Master's Project

# Implementing Uniqueness and Ownership Transfer in the Universe Type System

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**Introduction.** The _Universe type system_ allows a programmer to control aliasing and dependencies in object-oriented programs by applying an ownership relation to structure the object store.

An (externally) _unique_ variable or field is either `null` or contains the only reference to an object from outside its internal representation. Apart from helping reason about programs, unique references safely enable the transfer of ownership of object structures, which is an important idiom manifesting itself in various object-oriented design patterns, e.g., in the factory pattern.

One way to handle unique variables is to access them with a _destructive read_, which nullifies the variable after the value is obtained.

**The goal of this master's project** is the implementation of uniqueness and ownership transfer in the MultiJava/JML Compiler as extension to the Universe Type System. Since destructive reads change the semantics of the programming language and are unintuitive for programmers, it is desirable to replace them by developing a modular, static data flow analysis ensuring that no destructive reads are needed.

**The main parts** of the project are:

1. Development of a modular, static data flow analysis to get rid of the need for destructive reads.

2. Implementation of uniqueness and ownership transfer in the MultiJava/JML compiler, including

    (a) type checking,
    (b) runtime checking and
    (c) the data flow analysis.

Should the development of the data flow analysis turn out to be fruitless, destructive reading will be implemented instead.

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