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A Study on Mobile Networks and Their Generations

Dr. Kiran B Malagi[1], Adarsh K M[2], Brijesh Reddy[3], Anusha T R[4], Bindhu R[5]
Associate Professor, Department of Information Science and Engineering[1]
Students, Department of Information Science and Engineering[2,3,4,5]
Alva's Institute of Engineering and Technology, Mijar, Mangalore, Karnataka

Abstract: *The main purpose of this paper is to provide detailed and comprehensive research on the emergence of various cell phone manufacturing technologies in wireless communication. In this paper we focus on studying mobile generations from 1G to 5G and future mobile phones. The first generation has fulfilled the basic needs of the voice, and the second generation has delivered a high volume and a large amount of integration. The third generation included high-speed data transfer which gave its users a 'mobile broadband experience'. The fourth generation will provide access to a variety of telecommunications services, including advanced mobile services, supported by mobile networks and fixed networks. We have compared all the mobile phones that have been created so far based on their technology.*

Keyword: Mobile Communications, Wireless, LTE, 1G, 2G, 3G, 4G, 5G, 6G, Mobile Generations, WCDMA, CDMA, TDSCDMA, Telecommunications, Broadband.

I. INTRODUCTION

Cell phone communication has completely changed the way people use communication to share information. From the original 1G technology where information was exchanged in the form of basic voice signals while 2G came up with many features that add features with new capacity and integration capabilities. This is followed by 3G which was designed to achieve greater speed with mobile broadband information. The recently developed 4G offers many telecommunications services. Wireless communication has become very technologically advanced from 1G in the late 80's to 4G in 2010. Although communication technology has improved in a short period of time, customers worldwide they are not content to use these platforms and expect greater speed and services than current technology. This has led to the development of a new telecommunications study named 5G by 2020, which has promised revolutionary changes in communication and its technological advancement to accelerate communication at lightning speed. This paper will provide an overview of previous mobile communication technologies and current technologies as well as an overview of the future technology.

1.1 1G Technology

The first generation of wireless cellular communication is based entirely on analog signal. The analog system was first used in North America, and the system was used in Europe. This type of analog mobile system is primarily based on voice only, not data. First Generation Analog Telecommunication standard was introduced in 1980 and continued until it was replaced by Second Generation Digital Telecommunication.

Its successor, 2nd generation (2G) using digital signals, 1G wireless networks are used as analog radio signals. With 1G, the voice call can be switched on at high frequencies of about 150 MHz and above as it transmits radio towers. This is done through the Frequency Division Multiple Access (FDMA) process. In terms of overall communication quality, 1G stands at the bottom of the following. It has low volume, poor voice links, and no security at all as the voice call is also played on radio towers, making this call easy for unwanted third parties.

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1.2 2G Technology

2G mobile services are a step forward for 1G service by providing short messaging (SMS) and multimedia messaging (MMS) services as opposed to 1G which focuses mainly on voice transmission services. The bandwidth required for 2G transmission is about 20-200KHz. In the second generation, the telecommunications industry has experienced significant growth in both its subscribers and additional value-added services. Improved 2G phones introducing GSM technology. The global mobile communications system or GSM uses digital flexibility to improve voice quality but networks that provide limited data services. As the demand for mobile phones grows, the 2G network company has continued to improve transmission and installation quality.3G Technology

1.3 3G Technology

It is the third generation of wireless communication. Comparing 1G & 2G technology with 3G technology 3G, in 3G Data transfer speed has increased from 144Kbps-2Mbps.3G multimedia mobile technology, commonly referred to as a smart phone. In 3G, bandwidth and transmission rate have been upgraded to meet web-based applications as well as audio and video files. The speed at 3G is much higher compared to 2G. This generation offers a variety of strategies such as voice chat on the wireless web, the web web, video calls and TV. In 3G, there are three types of mobile access technology,

1. CDMA (code division multiple Accesses): Proposed by North American wireless standards groups.
2. WCDMA (Wide band code division multiple access): The first international W-CDMA FOMA commercial service was launched by NTT Do Como in Japan in 2001.
3. TDSCDMA (Time Division separates multiple access synchronization codes): Proposed groups of China's wireless Telecommunication standards.

1.4 4G Technology

4G offers a voice call at a higher price, and offers more services than 3G. In this generation there has been a dramatic change, providing broad bandwidth, high security and fast internet access. This generation is based on Long Term Evolution (LTE). LTE is a 4G standard used worldwide to transmit data over mobile networks.

The terms 4G and LTE are often used in the same way; however, they do not mean the same thing. There are different levels of 4G, and LTE is one of the most common. Provides 10x speed for 3G networks. The speed detected by the International Telecommunication Union (ITU) is 100 Mbps. 4G was first shipped to Stockholm and then to Oslo Norway in 2009 via Long-Term Evolution (LTE). So that is being introduced around the world. 4G promotes games, HD recording & HQ video conferencing.

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4 Cell Phone Generations Compared

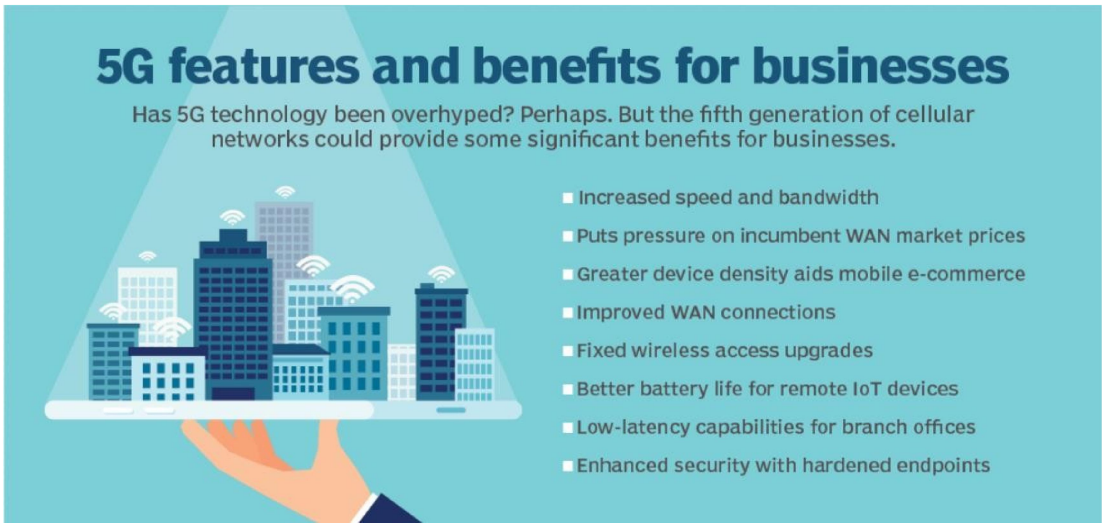
	Standards	Technology	SMS	Voice Switching	Data Switching	Data Rates
1G	AMPS, TACS	Analog	No	Circuit	Circuit	N/A
2G	GSM, CDMA, EDGE, GPRS	Digital	Yes	Circuit	Circuit	236.8 kbps
3G	UTMS, CDMA2000, HSPDA, EVDO	Digital	Yes	Circuit	Packet	384 kbps
4G	LTE Advanced, IEEE 802.16 (WiMax)	Digital	Yes	Packet	Packet	up to 1 Gbps

1.5 5G Technology

5G, this is not yet working but has already been developed and is ready for use in countries like South Korea, China, Sweden and Japan. These generations bring a higher standard of mobile communication than 4G. The development of 5G makes it as real wireless as the World-Wide Wireless Web (WWWW). A 5th generation communication network based on the integration of 4G with the Wireless System for Dynamic Operating Mega Communication (WISDOM), which is a unique concept focused on new wireless connectivity.

Four big challenges facing 5G:

1. **Frequency bands:** Although 4G LTE already works on fixed frequency bands of less than 6GHz, 5G requires frequent frequencies of up to 300GHz. Some are better known as mm Wave. Those bands can carry more volume and deliver faster speeds. Wireless carriers still need to bid for higher spectrum bands as they build and deploy their 5G networks.
2. **Deployment and coverage:** Although5G offer significant increases in speed and bandwidth, its limited bandwidth will require more infrastructure. The challenge is that 5G antennas, should be able to handle multiple users and data, reach shorter distances. Extra and multi-horned horns will probably need to be installed in buildings or houses in order to increase the width and maintain a constant speed.



3. **Build and Buy Costs:** Building a network is expensive, and carriers will increase revenue by increasing customer revenue. Like LTE systems that created high initial costs, 5G will probably follow the same path. And it's not just about building a layer over an existing network, but laying the foundation for something completely new.

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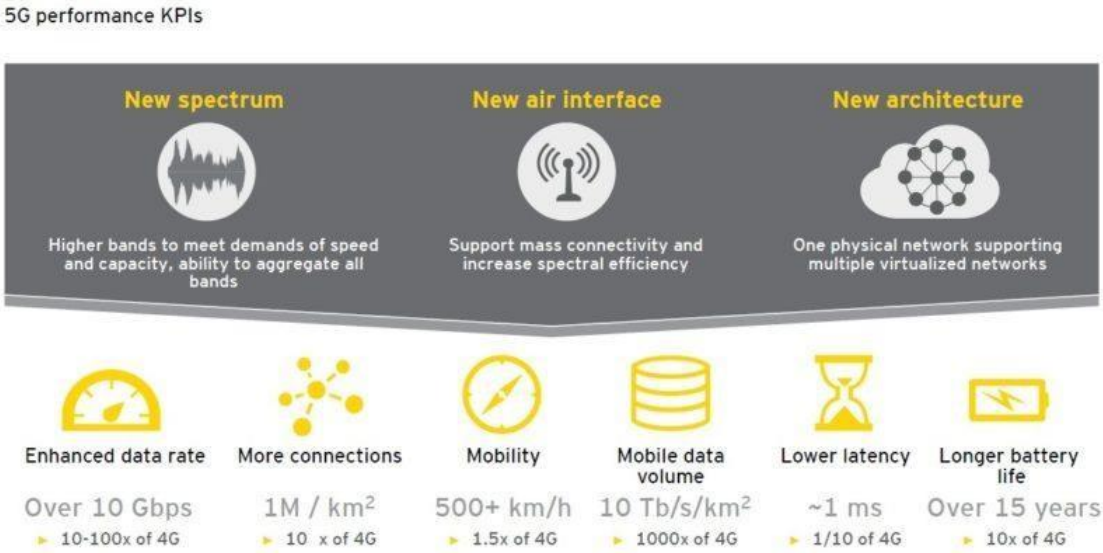
4. **Security and Privacy:** This can be a challenge for any data-driven technology, but the release of 5G will have to deal with both common threats and cyber security. Although 5G falls under the Authenticator and Master Agreement (AKA), a system designed to establish trust between networks, it will now be possible to track people nearby using their phones.



1.6 6G Technology

Features	5G	6G
Year	2020	May be 2030
Speed	1Gbps and Higher	10 to 11Gbps
Technology	4G+www	5G+Satellite
Standards	Wi-max LAS, WCDMA, OFDM, UWB, Network- LMDS, IPv6	GPS, COMPASS, GLONASS, Galileo System
Core network	Internet	Internet
Handwork	Horizontal & Vertical	Horizontal & Vertical

II. Comparison between 5G and Possible Capabilities of 6G

With 5G networks still spreading around the world and many parts of the world still using 4G and 3G networks, it seems too early to throw the word 6G. We have been able to move from 1G to 5G in such a short time, so 6G is a natural progression towards faster and better wireless connectivity.

Aside from the fact that 6G is still only a decade old, a few telecommunications companies are actually taking it seriously right now, here are the indications that 6G development is already in the first phase:

- The Federal Communications Commission (FCC) has taken the initiative to launch the terahertz wave spectrum (frequencies between 95 GHz and 3 THz).
- In early 2018, the University of Oulu in Finland announced funding for its 6G Flagship program on research materials, sticks, software, and other materials that will be needed to deliver 6G.
- 6G research has started from Virginia Tech with companies like Samsung and LG.
- Shortly after China unveiled 5G in 2019, the Department of Science and Technology announced that it would launch 6G research and development with the help of government departments, research institutes,

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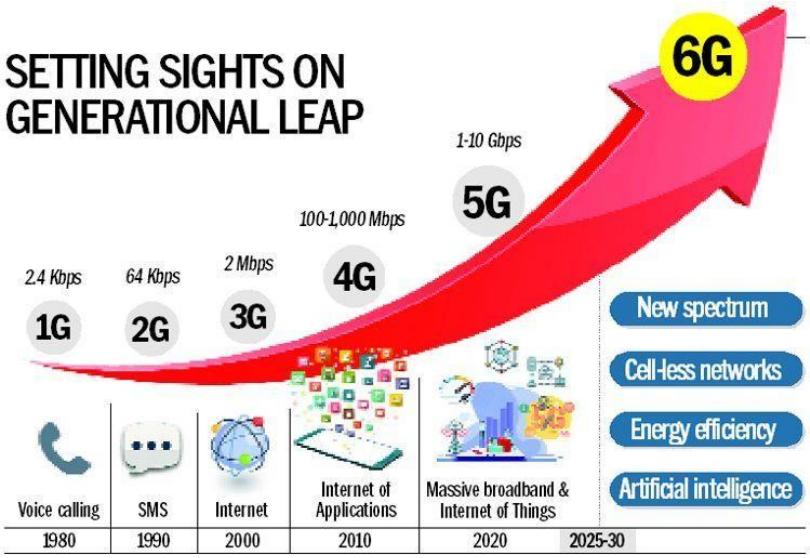
universities, and businesses.

- China sent 6G satellite to orbit in late 2020 to test high-speed using terahertz waves.

III. Conclusion

In the above page, we learned about different wireless technologies and generation bands of 1G, 2G, 3G, 4G, 5G and 6G possibilities. The current generation wants everything faster which is why we are planning for the next generation of 6G wireless network. 6G will meet most of the needs of the current and next generation user.

The paper shows how the emergence of wireless technology came about and how they came to be. Advanced wireless technology has proved to be very useful in the field of communication in developing it. With the latest research and development, the user's goal is given more than the user makes it more reliable for the user. We can say that generations take us to another level of communication and make it seem possible.



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