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Hybrid Random Access and Data Transmission Protocol for Machine-to-Machine Communications in Cellular Networks

Abstract:

To address random access channel (RACH) congestion and high signalling overhead problems of machineto- machine (M2M) communication in cellular networks, we propose a new design of a random access procedure that is engineered exclusively for the M2M communication. Our design has two prominent features. One is a fast signaling process that allows M2M user equipments (UEs) to transmit data right after preamble transmission on a physical random access channel (PRACH) to reduce the signalling overhead. The other is a selfoptimization feature that allows the cellular system to produce optimal M2M throughput by adaptively changing resource block (RB) composition and an access barring parameter according to the amount of available RBs and the M2M traffic load. We derive a closed-form analytic formula for the M2M traffic throughput and propose a joint adaptive resource allocation and access barring scheme based on the analytic results. By simulation, we show that the proposed scheme exhibits a nearoptimal performance in terms of the capacity.