



THE CHINESE UNIVERSITY OF HONG KONG
 Department of Information Engineering
Seminar

**Pricing Mechanisms for Incentivized Radio Mapping
 and Spectrum Sharing**

by
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Time : 4:00pm - 5:15pm
Venue : Room 1009, William M.W. Mong Engineering Building
The Chinese University of Hong Kong

Abstract

This talk will present summary of two recent pieces of work on the theme of pricing-based mechanisms for wireless network scenarios:

i. Networking on white spaces (i.e., locally unused spectrum) relies on active monitoring of spectrum usage to create spectrum databases. A means for fast and accurate spectrum data collection is via crowd-sensed radio mapping by mobile clients who acquire local spectrum data and transmit it to a central aggregator (platform) for processing. Success of such crowd-sensing systems requires some incentive mechanisms to attract user participation. We describe a scenario where a radio mapping platform makes one-time offers (the incentive for participation) to users, and collects data from those who accept the offers. We design pricing mechanisms based on expected utility (EU) maximization, where EU captures the tradeoff between radio mapping performance (location and data quality), crowd-sensing cost and uncertainty in offer outcomes (i.e., possible expiration and rejection). Specifically, we consider both sequential offering, where one best price offer is sent to the best user in each round, and batched offering, where a batch of offers is made in each round.

ii. We apply fundamental market mechanisms to wireless spectrum sharing between a licensed primary user (PU) and an unlicensed secondary user (SU). We consider both orthogonal and non-orthogonal modes of Dynamic Spectrum Access (DSA), and explore rates and profits at market equilibrium. Our analytical formulation is distinct from prior art: we assume that (i) PU increases its transmit power (within bounds) to avoid any rate loss from DSA, and (ii) the spectrum owner provides compensation to exactly offset PU's increased power costs, leaving PU's overall economic well-being unaffected by DSA. This allows quantification of the marginal costs for various DSA schemes for fair comparison and insights into corresponding market behavior. Our analysis suggests that non-orthogonal DSA is more profitable when (a) spectrum owners face low competition, (b) SU is very sensitive to power consumption but not very sensitive to data rates (low or moderate rate applications) and (iii) channel conditions imply low mutual interference between PU and SU; otherwise, orthogonal DSA is more profitable. Market competition has a very large impact on profits and rates under non-orthogonal DSA but not for orthogonal DSA.

Biography

Sumit Roy received the B. Tech. degree from the Indian Institute of Technology (Kanpur) in 1983, and the M. S. and Ph. D. degrees from the University of California (Santa Barbara), all in Electrical Engineering in 1985 and 1988 respectively, as well as an M. A. in Statistics and Applied Probability in 1988. Presently he is Integrated Systems Professor of Electrical Engineering, Univ. of Washington where his research interests include fundamental analysis/design of wireless communication and sensor network systems spanning a diversity of technologies and system application areas: next-gen wireless LANs and beyond 4G cellular networks, heterogeneous network coexistence, spectrum sharing, white space networking and software defined radio platforms, vehicular and airborne networks, smart grids and RFID sensor networking.

He spent 2001-03 on academic leave at Intel Wireless Technology Lab as a Senior Researcher engaged in systems architecture and standards development for ultra-wideband systems (Wireless PANs) and next generation high-speed wireless LANs. During Jan-July 2008, he was Science Foundation of Ireland's E.T.S. Walton Awardee for a sabbatical at University College, Dublin and was the recipient of a Royal Acad. Engineering (UK) Distinguished Visiting Fellowship during summer 2011. His activities for the IEEE Communications Society (ComSoc) includes membership of several technical and conference program committees, notably the Technical Committee on Cognitive Networks, for which he currently serves as Distinguished Lecturer. He has served as Associate Editor for all the major ComSoc publications in his area at various times, including the IEEE Trans. Communications and IEEE Trans. on Wireless Communications. He was elevated to IEEE Fellow by Communications Society in 2007 for "contributions to multi-user communications theory and cross-layer design of wireless networking standards".

** ALL ARE WELCOME **