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Utility-based Bandwidth Allocation in Femtocell Networks

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Abstract:

In this talk we present a distributed resource allocation scheme based on non-cooperative game theory for OFDMA-based femtocell networks. It allows different femtocells to adjust their transmission bandwidths (OFDM subchannels or resource blocks) autonomously without mutual information exchange. Every femtocell relies only on the feedback from its own users. The system converges to a unique solution (Nash equilibrium) under a wide range of conditions, and the network self-optimizes based on the real-time interference situation. The algorithm features low communication and computation overhead and is scalable ($O(1)$ for each femtocell and $O(N)$ for the entire network). It can be implemented in different paradigms, from fully distributed, to hybrid or centralized network control architectures. We also discuss how the algorithm enables real-time network tuning and can operate the network under different fairness considerations (rate fair or resource fair). It can be applied to LTE or WiMAX femtocell and heterogeneous networks.

Dr. Zhu Chenxi obtained his B.E. degree in Electronics Engineering from Tsinghua University in 1993, his M.Sc. in Chemical Physics from University of Guelph, Canada in 1996, and Ph.D. in Electrical Engineering from University of Maryland, College Park in 2001. His M.Sc. thesis on "Overtone spectra of fluora-toluene molecules" received H. S. Armstrong Award from Sigma Xi, awarded to the best M.Sc. thesis in the entire university. His Ph.D. thesis on "Medium Access Control and QoS Routing in Mobile Ad Hoc Network" was widely recognized in the ad hoc network research community and received over 600 citations. From June 2001 to Oct 2004, he worked at Flarion Technologies Inc. in its Architecture and Algorithm Department on flash-OFDM, the first commercial mobile broadband network based on OFDMA. Since Nov 2004, he has been with Fujitsu Laboratories of America and worked on a wide range of topics, including WLAN, WiMAX, LTE and smart grid networks, from PHY, MAC, systems and network security. He has published 28 journal or conference papers, received or applied over 48 patents and made numerous contributions to industry standards including IEEE 802.16 and 3GPP LTE-A. He received special recognition from IEEE-SA committee for "Outstanding contribution to IEEE 802.16j multihop relay standard". He also co-supervised Ph.D. students at University of Maryland in collaboration with Prof. John Baras and Prof. Anthony Ephremides. His current research interest is in distributed control, game theory and machine learning theory in self-optimizing networks.

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