

## **The Impact of Incomplete Secure Connectivity on the Lifetime of Wireless Sensor Networks**

Key predistribution schemes accommodate secure connectivity by establishing pairwise keys between nodes. However, ensuring security for all communication links of a wireless sensor network (WSN) is nontrivial due to the memory limitations of the nodes. If some of the links are not available due to the lack of a primary security association between the transmitter and the receiver, nodes can still send their data to the base station but probably not via the best route that maximizes the network lifetime. In this study, we propose a linear programming framework to explore the incomplete secure connectivity problem with respect to its impact on network lifetime, path length, queue size, and energy dissipation. The numerical results show that if any two nodes share a key with a probability of at least 0.3, then we should expect only a marginal drop (i.e., less than 3.0%) in lifetime as compared to a fully connected network.