OSCAR: The First Workshop on Open-Source Computer Architecture Research

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OSCAR 2022

- OSCAR 2022 is the first edition of a workshop aimed at fostering the community of researchers who are interested in developing and sharing open-source hardware and software for the design of next-generation computer architectures

- Organizers:
  - Sarita Adve (University of Illinois)
  - Luca Benini (ETH Zurich and University of Bologna)
  - Pradip Bose (IBM)
  - Luca Carloni (Columbia University)

Why OSCAR?

- ## The Premise
  - We are in the age of heterogeneous computing. This heterogeneity brings new challenges to hardware designers as well as software programmers
  - Addressing many of these challenges requires collaborative and open-source research

- ## The Rationale
  - Many innovations are best evaluated in the context of complete system-level implementations, which go beyond traditional simulation methods
  - Most individual research groups do not have the resources to realize such implementations

Why OSCAR?

- The Goal
  - Bring together a community of researchers from academia, industry and government labs who are interested in open-source computer architectures
  - The recent past has seen significant progress in this direction, including contributing open-source hardware components, software tools, as well as integration platforms to simplify the realization of system prototypes with FPGA or ASIC technologies. The number of developers and users of these open-source artifacts has increased substantially
  - It is time to provide a venue that promotes the growth of this community and fosters its efforts!

Today's Program - 1

8:30-8:50: Opening Remarks

8:50-9:50: Invited Talk

- **Shashank Nemawarkar**

  Open-Source Silicon Development as an Enabler for Novel Computer Architecture Research (abstract)

9:50-10:50: Session I - Architectural Components

1. **Blaise Tine**, Ruobing Han and Hyesoon Kim.

   The Tip of Iceberg in Open-Source Hardware GPU
2. **Samuel Riedel**, Matheus Cavalcante, Sergio Mazzola and Luca Benini.

   Efficient Systolic Execution on a Shared-Memory Manycore System
3. Xuan Guo, **Daniel Bates**, Robert Mullins and Alex Bradbury.

   Muntjac – Open Source Multicore RV64 Linux-capable SoC

10:50-11:00: Break

Today's Program - 2

11:00-12:00: Session II – Verification

1. **Marcelo Orenes-Vera**, Aninda Manocha, David Wentzlaff and Margaret Martonosi.
   AutoSVA: Democratizing Formal Verification of RTL Module Interactions
2. **Andres Meza**, Jason Oberg and Ryan Kastner.
   Performing Security Verification on an Open-Source Hardware Root-of-Trust
3. **Yao Hsiao**, Dominic Mulligan, Nikos Nikoleris, Gustavo Petri and Caroline Trippel.
   Scalable Assurance via Verifiable Hardware-Software Contracts

12:00-13:30: Lunch

Today's Program - 3

13:30-14:30: <u>Session III – Compilation & Design-Space Exploration</u>

1. **Hasan Genc**, Seah Kim, Vadim Vadimovich Nikiforov, Simon Zirui Guo, Borivoje Nikolić, Krste Asanović and Yakun Sophia Shao.
   Gemmini: An Open-Source, Full-System DNN Accelerator Design and Evaluation Platform

2. Nicolas Bohm Agostini, Serena Curzel, Michele Fiorito, Reece Neff, **Ankur Limaye**, Vinay Amatya, Marco Minutoli, Vito Giovanni Castellana, Joseph Manzano, Fabrizio Ferrandi and Antonino Tumeo.
   SODA Synthesizer: an End-to-End Compiler from High-Level Frameworks to Silicon

3. **Subhankar Pal**, Aporva Amarnath, Behzad Boroujerdian, John-David Wellman and Pradip Bose.
   Early-Stage System-on-Chip Design Space Exploration for Autonomous Vehicles

Today's Program - 4

14:30-15:30: <u>Poster Session</u>

1. Johanna Baehr, **Maja Malenko** , Alexander Hepp, Michaela Brunner and Georg Sigl.
   Open Source Hardware and Reverse Engineering
2. **Joseph Faye** , Maxime Pelcat, Jean-François Nezan, Kevin Martin and Bhattacharyya Shuvra.
   Dataflow Programming for Near-Sensor Signal Processing and Machine Learning Specific Architectures
3. **Vighnesh Iyer**, Kevin Laeufer, Koushik Sen and Borivoje Nikolić.
   A High Performance Multi-Threaded RTL Testbench API
4. **Vaishnavi Lakkalkatti** and Neel Gala.
   Formally Verified Building Blocks for A RISC-V Processor
5. **Yingjie Li**, Ruiyang Chen, Minhan Lou, Berardi Sensale-Rodriguez, Weilu Gao and Cunxi Yu.
   An Open-source Compiler Framework for Diffractive Optical ML Architectures
6. **Mihailo Rancic** and Akshitha Sriraman.
   Designing Open-Source Hardware for Hyperscale Microservices
7. Sneha Sivaraman and Neel Gala. (presented by **Vaishnavi Lakkalkatti**)
   RISC-V CSRBOX

Today's Program - 5

15:30-16:30: <u>Session IV – Platforms</u>

1. **Sagar Karandikar, Nayiri Krzysztofowicz,** David Biancolin, James Dunn, John Fang, Abraham Gonzalez, Daniel Grubb, Harrison Liew, Albert Ou, Nathan Pemberton, Tim Snyder, Jerry Zhao, Yakun Sophia Shao, Borivoje Nikolic and Krste Asanovic.
   Chipyard, FireSim, and Hammer: A Push-Button End-to-End Stack for Open-Source Computer Architecture Research

2. Arpan Prasad, Gianna Paulin, **Yvan Tortorella**, Luca Bertaccini, Luca Benini and Francesco Conti.
   Open-Source Heterogeneous Computing with Cluster-Coupled Accelerators: A Neural Engine Case Study

3. **Joseph Zuckerman**, Davide Giri, Paolo Mantovani, Maico Cassel Dos Santos, Kuan-Lin Chiu, Giuseppe Di Guglielmo, Guy Eichler, Jihye Kwon, Luca Piccolboni, Biruk Seyoum, Gabriele Tombesi and Luca P. Carloni.
   System-Level Computer Architecture Research with Open ESP

16:30-17:00: <u>All-Hands Discussion and Concluding Remarks</u>

Davide Giri (1990-2021)