

Upcoming Technologies: 5G and 6G

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Abstract: *The world wide uprising in mobile is changing our lives in terms of the technologies used, the way we work and connect. In this paper, an effort has been made to study the existing generations of mobile wireless technologies in terms of performances, advantages and disadvantages. The paper deals with the evolutions and descriptions of the various technologies used with their significances and advantages over one another. In the past, 4 or 5 generations of mobile wireless technologies came into existence, namely from 0G to 4G. 5G technology is still not officially used but it will be launched very soon. Currently, researches are being made on 6G with certain assumptions that are described in the paper.*

Keywords: 1G, 2G, 3G, 4G, 5G, nano core, 6G

1. Introduction

Mobile wireless industry started its technology in the early 1970s. Earlier it has experienced 4 or 5 generations of technology revolution. The cellular concept was introduced in 5G technology abbreviated as 5th Generation mobile technology. One can use the cell phones within high range of bandwidth. The 5G include all types of advanced features that makes it very useful for users. 5G is highly supportable to www(wireless world wide web). 6G technology is the upcoming name in the field of wireless communication and it will enable devices to connect internet to broadband wireless access.

2. The Evolution of “G” from 1st to 5th Generation

The telecommunication field has provided many useful services in last few years. 6 billion people use cell phones, so we are going to analyze the various generations of cellular system from 1st generation to 6th generation. Currently, there are four generations in the mobile industry. These are respectively 1G- the first generation, 2G- the second generation, 3G- the third generation and 4G- the fourth generation. 5G was started from late 2010s and still is under process while 6G is assumed that it will be in the market in 2020s.

2.1 1G Generation

This is the first generation of wireless telephone technology. These are analog telecommunication standards that were developed in 1980s and were continued until being replaced by 2G digital telecommunications. 1G technology replaced 0G technology that featured mobile radio telephones. Through 1G, a voice call gets modulated to a higher frequency of about 150MHz and is transmitted between radio towers using Frequency-Division Multiple Access (FDMA).

But its failure in some fields is unfavorable to its successors. It has low capacity, poor voice links and unsecured communication.

2.2 2G Generation

The second generation cellular telecom network were commercially launched on GSM standard in 1991. This generation was planned mainly for voice transmission with digital signal and speed up to 64kbps. This provided facility of short service message (SMS), picture messages and MMS (multimedia message), the phone conversation were digitally encrypted. The bandwidth is 30-200 kHz. This technology can be divided into Time-Division Multiple Access (TDMA) and Code-Division Multiple Access (CDMA) based standards depending on the type of multiplexing used.

2.3 2.5G Generation

It is used to describe 2G systems that have implemented a packet switched domain in addition to circuit switched domain. It provides datarate up to 144kbps. GPRS, EDGE and CDMA2000 are 2.5 technologies.

2.4 3G Generation

This uses wideband wireless network with which clarity increases and perfection is achieved like a real conversation. The data is sent through packet switching and voice call is interrupted through circuit switching. It is based on the standards that comply with International Mobile Telecommunications-2000(IMT-2000) specifications. It operates at a range of 2100 MHz and has a bandwidth of 15-20 MHz. It finds its application in wireless voice telephony, mobile internet access, fixed wireless internet access, video calls and mobile TV.

With the help of 3G, we can access many new services too.

One such service is Global roaming. Its advantage is that it provides greater security but its biggest disadvantages are its cost and poor performance. Although it is possible that some of the weaknesses at physical layer will still exist in 4G system.

2.5 4G Generation

This generation in addition to usual voice and other services of 3G, provides mobile broadband internet access, for example to laptop with wireless modems, to smart phones and other mobile devices. It promises a downloading speed of 100 Mbps. It finds its applications in mobile web access, high definition mobile TV, video conferencing, 3D television and cloud computing. Also it sends data much faster than that of previous generations.

2.6 5G Technology

5G stands for 5th generation wireless system. It denotes the next major phase of mobile telecommunication beyond the current 4G standards. Here researches are being made on development of Wireless World Wide Web (WWW), Dynamic Ad hoc Wireless Network (DAWN) and Real Wireless World. It has 10 times more capacity than previous generations. Lower cost than its predecessors and expected throughput speed of 1 Gbps and connectivity speed of 25 Mbps. It is a complete wireless communication with no limitations and is based on Open Wireless Architecture (OWA).

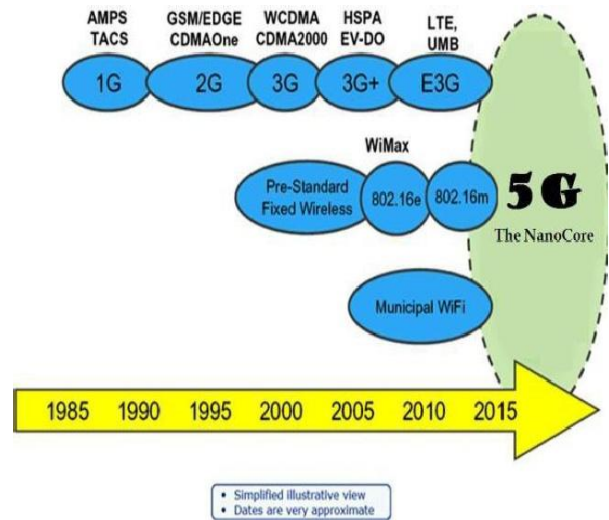


Figure 1: Evolution of Different Generations

3. Architecture of 5G



Figure 2: Architecture of 5G

4. Comparison

Table 1: Comparison Table of Different Generations

Generation	Definition	Throughput Speed	Technology	Time Period	Features	Disadvantages
1G	Analog	14.4 kbps	AMPS, NMT, FDMA	1970-1980	Phones are used for voice only	Unsecured Communication
2G	Digital narrow band circuit data	9.6/14.4 kbps	TDMA, CDMA	1990-2000	The phone conversations were digitally encrypted by allowing multiple users on a single channel	At higher frequencies, if weaker digital signal is transmitted by a cell phone, it may not be sufficient to reach a cell tower
2.5G	Packet Data	171.2 kbps (peak) 20-40 kbps	GPRS	2001-2004	Introduced data services for mobile starting with SMS, MMS, picture messages	It does not necessarily provides faster services
3G	Digital broadband packet data	3.1 Mbps (peak) 500-700 kbps	CDMA 2000, UMTS, EDGE	2004-2005	Universal access and portability across different device types are made possible	Poor performance and costly
3.5G	Packet data	14.4 Mbps (peak) 1-3 Mbps	HSPA	2006-2010	Supports higher throughput	Costly

4G	Digital broadband packet All IP very high throughput	100-300 Mbps (peak) 3-5 Mbps 100 Mbps (Wifi)	WiMax, LTE, Wifi	2010-2012	Provides mobile broadband internet access, cloud computing, IP telephony. Worldwide roaming is not a distant dream	Connectivity is still limited to certain specified carriers and regions, poor battery life
5G	Flat IP network	Expected up to 1 Gbps	OFDM, LAS-CDMA	Probably 2015-2016	It is not used officially, 10 times more capacity than predecessor, lower cost and more faster	
6G	Not Yet	Expected in terabit range	Not yet	Probably in 2020s	It can be a combination of nano core and artificial intelligence,	

5. How 5G will Help

5.1 Key Concepts

- Real wireless world with no limitations with access and zone issues.
- Wearable devices with AI capabilities
- IPv6, where a visiting care of mobile IP address is assigned according to location and connected network
- One unified global standard
- Smart radio
- The user can simultaneously be connected with several wireless access technology
- Multiple concurrent data transfer path
- Also supported by LAS-CDMA, OFDM, Network-LMDS
- The router and switch technology provides high connectivity
- High altitude stratospheric platform station (HAPS) system

5.2 Features of 5G

- Offers high resolution for cell phone users with large bandwidth
- Advanced billing interface
- Subscriber supervision tools for fast actions
- Large broadcasting of data in Gigabyte
- Traffic statistics can be made more accurate
- Remote diagnostics has a great future
- Supports virtual private network

5.3 Beyond 5G

- Complete wireless network with no limitation
- Incredible transmission speed in terabit range
- Zero distance connectivity between people
- It will maximize data throughput and input output operations per second
- High internet access speed without any fluctuations can be achieved
- The future scope will be incredible if nanocore combines with artificial intelligence
- Intelligent Robot can be controlled
- We might have a single nanocore for all nations
- Probability of expansion in data center configuration options

6. Conclusion

5G technology and its beyond technology is going to prove a new revolution period for mobile wireless communication. Also nanotechnology and cloud computing are the next great technology wave. The upcoming technologies has a bright future because it can handle best technologies with reasonable costs that can be easily used by the customers. The upcoming technologies will promote concept of nanocore where all the network operators will be connected to one single core and have one infrastructure, regardless of their access technologies. As in evolution and explosion, many will become extinct but some will change the world. So we pursue the strategy of diversified portfolio

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