TIMESQUARE
On the Formal Execution of UML and DSL Models

Julien DeAntoni, Frédéric Mallet, Charles André, Benoît Ferrero
Aoste Team-Project
Université de Nice Sophia Antipolis
INRIA Sophia Antipolis Méditerranée
Email: firstname.name@sophia.inria.fr

1. Objectives

Model-Driven Engineering intensively uses models and model transformations. Transformation tools ensure that the target model conforms to the target metamodel, so that it is syntactically correct. However, there is little assistance, or none at all, to guarantee that the semantics is preserved during the transformation. This is mainly due to the absence of an explicit semantics within the models. Models bring the syntax while the related (application-specific) analysis tools bring their own semantics.

We propose here a model-driven approach to describe a formal and explicit semantics as a separate model. This formal semantics can then be attached to different models (Uml-based or DSL) and a model can be executed with different semantics.

2. TIMESQUARE

TIMESQUARE is the software environment we have developed to support the modeling approach presented in section 1.

TIMESQUARE has five main features: 1) modeling of user defined libraries to ease semantic description, 2) modeling of CCSL system and applying it to a specific model, 3) generation of a solution, 4) displaying and exploring waveforms, 5) animating UML-based model and storing the result inside the model.

TIMESQUARE is a basic environment for model specification (both libraries and CCSL systems) in eclipse. With this environment a CCSL model can be associated with a specific model described in Eclipse. Based on the KerMeta framework, it is possible to execute the CCSL system in order to simulate the models. A very crude version of the exhaustive simulation is also possible. The simulation of a CCSL system allows the generation of traces, given as waveforms written in VCD format. VCD (Value Change Dump) is an IEEE standard textual format for dumpfiles used by EDA (Electronic Design Automation) logic simulation tools.

Waveforms can be displayed with any VCD viewer. TIMESQUARE has its own viewer enriched with interactive constraint highlighting and access facilities.

For UML-based models graphically modeled with Papyrus1, it is also possible to animate the model. It is then possible to navigate interactively in the steps to see the state of the model entities on which CCSL specifications are applied. Moreover, the state of model elements are store directly inside the UML model.

It is important to note that TIMESQUARE uses a common trace model for all outputs. This trace model keeps the trace between the model entities, the CCSL specification and the resulting model element states. Moreover, it keeps additional information like the internal state of the CCSL system, which can be useful for better user feedback.

A screenshot of the tool (used in debug mode) is provided on figure 1. On the lower right side of the figure, the VCD is currently tracing the state of each MOCC element. The central part highlights the active elements (in red). The left side of the figure is the TIMESQUARE MOCC description. Finally, the left upper part is the classical debug windows that drives the model simulation.

Figure 1. TIMESQUARE during debugging
A first version of this tool is already available at http://www.inria.fr/sophia/aoste/dev/time_square

1. http://www.papyrusuml.org