Tutorial Conclusion

Sagar Karandikar

UC Berkeley

sagark@eecs.berkeley.edu

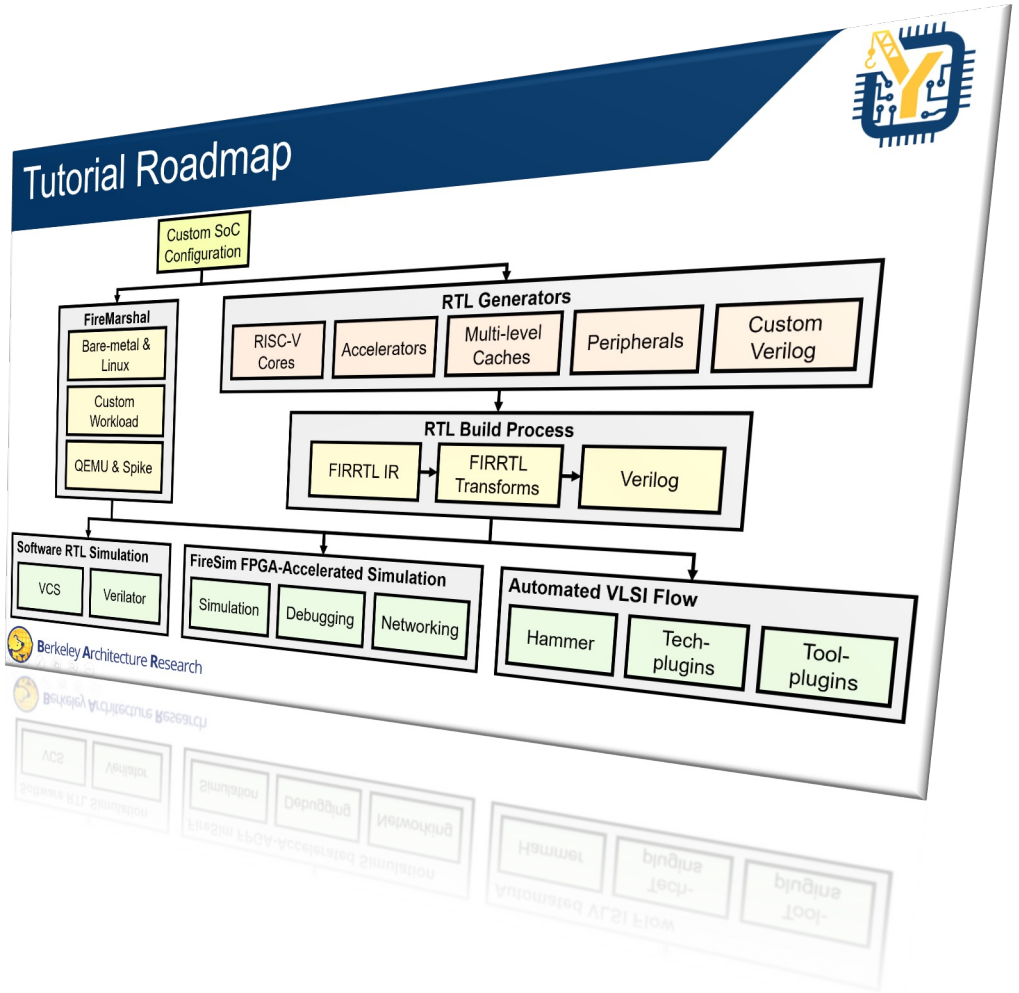
Berkeley Architecture Research

FireSim

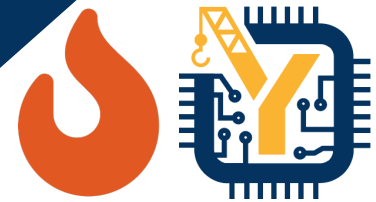
CHIPYARD

Recap

- Chipyard Basics
  - Composing SoC using generators
    - **New!**: Constellation NoC generator
  - Adding custom accelerators
  - Simulation
  - VLSI flow:
    - **New!**: fully open-source RTL to GDS flow
- FireSim
  - Full-system FPGA-accelerated simulation
  - Linux-based software workloads
  - Debugging and instrumentation
  - Network simulation
  - **New!**: distributed metasim support!
  - **New!**: local (on-premises) FPGA support!
    - Xilinx VCU118
    - Xilinx Alveo U250/U280
    - RHS Research Nitefury II



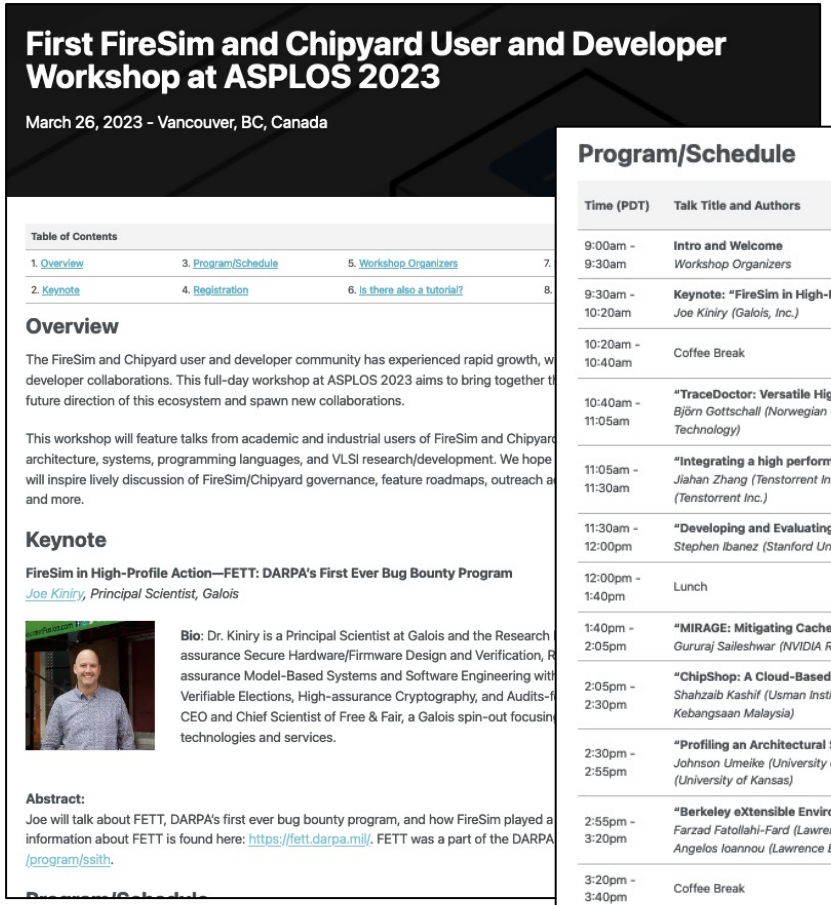
Join The Community!



- Used in industry and academia
- Development is all open-source and on GitHub
  - “main” branch is active development, may be unstable
  - We recommend using tagged releases (e.g. Chipyard 1.10.0 / FireSim 1.17.0 will release this evening or tomorrow)
- Sub-projects managed using submodules
- Hundreds of pages of documentation!
  - If something isn’t clear, please let us know
- We appreciate feedback! We appreciate PRs even more!
- Thank you for attending!

Learn more about use-cases, directly from the users!

- Videos from the First FireSim/Chipyard Workshop, co-located with ASPLOS 2023, are now available on YouTube!
  - 10 great talks from users across academia and industry
- Links available at: https://fires.im/workshop-2023/



First FireSim and Chipyard User and Developer Workshop at ASPLOS 2023

March 26, 2023 - Vancouver, BC, Canada

Table of Contents

1. Overview
2. Keynote
3. Program/Schedule
4. Registration
5. Workshop Organizers
6. Is there also a tutorial?
7.
8.

Overview

The FireSim and Chipyard user and developer community has experienced rapid growth, w
developer collaborations. This full-day workshop at ASPLOS 2023 aims to bring together t
future direction of this ecosystem and spawn new collaborations.

This workshop will feature talks from academic and industrial users of FireSim and Chipyar
architecture, systems, programming languages, and VLSI research/development. We hope
will inspire lively discussion of FireSim/Chipyard governance, feature roadmaps, outreach a
and more.

Keynote

FireSim in High-Profile Action—FETT: DARPA's First Ever Bug Bounty Program

Joe Kiniry, Principal Scientist, Galois

Bio: Dr. Kiniry is a Principal Scientist at Galois and the Research
assurance Secure Hardware/Firmware Design and Verification, R
assurance Model-Based Systems and Software Engineering with
Verifiable Elections, High-assurance Cryptography, and Audits-f
CEO and Chief Scientist of Free & Fair, a Galois spin-out focusin
technologies and services.

Abstract:
Joe will talk about FETT, DARPA's first ever bug bounty program, and how FireSim played a
information about FETT is found here: https://fett.darpa.mil/. FETT was a part of the DARPA
/program/ssith.

Program/Schedule

Time (PDT)	Talk Title and Authors	Slides (coming soon)
9:00am - 9:30am	**Intro and Welcome** *Workshop Organizers*	PDF
9:30am - 10:20am	**Keynote: "FireSim in High-Profile Action—FETT: DARPA's First Ever Bug Bounty Program"** *Joe Kiniry (Galois, Inc.)*	PDF
10:20am - 10:40am	Coffee Break	
10:40am - 11:05am	**"TraceDoctor: Versatile High-Performance Tracing for FireSim"** *Björn Gottschall (Norwegian Univeristy of Science and Technology), Magnus Jahre (Norwegian Univeristy of Science and Technology)*	PDF
11:05am - 11:30am	**"Integrating a high performance instruction set simulator with FireSim to cosimulate operating system boots"** *Jiahan Zhang (Tenstorrent Inc.), Varun Koyyalagunta (Tenstorrent Inc.), Joe Rahmeh (Tenstorrent Inc.), Divyang Agrawal (Tenstorrent Inc.)*	PDF
11:30am - 12:00pm	**"Developing and Evaluating the nanoPU and nanoSort using Chipyard and Firesim"** *Stephen Ibanez (Stanford University & Intel), Theo Jepsen (Stanford University & Intel)*	PDF
12:00pm - 1:40pm	Lunch	
1:40pm - 2:05pm	**"MIRAGE: Mitigating Cache Attacks with a Randomized Fully-Associative Cache"** *Gururaj Saileshwar (NVIDIA Research & University of Toronto), Moinuddin Qureshi (Georgia Tech)*	PDF
2:05pm - 2:30pm	**"ChipShop: A Cloud-Based GUI for Accelerating SoC Design"** *Shahzaib Kashif (Usman Institute of Technology), Talha Ahmed (Usman Institute of Technology), Farhan Ahmed Karim (Universiti Kebangsaan Malaysia)*	PDF
2:30pm - 2:55pm	**"Profiling an Architectural Simulator"** *Johnson Umeike (University of Kansas), Alex Manley (University of Kansas), Neel Patel (University of Kansas), Mohammad Alian (University of Kansas)*	PDF
2:55pm - 3:20pm	**"Berkeley eXtensible Environment: A Cloud-Based Open-Source Computer Architecture Simulation Environment"** *Farzad Fatollahi-Fard (Lawrence Berkeley National Laboratory), Nirmalendu Patra (Lawrence Berkeley National Laboratory), Angelos Ioannou (Lawrence Berkeley National Laboratory), John Shalf (Lawrence Berkeley National Laboratory)*	PDF
3:20pm - 3:40pm	Coffee Break	
3:40pm - 4:05pm	**"FireSim on Xilinx U250 and Other Custom Host Platforms"** *David Christoph Metz (Norwegian University of Science and Technology), Magnus Själander (Norwegian University of Science and Technology)*	PDF
4:05pm - 4:30pm	**"Ocelot Vector Unit and Integrating SV-based Modules in BOOM"** *Dongjie (DJ) Xie (Tenstorrent Inc.), Srikanth Arekapudi (Tenstorrent Inc.)*	PDF
4:30pm - 5:00pm	**Wrap-up and Discussion** *Workshop Organizers/Attendees*	PDF

ISCA-50 FireSim Retrospective

- Stay tuned for the release of the ISCA-50 retrospectives, including FireSim!

RETROSPECTIVE: FireSim: FPGA-Accelerated Cycle-Exact Scale-Out System Simulation in the Public Cloud

Sagar Karandikar[1], Howard Mao[2,*], Donggyu Kim[3,*], David Biancolin[4,*], Alon Amid[5,*], Dayeol Lee[6,*], Nathan Pemberton[7,*], Emmanuel Amaro[8,*], Colin Schmidt[4,*], Aditya Chopra[2,*], Qijing Huang[5,*], Kyle Kovacs[9,*], Borivoje Nikolić[1], Randy Katz[1], Jonathan Bachrach[10,*], Krste Asanović[1]

[1]UC Berkeley, [2]Google, [3]Apple, [4]SiFive, [5]NVIDIA, [6]Anyscale, [7]Amazon Web Services, [8]VMWare Research, [9]DiCon Fiberoptics, [10]JITX

I. Introduction

"Why is it called *FireSim*?" is a question we receive often, posed by users who today employ FireSim to simulate a variety of systems beyond its initial goal: as a "from-the-RTL-up" simulator for a specialized Warehouse-Scale Computer (WSC) architecture called *FireBox* [O8][1]. When we set out to build FireSim, the published mandate [O8] was to:

> *"...simulate an entire FireBox, including the fiber-optic network, the switch, the NIC, and 1000 SoCs, with every core running the full BDAS stack (from the AMP Lab) and the Linux OS, as well as interactive services and batch applications, with only a factor of 1000x slowdown from realtime."*

The FireSim ISCA'18 paper [13] exceeded these objectives, with one caveat: our demo applications were not JVM-based as no usable RISC-V JVM existed in 2017. While the achieved scale was exciting, the true promise and broader adoption of

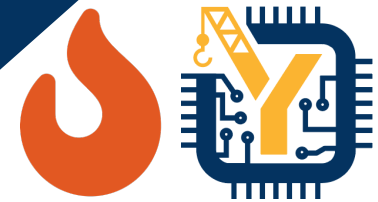
FPGAs in the public cloud became broadly available [5]. Cloud computing, established for years in systems research [O23], could now benefit architects. Academics/startups could elastically scale high-fidelity simulations to 1000s of nodes without buying millions of dollars of FPGAs. In large organizations, architects/systems SW developers, who rarely get access to costly "big metal" HW-accelerated simulators, could now co-design HW/SW directly using real RTL.

FPGA capacity grew sufficiently to host interesting research targets without *immediately* requiring "tricks" (multi-threading, abstract modeling, partitioning, etc.) from the FPGA simulator literature. Many were later added to FireSim, but critically, were not initially *required* to ship a useful simulator.

Open-source, industry-verified hardware implementations became available. These were sufficiently capable to serve as a base for architecture research and included micro-processors, caches, on-chip networks, and peripherals [1]–[3].

Berkeley Architecture Research

Learn More



- Chipyard
  - Github: https://github.com/ucb-bar/chipyard/
  - Docs: https://chipyard.readthedocs.io/en/latest/index.html
  - Mailing List: https://groups.google.com/forum/#!forum/chipyard

- FireSim
  - Website: https://fires.im/
  - Github: https://github.com/firesim/firesim/
  - Docs: https://docs.fires.im/en/latest/
  - Mailing List: https://groups.google.com/forum/#!forum/firesim

Tutorial Feedback:
https://fires.im/tutorial-feedback/