Guest Editorial: Special Section on IEEE INFOCOM

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I welcome you to read this special section comprised of four very high-quality papers in the areas of mobile wireless networks. These papers were selected through the fast track process. Initially, a small set of papers were selected from all of the papers presented at the IEEE INFOCOM 2004 Conference covering topics on mobile computing and wireless networks. These papers were short listed by the INFOCOM TPC Chairs based on the reviews received for the conference. The final selection of the papers for the fast track process was done by the guest editor through additional inputs from the TMC editor-in-chief Tom La Porta. The authors were invited to submit an extended version of their paper while identifying the differences from the conference version of the papers. The submitted papers were sent for a fresh round of reviews and the normal process of reviewing was undertaken using a short turn-around time. Most of the papers went through two rounds of reviews before being accepted for publication.

The first paper, "Rate Performance Objectives of Multihop Wireless Networks," by Bozaidar Radunovic and Jean-Yves Le Boudec, addresses the selection of performance metrics for multihop wireless networks. They have focused on maximizing rates under the constraints of battery-lifetime and power. They have shown the shortcomings of using capacity as a metric in wireless networks with those constraints. The authors show that the proportional fairness of rates, which is a particular instance of utility-based metrics, is robust and achieves a good tradeoff between efficiency and fairness, unlike the total rate and the maximum fairness. This metric and the results are applicable for wireless networks, and are different from what is observed for wired networks.

The second paper, "Medium Access Control in Ad Hoc Networks with MIMO Links: Optimization Considerations and Algorithms," by Karthikeyan Sundaresan, Raghupathy Sivakumar, Mary Ann Ingram, and Tae-Young Chang proposes a new medium access control (MAC) protocol for ad hoc networks with multiple input multiple output (MIMO) links. MIMO links exploit multipath to provide the spatial multiplexing gain. They achieve high spectral efficiency by simultaneously transmitting multiple independent data streams in the same channel. In this paper, several advantages of MIMO links are identified and the authors have proposed an effective MAC protocol for this environment. They have first presented a centralized algorithm called stream-control medium access (SCMA) that incorporates optimization considerations. Then, the authors propose a distributed SCMA protocol that approximates the centralized algorithms. Detailed performance comparisons have been done with respect to the CSMA/CA-based protocols.

In the third paper, "HEED: A Hybrid, Energy-Efficient, Distributed Clustering Approach for Ad Hoc Sensor Networks," Ossama Younis and Sonia Fahmy have proposed a hybrid, energy-efficient, distributed (HEED) clustering approach for ad hoc sensor networks. Their approach is based on topology control and is applicable for long-lived ad hoc sensor networks. Assuming the presence of multiple power levels in sensor nodes, HEED periodically selects cluster heads depending on the node residual energy, node proximity to its neighbors, and the node degree. Through simulations, the authors have shown that the proposed approach is effective in prolonging the network lifetime and supporting data aggregations. Several extensions to HEED are also discussed in the paper.

The last paper, "Courtesy Piggybacking: Supporting Differentiated Services in Multihop Mobile Ad Hoc Networks," by Wei Liu, Xiang Chen, Yuguang Fang, and John M. Shea proposes a novel scheme, called Courtesy Piggybacking, to support differentiated services in multihop mobile ad hoc networks. This paper addresses provisioning of quality of service (QoS) in multihop mobile ad hoc networks. The authors have proposed a scheme which lets the high-priority traffic help the low-priority traffic by sharing unused bandwidth with courtesy. The scheme exploits the channel dynamics and stochastic traffic features, and is applicable for either reservation-based or contention-based MAC protocols.

Overall, this special section provides the readers with various novel ideas solving interesting aspects of wireless ad hoc and sensor networks. In addition to the coverage on the MAC and network layers, this special section also covers the evaluation metrics for wireless networks. Identifying proper metrics and deploying efficient MAC and network layer protocols will greatly enhance the design, effectiveness, and performance of wireless networks. The efforts and the research problems addressed in the papers of this special section will further incite the research on the topics covered in this issue.

The fast track process requires responses from the reviewers in a very prompt manner. I am very thankful to the reviewers, all of whom managed to provide detailed
reviews within a short time frame. Their timely help is highly appreciated. I take this opportunity to thank the TPC Chairs of INFOCOM 2004, Professors Marwan Krunz and Bo Li. Working with them as the TPC Vice-Chair was a pleasant experience for me. I am indebted to the Editor-in-Chief, Professor Tom La Porta for not only his willingness to facilitate this special section, but also his prompt help during the reviewing process. I appreciate all the help and support from Jennifer Carruth in coordinating aspects of this issue in a timely manner.

I hope the readers will enjoy and gain valuable knowledge from reading the papers in this special section.

Prasant Mohapatra
Guest Editor

Prasant Mohapatra received the PhD degree in computer engineering from the Pennsylvania State University in 1993. He is currently a professor in the Department of Computer Science at the University of California, Davis. In the past, he was on the faculty at Iowa State University and Michigan State University. He has also held visiting scientist positions at Intel Corporation, Panasonic Technologies, and the Institute of Infocomm Research (I2R), Singapore. He was on the editorial board of the IEEE Transactions on Computers, and has been on the program/organizational committees of several international conferences. He was the program vice-chair for the ICPP-2001 and INFOCOM 2004. He is the program cochair of the First IEEE International Conference on Sensor and Ad Hoc Communications and Networks (SECON 2004). He was the coeditor of the January 2003 issue of IEEE Network, and will be the guest editor of a special issue of IEEE Computer to be published in 2004. Dr. Mohapatra’s research interests are in the areas of wireless networks, sensor networks, Internet protocols, and QoS. His research has been funded though grants from the US National Science Foundation, Intel Corporation, Siemens, Panasonic Technologies, Hewlett Packard, and EMC Corporation.