The new 5G technology will take all delivery service out of business prospect.
- The traffic statistics by 5G technology makes it more accurate.
- The remote diagnostics also a great feature of 5G technology.

- With 5G enabled phones, you might be able to connect your phone to your laptop to get access to broadband. [12].

VI. BENIFITS OF 5G TECHNOLOGY

- High speed, high capacity, and low cost per bit.
- Support interactive multimedia, voice, streaming video, Internet, and other broadband services ,more effective and more attractive ,Bi directional ,accurate traffic statistics.
- Global access, service portability, and scalable mobile services.
- The high 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.
- Through remote management offered by 5G technology a user can get better and fast solution.

VII. APPLICATIONS OF 5G TECHNOLOGY

- Real wireless world with no more limitation with access and zone issues.
- Wearable devices with AI capabilities.
- Internet protocol version 6(IPv6), where a visiting care-of mobile IP address is assigned according to location and connected network.
- One unified global standard.
- Pervasive networks providing ubiquitous computing: The user can simultaneously be connected to several wireless access technologies and seamlessly move between them these access technologies can be a 2.5G,3G, 4G or 5G mobile networks, Wi-Fi, WPAN or any other future access technology. In 5G, the concept may be further developed into multiple concurrent data transfer paths.
- Cognitive radio technology, also known as smart radio: allowing different radio technologies to share the same spectrum efficiently by adaptively finding unused spectrum and adapting the transmission scheme to the requirements of the technologies currently sharing the spectrum. This dynamic radio resource management is achieved in a distributed fashion, and relies on software defined radio.
- High altitude stratospheric platform station (HAPS) Systems. The radio interface of 5G communication systems is suggested in a Korean research and development program to be based on beam division multiple access (BDMA) and group cooperative relay techniques. [11]



VIII. CONCLUSION

In this paper we conclude that the migration to 5G networks ensures convergence of networks, technologies, applications and services. 5G can serve as a flexible platform. Wireless carriers have an opportunity to shorten Investment return, improve operating efficiency and increase revenues. 5G is a promising Generation of wireless communication that will change people's lives.

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