

Analysis of the 4G Technologic Requirements and Key Technology

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ABSTRACT

The mobile communication technology has been developed for three generations. Although the 3G Mobile Communication system can provide many wide frequency belt information services which the former two generations can't offer, it still has limitation that especially follows the structure of 2G system, which leads to the dissatisfaction of intelligence by mobile terminal. So the 4G system has been taken into consideration. The paper analyzes the technological requirements and technology of 4G Mobile Communication.

Keywords- mobile communication; 4G; technological, requirements; key technology

1. INTRODUCTION

Currently, the rapid development of mobile communications technology, in the course of the construction 4G system to analyze the requirements and key technology of 4G is necessary. Fourth generation mobile communication technology may be called broadband access and distribution network, with more than 2Mbit/s of no symmetrical data transfer capability. It includes fixed broadband wireless access, broadband wireless local area network (WLAN), mobile broadband systems and interactive broadcast network. 4G can be in different fixed platforms, wireless platforms and networks provide wireless service that spans different frequency bands, broadband Internet access in any place (including satellite and stratospheric communication), can provide positioning timing, data collection, integrated features like remote control. In addition, 4G is both an integrated multifunctional broadband mobile communication systems and broadband IP system, that is, 4G will be a wide range of wireless technology and integrated systems. It incorporates enhancement of an existing 3G, set 3G network technology and wireless LAN system as a whole.

2. 4G System Technical Requirements

4G communication systems of the future will be more perfect than the 3G of the emerging wireless world, it needs to achieve the following technical requirements:

A. The more technologically advanced, high communication speed.

Because people 4G aim at the outset of the study is to improve the wireless cell phones and other mobile devices accessing the Internet rate, so 4G communication features than it has a faster wireless communication speed. Lieutenant 4G communication using OFDM technology, wireless access technologies, radio technology in optical fiber communication technology, software, communications systems for emergencies and grouping operations, maximum data transfer rate of up to 100Mbps. Feed from pace to speed, this is the

data transfer rate of mobile phones at a rate 10,000 times, is also a 3G mobile phone rate 50 times. At the same time, wireless frequency usage efficiency and system realization of can be greatly improved. Network spectrum width, low transmitting power. Digital communication has not only easier to process information, encrypted information, and characterized by high reliability and strong anti-interference ability, and with the development of digital circuits and VLSI production levels increased, digital communications have replaced the analogue communication trends. Analog communications contents focus mainly on amplitude modulation, phase modulation and FM modulation technology of three explanations, these types of technology students through the "high frequency circuits" course of study, believed to have a preliminary understanding, therefore, we should have more content digital communication systems, in particular, to strengthen the principles of modern communication explaining, teaching practical, advanced.

B. Enhanced m-ary carrier modulation technique and content of new modulation techniques.

In order for the 4G transfer rates of up to 100Mbps, operators must be in 3G communication networks on the basis of substantial transformation, so that it applies to business 8Kbit/s~20Mbit/s wide dynamic range of transmission rate, spectrum utilization should be much larger than the 3G system Relevant studies show that 4G each channel occupies a spectrum of 100MHz, equivalent to WCDMA (3G network) 20 times, transmitting power than it is now reduced from 10 to 100 times to solve electromagnetic interference problem.

C. Multimedia communication of wisdom higher and access flexibility.

4G communications terminal device of design and operation has wisdom sexual, 4G phone of function has cannot simple classified Mandarin machine of areas, it has interactive performance; many mobile device also are can became 4G of Terminal, as may wearing radio.; 4G system intends used intelligent technology makes its can since adaptation to for resources distribution, can adjustment system on communications process in the changes of business flow size for corresponding processing and meet communications requirements, Intelligent signal processing technology for different channel conditions all complex environment to normal sending and receiving of signals, have a lot of wisdom, resilience, and flexibility.

D. Better compatibility.

At present, three large global GSM, CDMA and TDMA mobile communication standards, only by the fourth generation mobile communication standard developed to address compatibility issues. Therefore, 4G communication system should meet the global roaming, open interfaces, with

a variety of network interconnection, Terminal diversification and smooth transition from 2G and so on.

E. Cheaper communication costs.

Because 4G not only solved a compatibility issue with the 3G, so that more users can easily upgrade existing traffic to 4G, and 4G introduced many sophisticated communications technology, which, compared to other technologies, 4G it's much easier to deploy. 4G communication systems at the same time, often operators will be considered directly in the 3G communications network infrastructure, using progressively introduce methods so that you can effectively reduce operating costs.

F. Wireless system with high capacity.

In communication capacity, FDMA, TDMA, and CDMA as possible on the basis of introducing SDMA. Space-division multiple access (SDMA) using adaptive beam, like radio waves, connected to each user, so as to allow the wireless systems capacity than it is now 12 orders of magnitude.

3. Key Techniques in the System

4G system technology has two basic objectives: first global coverage for wireless communication; the second is to provide seamless and high quality wireless services. In order to achieve this goal, you need to make efforts in the following aspects: efficient use of spectrum, dynamic allocation of bandwidth, secure wireless applications, higher service quality, high-performance signal modulation and transmission technology. To this end, the 4G system used many new technologies, including physical location positioning technology and specific dynamic Adaptive wireless network technology, networking technology, intelligent dynamic allocation of spectrum radio technology and software, and so on, with key technologies are described below.

A. Positioning technology.

Positioning refers to measurement method and calculation method of mobile terminal locations. It is mainly divided into mobile network based on mobile terminal positioning, based on position or mix position in three ways. 4G mobile communication system, mobile terminal may be in a different system (platform) for mobile communication. Therefore, the positioning and tracking of mobile terminals, the realization of mobile terminals in different system (platform) seamless connectivity and high-rate in the system and prerequisite and guarantee of high quality mobile communications.

B. Switching technology

Switching between different mobile community technology for mobile terminals, communication or signal to lower channel selection between different frequencies and so on. Switching technology is the mobile user terminal in during a call from a base station coverage in mobile to another base station coverage area, or from a mobile switching Center (MSC) within the service area to another MSC service area in order to maintain the mobile users do not interrupt. Effective handoff algorithm can improve capacity and QoS in cellular mobile communication system in 4G communication system, applies to a wide range of switching technology. Switching technology is generally divided into hard switching, soft handoff, soft switching, switch between frequency and switch between systems, suitable for mobile terminals in different mobile communication between communities and between different frequencies, or signal to lower channel selection, and so on.

C. Software radio technology.

In order to achieve seamless access and transparent business, user terminal must be multimode, multiband operation, and must be able to automate pattern recognition, and the user and the network under the direction of or based on user service and QoS requirements, Adaptive mode, and the corresponding a series of actions. Currently, configurable terminal development is mainly based on software radio technology, software defined radio technology is considered to be different forms of communication technology can be effectively linked with unique technology. Software radio is a highly developed computer and digital signal processing technology and the urgent requirement of the military communications product. So-called software radio is the use of various features of the software to achieve radio communication system, is a standardized, modular hardware function a units to go through a common hardware platform, software loading to achieve various types of radio communication system for a new technology with open architecture. By downloading a different software program, can achieve a variety of functions on the hardware platform to meet in a different system with a single terminal roaming, it is to address key technology of mobile terminals in different aspects of the system work.

D. Smart antenna technology.

Smart antenna with inhibition of signal interference, automatic tracking, and digital beam control and other functions, is the key technology of mobile communication. Intelligent antenna initially application Yu radar, and sonar and the military communications area, in recent years, modern digital signal technology development quickly, DSP chip processing ability of new technology and new business constantly improve and chip price of constantly fell, makes using digital technology in base with formation antenna beam became feasible, prompted intelligent antenna technology began in wireless communications in the widely application intelligent antenna forming beam can in space domain within suppression interactive interference, enhanced special range within wants to of signal, Such technology can improve the signal quality and increase the transport capacity, the rationale is that side the wireless base station antenna arrays and coherent RF signal wireless transceiver to receive and transmit, at the same time, through base-band digital signal processor for each antenna receives signals on the link a certain algorithm for merging and achieve uplink beam-forming. Smart antennas can significantly improve the performance of wireless communication systems, increases system capacity, as reflected in the following areas: improve spectrum utilization; speedy settlement of the dense urban capacity bottlenecks; suppress interference signal fading; implementation of mobile station location.

E. Interference suppression and multi-user

interactive identification technology.

Interactions in the development of interference cancellation and multi-user recognition should become part of the 4G, interactive interference rejection of introducing them to the base station and mobile phone systems, proximity and to eliminate unnecessary user total channel crosstalk between ensure that high quality receiver receives a signal. This combination will satisfy greater capacity needs of users, but also to increase coverage. Interactive interference suppression and multiuser recognizes two combinations of technologies will significantly decrease network infrastructure deployment, ensure business quality improvements.

F. Reconfigurable/self-healing network technology.

When the processor is used in 4G wireless network, they will be able to handle node failures or base station is overloaded. Web parts use answering device based on knowledge, will be able to correct network failures, the answering device placed on the wireless network controller based on knowledge.

G. OFDM technology.

At high frequencies for high speed mobile communication, will face serious frequency selective fading. In order to improve the signal performance, research and development of intelligent modulation (such as orthogonal frequency division multiplexing (OFDM) technology and single carrier Adaptive equalization techniques and so on) can inhibit this decline. OFDM is a high-speed transmission technology in wireless environment, is a multi-carrier digital modulation technique, which is characterized by ease of achieving channel balance, reduce the complexity of the equalizer. Wireless channel is mostly non-flat frequency response curve, OFDM technology in frequency domain is the main idea of orthogonal subchannel given channel is divided, each channel using a sub-carrier modulation, the sub-carrier parallel transmission. In this way, although the channel frequency response is flat, that is, for frequency-selective fading channels, but each subchannel are relatively flat, and on a per-channel is the narrow-band transmission, signal bandwidth is less than the bandwidth of the channel, thus greatly eliminating interference between signal waveform. OFDM technology can counteract is the biggest advantage of frequency selective fading or narrow-band interference. In the carrier for each channel in OFDM Systems mutually orthogonal, spectral overlap and this will not only reduce mutual interference between the subcarrier and improve spectrum utilization.

H. Channel transmission technology.

Spectrum is a finite resource, in the 4G system, we should adopt effective measures to improve spectrum utilization, on the other hand we have to develop new spectrum resources. Therefore, research on high frequency wide-band signal transmission is becoming very important. AWACS project European study on broadband wireless access system transmission characteristics in the 17~19GHz band; the SAMBA project study on access system transmission characteristics in the 30~40GHz band; MEDIAN project study on broadband wireless access system transmission characteristics in the 60GHz band.

I. Multi-user detection.

In a CDMA there is signal, this interference. multiple the number increases, major communication technology directly sequence user of signal code match interference broadband anti interference traditional Shang, full all user signal for detection, performance, problem, precision efficient significantly multiuser various complex 4G actual technology

J. Radio resource management techniques.

In high speed mobile communications system in the, not only frequency resources limit mobile user signal of transmission rate, and base station and terminal of launch power also limit has user of transmission rate, therefore, used a good of wireless resources management policy, it can detection available of resources and signal of quality, then under different user, and different business quality requirements dynamic of distribution frequency resources and signal launch power, such can greatly improve system of performance.

4. 4G Systems Perspective

We convinced, in does not far of future 4G of research results set will influx market, in function, and business, and bandwidth Shang are is different from Yu zhiqian of communications system, should is will all wireless service integrated in together, can in any local access Internet, not only can improve information communications quality, and can provides positioning scheduled, and data acquisition, and remote control, integrated function, while can real-time for more rate access, formation virtual office or family of environment, support various wireless and mobile IP business. We believe that the not-too-distant future people will not restricted by time, place, you can use mobile Internet to obtain and impart information freely, leading to people in terms of learning, working and living convenience.

5. Conclusion

In this paper, technical requirements, the key technologies both to an in-depth analysis of the fourth generation mobile communication system and future development prospects of 4G. To achieve the 4G system, we must mention them one at a breakthroughs in key technologies, this will be a long, but worth looking forward to the process, we firmly believe that the future 4G will be multifunctional integration of broadband mobile communications system, is the next-generation mobile communications system to meet future market demands.

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7. References

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