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Energy Efficiency of Collision Resolution Protocols

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Abstract

Energy consumption of the medium access control (MAC) algorithm is one of the key performance metrics in today's ubiquitous wireless networks of battery-operated devices. We concentrate on random access MAC algorithms called Collision Resolution Protocols (CRPs) that have the best stable properties and excellent delay characteristics for a large population of "bursty" users. The main concern of the analysis of CRPs has so far been the stability conditions, the throughput-delay tradeoffs and how the algorithms can be optimized for these properties. The contribution of our work is the introduction of a novel utility function that reflects the tradeoff between the energy consumption induced by a CRP and its throughput, thus representing the energy efficiency of the algorithm. We exemplify the use of this utility function by analyzing several CRPs, including full and limited sensing algorithms. In particular, we introduce a modification of the "0.487" algorithm that improves its energy efficiency.

Key words: Wireless MAC, Energy Efficiency, Collision Resolution Protocols, Performance Analysis.

1 Introduction

In many wireless networks the preferred *medium access control* (MAC) mechanism is a random access algorithm. It is known that for a large group of "bursty" users, such algorithms display better delay characteristics than TDMA schemes. Moreover, these random access algorithms are usually easier to implement and deploy than an access algorithm that is based on *scheduling*. One needs only to consider the current deployment of the 802.11 wireless local

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