Chapter 2
Dynamic Data Mediation in Enterprise Application Integration Scenarios

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ABSTRACT
If we try to increase the level of automation in enterprise application integration (EAI) scenarios, we confront challenges related to the resolution of data and message heterogeneities between interoperating services, which traditional EAI technologies are weak to solve. We propose a semantically-enriched approach for dynamic data mediation in EAI scenarios, focusing on the resolution of message level heterogeneities between collaborative enterprise services, facilitating automated data mediation during execution time by providing formal transformations of the output and input messages (of the participating services) to a common reference business data model, that is, the enterprise interoperability ontology. Moreover, we present a tool that has been developed to support the user to provide business data-related semantic annotations and XSLT transformations of the input and output message parts of collaborative enterprise services. Finally, we demonstrate the utilization of the proposed approach and toll in a real-world EAI scenario.

INTRODUCTION
In the mid-1990s, a new term called enterprise application integration (EAI) was established, which introduced several methods and software components for efficiently integrating software in an enterprise. While in the past, the need for integration was driven by lower-level needs to share information among applications, today, business drivers fuel the need for integration (Vollmer & Peyret, 2005) – the need for business to respond to regulatory challenges, improve business process execution, grow...
employee productivity, and improve customer service is a hallmark driving organizations to integrate applications. In response to these new requirements, the integration market landscape is shifting. Service-Oriented Architectures (SOAs), business process management (BPM), composite applications, and other new application requirements have become the driving force in the market (Rymer et al., 2004).

The currently available enterprise application integration software address integration problems for example in the following ways (Friesen et al., 2007): a) graphically supporting the mapping of systems’ interfaces to each other (e.g. SAP NetWeaver Exchange Infrastructure), b) reducing complexity using intermediate data-exchange languages (e.g. eXtensible Markup Language – XML), or c) reducing the number of connection adapters needed through the introduction of hubs (e.g. Enterprise Service Bus). These efforts entail significant costs and typically due to the “lack of automated support in defining integration, it takes a long time for a human engineer to define semantically correct integration” (Bussler, 2003).

Current industrial EAI trends and technologies, like SOA, Enterprise Bus and Web Services, are up to now quite mature. However, if we try to increase the level of automation in integration scenarios, we confront several problems and challenges (Bouras et al., 2007), such as a) data and message level heterogeneities between interoperating services, b) insufficient search and discovery of published Web Services in a common registry, and c) inadequate Web Process composition with regard to the desired functionality and operational requirements. The problem that still exists, which the traditional, syntactic EAI technologies are weak to solve, refers to the formalization and the documentation of the semantics related to the interfaces and the data structures of the deployed Web Services. This lack of formal semantics of applications and services to be integrated makes it difficult for software engineers and developers to interconnect heterogeneous applications and thus creates obstacles in the automating EAI activities (Haller et al., 2006). There is no doubt that these needs impose the use and interpretation of semantics in EAI and that semantically enriched approaches will hopefully mitigate these problems.

In this book chapter, we present a semantically-enriched approach for dynamic data mediation in Enterprise Application Integration scenarios, based on Ontologies, Semantic Web and Semantic Web Services Technologies. Our approach, which is presented in the next section, focuses on the resolution of message level heterogeneities between collaborative enterprise services exposed from the participating business systems, facilitating automatic, dynamic data mediation during execution time by providing formal transformations of the input and output messages (of the participating Web Services) to a common reference model, i.e. an enterprise data ontology.

In addition, Section 3 provides an overview of the enterprise data ontology that we have developed and utilized as part of a multi-layered and –faceted interoperability ontology, called Enterprise Interoperability Ontology, which provides a shared, common understanding of data, services and processes within enterprise application integration scenarios.

Moreover, in Section 4, we present a tool that has been designed and developed to support the user to provide business data related semantic annotations to specific web services exposed from enterprise applications, realizing parts of their functionality. The developed tool enables the user to graphically define the required transformations of the output and input messages between web services with regard to the respective data entities (used for the annotation of these message parts) of a common ontological model. These transformations are further utilized to enable dynamic data mediation among several interconnected enterprise services, during the execution of a business process which contains these services.

Finally, we provide (in Section 5) an indicative business scenario demonstrating how our