

WiOpt 2015- Invited Talk

Professor Sanjay Shakkottai (The University of Texas at Austin)

Title

Spectrum Sharing and Scheduling in D2D-Enabled Dense Cellular Networks

Abstract

We study device-to-device (D2D) enabled hierarchical cellular networks consisting of a macro base station (BS), a dense network of access nodes (ANs) and mobile users, where spectrum is shared between cellular traffic and D2D traffic. Further, (the receivers of) mobile users dynamically time-share between the cellular and D2D networks. We develop algorithms for channel allocation and mobile user receiver mode selection (choosing which network to participate in) with the objectives of minimizing delay for cellular traffic, and capacity maximization for D2D traffic. Our proposed solution takes advantage of the unique features offered by large and densified cellular networks such as multi-point connectivity, channel diversity, spatial reuse and load distribution. Given a BS-to-mobile delay requirement of $d + 1$ time-slots, we show that by appropriately scheduling channels and receiver modes, we can (with exponentially high probability) guarantee that cellular traffic reaches its intended destination within d time-slots. By leveraging spatial channel reuse, we show that this is achieved by utilizing a vanishingly small fraction of the available spatial capacity. Further, in the presence of delay-constrained cellular traffic, our scheduling algorithm guarantees D2D traffic can achieve rates within a $(1 - 1/d)$ factor of the corresponding achievable rates without cellular traffic.