July 11th, 2017

Performance Matters

Prof. Emery Berger
University of Massachusetts Amherst

Abstract

Performance clearly matters to users. The most common software update on the AppStore *by far* is "Bug fixes and performance enhancements." Now that Moore's Law Free Lunch has ended, programmers have to work hard to get high performance for their applications. But why is performance so hard to deliver? I will first explain why our current approaches to evaluating and optimizing performance don't work, especially on modern hardware and for modern applications. I will then present two systems that address these challenges. Stabilizer is a tool that enables statistically sound performance evaluation, making it possible to understand the impact of optimizations and conclude things like the fact that the -O2 and -O3 optimization levels are indistinguishable from noise (unfortunately true).

Since compiler optimizations have largely run out of steam, we need better profiling support, especially for modern concurrent, multi-threaded applications. Coz is a novel "causal profiler" that lets programmers optimize for throughput or latency, and which pinpoints and accurately predicts the impact of optimizations. Coz's approach unlocks numerous previously unknown optimization opportunities. Guided by Coz, we improved the performance of Memcached by 9%, SQLite by 25%, and accelerated six Parsec applications by as much as 68%; in most cases, these optimizations involved

modifying under 10 lines of code. This talk is based on work with Charlie Curtsinger published at ASPLOS 2013 (Stabilizer) and SOSP 2015 (Coz), which received a Best Paper Award and was selected as a CACM Research Highlight.

Short Bio

Emery Berger is a Professor in the College of Information and Computer Sciences at the University of Massachusetts Amherst, the flagship campus of the UMass system. He graduated with a Ph.D. in Computer Science from the University of Texas at Austin in 2002. Professor Berger has been a Visiting Scientist at Microsoft Research (7 times) and at the Universitat Politecnica de Catalunya (UPC) / Barcelona Supercomputing Center (BSC). Professor Berger's research spans programming languages, runtime systems, and operating systems, with a particular focus on systems that transparently improve reliability, security, and performance.

He is the creator of a number of influential software systems including Hoard, a fast and scalable memory manager that accelerates multithreaded applications (used by companies including British Telecom, Cisco, Crédit Suisse, Reuters, Royal Bank of Canada, SAP, and Tata, and on which the Mac OS X memory manager is based); DieHard, an error-avoiding memory manager that directly influenced the design of the Windows 7 Fault-Tolerant Heap; and DieHarder, a secure memory manager that was an inspiration for hardening changes made to the Windows 8 heap.

His honors include a Microsoft Research Fellowship, an NSF CAREER Award, a Lilly Teaching Fellowship, a Most Influential Paper Award at OOPSLA 2012, a Google Research Award, a Microsoft SEIF Award, a Best Artifact Award at PLDI, and Best Paper Awards at FAST, OOPSLA, and SOSP; he was named an ACM Senior Member in 2010. Professor Berger is currently a Member of the SIGPLAN Executive Committee and an Associate Editor of the ACM

Transactions on Programming Languages and Systems, and served as Program Chair for PLDI 2016.