

Making Healthcare Information Systems Talk to Each Other: IST-1-2103 ARTEMIS Project

<http://www.srdc.metu.edu.tr/webpage/projects/artemis/>



A typical healthcare organization uses a multitude of separately developed IT applications. The exchange of healthcare related data between these systems is required both for administrative as well as clinical reasons. For example, there is an increasing need to be able to access all of the patients' medical data from any place at any time for better treatment.

In order to handle the inability of different healthcare information systems to talk to one another there are both messaging standards such as HL7v3 and electronic healthcare record (EHR) standards such as HL7 CDA, CEN's EHRcom or openEHR. For standards to be truly useful, all the applications that need to talk to each other should conform to the same standard. Yet, there are very many standards in the healthcare domain and it is not realistic to expect one global standard to dominate the market. The solution seems to be in using the semantic information to mediate between different healthcare applications and standards.

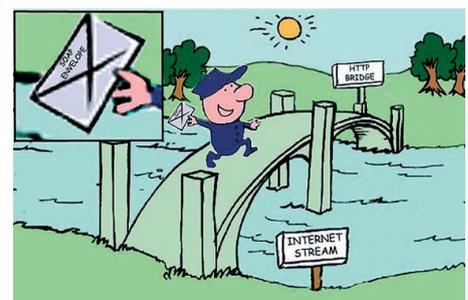
IST-1-002103-STP Artemis Project is supported by the European Commission HI - ICT for Health Unit (<http://www.cordis.lu/ist/health/>). The mission of this unit is to contribute to better health status and well-being of all European citizens, to bring economic and productivity benefits to the health systems of all Member States, and to stimulate growth and competitiveness of the eHealth industry in Europe. The driving vision of the Unit is the concept of an ICT-enabled citizen centred health delivery system, with special emphasis on prevention and personalisation. The Artemis architecture, which is an effort in developing semantic mediation technologies among medical information systems relies on and develops the following technologies:

We use Internet for message passing: In transferring healthcare messages between application systems, communication protocols are needed. Today, TCP/IP is the de-facto on-line communication standard.

We use the most widely used message packaging standard: On top of TCP/IP, a network protocol like HTTP and a data transport binding protocol is needed. The transport binding defines how a message to be sent is encoded within the rules of a network protocol. Today, Simple Object Access Protocol (SOAP) is most widely accepted transport binding



We use Web services to exchange the healthcare messages and documents: A Web service is a piece of business logic, located somewhere on the Internet, that is accessible through standard-based Internet protocols such as HTTP. Web services are already being used for exchanging healthcare messages, for example, the Netherlands Institute for ICT in Healthcare (NICTIZ) has implemented the Dutch national infrastructure for healthcare messaging by wrapping HL7v3 messages as Web services.



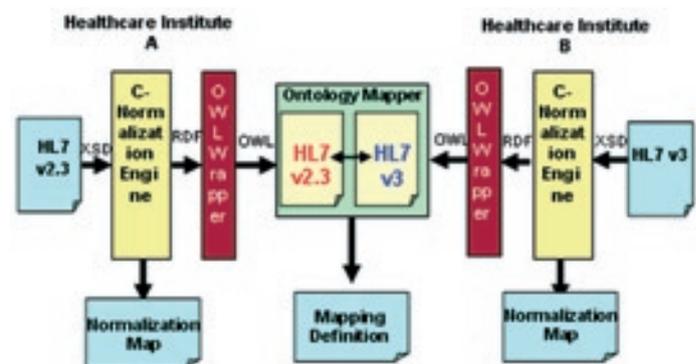
All these layers allow us to be able to exchange messages between different software applications but when it comes to understanding what the message intends, that is, what its meaning is we are at loss unless the talking applications use the same standard. Artemis semantic mediation comes into picture at this step: we have semantically annotated both the meaning of Web service functionalities and the messages they exchange by using ontologies based on the prominent healthcare standards. Ontologies are expected to play an important role in semantic interoperability of health information systems. Semantic interoperability is the ability for information shared by systems to be understood at the level of formally defined domain concepts so that the information is computer processable by the receiving system.



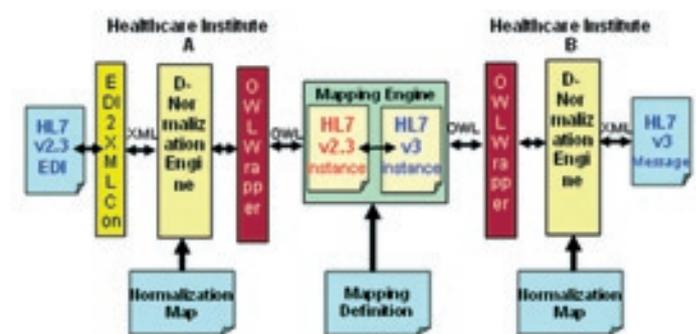
In Artemis, the semantics of Web services and the messages are formally defined through Web Ontology Language (OWL). The framework involves first providing the mapping of source ontology into target message ontology with the help of a mapping tool which produces a mapping definition. This mapping definition is then used to automatically transform the source ontology message instances into target message instances. Through a prototype implementation, we demonstrate how to mediate between HL7 Version 2 and HL7 Version 3 messages. However, the Artemis framework is generic enough to mediate between any incompatible healthcare standards that are currently in use.



Message Ontology Mapping Process: In the first phase, the message ontologies of two healthcare institutes are mapped one another. Assume that healthcare institute A is HL7 Version 2 compliant and healthcare institute B is HL7 Version 3 compliant. The message ontologies of these institutes are mapped one into other by using an ontology mapping tool. For this purpose we have developed an OWL ontology mapping tool, namely, OWLmt. With the help of a GUI, OWLmt allows defining semantic mappings between structurally different but semantically overlapping OWL ontologies, and produces a "Mapping Definition".



Message Instance Mapping: In the second phase, first the XML message instances of healthcare institute A are transformed into OWL instances by using the "Data Normalization" engine. Note that if the message is in EDI format, it is first converted to XML. Then by using the "Mapping definition"s, OWLsource (healthcare institute A) message instances are transformed into the OWL target (healthcare institute B) message instances. Finally the OWL messages are converted to XML again through the "Data Normalization" engine. A proof of concept implementation of the system is available at <http://www.srdc.metu.edu.tr/~artemis/owlmt/>.



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