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VYSOKÉ UČENÍ TECHNICKÉ V BRNĚ

FACULTY OF INFORMATION TECHNOLOGY
FAKULTA INFORMAČNÍCH TECHNOLOGIÍ

DEPARTMENT OF INTELLIGENT SYSTEMS
ÚSTAV INTELIGENTNÍCH SYSTÉMŮ

JUST-IN-TIME COMPILATION OF THE DEPENDENTLY-TYPED LAMBDA CALCULUS

JUST-IN-TIME PŘEKLAD ZÁVISLE TYPOVANÉHO LAMBDA KALKULU

MASTER'S THESIS
DIPLOMOVÁ PRÁCE

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Master's Thesis Specification

Student: **Zárybnický Jakub, Bc.**
Programme: Information Technology
Field of study: Intelligent Systems
Title: **Just-in-Time Compilation of Dependently-Typed Lambda Calculus**
Category: Compiler Construction
Assignment:

1. Investigate dependent types, simply-typed and dependently-typed lambda calculus, and their evaluation models (push/enter, eval/apply).
2. Get familiar with the Graal virtual machine and the Truffle language implementation framework.
3. Create a parser and an interpreter for a selected language based on dependently-typed lambda calculus.
4. Propose a method of normalization-by-evaluation for dependent types and implement it for the selected language.
5. Create a just-in-time (JIT) compiler for the language using the Truffle API.
6. Compare the runtime characteristics of the interpreter and the JIT compiler, evaluate the results.

Recommended literature:

- https://www.graalvm.org/
- Löh, Andres, Conor McBride, and Wouter Swierstra. "A tutorial implementation of a dependently typed lambda calculus." Fundamenta Informaticae 21 (2001): 1001-1031.
- Marlow, Simon, and Simon Peyton Jones. "Making a fast curry: push/enter vs. eval/apply for higher-order languages." Journal of Functional Programming 16.4-5 (2006): 415-449.

Requirements for the semestral defence:

- Items 1 to 3.

Detailed formal requirements can be found at https://www.fit.vut.cz/study/theses/

Supervisor: **Lengál Ondřej, Ing., Ph.D.**
Head of Department: Hanáček Petr, doc. Dr. Ing.
Beginning of work: November 1, 2020
Submission deadline: May 19, 2021
Approval date: November 11, 2020

Abstract

Do tohoto odstavce bude zapsán výtah (abstrakt) práce v anglickém jazyce.

Abstrakt

Do tohoto odstavce bude zapsán výtah (abstrakt) práce v českém (slovenském) jazyce.

Keywords

klíčová slova v anglickém jazyce, oddělená čárkami.

Klíčová slova

klíčová slova v českém jazyce, oddělená čárkami.

Reference

ZÁRYBNICKÝ, Jakub. *Just-in-Time Compilation of the Dependently-typed Lambda Calculus*. Brno, 2021. Master's thesis. Brno University of Technology, Faculty of Information Technology. Supervisor Ing. Ondřej Lengál, Ph.D.

Rozšířený abstrakt

Do tohoto odstavce bude zapsán výtah (abstrakt) práce v českém (slovenském) jazyce.

Just-in-Time Compilation of the Dependently-typed Lambda Calculus

Declaration

I hereby declare that this Master's thesis was prepared as an original work by the author under the supervision of Mr. X

The supplementary information was provided by Mr. Y

I have listed all the literary sources, publications and other sources, which were used during the preparation of this thesis.

.....
Jakub Zárybnický
February 6, 2021

Acknowledgements

Here it is possible to express thanks to the supervisor and to the people which provided professional help (external submitter, consultant, etc.).

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