DIGTITAL WARS:

Legal Battles and Economic Bottlenecks in the Information Industry

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Introduction

"Information is born free but is everywhere in chains …"

Well, not quite. The streets are not festooned with guillotines, and there is more information at hand than anyone can hope to digest.

Still, the digital revolution has produced a startling anomaly. Though new information is now very cheap to create and near costless to share, the Information Industry seems set on condensing into mega-empires:

- Microsoft continues to own desktop computing, a nearly 20 year dominance, and continues to spread its monopoly power hither and yon – out to corporate servers and databases, web servers and browsers and media players, Internet application interoperability standards, cell phones, video games, etc.

- The old Ma Bell empire is reappearing around the duopoly of SBC and Verizon, and the US cell phone industry is similarly condensing to a few mega-players (tracking the experience of most other nations).

- Cable TV systems are consolidating into a national duopoly of Comcast and Time Warner, and satellite TV is now a Direct TV (Newscorp) v. Echostar duopoly.

- TV programming channels and content are increasingly dominated by huge corporate conglomerates, e.g. GE/NBC/Universal, Disney/ABC, Viacom, Newscorp, and Time Warner.

At the same time, the Industry appears locked into several near-perpetual legal battles, e.g.

- The Open Source Wars, pitting free software against proprietary programs.

- The Windows Wars, challenging Microsoft's monopolies on antirust grounds.

- The Mogul Wars, where giant electronic publishers fight each other and the government to amass ever-larger swaths of digital content.

- The Last Mile Wars, arraying the telecomm and cable giants against each other to control broadband Internet access by households and businesses.

- The Spam and Spyware Wars, raising basic questions about who owns information about the whereabouts and behavior of Internet users.
- The Napster Wars, pitting intellectual property owners against technologies and services that exploit the costless share-ability of digital information.

This paper explains all these things …

Well, not quite, not by a long shot.

Instead the paper seeks only to survey in short compass this landscape of economic and legal turmoil by adopting a single point of focus. That point is a familiar proposition of neo-classical normative economics: industries should so function as to contribute the most value possible to the general economy, i.e. to the prosperity of everyone, and the framework of laws and public policy regarding an industry should be structured to enable that felicitous outcome.

By adopting a single norm, the paper sets aside the many other values that typically enter the fray, e.g. free speech, content diversity, democratic governance, privacy, the Dow Jones Average, America's geo-political interests, the current account deficit, etc. But the general prosperity – the focus here – is not inevitably at odds with any one these. And, to the extent it is, that is worth knowing.

By focusing on economic value-added, the paper can only scoot farabove the forest, ignoring lots of very consequential trees and bushes. The devils of the law always lurk in the details, and the paper must leave the fellows there, unattended. The aim here is merely to provide an introductory framework for understanding the Industry's persistent economic bottlenecks and major legal battles.

Part I summarizes the norm of economic value-added and offers a simple, rough economic taxonomy of the Information Industry. The paper then moves on to examine the major legal battlefields, grouping these around the two broad issues of contention, i.e. property rights (Part II) and the dilemma of "natural" monopolies (Part III).

I. The Concepts of "Economic Value-Added" and "Information Industry"

Economists break an industry into its various markets, defined generally by the product or service offered (and, implicitly, by the geography effectively served).

The standard model or graph of an industry market depicts the product's price (vertical axis) against the number of units bought and sold over a defined period (horizontal axis). The "equilibrium" price/quantity point is where the industry's upward sloping supply curve -- which reflects the marginal cost of providing the product – intersects the

industry's downward sloping demand curve. The supply curve slopes up because suppliers maximize profits by pouring more resources into the market the higher the price they can fetch, while the demand curve slopes down because cheapness makes the product more affordable for consumers.

The industry's "value added" is the area between the supply and demand curves, to the left of the equilibrium point, and this area is in turn allocated between supplier profits (the area below the horizontal equilibrium price line) and consumer surplus (the area above that line). Value-added – the sum of profits and consumer surplus -- is the economic benefit bestowed on the wider economy by the industry's existence and operation.

The central theorem emerging from this standard model is that competing suppliers in a market will generate more value added than will a monopoly supplier. This is because competition forces each participating supplier to take the equilibrium price as a given, while a monopolistic supplier can raise the market price (i.e. move upward to the left along the industry demand curve) by shrinking the quantity offered, creating a wedge area to the left of the competitive equilibrium point. This triangle represents the "deadweight loss" in value-added occasioned by monopoly.

The standard model's policy recommendation is, therefore, to keep markets competitive, chiefly by preventing suppliers from colluding with respect to prices or supply quantities.

The model is of course a simplification. It assumes, for instance, that all suppliers products are identical (except for their marginal costs of supply), while in practice suppliers seek to "differentiate" their offerings via branding and distinctive functions and features. The result is "imperfect competition" and a range of supplier-distinctive equilibrium prices; in effect, each supplier has some "monopoly power" for its distinctive product. But if there is adequately high "substitutability" among the products, from the consumers' perspective, the standard model still works, i.e. the market is still adequately definable as such. (In the case of information products, differentiation is invariably present; no two poems, paintings, or songs are identical.)

To apply this standard economic model to the Information Industry, we must first define that beast.

For purposes of this paper, an "information product" is any good or service designed to inform, entertain, communicate, or educate, and the Information Industry ("the Industry") includes all the people, firms, and activities directly involved in creating, marketing, and/or distributing "information products."

This industry definition obviously sweeps in millions of distinguishable products and markets -- including most of what are commonly labeled the media, software, communications, and education industries. The Industry definition deliberately excludes, however, myriad "information rich" goods and services designed to serve purposes other than informing, entertaining, communicating, or educating, e.g. smart bombs, self-

regulating thermostats, cars packed with transistors, avionics gear, toasters that sing before scorching your slice, etc. (Note that these definitions end up bifurcating the "software" industry: Software within "non-information products" is not an information product, but most standalone software programs are information products, as is software designed for use within devices -- including general purpose computers – designed to create, market, distribute, or use information products.)

The Industry can be segmented in a whole host of ways, depending on one's purpose. For basic economic analysis, however, a simple tripartite segmentation works adequately: Every person and firm on the "supplier" side of the Industry engages in one or more of these three activities – creating information products, marketing them (i.e. editing, packaging, branding, and promoting them), or distributing them from their creators or marketers to their final customers.

Most Industry firms do two or more of these things, but each of these three activities has distinct economic attributes.

Creating: People create information products because we are an intellectually fecund species. Throughout history, zillions of stories, novels, gossip, poems, lectures, carvings, songs, plays – and, more recently, digital videos and software programs – have emerged without the slightest expectation of financial recompense. Patronage has regularly delivered great art, but so also have numberless drafty garrets, back-alleys, and hackers' bedrooms. The digital age has now substantially shrunk the mechanical costs of intellectual creation and, in the process, greatly expanded the world-wide pool of creators. As a result, for any genre or type of information product, the "raw" supply curve – i.e. before the costs of marketing and distribution – is a horizontal line at zero or near-zero price. Because some potential creators will pitch in only for financial reward, this supply curve eventually turns up – but way out to the right.

Marketing: This is a more mundane and tedious set of activities – editing and packaging raw information products and branding and hawking them to potential consumers. These marketing activities could also be termed "publishing" (though absent the "physical" distribution function often included in that term). They servethe useful social purpose of reducing the search costs of potential customers and, in some circumstances, of creating a composite product more valuable to consumers than are its raw components. Few people will do "marketing" for nothing. The supply curve for these activities is therefore fairly conventional, sloping smoothly upward. That is, marketing is a classic "variable cost" endeavor.

Distributing: This function used to require lugging things from place to place – books, stone tablets, newspapers, rolls of film, phonograph records, etc. Distribution now occurs digitally, via either electronic (occasionally photonic) networks or so-called "platform software" which can host and deliver applications software and other information products to users. Once the network or software platform exists, the distribution costs are trivial. But the upfront costs of building networks or software platforms, and the vulnerability of both to "network effects" results in very odd supply and demand curves

for digital distribution activities. Indeed, it is the distribution function of the Industry that is most prone to bizarre outbreaks, and spreading epidemics, of monopoly power.

This brings us to the task of applying the standard economic modelof "value added" to the digital Information Industry.

The first problem that arises is that no two information products are identical: each poem (or song or story or painting) is distinct. But this problem is not unique to information products, and so does not itself prevent using the value-added model to analyze the Information Industry. The model, and its graphing of "a market" is *always* a "generalization" from a messier reality. In almost every market, each supplier seeks to "differentiate" its offering by uniqueness of brand, quality, or features. Each therefore enjoys a semi-unique demand curve, with the corollary limited ability to exercise a "mini-monopoly". Competition is "imperfect", consisting of consumer substitution among the different products, taking into account all their differences, including price.

There are, however, three genuinely serious obstacles to the simple application of the standard economic model and graph to markets for information products.

- The property dilemma: Unlike conventional products, digital information is costlessly sharable: if you and I synch our hard drives, I-Pods, or Ti-Vo's, we can each fully enjoy the same digital information without detracting from each other's enjoyment. With conventional products, by contrast, if you have it, I don't, and vice versa, and so a price mediated transaction is necessary to move the product to the user who values it most. With a digital information product, once it exists, the best way to maximize its value added to the economy is to price all copies at zero. However, this eliminates any financial incentive for someone to create the information in the first place (or to market it to potential consumers). Though lots of people will create information products without a financial incentive, some won't. This simply means that there is an open question in the value added computation as to the "optimal" regime of property rights for information products: what regime will optimally balance the incentives required to produce information with the huge value added potential of free or cheap information? The standard economic model doesn't help much in answering this question, because the standard model merely *assumes* thatownership and physical possession are more or less co-terminus.

- The natural monopoly dilemma: Collusion is not the only engine for achieving a lasting monopoly. In two situations, a "natural" monopoly can emerge – and both of these situations occur frequently and prominently in the Information Industry. In the first, the situation of "extreme scale economies", a supplier faces very high upfront expenses – causing a very high marginal cost for the first unit of supply – but the firm then enjoys very low and often decreasing marginal costs for the subsequent units it supplies. This gives the firm a *downward* sloping supply curve after the first unit. Enjoying a *temporary* monopoly from its initial entry into the market, the first-mover firm can price the subsequent units high enough

to recoup its upfront costs. Later entrants, however, will not have the monopoly power to recoup their entry costs – and may not enter at all. The result is a durable "natural" monopoly for the first entrant. An example is a fixed line telecommunications or cable TV service, where the first unit's marginal cost includes massive investment in trenches, poles, wires, cables, transmitters, etc., but subsequent units of the service incur very low marginal costs. The second "natural monopoly" situation, so-called "network effects", results in a demand curve that slopes bizarrely upward. This happens, for instance, with a proprietary communications service, e.g. a proprietary telephone or instant messaging network: each user will value this proprietary service at a higher price the greater is the number of other users. The initial service provider garners a natural monopoly because new users flock eagerly to where other users are accumulating. The same "network effects" phenomenon happens with platform software: the program that attracts the most third party "applications" will become more valuable per unit to its potential users, and more applications will inevitably get written for the most used platform. Natural monopolies – whether resulting from extreme scale economies or network effects -- are not curable by forced competition, e.g. by breaking up the monopoly firm into competing units: this merely destroys the value added generated by the extreme scale economies and/or network effects; and break-up would in any case prove only a temporary expedient, as the forces of natural monopoly would re-assert themselves all over again: one of the newly broken-up units would again take over the entire market.

- Cross-market leveraging of monopoly power: The standard model's graph deals with a single market over a defined time period. It therefore cannot capture the phenomenon of "leveraging" monopoly power from one market into an adjacent market (e.g. a market that the monopolist buys from or sells to or that provides products complementing the monopolist's product). Leveraging could occur by acquiring a firm in the adjacent market or simply by entering it aggressively. For many years, prevailing economic opinion held that cross-market monopoly leveraging was a rare and harmless phenomenon, because monopoly profit in the primary market is maximized by keeping adjacent markets conventionally competitive: such competition minimizes the monopolist's input costs and/or maximizes end market demand for its product. So "leveraging" merely re-allocates the monopoly profit from the primary markets into the adjacent markets and doesn't add to total profits. This logic is generally sound -- but only if the adjacent markets *can* remain competitive. If, on the other hand, they have strong natural monopoly characteristics, *someone* will monopolize these adjacent markets, and it is clearly in the primary monopolist's profit-making interest to be that someone. This is doubly so if the adjacent market's product is in fast-growing demand and/or has the potential to obsolete totally or in part the primary monopolist's product. Leveraging then becomes a tactic of long term survival and also a way to control the *dynamic* pace of product innovation and new market emergence. In that sense, cross-market leveraging allows the firm practicing it to retard or otherwise tame the forces of "creative destruction" in the industry. All this is intensely relevant in the Information Industry, because this is an arena

> where natural monopoly markets abound, and wherethe rapid invention of entirely new products and markets is itself a significant engine of competition and economic value creation.

These three "dilemmas" do not make the norm of "economic value added" any less persuasive, but they do mean that merely preventing collusion among suppliers is insufficient to optimize Industry value-added. Doing so instead requires special attention to property rules and to government policies regarding natural monopolies and the cross-market leveraging of monopoly power. And, not coincidentally, it is in precisely these areas that the Industry's most persistent legal wars are being waged.

I. The Property Wars

To create a property right in a digital information product requires either a legislated regime of intellectual property protection, capable in its enforcement of foiling free copying, or a technology that makes possible the "physical possession" of information products. The chief forms of legislated intellectual property are copyright and patents, while the technology promising physical possession is called "digital rights management" ("DRM").

A. Copyrights and patents

Any legally recognized property right, but particularly one created without physical possession, requires specifying three variables: the right's trigger event, its duration, and its scope. Copyright and patent law have spawned enormous controversies by their recent treatment of each of these variables. The only point of wide-spread agreement is that economic value-added is indeed the correct criterion for testing various specifications. Though continental European law recognizes for creators an inalienable "natural right" to property in intellectual and artistic products, the American Constitution regards information as unowned by anyone absent positive law to the contrary; vests vestsexclusively in the federal Congress the power to create and recognize intellectual property rights; and limits this power to rights that _____. But of course, the document does not detail how to craft the three variables of those property rights, and therein lies the rub.

1. Copyright

Before ____, the trigger event for copyright protection was the creator's formal "registration" of his claim with the U.S. Copyright Office. This served to winnow out myriad information products whose creators didn't care enough about financial reward to

bother with the registration formalities, and it also of course gave other creators a handy place to check on whether information they thought about using or re-working was legally protected. Today, however, copyright protection arises automatically upon the mere creation of an information product. No registration is required unless and until the claimant wishes to sue upon the claim. This simple change in trigger has extended copyright all over the landscape; one must now prudently assume that every shred of information is legally protected, and there is in any case no way to find out one way or the other.

It is difficult to square this change in trigger with the norm of value-added. New information, of any type or genre, builds on old information. That's the nature of intellectual innovation and cultural evolution. To throw an automatic "don't use or copy this" ban across all fragments of information in a society does not plausibly optimize the creation of new information. It retards it by generating needless uncertainty.

The duration of copyright has also greatly expanded since the Nation's first copyright statute. The original protection lasted 14 years, with one 14 year renewal possible (through re-registration). Today, after several dramatic extensions, copyrights last 75 years. {details} Like the liberalization of the trigger event, this longer duration radically shrinks the scope of the public domain without adding plausibly to a new creator's incentive to create. How many creators would really decide to down tools if their potential royalty period were 28 rather than 75 years; do you know any such peculiar people? I haven't. Of course, those very few creators who hit upon a durable classic will always be happy to keep on reaping royalties for it – but would they really have decided not to create the thing at the outset if limited to 28 years of royalties? {extensions included already active copyrights}

However, the weirdest deformities of modern copyright law – from a "value added" perspective -- concern the "scope" of protection, the third variable of the property right.

- The first copyright statute covered only words. Today the protection extends to all information products – songs, recordings, cartoons, pictures, plays, musical and stage performances, statues, movies and videos, and software programs – in a phrase, everything in the culture. One can certainly argue that each of these things needs some sort of legal ownership right, but the statutes make little or no distinction concerning the kind of legal protection these wildly diverse artifacts should enjoy.

- The application of copyright to software is particularly vexing. This is in part because software, even more than other information products, necessarily builds upon prior software: there are only so many "good" ways to program particular ideas and desired effects, and software programs must generally co-exist and co-operate with software products already lodged on user computers. The coverage of software isalso problematic because software programs are created in five distinguishable stages, and no one can ever be sure what manifestations of which of these stages is in fact copyrightable. The first stage is the "functional

specification", which typically is a general wish list of things some manager or entrepreneur would like to see the software accomplish for its customers. The second stage, the "technical specification", is a programmer's roadmap for building the software. The third stage, the "source code", describes the program in detail in a "high level" language (e.g. Java, C++, Basic, Fortran) readable by other programmers. The forth stage, "object code", is merely thousands or millions of "1's" and "0's" that are readable only by a computer operating system, which then follows these digital instructions in telling the machine what to do. Object code is what the firm sells or licenses to users. (The firm generally keeps the source code a dark secret, files away the technical specification, and largely forgets the functional specification.) The firth stage is the "look and feel" of the program's user interface on a computer monitor. Which of these five things is covered by a copyright on the "program", and to what extent, is left by copyright law to case-by-case adjudication and the gradual accumulation of inevitably inconsistent precedents grounded in facts and circumstances that are of course never exactly duplicated. The result is a legal regime that shrouds the entire software industry in uncertainty.

- Through a ___ quirk in legislative draftsmanship, copyright today protects against "copying" rather than, as originally intended, against "publishing". In the printing press age, the two were roughly identical. In the digital age, however, every *viewing* of a piece of information – every repeated "use" of it – generates a fresh computer copy of the thing. View a thing twice on the monitor and you are violating the copyright, unless specifically licensed for multiple copies. This infelicity in copyright's formulation is, again, particularly anomalous as concerns software products. Most new programs are written to duplicate or improve upon what prior programs do, without however "copying" those other programs. This is how new programs compete against old ones in the market place. It is therefore standard practice in the industry to run an old programs' object code multiple times in order to discern the logic of its source code, to learn how it does what it does, so that the new program can do these things better. This "re-engineering" process, because it entails repeated "copying", is technically a violation of the old program's copyright. The courts have fortunately – so far – exempted re-engineering from copyright liability, but this exemption is not embedded in statute and is accordingly subject to the shifting tides of judicial opinion.

- For conventional products, ownership of something is naturally delimited by the physical dimensions of the thing. Copyright protection, by contrast, extends to "derivatives" of the protected information. Since all new information builds necessarily builds upon prior information, the "derivative" concept is potentially – and sadly also in practice – a dark cave in which many devils may lurk. Modern case law has dramatically extended the derivative notion, casting inevitable uncertainty around every work that in some way echoes or is inspired by or makes reference to an earlier work.

- There now exist – thanks to the meandering course of case law -- three varieties of "secondary" liability for copyright infringement -- contributory, vicarious, and induced infringement. Bluntly put, no one, not even the most expert intellectual property lawyer, can reliably tell you what each means or how they differ from each other. The cases are all over the lot. This is particularly troublesome in the digital age because of the possibility that supplying a use-neutral technology or technology-based service might give rise to a secondary liability finding under one or more of these theories. Until this year, it was reasonably clear that a use neutral technology or service would escape such liability, even if used after sale to infringe copyrights, as long as the it also had "substantial non-infringing uses". In MGM v. Grokster, the Supreme Court reiterated this principle but held that copyright inducement could nonetheless attach to a use-neutral file sharing service if its supplier actively sought out infringing customers and – perhaps most significantly -- that failure to take {easy steps] to block such infringements might be taken as confirmatory evidence of an intent to induce infringement. What this will mean over the long term to the legal risks facing technology innovators, no one is sure. The only certain thing is that there will now be lots more time consuming and expensive litigation brought against every technology and technology service that arguably is used in part by copyright infringers – which is, in fact, most digital technology.

- Finally, the two doctrines designed to limit the scope of copyright protection – the idea/expression distinction and the "fair use" defense – are both inherently vague and continuously mutable in their judicial interpretations, spawning endless litigation, which inevitably turns on tortured consideration of "multiple factors" that vary with the "facts and circumstances" of each case. This kind of judging may look "judicious" to lawyers, and it undeniably keeps them profitably engaged. But for litigants – for the people actually trying to function in the Industry – it is merely a long-winded way to say that there is, effectively, no law on which any advance reliance may be placed.

In brief, it is difficult to believe that contemporary copyright law optimizes economic value-added from the Information Industry. By excessively blocking new creators' access to old information products—largely through the vagueness and over-reach of its component doctrines – copyright law has become a burden on, rather than an incentive for, Industry innovation. The remedies are obvious, though politically very unrealistic at this point: re-instate official registration as copyright's trigger event, shorten the length of protection (particularly for software products), dramatically narrow the definition of "derivative" products, embed in statutory law the exemption for the software re-engineering process, narrow the reach of secondary infringement liability as regards use-neutral technologies and technology services, sharpen the vital idea v. expression distinction, and expand and clarify the standards for fair use of copyrighted material.

2. "Copyleft"

The overreach of copyright law has in recent years spawned a very clever legal innovation that turns copyright upside down. Available in several variants, an "open source" copyright license essentially permits a creator to assure that his work – and all its future derivatives (by anyone) – will remain freely and permanently available in the public domain. A so-called copyleft license is a conventional copyright document except for these revolutionary provisions.

Open source licenses have spread rapidly throughout the software industry, giving birth – through unpaid cooperative efforts -- to such products as the Linux operating system, the Apache web server, the Firefox web browser, and many important software components of the public Internet. Linux now is challenging Microsoft Windows for market share in the corporate server market; Apache has long been the market leading web server; and Firefox is gaining market share (albeit from a small base level) from Microsoft's Internet Explorer browser. Sun Microsystems has recently released its Solaris operating system and some of its Java technology under specialized open source licenses. Linux is now championed by large technology vendors, such as IBM and Hewlett Packard, who have committed large sums to its marketing and technical support.

The open source model is also now being tried in non-software markets, e.g. for music, videos, and books. Particularly in underdeveloped economies, there is clearly widespread enthusiasm for the vision of "free culture".

The aim of the open source movement is to create a large storehouse of information products that everyone can freely use, adapt, customize, and improve (with such changes also entering the copyleft public domain). Doubts certainly remain whether this model of collaborative, financially uncompensated creative effort can produce products of the highest quality and sophistication. But it is difficult to disparage such early successes as Linux, Apache, and Firefox on those grounds. The real promise of the movement – other than the "anti-commerce" ideology and enthusiasm of its advocates – is the simple fact that creation in the open source universe does not face the financial barriers to the use and reworking of old information that burdens de novo innovation in today's conventional copyright universe.

3. Software Patents

Most information products (e.g. stories, poems, songs, videos, etc.) cannot be patented. Patent law was designed to protect (with a 20 year monopoly) inventions that are novel, useful, and non-obvious to people reasonably experienced in the particular trade or profession.

But software *can* be patented. This was not so until 15 years ago, because software programs were regarded as merely a collection of "if/then" algorithms – in effect as "mathematics" – and mathematical formulas and equations cannot be patented. The legal logic of the courts' self-reversal need not detain us. Some sort of reversal was no doubt inevitable, and economically justified, because machines today have progressively used

software to replace internal components that were once levers, cogs, and wheels. So inventing a new, useful, non-obvious "machine" for nearly any purpose is today in part a software programming exercise. However, the courts did not stop there; they deemed *all* software programs eligible for patent applications, i.e. including those stand-alone programs which this paper includes within the Information Industry, i.e. programs designed to inform, entertain, communicate, or educate or that host products that do these things. At the same time, the courts declared that even "business processes" and "business methods" are patentable (e.g. Amazon's "one click ordering" idea for online commerce).

This makes no economic sense.

- Software already enjoys copyright protection. Adding another layer of intellectual property is at best redundant, but is in fact usually much worse than that. Copyright and patent doctrines are confusingly inconsistent. (i) If it's uncertain in many cases which of the five stages of software production are covered by a copyright, patent protection imperially reaches out to cover all the stages. Software firms routinely claim patents on their "source code", even though – under standard patent doctrine – anything patented must be disclosed to the public, and source code is rarely disclosed. (ii) The idea/expression distinction that is supposed to limit copyright's scope has no place in patent law: ideas are patentable. That's why business methods and processes are now patentable, and so also (presumably) are the "functional specifications" and "technical specifications" which are drafted merely to guide a programming exercise. (iii.) Patent law recognizes no "fair use" defense to infringement. (iv.) Both copyright and patent law cover "derivatives" of the protected product, but the derivative doctrines are different under the two bodies of law. In consequence, the double intellectual property protection of software adds many layers of uncertainty for any innovator sitting down to write a new program that may echo in some way the logic or purposes, or even the conceptual ideas, of existing programs.

- Patent litigation is phenomenally expensive, lengthy, and uncertain in its results, even compared to copyright litigation (which is itself no slouch on these fronts). Big established firms can afford this burden, and can additionally afford to amass a sufficient portfolio of patents to counterattack any small or start-up firm that may choose to bring a patent infringement suit. Though ostensibly designed to protect the maverick entrepreneur and innovator, patent law in its litigation economics and dynamics tilts the odds heavily in favor of large, entrenched firms. Since many of the really important innovations in the Information Industry have historically emerged out of small, start-up companies, this is no trivial problem.

- The Patent Office is notoriously understaffed and ill-equipped to understand or vet the myriad, exotic software and business process/method patent applications streaming regularly from the Information Industry. Therefore,

thousands of such patents have been issued which no doubt would prove invalid in litigation (because of lack of novelty, utility, or non-obviousness). But the costs of litigation are so high that these roguish patents nonetheless often cow innovators into settling court challenges for large sums or, more often, into simply giving up on innovating in a field that shows lots of issued patents.

- Nearly all commercial software and business process/method innovation takes place under the spur of intense marketplace competition. The firm innovates because its survival and prosperity require it; absent the innovation, innovate competitors would surge ahead. In most cases, this sheer race for commercial survival and temporary competitive advantage provides more than enough "incentive" to innovate: slapping on a 20 year legal monopoly is not needed for these innovations to emerge. With software and business processes and methods, we are not dealing with the lone visionary who must spend years in his garage or basement to come up with a totally revolutionary new technology. We are instead dealing with a near continuous process of innovative improvements upon prior programs and business models. Patent law is simply not needed in this environment. And indeed the software industry, and business models throughout the Information Industry, witnessed extremely rapid change and invention for many years before the courts decided to recognize the patentability of such innovations.

- The patentability of software throws into question the viability of the entire "copyleft" movement mentioned above. Open source programs, which combine and mix the work of many programmers, can easily end incorporating some code against which some company could no doubt claim patent infringement and demand royalties. But the copyleft license will generally preclude payment of royalties, putting the user of the open source software into a legal Catch 22. Observers have noted, for instance, that Microsoft's vast patent portfolio likely contains some claims that could be lodged against the Linux open source operating system. Though I am not aware Microsoft has used patent infringement threats in its market share struggle against Linux, the possibility has already caused considerable consternation in the large community of companies now deploying Linux.

The obvious remedy for all this silliness is legislation to exclude stand-alone (or, if you prefer, "Information Industry") software from patentability, and throwing into the excluded category – for good measure – all business processes and methods. This would still leave patentable the "software innards" of conventional, machine-like inventions. Though such a solution would obviously require some tedious line drawing, the notion is hardly novel or impractical: the European Union is currently debating a similar scheme. Its major detractors are even more radical: they would leave *all* software outside the scope of patent protection.

B. Digital Rights Management ("DRM")

Just as digital technology makes feasible the costless and unlimited share-ability of information products, it now makes it possible the "physical" eradication of that peculiar attribute. Technology – called digital rights management ("DRM") technology -- is now coming to market that permits the creator or marketeer of a digital information product to dictate precisely who may use or otherwise experience, copy, and/or further distribute the product and on precisely what terms and conditions.

DRM re-unites ownership and possession in a far more detailed and exact manner than is true even for conventional tangible products. With a conventional product, you typically sell it or lease it on reasonably simple terms, and that's that. The buyer of a sold good can then do anything he wants with it. A lessee is bound by the lease terms. In effect, however, DRM enables the creator to break a product into many other products, each distinguished by its permissible use and the stipulated terms and conditions of that use. Products become "proprietary" *in detail*, a regime that makes copyright and patent protection look like a 98 pound weakling. DRM recognizes none of the "duration" or "scope" limitations of copyright (however excessive or vague these might be), and permits, for instance, the "ownership" of ideas, not just expressions, and need not allow for any "fair use". But DRM does require the non-trivial "trigger event" of setting up and technologically protecting the terms and conditions of use and distribution: the creator or marketer must decide upfront on how widely used and distributed he will make his product, and how expensively he will price it, and DRM does not cover "derivatives" of the product (so long as these have not been confected by someone via breaching the terms and conditions of the DRM). These are all economically value-adding features of DRM as compared with copyright protection. Using DRM alone, a creator cannot – as copyright law allows -- simply sit back and wait to see if, at some later point, someone has arguably intruded on his unregistered legal rights and therefore might be forced to pay damages for so doing. With DRM the fact and terms of protection are clear to all from the outset.

Needless to say, most opponents of copyright overreach are even more heated in their opposition to DRM technology, fearing it could in effect "enclose" the entire culture behind digital walls. Few if any of these opponents would outlaw the use of DRM. Rather the battles to come will no doubt center on laws that criminalize technological "circumvention" of DRM systems.

On grounds of value-added, it's difficult to fault DRM technology itself, as all it does is turn information into a precisely measurable and priceable product, and creators remain free to use it to recreate exactly the terms and conditions of a "copyleft" license. The real problem is, I believe, the combination of DRM *and* copyright law (not to speak of patent law). If government is to use anti-circumvention law to protect DRM, a provocative trade-off is worth considering: bar circumvention only where the creator using DRM has explicitly waived the protections of copyright.

C. Spam and Spyware:

Users of online services – email, websites, online commerce services, etc. – automatically generate lots of information about themselves: email addresses, the sites and subjects they consult on the Web, the stuff they buy or consider online, the things they talk about in their emailing or instant messaging, etc. Digital technology permits those on the other end of the line, and often third parties who scan and crawl about the Internet, to learn and amass this information. This information is then used by both "legitimate" commercial firms and assorted rogues and hackers to access the users who generated it, usually to advertise or offer products to them, and of course sometimes just to annoy or damage them. The result is email "spam" and various sorts of spyware and adware that gets stealthily implanted on the user's computer.

In sorting out the rights and wrongs of all this, judges and legislators have typically resorted to rough analogies with "off-line" commerce or to tangentially relevant legal doctrines that range from free speech, through copyright law and trespass on choses, to various privacy doctrines. But, to analyze the economics of alternative solutions, and also to achieve some kind of coherence to the emerging law across this whole area, the basic question is "who should be deemed to 'own' this user information?"

There are two conceivable answers: the users themselves or those who amass and compile the information (which is, at least initially, the provider of the online service or of sub-services riding atop the primary service).

The information is obviously very valuable: that's why it gets commercially used, rented, and abused so lavishly The value accrues in two stages, first at its generation by each user, and then by the compilation and cross-indexing of the raw information across a number of users. Though one can tarry here to consider whether one of the two assignments of property rights – to users or to the information-gathering online service -- would minimize "transaction costs", but this isn't necessary: transactions in cyberspace are very cheap.

The value maximizing solution would appear to be to vest ownership in the initial user – the modest fellow about whom the raw information pertains. This is the only solution that nicely and precisely slices the two stages of value and therefore accurately captures both in a pricing schema. The online service would, in such a regime, be required to secure the user's OK to include his information in a compilation of such information and, for this OK to be informed, the online service would have to disclose how the information may be used. One can imagine that for some users and some downstream uses, an OK will be forthcoming only for pay, in cash or kind. But so what? If the raw information will add value to the compilation, the compiler will pay accordingly, as in all commercial exchanges.

And indeed most legislation regarding spam and spyware does now give a central role to user permission, though none simply state that users "own" information about themselves. The differences among the various statutes and legislative proposals center on the exact type of user permission that is required (there being in practice an enormous behavioral difference between explicitly saying OK and simply neglecting to "opt out" of an otherwise automatic transfer of ownership.) Needless to say, companies in the business of compiling multi-user data prefer the weakest conceivable permission requirement, as this artificially reduces their cost of goods sold – not a compelling argument from the point of view of total economic value-added.

The really hard public policywork still to be done concerns practical issues regarding enforcement of the user ownership right. The difficulties are of several types, most prominently the technical problem of finding the violators (because the underlying protocols of the Internet permit great anonymity) and, secondarily, the legal problem of fashioning workable civil and/or criminal remedies that will optimally deter violations.

II. The Monopoly Wars

The distribution function in the Industry is rarely "competitive" in the normal sense. That's because digital information distribution is vulnerable to the two forces of "natural monopoly", i.e. extreme scale economies and network effects. These forces have created major economic bottlenecks in two large sectors of distribution, platform software and electronic networks.

A. Platform Software

The term "platform software" refers simply to any program whose purpose, in whole or part, is to host other software programs, i.e. "deliver" them to users. Microsoft's Windows operating system is the classic case: while its chief purported purpose is to control the internal functioning of a computer's various components, its users (and Microsoft itself) focus instead on Window's capacity to host software applications. And of course Windows has for several years been the target of mammoth antitrust battles in the United States and the European Union.

Everyone knows – and the courts have now found – that Windows enjoys a monopoly in the desktop/laptop operating system market. Whether Microsoft obtained this monopoly by superior technology and skill or by improper competitive tactics is of historic interest, but is economically uninteresting. (The issue is also not the focus of the antitrust litigation.) The economically salient reality is that this market constitutes a natural monopoly; someone was going to monopolize it, and Microsoft got the brass ring. The source of natural monopoly here was not extreme scale economies caused by high R&D launch cost. Operating systems do not require fortunes of money or time to invent, and in

any case Microsoft bought its initial operating system product for a song from its inventor. Rather, "network effects" were the source of natural monopoly: once Microsoft got a lead market share (through a skillful partnership with IBM), the company's operating system naturally attracted most of the industry's third party applications, which fact further expanded the operating system's user community, and so on and on in a virtuous cycle of market domination.

If monopoly was inevitable for someone, why care about it, especially because networks effects themselves generate lots of economic value?

There are two answers, and both center on the same phenomenon, the "proprietary" technical standard by which Windows interfaces with applications (i.e. the operating system's application program interface or "API").

It is in theory possible to conceive of non-proprietary, i.e. "open", API's. If such an open standard prevailed throughout the operating systems market, massive network effects would still occur, but these would not create monopoly. Since all suppliers' products would be "open" to the same applications, these suppliers would have to compete, in the "normal" way, solely on the technical merits and marketing appeal of their respective operating systems. In short, an open standard, by wedding network effects to the virtues of competition, would enhance the value-added by the operating system industry to the general economy. Needless, competition between open standards operating systems would result in lower prices and profits for all of them, but the corollary expansion in consumer surplus would more than make up the difference in terms of total value-added.

So the first reason to care about the Windows monopoly is that, in an ideal world of open API's, it was not inevitable.

The second reason is that Microsoft has sought to leverage its PC monopoly into all manner of adjacent markets, and its chief vehicle for this tactic has been that same proprietary API. When it targets an adjacent market for future dominance, the company uses its control of the Windows API to disadvantage all other adjacent market competitors, i.e. to keep them from interfacing easily with the Windows operating system. This can be accomplished by keeping API changes secret from those competitors or, more directly, by simply "incorporating" the Microsoft product into Windows as a new feature of the operating system, shielded by the proprietary API. These are tactics which no competing company in the adjacent market can mimic or effectively offset. These tactics have been much on display in Microsoft's assaults on the office applications, web browser, corporate server, and web media player markets.

As theory would predict, such leveraging makes eminent profit sense for Microsoft because each of these adjacent markets has natural monopoly effects of its own and a significant potential for displacing over time Windows' role as a platform for host for application programs. One can ask here, as earlier, whether it makes any difference whether Microsoft or someone else monopolizes these adjacent markets. As before, one answer points to the theoretical possibility of rendering these adjacent markets

competitive via open API standards. There is, however, yet another answer. When a single company can leverage its monopoly status across multiple markets, that company gains the power to control the very pace and contours of creative destruction in the market. It becomes able to dictate, often just by signaling its intentions, to retard the invention and marketing of new products and the emergence of new markets. The company achieves control over the dynamic development of a entire sector of the Industry.

The US and EU antitrust prosecutions both aimed squarely at this cross-market leveraging of monopoly power. The EU case drags on, but the European Commission does appear to have wrestled directly with the economic realities of monopoly leveraging. The US case is largely over (though with continued federal court monitoring of the consent decree agreed between Microsoft and the Justice Department and with follow-on private antitrust cases now moving toward final settlement). But the controlling appellate decision betrayed considerable hesitation in facing the leveraging phenomenon full on. (In essence, the Court affirmed that leveraging can constitute an illegal "defense" of an existing monopoly but refused, on the evidence developed at trial, to hold that this same leveraging constitutes an illegal attempt to monopolize the target market.) One suspects the Court felt restrained by the doctrinal muddle that has surrounded the leveraging phenomenon in American scholarly and judicial writings for a number of years.

There remains, on both sides of the Atlantic, considerable doubt that antitrust courts have the tools necessary to thwart or rectify monopoly leveraging in the software industry. The US consent decree and the EU tentative judgment both seek to insulate Windows' adjacent markets from leveraging by forcing the company to make its API standards more "open", in hopes that Microsoft's adjacent market products won't then enjoy an unfair advantage over competitors. But this approach to remedies is replete with problems. First, Microsoft never tires of characterizing this forced "openness" as a theft of its intellectual property. This is a spurious argument, because adverse judgments typically require property forfeiture in all areas of law, and because there is at any rate no public policy rational for affording intellectual property rights to the API's of monopoly software platforms. These are little strings of mundane code, requiring no great inventive genius. Second, the judiciary is plainly unsuited to the unending and very detailed technical monitoring necessary to assure that an API remains adequately open. Finally, of course, the sheer duration of antitrust litigation means that none of the markets initially at stake in the US and EU cases remains fully competitive; Microsoft has seized its critical competitive edge in each one already.

The US trial court did impose a remedy that would largely overcome this objection: forced divestiture of Microsoft into two independent companies, one owning Windows, the other Microsoft's various adjacent market products. This would have created a dynamically competitive industry structure in a single stroke. But the appellate court reversed this remedy, deeming it too "drastic". This is a common misunderstanding of US antitrust courts. Corporate America undertakes such wholesale divestitures on its own hook all the time, generally to the benefit of all constituencies involved. But such a

solution is unlikely to reappear in US or EU antitrust litigation regarding the monopoly leveraging of platform software programs.

The best solution for the monopoly leveraging problem is more aggressive US and foreign government assistance to and endorsement of industry-wide standard setting bodies, particularly those seeking to create and enforce technical "interconnection" standards across the Industry. These bodies face big obstacles. Interested parties have many reasons and opportunities to force delays and introduce complications, and it is no easy matter for a "neutral" body to keep up with the numerous technical issues and changes necessary to maintain a competent standard in a dynamic industry. But the relative success of the major Internet standards bodies suggest the task is doable, and it is almost always better to get a standard than to waste months and years chasing some technically ideal standard. Put simply, the economic value-creating potential of successful standard-setting efforts is enormous and deserves vigorous government support.

B. Electronic Networks

Since their advent with 19th century telegraphy, electronic networks have typically displayed strong natural monopoly characteristics because of both extreme scale economies (i.e. the high upfront cost of erecting the networks) and pervasive network effects (operating among both network consumers and at the interface with content or programming services that can reach consumers only via the networks). This has been true of radio and TV broadcast networks, cable TV systems, satellite TV, and fixed line and cell system telecommunications networks. The Internet has uniquely avoided the natural monopoly fate because its launch costs were borne by the federal government and its network effects have remained uncapturable by proprietary interconnection standards.

Unlike the case of platform software, "open" interconnection standards for electronic networks pose the potentially value-eroding "free rider" problem: if competing networks can openly attach to the market's "leading" network – either freely or for a mere "marginal cost" fee – the resulting collapse of monopoly pricing may well dissuade investors from the investment necessary to launch and upgrade networks. (This "free rider" problem doesn't arise for platform software, because software platforms can usually be created at fairly low upfront costs.)

As a result, natural monopoly has remained a major dilemma for public policy regarding all electronic networks. Masses of confusing, overlapping, and no doubt highly inefficient laws and regulations consequently emesh the electronic network universe at all levels of government, municipal, state, and federal.

Currently, the most important and heated debates in this area concern broadband (i.e. "fast") user access to the public Internet. Each type of existing electronic network is capable of providing such access (e.g. via DSL for fixed line telecommunications

networks, technical modifications for cable networks, and various technical supplements or upgrades for broadcast, satellite, and cellular phone networks). However, in each case, the particular network enjoys a monopoly or nearly so at the local level, facing serious competition only from networks based on other technologies (e.g. the phone company versus the cable TV company as one's broadband access provider). This local monopoly power constitutes the so-called "last mile problem", and it lies at the center of most of the current legal wars concerning electronic networks.

These legal battles have raised four broad issues:

- Should public policy seek to retard the national consolidation of local monopoly networks?
- Should each network be required, somehow, to "open" itself to competing networks?
- Should public policy seek to restrain the backward integration of electronic networks with content services?
- Can new technology itself solve the "last mile" dilemma?

1. National consolidation of local monopoly networks

Recent years have witnessed the rapid national consolidation of local players in each network type, via multiple acquisitions and mergers. The 1984 break-up of ATT produced eight regional phone companies and a long distance company, the latter facing competition from MCI. There are now only two giants in this vast space – SBC and Verizon – along with several smaller players. Similarly, the cable industry has morphed from a highly fragmented landscape to a near duopoly of Comcast and Time Warner at the national level, and similar trends of consolidation are evident in cellular telephony and satellite TV. Broadcast radio networks have condensed around Clear Channel, and TV broadcast networks seem stuck at five major players (NBC, CBS, ABC, Fox, and Univision).

Does this really matter in terms of Industry value-creation? The national consolidations have plausibly brought significant scale economy cost reductions in network infrastructure and operating routines, and arguably have done nothing to increase the local or "last mile" monopoly power of the companies vis a vis network consumers. Accordingly, federal antitrust authorities have generally hesitated to restrain the consolidating mergers, and the few exceptional cases of government objection (e.g. disapproval of the proposed merger of Sprint and Worldcom) appear in retrospect to have been ill advised.

However, the national consolidations have arguably led to serious value erosion by creating very considerable *monopsony* power over providers of network content (e.g.

television programs and cable TV channels). The competitive norm for value creation applies to supplier markets as well as to user markets. Indeed, reduction in programming costs has been a very major motive for the national network consolidations.

But the issue is now mute. The national network giants now exist, and no one is seriously urging their break-up.

2. Forcing electronic networks to "open up" to competing networks

During the Clinton Administration, the FCC actively sought to force telecommunications networks to lease access to other providers of Internet access (so-called ISP's) and to competing local phone companies (so-called CLEC's and ALEC's). Extremely elaborate pricing regulations emerged, strive to keep these lease prices low while avoiding the "free rider" problem.

The regulations remained controversial on every side and spawned massive litigation and political lobbying at all levels of government. The policy of forced openness did trigger the entry of many new ISP and CLEC/ALEC companies into the telecommunications space, but nearly all of them went bankrupt when the FCC changed course during the Bush Administration, pruned oreliminated the pricing regulations, and instead began to lean toward encouraging competition for phone and Internet access services between the cable and telecommunications industries.

Meanwhile, various industry and political partisans sought, through extensive legislative and regulatory lobbying and litigation, to force the cable systems companies to open their networks to ISP's. This issue was, for instance, a major factor in FTC deliberations on the merger of Time Warner and AOL, the concern being that AOL would become a sole or preferred provider of ISP services over Time Warner's cable networks.

The current trend at the FCC and in the courts is against forced openness, for either telecommunications or cable companies. Whether Congress will re-enter the fray on this issue, and seek a redrafting of the 1996 Telecommunications Act, no one knows. For right now, however, competition in the market for broadband Internet access is pretty clearly a contest between the national giants of the cable and telecommunications sectors, with each player enjoying a "last mile" monopoly in its own technology space. In short, each household and business desiring broadband access will face a duopoly. Whether the result will be quasi-competitive or quasi-monopoly pricing options is not something predictable through economic theory. Duopolies pose an indeterminate situation as regards pricing behavior, with "game theory" capable of indicating a variety of outcomes.

3. Backward integration of electronic networks into information/programming content

Should monopoly networks be legally permitted to own content providers, e.g. cable channels and TV program producers?

Many already do. The big cable systems companies have major ownership stakes in many of the leading cable channels, and Comcast even contemplated buying Disney; broadcast TV networks have for a number of years sought to produce their own programs; the big telecommunications network companies regularly make plans to develop or buy content providers.

This practice can have obvious anti-competitive tendencies. Network ownership can result in a balkanization of the content industry and raise significantly the cost and difficulty of entering that industry. That said, there are several reasons to doubt that backward integration should be legally banned:

- The content industry has very few "natural monopoly" characteristics. That means it is almost impossible to monopolize. The phenomenon of cross-market leveraging of monopoly power is unlikely to work through backward integration into the content business. The more likely long-term result is a dilution of the network's primary monopoly. And indeed it is questionable whether any of the networks engaging in backward integration hope to gain durable monopoly power over content. The more likely motives are to fashion some temporary way to differentiate the primary network product or to hedge against the rainy day when network monopoly power itself wanes through the forces of technological advance.

- With broadband access, virtually all content can be served directly to users via the Internet. Soon, for instance, cable channels and TV programs will likely be available on any computerized viewing device. Providing broadband access is the prime competitive arena between cable, telecommunications, and cellular networks. So none of these will in fact be able to provide "exclusive" access to content.

- Cable networks and broadcast networks that have attempted backward integration have swiftly found that, to maximize total profits, they have to buy and sell content to and from their backward-integrating competitors. This of course does away with any monopolizing potential for backward integration. (Indeed Viacom has recently decided to split into two companies, one owning the CBS broadcast network, the other holding most of the cable channel and movie and TV program production assets.)

4. New technology to dissolve the Last Mile Bottleneck

The last mile bottleneck derives ultimately from the high upfront costs of erecting electronic networks that bridge from a major Internet node out to households or businesses. These high costs characterize every "fixed line" network (e.g. copper wire, cable, or fiber optic networks) and also cellular wireless networks that requiring many re-transmitting cellular antennas and accelerators. The high costs create extreme scale economies, which in turn create natural monopoly power, and this, finally, is often fortified with government grants of monopoly franchises.

Current "Wi-Fi" technology radically reduces the upfront costs of Internet connections, but its range is only 100 yards or so, not a "mile". However, next generation Wi-Fi technology – which goes under the WiMax label -- promises to extend that range to 20-50 miles. The system would be based on powerful transceiver towers (each directly accessing a major Internet node) that communicate at high speeds, back and forth, with specialized chips embedded in the users' desktop, laptop, or other computerized device (e.g. a next generation television). Because of the vast range of each tower, the launch costs per potential user for such next generation networks would be very low.

Led by Intel, which is developing WiMax chips which it hopes to embed in all PC devices, a group of big technology and networking companies is very rapidly progressing on all elements of this new technology, aiming for mass market roll-out within the next 18-36 months.

WiMax would indeed appear to hold the promise of substantially banishing the last mile bottleneck and thereby greatly reducing the user costs of broadband access to the Internet (beyond which point digital information distribution becomes virtually free for users). The technology would of course simultaneously and drastically reduce the monopoly power and profits (and stock market capitalization) of all existing fixed line networks.

Whether this promise is fulfilled, however, will depend on the course of public policy at all governmental levels over the next several years.

- The industry-wide protocols and standards for WiMax are now nearing completion, but would be helped by firm federal government endorsement and encouragement of the effort, signaling for instance disapproval of any company interested lobbying to delay or sabotage the effort.

- The FCC will have to free enough radio spectrum to WiMax. Various species of that technology could – via "frequency hopping" that taps underutilized radio wave capacity -- largely avoid the spectrum interference problem that has for decades served to justify exclusive FCC spectrum allocations to particularly companies and uses. But the simplest near-term solution is for the FCC to clear a comfortably broad frequency range for WiMax. One expect that certain status quo spectrum owners, and certain large fixed-line network companies, may try to discourage or impede the FCC in this effort.

- Perhaps most important, the federal government, states, and/or local governments will need to sort out the basic question of "ownership" for the WiMax towers. If a single company in a locality is afforded an exclusive franchise to build and operate these towers, that company could of course charge users a monopoly price for its use, in effect re-introducing a last mile monopoly bottleneck. More ominously (and predictably), tower ownership by an existing fixed-line networking company would lead to WiMax service pricing designed to preserve the monopoly pricing advantages of the owner's other network(s). There are two alternate solutions. The first would simply permit all comers to build and own WiMax towers in a locality. Because of the relatively low upfront investment needed, one could expect several tower systems to develop in each locality, and competition between them would keep prices low to the user community. There would not likely emerge an unsightly "forest" of towers, in part because the returns from building a system would not justify such proliferation, and in part because the wide transception range of the technology requires so few towers per system. The second solution is for a locality to grant an exclusive franchise to one tower system owner but require that owner to lease use of the system to all ISP's on an even playing field basis. The lease costs would get baked into the fee each ISP charges to its users, but inter-ISP competition would keep these fees low and therefore set a ceiling on the tower system owner's lease charges. This solution has the obvious downside, however, of turning the tower system owner into a public utility or regulated "carrier", requiring some agency for policing of the whole system. History does not reflect kindly on the efficiency of such arrangements.

One can expect, at any rate, that all these public policy issues surrounding WiMax will become of the tomorrow's great battlegrounds for the digital Information Industry.

Conclusion

Two broad problems restrict the value which the Information Industry could contribute to the general economy: a confused and overreaching system of property rights, and the natural monopoly forces that extreme scale economies and network effects inflict across the Industry's distribution functions.

The property rights problem derives from major imperfections in intellectual property law. The goal of this law is to balance incentives to create new information against the inevitably value-eroding effect of limiting the costless use and sharing of digital information. Copyright and patent law have erected such broad and vague definitions of intellectual property that both sides of the balance are damaged. The definitions sharply erode the value of free use but, in the process, so restrict access to past information as to hamper the creation of new information.

There are two solutions.

One is to reform intellectual property law, e.g. providing a clear trigger event for copyright and sharply limiting the duration and scope of copyright coverage, and doing away with the patentability of Information Industry software.

The second solution is to junk intellectual property law for digitized information and replace it with governmental protection of DRM technologies, which would in effect turn intellectual property into a more or less normal form of "physical possession" property. DRM would likely create a more hermetically sealed "private domain" than today's, but it would likely be smaller, and its contours, and the terms and conditions for entering and using it, would be far clearer than is provided by contemporary intellectual property law. The value-added equation would obviously differ substantially between these two solutions, but this author at least remains agnostic as to which would best serve general economic prosperity, convinced only that either would be better than the confused regime we have now and, certainly, than a regime that merely adds DRM protection to the current imperfect system of intellectual property law.

The natural monopoly problem in the Industry's distribution segment centers on platform software and on fixed-line electronic networks.

The platform software problem is difficult to remedy via antitrust litigation. The most efficient public policy regarding the problem is aggressive government support for the rapid adoption of industry-wide "open" standards for the interoperability of software products. This solution preserves, indeed enhances, the value-creating potential of network effects but prevents the monopolistic "enclosure" of those effects behind proprietary API's and similar interoperability standards.

The electronic network problem traces ultimately to the high cost of building fixed-line networks out to the "last mile" to individual households and businesses. Only new technology can reduce that cost, and WiMax technology seems poised to do just that over the next few years. But, for WiMax to bear fruit for the general economy, government policy will need to help the technology overcome predictable legal and political barriers. It is particularly important that state and local governments prevent existing fixed-line network companies from securing exclusive, monopoly franchises to build and run tomorrow's WiMax systems.

Few of the proposals suggested in this paper would find favor with companies that have profited handsomely from the imperfections in intellectual property law or the natural monopoly forces surrounding platform software and contemporary electronic networks.