

# **Patents and "Patent Wars" in Wireless Communications: An Economic Assessment**

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**Abstract:** We examine various conceptual issues raised by the "patent wars" that have occurred in recent years in telecommunications. We conclude that "patent wars" are the natural consequence of the multi-invention nature and massive growth of the industry and the probabilistic and non-self-enforcing nature of patents with the resulting uncertainty about patent validity and infringement, and that concerns about patents have not precluded the successful development and deployment of telecommunications standards or the massive commercial success of new telecommunications technology.

**Key words:** patents, patent wars, litigation, telecommunications, standards, patent licensing.

Both the popular press and the academic literature (see, e.g., GRAHAM & VISHNUBHAKAT, 2013) have devoted much attention to the so called "patent wars" that have taken place in recent years in connection with wireless communications systems (including both cellular and Wi-Fi). Dozens of patent suits have been filed in numerous jurisdictions worldwide (including the U.S. International Trade Commission and courts in the U.S., the U.K, Germany, South Korea, and Australia) since 2009. Parties to those disputes include high profile firms such as Apple, Nokia, Motorola, Microsoft, Samsung, Google, Oracle, S3 Graphics, Ericsson, Qualcomm, Broadcom, Huawei, RIM, ZTE and numerous others.

Though litigation to date has largely been focused on selected jurisdictions (especially the U.S.), the disputes have worldwide significance.

Patent litigation is costly, time consuming, and risky. The American Intellectual Property Law Association's 2013 "Economic Survey" estimates that the average cost (per party) of U.S. patent litigation for cases with more than \$25 million at stake is \$3.9 million through the end of discovery and \$5.9 million through trial.<sup>1</sup> Costs increase significantly if there are appeals or retrials and adjudications in multiple jurisdictions.

This paper endeavors to put "patent wars" into perspective by helping to explain that patent disputes are in large measure a natural corollary of combinational innovation (i.e., innovation which creates new products embodying many inventions where inventions are sourced from both inside and outside the business enterprise). With many parties, many inventions, and many products, disputes should be no surprise, especially given the natural reluctance of some companies to pay others for technology when infringement looks like it might be the lower cost option.

## ■ The multi-inventions world

Patent disputes in communications are nothing new. Even Alexander Graham Bell was involved in some 600 lawsuits over patents relating to the invention of the telephone (HUURDEMAN, 2003, pp. 176-177).

In many high-technology industries (pharmaceuticals being a notable exception<sup>2</sup>), the world of one product and just a few patents has long gone. Many advanced products require the use of hundreds if not thousands of patented technologies. Disputes arise that involve hardware (including both

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<sup>1</sup> See <http://www.patentinsurance.com/custdocs/2013AIPLA%20Survey.pdf>. A survey by Freshfields estimated that the costs of a U.K. patent case which reaches trial is £1.5 million for each side. (FRESHFIELDS, 2011). McDonagh and Helmers estimated that costs range between £1 million and £6 million per case (not per side) for cases initiated during 2000-2008. (McDONAGH & HELMERS, 2013). We are not familiar with similar studies of patent litigation costs in other jurisdictions. A recent study of "Patent Litigation in Europe" provides some empirical data on patent litigation outcomes in four European jurisdictions, but does not provide more data on litigation costs (CREMERS *et al.*, 2013).

<sup>2</sup> Even in the pharmaceutical industry, the increasing number of patents on "research tools," coupled with the use of "reach-through royalties" in licensing such technologies, means that many pharmaceuticals bear multiple royalty burdens.

cellular base stations and consumer equipment such as cellphones, laptops and tablets), operating systems (such as Google's Android), computer software (such as Oracle's suit against Google over Java), and other products. Some of the asserted patents have apparatus claims; others have methods claims; others have system claims. Alleged infringers have been accused of direct infringement, contributory infringement, or inducement to infringe. Suits have been brought at multiple levels in the "value chain," from chipset manufacturers to device manufacturers to end users.

There is no dispute that technology has advanced significantly since the early days of wireless communication. Nor is there any dispute that there has been a surge in patenting in the field, though explanations for the surge differ. Some differentiate between "offensive patenting" (patenting to obtain patents to assert against others) and "defensive patenting" (patenting to obtain patents that can be used as "bargaining chips" in licensing and cross-licensing negotiations, and/or to prevent others from patenting the invention). Some deplore the growth in "defensive patenting" as not contributing to innovation. It is a phenomenon that needs to be better understood.

Standards play a significant role in wireless communications, ensuring that equipment from different suppliers is compatible and interoperable. Standards can have both mandatory features (that all standards-compliant products must have) and "optional" features.

Formal standards are adopted by standard setting organizations ("SSOs"). Developing standards takes a considerable amount of time. Even after the standard is formally adopted, it often takes several years between the date that a standard is adopted and the time that products complying with the standard first reach the market. As a result, SSOs are often seeking to "push the envelope" by incorporating the latest cutting-edge technology into new standards to govern the next-generation products. Such technology is often patented. Consequently, most (though not all) SSOs are willing to incorporate patented technology in a standard, as long as the patent holder is willing to commit itself to making licenses for its standards-essential patents ("SEPs") available on "reasonable and non-discriminatory" ("RAND") or "fair, reasonable and non-discriminatory" ("FRAND") terms to those seeking to make standards-compliant products. Such RAND or FRAND commitments can be patent specific, listing particular patents, or can take the form of "blanket" declarations that any patented technology that the firm may have that turns out to be "essential" to make standards-compliant products will be available for licensing on RAND/FRAND terms. If such commitments are not forthcoming, most SSOs are unwilling to

incorporate the patented technology into a standard. For many standards, there are hundreds or thousands of patents that have been declared to be essential to practice the standard, owned by dozens of different firms. Not all such "declared essential" patents turn out to be actually essential. As noted, complex products such as cell phones (or PCs) have embedded within them thousands of patented technologies (SOMAYA, TEECE & WAKEMAN, 2011). This reflects the fact that a lot of "common" (yet proprietary) technology is employed, in part because of standards, and in part because consumers expect certain common features to be in all quality products. In one sense it is quite remarkable that diverse technologies of different origin and ownership get combined so harmoniously in marketable products.

In our experience, active "patent wars" are most common when firms are "jockeying for position," trying to hammer out disputes about their respective rights and the terms of their relationships with one another. Such disputes are especially likely when firms' market positions and technological contributions are changing over time and when the industry is large (and growing) and profitable (so that there is a lot of money at stake), where there is a strong asymmetry in the technological contributions made to the stock of knowhow in the industry, where firms pursue different business models (so that resolution via explicit cross-licensing or informal "Mexican standoff" relationships, in which one firm does not assert its patents against another firm's products because of the prospect that the other firm would assert its own patents against the first firm's products, is less likely), and when the parties' respective IP rights are disputed.

Once there is a "track record" of decisions regarding whose patents are valuable and whose are not, the industry can settle down to a situation in which firms engage in explicit cross-licensing or informal "standoff" relationships. But when the legal situation is uncertain, such resolution is difficult to achieve, especially when so much money is potentially at stake and when parties have divergent beliefs about the likely outcomes of litigated disputes. Hence, the changing and uncertain legal landscape is itself often the biggest contributor to disputes.

This is not to say that smartphone patent wars are a transient phenomenon. The multi-invention nature of the industry, coupled with the rapid pace of technological innovation, the amount of money at stake, and the probabilistic nature of patent rights, all suggest that disputes are likely to persist even after an initial "shake out." But we anticipate that the pace of litigation will slow.

## ■ Technology commercialization strategies

The diversity of economic roles played by innovators and implementers – from "pure play" technology companies that rely on licensing their inventions to others, to "non-practicing entities" that often buy and commercialize patents developed by others, to chipset manufacturers, to device manufacturers, to software developers, to cellular service providers (carriers), to businesses that operate Wi-Fi networks on their premises – has led to a situation in which different firms pursue a range of different commercialization strategies. Many firms in the industry "wear multiple hats." As innovators, they develop technology and commercialize it, whether by using it themselves or by licensing it to others. As implementers, they often need to use others' patented technology to make and sell their own products. Cross-licenses (whether royalty free or royalty bearing) are common.

Patent holders have sought significant royalties for others' use of their patented technology, although to date court-awarded damages have been relatively modest. Dozens of licenses and cross-licenses have been entered into, some following litigation.

Patent portfolios in the field can be extremely valuable. Several significant portfolios of patents relating to cellular communications have changed hands for considerable sums, including the \$12.5 billion that Google paid for Motorola Mobility and its portfolio of some 24,000 patents and patent applications (GOLDMAN, 2012), the \$4.5 billion that a coalition of firms including Apple, RIM, Sony, Microsoft and EMC paid for a portfolio of some 6,000 Nortel patents following Nortel's bankruptcy (BRICKLEY, 2011), and the \$1.1 billion that Microsoft paid for a portfolio of some 800 AOL patents (LOHR, 2012).

Though some have expressed concerns about the possibility of "patent thickets" and "royalty stacking," in which implementers needing licenses to patents held by multiple patent holders may have to pay significant cumulative royalties to multiple patent holders, the prospect of socially undesirable royalty stacking has not been sufficient to deter the widespread and dramatic commercial success of cellular communications standards. Indeed, the success of many products stems from their employment of multiple inventions. "Stacks" are desirable if the technologies represent net value to the consumer.

## ■ Economic factors that help explain disputes

Several features of the patent system and the current "patent wars" are worth viewing through the lens of economic analysis.

It is often forgotten that patents are not self-enforcing. Unlike the situation with tangible goods, where the supplier is unlikely to supply the goods unless it is paid to do so, infringers can and do use patented technology without paying for it. Unlike the situation with tangible goods, patent holders cannot physically withhold their technology from infringers. In order to get recalcitrant infringers to pay for the use of patented technology, patent owners must appeal to the courts, and patent litigation is costly (both for the parties and for the legal system itself), time consuming, risky and uncertain. Patented technology is, in one sense, there for the taking, since a description of the invention is published for all to see when the patent is awarded or the patent application is made public.<sup>3</sup> Unlike the situation with trade secrets, where information about inventions is kept secret from rivals, with patents the invention is disclosed and as a result can end up being used (though not legally) by infringers. It is possible to use patented technology without explicit copying. Competitors may do so in ignorance of the patent or its scope. "Independent invention" is common, but it does not suffice to override a patent. The situation in which implementers ignore other firms' patents unless and until they are sued for infringement is common even if the implementer has good reason to believe that such patents exist (LEMLEY, 2008). Of course, such conduct contributes to the number of patent infringement suits brought.

The metes and bounds of patent rights are often unclear. This also increases the likelihood of disputes. Patent claims do not construe themselves, and claim construction can be and often is highly disputed. Even after a court construes the patent claims, the parties often disagree as to whether or not particular products infringe the claims. Empirical studies of "win rates" in patent litigation show that patent holders only win about half of

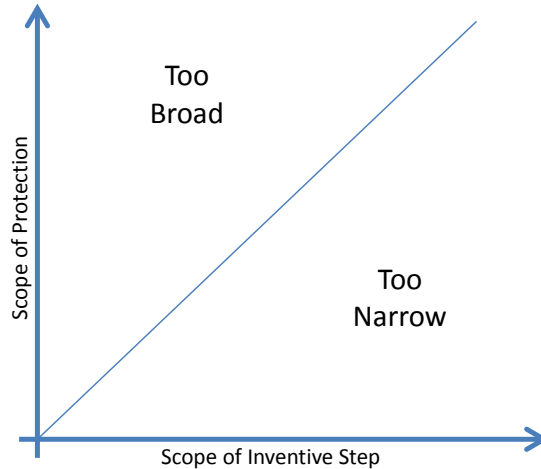
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<sup>3</sup> Though some firms forbid their employees to examine other firms' patents or patent applications (largely because of concerns about being found liable for "willful infringement" and having to pay up-to-treble damages if they have actual knowledge, not merely constructive notice, of others' patents), there are other ways of learning about others' technology than by reading patents or patent applications. In addition, there is the possibility of "independent invention."

the time.<sup>4</sup> Economists have long acknowledged the "probabilistic" nature of patent rights (LEMLEY & SHAPIRO, 2005).

Much has been made of the quality of issued patents, with critics arguing that far too many "poor quality" patents have been issued and urging the PTO to improve the quality of the patent examination process.<sup>5</sup> We believe that the real problem in this regard<sup>6</sup> lies in the prospect of a "mismatch" between the scope of the invention actually made by the inventor and the scope of the patent claims granted. This is illustrated in Figure 1, which compares the scope of the invention actually made against the scope of the issued patent claims.

**Figure 1 - Unmerited breadth or narrowness of patent claims and protection**



Patents lying along the 45-degree line have issued claims that match the scope of the invention. Patents lying above the 45-degree line have issued patent claims that are broader in scope than the invention warrants and are thus "too broad," while patents below the 45-degree line have issued patent

<sup>4</sup> See SHERRY & TEECE, 2004, and articles cited therein (data on U.S. patent cases). See also CREMERS *et al.*, 2013 (data on patent litigation outcomes in four European countries show lower patent holder win rates than in the U.S.).

<sup>5</sup> A recent working paper concludes that "the EPO [European Patent Office] provides higher-quality and more expensive patents than the USPTO." (POTTELSBERGHE DE LA POTTERIE, 2010)

<sup>6</sup> In addition to the inherent difficulty in reaching agreement among the parties as to the actual scope of patent protection and patent validity. That difficulty is exacerbated if patent claims are not clear.

claims that are narrower in scope than the invention warrants and are thus "too narrow." Our suggestion is that improving the quality of patents would involve making it more likely that issued patents fall on or close to the 45-degree line, not "strengthening" or "weakening" patents *per se*.

It is important to differentiate between a product feature and the scope of the patents relating to that feature. It is often possible to "work around" particular patents and provide virtually the same feature or functionality without using the patented technology and without significantly affecting consumer demand (though there may, or may not, be cost considerations associated with the work-around). That said, disputes as to whether such proposed work-arounds do or do not avoid infringement can occur and may themselves result in further litigation.

The cellular communications industries are made up of a number of related "value chains," from inventors, to chipset manufacturers, to device manufacturers of both carrier equipment (e.g., cellular base stations) and consumer products (e.g., cellphones, smartphones, cellular-enabled laptops and tablets), to cellular service providers (carriers), to end-users (individuals and businesses). Being able to use patented technology at multiple levels in the value chain may augment its value. Patent suits have occurred at various levels of the value chain, and firms "upstream" have sometimes intervened in cases brought against those "downstream" from them in the value chain, especially when the "downstream" entities are seeking indemnification from their "upstream" suppliers.

A legal doctrine known as the "patent exhaustion doctrine" also plays a significant role in licensing and in disputes. To simplify somewhat, the "patent exhaustion doctrine" says that, if a patent holder licenses an entity at one level of the "value chain," that licence "exhausts" the patent holder's rights to collect additional royalties from entities "downstream" in the value chain from the licensee. Thus if a patent holder licenses cellular chipset manufacturers, it cannot go after device makers who incorporate licensed chipsets in their cellphones, or cellular carriers who use cellphones containing licensed chipsets, or end-users who use such phones, despite the fact that, without a licence, those others might be liable for patent infringement (whether for direct infringement, contributory infringement, or inducement to infringe). This suggests that it is important for a patent holder to choose to license at the "right" level of the "value chain."



Much concern has been expressed, especially in the U.S.,<sup>7</sup> regarding so-called "patent trolls," sometimes referred to less pejoratively as "non-practicing entities" or "NPEs", entities that do not themselves practice the patented technology but (in some cases<sup>8</sup>) instead acquired the patent from others and seek to commercialize it by licensing it in exchange for royalties. None of the most-widely-publicized "patent wars" in cellular communication involve "trolls," though certain NPEs have been involved in less-widely-publicized litigation. Many of the NPEs acquired their patents subject to RAND commitments, which impose certain constraints on their ability to exploit their patents.

Because NPEs do not make or sell the relevant products, they do not need licences to use others' technology. Consequently, they are not interested in cross-licensing. This is often upsetting to other firms that are used to engaging in cross-licensing with others, whether royalty-free or for relatively low "balancing payments."

It is important to note that despite the large number of patents, and the large number of unlicensed firms, there have been a relatively small number of patent disputes.<sup>9</sup> However, many disputes have been widely publicized. This is in part due to the stakes involved, to the business relationships between the parties, and to the vistas provided into business decisions and behaviors through open court litigation.

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<sup>7</sup> Though a number of non-practicing entities (notably IPRCom) have brought patent infringement suits in Europe, much of the publicly-stated concern about "trolls" appears centered in the U.S., where so-called "trolls" account for an increasing share of patent litigation, especially against end-users. The fact that in the U.S., each party bears its own litigation costs, whereas in many European jurisdictions the loser pays the winner's fees, may partially explain the difference.

<sup>8</sup> Other NPEs (such as universities and pure-play technology companies such as Rambus) developed the patented technology but do not practice it. Some practicing entities have "spun off" a portion of their patent portfolios to NPEs that seek to license the patents for royalties. Other formerly-practicing entities (such as Nortel) have gone bankrupt and have sold their patent portfolios to others. Still other NPEs are formerly practicing entities that have exited the product market and seek to license their patented inventions.

<sup>9</sup> Talk of a "litigation explosion" needs to be put into context. Given the increasing number of patents (though the number of patents issued per billion dollars of GDP has stayed relatively constant over time), it would not be surprising that the number of patent lawsuits has increased (though the available data indicate that the litigation rate per issued patent has stayed roughly constant over time). Compare BESEN & MEURER (2005), with MOSSOF (2012), and CONNOLLY (2012).

## ■ Standards setting and patent licensing disputes

Many of the patents involved in "patent wars" suits are standard-essential patents (SEPs), which every firm making standards-compliant products must use (at least, if the patent reads on a "mandatory" part of the standard). Others are not SEPs, but instead are patents on so-called "differentiating features." The "design patents" that Apple asserted against Samsung fall into this category. Holders of such patents have typically not made commitments to license them (on RAND terms or otherwise), but instead often prefer to keep the patented technology for their own exclusive use.

The meaning of the term "RAND" or "FRAND" is itself subject to dispute. Many commentators have lamented the fact that most SSOs provide little or no guidance as to whether particular licence terms are or are not RAND, leaving licensing terms to be negotiated between the parties outside the SSO, and leaving disputes to the courts. There have been a number of proposals for SSOs to "clarify" what they mean by RAND, but to date none of them have been accepted.

In recent years, a number of U.S. courts, notably in the *Motorola v. Microsoft*<sup>10</sup> and *In re Innovatio*<sup>11</sup> cases, have given some guidance as to what constitute RAND terms, acknowledging that "RAND" is not a single number but a range of possible royalty structures and rates. We are not aware of any non-U.S. courts that have addressed the issue yet, though cases are pending in a number of European jurisdictions. The European Commission recently said that the Commission does not determine what RAND terms are, leaving such issues to courts or arbitrators.<sup>12</sup>

One issue that has generated considerable controversy is whether a patent holder that has made a RAND commitment should be able to seek (not necessarily obtain) injunctive relief against those who use its patented technology without paying for it. To our knowledge, no SSO has explicitly

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<sup>10</sup> "Findings of Fact and Conclusions of Law," April 25, 2013, *Microsoft v. Motorola, Inc.*, Case No. C-10-1823JLR, U.S. District Court, Western District of Washington at Seattle (Judge Robart). <http://essentialpatentblog.com/2013/05/an-annotated-version-of-judge-robarts-microsoft-motorola-rand-royalty-setting-order/>.

<sup>11</sup> "Memorandum Opinion, Findings, Conclusions, and Order," *In Re Innovatio IP Ventures, LLC Patent Litigation*, MDL Docket No. 2303, Case No. 11 C 9308 (Judge Holderman), October 3, 2013, p. 37. <https://docs.google.com/a/umn.edu/file/d/0B8xYsG-VkgXNaW9tOTY3N1VDbkE/edit?pli=1>

<sup>12</sup> European Commission, Memo, "Antitrust decisions on standard essential patents (SEP)," April 29, 2014. [http://europa.eu/rapid/press-release MEMO-14-322\\_en.htm](http://europa.eu/rapid/press-release_MEMO-14-322_en.htm)

addressed this issue. Some competition authorities<sup>13</sup> have taken the position that a patent owner that has made a RAND commitment should not be able to seek injunctive relief against a "willing licensee" even if the accused infringer elects to challenge the assertion that the patent(s) being asserted are valid and/or infringed in court (European Commission, April 2014). Some commentators have pointed out that RAND commitments are contractual commitments, and should be interpreted in accordance with standard contract interpretation guidelines, and have argued that nothing in a RAND commitment explicitly waives the right (which patent owners clearly otherwise have) to seek injunctive relief against unlicensed firms (BROOKS & GERADIN, 2010).

Besides RAND commitments, a number of mechanisms have evolved to address the issue of royalty stacking. These include explicit cross-licensing (either on a royalty-free basis or for relatively small "balancing payments" that reflect, not the full value of the cross-licensed technology, but the difference in value between the two cross-licensed portfolios) and informal "Mexican standoff" / "mutually assured destruction" situations (in which one firm does not assert its patents against another firm because it knows that the other firm has patents of its own that it could assert against the first firm's products), and "repeat play" and "reputation" effects (a firm that seeks to aggressively exploit its patents in connection with the current standard may find that SSOs will reject its technology when it comes to developing future standards).

Standard setting in telecommunications is a "repeated game," with older standards being amended over time as technology improves, and with new standards promulgated to supplant older standards. As a result, patent holders have to be aware that attempts to aggressively exploit their SEPs relating to a current standard could result in a situation in which SSOs elect not to incorporate their technology into future standards.

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<sup>13</sup> The European Commission took the position that Motorola's attempt to seek an injunction against Apple over certain Motorola SEPs relating to ETSI's GSM/GPRS standard constituted an abuse of a dominant position in violation of EU competition law. See [http://europa.eu/rapid/press-release\\_IP-14-489\\_en.htm?locale=en](http://europa.eu/rapid/press-release_IP-14-489_en.htm?locale=en). The one US appellate court that has addressed the issue held that there is no blanket rule prohibiting holders of SEPs from seeking or obtaining injunctive relief, and that the four-factor test for obtaining injunctive relief laid out in *eBay v. MercExchange* applies to SEPs as well as non-SEPs. See *Apple v. Motorola* (Federal Circuit), April 25, 2014. <http://cafc.uscourts.gov/images/stories/opinions-orders/12-1548.Opinion.4-23-2014.1.PDF>, p. 7.

In short, RAND and FRAND issues provide additional complexity to licensing negotiations. Not surprisingly, disputes are more likely the more complex the landscape and the greater the uncertainties. Regulatory intervention, or even the threat of it, can compound uncertainty and amplify the likelihood of disputes.

## ■ Conclusion

Despite the "patent wars," various wireless communications standards have been very successful commercially, with hundreds of millions of cellphones embodying many thousands of patented technologies being sold and billions of dollars in revenue at the chipset, cellphone, base station, and cellular service provider levels of the industry. Concerns about patents and the potential for patent litigation or the potential of having to pay damages clearly have not deterred firms from entering the market and selling products. On a quality-adjusted basis (holding performance constant), real prices have been falling dramatically over time. We are not aware of any evidence that the large and growing number of patents has constrained product and technology innovation. To the contrary, new products with new features have proliferated, and new technology has developed apace.

Overall, the system seems to be working well. The presence of "patent thickets" and the prospect of "royalty stacking" have not stifled competition or innovation; the wireless industry is extremely vibrant. As noted, patent "thickets" often reflect the positive plethora of value enhancing technologies which can be designed into products to support the rich feature sets that customers enjoy. To be sure, "patent wars" are costly and disruptive, and the industry could well be better off if they were reduced,<sup>14</sup> but it is difficult to see how things could be otherwise absent some major change in the system,<sup>15</sup> given the poor quality of some patents, the fact that patents are not self-enforcing, the tendency of implementers to ignore others' patents

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<sup>14</sup> To determine whether a world without patent wars would be preferable to the current world, one would have to clearly identify what such a world would look like. One could, for example, eliminate patent wars by eliminating patents, but such a "cure" might be worse than the "disease," as the dynamic-efficiency-enhancing benefits of the patent system in encouraging innovation are well-recognized.

<sup>15</sup> E.g., if patent litigation became significantly faster, less costly, and more predictable, or if patent quality were significantly improved.

unless and until sued, disagreements about patent validity and scope, and the stakes involved.

We are in favor of reform directed toward improving the quality of patents, and in particular toward making the scope of issued patent claims more accurately match the scope of the actual invention. Enhanced clarity and predictability is also desirable. But many of the current proposals for reform of the patent law strike us as little more than cosmetic Band-Aids not directed to the fundamental underlying issues. Whatever reforms are contemplated, it is critical to maintain, if not expand, incentives for invention and innovation. There are generally fewer inventors than there are implementers of technology, so it is especially important to keep politics out of "reform" efforts, as politics is likely to favor the here and now. Good policy making favors the future.

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