

Chapter 7

The Internet of Things: From Things to Valuable Outcomes

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ABSTRACT

Objects become embedded and gain the ability to communicate. The resulting information networks promise to create new business models, improve business processes, and reduce costs and risks. The massive numbers of connected things and the explosion of data generated by these things will change the way we do business forever. Connected devices are proliferating in a communicating and actuating network named “Internet of Things” (IoT) wherein sensors and actuators blend seamlessly with the environment around us, and the information is shared across platforms in order to develop a common operating picture (Gubi et al., 2013). The IoT digitizes the physical world and is a basis for new business models whose main objective is to integrate or connect things. This chapter outlines the key enabling technologies, drivers and business value as well as benefits and challenges.

INTRODUCTION

The IoT describes a system where items in the physical world, and sensors within or attached to these items are connected via wireless and wired Internet connections (Lopez Research, 2013; Meadon, 2013), this system is a key part of the so called future internet (Gavras et al., 2010; Haller, Karnouskos, & Schroth, 2008).

The IERC has formulated the following definition (International Telecommunication Union, 2012) on the IoT: “A global infrastructure for the information society, enabling advanced services by inter-connecting (physical and virtual) things based on existing and evolving interoperable information and communication technologies”. NOTE 1 — Through the exploitation of identification, data capture, processing and communication capabilities, the IoT makes full use of things to offer services to all kinds

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The Internet of Things

of applications, whilst ensuring that security and privacy requirements are fulfilled. NOTE 2—from a broader perspective, the IoT can be perceived as a vision with technological and societal implications.

The IERC definition (Vermesan, et al., 2013) states that the IoT is “a dynamic global network infrastructure with self-configuring capabilities” based on standard and interoperable communication protocols (van Kranenburg, 2007) where physical and virtual “things” have identities, physical attributes, and virtual personalities using intelligent interfaces, and are seamlessly integrated into the information network. The IoT integrates a large number of technologies and envisions that the things connected to the internet are clearly distinguished from the things participating within the Internet around us (Bleecker, 2006) – through unique addressing schemes and standard communication protocols. These things are able to interact with each other and cooperate with their neighbors to reach common goals (Atzori, Iera, & Morabito, 2010; Sarma, Brock, & Ashton, 1999). The combination of the internet and emerging technologies such as near field communications, real-time localization, and embedded sensors (Miorandi, 2012) allow the transformation of everyday objects into smart objects that can understand and react to their environment and transform this environment to a smart environment. The IoT infrastructure components and services of a city administration, education, healthcare (Domingo, 2012), public safety (Andrews, El-Attrash, Jarvis, Johnson, & Moss), real estate, transportation (Atzori, Iera, & Morabito, 2010) and utilities (SAP, 2014) lead to a more aware, interactive and efficient environment (Belissent, 2010). The IoT addresses the following topics:

- *Connect* core business operations to intelligence at the edge of the network generated by newly connected things connecting anytime, anyplace for anyone, for anything” (Dunkels & Vasseur, 2008). Cyber-physical integration occurs at the edge of a network and connection with intelligence on the edge.
- *Transform* existing business processes to gain efficiencies and provide competitive advantages in terms of process optimization (Spiess & Karnouskos, 2007). The IoT acts as a catalyst for the networked economy and transforms the business operations. A core element of IoT in the context of a “connections economy” is that value will accrue to those who best foster, embody, and exploit network effects. (The Networked Economy, 2014)
- *Reimagine* products, services and business models and as a result reimagine the customer experience. By reimaging the business models the operational technology (OT) and the information technology (IT) will merge towards new business models. These new business models heavily rely on the decomposition and decentralization of existing business processes, increase scalability and performance, allows better decision making, and lead to new revenue streams (Odenwald, 2007).

These IoT roles guide the development of novel computing applications (Kortuem et al, 2010). The following give a brief view on what have been discussed in the IoT community:

- The IoT refers to the use of sensors, actuators, and data communication infrastructure built into physical objects (Toma, Simperl, & Hench, 2009) that enable those objects to be tracked, coordinated, or controlled across a data network or the Internet (McKinsey, 2013).
- The IoT and the world of smart systems are ushering in an era where people, machines, devices, sensors, and businesses are all connected and able to interact with one another. As these previously disaggregated parties come together, new modes of collaboration and intelligence will abound fostering a trend called “Smart Business” (Harbor-Research, 2013).

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