

WiOpt 2016 – Invited Talk

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Invited Paper:

Fast Multi-Channel Gibbs-Sampling for Clustering in Cloud-Based Radio Access Networks

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Abstract:

In this paper, we study how to cluster Remote Radio Heads (RRH) into Virtual Base-Stations (VBS) in a Cloud-based Radio Access Network to optimally manage the tradeoff between improving the performance of cell-edge users and maintaining high spatial reuse for the overall system. We develop Gibbs-sampling based algorithms that can find the desirable global VBS configuration from an arbitrarily given set of allowable VBS configurations. While Gibbs-sampling has been used to solve other wireless control problems, its application to VBS clustering faces new challenges both due to the difficulty in estimating the quality of a VBS configuration under rapid channel variations, and due to a new global coupling effect. We leverage Random Matrix Theory to develop a method that can quickly estimate the quality of a VBS configuration based only on average channel statistics. Further, we use perturbation analysis to develop a distributed approximation of the Gibbs sampler to circumvent the global coupling effect, which then allows different parts of the network to search for better VBS configurations in parallel. Our numerical results demonstrate how the proposed algorithm can be used as a general tool to evaluate the system performance under a variety of clustering constraints.