Research Article

Link optimization for energy-constrained wireless networks with packet retransmissions

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Abstract

With the objective to minimize the energy consumption for packet based communications in energy-constrained wireless networks, this paper establishes a theoretical model for the joint optimization of the parameters at the physical layer and data link layer. Multilevel quadrature amplitude modulation (MQAM) and automatic repeat request (ARQ) techniques are considered in the system model. The optimization problem is formulated into a three dimensional nonlinear integer programming (NIP) problem with the modulation order, packet size, and retransmission limit as variables. For the retransmission limit, a simple search method is applied to degenerate the three dimensional problem into a two dimensional NIP problem, for which two optimization algorithms are proposed. One is the successive quadratic programming (SQP) algorithm, combining with the continuous relaxation based branch-and-bound method, which can obtain the global optimal solution since the continuous relaxation problem is proved to be hidden convex. The other is a low-complexity sub-optimal iterative algorithm, combining with the nearest-neighboring method, which can be implemented with a polynomial complexity. Numerical examples are given to illustrate the optimization solution, which suggests that the joint optimization of the physical/data link layer parameters contributes noticeably to the energy saving in energy-constrained wireless networks. Copyright © 2010 John Wiley & Sons, Ltd.

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