World Academy of Science, Engineering and Technology
International Journal of Mathematical and Computational Sciences
Vol:14, No:12, 2020

The Security Trade-Offs in Resource Constrained Nodes for IoT Application

Authors : Sultan Alharby, Nick Harris, Alex Weddell, Jeff Reeve

Abstract : The concept of the Internet of Things (IoT) has received much attention over the last five years. It is predicted that the IoT will influence every aspect of our lifestyles in the near future. Wireless Sensor Networks are one of the key enablers of the operation of IoTs, allowing data to be collected from the surrounding environment. However, due to limited resources, nature of deployment and unattended operation, a WSN is vulnerable to various types of attack. Security is paramount for reliable and safe communication between IoT embedded devices, but it does, however, come at a cost to resources. Nodes are usually equipped with small batteries, which makes energy conservation crucial to IoT devices. Nevertheless, security cost in terms of energy consumption has not been studied sufficiently. Previous research has used a security specification of 802.15.4 for IoT applications, but the energy cost of each security level and the impact on quality of services (QoS) parameters remain unknown. This research focuses on the cost of security at the IoT media access control (MAC) layer. It begins by studying the energy consumption of IEEE 802.15.4 security levels, which is followed by an evaluation for the impact of security on data latency and throughput, and then presents the impact of transmission power on security overhead, and finally shows the effects of security on memory footprint. The results show that security overhead in terms of energy consumption with a payload of 24 bytes fluctuates between 31.5% at minimum level over non-secure packets and 60.4% at the top security level of 802.15.4 security specification. Also, it shows that security cost has less impact at longer packet lengths, and more with smaller packet size. In addition, the results depicts a significant impact on data latency and throughput. Overall, maximum authentication length decreases throughput by almost 53%, and encryption and authentication together by almost 62%.

Keywords : energy consumption, IEEE 802.15.4, IoT security, security cost evaluation
Conference Title : ICSRD 2020 : International Conference on Scientific Research and Development
Conference Location : Chicago, United States
Conference Dates : December 12-13, 2020