

Comparing Low-level Behavior of SPEC CPU and Java Workloads

Andy Georges, Lieven Eeckhout, and Koen De Bosschere

Department of Electronics and Information Systems (ELIS), Ghent University
St.-Pietersnieuwstraat 41, B-9000 Gent, Belgium
{ageorges, leeckhou, kdb}@elis.ugent.be
<http://www.elis.ugent.be/paris>

Abstract. Java workloads are becoming more prominent on a wide range of computing devices. In contrast to so-called traditional workloads written in C and Fortran, Java workloads are object-oriented and comprise a virtual machine. The latter includes a runtime environment with garbage collection, Just-In-Time (JIT) compilation, etc. As such, Java workloads potentially have different execution characteristics from traditional C or Fortran workloads. In this paper, we make a thorough comparison between SPEC CPU and Java workloads using statistical data analysis techniques and performance counters on an AMD Duron platform. In our experimental setup we use four virtual machines for the Java workloads running SPECjvm98, SPECjbb2000 and Java Grande. Our main conclusion is that Java workloads are significantly different from SPEC CPU and that the execution characteristics for which Java workloads differ from SPEC CPU, is subjective to the virtual machine; we can make a distinction between mixed-mode and compilation-only virtual machines.

1 Introduction

Performance evaluation of a microprocessor, during and after design time, is a time-consuming process, involving a large number of benchmarks. It is paramount that the benchmarks used for performance analysis are representative for the workloads that will actually be run on the hardware. One particular CPU-intensive benchmark suite offering 26 real-life applications is the Standard Performance Evaluation Corporation's (SPEC) CPU suite.

However, with the recent advent of Java applications on various computing devices, the point can be raised whether Java workloads should be taken into account next to SPEC CPU during performance analysis. To address this issue a number of questions need to be answered. How different are Java workloads from SPEC CPU workloads? If they are, can we pinpoint the main reasons for this? Do the differences depend on the VM we use in the experiments?

To answer these questions, we have done extensive measurements using the performance counters on an AMD K7 microprocessor, for a large number of benchmarks: SPEC CPU2000 and four Java virtual machines (VMs) running

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