Software Component Technology Group

Master Project

Universe Type System for Scala

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Introduction The Universe type system was developed to handle problems like leaking or violations of the representation encapsulation. It does this by applying aliasing control without completely losing the power of aliasing alltogether. The Universe type system has already been successfully applied as an extension of the Java programming language [1]. As a next step it is currently being integrated with other programming languages as well.

"Scala is a modern multi-paradigm programming language designed to express common programming patterns in a concise, elegant, and type-safe way. It smoothly integrates features of object-oriented and functional languages." [2]

Goal of this master's project is the evaluation and conception of applying the Universe type system to Scala. In other words combining them and making both ideas more powerful by mutually profitting from each others advantages.

The main parts of this project are:

1. establishing the ownership hierarchy for the object-oriented subset of Scala - analogously to the Universe type system for Java.
2. using Scalas path-dependent and abstract types to separate the owner-as-modifier property from the ownership hierarchy. This will make the aliasing control more fine grained and eliminates the need for pure functions.
3. look into Scalas extended support for generics and user-defined variance and evaluate its influence on the Universe type system.
4. inspect the problems caused and possibilities offered by the functional features of Scala, especially the passing of functions as method arguments.

Possible extensions of this project are:

1. analyze the type inference algorithm used to infer the types of local variables in Scala [3] and see if it can be extended to infer Universe types with less expenses than the algorithms currently used [4].
2. look into the case classes which are used for pattern matching in Scala. They may make it necessary to adjust parts of the Universe type system.

References

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

[2] The Scala homepage.
`http://scala.epfl.ch/`.

[3] Martin Odersky, Christoph Zenger, and Matthias Zenger. Colored local type inference. In *POPL '01: Proceedings of the 28th ACM SIGPLAN-SIGACT symposium on Principles of programming languages*, pages 41–53, New York, NY, USA, 2001. ACM Press.

[4] M. Niklaus. Static universe type inference using a SAT-solver. May 2006. Master Thesis.