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## Preface

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**Biographical notes:** Elhadi Shakshuki is an Associate Professor at the Jodrey School of Computer Science at Acadia University, Canada. He is the founder and the Head of the Cooperative Intelligent Distributed Systems Group at the Computer Science Department, Acadia University. He received his BSc in Computer Engineering in 1984 from El-Fateh University, and his MSc and PhD in Systems Design Engineering in 1994 and 2000, respectively, from the University of Waterloo, Canada. He is an Adjunct Professor at Dalhousie University, Canada. He manages several research projects in his research expertise in the area of intelligent agent technology and its applications. He is a member of IEEE, ACM, AAAI, APENS and IAENG.

Jiang (Leo) Li is an Assistant Professor in the Department of Systems and Computer Science at Howard University, Washington, DC, and is the Director of the Computer Networks Lab in the department. He received his BSc (1995) and MSc (1998) in Computer Science from University of Science and Technology of China, and PhD (2003) in Computer Science from Rensselaer Polytechnic Institute. He is interested in research on computer networking, network security and network simulations, and has published in such areas as congestion control, multicast and sensor networks. His research now focuses on mobile ad hoc networks and delay/disruption tolerant networks and is externally funded. He is a member of ACM and IEEE.

Ming Yu received his Doctor of Engineering from Tsinghua University, Beijing, in 1994, and PhD from Rutgers University, New Brunswick, NJ, in 2002, both in Electrical and Computer Engineering. He joined AT&T, Middletown, NJ, in 1997 as a Senior Technical Staff Member. As of September 2006, he joined the Dept. of Electrical and Computer Engineering, Florida State University (FSU), Tallahassee, FL, and currently he is an Associate Professor. His research interests are routing and MAC protocols, security, radio resource management, traffic modelling and performance analysis, for both wired and wireless networks. He is a senior member of the IEEE. He was awarded an IEEE Millennium Medal in 2000.

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In terms of the popular wireless network models, the research in wireless communications and networks can be divided into several major areas including wireless voice networks or Wireless Wide Area Networks (WWAN), Mobile Ad hoc Networks (MANET), Wireless Personal Area Networks (WPAN) and Wireless Local Area Networks (WLAN).

To reflect the rapid progress in the research of wireless communication and mobile computing, the 20th International Conference on Advanced Information Networking and

Applications (AINA 2006), sponsored by IEEE Computer Society, was held in Vienna University of Technology, Vienna, Austria, from 18 to 20 April 2006. The conference showcases the excellent research work done over the globe and strong international participation. Following a long tradition of excellence, this special issue on 'Issues and Challenges in Wireless Communications and Networks' publishes the related papers selected from the AINA 2006 conference. Among the submissions we received, nine papers presented in the

conference were accepted for the special issue. Each paper has been thoroughly reviewed by at least two reviewers with excellent ratings. The topics of the papers include the architecture of wireless networks, key management protocols for mobile ad hoc networks (MANET), on-demand routings protocols for MANET, QoS support and performance analysis for 3G, WPANs and WLANs, which have been the main topics in wireless and mobile computing. The results presented in these papers, including analysis, simulation and experiments, reflect the latest progress in these areas and can be summarised as follows.

The paper ‘Hierarchical multi-spanning architecture for managed wireless networks’, by B. Kovacs and R. Vida, presents network architecture to support the best effort multihop extension of managed wireless hotspots. In this architecture, nodes are organised into multiple, dynamic address tree hierarchies based on their radio connections.

The next two papers are about security. One is ‘An on-demand key establishment protocol for MANETs’, by K. Mounis, M. Abdallah and A. Hossam, and the other is ‘Prevention of management frame attacks on 802.11 WLANs’, by W. Ge, J. Li and S. Sampalli. The former paper presents an efficient protocol for key management by using the underlying routing protocols of the ad hoc network. The latter paper addresses the issues of how to protect the management frames against the attacks, such as Denial of Service (DoS), impersonation and Man-In-The-Middle (MITM). The authors propose a per-frame authentication scheme that is compatible with the original IEEE 802.11 standard. The effectiveness of their proposed work is demonstrated by their experimental and testing results.

The third part, about routing protocols for ad hoc networks, includes three papers. They are ‘ARM: anonymous routing protocol for mobile ad hoc networks’, by S. Seys and B. Preneel; ‘AODV-based multipath routing protocol with preferential path selection probabilities’, by F. Jing, R.S. Bhuvaneswaran, Y. Katayama and N. Takahashi; and ‘Multi-agent-based clustering approach to wireless sensor networks’, by E.M. Shakshuki, H. Malik and T.R. Sheltami. The first paper develops an anonymous on-demand routing protocol that is secure against both active participants in the network and a passive global adversary who monitors all network traffic. The second paper improves AODV by introducing a preferential path selection policy that is decided

between the best selection and the moderate load balance. The improvement in network performance is verified by simulation results for various load conditions. The third paper presents a multi-agent system for hierarchical routing in Wireless Sensor Networks (WSN).

The fourth part is about QoS support, and includes three papers: ‘Using buffer management in 3G radio bearers to enhance end-to-end TCP performance’, by J.J. Alcaraz and F. Cerdán; ‘Multi-hop mesh networking for UWB WPANs with QoS support’, by Z. Fan; and ‘Performance modelling of IEEE 802.11 DCF using equilibrium point analysis’, by X. Wang, G. Min and L. Guan. The first paper discusses how to enhance the TCP performance over 3G by means of active queue management technique at the downlink buffer of the mobile network link layer. The paper proposes a deterministic buffer management technique, called slope-based discard policy, which is based on the observation of the filling rate of the buffer. The second paper presents mesh network architecture and a simple method to establish communications across multiple Pico nets via multihop connections in 802.15.3 networks. It also presents a measurement-based admission control scheme to support QoS traffic by limiting the traffic load in the network. The third paper proposes an analytical performance model for IEEE 802.11 DCF protocol using multi-dimensional discrete-time Markov Chain and Equilibrium Point Analysis (EPA). It then presents how to model the binary backoff scheme under more flexible traffic sources, instead of focusing on throughput analysis as most existing methods.

Finally, we sincerely hope that the results will provide inspirations to colleagues on a broad range of topics relevant to the issues and challenges in wireless and mobile computing.

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It would have been impossible to organise such a special issue without the help of many individuals. We would like to express our appreciation to the authors of the submitted papers and the referees who provided timely and significant reviews. It is an honour to organise this special issue, and we owe a special thanks to the Editor-in-Chief, Dr. Laurence T. Yang, for giving us the great opportunity of serving the community.