

Business Process Simulation for Management Consultants: A DEVS-Based Simplified Business Process Modelling Library^{*}

Igor Rust¹, Deniz Cetinkaya¹, Mamadou Seck¹, and Ivo Wenzler²

¹ Systems Engineering Group; Faculty of Technology, Policy, Management; Delft University of Technology; Jaffalaan 5, 2628BX, Delft, THE NETHERLANDS

² Accenture Nederland; Gustav Mahlerplein 90, 1082 MA, Amsterdam, THE NETHERLANDS

Extended abstract

A business process is a series of activities that produces a product or service for a customer. Business Process Modelling (BPM) is the activity resulting in a representation of an organisation's business processes so that they may be analyzed and improved. A distinction can be made between static modelling and dynamic modelling of business processes. Static modelling tools often provide a graphical process representation, for example simple flowcharts, IDEF0 or BPMN diagrams to depict business processes. Business Process Simulation (BPS) tools, provides the possibility to simulate and evaluate the dynamic behaviour of business processes.

The usefulness of business process simulation was proven by many authors and various simulation tools are available, still many management consultants and business analysts rely on simple static process mapping methods. Some reasons for the lack of adoption are that much experience is needed to develop valid simulation models and simulation model development is time consuming and costly. More specifically, there is a lack of business process simulation tools which supports an easy and quick approach of modelling and analysis of business process by consultants and business analysts. This paper presents a business process simulation method to support management consultants to model, simulate and analyze business processes in a well defined manner.

A user-centred design (UCD) approach is chosen to increase the likelihood that a designed and developed solution is found usable by its end-users, the management consultants. User-centred design is concerned with incorporating the end-users perspective during the design and development process to achieve a usable system. To incorporate management consultants in this research, a series of design and evaluation rounds are held (in the form of workshops) with management consultants of a large international management consultancy firm.

^{*} Original version of this paper: Rust, I., Cetinkaya, D., Seck, M., Wenzler, I. (2011). Business Process Simulation for Management Consultants: A DEVS-Based Simplified Business Process Modelling Library. In Proceedings of The European Modelling & Simulation Symposium 2011. Genova : Universita di Genova, 2011. 709-714.

The modelling representation that was the outcome of the design research process is based on the Business Process Modelling Notation (BPMN). BPMN is an industry-wide standard for modelling of business processes. A set of business process modelling (BPM) elements are determined, which allow modelling of business processes by consultants as how they actually perceive business processes.

We use the Discrete Event System Specification (DEVS) to specify our simulation models. The suggested BPM elements and some supplementary elements are matched to DEVS simulation components. For every element a state-diagram was developed and validated. The supplementary components are developed to support some of the needed simulation functionality as discussed by the consultants.

DSOL, which stands for “Distributed Simulation Object Library”, was selected to provide the simulation and execution functionalities. DSOL is a proven multi-formalism simulation library which can be considered as a generic purpose simulation tool. It is written in the Java programming language and has been used effectively in various simulation projects. DSOL also supports execution of simulation models based on the DEVS formalism through the DEVSDSOL library (which is compatible with hierarchical DEVS). Each DEVS component has been implemented in Java and these components are executable with DEVSDSOL simulation library.

In order to provide a higher level abstraction mechanism to our library, we applied the model-driven development framework presented by Cetinkaya (2011). MDD4MS is a model-driven development framework for modelling and simulation. The framework suggests an M&S life cycle with five stages (Problem Definition, Conceptual Modelling, Specification, Implementation and Experimentation), metamodel definitions for different stages, model to model (M2M) and model to text (M2T) transformations for the metamodels and a tool architecture for the overall process. MDD4MS presents a sample prototype implementation which is developed in Eclipse.

In this study, we used the BPMN editor to draw our business process models. Since the MDD4MS prototype provides generic model transformation rules for BPMN, we rewrote some rules for BPMN2DEVS M2M transformation. In this way, we directly transformed the visual modelling elements to the DEVS components that we implemented in our library. Once we have the DEVS model, the MDD4MS prototype automatically generates the DEVSDSOL model and the java code for coupled components that uses the implemented classes for BPM modeling elements in our library. In other words, visual business process models, drawn by the BPMN editor, are transformed to executable Java code and they can be simulated with DSOL.

This work proposed a new modelling approach for management consultants to model and analyse business processes based on a proven theory, industry-wide standards and active end-user involvement during the design process. A library of DEVS-based BPMN modelling elements is implemented with Java that uses the DSOL simulation library to provide the simulation capabilities.