Vrije Universiteit Brussel

Proposal bachelor thesis

Title: Effect types and region based memory

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Includes preparation course: Yes

Context

Memory management is a very complex and time-consuming task. While most languages nowadays have a garbage collector, memory management is not entirely out of the picture. Especially in the context of distributed and concurrent languages, keeping track of the data in memory is still very much a manual process. In order to mitigate the problem of manual memory management, researchers have proposed the use of a type system. Typically, type systems are used to express simple predicates, for example “Is expression e an integer?”. However, there are advanced type systems which can express much more powerful predicates, for example type and effect systems or ownership types. Type systems are often inspired by logics in the mathematics field. A good example of this is separation logic. It provides a simple but powerful technique for reasoning about programs that use shared data structures. Simply stated, a type system is a collection of logic rules (like the rules in natural deduction) that are used to proof that a program is correctly typed.

Proposal bachelor thesis

The goal of this thesis is to develop an advanced type system for memory management. The student may decide in which programming language he/she wants to implement the type system, but students are encouraged to use functional programming languages like Haskell, which are particularly suited for implementing type systems.
The advanced type system would make it possible to statically know which parts of the program will be local and which parts will be remote.

To do this, the student will first implement a basic type system (for the simply typed lambda calculus), and extend this type system to support region-based memory, by for example adding features of the advanced type systems discussed above.

Preparatory course bachelor thesis

Before you can start with this bachelor thesis, you first need to understand how type systems work, and what the most important type systems for functional/procedural

languages are. A famous book for type systems called “Types and Programming Languages” (written by Benjamin Pierce). The student will need to read and understand more or less half of this book.

This proposal is suited for students who have an interest in the Lambda Calculus, Interpretatie 2 and Grondslagen 2.