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A cross-layer optimization framework for joint channel assignment and multicast routing in multi-channel multi-radio wireless mesh networks

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ABSTRACT

Existing literature on multicast routing protocols in wireless mesh networks (WMNs) from the view point of the links involved in routing are divided into two categories: schemes are aimed at multicast construction with minimal interference which is known as NP hard problem. In contrast, other methods develop network-coding-based solutions with the main objective of throughput maximization, which can effectively reduce the complexity of finding the optimal routing solution from exponential to polynomial time. The proposed framework in this paper is placed in the second category. In multi-channel multi-radio WMNs (MCMR WMNs), each node is equipped with multiple radios, each tuned on a different channel. In this paper, for the first time, we propose a cross-layer convex optimization framework for joint channel assignment and multicast throughput maximization in MCMR WMNs. The proposed method is composed of two phases: in the first phase, using cellular learning automata, channels are assigned to the links established between the radios of the nodes in a distributed fashion such that the minimal interference coefficient for each link is provided. Then, the resultant channel assignment scheme is utilized in the second phase for throughput maximization within an iterative optimization framework based on Lagrange relaxation and primal problem decomposition. We have conducted many experiments to contrast the performance of our solution against many representative approaches.

KEYWORDS: Wireless mesh network, multi-channel, multi-radio, channel assignment, multicast routing, primal decomposition

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