

Demand-Based Wireless Network Design by Test Point Reduction

Abstract:

The problem of locating the minimum number of Base Stations (BSs) to provide sufficient signal coverage and data rate capacity is often formulated in manner that results in a mixed-integer NP-Hard (Non-deterministic Polynomial-time Hard) problem. Solving a large size NP-Hard problem is time-prohibitive because the search space always increases exponentially, in this case as a function of the number of BSs. This research presents a method to generate a set of Test Points (TPs) for BS locations, which always includes optimal solution(s). A sweep and merge algorithm then reduces the number of TPs, while maintaining the optimal solution. The coverage solution is computed by applying the minimum branching algorithm, which is similar to the branch and bound search. Data Rate demand is assigned to BSs in such a way to maximize the total network capacity. An algorithm based on Tabu Search to place additional BSs is developed to place additional BSs, in cases when the coverage solution can not meet the capacity requirement. Results show that the design algorithm efficiently searches the space and converges to the optimal solution in a computationally efficient manner. Using the demand nodes to represent traffic, network design with the TP reduction algorithm supports both voice and data users.