Title

GraalVM and Walnut: High-Performance Polyglot Virtual Machines for Databases, Cloud, and Embedded Environments

Abstract

GraalVM is a universal virtual machine, developed at Oracle Labs, that can run programs written in JavaScript, Python, Ruby, R, JVM-based languages such as Scala, Java and Kotlin, and LLVM-based languages such as C, C++ and Rust. One of GraalVM's main benefits is that it removes the isolation between programming languages and allows them to interoperate in a shared runtime. Another benefit is that it allows efficient ahead-of-time compilation, which improves the application startup time, and allows running the application without a pre-installed JDK. GraalVM can be used standalone, or embedded into other runtimes, such as Node.js and the Oracle Databse. In this presentation, we will start by showing for each of the components of the GraalVM stack some challenges we face, our ongoing projects, as well as our future directions and opportunities. We will then focus more on just-in-time compilation (JIT) and partial evaluation and show how GraalVM uses this concept to turn a language interpreter or a library into a self-optimizing compiler with speculative optimizations. We will discuss how databases in general can benefit from such a speculative just-in-time compiler and further demonstrate this in the context of the Oracle Database Multilingual Engine -- the embedding of GraalVM in the Oracle Database. Finally, we will conclude with an overview of further exciting projects in Oracle Labs.

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Bio Francois: François received his Master's degree in Communication Systems from EPFL in 2016. After an internship in California, he joined Oracle Labs as a researcher in Zürich, first working on database performance, then in the GraalVM team to explore data driven techniques for improving compiler performance.

Bio Lucas: Lucas Braun received his doctoral degree from the Computer Science Department (Systems Group) of ETH Zurich in the beginning of 2017 and joined Oracle Labs Zurich right afterwards. At Oracle Labs, Lucas is a program manager in the team that develops the Oracle Database Multilingual Engine (MLE). This engine allows to use modern languages and tools to write and deploy database code. During his doctoral research, Lucas studied the performance and confidentiality of cloud databases. Lucas also has a Computer Science teaching degree and has given various guest lectures at the universities of applied sciences of Northwestern Switzerland (FHNW) and Zurich (ZHAW).