

The Effect of Unrolling and Inlining for Python Bytecode Optimizations

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Abstract

Our study is based on paper The Effect of Unrolling and Inlining for Python Bytecode Optimizations of Yosi Ben Asher and Nadav Rotem. They consider bytecode optimizations for Python, a programming language that combines object-oriented concepts with features of scripting languages, such as dynamic dictionaries. Due to its design nature, Python is relatively slow compared to other languages. It operates through compiling the code into powerful bytecode instructions that are executed by an interpreter. Python's speed is limited due to its interpreter design, and thus there is a significant need to optimize the interpretation. In their paper, they discuss one possible approach and limitations in optimizing Python based on bytecode transformations. In the first stage of the proposed optimizer, the bytecode is expanded using function inlining and loop unrolling. The second stage of transformations simplifies the bytecode by applying a complete set of data-flow optimizations, including constant propagation, algebraic simplifications, dead code elimination, copy propagation, common sub expressions elimination, loop invariant code motion and strength reduction. While these optimizations are known and their implementation mechanism (data flow analysis) is well developed, they have not been successfully implemented in Python due to its dynamic features which prevent their use. In their work, they attempt to understand the dynamic features of Python and how these features affect and limit the implementation of these optimizations. In particular, they consider the significant effects of first unrolling and then inlining on the ability to apply the remaining optimizations. The results of their experiments indicate that these optimizations can indeed be implemented and dramatically improve execution times.

We will focus on understanding of unrolling and inlining as the preparation for our presentation of their work.

General Terms

Performace

Keywords

Python, Bytecode optimizations, Dynamic Languages

Bibliography

Yosi Ben Asher, Nadav Rotem. „The Effect of Unrolling and Inlining for Python Bytecode.“ *SYSTOR '09 Proceedings of SYSTOR 2009: The Israeli Experimental Systems Conference*. 2009. 14.