# A survey : Mobile Communication and 5G Technology

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***Abstract* - Current research work in mobile communication is related to 5G technology. In 5G, researches are associated with the improvement of world huge wireless web (WWWW), Dynamic Adhoc wireless Networks and actual wi-fi conversation. This time, it's miles consequently essential to recognize the course of research and tendencies allowing 5G era. The new upcoming era of the 5th generation wi-fi mobile community is marketed as lightning speed internet, anywhere, for everything, for all of us in the nearest future. There are quite a few efforts and research carrying on many factors, e.g. millimeter wave (mmw) radio transmission, massive multiple input and multiple output (massive-MIMO) new antenna era, the promising approach of SDN structure, internet of Things (IoT) and many more. On this short survey, we highlight some of the most recent trends in the direction of the 5G cell network.**

*Index Terms* – **5G, 4G, wwww, IoT, mmw, SDN, MIMO.**

## I.INTRODUCTION

The first generation of mobile communication system based on analog signal which was started in the year 1980s, and it helped people to clear of the hindrance in telephone line. In the 1990s an efficient second-generation (2G) mobile communication system based on digital signals occurred, and after those personal mobile communications have had a rose in development on a global scale. Later in 2000, with the deployment of Third Generation systems, people can experience faster mobile Internet facilities, such as video conferencing. However, in 2010, dispersal of Long-Term Evolution (LTE) based 4G commercial network further enhanced the system capacity and user experience. The development of mobile communications from the year 1980s is plotted in Figure 1. With the IMT-Advanced (IMT- A) systems being disposed in the world, later on the 5th-Generation (5G) mobile communication technologies are trending into research fields. In order to drive future development of mobile communication techniques, the METIS (Mobile and Wireless Communications Enablers for the Twenty-Twenty Information Society) project [1] of European Union started research work of 5G at the end of 2012. In China, IMT-2020 promotion group was founded in the year 2013, which promoted and distributed them in groups for encouraging 5G study. Its aim is to arrange domestic forces to actively participate in an international cooperation and to promote the international development of 5G. In Korea, after examination and verification Samsung declared their technical feasibility of millimeter wave in the bands of about 28 GHz [2]. Other possible candidate technologies such as massive MIMO [3], novel multiple access [4], and new channel coding [5–7] has gained more and more interest. The study of International Mobile Telecommunication system started from the year 2013 by International Telecommunication Union. 3G Partnership Project will start its study and standardization work on IMT-2020 from March 2016 [9]

Figure 1. Evolution of mobile communication 1G-5G

## II VISION FOR MOBILE COMMUNICATION TOWARDS 2021

Global LTE deployment is improving mobile users mobile data used in their daily lives too. The video service and social networking apps, for example, WeChat, Facebook, and Twitter, have dramatically changed our lives with the potential of LTE, especially high and low data rates delay. It is believed that mobile communication will not get into all aspects of future society and create a comprehensive, user-centered information ecosystem. A fully mobile and connected community is expected soon future, which will be characterized by a very large number of communication growth, traffic volume, and broad expansion list of conditions of use [10]. Thus, the Mobile Broadband (MBB) service as well The Internet of Things (IoT) will be two major drivers the development of the future of mobile communication, and will provide widespread hope for the next generation of mobile phones communication system (5G), its general view shown in Figure 2.

The Mobile Broadband service disrupted the normal business model for mobile communications, allowing dental user information and had a significant impact all aspects of work and human health. Looking forward to the year 2021 and above, MBB service will improve continuity the emergence of how people interact and provide users superior experience with such immersive immersion services as the unpopularity of taxpayers we see in reality, in reality visible, very high definition (UHD) 3D video, and mobile cloud[11].Continuous improvement mobile network will trigger the growth of mobile traffic by the size of thousands in the future and promote a new one a wave of development and change in mobile communications technology and industry as a whole. Looking forward to 2020 and beyond, there will be significant growth in mobile data traffic as shown in Figure 3.

It is estimated that global mobile data traffic will increase more than 200 times from 2010 to 2021 and approx. 20,000 times from 2010 to 2030. In China, growth factors they seem too high, with mobile data traffic it is expected to grow more than 300 times since 2010 to 2021 and more than 40,000 times from 2010 to 2030. In the developed cities and tropical areas of China, the growth of mobile data traffic will exceed the estimated average growth to all Chinese. For example, from 2010 to 2021 in Shanghai, mobile data traffic is expected to increase 600 times. In Beijing and during this same period, it is estimated that hotspot traffic can increase up to 1,000 times. IoT has expanded the range of mobile communication services from interpersonal communication to intelligent communication between objects and between people and objects, allowing mobile communication technology to entry into industry and wider forums[13]. Looking forward to the year 2021 and beyond, applications such as mobile health, Vehicle Internet (IoV), smart home, industry managing, and monitoring the environment will drive the dynamic growth of IoT applications, helping hundreds billions of devices to connect to the network create a true "Internet of All". This will make it easier to appear industries of unprecedented level and focus on endless vitality on mobile communications. At the time, a large number of connected devices and various IoT services will do and created new challenges for mobile communication. As shown in Figure 4, the total number of devices connected to a global mobile communication network will reach 100 billion in the future. By 2021, it is estimated that the number of mobile terminals worldwide will exceed 10 billion, China will donate more than two billion. I the number of IoT connections will also grow rapidly, reaching the global population size of 7 billion by 2021, available China will donate $ 1.5 billion. By 2030, the number of IoT global connectivity will reach 100 billion, which is China will be more than 20 billion. Among all kinds of terminals, smart phones will contribute a lot to traffic and IoT terminals will give less, albeit this amount devices are too large. By the end of 2021 and beyond, standard styles are possible abbreviated as follows. (i) Explosive Growth in Data Traffic. There will be a huge increase in traffic; global data traffic will be increase more than 200 times from 2010 to 2021 and about 20000 times from 2010 to 2030. (ii) High Growth Device in Connectivity. Although smart phones are expected to remain individual devices, a number of other types of devices, including wearable devices and MTC devices, will not always increased. (iii) Continued Emergence of New Services. The opposite types of services, for example, services from input rates, specific industries, and online companies, will be exploited. To meet service and market demand by the end of the year 2021 and beyond, IMT-2021 is intended for use the year 2021 (5G) and meet new and unprecedented needs beyond the power of previous generation plans[14]. 5G will exceed the time and place limit to allow a focused and interactive user experience. 5G will be and reduce the distance between man and things as well use seamless integration to achieve easy and intelligent communication between people and all things. 5G will provide users with access data such as fiber and “zero” delays user information. 5G will be able to connect 100 billion devices. 5G will be able to bring the same feeling in all various cases including very high cases traffic volume congestion, high traffic congestion, and very high mobility.

5G will also be able to provide intelligence and service- based efficiency and user awareness and will improve the power and efficiency of more than a hundred costs times, which enables us all to see the vision of 5G, “knowledge finger away, all communication. "


Figure 2. Overall vision of 5G

## 5 G ARCHITECTURE

The main goal of past generations of mobile networks has been to simply provide fast, reliable mobile data services to network users. 5G has expanded this space to provide a wider range of wireless services delivered to the end user across multiple accessibility platforms and multi-layer networks [15].

5G is a functional, flexible and flexible framework for many advanced technologies that support a variety of applications.

5G uses a very intelligent architecture, with Radio Access Networks (RANs) that can no longer be pressed to be near a station or complex infrastructure. 5G leads the way towards a separate, flexible and virtual RAN with new environments that create additional data access points.

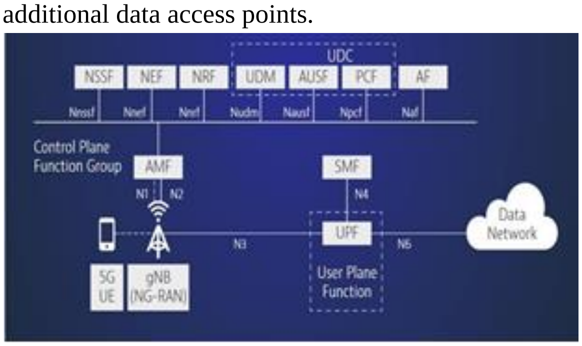


Figure 3. Architecture of 5G

### A. 5G Architecture 3GPP

The 3rd Generation Partnership Project (3GPP) incorporates communication technologies including RAN, core transport networks and service capabilities. 3GPP has provided a complete overview of the 5G network building system that is more focused on service than previous generations. Services are provided in a standard framework for network operations permitted to use these services. Modularity, usability and authenticity of network functions are additional features of the design of 5G network architectures defined by 3GPP specifications.

### B. 5G spectrum and Frequency

Many frequency ranges are now offered on the new 5G (NR) radio. The section of the radio frequency ranges between 30 GHz and 300 GHz is known as the millimeter wave, as the wavelength ranges from 1-10 mm. Frequencies between 24 GHz and 100 GHz are now distributed to 5G in many regions around the world [18]. In addition to the millimeter waves, UHF waves that can be used slightly between 300 MHz and 3 GHz are also targeted at 5G. The variability of the frequencies used may be different for different applications considering the higher frequencies are characterized by higher bandwidth, or shorter bandwidth. The millimeter waves are suitable for densely populated areas, but do not work over long-distance communications. In the high and low frequency bands dedicated to 5G, each network company has started recording its different parts of the 5G spectrum.

### C. MEC

Multi-Access Edge Computing (MEC) is an important feature of 5G architecture. MEC is the evolution of cloud computing to deliver applications from central data centers to the edge of the network, and therefore closer to end users and their devices. This creates a shortcut to the delivery of content between the user and the host, as well as the long network path that once separated them. This technology is not unique to 5G but is certainly part of its efficiency. MEC features include low latency, high bandwidth and real-time access to RAN information that separates the previous 5G formats. This integration of RAN and critical networks will require operators to use new methods to monitor and validate the network [20]. 5G networks based on 3GPP 5G specifications are ideal for MEC deployments. 5G specification means end-to-end computer providers, allowing MEC and 5G to track traffic together. In addition to the benefits of the delay and bandwidth of MEC buildings, computer power distribution will better empower large-scale connected devices connected to 5G distribution and the rise of Internet of Things (IoT).

D. NFV and 5G

Network function virtualization (NFV) removes software from hardware by altering various network functions such as firewalls, loaders and routers with virtual reality operating systems. This eliminates the need to invest in more expensive hardware and can speed up installation times, thus providing the customer with faster revenue-generating services. NFV empowers 5G infrastructure by making electronic devices work within the 5G network. This includes network cutting technology that allows multiple visible networks to operate simultaneously. NFV can address other 5G challenges through virtual computer, storage, and customized network applications based on applications and customer components.

E. 5G RAN Architecture

The concept of NFV extends to RAN for example network partition promoted by cooperatives such as O-RAN. This enables flexibility and creates new competitive opportunities, provides open communication and open source development, ultimately facilitating the deployment of new features and technologies on a scale [22]. The purpose of O-RAN ALLIANCE is to allow for the sending of multiple vendors via off-the-shelf computer for the purpose of facilitating and speeding up interoperability. Network fragmentation also allows network components to be virtual, providing a way to measure and improve user experience as capacity increases. The benefits of virtual RAN components provide the most effective means from hardware and software perspective especially in IoT applications where the number of devices is millions.

F. eCPRI

Network division by operational division also brings other cost benefits especially with the introduction of new links such as eCPRI. RF connectors are less expensive when testing large numbers of 5G carriers as RF costs increase exponentially. The introduction of eCPRI communications provides a cost-effective solution as a few connections can be used to test multiple 5G carriers. ECPRI is intended to be a fixed 5G optical connector used as an example to a pre-O-RAN optical connector such as DU [24]. CPRI unlike eCPRI is designed for 4G, however in most cases it was straightforward vendor making it a problem for operators.

G. Network slicing

Perhaps the key ingredient that enables the full power of 5G architecture to achieve network cutting. This technology can add an extra dimension to the NFV domain by allowing multiple sensible networks to operate simultaneously over a shared virtual network infrastructure. This becomes a key factor in the development of 5G by building end-to-end virtual networks that cover both network and end-to-end operations. Operators can successfully manage different 5G operating conditions with different output requirements, delays and availability by separating network resources from multiple users or “employers”.

Network cutting is very useful in systems such as IoT where the number of users can be very high, but the bandwidth requirement is low. Each straightforward 5G will have its own requirements, so network cutting becomes a consideration for the important design of 5G network construction. Costs, resource management and network configuration flexibility can all be improved with this level of customization that is now possible. In addition, network cuts enable faster tests for new 5G services and faster market time [25].

H. Beamforming

Another key success technology for 5G success is lighting. Standard basic channels transmit signals to multiple locations without regard to the location of targeted users or devices. With the use of multi-input, multi-output (MIMO) that includes a large number of small horns integrated into a single structure, signal processing algorithms can be used to determine the most efficient transfer method for each user while individual packages can be shipped in bulk. directions are then configured to reach the end user in a predetermined sequence. With 5G data transfer taking a millimeter wave, the loss of free space, equivalent to the small size of the antenna, and the loss of diffraction, which is natural for high frequencies and lack of wall penetration, is enormous. On the other hand, the smaller the size of the antenna and allows larger arrays to take up the same visual space. For each of these tiny horns that can provide beam redirection a few times per millisecond, a large beamforming design to support the challenges of 5G bandwidth becomes more likely [26]. With a larger antenna volume in the same visible area, smaller beams can be achieved with a larger MIMO, thus providing a way to achieve a higher result with effective user tracking.

## IV SECURITY IN 5 G ARCHITECTURE

The implementation of 5G will bring great performance benefits and diversity of applications by making the most of cloud-based resources, virtualization, network cutting and other emerging technologies. With these changes comes new security risks and additional “attack areas” introduced within the 5G security infrastructure. 5G builds on the security systems of previous generations of mobile technology, however the model of trust has grown significantly as more players have participated in the service delivery process [27]. IoT and user distribution creates a very high number of multiple points with most of these unattended traffic input by human hands. Among the advanced 5G security features defined by 3GPP standards are integrated authentication to terminate authentication from access points, expanding authentication agreements to meet secure functions, flexible security policies to deal with multiple users and permanent subscribers (SUPI) securities to ensure security. As 5G deployment progresses and key performance nodes become increasingly visible, operators will need to continue to monitor and evaluate security performance. Adherence to best practices means network security monitoring of all system properties, devices and applications. Undoubtedly, 5G will bring speed developers familiar to each new generation of mobile networks, but speed is still a start.

Expected industrial changes ranging from personal transport to manufacturing and agriculture will be so significant that many have called 5G the next Industrial Revolution. At the heart of this paradigm shift is a multi-dimensional 5G structure, with MECs, large MIMO NFV and a cloud-based, service-based concert-based service to deliver a new wave of services. The 5G test solutions designed to address this structural seed change will be a real force for the upcoming 5G transformation.

## V FUTURISTIC SCENARIOS AND 5G COMPLIANCE

The 2021 community will be a connected community. IoT and intelligent and integrated sensory systems and home sensory networks will change the way people live. “Smart” people will need a permanent and ubiquitous mobile connection to the network in order to upload their work data and IoT control commands, thereby producing “greater reporting” data flow [28]. Major machine-to-machine connectivity and critical machine-to-machine communication will play a key role in service delivery and industry performance. Vehicle advertising networks (VANETs) are constantly evolving. By 2021, VANETs connected to mobile networks will be acting as VANET's cloud, leading to a smarter and safer transport system [3]. If the number of connected devices exceeds tens or hundreds of billions in the next decade, network data loading on unlicensed bands will play a significant role in network load balancing, providing limited guaranteed services and reducing regulatory signature. Therefore, it is important that 5G will provide seamless connectivity with various dense networks to meet the great need for real-time traffic, so that end users can get smooth communication on the network [4].

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