Site-Specific Knowledge and Interference Measurement for Improving Frequency Allocations in Wireless Networks

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IEEE Transactions on Vehicular Technology
Volume 58, Issue 5
June 2009
Pages 2366 – 2377

Abstract:

We present new frequency allocation schemes for wireless networks and show that they outperform all other published work. Two categories of schemes are presented: 1) those purely based on measurements and 2) those that use site-specific knowledge, which refers to knowledge of building layouts, the locations and electrical properties of access points (APs), users, and physical objects. In our site-specific knowledge-based algorithms, a central network controller communicates with all APs and has site-specific knowledge so that it can a priori predict the received power from any transmitter to any receiver. Optimal frequency assignments are based on predicted powers to minimize interference and maximize throughput. In our measurement-based algorithms, clients periodically report in situ interference measurements to their associated APs; then, the APs' frequency allocations are adjusted based on the reported measurements. Unlike other work, we minimize interference seen by both users and APs, use a physical model rather than a binary model for interference, and mitigate the impact of rogue interference. Our algorithms consistently yield high throughput gains, irrespective of the network topology, AP activity level, number of APs, rogue interferers, and available channels. Our algorithms outperform the best published work by 18.5%, 97.6%, and 1180% for median, 25th percentile, and 15th percentile user throughputs, respectively.