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A Novel Unified Analytical Model for Broadcast Protocols in Multi-

Hop Cognitive Radio Ad Hoc Networks

Abstract:

Broadcast is an important operation in wireless ad hoc networks where control information is usually propagated as broadcasts for the realization of most networking protocols. In traditional ad hoc networks, since the spectrum availability is uniform, broadcasts are delivered via a common channel which can be heard by all users in a network. However, in cognitive radio (CR) ad hoc networks, different unlicensed users may acquire different available channels depending on the locations and traffic of licensed users. This non-uniform channel availability leads to several significant differences and causes unique challenges when analyzing the performance of broadcast protocols in CR ad hoc networks. In this paper, a novel unified analytical model is proposed to address these challenges. Our proposed analytical model can be applied to any broadcast protocol with any CR network topology. We propose to decompose an intricate network into several simple networks which are tractable for analysis. We also propose systematic methodologies for such decomposition. Results from both the hardware implementation and software simulation validate the analysis well. To the best of our knowledge, this is the first analytical work on the performance analysis of broadcast protocols for multi-hop CR ad hoc networks.