Abstract

In this paper, we present two approximation algorithms for near-optimal design of hierarchical wireless sensor networks (WSNs) in environmental monitoring applications. Since the problem of our interest is NP-hard, we design two approximation algorithms for this problem. The first algorithm is a natural bottom-up algorithm that uses an approximation algorithm of the k-median problem with approximation ratio ρ. The second algorithm is a less obvious, top-down algorithm that also uses the same ρ-approximation algorithm. We show that the bottom-up algorithm is a $((\rho+1)^p-1)$-approximation algorithm, where p is the number of levels in the hierarchy, while the top-down algorithm is a 3ρ- approximation. That is, the performance of the top-down algorithm does not depend on p. Our experimental results show that these two algorithms perform very well, with the top-down algorithm being superior.