



# circuit cellar

Inspiring the Evolution of Embedded Design

## The Future of FPGA- and AI- Dev Tools

# Into the Great Wide Open

If you had asked me about the significance of open-source tools for FPGA design a few years ago, I probably would have yawned and answered that they're occasionally handy for students and hobbyists, but that no "real" customers would ever use them—for a variety of reasons. I would have said that they couldn't provide a complete development solution, that Quality of Results (QoR) was an issue, and that management at our customers wouldn't trust that they were reliable.

FPGA companies like ours had always built proprietary tools to support design development for our silicon products. In the beginning that was because we had to, otherwise it would have been impossible for our potential customers to implement designs for (and subsequently buy) our devices. Along the way, though, we learned to value what I called the "walled garden." Having our own proprietary tools required our customers to invest a lot of time learning our design flow, and that made them less likely to want to try out one of our competitors. We convinced ourselves that no one else could, or should, try to produce software to support our devices as surely nothing good would come from such an effort. When other companies tried, we did our best to ignore them.

That perspective changed significantly around two years ago after our CTO, Tim Saxe, and I attended a conference that showed some amazing results coming from an open-source FPGA tool chain. Not only had the tools evolved enough to provide a complete end-to-end solution, but the QoR was excellent and customers from the smallest design houses to some of the largest names in the industry had come to trust them completely. To say

that I was surprised would have been an understatement.

Seeing customers getting such good results started me wondering whether open-source tools were really such a bad thing for us silicon providers. It was clear that not only had the tools evolved to a surprising level of maturity, but it was also clear that thanks to the crowd-sourcing leverage inherent in the open-source model, they would continue to evolve at a rapid pace and possibly even quicker than we could evolve our own proprietary tools.

Yes, they made designs more portable between vendors, but at the same time not having to make a large and continuous investment in tool development would allow us to invest those precious R&D dollars in



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### Supported Open Source Tools



**FIGURE 1**  
 QuickLogic's open-source tools



**FIGURE 2**  
SensiML's Endpoint AI workflow

other areas such as silicon innovation, and ultimately deliver a better product in terms of performance, power consumption and cost.

### OPEN-SOURCE COMMITMENT

With all that in mind, last year we made the decision to fully commit to supporting open-source tools for our programmable products and embedded FPGA technology. In June we announced our QuickLogic Open Reconfigurable Computing (QORC) initiative in collaboration with Google and Antmicro. QORC is our commitment to openly embrace open-source tools and to provide all of the necessary information so that those tools, such as SymbiFlow, Renode and Zephyr, can fully support our programmable platform SoCs with embedded FPGA (eFPGA) and RISC processors and our embedded FPGA technology (**Figure 1**).

There are several third-party initiatives and alliances, which have sprung up to support open-source tools and are complementary to our QORC initiative. For example, there is the open-source processor ISA initiative called RISC-V. Then there is the OpenHW Group that is dedicated to the collaborative development of open-source cores, IP, tools and software, which has an active RISC-V based project called CORE-V. There is also another group called CHIPS Alliance, which is focused on open-source IP for core and peripheral/connectivity functions and associated software development tools.

Our platform SoCs and embedded FPGA technology is particularly well suited to edge IoT applications. The current trend in IoT is to

add artificial intelligence (AI) to edge devices so that they can make smart decisions without having to rely on cloud-based connectivity. Industry research conducted by Google and McKinsey suggests that edge AI will require tens to hundreds of billions of semiconductor units over the next few years, just for edge inferencing.

QuickLogic's subsidiary, SensiML, provides AutoML tools that enable devices with embedded low-power processors to utilize AI to sift gems of application-specific insight from mountains of raw sensor data (**Figure 2**). SensiML adopts a developer-friendly, open-source approach to key aspects of its toolkit as well including sample datasets, data ingest and model validation tools, and source code output capability. Openness is particularly important when it comes to AI models and the AutoML tools that create them. As the nature of the models can often defy intuitive understanding, having transparency in the AI code, methods, and parameters is vital to explaining their behavior, insights, and supporting products built around them.

### HARDWARE SOLUTIONS

The open-source concept extends from tools and IP to hardware such as development boards and kits. For example, we recently announced our QuickFeather and Qomu development boards, as well as our collaboration with SparkFun resulting in the "Thing Plus - QuickLogic EOS S3"—all of which are 100% open-source hardware. That means the designs are open and available to anyone, increasing accessibility, decreasing cost and making it easy for people around the world to explore, develop with, and ultimately integrate our technology into their own products.

Eventually open-source tools will likely become more pervasive than closed-source and proprietary in the industry. More and more customers will embrace them, and other vendors will be forced to more proactively support them. As the walls surrounding the once-private and proprietary technology gardens begin to come down, everyone will benefit. The tools will evolve rapidly thanks to vendor and user support, QoR and reliability will continue to improve, and support will continue to broaden. That will create its own virtuous cycle and engender a democratic revolution within the tech industry and beyond. 

**Brian Faith** is the President and CEO of QuickLogic. He serves on the Boards of the Open-Source FPGA Foundation (OSFPGA) and the Global Semiconductor Alliance (GSA). Mr. Faith holds a B.S. degree in Computer Engineering from Santa Clara University and was an Adjunct Lecturer at Santa Clara University for Programmable Logic courses.

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