

Maya: Multiple-Dispatch Syntax Extension in Java

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UUCS-01-015

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December 11, 2001

Abstract

We have designed and implemented Maya, a version of Java that allows programmers to extend and reinterpret its syntax. Maya generalizes macro systems by treating grammar productions as generic functions, and semantic actions on productions as multimethods on the corresponding generic functions. Programmers can write new generic functions (i.e., grammar productions) and new multimethods (i.e., semantic actions), through which they can extend the grammar of the language and change the semantics of its syntactic constructs, respectively. Maya's multimethods are compile-time metaprograms that transform abstract syntax: they execute at program compile-time, because they are semantic actions executed by the parser. Maya's multimethods can be dispatched on the syntactic structure of the input, as well as the static, source-level types of expressions in the input.

In this paper we describe what Maya can do and how it works. We describe how its novel parsing techniques work and how Maya can statically detect certain kinds of errors such as hygiene violations. Finally, to demonstrate Maya's expressiveness, we describe how Maya can be used to implement the MultiJava language, which was described by Clifton et al. at OOPSLA 2000.