

## Master Internship

### Model Transformation Testing

#### Keywords:

*Software Engineering, Metamodeling, Model Transformation, and Test.*

#### Scientific Context:

Nowadays, object-oriented meta-languages such as MOF (Meta-Object Facility) [1] are increasingly used in Model-Driven Engineering (MDE) to define *Domain Specific Modeling Language* (DSML). However, these meta-languages focus on the definition of the structural part of languages (i.e., the metamodel), and do not encompass behavioral description. Triskell team developed the executable meta-languages Kermeta (<http://www.kermeta.org/>) allowing to add precise description of behavior to a metamodel, potentially using aspect-oriented (meta)modeling (AOM) [2]. Kermeta is defined as an extension of the standard EMOF (*Essential Meta-Object Facilities*) providing an imperative, object-oriented, and model-oriented action language to define the body of metamodel operations [3].

Kermeta allows giving a precise operational semantics or implementing a transformation for a metamodel to be applied to models that are compliant. Such behaviors can be run using either the interpreter or the (java) compiler, both provided by Kermeta. Then, it becomes possible to simulate or transform domain specific model.

Applicable to a very large number of models, in a wide variety of context, such programs require special attention for design and verification. For the purpose of verification, the Triskell team has developed a bridge between Kermeta and the Yeti random testing framework [4]. This makes it possible to automatically generate random test data and run test cases on a Kermeta program.

#### Work:

The main objective of this internship is to improve the existing test module by offering an innovative approach to generate test data according to different strategies, other than random. The work will be twofold: (i) extend the work from [6] to define criteria that will drive the generation of test data; (ii) investigate the automatic generation of test data that satisfy these criteria. The test data in such an approach are models, usually represented as a graph of objects, which structure is constrained by the source metamodel of the transformation under test.. To generate such a graph, the objective of the internship is to use Pramana [5], another tool developed in the Triskell team using Alloy.. Thus, the candidate will study the extend Pramana to transform the test objectives (test criteria) in Alloy.

The internship's objective is to set a tool to automate the testing activity for Kermeta programs according to specific criteria. The approach will be validated through experimental studies that evaluate whether the use of such a tool can increase the quality of Kermeta programs.

#### Bibliography:

- [1] Object Management Group, Inc. Meta Object Facility (MOF) 2.0 Core Specification, January 2006.
- [2] Jean-Marc Jézéquel. *Model driven design and aspect weaving*. Journal of Software and Systems Modeling (SoSyM), 7(2):209--218, May 2008.
- [3] Pierre-Alain Muller, Franck Fleurey, and Jean-Marc Jézéquel. *Weaving executability into object-oriented meta-languages*. In MODELS/UML'2005, Springer.
- [4] Cf. <http://www.yetitest.org/>
- [5] Sagar Sen, Benoit Baudry, Jean-Marie Mottu. *Automatic Model Generation Strategies for Model Transformation Testing*. In Proceedings fo the International Conference on Model Transformation, 2009.
- [6] Franck Fleurey, Benoit Baudry, Pierre-Alain Muller, Yves Le Traon. *Towards Dependable Model Transformations: Qualifying Input Test Data*, In Journal of Software and Systems Modeling (SoSyM), volume 8, 2009.

#### Working Environment:

- Laboratory:
  - o [IRISA](#), [EPI Triskell](#) (Campus de Beaulieu, Université de Rennes 1, France)
- Scientific Advisors:
  - o [Benoît Baudry](#) and [Benoît Combemale](#) (IRISA, Triskell)