EMILIO G. COTA

atocme@gmail.com
https://github.com/cota
http://www.cs.columbia.edu/~cota

education

Columbia University (New York, NY, USA)

Ph.D. in Computer Science — May 2019

"Scalable Emulation of Heterogeneous Systems." Advisor: Prof. Luca Carloni

M.S. in Computer Science — May 2012

University of Seville (Seville, Spain) — with 5th year at Imperial College (London, UK)

Industrial Engineer, "Ingeniero Industrial, Intensificación Electrónica" — June 2008

"Autonomous Navigation of a Simple Mobile-Robot." Advisors: Prof. A. Astolfi, Dr. P.D. Mitcheson

experience

Google LLC (New York, NY, USA), *Software Engineer* — 2019—

2021—: MLIR-based compilers for ML workloads running on CPU.
2019—2021: Distributed systems for structured search.

Columbia University (New York, NY, USA), *Graduate Research Assistant* — 2010—2019

Computer architecture research on hardware accelerators. Quantified the importance of private local memories for accelerator performance. Devised a technique to reuse these private memories to expand the last-level cache when the accelerators are otherwise inactive. Wrote an architectural simulator to evaluate these ideas.

Software systems research on fast, scalable cross-ISA machine emulation and instrumentation for multi-cores. Most of the resulting implementation is in *upstream* QEMU (300+ commits). Highlights: scalable dynamic binary translation and subsequent execution (after this work, cross-ISA scalability is similar to that with KVM) while using a shared code cache and correctly handling guest-host differences in atomic instructions (i.e., LL/SC on CAS hosts), scalable hash table (QHT), scalable lock profiler, fast guest instrumentation, fast and correct cross-ISA FP emulation (2×+ SPECfp06 average speedup) by selectively leveraging the host FPU, dynamic TLB resizing (1.8× SPECint06 speedup), indirect branch handling improvements (1.3× SPECint06 speedup).

CERN (Geneva, Switzerland), *Junior Fellow* — 2008–2010

Wrote Linux kernel drivers for custom and commercial devices, including the VME bus, whose driver was eventually merged into mainline Linux. Developed an event logging infrastructure and an automated testbed to validate the LHC's Central Timing system. Wrote kernel and user-space software for the original White Rabbit slave nodes.

skills

Systems programming: C, C++, multi-core scalability, performance optimization, Linux kernel hacking, MLIR, LLVM.

Development: git, Perl and Python scripting.

publications

Cross-ISA Machine Instrumentation using Fast and Scalable Dynamic Binary Translation
Emilio G. Cota, Luca P. Carloni.
Intl. Conf. on Virtual Execution Environments (VEE), 2019.

Cross-ISA Machine Emulation for Multicores
Emilio G. Cota, Paolo Bonzini, Alex Bennée, Luca P. Carloni.

Intl. Symp. on Code Generation and Optimization (CGO), 2017.

Handling Large Data Sets for High-performance Embedded Applications in Heterogeneous Systems-on-chip
Paolo Mantovani, Emilio G. Cota, Christian Pilato, Giuseppe Di Guglielmo, Luca P. Carloni.
Intl. Conf. on Compilers, Architectures and Synthesis for Embedded Systems (CASES), 2016.

An FPGA-Based Infrastructure for Fine-Grained DVFS Analysis in High-Performance Embedded Systems
Paolo Mantovani, Emilio G. Cota, Kevin Tien, Christian Pilato, Giuseppe Di Guglielmo, Ken Shepard, Luca P. Carloni.
Design Automation Conference (DAC), 2016.

Exploiting Private Local Memories to Reduce the Opportunity Cost of Accelerator Integration
Emilio G. Cota, Paolo Mantovani, Luca P. Carloni.
Intl. Conf. on Supercomputing (ICS), 2016.

An Analysis of Accelerator Coupling in Heterogeneous Architectures
Emilio G. Cota, Paolo Mantovani, Giuseppe Di Guglielmo, Luca P. Carloni.
Design Automation Conference (DAC), 2015.

Accelerator Memory Reuse in the Dark Silicon Era
Emilio G. Cota, Paolo Mantovani, Michele Petracca, Mario R. Casu, Luca P. Carloni.
Computer Architecture Letters, Jan. 2014.

teaching

Teaching Assistant, *Computer Architecture* — Fall 2011, Fall 2012, Summer 2018
Assisted with teaching, lab grading and final project design of Columbia's graduate computer architecture course (CSEE4824).

honors

Extraordinary Teaching Assistant Award from Columbia Engineering — Fall 2011