Software Component Technology Group

Master Thesis

Generic Universe Types in JML

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Introduction The Universe Type System [1] allows a programmer to control aliasing and dependencies in object-oriented programs by applying an ownership relation to structure the object store. The so-called Generic Universe Types [2] are an extension allowing generic types similar to Java 5 or C# 2.0. This gives even stronger static guarantees and preserves the *owner-as-modifier* discipline and the small annotation overhead.

Goal of this master's project is to integrate Generic Universe Types into the JML tools [3] developed at Iowa State University. The existing implementation of the Universe Type System has to be extended as presented in [2]. Along the way, the MultiJava compiler [4], which the JML tools build on, needs to be improved. Its implementation of generic types, as they are defined in Java 5, still has some known problems [5].

Currently, Generic Universe Types do not support wildcards and raw types. Thus, this master's project aims at extending Generic Universe Types to include wildcards and raw types.

The main parts of this project are:

1. Improving the way MultiJava handles generic types
2. Implementing Generic Universe Types in the JML tools by extending the Universe Type System implementation
3. Extending Generic Universe Types by adding support for wildcards and raw types

Possible extension of this project are:

1. Implementing wildcards/raw types for Generic Universe Types in the JML tools
2. Static inference, i.e. automatically deriving ownership modifiers [6]
3. Storing generic ownership information at runtime
4. Comparing generics in C# 2.0 and Generic Universe Types

References

[1] W. Dietl and P. Müller. Universes: Lightweight ownership for JML. *Journal of Object Technology (JOT)*, 4(8) : 5–32, October 2005.

[2] W. Dietl and S. Drossopoulou and P. Müller. Generic Universe Types. *Foundations and Developments of Object-Oriented Languages (FOOL/WOOD '07)*, January 2007.

[3] JML Tools project website. `http://www.jmlspecs.org`

[4] MultiJava project website. `http://www.multijava.org`

[5] O. Mallo. MultiJava, JML, and Generics. Semester Project, ETH Zurich, 2006. `http://sct.inf.ethz.ch/projects/student_docs/Ovidio_Mallo/`.

[6] Matthias Niklaus. Static Universe Type Interference using a SAT-Solver. Master Thesis, ETH Zurich, 2006. `http://sct.inf.ethz.ch/projects/student_docs/-Matthias_Niklaus/`.