

Chapter 95

An Introduction to IWoT: How the Web of Things Helps Solve Industry 4.0 Challenges

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ABSTRACT

The major drawback of the industrial internet of things is the lack of interoperability across the plethora of IoT platforms. Cross-platform services often require the development of complex software components for protocol translation, device discovery, and thing lifecycle management. As a result, these systems are too expensive and hard to develop. The W3C Consortium launched the Web of Things Working Group to develop the standards for open interoperability in the internet of things. This chapter presents the web of things specifications for systems architecture and communication protocols and how they can be applied in industrial domains, building the industrial web of things. Finally, this chapter shows that this industrial web of things is built upon a network of systems and devices linked with universal open standards such as enterprise systems, which are nowadays communicated through the conventional “web of pages,” as a key player in the Industry 4.0 revolution.

INTRODUCTION

The Internet of Things (The IoT in its acronym) integrates a series of techniques and technologies that allow common objects and any kind of device to gather data from the environment, store and expose it. A Thing can be defined as any physical object or entity with a unique identifier, an embedded system and able to communicate with other things in its surroundings. Common daily use objects like fridges, TVs and phones have become Things, integrated into an intelligent environment and connected to the internet.

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This also applies to the industry, where all kind of machinery is, or will be, able to send and capture data about its functioning and the environment or expose a way to control it through the internet. Industrial systems are a composite of different apparatuses, each one of them has its own way of communication, functioning and capabilities. This turns rapidly into a messy pile of devices, nearly impossible to maintain. Furthermore, each equipment has its own application, program or even another device to show its data. At the end, everything is so fragmented that human intervention is often the only way to achieve interoperability between industrial systems. The hyper-fragmentation in The Internet of Things ecosystem is defined by (Chen & Helal, 2008) as “a Sensor Jungle”.

This chapter intends to introduce the reader to the World Wide Web’s (W3C) Web of Things (WoT) standard to shed some light on its objectives, the problems it addresses, its current status and how it fits simultaneously within the current The Internet of Things (The IoT) and Industrial Systems landscapes.

Along with this chapter, the WoT standards for systems architecture, communication protocols and definition formats for achieving semantic interoperability between Things will be exposed and how they are applied in real industrial use cases.

BACKGROUND

There are some key challenges that The Internet of Things has to face to be adopted by industry: a) aggressive environments, b) real time, c) trust, d) silos and e) lack of standards. Each one of these challenges establishes restrictions and needs in the devices themselves, the companies and the people.

Aggressive Environments

Industrial platforms for data gathering, for example, a production chain, are designed to resist the aggressive industrial environment where it might be exposed to high temperatures, electrical noise, electromagnetic fields, dust and many other threats. However, the integration of The IoT in the industry requires, in many cases, the integration of microprocessors very sensitive to temperature, electrostatic and/or hits. These apparatuses might be suitable for an office environment, but they are not really appropriate for a hazardous environment. Device protection, as hardening or waterproofing, is essential in an industrial environment.

This all concerns physical requirements, but there are some other problems to take into account in an industrial environment, like connectivity. One of the key factors of The IoT is, obviously, the internet connection: no device is an The IoT Thing until it is connected. However, a public regulation, such as ATEX normative for hazardous and potentially explosive environments, usually restricts wirelessly connectivity. It might not be an internet access point (Ethernet cable) or a wireless connection (Wi-Fi) in key areas of a given industrial facility; it might even not be possible to deploy one. Because of this lack of conventional connectivity, devices must rely on other ways of communication, stronger, wider and shielded from the environment.

Real Time

In terms of industry, The IoT has strict requirements such as bandwidth, latency, and determinism. Industrial machines often need a millisecond precision for decision-making, so the thing that monitors

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