

GUEST EDITORIAL

Security for QoS Assured Wireless and Mobile Networks

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The rapid evolution of wireless technologies as well as their pervasive diffusion in everyday's life has dramatically changed the world in the last two decades. On one side, service providers/operators can nowadays leverage new wireless technologies to reach new types of customers in a cost effective way; on the other side, end users are actually given richer and more flexible "connectivity opportunities" to obtain the required services.

The down side of this scenario deals with the increased complexity in the management of all the system components. Users/customers are becoming more and more demanding in terms of the perceived quality of service (QoS), eventually expecting the very same quality they experience in wired networks in the wireless realm. To this extent, advanced wireless systems must be able to support and manage high-quality services, thus matching the heterogeneous requirements coming from the users.

Concurrently, risks and security threats are inherent in any wireless network, and there is an increasing demand for effective security-enforcing techniques to attain authentication, privacy, confidentiality, data integrity, privacy, access control, and non-repudiation, when operating and/or using wireless networks.

In this scenario, the deployment of security measures and the provision of QoS represent two critical and tightly coupled challenges in the design of network services, architectures, and protocols in today's inter-networked world. Such challenges are even made harder in mobile wireless scenarios where the network infrastructure may feature mobile, energy and resource-constrained network devices. To this extent, the success of specific wireless networking technologies is often dependant on the capability of the specific technology to support QoS, on one side, and to provide security, on the other side.

The aim of this special issue is to provide an up-to-date snapshot on advanced solutions to support the design and deployment of secure and efficient services in wireless mobile networks. The special issue is com-

posed of seven high-quality contributions, each one focusing on a specific component of the aforementioned framework.

The first batch of four papers deals with security aspects. The first two papers in the batch focus on security solutions for Wireless Mesh Networks (WMNs); namely, the first one, *DSA-Mesh: a Distributed Security Architecture for WMNs*, proposes a fully distributed security architecture to ensure security and data confidentiality of the communications occurring in the backbone of a WMN; the proposed solution provides a distributed authentication and access control scheme for the wireless mesh routers taking part in the network, as well as a dynamic key distribution algorithm that supports layer-2 encryption. Whilst the wireless mesh architecture addressed in the first paper is general, in the second manuscript on *Differentiated Security in WMNs*, the authors target the design of secure mechanisms for IEEE 802.11s-based WMNs. The rationale and main contribution of the work is the replication in the wireless environment of the virtual LAN structures typical of the wired networks to achieve protection against internal/external attacks including selective forwarding attacks, routing attacks, and eavesdropping.

The third contribution, *Fast 802.11 handovers with 802.1X re-authentications*, targets the issue of supporting secure client mobility in multi-access point Wireless LAN deployments. Namely, the authors analyze the impact of pre-authentication and re-authentication of a mobile client when handing over between two contiguous WLAN access points, and further propose an advance algorithm to reduce the handover latency while maintaining the authentication of the client itself.

The last manuscript dealing with security aspects, *Characterizing The Greedy Behavior in Wireless Ad Hoc Networks*, switches the focus from static wireless network (wireless mesh and wireless LANs) to dynamic wireless *ad hoc* networks, by analyzing the network-wide impact of greedy behaviors of single wireless nodes. The authors further introduce a *rational greedy strategy* in the radio

resource usage which allows malicious nodes to gain higher shares of the available bandwidth.

The last three contributions of this special issue focus on the provision of quality of service/quality of experience under different network scenarios and wireless technologies. The work in “*Real-time support for hybrid coordinated function (HCF) controlled channel access (HCCA) function in IEEE 802.11e networks: a performance evaluation*” refers to static wireless local access networks based on the IEEE 802.11e standard, and analyzes the performance of different packet scheduling techniques under the HCF controlled channel access (HCCA) operation mode. The authors propose a thorough performance evaluation through simulation of several scheduling schemes.

The last two manuscripts share the same reference scenario, that is, vehicular networks. The authors of “*MANET QoS Support without Reservations*” propose a distributed call admission control strategy to manage the set up of in-elastic multi-hop flows over vehicular networks. The proposed solution is validated through simulation and it is further shown that it can be adapted to multicast flows as well. On the other hand, the last paper “*On the quality of broadcast services in vehicular ad hoc networks*” mainly addresses the broadcast transmission paradigm and provides a thorough comparative analysis of beaconless and beacon-enabled solutions for the support of heterogeneous services within suburban and highway inter-vehicular networks.

To conclude, we would like to thank the Editor in Chief, Dr Hsiao Hwa Chen, for giving us the opportunity to participate in this endeavor, and for his continuous valuable advices and support. We also wish to thank the anonymous reviewers who contributed with their expertise and time to select and enhance the contributions which appear in this issue. We truly hope that the contents of this special issue will be useful for your research.

AUTHORS' BIOGRAPHIES



Matteo Cesana received his MS degree in Telecommunications Engineering and his Ph.D. degree in Information Engineering from the Politecnico di Milano in July 2000 and in September 2004, respectively. From September 2002 to March 2003 he has been working as a visiting researcher at the Computer Science Department of the University of California in Los Angeles (UCLA). He is now an Assistant Professor at the Electronics and Information Department of the Politecnico di Milano. He is a co-founder and vice-director of the Advanced Network Technologies Laboratory (ANT Lab) at the Electronics and Information Department of Politecnico di Milano. His research activities are in the field of performance evaluation and optimization of wireless mobile systems including wireless *ad hoc* networks, wireless sensor networks, wire-

less mesh networks, and wireless cognitive networks. He is an associate editor for the *Ad Hoc Networks Journal* (Elsevier), and he has served in the technical program committees of several international conferences and workshops. He is a regular reviewer of the main journals in the networking area. He is a member of IEEE Communication and Computer societies.



Azzedine Boukerche is a full professor and holds a Canada research chair position at the University of Ottawa. He is the founding director of PARADISE Research Laboratory at Ottawa. Prior to this, he held a faculty position at the University of North Texas, and he was working as a senior scientist at the Simulation Sciences Division, Metron Corporation located in San Diego. He was also employed as a faculty at the School of Computer Science at McGill University and taught at Polytechnic of Montreal. He spent a year at the JPL/NASA-California Institute of Technology, where he contributed to a project centered about the specification and verification of the software used to control interplanetary spacecraft operated by JPL/ NASA Laboratory. His current research interests include wireless *ad hoc* and sensor networks, wireless networks, mobile and pervasive computing, wireless multimedia, QoS provisioning, performance evaluation, and modeling of large-scale distributed systems, distributed computing, large-scale distributed interactive simulation, and parallel discrete event simulation. He has published several research papers in these areas. He was the recipient of the Best Research Paper Award at IEEE ICC 08, ICC 09, IWCMC 09, IEEE/ACM PADS 1997 and ACM MobiWac 2006, the recipient of the 3rd National Award for Telecommunication Software 1999 for his work on a distributed security systems on mobile phone operations, and has been nominated for the Best Paper Award at the IEEE/ACM PADS 1999 and ACM MSWiM 2001. He is a holder of an Ontario Early Research Excellence Award (previously known as Premier of Ontario Research Excellence Award), Ontario Distinguished Researcher Award, and Glinski Research Excellence Award. He is the co-founder of the QShine International Conference on QoS for Wireless/Wired Heterogeneous Networks (QShine '04), served as a general chair for the 8th ACM/IEEE Symposium on Modeling, Analysis and Simulation of Wireless and Mobile Systems, and the 9th ACM/IEEE Symposium on Distributed Simulation and Real-Time Application, a program chair for the 13th IEEE ISCC 2009 Symposium, the ACM Workshop on QoS and Security for Wireless and Mobile Networks, the ACM/IFIPS Europar 2002 Conference, the IEEE/ SCS Annual Simulation Symposium (ANNS '02), the ACM WWW 2002, the IEEE MWCN 2002, the IEEE/ACM MASCOTS 2002, the IEEE Wireless Local Networks (WLN 2003–2004), the IEEE WMAN 2004–2005, the ACM MSWiM 1998–1999, and TPC member of numerous IEEE and ACM sponsored conferences. He served as a guest edi-

tor for the Journal of Parallel and Distributed Computing (JPDC) (Special Issue for routing for mobile *ad hoc*, Special Issue for wireless communication and mobile computing, Special Issue for mobile *ad hoc* networking and computing), and ACM/Kluwer Wireless Networks and ACM/Kluwer Mobile Networks Applications, and the Journal of Wireless Communication and Mobile Computing. He served and/or is serving as the vice general chair for the IEEE WoW-MoM 2010, IEEE MASCOTS 1998, and the Third IEEE Distributed Computing for Sensor Networks (DCOSS) Conference 2007, program cochair for Globecom 2007 and 2008 Symposium on Wireless *Ad Hoc* and Sensor Networks, and finance chair for the ACM Multimedia 2008. He serves as associate editor for IEEE Transactions on Vehicular Technology, IEEE Surveys/Tutorials, Elsevier *Ad Hoc* Networks, the ACM/Springer Wireless Networks, the IEEE Wireless Communication Magazine, the IEEE Transactions on Parallel and Distributed Systems, Wiley International Journal of Wireless Communication and Mobile Computing, Wiley's Security and Communication Network Journal, Wiley's Pervasive and Mobile Computing Journal, the Elsevier's JPDC, and the SCS Transactions on Simulation. He also serves as a steering committee chair for the ACM Modeling, Analysis and Simulation for Wireless and Mobile Systems Conference, the ACM Symposium on Performance Evaluation of Wireless *Ad Hoc*, Sensor, and Ubiquitous Networks, and the IEEE/ACM Distributed Simulation and Real-Time Applications Symposium (DS-RT). He serves as Vice Chair for the IEEE ComSoc Technical Committee on *Ad Hoc* and Sensor Networks. He is a senior member of the IEEE.



Albert Y. Zomaya is currently the Chair Professor of High Performance Computing and Networking in the School of Information Technologies, The University of Sydney. He is also the Director for the newly established Sydney University Centre for Distributed and High Performance Computing. Prior to joining Sydney

University he was a Full Professor in the Electrical and Electronic Engineering Department at the University of Western Australia, where he also led the Parallel Computing Research Laboratory during the period 1990–2002. He is the author/co-author of seven books, more than 350 publications in technical journals and conferences, and the editor of eight books and eight conference volumes. He is currently an associate editor for 16 journals, the Founding Editor of the Wiley Book Series on Parallel and Distributed Computing and a Founding Co-Editor of the Wiley Book Series on Bioinformatics. Professor Zomaya was the Chair of the IEEE Technical Committee on Parallel Processing (1999–2003) and currently serves on its executive committee. He also serves on the Advisory Board of the IEEE Technical Committee on Scalable Computing and IEEE Systems, Man, and Cybernetics Society Technical Committee on Self-Organization and Cybernetics for Informatics and is a Scientific Council Member of the Institute for Computer Sciences, Social-Informatics, and Telecommunications Engineering (in Brussels). He received the 1997 Edgeworth David Medal from the Royal Society of New South Wales for outstanding contributions to Australian Science. Professor Zomaya is also the recipient of the Meritorious Service Award (in 2000) and the Golden Core Recognition (in 2006), both from the IEEE Computer Society. He is a Chartered Engineer (CEng), a Fellow of the American Association for the Advancement of Science, the IEEE, the Institution of Electrical Engineers (U.K.), and a Distinguished Engineer of the ACM. His research interests are in the areas of high performance computing, parallel algorithms, mobile computing, and bioinformatics.