

## Future of 5G Wireless System

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**Abstract:** The purpose of this review paper is detailed study of 5G technology and what can we expect from this technology in future. Several research areas in 5G technology are going on, which will help us to create awareness of improvement in this technology, its potential applications and presumption, and the difficulties surrounding it. 5G Technology stands for 5th Generation Technology. In this technology, highest priority is given to the mobile users in comparison with others. 5G technology is to operate smart phones within very high bandwidth, it is designed having superior connectivity for other types of devices aside from smart phones. The 5G technology is an ultimate experience that the people have never experienced before. The 5G technology includes various types of advanced attributes which going to make it one of the ruling technology in the coming years. This paper also presents an overview on the road to future of 5G technology and what users can look forward to from it

**Key Word:** 5G, WWW, VoIP

## I. INTRODUCTION

In recent years, we have observed the tremendous modifications in the world of technology. The 5G is the short form for 5<sup>th</sup> Generation where 5 is the number denoting the improvement in the field of technology. According to dictionary, wireless means "having no wires". There is no physical wired connection in wireless technology between the receiver, instead it is connected through micro and radio waves. The Wireless phone technology came into picture with 1G in the 1980s and was later upgraded to 2G, when people got fascinated by its sending text feature between two cell phones. 2.5G also came into picture before 3G. Gradually the world switched to 3G which granted us the freedom of calling someone, browse the internet at very good speed and send text messages. Many of the features of 4G technology was amplified and were made available, and it was only made possible because of the 3G wireless technology. People were able to make phone calls, browse the internet at good speed, send text messages and the user can download and upload the multimedia files in a short span of time without any issues. Afterwards, LTE which stands for long term evolution was added to 4G. LTE became the most consistent and fastest modification of 4G and it began challenging technologies like WiMax (Worldwide Interoperability for Microwave Access). Both the technologies gave alike results; however, it was essential to establish a standard of living so it can be used by everyone. <sup>2</sup>. The same was done by LTE, it made the 4G technology even faster and this laid the understructure of 5G technology. In the late 2010 5G started developing and it is a complete wireless system with almost no restrictions. It has superior connectivity; fastest data transmission and it is highly supported to Wireless World Wide Web (WWW). So, it can be said that there is going to be a major development in the way we are living now. Several researches are being done on Dynamic Adhoc Wireless Network (DAWN), Real Wireless World and Wireless World Wide Web (WWW).5G focuses on VoIP (Voice Over IP) – enabled devices so that the user can practice a high level of call volume and data transmission. The one of the important characteristic of this network is that it allows the user to connect to no. of multiple technologies all at once and can shift between them whenever required. Flat IP and IPv6 is supported by the 5G technology. <sup>1</sup>. The recent direction of 5G technology has a great future. The paper is divided into following sections.

- Evolution from 1G to 5G
- Architecture of 5G

- Features and Applications of 5G
- Emerging fields in 5G and it's future
- Conclusion

## II. REVIEW ON EXISTING LITERATURE

### A. Evolution from 1G to 5G

Due to the fast uprising of mobile technology, mobile communication has become an important part of our day to day lives since the last few years. They have revolutionized from generation to generation over the years.

#### 1) 1st Generation (1G)

1<sup>st</sup> Generation of technology evolved in 1980s. It is based on analog systems and it was the first time that any network could make a phone call possible between two people. It introduced various mobile technologies like Advanced Mobile Telephone System (AMTS), Mobile Telephone System (MTS), Push to Talk (PTT) and Improved Mobile Telephone Service (IMTS). Voice call modulation is done in 1G by using Frequency Division Multiple Access (FDMA) and it uses analog radio signals. It allowed the voice calls in only one country and its speed was upto 2.4 Kbps.

Shortcomings of 1G-

- Limited capacity
- Poor battery life
- Large phone size
- Poor voice quality

To overcome these shortcomings 2G was introduced in the technology world.

#### 2) 2nd Generation (2G)

2G stands for 2<sup>nd</sup> generation network which was launched in Finland in the year 1991. This system works on the principle of digital signals. Apart from just having voice call feature, there were some additional features like MMS, e-mails and SMS that were introduced through 2G. Its speed was upto 64Kbps.

TDMA which stands for Time Division Multiple Access and CDMA which stands for Code Division Multiple Access are two of the schemes of modulation used in the 2G technology. It's frequency band lies in the range of 850-1900 MHz. 2G works more effectively as compared to 1G because it gives security for the users at both the ends i.e., sender's and receiver's end. The members of this generation are 2G, 2.5G and 2.75G. 2.5G technology is similar to 2G with a add on of GPRS i.e., General Packet Radio Services which is not endowed commonly by the previous technologies. It introduced web browsing and supported speed upto 64-144 Kbps.

Shortcomings of 2G-

- It requires strong digital signals to improve the working of cell phones and if there is loss of network coverage, the digital signals would become weak.
- It is not possible to handle data like videos in a 2g network system.

#### 3) 3<sup>rd</sup> Generation (3G)

3<sup>rd</sup> Generation was evolved between the 1990s and early 2000s. So, by 2005 3G was all ready to perform its corresponding tasks and give its performance in the field of computer networks like WLAN, WCDMA, etc and in the area of mobile devices like GPS. One of the application of 3G technology focuses on transferring packets of data more constructively at increased and better bandwidth. As 3G is the development took place after 2G it offers more advanced facilities than 2G. The features which make 3G superior than any other previous generation technologies are that it supports multimedia services, it has access to wireless web, video calling and so much more. Also, it is said that 3G gave birth to smart phones<sup>3,4</sup>. In this technology the data is transferred by using process known as packet switching and the interpretation of voice call is done with help of circuit switching process. Transmission speed of 3G ranges from 125 Kbps to 2Mbps. Features of 3G includes clarity in video calls, superior voice quality, Global roaming, Fast Communication, Internet, watching T.V on mobile, on-line shopping/banking, MMS, 3D gaming, etc. The 3G system offered more security, large capacities and broadband capabilities. Despite the fact that 3G changed a lot of things in the field of wireless technology some shortcomings of 3G were present.

Shortcomings of 3G-

- High bandwidth requirement
- 3G phones supports this wireless technology, and is quite expensive

So, after working on these shortcomings and to enhance the technology birth was given to the 4<sup>th</sup> Generation Technology.

#### 4) 4<sup>th</sup> Generation (4G)

The 4<sup>th</sup> Generation (4G) is the evolved technology after the 3G and 2G technology. This system has been upgraded from the previous generations and it provide us a secure safe IP based network offering services like streamed multimedia, high data capacity that will be rendered to the people on an “ANYTIME, ANYWHERE” basis. 4G allow us to surf and transfer data at much higher data rates compared to previous generations and supported transmission speed upto 100 Mbps.

4G was developed with an aim to include the Quality of Service and rate the demand set by the upcoming applications like MMS, wireless broadband access, HDTV content, some essential services like voice and data, and other facilities that utilizes bandwidth.

LTE (Long Term Evolution) is considered as 4G technology only. But LTE release 10, also known as LTE-Advanced, is considered to be the real step taken in evolution of technology in 4G. Previous versions of LTE are all together combined parts of LTE release 10, which provides it's a customer a network with more forward compatibility and abutment of legacy terminals. Following are some of the applications of 4G network-

- With the help of Tele-medicine, a doctor can check his/her patients and can give them the correct advice.
- With the of this technology the users can track the places around them, also they can collect information about the traffic situations nearby and the localized weather by using his/her phone.
- Video conferencing – users can see as well as communicate with each other.

Some shortcomings of 4G system are as follows-

- Require complicated hardware
- Hard to implement
- Battery use is more

#### 5) 5<sup>th</sup> Generation (5G)

The way of using our mobile phones have definitely changed after the coming of 5<sup>th</sup> generation (5G) technology. People have never seen such high bandwidth and high value technology before. It is a very powerful technology consisting of all the upgraded features which can led to it's huge demand in the coming days. The massive assembling of such inventive technology that is being developed in our devices is astonishing. It is believed that as compared to lunar modules it will be providing thousand times more advanced features and power. With the help of 5G one could also connect his/her laptop to his/her 5G phone to access the broadband internet. It consists of attributes including large phone memory, MP3 recordings, camera, video player, good dialing speed, audio player and so much more which is beyond our imagination

As the demand is increasing of the user day by day, we can now easily replace 4G with 5G technology which differs with every other technology because of having an exceptional access technology called as Beam Division Multiple Access i.e., BDMA or Filter Bank as FBMC multiple access. We can understand the actual logic behind the BDMA strategies by taking into consideration of the idea of base station sharing signals with the mobile stations where each beam is binded with the mobile stations orthogonally and by using BDMA the division of antenna beam with respect to locations of the mobile stations takes place so that the it can be accessed openhandedly by the mobile stations. Which furthermore increases the actual potential of the system and is considered to be the major process of communication. The concept of moving to 5G technology is due to the consideration of present changes and it is presumed that these problems can be only be fixed by 5G i.e.

- Consistent quality
- Reduced cost
- End to End lag period has been reduced
- Superior connectivity to devices that have been reported as mass storage.
- Higher capacity
- Higher data rate

The 5G network has 10 times more capacity than the other networks and expected to provide speed upto 1Gbps.

#### B. Architecture of 5G

On comparing the layers of OSI model and 5G mobile network following are the observation made-

**Table No. 1 : Comparison with OSI Model**

OSI Layers	5G Mobile network layers
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1	Application Layer	Application (Service)
2	Presentation Layer	
3	Session Layer	Open Transport Protocol
4	Transport Layer	
5	Network Layer	Upper network layer Lower network layer
6	Data Link Layer	Open Wireless Architecture
7	Physical Layer	

1) OPEN WIRELESS ARCHITECTURE

- Data link layer + Physical layer = Open Wireless Architecture
- Both the layers of OSI models specify about the wireless technology
- Combining these two layers, our 5G network is located on the Open Wireless Architecture

2) NETWORK LAYER

- Classification of network layer is into two sub-layers:
  - (i) For the use of each interface we have Lower network layer
  - (ii) For the use of mobile terminal, we have the Upper network layer
- Execution of IPv6 takes place in the cell phones.
- We can connect our device to several other devices and wireless network simultaneously.

3) OPEN TRANSPORT PROOCOL (OTP)

- Session Layer + Transport Layer = Open Transport Protocol
- Both the networks, wired and wireless differs through the transport layer.

4) APPLICATION LAYER

- Application Layer + Presentation Layer = Application Layer of 5G Network
- It also provides intelligent Quality of Service management for different types of networks.
- The work of application layer also includes to select for the given services the finest wireless connection possible.

The network architecture design of 5G mobile network is proposed by an all-IP based model for mobile networks and wireless interworking abilities which is called as the system model. The number of free radio access technologies and user terminal which plays a very important role in the latest architecture is a part of the system. Inside each terminal each and every radio access technologies is assumed as the IP link to the Internet.

*C. Features and Applications of 5G*

1) FEATURES OF 5G TECHNOLOGY

- To avoid error there are no. of polices related to high quality services.
- One of the greatest feature of this technology is the remote testing technique.
- Big bandwidth shaping for bidirectional and high resolution for users is also offered by 5G.
- The speed for downloading and uploading in 5G is at it's peak
- The 5G network give us the best amplified connectivity all around the globe.
- For faster action subscriber and supervision tool is also provided by the 5G technology.
- All virtual private networks are supported by the 5G technology.

2) APPLICATIONS

- Wearable device with AI capabilities.
- Radio resource management.
- Global networks
- Supports 6th sense technology

- HAPS (High Altitude Stratospheric Platform systems).
- Station VoIP (Voice over IP) enabled device.

#### *D. Emerging fields in 5G and it's future*

5G is on the peak to rise as it has all the potential and capabilities to do wonders all around the globe. The introduction of 5G technology to the people is not only about the change in technology but it is also going to give a whole of a new experience to the mobile users. This 5G technology is arriving with a vision of keeping an eye on energy consumption and reducing the maintenance cost.

According to the studies, Let's see some areas where 5G technology is expecting to give major transformation-

##### 1) BEGINNING OFF WITH NON-STANDALONE 5G

The 5<sup>th</sup> generation network is expected to bring an incredible change in the technology sector. The non-standalone 5G networks would bring a spotlight on showing how exactly the superfast 5G network will be like. It is considered that the simultaneous use of various radio frequency ranges can be practised by the network of 5G. In simple words, for faster speed the network make use of two different higher bandwidths frequencies. We can conclude this by saying that it will be possible to download anything from internet much faster than the 4G LTE network. <sup>6</sup>.

##### 2) INTERNET OF THINGS (IoT)

One of the most prime feature of 5G technology is that it has a major impact on the Internet of Things (IoT). Although we are surrounded with all the devices and sensors having the capability of communicating with each other but they need multiple assets which results in the data capacity draining of LTE. The time has come to replace the normal devices in our home with the smart devices as 5G has the capability of supplying unbeatable speed and providing lower lag period in connectivity of devices which can act as a great help in our day-to-day household work. These devices will receive the instructions through the computing system that are near to them <sup>5,7</sup>. Things will become a lot easy for us to control in many ways like keeping an eye on health monitors, keeping a control on kitchen appliances and so much more. Furthermore, it is been said by the researchers that the role that is being played by IoT today is possible to be played by the 5G technology in the coming years.

##### 3) IMPROVEMENT OF HEALTH CARE SECTOR

The 5G technology has the capability of fundamentally transforming the health care for people that too all across the globe because of the obtainability of URLLC (ultra- reliable low-latency communication) which is a part of this 5G technology. As the URLLC is incharge of decreasing the 5G latency, we are about to witness one of the biggest transformation in the mobile technology and the future world of new possibilities will be unrolled. People suffering from diseases in villages would no longer had to be pressurized to move to the cities for their treatment. Just to get a good level of care and treatment which everybody deserves they don't have to compromise their lifestyle and leave their relatives behind. Aside from this facility we are going to witness a big change in the field of telemedicine, precision surgery, remote surgery and also the physical therapy with the help of AR in the coming future years. In addition to that an important role is expected to be played by the massive Machine-type Communications (MMTC) in the healthcare sector. With the help of it our healthcare sector would be able to make the giant sensor networks which will be used by the doctors to keep an eye on patients, their health and activities by using the sensors in their smartphones, wearable and many other connecting devices.

##### 4) AUTONOMOUS VEHICLES

We have never imagined two vehicles communicating with each other but now with 5G, the time has come to witness this. In future years it is expected that our automobile will have the potential to give its working information and it will also give the details to drivers and automakers about the present condition of roads, details regarding the safety and security of automobile and so much more.

##### 5) BROADBAND IMPROVED

The drastic idea of switching to 5G technology will definitely change the way we communicate with our technology regularly every day. In metro cities, the organizations of wireless technologies are already falling short for full capacity of LTE and it is not able to fulfil the demands of the customers. And infact, in some areas the customers are facing the issue of slow broadband speed as well. Therefore, this is the reason that 5G has added a spectrum in the bands which are used for resolving the issue of broadband traffic.

And according to the statistics the global 5G adoption will be triple till 2021 as shown in fig.1

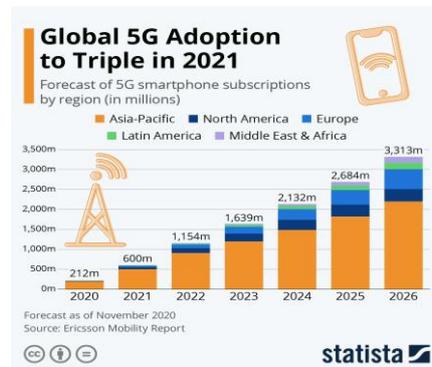


Figure 1: Global 5G adoption will be triple till 2021

### III. CONCLUSION

This survey paper was aimed for giving the bird's eye view on 5G technology, its applications and its future aspects. The uprising of 5G technology is going to give a tough competition to normal computer and laptops who will be facing unfortunate consequences on their marketplace value in future. The latest 5G technology is accessible in the market in affordable price, it's demand will be increasing to peak in the coming time and it is much more reliable than its previous technologies.

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