Chapter XII

Archetype-Based Semantic Interoperability of Web Service Messages in the Health Care Domain

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Abstract

In this chapter, we describe an infrastructure enabling archetype-based semantic interoperability of Web service messages exchanged in the health care domain. We annotate the Web service messages with the OWL representation of the archetypes. Then, by providing the ontology mapping between the archetypes, we show that the interoperability of the Web service message instances can be achieved automatically. An OWL mapping tool, called OWLmt, has been developed for this purpose. OWLmt uses OWL-QL engine, which enables the mapping tool to reason over the source archetype instances while generating the target archetype instances according to the mapping patterns defined through a GUI.
Introduction

Health care is one of the few domains where sharing information is the norm rather than the exception (Heard, Beale, Mori, & Pishec, 2003). On the other hand, today there is no universally accepted standard for the digital representation of clinical data. There is a multitude of medical information systems storing clinical information in all kinds of proprietary formats.

We address this interoperability problem within the scope of the ARTEMIS project by wrapping and exposing the existing health care applications as Web services. However, given the complexity of the clinical domain, the Web service messages exchanged have numerous segments of different types and optionality. To make any use of these messages at the receiving end, their semantics must be clearly defined.

In a previous effort described in Dogac et al. (in press), we annotated Web services through the reference information models of electronic healthcare record (EHR) standards. EHR standards define the interfaces for clinical content exchange. The prominent EHR standards include openEHR (openEHR Community, 2005), HL7 CDA (HL7 Clinical Document Architecture, 2004), and CEN TC/251 prEN 13606-1 (referred to as EHRcom) (CEN TC/251 prEN 13606-1, 2004). Although such an approach allowed us to achieve a certain degree of interoperability, there were further problems to be addressed as follows:

- The reference information models of EHRs contain generic classes rather than having a class for each specialized clinical concept. Therefore, given a class in source ontology, the corresponding class in the target ontology is not clear unless the context is known. For example, an instance of an ENTRY class in EHRcom corresponds to one of the instances of ACT or ORGANIZER or OBSERVATION or PROCEDURE classes in HL7 CDA.
- Another problem in mapping reference information models one into another is as follows: different reference information models structure their classes differently. As an example, both CEN EHRcom and HL7 CDA have a class name called SECTION, and sections can have nested sections. When the sections of a clinical document are organized differently, then generating the same hierarchy for the target domain as in the source domain would not be correct.

In this chapter, we address these problems by using archetypes to complement the work described in Dogac et al. (in press). An archetype is a reusable, formal expression of a distinct, domain-level concept such as blood pressure, physical ex-
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