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Current and Future Trends In Wireless Mobile Communication Systems

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Abstract: *Since from the last few years research technology will open a new era in mobile communication systems, the technology goes soft and simple for the people to use multiple functions with a single smart device. One of the best examples is the wireless mobile communications. The evolutions of mobile communications are rapidly changing from 1G to 5G. Is the communication systems has been a shift from landline to cellular mobile telephony, resulting in Network architecture Planning and Optimization related services coming in to sharp focus. The paper is particularly designed to introduce the fundamental wireless mobile communications for future or next Generation Technology. It gives an overview of current and future trends in the areas of wireless mobile communications with different applications.*

Keywords: *LTE (Long Time Evolution), IMT-Advance, IP (Internet protocol), RAT (Radio Access Technology), WWWW (World-Wide Wireless Web)*

I. Introduction

Wireless communication started from 1970s and it was continuously upgraded to 5G.That is in next four decades, a mobile wireless technology has evolved from 1G to 5G generations. Fifth generation wireless mobile communication systems offer very high bandwidth that user never experienced before and it gives new advanced features which makes it most powerful and in huge demand in the future . The current trends of different wireless and mobile communications technologies are present such as third generation mobile networks (UMTS-Universal Mobile Telecommunication system with CDMA2000), fourth generation mobile technology LTE (Long Time Evolution), WiMAX, as well as sensor and personal area networks (e.g. Bluetooth). Figure 1 shows the evolution of mobile communication systems with more services, data, use and benefits to the upcoming generation over 4G.5G will be smarter technology with no limits and to interconnect the whole world without limits.

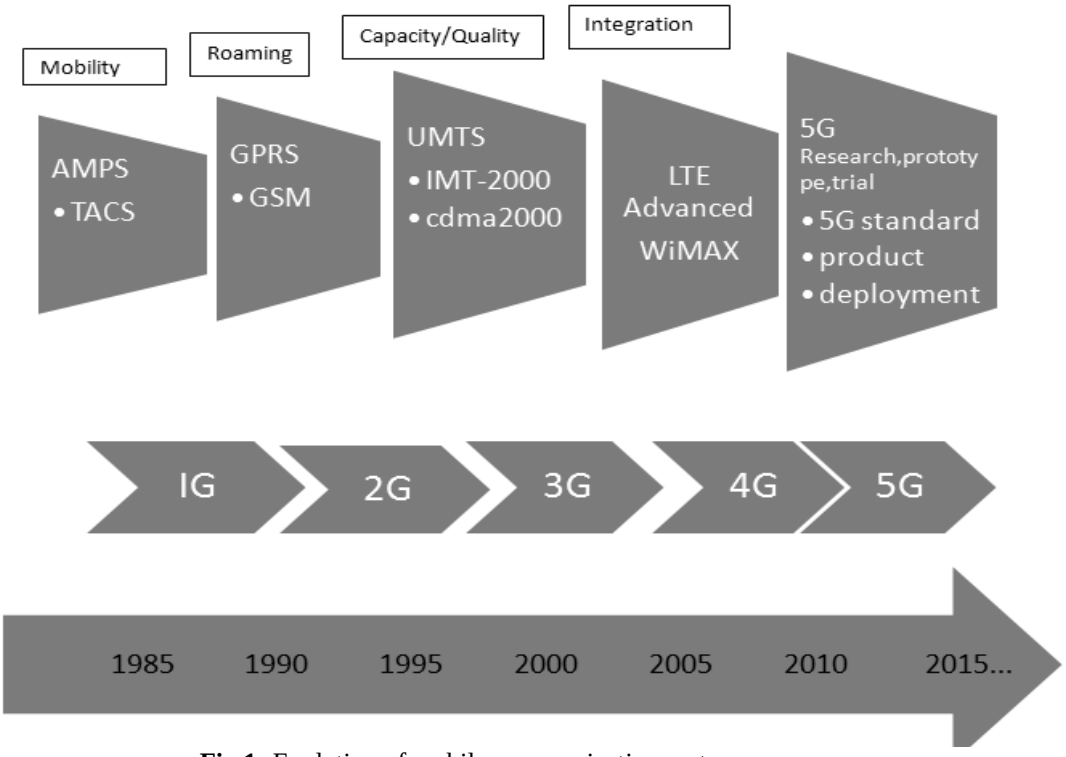

Fig 1: Evolution of mobile communication systems

The future wireless communication system is fifth generation wireless mobile multimedia internet networks can be completely wireless communication without limitation, which makes perfect wireless real world – World Wide Wireless Web (WWWW). That fifth generation is based on 4G technologies. The 5th 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. Fifth generation technologies offers tremendous data capabilities and unrestricted call volumes and infinite data broadcast together within latest mobile operating system. Fifth generation should make an important difference and add more services and benefits to the world over fourth generation. Fifth generation should be more intelligent technology that interconnects the entire world without limits. This generation is expected to be released around 2020. The world of universal, uninterrupted access to information, entertainment and communication will open new dimension to our lives and change our life style significantly.

II. Evolution

Wireless mobile communication system has become more popular due to rapid changes in mobile technology. Fast development of wireless communication systems are due to very high increase in telecoms customers. The revolution of mobile communications is from 1G-the first generation, 2G-the second generation, 3G-the third generation, 4G-the fourth generation, 5G-the fifth generation.

First Generation (1G)

The first generation of mobile communication technology emerged in 1980s. The first generation mobile communication system used analog transmission of speech signal services. In the year 1979, the first cellular system in the world operated by Nippon Telephone and Telegraph (NTT) in Tokyo, Japan. At that time the most popular analogue systems were Nordic Mobile Telephones (NMT) and Total Access Communication Systems (TACS), some other analog systems also introduced in 1980s across the Europe. The main drawback of the first generation is all of those systems offered handover and roaming capabilities but cellular networks were unable to interoperate between the countries. In the year 1982s Advanced Mobile Phone System (AMPS) was launched in United States. AMPS and TACS use the Frequency Modulation (FM) technique and frequency division duplex (FDD) for radio transmission. In this generation uses Frequency Division Multiple Access (FDMA), channel bandwidth is 30KHz.

Second Generation (2G)

Second generation enabled to provide the services such as text messages, picture messages and Multimedia messages (MMS) for various mobile phone networks. The second generation telecommunication networks were commercially launched on the Global system for Mobile communications (GSM) standard in 1991.Three primary goals and benefits of 2G networks over their predecessors were that phone conversations were digitally encrypted; 2G systems were significantly more efficient on the spectrum allowing for far greater mobile phone penetration levels; and 2G introduced data services for mobile, starting with SMS text messages. Second generation can be divided into two standards based multiple access used: TDMA based and CDMA based. 2.5G was GPRS which could enable much faster communications uses packet switching and circuit switching domain to provide data rate up to 144kbps. In less populous areas, the weaker digital signal may not be sufficient to reach a cell tower. This tends to be a particular problem on 2G systems deployed on higher frequencies, but is mostly not a problem on 2G systems deployed on lower frequencies.

Third Generation (3G)

Third generation technology is carried out by the International Telecommunication Union (ITU) in the year 1980. 3G communication frequency spectrum between 400 MHz to 3GHz. 3G technology approved by both the government and communication companies unanimously. 3G technical specifications were made available to the public united the name International Mobile Telecommunications-2000 (IMT-2000). The first commercial 3G technology was launched by NTT DoCoMo in Japan on 1 October 2001 of W-CDMA. It was initially somewhat limited in scope; broader availability of the system was delayed by apparent concerns over its reliability. 3rd generation is a set of standards used for mobile devices and mobile telecommunication services and networks that comply with the IMT-2000. Advantages of using 3rd generation in fixed Wireless Internet Access, Wireless Voice Telephony, Video calls, Mobile Internet Access and Mobile TV.

Many of the telecommunications companies market wireless mobile Internet services as 3G, indicating that the advertised service is provided over a 3G wireless network. Services advertised as 3G are required to meet IMT-2000 technical standards, including standards for reliability and speed (data transfer rates). To meet

the IMT-2000 standards, a system is required to provide peak data rates of at least 200 Kbps (about 0.2 Mbps). However, many services advertised as 3G provide higher speed than the minimum technical requirements for a 3G service. Recent 3G releases often denoted 3.5G and 3.75G also provide mobile broadband access of several Mbps to smart phones and mobile modems in laptop computers. CDMA technology can sharing infrastructure with the IS-95 2G standard. The mobile devices are typically CDMA-2000 and IS-95 hybrids.

Fourth Generation (4G)

Increasing growth of user demand and also the emergence of new technologies in the mobile communications have triggered researchers and industries to come up with comprehensive manifestations of the upcoming fourth generation (4G) wireless communications in mobile technology. The main concept in fourth generation for the transition to the All-IP is to have a common platform for all the technologies that have to develop so far and to harmonize with user expectations of the many service to be provided. The main difference between the All-IP and GSM/3G is that the functionality of RNC and BSC is now distributed to BTS and a set of servers and gateways. In contrast to 3G, the new 4G framework to be established will try to accomplish new levels of user experience and multi service capacity by also integrating all the mobile technologies that exist (e.g. GSM, GPRS, IMT-2000, Wi-Fi, Bluetooth, ZigBee). 4G technology data transfer will be much faster and will be less expensive. 4G will be so smart for friendly operating functions flexibility and any desired service with reasonable quality of services (QoS) at anytime, anywhere. Fourth generation mobile communication technology started in 2010 but will mass market in about 2015-2016.

Forth generation technology may provide peak data rate of 1Gbps for downlink and 500Mbps for Uplink. 4G is considered as Long Term Evolution (LTE) and gives the additional features of 3G, like wireless broadband access, Multimedia Messaging Service (MMS), Video chart, Mobile TV, HDTV content, Digital Video Broadcasting (DVB), minimal services: voice and data. 4G is widely accepted that the individual (wireless or/and wire) access networks will interface to core and/or backbone network elements over the IP protocol, the lingua franca of networking technology. Regardless of their particular technological blueprints these wireless access networks are expected to have a dynamic address assignment mechanism that is capable of associating a short-lived or long-lived IP address to the respective wireless interface at the mobile terminal, A transparent IP forwarding service that is accessible over the logical termination of the IP layer at the mobile terminal and one or more gateways at the wireless access network infrastructure.

IMT-Advanced 4G standards will usher in a new era of mobile broadband communications, according to the ITU-R. IMT- Advanced provides a global platform on which to build next generations of interactive mobile services that will provide faster data access, enhanced roaming capabilities, unified messaging and broadband multimedia. According to ITU, "ICTs and broadband networks have become vital national infrastructure similar to transport, energy and water networks but with an impact that promises to be even more powerful and far-reaching. These key enhancements in wireless broadband can drive social and economic development, and accelerate progress towards achieving the United Nations' Millennium Development Goals, or MDGs." .The current agreements on the requirements for IMT-Advanced are:

- Regarding latency, in the Control plane the transition time from Idle to Connected should be lower than 100ms. In the active state, a dormant user should take less than 10ms to get synchronized and the scheduler should reduce the User plane latency at maximum.
- In the same scenario with 10 users, cell edge user spectral efficiency will be 0.06 in DL 4 × 2. In the UL, this cell edge user spectral efficiency must be 0.03 with MIMO 2 × 4.
- Mobility up to 350 km/h in IMT-Advanced.
- IMT-Advanced system will support scalable bandwidth and spectrum aggregation with transmission bandwidths more than 40MHz in DL and UL.
- Backward compatibility and inter-working with legacy systems.

Fifth Generation (5G)

Fifth generation technology is very fast and reliable to be a new mobile revolution in mobile market. All the services of the networks and applications are going to be accessed by the single IP as telephony, gaming and many other multimedia applications. Through this 5G technology, worldwide cellular technology comes under one umbrella.5G networks carriers' extraordinary data capabilities and has ability to tie together unrestricted call volumes and infinite data broadcast with in the upcoming mobile operating system. Fifth generation mobile with Nanocore is a convergence with Nanotechnology, Cloud Computing and the entire IP platform. Fifth generation requires secure and reliable service providers, capabilities that operators have deep expertise in. 5G technology provides subscriber supervision tools for action and offer high resolution for cell phone users and bi-directional large bandwidth. The uploading and downloading data speed touching the peak. 5G functional architecture has been shown in fig 2.

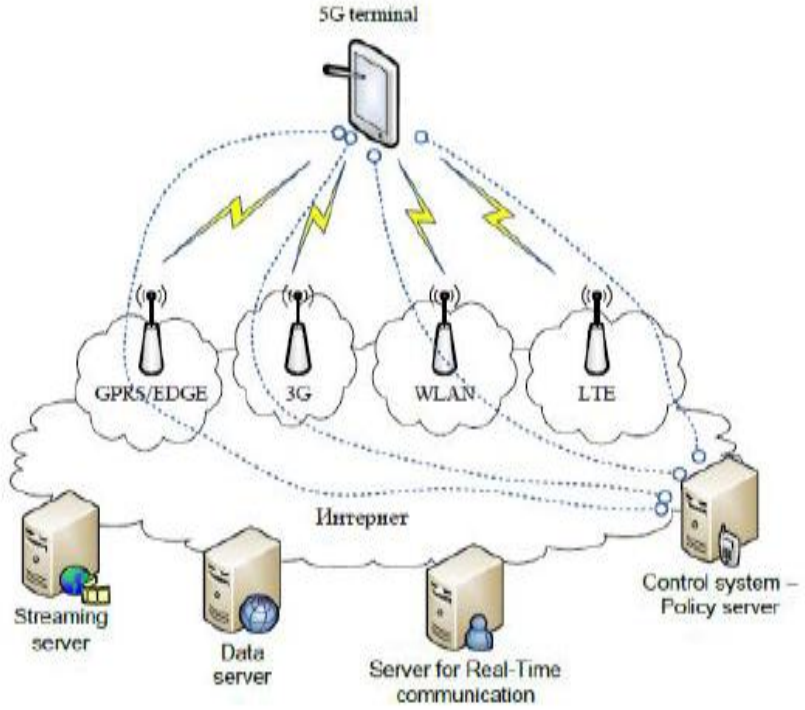

Fig 2: Functional architecture for 5G.

Fifth generation wireless technology consists of a user terminal 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. However, there will be different radio interface for each Radio Access Technology (RAT) in the terminal. The link of communications from end to end between the client and server using internet protocol is necessary to raise the appropriate internet socket uniquely determined by the application of the client and server. This means that in case of interoperability between heterogeneous networks and for the vertical handover between the respective radio technologies, the local IP address and destination IP address will be fixed and unchanged. All the radio access technology that is available to the user in achieving connectivity with the relevant radio access is presented with appropriate IP interface. Due to introduction of a fifth generation radio system is possible in which different radio technologies will share the same spectrum. It is possible to provide large broadcasting of data in GBPS which supporting almost 65000 connections.

In the fifth generation expected requirements are increased maximum throughput and other includes:

- ✓ Very low battery power consumption.
- ✓ Worldwide wireless web (WWWW).
- ✓ Cheaper traffic fees due to low infra structure deployment costs.
- ✓ High data rate
- ✓ Better coverage at cell end.
- ✓ Multiple data transfer paths.
- ✓ Every mobile in a 5G technology will have an IP (IPV6) address (IPV6) according to the location and network being used.

III. Conclusion

Examining the current and previous performance of the wireless mobile communication system, it was discovered that they are still unable to solve the unending problems of poor coverage, bad interconnectivity, flexibility and poor quality of service. The main advantage of fifth generationwill revolutionizes the field of wireless communications domain to a completely new features and services making the world a smaller place to live. For the future generation the 5G technology helps to promote stronger links between people working in different fields creating future concepts of mobile communications, nanotechnology, cloud computing and internet service. In 5G technology expecting more bandwidth would not be the answer but utilizing the existing bandwidth through innovative network design is need of the hour. In 5G expecting the network management modules need to more intelligent i.e., cognitive software will make the task of radio resource scheduling simpler.

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