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Security Games for Node Localization through Verifiable Multilateration

Abstract:

Most applications of wireless sensor networks (WSNs) rely on data about the positions of sensor nodes, which are not necessarily known beforehand. Several localization approaches have been proposed but most of them omit to consider that WSNs could be deployed in adversarial settings, where hostile nodes under the control of an attacker coexist with faithful ones. Verifiable multilateration (VM) was proposed to cope with this problem by leveraging on a set of trusted landmark nodes that act as verifiers. Although VM is able to recognize reliable localization measures, it allows for regions of undecided positions that can amount to the 40 percent of the monitored area. We studied the properties of VM as a noncooperative two-player game where the first player employs a number of verifiers to do VM computations and the second player controls a malicious node. The verifiers aim at securely localizing malicious nodes, while malicious nodes strive to masquerade as unknown and to pretend false positions. Thanks to game theory, the potentialities of VM are analyzed with the aim of improving the defender's strategy. We found that the best placement for verifiers is an equilateral triangle with edge equal to the power range R, and maximum deception in the undecided region is approximately 0.27R. Moreover, we characterizedâin terms of the probability of choosing an unknown node to examine furtherâthe strategies of the players.