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Adaptive multi-antenna power control in wireless networks

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3 493

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ABSTRACT

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ABSTRACT

Transmission power control has often been used in wireless packet networks to improve the channel reuse and reduce energy consumption. It has been mainly applied to single-input single-output (SISO) systems, where each node is equipped with a single antenna. In this paper, we propose a power-controlled channel access

on a per-packet basis so as to minimize the total energy consumption. By "transmission mode" we mean one of the four possible transmit/receive antenna configurations: 1 x 1 (SISO), 2 x 1 (MISO), 1 x 2 (SIMO), and 2 x 2 (MIMO). Our energy model accounts for both the transmission and the circuit powers. While the MIMO mode requires less RF transmission energy than the other three modes, it also incurs the highest circuit energy consumption. Depending on the transmitter-receiver distance, any of the four modes can be the "optimal" one in terms of minimizing the *total* energy consumption. We study the performance of E-BASIC in ad hoc and infrastructure-based scenarios and compare it with two channel access protocols (802.11 and BASIC) that use a fixed transmission mode (SISO or MIMO) all the time. Our simulations show that E-BASIC often consumes much less total energy than the reference protocols. We further incorporate E-BASIC into the design of a power-aware routing (PAR) scheme that uses a variant of Dijkstra's algorithm to select the most energy-efficient end-to-end path between nodes.



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