Fair and Optimal Power Allocation in a Two-hop Relay Network for QoS Support

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We consider a two-hop and decode-and-forward relay network where a source node, a destination node, and multiple relay nodes cooperate. We assume that relay nodes have different channel conditions. Considering a simple relay node selection based on thresholds for channel conditions, we propose a new fair and optimal power allocation scheme for relay nodes where individual threshold values of relay nodes for relay node selection are determined based on the following three criteria: i) the average amounts of power consumption at relay nodes are all equal, ii) given outage probability and data rate requirements are guaranteed to support quality of service (QoS), and iii) the total sum of average amounts of power consumption at all relay nodes is minimized.

To determine the threshold values for relay nodes we first mathematically model the relay network and analyze the average power consumption of each relay node. We then formulate an optimization problem with which we can determine the threshold values, and show that the threshold values are uniquely determined for given criteria. Numerical and simulation results are also provided to demonstrate merits and various properties of our proposed power allocation scheme.