Hindawi Publishing Corporation
EURASIP Journal on Wireless Communications and Networking
Volume 2006, Article ID 70210, Pages 1–3
DOI 10.1155/WCN/2006/70210

Editorial
Radio Resource Management in 3G+ Systems

Alagan Anpalagan,[1] Rath Vannithamby,[2] Weihua Zhuang,[3] and Sonia Aïssa[4]

[1] *Department of Electrical and Computer Engineering, Ryerson University, Toronto, ON, Canada, M5B 2K3*
[2] *Intel Corporation, 2111 NE 25th Avenue, Hillsboro, OR 97229, USA*
[3] *Department of Electrical and Computer Engineering, University of Waterloo, 200 University Avenue West, Waterloo, ON, Canada N2L 3G1*
[4] *INRS-EMT, Université du Québec, Place Bonaventure, 800 de la Gauchetiere Ouest, Suite 6900, Montreal, QC, Canada H5A 1K6*

Received 9 July 2006; Accepted 9 July 2006

The 3G+ wireless systems can be characterized by aggregate bit rates in the range of Mbps, quality-of-service (QoS) support for interactive multimedia services, global mobility, service portability, enhanced ubiquity, and larger user capacity and coverage. All digital entirely packet-switched radio networks involving hybrid networking and access technologies are envisioned in 3G+ systems. In such systems, radio resource management (RRM) plays a major role in the provision of QoS and efficient utilization of scarce radio resources. With the required support for multimedia services to multiple users over diverse wireless networks and the ever-increasing demand for high-quality wireless services, the need for effective and efficient RRM techniques becomes more important than ever. The addition of efficient packet data channels in both forward and reverse directions and QoS support in 3G standards lead to a more flexible network, but at the same time increase the complexity of determining the optimal allocation of resources especially on the radio interface. This special issue is devoted to addressing the urgent and important need for efficient RRM techniques in the evolving next-generation wireless systems.

This special issue consists of thirteen papers that have been selected following an extensive review process. Of those papers, two papers are on capacity prediction and outage analysis, two are on downlink power minimization algorithms, three are on rate scheduling based on real-time channel conditions, two are on multicast multimedia service delivery, three are on cross-layer design, and one is on vertical handoff mechanism. All of the papers are within the framework of the radio resource management and are summarized as follows.

In the first paper "Space-time water-filling for composite MIMO fading channels," Shen et al. analyze the ergodic capacity and outage probability of the MIMO fading channel. The above capacity and probability with space-time water-filling are evaluated through numerical integration which is simplified by the approximation of the eigenvalue distribution of the composite MIMO fading channel. The authors compare the performance of space-time water-filling with that of spatial water-filling and show that the former outperforms the latter in terms of capacity per antenna in the presence of large shadowing effects at lower-SNR regions, however with the higher outage probability.

The second paper "Capacity planning for group-mobility users in OFDMA wireless networks" by Lee and Leung proposes three admission capacity planning methods for OFDMA cellular networks in which a significant fraction of users experience group-mobility. This is achieved first by deriving the outage ratio and excess capacity ratio based on the average channel gains, and then solving the optimization problems by maximizing the reduction of the outage ratio, the excess capacity ratio, and the convex combination of both.

In the third paper "Joint downlink power control and multicode receivers for downlink transmissions in high speed UMTS," Sayadi et al. investigate how to combine downlink power control and joint multicode detection for an HSDPA link. The authors present an iterative algorithm that controls both the transmitted code powers and the joint multicode receiver filter coefficients at the base station for a high-speed multicode user to decrease intercode interference and to increase the system capacity.

The fourth paper "Adaptive downlink resource allocation strategies for real-time data services in OFDM cellular systems" by Damji and Le-Ngoc presents a framework to analyze the outage probability of different transmission bandwidths and modulation schemes in fading and shadowing environments in cellular OFDM networks. It is shown that the power minimization scheme outperforms the proposed bandwidth-constrained power minimization scheme in low shadowing environment; however, in severe shadowing environment with both frequency-selective and flat fading, the proposed scheme significantly outperforms the power minimization scheme.

In the fifth paper "Opportunistic nonorthogonal packet scheduling in fixed broadband wireless-access networks," Rahman et al. consider packet scheduling as a means of interference management in the downlinks of fixed broadband wireless-access networks. This is achieved by forming interferer groups of base stations and allowing more than one base station to transmit packets at a time. To this end, the authors propose a nonorthogonal transmission scheme that requires SINR estimation at the scheduler. The performance in terms of spectral efficiency, mean packet delay, and packet dropping rate is compared against the orthogonal scheme to show the superior performance of the proposed nonorthogonal scheme.

In the sixth paper "Rate-optimal multiuser scheduling with reduced feedback load and analysis of delay effects," Hassel et al. propose a feedback algorithm that always collects feedback from the user with the best channel conditions so that to reduce the load compared to full feedback. Closed-form expression for the CNR threshold that minimizes the feedback load for this algorithm is derived and the impacts of scheduling delay and outdated channel estimates are analytically and numerically evaluated.

The seventh paper "Adaptive rate scheduling with reactive delay control for next generation CDMA wireless mobile systems" by Yu et al. proposes an adaptive rate scheduler called feedback-enhanced target-tracking weighted fair queuing (FT-WFQ) rate scheduler that mitigates for the arrival rate estimation errors and delay-bandwidth coupling. Analytical and simulation results indicate that the FT-WFQ scheduler can significantly reduce degradations caused by arrival rate estimation errors and can minimize delay degradations during nonstationary loading conditions.

In the eighth paper "Effective radio resource management for multimedia broadcast/multicast services in UMTS networks," Souto et al. discuss a mechanism for multimedia broadcast and multicast delivery of layered video based on the user location. Using this scheme, the users close to the base station can enjoy richer video quality compared to when layered video coding is not used. This paper also proposes a nonuniform constellation mechanism based on channel condition. The capacity and coverage are improved using these advanced schemes.

The ninth paper "Impact of video coding on delay and jitter in 3G wireless video multicast services" by Psannis and Ishibashi addresses the issues due to mobility in multimedia multicast services. It is important to provide the required QoS in supporting multimedia service. This paper proposes a scheme that dynamically selects the video frame sequence based on storing multiple differently encoded versions of the video stream at the server in order to improve the delay and jitter seen by the user.

In the tenth paper "Cross-layer quality-of-service analysis and call admission control in the uplink of CDMA cellular networks," Nie et al. present an analytical formulation for the QoS performances of the four UMTS traffic classes jointly at both the data link and network layers, study the effect of lengthening the ON periods of the NRT services under Go-Back-N (GBN) automatic retransmission request, and propose a QoS-based call admission control (CAC) scheme to achieve the maximum system capacity.

The eleventh paper "Cross-layer design and analysis of downlink communications in cellular CDMA systems" by Sun et al. focuses on cross-layer analysis and design for the downlink of a cellular CDMA network with voice and data communications. The authors propose adaptive scheduling for link layer, priority-based handoff strategy for network admission control, and an algorithm for the avoidance of TCP spurious timeouts at the transport layer. They demonstrate that the system performance in terms of the capacity, throughput, dropping probability, outage, power efficiency, delay, and fairness can be enhanced by jointly considering the interactions across layers.

In the twelfth paper "On cross-layer design for streaming video delivery in multiuser wireless environments," Choi et al. discuss a cross-layer design mechanism that interacts across application layer, data link layer, and physical layer to optimize the quality of wireless streaming video application. Cross-layer optimization is realized via three concepts, namely, parameter abstraction, cross-layer optimization, and decision distribution. The paper also analyzes the performance such as peak signal-to-noise ratio with and without joint optimization.

The final paper "Multiservice vertical handoff decision algorithms" by Zhu and McNair addresses vertical handoff for a mobile node to handoff between different types of networks. Several optimizations are proposed for the execution of vertical handoff decision algorithms, with the goal of providing the QoS experienced by each user. The optimizations incorporate a network elimination feature to reduce the delay and processing required in the evaluation of the cost function, and a multinetwork optimization is introduced to improve users satisfaction for mobile terminals with multiple active sessions.

ACKNOWLEDGMENTS

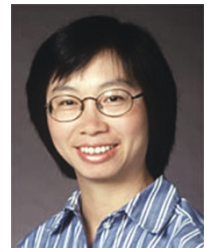
Many people deserve our gratitude for helping us to put together this special issue within a relatively short period of time. First of all, we wish to thank the authors who submitted their valuable and timely contributions to this special issue. Certainly, the many submissions resulted in high-quality papers being published in the special issue. Our sincere appreciation goes to many dedicated and hardworking reviewers without whom our decision making would have been very

difficult. Last but not the least, thanks to the Editor-in-Chief and the Editorial Board of EURASIP JWCN for giving us this opportunity and the support to make this special issue a reality.

Alagan Anpalagan
Rath Vannithamby
Weihua Zhuang
Sonia Aïssa

Alagan Anpalagan received the B.A.S., M.A.S., and Ph.D. degrees in electrical engineering from the University of Toronto, Canada, in 1995, 1997, and 2001, respectively. Since August 2001, he has been with the Ryerson University, Toronto, Canada, where he cofounded WINCORE Laboratory in 2002 and leads the WAN (Wireless Access and Networking) R&D Group. Currently, he is an Associate Professor and Program Director for graduate studies. His research interests are in general wireless communication, mobile networks, and system performance analysis; and in particular QoS-aware radio resource management, joint study of wireless physical/link layer characteristics, cross-layer resource optimization, and wireless sensor networking. Prior to his academic career, he was a Technical Consultant at Bell Mobility working on 1×RTT system deployment studies in 2001, and in 1997 he was with Nortel Networks working on R&D projects in systems engineering. He currently serves as IEEE Toronto Section Chair, previously he served as Chair, Communications Chapter—IEEE Toronto Section (2004-2005) and Technical Program Cochair, and IEEE Canadian Conference on Electrical and Computer Engineering (2004). He also serves as an Associate Editor EURASIP Journal of Wireless Communications and Networking. He is an IEEE Senior Member and a Registered Professional Engineer in the province of Ontario, Canada.

Rath Vannithamby received his B.S., M.S., and Ph.D. degrees in electrical and computer engineering from the University of Toronto, Ontario, Canada, in 1994, 1996, and 2001, respectively. He was a Research Assistant in the Network Architecture Lab and Wireless Communications Lab at the University of Toronto from 1994 to 1996 and from 1996 to 2000, respectively. He was also a Teaching Assistant at the University of Toronto from 1994 to 2000. He is currently a Research Scientist at Intel Corporation, Hillsboro, Oregon, USA and leads a group responsible for the MAC and signaling layer standardization of 3G systems. Prior to joining Intel, he was a Staff Engineer at Ericsson Inc., San Diego, California, USA. He is a Member of IEEE and IEEE/TCPC. He has published over 15 papers, and has over 30 patents pending. He has served on technical program committee for major wireless communication conferences. His research interests are in the area of radio resource management techniques and MAC and signaling layer protocols for high-speed wireless-access networks using OFDMA/CDMA technologies including 3G and IEEE 802.16.



Weihua Zhuang received the B.S. and M.S. degrees from Dalian Maritime University, China, and the Ph.D. degree from the University of New Brunswick, Canada, all in electrical engineering. Since October 1993, she has been with the Department of Electrical and Computer Engineering, University of Waterloo, Canada, where she is a Professor. She is a coauthor of the textbook *Wireless Communications and Networking* (Prentice Hall, 2003). Her current research interests include multimedia wireless communications, wireless networks, and radio positioning. She is a licensed Professional Engineer in the Province of Ontario, Canada. She received the Distinguished Performance Award in 2006 from the Faculty of Engineering, University of Waterloo, and the Outstanding Performance Award in 2005 from the University of Waterloo, for outstanding achievements in teaching, research, and service, and the Premier's Research Excellence Award (PREA) in 2001 from the Ontario Government for demonstrated excellence of scientific and academic contributions. She is an Editor/Associate Editor of IEEE Transactions on Wireless Communications, IEEE Transactions on Vehicular Technology, EURASIP Journal on Wireless Communications and Networking, and International Journal of Sensor Networks.

Sonia Aïssa received her Ph.D. degree from McGill University, Canada, in 1998. She is now an Associate Professor at INRS-EMT, University of Québec, Montreal, Canada, where she holds the Québec Government FQRNT Fellowship "Strategic Program for Professors-Researchers," and Adjunct Professor at Concordia University, Canada. From 1996 to 1997, she was a Visiting Researcher at the Department of Electronics and Communications of Kyoto University, Japan. During that period, she also conducted research at the Wireless Systems Laboratories of NTT, Kanagawa, Japan. From 1998 to 2000, she was a Research Associate at INRS-Telecommunications, Canada. From 2000 to 2002, she was a Principal Investigator in the major program of personal and mobile communications of the Canadian Institute for Telecommunications Research. In 2006, she was a Visiting Associate Professor at the Graduate School of Informatics, Kyoto University, Japan. Her research interest includes radio resource management and cross-layer design for MIMO wireless networks. She serves as an Editor for the IEEE Transactions on Wireless Communications, and Associate Editor for the IEEE Communications Magazine, and the IEEE Wireless Communications Magazine. She is the Chair of the Montreal Chapter IEEE Women In Engineering Society, served as Technical Program Chair for the Wireless Communications Symposium of IEEE ICC '2006, and is acting as PHY/MAC Program Chair for the IEEE WCNC '2007.