

Abstract: A+MAC: A Streamlined Variable Duty-Cycle MAC Protocol for Wireless Sensor Networks

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Abstract

To improve the energy efficiency and the transmission performance of a sensor network MAC protocol under time varying traffic conditions, recent researches have adopted a variable duty cycle operation that makes each node dynamically adjust its own wakeup and sleep schedule according to a predefined trigger condition. However, most of the existing protocols still waste energy on a long preamble packet for waking up a receiver or long idle listening for checking potential communications. To address the energy waste problem, this paper introduces a hybrid MAC protocol called A+MAC that exploits a complementary cooperation between CSMA/CA and preamble sampling. In A+MAC CSMA/CA is used for carrying out communication processes, and preamble sampling is used for checking potential communications. Therefore, A+MAC minimizes both idle listening and the length of a preamble packet by exploiting a short preamble that makes nodes check only the event occurrence. A+MAC also optimizes control packet formats and eliminates both virtual carrier sensing and a separate clock synchronization period from conventional CSMA/CA based MAC protocols. We evaluated both the energy and the network performance of the protocol by using both NS-2 and MICA2 platforms. Our experimentation results show that A+MAC can achieve an order of magnitude energy savings while providing near optimal latency compared to the existing solutions.

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