

Joint Clustering and Resource Allocation for Dense Femtocells in a Two-Tier Cellular OFDMA Network

Amr Adel Nasr Abdelnasser
Dept. Electrical & Computer Engineering
University of Manitoba
Email: nasra@cc.umanitoba.ca

ABSTRACT

Small cells such as femtocells overlaying the macrocells can enhance the coverage and capacity of cellular wireless networks and increase the spectrum efficiency by reusing the frequency spectrum assigned to the macrocells in a universal frequency reuse fashion. However, management of both the cross-tier and co-tier interferences is one of the most critical issues for such a two-tier cellular network. Centralized solutions for interference management in a two-tier cellular network with orthogonal frequency-division multiple access (OFDMA), which yield optimal/near-optimal performance, is impractical due to the computational complexity. Distributed solutions, on the other hand, lack the superiority of centralized schemes. In this paper, we propose a semi-distributed (hierarchical) interference management scheme based on joint clustering and resource allocation for femtocells. The problem is formulated as a Mixed Integer Non-Linear Program (MINLP). The solution is obtained by dividing the problem into two sub-problems, where the related tasks are shared between the Femto Gateway (FGW) and femtocells. The FGW is responsible for clustering, where correlation clustering is used as a method for femtocell grouping. In this context, a low complexity approach for solving the clustering problem is used based on Semi-Definite Programming (SDP). In addition, an algorithm is proposed to reduce the search range for the best cluster configuration. For a given cluster configuration, within each cluster, one femto access point (FAP) is elected as a Cluster Head (**CH**) that is responsible for resource allocation among the femtocells in that cluster. The **CH** performs sub-channel and power allocation in two steps iteratively, where a low-complexity heuristic is proposed for the sub-channel allocation phase. Numerical results show the performance gains due to clustering in comparison to an uncoordinated interference management scheme. In addition, the proposed schemes give near optimal performance with low complexity.

ADVISOR: Ekram Hossain