ON OUR RADAR

OPEN SOURCE HARDWARE

By Sydney Ulvick

At first blush, the concept of open source hardware as a business is difficult to comprehend. Why do engineers develop hardware for others to use at no charge, or invest resources in improving others' designs for the benefit of all? Traditional engineering management is akin to herding cats. Doesn't somebody need to be in charge? And how do these people pay for their groceries?

The open source hardware movement found its origins in Open Source Software (OSS). Wikipedia defines open source software as "computer software with its source code made available and licensed with a license in which the copyright holder provides the rights to study, change, and distribute the software to anyone and for any purpose." Note that "open source" doesn't necessarily mean "free of charge" (though it is often free). The license that goes along with the software provides the terms of sharing, which typically require the user to also share modified, improved, or updated versions.

But what are the benefits of going open source? Peter Wayner elaborates in his *InfoWorld* article:

- Low-cost marketing; open source marketing is self-perpetuating
- Reduction in support costs; the community optimizes the software for its own purposes
- Reduction in development costs; the community substantially augments in-house resources
- Open-sourcing code to push back against a rival; a non-open source rival pays more for development and IP protection, and has to charge more
- Tapping open source to launch a competitor; open source licenses permit reproduction for sale[1]

These benefits show how OSS reduces cost and increases competitiveness, but how can it generate revenue? The most common OSS business model seems to be providing support services for adopters of the open source technology. The flagship example of this model is Red Hat, Inc., which has built a robust business supporting the Linux operating system.

What is Open Source Hardware?

The Open Source Hardware Association defines open source hardware (OSH) as "hardware whose design is made publicly available so that anyone can study, modify, distribute, make, and sell the design or hardware based on that design."

The challenge to OSH lies in the logistics. For open source software, the logistical platform is well standardized and commoditized: the personal computer. The process of improving software is also well understood: write, test, and debug code. It does not require outsourced production or an investment in manufacturing, and producing copies costs approximately nothing.

For hardware, performing "open source" can be either simple or complex, depending upon the technologies involved. Understandably, the most common examples of open source hardware involve electronics; electronics design and manufacture are commoditized. However, a cash layout is still required to spin and populate a circuit board, and debugging iterations require further cash resources. Test equipment is also required, which can be complex and expensive. Both OSS and OSH require a computer with programming software, but OSH may also require utilities for embedded software, pricey

CAD packages for board layout, mechanical design, thermal modeling, or the like. By traditional logic, the developer of a hardware product would protect his or her intellectual property in order to limit risk before cash outlays become too extreme. Further investment would be required to support a staff of technologists to fully develop and optimize the product for a defined target market before introducing the hardware product for sale.

In contrast, consider Arduino and Raspberry Pi, arguably the two flagship examples of OSH. Both of these are electronics prototyping platforms with powerful on-board capabilities, which permit users to freely adapt these systems to a myriad of applications requiring computing power and a circuit interface to the real world. Both platforms were also released in an open source format. The user communities evolved the platforms for their particular applications, which by licensing terms are also open source. The advanced optimized systems can now each be obtained for around $35, and are also found at the core of numerous commercial products. A variety of companies sell the hardware (including Arduino, which originated the technology), and a variety of companies provide support to others who desire to incorporate these systems. Arduino itself makes approximately $1 per board; the bulk of its revenue comes from support services for entities that use the Arduino system. Interestingly, Arduino staff can also access the open source "literature" for solutions to be re-employed as custom services by Arduino.

Other technologies do not lend themselves to the OSH model so easily. Complex mechanical systems seem to be missing from the OSH community, although there are examples of open source communities for additive manufacturing. Whole systems also seem to be much rarer than open source subsystems and components, though systems comprised entirely of integrated open source components are on the market. This author suspects that for each technology type, a natural dollar value threshold will exist whereby the capital outlay for equipment required to produce copies will simply cost too much for an open source approach.

In summary, here's a version of how all of this could work. You're an entrepreneur with an idea for a component or subsystem. You post your idea on Kickstarter and successfully hit your dollar threshold. You use the money to produce a prototype, which you then provide to the world as open source. The idea is a good one, so others make improvements, and a significant number share their improvements with you directly. The iterative process further optimizes the product for markets where it is enjoying traction, leading to even greater consumption. Others are copying your work, but you were the originator and accordingly are the focal point for feedback. Your version of your product is therefore of higher quality, and your brand is the primary brand associated with the product. You build a significant business providing support services to others. Ultimately, someone contacts you to mass produce your product because you are the brand holder. The mass producer could simply copy it themselves, but the brand presence is needed for sales. This also undercuts motivation by a foreign entity to produce the product without permission.

With the right technology, open source hardware offers a new paradigm to be considered. The skillful entrepreneur might build an open source hardware business whose returns pay far beyond the grocer's bill.

Open Source Hardware for Mission Requirements

The IQT mission is to identify, adapt, and deliver innovative technology solutions to support the missions of the U.S. Intelligence Community. The advantages of the model are significant: lower initial and long-term costs, faster development, and enhancements that meet IC mission requirements. This statement mirrors the advantages of open source hardware, where "to meet IC mission requirements" could be replaced with "to meet the needs of [insert market here]." Open source hardware represents a new paradigm in tech development, providing an emerging rich source of technology solutions to meet mission capability needs. IQT looks forward to continuing its existing engagement in open source hardware. Q

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REFERENCES

[1] https://www.infoworld.com/d/open-source-software/greed-good-9-open-source-secrets-making-money-228428