

3G Technology in the Wireless Communications

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Abstract. This article from the 3G technology development at home and abroad studies the basic features of 3G technology, including international standards and the leading technology of China Unicom. It discusses and analyzes the application of 3G technology, such as video calls, wireless Internet access and remote monitoring. Finally, it puts forward the growth trends of 3G technology in the future.

Keywords: 3G, mobile communication, applications

1. Introduction

Back in 2001, some countries has operated 3G communication. With several years of development, there is rapid growth in 3G communication users. In China, 3G licenses are officially released for three operators in January 2009, which opened China's 3G telecommunications market. In the past two years, with the continuous development of communication network and the technology, value-added telecom business with 3G technology has come into a high-speed development with expanding business, diversified business entities tend and increasingly innovative new business model. In a 3G era, the mobile multimedia data service is bound to be widely applied.

2. The basic characteristics of 3g technology

In May 2000, International Telecommunication Union (ITU) determined WCDMA, CDMA2000 and TD-SCDMA as three major wireless interface standards, which has been written into 2000 International Mobile Communications Plan (referred to as IMT-2000 3G technical guidance document). In October 2007, WiMAX was accepted by ITU as one of 3G international standard.

- WCDMA

The Wideband CDMA, also known as CDMA Direct Spread, means wideband code division multiple access, whose supporters are mainly European-based GSM system manufacturers.

- CDMA2000

CDMA2000 is also known as CDMA Multi-Carrier, which is proposed by North America Qualcomm.

- TD-SCDMA

The standard was developed in China, which Ministry of Posts and Telecommunications of China Academy of Telecommunications Technology (Datang Telecom) presented to the ITU on June 29, 1999.

- WiMAX

Worldwide Interoperability for Microwave Access, is a global microwave Internet access, which was proposed by Intel Corporation and a number of companies involved in developing standards.

TD-SCDMA standard, including intelligent wireless, synchronous CDMA, and software radio technology, has unique advantages in the spectrum efficiency, flexibility of business support, frequency flexibility and cost. In addition, more than half of the world equipment manufacturers have announced to support TD-SCDMA standard owing to a huge market in China. In view of 3G standards, the network mainly features in the wireless interface technology. Wireless technology of cellular mobile communication

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systems include cell multiplexing, multiple access / duplex mode, application frequency, modulation, radio channel parameters, channel coding and error correction, frame structure, the physical channel structure, and multiplexing mode and so on. 3G wireless technology has fully drawn the application technology of 2G network operators [1]. The innovations of 3G wireless technology mainly are as follows:

2.1. High frequency spectrum

To achieve the goal of global roaming, it uses 2G frequency bands with bandwidths up to 230MHz, of which 170MHz is assigned to the terrestrial network and 60MHz to the satellite network. It provides a broad spectrum space for the 3G network capacity to achieve global multi-services.

2.2. Wideband radio channel to support high-speed services

Taken fully consideration of carrying multimedia services, 3G network radio carrier channel uses channel bandwidth 5/10/20M. Meanwhile, it further improves the chip rate and the system capacity of anti-multipath fading.

2.3. Multi services and multi-rate transmission

In the broadband channel, the technology of time multiplexing and code reuse can be flexibly applied to control the quality of each business. Through selecting different spreading factors, various rates requirements of different QoS can map into the broadband channel to realize multi-service and multi-rate transmission.

2.4. Fast power control

For mainstream technology of 3G, fast closed loop power control technology is applied to downlink channels to improve the performance of the downlink transmission channel. On one hand it improves the system capacity of anti-multipath fading, but on the other hand it increases the system's deviation from the interference as multipath channel results in spread-spectrum code division. But in general, the application of fast power control is good to improve system performance.

2.5. Adaptive antennas and software radio technology

Adaptive antenna arrays are applied to the 3G base station, which, due to programmable electronic phase relationship, beamforming can be sent a letter to adaptively adjust the power, reduce the system self-interference and improve receiver sensitivity and increase the system capacity. Moreover, the other software radio technologies for the base station and terminal products application play a critical in improving the system flexibility and lower costs.

China Unicom has mastered the key technology of WCDMA, mainly contains the following two aspects:

2.5.1. Channel coding

Channel coding and decoding is to reduce signal transmission power and to resolve the inevitable problem of signals fading in the wireless communication environment. Coding and decoding technique can improve the BER performance. Compared with no coding, conventional convolutional codes can increase error rate of 10^{-3} to 10^{-4} while the Turbo codes can increase error rate of 10^{-6} .

Channel coding scheme not only solves the problems of the choice of error correction, encoding and decoding algorithms and interleaving algorithm, but also involves communication with the high-level message to achieve different business encoding and reuse scheme for the most efficient combination of multiple services. In order to adapt to a variety of transmission rates, channel coding scheme has also increased the rate adaptation function. A rate adaptation algorithm in WCDMA aims to adapt the business rate into the standard rate.

2.5.2. Power control

Power control is one of the key technologies in WCDMA system. Due to the distance and self-interference, power control will determine the effectiveness of the WCDMA system, and largely the performance such as the system capacity, coverage, QoS service (quality of service system). Power control is to ensure that QoS required by users minimize transmit power and reduce the system interference in order to increase system capacity. Power control contains open loop power control and closed loop power control.

2.5.3. Switch

When the terminal is moved from the coverage of one base station to one of another base station, switching technology is required to communicate terminal with mobile networks, including soft switching / softer switching and hard switching.

3. 3G technology

3G refers to as third generation mobile communication technology, which is a new generation of mobile communications systems combining wireless communications, Internet and other multimedia communications. It can provide, including video telephony, wireless Internet access, mobile Internet, mobile TV, mobile music and other information services. 3G in China Unicom has innovated telecom business experience, by which information and communication are more freely and more exciting faster and more personalized in provision of broader network coverage extensive business. Practically, mobile streaming media provides the businesses of on-demand, live and download play.

The on-demand business include movie trailers, highlights, MTV, and etc.; live business includes television programs, video surveillance, major events, music, on-site meetings, and etc.; download play business is more suitable for those who are not online and audio and video multimedia programs are required the higher quality, taken typical video phone, wireless Internet access and remote video technology as examples.

3.1. Video Phone Technology

3G video call center system bases on WCDMA circuit domain video phone technology. Signaling protocol is No 7 ISUP signaling protocol while the 3G-324M protocol is used in a media negotiation. The technology of synchronized streaming video and voice is applied to artificial agents, in which speech bases on the traditional 2G lines and video on IP-based transmission, effectively solving the synchronization problem of voice and video [2].

Main system modules:

- Media Gateway: is responsible for 3G video calling customer service access to achieve domain-based mobile network access circuit. In a video call, the ISUP / BICC signaling in the mobile network continue to build a 3G-324M consultations to complete call control in video telephone.
- IVP (Interactive Video Platform) server: to complete interactive video processing, and streaming and merging of audio and video.
- Database: to store user data.
- Media Server: to store audio and video source files.
- Interface server: to complete the interface with tents and a card charging platform.

3.2. Wireless Internet

WCDMA technology is built on the CDMA, which provides users with the highest 2Mbit / s data transfer rate. The advantages of WCDMA are high chip rate effectively use the frequency selective diversity and space to receive and transmit diversity, which solves the problems of multipath and fading. Channel coding and decoding in Turbo offer higher data transfer rate. FDD provides full coverage of wide-area base station, where downlink uses the unique cell search method. There is no strict synchronization between base stations. A continuous pilot technology supports high-speed mobile terminals (500km/h). Compared to the second generation of mobile communication technology, WCDMA system are not of greater capacity, better voice quality, higher spectrum efficiency, faster data rates, a stronger anti-fading capability, better resistance to multipath resistance, but also to smooth the transition from the GSM system, to ensure that the operator's investment for 3G operators with a good technical foundation. By the effective use of broadband, WCDMA not only solve the problem of the process sounds, images, data, and Internet connection speed, but handle dynamic images with the combination of MPEG-4 technology [3].

3.3. SLR cameras.

For example: Document No. 200610027919.5 involves a Concealed surveillance camera, including the reflector fixed on the wall. Document No. 200620062657.1 involves a miniature camera, including the

brackets and camera housings, lens group, image sensors, image sensors and micro-circuit board connections placed in the shell [4].

4. Conclusion

In short, it is a gradual process for 3G application, which will be gradually so mature and rich that covers daily life, work and all aspects of enterprise applications. It has become a major revenue boost in mobile power with the accelerating development. The rapid development of 3G technology and the terminal performance has promoted mobile Internet services. The focus of Mobile business has shifted from the voice to data services. Since mobile video service has represented the rapid development of 3G services, entertainment-oriented business has transferred to the various types of application development, which will become important revenue for carriers In the future, 3G services will be innovative, cross-content to meet growing demand for customer.

5. References

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