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Making Truffle Self-Optimizations Thread-Safe

Master thesis for …
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The Truffle framework [1, 2] enables simple and efficient language implementation based on abstract-syntax-tree (AST) interpreters and has been used to implement a wide range of languages including JavaScript, R, Ruby, Python, Clojure, and Smalltalk. The key idea of the Truffle approach is that a program's AST self-optimizes itself during execution to reach optimal performance. Common self-optimizations are to use a specific operation such as an integer addition in the add node of the AST, instead of using a generic addition that works for all possible types of the language. Since these self-optimizations are done at runtime, sharing an AST between multiple thread requires much care to avoid race conditions between threads that try to apply different self-optimizations.

In this thesis, we want to explore what the best approach is for making complex self-optimizations on these ASTs thread-safe. Possible solutions include classic locking strategies as well as the use of immutable data structures such as *Persistent Trees*, which could avoid the complexity of locking as well as the resulting sequentialization.

The scope of this thesis is as follows:

- Adapt an existing Truffle language to use for instance Persistent Trees or different locking strategies
- Assess the practicality of the approaches and their tradeoffs in terms of complexity of the necessary synchronization strategy as well as their compatibility with the Truffle execution model.

The work's progress should be discussed with the supervisor at least every 2 weeks. Please note the guidelines of the Institute for System Software when preparing the written thesis.

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[1] http://ssw.uni-linz.ac.at/Research/Projects/JVM/Truffle.html

[2] Würthinger, T., Wöß, A., Stadler, L., Duboscq, G., Simon D. and Wimmer, C. "Self-Optimizing AST Interpreters." In Proc. of the 8th Dynamic Languages Symposium, 2012.

[3] http://blogs.msdn.com/b/ericlippert/archive/2012/06/08/persistence-facades-and-roslyn-s-red-green-trees.aspx