Guest Editorial

Special Issue on "Advances in Modelling and Optimisation of Wireless Networks"

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Wireless networks are nowadays considered a founding part of the global communications and computing infrastructure that we broadly refer to as "the Internet". Their inherent ability to support users on the move and to seamlessly interface with a variety of communications-enabled devices has opened up a number of novel research areas, including, e.g., Internet-of-Things and pervasive computing environments. At the same time, their use as de facto standard for accessing Web-based services is becoming more and more relevant with the introduction of LTE/LTE-Advanced technologies for cellular networks. In this perspective, the ability to model wireless networks at the system level and to optimise their internal functioning in various operational conditions is becoming a key factor for ensuring that the innovation pace in wireless networks technologies can be maintained.

This Special Issue of MONET contains four articles, representing extended versions of papers presented at WiOpt 2009. The 2009 edition of WiOpt represented the 7th edition of the series of Symposia on Modelling and Optimization in Mobile, Ad Hoc, Wireless Networks. The symposium took place in Seoul in June 2009 and saw the participation of more than 100 attendees. The four papers we selected for this Special Issue represent some of the most relevant research lines active in the field.

The issue starts with a paper on "Distributed Adaptive Algorithms for Optimal Opportunistic Medium Access" by S. Borst and Y. Al-Harthi. In this work, the authors deal with the design of threshold-based transmission strategies for distributed opportunistic medium access in a wireless scenario. They address the problem of setting, in an adaptive and distributed fashion, the threshold values so as to optimize the aggregate throughput utility of the various users under the proportional fairness scheme.

The second article, by W. Saad, Z. Han, T. Başar, M. Debbah and A. Hjørungnes proposes a game-theoretical approach to physical layer security in wireless networks. In particular, the authors model the physical layer security problem as a coalitional game with non-transferable utility and propose a distributed algorithm for coalition formation. Through the proposed algorithm, the wireless users can cooperate and self-organize into disjoint independent coalitions, while maximizing their secrecy rate taking into account the security costs related to information exchange. The proposed approach is applied to both decode-and-forward and amplify-and-forward schemes.

Wireless communication systems, especially those operating in unlicensed bands (WiFi, Bluetooth, ZigBee among the others) are potentially subject to denialofservice attacks caused by interference intentionally created by jammers. In "Jamming in wireless networks under uncertainty", E. Altman, K. Avrachenkov and A. Garnaev provide a game theoretical framework for studying this problem. In particular,

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they deal with the case in which the user does not know whether or not the jammer is indeed present and how interference is distributed among sub-carriers. They show that the problem can be formulated as a zero-sum game and specify the equilibrium strategies in closed form.

The last article of this Special Issue deals with the performance improvements obtainable in multi-user random access wireless networks through the use of ZigZag decoding, a recently proposed receiver design that allows successful reception of packets despite collision. The authors of "Mathematical Analysis of Throughput Bounds in Random Access with ZIGZAG Decoding" (J. Paek and M. J. Neely) provide an analysis of throughput bounds in four different idealized multi-access schemes. Simulation results are presented, showing that ZigZag decoding can significantly improve the performance of random access systems.

We wish to thank all the authors and referees for their contributions toward making this Issue possible. We also thank the many authors of papers that we could not include in this Issue. Last, but not least, we would like to thank the MONET EiC (Prof. I. Chlamtac) and the Springer Publication Office for their support.

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Muriel Médard is a Professor in the Electrical Engineering and Computer Science at MIT. She was previously an Assistant Professor in the Electrical and Computer Engineering Department and a member of the Coordinated Science Laboratory at the University of Illinois Urbana-Champaign. From 1995 to 1998, she was a Staff Member at MIT Lincoln Laboratory in the Optical Communications and the Advanced Networking Groups. Professor Médard received B.S. degrees in EECS and in Mathematics in 1989, a B.S. degree in Humanities in 1990, a M.S. degree in EE 1991, and a Sc D. degree in EE in 1995, all from the Massachusetts Institute of Technology (MIT), Cambridge. She has served as an Associate Editor for the Optical Communications and Networking Series of the IEEE Journal on Selected Areas in Communications, as an Associate Editor in Communications for the IEEE Transactions on Information Theory and as an Associate Editor for the OSA Journal of Optical Networking. She has served as a Guest Editor for the IEEE Journal of Lightwave Technology, the Joint special issue of the IEEE Transactions on Information Theory and the IEEE/ACM Transactions on Networking on Networking and Information Theory and the IEEE Transactions on Information Forensic and Security: Special Issue on Statistical Methods for Network Security and Forensics. She serves as an associate editor for the IEEE/OSA Journal of Lightwave Technology. She is a member of the Board of Governors of the IEEE Information Theory Society. She has served as TPC co-chair of ISIT, WiOpt and CONEXT. Professor Médard's research interests are in the areas of network coding and reliable communications, particularly for optical and wireless networks. She was awarded the 2009 Communication Society and Information Theory Society Joint Paper Award for the paper: Tracey Ho, Muriel Médard, Rolf Kotter, David Karger, Michelle Effros Jun Shi, Ben Leong, "A Random Linear Network Coding Approach to Multicast", IEEE Transactions on Information Theory, vol. 52, no. 10, pp. 4413–4430, October 2006. She was awarded the 2009 William R. Bennett Prize in the Field of Communications Networking for the paper: Sachin Katti , Hariharan Rahul, Wenjun Hu, Dina Katabi, Muriel Médard, Jon Crowcroft, "XORs in the Air: Practical Wireless Network Coding",

IEEE/ACM Transactions on Networking, Volume 16, Issue 3, June 2008, pp. 497–510. She was awarded the IEEE Leon K. Kirchmayer Prize Paper Award 2002 for her paper, "The Effect Upon Channel Capacity in Wireless Communications of Perfect and Imperfect Knowledge of the Channel," IEEE Transactions on Information Theory, Volume 46 Issue 3, May 2000, Pages: 935–946. She was co- awarded the Best Paper Award for G. Weichenberg, V. Chan, M. Médard, "Reliable Architectures for Networks Under Stress", Fourth International Workshop on the Design of Reliable Communication Networks (DRCN 2003), October 2003, Banff, Alberta, Canada. She received a NSF Career Award in 2001 and was co-winner 2004 Harold E. Edgerton Faculty Achievement Award, established in 1982 to honor junior faculty members "for distinction in research, teaching and service to the MIT community." In 2007 she was named a Gilbreth Lecturer by the National Academy of Engineering.