What is the Future of Open Source?

Panelists:
Bill Leszinske, Cambium Capital
Peter Gadfort, Army Research Labs
Noel Menezes, Intel
Chuck Alpert, Cadence Design Systems, Inc.
Mamta Bansal, Qualcomm

Moderator:
Andreas Olofsson, Zero ASIC

Organizer:
Andrew Kahng, UC San Diego
What is Open Source?

Copyright (c) <year> <copyright holders>

Permission is hereby granted, free of charge, to any person obtaining a copy of this software and associated documentation files (the "Software"), to deal in the Software without restriction, including without limitation the rights to use, copy, modify, merge, publish, distribute, sublicense, and/or sell copies of the Software, and to permit persons to whom the Software is furnished to do so, subject to the following conditions:

The above copyright notice and this permission notice shall be included in all copies or substantial portions of the Software.

THE SOFTWARE IS PROVIDED "AS IS", WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT. IN NO EVENT SHALL THE AUTHORS OR COPYRIGHT HOLDERS BE LIABLE FOR ANY CLAIM, DAMAGES OR OTHER LIABILITY, WHETHER IN AN ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF OR IN CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN THE SOFTWARE.

TLDR Summary:

- **Rights:**
  - Use, copy, modify, merge, publish, distribute, sublicense, sell, pass on rights.

- **Conditions:**
  - Include License in copies

- **Disclaimers:**
  - AS IS
  - No warranty whatsoever
How IDEA and POSH Started

B. Page 3 Design Description

The Page 3 Design thrust includes two programs that will operate independent of each other:

- **Intelligent Design of Electronic Assets (IDEA):** “No human in the loop” 24-hour layout generation for mixed signal integrated circuits, systems-in-package, and printed circuit boards.
- **Posh Open Source Hardware (POSH):** An open source System on Chip (SoC) design and verification eco-system that enables cost effective design of ultra-complex SoCs.

In addition to novel research, the program will emphasize delivery of working high quality software. Software modules created in the program are expected to be interoperable with modules developed by other program performers, and intellectual property rights asserted by proposers are strongly encouraged to be aligned with non-viral open source licenses such as the Apache 2.0, Massachusetts Institute of Technology (MIT), and Berkeley Software Distribution licenses. If a proposed approach includes proprietary software or technical data as a component of the approach, the proposer is expected to provide 1) clear justification for the need for the proposed software, and 2) a description of how the IDEA program goals will be met with use of the proprietary model.

IDEA and POSH Status (2022)

OpenROAD: https://github.com/The-OpenROAD-Project/OpenROAD
OpenSTA: https://github.com/The-OpenROAD-Project/OpenSTA
Align: https://github.com/ALIGN-analoglayout/ALIGN-public
Magical: https://github.com/magical-eda/MAGICAL
ACT: https://github.com/asyncvlsi/act
Xyce: https://github.com/Xyce/Xyce
SystemC-TLM-lib: https://github.com/Xilinx/libsystemctlm-soc
Pono: https://github.com/upscale-project/pono
LSOracle: https://github.com/lnis-uofu/LSOracle
OpenFPGA: https://github.com/lnis-uofu/OpenFPGA
PRGA: https://github.com/PrincetonUniversity/prga
BlackParrot: https://github.com/black-parrot/black-parrot
OpenFASOC: https://github.com/idea-fasoc/OpenFASOC

Were IDEA/POSH successful?
Dunno, you be the judge!

Summary of state of EDA/IP…
https://github.com/aolofsson/awesome-hardware-tools
https://github.com/aolofsson/awesome-opensource-hardware
Reminder: Software is a Lifetime of Maintenance…. 
My “Former View” of EDA Research
From the 2019 Panel

THE ISPD98 CIRCUIT BENCHMARK SUITE

Charles J. Alpert
IBM Austin Research Laboratory, Austin TX 78758
alpert@austin.ibm.com

Abstract

From 1985-1993, the MCNC regularly introduced and maintained circuit benchmarks for use by the Design Automation community. However, during the last five years, no new circuits have been introduced that can be used for developing fundamental physical design applications, such as partitioning and placement. The largest circuit in the existing set of benchmark suites has over 100,000 modules, but the second largest has just over 25,000 modules, which is small by today's standards. This paper introduces the ISPD98 benchmark suit which consists of 18 circuits with sizes ranging from 13,000 to 210,000 modules. Experimental results for three existing partitioners are presented so that future researchers in partitioning can more easily evaluate their heuristics.

ISPD 2007 Global Routing Contest

ISPD 2009 Clock Network Synthesis Contest
1.) What role does open source software play in EDA today?
   • It encourages academia to work on somewhat real EDA problems

2.) What is your vision for open source EDA in 5-10 years?
   • Academia research focuses on actual EDA problems

3.) What are the biggest gaps to realizing that vision?
   • Academic culture
   • 10,000 tape-outs rule
Academic Culture

Journals/conferences want to publish next big thing not today’s thing

First author matters

Few tenure-track academic jobs in EDA
The 10,000-hours rule says that if you look at any kind of cognitively complex field, from playing chess to being a neurosurgeon, we see this incredibly consistent pattern that you cannot be good at that unless you practice for 10,000 hours, which is roughly ten years, if you think about four hours a day.

— Malcolm Gladwell —
10,000 tape-outs rule

The 10,000 tape-outs rule says that an EDA tool cannot be a fully robust and complete product until it has participated in 10,000 tape-outs.
Biggest value of Open Source: Talent Creation
Dr. Peter Gadfort
Team Lead for Silicon Technologies
DEVCOM Army Research Laboratory

Open-Source Roles:
Evaluator, user and contributor
About my team

• **Focus areas:**
  - Energy efficient electronics
  - Reconfigurable computing
  - Trusted microelectronics

• **Some issues we face as a small Government team:**
  - Lengthy and complex license negotiations.
  - Time limited licenses (limited budget) and lengthy and unpredictable contracting actions makes lining up tapeouts and tools a challenge.
How are we using Open-Source?

- Using Open-Source to allow us to focus on research:
  - Leveraging existing solutions from the DARPA IDEA/POSH programs to explore new architectures
  - Researching methods for trusted microelectronics with integration, not possible with commercial tools
  - Currently working on taping out on Intel16 using:
    - OpenROAD and SiliconCompiler

GF55:
- 800k instances, ~8.5 hours run time

GF12:
- ~30k instances, ~30 minutes run time
Where would we like Open-Source to be in 5-10 years?

- Grow the user base of Open-source EDA tools
  - Used as teaching and research tools at universities
  - Silicon validation where possible

- Expand Army and DoD involvement
  - Participate in increasing the quality of the tools

- Co-existing with commercial solutions
  - Lots of flows rely on a mixture of tools
What are the biggest gaps to realizing that vision?

- Developing a sufficiently large user and contributor base to be self-sustaining
- Sustainable business models
- Full integration with foundry support
EDA at a glance

300++ tools required in entire chip SW/HW design process

35%+ revenue spend on R&D

++++ Mergers and Acquisitions

20,000ish hardcore developers in Big4

20,000-- students Niche skillset CS, Math, EE, Microelectronics

100s of smaller start-up efforts, mixed success
Open Source Potential: Rebuild EDA Community

Talent, more developers, projects, algorithms, learnings

Collaboration academia, companies, vendors, users, contributions

Efficiency, standardize simpler elements, a common platform

Lower the barrier to Contribute, Customize, Differentiate..
Sample business models serving small to large organizations

Open-source success in software tools space
GitLab/GitHub (Git), MongoDB, RedHat/IBM (Linux), Kafka (Confluent), Android (Google) …

- Licensed
- Supported
- Customized
## Managed Open Source Possibility

### Open platform flexibility

1. **Common**
   - Data model, API, Parsers
   - Standardize common elements

2. **Contiguous**
   - Common code repo
   - Coherent development

3. **Process**
   - Release/Bugs tracking
   - Test planning

### Licensed & supported operations

1. **License**
   - Tier models
   - Or like Si2-Openaccess? ..

2. **Support**
   - Fee based on effort/duration
   - Funded projects, membership fee

3. **Traceable**
   - Code/testcase contributions
   - Download controls
Noel Menezes
Director Intel Labs/Strategic CAD Labs
Intel
Several open-source EDA successes in the seventies and eighties!
Successful open-sourcing
Incentives for open-sourcing in software

Source: Andreessen Horowitz, State of Crypto
Grading of open-source criteria

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Software</th>
<th>80’s EDA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Developer community</td>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td>Users</td>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td>Incentives</td>
<td>A</td>
<td>A</td>
</tr>
</tbody>
</table>
A New Golden Age for Computer Architecture:
Domain-Specific Hardware/Software Co-Design, Enhanced Security, Open Instruction Sets, and Agile Chip Development

John Hennessy and David Patterson
Stanford and UC Berkeley
13 June 2018

https://www.youtube.com/watch?v=3LVeEjsn8Ts
Future of EDA open sourcing
Domain specific architectures may be the right disruptor for open-source IP/EDA to flourish. The best chances for success are in segments where commercial EDA incentives do not align.
Bill Lezsinske
Operating Partner
Cambium Capital
Cambium Capital

• Cambium Fund II
  • Thesis: Investing in companies that form the next generation of computing
  • $100M fund focused on Seed and A-Round Investments
  • Engage on chips, interconnects, storage/memories and low-level software
  • Invested in Rapid Silicon, Vorticity, Black Semiconductor, Groq, Analog Inference

• Bill Leszinske >30 Years Industry Experience
  • Intel CVP – Customers, PC clients, datacenter and memory/storage products
  • Groq VP – AI/ML startup - products, marketing and SW development
  • Operating Partner at Cambium Capital
Cambium World View

• Growth Opportunities
  • Demand for compute continues unabated
  • Slowing of Moore’s law creates new opportunities for new solutions
  • Utilize Industry/Gov’t/Academic networks to identify underserved opportunities
  • Encourage new companies through investment

• Driving Innovation
  • Open standards accelerates new products/solutions
  • Open Source projects are a key catalyst
  • Lower the barriers to creating new chips and solutions