
Computer Science Colloquium

Exploiting Sink Mobility to Improve the Performance of Wireless Sensor Networks

Prof. Stefano Basagni

Department of Electrical and Computer Engineering, Northeastern University

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Olsen 311

Refreshments at 2:30, Talk from 3:00-4:00

This talk concerns the definition of an analytical model and distributed protocols for determining the routes of a mobile data collector (sink) traveling through the nodes of a wireless sensor network (WSN). The routes are determined with the aim of maximizing the network lifetime.

The contribution of our work is twofold. First, we introduce a novel mixed integer linear programming formulation for determining the sink's route and the sojourn time at the different "sink sites." The model takes into account realistic parameters such as the maximum distance the sink can travel between sites, different sink mobility rates, as well as the costs to support and perform data routing. Solutions to the model provide the route of the sink as a sequence of sites and the sojourn times at those sites that induce the maximum network lifetime.

We then propose the Greedy Maximum Residual Energy (GMRE) protocol for sink mobility. GMRE is distributed and localized, thus being suitable for wireless sensor networking. In GMRE the sink greedily keeps moving toward those areas in the network where there is the most residual energy, as if "drawn" to them. This heuristic is then compared with a very simple and energy-unaware protocol where the next site in the sink route is chosen randomly and uniformly each time the sink moves. Simulation results show that GMRE leads to improvements in network lifetime that are four times as much as the lifetime when the sink is kept static, while balancing energy consumption throughout the network. At the same time, we show how the expected increases in data latency are reasonably contained.

Bio: Stefano Basagni holds a Ph.D. in electrical engineering from the University of Texas at Dallas (December 2001) and a Ph.D. in computer science from the University of Milano, Italy (May 1998). He received his B.Sc. degree in computer science from the University of Pisa, Italy, in 1991. Since Winter 2002 he is on the faculty at the Department of Electrical and Computer Engineering at Northeastern University, in Boston, MA. From August 2000 to January 2002 he was professor of computer science at the Department of Computer Science of the Erik Jonsson School of Engineering and Computer Science, The University of Texas at Dallas.

Dr. Basagni's current research interests concern research and implementation aspects of mobile networks and wireless communications systems, Bluetooth and sensor networking, definition and performance evaluation of network protocols and theoretical and practical aspects of distributed algorithms.