
Licensed and Unlicensed Spectrum Allocation in Heterogeneous Networks

Abstract:

In future networks, an operator may employ a wide range of access points using diverse radio access technologies (RATs) over multiple licensed and unlicensed frequency bands. This paper studies centralized user association and spectrum allocation across many access points in such a heterogeneous network. Such centralized control is on a relatively slow timescale to allow information exchange and joint optimization over multiple cells. This is in contrast and complementary to distributed scheduling on a fast timescale. A queueing model is introduced to capture the lower spectral efficiency, reliability, and additional delays of data transmission over the unlicensed bands due to contention and/or listen-before-talk requirements. Two optimization-based spectrum allocation schemes are proposed along with efficient algorithms for computing the allocations. The proposed solutions take into account traffic loads, network topology, as well as external interference levels in the unlicensed bands. Packet-level simulation results show that the proposed schemes significantly outperform orthogonal and full-frequency-reuse allocations under all traffic conditions.