



The Performance Impact of Language Design And, Did We Reach Peak-Performance Yet?

Master thesis for ...

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The Truffle framework [1, 2] enables simple and efficient language implementations and is used successfully for a wide variety of languages such as JavaScript, Lua, R, Ruby, Python, Clojure, and Smalltalk. While for instance JRuby+Truffle easily outperforms the existing Ruby implementations, two important aspects remain unexplored so far.

Language designers and implementers have to consider performance as one of the practical issues for wider adoption. With the wide range of Truffle languages, we got the unique opportunity to investigate the influence of language design on peak performance. For language implementers, one of the main questions is whether they already reached the best possible performance. For language designers, the question on the other hand is what are the tradeoffs between expressivity and performance, and how can language features be designed to provide programmers with a high-level programming model without sacrificing performance.

In this thesis, we want to explore on the one hand how we can assess whether a language implementation already reached the best possible performance. On the other hand, we want to study how different language designs impact overall performance.

The scope of this thesis is as follows:

- Experiment with language design choices within a give language as well as between languages. This should be done based on microbenchmarks as well as a suite of existing/adapted macrobenchmarks.
- Devise a methodology designing and porting benchmarks between languages and for assessing whether a language reached peak performance based on a set of larger benchmarks.
- Contribute performance improvements, and fixes for performance issues to existing language implementations.

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.

Supervisor: Dr. Stefan Marr

[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.