

A Report on the “MathBroker” Project for Brokering Mathematical Web Services?

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Abstract

We report on the past achievements and on the current status of a project on the development of a software framework for brokering mathematical services in the Web. The World Wide Web is currently evolving from an infrastructure for delivering static Web pages coded in HTML to an infrastructure for providing dynamic *Web services* that use XML as the common format for object data and metadata. These services communicate with clients (and other services) using the SOAP protocol [6], their interfaces are described in the Web Service Description Language WSDL [9], their behavior is described by semantic Web technologies like OWL-S [4], interface/behavior descriptions are stored in Web registries such as the one developed by the ebXML initiative [5] that can be queried by clients for lookup of appropriate services.

While most Web developers focus on the use of Web service technologies for business applications, projects like our “MathBroker” project or the European MONET project [7] aim to support the area of computer mathematics where services provide functionality related to e.g. computer algebra or automated theorem proving. The general idea is that a client (human or software) in need of advanced mathematical capabilities can automatically discover and use corresponding services provided in the Web. The challenge of this particular application area is that it operates with semantically rich objects and provides complex functionality whose specification requires a precise formalism to be useful to potential clients.

Our work in the “MathBroker” project began in 2001 with the goal to use and adapt the then emerging Web service technologies for the purpose of computer mathematics. A starting point for this project was previous work by the OpenMath (OM) initiative [8] on describing mathematical objects for semanticspreserving communication e.g. between a mathematical service provider and service requester. OM has an XML representation that makes it suitable for communication in SOAP-based web service communication. Upon this foundation, we have based the following achievements:

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Mathematical Service Framework We have elaborated the use of the AXIS software to implement for the first time mathematical demonstrator services based on Web service technologies (SOAP and WSDL) using the XML encoding of OM objects [2]. This work pushed existing Web service software to their limits and revealed several deficiencies at that time.

Mathematical Service Description Language We developed a “Mathematical Service Description Language” (MSDL) which in a highly structured way extended the interface description features of WSDL by semantic information such as the mathematical problem solved by particular service [3].

MSDL was later revised as an extension of the simultaneously developed description language of the MONET project.

Mathematical Registry Provider Having experimented with Sun's JWSDP registry, we developed on the basis of ebXML a Web registry for storing respectively retrieving MSDL descriptions by mathematical Web services respectively clients [1].

Mathematical Query Language Currently, we work on the development of a mathematical query language. On the basis of the ebXML registry of MSDL descriptions, a brokering service shall be developed to which clients can submit descriptions of their problems and retrieve those services that can solve the specified problems.

The current status of the project with sample services and software can be found at <http://www.risc.uni-linz.ac.at/projects/basic/mathbroker>.

References

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