



Review Paper on Generation of Mobile Communication Technologies (1G to 5G)

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Abstract

Wireless technology is very much in demand these days. A newly wired network was needed to get online. Even wired telephones are becoming a thing of past. Nowadays, Mobile networks have full-blown tremendously in the last four decades. The inception was the Cellular concept which was introduced with 1G, where, 'G' stands for generation networks. It had grown so fast, from generation to generation, nurturing from 1G, 2G, 3G, and finally, launched to 4G. And, today, we are using 4G technologies. And, also, 5G technology is almost ready to spread its wings to storm this competitive global mobile network market. Integrated Research on 5G is being carried on and is expected to come in usage commercially by 2020. The birth of 5G technology can be an optimal solution to the various problems that we are facing in the current technologies nowadays. 5G will emerge as an intelligent technology that will reduce the number of different technologies to a single entity of a global standard. This paper is mainly focused on the development of mobile wireless communication network from 1G to 5G and how they are different from each other and their advantages and disadvantages they possess.

Key words- Wireless Technology, Wired telephone, Cellular concept, 1G, 2G, 3G, 4G and 5G.

INTRODUCTION

Over the most recent couple of decades, Mobile Wireless Communication systems have encountered a remarkable change. The mobile wireless Generation (G) for the most part alludes to an adjustment in the idea of the framework, speed, technology, frequency, data capacity, latency etc. Each generation has some standards, different capacities, new techniques and new features which separate it from the past one. The first generation (1G) mobile wireless communication network was analog utilized for voice calls only. The second generation (2G) is a digital technology and supported text messaging. The third-generation (3G) mobile technology provided higher data transmission rate, increased capacity and gave interactive media bolster. The fourth generation (4G) incorporates 3G with fixed internet to help wireless mobile internet, which is an advancement to mobile technology and it beat the limitations of 3G. there was an increase in the bandwidth and reduced the cost of resources [1]. 5G stands for fifth Generation mobile technology and will be unveiled as another unrest in a portable market which will change the way of utilizing cell phones within the very high bandwidth. A user will never experience ever before such high esteem technology which will incorporate all kinds of advanced features and 5G technology will be the most intense and in huge demand in the coming future.

EVOLUTION

Mobile communication had turned out to be well known in the most recent couple of years because of its quick change from 1G to 5G in the field of mobile technology. This change is because of the necessity of service compatible transmission technology and high increment in telecom clients. Basically, Generation refers to change in nature of service compatible transmission technology and new frequency bands. In 1980, for the first time the mobile cellular system was introduced, and since then, the mobile communications had experienced tremendous changes which pursued its vast sustainment.



Figure 1 Evolution of mobile wireless technology

LITERATURE REVIEW

First Generation, 1G

These telephones were the first and the foremost cell phones to be utilized, which was presented in 1982 and finished in mid-1990. It was utilized for voice benefits and depended on the technology called Advanced Mobile Phone System (AMPS). The AMPS framework was frequency modulated and utilized the frequency division multiple access (FDMA) with a channel limited to 30 KHz and with a frequency band of 824- 894 MHz[5].

The primary highlights of 1G are:[20] Speed- 2.4 Kbps, Allows voice brings in one nation, Use analog signal, Poor voice quality, Poor battery life, Large phone measure, Limited capacity, Poor handoff unwavering quality, Poor security, and Offered low level of spectrum efficiency.

It presents Mobile Technologies, for example, Mobile Telephone System (MTS), Advanced Mobile Telephone System (AMTS), Improved Mobile Telephone Service (IMTS) and Push to Talk (PTT). It has low capacity, problematic hand-off, poor voice quality and no security at all since voice gets back to were played in radio towers, making these calls helpless to undesirable in listening stealthily by outsiders.[1]

The main drawback of 1G technology is that it uses analog signals rather than digital signals, this is less effective means of transmitting information, it is slower, and the signals cannot reach as far in terms of secluded areas so 2G is coming to overcome these problems.

Second Generation (2G)



2G alludes to the second generation based on GSM and was developed in the late 1980s. It utilizes digital signals for voice transmission. Fundamental concentrate of this technology was on digital signals and gives services to convey content and provide picture message at low speed (in kbps). It utilized the bandwidth of 30 to 200 KHz. Three types of developments took place in second generation wireless communication system, IS-54(TDMA) in 1991, IS-95(CDMA) in 1993, and IS-136 in 1996. Besides 2G, 2.5G framework utilizes packet switched and circuit switched domain and gave data rate up to 144 kbps example GPRS, CDMA, and EDGE [5].

The primary highlights of 2G and 2.5G are [20] Data speed was up to 64 kbps, Use digital signals, Enables services, for example, instant messages, picture messages and MMS (Multimedia message), Provides better quality and capacity, Required solid digital signals to enable cell phones to work. On the off chance that there is no network coverage in any particular range, digital signals would frail, Need to enhance transmission quality, Spotty coverage, Unfit to help complex data for example video, System capacity, Cell towers has a constrained coverage region, and Unexpected dropped calls.

The GSM Technology was persistently enhanced to give better services which prompted improvement of advanced technology between 2g and 3g. Provides phone calls, Send/ get email messages, Web browsing, Speed: 64-144 kbps, Camera cell phones, and Take a period of 6-9 mins. To download a 3 min. MP3 tune.[20]Weaker digital signal is one of the main disadvantage of 2G technology to overcome this problem 3G technology is coming.

Third Generation (3G)

3G depends on GSM and was propelled in 2000. The point of this technology was to offer high-speed data. The first technology was enhanced to permit data up to 14 Mbps and additionally utilizing packet switching. It utilizes Wide Band Wireless Network with which lucidity is enhanced. It likewise offers data services, access to TV/ video, new services like Global Roaming. It works at a range of 2100 MHz and has a bandwidth of 15-20 MHz utilized for high- speed web access, video chatting [5].

The primary highlights of 3G are:[20] Speed 2Mbps, Typically called advanced mobile phones, Increased bandwidth and data transfer rates to oblige web-based applications and furthermore, video documents, Provides quicker communication, Send/get expansive email messages, High speed web/ greater security/ video conferencing/ 3D gaming., Large capacities and broadband capabilities, TV streaming/ Mobile TV/ Phone calls, To download a 3 minute MP3 tune just 11 sec-1.5 minutes time required, Expensive charges for 3G licenses services, It was test to assemble the frame work for 3G, High bandwidth required, Expensive 3G phones, and Large cell phones.

The 3G mobile system was called as UMTS (Universal Mobile Telecommunication System) in Europe, while CDMA 2000 is the name of American 3G variant. Additionally, the IMT 2000 has acknowledged another 3G standard from China, i.e. TD-SCDMA, WCDMA is the air-interface technology for UMTS [1].

The service provider has to pay the high amount for 3G licensing & agreements, the problem with the availability of handsets in few regions and their costs, 3G networks need different devices and the power consumption is high is the main disadvantages of 3G to overcome this 4G is coming.

Fourth Generation (4G)

A term MAGIC is used to explain the 4G technology [9]. M= mobile multimedia

A= any time any where G= global mobility support
 I= integrated wireless solution C= customized personal service
 4G wireless technology should put together different presently existing and prospect wireless network technologies (e.g. OFDM, MC-CDMA, LAS-CDMA and Network- LMDS) to make sure

that free movement and faultless roaming from one technology to another is achieved [10].

4G offers a downloading speed of 100 Mbps. 4G gives same features as 3G and extra services like multi-media newspapers, to watch television programs with greater clearness and send data substantially speedier than past generations[3].

LTE (Long-term evolution) is considered as 4G technology. 4G is being created to accommodate the QoS and rate requirements set by expected applications like wireless broadband access, Multi-media Messaging Service (MMS), video chat, Mobile TV, HDTV content, Digital Video Broadcasting (DVB), minimal services like voice and data and different services that use bandwidth [2].

The fundamental highlights of 4G are: [20] Capable of give 10Mbps-1Gbps speed, High quality streaming video, Combination of Wi-Fi and Wi-Max, High security, Provide any sort of service whenever according to user necessities anyplace, Expanded multi-media services, Low cost per-bit, Battery consumption is more, Hard to implement, Need convoluted hardware, and Expensive equipment required to actualize next generation network

Obtaining the information from the people illegally becomes easier, the 4G technology involves the possibility of some interference though not much, It is capable of being attacked (jamming frequencies) and the invasion of the privacy increased. The consumer is forced to buy a new device to support the 4G , New frequencies

means new components in the cell towers, Higher data prices for the consumers, Your current equipment cannot be compatible with the 4G network , It has different network bands for different phones It is expensive & hard to implement .4G technology requires expensive infrastructure for operation , This is embodied in the eNodeB's (Access Points) & mainly EPC's (Gateways or Routers), 4G is optimal for data rates , but not necessarily the best for Voice services , Some of these services are offloaded (delegated) to Wi-Fi or 3G/GSM cellular technologies on your phone. To overcome the above disadvantages of 4G, 5G is coming.

REQUIREMENT FOR FIFTH GENERATION WIRELESS COMMUNICATION SYSTEM



As a customer point of perspective, the main divergence among present generations and coming 5G techniques ought to be as per the following[12]:Lower latency, To help gadgets in the internet of things, Higher capacity then 4G, Latency decreased fundamentally contrast with LTE, Enhanced coverage, Concurrent vast number of connections for wireless sensors, Data rates approx 100Mbps, Improved signalling efficiency, Enhanced and creative data coding techniques, Millimeter waves frequencies for wireless access and back haul utilize, Smart beam antenna systems, Bring down blackout problem, Not destructive for well being, Less expensive traffic charges, World Wide Wireless web, More secure and SDR security, Lower battery utilizations, Numerous simultaneous data exchange ways, and Accommodating being used of artificial intelligent in human life for securing communications

Above examined brings up out the requirements for 5g. The fifth generation is to be another technology that will give all the available applications, by using just a single worldwide device and joining about the whole already alive communication infrastructure. Fifth generation stations will be empowered of an unlikely multimode and cognitive radio. The fifth-generation cellular networks will accentuation on the advancement of the user



stations where stations will have passage to different wireless technologies at the same time and will combine different issues from different technologies. Also, the station will make the best choice between different wireless/cellular access network providers for likely service [13].

5G technology will be deployed by 2020. It provides the great feature to users, having higher data rate 1Gbps or higher. 5G support 4G+WWWW (4th Generation +Wireless World Wide Web). It operates on IPv6 protocol. Fifth generation technology utilizes CDMA and BDMA and millimeter wireless which approves speed is higher than 100Mbps at full speed and more prominent than 1Gbps at low speed. The fifth-generation networks work on encoding type known as OFDM [11]. 5G aim to provides unlimited access and information at anywhere anytime with high speed. It is a complete wireless communication with no limitations. The fundamental highlights of 5G are:[20]

It is exceptionally supportable to WWW (wireless world wide web), High speed, high capacity, Provides substantial broadcasting of data in Gbps, Multi-media newspapers, watch TV programs with the clarity (HD clarity), Faster transmission that of the previous generation, Large phone memory, dialing speed, lucidity in sound/video, Support intelligent multimedia, voice, streaming video, web and other, and More successful and appealing.

Table 1. Correlation of Mobile Generation: 1G To

| Technology | 1G | 2G | 3G | 4G | 5G |
|--------------------|---|---|---|--|--|
| Start/Deployment | 1970-80 | 1990-2004 | 2004-2010 | Now | Soon(probably by 2020) |
| Data Bandwidth | 2 Kbps | 64 Kbps | 2Mbps | 1Gbps | 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 Services | Analog phone cells | 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 issues | Limited data rates, difficult to support demand for internet and e-Mail | Real works fail to match type, failure of WAP for internet access | Battery use is more, required complicated and expensive hardware | ? |

5G

CONCLUSION

Mobile has become the essential part of our everyday life. Their current development is the outcome of various generations. In this paper we review the various generations of mobile wireless technology, their technologies use in various generations, performance, advantages, and disadvantages of one generation over other

and comparison. This field is still full of research opportunities and research on upcoming technology 5G is carry on which is coming in 2020.

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