

A BRIEF HISTORY OF MOBILE GENERATIONS AND SATELLITE WIRELESS COMMUNICATION SYSTEM

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ABSTRACT: The purpose of this article is details study related to mobile generations technology of communication. In today's world, wireless mobile communication plays a vital role in information exchange which demands high speed data transfers, users' fast access to data, secure and reliable network protocols that too at low costs. Moreover, the ability to connect instantly and anywhere, made them more popular and successful. However, wireless is not a recent technology. Several wireless technologies are available with their own advantages and disadvantages. This research article also presents a review of several generations which are being used viz. 0G, 1G, 2G, 3G, 4G and 5G, along with the future generations which are under research like 6G, 7G and 7.5G.

Keywords: Mobile Phone, Wireless Communication Technology. 5G Architecture, Evolution from 0G to 7.5G, etc.

I. INTRODUCTION

Mobile communication has become a major source for information exchange throughout the world. Year by year, we see lot of development in the world of mobile technology. All the mobile technologies which have been developed up to now have really improved our way of living. It has always been our aim to empower world community with top class internet capabilities, thereby designing a future-proof groundwork for new ideas as well as opportunities to build on, so as to start the revolution of communication. Wireless Technology helps in transferring information over a distance without the use of wires. The distance can be short or it can be of thousands of kilometers. A new subscriber signs up after every 2.5 seconds .With the increasing demands in the field of mobile and data communications, the sole aim is to connect users as fast as possible. Mobile communication deals with talking, text or sending data as well as image files through a wireless network, which is a technology in which the information is transmitted as well as received using microwaves. We have been continuously looking at the growing mobile technology which is driving mobile devices at a very fast speed. Gadgets supporting mobility have become very powerful and useful as well as very handy by being small in size. We see different uses of these devices everywhere, thereby making lives of all of us very easy and interesting also. Throughout the world, mobile devices availability is expanding rapidly with different features and technologies which are making our lives really better than before. It is only through this mode of communication that we are in touch with people we need to reach, it can be either work related or for some personal reasons. We are capable of sending important files anywhere in the world within a very short time thereby addressing business needs. Also we can get on spot approval for vital decisions, so as to enrich our lives. It is making communication possible for those who live in remote parts of the world. Loved ones living very far from each other have become close, no matter in which part of the world they live. Actually mobile communication has brought the world together, which is really an amazing situation. We saw as early as 1940s, the invention of mobile phones when some engineers working at AT&T came with the development of cells for base stations of mobile phones. Mobile devices have come up with different faces, if we go into the history of mobile phones; we see that the first device was not an actual phone. They were actually two way radios, allowing users such as taxi drivers to communicate. Rather than using base stations with separate cells with signal passing between cells, the very first mobile phone network was based on a powerful base station allowing communication in a much wider area.

II. HISTORY OF MOBILE GENERATIONS

History was created in April 1972 with first call made on a mobile phone. “G” refers to generation, related to next generation wireless technologies. Mobile phones started out coming in the market with Motorola introducing the first mobile phone on 3 April 1973. Generation of these phones were known as 0G mobile phones in which different technologies were used like push to talk, mobile telephone system, improved mobile telephone system etc. Martin Cooper, an employee of Motorola Company is considered as key player as he developed the first mobile phone. Before him, handsets were used in vehicles, but he came with the development of first truly portable mobile phone. We have gone through a very big change in the generation of mobile communication. Each of the generation is making us faster, secure as well as more reliable as compared to previous ones. It is hard to overcome this reliability factor. We see smart phones as our companions today and we are dependent on these devices in large number of ways. Below we start with the generation 1G of mobile world, moving towards all the latest development that has been done up to 7.5G connectivity. In this paper the birth of different generations of mobile wireless technology with their advantages and significance are presented. In past few years, mobile wireless communication has experienced different generations of technology mainly from 0G to 4G. A snapshot of future technologies such as 5G, 6G and 7G has also been shown providing immense scope for innovative research and development. Wireless Technology helps in transferring information over a distance without the use of wires. The distance can be short or it can be of thousands of kilometers. A new subscriber signs up after every 2.5 seconds .With the increasing demands in the field of mobile and data communications, the sole aim is to connect users as fast as possible. In this paper the birth of different generations of mobile wireless technology with their advantages and significance are presented. In past few years, mobile wireless communication has experienced different generations of technology mainly from 0G to 4G. A snapshot of future technologies such as 5G, 6G and 7G has also been shown providing immense scope for innovative research and development.

TABLE [1]: COMPARISON OF ALL GENERATIONS OF MOBILE TECHNOLOGIES

| Technology → Features ↓ | 1G | 2G | 3G | 4G | 5G |
|----------------------------|----------------------------|---|---|--|---|
| Start/ Deployment | 1970 – 1980 | 1990 - 2004 | 2004-2010 | Now | Soon (probably 2020) |
| Data Bandwidth | 2kbps | 64kbps | 2Mbps | 1 Gbps | Higher than 1Gbps |
| Technology | Analog Cellular Technology | Digital Cellular Technology | CDMA 2000 (1xRTT, EVDO) UMTS, EDGE | WiMax LTE Wi-Fi | WWWW(coming soon) |
| Service | Mobile Telephony (Voice) | Digital voice, SMS, Higher capacity packetized data | Integrated high quality audio, video and data | Dynamic Information access, Wearable devices | Dynamic Information access, Wearable devices with AI Capabilities |
| Multiplexing | FDMA | TDMA, CDMA | CDMA | CDMA | CDMA |
| Switching | Circuit | Circuit, Packet | Packet | All Packet | All Packet |
| Core Network | PSTN | PSTN | Packet N/W | Internet | Internet |

III. VARIOUS GENERATIONS OF MOBILE

[1] ZERO GENERATION (0G – 0.5G)

Wireless telephone started with what you might call 0G if you remember back that far. In those pre-cell days, you had a mobile operator to set up the calls and there were only a handful of channels available. 0G refers to pre-cell phone mobile telephony technology, such as radio telephones that some had in cars before the advent of cell phones. Mobile radio telephone systems preceded were the predecessors of the first generation of cellular telephones; these systems are called 0G (zero generation) systems. These early mobile telephone systems can be distinguished from earlier closed radiotelephone systems in that they were available as a commercial service that was part of the public switched telephone network, with their own telephone numbers, rather than part of a closed network such as a police radio or taxi dispatch system. These mobile telephones were usually mounted in cars or trucks, though briefcase models were also made.

[2] FIRST GENERATION (1G)

The first generation of cellular systems used analog radio technology. Analog cellular systems consist of three basic elements: a mobile telephone (mobile radio), cell sites, and a mobile switching center (MSC). A mobile telephone communicates by radio signals to the cell site within a radio coverage area. The cell site's base station (BS) converts these radio signals for transfer to the MSC via wired (landline) or wireless (microwave) communications links. The MSC routes the call to another mobile telephone in the system or the appropriate landline facility. These three elements are integrated to form a ubiquitous coverage radio system that can connect to the public switched telephone network (PSTN). It support speed up to 2.4kbps. Major contributors were AMPS (Advance mobile phone system) was first launched by the US, NMT, and TACS.

[3] SECOND GENERATION (2G)

It is based on GSM or in other words global system for mobile communication. It was launched in Finland in the year 1991. It was the first digital cellular networks, which had a number of obvious benefits over the analog networks they were supplanting: improved sound quality, better security, etc. [1]. 2G technologies have replaced the analog technology by digital communication by providing services such as text message, picture message and MMS. All text messages are digitally encrypted in 2G technology. This digital encryption allows for the transfer of data in such a way that only the intended receiver can receive and read it. There are 3 different types (FDMA, TDMA/GSM, and CDMA) of 2G mobile technologies are designed with different working methods, properties and specifications.

[4] THIRD GENERATION (3G)

The third generation of mobile systems provides high speed data transmissions of 144kbps and higher. It comes with enhancements over previous wireless technologies, like high-speed transmission, advanced multimedia access and global roaming. 3G is mostly used with mobile phones and handsets as a means to connect the phone to the Internet or other IP networks in order to make voice and video calls, to download and upload data and to surf the net. 3G will support multimedia applications such as full-motion video, video conferencing and Internet access. The data are sent through the technology called Packet Switching. Voice calls are interpreted through Circuit Switching. It is a highly sophisticated form of communication that has come up in the last decade.

[5] FOURTH GENERATION (4G)

The Fourth Generation of mobile communication upgrade existing communication networks and is expected to provide a comprehensive and secure IP based solution where facilities such as voice, data and streamed multimedia will be provided to users on an "Anytime, Anywhere" basis and at much higher data rates compared to previous generations.

[6] FIFTH GENERATION (5G)

In 5G, researches are related to the development of World Wide Wireless Web (WWWW), Dynamic adhoc Wireless Networks (DAWN) and Real Wireless Communication. The most important technologies for 5G technologies are 802.11 Wireless Local Area Networks (WLAN) and 802.16 Wireless Metropolitan Area Networks (WMAN), Ad-hoc Wireless Personal Area Network (WPAN) and Wireless networks for digital Communication. Some features of 5G Technology are given below:

- ❖ 5G is a completed wireless communication with almost no limitation; somehow people called it REAL wireless world
- ❖ Additional features such as Multimedia Newspapers, also to watch T.V programs with the clarity as to that of an HD T.V.
- ❖ We can send Data much faster than that of the previous generations.
- ❖ 5G will bring almost perfect real world wireless or called “WWW: World Wide Wireless Web
- ❖ Wearable devices with AI capabilities.

[7] SIXTH GENERATION (6G)

Sixth Generation technologies use a combination of the latest in radio and fiber optics technology. We deliver through via line of sight which means we don't have to rely on the copper cable or base. The 6G mobile system for the global coverage will integrate 5G wireless mobile system and satellite network. The telecommunication satellite is used for voice, data, internet, and video broadcasting; the earth imaging satellite networks is for weather and environmental information collection; and the navigational satellite network is for global positional system (GPS). It is assumed that 6G will proffer the speed of 1GB datatransfer. 6G mobile communication networks can integrate satellite communication networks and 5G to make global coverage. The four different countries which developed these satellite systems are; the GPS by USA, the COMPASS system developed by China, the Galileo system developed by EU and the GLONASS system by Russia. Handoff and roaming will be the big issues in 6G because these satellites systems are different networks. 6G has four different standards namely Pico cell, Micro cell, Macro cell, satellite cell. So the handoff and roaming must take place between these four networks but how it will occur is still to be to be answered.

[8] SEVENTH GENERATION (7G)

These mobile networks are like the 6G for global coverage but it will also define the satellite functions for mobile communication. In satellite system, the telecommunication satellite will be for voice and multimedia communication; navigational satellite will be for global positional system (GPS) and earth image satellite for some extra information like weather update. The 6G mobile wireless networks will support local voice coverage and other services. The 7G will be the most advance generation in mobile communication but there will be some research on demanding issues like the use of mobile phone during moving condition from one country to another country, because satellite is also moving in constant speed and in specific orbit, the standards and protocols for cellular to satellite system and for satellite to satellite communication system. The dream of 7G can only be true when all standards and protocols are defined. The major factor here will be cost of phone call and other services. It provides seamless movement of mobile phone from one country to the other. This will be major benefits for frequent international travelers.

[9] FUTURE GENERATION [7.5G]

It provides the very high speed of peak download and peak upload of data rate. Here space time block codes are used to view the high definition of video broadcasting. Within a second we can download the five films that are 20 GB files and upload the 15 GB files or any datum. Therefore it also navigates the satellite networks techniques, hence using the OFDM methodology and FEC for the speed of communication process. It is possible technique only when achieve the higher bandwidth and improves the satellite cell sensitivity with its signal fidelity. The benefits of 7.5 G can easily communicate to the other even they are in the centre of the sea.

IV. THEORETICAL FRAMEWORK

5G Technology is a name used in various research papers and projects to indicate the next most important stage of mobile communication standards beyond the 4G standards presently, 5G is not a term officially used for any particular specifications. 3GPP standard release beyond 4G and LTE. The implementation of standards under a 5G umbrella would likely be around the year of 2020. Key terms of 5G Technology:

1. 5G is a completed wireless communication with almost no limitation; somehow people called it real wireless world
2. Additional features such as Multimedia Newspapers, also to watch T.V programs with the clarity as to that of an HD TV.

3. We can send Data much faster than that of the previous generations.
4. 5G will bring almost perfect real world wireless or called “WWW: World Wide Wireless Web
5. Real wireless world with no more limitation to access and zone issues.
6. Wearable devices with AI capabilities.
7. Internet protocol version 6 (IPv6), where a visiting care-of mobile IP address is assigned according to location and the connected network.
8. One unified global standard.
9. Pervasive networks providing ubiquitous computing: The user can simultaneously be connected to several wireless access technologies and seamlessly move between them (See Media independent handover or vertical handover, IEEE 802.21, also expected to be provided by future 4G releases). These access technologies can be a 2.5G, 3G, 4G or 5G mobile networks, Wi-Fi, PAN or any other future access technology. In 5G, the concept may be further developed into multiple concurrent data transfer paths.

V. CONCLUSIONS

In this article we have discussed the existing (0G-4G) and future (5G-7.5G) wireless mobile communication generations. The first generation (1G) has fulfilled the basic mobile voice, while the second generation (2G) has introduced capacity and coverage. This is followed by the third generation (3G), which has quest for data at higher speeds to open the gates for truly “mobile broadband” experience. Moreover, the demanding requirements in terms of QoS, were realized by the fourth generation (4G). The 5G mobile networks will focus on the development of the user terminal where we can watch an HD TV channel in our mobile phones without any disturbance. 5G technology offers high resolution for passionate mobile phone consumer. Satellite network will be used from 6G mobile communication systems and onwards. A new revolution of 5G technology is about to begin because 5G technology going to give tough completion to normal computer and laptops whose marketplace value will be affected. 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. 5G network technology will release a novel age in mobile communication. The 5G mobiles will have access to different wireless technologies at the identical time and the terminal should be able to merge different flows from different technologies. 5G technology offers high resolution for passionate mobile phone consumer. The 5G mobile phones will be a tablet PC. Many mobile embedded technologies will develop.

ACKNOWLEDGMENTS

One of the authors **DR. HRIDAYA NAND SAH** takes this opportunity to thank Prof. (Dr.) B.K. Azad (M.Sc., PhD), Retired Principal, R.D.S. College, Muzafferpur Former HOD, Department of Mathematics R.D.S. College, Muzafferpur, Bihar (INDIA), for numerous discussions, valuable suggestion and help in preparing the present research paper for publication. I also feel indebted to some scientific spiritualists who provided us the enthusiasm to undertake scientific studies with a wholesome attitude.

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