

REGULATING NETWORK INDUSTRIES: A LOOK AT *INTEL*

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The question “Does Regulation Promote Efficiency in Network Industries?”—the topic for the panel discussion associated with this paper—can best be answered through an initial general orientation on the topic, followed by a careful consideration of a particular situation. To that end, Part I discusses ways of defining network industries, while Part II sets out briefly the patterns of regulation that we see in network industries. Part III turns to the Federal Trade Commission’s recently settled case against Intel. Part IV concludes.

To preview the conclusions, evaluating the FTC’s case against Intel turns on tricky issues regarding the dynamics of cross-licensing. That case appears to give very little weight to the benefits that arise from royalty-free cross-licenses. This practice reduces the royalty rates that will be charged to personal computer makers to the direct benefit of consumers. The settlement may very well make it more difficult for Intel to negotiate royalty-free cross-licenses. Indeed, from the FTC’s perspective, that is the main point. This settlement makes it possible for prospective PC makers who might otherwise decline to deal with Intel to do so—though this is not a point that appears to have figured in the FTC’s calculus—and may foster research and development on microprocessors, which was the chief focus of the FTC’s complaint. Still, there is little public evidence to suggest such an outcome, and in any event, this conclusion turns on the unexamined question of the

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relative importance for a licensor of cash returns versus the in-kind returns that are obtained from cross-licenses.

As for the initial question about whether regulation promotes efficiency in network industries, the irony here is that the settlement is generally seen as quite narrow and that Intel settled to avoid much more stringent possibilities. That is certainly true, but the sharpness of the scalpel has little to do with the possible pain that it can inflict. Whether the settlement promotes efficiency turns on very subtle assessments, none of which are accessible from the public record in the case, if they were made at all.

I. DEFINING NETWORK INDUSTRIES

We should start by trying to define a network industry. For our purposes, two settings are relevant. In the first setting—where a network industry is defined by a physical network—a distribution grid typically is the backbone that defines the network and that in turn makes a network industry. Natural settings include telegraphs, railroads, telecommunications, oil and natural gas pipelines. Substantial fixed costs, natural uses and weak alternative uses, and an essential physical connectivity all characterize these industries.

These industries often coexist physically because the same connected set of rights-of-way can be used over and over. Telegraphs were strung up to parallel railroads from the very start. When Congress played amateur venture capitalist—giving cash and taking back no equity—and appropriated \$30,000 to allow Samuel Morse to test the “practicability and utility” of the “electro-magnetic telegraph,”¹ Morse turned to the Baltimore & Ohio Railroad to seek permission to string his wires along its rights-of-way, which he received in exchange for giving the railroad the right to use the telegraph for nothing.² Congress came to understand the natural relationship between railroads and the telegraph—one set of rights-of-way, two uses—and the land-grant program that led

1. Act of Mar. 3, 1843, ch. 84, 5 Stat. 618 (allocating funds to test the practicality of establishing a system of electro-magnetic telegraphs).

2. See ROBERT L. THOMPSON, *WIRING A CONTINENT: THE HISTORY OF THE TELEGRAPH INDUSTRY IN THE UNITED STATES, 1832-1866* 21-22 (1947).

to the great railroads of the nineteenth century, including the Union Pacific, called for joint development of railroads and the telegraph.³ This relationship continues today: Qwest Communications, a recent entrant into the high-bandwidth communications business, built its network along the tracks of the Union Pacific,⁴ while Williams Communications, a like-minded entrant, installed fiber-optic cable next to its natural gas pipelines.⁵

The second setting is the virtual network industry, which typically is organized around an ubiquitous standard. The Wintel duopoly—Intel microprocessors coupled with the Microsoft Windows operating system—defines such a standard for PCs. The standard specification for DVDs is another example. Sun's recent attempt to offer Java as a universal platform for software is yet another. Again, we often have very large fixed costs—the research and development to develop a microprocessor or an operating system—and low marginal costs. These cost considerations will limit the number of standards that will be at work at any one time. In addition, though much less relevant for physical network industries, demand-side considerations—or network externalities, in a phrase—will also apply pressure to limit the number of extant standards.

Tease these out a bit. Networks come and go as technology changes. For example, in an era in which generation of electricity was thought to be subject to substantial economies of scale and in which transmission losses precluded substantial distribution over a distance, the electricity business was characterized by local natural monopolies. These were traditional regulated industries—the quintessential public utilities. In time, we learned that bigger was not necessarily better for generating electricity. Very large nuclear power

3. See Act of July 1, 1862, ch. 120, 12 Stat. 488 (providing aid for the construction of a railroad and telegraph line from the Missouri River to the Pacific Ocean and securing government use of the line); see also Act of July 2, 1864, ch. 217, 13 Stat. 365 (creating the Northern Pacific Railroad); see generally Act of July 24, 1866, ch. 230, 14 Stat. 220 (providing aid for the construction of telegraph and railroad lines).

4. See Lisa Brownlee, *Going the Distance: Joseph Nacchio Isn't Relenting in his Qwest for U.S. West*, N.Y. POST, June 27, 1999, at 56.

5. See Jennifer Walsh, *Crossing Lines: Pipeline Firms See the Light in Fiber Optics*, HOUSTON CHRON., June 23, 1999, at 1.

plants had disproportionately larger downtimes than smaller plants.⁶ Large plants also had very long lead times and therefore locked generators onto a path that could not be responsive to changes in market conditions. In contrast, smaller plants could be brought on-line in a much shorter time period, creating valuable flexibility.⁷ It thus becomes plausible that electricity in Chicago should be generated by multiple sources.⁸ That of course says nothing about the ownership of those sources—one company could build five 100-Megawatt plants rather than one 500-Megawatt plant—but this clearly makes it easier to have many companies in the generation business.

Shift from generation to transmission. Even if we want to have many companies *generating* electricity, it is less obvious that we want to have many companies *transmitting* electricity. Put differently, even if generation is no longer subject to natural monopoly characteristics, transmission may be, in the sense that it may make sense to have a single transmission grid. Again, the number of facilities says nothing about the ownership of the facilities. We could have a single owner of the transmission grid, or we could have shared ownership of the grid by all generators.

We can now step back and see how the electricity business has evolved into a network industry. Before, we had a single generator and a single owner of the transmission grid. Now, we have multiple generators, and we are going to match those generators with a single transmission grid. Ownership of the grid itself must be addressed, and the Federal Energy Regulatory Commission is doing exactly that through its independent system operator approach and its newly proposed regional transmission organization plan.⁹ Ownership,

6. See Promoting Wholesale Competition Through Open Access Non-Discriminatory Transmission Services by Public Utilities: Recovery of Stranded Costs by Public Utilities and Transmitting Utilities, 18 C.F.R. §§ 35 & 385 (1996) [hereinafter *Order 888*].

7. For a precise method of valuing this flexibility using real options, see AVINASH K. DIXIT & ROBERT S. PINDYCK, INVESTMENT UNDER UNCERTAINTY 51-54 (1994).

8. See Steve Daniels, *ComEd Rival Puts Money on the Barrel: Enron Offers First Glimpse at Pricing War; Others Expected to Follow*, CRAIN'S CHICAGO BUS., July 19, 1999, at 1.

9. See Regional Transmission Organizations, 64 Fed. Reg. 31,390 (1999) (to be codified at 18 C.F.R. pt. 35)(proposed June 10, 1999) [hereinafter *FERC RTO*], issued as FERC Order No. 2000, 89 FERC 61,285 (December 20, 1999).

however, merely leads to the issues of more direct concern: generator access to the grid and continued development of the grid.

Consider virtual network industries. In these industries, the existence of a universal standard defines the scope of the network. Multiple standards may be at work in such an industry, as in the early days of the VCR market and as in the current PC market, but the ultimate success of one standard over another—VHS over Beta and Windows over Macintosh—means that access to the successful standard becomes important for continuing success in the industry. Consider, for example, music distribution, which has moved from vinyl records to cassettes and 8-tracks to CDs, and now perhaps to online distribution over the Internet. A recording artist denied access to these media simply would not exist. The artist could be the greatest thing since Mozart, but if she were distributing her work on modified clam shells, it wouldn't matter. Access to the standard means of distribution is essential.

These standards do not arise through a single process. For example, in the early 1980s, when the original CD format was established, the industry used three competing approaches: a 12-cm optical compact disk system from Philips and Sony (the eventual winner); a 7-cm mini-disc system from Telefunken; and the much larger 26-cm audio high density system from JVC.¹⁰ Each of these represented a move into the world of digital music, but certain important features differentiated the systems. The Telefunken system used the prior generation of record-pressing equipment, thereby reducing switching costs for manufacturers. The JVC system was backwards compatible with JVC's proprietary videodisc machines.¹¹ A group formed in Japan, the Digital Audio Disc Council, provided the industry with a forum for evaluating these competing platforms, with the hope of agreeing on a single standard. In January of 1981, before that group could act, Matsushita, the corporate parent of

10. See *Digital Audio Disc Council Disbands After Three Years*, NIHON KEIZAI SHIMBUN (JAPAN ECONOMIC JOURNAL), Apr. 21, 1981, at 9; see also *Digital Audio is Due to Become Popular in Two Years*, NIHON KEIZAI SHIMBUN (JAPAN ECON. J.), Sept. 16, 1980, at 8.

11. See *The Digital Revolution Ahead for the Audio Industry*, BUS. WK., Mar. 16, 1981, at 40.

JVC, announced that it would support the Philips/Sony system and would sign appropriate cross-licenses with Philips and Sony. This agreement decisively tilted the tables in favor of the now-standard 12-cm format.¹²

In the case of DVDs, an elaborate specification process¹³ has resolved differences between competing approaches backed by Sony-Philips, on the one hand, and Toshiba-Time Warner, on the other. This process has also led to the formation of two patent pools that facilitate the creation of the standards infrastructure necessary to make DVDs workable.¹⁴ In other cases—including that of the Wintel standard—a single provider emerges as the dominant source of the product and exercises strong control over the standard. The dominance of Intel over microprocessors has meant that Intel sets the standards, while its competitors, at best, attempt to replicate what Intel has done. In operating systems that use Intel microprocessors, Microsoft has simply set the standard.

Even in the case of a dominant standard owned by a single party, complete victory after the fact may just reflect the powerful combination of demand- and supply-side economies of scale, which obscures the reality that substantial competition existed at the standard-setting stage. It is easy to forget that Windows itself once competed in a crowded marketplace for the chance to determine the next step from the character-based, single-tasking world of DOS. Windows started as a DOS

12. See *Matsushita Electric Ind. Will Use Philips formula*, Nihon Keizai Shimbun (Japan Econ. J.), Jan. 27, 1981, at 8. For an interesting look at the chicken-and-egg problem that exists with hardware and software complements, see Neil Gandal et al., *The Dynamics of Technological Adoption in Hardware/Software Systems: The Case of Compact Disc Players* (unpublished manuscript, February 1, 1998). And now the fight has begun again, as it is now possible to make "warmer" CDs that should appeal to audiophiles. Matsushita has one version, Sony-Philips another, and so it goes. See Peter Landers, *Japanese Makers are Introducing Rival Successors to CD Player*, WALL ST. J., July 29, 1999, at B1.

13. See Martin Levine, *Single DVD Standard Reached: Market Debut Still a Question*, VIDEO BUS., Dec. 22, 1995, at 6. For the specifications, see *DVD Specifications* (visited Oct. 1, 1999) <<http://www.licensing.philips.com/dvdsystems/dvdspecs.html>>, and for further background, see *DVD Forum* (visited Oct. 1, 1999) <<http://www.dvdforum.org/forum.htm>>.

14. The Department of Justice has blessed both of the DVD patent pools through its business review process. See Department of Justice, *Justice Department Approves Joint Licensing of Patents* (visited Oct. 1, 1999) <http://www.usdoj.gov/atr/public/press_releases/1999/2484.htm> and <http://www.usdoj.gov/atr/public/press_releases/1998/2120.htm>.

shell—an overlay that insulated the end-user from the cold, single-line character-based world of the DOS C:\ prompt. Microsoft announced its new product on November 10, 1983. The original *New York Times* story of November 11, 1983, is quite illuminating and is worth quoting in full:

The Microsoft Corporation, a leading personal computer software company, introduced a new program to allow computer screens to be divided into several windows, each displaying different tasks that can be performed with the aid of a handheld device called a mouse.

The new program will compete with Visicorp's new Visi-on program. Apple Computer Inc.'s Lisa computer also allows different programs to run in different windows.

Microsoft Windows, as the product is called, will become an optional part of Microsoft's MS-DOS operating system, which is used on several personal computers.¹⁵

Lest we forget, Visicorp created Visicalc, the first software killer app. Visicorp's annual revenues exceeded those of Microsoft, which in 1982 were about \$35 million.¹⁶ Digital Research, the producer of CP/M, the DOS of its day, already had introduced its DOS shell, or "operating environment," as these were sometimes called. In addition, IBM had Topview, a character-based, multi-tasking environment. Quarterdeck was selling DesQ, and Apple was soon selling the Macintosh. Plus, leading applications sellers—Visicorp and Lotus—were offering their visions of the next step through comprehensive integrated products. We know that Windows won, but standards are often set through a substantial competitive struggle.

So, start with two basic ideas for network industries: physically-connected grids distributing the three Ps—people, product, and packets—and virtually-connected business ecologies organized around a dominant standard. The physical grids are frequently described as natural monopolies, but to avoid that phrase, we might say that it simply makes more sense to have a single integrated facility. The virtual network could also be described as a natural monopoly, pushed into

15. *Microsoft Displays Window Program*, N.Y. TIMES, Nov. 11, 1983, at D4.

16. *See Microsoft Opens its Windows*, ECONOMIST, Nov. 19, 1983, at 85.

existence by both supply-side costs and demand-side spillovers. For this paper, what is interesting is that the patterns of regulation in these two industry types are completely different, and it is to that issue that I turn next.

II. PATTERNS OF REGULATION IN NETWORK INDUSTRIES

The pattern of regulation in network industries ranges from none whatsoever to episodic intervention through antitrust litigation, to comprehensive regulation in the form of statutes such as the Telecommunications Act of 1996.¹⁷ These patterns may occur in sequence, as they did in telecommunications, in which an antitrust action initially brought against AT&T resulted in substantial judicial oversight under the modified final judgment.¹⁸ Only later did Congress intervene directly through the 1996 legislation. Whether we are on that path now with regard to the regulation of Microsoft is obviously an open question.

Regulation through antitrust litigation can result in the type of narrow injunctive relief that emerged from the Department of Justice's original action against Microsoft.¹⁹ To an outside observer at least, the judgment had few important consequences for Microsoft, unlike the complete restructuring of an industry that resulted from the action against AT&T. This form of regulation is anti-democratic in some basic sense because it is implemented by agencies, parties, and a randomly chosen judge, but it is also quite tailored to the needs of the situation. This tailoring is an important benefit of regulation through antitrust. When we regulate through antitrust, though, we are also stuck with its most essential feature, namely, that it is monopolization that is bad, not monopoly. Judge Hand captured this idea most memorably in *Alcoa*, where he wrote that "[t]he successful competitor, having been urged to compete, must not be turned upon when he wins."²⁰

17. 47 U.S.C. §§ 151-614 (Supp. II 1997).

18. See *United States v. AT&T Corp.*, 552 F. Supp. 131 (D.D.C. 1982), *aff'd sub nom.*, *Maryland v. United States*, 460 U.S. 1001 (1983); see also MICHAEL K. KELLOGG ET AL., *FEDERAL TELECOMMUNICATIONS LAW 199-248* (1992).

19. See *United States v. Microsoft Corp.*, 56 F.3d 1448 (D.C. Cir. 1995).

20. *United States v. Aluminum Co. of Am.*, 148 F.2d 416, 430 (2d Cir. 1945).

If a company is fortunate enough to have a monopoly thrust upon it and does not take too many steps to maintain it but somehow magically continues to enjoy that monopoly, it is outside the purview of antitrust. Nonetheless, we lose deadweight-loss triangles whenever we have a monopoly, regardless of the manner in which that monopoly is obtained, whether as manna from heaven or through cunning worthy of the greatest robber baron bogeyman of that day.

In contrast, legislation aimed at a network industry can address the monopoly issue quite directly. Indeed, traditional regulation of so-called regulated industries has addressed exactly that problem. This regulation has taken the form of controls directed at prices of outputs—rate of return regulation coupled with price setting or price caps—coupled with a public interest standard for building new inputs. These regulations were designed to control the market power associated with natural monopoly while ensuring an appropriate return for investors.

Modern regulation builds on changes in these industries. If we still need one electric grid, but it makes sense to have many electricity producers sharing that grid, we need a new approach to regulation. We move from price regulation directed at the output market, electricity, to interconnection and unbundling rules aimed at inputs, transmission service, with regulated prices at that input level. A new electricity merchant producer generates electricity but buys transmission service from the grid owner. In physical network industries, the grid remains the one-of-a-kind facility, and access to it is the key regulatory issue. To put the matter most simply, we have reallocated the interconnection property right away from the facility owner to third parties. An entrant can jump into the electricity market just by building a new power plant—and many firms are doing this²¹—without needing to build an additional (and redundant) transmission grid.

Access regulations shift the interconnection property from the grid owner to the entrant. Why should this matter? After all, a potential entrant could have negotiated for access before,

21. See *FERC RTO*, *supra* note 9, at 31,393.

so if it really made sense for the entrant to be in business, should not a deal have been made? The grid owner could have voluntarily given access to the grid to merchant generators, just as it was forced to give limited access to "green" electricity generators through the PURPA legislation.²² Voluntary access was always an option, so the bastardized version of the Coase Theorem suggests that sensible deals should have been made even when the interconnection property right was held by the grid owner.

Should we think that this analysis is correct? Probably not. Notably, the facts seem to suggest, for example, that the independent power production business has seen an explosion after the adoption of FERC Order 888.²³ It is difficult to see how an independent developer could negotiate for access to the grid or build a plant to sell to the grid owner when the arrangements involve single-use assets with only one purchaser. The developer would probably sell plants built speculatively to the grid owner for next to nothing. Deals negotiated up front would more closely resemble outsourcing arrangements with a monopoly purchaser, and these deals would only make sense if the outsider had a comparative advantage in building plants. In any event, the monopolist has no reason to want to create a competitor. Under the new approaches, access to the monopoly input makes it possible for the entrant to marry its new generating facility with the old grid and to compete directly with the grid owner.

Creating an access regime is far from easy. The first iteration of the key rules in the electricity industry, FERC Order 888, ran for nearly 200 pages of dense, triple-column text in the *Federal Register*.²⁴ Three years later, FERC has now changed these rules substantially.²⁵ We have seen a partial iteration on the telecommunications rules with the Supreme Court's recent decision in *AT&T Corp. v. Iowa Utilities Board*.²⁶ In light of this

22. See Public Utility Regulatory Policies Act (PURPA), Pub. L. No. 95-617, 92 Stat. 3117 (1978); see also Peter S. Fox-Penner, *Cogeneration After PURPA: Energy Conservation and Industry Structure*, 33 J. LAW & ECON. 517 (1990).

23. See *FERC RTO*, *supra* note 9, at 31,393.

24. See *Order 888*, *supra* note 6.

25. See *FERC RTO*, *supra* note 9.

26. 119 S. Ct. 721 (1999).

decision, the FCC must rewrite—and has rewritten—its unbundling regulations so as not to conflict with the “necessary and impair” standards set forth in Rule 319,²⁷ which may set up a new challenge to the FCC’s Total Element Long Run Incremental Cost (“TELRIC”) pricing scheme. Also, we must address whether single or joint ownership of the key facility is preferable. We might tolerate a single owner if we couple that with mandatory access—this is the path we have gone down in telecommunications—or we might insist instead on joint ownership, as we are doing in electricity through independent system operators today.²⁸ Joint ownership of bottleneck facilities was precisely the solution offered by the Supreme Court in the great antitrust case of *United States v. Terminal Railroad Association of St. Louis*²⁹ when Jay Gould had acquired the Eads and Merchant Bridges and the Wiggins Ferry to seize control over railroad crossing of the Mississippi River at St. Louis.

III. THE *INTEL* CASE AND THE REGULATION OF NETWORK INDUSTRIES

The antitrust case against Intel provides a natural context in which to discuss the appropriate scope of regulation in network industries. This case is fundamentally about access and distribution in the context of a dominant standard. The FTC and Intel have settled the original action, but other investigations are ongoing. The key point here is to contrast a purely antitrust focus with one that considered Intel as part of a regulated industry.

A. *FTC Action Against Intel*

On June 8, 1998, the Federal Trade Commission issued a complaint against Intel.³⁰ The FTC complaint alleged that Intel had monopoly power over general-purpose microprocessors.³¹

27. *Id.* at 733-36. For the proposed revision, see Third Report and Order and Fourth Further Notice of Proposed Rulemaking, FCC 99-238 (November 5, 1999).

28. See *Order 888*, *supra* note 6.

29. 224 U.S. 383 (1912).

30. See Federal Trade Commission, *In the Matter of Intel Corp.* (visited Oct. 1, 1999) <<http://www.ftc.gov/os/adjpro/d9288/index.htm>> [hereinafter *Complaint*].

31. See *id.* at ¶ 6.

Intel was alleged to have entrenched its monopoly power by refusing to continue to deal with certain customers as a means of coercing intellectual property licenses relating to potentially competitive microprocessor technology.³² Three particular instances of such abuses were alleged relating to dealings with Digital Equipment Corporation, Intergraph Corporation, and Compaq.

On May 12, 1997, Digital had sued Intel for patent infringement, claiming that the Pentium Pro microprocessor infringed Digital patents relating to its Alpha microprocessor. The FTC complaint alleged that Intel responded to the Digital lawsuit by cutting Digital off from access to relevant information relating to Pentium microprocessors.³³ In similar fashion, according to the FTC complaint, Intel demanded a royalty-free license for Intergraph's Clipper microprocessor technology as a condition of its willingness to continue disseminating technical information and advance chips to Intergraph.³⁴ At this time, Intergraph was a leading seller of Intel-based Windows NT workstations. Intel's refusal to distribute information to Intergraph was followed by a substantial decline in Intergraph's business.³⁵ Finally, in November, 1994, Compaq sued computer manufacturer Packard Bell, alleging that Packard Bell's systems infringed Compaq's patented technology. The parts in question had been supplied by Intel to Packard Bell, and therefore Intel intervened in the lawsuit. Again, according to the FTC complaint, Intel stopped sending Compaq technical information in an effort to pressure Compaq to resolve its lawsuit against Packard Bell.³⁶

In the FTC's view, these refusals to deal entrenched Intel's monopoly in general-purpose microprocessors. Intel "willfully maintained its monopoly power in the general-purpose

32. *See id.* at pt. C.

33. *See id.* at ¶ 19.

34. *See id.* at ¶¶ 26 & 29.

35. Intergraph filed a private antitrust suit against Intel alleging that Intel had violated the Sherman Act by cutting it off from access to key information and microprocessors. It received a preliminary injunction in its favor, *see Intergraph Corp. v. Intel Corp.*, 3 F. Supp.2d 1255 (N.D. Ala. 1998), which was vacated on appeal. *See Intergraph Corp. v. Intel Corp.*, 195 F.3d 1346 (Fed. Cir. 1999).

36. *See Complaint, supra* note 30, at ¶ 35.

microprocessor market.”³⁷ The complaint further alleged that Intel had the requisite intent to attempt to monopolize the current generation and future generation general-purpose microprocessor markets. As a consequence, in the Commission’s view, Intel’s activities constituted unlawful monopolization, unlawful attempted monopolization, and unfair competition, all in violation of section 5 of the Federal Trade Commission Act.³⁸

On March 8, 1999, a proposed settlement was issued; on August 3, 1999, by a 3-1 vote, the Commission approved that settlement without any changes.³⁹ In the settlement, Intel agrees not to withhold key information or access to microprocessors in intellectual property disputes for a period of ten years. This agreement is limited only in that if the customer has not consented in writing that it will not seek an injunction barring Intel from selling its key microprocessors, then Intel is entitled to withhold information about the microprocessors. Most importantly, Intel generally maintains the right to refuse to deal with customers or to withhold information for virtually any other business reason. Put differently, the proposed order does not impose a compulsory licensing scheme on Intel. In the FTC’s view, this order facilitates competition in microprocessor technologies. Companies that might have been chilled from developing competing technologies or from defending their existing intellectual property rights can do so, secure perhaps in the knowledge that Intel will not be able to cut them off for that reason.

The FTC’s published analysis of the consent order⁴⁰ identified three allegedly harmful consequences of Intel’s behavior. First, it said that Intel received preferential access to

37. *Id.* at ¶ 40.

38. See 15 U.S.C. § 45 (1994).

39. See Federal Trade Commission, *In the Matter of Intel Corp.* (visited Oct. 29, 1999) <<http://www.ftc.gov/alj/D9288/index.htm>>. The press release announcing the final approval of the settlement is available at Federal Trade Commission, *Announced Actions for Aug. 6, 1999* (visited Oct. 29, 1999) <<http://www.ftc.gov/opa/1999/9908/fyi9921.htm>>.

40. See Federal Trade Commission, *Analysis of Proposed Consent Order to Aid Public Comment* (visited Oct. 1, 1999) <<http://www.ftc.gov/os/1999/9903/d09288intelanalysis.htm>>.

industry technologies through royalty-free licenses. This access put Intel in a superior position in the microprocessor market.⁴¹ Second, the FTC argued that the royalty-free licenses that Intel received reduced the returns on the competing patents, which in turn should reduce innovation.⁴² The third consequence is more complex:

Finally, Intel's conduct tends to make it more difficult for an OEM [original equipment manufacturer] to serve as a platform for microprocessors that compete with Intel's. Intel's actions ensure that Intel can act as a conduit for technology flows from one OEM to another The result is that OEMs find it more difficult to differentiate their computer systems from their competitors through patented technology.⁴³

It is worth noting that the FTC's analysis assumes that more innovation is always better, or, perhaps more precisely, that innovation should never be discouraged through exclusionary acts by monopolists. This ignores the fact that it is next to impossible to assess whether we as a society are doing the right level of research. Two fundamentally conflicting ideas—too much research in a tragedy of the commons scenario and too little research due to the inability of the inventor to grab a big enough chunk of the benefits of a new idea—suggest the difficulty with making this assessment. The tragedy of the commons notion suggests that too many researchers are pursuing the same ideas. Prior to discovery, no one has a property right; therefore, getting there first produces huge gains for the winner. Many entrants rush into the field in an attempt to obtain these gains, ignoring the fact that in so doing they are just re-cutting the pie, and at best expanding it only slightly. Some researcher would find the new idea—a great deal of nearly simultaneous discovery occurs when an idea is ready to emerge—and adding another researcher may push up the date of discovery slightly, but not substantially if many are already pursuing it. From this perspective, we would need devices that actually *weaken* the incentive to do research (or at least we need to coordinate research). Intel would be

41. *See id.*

42. *See id.*

43. *Id.*

performing a social good by reducing the incentive to do research.⁴⁴

The alternative vision is driven by the empirical fact that innovators seem to capture a relatively small share of the benefits of new ideas.⁴⁵ For this purpose, what matters is that the figure is not 100 percent. If I have to invest \$1 in something that makes society better off by \$2, I need to get at least \$1 back for me to move forward. If I would only get 75 cents, and the rest of society would get \$1.25, I am not going to undertake the investment. Any figure less than 100 percent means that the private sector will pass on some projects that make sense for a society as a whole. This tells us that we have too little research, and that we need to take steps to bolster research (subsidies to universities perhaps). Intel's behavior would just make a bad situation worse.

To complete the list, it is also possible that we are getting it just right. The fact that value seeps away from the innovator into society at large means that the patent race is much less winner-take-all, and that may discourage individuals from jumping into the race. If our intellectual property system leaks at just the right rate—optimal seepage or leakage—we may just counteract the tragedy of the commons problems. The key point is that how we are doing is unknown and perhaps unknowable. The FTC's case accepts, largely blindly, the idea that more innovation is always better. To be fair, the FTC would probably say that even if we were confident that we needed to adjust innovation incentives, we would probably not want to delegate that decision to Intel. Fair enough. So I will assume, as does the FTC, that more innovation is a good thing.

B. *An Antitrust Analysis of Intel*

The settlement of the FTC's suit against Intel prevented us from learning more about the case from witnesses and an ultimate decision. We can do no more than speculate about

44. Intel claimed that no evidence was produced to show that its behavior had any consequence for innovation. See Federal Trade Commission, *Intel Corporation's Trial Brief, Public Version* (visited Oct. 29, 1999) <<http://www.ftc.gov/alj/D9288/intelbrief.pdf>>, at 14-19 [hereinafter *Intel Brief*].

45. See Michael L. Katz & Janusz A. Ordover, *R&D Cooperation and Competition*, BROOKINGS PAPERS ON ECONOMIC ACTIVITY, MICROECONOMICS 137-39 (1990).

how the complex issues posed by the case would have been resolved. My purpose now is not to try to resolve these issues, but instead to just lay clear the analytical path that an antitrust analysis would require.⁴⁶ For that purpose, the heavily redacted, public pretrial briefs filed by the FTC and Intel will suffice.⁴⁷

The FTC stated its case quickly. Intel was a monopolist in the market for general purpose microprocessors. It used its position to maintain market dominance, and did so by creating a "privately-administered compulsory licensing regime" through which it extracted beneficial licenses of competing technology. This bolstered Intel's monopoly position directly, by providing access to its own technology as well as that of its competitors, and indirectly, by discouraging competitors from developing technology, since the benefits would just flow to Intel.

The FTC brought its claim under section 5 of the Federal Trade Commission Act,⁴⁸ which declares unlawful "unfair methods of competition." That expansive language is quite open-ended, but permits the FTC to pursue illegality under the standards of the Sherman Act.⁴⁹ On this basis, the FTC made claims of monopolization and attempted monopolization under section 2 of the Sherman Act.⁵⁰ In *United States v. Grinnell Corp.*,⁵¹ the Supreme Court announced the test that still applies today: "The offense of monopoly under § 2 of the Sherman Act has two elements: (1) the possession of monopoly power in the relevant market and (2) the willful acquisition or maintenance of that power as distinguished from growth or development as a consequence of a superior product, business acumen, or historic accident."⁵² Under the test of *Spectrum Sports, Inc. v.*

46. For an early, careful, antitrust analysis of the case, see Ronald W. Davis, *The FTC's Intel Case: What are the Limitations on "Throwing Your Weight Around" Using Intellectual Property Rights?*, 13 ANTITRUST L.J. 47 (1999).

47. See *Intel Brief*, *supra* note 44; Federal Trade Commission, *Complaint Counsels' Pretrial Brief, Public Version* (visited Oct. 29, 1999) <<http://www.ftc.gov/alj/D9288/990225ccpb.pdf>> [hereinafter *FTC Brief*].

48. 15 U.S.C. § 45.

49. See *FTC v. Indiana Fed'n of Dentists*, 476 U.S. 447, 454 (1986).

50. 15 U.S.C. § 2.

51. 384 U.S. 563 (1966).

52. *Id.* at 570-71. See also *Aspen Skiing Co. v. Aspen Highlands Skiing Co.*, 472 U.S.

McQuillan,⁵³ attempted monopolization under section 2 turns on a showing that “(1) the defendant has engaged in predatory or anticompetitive conduct with (2) a specific intent to monopolize and (3) a dangerous probability of achieving monopoly power.”⁵⁴

From there we move to a definition of monopoly power (under *Grinnell*, “the power to control prices or exclude competition”),⁵⁵ a definition of the relevant geographic market (the world), and a definition of the relevant product market (“general purpose microprocessors used as central processing units (‘CPUs’) in reprogrammable digital computers”).⁵⁶ The FTC’s brief spends some time segmenting that market: it differentiated x86 instruction set computers (Wintel) from non-x86 (Macintosh), high-end workstations (often based on RISC chips (reduced instruction set chips)) from powerful Intel CISC chips (complex instruction set chips), and low-end machines where Intel’s Celeron chip competes with chips from Advanced Micro Devices, Inc. and Cyrix Corporation. The FTC’s brief sets out Intel’s share of revenues from CPUs for 1993 through the first half of 1998, but these figures were redacted from the public version of the brief. The FTC contended that these figures were buttressed by the fact that chip production was subject to substantial barriers to entry. These barriers arose from the expense of fabrication plants—the brief cited a \$2 billion 1997 figure—and the lead-time required to build these plants, economies of scale driven by learning-by-doing, network externality effects, intellectual property rights, and reputation. The brief then detailed the individual cases involving Intergraph, Digital, and Compaq described above.⁵⁷

The FTC’s complaint then turned to characterizing Intel’s conduct as “exclusionary,”⁵⁸ citing the *Aspen Skiing*⁵⁹ standard that conduct is unlawful when it “exclude[s] rivals on some

585, 596 n.19 (1985).

53. 506 U.S. 447 (1993).

54. *Id.* at 456.

55. 384 U.S. at 571 (quoting *United States v. E.I. du Pont de Nemours & Co.*, 351 U.S. 377, 391 (1956)).

56. See *FTC Brief*, *supra* note 47, at 8.

57. See *id.* at 25-40.

58. *Id.* at 40.

59. 472 U.S. 585, 605.

basis other than efficiency."⁶⁰ In the FTC's view, Intel had no legitimate reason for declining to provide advance technical information and chip samples. Instead, Intel was using its monopoly position to gain superior access to competing technologies and to deter innovation by its competitors, all with the hope of preserving its CPU monopoly.

Intel responded, opening with a drumbeat based on the deposition of the FTC's chief economics expert, Professor F.M. Scherer: "Dr. Scherer acknowledges that there is no evidence that [competitor's] innovation efforts have been impaired as a result of the conduct alleged in the Complaint."⁶¹ If harm to innovation was at the heart of the FTC's case, Intel would try to cut that heart out by showing that the FTC had not been able to adduce *any* direct evidence of harm to innovation. Intel went through competitor after competitor—IBM, Compaq/Digital, Motorola, Hewlett-Packard, Sun, AMD, and Cyrix among others—each time ending with the statement "Dr. Scherer acknowledges . . ."⁶² Intel stood ready to dispute the FTC's conclusion that Intel had monopoly power in the general CPU market and emphasized repeatedly that the FTC had offered no evidence of harm to consumers.

On the key issue of duty to deal/refusal to deal, Intel argued that only extraordinarily narrow circumstances justify compulsory access of the sort characterized by the essential facilities doctrine.⁶³ Intel characterized successful claims under the essential facilities doctrine as only arising in the context of horizontal relationships. *Aspen Skiing* was described as exactly such a case, one in which joint marketing was seen as necessary. Finally, Intel argued that it had an abundance of legitimate business reasons for not giving advance information and chips to the three companies. Intel held patent, copyright, and trade-secret rights in this property that it had a strong right

60. See *FTC Brief*, *supra* note 47, at 40.

61. *Intel Brief*, *supra* note 44, at 15-19.

62. *Id.*

63. It is worth noting that the FTC had avoided the language of essential facilities, if not the idea itself, perhaps because of the skepticism with which the doctrine is met. See Phillip Areeda, *Essential Facilities: An Epithet in Need of Limiting Principles*, 58 ANTITRUST L.J. 841 (1990); Abbott B. Lipsky, Jr. & J. Gregory Sidak, *Essential Facilities*, 51 STAN. L. REV. 1187 (1999).

to control. Moreover, in this situation, the private litigation against Intel made it more important for Intel to restrict access to its intellectual property. Additional access might give information that would otherwise be non-discoverable, and this information might make it easier for the litigant to prosecute its action against Intel. In addition, the point of giving advance information and chips to customers is not only to make it possible for the customer to produce new machines, but also to give important feedback to Intel about its new chips. There was every reason to think that that feedback would suffer given the litigation between the companies.

Putting to one side the key factual questions that require access to the information that would have come forth at trial for proper assessment, from an antitrust perspective, this case turns on both the breadth of the mandatory dealing obligation, which was addressed most recently by the Supreme Court in *Aspen Skiing*, and the additional layer of the federally-created rights of the holder of intellectual property. It is important to recognize that this case is really quite different from *Aspen Skiing*. *Aspen Skiing* was a we-don't-want-you case. The affiliated mountains thought that there were sufficient synergies among those mountains that they did not need to strike a deal with the excluded mountain/competitor and went so far as to omit the name of the excluded mountain from the billboard map of the mountains at the Denver airport. In contrast, the FTC's claim here is that Intel needed access to the patents of Intergraph, Digital, and Compaq to maintain its dominant position in the microprocessor market. Intel wanted to strike a deal with these companies; the only questions were whether they would do so, at what price, and whether Intel could somehow use its position to enhance the terms of trade. *Intel* is a case where *both* sides want access to valuable intellectual property.

The idea that this case was about preservation of Intel's monopoly is not very clear in this instance. Intergraph exited the CPU business when it switched over to Intel chips. Nothing suggests that Intergraph is in a position to produce competing chips today. Intergraph will get a bunch of money if the Pentium line is found to infringe Intergraph's Clipper

patents, but it is hard to imagine that the operations of the Pentium will be changed in any fundamental way, as we should expect Intergraph and Intel to strike a deal. Digital's Alpha chip was already competing with Intel's chips—rather unsuccessfully—when the dispute between Digital and Intel arose. The resulting lawsuits back and forth were resolved through a settlement, which, after FTC-imposed modifications, ensured that Alpha production and development would continue.⁶⁴ In both cases, if one believed the underlying lawsuits against Intel, Intel was using ideas patented by another company. It needed either to stop using the ideas—possibly disrupting the Pentium edifice—or to get a license to use the patents.

Indeed, given that there is little reason to think that competition in CPUs would increase in the short run, the most likely immediate effect of forcing Intel to pay royalties to Intergraph or Digital would be to raise the price of Pentium processors to customers. Intel would face a monopoly supplier of an input for its Pentium, or PC makers would need to acquire licenses directly from both Intel and Intergraph. If one believes the FTC's complaint, Intel has a monopoly in general-purpose CPUs. Layering one monopoly on a second—or placing one monopoly next to another when both inputs are required—gives rise to double-marginalization (monopoly profits taken out at two levels), which raises prices to Intel's customers and makes those customers and society worse off. The key idea here is that Intel and Intergraph would impose externalities on each other through their royalty decisions.⁶⁵ With integration—and the royalty-free cross-license is equivalent to integration for these purposes—these externalities vanish. Prices of chips to PC makers should be lower with the royalty-free cross-licensing than they would be otherwise.

To see this more formally, suppose that demand for PCs is

64. See Federal Trade Commission, *FTC Ensures that Digital's Alpha Chip—A Key Rival to Intel's Chips—Remains Competitive* (visited Oct. 4, 1999) <<http://www.ftc.gov/opa/1998/9804/digitala.htm>> [hereinafter *FTC Alpha Press Release*].

65. Intel makes this point as well. See *Intel Brief*, *supra* note 44, at 42 n.19.

given by $p = a - bq$. Assume that PC makers face a marginal cost of c , and royalty rates set by, say, Intel and Intergraph, of r_1 and r_2 . Assume further that the PC business is competitive. Then, we can work our way back quickly to determine the royalty rates that will be set, the price of PCs, the quantity of PCs, and overall social welfare. Competition in the PC business imposes a zero-profits condition:

$$0 = pq - c(q) = (a - bq - r_1 - r_2 - c)q \quad (1)$$

This gives industry output and the market-clearing price as a function of the royalty rates:

$$q^* = \frac{a - c - (r_1 + r_2)}{b}, \quad p^* = c + r_1 + r_2 \quad (2)$$

Intel and Intergraph would set royalty rates to maximize their individual profits, respectively, $r_1 q^*$ and $r_2 q^*$. The Nash equilibrium of their simultaneous decisions—Intel is content with its royalty given Intergraph's and vice versa—gives royalty rates of:

$$r_1^* = \frac{a - c}{3} \quad \text{and} \quad r_2^* = \frac{a - c}{3} \quad (3)$$

Plugging these back into the quantity and price formulas gives us:

$$q^* = \frac{a - c}{3b}, \quad p^* = c + \frac{2}{3}(a - c) \quad (4)$$

Now suppose that Intel has a royalty-free license from Intergraph, so that Intel can deliver both patents to PC makers. Competition in PCs again would be as before, except that the single royalty rate of r would replace $r_1 + r_2$. Intel would maximize $r q^*$, and this would give a royalty-rate of:

$$r^* = \frac{a - c}{2} \quad (5)$$

The total royalty rate has dropped by $1/6$ (from $2/3$ to $1/2$ $(a - c)$), so final market output goes up, and prices drop:

$$q^* = \frac{a - c}{2b}, \quad p^* = c + \frac{1}{2}(a - c) \quad (6)$$

Royalty-free cross-licensing means that we do a better job of getting private costs in line with social costs. The FTC's brief characterizes Intel's behavior as creating a "privately-

administered compulsory licensing regime."⁶⁶ This characterization ignores the fact that royalty-free cross-licensing is a common industry practice. Both parties to the deal benefit from free access to the patent portfolio of both parties. These benefits are in-kind from research and development that should in turn translate into dollars when each company sells to its customers. Also, as the above analysis shows, royalty-free cross-licensing would result in lower prices in the chip market and increased benefits to the public.⁶⁷

This analysis lets us look at the special issues posed by an intellectual property overlay on *Aspen Skiing*. Notwithstanding how we casually talk about patents or copyrights, the immediate goal of the patent law or copyright law is not to confer a monopoly on the rights holder. The point of intellectual property law is to create a scheme of meaningful property rights for a particular slice of intellectual property. The intellectual property rights holder should have the same right to intangible property that I have for my tangible property. I exclude you from my watch by possessing it, but I cannot exclude you from my intellectual property in the same way. Hence, intellectual property law creates the power to exclude others, a power implemented through an infringement action. We could say that we have given you a monopoly over your intellectual property, but that would not be any more meaningful than saying that I have a monopoly over my watch.

This realization suggests that the generally applicable anti-competition policy should apply equally to rights tangible and intangible. We want individuals to write songs and build watches. If we would impose a mandatory dealing obligation under antitrust law relating to tangible property, we should not pause when we switch our gaze to intellectual property.

The royalty-free cross-licensing analysis suggests that there would be a substantial downside to that access here. I have not

66. *FTC Brief*, *supra* note 47, at 1.

67. The FTC and the Department of Justice do recognize that cross-licenses can have procompetitive effects. See Department of Justice, *Antitrust Guidelines for the Licensing of Intellectual Property* (visited Oct. 4, 1999) <<http://www.usdoj.gov/atr/public/guidelines/ipguide.htm>>.

tried to model the bargaining issues that arise between intellectual property rights holders, but we can be sure that the analysis is quite complex. There is every reason to think that it would be more difficult for Intel to get access to the patents of others if it lacked the power to withhold its own intellectual property. Indeed, that premise forms the basis of the FTC's action. We could therefore lose the substantial benefits that we get under royalty-free cross-licensing.⁶⁸

C. Intel's Contracting Incentives

Turn from the pure antitrust look to a focus on Intel as the center of a regulated industry-to-be. To get a handle on the critical question of mandatory access, start by trying to understand Intel's private access incentives. Intel faced a number of basic choices. Intel could have vertically integrated into computers and sold microprocessors to no one, vertically integrated into PCs but also sold chips, or stayed out of the PC market altogether and just sold chips. If Intel sells chips to outsiders, it must decide whether to sell to all comers or only to a selected few. These decisions determine the precise sense in which the Intel situation might have tracked a more conventional regulated network industry. If Intel sells to all, then we have a universal access regime, one reached voluntarily rather than through regulation. If Intel also integrates vertically, then we have the electricity model, where grid owners generate electricity but are required to sell access to competing generators.

The extent to which Intel has vertically integrated has changed over time, as Intel has gone from producing microprocessors to adding motherboards, but Intel has never gone into the PC market. Instead, it sells components to the PC manufacturer. Intel might have pursued this strategy for any number of reasons. The conventional wisdom is that the open architecture scheme of the Wintel platform has decentralized

68. Other wrinkles in the analysis present additional lines of inquiry. For example, we must consider what happens to innovation when ex-post cross-licensing is anticipated ex ante. For an analysis, see Michael L. Katz, *An Analysis of Cooperative Research and Development*, 17 RAND J. ECON. 527 (1986) (arguing that royalty-free cross-licensing will reduce innovation under some circumstances).

decisions about PCs while ensuring that a basic uniform standard is met. Apple, in contrast, has been much more vertically integrated, having a stake in the PowerPC chip while serving—for most of its life—as the sole source of Macintosh computers. Intel receives the benefits of having many companies producing innovation and value to supplement its chip.

To how many PC makers should/will Intel sell? If Intel stands ready to sell to everyone on non-discriminatory terms, we are close to a voluntary version of the mandatory access regime, save for the important point that Intel will set prices that reflect its monopoly power while the government will set prices through administrative proceedings. If the government price would be lower than the monopoly price—which obviously would be the goal if not the result—effective access would be improved.

To begin at the most basic level, think of Intel as having three instruments with which to work: a fixed licensing fee, a per-chip royalty rate, and the number of permitted PC manufacturers (licensees). Intel would set each of these to maximize its profits. The general learning of the patent licensing literature is that the patent owner should auction a fixed number of licenses, or if an auction is unrealistic, set a fixed fee for a fixed number of licenses. If that too does not work, the patent owner should license to anyone at a fixed royalty rate.⁶⁹ This conventional wisdom, though, is fuzzy, and with good reason, as this literature spends little time on the risk allocation issues that create uncertainty and that might push in one direction or another. The other point to note is that the patent case is not perfectly analogous here. Intel spends billions per year on research and development⁷⁰ and then spends billions more to build the fabrication plants for the chips.⁷¹ So even after research and development, Intel incurs a substantial marginal cost to produce each chip it sells. An auction at a fixed amount or a flat-fee purchase for access

69. See Morton I. Kamien, *Patent Licensing*, in 1 HANDBOOK OF GAME THEORY WITH ECONOMIC APPLICATIONS 331-54 (eds. Robert J. Aumann & Sergiu Hart) (1992).

70. See *FTC Brief*, *supra* note 47, at 15 (citing the Intel 1997 Annual Report).

71. See *id.* (quoting Albert Yu, an Intel senior vice president).

would not send PC makers the right price signals, as the PC makers would ignore Intel's marginal costs in producing a chip. We should think that Intel should engage in two-part pricing, with a royalty rate set at Intel's marginal cost, and with the fixed-licensing fee set to extract profits fully from the PC makers.

If, as probably tracks the facts, Intel looks principally to royalty rates—per-chip prices—to make its money, then Intel should be willing to license anyone at the profit-maximizing royalty rate. A quick look at the relevant equations from the standard Cournot model will make this clear. Suppose that demand for PCs is given by $p = a - bQ$. Assume that production costs are given by $z + cq$, where z is the fixed cost of producing PCs and c is the marginal cost of production. Profits for a given PC maker are given by $(p - c - r)q - z - F$, where r is Intel's royalty rate, and F is Intel's fixed licensing fee. Maximizing profits in a Cournot equilibrium means that each producer chooses its q for given rest-of-the-industry output. With a little work,⁷² we can establish that industry output Q is given by:

$$Q = \frac{N(a - c - r)}{b(N + 1)} \quad (7)$$

This is total industry output under Cournot competition with N licenses and a royalty rate of r .

With marginal costs of c_p , profits for Intel are given by:

$$\Pi_p = (r - c_p)Q + NF \quad (8)$$

or, in equilibrium,

$$\Pi_p = (r - c_p) \frac{N(a - c - r)}{b(N + 1)} + NF \quad (9)$$

Intel sets r , F and N .

72. Differentiate, with respect to individual firm quantity, the profit function for each of the N producers to get:

$$\frac{\partial \Pi_i}{\partial q_i} = (a - bQ - c - r) + q_i(-b)$$

We have N of these equations, where N is the number of Intel licensees. To solve this, set the N first order conditions to zero and sum across the N firms to get:

$$N(a - bQ - c - r) = bQ$$

If we constrain F to be 0—the idea being that other reasons, probably uncertainty, push towards revenues through chip prices—Intel chooses r and N . Differentiating Intel's profits with respect to r and solving the first-order maximization condition for r gives:

$$r^* = \frac{a - c - c_p}{2} \quad (10)$$

Plug this into the formula for Intel's profits, and we get:

$$\Pi_p = \frac{N(a - c - c_p)^2}{4b(N + 1)} \quad (11)$$

This is rising in N , so under these assumptions, Intel wants as many PC makers as possible. A zero-profits condition in the PC market will determine ultimate entry.

This crude starting point gives some sense of how we should expect Intel to behave. Intel would offer licenses to everyone but would set a monopoly price. If the government had the will and the information, it might do better by lowering the price to that which would maximize overall welfare. This scheme is no more a universal access regime than the one that Intel would set up privately, only the price is different, so effective access is higher. In any event, we know that this analysis ignores many issues that we should expect to be relevant. Our PC makers are identical, boring zeros, making only the Cournot quantity decision. Such analysis assumes that Intel does not care about the identity of the PC makers, it just wants as many licensees as possible. We have not yet given any reason that Intel should prefer one licensee to another or why it should have any interest in cutting off a licensee.

For better or worse, we know that such an assumption runs contrary to the facts. Like many manufacturers of complex products, Intel segments its customers into many categories.⁷³ Intel customers who qualify as Intel Product Dealers receive training, rebates, and technical information from Intel.⁷⁴ This category applies to systems integrators building fewer than 20,000 PCs per quarter. Customers can take the additional step

73. See Intel Corp., *U.S. & Canada Membership Programs* (visited Oct. 29, 1999) <<http://channel.intel.com/business/programs/uscanada.htm>>.

74. See Intel Corp., *I.P.D. Program Benefits* (visited Oct. 4, 1999) <<http://channel.intel.com/business/america/ipd/progsumm.htm>>.

of seeking to become an Intel Authorized Solution Provider.⁷⁵ These customers must already be in a program such as the product dealers program, and they must also satisfy Intel certification tests and other requirements. More steps mean more benefits, including early information and controlled use of the Intel logo. These programs are separate from the highly secretive deals struck by Intel with original equipment manufacturers. The FTC has an ongoing investigation into this program, including the very visible "Intel Inside" advertising program.⁷⁶ Of course, Intel could be acting just in its private interests through this program, but there is every reason to think that broader interests are at stake as well.

The formula for Intel's profits in equilibrium gives us some sense of why Intel—and society as well—should care about Intel's customers. Intel's profits are bigger if c is smaller. Imagine a setting in which the marginal cost of production of the PC maker is not known, to either the company or Intel, before production starts. Operations give information. Intel will want to swap high-cost producers for low ones and could push exit through its termination policy. The marginal cost of production is just a proxy for any value that might be added by the PC manufacturer. This value would include innovations by a PC maker that would make the computer more attractive for consumers. To return to the antitrust argument for a moment, whatever the merits of the FTC's position on competition in microprocessors, it is hard to see without a much more complex story why Intel would want to thwart innovations in products complementary to its CPUs. This claim formed a key component regarding Intel's behavior as to Compaq. As should be clear intuitively, Intel cares about the quality of its licensees; this shows up in equation (11) through the marginal cost c but applies more generally as well.

D. Strategic Licensing

We still have not approached anything like the facts as seen

75. See Intel Corp., *Requirement for Becoming Authorized* (visited Oct. 4, 1999) <<http://channel.intel.com/business/authorization/who/index.htm>>.

76. See Lisa Dicarlo, *Inside Intel: Chip maker's restrictive marketing program—and millions in subsidies—shackle PC makers*, PC WEEK, Apr. 5, 1999, at 1.

by the FTC. Intel did not allegedly cut off or threaten to cut off Intergraph, Digital, or Compaq because they were bad at what they did. So turn instead to two possible strategic and anticompetitive uses of licensing. First, Intel might license potential competitors in order to reduce incentives to develop competing microprocessors. Suppose that Intel refused to license those who might be best situated to compete with it and either vertically integrated into computer production, or, more realistically, licensed its microprocessors only to those firms who were unlikely to enter the microprocessor market. Firms left outside the PC market would need to enter the microprocessor market first in order to enter the PC market. Entry of this sort might ultimately put at risk Intel's market position in microprocessors. In this scenario, Intel chooses to keep its enemies close at hand by licensing those firms that would be its strongest competitors and giving them a chunk of the returns in the PC market, thereby reducing their incentive to develop independently competing microprocessors.⁷⁷ Thus, Intel would license to strong potential competitors and would refuse to license weak potential competitors, all in an effort to perpetuate its market position in microprocessors.

How would we tell whether or not that happened here? Intergraph initially built its workstations using the Clipper chip, a RISC chip sold by the advanced processor division of Fairchild Semiconductor.⁷⁸ In 1987, Intergraph vertically integrated by purchasing the division and the chip. Five years later, in 1992, Intergraph decided to consider switching to Intel processors. The next year, it made the change and dropped further development of the Clipper chip. According to Intergraph's complaint, in July 1996, Intel started discussing the patents covering the Clipper. Intergraph's lawsuit resulted in a preliminary injunction against Intel. That litigation is still pending, with the judge having ruled most recently that Intel does have a license for the Clipper patents,⁷⁹ and a jury trial on

77. For development of this idea, see Nancy T. Gallini, *Deterrence by Market Sharing: A Strategic Incentive for Licensing*, 74 AMER. ECON. REV. 931 (1984).

78. See Intergraph Corp., *Intergraph Corp.'s Amended Complaint* (visited Oct. 29, 1999) <<http://www.intergraph.com/intel/complnt.htm>> [hereinafter *Intergraph Amended Complaint*].

79. See *Intergraph Corp. v. Intel Corp.*, CV-97-3023-NE (N.D. Ala. October 12, 1999)

the patent infringement issue is scheduled for June, 2000.⁸⁰

The FTC's complaint did not address this issue; instead, it focused on the second strategic use of licenses and information: threatened withdrawal after the customer has become dependent on access to Intel technology. The customer invests heavily in Intel chips, and in the words of the Intergraph complaint:

As a result of the assurances of Intel, and the transition to Intel-based workstations, Intergraph is now technologically and economically "locked in" to the use of Intel's CPUs. Intergraph has designed its products and systems based on Intel's CPUs and, because there are no high performance alternatives, Intergraph cannot economically or feasibly switch to other CPUs.⁸¹

With the customer completely dependent on Intel technology, Intel has the upper hand and can expropriate value from its customer through the threat of withdrawal. Intel therefore could demand, and did, a royalty-free license to the Clipper technology.

This story only works so well. Intergraph's lock-in must have been anticipated by both sides. This is a simple case of specific investments with the threat of after-the-fact hold-up. There is nothing particularly interesting there; indeed, the more interesting side is the set of institutional responses, such as second-sourcing, which are designed to make the hold-up more difficult.⁸² Hold-up could have taken the form of demanding higher payments for chips down the road, or separate fixed-fee cash payments, or virtually anything else.

Hold-up after specific investment is completely generic. It is a risk that would be faced by any Intel licensee—not just those with possibly competing intellectual property rights. The threat of expropriation is determined by the size of the

[hereinafter *October 12th Order*], *vacating Intergraph Corp. v. Intel Corp.*, CV 97-N-3023-NE (N.D. Ala. June 4, 1999) [hereinafter *June 4th Order*] (visited Oct. 4, 1999) <<http://www.intergraph.com/intel/integra.htm>>.

80. See <<http://www.intergraph.com/intel/>>.

81. *Intergraph Amended Complaint*, *supra* note 78, at ¶ 13.

82. See Joseph Farrell & Nancy T. Gallini, *Second-Sourcing as a Commitment, Monopoly Incentives to Attract Competition*, 103 Q. J. ECON. 673 (1988); Michael H. Riordan & David E.M. Sappington, *Second Sourcing*, 20 RAND J. ECON. 41 (1989). Indeed, second-sourcing had been a key element of Intel's early success. See TIM JACKSON, *INSIDE INTEL: ANDY GROVE AND THE RISE OF THE WORLD'S MOST POWERFUL CHIP COMPANY*, ch. 10 (1997).

investment and the cost of switching to competing technology. If Intel asks for value and gets it, the form in which tribute is paid may depend on whether the target has valuable intellectual property rights, but as a first cut, the amount itself should be independent of those rights.

We therefore need to say something more refined for the FTC's story to work. Compare, for example, a royalty-free license sought before dependence on Intel's technology with one sought afterwards. When it first dealt with Intergraph, Intel could have sought a royalty-free license for any patented Clipper technology arguably infringed by the Pentium line.⁸³ Licensing of this sort is the order of the day in the high-tech business. Recall that the FTC action focused on patents of Intergraph, Digital, and Compaq. Digital's original suit against Intel—and the resulting countersuit by Intel—resulted in a complex settlement, one piece of which was cross-licensing of the relevant patents.⁸⁴ Intel intervened in Compaq's suit against Packard Bell, but that suit was ultimately settled with undisclosed payment terms and a license running in favor of Packard Bell.⁸⁵ Indeed, Compaq eventually stood ready to license its patent portfolio to other PC manufacturers, including Gateway, and entered into a cross-licensing program with Intel itself.⁸⁶

So suppose that Intergraph and Intel had discussed licenses before Intergraph tied itself to the Pentium line. Assume that the Pentium chips actually infringed the Clipper technology. What matters for the negotiation is what the parties know about this. Think through four rough combinations on the infringement information: both know the chips infringe; neither knows; Intel does and Intergraph does not; and vice versa. If both know, nothing interesting happens; the price

83. Indeed, Intel believed that it had such a license, a position ultimately adopted by the district court. See *October 12th Order*, *supra* note 79.

84. See *FTC Alpha Press Release*, *supra* note 64.

85. See *Compaq & Packard Bell Settle Patent Litigation*, in *EDGE: WORK-GROUP COMPUTING REPORT*, June 24, 1996; see also Intel Corp., *Compaq and Intel Corporation Announce New Agreements in Engineering and Marketing* (visited Oct. 29, 1999) <<http://www.intel.com/pressroom/archive/releases/cpqii.htm>>.

86. See Lisa DiCarlo, *Compaq Licenses Patents to Gateway PC WEEK*, Dec. 26, 1994, at 101; Dwight Silverman & Bill Mintz, *Compaq, Intel End Feud, Will Share Patents*, *HOUS. CHRON.*, Jan. 19, 1996, at 1.

associated with the infringement action is just that, and it will either be paid by Intel to Intergraph or netted out if they do a deal. If neither knows whether the Pentium line infringes the Clipper patent, whatever terms the parties strike represent a bet over their ignorance.

If Intel is worried about potential infringement claims, Intel might use the offer of a royalty-free license from the customer as a way of smoking out lurking infringement claims.⁸⁷ Customers without competing technology could grant the license easily, while possible competitors, such as Intergraph, would be giving up something of value. Intel would effectively be charging different prices to different customers as a function of the value of their technology, which is a form of price discrimination. One would expect knowing potential customers to separate out, with those with the best technology refusing to become Intel customers and being forced to compete with Intel. That makes clear the risk to Intel of this approach. Much like the story described above, Intel might very well prefer to have its strongest competitors dump their technology and switch to Intel. The upfront royalty-free license has just the opposite effect with potential customers who have valuable patents and knowledge.

In the fourth case—Intel knows and Intergraph does not—if Intel usually seeks royalty-free licenses from customers, Intergraph learns nothing from the request. Obviously, an Intergraph-specific request should convey information to Intergraph about what Intel knows. Indeed, the facts suggest that Intel added the royalty-free license to a particular non-disclosure agreement it presented to Intergraph after Intel faced indemnification claims from Intel customers, who in turn faced patent infringement claims from Intergraph.⁸⁸

Thus, the possibility of upfront licensing turns on the state of the parties' knowledge. Intel should find it difficult to get an upfront license from a company that knows that it has valuable patent rights. Intel might choose not to pursue such a license if

87. This is a genuine possibility, as the patent law appears to allow patent holders to wait to assert their claims for as much as six years. *See* *Wanlass v. General Elec. Co.*, 148 F.3d 1334, 1337 (Fed. Cir. 1998).

88. *See June 4th Order*, *supra* note 79.

it thought that that would merely push away companies that would then be forced to compete with it. Intel might turn instead to after-the-fact licenses of the sort alleged in the FTC complaint.

There is no general claim that Intel tries to rip off all of its customers. That fact might be explained through a standard repeat play/reputation story, or, if worse came to worst, common sense. The more interesting question to ask is why Intel grabs only from those customers with competing technologies and why this might be perceived as legitimate by Intel's customers as a group. This inquiry takes us back to the double monopolization problem described before. Absent the royalty-free license, we will have two licensors for the relevant technology—in this case, Intel and Intergraph. In this scenario, both technologies would be required to use the Pentium chip. As we saw before, separate royalty rate-setting by Intel and Intergraph would result in higher royalty rates than would be set by a single owner of both patents. Such rate setting will make Intel's customers as a group worse off. Intel's threat, if successful, restores single ownership of the patents at stake.

In this framework, potential customers who know that they have valuable patents will decline to deal with Intel. They will fear the after-the-fact grab alleged in this case. Potential customers who do not know that they have valuable patents will go ahead and deal with Intel, and then face the after-the-fact grab. In this scenario, the customers' patent rights lose value, and Intel's strategy should discourage innovation at the margin. If the law forbids after-the-fact grabs from customers with competing patents, customers with knowledge who would not otherwise deal with Intel will do so, and customers without knowledge will deal with Intel and receive a greater return on their patents.

E. Access and Pricing Regimes

Put differently, the standard approach of network industry regulation—non-discriminatory, open access—makes it possible for knowing potential customers to do business with Intel when they would otherwise decline, and this approach should increase returns to the ignorant with patents who

would blithely contract with Intel and risk after-the-fact plunder. This result all comes on top of whatever benefits, if any, are achieved by substituting government price-setting for access for Intel's monopoly price-setting of access.

It also would come at the price of substantial government oversight of an unbelievably dynamic industry. We can slice and dice the access and pricing rules to gain a better sense of the possibilities:

1. *None.* No regulation at all. This is the world prior to the FTC's action.
2. *Context-Specific Negative Duties.* Intel cannot bar for specified reasons access that it would otherwise grant absent those reasons. This result comes out of the settlement itself, as Intel cannot use an intellectual property dispute as a basis for refusing to deal with a customer.
3. *Mandatory Access with Private Prices.* Intel can adopt whatever price schedule it wants, but it must deal with everyone at these prices.
4. *Mandatory Access with Regulated Prices.* This is the contemporary scheme of mandating access to inputs and regulating the price of those inputs.⁸⁹

Take these in reverse order. The fourth possibility is now familiar to us. It has the virtue of controlling the exercise of monopoly power, but it comes at the cost of forcing the government to make repeated, difficult calculations of appropriate prices. Maintaining this scheme would be especially challenging for the government given the speed of change in the CPU industry. The third possibility is rarely used, if ever, but it has the benefit of eliminating the asymmetric information and bargaining issues described above. It means accepting monopoly pricing. It also risks disturbing the voluntary process of negotiated, royalty-free cross-licenses. We need to know much more about those dynamics before we can confidently say that we improve matters by taking away from Intel the right to withhold its

89. I will ignore a fifth possibility, namely, that the FTC could regulate prices and leave the access decision to Intel.

intellectual property rights as part of an effort to get intellectual property rights from others.

The second possibility could be imposed either through antitrust litigation—as occurred here—or through legislation. These options preserve some dealing and pricing flexibility for the target of the regulation, but also solve, at least in theory, the asymmetric information problem. I say in theory, because as Commissioner Swindle noted in his comments on the settlement,⁹⁰ negative duties are very difficult to enforce. Intel could deny access for a pretextual business reason, when in reality it was driven by intellectual property motives. If one believed that such a negative duty was essentially unadministrable, one would prefer the first or third scheme. The second approach, like the third approach, may make it difficult for Intel to strike socially-beneficial royalty-free cross-licenses. Finally, the first possibility—no regulation at all—speaks for itself.

IV. CONCLUSION

As noted before, the FTC's case against Intel turns on tricky issues regarding the dynamics of cross-licensing. These issues are essentially barter transactions, and we have only a weak understanding of when firms will turn to barter. Interfering with cross-licensing will make it more difficult for these transactions to take place, and to understand the importance of that, we need to have a better handle on the relative importance for a licensor of cash returns versus the in-kind returns that are obtained from cross-licenses.

We can say with more confidence that the FTC's case appears to give very little weight to the benefits that arise from royalty-free cross-licenses. These licenses eliminate the double monopoly problem that can arise when two patent holders hold essential patents. Royalty-free cross-licensing eliminates through a contract an externality between the patent holders that would otherwise push up prices, to the detriment of the patent holders and their customers. The settlement may very

90. See Federal Trade Commission, *Statement of Commissioner Orson Swindle in the Matter of Intel Corporation* (visited Oct. 4, 1999) <<http://www.ftc.gov/os/1999/9904/swindle.htm>>.

well make it more difficult for Intel to negotiate royalty-free cross-licenses and may harm society in doing so.

But, from the FTC's perspective, that is the main point of the settlement. The settlement should have the benefit of making it possible for prospective PC makers who might not deal with Intel to do so—though this point does not appear to have figured in the FTC's calculus. These prospective PC makers will have less reason to fear that Intel will later pressure them into a cross-license. This security will increase the pool of PC makers, though the benefits of this are quite speculative. Equally speculative is whether the settlement will foster research and development on microprocessors—the chief focus of the FTC's complaint—though little public evidence suggests that outcome.

As to the question of whether regulation promotes efficiency in network industries, the irony here is that the settlement is generally seen as quite narrow and that Intel settled to avoid much more draconian outcomes. Although that statement is certainly true, it should not suggest that small steps necessarily do little harm. What matters is precisely how close you are to the cliff when you start taking steps, small or large. On that score, whether the settlement promotes efficiency turns on quite subtle assessments, none of which are accessible from the public record in the case, assuming that they were made at all.

