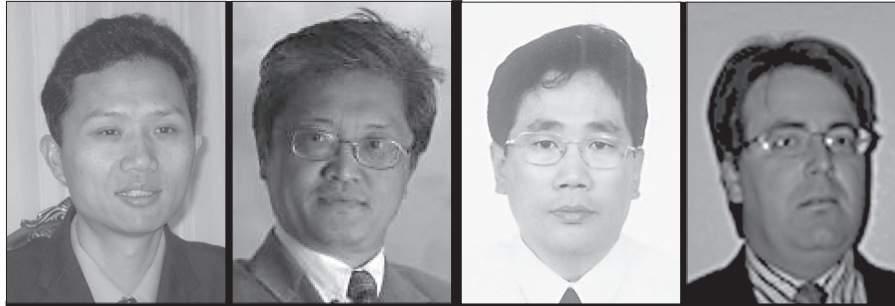


GUEST EDITORIAL

TECHNOLOGIES ON THE FUTURE CONVERGED WIRELESS AND MOBILITY PLATFORM



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Future wireless service provision will be characterized by global mobile access (terminal and personal mobility), high quality of services (full coverage, intelligible, no dropping, 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 terminal per user.

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. Fourth-generation mobile systems will mainly be characterized by a horizontal communication model, where different access technologies such as cellular, cordless, WLAN type systems, short-range wireless connectivity, and wired systems will be combined on a common platform to complement each other in an optimal way for different service requirements and radio environments, which is technically called the converged broadband wireless and mobility platform, or open wireless architecture (OWA) in a more technical sense.

OWA defines the open interfaces in wireless networks and systems, including the baseband signal processing system, radio frequency (RF) system, networking, and service/application and operating system, so that the system can support different wireless industrial standards and integrate the various wireless networks into an open broadband platform. For comparison, software defined radio (SDR) is only a radio in which the preset operating parameters, including inter alia frequency range, modulation type, and/or output power limitations, can be reset or altered by software. Therefore, SDR is just coupling different wireless systems into a reconfigurable radio without defining an open interface within the converged wireless platform. SDR consumes much more power when the number of supported wireless standards increases, especially in the RF and baseband processing systems.

Cognitive radio is a radio or system that senses and is aware of its operational environment and can dynamically, autonomously, and intelligently adjust its radio operating parameters. In order to maximize the spectrum efficiency, the cognitive radio must be constructed on the OWA platform to support future open spectrum management capability. For example, based on OWA, cognitive radio can be automatically operative in a WLAN air interface whenever the user enters the WLAN service area, hand

over to WiMax air interface whenever the user leaves a WLAN area and enters a WiMAX service area, and switch back to a GSM network if other wireless access networks are not available. In this way, wireless spectrum utilization efficiency can be maximized, and the available spectrum shared and recycled.

OWA will eventually become the global industry leading solution 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. As the mobile terminal (rather than 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 wireless communications.

As stated in the Organization of Economy, Cooperation and Development (OECD) report in April 2005, "As too many wireless systems come out every day, the current closed architecture and proprietary systems do not bode well for its success"; therefore, an open architecture platform will definitely drive future wireless and mobile communications.

Fourth-generation (4G) mobile communications will basically focus on OWA, and cost-effective and spectrum-efficient high-speed wireless mobile transmission. The 3G system has suffered tremendously worldwide because it did not fundamentally improve the wireless architecture; making the architecture open is the final solution for the wireless industry.

OPEN WIRELESS ARCHITECTURE

Fourth-generation mobile communications will be based on OWA to ensure that a single terminal can seamlessly and automatically connect to the local high-speed wireless access systems when the user is in the office, home, airports or shopping centers where wireless access networks (WLAN, broadband wireless access, wireless local loop, HomeRF, wireless ATM, etc.) are available. When users move into the mobile zone (highway, beach, remote area, etc.), the same terminal can automatically switch to wireless mobile networks (GPRS, W-CDMA, cdma2000, TD-SCDMA, etc.). This converged wireless communications can provide the following advantages:

- Greatly increase the spectrum efficiency and facilitate the spectrum sharing and open spectrum management strategy
- Mostly ensure the highest data rate to the wireless terminal
- Best share network resources and channel utilization
- Provide seamless networking among different wireless standards

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- Optimally manage service quality and multimedia applications
- Construct a truly service-oriented mobility infrastructure

The wireless industry is rapidly transitioning from proprietary architecture to more flexible, cost effective open wireless architecture (OWA) systems. This transition is creating interesting challenges for developers, manufacturers, integrators, operators, and end users as they wrestle with the complexities of open wireless systems.

Fourth-generation mobile communications should not focus only on the data rate increase and new air interface. 4G mobile should instead converge the advanced wireless mobile communications and high-speed wireless access systems into the OWA platform that becomes the core of this emerging next-generation mobile technology. Based on this OWA model, 4G mobile will deliver the best business cases to the wireless and mobile industries, that is, cdma2000/WLAN/GPRS 3-in-1 product, TD-SCDMA/WIMAX/WLAN 3-in-1 product, and so on.

Any single-architecture wireless system, including single W-CDMA, HSDPA, and others, is a transitional solution only, and will be replaced by an OWA system very soon where various different wireless standards can be integrated and converged on this open platform.

SERVICE-ORIENTED WIRELESS AND MOBILITY INFRASTRUCTURE

The future mobile communications will be based on a service-oriented mobility platform rather than a wireless-standard-specific platform to support true wireline, wireless, and mobile convergence. In order to facilitate this service-oriented mobility infrastructure, wireless systems must be constructed on the OWA platform to enable each system module to be extensible, upgradeable, and removable to optimize the open service architecture of the future mobile systems and networks.

A service-oriented mobility platform has many benefits including open module mobility, more security, better testing/fewer defects, support for multiple client types, easy service assembly, better maintainability, more reusability, better parallelism in development, better scalability, higher availability, and better return on investment. It is critical for future mobile phone development, such as iPhone by Apple Inc., to enable the open service and application architecture platform in order to foster the killer applications of next-generation mobile communications. This future-proven service-oriented mobility infrastructure demands the underlying wireless architecture to be fully, open which is actually powered by the OWA approach.

This special issue presents recent research and development on this emerging topic focusing on security, quality of service (QoS), mobility management, system architecture, resource management, admission control, and medium access control. It is timely and valuable for future research and strategy activities in the field because 2007 is a global 4G initialization year with new 4G spectrum will be allocated at the World Radio Congress (WRC) 2007 in Geneva, and the 4G standardization on converged wireless platform will be launched worldwide.

An integrated security mechanism is very important for the future converged wireless and mobility platform. Prof. Haas *et al.* from Cornell University, comparatively analyze the unique network-centric features and security mechanisms of various heterogeneous wireless networks expected to be part of the OWA converged platform, and propose a new integrated security platform based on the security profile concept.

In the second article, Dr. Chen from Universität Stuttgart proposes a general customizable QoS scenario for the heterogeneous wireless access network technologies providing robust and flexible QoS support by adapting the amount of resources reserved for the characteristics of the wireless channel as well

as automatic reconfiguration mechanisms for the multimedia encoding rate and error-resilient techniques in order to adapt to the dynamic mobile communication environment of the future OWA mobility platform.

The service-oriented mobility architecture is a key issue to implement the future 4G mobile communications. Dr. Kashihara *et al.* from Nara Institute of Science and Technology propose a new way to properly use the number of frame retransmissions as a new handover decision criterion to accomplish seamless handover of the service-oriented mobility management.

As one of the main features of a future 4G mobile system based on OWA infrastructure, always best connected (ABC) services enable users to choose the best available access networks in a way that best suits their service needs. Prof. Yang's article introduces a new architecture capable of supporting ABC service with a novel access discovery mechanism and a new personalized network selection scheme.

The fifth article, by Drs. Choi and Lee, discusses a new approach for designing an architecture and QoS model in 4G networks that uses cross-layer techniques to cover layers 1 through 3 of future OWA-based converged wireless and mobile communications.

Admission control in a common radio resource management (CRRM) environment is used to select the most appropriate wireless access method based on service type, user preference, and network load. In the sixth article, by Dr. Skehill *et al.*, the authors propose a real-time converged wireless test platform to test and deploy CRRM algorithms and support the signaling of the heterogeneous networks of the OWA broadband infrastructure.

In last article, Prof. Tian *et al.* from Beijing University of Posts and Telecommunications propose a future access network architecture and the centralized mini-slot packet reservation multiple access protocol by dividing the resources into mini-time-frequency blocks to make resources allocation more flexible. Meanwhile, the adaptive permission probability threshold policy and resource reservation scheme can increase system capacity and radio resource utilization to improve the system performance of future beyond 3G (B3G) mobile systems based on OWA technology.

In closing, the guest editors would like to thank all the authors who responded to the call for papers, regardless of whether their paper has been included in this issue or not due to space limitations. The editors would also like to acknowledge the contributions of many experts who participated in the review process, and provided helpful suggestions to the authors on improving the content and presentation of the articles. The advice and support of Prof. Jamalipour, Editor-in-Chief of the magazine, and the assistance of Sue Lange and the publication team are greatly appreciated.

BIOGRAPHIES

WILLIE W. LU [SM] is executive director of U.S. Center for Wireless Communications (USCWC), Palo Alto, California, and a special advisor on emerging technologies and strategies to several Chinese information and communications authorities as well as a technology expert committee member and examiner for European Commission's FP6 and FP7 programs. He was a member of the Technological Advisory Council of the U.S. Federal Communications Commission (FCC-TAC), and a senior principal architect and vice president of Siemens and Infineon Technologies. He is also an internationally very well recognized and accredited senior expert in emerging wireless technologies, and has been a senior technical advisor for 22 wireless communication authorities in more than 10 countries. He is an independent technical examiner for many high-tech venture capital firms in the United States, Europe, Asia, and other places. He has guest edited around 50 special issues on emerging wireless communications in IEEE, IEICE, ACM, and other major publications, and has had over 180 papers published in major professional publications as well as about 80 papers in the SCI index. He is a member of the editorial board of *IEEE Spectrum*, the flagship publication of the IEEE. He has been technical program chairman of numerous IEEE conferences, including GLOBECOM '03, WNCN '02, VTC '03, and WWV 2000-'06, and wireless feature editor of *IEEE Communications Magazine*, *IEEE Transactions on Wire-*

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KAI X. MIAO is currently a senior researcher and regional program manager of Information Technology Research at Intel for the Greater Asia Region. Before his current position, he was the lead solutions architect of Intel for the North America Region, responsible for end-to-end converged communication architectures and technical engagements with U.S. service providers. He has held various technical and management positions in several different divisions inside Intel in the past nine years. He received his M.S. and Ph.D. degrees in electrical engineering from the University of Cincinnati, and his B.S. degree in communications from Northern (Beijing) Jiaotong University. He has published a number of journal and conference papers, is an author of two published books, and holds a number of U.S. patents. In addition, he has been a keynote speaker and conference chair at multiple industry events, and an active participant in IETF, ITU, and MIT CFP Program activities.

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