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Chapter III

General Adaptation Framework: Enabling Interoperability for Industrial Web Resources

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Abstract

Integration of heterogeneous applications and data sources into an interoperable system is one of the most relevant challenges for many knowledge-based corporations nowadays. Development of a global environment that would support knowledge transfer from human experts to automated Web services, which are able to learn, is a very profit-promising and challenging task. The domain of industrial maintenance

is not an exception. This chapter outlines in detail an approach for adaptation of heterogeneous Web resources into a unified environment as a first step toward interoperability of smart industrial resources, where distributed human experts and learning Web services are utilized by various devices for self monitoring and self diagnostics. The proposed General Adaptation Framework utilizes a potential of the Semantic Web technology and primarily focuses on the aspect of a semantic adaptation (or mediation) of existing widely used models of data representation to RDF-based semantically rich format. To perform the semantic adaptation of industrial resources, the approach of two-stage transformation (syntactical and semantic) is elaborated and implemented for monitoring of a concrete industrial device with underlying XML-based data representation model as a use case.

Introduction

At the current stage of ICT development, there is a diversity of heterogeneous systems, applications, standards of data representation, and ways of interaction. All those systems were tailored for particular tasks and goals. The world is heterogeneous, and modern industry is looking for fast, global solutions related to knowledge management, enterprise application integration, electronic commerce, asset management, and so forth. However, in spite of advancements in data processing and acquisition, it is still difficult to automatically process and exchange data among the heterogeneous systems. Various industrial standards, which have been created and implemented by different consortia, appear not to be sufficient for growing interoperability demands.

Taking into account a great variety of possible types of information resources, data formats, and ways of data accessing and acquisition, an integration of such resources into a unified environment is an important development challenge (BMC Press, 2003; Khanna, 2004).

Basically, the integration tasks can be solved by adaptation of data from heterogeneous formats to some commonly accepted and semantically reached format (i.e., adaptation of heterogeneous applications and data originally represented according to a standard different from the common standard.

The integration process may include the following key functions (Apte, 2002; Sun Press, 2003):

- **Extracting, transformation, and loading:** For building data warehouse or operation data stores and giving to an end user/application a possibility to work with integrated data.
- **Data replication:** To allow heterogeneous servers and databases to share data in real time.

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