A Batch-based MAC Design with Simultaneous Assignment Decisions for Improved Throughput in Guard-band-constrained Cognitive Networks

The adjacent channel interference (ACI) resulting from imperfect filtering can severely degrade the performance of any wireless communication system. Despite this fact, most of previously proposed medium access control (MAC) protocols for cognitive radio networks (CRNs) were designed while ignoring the effects of ACI (assuming ideal filtering). The effect of ACI can be reduced by introducing guard bands (GBs). However, this solution comes at the expense of degrading spectrum efficiency. In this paper, we develop an efficient GB-aware MAC protocol that attempts at maximizing network throughput while improving fairness in CRNs. Unlike most of previously proposed GB-aware MAC protocols that perform channel assignment sequentially, our MAC performs the channel assignment for multiple CR links simultaneously (the so-called batch method). Batching enables concurrent channel assignment for multiple CR links, which consequently allows for concurrent data transmissions. Batching can be realized by introducing an admission control phase for CR users to share their control information. The batch method can effectively provide distributed decisions that achieve better throughput while reducing the number of GBs. Our MAC also allows the CR users to utilize the reserved GBs of primary networks under predefined FCC power constraints. Simulation results indicate that our protocol achieves significant performance improvement compared to previous GB-aware protocols.