

Web Services with generic simulation models for discrete event simulation

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Abstract

Today the Internet and the World Wide Web (WWW) are on the cusp of a paradigm shift. Up to now most actions in the WWW are sorts of human–computer interaction, but the introduction of the eXtensible Markup Language (XML) changed the perception. The Internet will be seen as a great space of information and with the use of XML and following technologies like Web Services, Grid Computing and Semantic Web the difference between human–machine interaction and machine–machine interaction vanishes. This work investigates the usefulness of XML in the simulation domain and uses Web Service technology to build the SimASP framework for discrete event simulation (DES).

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1. Introduction

Not only outstanding persons in the field of computer science underrated the upcoming importance and possibilities of computers and computer networks—e.g. Thomas Watson, chairman of IBM in 1943 thought that “. . . there is a world market for maybe five computers”. In the early nineties of the last century, computer networks and in particular the Internet was well established. But scarcely anybody had knowledge of Tim Berners-Lee’s World Wide Web (WWW) or foresaw the importance of the WWW.

Today the Internet and the WWW are on the cusp of a paradigm shift. Up to now most actions in the WWW are sorts of human–computer interaction, but the introduction of the eXtensible Markup Language (XML) changed the perception. The Internet will be seen as a great space of information and with the use of XML and following technologies like Web Services, Grid Computing and Semantic Web the difference between human–machine interaction and machine–machine interaction vanishes.

Meanwhile the simulation domain noticed an emerging demand and development of web-based simulation. The combination of the simulation with the Internet and more precisely with Web technology gives hope to the overcoming of some limitations due to deficiencies of existing multidomain simulation software the simulation community stated during the past few years [10,13,15–17]:

- High investment costs.
- Only suitable for simulation experts or experienced users.

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- The lack of integration in existing information systems.
- Despite the multidomain approach of the simulation software most enterprises favor the proprietary development of their simulation software.
- Most simulation software uses proprietary data formats and definition standards.

Hence, it is not surprising that only a relative small percentage of industrial enterprises use simulation as a standard tool.

This work addresses some of these problems by adopting the concept of Application Service Providing (ASP) from Business to Business (B2B) communication and using XML as a core technology. A framework for discrete event simulation (DES) was built.

This paper is organized as follows. In Section 2 the concept of the framework and some details of the implementation are outlined. Section 3 deals with the use of XML in the DES domain. Section 4 presents some concluding remarks.

2. SimASP—a framework for DES service providing

The SimASP framework uses some of the very latest technologies of the World Wide Web to extend the possibilities of DES. The main concepts are outlined as follows.

2.1. Simulation Service Providing

In a conventional way of selling simulation software, the customer typically buys the software (or the license to use it) from the vendor that generates high investment costs. While the running costs are not to high, with the most multidomain simulation software the user has to become kind of an expert to use it in a profitably way.

Simulation Service Providing tries to offer a client a useful service that he can use via the Internet. A charge is paid for the amount of the used services.

2.2. Modular Services

The implication of useful means that a costumer (and that means not a simulation expert—he would buy a simulation software anyway), who is normally an expert in his domain, must be enabled to use simulation for his purpose. Therefore the functionality of a simulation study is divided in several modules (Fig. 1).

The client can choose according to his needs which functionality he wants. Projected functions are

- several simulation engines;
- experiment control;
- optimization;
- advanced data analysis;
- animation.

2.3. XML for data management

As all modules have to operate on the same model a data repository is needed. Therefore different types of databases can be used (e.g. a RDBM system or an XML database). But for different modules, different parts of the model have to be extracted, are sent to the accordingly chosen simulation or other software and the produced output has to be stored in the model respectively linked to it.

For this purpose of data communication XML fits well [1,7,16]. XML is an open well-accepted standard with a lot of follow up technologies usable for software development. Fig. 2 depicts some of the interaction of the software components on the application server.

The model stored in the database is translated in an according XML-model. The information how to transform is stored in an XML schema. From the XML representation of the whole model (which is usually very small because XML files are plain text files), the needed subset for the specific SimASP module is extracted and sent to the software (simulation or other). The software output is compiled again in XML and linked to the model data in the data repository.

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