

## Original Research Article

# Talking about 5G Mobile Communication Technology

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### ABSTRACT

In December 2013, China's Ministry of Industry and Information Technology officially issued three licenses to the three operators, 4G in China officially to commercial. In the February 2013, the EU announced that it will allocate 50 million euros to speed up the development of 5G mobile technology, plans to launch a mature by 2020. The development of 4G technology is now in full swing, in February 2013, the EU announced that it will allocate 50 million euros to speed up the development of 5G mobile technology, standard. Samsung said its 5G network has successfully reached 1Gbps in the 28 GHz band, compared to 75Mbps for the current fourth-generation Long Term Evolution (4GLTE) service. April 8, 2013 "Boao" Forum for Asia, China Mobile strategic decision-making advisory committee director Wang said that from a global perspective, 4G rapid development has become a reality, 5G research is also rapidly expanding and mature.

**KEYWORDS:** 5G, Performance characteristics, Development momentum, Evolution, Wireless transmission, Wireless network

## 1. Citation

Since the beginning of the 21st century, the popularity of smart terminals and the rapid development of mobile business applications have prompted the mobile Internet to show explosive trends. Statistics show that wireless traffic flows at an annual rate of nearly 100%, which means that the next decade, Wireless data traffic will grow 1000 times. Data show that after 2020, 4G technology is being deployed at this stage has been unable to meet the growing demand for mobile Internet and Internet of things business development. This is the main driving force for the development of 5G, the future 5G will serve people in the daily life of all aspects of life, such as: wireless payment, mobile office, smart home, location services, and telemedicine and so on. At the same time, will also be with the power grid, transportation, medical, home and other traditional industries in-depth integration, derived from a large number of objects as the main terminal. These are the future 5G performance indicators put forward more and higher requirements, compared with 4G, in addition to speed, delay and other traditional airport performance indicators need to further enhance, but also need to consider the user experience rate, the number of connections density, spectrum efficiency, energy efficiency and cost to further reflect the 5G system of advanced indicators.

### 1.1. Band utilization is high

In the 5G mobile communication technology, the high frequency spectrum resources will be applied more widely, but under the current level of science and technology, due to the high frequency band radio wave penetration ability, high frequency spectrum resource utilization efficiency will Subject to a certain degree of restrictions, but this will not affect the optical wireless networking, wired and wireless broadband technology integration and other technologies commonly used.

### 1.2. Communication system performance has greatly improved

The traditional communication system concept, is the information coding and decoding, between the physical level of transmission and other technologies as the core objectives, and 5G mobile communication technology is that it will be more extensive multi-point, multi-antenna, multi- Multi-cell mutual cooperation, mutual networking as a breakthrough in research points to significantly improve the performance of communication systems.

### 1.3. Advanced design concept

In the communication business, the dominant position is the application of the indoor communication service. The priority design goal of the 5G mobile communication system is targeted at the coverage performance of the indoor wireless network and its business support capability, which will change the design concept of the traditional mobile communication system.

### 1.4. Reduced energy and operating costs

5G wireless network 'soft' configuration design, the future of the technology will be an important research, explore the direction of the network resources can be dynamically adjusted by the business traffic changes in real time, so that can effectively reduce energy consumption and network resources operating costs.

### 1.5. The main consideration

5G communication network technology research, will pay more attention to user experience, interactive games, 3D, virtual implementation, transmission delay, the average network throughput and efficiency and other indicators will be considered 5G network system performance key indicators.

### 1.6. 5G mobile communication technology advantages

5G mobile communication technology, as the latest generation of mobile communication technology, its application will greatly improve the efficiency of spectrum utilization and its energy efficiency in resource utilization and transmission speed efficiency than 4G mobile communication technology can improve at least one level in the system security, transmission Delay, user experience, wireless coverage of the performance and other aspects will also be significantly improved. 5G mobile communication technology combined with other wireless communication technology, will constitute a new generation of efficient and perfect mobile information network, to meet the next decade the development of mobile information network needs. In the near future, 5G mobile communication system will also have a greater degree of flexibility, to achieve self-adjustment, network self-perception and other intelligent functions, can be fully prepared to deal with the future of mobile network information society unpredictable rapid development.

## 2. The main driving force

### 2.1. The rapid development of the Internet

The rapid development of mobile Internet is to promote the development of 5G mobile communications technology, the main driving force, mobile Internet technology is the basis of a variety of emerging business platform, the current fixed network of various services will be provided through the wireless network to the user, Background services and cloud computing is expected to be widely used 5G mobile communication technology system put forward higher requirements, especially in the system capacity requirements and transmission quality requirements. 5G mobile communication technology development goals are mainly located in close to other wireless mobile communication technology, for the rapid development of network communication technology to provide comprehensive and basic business services.

The initial estimates of countries around the world, including 5G mobile communications technology, including wireless mobile networks, its ability to enhance the network business is bound to be synchronized in three dimensions: First, the introduction of advanced wireless transmission technology, the network resources The utilization rate will increase by at least 10 times on the basis of 4G mobile communication technology. Second, the introduction of new architecture (such as high-density cell structure, etc.), the expansion of intelligent ability in depth, is expected to advance the whole Wireless network system throughput rate of about 25 times; third, in-depth mining more advanced frequency resources, spectrum resources is to promote the development of mobile communications and information industry, the core resources, 4G era spectrum resources have been scarce, the future 5G not Do not consider this serious problem, it is necessary to dig into more advanced frequency resources, such as visible light, millimeter wave, high frequency band, making the future of wireless mobile communication resources than 4G era expansion of about 4 times.

In order to enhance the 5G mobile communication technology business support capabilities, its network technology and wireless transmission technology is bound to have a new breakthrough. In the network technology, will use a more intelligent, more flexible networking and network architecture, such as the use of control and forwarding separate software to define the network architecture, heterogeneous ultra-intensive deployment. In the wireless transmission technology, will focus on improving the efficiency of spectrum resource utilization and mining spectrum resource use potential, such as multi-antenna technology, coding and modulation technology, multiple access technology and so on.

## **2.2. Business development**

Technology and business development are complementary relationships. Sometimes technology is driving business development, and sometimes business competition is driving technological advances. In Korea, the introduction of 5G is a major reason to boost economic development, through the 5G, the South Korean government hopes to increase the South Korean operators and manufacturers of investment and cooperation to achieve the development of national infrastructure equipment industry. In the country, operating companies and well-known equipment manufacturers are also gearing up in order to obtain market opportunities. It is understood that Huawei as early as 2009 to start the 5G study, and said it will be in 2013-2018 years at least 600 million US dollars for 5G research and development.

## **3. 5G evolution route**

At present, 4G has entered the commercial stage of scale, 5G is a new generation of mobile communication technology after 4G, from the development of mobile communications status and technology, standards and industry evolution trend, the future evolution of 5G mobile communication technology there are three important evolution Route, respectively, to LTE / LTE-Advanced as the representative of the cellular evolution route, WLAN evolution route and the revolutionary evolution of the line.

### **3.1. LTE / LTE-Advanced**

LTE / LTE-Advanced is the de facto global unified 4G standard, because LTE's large-scale technological innovation has been widely used in nearly 20 years of academic accumulation of advanced signal processing technology, such as OFDM, MIMO, adaptive technology, While continuing to improve technology applications, LTE-Advanced's technology development will focus more on RRM (radio resource management) technology and network layer optimization. And will continue to evolve in the 5G stage. In terms of industrialization, LTE in the global commercialization process is accelerating. Standardization, although due to LTE and existing versions of the existing version of 3Gpp compatibility is poor, resulting in 4G commercial LTE need to invest a greater deployment costs and longer popularity time, but the 3GPP R12 version of the standardization work is on small cell enhancement technology, New multi-antenna technology, terminal through technology, inter-machine communication and other new technologies to carry out research and standardization work, new technology investment is faster, better LTE version of the perfect. With more advanced technology into the LTE / LTE-Advanced technical standards, to the cellular mobile communications has brought a strong vitality and development potential.

### **3.2. WLAN**

Wireless local area network (WLAN) is one of the most popular broadband wireless access technologies in today's global application. It has a good industry and user base. The huge market demand drives the development of WLAN technology. A large number of non-authorized bands also provide WLAN technology. Huge development space. In the strong market demand, WLAN and mobile communication system gradually to the full range of integration, in the terminal, WLAN has become a necessary feature of smart phones, smart phones to support mobile phone traffic and automatic switching between WLAN. In the network, more and more manufacturers began to provide a complete 'cellular + WLAN' solution, to achieve the WLAN and cellular sharing, not only to facilitate network deployment, operation, management and maintenance, but also save a lot of expenses. It can be seen, in the rapid growth of mobile data services, driven by a strong, WLAN and mobile communications to a wide range of deep integration is the future trend, may be in the 5G development of a fundamental change.

At present, IEEE has launched the next generation WLAN standard 'High-efficiency WLAN' research, will further enhance the operator's business capabilities, and promote the integration of WLAN technology and cellular networks.

### **3.3. Revolutionary technology**

In addition, we should pay special attention to the possible emergence of revolutionary 5G technology. From the evolution of cellular mobile communications, each generation of evolution has revolutionary technology, from 2G GSM to 3G CDMA, to 4G OFDM, then, 5G will appear a new generation of revolutionary technology, and this Whether the revolutionary technology needs to use LTE technology with different technologies, and then generate a new generation of air interface technology, will become our focus on the content.

## **4. 5G key technology**

To enhance its business support capabilities, 5G in wireless transmission technology and network technology will have a new breakthrough. In the aspect of wireless transmission technology, technologies such as advanced

multiple access technology, multi-antenna technology, coding and modulation technology, new waveform design technology and so on, which can further exploit the potential of spectrum efficiency, will be introduced. In the wireless network, Flexible, more intelligent network architecture and networking technologies, such as the use of control and forwarding separation of software to define the wireless network architecture, unified self-organizing network (SON), heterogeneous ultra-intensive deployment. 5G mobile communication iconic key technology is mainly reflected in the ultra-high performance wireless transmission technology and high-density wireless network (high density wireless network) technology. Which is based on large-scale MIMO wireless transmission technology will likely make the spectral efficiency and power efficiency on the basis of 4G to enhance an order of magnitude, the technology to the practical bottleneck problem is high-dimensional channel modeling and estimation and complexity control. Full duplex technology will likely open up a new generation of mobile communication spectrum utilization. Ultra-dense network (UDN)

Has caused widespread concern in the industry, network collaboration and interference management will be to enhance the high-density wireless network capacity of the core key issues.

The architecture change will be the main direction of the development of the new generation wireless mobile communication system. The existing flattened SAE / LTE (system architecture evolution / long term evolution)

The architecture facilitates the high integration of mobile communication systems and the Internet. High-density, intelligent and programmable represent the further development trend of future mobile communication evolution. The content distribution network (CDN) is deployed to the edge of the core network, Network access to the routing load, and significantly improve the mobile Internet user's business experience.

1) Ultra-dense network: The future network will further miniaturize the existing cell structure, distributed, and through the mutual cooperation between the cells, the interference signal for the useful signal, so as to solve the miniaturization and distribution of the district Interfere with the problem, and maximize the overall network capacity of the system.

2) Intelligent: The future network will be based on the existing SON technology, with a wider range of perception and more powerful self-optimization capabilities, through the perception of the network environment and user business needs, in a heterogeneous environment to provide users with The best service experience.

3) Programmable: The future network will have the software can be defined (SDN) capabilities, data plane and control plane will be further separated, centralized control, distributed control or the combination of the two, will be the evolution of network development need to solve the technical route problem The Base stations and routing and other infrastructure with programmable and flexible scalability to a unified platform to adapt to a variety of complex and different sizes of application scenarios.

4) Content distribution marginalized deployment: Although the content of the mobile terminal access to the quantitative trend, but most concentrated in some hot spots and large-scale portal, in the future 5G network using CDN technology will be to improve the utilization of network resources is important potential means.

## 4.1. Wireless transmission technology

### (1) Large-scale MOMI technology

Multi-antenna technology has been applied to a variety of wireless communication systems such as 3G system, LTE, LTE-A, WLAN and so on as an effective means to improve the system spectrum efficiency and transmission reliability. According to the information, the more the number of antennas, the more obvious the spectral efficiency and reliability. In particular, when the number of transmit and receive antennas is large, the MIMO channel capacity will grow linearly with the minimum of the number of transmit and receive antennas. Therefore, the use of a large number of antennas, to greatly improve the capacity of the system provides an effective way. Due to the space occupied by the multi-antenna and the complexity of the technical conditions, the number of antennas in the current wireless communication system is not large. For example, up to four antennas are used in the LTE system. In the LTE-A system With up to eight antennas, due to its huge capacity and reliability gain, research on MIMO-related technologies for large antennas has attracted the attention of researchers, where the base station is equipped with a much larger number of mobile stations than in the case of a single cell In 2010, Bell Labs Marzetta studied multi-cell, TDD (time division duplexing) case, the base station configuration of an unlimited number of antennas in the extreme situation of multi-user MIMO technology, proposed by the multi-user MIMO system of the antenna, the concept of large-scale MIMO (large scale MIMO, or Massive MIMO) has found some different characteristics with single-cell, finite number of antennas. After a large number of researchers on the basis of the study of the number of base stations configured limited antenna in the large-scale MIMO, the base station configuration is very large (usually tens to hundreds of root, the number of existing system antenna 1 ~ 2 Above the order of magnitude) of the antenna, in the same time-frequency resources at the same time a number of users. In the arrangement of the antenna, these antennas can be centrally located on a base station, forming a centralized large-scale MIMO, or distributed in a plurality of nodes to form a distributed large-scale

MIMO. It is worth to mention that our scholars in the research of distributed MIMO has been at the forefront of the international.

The benefits of large-scale MIMO are mainly reflected in the following aspects: First, the spatial resolution of large-scale MIMO is significantly enhanced compared with the existing MIMO, and the spatial dimension resources can be excavated in depth so that multiple users in the network can The same time-frequency resource utilizes the spatial degrees of freedom provided by large-scale MIMO to communicate with the base station at the same time, thus greatly improving the spectral efficiency without increasing the base station density and bandwidth. Second, large-scale MIMO can focus the beam in a very narrow range, thus greatly reducing the interference. Fourth, when the number of antennas is large enough, the simplest linear precoding and linearity detectors tend to be optimal, and noise and uncorrelated disturbances are negligible.

### (2) Based on the filter group of multi-carrier technology

OFDM (orthogonal frequency di-vision multiplexing) technology is widely used in all kinds of wireless communication systems, such as WiMaX, LTE and LTE-A system, because of the advantages of spectrum efficiency, anti-multipath fading and low implementation complexity. Link, but there are many shortcomings of OFDM technology. For example, it is necessary to insert a cyclic prefix to combat multipath fading, resulting in waste of radio resources; high sensitivity to carrier frequency offset, high peak to average ratio; In addition, each subcarrier must have the same bandwidth, must be kept in sync between each subcarrier must be kept orthogonal, etc., limiting the flexibility of the use of the spectrum. In addition, because OFDM technology uses square wave as the baseband waveform, the carrier side lobe is larger, so that the carrier synchronization cannot be strictly guaranteed in the case of the interference between adjacent carriers is more serious. In a 5G system, bandwidth of up to 1 GHz may be required due to the need to support high data rates. However, in some lower frequency bands, it is difficult to obtain continuous broadband spectrum resources, and in some frequency bands, some wireless transmission systems, such as television systems, have some unused spectrum resources (blank spectrum). However, the gaps of the spectrum may be discontinuous, and the available bandwidth is not necessarily the same, using OFDM technology is difficult to achieve the use of these available spectrum. Flexible and effective use of these blank spectrum, 5G system design is an important issue.

In order to solve these problems, to find other multi-carrier implementation program has attracted the attention of researchers, based on the filter group multi-carrier (FBMC, filter-bank based multicarrier) implementation program is considered to solve the above problems an effective means, scholars first applied to the national 863 program after the 3G test system. Filter group technology originated in the 20th century, 70 years, and in the 20th century began to be concerned about the 80's, is now widely used in image processing, radar signal processing, communication signal processing and many other areas. In the multi-carrier technology based on the filter group, the transmitter realizes the multi-carrier modulation through the synthesis filter bank, and the receiver realizes the multi-carrier demodulation by analyzing the filter bank. The synthesis filter group and the analysis filter group are composed of a group Parallel component filter, in which each member filter is modulated by the carrier filter by the modulation filter and OFDM technology is different from the FBMC, because the prototype filter shock response and frequency response can be designed according to need , Each carrier must no longer be orthogonal between, do not need to insert the cyclic prefix; can achieve the sub-carrier bandwidth settings, the sub-carrier between the degree of flexibility of the flexible control, which can be flexible control between adjacent sub-carriers And it is easy to use some scattered spectrum resources. There is no need for synchronization, synchronization, channel estimation and detection between subcarriers to be processed separately on each carrier. Therefore, it is particularly suitable for realizing the strict synchronization between users of the uplink. On the other hand, because the carriers are not orthogonal to each other, there is interference between the subcarriers; the use of non-rectangular waveform, resulting in the existence of time-domain interference between symbols, the need to use some technology to eliminate the interference.

### (3) Full-duplex technology

Full-duplex communication technology refers to both the same time, the same frequency for two-way communication technology. As in the wireless communication system, the network side and the terminal side of the inherent transmission signal to receive signal self-interference, the existing wireless communication system, Conditions cannot be achieved at the same time with the same frequency of two-way communication, two-way links are through time or frequency to distinguish, corresponding to TDD and FDD way. As cannot be carried out at the same time, with the frequency of two-way communication, theoretically wasted half of the wireless resources (frequency and time).

Because full-duplex technology can improve the spectrum utilization rate twice the huge potential, can achieve more flexible spectrum use, and because of the device technology and signal processing technology development, the same frequency at the same time full-duplex technology has become a research hotspot, Is a 5G system to fully tap an important direction of wireless spectrum resources but full-duplex technology also faces some challenging problems due to the power difference between the received and transmitted signals is very large, resulting in serious self-interference (typically 70 DB), the primary problem with full-duplex technology applications is self-interference cancellation. In recent years, researchers have developed various types of interference cancellation techniques, including



analog-side interference cancellation, digital-to-interference interference with known interfering signals, the use of additional placement in a specific location of the antenna to offset the offset technology and later some of the improved technology through the joint application of these technologies, in a particular scenario, can eliminate most of the self-interference. Researchers have also developed experimental systems to validate the feasibility of full-duplex technology through experiments. In some conditions to achieve the full-duplex system theoretical capacity of about 90%. Although these experiments prove that full-duplex technology is feasible, but these experimental systems are basically a single base station, the number of small terminals, there is no large number of base stations and a large number of terminal experimental verification, and the existing results show that full-duplex Technology does not achieve the desired performance gain under all conditions. For example, the antenna cancellation technology requires multiple transmit antennas, the elimination of the effect of large bandwidth is not ideal, and most can only support single data stream work, cannot fully play the capacity of MIMO, and therefore cannot be applied to MIMO systems ; MIMO technology under the full-duplex technology and half-duplex technology performance analysis is also some simple, for small antenna number of the simulation results of the comparison, especially for large-scale MIMO performance differences between the lack of in-depth theory Analysis of the need to establish a more reasonable interference model on the basis of its in-depth analysis of the system; At present, the full-duplex system capacity analysis are mostly for a single cell, the number of users is relatively small, and the transmission power and transmission distance is relatively small The interference elimination technology, the resource allocation technology, the networking technology, the capacity analysis, and the MIMO technology in the full-duplex technology under the multi-cell dynamic range are lacking in the research results under the conditions of multi-cell and large number of users. Technology, as well as large-scale networking under the conditions of experimental verification, is the need for in-depth study of the important issues.

## 4.2. Wireless network technology

### (1) Ultra-intensive heterogeneous network technology

As the 5G system includes both new wireless transmission technology and the subsequent evolution of various wireless access technologies, the 5G network is bound to a variety of wireless access technologies such as 5G, 4G, LTE, UMTS (universal mobile telecommunications system ) and WiFi (wireless fidelity) coexist, both responsible for the basic coverage of the macro station, but also bear the hot spots covered low-power small stations, such as Micro, Pico, Relay and Femto and other multi-layer coverage of multi-wireless access technology multi-layer coverage Heterogeneous networks In these large numbers of low-power nodes, some are operator-deployed, planned macro nodes, low-power nodes; more likely to be user-deployed, unplanned low-power nodes, and these user deployments are low The power nodes may be of type OSG (open subscriber group) or may be of type CSG (closed subscriber group), making network topology and characteristics extremely complex.

In the super-dense heterogeneous network, the network density makes the network nodes closer to the terminal, resulting in power efficiency, spectrum efficiency, greatly improve the system capacity, and business in a variety of access technologies and the coverage level to share the flexibility. Although the ultra-dense heterogeneous network shows a bright future, due to the reduction of the distance between nodes, will lead to some problems with the existing system. In the 5G network, there may be interference between the same radio access technology with the same frequency, different wireless access technology due to the interference between the shared spectrum, different coverage between the interference, how to solve the performance of these disturbances Damage, to achieve a variety of wireless access technology, coexistence between multiple levels of coverage is an important issue requiring in-depth study due to the proximity node transmission loss is not significant, there may be multiple intensity close to the interference source, leading to more serious interference So that the existing interference coordination algorithm for a single source of interference cannot be directly applied to the 5G system. Due to the different requirements of different services and users, the sharing of different services in the network, Collaborative strategy, network selection, based on the user needs of the system energy efficiency of the lowest cell activation, energy-saving configuration strategy is to ensure that the system performance of the key issues. In order to achieve large-scale node collaboration, the need to accurately and effectively find a large number of adjacent nodes. As the community boundaries more, more irregular, resulting in more frequent, more complex switching, it is difficult to ensure mobility performance, therefore, need for ultra-dense network scenarios to develop a new switching algorithm. Due to the sudden and random opening and closing of a large number of nodes deployed by the user, the network topology and interference patterns are randomly and dynamically changed in a large dynamic range. The number of service users in each station is often small, so that the spatial and temporal distribution of the service. So it is necessary to study the dynamic deployment of networks that adapt to these dynamic changes. The intensive deployment of the site will require a large and complex backhaul network. If a wired backhaul network is used, the difficulties of network deployment and the cost of operators In order to improve the flexibility of node deployment, reduce deployment costs, the use of access and access to the same spectrum and technology for wireless backhaul transmission, is to solve this problem is an important direction. Wireless return mode, wireless Resources are not only for the terminal service, but also for the node to provide relay services, wireless backhaul networking technology is very complex, therefore, wireless backhaul network key technology, including networking, radio resource management is an important research content.

## (2) Self-organizing network technology

In the traditional mobile communication network, network deployment, operation and maintenance and other basic rely on the artificial way, need to invest a lot of manpower, to the operators to bring huge operating costs. According to the analysis of major operators operating costs are basically accounted for about 70% of their respective income. Moreover, with the development of mobile communication network, it is difficult to realize the optimization of the network by artificial way. Therefore, in order to solve the problem of network deployment and optimization complexity, reduce the proportion of operation and maintenance costs relative to total revenue, so that operators can operate efficiently, Maintenance network, to meet customer needs at the same time, their own can continue to develop by the NGMN (next generation mobile network) alliance operators in the main, together with the major equipment manufacturers proposed self-organizing network (SON) concept of self-organizing network The idea is to introduce self-organization (network intelligence) in the network, including self-configuration, self-optimization, self-healing and so on to achieve network planning, deployment, maintenance, optimization and troubleshooting and other aspects of the automatic, minimized Manual intervention. At present, self-organizing network has become a necessary feature of new laying network, and gradually enter the commercial, and show a significant advantage.

5G will be a fusion, collaborative multi-standard coexistence of heterogeneous networks. From the technical point of view, there will be multi-layer, multi-wireless access technology coexistence, resulting in a very complex network structure, a variety of wireless access technology and a variety of coverage of the network nodes between the complexes, network deployment. Maintenance will be a very challenging job. In order to reduce the network deployment, operation and maintenance complexity and cost, improve the quality of network operation and maintenance, the future 5G network should be able to support more intelligent, unified SON function, can achieve a unified wireless access technology, self-optimizing, self-healing. At present, for LTE, LTE-A and UMTS, WiFi SON technology development has been relatively perfect, and gradually began in the newly deployed network applications. But the existing SON technology is for their own networks, independent from the perspective of the network from the deployment and self-configuration, self-optimization and self-healing, cannot support multi-network collaboration between. Therefore, the need to support collaborative Such as cooperative wireless transmission parameter optimization, cooperative mobility optimization technology, collaborative energy efficiency optimization technology, such as collaborative wireless transmission parameter optimization, cooperative mobility optimization technology, collaborative energy efficiency optimization technology, and different systems under the collaborative network fault detection and location, in order to achieve self-healing function.

## 5. Concluding remarks

The rapid development of contemporary science and technology, especially the rapid development of network communication technology, will effectively promote the development of 5G mobile communication technology, according to the development of mobile communication technology. After 2020, 5G mobile communication technology is expected to achieve commercial, to meet the future development needs of mobile Internet business, and to bring mobile Internet users an unprecedented new experience. At present, 5G mobile communication technology research is still in its infancy, and will soon enter the critical period of development, its key indicators and technical requirements will be introduced in the next few years, will lead China's mobile communications industry to a new round of change.

## References

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1. 5G SIG white paper
2. You Xiaohu, Pan Zhiwen, Gao Xiqi, etc .. 5G mobile communication development trend and a number of key technologies. Science in China: Information Science. 44, No. 44
3. Jiao fei, Peng Jingle. Analysis of 5G mobile communication technology and future development trend
4. Pan Zhiwen and so on. 5G mobile communication development trend and some key technologies [J]. China Science Information Technology. 2014, 11, (6): 155-156
5. Hua Y B, Liang P, Ma Y M, et al. A method for broadband full-duplex MIMO radio. IEEE Signal Process Lett, 2012, 19: 793-796
6. METIS. Mobile and wireless communications enablers for the 2020 information society. In: EU 7th Framework Program Project, <https://www.metis2020>