Lightning Introductions

Digital Computing Beyond Moore's Law

May 3-4, 2018

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Catalyst

Sarita Adve/University of Illinois at Urbana-Champaign

ILLINOIS

Rethinking the hardware-software interface

Heterogeneous memory systems

Approximation

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Srinivas Aluru/Georgia Tech

Georgia Tech Institute for Data Engineering and Science

- Expertise at the intersection of high performance computing and biology/medicine
- Application-specific and architecture-aware parallel algorithms research in bioinformatics/ computational biology

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Saman Amarasinghe/MIT

Massachusetts Institute of Technology

What do you hope to bring to the workshop?

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Daniel Armbrust/Silicon Catalyst

Si
SILICON
CATALYST

Expertise in semiconductor processing, design and materials

Experience in consortia and collaborations

Experience in hardware incubator

Beyond Moore's Law perspective

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Krste Asanovic/UC Berkeley/RISC-V/SiFive

Experiences in building open-source silicon community.
Development of productive environments for building and deploying specialized silicon with accessible NRE.

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Rastislav Bodik/University of Washington

UNIVERSITY of WASHINGTON

Automatic synthesis of programs

Applications in mapping SW to accelerators.

Beyond synthesis of *programs*: generate specs, consistency models, new instructions, compilers, interfaces.

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Aydin Buluc/Lawrence Berkeley National Lab

BERKELEY LAB

Scalable parallel algorithms for scientific data analysis problems:

- **Machine learning**
- **Graphs as matrices (http://graphblas.org)**
- **Computational biology**

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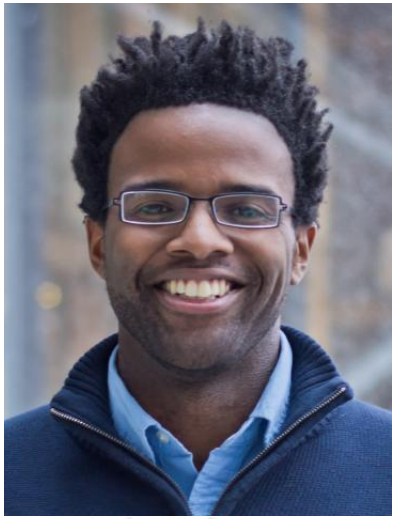
Michael Carbin/MIT



Massachusetts Institute of Technology

Experience developing programming models for new software/hardware domains.

Perspective that advances in programming languages create new opportunities for programmability, performance, correctness, and reliability.

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Jason Cong/UCLA

Center for Domain Specific Computing

Customizable Domain-Specific Computing --
Architecture, compilation, & runtime support

FPGA-based acceleration in the cloud

High-level synthesis (Vivado-HLS)

Acceleration of computational genomics

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Tom Conte/Georgia Tech

Georgia Tech

Perspectives from the
IEEE Rebooting Computing Initiative
and
The International Roadmap for Devices and Systems 2017 edition

and bad jokes

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Christopher De Sa/Cornell University

A machine learning perspective.

Interest in ML accelerators as a major class of new beyond-Moore's-law architectures.

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Khari Douglas/CCC

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How can we continue to build on the outcomes of the workshop?

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Ann Drobnis/CCC

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An understanding of how we can bring this community together to ensure continued growth

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Mattan Erez/UT Austin

TEXAS
The University of Texas at Austin

Expertise in memory systems, resilience, and the interactions of architecture with runtimes and programming models

An eagerness to learn and interact

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Mary Hall/University of Utah

THE UNIVERSITY OF UTAH

Expertise in: compiler and programming system technology for high-performance computing

Interest in: new programming system technology requirements for novel high-performance architectures

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Peter Harsha/Computing Research Association

Hoping to learn what a research agenda in this area looks like and how we can best convey that to policymakers.

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Computing Research Association

CRA
Government Affairs
For America!

(Unofficial logo)

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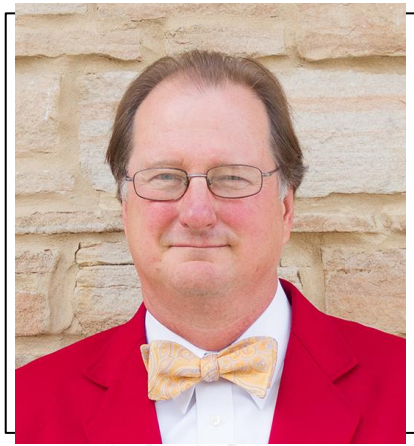
Mark D. Hill/University of Wisconsin-Madison



UW-Madison & CCC Vice Chair
& Google Hardware Sabbatical

With apologies to “Field of Dreams” [1989]:

If we build them, will they come?

we==hardware designers
them==accelerators
they==application developers

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Ji Lee/NITRD NCO

What do you hope to bring to the workshop?

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Sasa Misailovic/University of Illinois

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Interest in improving performance, energy efficiency, and resilience in the face of software errors and approximation opportunities.

Experience in probabilistic program analysis and compiler optimization under uncertainty.

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Kunle Olukotun/Stanford University/SambaNova

Stanford

Domain Specific Languages
High-level Compilers
Domain Specific Accelerators
Machine Learning

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Jonathan Ragan-Kelley/UC Berkeley

Berkeley
UNIVERSITY OF CALIFORNIA

Graphics, Vision, Computational Imaging

Domain-specific languages
Halide (dense, *differentiable*)
Simit (sparse)
Opt / ProxImaL (optimization)

Domain-specific architectures

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Chris Ré/Stanford University

Stanford

Experience with Machine Learning and Data Applications
(Software 2.0)

New ML Algorithms with interesting systems aspects (Low-precision, compression, coordination-free)

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Adrian Sampson/Cornell

A perspective: programming languages and compilers can take responsibility for concepts that traditionally live in the hardware domain.

An application: real-time, embedded vision.

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Daniel Sanchez/MIT

Massachusetts Institute of Technology

Experience in hardware-software codesign for data-intensive and hard-to-parallelize algorithms.

Interest in graph analytics and other irregular applications.

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Vivek Sarkar/Georgia Tech

Georgia Tech

What do you hope to bring to the workshop?

A vertical approach to programming systems that spans programming models, compilers, and runtimes, for a wide variety of hardware platforms.

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Gunasekaran Seetharam/ONR and NRL

U.S. NAVAL RESEARCH LABORATORY

What do you hope to bring to the workshop? Low latency, real-time and forensic application based technical insights from DoD C4ISR perspective. Where to compute, what compute with, and what to provision & where?

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John Shalf/Lawrence Berkeley National Lab

Discussion of how we can link discoveries in fundamentally new materials and devices up to computer architecture and computer science.

Cross-link to DOE's Exascale (former deputy director for Hardware) and to emerging Cross-agency (DOE/DOD) efforts in Beyond Moore technologies.

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Armando Solar-Lezama/MIT

MIT CSAIL | Massachusetts Institute of Technology

Experience in programming systems
Program synthesis
Applications of ML to programming problems

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Edgar Solomonik/University of Illinois

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Perspectives on key challenges in parallelism and communication cost for numerical algorithms and applications, in particular, tensor methods, software, and computational quantum chemistry on parallel architectures.

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Josep Torrellas/University of Illinois

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Basic hardware architecture primitives to use in specialized platforms

One example is in graph applications

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Jeffrey Vetter/Oak Ridge National Laboratory

OAK RIDGE National Laboratory

Experiences and perspectives on integrating emerging technologies (GPUs, NVM, FPGAs, Quantum) into HPC architectures, and preparing the software ecosystem and application community.

PMES16: http://j.mp/pmes2016
PMES17: http://j.mp/pmes2017
DOE Workshop on Extreme Heterogeneity: http://bit.ly/doe-eh2018

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Kathy Yelick/UC Berkeley

Berkeley
UNIVERSITY OF CALIFORNIA

BERKELEY LAB
Lawrence Berkeley
National Laboratory

Understanding of scientific applications and high performance computing, as well as code generation and performance optimization

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Cliff Young/Google Brain

Google

Perspective from building TPUs for machine learning and Anton supercomputers for molecular dynamics.

A focus on application requirements and non-requirements.

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