

Abstract

Mobile users often experience communication outage and low data rate. To efficiently and economically cope with this problem, *cooperative relaying* is promising. In theory, this new approach shows tremendous *diversity gains* with uncorrelated fading channels, full channel knowledge, perfect network connectivity, and ideal protocol operation. However, so far these idealistic assumptions are not validated and cooperation's high gains are not experimentally proven. Bridging this gap between theory and practice is targeted in this thesis.

We do so in three steps. First, we analyze how realistic assumptions decrease the performance of ideal cooperation. This provides new theoretical tools to choose the beneficial relaying protocol with limited channel knowledge and limited network connectivity. Second, we develop practical resource allocation techniques to maintain cooperative gains even under realistic assumptions. Third, we implement a prototype for *cooperative* Wireless Local Area Networks (WLANs). Our extensive field measurements (e.g., using an actual train to move the cooperating terminals) not only demonstrate the feasibility and high performance of our solutions. Moreover, our measurements provide the missing experimental proof that, even under realistic constraints, cooperation achieves the performance order promised by theory. Even with today's technology and in real mobile scenarios, letting nodes cooperate is feasible, efficient, and ready for standardization.