



Evolution of Mobile Communications Systems from Zero Generation to Fifth Generation: A Review

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ABSTRACT

Nowadays, the communication ability with people on move has been evolved. Mobile wireless system is become more outstanding in the past few years due to this from zero generation to fifth generation. Time Division Duplex(TDD) is two duplex methods in which Time Division Synchronous (TD-SCDMA) is first TDD based mobile communication systems which issued in large scale and wide range and also Time Division Synchronous (TD-SCDMA) is first mobile communication systems which have adopted smart antenna system which is known as beam forming. In this paper, development of distinct mobile generation systems has been discussed. In a few decades, from zero generation to fourth generation. Now fifth-generation mobile wireless communication improvements have been progressed. Analog technology has been replaced by digital communication in the second generation (2G) which relatively improved wireless communication systems. In first generation, the fundamental need for voice has been fulfilled while high capacity and vast coverage area has introduced by the second generation. In 3G technology, voice communication systems were the main focus. The fourth generation is provided entrance to a broad of communication technologies. The fifth generation of communication systems is designed by IEEE 802.11 systems.

Keywords: wireless communication, Fifth generation, Quality of Service, Efficiency.

Introduction

The wireless trade has been evolution since 1970s. Mobile network subscribers are expanding 45 percent per year. By the resolution of 2021, four times extra subscribers will be using this service than the current number [1]. In earlier years, mobile wireless communication technologies have experienced an incredible transformation. The generation of mobile wireless pertains to a modification in the character of the system performance, efficiency, connectivity etc. Every era includes new technologies, features, standard which distinguish it [2]. First generation of wireless system was based analog which is applicable only for calls in which analog signals transmitted while the second generation of mobile technology was transmitted digital signals which is used for messaging. In third-generation wireless system, high value of data transfer rate, multimedia supports, higher performance etc was provided and also supports mobile wireless internet. Fourth generation wireless communication was called Long Term Evolution (LTE). It improves the bandwidth and reduces the fetch of the expedient [3]. The fifth-generation is based on Open Transport Protocol (OTP) and Open Wireless Architecture (OWA) [4].

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2. Mobile Telecommunication System Generation

Mobile telecommunication system generation are studied from zero generation to five generation which is discussed below:

2.1 Zero Generation (0G)

Wireless telephone systems were started with zero generation. Generally, zero generation is usually refers to as pre-cell mobile technology in 1970s i.e. radio telephone which was used in cars and this technology is known as zero generation because its arrival was before the first generation systems [1,2]. Zero generation comprises of different systems i.e. Push-Talk and cell phone [5, 15].

2.2 First Generation (1G)

In 1982, first mobile phone was used. It was worked on Advanced Mobile Phone Technique (AMPT) in which Frequency Division Multiple System (FDMS) was used which have channel size of 30Khz frequency band of 824-894 MHz. Telecommunication systems used by Italy was RTMI. First Generation replaced the Zero generation technology. First Generation technology has low capacity, poor voice quality, larger phone size, speed up to 2.4 kbps and poor security [2, 5].



Fig. 1. 1G mobile phone [1].

2.3 Second Generation (2G)

The second generation telecommunication systems were started since 1991 by Radioing in Finland for Global system for mobile communication which was planned for voice transmission as well as digital signal. Speed of this generation is limited to 64 kbps. For 2G transmission generally, 20-200 KHz bandwidth are required. 2G telecommunication systems are divided into two categories which are Time Division Multiple System and Code Division Multiple System. Thus, second generation telecommunication systems provides digital signal, better quality and enable services like Text Messages, Picture Messages and Multimedia Message (MMS) [4,5].

The most significant customize reform of 2G over its precursor is the digital encoded of telephone conversations, and greatly higher productivity on the spectrum, which authorize for appreciable penetration intensity for mobile phones. 2G also instigate mobile data amenity, conception with SMS text messaging.

2.4 General Packet Radio Service (2.5G)

2.5G is known as second and half generation telecommunication systems and it is successor of 3G. GPRS provides data range 56Kbit/s to 15Kbit/s and it includes the service like wireless application, access multimedia messaging and also provides internet service, web browsing, send/receive e-mail messages [2, 14].

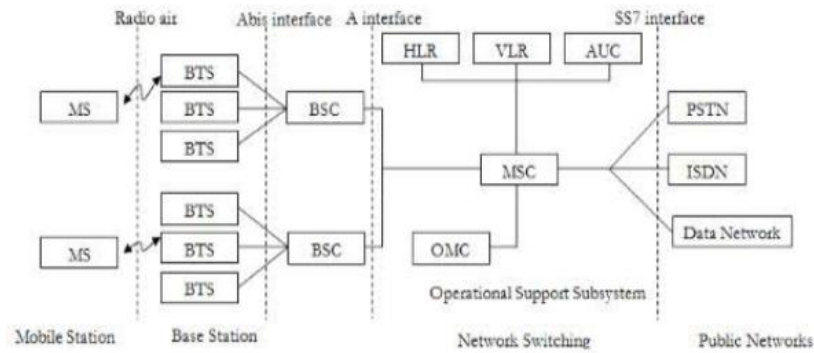


Fig 2. GSM network system [2].

2.5 Third Generation (3G)

Third Generation is worked on (GSM) global system for mobile communication technology which was inaugurated in year of 2000 and it provides a high data speed internet service which includes data transmission speed up to 15 Mbps and more with the help of packet data switching. 3G range was 2100 MHz and additionally having bandwidth range of 20-25 MHz and cast-off for internet, video calling and other useful services [6, 11]. 3G characteristics includes such as faster communication, send/received large emails and high bandwidth. First marketable 3G phone which was LG K 8000 was adopted in European as presented in Figure 2. High Speed Downlink Packet Access is a telephonic procedure which is delivering higher speed than 3G (8.2 Mbit/s data transmission). 3G mobile network is also familiar as Universal Phone Telecommunication Network (UPTN) in Europe and WCDMA is air-interface communication system for Universal Phone Telecommunication Network [7, 8].

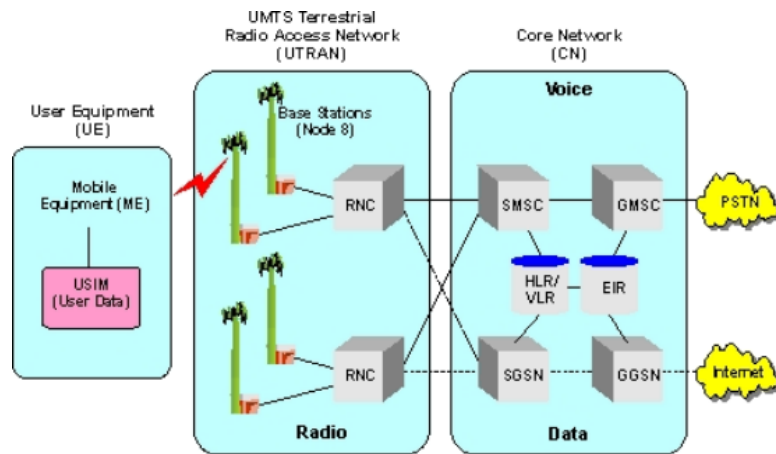


Fig. 3. WCDMA network diagram [2].

2.6 Fourth Generation (4G)

Forth Generation is a high speed data transmission system which provides a downloading speed up to 100 Mbps. In 4G technology, Long Term Evolution (LTE) is used which provides more coverage area. Main features of 4G generation are high quality of data transmission, low cost per bit, capable of providing 10Mbps-1Gbps speed and high security [9]. 3GPP organisation introduced two important wireless ideals which is LTE and IEEE802.16 which comprised the 4G type in which Wireless Mobile Broadband Access (WMBA) is used normally [10]. Downlink and Uplink data rate are 128Mbps and 56Mbps respectively [12].

2.7 Five Generation (5G)

Five Generation Telecommunication system is utilized in number of study paper and projects to indicate next generation of communication technology in which various types of the technologies have been done and still is going on to obtained high range of data transmission, fast downloading and uploading etc [2, 7].

5G technologies were the upcoming paramount phase of mobile telecommunications standards far away the ongoing 4G/IMT-Advanced standards.

NGMN Alliance or succeeding Generation Mobile Networks Alliance explicates 5G network must have as:

- Data rates of considerable tens of megabits per second (Mbit/s) should be assist for tens of thousands of end user.
- 1 Gbit/s to be recommended, simultaneously to tens of employee on the one and the same office ground.
- Dissolvable hundreds of thousands of concurrently interrelation to be hold up for massive sensor formations [12].
- Spectral efficiency should be remarkably magnified compared to 4G.
- Coverage should be upgrade.
- Signaling productivity enhanced.
- Latency should be notably bring down collate to LTE.

Upcoming generation mobile communication feels that 5G should be arise by 2020 to meet business and patron dictate. In incorporation to simply equip faster speeds, they forecast that 5G networks will as well require to meet the needs of new use-cases similarly the Internet of things (IoT) as well as telecast-like assistance and lifeline communications in times of tragedy [12].

2.7.1 Characteristics of 5G technology

- 5G technology put forward excessive outcome for demented phone and duplex huge fashion [7].
- 5G technologies additionally subscriber management tools for quick action.
- 5G also provided high quality resources based on strategy to keep away delusion.
- 5G technology is used to transmitting the data in gigabyte which are assistance more or less 65000 connections.
- 5G technologies provided more or less 25 Mbps connectivity speed.
- 5G technologies hold up as well virtual private network [9].

3. Comparatively Analysis of Generations based on DifferentParameters

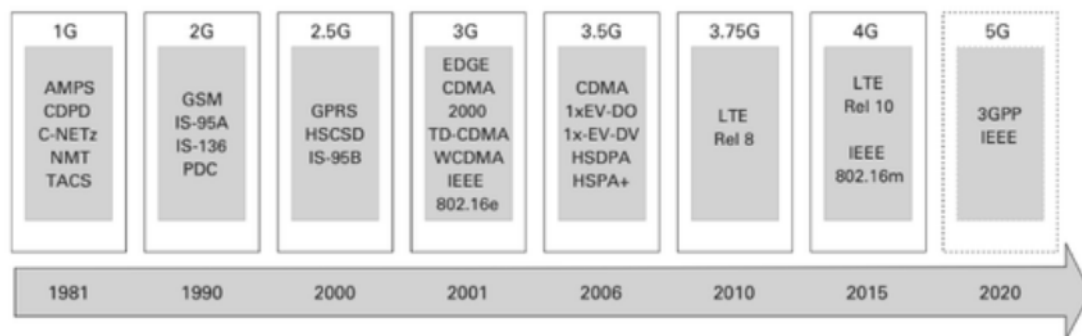


Fig. 4. Technology used in past years to now [13].

Table 1. Comparison table of different generations [13].

Technology	1G	2G	3G	4G	5G
Start/Deployment	1970-80	1990-2004	2004-10	Now	Soon (probably by 2021)
Data Bandwidth	2Kbps	64 Kbps	2 Mbps	1 Gbps	Higher than 1 Gbps
Technology	Analog	Digital	CDMA 2000, UMTS,EDGE	Wi-Max, Wi-Fi, LTE	WWWW
Core Network	PSTN	PSTN	Packet N/W	Internet	Internet
Multiplexing	FDMA	TDMA/CDMA	CDMA	CDMA	CDMA
Switching	Circuit	Circuit,Packet	Packet	All Packet	All Packet
Primary Service	Analog Phone Calls	Digital Phone Calls and Messaging	Phone calls, Messaging, Data	All-IP Service (including Voice Messages)	High speed, High capacity and provide large broadcasting of data in Gbps
Key differentiator	Mobility	Secure, Mass adoption	Better Internet experience	Faster Broadband Internet, Lower Latency	Better coverage and no dropped calls, much lower latency, Better performance
Weakness	Poor spectral efficiency, major security issue	Limited data rates, difficult to support demand for internet and e- mail	Real performance fail to match type, failure of WAP for internet access	Battery use is more, Required complicated and expensive hardware	?

4. Key Challenges

Key challenges in migration to 5G involves spoofing, jamming, data security, integration of various standard, common platform, transparency, IP concept and evolution of managed service [8].

5. Conclusions

Wireless communication for mobile system is instantly improving. In few years, incredible improvement of technology was observed. 5G technology will change the way of living in which number of new features and technology will involved.

Trials of 5G have already started which is expected to be available around by the end of 2021-2022. In future, new generation of mobile communication systems will also come like 6G which will be totally different from past generations in which high speed of data transmission system will involve which will totally change one's life through new invention.

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