Impact of Heterogeneous Deployment on Lifetime Coverage

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While most research on wireless sensor networks has focused on the deployment of large numbers of cheap homogeneous sensor devices, in practical settings it is often feasible to consider heterogeneous deployments of devices with different capabilities. Under prescribed cost constraints, we analyze such heterogenous deployments both mathematically and through simulations, and show how they impact the coverage of a sensor network with two coverage metrics. We derive expressions for the heterogeneous mixture of devices that optimizes the lifetime coverage in both single-hop direct and multi-hop communication models. Our results show that using an optimal mixture of many inexpensive low-capability devices and some expensive high-capability devices can significantly extend the duration of a network's sensing performance, especially in a network with low spatial correlation.