Performance Evaluation of Key Performance of 5G Mobile Communication System And Development Countermeasures

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Abstract. This paper mainly studies the key performance of 5G mobile communication system and its development countermeasures. This paper introduces the challenges faced by 5G mobile communication system, which mainly come from increasing mobile data volume, connecting mass terminals anytime and anywhere, shortage of spectrum resources, and green environmental protection and energy efficiency; In order to study the key performance of 5G mobile communication system more comprehensively, first, this paper analyzes the practical significance of establishing the key performance indexes system of mobile communication system. Second, the performance requirements of mobile communication systems in six main application scenes are discussed. Third, the key performance indexes system of mobile communication system is constructed; This paper introduces the purpose and steps of performance evaluation of key performance of mobile communication system, and compares and evaluates the key performance of 5G and 4G in wide-area continuous coverage scene based on AHP. Suggestions on the development of 5G mobile communication system are put forward from four aspects: policy and system, demand and service, technology and talents, and sustainable development.

1. Introduction
Communication technology is one of the most active fields in the field of science and technology today. With the new ideas, new concepts and new technologies such as cloud computing, Internet of things and big data being put forward continuously and achieving fruitful results. However, 4G mobile communication system can not provide effective support for the above technologies in terms of transmission rate, connection density, end-to-end delay, etc. This requires a more efficient and reliable mobile communication system. The fifth generation mobile communication system (5G) came into being. 5G has been put into trial operation in some areas of some cities.

2. Challenges facing 5G mobile communication system
2.1. Challenges of increasing mobile data volume
With the development of economy and the increasing material and cultural requirements of people, the mobile Internet services is developing rapidly and tends to be intelligent. The mobile data volume is growing at an alarming rate. In the past ten years, the mobile data volume has doubled every year. According to the research forecast of China's IMT-2020 (5G) Promotion Group, compared with 2010, the global mobile data volume will increase 200 times in 2020. At the same time, video monitoring,
VR and other services require high transmission rate, while industrial manufacturing and remote surgery require millisecond delay and nearly 100% reliability. In order to cope with the exponential growth of mobile data volume and the high standards of system reliability and delay, mobile communication systems are facing the challenge of providing faster system transmission rate, higher reliability and shorter delay.

2.2. Challenges of connecting mass terminals anytime and anywhere
The traditional mobile communication system mainly provides communication services for people-to-people. The target of 5G mobile communication system is to realize the interconnection for people-to-things, and things-to-things. That is to say, it requires that all objects should be perceived and connected to the network to serve human beings. Its prototype is similar to the smart city application scene, which requires the network to support massive terminal equipment connection and a large number of data frequent transmission. It is estimated that 5G is required to provide 100-1000 times of the current network connection capacity. In addition, because the objects are all over every corner of the nature, a large number of network equipment will be deployed in remote areas such as mountains, deserts and other areas where signals are difficult to reach, so the coverage ability of 5G mobile communication network is facing greater challenges.

2.3. Challenges of shortage of spectrum resources
The growth of a large number of mobile data volume can hardly effectively solved only through the improvement of spectrum efficiency and the high-density deployment of communication base stations, which can only be the coping strategy in the transitional period. In addition to technical improvements, the fundamental solution to the problem should be to broaden the frequency bandwidth and add new spectrum resources, which is also an important issue in the development of 5G mobile communication system. At present, the domestic 5G spectrum resources use the 160MHz bandwidth of 2515-2675MHz, 200MHz bandwidth of 3.4-3.6GHz, 100MHz bandwidth of 4.8-4.9GHz, but the spectrum resources are non-renewable resources, with the application and deployment of 5G and higher performance mobile communication systems in the future, scarce spectrum resources will be one of the challenges.

2.4. Challenges of green environmental protection and energy efficiency
The power consumption of the existing mobile communication system equipment and terminal equipment has been very large, 5G mobile communication system in order to obtain more spectrum resources is bound to use a higher frequency band, that is to say, its system equipment and user terminal equipment will use higher signal transmission power, and at the same time, it will also lead to the requirements for more base stations for more intensive deployment, thus consuming more power [1]. For communication operator, this means that they will bear hundreds of times of the increased electricity charges of the mobile communication system; for users, especially mobile users, it will lead to a significant decline in the endurance capacity of user terminal equipment. Therefore, 5G mobile communication system is facing the challenge of improving the energy efficiency of system equipment by at least hundreds of times.

3. Key performance indexes system of mobile communication system

3.1. The practical significance of constructing the key performance indexes system of mobile communication system
First, it is more conducive to understand the basic contents and characteristics of the mobile communication system, such as its architecture, operation mechanism, technical performance, etc. The process of establishing the key performance indexes system is essentially a process of in-depth study of the research object, which is a process from the overall macro understanding of the research object to the internal micro understanding of the research object, which is helpful to understand the essence,
reveal the rules and judge the trend.

Second, it is more conducive to evaluate the key performance of mobile communication system, making the evaluation results more authentic, scientific and objective. As long as the evaluation indexes are system is reasonably established, the indexes of each layer are scientifically evaluated and measured, and the mathematical method is properly selected for quantitative calculation, the evaluation conclusion consistent with the actual situation of the research object can be obtained, which has high credibility and reference value.

Third, it is more conducive to in-depth analysis of problems, finding problems from multiple perspectives and solving problems in an all-round way. Systematic research on the key performance index system of the mobile communication system is conducive to analyzing the overall and local advantages and disadvantages of the mobile communication system, finding out the key links and weak links, according to the analysis results, the development plans and objectives of the mobile communication system are formulated, and countermeasures are sought.

3.2. Requirement analysis of key performance indexes of mobile communication system in several typical application scenes
The three application scenes of 5G in the future are: eMBB, mMTC and uRLLC[2]. In order to analyze the key performance indexes required by the mobile communication system in a more in-depth and detailed way, the above-mentioned three application scenes of 5G mobile communication system are detailed into wide-area continuous coverage scene, ultra-high speed experience scene, local ultra-high user density scene, ultra-high speed mobile scene, low delay and high reliability connection scene, and mass terminal connection scene for analysis.

3.2.1. Wide-area continuous coverage scene. It is one of the most basic application scenes of mobile communication system, and its function is to provide high-quality, continuous and seamless mobile communication services for users who move in the wide-area continuous coverage scene. Based on the traditional cellular network, the user experience rate, connection density, traffic density and spectrum efficiency can be generally improved by improving antenna technology, access technology and coding technology. The main performance indexes are user experience rate, connection density, data traffic density, spectrum efficiency and mobility.

3.2.2. Ultra-high speed experience scene. It introduces the concept of ‘mobile broadband’. Its target is to provide users with a transmission rate close to that of optical fiber transmission, enabling users to obtain the instantaneous time-delay free and ultra-high rate services experience. It is the most intuitive experience of 5G and 4G in terms of performance improvement. This scene is mainly used in augmented reality, VR, cloud office and other services. The main performance indexes are user experience rate, user peak rate, data traffic density and end-to-end delay.

3.2.3. Local ultra-high user density scene. It is mainly to provide users with satisfactory user peak rate and user experience rate in areas such as dense residential buildings, offices, sports venues, open-air gatherings, large shopping malls and other areas where users are distributed in an ultra-high density, at the same time, the problem of denying more users access due to limited network carrying capacity and the problem of mutual interference are avoided. The main performance indexes are user experience rate, user peak rate, connection density, transmission error rate, data traffic density and interference elimination capability.

3.2.4. Ultra-high speed mobile scene. It mainly provides mobile communication services for users in fast or relatively fast moving conditions such as expressway and high-speed trains. The main demand and challenge of this scene is to provide high-speed mobile (500km /h) users with the same services experience as low-speed mobile scene such as dense residential areas and offices. The main performance indexes are mobility, user experience rate and end-to-end delay.
3.2.5. **Low delay and high reliability connection scene.** It is mainly for the special application requirements of Internet of vehicles, industrial control, telemedicine, etc. Due to the problems of involving safety and manufacturing accuracy, this kind of application requires extremely high end-to-end delay and reliability of data. The main requirement and challenge of this scene is to provide millisecond end-to-end delay and 99.999% reliability guarantee for users. The main performance indexes are end-to-end delay, equipment reliability and transmission error rate.

3.2.6. **Massive terminal connection scene.** It is a scene of mobile communication transforming from ‘Internet’ to ‘Internet of things’, It is characterized by the extensive use and deployment of sensor devices, and also gives rise to the problems of large number of base stations, high cost and large energy consumption. The main requirement and challenge of this scene is to provide access services for massive sensor devices in the scene, and at the same time to ensure the system capacity, it is necessary to minimize the deployment of base stations to reduce the overall cost of the network and the energy consumption of the system. The main performance indexes are connection density, cost efficiency and energy efficiency.

3.3. **Establish the key performance indexes system of mobile communication system.**

The specific application scene of the future mobile communication system mainly include the six scenes mentioned above. The main application sites are densely populated residential areas, offices, stadiums, outdoor gatherings, subways, expressways, high-speed trains and others. Typical application services mainly include augmented reality, virtual reality, ultra-high definition video, cloud office, Internet of vehicles, smart city, etc. Therefore, the key performance indexes system of the mobile communication system is established according to the location of users or terminals in each typical application scene and the characteristics of required services[3], as shown in ‘Figure 1’.

![Figure 1. Key performance indexes system of mobile communication system.](image)

3.3.1. **System communication capability.** Since the optical fiber communication is adopted between the base station and the base station, we will not do any research here. The communication capability here refers to the wireless communication capability, which refers to the capability of use electromagnetic wave as the information carrier to spread in the atmospheric environment and complete the information exchange. The communication capability is the foundation of the realization of the business function of the mobile communication system and an important capability of the mobile communication system. The main indexes of the communication capability include user experience rate, user peak rate and end-to-end delay.

3.3.1.1. **User experience rate.** The lowest transmission rate available to a single user in a real
network environment.

3.3.1.2. User peak rate. The maximum transmission rate available to a single user in a real network environment.

3.3.1.3. End to end delay. The time interval between the data being transmitted from the sender and the sender receiving the acknowledgement sent by the receiver.

3.3.2. System access capability. The interconnection of everything means that there will be tens of thousands of terminal access requirements and massive data traffic requirements in the unit area in the future. Therefore, the system access capacity is the capacity to access equipment and carry data traffic per unit area of the system. The main indexes of system access capability include connection density and data traffic density.

3.3.2.1. Connection density. The total number of online devices connected to the mobile communication system per unit area.

3.3.2.2. Data traffic density. The total number of data traffic of the mobile communication system per unit area.

3.3.3. System efficiency. It refers to an evaluation index that makes the most effective use of resources to meet the set needs under the given input and technology conditions of the system. If anything wants sustainable development, how to improve efficiency is a key research aspect, and also an important method for operators to improve business interests. The main indexes of system efficiency include spectrum efficiency, energy efficiency and cost efficiency[4].

3.3.3.1. Spectrum efficiency. The amount of data exchanged per unit of area per unit of spectrum resources.

3.3.3.2. Energy efficiency. The number of bits that can be transmitted per unit of energy consumed.

3.3.3.3. Cost efficiency. Cost includes the sum of materialized cost and operation and maintenance cost, cost efficiency is the number of bits that can be transmitted per unit cost.

3.3.4. System stability. It refers to the capability of the system to successfully send the specified data information to the receiving end within a certain period of time and under complex conditions. It is a measure of the capability of the whole communication system to accurately complete the services required by users under the specified conditions and within the specified time. The main indexes of system stability include equipment reliability, transmission error rate, interference elimination capability and mobility.

3.3.4.1. Equipment reliability. The capability of the system equipment to complete the specified functions under the specified conditions and within the specified time, measured by the probability of completing the functions.

3.3.4.2. Transmission error rate. The ratio of the number of error bits (number of error codes) to the total number of transmission bits (total number of transmission codes).

3.3.4.3. Interference elimination capability. The capability to reduce the interference power of the system, measured by the interference power ratio before and after interference elimination.

3.3.4.4. Mobility. The maximum relative mobile speed of both the sender and the receiver is allowed
when the system performance requirements are met.

4. Performance evaluation of key performance of mobile communication system based on AHP[5]

4.1. Purpose of performance evaluation of key performance of mobile communication system
From the aspect of mobile communication system performance, 5G has greater advantages than 4G mobile communication system. In the future, the application scenes of mobile communication put forward higher requirements for all aspects of the system performance. After all, as a civil mobile communication system, it is to provide commercial business services for users, and to seek the maximum benefits. Therefore, as an operator, in the future, it must provide corresponding services according to the user's business requirements, reduce costs, avoid wasting resources; as a user, in fact, most of the performance of the current mobile communication system can already meet the basic life requirements, so they must choose the corresponding mobile communication services according to their own requirements Information system services, to avoid wasting communication fees. By evaluating and comparing the key performance of 5G and 4G, the advantages and disadvantages of the two communication systems in several major application scenes can be analyzed, which can provide reference for the optimization and improvement of their technical solutions, balance the best balance between performance and cost, and achieve the best cost performance.

4.2. Performance evaluation steps of key performance of mobile communication system, as shown in ‘Figure 2’

4.2.1. First step. Establish the hierarchical structure between the evaluation object (layer U) -primary performance indexes layer (layer B)-secondary performance indexes layer (layer C) - system schemes (layer D), as shown in ‘Figure 1’.

4.2.2. Second step. Select a specific application scene for research to determine the main performance indexes and other performance indexes.

4.2.3. Third step. The AHP is used to construct judgment matrices among all layers, respectively calculate the relative weights of each factors of $U \cdot B$ layer and layer $B \cdot C$ layer $C$- layer $D$. 
4.2.4. Fourth step. Comprehensively calculate comparative evaluation of the performance of 5G and 4G mobile communication systems in the selected specific application scene.

4.3. Calculation of the key performance of 5G / 4G based on AHP

Here we choose the wide-area continuous coverage scene as the application scene for research.

4.3.1. Calculating relative weight vector $W$ of layer $U$- layer $B$. According to the key performance indexes system of the mobile communication system established above and ‘Table 1’. In the wide-area continuous coverage scene, the judgment matrix $A$ of layer $U$- layer $B$ is established by comparing the relative importance of each factors $B_1, B_2, B_3, B_4$ of layer $B$. The relative weight vector $W$ of layer $B$- layer $U$ is calculated by the judgment matrix $A$, and the consistency of the judgment matrix $A$ is tested.

**Table 1. Scale definition.**

| Scale | Meaning                                      |
|-------|----------------------------------------------|
| 1     | The two factors are of the same importance   |
| 3     | The former is slightly more important than the latter |
| 5     | The former is obviously more important than the latter |
| 7     | The former is strongly more important than the latter |
| 9     | The former is exceedingly more important than the latter |
| 2, 4, 6, 8 | Represents the intermediate value of the above adjacent judgments |

$$A = \begin{bmatrix}
B_4 & B_3 & B_2 & B_1 \\
B_4 & B_3 & B_2 & B_1 \\
B_4 & B_3 & B_2 & B_1 \\
B_4 & B_3 & B_2 & B_1 \\
\end{bmatrix} = \begin{bmatrix}
1 & 1 & 1 & 2 \\
3 & 1 & 3 & 5 \\
1 & 1 & 1 & 2 \\
1 & 1 & 1 & 2 \\
\end{bmatrix}$$

Using the square root method to calculate the weight vector $W$ of mobile communication system factors $B_i$ about layer $U$ is:

$$W = (0.154, 0.627, 0.154, 0.065)^T$$

Check the consistency of judgment matrix $A$:

$$A \times W = (0.154, 0.627, 0.154, 0.065)^T = (0.6469, 1.8754, 0.6469, 0.3444)^T$$

$$\lambda_{max} = \sum_{i=1}^{4} \frac{(AW)_i}{nW_i} = 4.17, CI = \frac{(\lambda_{max} - n)}{(n-1)} = 0.057$$

**Table 2. RI of 1st to 8th order judgment matrices.**

| Order number(n) | 1     | 2     | 3     | 4     | 5     | 6     | 7     | 8     |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|
| RI              | 0     | 0     | 0.58  | 0.9   | 1.12  | 1.24  | 1.32  | 1.41  |

As shown in ‘Table 2’, when $n = 4$, $RI = 0.9, \frac{CI}{RI} = 0.063 < 0.1$

Therefore, the judgment matrix $A$ has satisfactory consistency.

4.3.2. Calculating relative weight vectors $P_i$ of layer $B$- layer $C$. In the same way, Four judgment matrices of layer $B$- layer $C$ are constructed, and the relative weight vectors $P_i$ of layer $B$- layer $C$ are calculated by the four judgment matrices, and the consistency of the judgment matrices are tested, as shown in ‘Table 3’.
Table 3. The four tables of layer B- layer C judgment matrices.

| B₁ | C₁ | C₂ | C₃ | P₁ |
|----|----|----|----|----|
| C₁ | 1  | 3  | 5  | 0.651 |
| C₂ | 0.333 | 1 | 1.667 | 0.217 |
| C₃ | 0.2 | 0.6 | 1 | 0.132 |

\[ \lambda_{\max}=3.00012, \ \text{CI}_{\text{RI}}<0.1 \] (a)

| B₂ | C₄ | C₅ | P₂ |
|----|----|----|----|
| C₄ | 1  | 3  | 0.75 |
| C₅ | 0.333 | 1 | 0.25 |

\[ \lambda_{\max}=2, \ \text{CI}_{\text{RI}}<0.1 \] (b)

| B₃ | C₆ | C₇ | C₈ | P₃ |
|----|----|----|----|----|
| C₆ | 1  | 3  | 4  | 0.632 |
| C₇ | 0.333 | 1 | 1.667 | 0.211 |
| C₈ | 0.25 | 0.6 | 1 | 0.158 |

\[ \lambda_{\max}=3.01667, \ \text{CI}_{\text{RI}}<0.1 \] (c)

| B₄ | C₉ | C₁₀ | C₁₁ | C₁₂ | P₄ |
|----|----|-----|-----|-----|----|
| C₉ | 1  | 2  | 3   | 0.333 | 0.220 |
| C₁₀| 0.5 | 1  | 2   | 0.25 | 0.131 |
| C₁₁| 0.333 | 0.5 | 1 | 0.125 | 0.070 |
| C₁₂| 3  | 4  | 8   | 1   | 0.579 |

\[ \lambda_{\max}=4.01634, \ \text{CI}_{\text{RI}}<0.1 \] (d)

\[ P₁=(0.651, 0.217, 0.132)^T \]
\[ P₂=(0.750, 0.250)^T \]
\[ P₃=(0.632, 0.211, 0.158)^T \]
\[ P₄=(0.220, 0.131, 0.070, 0.579)^T \]

4.3.3. Calculating the relative capability weight vectors \( W₁ \) of 5G/4G. The relative capability matrices of 5G mobile communication system \( D₁ \) and 4G mobile communication system \( D₂ \) on the key performance indexes \( Cᵢ \) are constructed, as shown in ‘Table 4’.

Table 4. The twelve tables of layer C- layer D judgment matrices.

| C₁ | D₁ | D₂ | W₁ |
|----|----|----|----|
| D₁ | 1  | 9  | 0.9 |
| D₂ | 0.111 | 1 | 0.1 |

| C₂ | D₁ | D₂ | W₂ |
|----|----|----|----|
| D₁ | 1  | 9  | 0.9 |
| D₂ | 0.111 | 1 | 0.1 |

| C₃ | D₁ | D₂ | W₃ |
|----|----|----|----|
| D₁ | 1  | 3  | 0.75 |
| D₂ | 0.333 | 1 | 0.25 |

| C₄ | D₁ | D₂ | W₄ |
|----|----|----|----|
| D₁ | 1  | 1  | 0.5 |
| D₂ | 1  | 1  | 0.5 |

| C₅ | D₁ | D₂ | W₅ |
|----|----|----|----|
| D₁ | 1  | 1  | 0.5 |
| D₂ | 1  | 1  | 0.5 |

| C₆ | D₁ | D₂ | W₆ |
|----|----|----|----|
| D₁ | 1  | 0.5 | 0.33 |
| D₂ | 2  | 1  | 0.67 |

| C₇ | D₁ | D₂ | W₇ |
|----|----|----|----|
| D₁ | 1  | 1  | 0.5 |
| D₂ | 1  | 1  | 0.5 |

| C₈ | D₁ | D₂ | W₈ |
|----|----|----|----|
| D₁ | 1  | 0.333 | 0.25 |
| D₂ | 3  | 1  | 0.75 |

| C₉ | D₁ | D₂ | W₉ |
|----|----|----|----|
| D₁ | 1  | 1  | 0.5 |
| D₂ | 1  | 1  | 0.5 |

| C₁₀| D₁ | D₂ | W₁₀ |
|----|----|----|-----|
| D₁ | 1  | 1  | 0.5 |
| D₂ | 1  | 1  | 0.5 |

| C₁₁| D₁ | D₂ | W₁₁ |
|----|----|----|-----|
| D₁ | 1  | 1  | 0.5 |
| D₂ | 1  | 1  | 0.5 |

| C₁₂| D₁ | D₂ | W₁₂ |
|----|----|----|-----|
| D₁ | 1  | 9  | 0.9 |
| D₂ | 0.111 | 1 | 0.1 |
Since all of the above are second-order judgment matrices, it naturally meets the requirements of consistency, and no more tests are required.

4.3.4. Calculating the comprehensive weight vector $W'$ of layer $U$-layer $C$.

$$W' = W \times P_1 = \begin{bmatrix} 0.154 \\ 0.627 \\ 0.154 \\ 0.065 \end{bmatrix} \times \begin{bmatrix} P_1 & 0 & 0 & 0 \\ 0 & P_2 & 0 & 0 \\ 0 & 0 & P_3 & 0 \\ 0 & 0 & 0 & P_4 \end{bmatrix}$$

$$= (0.100, 0.034, 0.020, 0.470, 0.157, 0.096, 0.033, 0.024, 0.014, 0.009, 0.005, 0.038)^T$$

4.3.5. Calculation of key performance comparison efficiency of 5G / 4G mobile communication system. Fill in the above results in ‘Table 5’.

| $U$ | $C_1$ | $C_2$ | $C_3$ | $C_4$ | $C_5$ | $C_6$ | $C_7$ | $C_8$ | $C_9$ | $C_{10}$ | $C_{11}$ | $C_{12}$ |
|-----|------|------|------|------|------|------|------|------|------|--------|--------|-------|
| $D_{ij}$ | 0.9  | 0.9  | 0.75 | 0.5  | 0.5  | 0.33 | 0.25 | 0.5  | 0.5  | 0.5    | 0.5    | 0.9   |
| $D_{12}$ | 0.1  | 0.1  | 0.25 | 0.5  | 0.5  | 0.67 | 0.75 | 0.5  | 0.5  | 0.5    | 0.5    | 0.1   |

Use formula: $E_i = W' \times [D_{11}, D_{12}, \ldots, D_{111}], i = 1,2$

Calculating the key performance comparison efficiency of 5G/4G mobile communication systems $E_1$ and $E_2$.

$$E_1 = W' \times [D_{11}, D_{12}, \ldots, D_{111}] = 0.56219$$

$$E_2 = W' \times [D_{21}, D_{22}, \ldots, D_{211}] = 0.43781$$

From the analysis of the calculation results, in the wide-area continuous coverage scene, at present, the key performance of 5G mobile communication system is better than 4G.

5. Suggestions on the development of 5G mobile communication system

On October 31, at the opening ceremony of 2019 China International Information and Communication Exhibition, the ministry of industry and information technology, together with three major operators and China Tower, held the 5G commercial launching ceremony, announcing the official opening of large-scale 5G commercial in China. The long-awaited 5G era has finally arrived. Countless people predict that 5G will reconstruct our life, so how to develop 5G mobile communication system and related industries well and fast way becomes a problem before us.

5.1. Strengthen overall planning, improve the policy system, and create a good development environment for 5G development

To speed up the formulation of 5G industrial development related plans and support policies, it is necessary to raise the development of 5G to a strategic level, clarify the functional organizations of governments at all levels, and the functional organizations are responsible for formulating 5G development plans in their respective regions, define the time nodes, task division, and construction objectives, and coordinate the support funds through multiple channels to help the enterprises that are outstanding in promoting 5G industrial development. In this way, responsibility is compacted, competition is introduced and motivation is stimulated.

5.2. Strengthen demand guidance, base on serving the society, and point out the right development direction for 5G development

In the face of the extreme differential performance requirements of all kinds of people, groups and diverse scenes in the society, we can summarize the characteristics of 5G mobile communication system into big data, mass connection and scene experience. Big data is the large amount of data, high transmission rate and data service; mass connection is the massive end-user access of the Internet of
things, providing the capability of everything to connect; scene experience is to provide high-quality user experience according to different scene requirements. 5G is difficult to provide solutions for all scenes based on a single technology like the previous mobile communication system. Therefore, we must develop mature technologies to support various extreme performance requirements under each scene. When a scene is needed, it is necessary to organically integrate the key technologies involved to ensure that effective solutions can be provided for each application scene.

5.3. Adhere to technological innovation, strengthen the talent team, and provide an inexhaustible source of power for 5G development

Innovation is the first driving force to development, and talents are the key to scientific and technological innovation. We need to explore an innovative way for 5G equipment manufacturing enterprises to build a cooperation platform with communication operators, professional colleges and research institutes, break through 5G key technologies, and accelerate the transformation of innovation achievements in combination with market demand. Building 5G industrial talent team, introduce high-end 5G talents into 5G scientific research and innovation activities with the help of various talent plans, and give various experts preferential policies and economic subsidies for 5G industry innovation and entrepreneurship.

5.4. Strengthen facilities construction and adhere to green development, and lay the foundation for sustainable development of 5G industry [6]

In terms of hardware, we will accelerate the establishment of a new generation of mobile communication infrastructure construction system led by 5G, promote the signing of 5G infrastructure construction cooperation agreements between the functional departments of governments at all levels, the three major operators, China Tower and facilities and equipment manufacturing enterprises, reasonably coordinate the deployment of communication network facilities and equipment, and form a win-win situation of 5G infrastructure construction. At the same time, we should also consider reducing the consumption of energy resources, energy saving can reduce emissions, energy saving can reduce costs, energy saving can extend the service life of various equipment, so as to ensure the sustainable development of 5G industry.

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