

ECE Department Seminar
Communications and Networking Lab (CNL)

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Cooperate to Access: Revisiting Spectrum Leasing

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Abstract - The concept of cognitive radio (or secondary spectrum access) is currently under investigation as a promising paradigm to achieve efficient use of the frequency resource by allowing the coexistence of licensed (primary) and unlicensed (secondary) users in the same bandwidth. According to the property-rights model of cognitive radio, the primary terminals own a given bandwidth and may decide to lease it for a fraction of time to secondary nodes in exchange for appropriate remuneration. In this paper, we propose and analyze an implementation of this framework, whereby a primary link has the possibility to lease the owned spectrum to an ad hoc network of secondary nodes in exchange for cooperation in the form of distributed space-time coding. On one hand, the primary link attempts to maximize its quality of service in terms of either rate or probability of outage, accounting for the possible contribution from cooperation. On the other hand, nodes in the secondary ad hoc network compete among themselves for transmission within the leased time-slot following a distributed power control mechanism. The investigated model is conveniently cast in the framework of Stackelberg games. We consider both a baseline scenario with full channel state information and information-theoretic transmission strategies, and a more practical model with long-term channel state information and randomized distributed space-time coding. Analysis and numerical results show that spectrum leasing based on trading secondary spectrum access for cooperation is a promising framework for cognitive radio.

(joint work with R. Pickholtz, I. Stanojev, S. Savazzi, U. Spagnolini, and Y. Bar-Ness)

Bio - Osvaldo Simeone received the M.Sc. degree (with honors) and the Ph.D. degree in Information Engineering from Politecnico di Milano, Milan, Italy, in 2001 and 2005 respectively. He is currently with the Center for Wireless Communications and Signal Processing Research (CWCSRP), at the New Jersey Institute of Technology (NJIT), Newark, New Jersey, where he is an Assistant Professor. His current research interests concern the cross-layer analysis and design of wireless networks with emphasis on information-theoretic, signal processing and queuing aspects. Specific topics of interest are: cognitive radio, cooperative communications, ad hoc, sensor, mesh and hybrid networks, distributed estimation and synchronization. Dr. Simeone currently serves as an Editor for IEEE Trans. Wireless Commun.