Low Overhead Dynamic Channel Selection with Cluster-Based Spatial-Temporal Station Reporting in Wireless Networks

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Abstract : Choosing the operational channel for a WLAN access point (AP) in WLAN networks has been a static channel assignment process initiated by the user during the deployment process of the AP, which fails to cope with the dynamic conditions of the assigned channel at the station side afterward. However, the dramatically growing number of Wi-Fi APs and stations operating in the unlicensed band has led to dynamic, distributed, and often severe interference. This highlights the urgent need for the AP to dynamically select the best overall channel of operation for the basic service set (BSS) by considering the distributed and changing channel conditions at all stations. Consequently, dynamic channel selection algorithms which consider feedback from the station side have been developed. Despite the significant performance improvement, existing channel selection algorithms suffer from very high feedback overhead. Feedback latency from the STAs, due to the high overhead, can cause the eventually selected channel to no longer be optimal for operation due to the dynamic sharing nature of the unlicensed band. This has inspired us to develop our own dynamic channel selection algorithm with reduced overhead through the proposed low-overhead, cluster-based station reporting mechanism. The main idea behind the cluster-based station reporting is the observation that STAs which are very close to each other tend to have very similar channel conditions. Instead of requesting each STA to report on every candidate channel while causing high overhead, the AP divides STAs into clusters then assigns each STA in each cluster one channel to report feedback on. With the proper design of the cluster based reporting, the AP does not lose any information about the channel conditions at the station side while reducing feedback overhead. The simulation results show equal performance and, at times, better performance with a fraction of the overhead. We believe that this algorithm has great potential in designing future dynamic channel selection algorithms with low overhead.

Keywords : channel assignment, Wi-Fi networks, clustering, DBSCAN, overhead