ISSN: 2278 – 1323
International Journal of Advanced Research in Computer Engineering & Technology (IJARCET)
Volume 5, Issue 6, June 2016

5th GENERATION MOBILE NETWORK

VRUSHALI D.JORWAR

MCA (IMCOST), Mumbai University
C-4,Wagle Industrial Estate, Near Mulund (W)
Check Naka, Thane (w) - 400604

Abstract- 5G Technology stands for 5th generation mobile technology. 5G denote the next major phase of mobile telecommunication standards beyond the upcoming 4G standards. 5G technology will change the way most high bandwidth users access their phones. With 5G pushed over a VOIP enabled device, people will experience a level of call volume and data transmission never experienced before. 5G technology is offering the service in Product Engineering, Documentation, supporting electronic transactions, etc.

As the customer become more and more aware of the mobile phone technology, he or she will look for a decent package all together including all the advanced features a cellular phone can have.

Hence the search for new technology always the main motive of the leading cell phone giants to out innovate their competitors. The goal of a 5G based telecommunication network would ideally answer the challenges that a 4G model would present once it has entered widespread use.

Introduction

The present cell phones have it all. Mobile wireless industry has started its technology creation, revolution and evolution since early 1970s. In the past few decades, mobile wireless technologies have experience 4 or 5 generations of technology revolution and evolution, namely from 0G to 4G.

Today phones have everything ranging from the smallest size, largest phone memory, speed dialing, video player, audio player, and camera and so on. Recently with the development of Pico nets and Bluetooth technology data sharing has become a child's play. Earlier with the infrared

Today phones have everything ranging from the smallest size, largest phone memory, speed dialing, video player, audio player, and camera and so on. Recently with the development of Pico nets and Bluetooth technology data sharing has become a child's play. Earlier with the infrared
feature you can share data within a line of sight that means the two devices has to be aligned properly to transfer data, but in case of blue tooth you can transfer data even when you have the cell phone in your pocket up to a range of 50 meters. The creation and entry of 5G technology into the mobile market place will launch a new revolution in the way international cellular plans are offered.

The global mobile phone is upon the cell phone market.

The dramatic growth in the number of smart phones, tablets, Wearable's, and other data consuming devices, coupled with enhanced applications are expected to use up the extra capacity from additional spectrum and higher spectral efficiency of 4G systems. According to estimates such increase in data rates is expected to continue in the coming years and around 2020, the cellular networks might need to deliver as much as 1000 times the capacity relative to current commercial cellular systems. In parallel, there is a strong drive from every industry sector including utility companies, car and manufacturing industries, as well as health and education sectors to exploit the benefits of wireless connectivity.

Such evolution, combined with the proliferation of wearable wireless devices, will make the Internet of Things (loT) a reality. As per one estimate perhaps as many as 50 billion devices will be connected around 2020. These wireless devices are going to have very diverse characteristics in terms of RF hardware, baseband processing capabilities, and overall platform form factor and cost. Consequently, the nature of applications is also going to be diverse in terms of data rates and latency requirements.

Evolution of Mobile Networks 1G to 5G

Cell phones are used millions and billions of users worldwide. How many of us know the technology behind cell phones that is used for our communication? I have also intrigued about the type of technology used in my phone. What are 1G, 2G, 3G and 4G technologies?1G, 2G, 3G & 4G ("G" stands for "Generation") are the generations of wireless telecom connectivity. In 1945, the zero generation (0G) of mobile telephones was introduced. Mobile Telephone Service, were not officially categorized as mobile phones, since they did not support the automatic change of channel frequency during calls. 1G (Time Division Multiple Access and Frequency Division Multiple Access) was the initial wireless telecom network system. It's out-dated now. The analogue “brick phones” and “bag phones” are under 1G technology. Cell phones era began with 1G.The next era, 2G has taken its place of 1G. Cell phones received their first major upgrade when they went from 1G to 2G.

This leap effectively took cell phones from analogue to digital. 2G and 2.5G were versions of the GSM and CDMA connections. And GSM is still the most popular technology, but with no internet. Fortunately, GPRS, an additional service, is provided over GSM for the purpose of internet access. GPRS has been developed and thus, EGPRS was created. It's more secure and faster than GPRS. Then 3G came, the new Wireless CDMA technology. It is the first wireless telecom technology that provides broadband-speed internet connection on mobile phones. It has been specially made for the demand of internet on smart phones. Further development led to the creation of 3.5G, which provides blazing fast internet connection on phones, up to the speed of 7.2 MBPS. A smartphone can be connected to a PC to share its internet connection and 3G and 3.5G are ideal for this. But, as this WCDMA technology is not available in all regions, its not as popular as GSM yet.

First Generation(1G)

First Generation wireless technology (1G) is the original analogue(An **analogue** or analogue signal is any continuous signal for which the time varying feature (variable) of the signal is are presentation of some other time varying quantity), voice-only cellular telephone standard, developed in the 1980s. 1G technology replaced 0G technology, which featured mobile radio telephones and such technologies as Mobile Telephone System (MTS), Advanced Mobile Telephone System (AMTS), Improved Mobile Telephone Service (IMTS), and Push to Talk (PTT). The main difference between two succeeding mobile telephone systems, 1G and 2G,is that the radio signals that 1G networks use are **analogue**, while 2G networks are digital. Although both systems use digital signaling to connect the radio towers(which listen to the handsets) to the rest of the telephone system, the voice itself during a call is encoded to digital signals in 2G whereas 1G is only modulated to higher frequency ,typically 150 MHz and up. One such standard is NMT (Nordic Mobile Telephone), used in Nordic countries, Eastern Europe and Russia. Others include AMPS (Advanced Mobile Phone System) used in the United States, TACS (Total Access Communications System) in the United Kingdom, JTAGS in Japan, C-Netz in West Germany, Radio com 2000 in France, and RTMI in Italy. A**nalogue** cellular service is being phased out in most places worldwide. 1Gtechnology replaced 0Gtechnology, which featured mobile radio telephones and such technologies as Mobile Telephone System (MTS), Advanced Mobile Telephone System(AMTS), Improved Mobile Telephone Service (IMTS), and Push to Talk (PTT)

- Developed in 1980s and completed in early 1990's
- 1G was old **analogue** system and supported the 1st generation of **analogue** cell phones
- Speed up to 2.4kbps
- Advance mobile phone system (AMPS) was first launched by the US and is a 1G

Second Generation(2G)

2G is short for second-generation wireless telephone technology. Second generation2G cellular telecom networks were commercially launched on the GSM standard in Finland in 1991. 2G network allows for much greater penetration intensity. 2G technologies enabled the various mobile phone networks to provide the services such as text messages, picture messages and MMS (multimedia messages). 2G technology is more efficient.

2G technology holds sufficient security for both the sender and the receiver. All text messages are digitally encrypted. This digital encryption allows for the transfer of data in such a way that only the intended receiver can receive and read it. Second generation technologies are either While a call made from a 1G handset had generally poor quality than that of a 2G handset, it survived longer distances.

Third Generation(3G)

International Mobile Telecommunications-2000 (IMT--2000), better known as 3G or 3rdGeneration, is a generation of standards for mobile phones and mobile telecommunications services fulfilling specifications by the International Telecommunication Union. The use of 3G technology is also able to transmit packet switch data efficiently at better and increased bandwidth. 3G mobile technologies proffers more advanced services to mobile users. The spectral efficiency of 3G technology is better than 2G technologies. Spectral efficiency is the measurement of rate of information transfer over any communication system. 3G is also known as IMT-2000.

- Transmission speeds from 125kbps to 2Mbps
- In 2005, 3G is ready to live up to its performance in computer networking
- (WCDMA,WLAN and Bluetooth) and mobile devices area (cell phone and GPS)

Forth Generation(4G)

4G refers to the fourth generation of cellular wireless standards. It is a successor to 3G and 2G families of standards. The nomenclature of the generations generally refers to a change in the fundamental nature of the service, non-backwards compatible transmission technology, and new frequency bands.3G technologies make use of TDMA and CDMA. 3G (Third Generation Technology) technologies make use of value added services like mobile television, GPS (global positioning system) and video conferencing. The basic feature of 3G Technology (Third Generation Technology) is fast data transfer rates. However this feature is not currently working properly because, ITU 200 is still making decision to fix the data rates. It is expected that 2 Mbit/sec for stationary users, while 348 Kbits when moving or travelling. ITU sell various frequency rates in order to make use of broadband technologies.

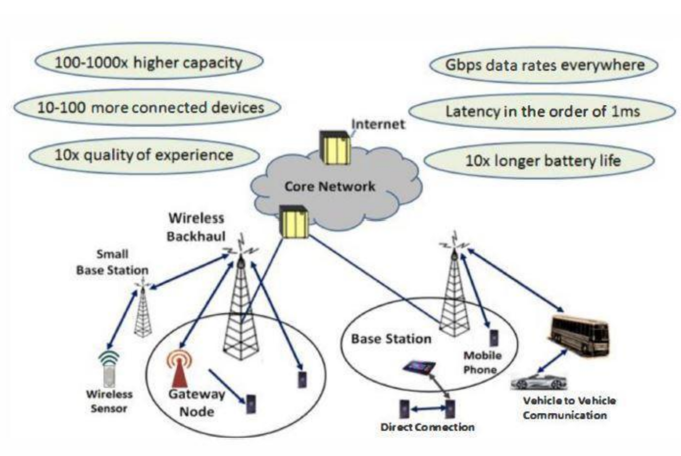
- Mobile TV- a provider redirects a TV channel directly to the subscriber's phone where it can be watched.
- Video on demand- a provider sends a movie to the subscriber's phone.
- Video conferencing- subscribers can see as well as talk to each other.

ISSN: 2278 – 1323
International Journal of Advanced Research in Computer Engineering & Technology (IJARCET)
Volume 5, Issue 6, June 2016

- Tele-medicine a medical provider monitors or provides advice to the potentially isolated subscriber.
- Mobile ultra-broadband(gigabit speed) access and multi-carrier transmission.

Fifth Generation(5G)

5G Technology stands for 5th Generation Mobile technology. 5G technology has changed the means to use cell phones within very high bandwidth. User never experienced ever before such a high value technology. The 5G technologies include all type of advanced features which makes People are not in a circumstance to make use of those benefits in an effective manner LTE might be rigorously used in Commercial/Industrial areas. But think of a common man who utmost utilize LTE for downloading a movie or make a video call. Fact is that there is no such ground-breaking application exists in real world to be utilized by a common man. You might doubt how this verdict is applicable for current innovative world, where have enormous splendid real time applications. Concern is that our present wireless telecommunications is bottlenecked to use those applications in an effective manner. This paper mainly focuses on how a 5G network can provide more approach to a common man to utilize his available possessions in an immense way to make him to feel the real



Technology / Features	1G	2G/2.5G	3G	4G	5G
Start/ Deployment	1970/ 1984	1980/ 1999	1990/ 2002	2000/ 2010	2010/ 2015
Data Bandwidth	2 kbps	14.4-64 kbps	2 Mbps	200 Mbps to 1 Gbps for low mobility	1 Gbps and higher
Standards	AMPS	2G: TDMA, CDMA, GSM 2.5G: GPRS, EDGE, 1xRTT	WCDMA, CDMA-2000	Single unified standard	Single unified standard
Technology	Analog cellular technology	Digital cellular technology	Broad bandwidth CDMA, IP technology	Unified IP and seamless combination of broadband, LAN/WAN/ PAN and WLAN	Unified IP and seamless combination of broadband, LAN/WAN/PAN /WLAN and wwww
Service	Mobile telephony (voice)	2G: Digital voice, short messaging 2.5G: Higher capacity packetized data	Integrated high quality audio, video and data	Dynamic information access, wearable devices	Dynamic information access, wearable devices with AI capabilities
Multiplexing	FDMA	TDMA, CDMA	CDMA	CDMA	CDMA
Switching	Circuit	2G: Circuit 2.5G: Circuit for access network & air interface; Packet for core network and data	Packet except circuit for air interface	All packet	All packet
Core Network	PSTN	PSTN	Packet network	Internet	Internet
Handoff	Horizontal	Horizontal	Horizontal	Horizontal and Vertical	Horizontal and Vertical

Why is there a need for 5G?

The major difference, from a user point of view, between current generations and expected 5G techniques must be something else than increased maximum throughput; other requirements include:

- Lower battery consumption.
- Lower outage probability; better coverage and high data rates available at cell edge.
- Multiple concurrent data transfer paths.
- Around 1Gbps data rate in mobility.
- More secure; better cognitive radio/SDR Security.
- Higher system level spectral efficiency.
- Worldwide wireless web (WWWW), wireless-based web applications that include full multimedia capability beyond 4G speeds.
- More applications combined with artificial intelligent (AI) as human life will be surrounded by artificial sensors which could be communicating with mobile phones.
- Not harmful to human health.
- Cheaper traffic fees due to low infrastructure deployment cost.

5G Landscape and performance requirements

- **Simultaneous transmission and reception (STR)**

Full duplex enables a wireless device to transmit and receive data simultaneously in the same frequency band. It is a promising technology for 5G wireless systems as it potentially increases physical layer capacity by a factor of two, improves latency of feedback mechanisms, provides security in physical layer, amongst other benefits. In full duplex, the received signal at the wireless device is corrupted by direct interference from transmitted signal at the same node. As such, self-interference power is much higher than the received signal. Thus, the key challenge in realizing a full duplex system is how to suppress self-interference, especially before the low noise amplifier (LNA). Recently, there has been revival of interest in the research community in addressing the self-interference suppression problem to enable full duplex. Various RF, analogue, and digital self-interference cancellation techniques have been proposed that can provide up to 120 dB self-interference cancellation, enabling full duplex communications over femto-cell and Wi-Fi devices. Also with all these technologies we are going to need tremendous support from the satellites for the 5G networks the key area where the satellites will be working are ,

- **Coverage**

Satellites can provide the wide coverage to complement and to extend the dense terrestrial cells, which is in line with the ubiquitous coverage targeted by 5G networks They will not be able to match the area spectral efficiency of the 5G terrestrial but they can provide larger cells in a heterogeneous arrangement which can also be used for critical and emergency services and possibly to relieve the terrestrial cells of signaling and management functions in a software defined network configuration.

cells, which is in line with the ubiquitous coverage targeted by 5G networks They will not be able to match the area spectral efficiency of the 5G terrestrial but they can provide larger cells in a heterogeneous arrangement which can also be used for critical and emergency services and possibly to relieve the terrestrial cells of signaling and management functions in a software defined

Integration

Integrating satellites with the terrestrial system is perhaps the key area that enables many advantages. Improving QoE by intelligently routing traffic between the delivery systems and caching high capacity video for onward transmission terrestrially. This can be empowered by the inherent multicast/broadcast capabilities of satellite systems, while propagation latency is no longer an issue thanks to intelligent caching. Off-loading traffic from the terrestrial system to save on valuable terrestrial spectrum opens up the possibility of improving resilience and security using the two.

Backhaul

One of the major issues in 5G is seen to be the increased demands on the backhaul with very large numbers of small cells. High throughput satellites can be used here to compliment terrestrial provision and provide backhaul in areas where it is difficult to do so terrestrially. In a virtualized and SDN it might also be possible to include some of the network node functions on board the satellite and thus save.

Resilience, security and availability

We have seen that this is a key feature in 5G and satellites can be used to provide an overlay network that can take over and keep alive the network in case of man-made or natural disasters. They will not be able to provide the full set of services but they are key to retention of critical and life-saving services. As 5G becomes not just a nice to have facility but an essential part of national

Spectrum

The lack of spectrum was seen as one of the key drivers to the 5G network architecture. The demands on the design of the network could be relaxed if more spectrum could be made available. Frequency sharing on a dynamic basis between mobile and satellite systems can deliver major incre-ases in the spectrum provided both sectors accept the sharing principles. Here techniques of data bases and cognitive radio can be built into future systems to allow such frequency sharing. This can be a win-win situation to both sectors and would be enhanced by an integrated approach.

Internet of Things (IoT)

The inclusion of billions of sensors in the IoT all transmitting low date rate M2M and being scattered over wide areas makes it well suited to satellite collection and distribution. Here again integrated systems are for seen with new network architectures collecting from clusters of sensors and satellite being used to backhaul them to fusion POP's. Based on the wide satellite coverage, IoT economies of scale can be achieved and promote viable business models for a large number of Bur sty-low rate transmissions.

Primary technologies addressing the requirement for higher system capacity and data rates are

- **Densification of existing**

Work in the densification of heterogeneous networks with the massive deployment of small cells has started already in the context of 4G systems. Even denser deployments are anticipated for 5G in order to meet the higher capacity and data rate requirements. It is expected that LTE small base stations will be augmented with WiFi capability, creating rich opportunity for intelligently combining and aggregating the capacity and coverage available across the two protocols. As shown in Tables I and II, significant gain in average cell and cell-edge throughput is possible with multi-radio small cells compared to LTE-only small cells in a typical deployment with 4 outdoor small cells (pico cells) per macro cell . Further, radio access technologies such as a new RAT for mm Wave spectrum systems, or other short range RATs, such as the evolution of Bluetooth, or WiFi, or Zig Bee used for the communication of sensors and wearable devices might be supported by the single network node (gateway) in parallel to LTE. Efficient RAT association mechanisms are crucial for the smooth interworking among RATs.

- **Massive MIMO schemes**

Advanced MIMO techniques are at the heart of achieving higher spectral efficiency for cellular systems. Multi-user MIMO (MU-MIMO) offers increased multiplexing gains and, even though it has been included in the 3GPP LTE Advanced standard, its full potential is yet to be realized.

Drastically higher capacity can be obtained by leveraging higher number of antennas at the base station. In massive MIMO systems (also known as Very Large MIMO, VLM) the number of jointly preceded base station antennas per cell is larger than the number of users having thus desirable implications for coverage, inter-symbol and intra-cell interference control, and transmit power budget optimization . Fortunately, most of the gains can be realized even at manageable antenna dimensions. It is expected that VLM will be a core technology to create significantly higher capacity either in the form of distributed radio heads with centralized processing or in deployment of hundreds of antenna elements in higher frequency bands such as mm-

ISSN: 2278 – 1323
International Journal of Advanced Research in Computer Engineering & Technology (IJARCET)
Volume 5, Issue 6, June 2016

wave, where antenna dimensions become more practical.

Millimeter-wave (mm-wave) spectrum

usage

5G systems will need to provide significant improvement in cell capacity to accommodate the rapidly increasing traffic demands. Although 5G will introduce an array of new technologies that enable networks and devices to make better use of scarce spectrum resources, this will not be sufficient to keep pace with the mobile data requirement increase, which is expected to reach levels of gigabits per second. This could only be realized with much more spectrum than the spectrum currently available to IMT systems through the International Telecommunications Union's (ITU) process. Due to the high fragmentation of existing spectrum in different regions of the world and due to the long time required for the spectrum reforming, contiguous and broader frequency bands at higher frequencies is a promising way forward. Millimeter (mm)-wave bands, between 30 and 300 GHz, where the available bandwidths are much wider than today's cellular networks are suitable for 5G communication systems . Indeed, available spectrum at these frequencies can be 200 times greater than all cellular allocations today under 3 GHz. Moreover, the very small wavelengths of mm Wave signals combined with advances in low-power CMOS RF circuits enable large number of miniaturized antennas to be placed in small dimensions.

Enhanced direct device to device (D2D) connectivity as well as

D2D communication enables the exchange of data traffic directly between user equipment without the use of base stations or the core network, other than for assistance in setting up direct connections. D2D communication supports new usage models based on the proximity of users, including social networking applications, peer-to-peer content sharing, and public safety communications in the absence of network coverage. Additionally, D2D communication serves as another "cell tier” in the

5G HetNet, where clusters of devices cooperate with each other to dramatically increase network capacity, by either reusing the same spectrum as the macro cell or by using unlicensed spectrum. In , it is shown that if devices use their direct connectivity capabilities whenever possible, cellular traffic can

be effectively offloaded onto D2D links. As a function of offload percentage, can be achieved by offloading data onto Wi-Fi-Direct (WFD) links. D2D communication also presents additional benefits beyond increased area spectral efficiency, including improved cellular coverage, reduced end-to-end latency and reduced power consumption.

- Conclusion
  - Future network will robust.
  - At less risk of complete network failure provide at least some parts working.
  - Use less energy then today’s network with increased performance.
  - More connectivity between network because or multiple Radio access technology.

References

1) C.-L. I, C. Rowell, S. Han, Z. Xu, G. Li, and Z. Pan, "Toward green and soft: a 5G perspective," IEEE Commun. Mag., vol. 52, pp. 66–73, Feb. 2014.

2) J. G. Andrews, S. Buzzi, W. Choi, S. V. Hanly, A. Lozano, A. C. K.Soong, and J. C. Zhang, "What will 5G be?" IEEE J. Sel. Areas Commun., vol. 32, pp. 1065–1082, Jun. 2014.

3) A Brief Overview of 5G Research Activities, Pekka Pirinen Centre for Wireless Communications P.O. Box 4500, FI-90014 University of Oulu, Finland Email: pekka.pirinen@ee.oulu.fi

4) "Functional Architecture for 5G Mobile Networks" by Aleksandar Tudzarov and Toni Janevski published in International Journal of Advanced Science and Technology Vol. 32, July, 2011

5) 5g Wireless Architecture" By Vadan Mehta

6) 5G Technology – Redefining wireless Communication in upcoming years" by Akhilesh Kumar Pachauri 1 and Ompal Singh published in International Journal of Computer Science and Management Research Vol 1 Issue 1 Aug 2012 ISSN 2278 – 733X

7) Prospective of Fifth Generation Mobile Communications by Dr. Anwar M. Mousa University of Palestine,Gaza- Palestine published in International Journal of Next-Generation Networks (IJNGN) Vol.4, No.3,September 2012

8) "5G Mobile Technologies"

9) "Prospective of Fifth Generation Mobile Communications" by Dr. Anwar M. Mousa of University of Palestine,Gaza- Palestine published in International Journal of Next-Generation Networks (IJNGN) Vol.4, No.3,September 2012

10) "5G Mobile Phone Technology" from www.pediain.com