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Navigating the Patent Thicket: Cross Licenses, Patent Pools, and Standard Setting

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Executive Summary

In several key industries, including semiconductors, biotechnology, computer software, and the Internet, our patent system is creating a *patent thicket:* an overlapping set of patent rights requiring that those seeking to commercialize new technology obtain licenses from multiple patentees. The patent thicket is especially thorny when combined with the risk of holdup, namely the danger that new products will inadvertently infringe on patents issued after these products were designed. The need to navigate the patent thicket and holdup is especially pronounced in industries such as telecommunications and computing in which formal standard setting is a core part of bringing new technologies to market. Cross licenses and patent pools are two natural and effective methods used by market participants to cut through the patent thicket, but each involves some transaction costs. Antitrust law and enforcement, with its historical hostility to cooperation among horizontal rivals, can easily add to these transaction costs. Yet a few relatively simple principles, such as the desirability package licensing for *complementary* patents but not for *substitute* patents, can go a long way toward insuring that antitrust will help solve the problems caused by the patent thicket and by holdup rather than exacerbating them.

I. The Patent Thicket

Is our patent system slowing down the commercialization of new technologies?

The essence of science is cumulative investigation combined with hypothesis testing. The notion of cumulative innovation, each discovery building on many previous findings, is central to the scientific method. Indeed, no respectable scientist would fail to recognize and acknowledge the crucial role played by his or her predecessors in establishing a foundation from which progress could be made. As Sir

Isaac Newton put it, each scientist "stands on the shoulders of giants" to reach new heights.

Today, most basic and applied researchers are effectively standing on top of a huge pyramid, not just on one set of shoulders. Of course, a pyramid can rise to far greater heights than could any one person, especially if the foundation is strong and broad. But what happens if, in order to scale the pyramid and place a new block on the top, a researcher must gain the permission of each person who previously placed a block in the pyramid, perhaps paying a royalty or tax to gain such permission? Would this system of intellectual property rights slow down the construction of the pyramid or limit its height?

Clearly, pyramid building, namely research and development (R&D), is taking place at an impressive pace today, so there is no great cause for alarm, especially in the area of basic research where the "royalty" is often (but not always) nothing more than a citation. As we move from pure R to applied R and ultimately to D, however, one can fairly ask whether our legal and commercial institutions are in fact properly designed to promote rather than discourage the creation of products and services that draw on many strands of innovation and thus potentially require licenses from multiple patent holders. To complete the analogy, *blocking patents* play the role of the pyramid's building blocks.

Mixing metaphors, thoughtful observers are increasingly expressing concerns that our patent (and copyright) system is in fact creating a patent thicket, a dense web of overlapping intellectual property rights that a company must hack its way through in order to actually commercialize new technology. With cumulative innovation and multiple blocking patents, stronger patent rights can have the perverse effect of stifling, not encouraging, innovation.[1]

In fact, even while a consensus has emerged that innovation is the main driver of economic growth, we are witnessing somewhat of a backlash against the patent system as it is currently operating. Especially unpopular are patents on business methods, such as Priceline.com's patent on "buyer-driven conditional purchase offers" (asserted against Microsoft) or Amazon's patent on a one click online shopping system (asserted against Barnes & Noble). The Patent and Trademark Office (PTO) does indeed seem to have allowed a number of patents on ideas that would not appear offhand to meet the usual standards for novelty and nonobviousness, such as the patent held by Sightsound.com which reputedly covers "the sale of audio or video re-

cordings in download fashion over the Internet." Emboldened by a key appeals court decision in 1998 supporting a patent for a business method enabled by computer software, patent applications for computer-related business methods have jumped from about 1,000 in 1997 to over 2,500 in 1999. In an attempt to call a truce in what could otherwise prove to be a mutually destructive patent battle, Jeff Bezos, the Chairman of Amazon.com, recently suggested that patents on software and Internet business methods be limited to 3 or 5 years, rather than the usual 20 years from the date of application.[2]

But concerns about a patent thicket, and excessively loose standards at the PTO, are hardly confined to e-commerce and business method patents. For example, in the semiconductor industry, companies such as IBM, Intel, or Motorola find it all too easy to unintentionally infringe on a patent in designing a microprocessor, potentially exposing themselves to billions of dollars of liability and/or an injunction forcing them to cease production of key products.[3] So-called submarine patents, that take years if not decades to work their way through the Patent and Trademark Office, are another great source of anxiety, especially for large manufacturing firms. Plus, more and more companies are following the lead of Texas Instruments and engaging in patent mining, trying to get the most out of their patents by asserting them more aggressively than ever against possible infringing firms, even those who are not rivals. And considerable research shows that companies are increasingly inclined to seek patents, causing an increase in the propensity to patent, as well as an increase in the practice of defensive patenting.[4]

In short, our patent system, while surely a spur to innovation overall, is in danger of imposing an unnecessary drag on innovation by enabling multiple rights owners to "tax" new products, processes, and even business methods. The vast number of patents currently being issued creates a very real danger that a single product or service will infringe on many patents. Worse yet, many patents cover products or processes already being widely used when the patent is issued, making it harder for the companies actually building businesses and manufacturing products to invent around these patents. Add in the fact that a patent holder can seek injunctive relief, that is, can threaten to shut down the operations of the infringing company, and the possibility for holdup becomes all too real.

This paper takes as given the flood of patents currently being issued by the PTO, and assumes that these patents are indeed creating a

patent thicket in the sense that many new products would likely infringe on multiple patents. Remaining agnostic (but suspicious) about whether the PTO is too lax in granting patents (especially software patents), or whether the courts are too generous in upholding patents that are granted, I look at the business arrangements that are being used to cut through the patent thicket.

More specifically, I consider the evolving and growing role of *cross licenses* and *patent pools* to solve the complements problem that arises when multiple patent holders can potentially block a given product. I discuss specifically the *standard setting process,* that increasingly involves complex negotiations over patent rights and licensing terms. I also consider other ways in which companies resolve disputes over intellectual property, including acquisitions.

For each business practice, in addition to describing the economics underlying that practice and examples of its use, I consider whether antitrust limits are contributing to the problems caused by the patent system. Unfortunately, antitrust enforcement and antitrust law have a deep rooted suspicion of cooperative activities involving direct competitors. But such cooperation, in one form or another, may be precisely what is required to navigate the patent thicket. As a result, unless antitrust law and enforcement are quite sensitive to the problems posed by the patent thicket, they can have the perverse effect of slowing down the commercialization of new discoveries and ultimately retarding innovation, precisely the opposite of the intent of both the patent laws and the antitrust laws.

II. Market Responses to Overlapping Patents

The Economic Theory of Complements

The generic problem inherent in the patent thicket is well understood as a matter of economic theory, at least in its static version. Consider, for example, a company seeking to manufacture a new graphics chip for use in personal computers or video game consoles. (Substitute a biotech firm using patented tools for genetic engineering, or an e-commerce firm using patented business methods, if you would prefer.) Suppose that the company's preferred design for this chip is likely to infringe on a number of patents; the process manufacturing methods used to actually produce the chip infringe on a number of additional

patents. In order to produce the chip as designed, the company needs to obtain licenses from a number, call it N, of separate rights holders.

This situation is precisely the classic complements problem originally studied by Cournot in 1838. Cournot considered the problem faced by a manufacturer of brass who had to purchase two key inputs, copper and zinc, each controlled by a monopolist.[5] As Cournot demonstrated, the resulting price of brass was *higher* than would arise if a single firm controlled trade in both copper and zinc, and sold these inputs to a competitive brass industry (or made the brass itself). Worse yet, the combined profits of the producers were lower as well in the presence of complementary monopolies. So, the sad result of the balkanized rights to copper and zinc was to harm both consumers and producers.[6] The same applies today when multiple companies control blocking patents for a particular product, process, or business method.

How can the inefficiency associated with multiple blocking patents be eliminated? One natural and attractive solution is for the copper and zinc suppliers to join forces and offer their inputs for a single, package price to the brass industry. The two monopolist suppliers will find it in their joint interest to offer a package price that is less than these two components sold for when priced separately. The blocking patent version of this principle is that the rights holders will find it attractive to create a package license or patent pool, or in some situations to simply engage in cross licensing so they can each produce final products themselves.

The appendix offers a short, modern, and more general version of Cournot's theory of complements cast in terms of blocking patents. This basic theory of complements (used in fixed proportions) gives strong support for businesses to adopt, and for competition authorities to welcome, either cross licensees, package licenses, or patent pools to clear such blocking positions. If two patent holders are the only companies realistically capable of manufacturing products that utilize their intellectual property rights, a royalty-free cross license is ideal from the point of view of *ex post* competition. But *any* cross license is superior to a world in which the patents holders fail to cooperate, since neither could proceed with actual production and sale in that world without infringing on the other's patents. Alternatively, if the two patent holders see benefits from enabling many others to make products that utilize their intellectual property rights, a patent pool, under which all the blocking patents are licensed in a coordinated fashion as a package, can be an ideal outcome. The simple theory, which is sketched out in the

appendix, suggests that coordinating such licensing can lead to *lower* royalty rates than would independent pricing (licensing) of the two companies' patents.

In other words, without cross licenses or patent pools, there is a tendency for products to bear multiple patent burdens. The buildup of licensing fees can have several unattractive consequences. First, the well-known costs of static monopoly power are magnified: prices are well above marginal costs, causing inefficiently low use of these products. As shown in the appendix, with N rights holders, equilibrium markups are N times the monopoly level. Of course, this is merely a magnified version of the monopoly burden resulting from the patent system itself, but it is well to remember Cournot's lesson that the multiple burdens reduce both consumer welfare and the profits of patentees in comparison with a coordinated licensing approach. Second, these burdens may cause certain products not to be produced at all, if that production is subject to economies of scale. Third (this is a dynamic version of the previous point), the prospect of paying such royalties necessarily reduces the return to new product design and development, and thus can easily be a drag on innovation and commercialization of new technologies.

Heller and Eisenberg (1998) discuss the complements problem in the context of biotechnology patents, making a nice comparison to the classic tragedy of the commons. The well-known tragedy of the commons refers to the fact that a resource can be overused if it is not protected by property rights; fishing grounds and clean water are standard examples. Heller and Eisenberg point out that quite a different problem arises when there are multiple blocking patents; they label this problem the tragedy of the anti-commons. The tragedy of the anti-commons arises when there are multiple gatekeepers, each of whom must grant permission before a resource can be used. With such excessive property rights, the resource is likely to be underused. In the case of patents, innovation is stifled.

The Holdup Problem

As noted above, the complements problem is at its worst when the downstream firms using the various inputs truly require each input to make their products. In the patent context, if a manufacturer finds it relatively easy to design around a given patent, the royalties that the patentee can assert are necessarily limited. So, unless the patent in

question is quite broad, one might think that any burden on the manufacturer would be modest, and arguably the very return we wish to provide to the patentee as a reward for innovation.

Unfortunately, this rather romantic view of patents is less and less applicable in our economy, for three reasons. First, even a modest tax is counterproductive if the patent was improperly granted, that is, if the patentee did not truly made a new and useful discovery, or if the patent as granted was too broad, covering some prior art as well as something truly new. Second, the cumulative effect of many small taxes can become quite large; there are sound reasons to believe that the static deadweight loss associated with these royalties is increasing and convex in the tax rate, at least over some range of royalties. The danger of paying royalties to multiple patent owners is hardly a theoretical curiosity in industries such as semiconductors in which many thousands of patents are issued each year and manufacturers can potentially infringe on hundreds of patents with a single product.

Third, and most important, is timing. Suppose that our representative manufacturer could, with ease, invent around a given patent, if that manufacturer were aware of the patent and afforded sufficient lead time. Clearly, in this case the patented technology contributes little if anything to the final product, and any reasonable royalty would be modest at best. But, oh, how the situation changes if the manufacturer has already designed its product and placed it into large scale production before the patent issues. In this case, even though the timing is strongly suggestive that the manufacturer did not in fact rely on the patented invention for the design of its product, the manufacturer is in a far weaker negotiating position. The patentee can credibly seek far greater royalties, very likely backed up with the threat of shutting down the manufacturer if the Court indeed finds the patent valid and infringed and grants injunctive relief. The manufacturer *could* go back and redesign its product, but to do so (a) could well require a major redesign effort and/or cause a significant disruption to production, (b) would still leave potential liability for any products sold after the patent issued before the redesigned products are available for sale, and (c) could present compatibility problems with other products or between different versions of this product. In other words, for all of these reasons, the manufacturer is highly susceptible to holdup by the patentee. I submit that this holdup problem is very real today, and that both patent and antitrust policymakers should regard holdup as a problem of first order significance in the years ahead.

The holdup problem is worst in industries where hundreds if not thousands of patents, some already issued, others pending, can potentially read on a given product. In these industries, the danger that a manufacturer will step on a land mine is all too real. The result will be that some companies avoid the mine field altogether, that is, refrain from introducing certain products for fear of holdup. Other companies will lose their corporate legs, that is, will be forced to pay royalties on patents that they could easily have invented around at an earlier stage, had they merely been aware that such a patent either existed or was pending. Of course, ultimately the expected value of these royalties must be reflected in the price of final goods.

In short, with multiple overlapping patents, and under a system in which patent applications are secret and patents slow to issue (relative to the speed of new product introduction), we have a volatile mix of two powerful types of transaction costs that can burden innovation: (1) the complements problem, the solution of which requires coordination, perhaps large scale coordination; and (2) the holdup problem, which is quite resistant to solution in the absence of either (a) better information at an earlier stage about patents likely to issue, and/or (b) the ability of interested parties to challenge patents at the PTO before they have issued and are given some presumption of validity by the Courts.

Clearly, these concerns form the basis for a serious discussion about reform of the patent system.[7] However, my intention in this paper is to explore how private companies can best navigate the patent system we currently have, and how our antitrust laws can be enforced in a way that is sensitive to the transaction costs associated with our current patent system. I see relatively little that private companies can do to overcome the holdup problem without reform of the patent system itself. But there is quite a bit they can do to solve the complements problem, which itself is greatly exacerbated by the holdup problem.

Overlapping Patents and Business Strategy in Practice

To solve the complements problem generally, and to cut through the patent thicket specifically, requires coordination among rights holders. Such coordination itself faces two types of obstacles. First, there are inevitably coordination costs that must be overcome. Second, antitrust sensitivities are invariably heightened when companies in the same or related lines of business combine their assets, jointly set fees of any sort, or even talk directly with one another. Because such coordination

may involve the elimination of competition, we have a complex interaction between private and public interests. Even as coordination between rights holders is critical, from a public policy perspective we cannot presume that private deals are in the public interest. Antitrust authorities will legitimately want to know whether consumers are helped or harmed by any arrangement; injured parties may seek redress under the antitrust laws or by alleging patent misuse.

Cross Licenses Cross licenses commonly are negotiated when each of two companies has patents that may read on the other's products or processes. Rather than blocking each other and going to court or ceasing production, the two enter into a cross license. Especially with a royalty free cross license, each firm is then free to compete, both in designing its products without fear of infringement and in pricing its products without the burden of a per unit royalty due to the other. Thus, cross licenses can solve the complements problem, at least among two firms, and thus be highly procompetitive.

A cross license is simply an agreement between two companies that grants each the right to practice the other's patents. Cross licenses may or may not involve fixed fees or running royalties; running royalties can in principle run in one direction or both. Cross licenses may involve various field-of-use restrictions or geographic restrictions. Cross licenses may involve some but not all relevant patents held by either party; carve-outs are not uncommon. And cross licenses, like regular licenses, may be confined to patents issued (or pending) as of the date of the license, or they may include patents to be granted through a certain time in the future.

Patent Pools and Package Licenses When two or more companies control patents necessary to make a given product, and when at least some actual or potential manufacturers may not themselves hold any such patents, a patent pool or a package license can be the natural solution to the complements problem. Under a patent pool, an entire group of patents is licensed in a package, either by one of the patent holders or by a new entity established for this purpose, usually to anyone willing to pay the associated royalties. Under a package license, two or more patent holders agree to the terms on which they will jointly license their complementary patents and divide up the proceeds. A nice example of a patent pool is the Manufacturers Aircraft Association formed in 1917 to license a number of patents necessary for the production of

airplanes, patents controlled by The Wright-Martin Aircraft Corporation, the Curtiss Aeroplane & Motor Corporation, and others.[8] I discuss below some more recent patent pools that have been used to help establish compatibility standards.

Cooperative Standard Setting The need to solve the complements problem tends to be especially great in the context of standard setting. For example, when the International Telecommunications Union (ITU) establishes a new standard for fax transmissions or modem protocols, the participants are loath to agree to a standard that can be controlled by any single firm through its patents. Thus, standard setting organizations like the ITU or the American National Standards Institute (ANSI) typically require that participants agree to license all patents essential to compliance with any standard on "fair, reasonable, and nondiscriminatory" terms. Rules such as this are explicitly intended to reduce or eliminate any holdup problems. However, it is well to note that many standard setting organizations are wary of sanctioning any specific agreement regarding the magnitude of licensing terms for fear of antitrust liability, as such agreements might be construed as price fixing. Perversely, by leaving the precise licensing terms vague, this caution can in fact lead to ex post holdup by particular rights holders, contrary both to the goal of enabling innovation and to consumers' interests.

The case in which multiple firms control patents essential to a standard fits well with the formal economic analysis described above. In essence, any manufacturer seeking to produce a compliant product must obtain a license from each rights holder to avoid facing an infringement action. Inventing around is typically impractical, as it would preclude the manufacturer from claiming that its products are compliant and thus assuring consumers that they are fully compatible with the prevailing standard. Thus, standard setting very often has especially strong elements of both the complements problem and the holdup problem.

Settlements of Patent Disputes Cross licenses (or simply licenses) are a common way in which companies resolve patent disputes. But other forms of settlement arise, two of which I touch on below. First, I discuss acquisitions, in which one firm simply acquires the other, thereby resolving the dispute and assembling the various intellectual property rights within a single company. Second, I comment on cash payments in exchange for exit, a strategy whereby one company pays the other company to exit the market, and thus to drop its challenge to the first

company's patent. In each of these cases, legitimate questions arise as to whether any particular private agreement truly is in the public interest.

Antitrust Limits

As I have indicated, many of the business solutions to the complements problem and the holdup problem raise antitrust issues. Quite generally, agreements among companies that either do compete, or might compete, directly with each other raise antitrust warning flags. For each business form, I consider below its antitrust treatment.

Generally speaking, one can imagine two rather different approaches that antitrust might take to firms' efforts to coordinate to solve the complements problem. One approach is to ask whether the agreement in question leads to more competition than would occur *without* that agreement. This is the approach advocated in the Department of Justice and Federal Trade Commission *Antitrust Guidelines for the Licensing of Intellectual Property,* which state in §3.1 that:

> However, antitrust concerns may arise when a licensing arrangement harms competition among entities that would have been actual or likely potential competitors in a relevant market in the absence of the license (entities in a "horizontal relationship").

Another quite different approach would be to ask whether the agreement in question is the most competitive agreement possible. Put differently, one could ask whether a given agreement is the least restrictive alternative that is workable in the sense of solving the legitimate business problem faced, such as unblocking patent positions. Clearly, this latter standard, which does not reflect current antitrust enforcement policy according to the Guidelines, would be far tougher on all forms of cooperation among patent and copyright holders.

III. Cross Licensing

Cross Licenses and Design Freedom

Cross licenses are the preferred means by which large companies clear blocking patent positions amongst themselves. Based in part on work I have done on behalf of Intel, I can report that broad cross licenses are the norm in markets for the design and manufacture of microprocessors.[9] For example, Intel has entered into a number of broad cross

licenses with other major industry participants, such as IBM, under which most of each company's vast patent portfolio is licensed to the other. Furthermore, the companies generally agree to grant licenses to each other for patents that will be issued several years into the future, typically for the lifetime of the cross licensing agreement. Often, these cross licenses involve no running royalties, although they may involve balancing payments at the outset to reflect differences in the strength of the two companies' patent portfolios as reflected in a patent pageant, and/or the vulnerability of each to an infringement action by the other. For example, Hewlett-Packard and Xerox recently announced a cross license that settled their outstanding patent disputes.

From the perspective of competition policy, cross licenses of this sort are quite attractive. The traditional concern with cross licenses among competitors is that running royalties will be used as a device to elevate prices and effect a cartel; see Katz and Shapiro 1985. Clearly, such concerns do not apply to licenses that involve small or no running royalties, but rather have fixed up-front payments. Another concern is that the granting of licenses to *future* patents will reduce each company's incentive to innovate because its rival will be able to imitate its improvements.[10] While correct in theory, it is clear, at least in the case of semiconductors and no doubt more widely, that this concern is dwarfed by the benefits arising when each firm enjoys enhanced design freedom by virtue of its access to the other firm's patent portfolio. There is little doubt that these broad cross licenses permit the more efficient use of engineers (arguably the resource that governs the rate of innovation in the semiconductor industry), better products, and faster product design cycles. In other words, when IBM and Intel sign a forward looking cross license, each is enabled to innovate more quickly and more effectively without fear that the other will hold it up by asserting a patent that it has unintentionally infringed. And neither firm is really all that worried that the other will actually *copy* its products, just because the other has a license to most of its patents. Of course, the impressive rate of innovation in the semiconductor industry in the presence of a web of such cross licenses offers direct empirical support for the view that these cross licenses promote rather than stifle innovation.

Intel's Policy of "IP for IP"

Despite all of these benefits, the Federal Trade Commission attacked Intel's cross licensing practices in 1998.[11] One key episode behind the

FTC's complaint involved Intel's conduct when faced with a lawsuit by Intergraph, a workstation manufacturer, asserting that Intel's microprocessors infringed on certain patents held by Intergraph. Of course, lawsuits like Intergraph's are a necessary part of the threat point behind any cross-licensing negotiation: if one party is not happy with the terms offered by the other, it always has the option of initiating patent litigation. In response to Intergraph's infringement action against Intel, Intel withdrew its own intellectual property from Intergraph by suing Intergraph for infringement of Intel's patents and by withdrawing the supply of Intel trade secrets to Intergraph, trade secrets that Intergraph valued highly for the purposes of designing systems built on Intel chips.

Evidently viewing Intel's conduct as unfair, the FTC attempted to fashion an antitrust case against Intel based on this conduct, along with a similar response by Intel to a lawsuit initiated by Digital Equipment Corporation.[12] The FTC action against Intel sharply exposed the fact that the FTC and Intel had fundamentally different views about the impact of the conduct at issue. The FTC saw Intel as using its existing monopoly power to fortify its position by lowering its royalty costs per chip and potentially offering superior products by incorporating technologies patented by others. Intel viewed itself as engaging in a defensive exercise which was a necessary aspect of cross licensing, namely trading intellectual property for intellectual property (IP for IP) and withdrawing its own intellectual property when faced with a frontal assault on its core product line in the form of an infringement action seeking injunctive relief. Intel, well aware of what a juicy target it posed, believed it had every right to protect itself from holdup, and certainly no duty to give special treatment in the form of Intel trade secrets and advance product samples to a company attempting to hold it up.

The problem for the FTC was that the conduct at issue, especially with respect to Intergraph, was directed at a *customer* of Intel's, not a competitor. Brushing aside concerns about holdup, and playing down the important role of cross licenses in the semiconductor industry, the FTC found no "business justification" for Intel's conduct, and thus was prepared to presume that the conduct was anticompetitive without actually studying the impact of the conduct on Intel's competitors. In fact, Intel's true rivals in microprocessor design and manufacturing (such as AMD, Motorola, Sun, or IBM) were either not subject to the conduct at issue (since they were not Intel customers at all and thus not recipients of the Intel trade secrets at issue), or had ongoing cross

licenses with Intel under which the litigation triggering these episodes would simply not occur in the first place.

Fortunately, a compromise was reached and a settlement agreed to between the FTC and Intel.[13] In essence, Intel agreed not to withdraw product information needed by its customers to build systems based on soon-to-be-released Intel chips. (Presumably, this promise provides some benefit to Intel by assuring its customers that *they* will not be held up once they are relying on Intel for their new systems.) But Intel is not obligated to continue to provide trade secrets on products farther out on their roadmap (i.e., products that will not be introduced for a year or two) to customers suing Intel, and Intel was not obligated to provide *any* trade secrets to a company suing Intel and seeking a court injunction to shut down Intel's microprocessor business.

The Intel situation also exposes the interplay between government enforcement of the antitrust laws and private antitrust actions. Even while the FTC was investigating Intel, bringing a complaint against Intel, and ultimately settling with Intel, Intergraph was engaged in its own antitrust and patent battle with Intel. Intergraph won a resounding victory in the first round of that battle, in which the District Court judge in Alabama issued a searing anti-Intel opinion ruling, among other things, that Intel's microprocessors and associated trade secrets were "essential facilities" under antitrust laws, thus imposing a duty on Intel to sell its microprocessors to Intergraph and to make its trade secrets available to Intergraph, Intergraph's lawsuit against Intel notwithstanding. This opinion was based on strands of antitrust law that require dominant companies to deal with their rivals, especially if the dominant firm has established an ongoing course of dealing with rivals in the past.[14]

Ultimately, however, Intel was vindicated. The District Court judge later ruled that Intel was not in fact infringing on Intergraph's patents. And, most significantly, the Court of Appeals for the Federal Circuit vacated the District Court's antitrust and essential facility opinion.[15] In a strongly worded and sweeping opinion, the appeals court ruled that Intel's conduct did not violate the antitrust laws because it was not directed at a competitor and indeed could have no adverse impact on competition in the market where Intel was alleged to have monopoly power, namely the market for microprocessors, in which Intergraph did not compete. The FTC's efforts to fashion an antitrust case out of Intel's conduct look even more dubious now in the light of this subsequent decision by the Court of Appeals.

The Intel episode is closely related to another ongoing debate regarding the intersection between intellectual property rights and antitrust law: can a company violate the antitrust laws simply by refusing to license its patents, or by refusing to sell patented items, to its rivals? Most commentators have said for some time that a refusal to license patents cannot in and of itself constitute an antitrust violation. However, the Supreme Court has signaled that unilateral refusals to sell can indeed constitute antitrust violations, especially if a company has established an ongoing course of dealing with its rivals.[16] The precise conditions under which a refusal to license a patent (or to sell patented items) could constitute an antitrust violation has remained unclear. Most observers were stunned when the Ninth Circuit Court of Appeals ruled in 1997 that Kodak was liable for refusing to sell patented spare parts for its machines to independent service organizations seeking to compete against Kodak in the business of servicing Kodak copiers and micrographics equipment. As the Court acknowledged, this was the first time a unilateral refusal to sell a patented item had been judged to be an antitrust violation.[17] Just recently, the Court of Appeals for the Federal Circuit came to a very different conclusion, ruling that a company's unilateral decision not to license a patent (or sell a patented item) could *never* in and of itself constitute an antitrust violation.[18] Hopefully, the Supreme Court will resolve this significant split among the Circuit Courts and clarify that unilateral refusals to license patents are immune from antitrust challenge.

Intel's practices, and those of other firms who require grantbacks of relevant patents in exchange for a license to key enabling patents, copyrights, or trade secrets, raises further interesting questions about the role of self help in the digital economy.[19] One view of such business strategies cum legal regimes is that they are a welcome effort by leading firms to establish a type of litigation-free zone likely to favor innovation and get around some of the current difficulties with our patent system and the patent thicket it causes. A less favorable view is that these arrangements represent efforts by powerful firms to establish private legal regimes that favor themselves and make it more difficult for upstarts to challenge the dominance of current market leaders. Is a cross licensing policy of IP for IP a beneficial way to cut through the patent thicket, or a strong-arm tactic by a dominant firm that enjoys powerful patent rights and seeks access to others' intellectual property in exchange?

IV. Patent Pools

A patent pool involves a single entity (either a new entity or one of the original patent holders) that licenses the patents of two or more companies to third parties as a package. In many respects, a patent pool (much like a package license) is the purest solution to the complements problem described above and analyzed in the appendix. Indeed, licensees may well welcome such a pool, both for the convenience of one-stop shopping and because a subset of the required patents may be of little or no value by themselves. Thus, from the licensee's perspective, licensing the entire package is simpler and avoids the danger of paying for some patent rights that turn out to be useless without other complementary rights.

Essential Patents vs. Rival Patents

The Department of Justice (DOJ) has clearly articulated its policy toward patent pools/package licensing in a trio of business review letters regarding an MPEG patent pool and two DVD patent pools. The essence of this approach, which precisely mirrors the economic principles articulated above, is that inclusion of truly *complementary* patents in a patent pool is desirable and procompetitive, but assembly of *substitute* or rival patents in a pool can eliminate competition and lead to elevated license fees. But differently, the key distinction in forming a patent pool is that between *blocking* or *essential* patents, which properly belong in the pool, and *substitute* or *rival* patents, which may need to remain separate.

In the MPEG case,[20] the Department approved the creation of a pool of patents necessary to enable manufacturers to meet the MPEG-2 video compression technology. This pool, encompassing patents from Fujitsu, General Instrument, Lucent, Matsushita, Mitsubishi, Philips, Scientific-Atlanta, Sony, and Columbia University, permits one-stop shopping for makers of televisions, digital video disks and players, and telecommunications equipment as well as cable, satellite, and broadcast television services. To support their formation of a patent pool, these nine patent holders conducted an extensive search to identify all patents essential to the MPEG-2 standard and include them in the pool. The licensing agent for the pool, MPEG LA, will employ an independent patent expert to determine whether a patent in the pool is in fact

essential, and whether other patents as well are essential and thus suitable for inclusion in the pool. As stated by the Department, "the use of the independent-expert mechanism will help ensure that the portfolio will contain only patents that are truly essential to the MPEG-2 standard, weeding out patents that are competitive alternatives to each other."

In the first Digital Versatile Disk (DVD) case,[21] the Department approved a proposal by Philips, Sony, and Pioneer to jointly license patents necessary to make discs and players that comply with the DVD-Video and DVD-ROM standards. Again, only essential patents are to be included in the joint licensing program. As with the earlier CD licensing program of Sony and Philips, licenses will be offered by Philips, in this case on behalf of all three firms. Again, an independent patent expert will be employed to ensure that the license only conveys the rights to essential patents. As stated by the Department, "the expert will help ensure that the patent pool does not combine patents that would otherwise be competing with each other." The Department subsequently approved a second joint licensing scheme relating to the DVD-Video and DVD-ROM standards,[22] this one including patents held by Toshiba (the licensing entity), Hitachi, Matsushita, Mitsubishi, Time Warner, and Victor Company of Japan. Note that the effect of these two patent pools appears to be to reduce but not eliminate the complements problem, since there remain two separate pools, not just one: two-stop shopping, it would appear.

A Patent Pool Created to Resolve Claims of Blocking Patents

In contrast to the Department of Justice's approval of these three patent pools, the Federal Trade Commission in March 1998 challenged a patent pool formed by Summit Technology, Inc. and VisX, Inc., two firms that manufacture and market lasers to perform a new, and increasingly popular, vision correcting eye surgery, photorefractive keratectomy.[23] According to the FTC: "Instead of competing with each other, the firms placed their competing patents in a patent pool and share the proceeds each and every time a Summit or VISX laser is used." The FTC was ostensibly following the same principles employed by the Justice Department, namely to permit the assembly of complementary or essential patents, but not rival patents, into a pool. According to the FTC, the two companies agreed not to license their patents independently.

However, the companies in this case argued vigorously that they did indeed have mutually blocking patents, making their pool, Pillar Point Partners, procompetitive. In August 1998 the two companies settled with the FTC and agreed to lift any restrictions on each other regarding the licensing of their patents; ultimately, their patent pool was dissolved.[24]

The Summit and VisX case raises a number of very interesting and tricky issues regarding patent pools and joint licensing programs in general. First, if two companies reasonably believed that their patents blocked each other at the time they formed the pool, was that sufficient to justify the formation of a pool? How hard are they required to look into the validity of each other's claims before agreeing to pool their patents? Second, if each firm believed it could, at considerable expense, delay, and risk, invent around the other's patents, should the two firms be prohibited from forming a pool and rather forced to attempt to invent around each other's patents, under the view that consumers *might* thereby enjoy the benefits of direct competition (although the product might be delayed, or never introduced, in the absence of the pool)? Third, is there competitive harm in placing some potentially rival patents into the pool, assuming that each party in fact controls valid blocking patents, making *some* type of pool procompetitive? Fourth, can the pool be attacked on antitrust grounds based on the argument that a less restrictive alternative, namely a cross license, would have achieved the same legitimate purposes and created additional *ex post* competition? If so, does it matter in this assessment if the two companies agree that the pool will license their patents to third parties, something that a cross license would not permit, unless it contained rather unusual sublicensing rights?

V. Cooperative Standard Setting

Blocking patents are especially common in the context of standard setting: once a standard is picked, any patents (or copyrights) necessary to comply with that standard become truly essential. If the standard becomes popular, each such patent can confer significant market power on its owner, and the standard itself is subject to holdup if these patent holders are not somehow obligated to license their patents on reasonable terms. As noted above, for precisely this reason, standard setting bodies require participants to license any essential patents on reasonable terms as a quid pro quo before adopting any standards.[25]

Fortunately, antitrust concerns have not prevented a great many cooperative standard setting efforts from proceeding forward. Some participants go so far as to say that much of the innovation taking place now in the telecommunications, Internet, and computer areas is standards based. Indeed, even the fiercest enemies often team up in the software industry to promote new standards. Back in 1997, Microsoft and Netscape, two companies hardly known as cozy partners, agreed to include compatible versions of Virtual Reality Modeling Language (developed by Silicon Graphics) in their browsers. This agreement was expected to make it far easier for consumers to view 3D images on the Web. Earlier, Microsoft agreed to support the Open Profiling Standard, which permits users of personal computers to control what personal information is disclosed to a particular web site, and which had previously been advanced by Netscape, along with Firefly Network, Inc. and Verisign Inc.

But neither is cooperative standard setting immune from antitrust scrutiny. In the consumer electronics area, for example, the Justice Department investigated Sony, Philips, and others regarding the establishment of the CD standard in the 1980s. Cooperative efforts to set optical disc standards have also been challenged in private antitrust cases, on the theory that agreements to adhere to a standard are an unreasonable restraint of trade:

> [d]efendants have agreed, combined, and conspired to eliminate competition . . . by agreeing not to compete in the design of formats for compact discs and compact disc players, and by instead agreeing to establish, and establishing, a common format and design . . .[26]

Does cooperation lead to efficient standardization, increased competition, and additional consumer benefits? Or is cooperative standard setting a means for firms collectively to stifle competition, to the detriment of consumers and firms not included in the standard setting group? Answering these questions and evaluating the limits that should be placed on cooperative standard setting efforts require an analysis of the competitive effects of such cooperation in comparison with some reasonable but-for world. Inevitably, an antitrust analysis of cooperative standard setting involves an assessment of how the market would likely evolve *without* the cooperation. One possibility is that multiple, incompatible products would prevail in the market, if not for the cooperation. Another possibility is that the market would eventually tip to a single product, even without cooperation. Even in this

latter case, an initial industrywide standard can have significant efficiency and welfare consequences, for three reasons: (1) cooperation may lock in a different product design than would emerge from competition; (2) cooperation may eliminate a standards war waged prior to tipping; and (3) cooperation is likely to enable multiple firms to supply the industry standard product, whereas a standards war may lead to a single, proprietary product.

The Costs and Benefits of Compatibility and Standards

There are significant benefits associated with achieving compatibility. These include:

- successful launching of a bandwagon or network,
- greater realization of network effects,
- protecting buyers from stranding, and
- enabling competition within an open standard.

Likewise, standardization and compatibility can impose very real costs on consumers:

- constraints on variety and innovation,
- loss of ex ante competition to win the market, and
- proprietary control over a closed standard.

Legal Treatment of Cooperative Standard Setting

I now look more closely at the intellectual property issues that arise specifically in the context of standard setting, where the participants typically agree to license their patents on fair, reasonable, and nondiscriminatory terms.

Firms are sometimes accused of hiding intellectual property rights until after the proprietary technology has been embedded in a formal standard. I view this issue primarily as one of contract law. Standard setting groups typically have provisions in their charters compelling participants either to reveal all relevant intellectual property rights or to commit to licensing any intellectual property rights embedded in the standard on reasonable terms.[27] Clearly, these rules help control the holdup problem. In some cases, however, the precise requirements imposed by a standard setting group may be unclear. In these circumstances, if the standard affects nonparticipants, including consumers,

there is a public interest in clarifying the duties imposed on participants in a fashion that promotes rather than stifles competition.

The question of whether firms should be allowed, or even encouraged, to set standards cooperatively is part of the broader issue of collaboration among competitors, a storied area within antitrust law. Most of the case law deals with quality and performance standards rather than compatibility standards.[28] Existing cases also have tended to focus on the standard setting process itself, rather than the outcomes of cooperative standard setting.

Antitrust liability has been found for participants in a standard setting process who abuse that process to exclude competitors from the market. One leading case is *Allied Tube & Conduit Corp. v. Indian Head, Inc.*, 486 U.S. 492 (1988), in which the Supreme Court affirmed a jury verdict against a group of manufacturers of steel conduit for electrical cable. These manufacturers conspired to block an amendment of the National Electric Code that would have permitted the use of plastic conduit. They achieved this by packing the annual meeting of the National Fire Protection Association, whose model code is widely adopted by state and local governments. The other leading case is *American Society of Mechanical Engineers v. Hydrolevel Corp.*, 456 U.S. 556 (1982), in which the Supreme Court affirmed an antitrust judgment against a trade association. In this case, the chairman of an association subcommittee offered an unofficial ruling that the plaintiff's product was unsafe, and this ruling was used by the plaintiff's rival (who enjoyed representation on the subcommittee) to discourage customers from buying the plaintiff's product.

Antitrust risks associated with excluding a rival from the market appear to be less of a problem for an open standard, but could arise if the companies promoting the standard block others from adhering to the standard or seek royalties from outsiders. The DOJ business review letters regarding the MPEG-2, DVD-Video, and DVD-ROM standards are excellent illustrations of how the enforcement agencies can successfully handle intellectual property in the standard setting context.

As the Supreme Court has noted, "Agreement on a product standard is, after all, implicitly an agreement not to manufacture, distribute, or purchase certain types of products."[29] To date, this type of reasoning has not been used to impose per se liability on software standard setting activities. Indeed, I know of no successful antitrust challenges to cooperation to set compatibility standards. The closest case of which I am aware is *Addamax Corporation v. Open Software Foundation, Inc.*,

888 F. Supp. 274 (1995). In *Addamax,* the District Court refused to grant summary judgment on behalf of the Open Software Foundation, an industry consortium formed to develop a platform-independent version of the UNIX operating system. OSF conducted a bidding to select a supplier of security software. After failing to be selected, Addamax brought antitrust claims against OSF, Hewlett-Packard, and Digital Equipment Corporation, asserting that OSF had chosen the winner not based on the merits but to favor specific companies and technologies. The Addamax case looks problematic, inasmuch as the primary purpose of OSF was to permit its members to team up to offer stronger competition against the leading UNIX vendors, Sun Microsystems and AT&T, and there was no evidence suggesting that OSF's failure to pick Addamax was based on its members desire to control the market in which Addamax itself operated.

Ultimately, the antitrust risks faced by companies that are trying to set compatibility standards appear to be relatively minor as long as the scope of the agreement truly is limited to standard setting and steers clear of distribution, marketing, and pricing. While the law has typically looked for integration and risk-sharing among collaborators in order to classify cooperation as a joint venture and escape per se condemnation, these are not very helpful screens for standard setting activities. The essence of cooperative standard setting is not the sharing of risks associated with specific investments, or the integration of operations, but rather the contribution of complementary intellectual property rights and the expression of unified support to ignite positive feedback for a new technology.

The limits imposed by public policy in the area of compatibility standards remain unclear. The most specific statement by the antitrust enforcement agencies can be found in a recent FTC Staff Report.[30] The Staff Report recognized a need for clarification in this area:

> the time has come for a significant effort to rationalize, simplify, and articulate in one document the antitrust standards that federal enforcers will apply in assessing collaborations among competitors. This effort should be directed at drafting and promulgating "competitor collaboration guidelines" that would be applicable to a wide variety of industry settings and flexible enough to apply sensibly as industries continue rapidly to innovate and evolve.[31]

Since that call for action, the FTC has conducted Joint Venture Hearings, and the Commission and the Antitrust Division issued in

April 2000 new "Antitrust Guidelines for Collaborations Among Competitors" (available at either Agency's web site).

Hidden Patents and Holdup in Standard Setting

A number of disputes have surfaced recently that illustrate the thorny problems associated with hidden patent rights that were later exerted against established standards.[32]

Dell Computer and the VESA VL-Bus Standard The leading U.S. example of this type of antitrust action is the FTC's consent agreement with Dell Computer Corporation, announced in November 1995. Although the case involved computer hardware, it is important for the software community as well. The assertion was that Dell threatened to exercise undisclosed patent rights against computer companies adopting the VL-bus standard, a mechanism to transfer data instructions between the computer's CPU and its peripherals such as the hard disk drive or the display screen. The VL-bus was used in 486 chips, but it has now been supplanted by the PCI bus. According to the FTC.

> During the standard-setting process, VESA [Video Electronics Standard Association] asked its members to certify whether they had any patents, trademarks, or copyrights that conflicted with the proposed VL-bus standard; Dell certified that it had no such intellectual property rights. After VESA adopted the standard—based in part, on Dell's certification—Dell sought to enforce its patent against firms planning to follow the standard.[33]

There are two controversial issues surrounding this consent decree: (a) the FTC did not assert that Dell acquired market power, and indeed the VL-bus never was successful; and (b) the FTC did not assert that Dell *intentionally* misled VESA. My analysis suggests that anticompetitive harm is unlikely to arise in the absence of significant market power and that the competitive effects are not dependent on Dell's intentions.

Motorola and the ITU V.34 Modem Standard Another good example of how competition can be affected when standard setting organizations impose ambiguous duties on participants is the case of Motorola and the V.34 modem standard adopted by the International Telecommunications Union. Motorola agreed to license its patents essential to the standard case to all comers on "fair, reasonable, and nondiscriminatory

terms."[34] Once the standard was in place, Motorola then made offers that some industry participants did not regard as meeting this obligation. Litigation ensued between Rockwell and Motorola, in part over the question of whether reasonable terms should mean: (a) the terms that Motorola could have obtained ex ante, in competition with other technology that could have been placed in the standard; or (b) the terms that Motorola could extract ex post, given that the standard is set and Motorola's patents are essential to that standard.

These issues are best dealt with by the standard setting bodies, or standard setting participants, either by making more explicit the duties imposed on participants, or by encouraging ex ante competition among different holders of intellectual property rights to get their property into the standard. Unfortunately, antitrust concerns have led at least some of these bodies to steer clear of such ex ante competition, on the grounds that their job is merely to set technical standards, not to get involved in prices, including the terms on which intellectual property will be made available to other participants. The ironic result has been to embolden some companies to seek substantial royalties after participating in formal standard setting activities.

VI. Settlements of Patent Disputes

Cross licenses and patent pools can be ways to settle intellectual property disputes. For example, the Summit and VisX patent pool discussed above, Pillar Point Partners, was essentially a settlement of a patent dispute between Summit and VisX.

Generally speaking, antitrust authorities have legitimate concerns that parties will settle their intellectual property disputes in ways that stifle competition. As a matter of economic theory, there is no reason to expect the two parties' collective interests in settlement, and especially in the *form* of any settlement they adopt, to coincide with the public interest, which includes consumer interests. So, while the law surely welcomes the settlement of disputes generally, and does not seek to force parties to litigate to the death, some settlements can be anticompetitive. Based on this general view, Assistant Attorney General for Antitrust Joel Klein recently suggested (see Klein 1997) that parties notify the Justice Department of certain settlements that they enter into, much as parties are required to notify the Justice Department and the FTC in advance of their intention to merge.

Firms are quite creative in crafting settlements of intellectual property disputes, and by no means restrict their attention to cross licenses and patent pools. For example, one tried and true method of settling a dispute is for the companies involved simply to merge. However, the antitrust authorities are well aware that such mergers can themselves eliminate competition, and they will view such mergers with skepticism if there is a good chance that the two parties will in fact be capable of competing against each other, their patent claims notwithstanding. A good example of such a merger that was modified in response to FTC concerns was the proposed merger of Boston Scientific and CVIS in the area of imaging catheters.[35] An interesting twist in such cases is that the parties' posturing in court, where they each have an incentive to assert that they are not infringing on the other's patents, provides direct ammunition to the FTC or DOJ to assert that the two companies could indeed compete independently if not for the merger.

A second method that companies can use to settle a patent dispute is for one company to simply pay the other company to drop its claims and exit the market. Such agreements raise obvious antitrust concerns, because an incumbent firm may be willing to pay handsomely to eliminate a potential competitor and avoid the risk of having its patent challenged, especially if no equally effective challenger is likely to arrive on the scene any time soon. The losers in such deals can easily be subsequent would-be entrants (if the patent were struck down) or consumers (who would benefit from a finding that the patent at issue is invalid or not infringed). Put differently, a settlement can generate negative externalities, either to other firms or to consumers, and thus there is a legitimate role of the Courts and the antitrust enforcement agencies to oversee such settlements.

One class of settlements that are suspicious on their face is that involving agreements between incumbent manufacturers of branded pharmaceuticals and would-be rivals who seek to offer generic competition by challenging the validity of the patents underlying the branded product's dominant position. It has been reported recently that the FTC is considering challenging several such settlements.[36] These cases have an interesting twist resulting from the fact that certain generic manufacturers can gain preferential rights to enter the market before others are permitted to do so. As a result, the branded manufacturer may be able to stall competition by entering into a suitable agreement with the uniquely-placed generic manufacturer, knowing that

subsequent rivals will face some delay. In order to identify and prevent any anticompetitive agreements of this nature, the FTC has asked that the FDA require companies to notify the FDA of any such settlements and make that information available to the FTC for its review.

VII. Conclusions

Our current patent system is causing a potentially dangerous situation in several fields, including biotechnology, semiconductors, computer software, and e-commerce, in which a would-be entrepreneur or innovator may face a barrage of infringement actions that it must overcome to bring its product or service to market. In other words, we are in danger of creating significant transaction costs for those seeking to commercialize new technology based on multiple patents, overlapping rights, and holdup problems. Under these circumstances, it is fair to ask whether the pendulum has swung too far in the direction of strong patent rights, ranging from the standards used at the Patent and Trademark Office for approving patent applications, to the secrecy of such applications, to the presumption afforded by the courts to patent validity, to the right of patent holders to seek injunctive relief by insisting that infringing firms cease production of the offending products.

Under these circumstances, we can ill afford to further raise transaction costs by making it difficult for patentees possessing complementary and potentially blocking patents to coordinate to engage in cross licensing, package licensing, or to form patent pools. Yet antitrust law can potentially play such a counterproductive role, especially since antitrust jurisprudence starts with a hostility toward cooperation among horizontal rivals.

So far, the Department of Justice has displayed a keen understanding of the need for those holding complementary rights to coordinate in the licensing of those rights, but the Federal Trade Commission has exhibited less restraint, and arguably is making it more difficult for firms to engage in cross licenses, to offer package licenses, or to form procompetitive patent pools. Many of these issues are likely to be extremely important in the near future, especially with the rise of standard setting as an essential part of the process by which new technologies are commercialized.

Notes

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1. For example, in 1995 Joseph Stiglitz, then Chairman of the Council of Economic Advisors, stated at the opening of the Federal Trade Commission's hearings on Competition Policy in the New High-Tech, Global Marketplace, that "some people jump . . . to the conclusion that the broader the patent rights are, the better it is for innovation, and that isn't always correct, because we have an innovation system in which one innovation builds on another. If you get monopoly rights down at the bottom, you may stifle competition that uses those patents later on and so . . . the breadth and utilization of patent rights can be used not only to stifle competition, but also have adverse effects in the long run on innovation." See FTC Staff Report, p. 6.

2. See http://www.amazon.com/exec/obidos/subst/misc/patents.html/103-4266077-5496631.

3. Nearly 5,000 patents were granted in the U.S. in a recent single year, 1998, relating to microprocessors alone, not to mention semiconductors more broadly.

4. See, for example, Kortum and Lerner 1998, Cohen et al. 2000, and Hall and Ham 1999.

5. For a brief description of Cournot's original work on complements, and modern extensions, see Shapiro 1989, p. 339.

6. Cournot assumed that the two inputs, copper and zinc, were required in certain fixed proportions for the production of brass. If one input can be substituted for the other, they have properties of *substitutes* as well as *complements*, in which case competition between the two input owners can go far to solving the problem posed here. Throughout this paper, I am assuming that the company in question requires rights to practice each of several patents, and that one patent license cannot substitute for another. Clearly, to the extent that a manufacturer, for example, can rely on multiple designs or production processes covered by separate patents with separate owners, the patent thicket is far less of a problem. But even in this relatively friendly setting, extra difficulties can still be raised by the holdup problem, discussed below.

7. For a thoughtful discussion of possible reforms at the Patent and Trademark Office, see Merges 1999.

8. See Klein 1997 for a further description of this pool and how it operated. In this case, the Assistant Secretary of the Navy, Franklin D. Roosevelt, had to lean on the industry to form a pool and help enable wartime production of aircraft.

9. See Hall and Ham 1999 and Grindley and Teece 1997 for additional studies of licensing practices in the semiconductor industry.

10. This concern about discouraging innovation also arises with respect to grantbacks, under which one company agrees to license its future patents in exchange for rights to use an existing patent held by another company. See Gilbert and Shapiro 1997 for a further discussion of grantbacks.

11. In the matter of *Intel Corporation*, Docket No. 9288, Complaint filed June 8, 1998. The

Complaint is available at http://www.ftc.gov/os/1998/9806/intelfin.cmp.htm. I was retained by Intel to work on this matter.

12. For one well-informed articulation of the theory underlying the FTC's position, see Baker 1999.

13. For more information on the settlement between the FTC and Intel, see http://www.ftc.gov/os/1999/9903/d09288intelagreement.htm.

14. The key recent Supreme Court case here is *Aspen Skiing Company v. Aspen Highlands Skiing Corp.*, 472 U.S. 585 (1985), although the essential facilities doctrine goes back to the case of *U.S. v. Terminal Railroad Association of St. Louis*, 224 U.S. 383 (1912).

15. *Intergraph Corporation v. Intel Corporation*, United States Court of Appeals for the Federal Circuit, 98-1308, Decided November 5, 1999, Judge Newman writing the opinion for the Court.

16. The classic cites are *Otter Tail Power Co. v. U.S.*, 410 U.S. 366 (1973) (duty to sell wholesale electric power to a retail competitor) and *Aspen Skiing Company v. Aspen Highlands Skiing Corp.*, 472 U.S. 585 (1985), (duty to continue to offer a joint lift ticket with a rival ski slope).

17. The Court set up a tortured standard under which a company's decision to refuse to license its patent was "presumptively valid," but could be overcome by evidence that the company's *intent* was anticompetitive. Of course, asserting intellectual property rights against a would-be rival is typically anticompetitive in the sense of trying to eliminate a competitor (or at least earn royalties from the competitor, which add to the competitor's costs), so this test is not in fact workable. Amazingly, the Court said that Kodak would be justified in refusing to sell patented parts if its intent was to earn a return on its R&D investment required to design and manufacture those parts, but not if its intent was to eliminate competitors who rely on those very patented parts. I testified on behalf of Kodak in this case.

18. United States Court of Appeals for the Federal Circuit, 99-1323, *In Re Independent Service Organizations Antitrust Litigation, CSU, et. al. v. Xerox Corporation*, Decided February 17, 2000, Judge Mayer writing the opinion.

19. For a discussion of self help focusing on copyright holders, see Dam 1998.

20. See the June 26, 1997 press release at http://www.usdoj/gov/atr/public/press_releases/1997/1173.htm.

21. See the December 17, 1998 press release at http://www.usdoj.gov/atr/public/press_releases/1998/2120.htm.

22. See the June 10, 1999 business review letter at http://www.usdoj.gov/atr/public/press_releases/1999/2484.htm.

23. See the March 24, 1998 press release at http://www.ftc.gov/opa/1998/9803/eye.htm.

24. For a description of the settlement, see the August 21, 1998 press release at http://www.ftc.gov/opa/1998/9808/sumvisx.htm. Despite this settlement, the FTC continued to pursue VisX for allegedly acquiring a key patent by inequitable conduct and fraud by omission on the U.S. Patent and Trademark Office. However, an administrative law judge subsequently dismissed this complaint; see the June 4, 1999 press release at http://www.ftc.gov/opa/1999/9906/visx.htm.

25. Note that these rules can create the perverse incentive for patent holders to assert that at least some of their patents are not in fact essential, but perhaps merely extremely helpful, in complying with the standard. By this device, a patent holder can in principle either refuse to license its patent to others (especially once the standard has become established, and perhaps for a patent that issued after the standard is established) or seek something more than fair and reasonable royalties. Of course, whether the terms fair and reasonable are evaluated on an ex ante or ex post basis is not precisely clear, although the terms would have little force if applied only on an ex post basis.

26. "Second Amended Complaint," *Disctronics Texas, Inc., et al. v. Pioneer Electronic Corp. et al.* Eastern District of Texas, Case No. 4:95 CV 229, filed August 2, 1996 at 12.

27. Note that a company might profit from *refusing* to participate in the standard setting process, in the hope that the resulting standard will nonetheless (perhaps inadvertently) infringe on the company's patent. Then the company would not be obligated to license its blocking patent on fair and reasonable terms, if at all. This would at least create the possibility that the company in question could control the standard and make it proprietary once it became established.

28. See Anton and Yao 1995 for a more complete discussion of the legal treatment of performance standards.

29. *Allied Tube & Conduit Corp. v. Indian Head, Inc.*, 486 U.S. 492, 500 (1988).

30. Federal Trade Commission. 1996, June. "Anticipating the 21st Century: Competition Policy in the New High-Tech Global Marketplace," Chapter 9, "Networks and Standards."

31. *ibid*, Chapter 10, "Joint Ventures," at 17.

32. There are many more examples of disputes involving hidden patent rights and standard setting, including: *Wang vs. Mitsubishi;* Microsoft and Cascading Style Sheets; and ETSI and Third-Generation Mobile Telephones.

33. See http://www.ftc.gov/opa/9606/dell2.htm.

34. I served as an expert in this matter retained by Rockwell; the views stated here do not necessarily reflect those of any party to the case.

35. See the May 3, 1995 press release at http://www.ftc.gov/opa/1995/9505/boscvis.htm. The recent merger of Gemstar and TV Guide is another example of a merger/settlement that raises antitrust issues.

36. One episode under investigation involves Abbott Laboratories, Novartis's Geneva Pharmaceuticals unit, and the popular hypertension drug, Hytrin. Another episode involves Aventis (the new company formed from the merger of Hoechst and Rhone-Poulenc), Andrx, and the heart drug Cardizem CD. Abbott reportedly agreed to pay Geneva $4.5 million per month to delay the launch of a generic version of Hytrin. Abbott asserts that its agreement with Geneva is "in accordance with all laws." See the *Wall Street Journal*, February 7, 2000, "FTC Panel Backs Suit Against Abbott, Novartis on Deal for Hypertension Drug," p. B20. See the FTC website for updates.

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Technical Appendix

Here I show that prices can be well above monopoly levels if multiple firms have critical patents, all of which read on a single product. More precisely, if N firms each control a patent that is essential for the production of a given product, and if these N firms independently set their licensing fees, the resulting markup on that product is N times the monopoly markup.

Suppose that N firms, $i = 1, \ldots, N$, each own a patent that is essential to the production of a given product. For simplicity, let us think of there being a competitive industry that produces this product, buying and assembling the necessary components from each of these N firms. For this purpose we can think of firm i either as setting a license fee for the use of its patent, or as setting a price at which it will sell its essential component to the competitive assembly industry; the theory is identical either way.

The cost to firm i per unit (for making and selling its component or for licensing its patent to assemblers) is denoted by c_i. The price of component i (or the license fee charged by firm i) is denoted by p_i. The price of the product itself is denoted by p. In addition to paying royalties (or buying components), the assembly firms incur an assembly cost per unit equal to α. Competition at the "assembly" level ensures that $p = \alpha + \sum_{i=1}^{N} p_i$.

Demand for the product in question is denoted by $D(p)$. The absolute value of the elasticity of demand is given by $\epsilon \equiv -D'(p)p/D(p)$. In general, ϵ will vary with p.

I assume that the N firms set their component prices, equivalently their license fees, independently and noncooperatively. In other words, I look for the Nash Equilibrium in the prices $p_1, \ldots, p_N$. The profits for firm i are given by

$$\pi_i = D(p)(p_i - c_i).$$

The first-order condition for firm i is given by

$$\frac{d\pi_i}{dp_i} = D(p) + D'(p)(p_i - c_i) = 0.$$

Adding up across all i gives

$$D(p)N + D'(p)\sum_{i=1}^{N}(p_i - c_i) = 0.$$

which can be rewritten as

$$\sum_{i=1}^{N}\frac{(p_i - c_i)}{p} = -\frac{D(p)}{pD'(p)}N.$$

Using the definition of the elasticity of demand, and the fact that $p = \alpha + \sum_{i=1}^{N} p_i$, we have

$$\frac{p - (\alpha + \sum_{i=1}^{N} c_i)}{p} = \frac{N}{\varepsilon}. \tag{1}$$

In other words, the percentage markup over cost for the product in question is equal to N times the inverse of the elasticity of demand. In contrast, the standard monopoly markup rule would be

$$\frac{p - (\alpha + \sum_{i=1}^{N} c_i)}{p} = \frac{1}{\varepsilon}. \tag{2}$$

The markup with N independent firms controlling key patents is equal to N times the monopoly markup.

It can be shown that the combined profits of the N firms under independent pricing is lower than would be earned by a monopolist selling all N components. This implies that the firms have an incentive to coordinate their pricing. A package license for all N components would lead to higher (combined) profits and lower prices for consumers.