Chapter 2
RPL and IoT Security: A Holistic Examination of Vulnerabilities

Mohamed Hechmi Jeridi
National Engineering School of Tunis, Tunisia

Tarek Azzabi
Tunisian Naval Academy, Tunisia

jalel Dziri
National Engineering School of Tunis, Tunisia

Tahar Ezzedine
National Engineering School of Tunis, Tunisia

ABSTRACT

The Internet of Things (IoT) represents a groundbreaking advancement in connectivity across homes, industries, healthcare, and transportation. It has introduced a multitude of possibilities for innovation, yet simultaneously raised critical concerns about the security of this interconnected landscape. This research provides an in-depth exploration of IoT, focusing on its core components and the pivotal protocols that enable seamless communication. Central to our analysis is the paramount concern of IoT security. This work meticulously scrutinizes vulnerabilities stemming from device weaknesses, network-related threats, and communication breaches, with a particular emphasis on fortifying IoT security. Furthermore, this study dissects the security of RPL-based IoT networks, identifying vulnerabilities and suggesting potential solutions. Subsequently, it delves into the pivotal role of Intrusion Detection Systems (IDSs) in bolstering IoT network defenses, offering insights into the deployment of IDSs within RPL-based IoT networks.

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1. INTRODUCTION

The advent of the Internet of Things (IoT) has triggered a profound revolution in connectivity, facilitating seamless communication among devices in various domains, including homes, industries, healthcare, transportation, and more. This technology, driven by a variety of IoT devices, not only holds the potential for numerous opportunities but also introduces new security challenges. In this research, we initiate an exhaustive study of IoT, examining the essential protocols to address security concerns. Our work examines carefully vulnerabilities originating from device weaknesses, network threats, and communication breaches, with a particular emphasis on enhancing IoT security. Our research initiates at the foundational level, where IoT devices gather data, progressing to the network layer where we meticulously assess threats and vulnerabilities within the Routing Protocol for Low-Power and Lossy Networks (RPL). Our examination extends to the application layer. This work, adopts a dual-pronged approach, first analyzing the security of RPL-based IoT networks to unveil vulnerabilities and explore potential solutions. Subsequently, we delve into the role of Intrusion Detection Systems (IDSs) in fortifying IoT networks, offering insights into deploying IDSs within RPL-based IoT networks.

Figure 1. Research challenges in Internet of Things (Nivedita & Sharnil,2021)