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Master's Thesis

ECMAScript's Pipeline operator for Graal.js

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Graal.js [1] is a JavaScript (ECMAScript 2022+) interpreter, implemented in Java. It uses specialization to optimize its execution, e.g., specialization on actually used data types or other types of run-time feedback (profiling). Graal.js is based on GraalVM's Truffle AST framework.

The ECMAScript specification is extended by so-called proposals. The Pipeline Operator proposal [2] is currently in stage 2 (of 4) of the proposal process. Its goal is to simplify chaining of expressions and aims for better readable code. Implementing it in Graal.js will require changes in the parser, as well as in the runtime system. Areas requiring special consideration are e.g. support for asynchronicity (async/await) and the GraalVM's polyglot interoperability feature.

The goal of this thesis is to provide a complete implementation of the current draft specification. It should be complete so that it can be merged into the Graal.js source base eventually, as an experimental feature. This requires passing all relevant tests (existing and implemented as part of this work) and having good benchmark results.

The scope of this thesis is as follows:

- Implement the Pipeline operator proposal as drafted by the proposal specification.
- Provide unit tests for all relevant features for good test coverage.
- Explore the interoperability with other Truffle-based languages.
- Provide benchmarks for relevant use cases, comparing to a) the equivalent code without pipeline operator b) the experimental implementation of pipeline operators in other engines, if available.
- Contribute this implementation under the UPL open source license to the Graal.js [1] repository (requires signing the Oracle Contributor Agreement [3])

The work's progress should be discussed with the supervisors at least every 2 weeks. Please note the guidelines of the Institute for System Software when preparing the written thesis. The deadline for the written thesis is October 31st, 2023.

References:

- [1] <https://www.github.com/oracle/graaljs>
[2] <https://github.com/tc39/proposal-pipeline-operator>
[3] <https://oca.opensource.oracle.com/>

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