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Open Source Patenting*

Introduction

The advent and growth of commercial biotechnology over the past quarter century has fostered controversy over the ownership of the fruits of basic biological research. Whereas the aspirational normative structure of science regards new biological discoveries as shared public resources, commercial biotechnology regards such discoveries as potential commodities to be patented, licensed, and marketed through the application of exclusive proprietary rights. Numerous commentators have explored and documented the conflict created by juxtaposing scientific research and proprietary claims, particularly patent claims, to significant biotechnological inventions.[1] Problems are particularly acute among enabling technologies – those that are themselves employed in the innovation process — where the indiscriminate use of patents has burdened research with high transaction costs and uncertainty.[2] When the tools of a science are privately appropriated and access to them is restricted, research and development follow paths directed by strategic intellectual property right ownership, rather than those dictated by scientific inquiry.[3]

Some large-scale biotechnology projects, such as the Human Genome mapping effort, have attempted to deter proprietary claims by rapidly injecting new discoveries into the public domain in order to frustrate the novelty requirement for patenting[4], as patent law specifies that inventions already known to the public cannot be patented.[5] However, researchers have become aware that simply relying on publication to place discoveries in the public domain may be insufficient, as it leaves them susceptible to capture in proprietary formats. While the publication of the Human Genome data is a step toward securing public access, it is no guarantee of public access, as publicly developed discoveries can be overlaid with proprietary modifications and improvements.

In addition to recognition of the shortcomings of defensive publishing, there has also been recent recognition of the picayune nature of the research exemption in U.S. patent law.[6] Many enabling technologies have been used in public and non-profit research without licenses. The result is that by the time the publicly-developed technology is ready for market, the initial proprietary tool or method may be so embedded in proprietary improvements as to make for an unequal bargaining over license terms that significantly favors the patentee. Consequently, in response to the need for publicly accessible enabling technologies, some public biotechnology efforts are now embracing patents, but coupling them with particular licensing models to control patent claims to follow-on innovations.

One such approach has been proposed as part of the Biological Innovation for Open Society project or "BIOS."[7] The BIOS project is intended to make publicly available certain biological research tools and techniques, and to attract contributions of further research tools. While the project organizers are not adverse to users of these tools filing patents on discoveries made by use of the tools, the intention is to preserve public access to the tools themselves. The danger to such access comes from patenting of improvements or modifications that users might make to the basic tools, encumbering the basic tools with proprietary claims. Consequently, BIOS is contemplating a user license that requires users

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1 Robert E. Merges, Property Rights Theory and the Commons: The Case of Scientific Research, 13 Soc. Philosophy & Pol'y 145 (1996); Rebecca Eisenberg, Proprietary Rights and the Norms of Science in Biotechnology Research, 97 Yale L.J. 177 (1987)

2 See Rebecca Eisenberg, Technology Transfer and the Genome Project: Problems with Patenting Research Tools, 5 Risk: Health, Safety, & Environment 163 (1994).

3 Paul David, Can 'Open Science' be Protected from the Evolving Regime of IPR Protections?, 160 J. Institutional and Theorectical Econ. 9 (2004).

4 See Eliot Marshall, Gene Patents: Sequencers Call for Faster Data Release, 276 Science 1189 (1997); Eliot Marshall, Bermuda Rules: Community Spirit, With Teeth, 291 Science 1192 (2001).

5 35 U.S.C. § 102(a).

6 See Madey v. Duke, 307 F.3d 1251 (Fed. Cir. 2002).

7 Graeme O'Neill, Open-Source Biology Stance Earns International Honour, Australian Biotechnology News, Mar. 12, 2003.

to license any such improvements to all others on the same terms that the initial tools were provided.

A somewhat different approach has been taken in the case of genomic data assembled in the governmentally funded "HapMap Project" which is building an informational haplotype map of human genetic variations.[8] Information in the database was intended to be publicly available, but there existed a substantial possibility that users might combine information from the database with their own data and assert proprietary claims over the resulting discoveries, effectively removing the database information from further public use. Consequently, the database is freely available on condition that those accessing the data not file patent applications on information derived from the database and share information only with others who have agreed to the same terms. Additionally, users of the database agree that any patents they obtain on uses derived from information in the database will be licensed on terms that allow others continued access to the information.

Both of these licensing approaches are consciously modeled on the so-called "open source" or "copyleft" approach found in certain distributed computer software programming projects.[9] However, the adaptation of this approach to patent licensing, and particularly to biological patent licensing, raises a series of challenging legal issues. In this paper, we succinctly examine several fundamental legal issues raised by such treatment of patent licensing. The majority of these issues arise from differences between the structure of copyright, where open source licensing was initially implemented, and the structure of patents, to which it has been proposed that open source licensing should be transplanted

We begin by briefly reviewing the philosophy and practice associated with the open source software movement, noting particularly the peculiarities of "copyleft" software licenses. We then discuss the extension of this model to patents, highlighting several legal and pragmatic differences created by the nature of the patent rights being licensed. We then turn to discuss certain problems and limitations of patent licensing and their application to the open source model. We conclude that open source patent licensing is a legally viable model, so long as certain idiosyncrasies of patent law are noted and respected. Although our conclusion is largely grounded in the current state of American law, we believe that our fundamental analysis has broader applicability in nations with analogous legal systems.

The Open Source Model

The label "open source" stems from the technical characteristics of most software, and from an opposition to the commercial practices arising from these characteristics.[10] Most commercial software is distributed only in machine-readable "object code" format. This format is functional, but difficult for humans to understand, analyze, or modify. Software is seldom written in machine-readable format, but instead written using high-level programming languages that are simpler for humans to understand. Before the human-readable or "source code" scripts can be executed by a computer, they must be compiled or translated by the machine into a machine-readable format.

This division between human and machine-readable code, between source and object code, has been exploited by commercial software firms in tactics to maintain proprietary control over their products.[11] Only the object code version of the program is sold to the public. Because it is difficult to understand, it is difficult for competitors to reverse engineer or learn from. Source code versions of a commercial program are typically kept proprietary and undisclosed in order to hamper competitors from producing rival products.[12] These commercial products are closed source; their source code is unavailable and inaccessible.[13]

The open source movement in general rejects the practice of keeping source code secret, holding instead that source code should be freely accessible and available.[14] In open source projects, source code is distributed along with object code so that it can be studied, improved, and modified by other programmers. While the purported benefits of such source code distribution are diverse, one highly visible wing of the open source movement advocates such distribution under the philosophy, almost

8 International HapMap Project, http://www.hapmap.org/abouthapmap.html

9 See Peter Wayner, Free for All: How Linux and the Free Software Movement Undercut the High-Tech Titans (2000).

10 See The Open Source Definition, version 9.1 <www.opensource.org/osd.html>.

11 Michael J. Madison, Reconstructing the Software License, 35 Loyola Univ. Chicago L.J. 275, 280-81 (2003)

12 Andrew Johnson-Laird, Reverse Engineering in the Real World, 19 U. Dayton L. Rev. 843 (1994).

13 See Lawrence Lessig, The Limit in Open Code: Regulatory Standards and the Future of the Net, 14 Berkeley Tech. L.J. 759, 764-65 (1999).

14 See Free Software Foundation, What is Free Software? <http://www.gnu.org/philosophy/free-sw.html>

approaching an ideology, that software should not be proprietary, but "free." Open source software is "free" in the sense that it is publicly available or accessible without restraint, not necessarily in the sense that it is costless. This free software philosophy is strongly grounded in concepts of communality and sharing; closed or proprietary behavior is considered ethically and morally suspect.[15] While some free software advocates may prefer that software be available without charge, the primary consideration is that it should be available without restraints upon modification, examination, or redistribution.

Open Source Production

A second, sometimes alternative, major tenet that runs through the open source movement is a strong strain of pragmatic or perhaps utilitarian justification. This school of open source advocacy is grounded not so much in lofty principles, but in the conviction that open source provides a superior production method.[16] This position holds that open source is a better means of producing software, when compared with the products of the traditional hierarchical firm model, because open source products display higher quality, shorter development time, and lower production costs. These characteristics are believed to arise from the open and collaborative nature of the projects undertaken where many programmers are working to de-bug a system, or improve it. As users and contributors they are in an unusual position to offer relevant improvements. Individual programmers may be particularly motivated to solve a bug that personally affects them. Immediately their improvements are disseminated and tried by others. Problems are corrected due to the number of contributors able to review the product; as one advocate puts it, "with enough eyeballs, all bugs are shallow."

Some commentators exploring the economics of open source production have argued that this approach has certain advantages over traditional software production within a hierarchical firm. Because open source projects are voluntarily able to recruit a large number of programmers to collaborate on production of complex computer programming projects, they may capture the benefits of decentralized production. In a firm, a centralized decision-maker prioritizes problems and allocates employees to solve them, but there may be inefficiencies in this process due to imperfect information about employee skills, preferences, and product development problems. In open source projects, programmers volunteer for the most appropriate task. Because they are both users of the product and contributors to its production, they hold valuable knowledge about the problems involved.

However, other commentators have noted that although open source development is in some senses self-selecting, it is by no means decentralized or non-hierarchical.[17] Close examination of the most prominent open source projects reveals that they are tightly controlled by a small number of project leaders, perhaps even one entrepreneurial leader, who "own" and direct the development of the project.[18] Strong normative expectations, backed by social sanctions such as disapproval or ostracization, are directed at maintaining the focus and trajectory of the project. Participants self-select for projects primarily by means of exit, by voting with their feet – they may volunteer for any project they wish, but not to develop the project contrary to the direction of the leaders. If a programmer's developmental vision differs from that of the project leaders, her options are to join some different project or to start a project of her own – not to create her own version of software already under development.

The role of normative constraints and reputational capital in open source software development suggests that it has much in common with the culture of science.[19] Scientists publish their work, ensuring it remains openly accessible and they depend on a culture of peer-review as quality control. The general normative expectations in science are largely communitarian rather than proprietary. Scientific submissions to the public body of knowledge are based on reputation incentives and are only indirectly related to a maximization of future profit, as their terms of employment reflect the quality of their work. And again, as programmers have freedom to work on the code that most stimulates their interest so too does considerable freedom exists in the setting of research agendas in open science.

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15 See Eben Moglen, Anarchism Triumphant: Free Software and the Death of Copyright, 4 First Monday (Aug. 2, 1999) <http://www.firstmonday.dk/issues.html>

16 See Eric S. Raymond, The Cathedral and the Bazaar (1999).

17 See David McGowan, Legal Implications of Open-Source Software, 2001 U. Illinois L. Rev. 241

18 See Ilkka Tuomi, Internet, Innovation, and Open Source: Actors in the Network, 6 First Monday (January 2001) <http://firstmonday.org/issues/issue6_1/ tuomi/index.html>.

19 See Paul de Laat, Open Source Software: A New Mertonian Ethos? in ETHICS AND THE INTERNET 33 (Anton Vedder, ed. 2001).

Open Source Licensing

But a potentially serious impediment to open source collaboration is the concern that participants could defect from the community and incorporate the software into a proprietary product that would only be available in "closed" or machine-readable versions. Third parties might also obtain the software and similarly attempt to divert it into a closed form. Such diversion of collaborative code not only violates the philosophical tenets of the community, it may also potentially disrupt the collaboration by free-riding from the work of the whole – programmers are less likely to contribute work to the project if they know it may be exploited by someone else. Adherents to the free software philosophy are particularly exercised that their work not be incorporated into closed proprietary formats.

Open source projects have developed an unusual set of legal mechanisms intended to ensure that communally produced code remains freely available and is not "captured" into closed, proprietary forms.[20] These concerns are addressed by licenses that accompany the distributed source code. Open source software may be distributed under a variety of licenses, which display a wide range of terms and conditions intended to address different concerns over capture. Some licenses impose restrictions on the modifications of licensed software; others do not. Some forbid commercialization of the licensed software; others permit or require fees for use of the code. However, to fall within the canon of open source licensing, all such licenses have in common the requirement that the recipient of the licensed software must be provided with the source code.

The most prominent and widely discussed versions of such licenses are those that further require licensees who improve or modify the software to make such modifications available on the same terms as the initial software was licensed. The license also precludes the addition of any legal terms besides those initially found in the license. Thus the terms of the original license have a "viral" quality that attaches to any subsequent products incorporating the original code. Such licenses are sometimes termed "copyleft" licenses to indicate what many proponents of free software view as a fundamental philosophical difference from the system of copyright: the assertion of proprietary rights to ensure the continued transparency and accessibility of creative works.[21]

However, copyleft is not free from copyright. Rather, copyleft licenses use the property rights arising from copyright to ensure adherence to the terms of the license.[22] The license is in essence an agreement not to sue: whereas the activity of the licensee in copying, distributing, or modifying the code constitutes a facial violation of the copyright holder's exclusive rights, the copyright holder agrees not to assert those rights so long as the licensee's activity is conducted under certain conditions. In the case of open source, those conditions include redistributing the code under the same conditions by which it was obtained – the licensee's activity remains authorized only when these conditions are met. While the underlying copyright provides a property right basis for the license, it is enforced only if additional property rights accrue.

Open Source Patents

The term "open source" as applied to patents necessarily results in something of a misnomer; as an essential function of the patent system is to ensure disclosure of the claimed invention. In return for the exclusive rights encompassed in the grant of a patent, the inventor must disclose to the public information concerning the invention, sufficient to allow one of ordinary skill in the art to make and use the invention.[23] This information is part of the patent application, and is part of the patent document that is published when the patent is granted. Failure to make a sufficient disclosure will result in the denial of the application, or, should the application be erroneously granted, will result in an invalid patent. Thus, at least in theory, the patent system inherently accomplishes the goal of keeping the characteristics of the invention "open" or publicly accessible.

This feature of the patent system to some extent parallels the disclosure purpose of open source licensing. In the case of software, open source disclosure of the source code simultaneously makes available both information about the invention as well as the invention itself. This could also be the case with regard to some patented inventions – for example, if source code were disclosed in the specification of a software patent, information on how to make and use the invention, as well as an embodiment of the invention are available from the pub-

20 See Joseph Scott Miller, Allchin's Folley: Exploding Some Myths About Open Source Software, 20 Cardozo Arts & Ent. L.J. 491, 495 (2003).

21 See Free Software Foundation, What is Copyleft? ,http://www.gnu.org/copyleft/copyleft.html>

22 See Yochai Benkler, Coase's Penguin, Or, Linux and the Nature of the Firm, 112 Yale L.J. 369, 446 (2002)

23 35 U.S.C. § 112, para. 1.

lished patent. But it is important to note that this is not always the case for inventions that are difficult to describe in a document. Biological inventions frequently fall into this category, because the organisms or biological starting materials may be unique or irreproducible. The published patent makes available information about the invention, but not the invention itself. Consequently, for biological inventions to meet the enablement requirement of patentability, the practice has grown up of depositing the materials in a publicly accessible repository so as to make the invention publicly available.[24]

Thus the characteristics of a patented invention are already made "open" in the sense that the patent makes information about the invention publicly accessible, and makes the invention publicly available through disclosure or deposit. What need then for "open source" patenting, if the patent system already provides for disclosure and availability? The answer is that "open source" also refers to a certain philosophy of access, improvement, and production, as we have outlined above. The "open" informational nature of patents does not necessarily mean that the invention is "open" in the sense that public use of the invention is available or that the invention is publicly accessible. The patent itself may block public use, even as it discloses and enables the invention.

The aspirational goals of biological scientists closely track those of the open source community in desiring to keep information and discoveries communal and accessible. Biological researchers might eschew patenting, but this could actually result in less accessibility and communality of development. As in open source software development, abandonment of the invention to the public domain would not necessarily make the invention publicly available. Technology made freely available might be "captured" in proprietary embodiments and so effectively removed from the public domain. Much as copyright has been deployed to maintain the accessibility of open source software, patents might be deployed to maintain the accessibility of biological discoveries. Consequently, a better term for the licensing considered here might perhaps be "free biology" to parallel the usage "free software," or even "open access biology" to emphasize the focus on accessibility rather than disclosure. But we believe the term "open source" remains appropriate as reflecting the ideals of access and philosophy of production that characterize the open source movement, even if biological inventions are in one sense already "open" due to the nature of the patent system.

The Nature of Patent Rights

Our discussion of the applicability of the term "open source" to patents foreshadows a series of instances in which "open source" patenting may diverge from the original open source model, due to differences in the nature of patent rights. Open source licensing in the software context has developed around the rights granted by copyright, where copyright protects the fixed and original expression of software in the form of symbols or indicia of computer code.[25] Such rights arise automatically, upon the fixation of the copyrighted work in a tangible medium, and require no formal institutional process to perfect the rights. In particular, no publication or distribution is necessary to obtain copyright in an expressive work such as software code.

Copyright is often conceptualized as form of property, or exclusive rights "against the world," but this formulation is not entirely accurate. Copyright confers exclusive rights only against unauthorized copying, or against other violations of the specifically enumerated rights of the copyright holder: unauthorized distribution of copies, unauthorized digital transmission of sound recordings, unauthorized adaptation, public performance, or public display of the copyrighted work.[26] Each of these prohibited activities requires access to a copy of the protected work, denoting that the exclusive rights of the copyright holder extend only to actions arising out of contact with the copyrighted work. Independent creation of a work, without derivation from the original expression of another, is a defense to claims of copyright infringement, even if the work is similar or identical to a protected work. If the creation is truly independent, no copying or other prohibited use of the protected work occurs.

Open source licensing takes advantage of this peculiarity of copyright law to create a contractual relationship between the creator of software and the user of that software. Whenever one of the exclusive rights of the copyright owner might be invoked — that is to say, whenever there has been access, there arises the opportunity to condition such access on agreement to particular terms of access. The copyright owner agrees not to assert his exclusive rights so long as the agreed upon terms are followed. Thus, the same activity that would potentially violate the rights of the copyright hold-

24 37 C.F.R. § 1.801-09.

25 See 17 U.S.C. § 101.

26 17 U.S.C. § 106.

er also creates the opportunity to impose a license governing that action.

However, the bundle of exclusive rights associated with patents is quite different than those associated with copyright, and present a different configuration for "viral" licensing mechanisms. Independent creation is not a defense to claims of patent infringement; patents prohibit any making, using, selling, offering for sale, or importation of the claimed invention, whether or not the infringing device is derived from the invention or information provided by the patent holder. Patents may cover activities where the actor is neither aware of the patent nor of the terms by which the patent owner would authorize the activity. For this reason, patents have been viewed as a threat to open source licensing approaches; software developed via open source collaboration could all unknowingly run afoul of third party patents, notwithstanding their open source licenses.

The "label licensing" approach taken under open source copyright, where the license accompanies the work and is invoked by use of the work has been used in the patent context – most notably, with regard to the "bag-tag" or "seedwrap" licenses accompanying bags of patented seeds.[27] Label licensing has also been used as part of university material transfer agreements, where biological materials are frequently provided under terms restricting the commercialization of any improvements.[28] In this respect, biological materials may resemble computer code, in that the starting materials must often be provided, as they are often difficult to re-create. A public repository or other point of access is a point where a license can be imposed, or at minimum notice of the license made available.

But an independent developer of a patented invention has not been in the position to trigger a license, and so remains prohibited from all uses of the invention. The purpose of open source licensing is not to generally prohibit use of the licensed innovation, but rather to encourage its use under specified conditions. Specifying those conditions is problematic, as licenses arise in specific contexts. It is unclear whether under U.S. law a patent holder can make the claimed invention available under binding generally announced terms of use. Valid contractual arrangements typically require a nexus of contact between the offeror and the offeree, a condition called privity. The world at large is not in privity with the patent owner, and no obligation is likely to arise from a general announcement of licensing terms to the world.[29]

Notification to a potential infringer of licensing terms also presents a practical problem, as the patent system itself has no mechanism to offer notice of license availability or terms. Neither does the patent system facilitate formal dedication of issued patents to the public. The U.S. patent system does include a mechanism for dedicating inventions to the public in lieu of applying for a patent[30], but no such mechanism for dedicating the use of a patent to the public, and particularly for dedicating it on specified terms. It is unclear how one might go about a general repudiation of a patent.

Of course, the patent holder may simply choose not to sue when a violation of the patent is discovered. But the failure to assert property rights in order to keep inventions publicly accessible may have very different results than an assertion of rights in order to keep the invention accessible. Patent owners have an obligation to enforce their rights against known violations of the patent; failure to do so over an extended period may be considered tacit acquiescence or approval of the infringement. In such situations of inaction by the patent owner, the equitable principles of laches and estoppel create a permanent, legally binding inference that the otherwise prohibited activity is permissible.[31] Thus, lack of enforcement may have the same practical effect as failure to patent in the first instance, abandoning the invention to potential capture in proprietary improvements.

Open Source Improvements

Open source patenting may be complicated by the existence of improvement patents. The patent system is designed to reward innovative activity, even if the activity is a follow-on improvement to an existing patented invention.[32] Patents may overlap, creating so-called "blocking patents." Non-obvious improvements on a patented invention may be entitled to their own patent, even though they fall within the scope of the original patent claims. In such situations the two patents exclude one anoth-

27 Keith Aoki, Weeds, Seeds, & Deeds: Recent Skirmishes in the Seed Wars, 11 Cardozo J. Int'l & Comparative. L. 247 (2003).

28 See Bertram I. Rowland, Legal Implications of Letter Licenses for Biotechnology, 1High Tech. L.J. 99 (1986).

29 See Robert Merges. The End of Friction? Property Rights and Contract in the Newtonian World of On-line Commerce, 12 Berkeley Tech L.J. 115, 128-29 (1997).

30 35 U.S.C. § 157.

31 4 D. Chisum, Patents § 19.05 (2004).

32 Robert Merges, Intellectual Property Rights and Bargaining Breakdown: The Case of Blocking Patents, 62 Tenn. L. Rev. 75 (1994).

er where their claims overlap: the initial patent, which is typically a broader or "dominant" patent prevents the follow-on innovator from practicing the improvement, but the later or "subservient" patent precludes the owner of the dominant patent from practicing the patented improvement. Unless some cross-licensing agreement is reached, neither patent owner can practice the improvement.[33]

This is quite a different situation from the copyright milieu in which open source licensing was developed. Depending upon the circumstances, authorized modification of a copyrighted work may result in a work of joint authorship or in a derivative work. The former occurs when authors contribute original expression to a work with the intent of producing a unified final product; the latter occurs when authors contribute expression individually or sequentially.[34] Unauthorized modification of a copyrighted work constitutes an act of infringement. Indeed, under U.S. law, the originator of an unauthorized adaptation is precluded from receiving a separate copyright.[35] This rule effectively means that the original copyright owner effectively controls all rights in the adaptation, as the unauthorized adaptor is denied any rights.

In licensing open source copyright, any modification to the underlying work will either result in an authorized derivative work or an unauthorized infringement. The former situation can be authorized and channeled by an accompanying license. The latter case, presumably in violation of the license, leaves the infringer with no independent copyright. But in licensing open source patents, improvements to the initial invention may well be entitled to their own patent, even though it infringes the initial patent. The improvement may be authorized and channeled by the accompanying license, or it may be created in ignorance of the license, in which case it can be blocked by the dominant patent until a license is taken. But if the improvement is valuable, the subordinate patent may give the improver an independent ground for bargaining against the original patentee.

By the nature of enabling technologies, it may be important to construct the license so that a line is drawn between an improvement and separate application technologies. In order to benefit from the network effects of having many researchers who are using the same techniques, contributing their knowledge to better the technology, improvements need to be made subject to open access provisions. However, in order to have an incentive to participate in open source licensing, licensees may need to be able to privately appropriate application-level technologies.

Separating open source improvements from independent inventions may be feasible on the basis of the patent claims covering the core technology. The scope of a patent is defined by written claims that are part of the published patent document.[36] These claims set forth the parameters of the patented invention so as to demarcate the patented invention from other technologies. Patent scope extends both to the explicit wording of the claims and to equivalents thereof. Under this "doctrine of equivalents," variations of the claimed invention that include known or obvious substitutions for elements of the invention are also encompassed within the scope of the patent, even if those variations are not explicitly set forth in the claims.37 Patent claims are used to determine whether an accused device infringes the patent; if the characteristics of the accused device coincide with those described in the claims, the device infringes. Claims might similarly be used to determine whether an improvement falls within or outside of the ambit of an open source license such as that contemplated by BIOS. If the patent claims of the core technology, including equivalents, are used as the line of demarcation, then inventions that fall outside the scope of the claims and equivalents are independent creations entitled to proprietary patenting under the BIOS approach. Inventions falling within the scope of the claims could be considered improvements subject to the open source license.

This is not to say that improvements falling within the claims of the licensed technology cannot be separately patented. An open source approach might not only allow, but encourage such patenting so that the improvement patent can be used to keep the improvement open and accessible. However, in the case of the BIOS project, the terms of the initial license may avoid the blocking patent stand-off, by requiring that the subservient patent, as an improvement on the original licensed technology, must be freely cross-licensed or dedicated back to the project. Cross-licensing thus becomes a term of initial access to the patented tool. Blocking patent situations could still arise if the improvement is independently developed without the licensing that accompanies access to the initial invention.

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33 See Mark A Lemley, The Economics of Improvement in Intellectual Property Law, 75 Tex. L. Rev. 989 (1997).

34 17 U.S.C. § 101.

35 See 17 U.S.C. § 103(a).

36 See 35 U.S.C. § 112 para. 2.

37 Graver Tank & Mfg Co. v. Linde Air Products Co., 339 U.S. 605 (1950).

The Limits of Licensing

Patent licensing is also characterized by a history of competitive concerns and attendant licensing doctrines not necessarily found in copyright law. Some of these relate to the constitutional and statutory status of patent rights; others relate to the interaction of such rights with antitrust and other competition laws. Open source licensing in the patent context may be constrained or altered by this constellation of licensing concerns. In a recent paper discussing open source patents and patent misuse, Professor Feldman has explored several ramifications of this question; here we extend and expand certain points in her analysis.[38]

First, "copyleft" licenses and their open source patent cousins are examples of a general class of adhesion contracts termed "mass market" or "shrinkwrap" or "label licenses" whereby the purchaser or consumer purportedly manifests agreement to standardized terms by engaging in some particular action.[39] Such purported contracts are troubling because the consumer may have had little opportunity to understand the terms of the agreement, or even that there was an agreement. Courts in the U.S. and elsewhere have for some time been wrestling with issues regarding the formation and enforceability of such contracts. Currently the general trend appears to favor holding such contracts valid and enforceable, except where the circumstances of formation are especially outrageous or where the terms of the contract are noticeably overreaching.[40]

Like any other contract, these licenses will be subject not only to the constraints found in contract law itself, but also to certain external constraints that may cabin the usual freedom to concoct contract terms. Where patent licensing is concerned, licensing terms that frustrate or impede the purposes of the patent system may be held void for public policy reasons. Under the U.S. federal system, such licensing terms may also be preempted by the policy of patent law, as state contract law must give way before the dictates predominant federal law.[41]

And there is some danger that the open source approach might be seen to frustrate the goals of the patent system. The United States Supreme Court has long held that a critical constitutional purpose of the patent system is to provide an economic incentive or reward for innovation.[42] Open source patenting might be viewed as an attempt to short-circuit that incentive, by requiring open access and non-exclusive licensing of inventions developed under the auspices of the license. Yet, another stated goal of the patent system is to move information and technology into the public domain as rapidly as possible commensurate with offering the incentive.[43] It is at least arguable that open source patenting would further this latter purpose. For this reason Professor Feldman concludes in her analysis that, on balance, open source patenting remains congruent with federal patent policy, but the question remains troublesome.[44]

Reverse Licenses

Some forecast of the treatment of open source patenting may be discernable in the treatment of analogous previous conventional licenses. For example, open source patent licenses bear some resemblance to a conventional licensing term called the "grantback" – a provision requiring the licensee to grant back to the patent licensor rights to use or own new improvements or discoveries created with the licensed invention.[45] Like the conventional grantback, the open source license seeks control over improvements arising out of the licensed invention. But in the context of open source patenting, the license accompanying the initial patented invention may well not be seeking an assignment of rights back to the owner of the licensed invention. It may, rather, be seeking to prevent or deter patenting of the follow-on improvement, or at a minimum to constrain assertion of follow-on patents. Thus, while we agree with Professor Feldman that this form of license bears a structural resemblance to the more common grantback license in that both seek to control, the open source version might be better termed a reverse grantback.

The open source patent license may alternatively bear a structural resemblance to the "reach-through" license now seen in some patent licensing

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38 See Robin C. Feldman, The Open Source Biotechnology Movement: Is it Patent Misuse?, 6 Minnesota J.L. Sci. & Tech (forthcoming 2004).

39 Robert W. Gomulkiewicz, How Copyleft Uses License Rights to Succeed in the Open Source Software Revolution and the Implications for Article 2b, 36 Houston L. Rev. 179, 185 (1999).

40 See Lucie M.C.R. Guibault, Copyright Limitations and Contracts: An Analysis of the Contractual Overridability of Limitations on Copyright (2002).

41 See Dennis S. Karjala, Federal Preemption of Shrinkwrap and On-line Licenses, 22 U Dayton L. Rev 511 (1997).

42 Mazer v. Stein, 347 U.S. 201, 219 (1954); Diamond v. Chakrabarty, 447 U.S. 303, 307 (1980).

43 Bonito Boats v. Thunder Craft Boats, 489 U.S. 141, 150-51 (1988).

44 See Feldman, supra note ___ .

agreements.[46] Under the terms of a "reach-through" license, the owner of a patent grants permission to use the claimed invention conditioned on royalties, not for the licensed invention, but for any follow-on invention developed using the licensed invention. The license thus "reaches through" the use of the claimed invention to control the follow-on inventions derived from use of the claimed invention. Note that such follow-on developments need not be improvements of the claimed invention; they may be wholly independent inventions developed with the licensed tool. But the open source version of such a license might once again be termed a "reverse reach-through," as it licenses the claimed invention not on condition of follow-on royalty payments, but on condition that the licensee not impose royalties for use of the follow-on development – negative royalties, so to speak.

Conventional grantbacks and reach-throughs pose some licensing concerns, although the caselaw on the latter is quite sparse. Treatment of grantbacks is mixed, but in general exclusive grantbacks and grantbacks of technology unrelated to the originally licensed invention have been the most problematic. Non-exclusive grantbacks, or grantbacks of technology related to the original patented invention are more likely to be found acceptable, as they preserve the ability of the patent licensee to market improvements.[47] The one court that to date has examined a reach-through license found it to be similarly acceptable.[48] But it is unclear whether these trends can be extended to reverse grantbacks and reach-throughs, because by preventing the collection of royalties or by requiring non-exclusive licensing to the world, they may tend to undermine the ability to market improvements. Certainly limiting such provisions to inventions within the scope of the original patent, as in the case of the proposed BIOS license, will help to ameliorate such concerns.

Tying Analysis

The restrictions imposed by open source patent licenses may also to some extent resemble a negative tying arrangement. Tying arrangements are frequently divided into two categories: tie-ins and tie-outs.[49] The former type of arrangement entails a requirement that the patented invention be purchased together with some other item, the purchase of one conditioned upon purchase of the other. The second type of arrangement is the inverse of the first: purchase of the patented item is conditioned upon an agreement not to purchase certain items from the competitors of the licensor. While tie-ins impose an affirmative requirement to deal with the patent owner, the negative "tie-out" version of tying uses the patented item to leverage an agreement not to deal with the patent owner's competitors.

Tie-ins were long considered a form of patent misuse, and were legally suspect as potential antitrust violations.[50] However, statutory amendments to the U.S. Patent Act in the late 1980s expressly approved patent tying unless the patent holder possesses market power in the tying item – the same situation that constitutes a prerequisite for antitrust tying analysis.[51] Some recent judicial decisions have indicated that tie-outs, as well as tie-ins, are similarly permitted, subject to the same market power analysis under the statutory provisions limiting application of patent misuse.52 This analysis of tie-outs appears to rest on somewhat shaky statutory ground, as the statute addresses situations where the license of a patented product is conditioned upon purchase of another product — tie-outs by definition are situations where the license of a patented product is conditioned upon not purchasing another product from a particular source.

However, to the extent that this somewhat dubious holding proves robust, it may have potential application to open source patent licensing. Open source licensing agreements are less likely to resemble a tie-in than they are a tie-out – a prohibition on certain types of dealings, rather than the bundling of purchased products. Thus open source patenting restrictions, if characterized as a type of "tie-out," and if brought within judicial treatment of tie-outs, may be authorized by the patent statute unless the patentee possesses market power in the tying item. Although the statue leaves ambiguous the consequences if the patentee possesses such market power, current misuse jurisprudence in the United States Court of Appeals for the Federal Circuit, the court with exclusive appellate jurisdiction over U.S. patent cases, would likely treat such

45 See H. Hovenkamp et al., IP and Antitrust § 25.1 (2004)

46 See Rebecca Eisenberg, Reaching Through the Genome in Perspectives on Properties of the Human Genome Project 209 (F. Scott Keiff ed., 2003).

47 Hovenkamp et al., supra note ___ at § 25.2.

48 See Bayer AG v. Housey Pharm., 228 F.Supp.2d 467 (D. Del. 2002).

49 See Hovenkamp et al., supra note ___ at §§ 21.1, 33.6c

50 Dawson Chem Co. v. Rohm & Haas Co., 48 U.S. 146 (1980).

51 35 U.S.C. §271(d)

52 In re Recombinant DNA Technology Patnet & Contract Litigation, 850 F.Supp. 769 (S.D. Ind. 1994).

a situation under an anti-trust tying analysis, looking for not only market power, but for

Tying arrangements form the basis for patent pooling arrangements, where access to patents is tied to other patents. Open source patenting licenses such as that used in the BIOS project might also be characterized as resembling such "patent pools" already found in certain industries.[53] These arrangements are essentially pervasive cross-licensing networks, by which each member of the pool licenses its patented technology to other members in return for licenses from them. Pooling arrangements sometimes present anti-trust concerns because they may function as coordinating mechanisms for cartels, possibly presenting barriers to entry against new market entrants who are not part of the pool, and assisting in monitoring cartel members for defection from the cartel.[54] Patent pools have also been identified as tending in certain circumstances to diminish the incentives for firms in concentrated industries to compete with one another in developing new technologies.[55]

Although the open source licensing arrangement proposed for the BIOS project in some ways resembles the structure of patent pool cross-licensing, it seems unlikely to trigger cartelization concerns, due to the non-exclusive nature of the licenses. Concerns regarding patent pool cartels are greatly diminished or eliminated when pools are nonexclusive.56 If any new entrant into the industry can join the pool and obtain access to the pooled technology, then the pool does not act as a barrier to entry, and oligopolistic price inflation will be deterred by the competitive threat of new entrants.

But it is possible that the BIOS "pooling" arrangement could raise some concern with regard to diminished competitive incentives, as the project is specifically intended to provide a non-proprietary alternative to proprietary research tools, potentially undermining the commercial incentive to develop such tools. These concerns may be ameliorated by the licensing provision permitting patenting of inventions that are independent of the licensed tools, especially if the patent claims are designated as the demarcation between and improvements and new applications. Only those inventions subordinate to the claims of the initial patent would be pooled, any inventions outside the claims could be commercialized as the inventors wished.

Anticompetitive Licensing

Patent licensing practices will also be limited to the extent that they may rise to the level of an antitrust violation, but that threshold for such concerns is relatively high. Closely related to the question of anti-trust limitations is the question of patent misuse. Patent misuse occurs when a patent holder attempts to use the patent rights granted under the statute to "leverage" or acquire additional rights not contemplated by the statute.[57] Patent misuse has long served to curtail overreaching by patent owners in their licensing practices, although the doctrine has fallen into some recent disfavor.[58] Certain practices that might formerly have been considered misuse are now explicitly authorized by the statute: refusals to license, conditioning licenses on purchase of unpatented items that are specially adapted for use with the patented invention, and even conditioning of licenses on the purchase of staple items of commerce.[59]

In addition to the statutory authorization of such licensing practices, the United States Court of Appeals for the Federal Circuit has indicated a highly permissive attitude toward licensing practices, including those that might formerly have been considered misuse.[60] In many instances, misuse is closely related to anti-trust violations or similar anti-competitive conduct and the Federal Circuit has indicated that it will generally evaluate misuse by the same legal criteria as antitrust violations.[61] Outside of a small number of practices that constitute "per se" misuse, misuse claims will be treated under the same standard as "rule of reason" antitrust claims; that is, the court would look for

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53 See Robert P. Merges, Institutions for Intellectual Property Exchange: The Case of Patent Pools in Intellectual Products: Novel Claims to Protection and Their Boundaries (Rochelle Dreyfuss, ed., 2001).

54 See George Priest, Cartels and Patent License Agreements, 20 J.L. & Econ. 309 (1977); Roger B. Andewelt, Analysis of Patent Pools Under the Antitrust Laws, 53 Antitrust L.J. 611 (1984).

55 See United States v. Manufacturers Aircraft Ass'n, 1976-1 Trade Cas. (CCH) ¶ 60,810 (S.D.N.Y. 1975); United States v. Automobile Mfrs. Ass'n, 307 F.Supp. 617 (C.D. Cal 1969).

56 See King v. Anthony Pools Inc., 202 F.Supp. 426 (S.D. Cal 1962); Cutter Labs v. Lyophile-Cryochem Corp., 179 F.2d 80 (9th Cir. 149).

57 Hovenkamp et. al., supra note ___ at § 3.2.

58 Kenneth J. Burchfiel, Patent Misuse and Antitrust Reform: "Blessed be the Tie," 4 Harv. J.L. & Tech. 1 (1991).

59 35 U.S.C. § 271(d).

60 See Robin Cooper Feldman, The Insufficiency of Antitrust Analysis for Patent Misuse, 55 Hastings L.J. 399 (2003); Robert J. Hoerner, The Decline (And Fall?) of the Patent Misuse Doctrine in the Federal Circuit, 69 Antitrust L.J. 669 (2002).

61 Mallinckrodt, Inc., v. Medipart, Inc., 976 F.2d 700 (Fed. Cir. 1992).

market power, for anti-competitive effects, and for a preponderance of anticompetitive effect over any pro-competitive effect.[62]

However, certain licensing terms continue to be automatically considered as misuse. For example, an attempt to condition purchase of the patented item on royalty payments that extend beyond the expiration of the patent is considered per se misuse.[63] The rationale behind this rule has been that Congress granted the inventor a patent term of a certain duration, and a contractual agreement to collect royalties beyond that term is an attempt to circumvent the intent of the legislature.

Because such rules limit the duration of licensing terms to the duration of the underlying intellectual property right, it is possible that some forms of open source licensing could under certain circumstances run afoul of misuse limitations. License provisions that attempted to require open source licensing beyond the term of the original underlying intellectual property right could be problematic. The potential impact of such rules on "viral" licensing schemes such as copyleft, is uncertain. Copyright law, like patent law, has its own doctrine of misuse, and there is some authority for the proposition that attempting to extend the terms of a copyright license beyond the span of the copyright itself constitutes misuse.[64] But copyright grants exclusivity of long duration and so such temporal limitations may as a practical matter never be encountered. By contrast, patent terms constitute something less than 20 years, so that the problem of temporal license overreaching is much more immediate.

Conclusion

Open source patenting presents a promising and intriguing approach to resolving the tension between the communality of science and the economic incentive of patent law. Philosophical commonalities between the open source software movement and biological science makes attractive the transfer of "copyleft" principles from their original milieu to that of biotechnology. And, if seen merely as an exercise in licensing property rights, albeit licensing with somewhat unusual terms, open source patenting may be viewed as uncontroversial. Just as with any other patent license, potential licensees are free to seek substitute technologies or "invent around" the patent if unhappy with the license terms. In the United States, the current permissive attitude of the Federal Circuit toward patent licensing generally would seem to lend credibility to such a view.

But the correspondence between the licensing of open source software and that of open source biotechnology is not perfect. The differing nature of patent and copyright shift the in a variety of ways, some stark and some subtle. Copyright is a relative newcomer to technological licensing, and have yet to address all of the issues that have arisen in the longer history of patent licensing. To the extent that open source patenting may be seen to frustrate the economic reward system of patent law, such licenses could prove controversial. Careful attention to the solutions found in past licensing analogs may help to lessen such controversy, but the stability of open source patent licenses cannot be certain until they are ultimately tested in the courts.

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62 Mallinckrodt, 976 F.2d at 708; Windsurfing Int'l, Inc. v. AMF, Inc., 782 F.2d 995, 1001 (Fed. Cir. 1986).

63 Brulotte v. Thys Co., 379 U.S. 29 (1964).

64 See Lasercomb Am., Inc. v. Reynolds, 911 F.2d 970 (4th Cir. 1990).