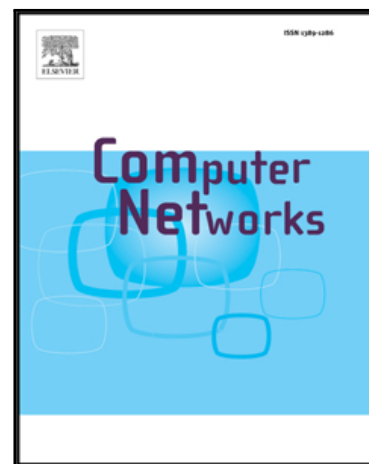


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Considering the Energy Hole Problem

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On the Deployment of Large-Scale Wireless Sensor Networks Considering the Energy Hole Problem

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Abstract

Heterogeneous sensor networks have been proposed to address some fundamental limits and performance issues present in homogeneous Wireless Sensor Networks (WSNs). Questions such as the number of high-end sensors should be used, and how to deploy them, need proper assessment. In this work, we propose a novel model capable of representing a wide variety of scenarios, from totally random to planned stochastic node deployment in both homogeneous and heterogeneous sensor networks. In particular, this model encompasses networks with the characteristics of small-world networks. Using only about 3% of high-end sensors, and deploying nodes by using the slightly attractive model defined herein, we observe improved characteristics of the network topology, such as: (i) low average path length, (ii) high clustering coefficient, and (iii) improved relay task distribution among sensors. We also provide a guide for deploying nodes in order to improve the network lifetime, showing that the aforementioned model can be used to diminish the energy hole effect. Moreover, we evaluate a topological metric, namely Sink Betweenness, suitable for characterizing the relay task of a node.

Keywords: Wireless sensor networks, network topology, complex networks, stochastic point process, heterogeneous Wireless Sensor Networks

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