

Chapter 10

A Study on M2M (Machine to Machine) System and Communication: Its Security, Threats, and Intrusion Detection System

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ABSTRACT

The increase of the applications of numerous innovative technologies and associated devices has brought forward various new concepts like Cyber-Physical System (CPS), Internet of Things (IoT), Smart environment, Smart cities, and so on. While the boundary lines between these concepts and technologies are often kind of blur and perhaps, each one's development is helping the development of the other, M2M (Machine to Machine) communication would surely play a great role as a key enabler of all these emerging scenarios. When we see the same smart concept from different angles; for instance, from the participating device, or human being's angle, we get different definitions and concept-specific standards. In this chapter, our objective is to study M2M system and communication along with its security issues and intrusion detection systems. We have also proposed our framework in line with the standardization efforts for tackling security issues of M2M.

INTRODUCTION

According to a prediction by Ericsson, by the year 2020, 50 billion devices will be connected to the Internet ("More than," 2011). We have already started seeing the effects of Internet-based communications in a massive scale. A key aspect of this kind of communication is the underlying technology

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of Machine to Machine (M2M) communication. M2M basically refers to technologies that allow both wireless and wired systems to communicate with other devices of the same type. In practice, Machine to machine (M2M) is a broad label which is applied to describe any technology that enables networked devices to exchange information and perform actions without the manual assistance of human beings. M2M is considered an integral part of the Internet of Things (IoT) and its nervous system (Duquet, 2015), which brings several benefits to industry and business. It is expected that in the coming years, both of our personal life and business life would be heavily influenced by M2M communication technologies. Usually, M2M systems allow a large number of diverse devices to communicate with each other over converged networks without human intervention. Recent studies (Duquet, 2015; Świątek, Tarasiuk, & Natkaniec, 2015; Hakiri & Berthou, 2015; Pathan, Khanam, Saleem, & Abdullallah, 2013) mention a significant increase in the number of connected devices in various application domains such as eHealth, city automation, and smart metering, which will make a significant impact in the way we live today.

To get a better picture of M2M, we need to know that for quite a long time, it has been a real challenge to connect smart devices, sensors, meters to a network or to the Internet and to enable all these devices to share an application (bidirectional: sending and receiving information) without any manual effort of humans. After years of research works, with the advancements of various technologies, this objective has been somewhat achieved today. The enhancements of the capabilities of the end devices have truly started changing our daily life and more innovating business opportunities are expected from these in near future (“The Global,” 2009; W. Ren, Yu, Ma, & Y. Ren, 2013). This scenario is what we call as M2M, i.e., Machine to Machine communication. Figure 1 shows a conceptual diagram.

A representative example of practical usage of M2M is in smart grid networks. The smart grid is an electronically controlled electrical grid that connects power generation, transmission, distribution, and consumers using Information and Communication Technologies (Zeadally, Pathan, Alcaraz, & Badra, 2013). Smart grid needs the support for bi-directional information flow between the consumer of electricity and the utility provider. To implement such an intelligent electricity network, smart metering system in M2M can facilitate flexible demand management in which case, a smart meter (SM) would be a two-way communicating device that would measure energy (e.g., electricity, gas, water, heat) consumption and communicate that information via some communications channels back to the local utility (Tan, Sooriyabandara, & Fan, 2011). In addition to that, there are models of M2M based sensor communications or mobile networks (Dohler, Boswarthick, & Alonso-Zárate, 2012) which could add more functionalities to the smart grid environment.

The European Telecommunications Standards Institute (ETSI) is now working as one of the leading standardization organizations producing globally-applicable standards for M2M sector (the readers are encouraged to see various M2M standards available at (W. Ren et al., 2013; “Machine-to-Machine communications,” 2015; Chang, Soong, Tseng, & Xiang, 2011). The fundamental idea is to develop the existing vertical M2M applications, which use a multitude of technical solutions and diverse standards, into a fully interoperable M2M service platform that would permit horizontal business models (as shown in Figure 2 (diagram generated based on (Koss, 2014)). To clarify a bit, a vertical application basically refers to any software or other application that can support a specific business-process and targets a relatively smaller number of users with specific skill sets and job responsibilities within an organization. The horizontal M2M architecture would allow applications to share common data, infrastructure and network elements.

Security in Machine to Machine communication is addressed especially in the later ETSI specifications releases (“Machine-to-Machine communications (M2M),” 2011). Bootstrapping (e.g., Generic

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