

TruFiX: a configurable trust-based cross-layer protocol for wireless sensor networks

ABSTRACT

The cross-layering concept has enabled flexibility in sensor communication by decreasing the level of modularity through inter-layer information exchange. This has improved adaptability, reliability, and efficiency in the communication process. This is principally so, because the inter-layer information is utilized to enable the selection of nodes that are perceived to foster efficient communication. However, despite these numerous achievements, the cross-layering concept suffers immensely as a result of security attacks, which prey on nodes utilized for data forwarding. In this paper, we propose T-XLM, a trust-based cross-layering framework to provide minimal defense against security attacks. The framework introduces a fuzzy-based trust estimation mechanism, which is used to formulate imprecise empirical knowledge that is utilized for reputation building in the nodes to ensure secure forwarding and reliable delivery of data. We further proposed trust-based fuzzy implicit cross-layer protocol (TruFiX), a T-XLM inspired protocol which utilizes multiple parameters pulled through inter-layer information exchange to mitigate the effects of security threats in a network. Using extensive simulation experiments, TruFiX was compared with resource bound security solution (RBSS)-based protocols, which also achieved minimal security by altering their routing semantics. The conducted experiments evaluated the security performance of the protocols and the results show that the proposed TruFiX significantly outperforms the RBSS-based protocols in terms of packet delivery.

Keyword: Blackhole; Cross-layering; Fuzzy logic system; Resource bound security; Sybil; Wireless sensor networks