Title: Algorithm and Graph Issues in Wireless ad hoc and sensor networks

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Abstract:

Wireless ad hoc and sensor networks have drawn a considerable amount of research interests from a number of researchers from electronic engineering to computer scientists including computer systems, architecture, and theoretician. This tutorial will cover some basics of applying graph and algorithmic techniques to solve some interesting and challenging questions from wireless ad hoc and sensor networks. The tutorial will cover three important areas of wireless ad hoc and sensor networks, namely, power assignment and management, topology control, and energy efficient routing.

The power assignment and management problem is to assign power to each wireless node such that the resulting communication graph has a certain property such as being connected, being k-connected, having a small diameter and so on. We will survey the current state of the art of power assignment results for random deployed networks (this is beneficial for studying the mobile networks) and for fixed static networks.

The topology control problem in wireless ad hoc networks is to either, for each wireless node, choose a certain subset of neighbors to communicate, or to choose a certain subset of nodes as the backbone of the network, in such a way that energy consumption is reduced and a certain property (such as being planar, fault-tolerant and so on) of the resulted communication graph is maintained. Topology control could reduce the energy consumption; increase the capacity of the network by implicitly reducing contention to access the wireless channel through using shorter links.

The energy efficient routing is to find the best route for unicast, multicast, and broadcast when the underlying routing structure is fixed either via the topology control mechanism or some other means. In this tutorial, we will summarize some recent theoretical results on energy efficient unicast, multicast and broadcast under a certain energy consumption model and link reliability model. In addition, we will briefly talk about how to do energy efficient routing when the possible relay nodes are selfish and will not follow the prescribed protocols unless it could not do better otherwise.

This tutorial has three major goals:

- To give the attendees a brief overview of the considerable body of literature devoted to algorithmic and graph theoretical approaches in wireless networks.

- To provide the attendees with an "algorithmic and graph theoretical toolkit" (including computational geometry, distributed systems, graph theory, algorithm design and analysis and game theory), i.e., with the expertise needed in the design and analysis of effective heuristics and mechanisms for wireless ad hoc and sensor networks.
- To outline the limitations of the current model for wireless networks, and to bridge the gap between the theoretician and engineers.

Audience:

The tutorial will address both theoretical and technological aspects related to wireless ad hoc and sensor networks in terms of graph theoretical and algorithmic design and analysis, such as power assignment and management, topology control (including flat structures and hierarchical structures), and energy efficient routing. For this reason, we believe this tutorial is appealing for researchers with both a computer science or engineering background, as well as for people from the industrial community. Graduate and undergraduate students, and any professional who is interested in entering into this fundamental field of wireless ad hoc networking research, are especially welcome.

Biography:

Dr. Xiang-Yang Li has been an Assistant Professor of Computer Science at the Illinois Institute of Technology since 2000. He received MS (2000) and PhD (2001) degree at Department of Computer Science from University of Illinois at Urbana-Champaign. He received his Bachelor degree at Department of Computer Science and Bachelor degree at Department of Business Management from Tsinghua University, P.R. China in 1995. He is a member of the Chinese national team prepared for the International Mathematics Olympics (IMO) from 1988 to 1990.
His research interests span the computational geometry, wireless ad hoc networks, game theory, cryptography and network security. Recently, he focuses on performing research on the cooperation, energy efficiency, and distributed algorithms for wireless ad hoc and sensor networks. He has published over 30 journal papers and over 60 conference papers in wireless networks, computational geometry, non-cooperative computing and optical networks. He is a Member of the ACM, IEEE, and IEEE Communication Society.

Dr. XiangYang Li served various positions (such as conference chair, local arrangement chair, financial chair, session chair, TPC member) at a number of international conferences. Dr. Li recently also co-organized a special issue of ACM MONET on non-cooperative computing in wireless networks.

For more information, please see http://www.cs.iit.edu/~xli