

A Review on Mobile Computing Wireless Communication Technology using 0th Generation to 7th Generation

Indra Kishor¹, Pragya Rathore², Pooja Samaria³

^{1,2,3}Department of CSE, Arya Institute of Engineering and Technology, Jaipur

Abstract: Mobile Wireless Generation has been involving generation-by-generation. There is a huge advancement in every new technology of mobile wireless communication on its introduction to the technology world. Mobile wireless communication started listing its generation from the 0th Generation. On looking forward and to improve the area of Wireless communication, new generations introduced. 0G was followed by 1G, 2G, 3G, 4G, and 5G. There are many pieces of research been going on the future generations of Mobile Wireless Communication, such as 6G and 7G, which are going to improve the previous generations with new advancements.

Key Words: Wireless, Communication, GSM, CDMA, FDMA, TDMA, 0G, 1G, 2G, 3G, 4G, 5G, 6G, 7G.

1. INTRODUCTION

Wireless communication means 'communication without the use of wires'. The basic medium to communicate in wireless communication is the 'vacuum' or 'air' medium. Wireless communication uses spectrum waves such as Radiofrequency waves and Infrared waves. Every device and the channel in the communication channel have their frequency and bandwidth. The sender sends the message signal at a bandwidth which is free and available for use. The receiver tunes to that particular bandwidth to receive the message signal. In Mobile Wireless communication, every mobile station is being given the particular by the mobile service provider from the range of frequencies assigned to them. This frequency is now being used by the mobile station user to send and receive the message signals the primary handheld mobile telephone was demonstrated by Motorola in 1973. The first commercial automated cellular network was launched by NTT in Japan in 1979. After that, this indeed launches of the Nordic Mobile Telephone (NMT) system in Denmark, Finland, Norway, and Sweden; in 1981. [1] And then the development of Wireless communication begins. Mobile Wireless Communication came into the communication world by the introduction of 0G, which uses the Push to Talk Technique. In advancement, there comes 1G, which was used for voice calls only. 2G was a reprised version of 1G, including digital technology and sending a message. 3G gave a wide platform to use internet services with high transmission rates. 4G came as the advanced version of 3G by increasing the bandwidth and capacity, also by providing the QoS. 5G increases the bandwidth of 4G and supports the real world wireless World Wide Web

(WWW). 6g integrates the 5G technology with global wireless connectivity and 7G will provide the global and space roaming. With the limitations of previous generations, new generations will get into research and will come into the communication world.

2. MOBILE WIRELESS COMMUNICATION TECHNOLOGY

2.1 0G (ZERO GENERATION) OF WIRELESS COMMUNICATION

0G refers to pre-cell phone mobile telephony technology, like radiotelephones that some had in cars before the arrival of cell phones. Wireless mobile systems preceded modern cellular mobile telephony technology.

Technologies utilized in 0G systems included:

- PTT (Push to Talk) also referred to as "Press to transmit", a way of conversing on half-duplex communication lines including two-way radio without having an existing connection.
- IMTS (Improved Mobile Telephone Service) units produced a dial tone when the receiver was lifted from the cradle and this manner seemed more sort of a landline telephone than a cellular handset.
- AMTS (Advanced Mobile Telephone System) operates on 900 MHz bands and it overcomes all the difficulties that occurred from IMTS.
- MTD (Swedish abbreviation for Mobile telephony system D) featured fixed wireless service with a high-speed internet connection without the need for a telephone line. It offers "always-on" internet access. [2]

2.2 1G (FIRST GENERATION) OF WIRELESS COMMUNICATION

1G refers to the primary generation of mobile wireless communication technology. Mobile telecommunications were first introduced in the 1980s and completed in the early 1990s. In 1979, the primary cellular system within the world became operational by Nippon Telephone and Telegraph (NTT) in Tokyo, Japan. In Europe two hottest analog systems were Nordic Mobile Telephone (NMT) and (TACS) other analog systems were also introduced in the 1980s across Europe. It was used for voice services and it was based on the Advanced Mobile Phone

System (AMPS) technology. The AMPS system was frequency modulated and used frequency division multiple access (FDMA) with a data rate of 30 kHz and a waveband of 824-894MHz. [3]

It has some basic features as following:

- Speed-2.4 kbps.
- Allows voice calls in 1 country.
- Use an analog signal.
- Poor voice quality.
- Poor battery life.
- Large phone size.
- Limited capacity.
- Poor handoff reliability.
- Poor security.
- Offered a very low level of spectrum efficiency.



Fig-1: 1G Technology Mobile phone

2.3 2G (SECOND GENERATION) OF WIRELESS COMMUNICATION

2G refers to the second generation of mobile telecommunications introduced at the end of the 1980s. 2G introduced a new digital technology known as Global System for Mobile Communication (GSM). The main focus of GSM technology was on digital signals. It provides services to deliver SMS and MMS at low speed (in kbps). It uses the bandwidth from 30 to 200 kHz. After 2G, 2.5G system uses the packet-switched and circuit-switched domain and provides data rate up to 144 kbps. e.g. GPRS, CDMA, and EDGE.

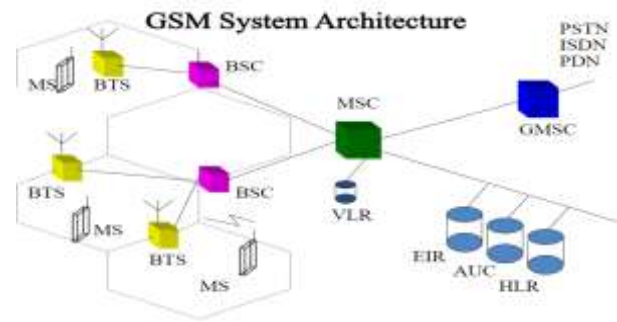


Fig-2: GSM Architecture in 2G

2G:

- It provides Data speed up to 64kbps.
- 2G provides services such as SMS, MMS (Multimedia Message) and picture messages.
- 2G cannot handle complex data such as videos.
- 2G required strong digital signals to help mobile phones work.
- 2G cannot handle complex data such as videos.
- 2G required strong digital signals to help mobile phones work. [3]

2.4 3G (THIRD GENERATION) OF WIRELESS COMMUNICATION

3G refers to the third generation. It is based on the International Telecommunication Union (ITU) family of standards, launched in 2000. The main aim of the 3G technology was to provide high data speed.

It uses Wide Band Wireless Network in which clarity is increased. It also offers services, access to TV/video, services like Global Roaming. It works with a range of 2100MHz and has a bandwidth of 15-20MHz used for High-speed internet services, video calling.[3]

There are some main features of 3G as following:

- It provides speed up to 2 Mbps.
- It provides high bandwidth and data transfer rates to adapt web-based applications and audio/video files.
- It provides faster communication.
- Provide sending/receiving large email messages.
- It provides more security/video conferencing/3D gaming.

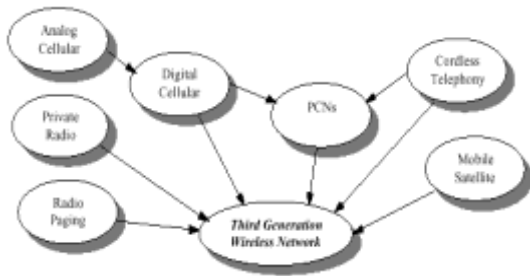


Fig-3 Third Generation Wireless Network

2.5 4G(FOURTH GENERATION) OF WIRELESS COMMUNICATION

4G refers to the fourth generation, offers a downloading speed up to 100 Mbps. 4G provides features of 3G and also provides additional services like Multi-Media, to watch T.V programs with more clarity and send data faster than third generations. 4G technology considers LTE (Long Term Evolution).[4] 4G is being developed to adapt the QoS(Quality of services) and rate requirements according to coming applications like, Multimedia Messaging Service (MMS), wireless broadband access, minimal services like data and voice, and other services that use bandwidth. [5]

There are some main features of 4G are as following:

- It provides speed from 10Mbps to 1Gbps.
- It provides high-quality streaming video.
- It is a combination of Wi-Max and Wi-Fi.
- It provides high security.
- It uses more battery.
- It is hard to implement.
- It needs complicated hardware.[6]

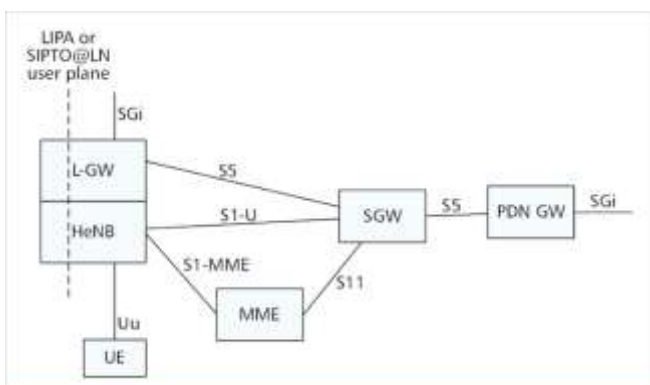


Fig -4: Fourth Generation Wireless Network

2.6 5G(FIFTH GENERATION) OF WIRELESS COMMUNICATION

5G refers to the Fifth Generation, which started from late 2010.5G technology includes better levels of connectivity and coverage area. The main focus of 5G is on the world-Wireless World Wide Web (WWWW).5G uses advanced technologies to deliver ultra-fast internet and multimedia experience for customers. LTE advanced networks transform into supercharged 5G networks. To achieve a higher data rate, 5G technology uses millimetre waves and an unlicensed spectrum for data transmission. [7]

2.6.1 There are some main features of 5G are as following:

- It highly supports the WWW (Wireless World Wide Web).
- It provides high speed and high capacity.
- It provides large data broadcasting in Gbps.
- Provides better multi-media services, newspapers, watch TV programs with HD Clarity.
- It provides faster data transmission than the previous generation.
- Large phone memory, clarity in audio/video, dialing speed, interactive multimedia, voice, streaming video, etc.
- It expanded multimedia services.
- Low cost-per-bit.
- It uses more battery.
- It is hard to implement.
- It needs complicated hardware.[8]

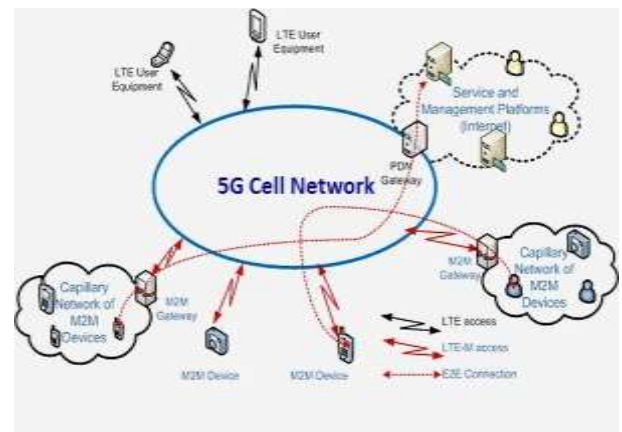


Fig-5: 5G Cell Network

2.7 6G(SIXTH GENERATION) OF WIRELESS COMMUNICATION

6G refers to the sixth generation. The satellite is used for voice, data, internet, and video broadcasting; the earth imaging satellite networks are for environmental information collection and weather, and the navigational

satellite network is for the global positional system (GPS). It will be considered as cheap and Fast Internet Technology to provide very fast Internet speed access on air. Specially designed Nano Antennas will be implemented at different locations or positions along roadsides, villages, malls, airports, hospitals, etc to broadcast such high-speed electromagnetic signals.[9]

There are advantages of 6G:

- It provides ultra-fast access to the Internet.
- Data rates will be up to 10-11 Gbps.
- It will home automation and other related applications.
- It will provide Smart Homes, Cities and Villages
- It can be used in the production of energy from the galactic world.[9]

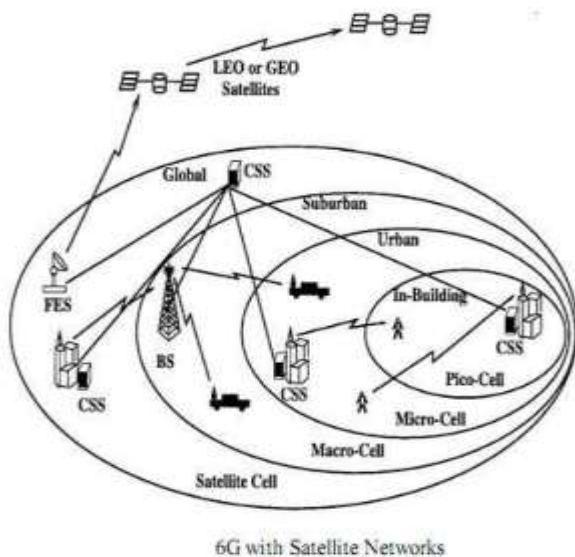


Fig-6: 6G with Satellite Networks

Table 1 Comparison between Various Generations of Wireless Mobile Technology [11]

| Gener.→ Features↓ | 0G | 1G | 2G | 3G | 4G | 5G | 6G | 7G |
|-------------------|----------------------|-----------------|------------------|--|--|------------------|--------------|-------------------|
| Year | 1960-1970 | 1970-1980 | 1980-1990 | 1990-2000 | 2000-2010s | 2015 onwards | After 5G | After 6G |
| Switching | Circuit | Circuit | Circuit & Packet | Packet except for circuit for an air Interface | Packet | Packet | Packet | Packet |
| Speed | Below 1Kbps | 2.4Kbps | 64Kbps | 2Mbps | 200Mbps to 1Gbps | 1Gbps and Higher | 10 to 11Gbps | 11Gbps and Higher |
| Technology | PTT, MTS, IMTS, AMTS | Analog Cellular | Digital Cellular | Broadband CDMA, IP | Unified IP & seamless combination of broadband | 4G+WWWW | 5G+satellite | 6G+Space Roaming |

2.8 7G(SEVENTH GENERATION) OF WIRELESS COMMUNICATION

7G refers to the seventh generation, is going to be the foremost advanced generation in the mobile communication network. it's similar because the 6G for global coverage but it'll also describe the satellite functions for communication. In 7G, there'll be some researches on demand issues just like the use of mobile during moving condition from one country to a different country, because the satellite is occupation constant speed and within the specific orbit, the standards and therefore the protocols for cellular to the satellite system and satellite to satellite communication system. The dream of 7G can only be true when all standards and protocols are defined. It is different, is direct HD video broadcasting for newsgathering purposes likewise. This might be the simplest solution of cost on lower level users. 7G will be using the global facility to provide space roaming so that people around the world can connect without giving extra roaming cost.

It is the additional version of 6G with the space roaming using the satellite. [10]

| | | | | | | | | |
|---------------------|----------------------|------------|--|--|--|---|----------------------------|----------------------------|
| | | | | | LAN, WAN, WLAN, PAN | | | |
| Services | Pre-Cellular Systems | Voice only | Digital voice and short messaging, packetized data | Integrated high-quality audio, video, and data | Dynamic information access, wearable devices | Dynamic information access, wearable devices with AI capabilities | Ultra-fast Internet access | Ultra space Roaming |
| Multiplexing | FDMA | FDMA | TDMA, CDMA | CDMA | CDMA | CDMA | CDMA | CDMA |
| Core Network | PSTN | PSTN | PSTN | Packet Network | Internet | Internet | Internet | Space Roaming and Internet |

3. CONCLUSIONS

The Wide scope and advancement in Mobile Wireless Communication will have a great impact on the future of mobile telecommunication technology. The increased interest to get the new services and advanced services over mobile stations will let the Industry empowers more researches over the technology. Every new generation introduced is an improvising version of the previous generation. These Generations will make ease to use the Telecommunication with more betterment and reliability. The increased version of the mobile generation will surely provide better security services too.

After studying different aspects like, features, advantages, disadvantages and applications of different generations of wireless communication technologies, we can conclude that till date, 7G (Seventh Generation) of Wireless Communication Technology is the most advanced and easiest technology to be used. It provides wide range of features which will definitely give an ease to the Human Resources. It will soon get additional features and being converted into a new generation of wireless communication technology.

4. REFERENCES

[1] "The Future of Mobile Wireless Communication Networks", a paper published by Xichun Li, Abudulla Gani, Rosli Salleh, Omar Zakaria in 2009 International Conference on Communication Software and Networks.

[2] Fumiyuki Adachi, "Wireless past and Future: Evolving Mobile Communication Systems". IEICE Trans. Fundamental, Vol.E84-A, No.1, January 2001.

[3] "wireless terrestrial communication; cellular telephony", Ariel Pashtun. Aware networks, Eolss publishers, Inc. 2006.

[4] Noah Schmitz "The Path To 4G Will Take Many Turns". Wireless Systems Design, (March 2005).

[5] "Review Paper on Development of Mobile Wireless Technologies (1G to 5G)" from "International Journal of Computer Science and Mobile Computing".

[6] Mishra, Ajay K. "Fundamentals of Cellular Network Planning and Optimization, 2G/2.5G/3G...Evolution of 4G", John Wiley and Sons, 2004.

[7] Molisch, Andreas, "Wireless Communications". WileyIEEE Press, (2005).

[8] <https://www.rfpage.com/evolution-of-wireless-technologies-1g-to-5g-in-mobile-communication/>

[9] <https://www.lifewire.com/1g-vs-2g-vs-2-5g-vs-3g-vs-4g-578681>

[10] "Future of Wireless Technology 6G and 7G" from "International Journal of Electrical and Electronics Research".

[11] <http://www.askbasic.com/telecom/1g-2g-3g-3-5g-4g-5g-6g-and-7g-technologies-and-difference-between-them/>

5. AUTHOR PROFILES

[1] Mr. Indra Kishor, Asso.Prff. Department of CSE. , Arya Institute of Engineering and Technology, Jaipur.

[2] Pragya Rathore, B.Tech Scholar, Department of CSE, Arya Institute of Engineering and Technology, Jaipur.

[3] Pooja Samaria, B.Tech Scholar, Department of CSE, Arya Institute of Engineering and Technology, Jaipur.