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Comparative Study of Multimedia over Mobile Generation Network

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Abstract*— The word wide revolution in mobile is changing our lives in term of the way we work, learn and interact. mobile devices are fast becoming the most pervasive and ubiquitous technology ever invented. In this paper, we review architecture and functionality of mobile Generation technology and compare it with various existing generations of mobile wireless technology in terms of their portals, performance, advantages and disadvantages. First-generation (1G) mobile phones had only voice facility. These were replaced by second-generation (2G) digital phones with added fax, data, and messaging services. The third-generation(3G) technology has added multimedia facilities to 2G phones.And now talks are on for the next-generation mobile technology with more advanced features, i.e. 4G,5G. 5G (Fifth Generation) network architecture consisting of re-configurable multitechnology core and a single fully re-configurable terminal able to autonomously operate in different heterogeneous access networks is proposed. The proposed network is enforced by nanotechnology, cloud computing and based on All IP Platform. The survey presented here will be helpful for designing the new strategies for the development of next generation mobile communication systems. This research work can steer all those learners who are trying to enhance their acquaintance in the field of mobile communication system, and also for such mentors and researchers who desire to have a foundation for further research and study in this field..

Keywords*— Transmission, Image Processing, Network, Mobile Generation Architecture, 1G, 2G, 3G, 4G, 5G.

I. INTRODUCTION

Cellular generations differ, in general, in four main aspects: radio access, data rates, bandwidth and switching schemes.The 1G (First Generation) cellular systems, mainly analog system, had a bandwidth ranging from 10 to 30 KHz depending on system type and service. Offered data rates were around 10 Kbps after analog to digital conversion. Radio access scheme was FDMA and switching was all circuit, suitable for voice services. The first phase of the 2G (Second Generation) GSM systems offered a data rate up to 9.6 Kbps and increased in the second phase and phase+ to reach a peak rate of more than 300Kbps with bandwidth of 200 KHz [1], [2]. Switching started to be packet in addition to circuit beginning from the second phase and radio access was TDMA/FDMA. For the 3G (Third Generation) systems, the peak data rate began of 2 Mbps in the first phase and approached 50Mbps in consecutive phases at constant wide bandwidth of 5 MHz [3]. The approved access scheme for the 3G was CDMA and switching continued to be circuit in addition to packet. However, at the start of 3.5G, with HSDPA system [4], and thereafter it was focused on packet switching only. In 4G (Fourth Generation) cellular systems, peak data rates started at 100 Mbps [5] and supposed to reach the order of more than 1 Gbps at the downlink benefiting from a variable bandwidth up to 20, 40 or even 70 MHz [6].

Switching was approved to be packet only- all IP, and radio access changed from CDMA to OFDMA and SC-FDMA. In addition to the cellular systems, current wireless technologies include Wireless Local Area Networks (WLAN) 802.11 [7] and Wireless Metropolitan Area. At present, 5G is not a term officially used for any particular specification or in any official document yet made public by telecommunication companies or standardization bodies such as 3GPP [10], WiMAX Forum [11], or ITU-R [12]. The rest of the paper is organized as follows: Section 2 reviews in brief the evolution of wireless and cellular systems focusing on the four main key factors: radio access, data rates, bandwidth and switching schemes in addition to change in network architecture. The 3G transitional cellular and wireless systems toward 4G and the true 4G IMT-advanced systems comprising mainly LTE advanced and Mobile WiMAX advanced are thoroughly presented. The section 3 shows brief comparision between mobile generation Network. Section 4, constituting the main body of the research, explores the expected future mobile system with emphasis on why there is a need for 5G..

II. EVALUATION OF MOBILE GENERATION

The nomenclature of the cellular wireless [1] generations (G) generally refers to a change in the fundamental nature of the service, non-backwards compatible transmission technology, and new frequency bands. New generations have appeared about every ten years since the first move from 1981 analog (1G) to digital (2G) transmission in 1992. This was followed, in 2001, by 3G multi-media support, spread spectrum transmission and peak throughputs of 200 kbit/s; and in 2011 by 4G, which refers to all-IP switched networks, mobile ultra-broadband (gigabit speed) access and multi-carrier transmission.

2.1. What is 1G: First generation refers to the analog "brick phones" and "bag phones" as they were first introduced for mobile cellular technology. Cell phones began with 1G and signify first generation wireless analog technology standards that originated in the 1980s. 1G was replaced by 2G wireless digital standards. 2.2.

What is 2G: 2G [2] emerged in late 1980s. It uses digital signals for voice transmission and has speed of 64 kbps. It provides facility of SMS (Short Message Service) and use the bandwidth of 30 to 200 KHz. Next to 2G, 2.5G system uses packet switched and circuit switched domain and provide data rate up to 144 kbps. E.g. GPRS, CDMA and EDGE. 2.3.

What is 3G: 3G [2][3] is the third generation of mobile phone standards and technology. Current 3G systems have been established through ITU's project on International Mobile Telecommunications 2000 (IMT-2000).

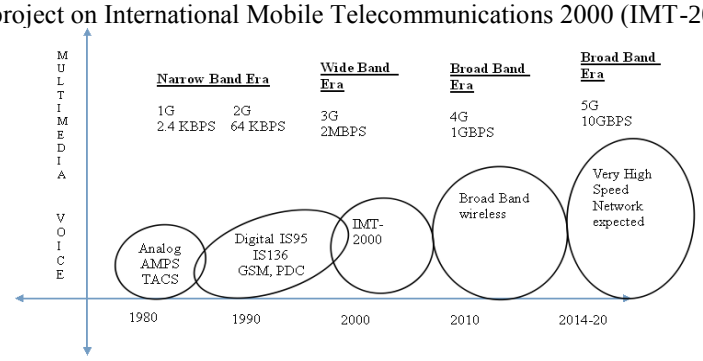

Figure 1: evolution of Mobile generation time point of view

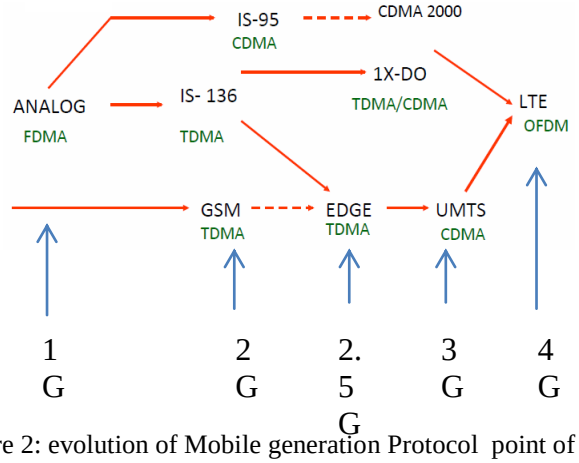

Figure 2: evolution of Mobile generation Protocol point of view

3G technologies have enabled faster data transmission speeds, greater network capacity and more advanced network services. In May 2001, NTT DoCoMo (Japan) launched the first pre-commercial 3G network – branded as FOMA. Following the first pre-commercial launch, NTT DoCoMo again made history on October 1, 2001, with the first commercial launch of 3G in Japan. UMTS-HSPA is the world's leading 3G technology. By 2015, UMTS-HSPA and LTE 3G technologies are expected to account for 3.9 billion global subscriptions, compared to 569 million CDMA EV-DO subscriptions and 59 million WiMAX subscriptions. 2.4.

What is 4G: 4G [5] 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 []. 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. 2.5.

What is 5G: 5G Technology stands for fifth Generation Mobile technology. Fifth generation network provide affordable broadband wireless connectivity (very high speed). Currently 5G term is not officially used. In fifth generation researches are being made on development of World Wide Wireless Web (WWWW), Dynamic Adhoc Wireless Networks (DAWN) and Real Wireless World. Fifth generation focus on (Voice Over IP) VOIP-enabled devices that user will experience a high level of call volume and data transmission.

III. COMPARISON OF TECHNOLOGIES

3.1 Tabular Comparison of 1G, 2G, 3G, 4G and 5G Technologies

Figure 1 shows the comparison of the three technologies (i.e., 1G, 2G and 3G) in terms of data services currently offered by the different carriers. The 3G is the next step leaving beyond the 2G standards (for instance CDMA and GSM). The important aspects of 3G consist of the skills to merge the cellular mobile networks with the internet, adding multimedia applications to a wireless computer/mobile phone by improving the range and QoS of voice and data services. In near future, the 4G is the upcoming technology of wire-less networks which will switch from 3G to 4G networks. To

understand both the technologies more clearly their detail comparison are as follows. 5G is to be a new technology that will provide all the possible applications, by using only one universal device, and interconnecting most of the already existing communication infrastructures. The 5G terminals will be a reconfigurable multimode and cognitive radio-enabled. It will have software defined radio modulation schemes.

TABLE I: COMPARISION OF MOBILE GENERATION

Generation	**1G**	**2G**	**2.5**	**3G**	**4G**	**5G**
Design Began	1970	1980	1985	1990	2000	2012-13
Implementation	1984	1991	1999	2002	2010	Expected 2020
Service	Analog voice , Synchronizes Data to 9.6KBPS	Digital voice, Short Messages	Higher capacity, packetized Data	Higher Capacity, Broadband data upto 2MBPS	Higher Capacity, Completely Ip-Oriented, data to hunders of megabytes	mobile 3D imaging, artificial intelligence, high-definition resolution capabilities, and holographic technologies.
Standard	AMPS.TACS, NTM , Etc.	TDMA, CDMA, GSM, PDC	GPRS, EDGE, 1xRTT	WCDMA, CDMA2000	Single Standard	Single Standard
Data Bandwidth	19 KBPS	14.6KBPS	384KBPS	2MBPS	200MBPS	Expected : Data rates 10 GBPS And Cell Rates 100 MBPS
Multiplexing	FDMA	TDMA CDMA	TDMA CDMA	CDMA	CDMA?	MIMO
Core Network	PSTN	PSTN	PSTN Packet network	Packet network	internet	fixed (fiber) networks

IV. WHY THERE IS NEED OF 5G?

The major difference, from a user point of view, between current generations and expected 5G techniques must be something else than increased maximum throughput; other requirements include:

• Lower battery consumption.
• Lower outage probability; better coverage and high data rates available at cell edge.
• Multiple concurrent data transfer paths.
• Around 1Gbps data rate in mobility.
• More secure; better cognitive radio/SDR Security.
• Higher system level spectral efficiency.
• Worldwide wireless web (WWWW), wireless-based web applications that include full multimedia capability beyond 4G speeds.
• More applications combined with artificial intelligent (AI) as human life will be surrounded by artificial sensors which could be communicating with mobile phones.
• Not harmful to human health.
• Cheaper traffic fees due to low infrastructure deployment costs.

The 5G terminals will be a reconfigurable multimode and cognitive radio- enabled. It will have software defined radio modulation schemes. All the required reconfigurable software should be downloaded from the Internet on the run. The 5G mobile networks will focus on the development of the user terminals where the terminals will have access to different wireless technologies at the same time and will combine different flows from different technologies. Besides, the terminal will make the final choice among different wireless/mobile access network providers for a given service. The 5G core is to be a Re-configurable, Multi-Technology Core. The core could be a convergence of new technologies such as nanotechnology, cloud Computing and cognitive Radio, and based on All IP Platform. These new technologies and the above mentioned requirements pose the following challenges toward 5G development:

Main Development Challenges:

- Cognitive Radio (CR)-New ways of Using Spectrum
- Software Defined Radio (SDR)-Reconfigurability enabler
- Reconfigurable-Interoperability between several types of wireless access Network
- Adaptive Coupling-Reconfigurable Integration
- Network Energy Efficiency

- Machine-Type Communication
- Nanotechnology
- All IP Network
- Cloud computing

V. CONCLUSIONS

In this paper we have surveyed, There are lots of improvements from 1G, 2G, 3G, and 4G to 5G in the world of mobile communication.The new coming 5G technology is available in the market at inexpensive rates, high peak expectations and much reliability than its foregoing technologies. We have seen how the technology has progressed through the years. 4G mobile technologies will stimulate subscriber interest in broadband wireless applications because of its ability and flexibility towards the world of wireless mobile communications. 4G just right started from 2002 and there are many standards and technologies, which are still in developing process. Therefore, no one can really sure what the future 4G will look like and what services it will offer to people. 4G is the evolution based on 3G's limitation and it will fulfill the idea of WWWW(5G), World Wide Wireless Web, offering more services and smooth global roaming with inexpensive cost Since 3G mobile is still in the market, 4G reduces the market competition in the mobile industry. Mobility is a double edged sword, it Degrades HSPA services, e.g. Throughput and Improves fairness in bandwidth allocation among users and traffic flows. Communication characteristics in HSPA transitional regions are very complicated.

VI. ABBREVIATION & ACRONYMS

1G	First Generation (Mobile Network)
2G	Second Generation (Mobile Network)
3G	Third Generation (Mobile Network)
3GPP	Third Generation Partnership Project
3GSGSN	Third Generation Serving GPRS Support Node
CAMEL	Customized Application for Mobile Network Enhanced Logic
EDGE	Enhanced Data Rates for GSM Evolution
FDMA	Frequency Division Multiple Access
GERAN	GSM/EDGE Radio Access Network
GSM	Global System for Mobile communication
GSMS	GPRS Short Message System
IMSI	International Mobile Subscriber Identity
ISDN	Integrated Service Digital Network
ME	Mobile Equipment
MS	Mobile Station
MSC	Mobile Switching Center
MSIN	Mobile Subscriber Identified Number
PSTC	Public Switched Telephone Network
RNC	Radio Network Controller
TDMA	Time Division Multiple Access
UE	User Equipment
UMTS	Universal Mobile Telecommunication System
URA	UTAN Registration Area
UTRAN	UMTS Terrestrial Radio Access Network
SIM	Subscriber Identity Modules
VLR	Visitor Location Register
WCDMA	Wide band Code Division Multiple Access
MIMO	Multiple Input Multiple Output

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