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Master's Thesis

Implementation of a Graph Coloring Register Allocator for the Graal Compiler

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Graal [1] is an effort to create a new just-in-time compiler for Java that is itself written in Java. It is based on a port of the HotSpot client compiler from C++ to Java.

Currently, Graal uses a *Linear Scan Register Allocator (LSRA)*. Because LSRA only requires a single linear pass to allocate registers it is fast and therefore especially suited for just-in-time compilation. The downside of this approach is that the result is not optimal.

Register Allocation via Graph Coloring is considered to find a better solution but requires polynomial time. Thus, it is mainly used for static compilation. Nevertheless it is interesting to see how big the gap really is.

The goal of this thesis is to implement and test a Graph Coloring Register Allocator for Graal and to compare both, the compile-time overhead as well as the run-time improvement to our current Linear Scan Allocator.

The scope of this thesis is as follows:

- Implement a Chaitin-style [2] Graph Coloring Register Allocator with the improvements proposed by Briggs [3].
- Test the implementation on a variety of non-trivial Java programs.
- Compare the implementation to the currently used Linear Scan allocation (compile time, run time).

Optional goals are:

- Identify the situations where LSRA is outperformed by graph coloring.
- Apply the improvements proposed by George and Appel [4].

The progress of the project should be regularly discussed with the advisor. A time schedule and a milestone plan must be set up within the first 3 weeks. It should be continuously refined and monitored to make sure that the thesis will be completed in time. The final version of the thesis must be submitted not later than 15.10.2016.

[1] http://openjdk.java.net/projects/graal
[2] Gregory J. Chaitin et al. Register allocation via coloring. 1981.
[3] Preston Briggs et al. Improvements to graph coloring register allocation. 1994.
[4] Lal George and Andrew W. Appel. Iterated register coalescing. 1996.