

The Internet of Things in an Enterprise Context

Stephan Haller¹, Stamatis Karnouskos², and Christoph Schroth³

¹ SAP (Schweiz) AG, SAP Research CEC Zürich,
Kreuzplatz 20, CH-8008 Zürich, Switzerland

² SAP AG, SAP Research CEC Karlsruhe,
Vincent-Priessnitz-Strasse 1, D-76131 Karlsruhe, Germany

³ SAP (Schweiz) AG, SAP Research CEC St.Gallen,
Blumenbergplatz 9, CH-9000 St.Gallen, Switzerland
{stephan.haller, stamatis.karnouskos, christoph.schroth}@sap.com

Abstract. This paper puts the Internet of Things in a wider context: How it relates to the Future Internet overall, and where the business value lies so that it will become interesting for enterprises to invest in it. Real-World Awareness and Business Process Decomposition are the two major paradigms regarding future business value. The major application domains where the Internet of Things will play an important role and where there are concrete business opportunities are highlighted. But there are also many technical challenges that need to be addressed. These are listed and it is shown how they are tackled by existing research projects with industrial participation.

Keywords: Internet of Things, Future Internet, Real-World Visibility, Business Process Decomposition, Business Value, SOA, Enterprise Services.

1 Introduction

The Internet of Things is a term that has been around for several years. It was first introduced by the MIT Auto-ID Center, the precursor to the current EPCglobal organisation, and at that time stood for the vision of a world where all physical objects are tagged with an RFID transponder with a globally unique ID – the EPC or electronic product code. RFID easily allows tracking the objects, and the EPC serves as a link to data which can be queried over the Internet about each individual object. Since then, the meaning of the Internet of Things has expanded. Using sensors or sensor networks, additional information about the objects or the environment that they are in can be recorded as well. Software embedded in the objects enables data processing directly on the item, and in combination with actuators, local control loops can be implemented.

The Internet of Things is a key part of the Future Internet. Many new opportunities can be foreseen for citizens as well as for businesses and other organisations, but also for the society as a whole.

2 The Internet of Things and the Future Internet

There are currently many terms flying around when trying to characterise the future development of the Internet: In addition to the Internet of Things, there is the Internet

of Services, 3D Internet, Internet of Content, and Next-Generation Networks, just to name a few. It is important to note that these terms should not be regarded as different “Internets” that will exist in parallel, but rather as different aspects of a common Future Internet. The European Commission has understood this and is therefore taking concerted action and clustering the research projects it is funding in the 7th Framework Programme into what it calls the *Future Internet Assembly*. Furthermore, collaborations are on-going and likely will be intensified with similar efforts in the USA and Japan.

From an enterprise and economic perspective, the Future Internet is the basis for a *web-based service economy* [1]. There will be service platforms and a multitude of services available over the Internet, hence the term Internet of Services. The granularity of these services will be very different, ranging from high-level business services to low-level sensor services provided by the Internet of Things. The role of the Internet of Things is to bridge the gap between the physical world and its representation in information systems. This leads us to our definition of the Internet of Things:

“A world where physical objects are seamlessly integrated into the information network, and where the physical objects can become active participants in business processes. Services are available to interact with these ‘smart objects’ over the Internet, query their state and any information associated with them, taking into account security and privacy issues.”

It is noteworthy that in this definition, we don’t talk about technologies. RFID, sensor networks, embedded systems etc. are just enabling technologies, and we will see the technologies change over the years, but the main concept behind the Internet of Things will remain. Furthermore, the objects can be passive, as is the case with RFID-tagged objects, or active as in the case of machines with embedded process logic. Key is though the seamless integration into the business processes.

3 The Business Value of the Internet of Things

For the Internet of Things to become reality and not just stay at the buzz-word and concept level, investments will be needed: to solve current research challenges, to develop the necessary hard- and software, and to deploy the infrastructure required. This will only happen if there is a clear economic benefit. We see two major paradigms from which business value can be derived, which we term *real-world visibility* and *business process decomposition*. In the following, we define and explain both these terms before looking at some of the application areas that stand to profit most from the possibilities in the Internet of Things.

3.1 Real-World Visibility

The term real-world visibility denotes the fact that through the use of automated identification and data collection technologies like RFID and sensors it will be possible for a company to better know what actually is happening in the real world, i.e., how