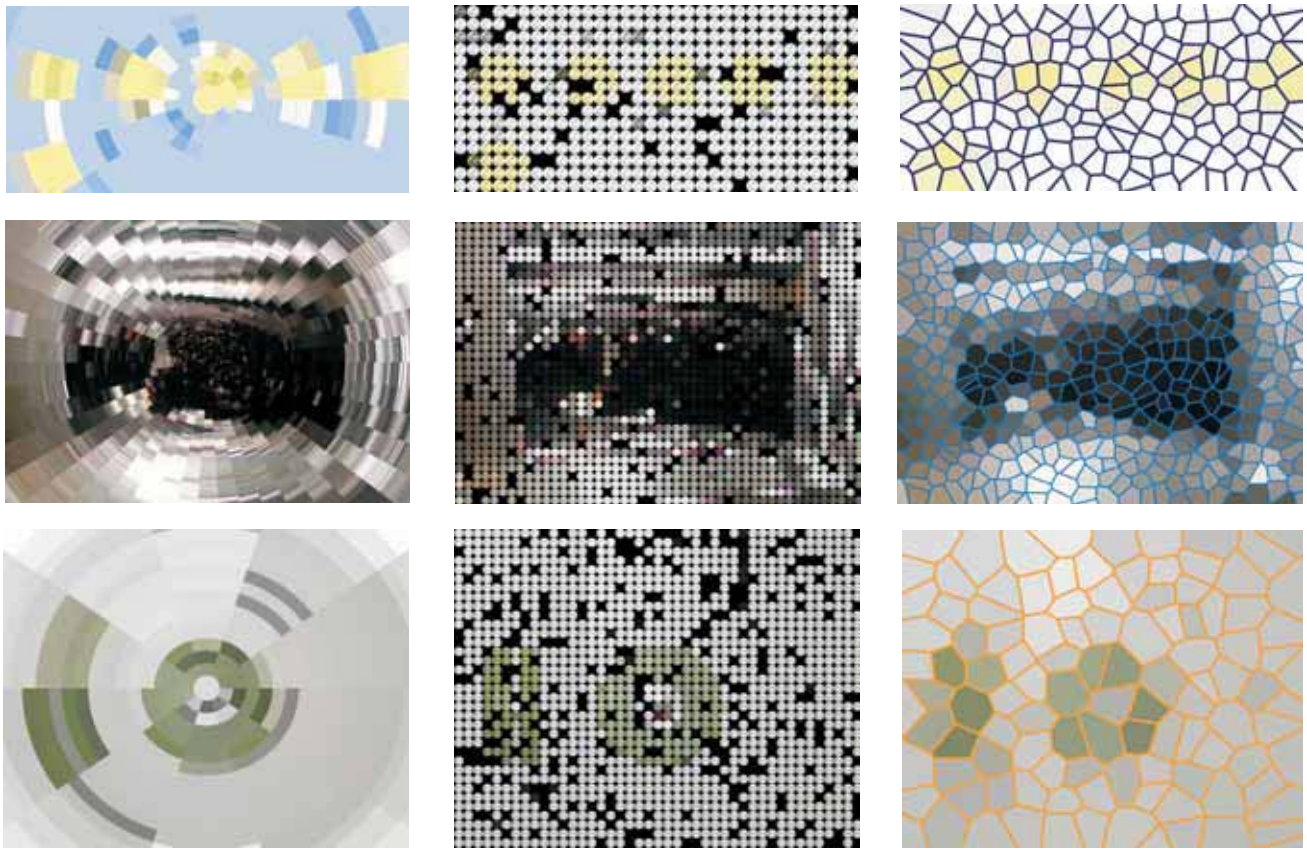
SNE SIMULATION NEWS EUROPE



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Journal on Developments and Trends in Modelling and Simulation

Membership Journal for Simulation Societies in EUROSIM

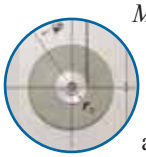
ARGESIM

Dear readers,
This is the second SNE issue with new layout, and we are glad, that we got positive reactions for changes in SNE layout and for opening the publication strategy of SNE. Together with this issue, we are proud to announce the first SNE Special Issue 'Parallel and Distributed Simulation Methods and Environments'. First born as idea in ASIM - ASIM Working Groups intend to publish alternately a Special Issue each year, the SNE Special Issues are open for all societies and conference organisers. The Special Issues cause a change in numbering the SNE issues: this regular SNE issue, SNE 46, is now identified as SNE 16/1 (Volume 16, Number 1), the first Special Issue as SNE 16/2; the next regular SNE double issue (SNE 47/48) will be numbered SNE 16/3-4. This remembers, that we are running SNE since 16 years, and we thank our faithful readers.
Together with the new layout, both editorial boards are being reorganised and will be enlarged for the future. We are also working on a new infrastructure for running an editorial office, together with tasks for SNE on the web.
We hope, the readers enjoy this issue, and the contributors appreciate the new editorial structure (more strict, but hopefully more efficient). Three Technical Notes and three Short Notes in this issue show the broad variety of modelling and simulation. The Technical Notes are special ones: based on a post-conference review procedure via Internet for contributions to MATHMOD 2006 Vienna, papers were selected for publication in SNE (to appear also in the next SNE issues). Furthermore, as first reaction on the ARGESIM / MATHMOD Yo-yo Challenge, the Techncial Note by Leon Zlajpah introduces into mechanical mysteries of Yo-yo control. The Comparison Section publishes an updated version of Comparison C13 'Crane and Embedded Control', reflecting the developments in this area of modelling and simulation; furthermore, seven comparison solutions concentrate on modelling issues and alternative approaches.
The News Section reports about progress in new structures for EUROSIM, and about activities in EUROSIM member societies and in Societes related to Modelling and Simulation. We thank all contributors, members of the editorial boards, and people of our ARGESIM staff for co-operation in producing this SNE issue.

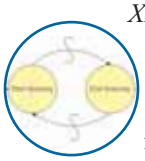
Felix Breitenecker, editor-in-chief; Felix.Breitenecker@tuwien.ac.at

SNE 16-1 / SNE 46 in Five Minutes

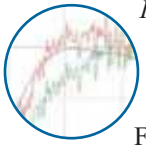
Process Modelling in a Sterilisation Tunnel (TN) - presents modelling and simulation for temperature profiles in an industrial production process – ***page 3***



Modelling and Control of Yoyo (TN) – deals with the classical Yoyo toy: mathmatical models for control and for haptic interfaces, control strategies, and verification by a robot – ***page 9***

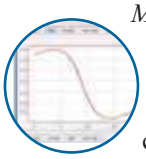


XML in DEVS (TN) – introduces XML as model basis for discrete event models for simulation via WWW and presents a prototype implementation – ***page 16***

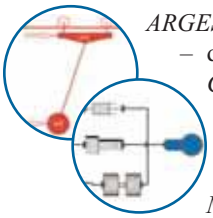


Real-time Simulation with DSPs (SN) - reports about a connection of two DSPs, one identifying the plant, the other performing Kalman Filter and LQ control – ***page 21***

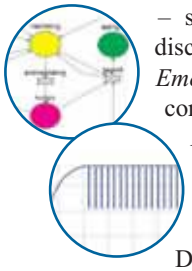
Simulation of Blood Glucose Regulation (SN) – presents MATLAB models glucose status together with a graphical interface for educational use – ***page 23***



Modelling and Control of a 2DOF - Robot (SN) – outlines modelling and simulation of a simple robot for E-learning of simulation and control via WWW – ***page 25***



ARGESIM Comparison Section – defines a revised benchmark C13 *Crane and Embedded Control* (implicit modelling, digital control, sensor action), followed by a sample solution with *Modelica/Dymola* – ***page 27***



– seven *Comparison Solutions* for discrete comparisons (*Dining Philosophers*, *Emergency Department*), continuous comparisons (*Switching States*, *SCARA Robot*) and general comparisons (*Cellular Automata*, *Identification*) show efficient implementations using MATLAB/Simulink, Dymola, DSOL/Java, Maxima and special Petri Net tools – ***page 31 - 38***

Book Reviews and *Journal News* – Eleven book reviews and one book news

Introduction of the SNE Special Issue *Parallel and Distributed Simulation Methods and Environments*

Call for next SNE Special Issue *Validation and Verification*
– ***page 39 - 47***

Young Simulationists – introduction of simulationists from Germany and Austria – ***page 48***

EUROSIM Society Reports – 20 pages reports from EUROSIM societies, followed by 8 pages from International Societies and Groups (ECMS/SCS, MATHMOD, Modelica, etc.) and 2 pages *Industry News* in the *News Section*

Content

SNE Editorial Boards

SNE - Simulation News Europe – is advised by two Editorial Boards. The *SNE Editorial Board* is taking care on reviewing and handling of Technical Notes, Shortnotes, Software Notes, Book and Journal Review, and of Comparison and Benchmark Notes. The *SNE News Editorial Board* (News Section) is responsible for reports from EUROSIM, EUROSIM societies, International Societies, and for Industry News.

Editorial board

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Editorial Info - Impressum

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Scope: Information on development in modelling and simulation, comparisons and bechmarks on modelling and simulation, membership information for EUROSIM and Simulation Societies.

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Using XML in the Domain of Discrete Event Modelling and Simulation

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Today the World Wide Web is undergoing a transformation from an HTML-based medium to XML and XML-based technologies. Up to now most actions in the WWW are sorts of human-computer interaction, but the introduction of the extensible markup language (XML) machine interaction and machine-machine interaction vanish. Meanwhile the domain of modeling and simulation notices an emerging demand and development of web-based simulation. In consequence the overall evolution of the WWW will produce some influence in the simulation domain. This contribution discusses the impact of XML in the discrete event simulation (DES) domain and the use of follow up technologies like web service technology or the semantic web for discrete event simulation. As example, an implementation of a small prototype is shown, understanding flow models.

SNE 16/1 (46), August 2006

Introduction

With the introduction of the *eXtensible Markup Language* (XML) 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 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 emerg-ing 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:

- High investment costs
- Only suitable for simulation experts or experienced users
- The lack of integration in existing information systems
- Despite the multidomain approach of the simulation software most enterprises favour the proprietary development of their simulation software.
- Most simulation software uses proprietary data formats and definition standards

Some of this limitations can be addressed by the use of the concept of *Application Service Providing* (ASP) from *Business to Business* (B2B) communication and using XML as a core technology to build simulation web services.
Therefore we developed a framework for a DES web service - the *SimASP* framework.

This paper is organized as follows. In the first section the concept of the SimASP framework is outlined. As a consequence of our work we investigated the concept of a so called *Generic DES Model*.

The implications of XML to such generic DES models are outlined in the second section. In the third section we give some concluding remarks as well as a small preview on forthcoming development.

1 SimASP - a Framework for DES Service Providing

1.1 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, which 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 services used.

1.2 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 (Figure 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

1.3 XML used 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). For different modules, different parts of the model have to be extracted. These model parts are sent to the accordingly chosen simulation or other software and the produced output has to be stored in the model (or linked to it).

For this purpose of data communication XML (*eXtensible Markup Language*) fits well. XML is an open well-accepted standard with a lot of follow up technologies usable for software development. Figure 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.

1.4 XML as core technology for web services

For client server interaction a web service approach was chosen. The use of XML-based technologies like SOAP, WSDL and UDDI web services provides a very flexible environment for service registration, service request and service communication.

UDDI (*Universal Description Discovery and Integration*) is an XML-based registry, where a provider can register his service. WSDL (*Web Service Description Language*) is an XML-based service description on how to communicate with the service.

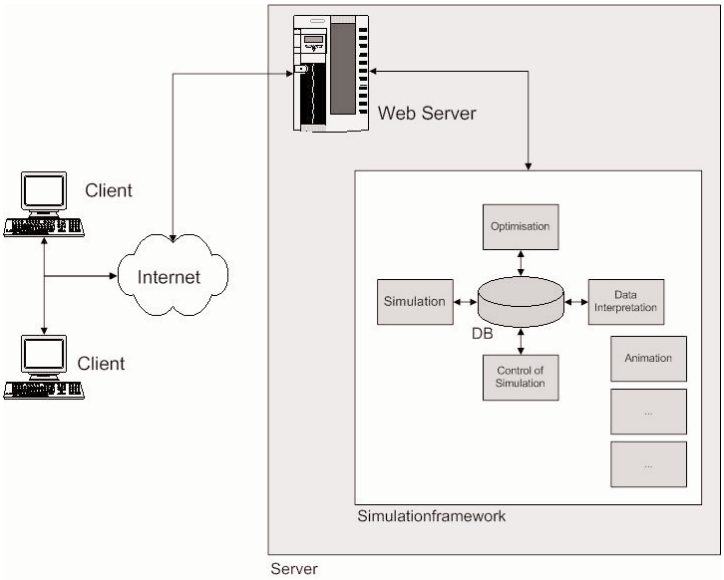

Figure 1: The modular concept of the SimASP framework.

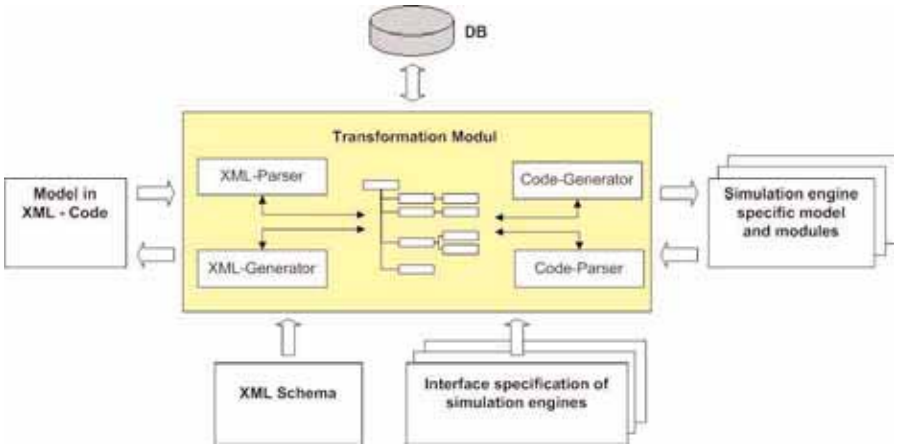

Figure 2: Different modules operating on the same model.

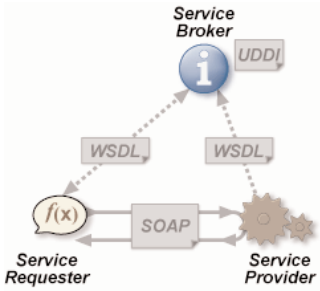

Figure 3: Functionality of a Web Service.

SOAP is a standard for exchanging XML - messages over a computer network and enables the communication in-between service requester and service provider.

2 Generic DES Models using XML

A consequence of the modular concept of the new SimASP framework is the possibility to use different simulation software for the simulation of a model. Hence the client can use the software he is used to or if he requires some functionality that is not supported from all simulation engines, the switching between the simulation engines can be encapsulated and is transparent for the client.
Therefore the generic DES model definition was developed. It is oriented on an object-oriented approach and defines some standard resources (like Sources, Server …), which are familiar in the DES domain. The representation of the model is independent from the finally used simulation engine although interfaces to the simulation engine have to exist. We developed interfaces for two different simulation packages with different modeling paradigms.

2.1 Definition of the generic DES models

We used XML as a definition language for the structure of the generic DES model. XML is an open standard and provides a lot of software technologies for the definition and management of data like SAX, DOM, XML Schema, XSLT …

The concept of Web Services and Grid Services relies heavily on the data representation in XML, too.
The hierarchical, structured way of data representation is very suitable for the definition of content related to an object oriented approach.

Thus the definition of the generic DES models is made in XML Schema, which is an XML document for itself. Unlike the older XML definition language DTD, XML Schema provides user defined data types as well as the possibility to restrict the content of XML elements and XML attributes by regular expressions.

A short graphical abridgement of the XML Schema for generic DES models is given in Figure 4. It defines the content and the shape of a valid XML representation of a generic DES model. A software application that tries to deal with such a file, expect the following structure.

The model file is expected to have a root element with name Simulation, which contains two more elements (head, model).
The head is expected to hold information about the simulation run and the experiment control, the model element contains an arbitrary number of simObjects, which again are either connectors or simEntities which descend from their types and so on.

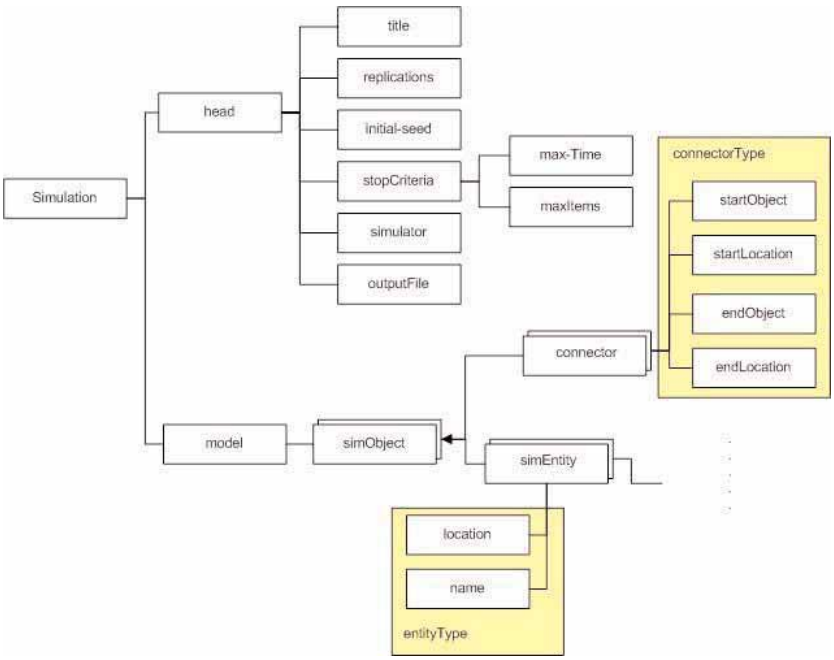

Figure 4: Part of the XML Schema definition of a generic DES model.

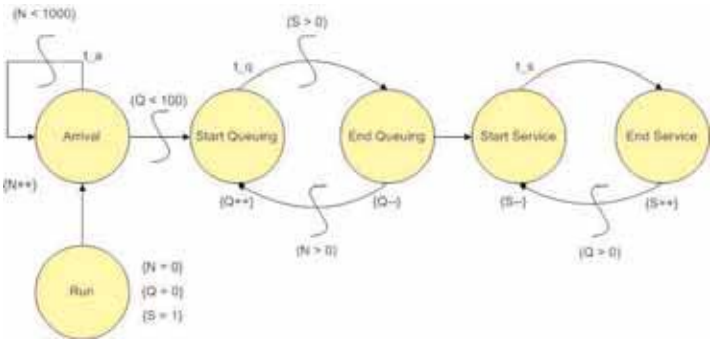

Figure 5: Event oriented definition - Job Shop Model with event graphs

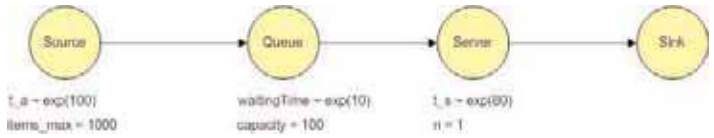

Figure 6: Process oriented definition - Job Shop Model with flow graph

The mapping of the defined model entities to the required objects of specific simulation software is not defined at the client side, but is made on the server side according to the specified functionality.

2.2 Example - Job Shop Model

Current available simulation engines in the SimASP (for which interfaces are written) are *Simkit*, a software package for implementing DES models written in Java, and the process oriented package *JSIM*, a Java-based simulation and animation environment supporting web based simulation.

The generic model interfaces are written in Java and translate the generic model in a simulation package specific format. Figures 5 and 6 depict the according definitions of a Job Shop Model.

Both simulation engines worked properly and their specific results have been translated in a generic XML output file (a fragment of the XML schema definition is shown in Figure 7)

The output files are readable through every XML-compatible software and can be displayed or processed in a convenient way.

3 Conclusion

In this work we showed different possibilities for the DES domain to benefit from the use of a service-oriented approach and the use of XML. The openness and flexibility as well as the availability of existing open standards and protocols make XML extreme powerful.

We used some of these strengths to build a framework for DES service providing and a generic DES model witch can be used as a starting point to overcome some obstacles which are founded in a proprietary way of building and running simulation models.

Neither the Generic DES model is finished nor are is the development of XML. Meanwhile the SimASP framework was built, new XML standards emerged and the use of ontologies and the semantic web will be the next XML-based trend that will influence the simulation domain.

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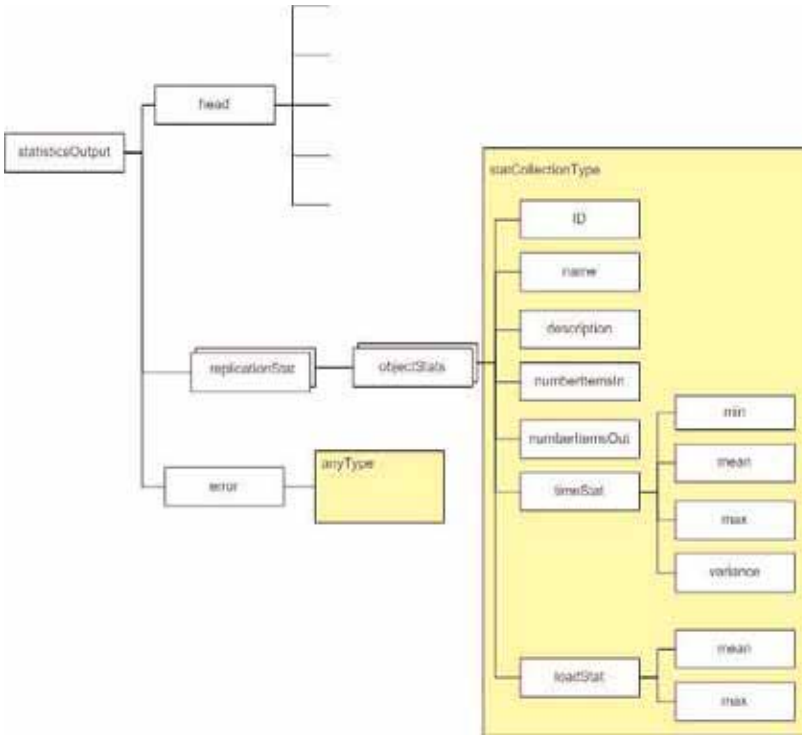

Figure 7: Generic Schema for statistic output.

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