GLIMMERS AND SIGNS OF INNOVATIVE HEALTH IN THE COMMERCIAL INTERNET

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INTRODUCTION

What are the signs of healthy behavior in an innovative industry?

This seemingly simple question isn't so simple to answer in a quickly evolving industry such as the Internet. Commercial behavior resides inside a complex value chain, which is a set of interrelated activities that produces a final product for end users. No single firm controls the value chain, and the quality, price, and user experience arise from the complex interactions between those participants. Moreover, over time many parts of this value chain have undergone innovative improvements, and no reasonable observer expects those improvements to cease tomorrow.

There is no agreement about which criteria observers and policy makers should use to assess the performance of the commercial Internet.

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Ever since the commercial Internet first emerged, there have been arguments about how to best organize its value chain to achieve maximum value for the most users. Disagreements have not diminished with time. If anything, this debate has grown shrill as the number of commercial interests and business commentators have grown.

This essay makes a novel contribution to this topic. It identifies patterns of healthy commercial behavior indicative of an innovative industry, and illustrates how to observe signs of such behavior in information technology markets, such as the Internet. Stated broadly, the essay identifies healthy behavior that correlates with desirable market-wide outcomes, such as improvement in products, lower prices, new capabilities, or other innovations that lead to productivity improvements among business users.

This essay highlights four signs of the healthy innovative behavior:

- economic experiments
- vigorous standards competition
- entrepreneurial invention
- the absence of unilateral bargaining

Unlike most prior writing in this area, the essay is not motivated by any normative proposal for governing the Internet value chain, such as net neutrality or reasonable network management, or any specific proposal for legal or regulatory reform. To be sure, the reasoning in the essay will have some implications for some aspects of these proposals, but that is not its primary purpose.

This essay is written in the spirit of aspirations to develop a "third way" for addressing infrastructure policy issues in the Internet. A third way seeks to nurture innovation by avoiding lengthy and protracted fights in agency hearings and courtrooms—avoiding events that sustain uncertainty about the value of commercial investments, sometimes for years at a time. Such sustained uncertainty damages the interests of *every* industry participant in a fast moving market, both users and suppliers.

A third way would rely on dispute resolution mechanisms that operate much faster, such as negotiations and guidelines.[1] This third way would employ arbitration and administrative resolution to disputes, avoiding the slow tools of regulatory command and control. It would avoid, in particular, an extremely damaging event that is all too common in regulatory processes for telecommunications in the United States—the slow and sometimes discursive processes associated with regulatory ping-pong between federal agency decisions and court-ordered remedies and

1. *See* Phil Weiser, *Institutional Design, FCC Reform, & the Hidden Side of the Administrative State* (Univ. Colo. Law Legal Studies, Research Paper No. 09-01 2009).

appeals.

If such "a third way" emerges, it also will aspire to reduce uncertainty. How does it do that? Such a process aspires to be predictable, saving all parties the trouble of adjudication in any but the rarest circumstances. To achieve predictability, the administrators will publish transparent guidelines for all relevant participants.

That is where this essay makes a contribution. Guidelines necessarily require a conceptual framework and benchmark for recognizing innovative behavior. The benchmark must help regulators quickly recognize when a market action does or does not contribute to a healthy innovative outcome. This essay proposes a framework for building such a benchmark.

At present, the closest any policy statements get to such a benchmark in the United States are the four Internet principles issued by the Federal Communication Commission (FCC). In their most recent restatement by the outgoing chairman of the FCC, Kevin Martin, the four principals are:

> Consumers are entitled to access the lawful Internet content of their choice; Consumers are entitled to run applications and services of their choice, subject to the needs of law enforcement; Consumers are entitled to connect their choice of legal devices that do not harm the network; Consumers are entitled to competition among network providers, application and service providers, and content providers.[2]

These principles are intended to signal the direction of future policy without committing the agency to specific actions. As noted by many observers, the principles aspire to contain both generality and flexibility in the face of inevitable change in the industry.[3] Yet, that also explains what I regard as their primary drawback. They are rather open-ended and curt in comparison to the efforts of other federal agencies to offer policy guidelines.

In my view, that curtness undermines their ability to reduce uncertainty by signalling what a federal regulator regards as healthy and unhealthy innovative behavior. They also fail to reduce regulatory delay

2. Appropriate Framework for Broadband Access to the Internet over Wireline Facilities, *Policy Statement*, 20 FCC Rcd. 14,986 (2005), *available at* http://www.publicknowledge.org/pdf/FCC-05-151A1.pdf/ [hereinafter *Policy Statement*]; *cf. Net Neutrality FCC / FTC,* CYBERTELECOM, *available at* http://www.cybertelecom.org/ci/neutralfcc.htm (past statements by ex-Chairman Michael Powell).

3. Footnote 15 of the *Policy Statement, supra* note 2, states, "Accordingly, we are not adopting rules in this policy statement. The principles we adopt are subject to reasonable network management," begging the question, "What is the definition of reasonable network management?" *See, e.g.,* Isen.blog, http://www.isen.com/blog/2005/08/how-martins-fcc-is-different-from.html (Aug. 7, 2005, 17:07 EST); *Net Neutrality FCC / FTC, supra* note 2.

because they are inviting regulatory hearings followed by court interpretation, triggering the usual damaging ping-pong.

One comparison with a standard benchmark of competition policy in the United States can illustrate why I perceive the four principles as open-ended and curt. In 1968 the Department of Justice and Federal Trade Commission first issued a set of very detailed merger guidelines, revising them most recently in 1997, and issuing extensive commentary on them again in 2006.[4] While the guidelines do not commit the DOJ or FTC to specific actions in specific mergers, these have become a benchmark for firms and agencies, helping firms anticipate likely DOJ and FTC responses to proposed mergers. This makes the process more predictable, which helps all parties plan, and it reduces negotiation costs for all participants.[5]

By comparison, do the four principles provide a similar level of guidance? It is not even close. The four principles cover only a narrow range of actions. There have been only a few examples to illustrate how the FCC intends to employ these principles, involving Madison River and Comcast. There are many plausible circumstances not covered, and in which the principles do not help market participants forecast whether their own decisions will generate close regulatory scrutiny or not. Such open-endedness seems particularly damaging for innovative behavior because, said simply, there are few indications about when commissioners and staff will view innovative behavior as healthy or not.

These concerns motivate focusing on identifying the behavioral signs of innovative health. I perceive there would be a gain for policy from clarifying benchmarks that any observer, even querulous lawyers on opposite sides of a policy issue, could use to assess the state of health of an innovative market, such as the Internet.

In Section I, I review the broad motivation behind the essay's core question. Section II provides an analysis of the four signs of innovative health. Section III discusses some implications of this approach for events involving dominant firms in which the FCC did or did not apply the four principles, such as disputes involving Comcast, and another between Sprint and Cogent.

I. THE VALUE CHAIN FOR THE INTERNET

The complexity and evolution of the Internet's value chain

4. DEP'T OF JUSTICE, ANTITRUST DIVISION, MERGER ENFORCEMENT GUIDELINES, http://www.usdoj.gov/atr/hmerger.htm.

5. DEP'T OF JUSTICE AND FTC, HORIZONTAL MERGER GUIDELINES, http://www.usdoj.gov/atr/public/guidelines/hmg.htm. *See also,* DEP'T OF JUSTICE AND FTC, COMMENTARY ON THE HORIZONTAL MERGER GUIDELINES, http://www.ftc.gov/os/2006/03/CommentaryontheHorizontalMergerGuidelinesMarch2006.pdf.

motivates the core question behind this essay. It is worthwhile to understand this motivation in some depth. The structure of the Internet value chain has evolved in a direction that will give rise to numerous policy issues into the foreseeable future.

The value chain for Internet services appears to be perpetually in transition. To paraphrase the economist, Bruce Owen, the players have only reached the fifth inning of a nine-inning ball game and there is no rain delay in sight.[6] That evolution raises a challenge for any regulatory framework: it makes it quite difficult to assess the general factors encouraging behavior that leads to innovative outcomes.

Indeed, ever since the Internet commercialized many of its participants have maintained a strong sense about their exceptional nature, as if innovation within the existing value chain for the Internet defied established archetypes of innovation. For example, the Internet did not arise as a consequence of one single breakthrough invention from one single genius, à la Edison and the light bulb.

That view raises a rather deep economic question about whether innovation within the Internet can be assessed with the same economic concepts used elsewhere in innovative markets, such as computing. This essay will largely argue that it can be.

The truth about the early development of the commercial Internet is less exciting than this attitude of exceptionalism would suggest. It involved a vastly dispersed set of actors. The Internet developed slowly and through a rather mundane process, accumulating capabilities over time from an enormous number of contributors. As such, it fits an archetype that scholars of innovation label as "Collective Invention."[7] For example, the creation, refinement, and improvement of e-mail prior to 1990 involved contributions from more than fifty different people over two decades, and that application was one new application among many.[8]

More specifically, the Internet initially accumulated capabilities over time in a government project hidden from mainstream view. Technical success generated interest and use, spread technology among researchers, and gained economic value by growing capabilities in a community that did not recognize its economic value for non-researchers.[9]

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6. Bruce Owen, *Broadband Mysteries*, *in* BROADBAND: SHOULD WE REGULATE HIGH-SPEED INTERNET ACCESS? 9–38 (Robert W. Crandall & James H. Alleman eds., Am. Enter. Inst. Press 2003).

7. *See*, *e.g.*, Robert C. Allen, *Collective Invention*, 4 J. ECON. BEHAVIOR & ORG. 1, 1–24 (1983); Peter B. Meyer, *Episodes of Collective Invention* (U.S. Bureau of Labor Statistics, Working Paper No. 368, 2003), *available at* http://ssrn.com/abstract=466880.

8. Craig Partridge, *The Technical Development of Internet E-mail*, 30 IEEE ANNALS OF THE HISTORY OF COMPUTING 3-29 (2008).

9. *See, e.g.*, JANET ABBATE, INVENTING THE INTERNET (MIT Press 2000); Shane Greenstein, *Wild Ducks and Inconspicuous Accumulation: Innovation in the Government-Sponsored Internet* (Kellogg Sch. of Mgmt., Working Paper, March 2009), *available at*

Once commercialized, the Internet began to accumulate more capabilities and functions, as a range of firms began to use pieces of the Internet to enhance services provided to paying customers. Over time, "the Internet" became a label for not only the Internet, but also for all the applications that accumulated around the Internet, used pieces of the Internet, and commercialized new functions for the Internet, which cumulatively delivered an enormous array of services to a wide range of users.

Three factors in particular altered the discussion about the value chain in the last decade. First, the predominant access mode for the Internet changed. Second, several leading businesses organized several different platforms to alter the potential value chains for users and developers. Third, the predominant contractual framework for governing transactions was never completed.

Each one of these factors raises further questions about the presence of market power and its distortion on innovative outcomes. Each factor also raises questions about the ability of a savvy observer to assess the innovative health of the Internet.

I describe each of these factors in turn and explore why they motivate the core question of this essay.

A. Broadband

In the 1990s the model Internet Service Provider (ISP) was a dial-up charging $20 a month on average.[10] By the turn of the millennium this industry had generated over $10 billion in revenue,[11] which was quite impressive for an economic activity so young. At a broad level, however, it supported only applications that could tolerate some delay in the delivery of data. That restriction on the value of output rendered moot many arguments about how to best govern the value chain. Subsequent developments brought those arguments to the forefront.[12]

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http://www.kellogg.northwestern.edu/faculty/greenstein/images/research.html.

10. Tom Downes & Shane Greenstein, *Universal Access and Local Commercial Internet Markets*, 31 RES. POLICY 1035–1052 (2002); Tom Downes & Shane Greenstein, *Understanding why Universal Service Obligations May be Unnecessary: The Private Development of Local Internet Access Markets*, 62 J. URBAN ECON. 2–26 (2007); Shane Greenstein, *Innovation and the Evolution of Market Structure for Internet Access in the United States*, *in* THE INTERNET AND AMERICAN BUSINESS 47 (William Aspray & Paul E. Ceruzzi eds., 2008) [hereinafter *Evolution of Market Structure for Internet Access*]; Shane Greenstein, *Building and Developing the Virtual World: The Commercial Internet Access Market*, 48 J. INDUS. ECON. 4 (2000).

11. Shane Greenstein & Ryan McDevitt, *The Broadband Bonus: Accounting for Broadband Internet's Impact on U.S. GDP.* (NBER, Working Paper No. 14758, 2009), *available at* http://www.nber.org/papers/w14758.

12. *See* JONATHAN E. NUECHTERLEIN & PHILIP J. WEISER, DIGITAL CROSSROADS: AMERICAN TELECOMMUNICATIONS POLICY IN THE INTERNET AGE (2005); *see also*,

The predominant mode of access changed in a short period. In September 2001, approximately 45 million U.S. households accessed the Internet through a dial-up connection, whereas only 10 million used a broadband connection.[13] By March 2006, a sharply contrasting picture emerged: approximately 47 million households (and growing) had broadband connections, whereas 34 million (and declining) used dial-up.[14] According to the latest survey of the Pew Internet and American Life Project, in April, 2009, less than 10% of U.S. households had dial-up Internet connections, and 63% of U.S. households had broadband.[15]

Consistent with the increasing adoption of broadband by households and its higher monthly prices on average, the total revenue in access markets grew. So, too, did the fraction of revenue going to broadband.[16]

Simple economic factors determined the growing trend to broadband internet serve. Dial-up became available first and diffused to more than half of U.S. households. Thereafter broadband emerged as a higher quality and more expensive alternative, albeit one available in only a few places and from a limited set of providers, if any. Over time, however, broadband became more reliable and more widely available, which enabled many households to upgrade their Internet service.

Today, most urban households face a duopoly of wire-line choice: (1) an offering from a local cable franchise, and (2) an offering from a local telephone company. In some locations, they also may face options for wireless providers, which potentially may convert the duopoly into a more competitive supply. In many suburban areas (less dense settings) households face that duopoly or only one wire-line provider. To the contrary, one wire-line provider services households in many rural settings or isolated small cities, where households lack alternatives to

Evolution of Market Structure for Internet Access, *supra* note 10, at 47–104 (Those arguments had antecedents in the open access movement, but became reformulated as broadband diffused. They were reformulated principally in the form of the "net neutrality" movement. As noted earlier, the FCC policy's ambiguity about the meaning of 'reasonable network management' left open many issues.); *see e.g.,* George Ou, *A Policy Maker's Guide to Network Management*, THE INFO. TECH. AND INNOVATION FOUND. (2008) (a review and analysis of various definitions and their implications), *available at* http://www.itif.org/files/Network_Management.pdf.

13. NATIONAL TELECOMMUNICATIONS AND INFORMATION ADMINISTRATION (NTIA), A NATION ONLINE: ENTERING THE BROADBAND AGE (2004), *available at* http://www.ntia.doc.gov/reports.html.

14. John Horrigan, *Home Broadband Adoption*, PEW INTERNET & AM. LIFE PROJECT (2007) *available at* http://www.pewinternet.org/Reports/2007/Home-Broadband-Adoption-2007/ Data-Memo/Findings.aspx?r=1.

15. John Horrigan, *Home Broadband Adoption*, PEW INTERNET & AM. LIFE PROJECT (2009) *available at* http://www.pewinternet.org/Reports/2009/10-Home-Broadband-Adoption-2009.aspx?r=1.

16. Greenstein & McDevitt, *supra* note 11.

dial-up internet service except through a satellite provider and/or other wireless ISP.

As a cause for both celebration and concern, broadband firms inhabit a position of monopoly or duopoly in a key part of the value chain. On the one hand, broadband's position reflects the ascendency of a superior product and service in replacing dial-up, an economic improvement over the near past. On the other hand, it raises concerns about the presence of market power and the incentives to make future improvements.

At a broad level, most texts in standard industrial economics stress the issues with this situation.[17] While society benefits from giving incentives to firms to create superior products and services, rewarding firms with monopoly power comes at a cost to society, presuming firms with high market share possess market power. Such firms may face weaker incentives to innovate than firms in any more competitive market structure.[18] Net neutrality advocates also have expressed a related concern that the retail market power will be used to shape the incentives of others in the value chain in adverse ways.[19]

Broadband's ascendency into the majority of households gave rise to another issue because it enabled a range of applications to blossom. Generally speaking, four types of rather different uses share the same capacity: (1) browsing and e-mail, which tend to employ low bandwidth and tolerate delay; (2) video downloading, which can employ high bandwidth and can tolerate some delay; (3) voice-over IP and video-talk, which tend to employ high bandwidth and whose quality declines with delay; and (4) peer-to-peer applications, which tend to use high bandwidth for sustained periods of time, and can tolerate delay, but, in some applications (e.g., Bit-Torrent) can impose delay on others.[20]

That range of uses and applications today also raises cheers and concerns. The Internet has evolved from a mere e-mail network for technically skilled users during its first decade into an e-mail or instant

17. *See* KIP VISCUSI, JOSEPH HARRINGTON & JOHN VERNON, ECONOMICS OF REGULATION AND ANTITRUST 4 (2005); *see also* DENNIS CARTON & JEFFREY PERLOFF, MODERN INDUSTRIAL ORGANIZATION (2004).

18. *See* Richard Gilbert, *Looking for Mr. Schumpeter: Where are we in the Competition-Innovation Debate*, 6 INNOVATION POL'Y & ECON. 159–215 (2006); *see also*, Jonathan Baker, *Beyond Schumpeter versus Arrow: How Antitrust Fosters Innovation*, 74 ANTITRUST L.J. 575, 575–602 (2007). While this broad point is generally accepted, there is considerable debate surrounding many aspects related to its general applicability and about what policy can/should do to foster competitive incentives aimed at raising innovation incentives.

19. *See e.g.,* LAWRENCE LESSIG, CODE AND OTHER LAWS OF CYBER SPACE (1999); LAWRENCE LESSIG, CODE, VERSION 2.0 (2006); Tim Wu & Christopher Yoo, *Keeping the Internet Neutral?: Tim Wu and Christopher Yoo Debate*, 59 FED. COMM. L.J. 575, 581 (2007); Ou, *supra* note 12.

20. *See* Ou, *supra* note 12.

messaging communications network for some, a gaming network for others, a source of news for others, and a distribution channel for video and musical entertainment for others. For others still, it is the principal media for engaging with geographically dispersed communities of friends.

While that diversity of applications wrings additional productivity out of the same capital supporting the network, it comes with a potential drawback: the use of one application affects the productivity of another. In part this is due to capacity constraints at bottleneck positions in the network; there are few backbone pathways to support browsing in isolated positions. Contributing to these constraints are geographically localized negative externalities (e.g., many modern peer-to-peer applications employ all available bandwidth, diminishing the quality of other applications in the same cable network that cannot tolerate delay).

The market for Internet access could become more complex over time. Options vary in speed, quality, and price. There have been data services from the major cellular carriers (e.g., Verizon, AT&T, and others) for several years, particularly for e-mail delivery to laptops. The most popular mechanism in the recent past was a simple device for delivery of e-mail (e.g., a BlackBerry). More complex devices have gained popularity (e.g., iPhones and smart phones), and these have download speeds that begin to approach the low end of wire-line broadband speeds.

Technological optimists forecast even faster download speeds from next generation wireless carriers (e.g., WiMax or LTE). There is still considerable uncertainty about how many of these services the market will support, about what price and sales levels will prevail, and, accordingly, what scale of deployment these prices and sales levels will support.

The pace and level of change suggest that the provision of Internet access has not stopped evolving, nor will they soon. In the best of all worlds the prior gains are permanent and the most worrisome concerns are temporary.

Why does this evolution pose a quandary for a regulator? It is not worrisome if the multiplicity of access choices erodes market power of any individual actor. It is worrisome if some actors retain market power, and use it to discourage innovations that do not serve their interests. The questions are central to any innovation policy for the Internet. What relevance will market power have to innovation policy in the Internet? Does limiting the distortions of market power provide justification for government intervention? If so, what type of action, and what are its limitations?

More to the point, in a setting where market power might or might not be present, and might or might not be employed for purposes that

run afoul of policy sensibility, private actors gain little insight into the thinking of public policy makers who publically commit to only four sentences. Surely private firms benefit from knowing how to anticipate the norms and standards employed by regulators to recognize the signs of healthy and unhealthy behavior in a situation that is changing so much.

B. Platforms

Well-designed standards and platforms hold one of the keys to the successful accumulation of functionality over time. Consider this brief overview about how platforms have changed over time, and how those changes altered the ability of a savvy observer to assess the innovative health of the Internet.

By way of background, typical use of Internet-related services requires successful execution of a set of technically interrelated activities coming from many independent firms. The failure or reduction in performance of any of these activities can lead to inferior outcomes for many users. Focusing solely on such technical action, however, misses a key dimension of how firms address the challenges. Even the simplest of activities in this value chain, such as sending e-mail, involves many participants, and efficient delivery of services depends on advanced agreement about how their business activities will interrelate. To reduce the uncertainty about how such services interoperate, commercial firms take one of two approaches: either they negotiate arrangements in advance with all relevant participants, or, if that fails, they do it all themselves.

In the parlance of business language, firms either negotiate standards with others so the task performs smoothly, or they offer a platform that accomplishes the task. Platforms are a standard bundle of components and designs around which vendors build services. Platform strategies played an important role in computing before the commercialization of the Internet.[21] Many firms naturally organized their strategic approach for commercial opportunities on the Internet with similar approaches.

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21. *See e.g.*, Timothy Bresnahan & Shane Greenstein, *Technical Progress and Co-Invention in Computing and In the Use of Computers*, BROOKINGS PAPERS ON ECON. ACTIVITY: MICROECONOMICS 1–78 (1997); Timothy Bresnahan & Shane Greenstein, *Technological Competition and the Structure of the Computer Industry*, J. INDUS. ECON. 1–40 (1999); *see also*, ANNABELLE GAWER & M.A. CUSUMANO, PLATFORM LEADERSHIP: HOW INTEL, MICROSOFT AND CICSO DRIVE INDUSTRY INNOVATION (2002); Annabelle Gawer & R. Henderson, *Platform Owner Entry and Innovation in Complementary Markets: Evidence from Intel*, 16 J.ECON. & MGMT. STRATEGY 1, 1–34 (2007); DAVID EVANS, ANDREI HAGIU, & RICHARD SCHMALENSEE, INVISIBLE ENGINES: HOW SOFTWARE PLATFORMS DRIVE INNOVATION AND TRANSFORM INDUSTRIES (2007); ANNABELLE GAWER, PLATFORMS, MARKETS AND INNOVATION (Edward Elgar ed., forthcoming Dec. 2009).

Ever since the emergence of the Internet, several leading businesses organized different platforms to alter the potential value chains for users and developers. There are proprietary platforms, open source platforms, and business platforms, all of which interoperate to provide services and some of which compete at the same time.

As with the rise of broadband, the rise of platforms on the Internet is a source of both celebration and consternation. While platforms perform functions that firms and/or users value, their presence usually suggests that some firms/users are better off with them than without. At the same time, large or dominant platform leaders (usually) possess market power, thereby raising questions about whether those firms use their discretion in ways that lead to more innovation.

The list of important platforms today is long. To illustrate this observation, I highlight two proprietary platform providers, Microsoft and Intel, and one non-proprietary platform, open source communities.

Perhaps the best known of the commercial platform providers is Microsoft, which develops and sells an operating system branded as Windows. It organizes the computing platform around the personal computer, as well as many Intel-based servers. To produce and deliver this product Microsoft engages with a multiplicity of actors, users (e.g., businesses and households), original equipment manufacturers (OEMs, *e.g.*, Dell, HP, and others), and application developers (e.g., software vendors). The operating system allows all of them to interact with one another for more efficient delivery of services.

Microsoft's platform strategy for the Internet over the last decade has been shaped by its lucrative position selling Windows for PCs and for server functions. This has led the firm to offer a mix of supporting functionality for the Internet. For example, in the early 1990s it offered TCP/IP compatibility in Windows as means to enhance the features of its networking software. In the mid 1990s it offered a browser, partly as a gateway towards developing a broader array of Web services, and partly for defensive purposes, because it matched browsers offered by others, notably Netscape at that time. Microsoft eventually won a rather confrontational war with Netscape for market share, and continues to hold a leading position in browser usage.

Microsoft has not, however, had as much success in other aspects of its commercial Internet ventures. Despite considerable resource commitments, its MSN division has never yielded enviable success. Its attempt to build an advertising-supported set of applications—including a recent attempt to buy Yahoo![22]—also has not yielded big advances.

22. Peter Henserson & Braden Reddall, *TIMELINE: Microsoft Attempt to Buy Yahoo!*, REUTERS, May 4, 2007, *available at* http://www.reuters.com/article/topNews/idUSGOR47298420080504.

Despite a leading position in enterprise computing, it has not yet found a successful transition to cloud computing applications, such as experienced by salesforce.com, for example. Only its investments in Xbox now generate revenues in excess of operating costs,[23] as well as a significant amount of Internet gaming traffic, but it will be considerable time before it generates enough profit to recoup the billions of dollars in losses spent developing the platform in the first place, if ever.

Intel is another prominent platform provider whose strategy arose from its lucrative position in PC markets. Intel's historical platform strategy had some similarities to Microsoft's. It too stands at the middle of a large ecosystem, interacting with a range of firms, providing leadership that drives towards the standard hardware design and specification used in most desk top computers, lap tops, and net books. Its behavior also differs from Microsoft's for a simple reason; Intel interacts much more with hardware than software firms. While Intel offered the most widely used microprocessor for personal computers, it feared losing leadership in new and growing markets for integrated circuits, especially processors. It developed a faster microprocessor and invested heavily in creating demand for platforms that used it. The latter motivated Intel to invest in a wide range of activities, some of them far afield from microprocessor manufacturing.

For example, Intel designed an input-output bus for PCs, even though, until that point, it had never been in that business. Intel also designed PC motherboards and virtually gave away the design to others, as a way to foster improvements that aided its microprocessors.[24] Intel helped design and sponsor USB and corresponding USB standards, including funding the testing for conformance.[25] It also branched into sponsoring a Wi-Fi standard for laptops under the Centrino label, helping to design further upgrades to the underlying technical standard, which was designed by IEEE committee 802.11, and helping to fund conformance-testing organizations as well.[26] More recently, it has invested heavily in designing and supporting another 802 wireless standard, known as Wi-Max. In addition, Intel has worked hard to develop a position as a microprocessor provider for standard designs of

23. Erick Schonfeld, *Microsoft Lost Nearly $500 Million on the Web Last Quarter,* TECHCRUNCH, January 22, 2009, *available at* http://www.techcrunch.com/2009/01/22/microsoft-lost-nearly-500-million-on-the-web-last-quarter/.

24. GAWER & CUSUMANO, *supra* note 21.

25. Jeffrey K. MacKie-Mason & Janet S. Netz, *Manipulating Interface Standards as an Anticompetitive Strategy*, *in* STANDARDS AND PUBLIC POLICY 231 (Shane Greenstein & Victor Stango eds., 2007); Intel.com, Intel Helped Make It Easier to Connect Devices to PCs, http://www.intel.com/standards/case/case_usb.htm.

26. Shane Greenstein, *Economic Experiments and Neutrality in Internet Access*, 8 INNOVATION POL'Y & ECON. 59 (2006).

smart phone devices.

Another organizational form for developing an interrelated platform of services involves the use of open source institutions, that is, employing some variation on the General Public License (GPL) for code or a Creative Commons license for copyrighted material. While intellectual property often receives the most attention, it is not the key factor for most commercial firms. Open source differs sharply from platforms organized by Microsoft or Intel in the responsibility and activities of management by raising transparency for developers about the features of the code and its evolution. In some organizations, open source has an additional function: it substitutes participatory/collective decision making for unilateral decision making at a single firm.

In some respects, the open source movement is not new at all as an institution for platform development and support. Transparency and wide participation have played a role in the development of key protocols and standards for the Internet, known as TCP/IP, which are employed by most Internet users. These are maintained by the Internet Engineering Task Force (IETF), who maintains a set of fully documented and accessible processes for making documented code available. It invites wide participation in the design of new protocols and standards. It was not called "open source" when it started, but the processes strongly resemble the modern transparent processes with wide participation (more below).[27]

Another important platform emerges from the Web standards maintained by the World Wide Web Consortium (W3C). It, too, has a transparent process, but it employs a different model for decision making and participation. The W3C requires firms to pay for their membership, and Tim Berners-Lee and his staff retain some authority to make decisions unilaterally after consultations with the membership.

A better known example of these open source platforms is Linux. The changes to this open source project hint at how commercialization and open source have both recently changed. Linux began as a volunteer project by Linus Torvalds, but today has firm support for a consortium operated by Torvalds. This consortium supports a range of businesses operated by many firms, including IBM, Red Hat, and others.

More broadly, open source platforms now appear in many commercial ventures on the Internet. A range of other business models have emerged for platform development around open source, including businesses organized by MySQL (for databases) and Mozilla and Webkit (for the Firebox, Safari, and Chrome browsers). The same could be said

27. Scott Bradner, *The Internet Engineering Task Force*, *in* OPEN SOURCES: VOICES FROM THE OPEN SOURCE REVOLUTION 47 (Chris DiBona, Sam Ockman & Mark Stone eds., 1999).

for a range of Web 2.0 efforts, such as Facebook, YouTube, and Flickr, which do not use the GPL but instead employ licenses designed by the Creative Commons.

Taking a "snapshot" of the structure today, we can see the infrastructure supports a rather complex value chain involving the interoperability of many different commercial platforms. This is an enormous evolution: the present arrangement looks nothing like the Internet of the early 1990s, when it first commercialized.

Today many observers believe Google has the most effective platform on the Internet.[28] Its search engine is the most popular in English,[29] as well as in many other languages. That supports a very lucrative ad-placement business. Many other firms also expend considerable resources optimizing their web pages to appear high on Google's search results, so, like any important platform, Google's actions have become central to the economic prosperity of others.[30] Some observers believe this will only continue, as its popularity will allow Google to develop a range of products supporting its search business.

Other prominent platforms include those provided by Cisco (networking equipment), Research In Motion (BlackBerry), Apple (iPhone, iPod), Yahoo! (search, news, mail), Oracle (enterprise databases), E-Bay (auctions), as well as many others. These examples are only a few among many prominent commercial platforms shaping development of the Internet. It is necessarily a short list and may not have the relevant platforms for policy in the near future. Each one of these platforms deserves a longer description, and the reader should be clear that the absence of that here is due to space constraints, not their lack of importance.

Platforms add an additional layer of decision making to the provision of services. That comes with a benefit, to be sure. It lowers coordination costs, and it can smooth transactions between participants with long term relationships. But platforms also come with some strings attached. Once they exist the firms with commercial interests in their continuance will take action to make sure they do not easily go away. Growth tends to agglomerate the successful platforms, but they also

28. RANDALL STROSS, PLANET GOOGLE: ONE COMPANY'S AUDACIOUS PLAN TO ORGANIZE EVERYTHING WE KNOW (2008); Sarah Lacy, *The New Bulls-Eye on Google*, TECHCRUNCH, Feb. 18, 2009, http://www.techcrunch.com/2009/02/18/the-new-bulls-eye-on-google/.

29. Erick Schonfeld, *March ComScore Search Numbers Offer a Sign of Hope for Google*, TECHCRUNCH, Apr. 14, 2009, http://www.techcrunch.com/2009/04/14/march-comscore-search-numbers-offer-a-sign-of-hope-for-google/ (reporting that the 2009 estimates from ComScore place Google at 63.7% of all searches done in the U.S., which is over 9 billion searches).

30. STROSS, *supra* note 28.

stand in the way of complementary entry which holds the potential to oppose the commercial interests of the present platform leaders.

Aphoristically, the Internet has been called a "network of networks" since it first began to diffuse to the general public. Yet, distilling the Internet to that aphorism is misleading; it does not reflect how commercial behavior shaped the evolution of technology in the last decade and a half. Leading firms and their business partners view the commercial Internet through the same lens they view activities in the rest of computing. For them, the commercial Internet is a "network of platforms."

In sum, firms do not make investment decisions aimed in general directions. Rather, they make investments aimed at advancing their own platform strategies. Firms do not merely defend themselves against entry by a new competitor. They develop sophisticated approaches to find out which other platforms may pose a threat to their existing profitable businesses. Platforms are a central strategic determinant of the direction a firm takes.

Which of these behaviors will not raise alarms and which will? This ongoing evolution of platforms poses a thorny question to regulators: how can they recognize signs of healthy and unhealthy platform behavior in an innovative industry when platforms play such an important role? Once again, the questions are central to any innovation policy for the Internet. Once again, surely private firms benefit from knowing how to anticipate the norms and standards employed to recognize the signs of healthy and unhealthy behavior in markets where most dominant firms employ platform strategies.

C. Contractual Incompleteness

Contractual incompleteness has become a central feature of the Internet value chain. Incompleteness refers to the absence of contracts governing regular transactions or, if such contracts exist, to contracts that lack fully specified terms for all contingencies. The maturation of the Internet value chain has not yet diminished this incompleteness much, and there are no signs of change.

To many economists, such an observation is only a philosophical statement. In this essay it is also an observation with pragmatic relevance to innovation policy. It provides both justification for government intervention, as well as a limitation to it. This justification is quite distinct from the two already discussed, both of which stress the role of market power.

Contractual incompleteness arises for many reasons. The Internet involves an extraordinarily large number of parties, which renders multi-lateral negotiations impractical. There are so many players, in part,

because the value chain supports an extraordinarily multi-purpose network, as earlier noted. Said simply, today many parties take action and their actions influence one another. There is just no practical way to get all these participants—or even their representatives—in the same room at the same time to work out a deal by horse-trading one set of economic concerns for another.

For example, even if one set of Skype users might be willing to pay another set of Bit-Torrent users to change their behavior, there is no practical way to get them all in the same room at the same time to negotiate and sign that deal. That incompleteness might further motivate another market participant, for example, an ISP, to take further action, though I will defer that discussion until later.

Incompleteness also arises where all parties may recognize the potential for technical change to generate new applications that alter circumstances, requiring renegotiation of prior contracts whose terms are no longer relevant. Yet, many pairs of parties in this setting may fail to come to agreement for numerous reasons. Even if the recognition exists, the parties may fail to negotiate a solution due to a lack of the type of trust and mutual assumptions that usually support renegotiating commercial transactions in the face of such contractual incompleteness.

Most interesting, contractual incompleteness inhibits negotiations, as it may be impossible to consummate a deal. The relevant party may not even exist yet (if they will be entrepreneurial start-ups) and, thus, lack representation in even a basic form, such as a trade-group or related commercial organization.[31]

Legal ambiguities for innovative activities also can play a role. While contractual obligations govern some of the routine activities, it may be more difficult to erect similar obligations for new activities. For example, contracts govern the handoff of data from one backbone carrier to another, or from one Web application to an edge-caching site, such as Akamai's, or to a content-delivery network, such as Amazon's. In contrast, a looser contractual foundation governs another set of interrelated activities. For instance, when an advertising-sponsored Web application sends data to a user, the ISP delivers it without alteration, because participants await legal rulings. YouTube was founded in an era when there were multiple plausible definitions for a precise, legal, and safe harbor for copyrighted material for user-supplied video. These definitions still remain ambiguous, though court cases continue to refine them into a tighter domain.

31. *See* Bruce M. Owen & Gregory L. Rosston, *Local Broadband Access: Primum Non Nocere or Primum Processi? A Property Rights Approach*, *in* NET NEUTRALITY OR NET NEUTERING, SHOULD BROADBAND SERVICES BE REGULATED? 163 (Bruce M. Owen & Gregory L. Rosston eds., 2006).

Between contractual incompleteness and legal ambiguities, an efficient bargaining solution—a so-called Coasian bargaining solution—fails to arise. Indeed, such failure is endemic to the setting. The very thing that makes the Internet economically successful—the accumulation of innovation that supports a wide set of applications for many participants, including entrepreneurs—gives rise to conditions that make it harder for Coasian solutions to arise.

The lack of a Coasian bargaining solution can provide an economic justification for a potential role for government regulators in specific circumstances: to settle disputes when many participants have a stake in the solution but private parties fail to account for these externalities; or, related, to define "default" terms of commercial relationships that many partake in, when the default remains undefined; or, related, to mandate terms of standards employed by participants in the value chain when they otherwise cannot or do not come to such standards on their own.

Note, however, this argument implies a limitation on that role. It covers only those activities that firms could not already settle themselves through contracting, those without externalities, or those which necessarily involve unanticipated circumstances. To be sure, however, that is not necessarily a substantial limitation if it involves participants who are not even in a market yet, such as entrepreneurs.

Once again, another limitation on decision making also is implied. The arguments for intervention presume the existence of a well-developed set of insights about how to recognize a problem in the Internet value chain.[32] As it turns out, some arguments against intervening also presume a problem can be recognized.[33] That too motivates looking more closely at how such recognition takes place.

In short, the evolution of the Internet value chain gives rise to many of the conditions that stand in the way of a Coasian agreement. That also implies that the evolution necessarily stands in the way of making an assessment about whether the situation merits intervention or not. Once again, the questions are central to any innovation policy for the Internet. Once again, private firms benefit from knowing how to anticipate the norms and standards employed to recognize failure of a Coasian solution, i.e., the signs of healthy and unhealthy behavior in an innovative industry such as this.

II. COMMERCIAL BEHAVIOR AND THE INTERNET

Four signs of innovative behavior are examined here: economic

32. *See* LESSIG, *supra* note 19; Wu & Yoo, *supra* note 19; Ou, *supra* note 12.

33. *See* Wu & Yoo, *supra* note 19; Ou, *supra* note 12; *see* Bruce M. Owen, *Antecedents to Net Neutrality*, REGULATION, Fall 2007, at 14.

experiments, standards competition, entrepreneurial invention, and the absence of one-sided bargaining. All four play a role in the accumulation of new functionality in services on the Internet, and all four could continue to play a role in the future if the structure enables them to.

A. Economic Experiments

An economic experiment is a market-oriented action designed to help a firm learn or resolve uncertainty about an unknown economic factor. Usually such lessons cannot be learned in a laboratory or controlled environment, either because they involve learning about the nuances of market demand or learning about sets of procedures for providing new services at a lower cost.[34]

Economic experiments vary in purpose. Some experiments focus on learning about the profitability of incremental changes in business processes, whereas others seek to learn about the restructuring of organizations and the profitability that may result from the simultaneous alteration of many processes or about the profitability of restructuring the relationship among many organizations within an industry.

Internet markets have been full of economic experiments in the last fifteen years. That was especially so in the latter part of the 1990s, when firms took a wide variety of bets to learn about unknown aspects of customer demand and the costs for meeting them using Web technologies. These experiments covered all parts of the value chain for delivering services—Internet access, client-server platforms, contracting among business partners, and so on. Carriers conducted them and so did content providers.[35]

To be sure, not all experiments work out. Indeed, if the learning occurs as part of a risky business venture, many of them should not. And, accordingly, history is littered with illustrations. In Internet application markets some of these firms survived (e.g., Google, Amazon, E-Bay), and some of these did not (e.g., WebVan, Pets.com). So it goes.

Against that backdrop it is pleasing to see that recent behavior looks similar. Some firms involved in the Web 2.0 movement (Facebook, Friendster, Digg, and others) and this decade's frontier businesses (Salesforce.com and YouTube, for example) will make it, while others

34. *Economic experiments* pertain to any market experience that alters knowledge about the market value of a good or service. Nathan Rosenberg, *Economic Experiments*, *in* EXPLORING THE BLACK BOX: TECHNOLOGY, ECONOMICS, AND HISTORY 87 (Nathan Rosenberg ed., 1994); Scott Stern, *Economic Experiments: The Role of Entrepreneurship in Economic Prosperity*, *in* UNDERSTANDING ENTREPRENEURSHIP: A RESEARCH AND POLICY REPORT 16 (2005). Firms engage in economic experiments to reduce uncertainties about market value.

35. *See* Greenstein, *supra* note 26 (examining the role of economic experiments in the evolution of Internet access).

won't. For example, most VCs today are convinced that there will be little further entry of new businesses into Web 2.0 and the future will involve exit of many of the entrants of the last few years. So it goes again. As long as many firms are trying to learn, then the industry looks healthy in this respect.

While some experiments do not succeed, many do. A successful business continues to operate and brings new goods and services to users. Indeed, while many can recall the failures of the dot-com boom, it should be pointed out that success rates for new firms during this era were comparatively high, leaving a long string of very valuable activities in place.[36] In addition, many of the lessons learned endure, handed out as free advice from one manager to the next, benefiting a new generation of businesses.

Note how this assessment differs from the common approach and orientation of Wall Street analysts.[37] By definition, economic experiments are risky learning exercises, designed to teach a firm (or set of firms or set of VCs) about something unknown but relevant to the value chain for delivering services. It is not unusual to observe a little messiness, and there is no particular reason to anticipate the learning to yield immediate profitability. In fact, the learning is usually expensive and the benefits come later, so immediate profitability is rare.

Wall Street's short run values typically do not reward experimentation, regardless of the potential long term gains from such lessons. Consider FiOS, Verizon's program to bring fiber to residences. Many technologists think Verizon is late to the party and many stock analysts remain skeptical about the potential for large financial returns from FiOS.[38] Many analysts also remain skeptical about whether FiOS will generate steady returns, much like a utility's revenue.[39]

Using this emphasis on economic experiments, however, one might

36. Brent Goldfarb & David A. Kirsch, *Small Ideas, Big Ideas, Bad Ideas, Good Ideas: "Get Big Fast" and Dot Com Venture Creation*, *in* THE INTERNET AND AMERICAN BUSINESS 259 (William Aspray & Paul E. Ceruzzi eds., 2008); Brent D. Goldfarb, David Kirsch & Michael D. Pfarrer, *Searching for Ghosts: Business Survival, Unmeasured Entrepreneurial Activity and Private Equity Investment in the Dot-Com Era* (Robert H. Smith School, Research Paper No. RHS 06-027, 2005), *available at* http://papers.ssrn.com/sol3/papers.cfm?abstract_id=825687.

37. I am using "Wall Street" as a generic term for a common style of analysis that emphasizes only firm profits of a single firm in the short term, neglecting the collective progress of a community of market participants whose activities ultimately shape user experience.

38. Saul Hansell, *Verizon's FiOS: A Smart Bet or a Big Mistake?*, N.Y. TIMES, Aug. 18, 2008, at C1; Saul Hansell, *A Bear Speaks: Why Verizon's Pricey FiOS Bet Won't Pay Off*, N.Y. TIMES, Aug. 19, 2008; Craig Moffett, *Network Upgrades Are for Ninnies*, BROADBAND DSL REPORTS, Aug. 19, 2008, http://www.dslreports.com/shownews/97086; DSLReports.com, Op-Ed, *Investor: Fios Is Doomed*, BROADBAND DSL REPORTS, Dec. 15, 2006, http://www.dslreports.com/shownews/80296.

39. Hansell, *supra* note 38; Moffett, *supra* note 38.

say, "Good for Verizon." That is precisely the type of disagreement that should arise if a firm's management undertakes a risky economic experiment. Profitable today or not, pushing the envelope will teach Verizon's management, as well as competitors like AT&T, quite a lot, and maybe that will help it lower costs or develop better targeted marketing next year.

Economic experiments also depart from another Wall Street bias for assessing the progress of innovation in terms of one firm's profitability. For purposes of public policy, it is often a poor idea to focus on one firm's success or failure to assess the benefits of learning. It is often more sensible to take a view of economic experiments taking place in an entire market, focusing instead on whether a community of suppliers or users are benefiting in the long run.

For example, this was the most insightful way to understand the earliest commercial experience with Wi-Fi, or IEEE standard 802.11b, between 1999 and 2001. During this early period of diffusion, many firms and users learned about the value of the short-range data transmission. The technology was defined, but the business case was not. Examining any single firm's experience would have yielded a rather pessimistic assessment, which was a distinctly uninformative way to understand what was happening.

While homes and enterprises explored the gains from installing wireless routers, so, too, did a completely unanticipated set of actors: coffee shops, cafés, and other hot spots. At the time all actors were trying to learn about which implementations created value and which did not. Lessons were shared in many public forums. It was a collective economic experiment, and it was generally beneficial for many users, though it was hard to identify any particular firm for whom it was super.[40]

What is an example of unhealthy experimentation? Here's one: Microsoft's lack of new releases for Internet Explorer 6.0 at the start of this decade. Microsoft deployed little new for five years, spending most of its energy and time responding to every new call for security patches, as well as dealing with the publicity nightmare that came with having its product panned so widely by so many technical experts.[41] After spending so much money to win the dominant position on browsers from

40. *See Evolution of Market Structure for Internet Access, supra* note 10.

41. *See* Martin LaMonica, *Gates Admits IE Failings, Looks to an AJAX Future*, ZDNET, Mar. 21, 2006, http://news.zdnet.co.uk/internet/0,1000000097,39258532,00.htm; *Internet Explorer 6 with Windows XP SP2*, N.Y. TIMES, http://nytimes.com.com/browsers/internet-explorer-6-with/4505-3514_7-31214886.html; CNET Reviews, http://reviews.cnet.com/4520-3514_7-5020542-1.html (last visited Apr. 2009); WinPlanet Windows Software Reviews and Downloads, http://cws.internet.com/file/11714.htm (last visited Apr. 2009); Software Informer, http://internet-explorer.software.informer.com/6.0/ (last visited Apr. 2009).

Netscape, this outcome was unnecessary, as there was no lack of capability or resources. It came from a company famous for its disciplined approach to a "three-version strategy," which deliberately takes a loss on an early version of a product in order to learn from economic experiments. It was as if all such capabilities were forgotten.

The Internet Explorer example illustrates the potential costs and benefits from having only one party conduct experiments. As to the costs, if that party has reasons not to conduct experiments, then it leaves users and third-party programmers with no alternatives. If new ideas have no channel into that one party, then all its partners and users lose from the foregone opportunity. Indeed, according to one observer, in Microsoft's case, this outcome partly resulted from the absence of market discipline after the collapse of the coalition built around Netscape, which permitted an especially bitter internal struggle for strategic direction for Internet services to permeate Microsoft's decisions, to the detriment of other firm goals, such as product development.[42] As to the benefits, only the appearance of Firefox a few years ago seemed to rouse Microsoft's managers and programmers from their internal squabbles to focus on making progress users could measure. I am pleased these days to see more activity, reversing past trends. There appear to be more new experiments coming out of the WebKit community (e.g., Safari, Chrome), as well as from Opera and others. Accordingly, some of the good ideas from these new initiatives have found their ways into the design of later releases of Internet Explorer.

The orientation of communications policy towards protecting or nurturing economic experiments has varied over time for two principle reasons. First, and broadly stated, advocates for policies to nurture experimentation generally bear a high burden of proof in public discourse, as they must argue about a future that has not yet occurred. They must argue that change in a policy will give rise to experimental behavior that has not yet arisen (or will diminish), while their opponents argue that such experimental behavior has no connection to policy.

For example, the recent debates about the need for a "Carterfone" policy in wireless technology divide precisely on these lines. One side argues that a change in policy will bring about more experimentation and the other argues that present policy encourages experimentation that

42. DAVID BANK, BREAKING WINDOWS: HOW BILL GATES FUMBLED THE FUTURE OF MICROSOFT (2001) (recounting the internal debates and fights leading up to the browser wars and beyond them); *see also* Timothy Bresnahan, Shane Greenstein & Rebecca Henderson, *Schumpeterian Competition within Computing Markets and Diseconomies of Scope* (Kellogg Sch. of Mgmt., Working Paper, 2008), *available at* http://www.kellogg.northwestern.edu/faculty/greenstein/images/research.html (providing one interpretation of these events, as a by-product of the costs of organizational diseconomies of scope between the Internet and Windows business).

would diminish if the policy changed.[43] Both points are logical, but cannot be proven without trying one policy that precludes the other.

Second, while some policies nurture the blossoming of economic experiments, that role may be unapparent until after the experiments blossom.[44] Such themes run throughout review of FCC intervention in the Internet's growth, for example. Many nurturing policies, such as policies for third party access providers, became established for reasons connected to historical events unrelated to the Internet.[45] Some, such as the policies that resulted from the *Computer Inquiries,* were in place for reasons connected to their role encouraging new entry in information technology equipment markets, but nobody had the Internet specifically in mind, and had they done so, policy makers may have made different choices.[46] In either case, such unintended consequences from prior policies make it difficult to give forward-looking advice.

I want to acknowledge these difficulties, and then restate the reason it is essential to nurture economic experiments in spite of the challenges. Said succinctly, nobody wants to see some of the Internet's biggest firms turn into Microsoft's browser division, sitting on its laurels with a buggy piece of software, slowly making upgrades, lacking any competitor to push it outward, and fighting an internal corporate fight at its own leisure, to the exclusion of other concerns. Experiments are a sign of progress; lack of them is a sign of stagnation.

B. Vigorous Standards Competition

Bleeding-edge technologies often cannot deploy on a wide scale without some routines or processes, and/or coordination of activities across many firms. Thus, the ratification of new standards generally acts as a leading indicator of impending technological progress and serves as another sign of a healthy innovative industry. While new standards and upgrades to existing standards may not arrive at a regular rate, a slow pace for development or a slow arrival of new standards should set off alarms.[47]

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43. *See* Tim Wu, *Wireless Carterfone*, 1 INT'L J. COMM. 389 (2007); Christopher Yoo, *Network Neutrality, Consumer, and Innovation*, 25 U. CHI. LEGAL F. 179 (2008).

44. *See* Jason Oxman, *The FCC and the Unregulation of the Internet* (Office of Plans & Policy, Working Paper No. 31, 1999), *available at* http://www.fcc.gov/Bureaus/OPP/working_papers/oppwp31.pdf; Greenstein, *supra* note 26.

45. Oxman, *supra* note 44.

46. Robert Cannon, *Where Internet Service Providers and Telephone Companies Compete: A Guide to the Computer Inquiries, Enhanced Service Providers, and Information Service Providers*, *in* COMMUNICATIONS POLICY IN TRANSITION, THE INTERNET AND BEYOND 3 (Benjamin M. Compaine & Shane Greenstein eds., 2001).

47. Lest this sound far-fetched, these ideas have been operationalized by frontier researchers. For example, this is the spirit of the exercise undertaken by Simcoe, in his study of new standards developed at the IETF. His principle finding concerns the slowing pace of

To be sure, this benchmark is particularly challenging to put into practice, because some standards are more important than others. The protocols known as TCP/IP have played a central role for decades, for example, and any alteration to them receives considerable attention, deservedly more attention than other standards. The same is so for protocols which govern the Web, as well as those standards that govern upgrades to Ethernet.

Those examples are a bit misleading, however, as they give a false sense of certainty to the enterprise of designing standards. As it turns out, there are often multiple solutions to the same problem. That may be due to differences of opinion about what the true problem is, or about how to best solve it. It shows up as different proposals for "standards." As it happens, many proposals for standards often do not get deployed or put into widespread use. In other words, new standards frequently get deployed in environments where their ultimate success remains uncertain long after development.[48]

Consider the following illustration. The deployment of Wi-Fi was far from assured. The release of 802.11b in early 1999, which eventually become widely deployed, came less than two years after the first beta release of a standard for 802.11 in 1997.[49] The first release contained multiple problems that simple field experiments revealed, generating two later descendants, given the labels "a" and "b." For numerous reasons "b" got deployed first in 1999. Though a fixed version of "a" came soon after, its availability did not determine deployment. It never deployed as widely to equipment firms. Most had largely already started to deploy "b."[50]

Another, more current example, and one more representative of the complexity and uncertainty pervasive in a standards fight, can be found in the market for "unified communications." These are a series of standard designs for making the e-mail, voice-mail, and other communications applications work more seamlessly with each other. Both Microsoft and IBM have begun to address an enterprise's communications processes by

development. Timothy Simcoe, *Delay and De Jure Standardization: Exploring the Slowdown in Internet Standards Development*, *in* STANDARDS AND PUBLIC POLICY 260 (Shane Greenstein & Victor Stango eds., 2007); Tim S. Simcoe, *Standard Setting Committees* (U. Toronto Joseph L. Rotman Sch. Mgmt., Working Paper, 2008). *See also* Iain M. Cockburn & Megan MacGarvie, *Entry, Exit, and Patenting in the Software Industry* (Nat'l Bureau of Econ. Research, Working Paper No. W12563, 2006); Iain M. Cockburn & Megan MacGarvie, *Patents, Thickets, and the Financing of Early-Stage Firms: Evidence from the Software Industry* (Nat'l Bureau of Econ. Research, Working Paper No. W13644, 2007) (investigating his principle finding concerns the slowing pace of development).

48. See URS VON BURG, THE TRIUMPH OF ETHERNET: TECHNOLOGICAL COMMUNITIES AND THE BATTLE FOR THE LAN STANDARD (2001) (documenting a similar case involving the early Ethernet standards).

49. *A Brief History of WiFi*, THE ECONOMIST, Jun. 10, 2004, at 26; Greenstein, *supra* note 26.

50. Greenstein, *supra* note 26.

offering distinct solutions.

These solutions do not arise out of the ether. They involve the integration of scores of standards into a platform upon which users customize their unique needs. Both IBM and Microsoft have had some success in developing and selling their solutions, but both have a long way to go towards an ideal. As in the above example, we can see that often no single firm can resolve a problem for every circumstance. Moreover, users may differ in whether they favor one solution or another.

Here is another illustration concerning one of the most interesting recent developments—the emergence of platforms at the edges of wireless networks. Microsoft has invested in organizing developer networks for wireless phones within its CE environment, using its platform experience as a guide. Meanwhile, Apple exported to the iPhone its experience organizing multiple providers of applications on its iPod platform and its Mac platform. Google's effort with the Android represents one alternative method for organizing the platform, and Nokia's recent efforts to develop its own music services and mapping services another. Research In Motion, the maker of BlackBerry, has organized yet another approach.

Once again, this competition among distinct platforms, with standards embedded in the platform that may not be explicit, can be interpreted as competition between bundles of standards. It is far from apparent which design offers the right solution for most users. Even the most sagacious observer cannot forecast how this competition will evolve in the next three years. In light of that intractable uncertainty, the availability of many options benefits users.

This is not to say, however, that standards competition only multiplies options. Occasionally such competition comes with substantial and durable costs. For example, there may be multiple problems that require distinct solutions, but these are inconsistent with one another, i.e., choosing one precludes another. In the face of uncertainty about the value of various alternatives or their technical efficacy, premature commitment to one standard can impose significant costs on later users. For example, Internet insiders will recognize that this is the present issue hindering different QoS proposals. Some serve to aid one goal but deter another.[51]

In short, because standards are extraordinarily important and valuable in introducing innovation to the value chain, their development and rollout anticipates new services and inventive activity. There also are often multiple solutions to similar problems, so competition between

51. See Ou, *supra* note 12.

standards proxies for multiple solutions for users.

Similar to the observation about economic experiments, this argument is headed towards a seemingly counter-intuitive observation: while this activity may be confusing to all but an insider, this messiness is a sign of good health. This may seem an especially surprising conclusion to any participant in standards processes. Any reasonably thorough case study of the processes behind the design of a standard will emphasize the frustration, confusion, and utter plethora of loose ends, even with ample funding and a functional certification process. Most participants in standards committees come out of the experience with nothing good to say about it.

All this is true, but somewhat irrelevant. More to the point, standards competition beats the alternative.

Think of one of Winston Churchill's famous quotes: "It has been said that democracy is the worst form of government except all those other forms that have been tried from time to time."[52] Similarly, there is only one saving grace for existing standards processes: standards designed in the absence of competition are usually much worse. A monopolist's tendency towards orderly, infrequent, and simplified standards leads an industry down about as unhealthy an innovative path as it can go.

If a firm with market power designs a new standard it will face strong incentives to roll it out slowly to protect a firm from cannibalizing monopoly rents. Sometimes this strategy is obvious. Consider this illustration from ancient history: in the days when IBM controlled a large part of the mainframe market it could not bring itself to abandon Extended Binary Coded Decimal Interchange Code (EBCDIC), its standardized proprietary language, or, for that matter, to help others migrate up from EBCDIC to the many other superior languages available. Despite plenty of improvements IBM could have made, its managers refused to deploy them, preferring instead to exploit locked-in users.[53]

Monopolies also face strong incentives to have a "quiet life," to paraphrase Sir John Hicks.[54] That is, monopolies may exert less effort when they choose standards, or design them to castrate user choices in such a way that leads to less inconvenience for the monopolist at the expense of the user (e.g., trimming product line breadth, or trimming away complex attributes of the product). It is less succinct an observation

52. ROBERT RHODES JAMES, 7 WINSTON S. CHURCHILL: HIS COMPLETE SPEECHES 1897–1963, at 7566 (Robert Rhodes James ed., Simon & Schuster 1983) (1974).

53. Gerald Brock, *Competition, Standards and Self-Regulation in the Computer Industry*, *in* REGULATING THE PRODUCT: QUALITY AND VARIETY 91 (Richard Caves & Marc Roberts eds., 1975).

54. John Hicks, *Annual Survey of Economic Theory: The Theory of Monopoly*, 3 ECONOMETRICA 1, 8 (1935).

than Hicks' might have preferred, but here it is: a self-interested firm faces strong incentives not to dissipate its profits (through interrupting its quiet life) if doing so serves customers in ways that do not generate additional revenue.

That may seem rather abstract, but consider this illustration from the good old days of the AT&T monopoly over residential customer premise equipment. Until the mid-1970s, most households faced a limited menu of (over-engineered and excessively rigid) choices for handset designs. Well engineered or not, there were too few choices in comparison to what a competitive market would have done. Eliminating the monopoly hold over designs led to more than one provider and over time showed just how badly the monopoly had done.

With multiple providers, each provider of customer premise equipment matched the offerings of its nearest rivals. In a short time the heated and urgent competitive behavior familiar to consumer electronics eventually overtook the market, leading to a plethora of choices at a range of prices. Compared with the choices found in just Target or Walmart today, it is remarkable that anyone in the past thought such a limited choice was a good idea.[55]

In other words, in the absence of restraining limitations on discretion, monopolies design selfish standards. An antidote to the selfish standards of monopolies is competition between standards. Indeed, it may be the best antidote. I say that even though very precise economic reasoning suggests no such conjecture can ever hold under all circumstances.[56]

An intriguing counter-example raised against this proposition is the rise of Global System for Mobile communications (GSM) in Europe, the first digital cellular standard to be put into wide use, the deployment of which led to a blossoming of designs for the European handset market. On the surface this experience seems to suggest that government-mandated standards (in a seemingly monopoly position) can sufficiently

55. Indeed, at one time, vocal and powerful participants *did* publically agree to limit customer premise equipment from third parties. From the time these debates first arose, AT&T's lawyers advanced a general argument. This stressed the potential harm an unauthorized attachment might cause to the network. The FCC initially accepted this argument in *Hush-A-Phone Corp. v. United States*, 238 F.2d 266, 269 (D.C. Cir. 1956), which the DC District Court subsequently reversed. Thereafter, and in many related cases, the FCC showed skepticism towards arguments related to potential harm from unauthorized attachments, though AT&T did persist in advancing them. *See* CYBERTELECOM FEDERAL INTERNET LAW & POLICY: AN EDUCATIONAL PROJECT, CUSTOMER PREMISES EQUIPMENT PART 68: CPE, http://www.cybertelecom.org/ci/cpe.htm.

56. See Joseph Ferrell, *Should Competition Policy Favor Compatibility?*, *in* STANDARDS AND PUBLIC POLICY 372 (Shane Greenstein & Victor Stango eds., 2006) and Joseph Ferrell & Phil Weiser, *Modularity, Vertical Integration, and Open Access Policies: Towards a Convergence of Antitrust and Regulation in the Information Age*, 17 HARV. J.L. & TECH. 85 (2003), for a review of these arguments.

nurture a competitive equipment industry.

The surface view is extremely misleading, and misinterprets the actual sequence of events. Upon close examination the rise of GSM is not a counter example at all. It rather supports the proposition that competition generates a variety of designs and variety helps. That is, GSM's design should be interpreted in light of the competition taking place between equipment firms at the time.

By the time the GSM standard was designed and proposed, most participants in the United States anticipated the beginning of competition between CDMA and TDMA, which would come at the expense of analog systems, supported by a flourishing equipment industry led by the U.S.-based Motorola. European equipment firms were secondary in commercial leadership. In this context, had the European regulators continued to adopt digital standards that already existed in the U.S. cellular market or coordinated their efforts with their U.S. counterparts,[57] they would have adopted either CDMA, TDMA, or both, or left the choice up to the market participants, as the US did. In any of those choices Motorola's existing advantages would have continued to have some effect, as it had considerable experience supplying for the U.S. and European market. Instead, adopting a new standard, such as GSM, wiped the technological slate clean, giving all firms—American, European, and Asian—a new opportunity at the new market. It did not wipe away all incumbency advantages, which, arguably, still arose from experience with distribution and branding. It only eliminated the advantage that came from familiarity with analog technologies or designs.

As it turned out, Motorola was quite late in organizing its products for GSM based equipment and lost considerable market share to Nokia and others during the initial rollout of GSM. Seen in this light, GSM was the product of healthy competition between standards, catching an incumbent flat-footed. Moreover, Europe today benefits from the 3G that came about only because CDMA had the chance to develop in the US, a byproduct of economic experiments in different countries.

Back to the main point: competition between standards also tends to beat monopolies because it makes the design process more transparent. *Transparent* processes are those in which policies let participants know what change is imminent. It informs others openly

57. Histories of these events exist in various places. *See, e.g.*, GSMWorld.com, History, http://www.gsmworld.com/about-us/history.htm (last visited Apr. 2009); Privateline Telecommunications Expertise, GSM History (Jan. 15, 2006), http://www.privateline.com/mt_gsmhistory/02_gsm_history/; Ravings, Rantings, etc.: Clancy's Blog, GSM—history, services, architecture, http://blogs.ibibo.com/takeonlife/gsm-history-services-architechture (Feb. 6, 2007).

and vocally. In other words, these are processes participants' actions make known—sometimes well in advance—when their change will diminish the returns on others' innovative investments.

Such transparency is one of the reasons why standards processes have become a leading indicator of the imminent release of bleeding edge technologies. Interested parties monitor the designs (because they can), and know that their near rivals do the same (because the data is available to anyone). All those parties plan to match each other along the dimension of the standard and differentiate along the dimensions in which each has competitive advantage. Competition ensues once the standard is upgraded from its beta to an endorsed and official standard.

Transparency is a feature found quite frequently in sponsored open source projects, but it is not unique to that setting. It can be found in standards processes. It is thought to have great importance in interdependent value chains. Other firms will not make long-term investments if they cannot understand at a fine level of detail how their software must interact with another's.

Open source observers find that transparency can lead to more participatory decision making for standards.[58] *Participatory* processes are those in which sponsoring organizations invite comment, discussion, and input from others affected by their actions. Such organizations solicit input through public forums, e-mail lists, blogs, community sites, and a range of other activities.

Standards organizations vary considerably in their policies for encouraging or discouraging participation. For example, some organizations require fees, some require participants to meet certain technical qualifications, and others will allow any observer to attend, though not vote.

Wide participation is also found quite frequently in open source projects, particularly those without sponsorship. Wikipedia, though non-profit, is perhaps the best-known example of an online project that encourages wide participation. The Firefox browser community has quite diverse participation from numerous corners. So, too, does Linux. In both the latter cases, most participants are quite technically skilled.

However, wide participation is probably the least common attribute among standards consortia sponsored by commercial private firms. Most managers prefer to retain decision-making authority, guarding investment decisions in the name of stockholders. There is concern that giving up such discretion risks having participants take investment in directions that do not serve firm interests.[59]

58. Joel West & Siobhan O'Mahoney, *The Role of Participation Architecture in Growing Open Sourced Communities*, 15 INDUS. AND INNOVATION 145 (Apr. 2008).

59. *Id.*

Accommodating wide participation normally comes at a cost, such as slower decision making and more onerous managerial challenges coming to consensus. That is one reason why Tim Berners-Lee established the W3C with a less participatory structure than found in the IETF, where he had personally experienced the drawbacks of slow decision making when he first tried to standardize the core inventions behind the World Wide Web.[60]

Competition between standards is not what Wall Street analysis values. By definition, competing standards raise the risks for those with stakes in past standards (which might become obsolete) or it raises risks for those who will face competitors or entrepreneurial entrants employing new standards. Once again, it is not unusual to observe a little messiness, and there is no particular reason to anticipate the new standards to yield immediate profitability.

Contemporary Internet infrastructure contains signs of vigorous standards competition. For example, Wi-Max and LTE vie today for next generation wireless data markets. One or both technologies, as implemented and deployed by commercial firms, might very well turn out to be an unprofitable flop, but until we know that for sure, they provide potential competition for the community of firms and researchers interested in developing high-speed data transmission in the near future. That fuels a sense of urgency and gets the government bureaucracies behind wireless telephony to move quickly when they otherwise might not have. The threat can be sufficient to generate earlier investment than later investment.

While competition among standards tends to broadly yield good outcomes for all users and firms, there is an important exception. From time to time the rollout of a new standard involves a "coalition" of firms who have signed up for one design, opposing another "coalition" who has signed up for another. Such coalitions emerged in the HD DVD versus Blu-Ray fight, the Wi-Fi versus Home-RF fights, and the 56K Flex versus X2 fights, which are among many examples from the last decade. In fights between coalitions, the battle is good for everyone, except, perhaps, those in the losing coalition of a big standards battle. The losing coalition may expend considerable resources for which its members do not gain returns.

Though more complex, a similar dynamic exists in competition between organizations for control of governance over standards. Competition between groups, organizations, and communities is a good thing in general, even if specific participants lose out on occasion.

60. See TIMOTHY BERNERS-LEE & MARK FISCHETTI, WEAVING THE WEB: THE ORIGINAL DESIGN AND ULTIMATE DESTINY OF THE WORLD WIDE WEB (2000), for a description of this frustration.

Competition between organizations is different than competition between designs, however: competition between organizations may involve competition between alternative designs of standards, but it often involves competition between commitments to different processes in the future for upgrading the standards as well. The latter involves choices between commitments by specific communities of managers, technologists, and/or sponsoring firms.

The history of the Internet itself provides the best illustration of this lesson.[61] Development of TCP/IP as a foundation for a national network occurred in the presence of an alternative process and model for the same activity, organized by the International Organization for Standardization (ISO). Competition between organizations led to development of data exchange standards sooner than otherwise would have occurred had the ISO made the decision all by itself. The reverse is also true. Competition from ISO generated urgency within the communities of the Internet Architecture Board (IAB) and eventually the IETF to organize their myriad ideas and implement them quickly.

Looking more closely, this competition stressed more than merely different designs, which illustrates why competition between groups is not perfectly analogous to competition between technologies. Throughout the latter part of the 1980s there were two processes for determining standards. One process existed at the ISO, and it emphasized committee consensus in advance of deployment, with committees comprising representatives of all major stakeholders. Another existed among the descendants of the Defense Advanced Research Projects Agency (DARPA), organized around activities at the IAB, who established the IETF midway through the decade. Their process stressed bottom-up suggestions and demonstrating workable solutions before adoption.[62]

As it turned out, a bottom-up process centered in the United States made considerably more pragmatic progress, but even that was due to more than just its bottom-up nature. Even from its earliest days, IETF leadership did its best to aid the process it governed. First, it tried to provide editorial guidance and support for the entire process. That resulted in remarkably clear and comprehensive documentation (particularly from some contributors who were not practiced at clarity and thoroughness).

Second, the IETF also helped coordinate and sponsor "plugfests"

61. ABBATE, *supra* note 9.

62. *See* Andrew L. Russell, *'Rough Consensus and Running Code' and the Internet-OSI Standards War*, 28 IEEE ANNALS OF THE HISTORY OF COMPUTING, July–Sept. 2006, at 48; *cf.* William J. Drake, *The Internet Religious War*, 17 TELECOMM. POL'Y 643 (Dec. 1993); ABATTE, *supra* note 9.

where vendors could test their interoperability of actual implementations. In principle, these fests were used to verify the existence of "running code" before advancing a proposal for an RFC to a final draft. Those efforts provided the administrative glue to accumulate technical suggestions from many disparate corners.[63]

In these examples we see the benefits of messy clashes between organizations over their domains of expertise and even over the proper processes for making technical progress. It infuses decisions with a healthy tension concerning multiple options. It might be irritating for the participants involved, but the sniping results from a healthy diversity of opinion in the face of opportunity.

In sum, these clashes beat any outcome likely to arise in the presence of monopoly provision of standards.

Just as with unfettered experimentation, competition between standards and between the organizations that sponsor them yields a benefit. It may lead to innovative entrants, or it may enhance the products of one particular firm. It forces incumbents to react, or, even better yet, anticipate the entrant and innovate in advance. This fosters incentives to lower prices and to sponsor more innovative products sooner, thereby benefiting users.

C. Inventive Entrepreneurialism

Entrepreneurial initiatives involve an organization in a risky and challenging business in pursuit of a new economic opportunity. These firms are the "participant" that makes the first intrepid attempts at deploying, distributing, or servicing a new good to a wide range of customers with the intent of making a profit. Small start-ups take entrepreneurial action and so do large firms. Sometimes small businesses that take such risks are bought by large organizations, such as Cisco, IBM, or Microsoft. Sometimes small start-ups go public and grow into large firms themselves.

While the addition of more and more entrepreneurs (after some point) does not always make a situation better, their complete absence is a sign of poor innovative health. The presence of entrepreneurs provides the simplest benchmark.

It might be tempting to use the presence of start-ups funded by venture capitalists or angel investors as a measure of the presence of entrepreneurship. That is not precise or even accurate in today's markets. To be clear, while most start-ups involve entrepreneurs, not all entrepreneurs must have venture funding. Entrepreneurship also arises inside small divisions of corporations, or stems from corporate funding of

63. *See* Bradner, *supra* note 27.

spin-offs and other corporate ventures. In other words, not all innovation comes from start-ups and venture capitalists.

Indeed, there are good reasons why entrepreneurship inside large firms does not resemble entrepreneurial actions undertaken by small firms. If large firms go after the same business opportunities as small and medium firms, it is not surprising that they will take heterogeneous approaches to the same opportunity. For example, small firms may have the advantages of dexterity and surprise, while the large have the advantages of established brands, distribution channels, and strong feedback networks with existing users. The large firm will tailor its actions to its advantages.

The following is also true: both VC-funded entrepreneurs and all other kinds tend to be present at the same time in the same settings chasing the same opportunities. And so the low points are most informative: the absence of any start-ups is a pretty reliable signal of hostile environment for innovative, entrepreneurial young firms.[64]

Recent history reinforces this point. The increasing presence of entrepreneurs in communications markets has been one of the sweetest developments in the last two decades. It has brought rapid change to many sub-markets. Today we take for granted our access to e-mail, instant messaging, IP-enabled video conferencing, picture sharing, amateur-video sharing, online mapping, accessible hosted CRM applications from any location, mobile push e-mail, and a host of other utilities that no non-technical individual can understand. In virtually every case of radical change the events did not arise solely from the actions of incumbent firms with existing businesses. At some point, entrepreneurial actions got involved.

Three benefits are affiliated with the presence of a variety of entrepreneurs in comparison to their complete absence. Entrepreneurs have incentives to differentiate from incumbent firms who over-commit to one technological forecast about direction of change.[65] A related benefit has to do with overcoming inadequacies in establish organizations. Even if established firms have *incentives* to pursue a portfolio of technical directions, they may fail to act on them due to the

64. In this sense the argument here overlaps with that found in ROBERT W. FARLIE, KAUFFMAN INDEX OF ENTREPRENEURIAL ACTIVITY 1996–2007 (2008), www.kauffman.org/pdf/KIEA_041408.pdf, which measures entrepreneurial activity across different locations in the US, using self-reported decisions to open a self-owned business from the Current Population Survey.

65. This theme runs throughout a large range of studies. *See* Rebecca Henderson, *Underinvestment and Incompetence as Responses to Radical Innovation: Evidence from the Photolithographic Alignment Equipment Industry*, 24 RAND J. ECON. 248 (1993); Rebecca Henderson & Kim Clark, *Architectural Innovation: The Reconfiguration of Existing Product Technologies and the Failure of Established Firms*, 35 ADMIN. SCI. Q. 1 (1990).

absence of internal champions for a new technical direction, or the protection of rents flowing to internal champions.[66] Once again, entrepreneurs view such situations as opportunities. Third, when it is unclear which of several technical directions is most valuable, society gains from pursuing a variety of the least cost alternatives. Entrepreneurship can foster investments from distinct firms with different cost structures, each of them facing heterogenous incentives to invest in the technology.

The best historical illustration of these ideas comes from the development of the Internet itself, as it transitioned from its academic origins into a commercial service.[67] Executives at many established firms, such as AT&T and IBM, simply *did not* invest in operations nurturing any commercial future for TCP/IP services, even into the early 1990s. Some entrepreneurs viewed that as an opportunity and acted according to their vision. Thus, the initial growth of the commercial Internet involved a mix of firms from a variety of backgrounds. They shared a vision that the Internet would grow.

Some, such as PSINet and UUNet, were entrepreneurial descendents from the NSFNet. Others, such as Netscape, involved personnel from university research laboratories and executives from prior entrepreneurial commercial ventures. Others, such as those at BBN and MCI, were entrepreneurial actors inside large enterprises, who came from quite distinct backgrounds and interests. Others still were small Internet Service Providers, descendents from the bulletin board industry, who saw opportunities to establish a new service for local customer base.[68]

Because entrepreneurs often are the first to perform an economic experiment with a newly designed standard, a market with thriving entrepreneurial activity often results from the same factors that encourage a healthy amount of economic experimentation and standards competition. Yet, other factors matter, too. Entrepreneurial activity also can increase and decrease for distinct reasons.

Three additional factors play a role in encouraging entrepreneurship: low development costs, fast speed to commercialization, and strong appropriability conditions as defined by the eco-system. These are important to recognize because pragmatic policy can shape these factors.

Development costs and speed to commercialization refer to two attributes of every young firm's experience, i.e., the expense before

66. *See* CLAYTON M. CHRISTENSEN, INNOVATORS DILEMMA, WHEN NEW TECHNOLOGIES CAUSE GREAT FIRMS TO FAIL (1997).

67. *See, e.g.,* ABBATE, *supra* note 9; Greenstein, *supra* note 26.

68. Greenstein, *supra* note 26.

shipping the first major release and the amount of time it takes. Both of these are usually measured from the time a young firm first gets its funding, or its founders assign full-time managerial responsibility to somebody for the development of a product, whichever comes first.

To give a sense of scale to this discussion in Internet markets consider this example: Netscape was founded in April 1994 and sought to ship its first beta browser in four months. In fact, it took slightly longer. The first beta browser shipped in November 1994, its official product in February 1995. That effort involved several million dollars for a few months of development work and initial distribution.[69] That was at the high end of software development costs. A typical application firm in the late 1990s was expected to burn through several million dollars in a couple years. A typical software firm was expected to launch its first product in less than year, perhaps more if the product was particularly complex.

In comparison most examples of young software firms from this decade are astoundingly inexpensive until they scale up. Using open source software, modern startups have tended to work just as fast or faster, and with considerably less expense. For example, YouTube went from founding to first service in less than three months, entirely financed on the credit cards of one of the founders.[70] They did not bring in millions of dollars of working capital from any venture capitalist—in this case, Sequoia Capital—until they needed to scale their server equipment and support personnel to accommodate their spectacular growth.

That is not an isolated example. In general, it is quite common for the software firms of the Web 2.0 movement to burn no more than a few hundred thousand dollars a year and operate with less than a couple dozen employees. Many programmers with Web 2.0 startups boast about their ability to survive on "ramen profitability"—just enough revenue to buy ramen noodles for a couple founders for a while until it finds a service with wide appeal.[71] Even after funding, many firms can

69. MICHAEL CUSUMANO & DAVID YOFFIE, COMPETING ON INTERNET TIME, LESSONS FROM NETSCAPE AND ITS BATTLE WITH MICROSOFT (1998).

70. David Greising, *YouTube Founder Rides Video Clips to Dot-Com Riches*, CHICAGO TRIBUNE, Oct. 15, 2006; Scott Woolley, *Video Fixation*, FORBES, Oct. 16, 2006.

71. This phrase is due to Paul Graham. The earliest use appears to be from an essay dated May 2005, in an essay "Hiring is obsolete." He states,

> Like everything else in technology, the cost of starting a startup has decreased dramatically. Now it's so low that it has disappeared into the noise. The main cost of starting a Web-based startup is food and rent. Which means it doesn't cost much more to start a company than to be a total slacker. You can probably start a startup on ten thousand dollars of seed funding, if you're prepared to live on ramen. The less it costs to start a company, the less you need the permission of investors to do it. So a lot of people will be able to start companies now who never could have before.

The phrase "ramen-profitability" emerged from those origins, and has diffused into wider use.

accomplish amazing tasks with few permanent staff. I have toured numerous start-ups that operate with less than ten employees, and they intend to stay that way until they get their product into mass markets, at which point they will expand to less than a few dozen.

In other words, modern Web start-ups generally face low development costs, and anticipate a small scale for a long period of their earliest development, prior to scaling for a mass market. They all dream of reaching a mass market quickly, to be sure. If they do not it is not their end. They can survive and experiment for a long period.

Generalizations about the level of entrepreneurship that signal a healthy level of such activity are hard to make, not surprisingly. Some determinants of development costs and speed are outside the control of any participant. Those need to be distinguished from determinants of development costs and speed within the control of some participants.

Here is an example of determinants outside the control of entrepreneurs. Level3 entered the backbone market in the late 1990s at high expense, burning through hundreds of millions of dollars a year (maybe billions) while it built thousands of miles of new lines for its national network.[72] While Level3 initially was able to receive top dollar in revenue for its new all-IP infrastructure, its example was not followed by any other entrant.

Indeed, once the contract prices fell for backbone services in 2000-01,[73] no large new entry was observed in the backbone market except Cogent (which began service in 1999). Cogent largely did not build its own network. Instead, it put together its network from the assets of previously bankrupt firms,[74] vaguely reminiscent of how Cornell

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See Josh Quittner, *The New Internet Startup Boom: Get Rich Slow*, TIME, Apr. 9, 2009.

72. The company's own web site boasts of something similar. It says,

> During 1998, Level 3 raised $14 billion and was called the 'best funded start-up in history.' The company constructed 19,600 route miles, and built the world's first continuously upgradeable network fully optimized for internet protocol (IP). Over the next few years, explosive demand for bandwidth fueled growth in sales. By the end of 2000, Level 3 provided service to 2,700 customers.

Level 3 Communications, A Network Built to Support the Silicon Economics Cycle, http://www.level3.com/index.cfm?pageID=245 (last visited Apr. 2009). Other web sites aimed at investors say something similar but in less generous language. For example, as recounted on fundinguniverse.com, Level 3's executives "secured rights of way from railroad companies and ordered legions of employees to dig trenches and lay cable, efforts that quickly exhausted billions of dollars in capital." Fundinguniverse.com, Level 3 Communications, http://www.fundinguniverse.com/company-histories/Level-3-Communications-Inc-Company-History.html (last visited Apr. 2009).

73. Greg Rosston, *The Rise and fall of Third Party High Speed Access*, 23 INFO. ECON. & POL'Y 21, 29 (2009).

74. On their company history web page they state:

> Although debuting at the height of the telecom industry, Cogent soon found vast market wealth eradicated and many other ISPs thrown into a state of turmoil. In a survival of the fittest competition, Cogent became the consolidator in a

assembled Western Union back in his day. The basic economics of entry suggest that new building is not justified when prices fall, capacity goes unused, and growth can be achieved through restructuring. Simply stated, the costs are too high to merit building a new frontier start-up, no matter how good they are. (Constructing a new firm from existing assets bought at fire-sale prices, apparently, is a different matter.)

Here is an example of determinants within the control of some participants. For the last decade Intel has released prototype designs for the inside of the PC and endorsed specific implementations. That action has reduced the costs of designing some components and speeded the development of others. It has fueled considerable entrepreneurial activity.[75]

Selective withholding of information also can serve strategic purposes that delay entrepreneurial competition. Intel was accused of actions, in particular of withholding technical information from other participants in a quid pro quo for licensing of its intellectual property, which generated an FTC investigation.[76] Outsiders frequently accused Microsoft of using its position to make its own life easier, such as documenting for Microsoft's use but not necessarily for any others', and not documenting code so the company could alter it to its advantage.[77]

Three aspects of these types of allegations deserve notice. First, they are extremely difficult to prove in court (at least in ways that lawyers and judges find satisfying). Second, once leveled, these allegations take on a life of their own, and continue on in many distorted forms in (on-line)

> consolidating market. Over three brief years, Cogent completed 13 acquisitions of other flailing providers. Whether it was an entire company or just select assets, Cogent was able to acquire valuable network assets, customers, peering relationships and building access agreements for pennies on the dollar.

Cogentco.com, Cogent Communication History, http://www.cogentco.com/us/about_history.php (last visited Apr. 2009).

75. *See, e.g.*, GAWER & CUSUMANO, *supra* note 21; Gawer & Henderson, *supra* note 21.

76. *In re* Intel Corp., 128 F.T.C. 213 (1999).

77. One developer suggests the following:

> Why [not document part of the internal subsystem for Win32], one might ask? Well, the official reasoning is that it allows Microsoft to tune and modify the system call layer at will, improving performance and adding features without being forced to provide backward compatibility application binary interfaces . . . . The more nefarious reasoning is that it allows Microsoft applications to cheat, and call directly into the undocumented Win32 subsystem system call interface to provide services that competing applications cannot. Several Microsoft applications were subsequently discovered to be doing just that, of course . . . . These days, this is less of a problem, as there are several books that document this system call layer . . . . But it left a nasty taste in the mouths of many early Windows NT developers (myself included).

Jeremy Allison, *A Tale of Two Standards, in* OPEN SOURCES 2.0: THE CONTINUING EVOLUTION 47 (Chris DiBona, Danese Cooper & Mark Stone eds., O'Reilly Media, Inc. 2006) (2005).

communities that mistrust the leading firm who stands accused. Third, such allegations usually presume the dominant firm could have acted differently, i.e., in a manner more considerate to the interests of other entrepreneurs, without much cost.

Internet insiders will recognize a familiar outline in the debate over Comcast's throttling of Bit-Torrent traffic. Many accusations have been leveled at Comcast for throttling traffic. When the behavior was first discovered, it unleashed more than a bit of torrent of speculation in online discussion groups about the extent of the action and the competitive motivation.[78] Not only did the lack of advance notification leave many parties suspicious about Comcast's policies, but it left observers puzzled about why it never dawned on management to issue a press release before taking action. Comcast's secrecy fueled rumors, and it came across as unnecessarily inconsiderate to users, entrepreneurs, and other on-line participants.

The final attribute of every young firm's experience is something called a*ppropriability conditions*. It refers to the ease with which entrepreneurs can retain exclusive rights over their inventions or other unique assets, usually through one of several strategies to prevent imitation: secrecy, patents, copyright, first mover advantages, or some combination of those. If conditions are weak, then entrepreneurs expect to lose quickly their unique advantages to others

Appropriability conditions are controversial for reasons related to the discussion about withholding information. They partly depend on the tenor of interfirm relationships in the competitive ecosystem constructed by leading incumbent firms. This factor has received attention by many others, so this discussion will remain brief.

For example, some incumbent firms, such as Cisco, have made it very clear that they intend to purchase other small start-ups who reach the frontier in an area Cisco considers important. That is regarded as a quite inviting setting for start-ups. Similarly, during its heyday in the late 1990s, AOL was known for its willingness to sign a reasonable deal with just about any start-up who had a service to offer for its platform. Venture capitalists also took note of these positions and started firms accordingly.

In contrast, for many years Microsoft was known to prefer internal growth over acquisitions, usually in a fast-follower strategy, *i.e.*, basing development on the lessons learned through the economic experiment

78. *See, e.g.*, PETER ECKERSLEY, FRED VON LOHMANN & SETH SCHOEN, PACKET FORGERY BY ISPS: A REPORT ON THE COMCAST AFFAIR, ELECTRONIC FRONTIER FOUNDATION, Nov. 28, 2007, http://www.eff.org/files/eff_comcast_report2.pdf; *Comcast Throttles BitTorrent Traffic, Seeding Impossible*, TORRENT FREAK, Aug. 17, 2007, http://torrentfreak.com/comcast-throttles-bittorrent-traffic-seeding-impossible.

conducted by other firms. That did not deter entry in application software, but it motivated firms to start young companies with no planning for acquisition, and to expect the potential for imitation from the very firm with whom they had to partner in order to reach users. More recently, Microsoft has changed its stance about acquisitions, particularly in areas related to cloud computing, and that has raised a number of questions among VCs about funding firms in related areas.

The legal environment also shapes appropriability conditions. This, too, has received much attention from others, so for this discussion I will keep my observations brief. For example, the changing legal and regulatory conditions of the late 1990s adversely affected the basic costs and viability of a wide range of CLEC business plans. To say the least, the environment went from friendly to hostile in a few years, and, not surprisingly, entry of young start-ups declined as a result.[79]

As noted earlier, large firms and incumbent firms can be entrepreneurial, too. That is why some entrepreneurial actions by large firms, though otherwise puzzling, may have a silver lining. For example, Nokia continues to struggle to find new initiatives beyond hardware design, whether it involves buying Navteq or starting new music services that anger its carrier partners. In light of the relevance of entrepreneurship, we should salute them. As the provider of almost half the smart phones in the world[80] and close to 40% of all cell phones, Nokia has considerable clout. Yet it refuses to stand still. It continues to restructure, a sign of taking entrepreneurial risks in advance of new opportunities in new markets.

As another example, Cisco's attempt to get into video conferencing by purchasing Webex seems strategically incongruent, because it involves integrating a large software firm into one that specializes in equipment markets. Yet, the merger also introduces the company to a wide range of new opportunities and challenges related to developing tele-presence. Even if I am skeptical that Cisco will gain a return on its investment in Webex, I am interested to see what it makes of its entrepreneurial action and this departure from prior strategic action.

Once again, established firms with market power do not tend to benefit from entrepreneurial inventiveness that threatens their economic rents. That raises concerns that dominant firms will attempt to shape development costs, entry speeds, and appropriability conditions to serve

79. NUECHTERLEIN & WEISER, *supra* note 12, at 15–16, 69–114 (examining the tension between the competitive goals of the Telecommunications Act of 1996 and the unavoidability of economies of scale); *see also* Greenstein & Mazzeo, *Differentiated Entry into Competitive Telephony*, 54 J. INDUS. ECON. 323–350 (Sept. 2006).

80. Kevin O'Marah, *Feasting on a Content Economy: Nokia Bites Apple*, AMR RESEARCH, June 30, 2008, http://www.amrresearch.com/content/View.aspx?compURI=tcm:7-37691.

its own strategic priorities. For example, established firms would rather buy out an entrepreneurial inventor than see it become an independent company and potentially compete.

Once again, Wall Street analysts may stress different factors than those that benefit society at large or users. In part that is because the value of many start-ups may be privately held for some time, not evaluated by any stock market pricing, as with established firms. In addition, as with a multiplicity of economic experiments and the regularity of standards competition, there are general benefits to buyers from competition between start-ups and established firms that Wall Street does not necessarily value. Even when such start-ups have only small chances of success in the long term, such competition enlarges buyer choice, multiples opportunities for learning, and enhances urgency at the established organizations.

More broadly, just as with unfettered experimentation and competition between standards, entrepreneurial inventiveness yields benefits at the level of the market even if the benefits are small at the level of the firm. Such entrepreneurship will serve a purpose in the plans of innovative entrants. It will generate reactions from other competitors or imitators. Once again, this fosters incentives that ultimately lead to lower prices and more innovative products, and sooner. Users benefit from that, and policy can encourage it.

D. Absence of Unilateral Bargaining

Negotiation shows up in every firm's life. From some of the above examples, it is easy to see why: suppliers complain about growing costs and suggest alternatives, technologists suggest alternative methods for accomplishing a task, programmers complain about the poor quality of code and seek to push out release dates, stockholders demand higher profits, buyers complain about tight budgets and threaten to choose another option. Managers caught between such complaints must constantly negotiate with many participants. More to the point, managers inside the Internet value chain have an especially difficult task because the addition of technical interrelatedness adds one more layer of complexity to an already tough negotiating task.

In a network with a high degree of technical interrelatedness, there are general gains to all parties from bringing routines into business processes and activities, much like there are gains to adopting standards and platforms to coordinate activities. While there may be no better way to reduce complexity, adopting such routines may require negotiation between multiple parties.

Such negotiation offers no guarantee of success. Many outcomes are possible. Occasionally both parties want an agreement, but just as often

one party will desire it more than the other. Alternatively, one party may have an ability to generate a better deal than the other, and sees bargaining as an opportunity to generate a strategic advance or gain additional revenue. As a general rule, the structure of bargaining sometimes can work out to a Goldilocks equilibrium that is just right—not too hot and not too cold—but more often it does not. One firm gets too powerful or another prominent bargainer loses its way.

In the extreme, bargaining becomes one-sided, with one party asking for something while the other refuses to provide it or only agrees to it at a high cost. The simplest manifestation of this extreme situation arises when the more powerful party declares a "take-it-or-leave-it" offer, leaving other parties no choice.

Given such a range of possible outcomes, how can we tell what signifies a healthy market? In short, the absence of one-sided bargaining.

That said, it is not as simple as it sounds. The presence of one-sided bargaining by itself is not bad. That is, the absence of one-sided bargaining is a sign of health, while the presence of one-sided bargaining is a sign of potential illness, which might have adverse consequences that might spread. The key question is whether the parties who receive such take-it-or-leave-it offers have access to reasonable alternatives. This will take some explaining.

Let me illustrate the role of negotiations with a comparatively uncontroversial example. Intel has a series of agreements with numerous OEMs about putting the Intel Inside and Centrino brands on their products to signal to users that the laptop includes a Wi-Fi compatible motherboard and antennae designed by Intel. In addition, Intel often includes certain compensation for the marketing expenses of putting the Intel copyrighted jingle inside a commercial.

A breakdown of negotiations can arise from one-sided bargaining, but this example illustrates that breakdowns can occur for other reasons as well. A few years ago Dell refused to carry the Centrino branded systems, and, accordingly, did not receive the quid pro quo compensation. Both parties went on their merry way for many years. Dell continued to carry both Intel products, but after that incident began to more prominently distribute designs with AMD chips. At the same time Intel reached deals with every other major OEM, and succeeded in making Centrino a feature of the majority of notebooks in use.

What does this example illustrate? First, that Intel's market power had its limits with Dell. It eventually reached a point in its negotiation with Dell where Intel gave Dell a take-it-or-leave-it offer and, indeed, Dell chose to leave it (unlike virtually everyone else in the industry). Second, as long as Dell had plenty of other options, the losses to Dell or society at large were not too large. Indeed, there might have been gains,

since Dell's choices translated into more buyer options beyond the Centrino.

One-sided bargaining can have some serious consequences, however. Some years ago there was a proposal to let all Internet participants simply negotiate compensation between them, so that Google/Yahoo/Disney would negotiate with Comcast/Time-Warner/Verizon, and every other possible combination. Intel's example suggests the problem with such a proposal: imagine the uproar among users in the locations where such negotiations failed to come to resolution and no other close substitutes existed. It would be far worse than the brief uproar last year among Yankee fans who could not get local baseball telecasts due to a negotiation breakdown between Major Leagues Baseball, the Yankees, and a local cable provider.

Indeed, this did happen a few years ago when negotiations broke down between Cogent and Sprint.[81] However, the situation was easy to misunderstand and misinterpret. In this case, the absence of market power reduced the policy concerns affiliated with the breakdown of bargaining, albeit some policy concerns still remained. That requires explanation.

Specifically, Cogent and Sprint were exchanging traffic through a third party and, like other backbone firms, sought to connect directly in a peering arrangement that bypassed the third party.[82] That is not a trivial step. First, it required the building of appropriate lines and equipment, which cost money. Second, as with other peering, it required measuring traffic directly to verify that traffic was sufficiently symmetrical back and forth. The two firms negotiated an agreement for building the connection and the terms for breach—that is, what type of traffic experience would justify ending the peering.

After building this connection, Cogent stated that it was satisfied with the traffic flow, while Sprint stated it was not. There was no dispute about the symmetry of the traffic back and forth, but there was a disagreement about its level. Sprint argued that Cogent did not provide enough traffic to justify a peering relationship.[83]

After declaring Cogent could no longer peer with it, Sprint did not immediately de-peer. Rather, it unilaterally declared that the two companies were in a paying relationship, as Sprint would do with any small ISP. Sprint then began to send bills to Cogent. Cogent argued that it had met the conditions for peering, and that Sprint's claims were

81. Scott Woolley, *The Day the Web Went Dead*, FORBES.COM, Dec. 2, 2008, http://www.forbes.com/2008/12/01/cogent-sprint-regulation-tech-enter-cz_sw_1202cogent.html.

82. *Id.*

83. Woolley, *supra* note 81.

disingenuous attempts to make money. In essence, Cogent refused to pay, and both companies put considerable spin on events.[84]

This standoff went on for many months until Sprint's management decided to shut down its side of the peering.[85] That action had consequences for users on both networks who did not multi-home, i.e., did not use more than one backbone firm. One set of exclusive Sprint users could not reach another set of exclusive Cogent users.[86]

To make a long story short, users of both carriers were angry. Cogent publically blamed Sprint's decision to de-peer, and, for reasons not made public, after a few days Sprint's management gave in, reversing the de-peering.[87] Soon after the two firms came to a long-term agreement whose details were not disclosed publically.[88] In other words, as of this writing, this negotiating tactic hurt users, but it is unclear which firm won the negotiation. It is not clear how much money changed hands (or will change hands).

The Sprint-Cogent case suggests four lessons. First, any outcome depends on the circumstances surrounding the use of the tactic. No generality could hold for all circumstances. Second, user (dis)satisfaction plays a role in those negotiations, but it is not the only determinant. Third, any rule about interconnection will have tactical consequences for users. For example, a must-carry rule for interconnection would simply have narrowed the set of actions Sprint could take.

The fourth lesson is more subtle. Several news stories tried to make an inference about the managerial style of Cogent's CEO, Dave Schaffer, since this is not the first negotiation breakdown his firm has encountered. That focus misses the forest for the trees. The personality of a CEO is not the point. Only his entrepreneurial vision is, because at the heart of this example lies a potential competition policy issue.

Specifically, Cogent has a "entrepreneurial" distinct vision about how to attract customers and serve their needs. To execute that vision Cogent necessarily must interact or exchange traffic with the very firms with whom it competes. It is not hard to interpret negotiation breakdown initiated by an incumbent firm as a tactic to discourage an entrepreneurial vision and deter an economic experiment by an entrant. In general, competition policy issues always arise any time an existing firm can shape the costs of an entrepreneurial entrant. If further

84. *Id.*

85. *Id.*

86. Numerous computer scientists and networking experts have pointed out to me that both Sprint and Cogent could have adjusted their routing tables in advance to prevent users from being cutoff. Hence, there is a sense in which both parties played brinkmanship and bear responsibility for imposing costs on their users.

87. Woolley, *supra* note 81.

88. *Id.*

investigation reveals that Sprint possessed market power, their refusal to interconnect would be especially disturbing.

In other words, if Sprint were found to have market power, then its attempts to bargain over interconnection are potentially more problematic.[89] Its actions could be interpreted as an attempt to shape competition.

One tactical gain from market power, for example, is the ability to ignore customer complaints at the retail level while pursuing other tactical goals, say, at the wholesale level, where interconnection takes place. It appears that Sprint's capitulation to its user base is, however, evidence that Sprint's management does not have the ability to ignore its users for very long.

I raised this example for a reason. In short, one-sided negotiations and bargaining breakdowns are, by themselves, insufficient to conclude definitively there is a problem. In the presence of market power, however, it is much more likely a sign of lack of innovative health.

Now consider the lessons from negotiated arrangements that are a bit more one-sided, and happened in the presence of market power. These days Apple offers a standard contract to all application developers for the iPhone about how their services will be sold, requiring them to sign non-disclosure agreements as a condition for inclusion on the Apple Web page where applications are sold.

What dispute arose? Developers complained that the non-disclosure agreement was too tight, even for firms whose applications were ultimately rejected. This made headlines when Apple "clarified" its policies, announcing that even the non-disclosure letter was subject to the non-disclosure agreement.[90] Apple argued that anything done by a developer for Apple could not be shared with others, even if Apple refused it for the iPhone after review. After considerable uproar on blogs and developer list serves,[91] Apple relented on this provision, but it continued to argue that it had a right to protect its innovations through use of these agreements.[92]

Once again, Apple made a take-it-or-leave-it offer and imposed conditions on others. The negotiation breakdown was not necessarily symptomatic of a problem, however, as long as alternatives existed. In

89. Because events suggest that Sprint in fact lacked market power, I am not concluding that Sprint acted in an attempt to shape competition.

90. *See, e.g.*, Arnold Kim, *Apple Extends Non-Disclosure to App Store Rejection Letters*, MACRUMORS.COM, Sept. 23, 2008, http://www.macrumors.com/2008/09/23/apple-extends-non-disclosure-to-app-store-rejection-letters/.

91. *Id.* (receiving over 1,000 negative ratings and over 400 comments).

92. Gregg Keizer, *Apple Drops iPhone NDA Gag Order*, COMPUTERWORLD, Oct. 1, 2008, http://www.computerworld.com/action/article.do?command=viewArticleBasic&articleId=9116007.

this case, however, not many alternatives existed for reaching Apple iPhone users. If a developer wanted to reach the Apple user-base they had to distribute through Apple's outlets and accept the condition. No other avenue for reaching them existed. Apple controlled them all.

If other devices are substitutes for the Apple iPhone, then this situation is less worrisome. If developers wanted to reach users through alternative devices for mobile computing, they had to reach deals with those device providers. Initially few existed, but increasingly announcements are being made about new entry. As some gain market share, the situation may change.

These examples illustrate several general points. Breakdown happens for many reasons, and those should be considered distinct from the reasons shaping one-sided negotiations, which can look similar. One-sided negotiations, in contrast, involve one party with enough bargaining power to make a take-it-or-leave-it offer that others have no choice but to accept.

What factors mitigate the public policy issues in Apple's case? Generally speaking, suppliers in young markets get wider licenses from a court just because they produce for a nascent set of users for new devices and services. For many good reasons there is a general presumption that no firm introducing a new product has market power at the early stage of growth, as it is subject to competition from established brands with established distribution channels and large market share.

So why does Apple get any scrutiny at all? Questions arose here because Apple is unique. The attention is a testament to Apple's unusual recent success commercializing small devices, such as the iPod, and its rather unique place today as a firm that every developer expects to succeed with users, even with a new product, unlike just about every other firm.

Perhaps a more famous example of one-sided bargaining came from Microsoft in the mid 1990s. While I do not mean to single out Microsoft in the use of one-sided negotiations, several circumstances contribute to a disproportionate number of examples in the essay from Microsoft's conduct in the 1990s. First, due to the antitrust trial,[93] many of its internal memos became public, providing a unique and well-documented window on how such negotiations were conducted. Second, Bill Gates was remarkably adept at pressing his negotiating advantages when he had them. His behavior provides good illustrations of how one-sided negotiations can become. Third, and similar to the Apple example, many developers wanted access to the users of Windows. However, in this case, the alternatives were quite limited, and, so, courts had no issue

93. United States v. Microsoft Corp., 147 F.3d 935 (D.C. Cir. 1998).

concluding that Microsoft's attempts to make access more or less difficult for those developers had real consequences.[94] The user base for Windows was large, so the stakes were quite high for many developers if they faced even a small degree of problems.[95]

For instance, prior to the rollout of Windows 95, Microsoft began to dictate conditions to its application developers. It started mildly, with design specifications that application providers were required to comply with, such as specifications for pull-down menus, and other processes that had to follow the available APIs. Most firms acquiesced to these for lack of any alternative, and some grumbled about it at the time.

The more controversial dictates started showing up closer to the rollout of the system. Perhaps the most interesting and dramatic example of bargaining arose in the deal between Apple and Microsoft. The newly returned Steve Jobs took over Apple when it was in a dire financial position, and one avenue for a quick infusion of cash was to settle a patent dispute with Microsoft. Microsoft, in turn, was willing to settle the dispute quickly only as part of a comprehensive deal that included Apple making Internet Explorer the default browser for the Mac.[96]

Transcripts of Microsoft e-mail (made public later) showed that Gates and other Microsoft executives discussed how to hint to Jobs that it was possible for a delay in the release of Word for the Mac, a threat to gain movement from Jobs, since such a delay could hurt Apple's slumping sales. In retrospect, even a hint of this delay to Jobs was remarkable, since the development of Word was (actually) proceeding in a timely manner. After the fact, it is difficult to know what role such a threat played in addition to all the factors at work.[97] As it turned out, Jobs accepted the deal for Internet Explorer and his own customers booed him soundly at a convention when he initially announced it.[98] It surely was not the way for a newly returned CEO to curry favor with customers, but he was over a barrel at the time.

Still, for sheer unpleasantness, the negotiation between Compaq

94. United States v. Microsoft Corp., 87 F. Supp. 2d 30 (D.D.C. 2000).

95. *Compare* Daniel Rubinfeld, *Maintenance of a Monopoly:* U.S. v. Microsoft, *in* THE ANTITRUST REVOLUTION: ECONOMICS, COMPETITION, AND POLICY 476, 476–501 (John E. Kwoka, Jr. & Lawrence J. White eds., 2008), *with* Timothy F. Bresnahan, *The Economics of the Microsoft Case* (2009) (unpublished manuscript), *available at* http://www.stanford.edu/~tbres/Microsoft/The_Economics_of_The_Microsoft_Case.pdf; *with* WILLIAM H. PAGE & JOHN E. LOPATKA, THE MICROSOFT CASE: ANTITRUST, HIGH TECHNOLOGY, AND CONSUMER WELFARE (2007).

96. John Markoff, *Microsoft Comes to the Aid of a Struggling Apple*, N.Y. TIMES, Aug. 7, 1997, at A1, *available at* http://www.nytimes.com/1997/08/07/business/microsoft-comes-to-the-aid-of-a-struggling-apple.html.

97. *See* BANK, *supra* note 42, at 12.

98. *See, e.g.*, Peter Burrows et al., *Is This Apple's New Plan?,* BUS. WK., Aug. 25, 1997, http://www.businessweek.com/archives/1997/b3541160.arc.htm.

and Microsoft has no equivalent. Compaq had heard from many customers who wanted Netscape browsers, and featured it prominently. As a reward for listening, Microsoft publicly roughed up Compaq. In 1996, for example, an employee at Compaq removed the Internet Explorer icon from shipped versions of computers. The employees viewed this as part of a range of actions to keep the icons less confusing, orienting them toward business obligations and toward the applications users wanted. Microsoft believed Compaq had a business obligation to display Internet Explorer, and it sent a letter to Compaq threatening to cut off its operating system license in sixty days if a removed Internet Explorer icon was not put back on all new systems[99] and the dispute did not come to resolution.[100]

Compaq capitulated on the dispute quickly. At the time it left everyone in the industry with the strong impression that Microsoft chose to make an example of Compaq, demonstrating the drawbacks to being a business partner that did not play by Microsoft's rules.

Why did it leave that impression? Because of the way negotiations took place. That dispute could have (and should have) been settled with a few phone calls to the right senior executives, or, at most, arbitration.[101] That did not happen in part because Microsoft's executives urgently wanted to keep their browser available in competition with Netscape, and they did not want to give the appearance of ceding even a temporary disadvantage. As was frequently pointed out in public forums, this was but one of several alleged strong-arm tactics that most computer company executives refused to discuss in public for fear of retaliation from Microsoft.[102] Similarly, no senior executive at Microsoft ever apologized, nor disavowed the action, nor did the firm ever give back any of the strategic gains it reaped from the action, which left the impression that the negotiating method was not an accident.

As it happened here, in time the executive team at Microsoft concluded that it had not been sufficiently strict with its business

99. Letter from Don Hardwick, Group Manager, OEM Sales Div., Microsoft Corp., to Celeste Dunn, Vice President, Consumer Software Business Unit, Compaq (June 6, 1996), http://www.usdoj.gov/atr/cases/exhibits/650.pdf.

100. United States v. Microsoft Corp., 84 F. Supp. 2d 9, 59–60 (D.D.C. 1999).

101. Indeed, it was apparently settled through a few phone calls, but only after the threatening letter had been sent, which makes one wonder how much of the public discussion was simply making the best of it by putting lipstick on a pig. Thereafter, the Netscape and Internet Explorer icons appeared on both desktops for a short period, but Compaq renegotiated its contracts with others. *See* Declan McCullagh, *Compaq: It Was All a Big Mix-Up*, WIRED, Feb. 16, 1999, http://www.wired.com/politics/law/news/1999/02/17938; *see also Microsoft*, 84 F. Supp. 2d at 59–60.

102. Rajiv Chandrasekaran, *Jabs at Company Figure into Trial*, WASH. POST, Jan. 27, 1999, at E01, *available at* http://www.washingtonpost.com/wp-srv/business/longterm/microsoft/stories/1999/jabs012799.htm.

partners, which motivated taking further action, accordingly to Judge Jackson's recounting of events.[103] Thereafter, Microsoft inserted clauses into operating system licenses, which included restrictions on OEMs, including restrictions on the "out of the box" experience for users when they first fired-up their systems. Those same contractual restrictions later were used to prevent OEMs from adding help screens for users of the Netscape browser, among other issues that helped Microsoft's competitive aims—albeit, by driving up OEM service expenses.[104]

Why are one-sided negotiations a bad sign for the innovative environment? They reveal one big problem: using their negotiating leverage, managers at the firm doing the dictating can find leeway to justify actions that make their own lives better or easier, even when it comes at the expense of others. That can become a detriment to innovation, especially when one-sided negotiations begin to serve defensive purposes of the dominant firm to the detriment of others. It can restrict the conduct of economic experiments and hinder the realization of competitive benefits from unfettered standards competition.

In the above examples, Microsoft tried to reduce Netscape's ability to distribute its products and made it difficult for users to find alternatives. It appears we can recognize unhealthy negotiations for innovative entrants when established firms prevent distributors from installing help screens for their users through contracting clauses, and when distributors complain about restrictions that limit users' options to modify their products.

To be sure, it is difficult to assess whether one-sided negotiation contributes to a negative outcome in general. While such open questions cannot be resolved entirely in a short essay such as this, consider three key questions as a start for diagnosing any specific example: (1) Does a firm dictating conditions possess market power and employ it in its bargaining behavior? (2) Are non-innovative tactics being employed to shape innovative behavior by others? (3) Are users being restricted for reasons that have any relationship to a product's merits and functionality?[105]

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103. *See Microsoft*, 84 F. Supp. 2d at 59–62.

104. After the introduction of these restrictions Hewlett Packard sent a letter to Microsoft with the strongly worded lines:

> We must have the ability to decide how our system is presented to our end users. If we had a choice of another supplier, based on your actions in this area, I assure you [that you] would not be our supplier of choice. I strongly urge you to have your executives review your decisions and to change this unacceptable policy.

Id. at 62.

105. *See, e.g.*, Shane Greenstein, Market Structure and Innovation: A Brief Synopsis of Recent Thinking for the Federal Trade Commission, Testimony for the Federal Trade

As illustration, consider the first screen restrictions (on help screens) that Microsoft employed on OEMs. The answer to the above questions would be yes, yes, and no, suggesting they are too one-sided and unhealthy. Not surprisingly, even while the appellate court reviewing Judge Jackson used dozens of pages to admonish his talking to reporters, its members could not bring themselves to alter his ruling about the use of first screen restrictions. That is, these were among the provisions the appellate court cited as violations of antitrust law.[106]

The epilogue to this episode is informative. As it turned out, the bright light of the court's inquiry turned into a partial antiseptic—albeit it was a slow acting one from the viewpoint of those wanting strong action taken against Microsoft.[107] Publicity about these actions had an effect on developers, who have increasingly moved to open source platforms. In 2006, several years after the antitrust trial, Microsoft took public action to counter developer defections.

Microsoft publicly declared that it had adopted a set of principles that bound the firm to remain consistent in its actions over time.[108] This action directly addressed one of the issues that perennially arose in the 1990s—accusations that Microsoft's employees altered APIs or other firm technologies in self-interested ways that discriminated between business partners.[109] This was thought to be a policy that application

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Commission Hearings on *Competition and Intellectual Property Law in the Knowledge Based Economy,* Washington, D.C. (2002) (transcript available at http://www.ftc.gov/opp/intellect/shanemitchell.pdf); Bresnahan, Greenstein, and Henderson, *supra* note 42; Phil Weiser, *Regulating Interoperability: Lessons from AT&T, Microsoft and Beyond* (Working Paper), *available at* http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1344828.

106. As further illustration of these questions, consider the negotiating breakdown between Sprint and Cogent. Focusing on Sprint's action, how would the questions come out? No, maybe, no. Indeed, Sprint capitulated to Cogent precisely because it lacked market power, which also is why it was not a situation of one-sided negotiations.

107. Timothy F. Bresnahan, *The Economics of the Microsoft Case* (Working Paper), *available at* http://www.stanford.edu/~tbres/Microsoft/The_Economics_of_The_Microsoft_Case.pdf.

108. Microsoft, Windows Principles: Empowering Choice, Opportunity, and Interoperability, http://www.microsoft.com/About/CorporateCitizenship/US/PromotingInnovation/WindowsPrinciples.mspx; *see also* Weiser, *supra* note 105, at 11.

109. One among the many provision seems particular aimed at these concerns:

> 1. APIs. Microsoft provides the developer community with a broad range of innovative operating system services, through documented application programming interfaces (APIs), for use in developing state-of-the-art applications. The U.S. antitrust ruling requires that Microsoft disclose all of the interfaces internal to Windows called by "middleware" within the operating system, such as the browser, the media player, and so forth. In this way, competitors in these categories will know that they can plug into Windows to get services in the same way that these built-in Windows features do. This has worked well, and Microsoft will continue to disclose these interfaces even after the U.S. antitrust ruling expires. In fact, we will go further, extending our API commitment to the benefit of all software developers. Going forward, Microsoft will ensure that all the interfaces within Windows called

developers would find encouraging, since it relieved concerns about the potential waste of time and effort out of negotiations. In 2008 Microsoft announced another set of principles for remaining consistent in its interoperability designs, and these reinforced the earlier points.[110]

Notice a key subtlety: Microsoft committed to consistency. *Consistent* policies from a firm are those that change slowly at most, allowing for the planning of others. They are changed without caprice, without an ad hoc approach, and without seemingly arbitrary timing, in other words, without actions that necessarily diminish the returns on others' innovative, long-term investments.

Consistency has great importance in interdependent value chains. Other firms will not make long-term investments if they fear not making a return on that investment due to changes by others, which are out of their control. Entrepreneurs will not take action if they fear conditions will change arbitrarily on them later, or systemically to their disadvantage. Firms will not undertake costly economic experiments if they cannot assure themselves that other firms won't interfere with the conditions that support learning from their market experience.

In adopting a commitment to consistency, Microsoft did not give up its rights to retain secrets (e.g., remain less than transparent) nor to give up its right to retain managerial discretion (e.g., exclude participation from outsiders) after engaging with business partners. Instead, Microsoft committed to not arbitrarily alter or apply what was decided unilaterally by management, inviting business partners (i.e., especially developers and OEMs) to inquire whether they receive treatment similar to another partner of Microsoft's (i.e., another developer's competitor).[111]

Will consistency lead to fewer take-it-or-leave-it offers? It depends on one's view. Many books have been written about the managerial preference of Bill Gates, and many of Microsoft's practices arose from his preferences.[112] His recent retirement suggests the firm would display less variance in its contracting activities in any event. In that case, the answer would seem to be yes.

Once again, this viewpoint differs from the standard approach on

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> by any other Microsoft product, such as the Microsoft Office system or Windows Live, will be disclosed for use by the developer community generally. That means that anything that Microsoft products can do in terms of how they plug into Windows, competing products will be able to do as well.

Id.

110. Microsoft, Interoperability Principles: Open Connections, Standards Support, Data Portability, http://www.microsoft.com/interop/principles/default.mspx; *see also* Weiser, *supra* note 105, at 11–12 .

111. *Id.*

112. *See, e.g.*, BANK, *supra* note 42.

Wall Street. That view typically stresses the profitability of being a leading firm and the benefits to employees working there—up to a point. For example, IBM in the 1970s had a great market position in large enterprise computing. Working there paid better than anything else in computing, albeit every veteran of that era talks about how internal politics consumed the organization.

More recently, working at Microsoft's Windows or Office division or Intel's microprocessor division has had its benefits, since those divisions have been awash in billions. That enabled these companies to fund some rather ambitious internal projects, which was fun for many employees, although more fun for those managers who won the internal debates than those who lost.

The focus on Microsoft's profitability, or on IBM's in the prior era, is simply too narrow a frame for thinking about the role of negotiations in shaping industry-wide innovative activity. The innovative health of many participants requires a broader vision and analysis, looking beyond the consequences of actions benefiting the largest incumbent firm.

In conclusion, the absence of one-sided bargaining is a sign of health. Absence of one-sided negotiation indicates that no firm has largely shaped the actions of others. Such actions do not need to be unhealthy, and can arise for a variety of reasons. But it can be unhealthy when dominant firms face incentives to shape the behavior of innovative entrants and competitors in ways that benefit only the dominant firm. Such actions have the potential to limit innovative behavior. Particularly worrisome is a firm with market power imposing constraints which undermines economic experimentation, standards competition, and entrepreneurial entry.

III. HEALTHY INNOVATIVE COMPETITION FROM DOMINANT FIRMS

If this essay has any broad lessons, they are these two observations: First, it is myopic for policy to cede full discretion over innovation in an evolving value chain to any firm who happens to have market power today, whether it is Microsoft, Comcast, or whomever. Second, it also is myopic to cede full discretion over policy to slow moving regulation and court decisions, particularly when courts do not have reason to consider the range of policies to nurture long term investments by innovative actors in a complex and interrelated value chain.

What is an alternative to such myopic policy? A third way, one that offers clear and predictable policy guidelines, coupled with administrative processes for quick resolution of disputes. This essay has stressed that such a regulatory policy would consist of more than just four sentences. It would stress four signs of innovative health as part of transparent and

consistent guidelines that private actors could use to anticipate policy.

This section will illustrate the steps such reasoning might take, and how it could apply the four principles, but will not develop a full argument. That is, I briefly will consider behavioral analysis consistent with examining the health of an innovative market. For that purpose I will illustrate the issues raised during negotiations between Cogent and Sprint, and those raised by Comcast after it throttled Bit-Torrent traffic.

First, consider Cogent's negotiation breakdowns with other firms, particularly Sprint. The breakdowns generally were short, but had consequences for users nonetheless.

Let's start with the four principles. This breakdown deprived some users of full access to the Internet, violating any strict interpretation of the first of the FCC's principals, i.e., access to the lawful Internet. A strict interpretation of the first of the four principles might require firms to interconnect under all circumstances, removing de-peering as a negotiating tactic. That policy would seem to be motivated by a desire to protect the user experience.

That is problematic, in my view, because this behavioral rule got to the right answer for the wrong reasons, and, thus, sets a policy precedent with little value for others. As pointed out above, it misses several key insights about what those negotiations entailed, and what curtailing them would effect.

Rather, these events raise issues in the competition policy for interconnection between an entrepreneurial firms and an established firm. In my view all parties behaved in ways that did not facilitate a path towards a Coasian solution. Non-participants in decision making were hurt by the actions of the parties involved. Government intervention was, thus, merited.

The four principles fail to draw attention to many of the relevant competition policy issues in this case. For example, de-peering by an incumbent firm could be a tactic in discouraging a new entrant's entrepreneurial behavior, or in discouraging an economic experiment. The key question is: Would the guidelines be implemented differently if they were preserving economic experiments or preventing incumbent firms from discouraging entrepreneurial entry? In my view this example illustrates that the answer is certainly yes.

As a second example, consider Comcast's unilateral declaration to throttle P2P applications on its lines with resets. The FCC eventually intervened, arguing that Comcast could not single out a specific application for such action. Comcast has responded with new proposals for ways to manage its traffic.

As it played out, one striking feature about this event was the willingness of all parties to act without asking for anyone else's

permission. P2P users acted as if they could run any application, irrespective of its consequences for others, even when it degraded the quality of service for neighbors during peak-load time periods. Comcast acted as if it had full discretion to manage its data over its facilities without informing anyone, even its own customers.

Using the analysis above, I would interpret this behavior as symptomatic of the lack of fully specified contracts (for the issues under dispute) between parties who (it would seem) actually have a contract. In other words, the development of P2P applications put both parties in a situation unanticipated by their original contract, which required a renegotiation of its terms.

In my view all parties behaved in ways that did not facilitate building trust between them, and, thus, their behavior departed very far from anything that positively contributed to a path aimed towards a Coasian solution. Once again, government intervention was, thus, merited.

To be sure, the basic economics of incomplete contracting partially favors giving discretion to Comcast's management. Management could internalize the externality one user imposes on others—managing traffic for many users' general benefit. That is, P2P applications, like Bit-Torrent, can impose large negative externalities on other users, particularly in cable architectures during peak-load time periods. Such externalities can degrade the quality of service to the majority of users without some sort of limitation or restriction.

That does not imply, however, that Comcast has unfettered discretion to manage the situation. There is at least one additional incomplete contract to consider, that between Comcast and other providers of applications presently in the market. Arguably, there is a public policy issue regarding those innovative entrepreneurs who are not in the market at present, but might be in the near term. It would be quite difficult for Comcast and future entrants to reach a Coasian bargain—some of them do not even exist yet! In brief, Comcast's actions also have consequences for long-run innovative incentives by other application providers.

In that sense, Comcast's behavior had many less appealing aspects, such as its lack of transparency, and the lack of participation from others in decision making, as well as its virtually one-sided negotiating stance with all other application providers and lack of clear statements about its own actions,[113] until the FCC intervened.[114] Moreover, the firm's initially

113. ELECTRONIC FRONTIER FOUNDATION, PACKET FORGERY BY ISPS: A REPORT ON THE COMCAST AFFAIR, http://www.eff.org/wp/packet-forgery-isps-report-comcast-affair.

114. Formal Complaint of Free Press and Public Knowledge Against Comcast

inflexible public stance appeared to be aimed at shaping the willingness of others to experiment. Arguably, if it persisted, it would also shape proposals for new applications using new standards, and entrepreneurial initiatives whose businesses depended on Comcast's actions. It is not obviously healthy for innovation to give Comcast's management unchecked discretion to make take-it-or-leave-it offers to providers of any application its management believes harms users.

Here, once again, the FCC's principles fall short of being guidelines. They do not direct attention towards the salient issues in several new areas of application development or an analysis that takes into account the signs of innovative health. An entrepreneur's returns on investments will depend on their ability to transmit data over Comcast's lines. The key question is: does the lack of rules for Comcast's behavior encourage or discourage entrepreneurship in new applications? In my view this example illustrates that the absence of a clear limitation to Comcast's discretion reduces investment incentives for any entrepreneur who anticipates putting their application over Comcast's lines.

Both these examples illustrate one additional aspect in which the FCC principles fall short of being guidelines. Both cases raise general issues that are likely to arise again, perhaps with different participants, perhaps in different locations. In neither case do the FCC principles translate into clear, positive behavioral guidelines for the firms under scrutiny. While there are implications for what not to do, there is scant, positive guidance for what to do.

Imagine the discussion taking place within the management at Comcast and Cogent, or any other firm who wants to learn lessons from watching the actions of these firms. When making their tactical strategies, they surely must be asking: What sort of behavior will generate a positive/negative policy response? By what norms for consistent, transparent, and participatory decision making, if any, will this firm's actions be judged? They had little information from which to forecast policy.

Consistency and transparency are virtues for policy making. If only the FCC elaborated on their meaning in publically available guidelines, these firms could anticipate what potential issues their own actions might trigger. That is the benefit of guidelines that go beyond four sentences. Guidelines remove impediments to anticipating the reaction of policy makers to a firm's actions. That might not improve the quality of decision makers, but almost certainly it will reduce the likelihood of running afoul of well reasoned guidelines, clearly articulated in advance. That has to improve the quality of managerial action.

Corporation for Secretly Degrading Peer-to-Peer Applications, *Memorandum Opinion & Order*, 23 FCC Rcd. 13,028 (Aug. 20, 2008).