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Open Source's New Hard Problem: Calls for Standard Licenses for Open Source Hardware

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"Hello. My name is Open Source." Created by Jessica Duensing for opensource.com. Licensed under CC BY-SA 2.0. https://www.flickr.com/photos/opensourceway/6554314981/

The term "Open Source" is often associated with the vibrant tech community of developers and entrepreneurs. Thanks to the popularity and the media coverage of software tech startup companies, the public usually treats "Open Source" synonymously with "Open Source Software." Despite its apparent defiance to many aspects of intellectual property law, Open Source Software is practically a specific application of intellectual property law that it "allows recipients to use the software without restriction, examine the source code, change the software, and make further distributions of the original or modified software to other recipients."[1] More importantly, it also mandates that any recipients further down the stream must enjoy exactly the same freedoms. Open Source Hardware shares the same model, yet, with added complexities of the physical property.

Historically, Open Source Hardware has not been as widely acknowledged as its older, more established sibling, Open Source Software. In exploring the reasons behind the apparent discrepancy of development level between Open Source Hardware and Open Source

Software, it is arguable that "Open Source" depends more on business models than it does on pure technologies or on individual technologists. As one researcher noted, firms seek inter-organizational innovation and work beyond their boundaries to obtain and commercialize innovation, thus forming a paradigm of "open innovation."[2] The development of Open Source Software has significantly enjoyed the boost brought by Network Effect[3] as emerging business models connect a constantly increasing quantity of users and contributors.

However, it would be an untenable position to ignore Open Source Software's reliance on technologies, too—the most fundamental amongst which is the Internet. Enabling technologies and innovative business models work in accordance while mutually reinforcing each other in turns. The process can be analogous to a pendulum movement, which pushes technology cycles forward. The hardware tech industries might be still waiting for a technology disruption that is able to transform them the same way as the Internet does to software industries. Yet, the public has already seen some trends that could incrementally redefine the hardware industries. Earlier this year, Facebook demonstrated "Minipack," an open modular switch for datacenters, which it donated to the Open Compute Project, an organization that shares data center product designs among companies.[4] The idea is "to provide the industry with a standardized solution toward the goal of mitigating errors and helping operators manage switches more effectively," and "to drive innovation and give these designs to the community for others to use."[5] Also, in July this year, Arm Holdings launched Flexible Access, a new licensing scheme "for startups to gain access to a wide range of Arm's intellectual property (IP) without any upfront licensing costs."[6] This move is significant because Arm is probably the most famous proprietary licensing business and it operates in probably the most secretive area of all hardware technologies, namely the semiconductor microprocessors (for example, CPUs and GPUs). As observed by *The Economist*, this move is, at least partially, motivated by the challenges brought to Arm by "RISC-V," a new technology which can be loosely defined as an Open Source alternative to Arm's proprietarily designed microprocessor architectures.[7]

The two instances discussed in the immediate above paragraph are joined by the ongoing trends in Internet of Things (IoT). Unlike pure software, the ecosystem of IoT involves, more extensively, physical devices and interfaces with material surroundings. Open Source Hardware is quickly gaining traction as more developers jump into IoT designs.[8]

From a law perspective, Open Source Hardware shares an important characteristic with Open Source Software, which is the seemingly paradoxical interaction with intellectual property law. As one legal scholar has put, "the rising interest in open source innovation also calls into question one of the fundamental assumptions underlying the law of intellectual property—namely that strong proprietary intellectual property rights are necessary to create an incentive to innovate . . . ."[9] On the other hand, Open Source developments "ultimately depend as much on the legal tools provided by existing intellectual property regimes . . . ."[10] Enquiries into the real definition of Open Source will inevitably touch on said paradox. CERN OHL[11],

one of the major licenses for Open Source Hardware, defines its license model as a legal framework that will allow for the formal recognition and endorsement of Open Source Hardware, while protecting intellectual property. Development methodologies aside, the only way to legally distinguish Open Source models from proprietary models or, the other end of the spectrum, free-wares, is to utilize the framework of intellectual property law. For instance, the forerunner in the Open Source Software movement, General Public License (GPL or GNU), "uses copyright law to ensure perpetual software freedoms, so long as the rules are followed. This unique use of copyright is called *copyleft*."[12] There are many licenses other than GPL and they are all uses of intellectual property law. To some extents, the legal definition of any Open Source development is its license and the license is its legal definition. Each of the Open Source developments applies a customized set of rules within the intellectual property law framework.[13]

During the three decades since the creation of GPL, a great number of Open Source Software licenses have emerged, which has led to the existence of "license proliferation."[14] Although it is proof of various viable business models of Open Source Software, license proliferation results in "confusion and potential liability."[15] Still early in maturity compared to software, Open Source Hardware could inherit the same issue. Moreover, the differences in nature between hardware and software may add complexities to the problem.

First, Network Effect in software development induces the community to gravitate towards several licenses. Although hardware design and manufacture can also benefit from standardization, it would happen only at relatively late stages because the hardware product life cycles lack the near-real-time feedbacks that are often inherent to the software. As a result, hardware developers tend to adopt a more fractured set up of licenses and it is more difficult to mitigate the incompatibility issues. Also, the geographical locations of hardware design inception and manufacture realization are sometimes far apart, which generates an extra layer of incompatibility.

Second, the value chain of the hardware industry does not share the near-zero marginal costs that the software industry often enjoys. In open innovation collaboration, contribution attribution (not necessarily monetary) is a key aspect.[16] Substantial marginal costs translate to significant "frictions" during the process of product development. It is thus substantially less intuitive to come up with a licensing scheme that reconciles between the "innovation-imitation-improvement dynamics"[17] and the free-riding problems.

Last but not least, a significant portion of the early adopters of Open Source Hardware are scientists in research institutions. They are often motivated by saving tooling cost or having full control of tools that facilitates their institutional projects.[18] Since the work products generated by these scientists using Open Source Hardware tools are proprietary to their respective institutions, careful design of relevant licenses is necessary.

In conclusion, Open Source Hardware is both following Open Source Software's steps and also exploring a path of its own. Despite major license like Creative Commons (CC), CERN OHL, and TAPR OHL[19], the community is still seeking several internationally recognized standard licenses. The goals of such industry standards will be both enabling design freedom and mitigating incompatibility confusion.

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[1] Jeffrey Robert Kaufman, *Sharing vs. free vs. public: The real definition of open source*, Opensource.com (Oct. 3, 2019), https://opensource.com/article/19/10/shareware-vs-open-source?utm_campaign=intrel.

[2] Joel West, *Policy Challenges of Open, Cumulative, and User Innovation*, 30 Wash. U. J.L. & Pol'y 17 (2009) (a paper in the "Business, Law, and Engineering Perspectives on Open Source Innovation" part of the symposium "Open Source and Proprietary Models of Innovation: Beyond Ideology").

[3] D'Arcy Coolican and Li Jin, *The Dynamics of Network Effects*, A16z.com (Dec. 13, 2018), https://a16z.com/2018/12/13/network-effects-dynamics-in-practice/.

[4] Kyle Wiggers, *Facebook debuts Minipack, an open modular switch for datacenters*, Venturebeat (Mar. 14, 2019), https://venturebeat.com/2019/03/14/facebook-debuts-minipack-an-open-modular-switch-for-datacenters/.

[5] *Id*. (Quoting director of engineering at Facebook Hans-Juergen Schmidtke).

[6] Frederic Lardinois, *Arm's new licensing option lets its partners experiment and test for free before they pay*, Techcrunch (July 16, 2019), https://techcrunch.com/2019/07/16/arms-new-licensing-option-lets-its-partners-experiment-and-test-for-free-before-they-pay/.

[7] *A new blueprint for microprocessors challenges the industry's giants*, The Economist, Oct. 3, 2019.

[8] *See* Scott Tattersall, *How to build custom IoT hardware with Arduino*, Opensource.com (Jan. 10, 2018), https://opensource.com/article/17/12/how-build-custom-iot-hardware-arduino; *see also* Leon Anavi, *Give old electronics new life with Linux and Raspberry Pi*, Opensource.com (Oct. 3, 2017), https://opensource.com/article/17/10/giving-retro-electronics-new-life.

[9] Charles R. McManis, *Introduction*, 30 WASH. U. J. L. & POL'Y 1, 2 (2009).

[10] *Id*. at 3.

[11] *See* Hal Gottfried, *Does your open hardware project need a license?*, Opensource.com (Feb. 19, 2015), https://opensource.com/law/15/2/intro-open-hardware-licensing.

[12] Jeffrey Robert Kaufman, *Sharing vs. free vs. public: The real definition of open source*, Opensource.com (Oct. 3, 2019), https://opensource.com/article/19/10/shareware-vs-open-source?utm_campaign=intrel.

[13] *See* DesignSpark, *Popular Open Source Licenses*, Rs-online.com (Jan. 1, 2013), https://www.rs-online.com/designspark/popular-open-source-licences (introducing a list of popular Open Source Software licenses).

[14] *See* Robert W. Gomulkiewicz, *Open Source License Proliferation: Helpful Diversity or Hopeless Confusion?*, 30 WASH. U. J.L. & POL'Y 261 (2009).

[15] *Id*. at 281.

[16] *See* Mark J. Jakiela, *Contribution Attribution as the Possible Next Step for "Crowdsourced" Engineering Design and Product Development*, 30 WASH. U. J.L. & POL'Y 79 (2009).

[17] Michele Boldrin and David K. Levine, *Market Structure and Property Rights in Open Source Industries*, 30 WASH. U. J.L. & POL'Y 325, 326 (2009).

[18] *See* Joshua M. Pearce, *Emerging Business Models for Open Source Hardware*, The Journal of Open Hardware (2017), https://openhardware.metajnl.com/articles/10.5334/joh.4/print/.

[19] Gottfried, *supra* note 11.