Research on Deep Coverage Technology of Mobile Communication Wireless Network

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Abstract: Based on the user's demand for mobile Internet services, the importance of developing deep coverage technology for mobile communication wireless networks is described. On the basis of summarizing the development status of deep coverage technology and understanding the main deep coverage technology, the application method of deep coverage technology is proposed: the progress is deeply studied through the network design optimization of deep coverage sites.

1. Introduction

With the rapid development of mobile Internet and Internet of Things technologies, mobile data services have shown an explosive growth trend, which also promoted the birth of the fifth generation mobile communication system, 5G. Although the comprehensive performance and technical level of the 5G system have been greatly improved compared with 4G and 3G, there are still some problems to be solved in the innovation process: for example, the impact of buildings on the airborne coverage of wireless signals, signal dead zone in the cellular coverage, increased user experience in a particular scenario, the development of mobile internet services, strengthening the signal in the building room, etc., which requires the use of deep coverage techniques to solve the above problems.

2. Development status of deep coverage technology

Deep coverage is developed in the GSM network coverage indoor signal, the main purpose is to meet the needs of high-speed Internet access, mobile access, large-capacity, intelligent access. Deep coverage refers to the use of small cellular base stations and indoor distribution systems to achieve coverage quality improvement in local areas and meet the requirements of deep coverage in the area [1]. At the same time, the deep coverage is used to supplement some hot spot complaint areas, hotspot use areas or blind areas covered by the network. Depth coverage can be divided into outdoor depth coverage and indoor depth coverage. In the past, the DAS (Distribute Antenna System) was widely used, which has obvious deficiencies. For example, network performance is susceptible to loss due to the influence of lines and devices, interference, long construction period, difficult maintenance, inconvenient maintenance, and complicated evolution. With the development of 3G, 4G and 5G technologies, the indoor coverage has undergone major changes, new devices and new technologies have emerged, reducing losses and interference, including micro base stations, integrated micro base stations, Radio Dot System (RDS), MDAS system, etc. These deep coverage technologies have their own advantages and disadvantages and scope of application and can be selected and applied according to their characteristics.

2.1 Micro base station

Compared to traditional base station BTS equipment, the professional manufacturer cabinet is used to install the carrier frequency board to provide signals, and the LTE base station equipment is further miniaturized and simplified into the BBU+RRU mode. On this basis, multiple antennas and GPS systems are adopted. The technical innovation of m RRU is that it adopts miniaturized and integrated micro RRU with antenna, which has the advantages of small equipment and integrated certain equipment capacity, providing high power and multiple 4G frequency bands to meet

complex networks. Network coverage requirements in the environment. m RRU is interconnected by fiber optic cable in a star or chain [2]. Flexible star structure, chain coverage results, centralized BBU unit, multiple antenna coverage options, to meet a variety of coverage scenarios.

The micro base station m RRU is ideally suited for coverage in closed large residential quarters. Large residential quarters are often the difficulty of current wireless signal coverage, macro stations can't get in, and peripheral signals are blocked. The micro base station m RRU can be used as an indoor source to supplement hotspot capacity and solve the problem of spectrum tension and uneven traffic distribution. Typical areas such as office building, communication equipment market, communication operator experience business hall, and commercial center.

2.2 Nano Cell

Nano Cell is more suiTable for solving single-building buildings, and the coverage area is small. The signal backhaul can be realized by PON and PTN, and the transmission power is small (2×125m W). The device synchronization uses GPS synchronization or air interface synchronization. Each Nano needs a synchronization source. It is difficult to deploy multiple synchronizations in the same building. Therefore, when multiple coverage is required, it is recommended to use the RDS coverage system. When Nano Cell is covered, each Nano supports at least 20MHz bandwidth capacity, and there is no sharing between multiple Nanos; Since it is usually different from the outdoor macro station, the balance optimization and mobility management of indoor and outdoor business is more complicated.

2.3 Radio Dot System

Radio Dot System is also called distributed pico base station. The RDS system architecture consists of: DU (Digital Baseband Unit) + IRU (Indoor Radio Frequency Unit) + Dot (Wireless Point System). The RDS networking is flexible and can be widely applied to various depth coverage scenarios. The DU adopts the base station products of the main equipment manufacturer, and the indoor and outdoor networks are fully integrated to improve the overall performance of the network. Therefore, the RDS system has advantage of elegant design, high capacity, high integration, simple and fast installation, low cost, easy monitoring, maintenance and expansion, etc.

2.4 MDAS system

MDAS (Multiservice Digital Distributed Access System) integrates network functions such as GSM, TD-SCDMA, and TD-LTE. The LTE MIMO, 2G, and 3G signals are introduced through the access unit, converted into optical signals through digital processing, and transmitted to the remote end through optical fibers for amplification output. Therefore, MDAS can be regarded as a wireless repeater with the development from 2G. After upgrading to a 4G network, the fiber coverage system is adopted, and the networking is relatively flexible.

3. Depth coverage site network optimization design

For all kinds of complex network coverage scenarios, the design of network depth coverage needs to be carried out according to actual conditions. How to choose a better coverage scheme, coverage technology to adopt, and implementation scheme will have a direct impact on the effect of deep coverage. The conventional methods in the deep coverage network design process are discussed below.

3.1 Deep coverage survey

Before the network deep coverage, the initial coverage plan should be formed by combining various coverage methods according to user needs, surrounding environment and local conditions. The general network coverage survey includes: wireless network survey, transmission professional survey, power professional survey, supporting system survey, through the advanced survey of different professions, select the most suiTable network coverage solution to meet the capacity, coverage, quality and other aspects. Through the survey selection process, more accurate data

information is collected to lay the foundation for later planning and optimization.

There are many outdoor surveys and wide coverage survey methods. The survey work is also relatively mature. According to environmental surveys, traffic distribution surveys, information collection, base station site selection, and top surface selection, the project survey stage is completed to complete the general survey of base stations. Survey records are recorded in combination with various special scenarios such as rural areas, basins, urban coverage, tunnel coverage, and mountainous areas. Cover 4G networks based on 2G and 3G base station location co-location. The new site selects the primary point and the alternate selection point, the station name, the latitude and longitude, the antenna parameters, and the target group.

Deep coverage survey mainly considers the coverage of the target area capacity users, especially the indoor active users' choice of the network. It is the key survey content, such as whether to use WLAN at home, using 4G signals, etc., to focus on the investigation.

After the equipment survey is completed, tools are used for top surface survey and design. Commonly used tools are: electronic map, GPS, compass, camera, range finder, etc. Data collection charts, electronic maps or paper maps are used to collect the surrounding environment data, GPS is used for positioning, the compass is used to determine the antenna orientation of the base station, the camera is used to record the surrounding coverage environment, and the rangefinder is used to record the relevant distance.

In the choice of antenna type, a 2-channel antenna and an 8-channel antenna are generally used. The 2-channel antenna has a built-in 0 to 10 degree adjusTable electronic downtilt; the 8-channel antenna has a built-in 6 degree fixed electronic downtilt.

In the use of the antenna, try to use LTE independent antenna, not with 2G, 3G common antenna, need a common antenna, a good combination needed to make. In the use of the existing network, the quality of the combiner and other antenna problems cause network quality problems, and thus form interference, standing wave and other issues, so try to use LTE independent antenna for network coverage; must be shared with 2G, 3G antenna In the case of the case, try to use a multi-band independent electrical adjustment antenna. The antenna downtilt angle uses the electronic downtilt angle, but in actual use, the mechanical downtilt is used more, as shown in Table 1 [3].

Table 1 Cover scene and antenna downtilt

cover scene	height	antenna downtilt (MT+ET)
dense urban area	< 25m	6
	> 25 m≤35m	10
	> 35m	12
urban area	< 25m	4
	> 25 m≤35m	8
	> 35m	10
suburbs	< 25m	2
	> 25 m≤35m	4
	> 35m	6

3.2 Different scene depth coverage technical solutions

For the property point buildings with room division system in the construction of 2G and 3G networks, under the premise of comprehensive coverage cost, construction difficulty and other factors, the first selection method is adopted for coverage, and the original room division system construction method of 4G combined roads is adopted; If the capacity demand is high and the building coverage needs are strong, independent 4G or rebuild according to the actual situation can be chosen; The building structure is empty, and the integrated leather base station can be selected. The building structure is complex, and the single road can be transformed into a two-way method.

For large-scale convention centers, large venues, transportation hubs, shopping malls and other

venues with high capacity requirements and empty building structures, distributed leather base station construction schemes are preferred.

For medium-sized and indoor open spaces, such as shopping malls, unobstructed office buildings, etc., nano cell base stations are preferred; If there are many indoor partitions, the traditional DAS system for coverage can be chosen.

For scenes with small area, small partition, and wide structure, and transmission conditions, it is preferable to deploy 4G integrated pico base station equipment for solution.

For scenes with more buildings and less traffic, you can choose the form of macro station, micro station, floor-to-building, indoor pole antenna and other outdoor coverage indoors. For urban villages with irregular buildings and small floor space, it is necessary to provide coverage of multiple systems at the same time. The blind spots are small and scattered. It is recommended to use MDAS and adopt cell consolidation to avoid cell interference. For the scenario of single-point patching and supplemental hotspots, the indoor coverage can be selected as an integrated pico base station, and the outdoor coverage indoor mode is selected by the micro base station.

4. Conclusion

In summary, there are a variety of deep coverage technologies that are commonly used at present, and various technologies with different characteristics and scope of application.

Combined with deep coverage networks to optimize construction project examples, the application frequency of the micro base station is the highest, followed by the distributed base station and the pico base station.

In recent years, the comprehensive application of various deep coverage technologies is also increasing, which fully demonstrates that the application level of deep overlay network technology has been improved, but with the increasing number of users and the increasingly complex scenes, further deepening coverage is needed.

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