# Software Development Tools for Polyglot Programming

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Polyglot programming is the practice of writing code in multiple programming languages, which gives software engineers a much broader choice in terms of software libraries and frameworks they can use for building applications.

In this project, we will explore the domain of polyglot programming with focus on the programming experience. In particular, we will design and build software development tools that support developers in writing polyglot applications. For this, we will use GraalVM and GraalSqueak. Students should be familiar with Smalltalk and at least one of the following programming languages: C, C++, Java, JavaScript, Python, R, Ruby (*in alphabetical order*).

The Polyglot Programming Experience

Foreign function interfaces (FFIs) and inter-process communication (IPC) demonstrate that there is a need for combining software written in different programming languages. However, these mechanisms usually use the operating system or a network connection as an additional abstraction layer and are therefore often poorly supported by software development tools. This, in turn, makes for a rather inconvenient programming experience.
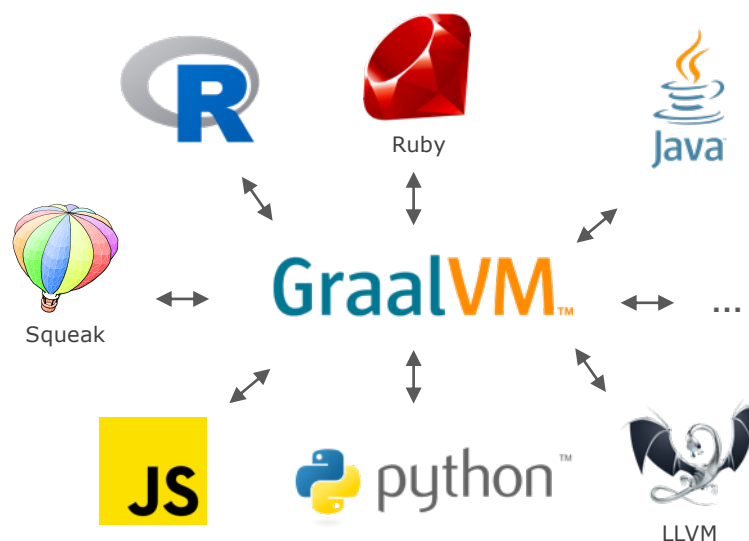
GraalVM is a polyglot virtual machine and enables fast and direct interaction between programming languages [4]. For this, all languages produce the same kind of abstract syntax tree (AST), which is then executed by the Graal just-in-time compiler. Hence,

combining languages can be achieved by mixing ASTs of different languages [3]. Nonetheless, this level of language integration is comparatively new and consequently, tooling support is limited. First steps towards tools for polyglot programming have led to promising results: Examples are GraalVM's support for the Chrome Debugging Protocol [5], the polyglot notebook system PolyJuS [2], and the upcoming Language Server Protocol (LSP) support.

The goal of this project is to gather the needs of polyglot programmers and, based on that, develop new tools that further improve the polyglot programming experience. As previous work has shown, GraalSqueak, a Squeak/Smalltalk implementation for the GraalVM, is a great prototyping platform for these kinds of tools and experiments.

Related Work

[1] Niephaus et al., *Live Multi-language Development and Runtime Environments*, ‹Programming›, 2018.

[2] Niephaus et al., *PolyJuS: A Squeak/Smalltalk-based Polyglot Notebook System for the GraalVM*, PX/19, 2019.

[3] Grimmer et al., *High-performance cross-language interoperability in a multi-language runtime*, DLS, 2015.

[4] Würthinger et al., *One VM to Rule Them All*, Onward!, 2013.

[5] GraalVM Documentation, 2019.

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