Abstract

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Enhancing Performance of Wireless Networks Routing

In recent years, wireless sensor networks have gained the interest of a lot of researchers due to their use in a wide variety of modern applications, which range from military to medical applications and from industry to home appliances. A wireless sensor network consists of hundreds to thousands of low-cost wireless sensor nodes which could either have a fixed location be randomly deployed in an environment. These sensor nodes collaborate together for sensing, measuring, and gathering information from this environment of interest, and transmitting these sensed data to the user. Although the wireless sensor networks have a lot of algorithms focusing on enhancing their routing performance, many of these algorithms pay little attention to securing that route. Nowadays, security goal is vital for ensuring the performance and the acceptance of the wireless sensor networks in many recent applications. This goal is still a challenge on account of the constrained resources of these wireless sensor nodes. These constrained resources include a lower computational capability, a small amount of storage memory, a limited wireless communication bandwidth, and limited power sources (usually non-rechargeable batteries). These constrained resources combined with the nodes' randomly deployment fashion in unattended environments make the wireless sensor networks vulnerable to a variety of potential attacks. The thesis investigated the impacts of using one of the currently known pairwise key pre-distribution security schemes on the routing behavior and the performance of a specific category of these wireless sensor networks - those using topology control protocols. This investigation showed that the use of such a security scheme is devastating the performance of theses wireless sensor networks as a result of increasing the number of active nodes nearly by 40% of the network’s capacity. This high number of active nodes increases the network’s energy consumption rate. As a result, this leads to a reduction in the whole network’s working lifetime. The thesis further proposes two new security schemes based on prior deployment knowledge for enhancing the performance of the wireless sensor networks. The first scheme is entitled First Proposed Key Pre-distribution scheme, while the other scheme tagged Second Opportunity Pairwise Key scheme. Both of the new proposed security schemes use the node's remaining energy as a pre-deployment knowledge to provide an efficient security key assignment and shared keys discovery mechanisms. The performance evaluations of the new proposed schemes showed that the suggested schemes enhanced the performance of the whole network routing the number of active nodes that guarantee the network coverage is decreased to become around 8% of the network’s capacity. Thus, the network's energy is being conserved. As a consequence of energy conservation, the network’s lifetime is increased almost by 24%.