

Trends In Technology IP Licensing

By Terry Ludlow, Founder and CEO, Chipworks

SUMMARY

Today, patents are being leveraged to support business strategies in many diverse and innovative ways. The world of technology patent licensing, however, is opaque and secretive. License agreements are often not announced or publicized, and when agreements are public, very few details are released. The only way to even attempt to understand the changing licensing environment is to piece together scraps of information and hearsay from news reports, blogs, and conferences. Even so, as the IP business changes, important trends are emerging that affect patent strategy decisions, the ability to win settlements, and in particular how to leverage patents to generate additional intellectual property value.

THE GROWTH OF MEGA LICENSING

Patent licensing is becoming increasingly challenging. Individual patent values in the United States, still the main battleground for technology licensing, are being depressed by a combination of key judicial decisions and legislative changes or threats of change such as various proposed "Innovation Acts." Patent assertion is an increasingly expensive proposition that can embroil a company in years of high risk litigation, often for little benefit. Successful licensing requires extensive preparation – essentially preparing for litigation without the benefit of discovery – including building claim charts, anticipating validity arguments and doing damages modeling before contacting a future licensing partner. Lower damages values and rising costs mean shrinking margins, reducing incentives to monetize patents through litigation. Additionally, patent assertion entities (PAEs) are ramping up their activities and consuming the resources of IP groups that might otherwise be used for cross licensing or out licensing of technology. The net effect seems to be the encouragement and growth of mega licensing both for corporations and PAEs. Mega licensing requires large strategic portfolios of patents containing clusters of valuable patents that cover key technologies used in high volume products. The key implication: go big or stay home.

BOARD ROOM PRESSURE ON IP STRATEGY

When CEOs ask their senior IP people "what is the value of our patents?" they often don't get satisfactory answers. Often, this is because the satisfactory answer is an unknown. Is it simply a dollar value or is it the many ways that a patent portfolio supports an IP strategy that drives value for the business? Regardless, shareholder activists, directors and the corporate senior management themselves are beginning to understand some of the value and potential uses of IP in general, and of patents in particular.

Companies are responding to this C-suite pressure by exploring new ways to demonstrate the value of their patents. Many are working with brokers to sell what are considered surplus assets, which is driving a glut of patents on the market. Others are working with third party licensing organizations and privateers to realize the rewards of a longer term licensing program. Still others are looking to set up licensing programs – often focused on leveraging orphan patents into parallel markets outside of their own major markets. For example:

- America Online (AOL) sold a portfolio of more than 800 patents to Microsoft in April 2012 under pressure from Starboard Value LP – an investor and holder of ~5.2% of AOL shares at the time. Starboard had suggested before the deal that AOL's patents were worth more than \$1B on the market. AOL shares rose by 43% the day the \$1.1B deal with

Microsoft was announced. AOL insists that pressure from Starboard was a hindrance. The bottom line: Starboard experienced a large and fast increase in the value of their shares.

- Panasonic, a normally very risk averse Japanese company is exploring ways to leverage their patent assets more effectively. Panasonic placed 4th on the US Patent 100 list published in IAM March/April of 2013 with about 30,000 US patent families. They have also experienced very poor financial results in 2011 and 2012 resulting in business restructuring and senior management change. The IP strategy also was impacted. Panasonic contributed patents and staff to IP Bridge, a privateer like company in Japan founded with government participation in mid-2013. Panasonic has also transferred patents to three more traditional licensing companies – Sisvel (Jan. 2014 - DSL G.994.1 patents), WiLAN (Dec. 2013 ~900 semiconductor patents) and Inventergy (Jan 2013 ~500 3G & 4G telecommunications patents) – in deals that seem to provide a small upfront purchase payment with a piece of the revenue afterwards in a privateer like fashion.
- IBM recently transferred 750 patents to Twitter as part of a licensing deal and settlement of a litigation. Using surplus patents as an alternate form of currency is becoming a more common practice to reach settlements that both sides can live with. Often, litigation settlements see patents transferred to an NPE to bridge the gap in ask/buy price. In this case, Twitter may see more value in the orphan or surplus IBM patents than IBM does - and a deal was reached.

PATENT QUALITY VERSUS QUANTITY

The debate over patent quantity versus patent quality is swinging towards the quality side. Many companies are instituting invention programs that offer incentives for filing more strategic patents. In addition, companies are following continuation practices that identify and highlight more useful patent applications and provide an opportunity to craft more relevant claims that increase the number of valuable patents over time in a portfolio. However, for technology companies, having both sufficient quantity and quality in a portfolio is the best strategy.

There must be enough valuable patents, which are supported by enough additional patents, to assure potential licensees that it is impractical to consider invalidating an entire portfolio. Only a small number of patents are valuable, that is they are legally valid, technically important, and actually in use in high revenue products. A general rule of thumb is that 3% - 5% of patents in a large portfolio are 'valuable.' In most patent portfolios a few key patents are the deal drivers for licensing, litigation and sales. These are the patents that form the basis for infringement assertions and create the damages base. A portfolio needs additional quantity to increase the FUD (fear, uncertainty and doubt) factor. The necessary bench strength of the additional patents remains mysterious. In fact, many licensors found that after the settlement has been signed, a licensee will admit to being genuinely interested in a specific patent that is not on the list of patents driving the deal.

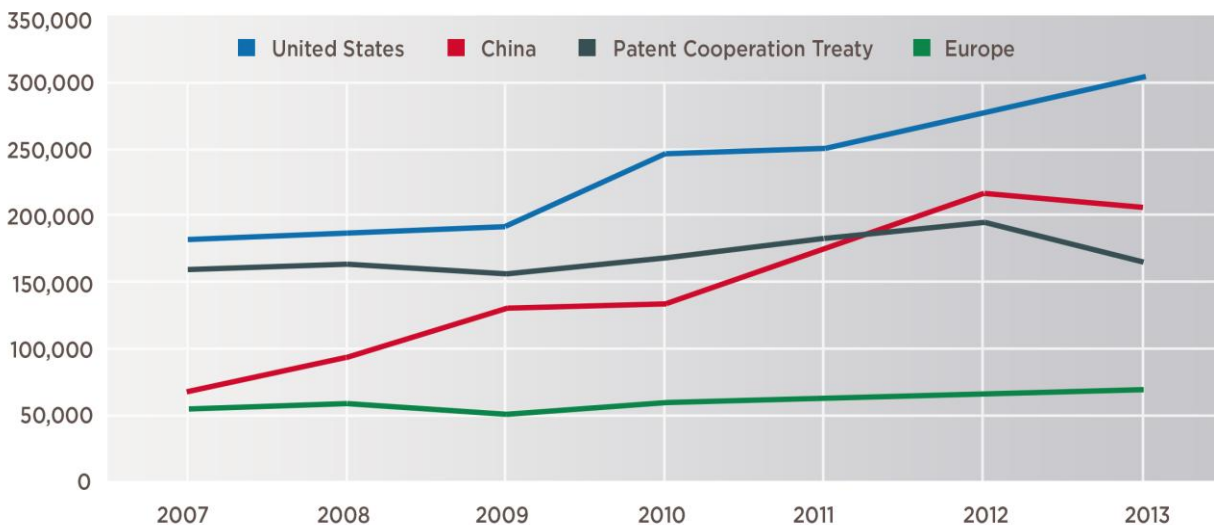
RECORD NUMBERS OF PATENTS ARE BEING GRANTED WORLDWIDE

Record numbers of patents are being granted worldwide. All major patent offices are reporting increases year-over-year in patent grants. There are more patents being issued and more issued patents in force now than ever before as illustrated in Table 1.

Table # 1: **There are more issued patents in force than ever before.**

Country	Total # of Patents in Force (2012 WIPO Statistics)
US	2,239,231
China	875,385 (Invention patents only)
Germany	549,521 (Germany only - largest total in EPO)

Figure 1. Annual patent grants at key patent offices 2007-2013



The patent thicket is getting ever more dense. Technology companies dominate the lists of top patent assignees. More than 80% of the IAM U.S. patent 100 largest patent portfolios and more than 80% of the IPO list of 2012 newly granted patent owners are technology companies. In technology products, there is a virtual certainty that you are using someone else's patents and most probably your competitor's.

In the Apple vs. Samsung trial Samsung's lawyers argued that there are as many as 250,000 patents in a smart phone. It is not possible or practical to design around or license all of them. Patent pre-clearance studies are useful in determining where you might have exposure and to indicate who might be a good cross-licensing partner. Many large competitors are not cross-licensed, instead they rely on the cold war principle of MAD (mutual assured destruction) creating huge arsenals of patents to deter any thoughts of an offensive patent assertion. When a strategic need for a cross license emerges or when a tactical opportunity to dominate a market and eliminate a competitor is perceived, there is usually no shortage of patent assertion ammunition in the average, overly endowed technology company's patent portfolio. The bigger problem is finding the useful and valuable patents buried in a large portfolio. In many cases, corporations are using the patent resale market to find patents that fit a strategic need or enable a short term tactic. For example, Samsung originally asserted 5 patents in their second patent litigation with Apple in Northern District of California (NDCA). Of these, 3 were not originally developed at Samsung. The 2 patents remaining in the suit are not originally Samsung assignee patents. Note that Samsung is ranked #1 on IAM's U.S. Patent 100 list with more than 45,000 patent families. Samsung's problem may be finding the few patents in this huge portfolio that actually read on Apple products.

WALL STREET DISCOVERING PATENTS

Investors, lured by big multiples and large transactions, are actively looking for ways to get into the IP and the patent market. Investors are funding PAEs directly; funding litigations with the judgment as security; loaning money with patents taken as security; investing in publicly traded IP driven businesses, and investing in peripheral IP driven businesses. However, investors speak and think differently from IP professionals. Translators, people who know the IP market and know how to talk in financial terms, are required to help investors understand the subtleties of patent driven deals. This is an evolving relationship as investors slowly discover how to understand patents, learn how to discern value in a portfolio, and comprehend how to make the kind of monetary returns they find attractive.

All this investor money encourages a thriving patent resale market. Known patent buyers are deluged with proposals from brokers and patent owners seeking to sell their patents. The challenges include how to quickly determine which patent portfolios are worth considering and spending time and effort on, and which ones are not useful or valuable. Knowledgeable buyers are insisting on evidence of use and often demand financial models illustrating potential value supporting the asking price. Tactically this means to successfully sell a patent portfolio for a high price you need to prepare a case as rigorously as a pre-litigation case. Valuable patents are selling, usually with a supporting portfolio wrapped around them. It is always a few key patents with supporting documentation that drive high value deals. Average price per patent metrics do not reflect this accurately. Undocumented and low value patents don't sell unless they are part of a supporting portfolio.

Corporations have joined the ranks of major sellers of patents. High profile transactions of large portfolios for tens or hundreds of millions of dollars have been widely reported. Ericsson selling patents to privateer Unwired Planet or Kodak selling patents to Apple and Google are two examples. Many other smaller transactions are also taking place. Companies with a good catalogue of their own portfolio know what patents should be retained to execute their IP strategy and conversely which patents are surplus or not relevant to their strategy. These patents become available for sale or privateering as an alternative to traditional assertive licensing. Savvy investors are now rewarding Companies that successfully execute sales and other patent deals in the stock market and through other investment vehicles. Often, more money is made indirectly through side investments than is made in the direct sale of patents.

PATENT LICENSING – A P&L DRIVEN BUSINESS UNIT?

More companies are coming to the conclusion that patents can be a revenue generator rather than a cost centre and are making their IP groups responsible for driving revenue.

- IBM, and Texas instruments were among the first to break US\$1B in annual patent royalty revenues.
- Qualcomm has consistently generated industry leading patent licensing revenues currently running at more than US\$6.6B per year.
- Microsoft and Ericsson have been reported at licensing revenue of more than US\$2B per year.
- Nokia reported US\$643M in patent licensing revenue in 2012 before divesting their handset business to Microsoft.

Patent assertion entities are by definition driving revenue and profit through patent assertion. Operating companies, even those that complain vociferously about “patent trolls”, are learning the tactics PAEs employ and adopting them for their own licensing programs. Many operating companies have also opted to feed PAEs by supplying them with patents in privateering arrangements that generate profit with little or no risk of cross license assertion. In today's licensing environment most successful licensing programs are driven by large portfolios of patents with sufficient clusters of valuable patents that drive large settlements. Privateers are fed with hundreds or even thousands of their sponsor's patents when success through monetization is the goal. For example:

- December 2008 - Micron Technology transferred about 3,400 US patents plus international equivalents to Round Rock Research to launch them as a privateer.
- June 2011 - Rockstar is created by Apple, Microsoft, Ericsson, RIM and Sony to monetize about 4,000 former Nortel patents.
- January 2013 - Ericsson sold 2,185 US and international patents (825 patent families) to Unwired Planet. In March of 2013, 21 of these patent families were sold to Lenovo for \$100M with a portion of the revenue flowing back to Ericsson to help pay for the patents.
- July 2013 - Spherix bought 222 former Harris Corp. wireless, antennae and communications patents and then later in the month Spherix bought additional telecommunications patents from Rockstar and promptly sued Cisco with 11 former Nortel patents.

INTERNATIONALIZATION

The US market is still the primary licensing battleground largely because the US patent system is still the strongest and most supportive of patent rights. US patents are still typically the deal drivers for licensing and sale of portfolios. Increasingly though China, Germany and other jurisdictions are being used to leverage better patent deals. For your IP strategy that means European and Chinese patents are more frequently being considered assets rather than liabilities requiring maintenance fees. The ability to obtain injunctions is an attractive feature of both European and Chinese patents. German litigation offers speed and low cost compared to the US. The German bifurcated system favours strong infringement cases and defers the validity discussion for a later action – often after an infringement and injunction driven settlement has been reached. With the coming of the Unified Patent Court in most of the EU, a market larger than the US covered by a single patent with a robust and reliable patent law will be created. Fears that it will attract PAEs are well founded, but if US experience is a guide, operating companies will be by far the biggest users of the new system once it is up and running.

In the case of China, there is still uncertainty about the ability to get to a judgment and more uncertainty about the effectiveness of enforcement of an injunction. Multinational operating companies are watching China closely and considering using Chinese litigation. A few good results may open the floodgates at some point. In all cases, courts outside of the US require most of the infringement case to be prepared before litigation is filed as discovery (disclosure, etc.) is limited. So, even though the legal costs are much less than US litigation, the demand for rigorous preparation in advance of negotiations or litigation is heightened.

LEGISLATIVE AND JUDICIAL CHANGES

Licensing disagreements that go public as part of a litigation are still a small minority of operating company to operating company licensing deals. Litigation is the threat that rarely needs to be

exercised, however it seems to be required more often as the risk of injunctions and fear of large damages awards has been reduced. More than 90% of patent litigations settle before trial. Of those that go to trial only a small percentage go to a decision. When the goal is to get to a negotiated settlement, a litigation is a means to an end. In corporate cross licensing, exemplar patents are sent to litigation as a negotiating lever. Licensors must effectively demonstrate the value of the larger portfolio in negotiations by showing numerous substantive claim charts describing broad use of your technology in your prospective licensee's products. The bench strength of the portfolio directs tactics and leads to broad global cross licenses.

Inter Partes Review (IPR) is a new (created by the AIA) post grant procedure has proven popular with corporations seeking to invalidate patents asserted against them in litigation and also to invalidate patents that pose a potential future threat. The majority of IPR cases are filed against patents that are already in litigation in District court (>85%). A clear majority (~60%) of IPRs are also being filed by operating companies against other operating companies. This is just slightly higher than the number of litigations by operating companies against other operating companies (reports range from ~50% - 60% dependent upon the definition of PAE used).

Values for single patents or small groups of patents have been driven downwards in the United States since the Ebay decision in 2006. Table 2 lists some of the decisions since eBay that have had significant impacts on technology licensing.

Table # 2: An incomplete table of Key decisions driving patent value down in the US since eBay

Case	Subject	Effect
eBay (2006)	Reduced (virtually eliminated) probability of getting an injunction if you win a patent litigation	Lowers penalty for infringing patents and thus reduces patent values – encourages use of International Trade Commission (ITC) as an alternate forum for a US Injunction like exclusion order and also the use of foreign courts, i.e. Germany where injunctions are still possible
Sandisk (from Medimmune) (2007)	Lowered the bar significantly on the grounds for filing a declaratory judgment	Makes it more difficult to license patents
KSR v. Teleflex (2007)	Lowered the bar for obviousness	Makes it easier to invalidate patents
Seagate (2007)	Raised the bar for wilful infringement	Reduces prospect of treble damages
Quanta Computer v LG (2008)	Patent exhaustion for downstream products	Limits options for licensing
Cornell U. v. Hewlett Packard (2009) Lucent v. Gateway (2009)	Virtual elimination of entire market value base for damages	Reduces royalty base to the value of a subcomponent in most cases reducing the potential damages award Allows Entire Market Value (EMV) as a royalty base only in cases where the patented technology "creates the basis for customer demand".
AIA – America Invents Act – US Patent Reform bill (2011)	Inter Partes Review becoming "death squads... killing property rights".	Still early, but most likely will have a large negative effect on patent values. Many patents in litigation get sent to Patent Trial and Appeals Board (PTAB) for review. Most settle in advance of judgment but about 95% of patent claims reaching decision have been cancelled to date.
Uniloc v. Microsoft (2011)	Elimination of 25% rule as an admissible rule of thumb to determine damages.	Requires comparable license agreements to determine royalty rates rather than empirical 25% of profits.
Laser Dynamics v. Quanta Computer (2012)	Continuing Apportionment – Damages based on smallest salable patent practicing unit	Damages case becomes much more important – damages values drop with shrinking royalty base
Motorola v Apple (2012)	Sufficiency of Damages Expert Opinions – Judge Posner	A seminal example that highlights the risks and uncertainty of damages law for patent cases.
Motorola v Microsoft (2013)	Standards Essential Patents (SEP)	Value of SEPs drops. Also the European Commission Competition Directorate General has investigated Microsoft/Nokia (2012) Samsung (2013), and Motorola Mobility (2013) for anti-competitive uses of SEPs. The US Federal Trade Commission (FTC) has conducted similar investigations.
Samsung v. Apple (2013 – ITC)	Standards Essential Patents	A Presidential veto was used for the first time since 1987 to deny an exclusion order based on the 'anti-competitive' use of SEPs
Alice Corp v. CLS Bank (2014)	Software Patent Eligibility – still under consideration at US Supreme Court	Could reduce (or even eliminate?) the value of many software related patents
Proposed Federal Rules of Civil Procedure revisions and various versions of the Innovation Act	Requiring more 'robust' pleading and complaints – potentially providing more information on infringement allegations at the outset of a trial See also: <ul style="list-style-type: none"> Judge Robinson's proposed new rules of procedure for Delaware Track B schedule for Eastern District of Texas (EDTX) 	There is a clear trend of continuing to "raise the bar" for patent assertion, which invariably has a negative influence on the value of patents, especially outside the context of a large portfolio.

STANDARDS ESSENTIAL PATENTS(SEPS).

Once upon a time SEPs were the gold standard in patents. Assertion was easy – if you use this technical standard, then you must be using my patent because European Telecommunications

Standards Institute (ETSI) (or some standards setting body) says it is essential. Recent judicial decisions have rewritten that story. The Fair Reasonable and Non Discriminatory (FRAND or RAND) commitment companies made to the standard setting bodies was considered benign by most companies. Indeed, they would try to get as many patents as possible classed as SEP to maximize their perceived value, both in independent licensing programs and potentially in patent pools. Traditionally, patent pools were considered effective means to generate significant returns. According to their annual report Technicolor collected more than €100M from the MPEG-LA patent pool in 2013.

SEPs became ubiquitous. For example, more than 3,000 patents have been declared essential to the LTE telecommunications standard administered by ETSI. However, many of these cannot be SEPs because they have design-arounds or are not directly referenced in the standard, e.g. they are not essential! For example, in the first Apple v. Samsung trial in NDCA in 2013, a Samsung SEP was found to be valid, Apple agrees it is practicing the standard, and yet the jury found no infringement.

FRAND obligations are now being enforced by courts. In Motorola v. Microsoft the courts determined that Motorola's royalty demand of 2.25% (~ \$6 – \$9) per Xbox was excessive and not in line with their FRAND commitment. Instead the court decided on 4 cents per Xbox as a royalty. The case is currently under appeal to the Court of Appeals Federal Circuit (CAFC). Then Samsung's win in an ITC case evaporated when a Presidential veto was used in 2013 for the first time since 1987. FRAND commitments thus have become encumbrances in licensing and SEPs are no longer the most desirable crown jewels of the portfolio.

The US Federal Trade Commissions, the EU and China have all investigated SEPs and SEP FRAND licensing terms under their antitrust laws. Microsoft, Nokia, Samsung, Motorola Mobility and Qualcomm have all had their licensing practices for SEPs examined by various bureaucrats enforcing anti-trust policies.

Instead, *feature essential* patents have become a focus of attention. These patents cover features in a product that have become de facto standards. They are not specified or required by the standard but they are required by the consumer who buys the product. They are unencumbered by FRAND commitments, and arguably form the basis for a consumer's choice of a particular product over a rival product.

DAMAGES CASE - MORE IMPORTANT THAN EVER!

Valid and infringed is no longer sufficient. For a patent to be highly valuable, it must enable or contribute to a key feature of an infringing product that sells in high volume and generates large profits. The damages case must be considered from the outset. What percentage of my licensing partner's revenue does my patent portfolio cover? What portion of their business is really at risk to my portfolio?

STRATEGIC PATENT PORTFOLIOS – SIZE MATTERS

In the 1980's I worked with a company who had a portfolio of less than 300 patents with 10 - 20 that could be asserted. They were able to mount a strong offensive licensing campaign and collect hundreds of millions of dollars. Today, a portfolio needs to be large enough to achieve critical mass and be hard to attack as a whole. Asserting a single patent or even a small portfolio of patents is almost suicidal today. Most companies will routinely ignore small assertions made via demand letter. Any reasonable sized technology company gets multiple demand letters each week. Since the Sandisk decision, there is very little substance in most demand letters. Without substance, you will not get the attention of the in house licensing team. When

substance (claim charts specifically) is added you expose yourself to the possibility of a Declaratory Judgment (DJ) or an Inter Partes Review filing.

However, looking at the statistics for Declaratory Judgment filings, we can see that the fear is larger than the reality. The number of DJ actions has not changed significantly since 2007 – the year of the Sandisk decision. About 7% of DJ actions in 2007 were filed against NPEs. We defined NPE's for this study using the Patent Freedom statistics that use the definition most broadly. In the 7 years since Sandisk, the average rate is 15% with a peak year in 2011 and 2012 at 17%. The cost and resource commitment of a DJ filing is the same as filing a litigation. Declaratory Judgements will only be used in cases where a very serious risk is perceived. Usually that is when operating companies are in discussions with operating companies.

Figure 2. Declaratory judgment cases

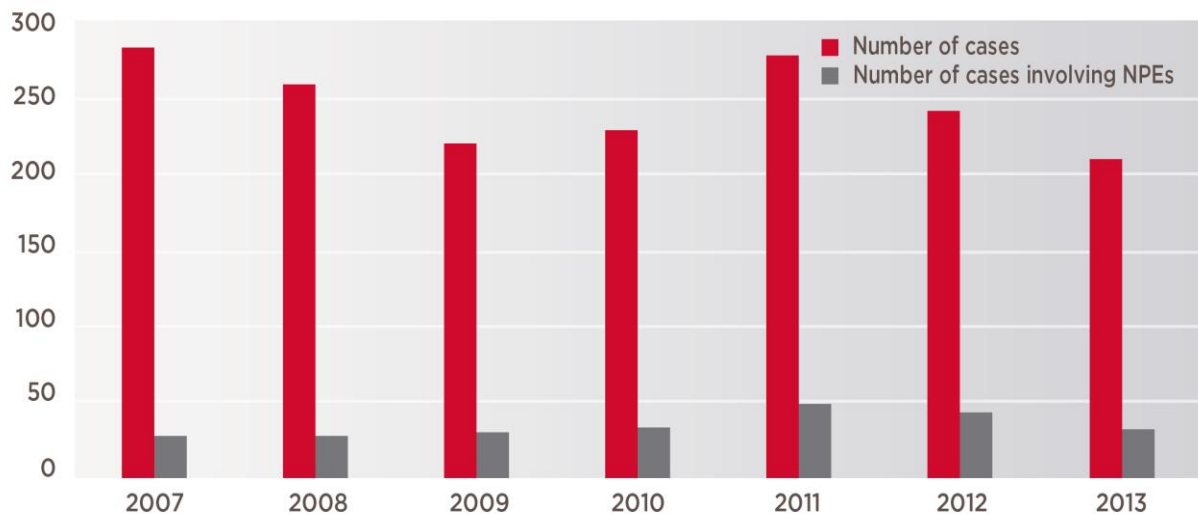
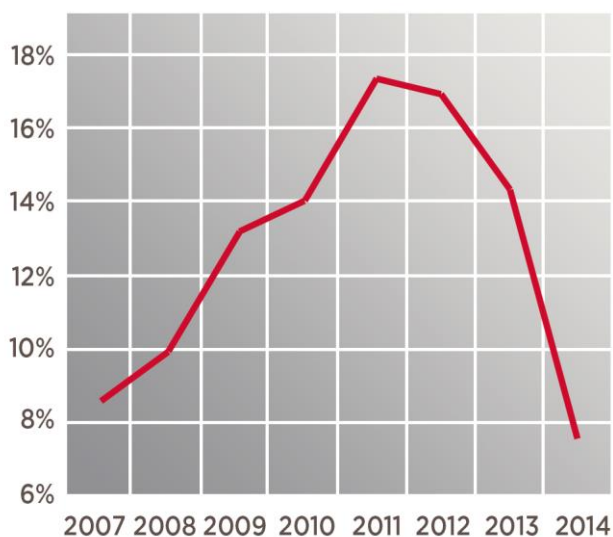


Figure 3. Percentage of declaratory judgments on NPE patents



Owners of small portfolios with only a few substantive patents will often skip directly to filing a litigation. Now you've got their attention. Unfortunately in many companies a litigation passes the matter from the licensing group to the litigation group and a confrontational mindset is assumed. When only a few patents are being asserted, both in the litigation and in the overall portfolio, the ingrained response decision is to fight the assertion. With the tools available today "scorched earth litigation" is lengthy and expensive. On the other hand, a larger portfolio with good documentation demands attention from a wider group within the potential licensee. While it is still probable that you can eliminate some or all of the patents in IPRs or in litigation, the remainder of the portfolio is a present and future danger to your business that can't be dealt with entirely in patent validity arguments.

Frequently, small portfolios get asserted in a litigation and are subjected to a rigorous validity check through the courts or at the PTAB in an IPR or other post grant review procedure. Those that survive validity and get a favourable Markman ruling may reach a successful settlement. However, a growing number of companies have decided as a policy to not settle with 'patent trolls' – a term that sometimes expands to include anyone who sues with a small portfolio and no cross license exposure. Newegg for example publicizes their desire to never settle patents assertions regardless of the validity of the patent or the infringement claim. The company's Chief Legal Officer Lee Cheng has said that "At Newegg, we have consciously decided to not settle with patent trolls, because settlement only feeds the beast".

IMPLICATIONS FOR IP STRATEGY

Large strategic portfolios generate large revenues. Costs are not linear. Small portfolios have much lower margins and the break-even point has risen in recent years. The work required to support a small portfolio or a single patent has also grown. When a portfolio has exceeded its critical mass – that is it is too big to successfully invalidate all the patents through IPRs or court challenges – then options for extracting value from the portfolio multiply.

IP and patents play a role in mergers and acquisitions, strategic sales and business partnerships. To be effective in today's more patent skeptical market patent owners must be prepared to demonstrate the tangible value of their patents. When patents are most directly able to contribute to a company business strategy through monetization, today's patent portfolio owners have the opportunity to monetize their patents in a wide range of methods including:

- Establish an internal licensing program
- Outsource to a third party licensing organization (privateering)
- Sell patents
- Leverage patent pools

The number and range of high value patents in a portfolio are the key driver in the range and choice of options. A sufficiently large cluster of patents in a narrow technology area highlighted by exemplary patents of proven value in commercial products is ideal for leveraging value in today's licensing environment.

CONCLUSION

Intellectual Property strategy has emerged as a key component driving business strategies in an increasing number of companies. The proliferation of patents and of patent owners who are

interested in leveraging their patents have been a catalyst generating a more competitive and difficult licensing environment.

The technology patent licensing environment has undeniably become more complex and difficult. Specifically, a combination of legislative and judicial factors has reduced the value of individual patents. Big operating companies have become much more willing to check the validity of individual patents or small portfolios by waiting until they are in litigations. Despite these pressures, large portfolios or aggregations of valuable patents that exceed critical mass are being successfully licensed for very large royalties or other important benefits to their owners. While there are still examples of highly successful small licensing programs, patent owners are being forced to look at alternative means such as outright sale or privateering deals to patent aggregators for extracting value from small patent portfolios.

ACTION PLAN

Success in licensing requires that you as a patent owner to really do your homework. You need to:

- Demonstrate the clear value of your patents by showing their use in competitive products and linking that use to your competitor's revenue
- Build a more valuable portfolio with a broad range of technologies that contribute to numerous aspects of a product rather than only one or two

Preparation is the key to success. Patent licensing campaigns require:

- Detailed preparation of claim charts and supporting economic damages modeling
- Preparation for licensing that needs to be as comprehensive as preparation for litigation
- Clear and convincing evidence that leads to a conclusion that a license is both required and inevitable - this will help convince your licensing partner to spend a large portion of a shrinking or non-existent licensing budget on your portfolio
- Demonstrating a continuing business risk by clearly documenting infringement allegations well beyond the typical one to five patents asserted in a first litigation

Terry Ludlow, Founder and CEO



Terry Ludlow, Founder, Chairman and Chief Executive Officer (CEO), is a recognized pioneer in semiconductor reverse engineering, and was among the first to realize its value for Intellectual Property (IP) groups and technology teams. He founded Chipworks in 1992 to offer semiconductor and microelectronics system reverse engineering services to companies seeking

to build a competitive advantage, and protect and grow the potential of their intellectual property. As CEO, Terry continues to provide the strategy, vision, and driving force that have earned Chipworks its position as the premier source of knowledge of what's inside technology.

Terry first developed his passion for reverse engineering while working at Mosaid Technologies as the Manager, Design Analysis Services, and heading the Reverse Engineering Group for three years. Responding to market demand, Mr. Ludlow seized the opportunity and launched the industry devoted to providing evidence of patent infringement and competitive intelligence through reverse engineering.

Today, Chipworks has more than 125 full time dedicated professionals worldwide. IP groups and their legal counsel in the world's semiconductor and electronics companies trust Chipworks for success in patent licensing and litigation – earning hundreds of millions of dollars in patent licenses and saving as much in royalty payments. Research & Development and Product Management rely on Chipworks for success in new product design and launch – saving hundreds of millions of dollars in design, and earning even more through superior product design and faster launches.

Mr. Ludlow frequently addresses industry conferences including the IPBC, Licensing Executives Society, and the Brussels IP Summit. He holds numerous patents for his reverse engineering innovations and regularly authors articles for publications around the world.