The Last Byte

Open-source hardware

Scott Davidson
Sun Microsystems

■ **OPEN-SOURCE SOFTWARE** has made great strides. You can now buy a machine with an open-source operating system, browser, and office productivity package. Recent reports have recommended users switch to open-source browsers, away from less-secure commercial ones. The market for these products is growing rapidly.

Does it make any sense to have open-source hardware (OSH)? Let's imagine some requirements for such a concept: First, there must be a big audience for OSH. Open source requires a pool of developers, and few will want to work on an obscure project. Next, the design must have an easily exchangeable form. It must also have clear and easy-to-understand specs, so potential customers can tell whether or not it's useful for them. And finally, there must be a simple way of verifying the design.

When hardware developers designed ASICs from scratch, most of these requirements were difficult to fulfill. Today, SoCs consist of a set of intellectual property cores, and these IP cores are well suited for OSH. Many of them (for example, a Universal Serial Bus core) are usable on several different chips, and thus have a large market. The design language problem is simple—everyone understands Verilog and VHDL. Many cores are implementations of well-understood and well-defined standards, so their functionality is well understood.

OSH isn't just a dream. Several groups, such as www.opencores.org, have a set of development projects and available cores, and they've even attracted commercial users. Several open-source reduced-instruction-set computing (RISC) microprocessor projects are also available.

However, OSH doesn't mean your design comes for free: There is still the matter of fabricating it. If you can use an FPGA, you can make small quantities cheaply, but the trade-off is no different from a normal design.

Developing a design still requires EDA tools. Although there are some open EDA projects such as Alliance (www-asim.lip6.fr/recherche/alliance/), it isn't clear that you would want to bet a project on them. There is also the cost of understanding, verifying, and closing the timing on an OSH. Finally, there is the cost of the new parts of the design. A design constructed entirely of OSH blocks is not likely to be a commercial success.

There are also trade-offs to consider. If a product requires hard cores, optimized for a specific technology, OSH won't do. You must also consider the trade-off of cost versus design support.

There is one more OSH market to take into consideration—universities. With OSH and various open-source or community-licensed microprocessor designs, students can finally gain access to real circuits. Various benchmarking efforts, like the ITC 99 circuits, also help. (See "Special Issue on Benchmarking," *IEEE Design & Test of Computers*, vol. 17, no. 3, July-Sept. 2000.) Students can build production-level designs from free OSH using FPGAs.

Will open-source hardware be as successful as open-source software? Look for large companies supporting these projects, perhaps to sell design support and tools. But whether you are interested in building a chip, finding inspiration, or checking out some design examples, the open-source hardware available today is a valuable resource.

Direct questions and comments about this department to Scott Davidson, Sun Microsystems, M/S USUN05-217, 910 Hermosa Court, Sunnyvale, CA 94085; scott.davidson@sun.com.

For further information on this or any other computing topic, visit our Digital Library at http://www.computer.org/publications/dlib.

Copublished by the IEEE CS and the IEEE CASS