Case Studies of the Renew Meta-Modeling and Transformation Framework

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The Renew Meta-Modeling and Transformation Framework (Rmt framework) provides a toolset for the development of domain-specific modeling languages (DSML) and tools [4]. In this contribution the Rmt framework and some case studies are presented. Abstract models facilitate high-level perspectives on the overall structure of software components, their services, and their interactions. They are mainly used to support the communication about software systems. Specific models are complemented with technical information, which lowers the level of abstraction, down to where they can be used as implementation artifacts in a specific environment. Generative techniques are applied to perform transformations between models, covering different levels of abstraction. In order to satisfy the individual requirements of the various application domains to the model, specific modeling languages are useful.

The Rmt framework supports an agile approach to prototypical DSML development. This means that DSML can quickly be built from scratch, evaluated within the Rmt environment, and incrementally improved. The process of developing a DSML comprises the specification of abstract syntax, representation and semantics. Each step is supported with an appropriate tool by the Rmt framework. The graphical editor of Renew [1] is used to provide the representations for a DSML in development. Standard figures can be adapted to customize the graphical constructs. The tooling component of the Rmt framework generates modeling plugins, which integrate into the GUI of Renew by registering menus and editor toolbars. The semantics of modeling languages are developed by providing Petri net mappings with the transformation component of the Rmt framework. This enables the transformation of (abstract) models to low-level Petri nets or to Java Reference nets, which can be executed within the Renew simulation environment.

The Rmt approach originates from the context of the P*aose approach (Petri net-based, Agent- and Organization-oriented Software Engineering) for the development of multi-agent applications on the basis of executable Petri net models, where various modeling techniques are applied to gain an abstract perspective of the system in development. While each of the modeling techniques serves a special purpose, the Rmt approach provides a common conceptual basis for the applied modeling languages and tools.

The ongoing work elaborates on the conceptual approach with an emphasis on the transformation of behavioral models to Java Reference nets [4]. With the improvements made to the Rmt framework we develop a domain specific

variation of BPMN - called BPMN_{AIP} [2] - and the mapping of this formalism to agent protocol nets, which are used within the P*AOSE approach to implement conversation patterns of the agents. Process models can also be created with a YAWL prototype. The Toueg plugin facilitates a structural modeling perspective and implements a Petri net-based variant of Touegs algorithm for the distributed computation of pairwise shortest paths in a distributed network [6]. Furthermore, the Rmt framework is applied to develop a Deployment Diagram formalism, which is used to model the initial distribution of agents in multi-agent applications [3]. In his current work Röder uses the Rmt framework to develop a plugin for the management of software projects by utilizing the Network Technique [5].

In its recent history the technical realization of the Rmt framework has been largely remodeled. Many small improvements and bug fixes enhance the stability and usability of the framework. The whole code base was refactored from a monolithic application to a plugin architecture consisting of the following modules: meta-model, core, serialization, representation, tooling and transformation. The plugin architecture can now be used as a basis to integrate further functional extensions into the Rmt framework.

The future research plan puts a focus on the improvement of support for modeling and on the transformation of models to Petri nets. More precisely, we want to facilitate hierarchical modeling, enable users to define annotation languages and improve support for the specification of model constraints. This will allow us to extend the applications of the Rmt framework to other domains in order to design modeling languages.

References

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