

## Chapter 18

# Improving Industrial Product Lifecycle Management by Semantic Data Federations

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### ABSTRACT

*It is expected that the amount of product information available from the Internet of Things and Services will be so tremendous that the main challenge will be to provide the right information, at the right time, in the right place, and to the right people. This objective is addressed by Aletheia – a distributed Information System that enables the federation and semantic integration of very heterogeneous information sources. This chapter discusses the goals, functionality, and architecture of Aletheia, guided by a real-world case study in the industrial service sector and conducted in cooperation with ABB, a major company providing power and automation technologies, products, and services for utility and industry customers. Further, the authors discuss several issues from the Aletheia project experience they believe to be valuable for researchers and implementers of semantic data federation systems as well as practitioners in the industrial service sector.*

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## INTRODUCTION

The importance of Information and Communication Technologies (ICT) in today's business environments is constantly increasing. It is expected that in the emerging Internet of Things (IOT) – a global architecture in which things (objects) are able to process, store, and communicate information about themselves and other things (EPCglobal 2009; Weiser 1995) – and Internet of Services (IOS) – a global marketplace of Web-based services (Schroth & Janner 2007) – the amount of available information will be so tremendous (Haller et al. 2009) that the main challenge will be to provide the right information, at the right time, in the right place, and to the right people (Benjamins et al. 2008). This development already poses challenges for enterprise information integration today, and leads to strategic advantages for companies that are able to optimize their internal and external information flows, therefore creating demand for new technologies that enable smart information federations, automatic aggregation, and targeted delivery of information (Oberle et al. 2005).

Especially in the area of product information management, many companies are facing problems. Today, a large amount of relevant product information is already available from very heterogeneous information sources. These sources include business applications, operational databases, data warehouses, but also data from the Web and Web 2.0 (wikis, blogs, social networks, etc.), external web services, and smart item infrastructures using sensor networks, Radio Frequency Identification (RFID), and the emerging EPCglobal Network (McIlraith et al. 2001; EPCglobal 2008; EPCglobal 2009). Existing enterprise information systems are usually not capable of systematically integrating and refining all of these product-specific information, which are created in different phases of the product lifecycle and have to be compiled from heterogeneous sources in structured as well as

unstructured form (McIlraith et al. 2001; Shadbolt et al. 2006). Furthermore, current enterprise information systems offer only limited coverage of the different phases within the product lifecycle – requirements analysis, development & design, manufacturing, sales, operation, maintenance, recycling, and logistics (Evdokimov et al. 2009). Today's systems primarily focus on development & design, manufacturing, and logistics, but mostly neglect other up- and downstream phases. Information and ICT systems related to the first phases of the product lifecycle, like requirements analysis, are expected to experience a considerable growth. Similarly, late product lifecycle phases like operation, maintenance, and recycling will become more important, because only during those phases client feedback can be retrieved.

The Aletheia project (Aletheia 2009), aims to close this gap by the means of Semantic Web technologies (Berners-Lee et al. 2001; W3C 2009b). The project scope is the development of Aletheia, an information system that provides federated and semantically structured product information from heterogeneous – often unstructured – sources throughout the product lifecycle (Ameri & Dutta 2005; Evdokimov et al. 2009) and corresponding value chains. Such an information base is crucial for a variety of business processes, and hence important for manufacturers, distributors, service providers, and consumers.

Following the design science research methodology for Information Systems (IS) research, proposed by (Peppers et al. 2008), we demonstrate the functionality and architecture of Aletheia by means of a case study on product lifecycle management in the industrial service sector in cooperation with ABB, a major company providing power and automation technologies, products, and services for utility and industry customers. The chapter is structured as follows: First, a short overview of the background and related work is provided. Then, the current practices of product information usage in this application domain are analyzed

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