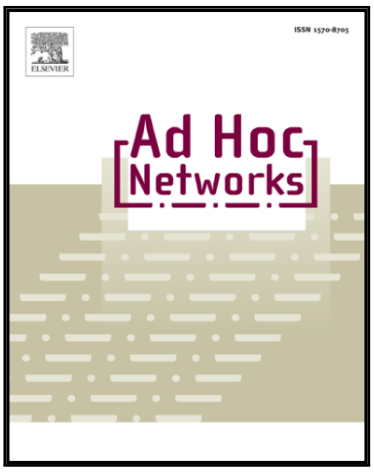

Fast Convergecast for Low-Duty-Cycled Multi-Channel Wireless Sensor Networks

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Fast Convergecast for Low-Duty-Cycled Multi-Channel Wireless Sensor Networks

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Abstract

Convergecast is a fundamental operation in many wireless sensor network (WSN) applications. To conserve energy, many previous WSN protocols discuss to periodically schedule active timings (or say *slots*) of transmission links in the network. When collecting data, the slots should be carefully assigned to conserve latency. Recently, the multichannel concept is utilized to facilitate slot assignment. When the network has multiple channels, the convergecast latency can be further reduced since the interferences between transmission links can be eliminated. In this work, we model the above scenario as a *minimal delay scheduling (MDS)* problem, and prove it as an NP-complete problem. We propose a heuristic algorithm, which contains three phases. In our design, the first phase connects nodes by a shortest path tree with constrained degrees. Then, the second phase assigns slots to links to achieve optimal report latency (regardless of interferences). Finally, the third phase assigns frequency channels to nodes to eliminate interferences between links, and carefully adjust some slots if necessary. Simulation and implementation results indicate that the proposed scheme can effectively reduce the convergecast latency in WSNs with multiple channels.

Keywords: convergecast, graph theory, multichannel, scheduling, wireless sensor network.