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Guest Editorial

Wireless and Mobile Network Modeling, Analysis, Design, Optimization, and Simulation

In 2014, the 17th ACM International Conference on Modeling, Analysis and Simulation of Wireless and Mobile Systems (MSWiM) was held in Montreal, Canada, building upon the high standards set by previous editions of the conference. The main topics of interest included

- Wireless network algorithms and protocols
- Performance evaluation and modeling
- Wireless mesh networks, mobile ad hoc networks, VANET
- Sensor and actuator networks
- Analytical models

This special issue includes a collection of seven outstanding research articles on wireless and mobile network modeling, analysis, design, optimization, and simulation. All are extended versions of selected contributions to MSWiM 2014.

The special issue begins with the paper "Handover-Related Self-Optimization in Femtocells: A Survey and an Interaction Study", contributed by K. Suleimana, A. Taha, and H. Hassanein. This paper studies the problem of self-optimization using cases related to handovers in LTE femtocell networks, which include handover self-optimization, call admission control self-optimization, and load balancing self-optimization. It has been shown through the work that the three use cases can interact either constructively or destructively. To provide an insightful understanding about such interaction, the authors have surveyed the proposed schemes for each of the handover-related self-optimization use cases and identified three representative schemes. The identified three schemes are used in the interaction study through LTE compliant simulation environment. Based on interaction simulation results, a set of guidelines has been recommended so that the users can follow and decide when to coordinate between the interacting handover-related self-optimization use cases in LTE femtocell networks.

The second paper, "Wireless Networking Testbed and Emulator (WiNeTestEr)", authored by J. D. Beshaya *et al.*, presents an efficient channel emulator which is better than existing commercial products in terms of cost, remote access, support for complex network topologies and scalability. The hardware and software architecture of the proposed channel emulator are presented in the paper and are used to explain the experiments to evaluate its performance against a commercial channel emulator. Repeatability, isolation and accuracy are the keys factors that have been closely focused on in the proposed channel emulator.

In the third paper, "Smartphone Positioning in Sparse Wi-Fi Environments," W. Waqar, Y. Chen, and A. Vardy studied the indoor localization problem using mobile devices such as smartphones. Indoor localization remains a challenging problem as GPS does not work inside buildings and the accuracy of other localization techniques typically comes at the expense of additional infrastructure or cumbersome war-driving. In this paper, the authors have proposed a localization scheme which uses motion information from the smartphone's accelerometer, magnetometer, and gyroscope sensors to detect steps and estimate direction changes. A Wi-Fi based fingerprinting technique is adopted for independent position estimation. These measurements along with an internal representation of the environment are combined using a Bayesian filter. This proposed system can effectively reduce the amount of training required and work in sparse Wi-Fi environments. The proposed localization scheme has been used in two real-world environments to demonstrate the benefits of incorporating user motion for indoor localization.

The fourth paper, "On Search and Content Availability in Opportunistic Networks," authored by Hyytia et al., studied the problem of content searching in mobile opportunistic networks where dynamically changing topology and intermittent connections conditions are presented. To better understand and balance between the expected value of the response and the costs incurred, the authors propose a model and formulate the problem of optimal search for two cases: a node holds 1) exactly matching content with some probability, and 2) some content partially matching the query. They design static search in which the search depth is set at query initiation, dynamic search in which search depth is determined locally during query forwarding, and learning dynamic search which leverages the observations to estimate suitability of content for the query. The impact of unreliable response paths to the optimal search depth and the corresponding search performance, the *a priori* learn of the availability of the content in the network based on passive observations, and the principal factors affecting the optimal search strategy are also investigated in the paper.

In the fifth paper, "Real-Time Lane Marking Localization, Tracking and Communication System," Dr. A. Mammeri et al. present an in-vehicle computing system which is capable of localizing lane markings and communicating them to drivers. The maximally stable extremal region (MSER) technique and the Hough transform are used to detect and recognize lane markings. The proposed scheme begins with the MSER technique to localize the region of interest, followed by a three-stage refinement computing algorithm to further enhance the results. To achieve the real-time system requirements, the progressive probabilistic Hough transform (PPHT) is used in the detection stage to detect line markings. After the recognition of the color

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and the form of line markings and the recognition of high-occupancy vehicle pictograms, Kalman filter is used to track both ends of each detected line marking in the tracking stage. Experiments have been conducted to demonstrate the efficiency of the proposed system.

The sixth paper, "Space-Time Efficient Network Coding for Wireless Multi-hop Networks," authored by Y. Yan, B. Zhang, and Y. Zheng, studies the problem of improving network throughput in a multi-hop wireless network by appropriately exploiting the interplay between transmission power, data rate, and network coding gain via localized network operations A decentralized network coding aware power/rate control mechanism, which can enable each node to adjust its transmission power and data rate such that the space-time resource usage is optimized, is proposed in the paper. Simulation results show that the proposed mechanism gives higher performance in network throughput as compared with existing mechanisms.

In the final paper, "Performance of the MAC Protocol in Wireless Recharging under E-limited Scheduling," M. Khana, J. Misic, and V. Misic propose a polling-based MAC protocol with round robin scheduling under E-limited service policy to enhance the lifetime of wireless sensor networks (WSNs) using recharging through radio frequency (RF) pulses. The WSN coordinator sends a recharging pulse upon reception of a recharging request from one of the nodes. A probabilistic model for energy depletion within the proposed MAC along with queueing delay model is evaluated. The behavior of time interval between two consecutive recharging events and packet waiting time under varying network size and traffic load are evaluated.

It is our hope that the papers included in this special issue present a good snapshot of the latest research progress in modeling, analysis, optimization, and simulation of wireless and mobile systems. We sincerely hope that those papers are informative and can become important references for researchers and practitioners in the area.

Cheng Li received the B.Eng. and M.Eng. degrees from Harbin Institute of Technology, Harbin, P. R. China, in 1992 and 1995, respectively, and the Ph.D. degree in Electrical and Computer Engineering from Memorial University, St. John's, NL, Canada, in 2004. He is currently a full professor at the Department of Electrical and Computer Engineering, Faculty of Engineering and Applied Science, Memorial University, St. John's, NL, Canada. His research interests include mobile ad hoc and wireless sensor networks, wireless communications and mobile computing, switching and routing, and broadband communication networks. He was a recipient of the *best paper award* at the 2010 *IEEE International Conference on Communications (ICC'10)*, Cape Town, June 2010. He is an editorial board member of *Wiley Wireless Communications and Mobile Computing*, an associate editor of *Wiley Security and Communication Networks*, and an editorial board member of *Journal of Networks*, *International Journal of E-Health and Medical Communications* and *KSII Transactions on Internet and Information Systems*. He has served a technical program committee (TPC) co-chair for the *ACM MSWIM*'14, *MSWIM*'13, *IEEE WiMob*'11 and *QBSC*'10. He has served as a co-chair for various technical symposia of many international conferences, including the *IEEE GLOBECOM*, *ICC*, *WCNC*, and *IWCMC*. He has also served as the TPC member for many international conferences, including the *IEEE ICC*, *GLOBECOM*, and *WCNC*. Dr. Li is a registered Professional Engineer (P.Eng.) in Canada and is a Senior Member of the *IEEE* and a member of the *IEEE* Communication Society, Computer Society, Vehicular Technology Society, and Ocean Engineering Society.

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