GUEST EDITORIAL

OPEN WIRELESS ARCHITECTURE AND ENHANCED PERFORMANCE

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The major step from second- to third-generation and further to fourth-generation (4G) mobile communications was the ability to support advanced and wideband multimedia services, including email, file transfers, and distribution services like radio, TV, and software provisioning (e.g., software download). These multimedia services can be symmetrical and asymmetrical, real-time and non-real-time. External market studies have predicted that in Europe in 2010 more than 90 million mobile subscribers will use mobile multimedia services and will generate about 60 percent of the traffic in terms of transmitted bits. Just in China, the DGI predicted that there will be over 400 million mobile phones in China by 2008, and over 150 million for multimedia applications.

In next-generation mobile communications, the combination and convergence of the different worlds of information technology (IT), media, and telecommunications will integrate communications. As a result, mobile communications together with IT will penetrate various fields of society.

In future 4G mobile communications, two economically contradictory demands will arise: ubiquity and diversity. Open, global, ubiquitous communications make people free of spatial and temporal constraints. Versatile communication systems will also be required to realize customized services based on diverse individual needs. Flexibility in mobile IT can satisfy these demands simultaneously. Therefore, mobile IT can be seen to play a key role in the 21st century.

User expectations are increasing with regard to a large variety of services and applications with different degrees of quality of service (QoS), which is related to delay, data rate, and bit error requirements. Therefore, seamless services and applications via different access systems and technologies that maximize the use of available spectrum will be the driving forces for future developments.

In addition, many types of objects as well as people will have network functions, and will communicate with each other through networks. Therefore, different communication relationships, such as person to person, machine to machine, and mainly machine to person and vice versa, will determine mobile and wireless communications in the future.

Given the increasing demand for flexibility and individuality in society, the means of the end user might be assessed. Potentially, the value could lie in the diversity of mobile applications, hidden from the complexity of the underlying communications schemes. This complexity would be absorbed into an intelligent personality management mechanism that would learn and understand the needs of the user, and control the behavior of their reconfigurable and open wireless terminals accordingly in terms of application behavior and access to future support services.

In the future, wireless service provision will be characterized by global mobile access (terminal and personal mobility), high QoS (full coverage, intelligible, no drop, and no/lower call blocking and latency), and easy and simple access to multimedia services for voice, data, message, video, Web, GPS, and so on via a single user terminal.

This vision from the user perspective can be implemented by integration of these different evolving and emerging wireless access technologies in a common flexible and expandable platform to provide a multiplicity of possibilities for current and future services and applications to users in a single terminal. Systems of 4G mobile will mainly be characterized by a horizontal communication model, where such different access technologies as cellular, cordless, wireless LAN type systems, short-range wireless connectivity, and wired systems will be combined on a common platform to complement each other in an optimum way for different service requirements and radio environments, which is called the converged broadband wireless platform, or open wireless architecture (OWA).

OWA will eventually become the global industry standard to integrate various wireless air interfaces into one wireless open terminal where the same end equipment can flexibly work in the wireless access domain as well as in mobile cellular networks. Because the mobile terminal (rather than the wireline phone) will become the most important communicator in the future, this single equipment with a single number and multiple air interfaces (powered by OWA) will definitely dominate the wireless communication industry.

In fact, this OWA model is being introduced into the wireless markets recently. In China and Europe, the initial OWA products include the GSM/cdma2000 2-in-1 terminal, GSM/TD-SCDMA 2-in-1 terminal, PHS/WCDMA 2-in-1 terminal, GPRS/WCDMA/WLAN 3-in-1 terminal, and WCDMA/OFDM/WLAN 3-in-1 terminal. Not only

can the OWA platform improve spectrum efficiency, increase wireless data rates, and optimize network resources; it can also provide a cost-effective solution to enhance wireless communication services, which is essential for the next-generation business model of mobile communications.

To report on this very hot research work, we have selected three articles for this issue. The first one, by Dr. Luo *et al.*, investigates the wireless network coupling structure between various radio access technologies for OWA. The convergence of WLAN and 3G cellular is currently receiving worldwide interest, and this article presents a very good radio resource management scheme in this field.

Many technical issues reside in the OWA implementation. A new transceiver is required to integrate the different radio transmission technologies. The smart antenna array takes a more important role in its implementation. In the second article, Dr. Liu *et al.* study the performance improvement given by a multi-antenna receiver on a mobile terminal for China's 3G standard, TD-SCDMA, which is very important in integrating with the GSM network.

As wireless LAN is being converged into mobile networks to enhance data services, QoS is becoming very critical in the upcoming OWA development. Dr. Gu *et al.*, in the third article, discuss a distributed medium access scheme to allow prioritized medium access for applications with QoS requirements to guarantee enhanced performance of the integrated systems.

The Editor would like to thank the authors and reviewers who have given so generously of their time to make this issue a reality. He would like to express sincere thanks to Roch Glitho for his initiative in preparing this issue, and his continued encouragement and support. Thanks are also given to Sue Lange, Digital Production Manager of the IEEE Communications Society, for her cooperation in making this issue possible. If you have any questions, comments, or suggestions about this topic, please feel free to contact me at wwlu@ieee.org.

BIOGRAPHY

WILLIE W. LU [SM] (wwlu@ieee.org) is a senior principal wireless architect and vice president at Infineon Technologies (formerly Siemens Microelectronics). He is also an internationally well recognized senior expert in emerging wireless technologies, and has been a senior technical advisor for over 22 wireless communication authorities in more than 10 countries. He is an independent technical examiner for many high-tech venture capitals in the United States, Europe, Asia, and other places, and is listed in major Who's Whos in the world. He has guest edited around 30 special issues on emerging wireless communications in IEEE, IEICE, ACM, CIC, and other major publications, and has had over 150 papers published in major professional publications. He has been technical chairman of numerous IEEE conferences including GLOBECOM '03, WCNC '02, VTC '03, and WWC, and is the Wireless Communications feature editor for *IEEE Communications Magazine*, *IEEE Transactions on Wireless Communications* (former *JSAC Wireless*), and others. He is a frequent keynote and featured speaker at lots of global technical fora, and a very well-known wireless pioneer on a worldwide basis. He is a member of ACM, IEICE, CIC, CIE, and Sigma Xi, and an adjunct professor at many world-class universities in the world.