



## ORIGINAL RESEARCH PAPER

## Engineering

### 5G: THE FUTURISTIC MOBILE COMMUNICATION TECHNOLOGY

**KEY WORDS:** 5th Generation, Mobile phones, Smart phones, Internet system

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#### ABSTRACT

All new 5G mobile communication technology is expected to rollout by 2020. Every one is looking forward to know, what it is? It is therefore crucial to know the direction of research and developments enabling 5G technologies. This paper provides an inside of this technology's key goals and associated challenges. How this generation of mobile technology is different from previous generation is presented here in brief. Beyond mobiles, it will have lot of impact in industrial environment at global level.

#### 1. INTRODUCTION:

Every one is talking of 5G technology these days, without knowing much of it. This next generation communication network is just not only the fast data rates and greater capacity, as most of us take it but it's about the interaction between humans and large number (extending to billions) of inelegant devices (1-3). It is assumed that by 2020, 50 billion devices will be connected to the global IP network, which would appear to present a challenge (4). This new technology, which is evolving fast, promises a reliable hyper-connected world to us. 5G new radio (NR) technological innovations and developments are presenting significant challenges. Certainly, one is expected to have more connected world with 5G internet system. This technology will make our mobile phones much smarter. It will also open doors to a lot of different consumer as well as industrial unbelievable applications because they are so futuristic. In a true "networked society" remote controlled operation of appliances and critical commercial machines over a reliable 5G network will be possible with zero delay. Real-time control of machines by using mobile devices will be possible, making the Internet of things (IoT) more available to all.

The first fairly substantial development in the 5G technology was in South Korea, April 2019, where SK Telecom claimed 38,000 base stations, KT Corporation 30,000 and LGU plus 18,000 in six major cities. They were using 3.5 GHz spectrum in NSA mode and tested download speed were 193 to 430 Mbps. In May 2019, Verizon opened 5G services on a very limited number of base stations in US cities of Chicago and Minneapolis using 400 MHz of 28 GHz spectrum of NSA mode with download speed in Chicago were from 80 to 900 Mbps and upload speed were from 12 to 57 Mbps and round the trip delay time was 25 msec.

#### 2. Different Generations of Mobile Technology - Evolution

During last two decades, the world has witnessed rapid evolution of mobile phone technologies from the 2G Global System for Mobile (GSM) to the 4G Long Term Evolution-Advanced (LTE-A) system. The main motivation has been the need of more bandwidth and lower latency.

The first generation (1G) mobile technology was analogue in nature with low band with of 30 kHz and was introduced in 1980s. Its speed was limited to 2.4 kilobits per second (kbps). The mobile phones working on this technology was quite large and not handy at all. In 1991, 2G Global System for Mobile (GSM) technology started in Finland with higher bandwidth, 30-200 kHz and was significantly efficient compare to 1G. It offered services like voice calls, SMS, text messages, picture messages and MMS with a speed of 64 kbps. Here all text messages sent by 2G phones are digitally encrypted and with greater data security. Together with performance enhancements measures some allied

parameters, such as jitter, inter channel interference, connectivity, scalability, energy-efficiency, and compatibility with legacy networks, are also taken into consideration when developing new mobile technology.

Next generation called 3G, brought quality changes in the voice and text messages with much higher bandwidth, 15-20 MHz. First 3G network was launched in Japan in 2001. When technology advanced from the 2G GSM to the 3G Universal Mobile Telecommunication System (UMTS), higher network speed and faster download speed allowed real-time video calls. This technology reached the US in 2003 and by BSNL in Bihar in 2008. In 2010, MTNL brought 3G services to Delhi and Mumbai.

Presently operating, 4G services brought a revolution in the field of mobile telecommunication. 4G truly constitutes mobile broadband. This technology works totally on packet technology and offers bandwidth of 100 MHz.

#### 3. Goals and Challenges in the Way of 5G:

One of key goal is to achieve is better level of connectivity and coverage and achieve data rate of 10 Gbps, in contrast to 1 Gbps in 4G network. Another key goal is ultra-low latency, means time it takes to send packet of data between to connected devices. Presently in 4G network, the latency rate is 50 ms but in 5G, it will be reduced to 1 ms. It is required for activities requiring quick response such as virtual reality, driverless cars, factory robots, emerging technology of Internet of Things (IoT), machine to machine communication, on line gaming etc. However, it is likely in time to come, the primary use of 5G will be beyond delivering of services on personal mobile devices but to provide services beyond expectations.

There are many challenges ahead in evolving the 5G technology. The standard for 5G technology has not been finalized yet and there are many problems with it because of business interests of various countries. Many groups in many countries are working on it (5-9). To achieve 1000× speed enhancement, the first step is to use the mm-wave spectrum (3-300 GHz range). At NYU WIRELESS, have experimented for 5G with an mm-wave propagation model and path losses in two cities, New York and Austin (10,11). 5GIC, UK's only research body dedicated to 5G research, recently achieved a remarkable breakthrough in wireless speed gain: a speed of 1 Tbps point-to-point communication. Its members are also considering ultra-low latency-sensitive application services for futuristic purpose (12). The Electronics and Telecommunications Research Institute (ETRI), Korea, in its GIGA 5G project, is focusing mainly on improving reliability, Device-to-Device communication technologies, and the mobile hotspot network (MHN) protocol stack (13,14). 5Gforum, the Republic of Korea, is also seeking innovations

and market research for the future standard. In another part of the world, 4G-Americas is the "voice of 5G" for the Americas. It has recently published (October 2015) its white papers on 5G evolution and recommendations, where information centric networking (ICN) is emphasized.

Much higher bandwidth, possibly 1-2 GHz, also poses new challenge for affordable cost, low weight and small size, hand set development. The 5G technology operates at higher frequency spectrum (3-300 GHz) than 4G mobiles, bound to create real challenges in terms of the circuit design, use of technology and development of proper system. This technology is going to use mm- waves which are unable to cross solid objects, therefore buildings, trees etc acts like obstacles for these waves. Apart from that bad weather – rains or presence of humidity in air cause absorptions of mm-waves. The attenuation of wave signal due to absorption and obstacles generated interference provides a big challenge to service provider to give good connectivity to the users. In order to offset this, many base stations with network of mini base stations are required. It means large number of installation of antenna towers and involving huge amount of investments and large amount of technical manpower. Issues around spectrum, which had already been witnessed with 4G, are likely to cope up.

Many groups and organizations are opposing installation of 5G networks, assuming it may be danger for life. Many studies are linked cell phone and cell tower radiations to memory loss, head aches, changes in vision and mood, sleep disorder, and leukemia etc. The rollout of 5G and infrastructure will only increase our risk of suffering major health issues down the road. It will make all of us to large exposure of unwanted harmful EM-Radiations emitted by gadgets and towers. However industry proponents of 5G technology argue that EMR are of safe level and of non- ionizing nature. Now the big question for future studies is whether there is any mechanism by which the non-ionizing radiation could harm human health?

#### 4. Indian Scenario Related to New Technology:

A government of India panel on 5G says that we plan to rollout new technology in market by 2020 but experts of IT predict it to be by 2022 (15). Panel also says that network of earlier generation mobile technology will continue to remain in use for many more years. Government of India making all efforts to keep the set timeline of 5G technology rollout in India because it could have an economic impact of about one trillion dollars. In June 2018, Department of Telecommunication (Do T) had invited various top companies such as Ericsson, Nokia, Samsung, Cisco and NEC, for running trials and for development of 5G in India. DoT had willfully excluded China Telecom equipment vender Huawei for these trials, though, in Feb., 2018 Huawei had conducted 5G trials with Bharti Airtel in India, where it achieved successfully broadband speed of more than 3 Gbps in 3.5 GHz spectrum band. America ban on Huawei by President Trump may slow down the Global connectivity and effect may be on Indian progress in this field. USA is putting pressure on different countries, not to buy 5G network equipment from Huawei, but Britain and Germany are not accepting USA request. DoT is pushing hard to bring 5G to India as soon as it is available for commercial rollout globally. Ericsson has installed a 5G test bed at IIT Delhi for developing applications in the broadband and low latency area. This will help to develop India- specific usage scenarios and applications.

We will have to wait, when and how the things unfold after the rollout of 5G technology in India. One thing is sure that it will bring revolutionary changes in the field of cell phone communication and various applications in different industries.

#### 5. CONCLUSION

This article provides basic information of 5G mobile

technology and its present status. Problems attached with its developments are present. Comprehensive review of some recent initiatives by various groups toward flexible, and mostly dominant 5G mobile communication standards are given as references China at present is well ahead of many country including USA. Indian Government is also in the race to rollout this technology in the country by year 2020. However, there are many issues that could not be presented because of space limitations.

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