

## Master Internship

### Title: From fUML to fMOF (*a Foundational Subset for Executable Meta-Modelling*)

#### Keywords:

*Executable Meta-Modelling, Aspect-Oriented (Meta-)Modelling, Modular Operational Semantics, Kermeta.*

#### Description:

*OMG has recently adopted a subset of UML to define executable models: fUML (Foundational Subset for Executable UML Models). The operational semantics of this subset is precisely described in [1] and allows an unambiguous interpretation of a fUML model. Nevertheless, with the ever growing diffusion of Model Driven Engineering technologies, modelling has evolved into meta-modelling that becomes a core activity of software development. MOF has been historically defined as a subset of the UML classifiers to define the abstract syntax and static semantics of Domain Specific Languages (DSLs). Complementary to that, an executable meta-modelling language such as Kermeta [2] or Java/EMF [3], extending the MOF by an action language, was proposed and can be used to prototype DSL operational semantics (typically by mapping the effect of the DSL actions onto a model of the DSL semantic domain), allowing models execution.*

*We propose in this internship to investigate a new generation of executable meta-modelling language taking advantage of the best previous experiences, with the Kermeta and the Java/EMF implementations and with the fUML specification. Accordingly, the main objective will be to promote a formal and advanced executable meta-modeling, and to propose a consistent integration of best practices in a proof-of-concept prototype.*

*The candidate will first evaluate the fUML action language to promote it at the MOF-level and to compare it with Kermeta and Java/EMF. Relying on this work, he/she particularly investigate modularity issues in defining DSL semantics, borrowing ideas from Modular Structural Operational Semantics [4] and building on recent advances on Model Typing [5] and Aspect-Oriented Modeling [6].*

#### Bibliography:

- [1] Object Management Group, Inc. *Semantics of a Foundational Subset for Executable UML Models (fUML) 1.0*, Beta 1, November 2008. [available online]
- [2] Pierre-Alain Muller, Franck Fleurey, and Jean-Marc Jézéquel. *Weaving executability into object-oriented meta-languages*. In MODELS/UML'2005, Springer. [available online]
- [3] Dave Steinberg, Frank Budinsky, Marcelo Paternostro, and Ed Merks. *EMF: Eclipse Modeling Framework (2nd Edition)*. Addison-Wesley, 2008.
- [4] P.D. Mosses. *Modular structural operational semantics*. Journal of Logic and Algebraic Programming, 60, 2004. [available online]
- [5] Jim Steel and Jean-Marc Jézéquel. *On model typing*. Journal of Software and Systems Modeling (SoSyM) 6(4), December 2007. [available online]
- [6] Jean-Marc Jézéquel. *Model Driven Design and Aspect Weaving*. Journal of Software and Systems Modeling (SoSyM) 7(2), 2008. [available online]

#### Working Environment:

- Laboratories:
  - o [IRISA](#) & [INRIA](#), [EPI Triskell](#) (Campus de Beaulieu, Université de Rennes 1, France)
- Scientific Advisors:
  - o [Jean-Marc Jézéquel](#) and [Benoît Combemale](#) (IRISA, Triskell)