

COMPUTER SCIENCE COLLOQUIUM

Department of Computer Science
City University of Hong Kong

Spectrum Sharing as Congestion Games

Prof LIU Mingyan
Associate Professor

Department of Electrical Engineering and Computer Science
University of Michigan
USA

Date :

28 July 2008 (Monday)

Time :

11:00am - 12:00noon (Refreshment will be served at 10:45am)

Venue :

CS Seminar Room, Rm Y6405, 6th Floor Yellow Zone, Academic Building,
City University of Hong Kong, Tat Chee Avenue, Kowloon Tong.

Abstract

A fundamental problem in wireless networking is efficient spectrum sharing. In this talk I will present our recent study in decentralized multi-user frequency adaptation, with the objective of designing protocols that are efficient, agile, robust, and incentive-compatible. Our approach is based on the theory of congestion games, which model the competition for resources by multiple selfish users. In a congestion game, when a player unilaterally switches her strategy, the change in her own payoff is the same as the change in a global objective known as the potential function. Hence any sequence of unilateral improvements results in a pure strategy Nash equilibrium. In other words, the game is such that selfish behaviors collectively result in a socially desirable outcome (in the form of a local optimum). The key challenge in casting spectrum sharing as a congestion game lies in the proper definition of resources. Simply treating the channels as resources fails to capture the effect of spatial reuse. We first show how to reformulate two existing distributed spectrum sharing protocols as congestion games. Such reformulation is done by introducing virtual resources that model pair-wise interference. We then provide a new formulation by treating frequency-space blocks as resources. We use this formulation to construct practical protocols for spectrum sharing between multiple base stations/access points. We further demonstrate that the proposed approach can be readily extended in several aspects, including the modeling of channel bundling and fractional frequency reuse. Results report here are joint work with Dr. Yunnan Wu at Microsoft Research, Redmond.

Biography

Mingyan Liu received her B.Sc degree in electrical engineering in 1995 from the Nanjing University of Aero. and Astro., Nanjing, China, M.Sc. degree in systems engineering and Ph.D. degree in electrical engineering from the University of Maryland, College Park, in 1997 and 2000, respectively. She joined the Department of Electrical Engineering and Computer Science at the University of Michigan, Ann Arbor, in September 2000, where she is currently an Associate Professor. Her research interests are in performance modeling, analysis, energy-efficiency and resource allocation issues in wireless, mobile ad hoc, and sensor networks. She is the recipient of the 2002 NSF CAREER Award, and the University of Michigan Elizabeth C. Crosby Research Award in 2003. She serves on the editorial board of IEEE/ACM Transactions on Networking and IEEE Transactions on Mobile Computing.

* * * * *

*In case of questions, please contact Dr Guoliang Xing at Tel: 2789 7525, E-mail: glxing@cs.cityu.edu.hk,
or visit the CS Departmental Seminar Web at <http://www.cs.cityu.edu.hk/>.*