APPENDIX A:

MAKING THE NETWORK CONNECTION

Excerpt from

Open Architecture as Communications Policy

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NETWORK THEORY

It is easy to look at the powerful technologies that have converged in the digital communications platform and assume that they are the engines of change. This is particularly the case in the presence of positive feedback loops. In this section I argue that the architecture of the network in which they have become embedded is at least as important. The technologies themselves would not be as powerful nor would the effect on the rest of society be as great if the platform had not evolved as an ultrarobust network. This section describes some of the key elements in the understanding of networks that has been emerging across a number of disciplines in the physical and social sciences. There are three primary reasons for turning to this literature.

First, the fact that science is finding a basic set of principles explaining the success of networks ranging from cells and simple life forms to the human brain and social institutions, like firms and social movements, highlights the importance of network principles. The architecture of the network dictates its robustness. The digital communications platform I have just described is a layered set of networks that exhibits particularly robust characteristics.

Second, individual networks are frequently part of a larger physical organism or social organization. In other words, networks of networks create larger systems. The digital communications platform is a critically important technology network that deeply affects the social, economic and political structure of society.

Third, the social scientific application of network theory has been policy oriented in the sense that it seeks to identify characteristics of social networks that can be changed to improve their robustness. The theory emphasizes success and failure based on the ability and willingness of institutions to adopt structures that adapt to changing environments and new challenges.

COMPLEX NETWORKS

Networks are built from nodes (or endpoints) connected through communications links.

Interconnectivity is a critical feature of networks. It prevails because "most systems displaying a high degree of tolerance against failures share a common feature: their functionality is guaranteed by a highly interconnected network."[76] Simply put, it "seems that nature strives to achieve robustness through *interconnectivity*."[77] Robust networks are typified by the formation of hubs: "the few highly connected nodes that keep these networks together."[78]

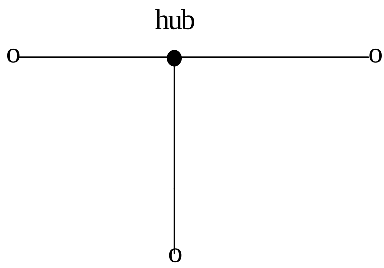
o————————o————————o
node   link   node.....link   node

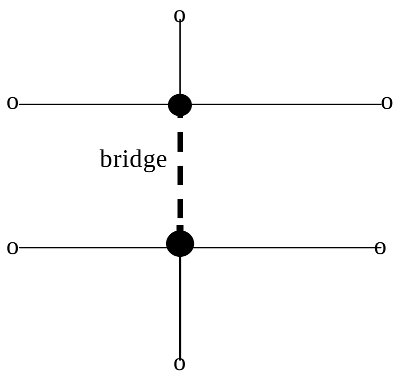
The links between hubs are especially important as bridges that hold the network together.

In robust networks, hubs and links form modules.[79] Modules share strong internal ties and specialize in discrete functions, but have weak ties to the rest of the network through links between hubs. Modularity implies a division of labor. That is, specialization allows modules to provide functions efficiently in the network.[80]

The modules in a robust network are hierarchically organized:

> Numerous small, but highly interlinked modules combine in a hierarchical fashion to a few larger, less interlinked modules…. Hierarchical modularity sheds new light on the role of the hubs





> as well: they maintain communication between the modules. Small hubs have links to nodes belonging to a few smaller modules. Large hubs… [are] bridging together communities of different sizes and cultures.[81]

Networks grow and establish structures according to rules that foster efficient structures. Hubs form because of preferential attachment,[82] but links are not added randomly because "building and maintaining new ties…leaves individuals less time for production; hence both congestion and ties are costly."[83]

Networks can be designed in various ways depending on the pattern of the links. The links can be connected in various ways including centralized (Figure 3a), decentralized (Figure 3b), and distributed (Figure 3c).

Networks gain robustness by creating links that reduce effort. Duncan Watt calls them shortcuts. The dictionary definition of a shortcut captures the essence of the process: "a method of doing or achieving something more directly and easily than by ordinary procedure… to make the work more simple and easy."[84] Watts notes that "[a]n obvious approach is to bypass the overtaxed node by creating a shortcut, thus rechanneling the congestion through an additional network tie."[85]

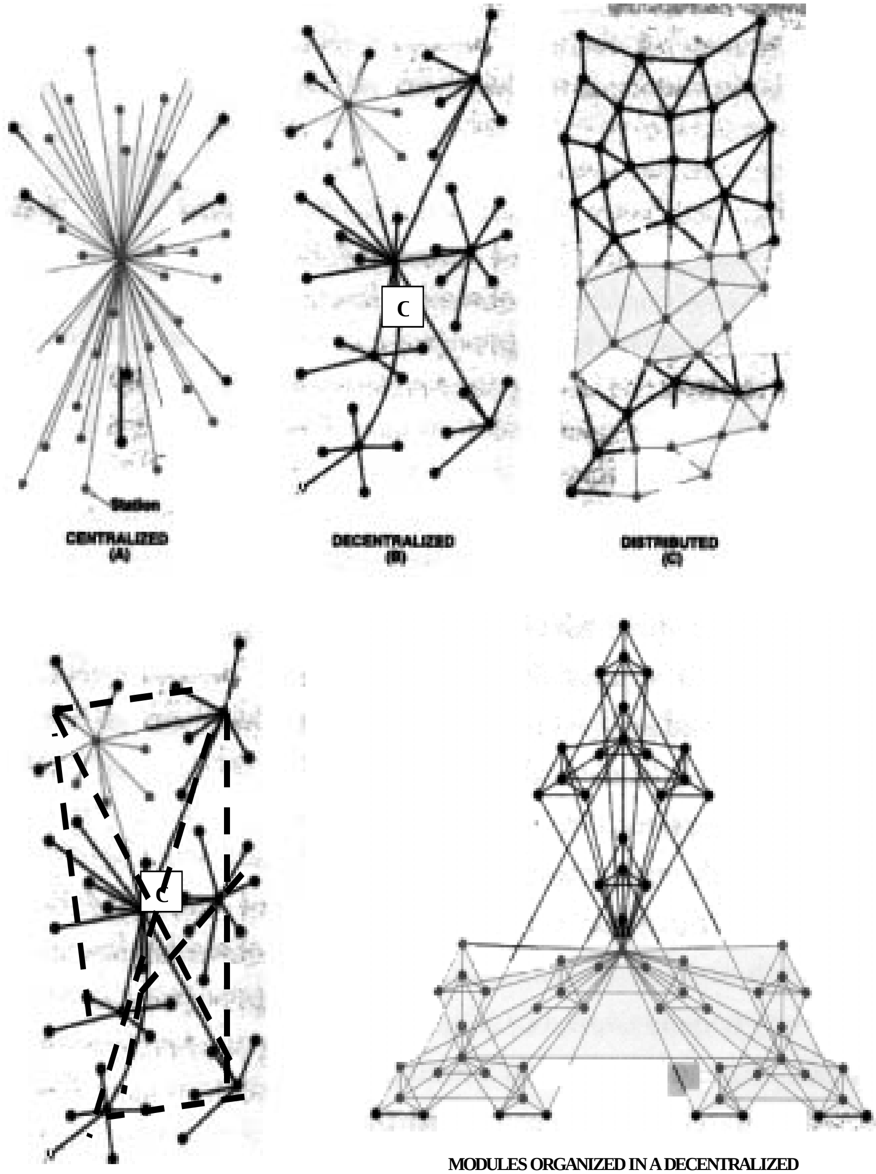
But, which links are most important to forge?[86] The answer that emerges is familiar to anyone who has studied the Internet: distributing communications increases efficiency. The expenditure of time and effort (energy) are critical factors in efficient structures. Watt's theoretical analysis finds that "[t]he addition of a single shortcut contracted the paths between many distant pairs of nodes simultaneously, thereby effectively reducing congestion along many long chains of intermediaries."[87] Buchanan notes that this is a pervasive principle: "Whatever the setting, computation requires information to be moved about between different places. And since the number of degrees of separation reflects the typical time needed to shuttle information from place to place, the small-world architecture makes for computational power and speed."[88]

> [T]he burden of any particular node can be relieved by the greatest possible amount by connecting the neighbors for whom it relays the most messages… Because the strategy always selects the most congested node to relieve, and because the nodes that it connects were handling those messages anyway, the effect is always to reduce overall congestion without increasing any individual's burden.[89]

We might call this the principle of distributed efficiency. There is a tension between preferential affiliation, in which hubs gain links, and distributed efficiency, in which important shortcuts bypass hubs that have become congested or overburdened and allow nodes to communicate. Nevertheless, the value of distributed efficiency can be easily identified.

Figure 3d adds distributed efficiency links (dashed lines) into a decentralized hub-dominated network. Buchanan calls the links between hubs "bridges," drawing on Mark Granovetter's observation that "weak links are often of greater importance than strong links because they are the crucial ties that sew the social network together."[90]

Figure 3:
Network Configurations



DECENTRALIZED AND DISTRIBUTED
(D)

MODULES ORGANIZED IN A DECENTRALIZED AND DISTRIBUTED HIERARCHICAL NETWORK
(E)

Sources: Barabasi, Albert-Laszlo, *Linked* (New York: Plume, 2002), A-C = p. 145, E = p. 233;

Important shortcuts (bridges) meet the criteria of reducing traffic between neighboring hubs that are already in communication through a third hub. By adding bridges to the decentralized network, it gains the characteristics of a distributed network. The example in Exhibit 3d has the following characteristics:

(1) By adding links at the periphery, congestion of the core is reduced. Communications capabilities are distributed to the nodes or end points.

(2) The additional links can relieve a great deal of traffic that had flowed through the central hub (c). Therefore, the network should have the necessary resources to free up to form the new links.

(3) Moreover, as configured, if module (c) is removed or rendered inoperative, all clusters could communicate with one another, a condition that did not obtain in the purely decentralized network.

(4) Under routine functioning, no node is separated by more than two degrees (one link, one bridge) from any other hub.

(5) Under stress, should any module be removed, no node is more than three steps (one link, two bridges) from any other hub.

(6) No matter how many modules are taken out, all the remaining nodes can continue to communicate although it becomes more difficult since each communication must traverse more bridges.

While we tend to "see" networks as nodes and hubs and measure them by counting the quantity or assessing the quality of messages that flow between them, the architecture of the network is dictated by the rules of communications and connectivity. In the robust, efficient network, information flows because it can (connectivity) and should (functionality). The architecture makes the observed pattern of communications between nodes and hubs possible.

The Architecture of Ultrarobust Networks

Watts describes a special characteristic of robust networks that result from balancing these architectural principles as <u>multiscale connectivity,</u>

and the network architecture that exhibits superior performance as an ultrarobust network. He describes the importance of multiscale connectivity in terms of avoiding or recovering from failure and also in facilitating success:

> Multiscale connectivity, therefore, serves not just one but two purposes that are essential to the performance of a firm in uncertain environments. By distributing the information congestion associated with problem solving across many scales of the organization, it minimizes the likelihood of failure [maximizes the chances for success]. And *simultaneously* it minimizes the effect of failures [maximizes the impact of successes] if and when they do occur… Because they exhibit this two-for-the-price-of-one robustness property, we call multiscale networks ultrarobust.[91]

The hierarchical, modular network that exhibits both decentralized and distributed communications traits allows experimentation at the periphery, without threatening the functionality of the network (see Figure 3e). Failure is not catastrophic; since it can be isolated and its impact minimized. Success can be pursued independently and exploited because of efficient communications. Successful nodes grow more rapidly through preferential attachment.

> Hierarchical modularity has significant design advantages. It permits parts of the network to evolve separately… The impact of genetic mutations [experimentation or innovation], affecting at most a few genes at once, is limited to a few modules. If a mutation is an improvement, the organism with the superior module will flourish. If, however, tinkering with a gene decreases the module's fitness, the organism will fail to survive.[92]

Watts goes on to identify searchability as a critical and "generic property of social networks."[93] Searchability is facilitated by paying attention to one's neighbors (chosen by preferential attachment).[94] As he puts it: "By breaking the world down the way we do – according to multiple simultaneous notions of social distance – and by breaking the search process itself down into manageable phases, we can solve what seems to be a tremendously difficult problem with relative ease."[95]

Searchability is one of the key advantages of multiscale networks because "in ambiguous environments, information congestion related to problem-solving activities causes individuals – especially those higher in the hierarchy – to become overburdened. The local response of these individuals is to direct their subordinates to resolve problems on their own by conducting directed searches."[96] Watts argues that "[w]hen problem solving is purely local, requiring messages to be passed between members of the same work team, for example, or subscribers to the same ISP, congestion can be relieved effectively by a process that corresponds to *team building*."[97]

> Lacking a central directory of organizational knowledge and resources, the subordinates rely on their informal contacts within their firm (or possibly in other firms) to locate relevant information… A direct consequence is that the internal architecture of the firm is driven away from that of a pure hierarchy by virtue of the new links that are being formed and consolidated over many repeated searches.
>
> The equilibrium state of this process is a multiscale network for the simple reason that only when the network is connected across multiple scales is individual congestion – hence the pressure to create new connections – relieved… the process of ties at multiple scales also renders the network highly searchable, so that the multiscale state becomes effectively reinforcing.[98]

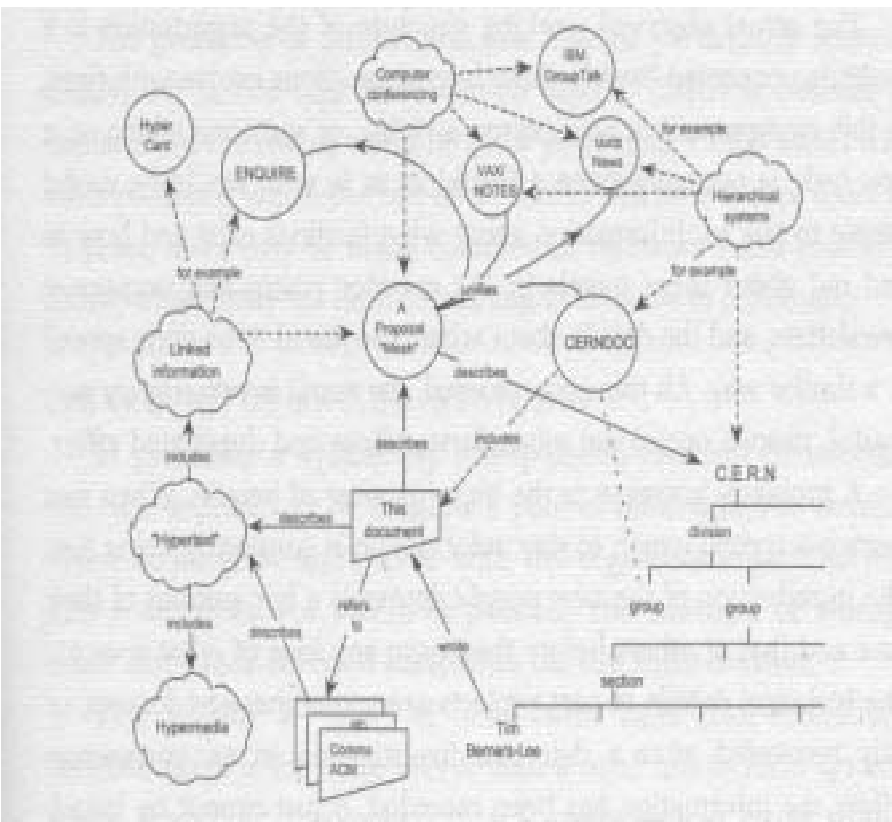
Albert Barabasi notes that the Internet "evolves based on local decisions on an as needed basis… The underlying network has become so distributed, decentralized, and locally guarded that even such an ordinary task as getting a central map of it has become virtually impossible."[99] Figure 4 presents a picture of what the publisher's note refers to as "the original proposal for the World Wide Web."[100] It is a module in the larger network whose function is to organize resources to manage information. It exhibits all of the characteristics of the networks I have described. It has hierarchy based on preferential affiliation (e.g. the "proposal mesh") with both decentralized clusters and bridges to achieve distributed efficiency. Note that not all bridges are built between hubs, reflecting the author's understanding of how information flows within the module. Only some bridges need to be built.

I have pointed out that several of the key components of the digital communications platform – the telecommunications facility, the appliance (PC), and the communications protocols (Internet and the web) – were open. The PC itself is considered a "platform," whose complementary elements exist in an open architecture. The Internet is a "stack" of protocols whose architecture is open. In other words, the digital communications platform is a nested set of open components that exhibit an unprecedented level of connectivity. It exhibits the modular, hierarchical, distributed, multiscale connectivity of an ultrarobust network.

INNOVATION IN HIGH TECHNOLOGY INDUSTRIES

Figure 4:

The Original Proposal For The World Wide Web



Sources: Berners-Lee, Tim, with Mark Fischetti, *Weaving the Web: the Original Design and Ultimate Destiny of the World Wide Web* (New York: Harper Business, 1999), p. 211.

THE TECHNOLOGY OF TECHNICAL CHANGE

Networks are critical to innovation, which "spreads from innovators [nodes] to hubs. The hubs in turn send the information out along their numerous links, reaching most people within a given… network."[101] Most importantly, "the structure of the network can have as great an influence on the success or failure of an innovation as the inherent appeal of the innovation itself."[102] The same tension exists for innovation as exists for all problems confronted by the network. "[T]he success of an innovation appears to require a trade off between local reinforcement and global connectivity."[103]

> Networks that are not connected enough, therefore, prohibit global cascades because the cascade has no way of jumping from one vulnerable cluster to another. And networks that are too highly connected prohibit cascades also, but for a different reason: they are locked into a kind of stasis, each node constraining the influence of any other and being constrained itself.[104]

Multiscale connectivity in hierarchical, modular architecture is the sweet spot between underconnected and overconnected networks and ideal for problem solving "by making problem solving itself a routine activity."[105] Effective adoption of an innovation or response to a disaster requires the ability to search the network for solutions and synchronize the modules when one is found.[106]

> Routine problem solving both balances the information-processing burden across the individuals of an organization and sets up the conditions under which exceptional problems can be solved.
>
> The precise *mechanism* by which a firm's response to routine ambiguity generates ultrarobustness is, as yet, an unsolved puzzle, but it seems to bear a deep resemblance to the property of network searchability.[107]

I have already suggested the link between the Internet and innovation in the concept of a bearer network. Applying network theory establishes the link between the digital communications platform and the stimulation of innovation with much greater detail. Recent analyses of technological innovation provide strong evidence that the digital communications platform transformed the very fabric of the innovation process of what Arora calls "the changing technology of technical change."[108] Consider the following description of the innovation process:

> von Hippel notes that greater efficiency can be achieved by dividing the overall problem-solving effort into tasks, showing maximal interaction within them and minimal interactions across them. In doing so, one can reduce one fundamental source of inefficiency, notably that actions in one particular innovation stage or activity may require information or even exchanges of actions in several other innovation stages or activities. This is a source of inefficiency because of the extensive coordination and information flow that this process requires and the potential disruptions that may be brought about by these interdependencies… [H]e argues that the development of innovations often relies upon information that is in the domain of different agents (e.g. the user and the manufacturer), and that some of this information can be "sticky" in the sense that it can only be transferred at very high costs to other parties. This information arises from tacit knowledge and the routines that are normally associated with the ordinary activities performed by each agent or organization.[109]

Technological innovation is framed as an information problem that challenges the network structure. There are two hurdles. First, knowledge is local and flowing it through hubs to solve problems creates inefficiency (uses energy). Second, the possibility of failure increases as the number of interrelated problems that must be solved sequentially increases, because of dependence on multiple solutions to problems across numerous nodes.

The solution to the first problem is to distribute responsibility:

> The traditional approach in this type of situation has been to try to move the sticky information…. [S]ystem developers would first undertake a great deal of work at the user site (e.g., a bank or an insurance company) to understand the needs for the system

> to be produced. Once they acquired this information, the developers returned to their company and designed it… [A] more effective approach would be to move the locus of the problem-solving effort. The user and the producer could then draw only upon their own local and idiosyncratic information sets, without having to move between locations.[110]

The parallel to the network problem is quite strong. Efficiency in technological innovation comes by breaking the problem down and solving it at the "local" level because local information is the ultimate source of the solution. The solution is efficient as long as one economizes on the need to flow information up through the hierarchy. When problem solving moves to the local level, the cluster must become modular. Modularity plays the same role in the context of technological innovation as it does in the broader network theory.

The solution to the second problem – sequential challenges – emerges from modularity with open interfaces. It loosens the dependence on simultaneous solutions to multiple problems:

> Modularity is a key component in a system of open architecture. Modularity in product design has received some attention in recent years due to its perceived advantages for innovation, particularly in view of shorter product life cycles, which reduce time-to-market and the growing value of product customization…
>
> This had natural implications for innovation. Most notably, provided one did not change the required interfaces, a great deal of innovation could take place in the components without requiring redesign of other components or of the entire architecture.[111]

The local nature of the robust network is not confined to the internal organization of firms. It extends to the network environment in which the firm exists. Silicon Valley has been described as a matrix,[112] essentially a multiscale network of firms of various sizes in which sticky knowledge spreads through links that "fall somewhere between market and firm. These hybrid links are most easily formed where interfirm relations are close, the lines between them dense."[113] The effect of "this sort of density is particularly important in fast-changing areas of the economy, in which all partners to a venture need to be able to change in coordinated fashion."[114] The proximity also facilitates modularity and specialization since "density... also allows people to differentiate finely between different firms, finding the most apt for a particular task or idea."[115] Key to the unbundling[116] of the production process is "the region's culture of open information exchange and interfirm mobility, which fosters a culture of recombination and new firm formation."[117] "Much of this innovative activity is less associated with footloose multinational corporations and more associated with high-tech innovative regional clusters, such as Silicon Valley, Research Triangle and Route 122."[118]

The most successful firms and regions take on the characteristics of layered multiscale networks:

> The sum of these associations is a vast network composed of many small networks of contributors to the Valley's process for innovation and entrepreneurship… Tight links built up over time by the rich accumulation of shared conversations, projects, and deals have yielded a treasure trove of rich and productive relationships…
>
> The prevailing philosophy of Silicon Valley promotes openness and learning, sharing of information, the co-evolution of ideas, flexibility, mutual feedback, and fast responses to opportunities and challenges… a regional network-based industrial system that promotes collective learning and flexible adjustment among specialist producers of complex related technologies.[119]

A Broad-Based, Transformative Revolution

The technological revolution of the late twentieth century has altered the information environment to make distributed solutions more feasible. The uniquely user-focused character of the communications-intensive Internet solution recurs.

Eric von Hippel argues that "the primary irreversible factor that we speculate is making user-based design an increasingly attractive option is technological advance."[120] Ashish Arora et al. note that "the recent evolution of technology and knowledge bases… has created greater opportunities for task portioning."[121] This allows greater local autonomy in decision-making:

> Specifically, the main force behind the changing technology of technical change is the complementarity between increased computational power and greater scientific and technological understanding of problems.[122]
>
> Advances in scientific understanding decrease the costs of articulating tacit and context-dependent knowledge and reduce the costs of technology transfer. Further, such knowledge can be embodied in tools, particularly software tools, which make the knowledge available to others cheaply and in a useful form… [A]dvances in science and the tremendous increase in computational capabilities have greatly contributed to extending the division of innovative labor.[123]

Arora et al. argue that the "changing technology of technical change" allows technological innovation to move outside the firm; others argue that the form of organization changes as well:

> [M]odularity in product design brings about modular organizations… the standard interfaces of a modular design provide a sort of "embedded coordination" among independent firms and innovators, which can coordinate their activities independently of a superior managerial authority. … [M]odular systems that are also open (i.e., where the interfaces are not proprietary standards) make market leaders more vulnerable to competition. While modularity can accelerate overall product innovation, because of the contribution of several specialists, the presence of many specialists can also lead to tougher competition and greater entry.[124]

As hierarchical modularity in the network replaces vertically integrated hierarchy in the firm, complex digital platform industries have benefited from open network approaches: "The open system approach fuels the growth of many smaller innovative firms. The presence of several firms for each subsystem or component, and the narrow focus pursued by each firm will lead to higher degrees of experimentation and innovation with a faster rate of technical progress."[125] Vertical integration and extreme hierarchical structure lose their comparative advantage in the context of open digital communications networks, while modular flexibility and connectivity gain significant advantage:

> Cross-functional interaction must take place concurrently, rather than sequentially, if firms are to cut time-to-market for new products and processes. Cross-functional and cross-departmental networks must be strengthened without causing information overload… If such activity becomes completely unstructured, it augments rather than displaces bureaucracy… With organizational sub-units cross-linked in this way, authority flows as much from knowledge as position in the organizational hierarchy. The challenge is to develop a culture which supports the establishment of cross-functional teams which draw on the requisite knowledge, wherever it may be located.[126]

The rewards to modules and networks that restructure effectively are clear. There is "a strong causal link between productivity gains in the ICT sector and a spread of these productivity improvements throughout the economy via investment in ICT capital."[127]

> When we turn to the assertion that rigorous industrial restructuring in the pre-1990 period may have been beneficial to economic performance, we find that a lack of restructuring indeed appears to have affected economic growth of industries adversely, probably especially for the case of high tech industries… [M]anufacturing industries, especially high tech industries with relatively high speed of restructuring have, *ceteris paribus,* performed best.[128]

Pinpointing the Key Technologies

While the overall thrust of network theory suggests that multiscale connectivity promotes ultrarobust networks, and the digital communications platform is the architecture that holds it together, it also leaves open the optimal mix between hierarchical networks and hierarchical firms.[129] What are the characteristics of technologies that are critical to broad-based progress? It is not hard to find the key to which technologies are important to make available. Arora et al. identify two situations in which the exploitation of available technologies and innovative opportunities can be problematic because private actions are not likely to achieve the optimal outcome. These are essentially collective action challenges.

First there is a strong "public goods" character to information and knowledge.

> The key here is that the knowledge has multiple potential applications, so that users do not compete. When knowledge is nonrival, protecting that knowledge through patents creates potential inefficiencies… A number of different potential users may have to get together to invest in creating knowledge. Such contracts are problematic because users will differ in the value they place upon the enterprises and, consequently, are likely to underreport their value.[130]

Second are transaction costs problems "in cumulative or systemic technologies," because "a commercializable innovation may require many different pieces of knowledge some of which may be patented and owned by people with conflicting interests."[131] This is the platform problem, where many complements must interoperate to achieve the full value of the platform:

> In a Coasian world with no transaction costs, given any initial distribution of property rights over the fragments, agents will bargain to a Pareto optimal solution. More realistically, the required collection of the property rights, although socially efficient, might not occur because of transaction costs and hold-up problems. An agent holding a patent on an important fragment ("blocking patent") may use the patent in an attempt to extract as much of the value of the innovation as possible…
>
> In other words, when several pieces of intellectual property have to be combined, the transaction costs implied could be so high as to prevent otherwise productive combinations.[132]

We could look to a variety of high technology industries to find examples of this process, but we should not be surprised to find that the best examples come from the components of the digital information platform. Interconnection and interoperability to maximize the availability of functionality have been the hallmarks of the open architecture of the digital communications platform.

> Things are different when a firm invests in developing a new platform interface…These are *enabling technologies.* They contain valuable content or information that probably could have value (i.e. price) in the marketplace. But protecting that content, such as by hiding the detailed specifications of the hardware or software interfaces, would defeat their entire *raison d'etre:* Interfaces exist to entice other firms to use them to build products that conform to the defined standards and therefore work efficiently with the platform.[133]

Intel's approach to platform leadership has been widely recognized and it provides a perfect example of the importance of open architecture. Intel "made a decision pretty early on that what we wanted was something that was *open* and *royalty-free* that the industry could adopt without huge concerns about infringing IP [intellectual property] or having to pay high royalties."[134] The distinction from standard-setting bodies is clear. "Generally, their policy is that any interface IP that is introduced into a specification has to be licensed under 'reasonable and non-discriminatory terms.' But 'reasonable' is a very subjective term."[135]

Intel imposed a further requirement of reciprocity: "anyone who would have access to [our] IP – if they had any [of their own] in that area – would have to make their IP open and available to the industry as well."[136]

Of course, Intel was not the only company to arrive at platform leadership as the key to dynamic innovation. The "Silicon Valley system" is described as one "where relationships are based on a shared recognition of the need to ensure the success of a final product. Traditional supplier relationships are typically transformed by a decision to exchange long-term business plans and share confidential sales forecasts and cost information."[137]

In short, "where informal connections are dense and the mysteries of practice are in the air, the inefficiencies that keep ideas within isolated firms, hedged in by intellectual property strategies and closely related, are less of a constraint on mobility."[138]

It is interesting to reflect on the factors that drove Intel to its aggressive approach to platform leadership. The PC had been an open platform throughout its existence, but IBM had chosen that path out of expediency, rather than a conviction about the superiority of an open platform. Caught behind in the shift from mainframes to PCs, IBM was forced to outsource development and supply of many components of the PC to get to market quickly. Open architecture was the answer, but IBM's commitment to the concept was weak.

> IBM was attempting to evolve the PC architecture in a proprietary manner with a new bus project: MCA. That strategy was in line with IBM trying to maintain (or more precisely, to revert to) a "vertical" industry: that is a structure of industry competition where highly integrated firms made most of their own components and competed on the merits of distinctive, proprietary architecture…
>
> Intel, by contrast, did not try to benefit from proprietary architectural interface for the PC. Instead, the company made sure that the new specification was free and open to everyone… It was in Intel's best interest for all PC manufacturers and developers of complementary products to plug their products together in the same way to make development of complements as easy and cheap as possible.[139]

A similar sequence of events played out in the development of the Internet's most important application, the World Wide Web. As the Internet moved out of the laboratory and into the commercial market, the specter of a closed interface arose. Tim Berners-Lee describes it as follows:

> It was about this time, spring 1993, that the University of Minnesota decided it would ask for a license fee from certain classes of users who wanted to use gopher. Since the gopher software was being picked up so widely, the university was going to charge an annual fee. The browser, and the act of browsing, would be free, and the server software would remain free to nonprofit and educational institutions. But any other users, notably companies, would have to pay to use gopher software.
>
> This was an act of treason in the academic community and the Internet community. Even if the university never charged anyone a dime, the fact that the school had announced it was reserving

the right to charge people for use of the gopher protocols meant it had crossed the line. To use the technology was too risky.

Industry dropped gopher like a hot potato. Developers knew they couldn't do anything that could possibly be said to be related to the gopher protocol without asking all their lawyers first about negotiating rights… It was considered dangerous as an engineer to have even read the specification or seen any of the code, because anything that person did in the future could possibly be said to have been in some way inspired by the private gopher technology.[140]

Open architecture is a powerful, but fragile design principle.

ENDNOTES

[76] Albert-Laszlo Barabasi, LINKED (2002), Barabasi, LINKED, *supra* note 8, at 110.

[77] *Id.*, at 110.

[78] *Id.*, at 113.

[79] *Id.*, at 232.

[80] The biological analogy is strong here, since "cells sustain a multitude of functions – i.e., multitask – thanks to a discrete modular organization… [T]he network behind the cell is fragmented into groups of diverse molecules, or modules, each module being responsible for a different cellular function." (Barabasi, LINKED, *supra* note 8, at 231).

[81] Barabasi, LINKED, *supra* note 8, at 236.

[82] Barabasi, LINKED, *supra* note 8, at 86.

[83] Duncan Watts, SIX DEGREES: THE SCIENCE OF A CONNECTED AGE (2003).at 277.

[84] WEBSTER'S THIRD NEW INTERNATIONAL DICTIONARY (1986), at 2102.

[85] *Id.*, at 277.

[86] *Id.*, at 277.

[87] *Id.*, at 277.

[88] Mark Buchanan, NEXUS: SMALL WORLDS AND THE GROUNDBREAKING THEORY OF NETWORKS (2002); at 58.

[89] Watts, SIX DEGREES, *supra* note 8, at 279.

[90] Buchanan, NEXUS, *supra* note 8, at 43.

[91] Watts, SIX DEGREES, *supra* note 8, at 286.

[92] Barabasi, LINKED, *supra* note 8, at 236.

[93] Watts, SIX DEGREES, *supra* note 8, at 279-80.

[94] Searchability in problem solving implies another characteristic of the network, feedback. Steven Johnson, EMERGENCE: THE CONNECTED LIVES OF ANTS, BRAINS, CITIES AND SOFTWARE (2001), at 134, frames the explanation in terms of neural networks asking, "why do these feedback loops and reverberating circuits happen?"

[95] Watts, SIX DEGREES, *supra* note 8, at 56.

[96] *Id.*, at 288.

[97] *Id.*, at 279.

[98] *Id.*, at 288.

[99] Barabasi. LINKED, *supra* note 8, at 148.

[100] Tim Berners-Lee, WEAVING THE WEB: THE ORIGINAL DESIGN AND ULTIMATE DESTINY OF THE WORLD WIDE WEB BY ITS INVENTOR (1999), at 211.

[101] Barabasi, LINKED, *supra* note 8, at 129).

[102] Watts, SIX DEGREES, *supra* note 8, at 244.

[103] *Id.*, at 230-231.

[104] *Id.*, at 241.

[105] *Id.*, at 287.

[106] Buchanan, NEXUS, *supra* note 8, at 69.

[107] Watts, SIX DEGREES, *supra* note 8, at 287.

[108] Ashish Arora, Andrea Fosfuri and Alfonso Gamardella, MARKETS FOR TECHNOLOGY: THE ECONOMICS OF INNOVATION AND CORPORATE STRATEGY (2001), at 112.

[109] *Id.*, at 106.

[110] *Id.*, at 106.

[111] *Id.*, at 103. The efficient solution emerges in a direct analogy to the biological cell. "A work cell is a small group of technical and human resources closely located and dedicated to processing a family of similar parts, products, information deliverables or services." Comparing work cells to an assembly line underscores the critical superiority of modular design. Real cells have "more flexibility in that they can produce a range of service or products within a family… [and] normally perform a broader range of tasks." They are a "hybrid that combines the focus of an assembly line with the flexibility of a job shop functional arrangement."

> [A] "real cell" links tasks and those who perform them in terms of space, time, and information.
>
> *Space Linkages:* Cell resources must be located closely together. Moreover proximal human and technical resources must include all the necessary skill sets and processing capabilities a product or service family will require…
>
> *Time Linkages:* both the physical layout of the cell and its operating routines must permit work to flow expediently from one station to the next…
>
> *Information Linkages:* A cell should be configured and operated such that information about the work being processed flows easily.

[112] Brown John Seely & Paul Duguid, *Mysteries of the Region: Knowledge Dynamics in Silicon Valley*, in THE SILICON VALLEY EDGE: A HABITAT FOR INNOVATION AND ENTREPRENEURSHIP (Chong-Moon Lee, William F. Miller, Marguerite Gong Hancock & Henry S. Rowen, eds., 2000), at 29.

[113] *Id.*, at 31-32.

[114] *Id.*, at 32.

[115] *Id.*, at 32.

[116] Annalee Saxenian, *The Origins and Dynamics of Production Networks in Silicon Valley*, in UNDERSTANDING SILICON VALLEY (Martin Kenney, ed., 2000), at 144.

[117] Id., at 145.

[118] David B. Audretsch & Charles F. Bonser, *Regional Policy in the New Economy*, in THE NEW ECONOMY AND ECONOMIC GROWTH IN EUROPE AND THE US (David B. Audretsch & Paul J.J. Welfens, eds., 2002), at 130.

[119] Chong-Moon Lee, William F. Miller, Marguerite Gong Hancock & Henry S. Rowen, "The Silicon Valley Habitat," in THE SILICON VALLEY EDGE: A HABITAT FOR

INNOVATION AND ENTREPRENEURSHIP (Chong-Moon Lee, William F. Miller, Marguerite Gong Hancock & Henry S. Rowen, eds., 2000), at 6.

[120] Von Hippel, at 642.

[121] Arora, *supra* note 108, at 112.

[122] *Id.*, at 112.

[123] *Id.*, at 113.

[124] *Id.*, at 104-105.

[125] *Id.*, at 255.

[126] David J. Teece, MANAGING INTELLECTUAL CAPITAL (2000), at 71.

[127] Werner Roger, *Structure Changes and New Economy in the EU and the US,* in THE NEW ECONOMY AND ECONOMIC GROWTH IN EUROPE AND THE US (David B. Audretsch & Paul J.J. Welfens, eds., 2002), at 18.

[128] Mark A. Carree, *The Effect of Restructuring the Organization of Production on Economic Growth*, in THE NEW ECONOMY AND ECONOMIC GROWTH IN EUROPE AND THE US (David B. Audretsch & Paul J.J. Welfens, eds., 2002), at 205… 210.

[129] Arora, *supra* note 108, at 113.

[130] *Id.*, at 263.

[131] *Id.*, at 263.

[132] *Id.*, at 263-64.

[133] Annabelle Gawer & Michael A. Cusumano, PLATFORM LEADERSHIP: HOW INTEL, MICROSOFT AND CISCO DRIVE INNOVATION (2002), at 55-56.

[134] Id., at 55.

[135] *Id.*, at 51.

[136] *Id.*, at 52.

[137] Saxenian, *The Origin and Dynamic, supra* note 115, at 148.

[138] Brown & Duguid, *Mysteries of the Region, supra* note 111, at 32.

[139] Gawer and Cusimano, PLATFORM LEADERSHIP, *supra* note 132, at 28-29.

[140] Berners-Lee, WEAVING THE WEB, *supra* note 22, at 72-73.

APPENDIX B:

V. ANTICOMPETITIVE PROBLEMS OF CLOSED COMMUNICATIONS FACILITIES

Excerpt from
Open Architecture as Communications Policy

Mark Cooper, Editor

(Center for Internet and Society, Stanford Law School,2004)

Collective action problems and positive externalities have been identified as critical justifications for public policies that promote open communications platforms. In this Chapter I argue that the heightened potential for negative, anticompetitive actions by private parties who have a dominant position at key locations of the platform also provides the basis for policies to defend the open architecture of the platform. Antitrust authorities reviewing mergers or evaluating complaints of anticompetitive conduct and Communications Act authorities considering obligations of interconnection and universal service must consider anticompetitive conduct because dominant firms in the critical layers of the platform may have the incentive and ability to protect and promote their interests at the expense of competition and the public.

The discussion starts with a framework for economic analysis of the digital communications platform that emphasizes the potential for new and more harmful types of anticompetitive behavior in platform industries. It shows that firms that own and control key layers of the platform can undermine competition, distort the architecture of the platform and slow innovation. By describing threats to the open architecture of the digital communications platform, the paper endeavors to create a broader understanding of the nature and role of networks that will convince policymakers to reconsider the decision to allow proprietary discrimination to undermine the open architecture of the digital communications platform. After outlining the theoretical concerns, I review complaints offered by major players in the industry. The analytic framework for anticompetitive concerns in the network industries is then applied to the case of Internet Service Providers, who were impacted severely as the openness of the digital communications platform was reduced as it moves from narrowband to broadband.

THE THREAT OF MARKET POWER

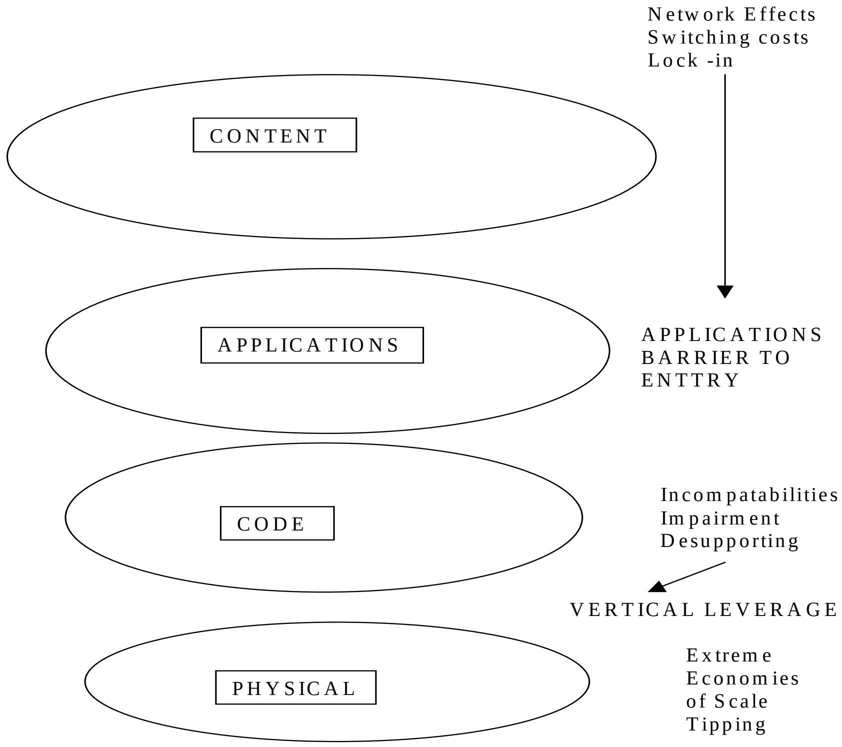
The vertical nature of the digital communications platform raises new concerns about these anticompetitive behaviors. Competition within a given layer, the equivalent of traditional horizontal competition, can take place without competition across layers.[1] The type of behavior across layers is very important, both because it can promote dynamic change and because it can involve powerful anticompetitive leverage. If it is procompetitive, it can move the whole platform to a higher level of production. If it is anticompetitive, it can be very dangerous. It can pollute a competitive layer and it can undermine the best basis for introducing competition in a layer that had not hitherto been competitive.

In old economy industries, vertical leverage is exploited by business practices. Companies vertically integrate to internalize transactions. Where concerns about vertical integration have traditionally been raised, they focus on integration for critical inputs across markets. Vertically integrated companies may withdraw business from the open market, driving up the cost of inputs for competitors, or deny supply to the market.[2] If they constitute a large share of the market or refuse to buy or sell intermediate inputs (or raise the costs to rivals) the impact can be anticompetitive. By integrating across stages of production, incumbents can create barriers to entry by forcing potential competitors to enter at more than one stage, making competition much less likely due to increased capital requirements.[3] Exclusive and preferential deals for the use of facilities and products compound the problem. They “reduce the number of alternative sources for other firms at either stage, [which] can increase the costs of market or contractual exchange."[4] Integrated firms can impose higher costs on their rivals, or degrade their quality of service to gain an advantage. "[F]or example, the conduct of vertically integrated firms increase[s] risks for nonintegrated firms by exposing downstream specialists to regular or occasional price squeezes."[5] Vertical integration facilitates price squeezes and enhances price discrimination.[6]

The platform nature of digital communications creates unique new sources of vertical leverage (see Figure 1). The physical and code layers that lie at the bottleneck of the platform makes threats to the openness of the network very potent. They have great leverage because of their critical location. In a platform industry, vertical leverage can take a more insidious

Figure 1

Unique Characteristics Of Communications Platforms That Raise Special Market Power Concerns



form, technological integration/manipulation.[7] Introduction of incompatibilities can impair or undermine the function of disfavored complements. The ability to undermine interoperability or the refusal to interoperate is an extremely powerful tool for excluding or undermining rivals and thereby short circuiting competition, as is the withholding of functionality. The mere threat of incompatibility or foreclosure through the refusal to interoperate can drive competitors away.

The dominant players in the physical and code layers have the power to readily distort the architecture of the platform to protect their market interests.[8] They have a variety of tools to create economic and entry barriers[9] such as exclusive deals,[10] retaliation,[11] manipulation of standards,[12] and strategies that freeze customers.[13] Firms can leverage their access to customers to reinforce their market dominance[14] by creating ever-larger bundles of complementary assets.[15] As the elasticity of demand declines over the course of the product life cycle, market power lodged in the physical layer results in excessive bundling[16] and overpricing of products under a variety of market conditions.[17] Control over the product cycle can impose immense costs by creating incompatibilities,[18] forcing upgrades,[19] and by spreading the cost increases across layers of the platform to extract consumer surplus.[20]

Scale and scope economies may be so strong in the critical layers of the platform that they may give rise to a unique characteristic of a market called tipping. Interacting with network effects and the ability to set standards, the market tips toward one producer. Firms seek to accomplish technological "lock-in."[21] These processes create what has been called an 'applications barrier to entry.' After capturing the first generation of customers and building a customer base, it becomes difficult, if not impossible, for later technologies to overcome this advantage.[22] Customers hesitate to abandon their investments in the dominant technology and customer acquisition costs rise for latecomers.

This creates an immense base of monopsony power for dominant players in the critical layers. I use the term monopsony broadly to refer to the ability to control demand. If a firm is a huge buyer of content or applications or can dictate which content reaches the public through control of a physical or code interface (a cable operator that buys programming or an operating system vendor who bundles applications), it can determine the fate of content and applications developers. In fact, network effects are also known as demand side economies of scale. To the extent that a large buyer or network owner controls sufficient demand to create such effects, particularly in negotiating with sellers of products, they have monopsony power.

These anti-competitive behaviors are attractive to a dominant new economy firm for static and dynamic reasons.[23] Preserving market power in the core market by erecting cross-platform incompatibilities that raise rivals' costs is a critical motivation. Preventing rivals from achieving economies of scale can preserve market power in the core product and allow monopoly rents to persist. Profits may be increased in the core product by enhanced abilities to price discriminate. Conquering neighboring markets has several advantages. By driving competitors out of neighboring markets, market power in new products may be created or the ability to preserve market power across generations of a product may be enhanced by diminishing the pool of potential competitors.

The growing concern about digital information platform industries derives from the fact that the physical and code layers do not appear to be very competitive.[24] There are not now nor are there likely to be a sufficient number of networks deployed in any given area to sustain vigorous competition. Vigorous and balanced competition between operating systems has not been sustained for long periods of time.

Most communications markets have a small number of competitors. In the high speed Internet market, there are now two main competitors and the one with the dominant market share has a substantially superior technology.[25] When or whether there will be a third, and how well it will be able to compete, is unclear. This situation is simply not sufficient to sustain a competitive outcome.

Confronted with the fact that the physical and code layers have very few competitors, defenders of closed, proprietary platforms argue that monopoly may be preferable. As the FCC put it, "[s]ome economists, most notably Schumpeter, suggest that monopoly can be more conducive to innovation than competition, since monopolists can more readily capture the benefits of innovation."[26] Thus, some argue that facility owners, exercising their property rights to exclude and dictate uses of the network, will produce a more dynamic environment than an open communications platform.[27] The hope is that a very small number of owners engaging in the rent seeking behavior of innovators will stimulate more investment, and that this enlightened self-interest will probably convince them to open their network. Notwithstanding the clear success of the open communications platform,[28] and the demonstrated unwillingness of incumbent facility owners to open their platforms when they are not required to do so,[29] monopoly proponents tell us that the next generation of the

Internet cannot succeed under the same rules of open communications that were responsible for its birth.

This argument is conceptually linked to long-standing claims that "firms need protection from competition before they will bear the risks and costs of invention and innovation, and a monopoly affords an ideal platform for shooting at the rapidly and jerkily moving targets of new technology."[30] Lately this argument is extended to claims that, in the new economy, "winner take all" industries exhibit competition for the entire market, not competition within the market. As long as monopolists are booted out on a regular basis, or believe they can be, monopoly is in the public interest.[31]

In a sense, this argument is a return to the pre-Internet logic of communications platforms, in which it is assumed that the center of value creation resides in the physical layer.[32] The contrast with the demonstrated impact of freeing the code and content layers to innovate and add value, while running on top of an open physical layer, could not be more dramatic.

The theory supporting Schumpeterian rents appears to be particularly ill-suited to several layers of the digital communications platform. It breaks down if the monopoly is not transitory, a likely outcome in the physical layer. In the physical layer, with its high capital costs and other barriers to entry, monopoly is more likely to quickly lead to anticompetitive practices that leverage the monopoly power over bottleneck facilities into other layers of the platform.

The theory has also been challenged for circumstances that seem to typify the code and applications layers of the Internet platform.[33] The monopoly rent argument appears to be least applicable to industries in which rapid and raucous technological progress is taking place within the framework of an open platform, as has typified the Internet through its first two decades.[34] The "winner take all" argument was firmly rejected in the Microsoft case.[35] The Internet seems to fit the mode of atomistic competition much better than the creative monopolist rent-seeking model, as did the development and progress of its most important device, the PC.[36]

One of the most important factors in creating a positive feedback process is openness in the early stages of development of the platform.[37] In order to stimulate the complementary assets and supporting services, and to attract the necessary critical mass of customers, the technology must be open to adoption and development by both consumers and suppliers.[38] This openness captures the critical fact that demand and consumers are interrelated.[39] If the activities of firms begin to promote closed technologies,[40] this is a clear sign that motivation may have shifted.[41] While it is clear in the literature that a company's installed base is important, it is not clear that an installed base must be so large that a single firm can dominate the market. Schumpeter's observation deals with the issue of the size of the firm, so that it achieves economies of scale, not the market share of the firm. As long as platforms are open, the installed base can be fragmented and still be large.[42] In other words, a large market share is not synonymous with a large market.[43] A standard is not synonymous with a proprietary standard.[44] Open platforms and compatible products are identified as providing a basis for network effects that are at least as dynamic as closed, proprietary platforms[45] and much less prone to anti-competitive conduct.[46]

FROM THEORY TO PRACTICE

The emerging model for closed communications platforms is one in which the firm with a dominant technology at the central layers of the platform can leverage control to achieve domination of applications and content. Given the hourglass shape of the platform, the critical layers are at the waist of the platform. Proprietary control of network layers in which there is a lack of adequate alternatives allows owners to lock in consumers and squeeze competitors out of the broader market. The observable behavior of the incumbent wire owners contradicts the theoretical claims made in defense of closed platforms. The track record of competition in the physical facilities of telephony and cable certainly should not be a source of encouragement for those looking for dynamic Schumpeterian monopolists.[47] For the last several decades of the 20th century, general analysis concerning vertical integration in market structure was muted. However, a number of recent mergers in the communications industries, between increasingly larger owners of communications facilities, have elicited vigorous analysis of the abuse of vertical market power (e.g. Comcast/AT&T/MediaOne/TCI, AOL/Time Warner/Turner, SBC Communications Inc. (SBC)/Ameritech/SNET/Pacific Bell and Bell Atlantic/GTE/NYNEX).[48] As one former antitrust official put it, "[t]he increasing number of mergers in high-technology industries has raised both horizontal and vertical antitrust issues . . . the interest in and analysis of vertical issues has come to the forefront.[49]

The behavioral analysis in this section relies on a variety of analyses and complaints from participants in the sector including AT&T as a long distance carrier, before it became a cable owner, [50] AOL as an ISP, before it became a cable owner,[51] analyses prepared by experts for local[52] and long distance[53] telephone companies, when they were not effectuating mergers of their own, Wall Street analyses of the business models of dominant, vertically integrated cable firms,[54] and observations offered by independent ISPs[55] and small cable operators.[56]

Current theoretical literature provides an ample basis for concerns that the physical layer of the communications platform will not perform efficiently or in a competitive manner without a check on market power. In this layer, barriers to entry are substantial, and go far beyond simple entrepreneurial skills that need to be rewarded.[57] At the structural level, new entry into these physical markets is difficult. AOL argued that the small number of communications facilities in the physical layer can create a transmission bottleneck that would lead directly to the problem of vertical leverage or market power. "[A] vertically integrated broadband provider such as AT&T will have a strong incentive and opportunity to discriminate against unaffiliated broadband content providers."[58]

Problems caused by vertical integration are particularly troubling in communications markets because a communications provider with control over essential physical facilities can exploit its power in more than one market. For example, a local voice service provider with control over physical transmission can provide vertically integrated digital subscriber line (DSL) service, preventing competition from other Internet providers over the same network.[59] At the same time, the company can bundle its voice services with the DSL service. Cable can bundle video with other services. Consumers may be more likely to choose the communications service that can provide for all of their needs, thereby inhibiting competition in the voice market as well. Whether we call them essential facilities,[60] choke points[61] or anchor points,[62] the key leverage point of a communications network is controlling access to facilities.

> The key, after all, is the ability to use "first mile" pipeline control to deny consumers direct access to, and thus a real choice among, the content and services offered by independent providers. Open access would provide a targeted and narrow fix to this problem. AT&T simply would not be allowed to control consumer's ability to choose service providers other than those AT&T itself has chosen for them. This would create

> an environment where independent, competitive service providers will have access to the broadband "first mile" controlled by AT&T – the pipe into consumers' homes – in order to provide a full, expanding range of voice, video, and data services requested by consumers. The ability to stifle Internet-based video competition and to restrict access to providers of broadband content, commerce and other new applications thus would be directly diminished.[63]

Experts for the local telephone companies, in opposing the merger of AT&T and MediaOne, made this point arguing that "the relevant geographic market is local because one can purchase broadband Internet access only from a local residence"[64] and that "a dominant market share is not a necessary condition for discrimination to be effective."[65] "[A] hypothetical monopoly supplier of broadband Internet access in a given geographic market could exercise market power without controlling the provision of broadband access in neighboring geographic markets."[66]

The essential nature of the physical communication platform was the paramount concern for AT&T long distance in determining interconnection policy for cable networks in Canada.[67] AT&T attacked the claim made by cable companies that their lack of market share indicates that they lack market power, arguing that small market share does not preclude the existence of market power because of the essential function of the access input to the production of service.[68] AT&T further argued that open access "obligations are not dependent on whether the provider is dominant. Rather they are necessary in order to prevent the abuse of market power that can be exercised over bottleneck functions of the broadband access service."[69]

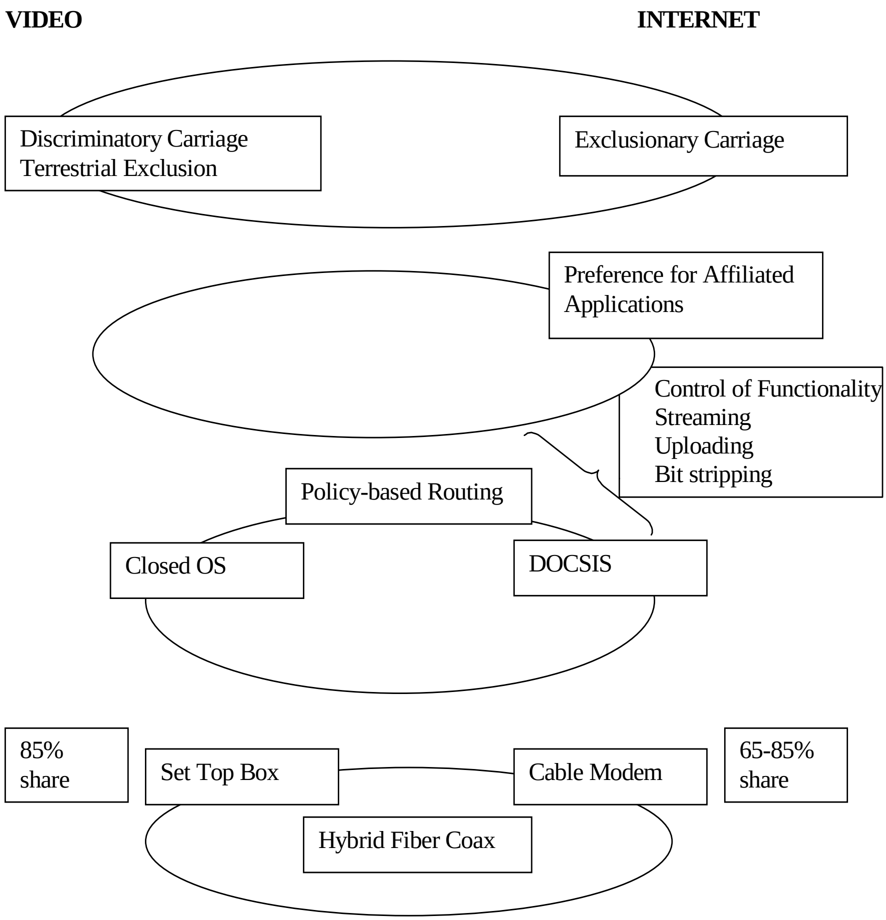
AT&T maintained that the presence of a number of vertically integrated facilities owners does not solve the fundamental problem of access that nonintegrated content providers face, pointing out that since independent content providers will always outnumber integrated providers, competition could be undermined by vertical integration. In order to avoid this outcome, even multiple facilities owners must be required to provide non-discriminatory access.[70] This also applies in the ISP arena. AOL also believed that the presence of alternative facilities did not eliminate the need for open access (see Figure 2).[71]

Two or three vertically integrated facilities in the broadband arena will not be enough to ensure vigorous competition.[72] It is also important to note the consensus that cable is the dominant and preferred technology.[73] Cable's advantages are substantial, and DSL is not likely to be able to close the gap.[74]

Content discrimination has been the focal point of concern in relation to high-speed Internet services. Content discrimination involves an integrated provider "insulating its own affiliated content from competition by blocking or degrading the quality of outside content."[75] It benefits the vertically integrated

Figure 2:

Anti-Consumer/ Anticompetitive Elements Of The Cable Industry Communications Platform



entity "by enhancing the position of its affiliated content providers in the national market by denying unaffiliated content providers critical operating scale and insulating affiliated content providers from competition."[76]

AT&T identified four forms of anticompetitive leveraging—bundling, price squeeze, service quality discrimination, and first mover advantage.[77] It describes the classic vertical leveraging tools of price squeezes and quality discrimination as content discrimination. The experts for the local telephone companies identified a similar series of tactics that a vertically integrated broadband provider could use to disadvantage competing unaffiliated content providers.

> First, it can give preference to an affiliated content provider by caching its content locally. . . Such preferential treatment ensures that affiliated content can be delivered at faster speeds than unaffiliated content.
>
> Second, a vertically integrated broadband provider can limit the duration of streaming videos of broadcast quality to such an extent that they can never compete against cable programming . . .Third, a vertically integrated firm such as AT&T or AOL-Time Warner could impose proprietary standards that would render unaffiliated content useless. . .Once the AT&T standard has been established, AT&T will be able to exercise market power over customers and those companies trying to reach its customers.[78]

Even after AT&T became the largest cable TV company in the U.S., its long distance division criticized local telephone companies for abusing their monopoly control over their telephone wires. AT&T complained about bottleneck facilities, vertical integration, anticompetitive bundling of services, and the distortion of competition when it opposed the entry of SBC into the long distance market in Texas.[79] These are the very same complaints AOL made about AT&T as a cable company at about the same time.[80] AOL expressed related concerns about the manipulation of technology and interfaces, complaining about "allowing a single entity to abuse its control over the development of technical solutions – particularly when it may have interests inconsistent with the successful implementation of open access… It is therefore vital to ensure that unaffiliated ISPs can gain access comparable to that the cable operators choose to afford to its cable-affiliated ISP.[81]

Long distance companies and competitive local exchange carriers have similar concerns about the merging local exchange carriers. Their experts argued in the proposed SBC-Ameritech and Bell Atlantic-GTE mergers that large size gave network owners an incentive to discriminate. "The economic logic of competitive spillovers implies that the increase in [incumbent local exchange carrier (ILEC)] footprints resulting from these proposed mergers would increase the ILECs' incentive to disadvantage rivals by degrading access services they need to compete, thereby harming competition and consumers."[82]

Wall Street analysts point out that the key to controlling the supply side is controlling essential functions through proprietary standards.[83] Independent ISPs point out that cable operators like AOL use control over functionalities to control the services available on the network.[84] Cable operators have continued to insist on quality of service restrictions by unaffiliated ISPs, which places the ISPs at a competitive disadvantage.[85] Cable operators must approve new functionalities whether or not they place any demands on the network.[86]

Price squeeze and extraction of rents are apparent in the implementation of closed platforms. Thomase Hazlett and George Bittlingmayer cite Excite@Home executive Milo Medin describing the terms on which cable operators would allow carriage of broadband Internet to AOL (before it owned a wire) as follows:

> I was sitting next to [AOL CEO] Steve Case in Congress during the open access debates. He was saying that all AOL wanted was to be treated like Excite [@]Home. If he wants to be treated like us, I'm sure he could cut a deal with [the cable networks], but they'll take their pound of flesh. We only had to give them a 75 percent equity stake in the company and board control. The cable guys aren't morons.[87]

In the high speed Internet area, conduit discrimination has received less attention than content discrimination. This is opposite to the considerable attention it receives in the cable TV video service area. Nevertheless, there are examples of conduit discrimination in the high speed Internet market.

In implementing conduit discrimination, the vertically integrated company would refuse to distribute its affiliated content over competing transmission media.[88] In so doing, it seeks to drive consumers to its transmission media and weaken its rival. This is profitable as long as the revenue gained by attracting new subscribers exceeds the revenue lost by not making the content available to the rival. Market size is important here, to ensure adequate profits are earned on the distribution of service over the favored conduit.[89] Although some argue that "the traditional models of discrimination do not depend on the vertically integrated firm obtaining some critical level of downstream market share,"[90] in reality, the size of the vertically integrated firm does matter since "a larger downstream market share enhances the vertically integrated firm's incentive to engage in discrimination."[91]

AT&T has been accused of conduit discrimination in the high speed Internet market.[92] The AOL-Time Warner merger has also raised similar concerns. The significance of AOL's switch to cable-based broadband should not be underestimated. This switch has a powerful effect on the hoped-for competition between cable modems and DSL.[93] Although telephone companies are reluctant to admit that their technology will have trouble competing, their experts have identified the advantages that cable enjoys.[94] Fearing that once AOL became a cable owner it would abandon the DSL distribution channel, the FTC required AOL to continue to make its service available over the DSL conduit.[95]

The focal point of a leveraging strategy is bundling early in the adoption cycle to lock in customers. AOL has also described the threat of vertically integrated cable companies in the U.S.[96] Once AT&T became the largest vertically integrated cable company selling broadband access in the U.S., it set out to prevent potential competitors from offering bundles of services. Bundles could be broken up either by not allowing Internet service providers to have access to video customers, or by preventing companies with the ability to deliver telephony from having access to high-speed content. For the Wall Street analysts, bundling seems to be the central marketing strategy for broadband.[97]

AOL argued that requiring open access early in the process of market development would establish a much stronger structure for a pro-consumer, pro-competitive market.[98] Early intervention prevents the architecture of the market from blocking openness, and thus avoids the difficult task of having to reconstruct an open market at a later time.[99] AOL did not hesitate to point out the powerful anticompetitive effect that integrating video services in the communications bundle could have. AOL argued that, as a result of a vertical merger, AT&T would take an enormous next step toward its ability to deny consumers a choice among competing providers of integrated voice/video/data offerings – a communications marketplace that integrates, and transcends, an array of communications services and markets previously viewed as distinct.[100]

Wall Street saw the first mover advantage both in the general terms of the processes that affect network industries, and in the specific advantage that cable broadband services have in capturing the most attractive early adopting consumers.[101] First mover advantages have their greatest value where consumers have difficulty switching or substituting away from the dominant product.[102] Several characteristics of broadband Internet access are conducive to the first mover advantage, or "lock-in."

The local telephone companies have outlined a series of concerns about lock in.[103] High-speed access is a unique product.[104] The Department of Justice determined that the broadband Internet market is a separate and distinct market from the narrowband Internet market.[105] There are switching costs that hinder competition, including equipment (modems) purchases, learning costs, and the inability to port names and addresses. Combining a head start with significant switching costs raises the fear among the independent ISPs that consumers will be locked in. In Canada, AT&T argued that the presence of switching costs could impede the ability of consumers to change technologies, thereby impeding competition.[106]

THE MONOPOLIZATION OF THE HIGH-SPEED INTERNET

The high degree of control and foreclosure of the broadband platform was encapsulated in a term sheet offered by Time Warner to Internet Service Providers. Time Warner sought to relieve the severe pressures of a merger review before policymakers had officially abandoned the policy of nondiscrimination by offering to allow unaffiliated ISPs to compete for Internet access service over their last mile facilities. Complete foreclosure was to be replaced with severe discrimination. There in black and white are all the levers of market power and network control that stand to stifle innovation on the Internet. Time Warner demanded the following:

(1) Prequalification of ISPs to ensure a fit with the gatekeeper business model
(2) Applying ISPs must reveal sensitive commercial information as a precondition to negotiation
(3) Restriction of interconnecting companies to Internet access sales only, precluding a range of other intermediary services and

functions provided by ISP to the public (e.g. no ITV [interactive TV] functionality)

(4) Restriction of service to specified appliances (retarding competition for video services)

(5) Control of quality by the network owner for potentially competing video services

(6) Right to approve new functionalities for video services

(7) A large nonrefundable deposit that would keep small ISPs off the network

(8) A minimum size requirement that would screen out niche ISPs

(9) Approval by the network owner of the unaffiliated ISP's home page

(10) Preferential location of network owner advertising on all home pages

(11) Claim by the network owner to all information generated by the ISP

(12) Demand for a huge share of both subscription and ancillary revenues

(13) Preferential bundling of services and control of cross marketing of services

(14) Applying ISP must adhere to the network operator's privacy policy.[107]

Under these conditions, the commercial space left for the unaffiliated and smaller ISPs is sparse and ever shrinking.[108] It took tremendous courage to put the Term Sheet in the public record in violation of the nondisclosure agreements that Time Warner had demanded,[109] especially in light of the threats and actions that the dominant cable operators have hurled at those who challenge their proprietary plans.[110]

At one time or another these "conditions" were written into a contract with a service provider or a consumer service agreement or were implemented in the network. In comments at the Federal Communications Commission, the High Tech Broadband Coalition noted "troubling evidence of restrictions on broadband consumers' access to content, applications and devices."[111] From the point of view of the technical design features of the Internet that unleashed the dynamic forces of innovation, the fact that these negotiations must take place at all is the truly chilling proposition.

The largest ISP, AOL, capitulated to the cable monopolists as part of the effort to untangle its holdings with AT&T, which was being acquired by Comcast. After a five-year struggle for carriage, AOL signed a three-year contract for access to less than one-half of Comcast's[112] lines under remarkably onerous conditions.[113] AOL agreed to pay $38 at wholesale for a service that sells for $40 in the cable bundle. It allowed Comcast to keep control of the customer and to determine the functionality available. It apparently agreed to a no–compete clause for video. As AOL put it, the deal turned the high-speed Internet into the equivalent of a premium cable channel, like HBO. Nothing could be farther from the Internet as it was.

Why did AOL agree? It was desperate for carriage. You cannot be a narrowband company in a broadband world, and DSL just does not cut it. The AOL-Comcast agreement punctuates a seven-year policy of exclusion. The deal with Comcast only allowed AOL to negotiate with the individual cable franchises for carriage, but AOL never reached the specific agreements that are necessary to actually deliver the service to consumers. Ultimately AOL gave up on the approach.[114]

Although telephone companies ostensibly have been required to provide access to their advanced telecommunications networks, they have made life miserable for the independent ISPs.[115] A major source of potential discrimination lies in the architecture of the network. The technical capabilities of the network controlled by the proprietor can be configured and operated to disadvantage competitors.

ISPs have identified a range of ways the dominant telephone companies impede their ability to interconnect in an efficient manner. The proprietary network owner can seriously impair the ability of competitors to deliver service by restricting their ability to interconnect efficiently and deploy or utilize key technologies that dictate the quality of service. Forcing independent ISPs to connect to the proprietary network or operate in inefficient or ineffective ways or giving affiliated ISPs preferential location and interconnection can result in substantial discrimination. Similarly, forcing competitive local exchange carriers (CLECs) to make digital to analog to digital conversions to implement cross connects raises costs. The result is a sharp increase in the cost of doing business or degradation of the quality of service.

Refusing to peer with other ISPs and causing congestion by "deliberately overloading their DSL connections by providing them with insufficient bandwidth from the phone company's central offices to the Internet"[116] creates a roadblock that forces ISPs to enter into expensive transport arrangements for traffic.[117] Refusing to guarantee quality of service to unaffiliated ISPs and imposition of speed limits[118] has the effect of restricting the products they can offer.[119] The network owners then add insult to injury by forcing ISPs to buy bundles of redundant services,[120] preventing competitors from cross connecting to one another,[121] restricting calling scopes for connection to ISPs,[122] and refusing to offer a basic service arrangement or direct connection to the network.[123] The effect is to undermine competition and restrict service offerings.[124]

The most critical architectural decisions are to impose network configurations that prevent competition for the core monopoly service, voice.[125] This bundling of competitive and noncompetitive services places competitors at a disadvantage.[126] Ironically, Cox complains that it is being discriminated against when incumbent telephone monopolists bundle voice and data, while it pursued a similar exclusionary tactic with respect to the bundling of video and data.[127] Independent ISPs have pointed out that their ability to offer voice is being frustrated by architectural decisions that deny them the ability to offer the voice/data bundle.[128] Moreover, incumbents are reserving the right to offer additional services, like video, over lines for which independent ISPs are the Internet access service provider.[129]

The price squeeze that AOL was subject to in its agreement with Comcast was similar to that imposed by both the cable modem and DSL network owners. The price for access to the network is far above costs and leaves little margin for the unaffiliated ISP.[130] The margins between the wholesale price ISPs are forced to pay and the retail price affiliated ISPs charge are as small as $1 on the telephone network.[131] For cable networks, the margins are as low as $5. In other words, independent ISPs are forced to look at margins in the single digits and never much above 20 percent. Cable and telephone company margins for these services are well in excess of 40 percent.[132]

Consumers pay a price too. With costs falling[133] and demand lagging in the midst of a recession, both cable operators and telephone companies raised prices. Cable companies imposed a severe interruption of service on their customers, which, in a highly competitive market, would have been suicidal.[134] In 2003, Comcast, the dominant high-speed modem service provider, raised the price of stand-alone cable modem service by $10 to $15 per month. In 2003, some of the Bell companies offered discounts, but the cable companies refused to respond to telephone company pricing moves. DSL service is not competitive on price on a megabit basis. Since DSL cannot compete on a quality-adjusted basis, the cable operators ignore it. Their advertising harps on their speed superiority. With the dominant technology insulated from cross-technology competition and operating a closed network, cable companies have strategically priced their digital services. This becomes quite apparent to any consumer who tries to buy the service in the marketplace. If a consumer adds a digital tier, the charge would be an additional $15 on average. If a consumer adds cable modem service, the consumer must pay $45 ($55 to $60 if basic cable is not taken). Moreover, if the consumer wants to keep an unaffiliated ISP, the charge is an additional $15. The resulting price is too high and dampens adoption.

ENDNOTES

[1] Michael L. Katz & Carl Shapiro, *System Competition and Network Effects*, 8 J. Econ. Perspectives 93, 105-6 (1994), argue that competition between incompatible systems is possible, depending on consumer heterogeneity. Paul Belleflamme, *Stable Coalition Structures with Open Membership and Asymmetric Firms*, 30 Games & Econ. Behavior 1, 1-3 (2000), and Berd Woeckener, *The Competition of User Networks: Ergodicity, Lock-ins, and Metastability*, 41 J. Econ. Behavior & Org. 85, 86-7 (2000), reach a similar conclusion in a different theoretic framework. Timothy F. Bresnahan & Shane Greenstein, *Technological Competition and the Structure of the Computer Industry*, 47 J. Industrial Econ. 1, 5-8 (1999), envision a great deal of competition within the layers of a platform and across layers in relatively short periods of time. The description of IBM's mainframe platform provided by Franklin M. Fisher, *The IBM and Microsoft Cases: What's the Difference?*, 90 Am. Econ. Rev. 180, 183 (1999), stresses both these points. See also Daniel L. Rubinfeld, *Antitrust Enforcement in Dynamic Network Industries,* 43 Antitrust Bull. 859, 873-75 (1998); Willow A. Sheremata, *New Issues in Competition Policy Raised by Information Technology Industries,* 43 Antitrust Bull. 547, 573-74 (1998); Timothy Bresnahan, *The Economics of the Microsoft Case* (available from the author); Steven C. Salop and R. Craig Romaine, *Preserving Monopoly: Economic Analysis, Legal Standards, and Microsoft*, Geo. Mason L. Rev. (1999).

[2] William G. Shepherd, The Economics of Industrial Organization (3d ed., 1990), at 289-90.

[3] *See* Martin K. Perry, *Vertical Integration: Determinants and Effects*, in Handbook of Industrial Organization (Richard Schmalensee & Robert D. Willigs, eds., 1989), at 183, 247; F. Michael Scherer & David Ross, Industrial Market Structure and Economic Performance (1990), at 526.

[4] Martin K. Perry, *Vertical Integration: Determinants and Effects*, in Handbook of Industrial Organization (Richard Schmalensee & Robert D. Willigs, eds., 1989), at 246; s*ee* also William G. Shepherd, The Economics of Industrial Organization (3d ed. 1990), at 294.

[5] Scherer & Ross, Industrial Market Structure, *supra* note 3, at 526.

[6] Other behavior effects may occur, for example, collusion, mutual forbearance and reciprocity may exist where the small number of interrelated entities in the industry recognize and honor each others' spheres of influence. The final behavioral effect is to trigger a rush to integrate and concentrate. Being a small independent entity at any stage renders the company extremely vulnerable to a variety of attacks. *See* Shepherd, Economics, *supra* note 4, at 290.

[7] Richard N. Langlois, *Technology Standards, Innovation, and Essential Facilities: Toward a Schumpeterian Post-Chicago Approach*, in Dynamic Competition & Pub. Policy: Technology, Innovations, and Antitrust Issues (Jerry Ellig, ed., 2001), *available at http://papers.ssrn.com/sol3/papers.cfm?abstract_id=204069* (last visited Jan. 24, 2003) at 52, "The owner of a dominant standard may thus want to manipulate the standard in ways that close off the possibilities for a competitor to achieve compatibility. This has a tendency to retard the generational advance of the system."

[8] *See id. See* also Franklin M. Fisher, *Innovation and Monopoly Leveraging,* in DYNAMIC COMPETITION AND PUBLIC POLICY: TECHNOLOGY, INNOVATION, AND ANTITRUST ISSUES 138 (Jerry Ellig, ed., 2001).

[9] *See* Joseph Farrell & Garth Saloner, *Installed Base and Compatibility: Innovation, Product Preannouncements, and Predation,* 76 AM. ECON. REV. 940, 948-51 (1986); Michael L. Katz & Carl Shapiro, *Product Introduction with Network Externalities*, 40 J. INDUS. ECON. 55, 73 (1992); Richard Makadok, *Can First-Mover and Early-Mover Advantages Be Sustained in an Industry with Low Barriers to Entry/Imitation?*, 19 STRATEGIC MGMT. J. 683, 685-86 (1998); Ulrich Witt, *"Lock-in" vs. "Critical Masses"–Industrial Change Under Network Externalities,* 15 INT'L J. INDUS. ORG. 753, 768-69 (1997); Robin Mansell, *Strategies for Maintaining Market Power in the Face of Rapidly Changing Technologies*, 31 J. ECON. ISSUES 969, 970 (1997).

[10] *See* Melissa A. Schilling, *Technological Lockout: An Integrative Model of the Economic and Strategic Factors Driving Technology Success and Failure*, 23 ACAD. MGMT. REV. 267, 276 (1998).

[11] *See* Willow A. Sheremata, *"New" Issues in Competition Policy Raised by Information Technology Industries*, 43 ANTITRUST BULL. 547, 573-74 (1998); Glenn A. Woroch et al., *Exclusionary Behavior in the Market for Operating System Software: The Case of Microsoft,* in OPENING NETWORKS TO COMPETITION: THE REGULATION AND PRICING OF ACCESS 221 (David Gabel & David F. Weiman, eds., 1998).

[12] Sheremata, *"New" Issues in Competition Policy, supra* note 11, at 560-61; *see* also Charles H. Ferguson, HIGH ST@KES, NO PRISONERS: A WINNER'S TALE OF GREED AND GLORY IN THE INTERNET WARS (1999), at 307; Mark A. Lemley & David McGowan, *Could Java Change Everything? The Competitive Propriety of a Proprietary Standard,* ANTITRUST BULL., 43 (1998), at 715, 732-33; Joseph P. Guiltinan, *The Price Bundling of Services: A Normative Framework*, J. MKTG. 74 (April 1987); Lester Telser, *A Theory of Monopoly of Complementary Goods*, 52 J. BUS. 211 (1979); Richard Schmalensee, *Gaussian Demand and Commodity Bundling*, 57 J. BUS. 211 (1984).

[13] Joseph Farrell & Michael L. Katz, *The Effects of Antitrust and Intellectual Property Law on Compatibility and Innovation*, 43 ANTITRUST BULL. 609, 643-50, (1998); Sheremata, *"New" Issues in Competition Policy, supra* note 11, at 547, 573-74.

[14] Makadok, *First-Mover and Early-Mover Advantages, supra* note 9, at 685.

[15] David B. Yoffie, *CHESS and Competing in the Age of Digital Convergence,* in COMPETING IN THE AGE OF DIGITAL CONVERGENCE (David B. Yoffie, ed., 1997), at 1, 27; *see* also Robert E. Dansby & Cecilia Conrad, *Commodity Bundling*, 74 AM. ECON. REV. 377 (1984).

[16] Carmen Matutes & Pierre Regibeau, *Compatibility and Bundling of Complementary Goods in a Duopoly*, 40 J. INDUS. ECON. 37 (1992).

[17] *See id.*; *see* also Joseph P. Guiltinan, *The Price Bundling of Services: A Normative Framework*, J. MKTG. 74 (April 1987); Lester Telser, *A Theory of Monopoly of Complementary Goods*, 52 J. BUS. 211 (1979); Richard Schmalensee, *Gaussian Demand and Commodity Bundling*, 57 J. BUS. 211 (1984).

[18] Jay Pil Choi, *Network Externality, Compatibility Choice, and Planned Obsolescence*, 42 J. INDUS. ECON. 167, 171-73 (1994).

[19] Glenn Ellison & Drew Fudenberg, *The Neo-Luddite's Lament: Excessive Upgrades in the Software Industry,* 31 RAND J. ECON. 253 (2000); Drew Fudenberg & Jean Tirole, *Upgrades, Trade-ins, and Buybacks*, 29 RAND J. ECON. 235, 235-36 (1998).

[20] *See* K. Sridhar Moorthy, *Market Segmentation, Self Selection, and Product Lines Design,* 3 MKTG. SCI. 256 (1985); Marcel Thum, *Network Externalities, Technological Progress, and the Competition of Market Contract*, 12 INT. J. INDUS. ORG. 269 (1994).

[21] Schilling, *Technological Lockout, supra* note 10, at 267, 268, 270; Willow A. Sheremata, *Barriers to Innovation: A Monopoly, Network Externalities, and the Speed of* Innovation, 42 ANTITRUST BULL. 937, 941, 964, 967 (1997); Robin Cowan, *Tortoises and Hares: Choice Among Technologies of Unknown Merit*, 101 ECON. J. 807, 808 (1991); Dominique Foray, *The Dynamic Implications of Increasing Returns: Technological Change and Path Dependent Efficiency*, 15 INT. J. INDUSTRIAL ORG. 733, 748-49 (1997); Joseph Farrel & Garth Saloner, *Standardization, Compatibility, and* Innovation, 16 RAND J. ECON. 70-83 (1986).

[22] Jeffrey Church & Neil Gandal, *Complementary Network Externalities and Technological Adoption*, 11 INT'L J. INDUS. ORG. 239, 241 (1993); Chou Chien-fu & Oz Shy, *Network Effects Without Network Externalities*, 8 INT'L J. INDUS. ORG. 259, 260 (1990).

[23] See Michael Katz & Carl Shapiro, *Antitrust and Software Markets*, in COMPETITION, INNOVATION AND THE MICROSOFT MONOPOLY: ANTITRUST AND THE DIGITAL MARKETPLACE, (Jeffrey A. Eisenach & Thomas M. Lenard, eds., 1999), at 70-80; Lansuz A. Ordover & Robert D. Willig, *Access and Bundling in High Technology Markets*, in COMPETITION, INNOVATION AND THE MICROSOFT MONOPOLY: ANTITRUST AND THE DIGITAL MARKETPLACE (Jeffrey A. Eisenach & Thomas M. Lenard, eds., 1999); Rubinfeld, *Antitrust Enforcement, supra* note 1, at 877-81; Steven C. Salop, *Using Leverage to Preserve Monopoly*, in COMPETITION, INNOVATION AND THE MICROSOFT MONOPOLY: ANTITRUST AND THE DIGITAL MARKETPLACE (Jeffrey A. Eisenach & Thomas M. Lenard, eds., 1999).

[24] Daniel L. Rubinfeld & John Hoven, *Innovation and Antitrust Enforcement*, in DYNAMIC COMPETITION AND PUBLIC POLICY: TECHNOLOGY, INNOVATION, AND ANTITRUST ISSUES (Jerry Ellig, ed., 2001), at 65, 75-76. T. Randolph Beard, George S. Ford & Lawrence J. Spiwak, *Why ADCo? Why Now: An Economic Exploration into the Future of Industry Structure for the "Last Mile" in Local Telecommunications Markets (*Phoenix Center, November 2001); Computer Science and Telecommunications Board, National Research Council, BROADBAND, BRINGING HOME THE BITS (2002), at 23; 152-154; Anupam Banerjee & Marvin Sirvu, "Towards Technologically and Competitively Neutral Fiber to the Home (FTTH) Infrastructure," paper presented at *Telecommunications Policy Research Conference, 2003; Stagg Newman, "Broadband Access Platforms for the Mass Market,* paper presented at *Telecommunications Policy Research Conference, 2003.*

[25] National Research Council, BROADBAND, *supra* note 24.

[26] Implementation of Section 11 of the Cable Television Consumer Protection and Competition Act of 1992, *Further Notice of Proposed Rulemaking*, 16 F.C.C.R. 17,312, ¶ 36 (2001) (citation omitted). *See also* 47 C.F.R. §§ 21, 73 & 76 (2001).

[27] *See* Phil Weiser, *Networks Unplugged: Toward a Model of Compatibility Regulation Between Communications Platforms* (paper presented at *Telecommunications Policy Research Conference*, Oct. 27, 2001), *at* http://www.arxiv.org/html/cs/

0109070 (last visited Jan. 24, 2003) stating "in markets where more than one network standard battle it out in the marketplace, users can benefit from a greater degree of dynamism."

[28] Lawrence Lessig, THE FUTURE OF IDEAS (2001), Ch. 8.

[29] *Id.*, at Ch. 10.

[30] Scherer & Ross, INDUSTRIAL MARKET STRUCTURE, *supra* note 3, at 31.

[31] *See* Stan J. Liebowitz & Stephen E. Margolis, WINNERS, LOSERS & MICROSOFT: COMPETITION AND ANTITRUST IN HIGH TECHNOLOGY (2001), using the term 'serial monopoly' (as do a bevy of other Microsoft supported experts); Mark Cooper, *Antitrust as Consumer Protection in the New Economy: Lessons from the Microsoft Case*, 52 HASTINGS L.J. 813 (2001) pointing out that there is nothing serial in Microsoft's monopolies. Rather, Microsoft conquers market after market using leverage and anticompetitive tactics, never relinquishing any of its previous monopolies.

[32] Weiser, *Networks Unplugged:*, *supra* note 27, at 29:

> ISPs cannot compete on the core value proposition in a broadband world unless they are offering a facilities-based service that enables them to compete on price and quality with a cable provider of Internet service. To the extent that a cable provider desires to find new marketing channels, it may well strike arrangements with ISPs to assist on that score, but the ISPs are not competing on the core product.
> At best, the ISPs are able to offer differentiated content on the portal screen, added security features, more reliable privacy policies and the like.

[33] Scherer & Ross, INDUSTRIAL MARKET STRUCTURE, *supra* note 3, at 660:

> Viewed in their entirety, the theory and evidence [in support of monopoly power] suggest a threshold concept of the most favorable climate for rapid technological change. A bit of monopoly power in the form of structural concentration is conducive to innovation, particularly *when advances in the relevant knowledge base occur slowly*. But very high concentration has a positive effect only in rare cases, and more often it is apt to retard progress by restricting the number of independent sources of initiative and by dampening firms' incentive to gain market position through accelerated R&D. Likewise, given the important role that technically audacious newcomers play in making radical innovations, it seems important that barriers to new entry be kept at modest levels. Schumpeter was right in asserting that perfect competition has no title to being established as the model of dynamic efficiency. But his less cautious followers were wrong when they implied that powerful monopolies and tightly knit cartels had any strong claim to that title. What is needed for rapid technical progress is a subtle blend of competition and monopoly, with more emphasis in general on the former than the latter, and with the role of monopolistic elements diminishing when rich technological opportunities exist.

[34] Daniel L. Rubinfeld & John Hoven, *Innovation and Antitrust Enforcement,* in DYNAMIC COMPETITION AND PUBLIC POLICY: TECHNOLOGY, INNOVATION, AND ANTITRUST ISSUES 65, 75-76 (Jerry Ellig, ed., 2001).

> One policy implication for antitrust is the need to preserve a larger number of firms in industries where the best innovation strategy is unpredictable. . . . Another implication is . . . that "Technical progress thrives best in an environment that nurtures a diversity of sizes and, perhaps especially, that keeps barriers to entry by technologically innovative newcomers low." . . . A third implication is the awareness that dominant firms may have an incentive to act so as to deter innovative activities that threaten the dominant position.

[35] United States v. Microsoft, 253 F.3d 34, 103 (D.C. Cir. 2001) (*per curiam*); Mark Cooper, *Antitrust as Consumer Protection in the New Economy: Lessons from the Microsoft Case*, 52 HASTINGS L.J. 815-25 (2001).

[36] Langlois, Technology Standards, supra note 7. In the case of the personal computer, the rise of a single dominant – but largely open and nonproprietary – standard focused innovation in modular directions. [I]t is the ensuing rapid improvement in components, including not only the chips but various peripheral devices like hard disks and modems, as well as the proliferation of applications software, that has led to the rapid fall in the quality-adjusted price of the total personal computer system.

[37] Yoffie, *CHESS and Competing,* supra note 15, at 21; *see* also Bresnahan & Greenstein, *Technological Competition*, supra note 1, at 36-37; Katz & Shapiro, *System Competition*, supra note 1, at 103.

[38] Schilling, *Technological Lockout*, *supra* note 10, at 280-81.

[39] Katz & Shapiro, *Antitrust and Software Markets, supra* note 23, at 424.

[40] *See* generally id.; Jay Pil Choi, *Network Externalities, Compatibility Choice and Planned Obsolescence*, 42 J. INDUS. ECON. 167 (1994).

[41] Robin Mansell, *Strategies for Maintaining Market Power in the Face of Rapidly Changing Technologies*, 31 J. ECON. ISSUES 969, 970 (1997).

[42] Schilling, *Technological Lockout*, *supra* note 10, at 274.

[43] Sheremata, *Barriers to Innovation*, supra note 21, at 965.

[44] Carl Shapiro & Hal R. Varian, INFORMATION RULES: A STRATEGIC GUIDE TO THE NETWORK ECONOMY (1999), at 22-23.

[45] Bresnahan & Greenstein, *Technological Competition*, supra note 1, at 36-37; Joseph Farrell & Michael L. Katz, *The Effect of Antitrust and Intellectual Property Law on Compatibility and Innovation*, 43 ANTITRUST BULL. 645, 650 (1998); Katz & Shapiro, *System Competition*, *supra* note 1, at 109-12; Carmen Matutes & Pierre Regibeau, *Mix and Match: Product Compatibility Without Network Externalities*, 19 RAND J. OF ECON. 221-233 (1988).

[46] Lemley & McGowan, *Could Java Change Everything?supra* note 12, at 715; Mark A. Lemley & David McGowan, *Legal Implications of Network Effects*, 86 CAL. L. REV. 479, 516-18 (1998).

[47] *See* Weiser, *Networks Unplugged*, *supra* note 27, at n.136 (suggesting that we "ask whether, 18 years after the rollout of this technology, will consumers benefit from

a number of alternative providers. . ." He then answers the question by looking at the wrong industry (cellular, instead of cable)).

[48] Time Warner Inc., 123 F.T.C. 171 (1997) [hereinafter *Time Warner/Turner/TCI*]. In the Time Warner/Turner/TCI merger analysis, the FTC found that entry into the distribution market was difficult in part because of vertical leverage.

[49] Daniel L. Rubinfeld & Hal. J. Singer, *Open Access to Broadband Networks: A Case Study of the AOL/Time Warner Merger*, 16 BERKELEY TECH. L.J. 631 (2001).

[50] AT&T in Canada before it became the nation's largest cable company. S*ee* AT&T Canada Long Distance Services, *Comments of AT&T Canada Long Distance Services Company*, REGULATION OF CERTAIN TELECOMMUNICATIONS SERVICE OFFERED BY BROADCAST CARRIERS, the Canadian Radio-television and Telecommunications Commission, Telecom Public Notice CRTC 96-36: (1997). The AT&T policy on open access after it became a cable company was first offered in a Letter from David N. Baker, Vice President, Legal & Regulatory Affairs, Mindspring Enterprises, Inc., James W. Cicconi, General Council and Executive Vice President, AT&T Corp., and Kenneth S. Fellman, Esq., Chairman, FCC Local & State Government Advisory Committee, to William E. Kennard, Chairman of FCC (Dec. 6, 1999), *available at* http://www.fcc.gov/mb/attmindspringletter.txt. Virtually no commercial activity took place as a result of the letter, which was roundly criticized. Subsequently their activities were described in Peter S. Goodman, *AT&T Puts Open Access to a Test: Competitors Take Issue with Firm's Coveted First-Screen Presence*, WASH. POST, Nov. 23, 2000, at E1. AT&T in the U.S. in situations where it does not possess an advantage of owning wires, *see AT&T Corp., Reply Comments*, DEPLOYMENT OF WIRELINE SERVS. OFFERING ADVANCED TELECOMMS. CAPABILITY CC Docket No. 98-147 (1998); *see AT&T Corp., Reply comments*, OPPOSITION TO SOUTHWESTERN BELL TEL. CO. SECTION 271 APPLICATION FOR TEX., APPLICATION OF SBC COMMUNICATIONS INC., SOUTHWESTERN BELL TEL. CO., & SOUTHWESTERN BELL COMMUNICATIONS SERVS., INC. D/B/A SOUTHWESTERN BELL LONG DISTANCE FOR PROVISION OF IN-REGION INTERLATA SERVICES. IN TEXAS (2000), *at* `http://gullfoss2.fcc.gov/ prod/ecfs/ comsrch_v2.cgi`.

[51] *See America Online, Inc., Comments*, TRANSFER OF CONTROL OF FCC LICENSES OF MEDIAONE GROUP INC., TO AT&T CORP., CS Docket 99-251 (filed Aug. 23, 1999) (providing, at the federal level, AOL's most explicit analysis of the need for open access); America Online Inc., *Open Access Comments of America Online, Inc.*, before the DEPARTMENT OF TELECOMMUNICATIONS AND INFORMATION SERVICES, SAN FRANCISCO, October 27, 1999 (on file with author).

[52] Jerry A. Hausman, et al., *Residential Demand for Broadband Telecommunications and Consumer Access to Unaffiliated Internet Content Providers,* 18 YALE J. ON REG. (2001).

[53] John B. Hayes, Jith Jayaratne, and Michael L. Katz, *An Empirical Analysis of the Footprint Effects of Mergers Between Large ILECS*, citing "Declaration of Michael L. Katz and Steven C. Salop," submitted as an attachment to PETITION TO DENY OF SPRING COMMUNICATIONS COMPANY L.P, IN AMERITECH CORP. & SBC COMMUNICATIONS, INC., FOR CONSENT TO TRANSFER OF CONTROL, CC Dkt. No. 98-141 (filed Oct. 15, 1998) and PETITION TO DENY OF SPRING COMMUNICATIONS COMPANY L.P, IN GTE CORPORATION AND BELL

Atlantic Corp. for Consent to Transfer of Control, CC Docket. No. 98-184 (filed Nov. 23, 1998) (on file with author).

[54] Sanford C. Bernstein and McKinsey and Company, *Broadband!*, January, 2000 (on file with author); Merrill Lynch, AOL *Time Warner*, February 23, 2000; Paine Webber, *AOL Time Warner: Among the World's Most Valuable Brands,* March 1, 2000; Goldman Sachs, *America Online/Time Warner: Perfect Time-ing*, March 10, 2000 (on file with author).

[55] Earthlink, the first ISP to enter into negotiations with cable owners for access, has essentially given up and is vigorously seeking an open access obligation. *See* Notice of Ex Parte, Presentation Regarding the Applications of America Online, Inc. & Time Warner Inc. for Transfers of Control CS Docket No 00-30 (filed Oct. 18, 2000), *available at* http://gullfoss2.fcc.gov/prod/ecfs/comsrch_v2.cgi; NorthNet, Inc., An Open Access Business Model For Cable Systems: Promoting Competition & Preserving Internet Innovation On A Shared, Broadband Communications Network, Ex Parte, *Application of America Online Inc. & Time Warner, Inc. for Transfers of Control*, F.C.C., CS-Docket No. 0030, October 16, 2000.

[56] *See American Cable Association, Comments*, In Re Implementation of the Cable Television Consumer Protection & Competition Act of 1992, Development of Competition in Video Programming Distribution: Section 628(c)(5) of the Communications Act: Sunset of Exclusive Contract Prohibition, CS Docket No. 01-290 (filed Dec. 3, 2001) *available at* `http://gullfoss2.fcc.gov/prod/ecfs/comsrch_v2.cgi`.

[57] *See* Legal Rights Satellite Org., *Communications Convergence of Broadcasting and Telecommunications Services* (arguing that there were barriers to entry into physical facilities), at http://www.legal-rights.org/Laws/convergence.html (last visited Jan. 17, 2003):

> In the opinion of AT&T Canada LDS, the supply conditions in broadband access markets are extremely limited. There are significant barriers to entry in these markets including lengthy construction periods, high investment requirements and sunk costs, extensive licensing approval requirement (including the requirements to obtain municipal rights-of-way) . . . Under these circumstances, the ability for new entrants or existing facilities-based service providers to respond to non-transitory price increases would be significantly limited, not to mention severely protracted.

[58] Hausman, et al., *Residential Demand for* Broadband, *supra* note 52, at 129, 134.

[59] Mark Cooper, *The Importance of ISPs in The Growth of The Commercial Internet: Why Reliance on Facility-Based Competition Will Not Preserve Vibrant Competition and Dynamic Innovation on the High-Speed Internet*, *Attachment A to Comments of the Texas Office of People's Council, et al.*, Appropriate Framework for Broadband Access to the Internet Over Wireline Facilities Universal Service Obligations of Broadband Providers Computer III Further Remand Proceedings: Bell Operating Company Provision of Enhanced Services; 1998 Biennial Regulatory Review – Review of Computer III and ONA Safeguards and Requirements, Federal Communications Commission, CC Dockets Nos. 02-33, 98-10. 95-20 (July 1, 2002), at 135.

[60] *See* Langlois, *Technology Standards, supra* note 7, at 195.

[61] *See* Mark Cooper, *Open Access to the Broadband Internet: Technical and Economic Discrimination in Closed, Proprietary Networks*, 71 U. COLO. L. REV. 1013 (2000).

[62] Bernstein, *Broadband!*, *supra* note 54, at 18, 21.

> [T]he current set of alternatives for reaching customers with broadband connections is inadequate. At least for the time being, cable is closed, meaning that much of the value is, in effect, ceded to the platform rather than captured by the content/applications providers
> [B]roadband access platforms are the anchor points for much of the value at stake and vehicles for accessing new revenue streams. Furthermore, access is currently a bottleneck, and access winners have the potential to leverage their privilege positioned to ensure long-term value creation.

[63] That is exactly what AOL said about AT&T, when AOL was a nonaffiliated ISP. *See AOL, Transfer of Control*, *supra* note 51, at 13.

[64] Hausman, et al., *Residential Demand for Broadband, supra* note 52, at 135.

[65] *Id.* at 156.

[66] *Id.* at 135.

[67] *AT&T Canada*, *Comments of AT&T Canada*, *supra* note 50, at 12.

> Each of these pronouncements made by regulators, policy makers and individual members of the industry reflects the strongly held view that access to the underlying facilities is not only necessary because of the bottleneck nature of the facilities in question, but also because it is critical for the development of competition in the provision of broadband services. AT&T Canada LDS shares this view and considers the control exercised by broadcast carriers over these essential inputs is an important factor contributing to the dominance of broadcast carriers in the market for access services.

[68] *Id.* at 8-9.

> By contrast, the telephone companies have just begun to establish a presence in the broadband access market and it will likely take a number of years before they have extensive networks in place. This lack of significant market share, however, is overshadowed by their monopoly position in the provision of local telephony services

Id. at 8.

> [I]n any event, even if it could be argued that the telephone companies are not dominant in the market for broadband access services because they only occupy a small share of the market, there are a number of compelling reasons to suggest that measures of market share are not overly helpful when assessing the dominance of telecommunications carriers in the *access* market.

Id. at 9 (emphasis in original).

[69] *Id.* at 24.

[70] *Id*. at 12.

> Because there are and will be many more providers of content in the broadband market than there are providers of carriage, there always will be more service providers than access providers in the market. Indeed, even if all of the access providers in the market integrated themselves vertically with as many service providers as practically feasible, there would still be a number of service providers remaining which will require access to the underlying broadband facilities of broadcast carriers.

[71] AOL, *Comments, Transfer of Control*, *supra* note 51, at 14.

> [A]n open access requirement] would allow ISPs to choose between the first-mile facilities of telephone and cable operators based on their relative price, performance, and features. This would spur the loop-to-loop, facilities-based competition contemplated by the Telecommunications Act of 1996, thereby offering consumers more widespread availability of Internet access; increasing affordability due to downward pressures on prices; and a menu of service options varying in price, speed, reliability, content and customer service.
>
> Another indication that the availability of alternative facilities does not eliminate the need for open access policy can be found in AOL's conclusion that the policy should apply to both business and residential customers. If ever there was a segment in which the presence of two facilities competing might alleviate the need for open access requirement, the business segment is it. AOL rejected the idea.

Id. at 1-2.

[72] *See* Mark Cooper, "Breaking the Rules," attached to Petition to Deny of Consumers Union, Consumer Federation of America and Media Access Project, Applications for Consent to Transfer of Control of Licenses, MediaOne Group, Inc. Transferor to AT&T Corp., Transferee, CS 99-251 (filed August 23, 1999) (on file with author).

[73] *See* Bernstein, *Broadband!*, *supra* note 54, at 30, 33, 50-51.

[74] *See id.* at 7; Merrill Lynch, AOL *Time Warner, supra* note 54, at 33.

[75] Hausman et al., *Residential Demand for Broadband, supra* note 52, at 158.

[76] *Id.* at 159.

[77] *AT&T Canada*, *Comments of AT&T Canada*, *supra* note 50.

[78] Hausman et al., *Residential Demand for Broadband*, *supra* note 52, at 160-62.

[79] *AT&T SBC*, *supra* note 50.

[80] *AT&T Canada*, *Comments of AT&T Canada*, *supra* note 50, at 15-16.

> The dominant and vertically integrated position of cable broadcast carriers requires a number of safeguards to protect against anticompetitive behaviour. These carriers have considerable advantages in the market, particularly with respect to their ability to make use of their underlying network facilities for the delivery of new services. To grant these carriers unconditional forbearance would provide them with the opportunity to leverage their existing networks to the detriment of other potential service providers. In particular, unconditional forbearance of the broadband access services provided

> by cable broadcast carriers would create both the incentive and opportunity for these carriers to lessen competition and choice in the provision of broadband service that could be made available to the end customer . . .
>
> The telephone companies also have sources of market power that warrant maintaining safeguards against anticompetitive behaviour. For example, telephone companies are still overwhelmingly dominant in the local telephony market and, until this dominance is diminished, it would not be appropriate to forebear unconditionally from rate regulation of broadband access services.

[81] *AOL, Open Access Comments, supra* note 51, at 8.

[82] Hayes, et al., *Empirical Analysis, supra* note 53, at 1.

[83] *See* Bernstein, *Broadband!, supra* note 54, at 57.

> Thus, the real game in standards is to reach critical mass for your platform without giving up too much control. This requires a careful balance between openness (to attract others to your platform) and control over standards development (to ensure an advantaged value-capture position). Of course, the lessons of Microsoft, Cisco, and others are not lost on market participants, and these days no player will willingly cede a major standards-based advantage to a competitor. Therefore, in emerging sectors such as broadband, creating a standards-based edge will likely require an ongoing structural advantage, whether via regulatory discontinuities, incumbent status, or the ability to influence customer behavior.

[84] *See* Hausman et al., *Residential Demand for Broadband, supra* note 52, at 133.

> Video streaming has received an immense amount of attention not only because it might compete directly with the cable TV product, but also because it embodies the qualitative leap in functionality and quantum jump in speed that broadband Internet provides.
>
> Video streaming is foreclosed as a threat to Time Warner's services. By singling out current cable TV customers for an extremely high floor price for independent ISP broadband Internet service, Time Warner is leveraging its monopoly position in cable into the broadband Internet market.
>
> Time Warner asserts complete control over video streaming by controlling the economic terms on which Quality of Service is offered. Time Warner goes on to build a wall around the video market with pricing policy that dissuades ISPs from competing for the Internet business of cable TV customers. Time Warner buttresses that wall with a marketing barrier and a service quality barrier that can further dissuade ISPs from competing for TV customers.

Northnet, An Open Access Business Model, supra note 55, at 6-7.

[85] Time Warner's Term Sheet and AT&T public statements about how it will negotiate commercial access after its technical trial give a clear picture of the threat to dynamic innovation on the Internet. The companies' own access policies reveal the levers of

market power and network control that stand to stifle innovation on the Internet. Under the imposed conditions, the commercial space available for unaffiliated and smaller ISPs (where much innovation takes place) is sparse and ever shrinking.

[86] The AT&T preference is illustrated as follows:

> Radio GoGaGa [is] a music radio network that transmits over the Internet [and] depends on word-of-mouth and bumper stickers to attract users. . . . [Radio GoGaGa f]ounder Joe Pezzillo worries that the competitive gap could widen as broadband brings new business models.
>
> He envisions AT&T making deals with major music labels to deliver its own Internet radio, with AT&T providing the fastest connections to its partners and slower connections to sites like his. "Someone's not going to wait for our page to load when they can get a competitor's page instantly," Pezzillo said.
>
> AT&T says it has yet to formulate business models with partners, but the software the company has designed for the Boulder trial – demonstrated at its headquarters in Englewood, Colo[rado] last week – clearly includes a menu that will allow customers to link directly to its partners. Company officials acknowledge that AT&T's network already has the ability to prioritize the flow of traffic just as Pezzillo fears.
>
> "We could turn the switches in a matter of days to be able to accommodate that kind of environment," said Patrick McGrew, an AT&T manager working on the technical details of the Boulder trial. Though the Boulder trial is focused on technical issues alone, AT&T will study the way customers navigate the system as it negotiates with ISPs seeking to use its network.

Goodman, *supra* note 156.

[87] Thomas W. Hazlett & George Bittlingmayer, *The Political Economy of Cable "Open Access*, (AEI-Brookings Joint Center for Regulatory Studies, Working Paper No. 01-06, 2001), *available at* http://www.aei.brookings.org/publications/working/working_01_06.pdf., at 17 n.47 (quoting Jason Krause & Elizabeth Wasserman, *Switching Teams on Open Access?*, The Industry Standard, Jan. 24, 2000, *available at* http://www.thestandard.com/article/display/1,1153,8903,00.html).

[88] *See* Hausman et al., *Residential Demand for Broadband*, *supra* note 52, at 159.

> [A] cable broadband provider will engage in conduit discrimination if the gain from additional access revenues from broadband users offsets the loss in content revenues from narrower distribution. . .
>
> To capture the gains from such discrimination, the vertically integrated cable provider must have a cable footprint in which to distribute its broadband portal service, either through direct ownership or through an arrangement to share the benefits of foreclosure with other cable providers.

[89] *See* Rubinfeld & Singer, *Open Access*, *supra* note 49, at 657.

> Hence, a cable broadband provider will engage in conduit discrimination if the gain for additional access revenues from broadband users offsets the loss in content revenues form narrower distribution. What determines whether conduit discrimination will be profitable? Simply put, if a cable broadband transport provider that controls particular content only has a small fraction of the national cable broadband transport market, then that provider would have little incentive to discriminate against rival broadband transport providers *outside of its cable footprint.* The intuition is straightforward: out-of-franchise conduit discrimination would inflict a loss on the cable provider's content division, while out-of-region cable providers would be the primary beneficiaries of harm done to non-cable competitors.

[90] Hausman et al., *Residential Demand for Broadband*, *supra* note 52, at 156 (footnote omitted). The ACA provides the calculation for cable operators:

> The major MSOs will be the clear winners in these transactions. MSOs granted exclusive distribution rights will have an opportunity to attract DBS subscribers with exclusive programming, resulting in increased subscriber revenues (a minimum of $40-$50 per subscriber) and increased system values (at least $3,500-$5,000 per subscriber)....
>
> Where do ACA members fit into these transactions? Nowhere. ACA members operate locally, not regionally or nationally. In situations involving regional or national exclusive distribution rights, there is little incentive to carve out exceptions for smaller cable systems. For each small system subscriber lost under exclusivity, the vertically integrated program provider will likely lose revenue between $0.10 and $0.75 per month, depending on the service. In contrast, for each former DBS subscriber gained through regional or national exclusive program offerings, the MSO with exclusive distribution rights will gain all monthly revenue from that subscriber, plus increased system value. In economic terms, an external cost of this gain will be the cost to small cable companies and consumers of reduced program diversity.

ACA, *Comments*, *supra* note 56, at 13-14.

[91] Hausman et al., *Residential Demand for Broadband*, *supra* note 52, at 156 (footnote omitted).

[92] *See* Comments of the Competitive Broadband Coalition, *Implementation of the Cable Television Consumer Protection & Competition Act of 1992*, Cable Services Bureau Dkt. No. 01-290, at 10-11 (Dec. 3, 2001).

> CTCN [CT Communications Network Inc.], a registered and franchised cable operator, has been unable to purchase the affiliated HITS transport service from AT&T Broadband, the nation's largest cable operator, despite repeated attempts to do so. . . . Based on its own experience and conversations with other companies who have experienced similar problems, CTCN believes that AT&T is refusing to sell HITS to any company using DSL technology to deliver video services over existing phone lines because such companies would

directly compete with AT&T's entry into the local telephone market using both its own cable systems and the cable plant of unaffiliated cable operators. AT&T simply does not want any terrestrial based competition by other broadband networks capable of providing bundled video, voice and data services.

[93] Bernstein, *Broadband!*, *supra* note 54, at 12-14; Merrill Lynch, AOL *Time Warner, supra* note 54, at 33.

[94] *See* Hausman et al., *Residential Demand for Broadband*, *supra* note 52, at 149.

> It is possible that at some point in the future new technologies will emerge, or existing technologies will be refined, in such a way that they will compete effectively with cable-based Internet services. . . . [W]ithin the relevant two-year time horizon, neither DSL nor satellite-based Internet service will be able to offer close substitutes for cable-based Internet service. Hence, neither will be able to provide the price-disciplining constraint needed to protect consumer welfare.

[95] *See* Am. Online, Inc., No. C-3989, at 12 (Fed. Trade Comm'n Apr. 17, 2001), *available at* http://www.ftc.gov/os/2001/04/aoltwdo.pdf.

[96] AOL has argued:

> At every key link in the broadband distribution chain for video/voice/data services, AT&T would possess the ability and the incentive to limit consumer choice. Whether through its exclusive control of the EPG or browser that serve as consumers' interface; its integration of favored Microsoft operating systems in set-top boxes; its control of the cable broadband pipe itself; its exclusive dealing with its own proprietary cable ISPs; or the required use of its own "backbone" long distance facilities; AT&T could block or choke off consumers' ability to choose among the access, Internet services, and integrated services of their choice. Eliminating customer choice will diminish innovation, increase prices, and chill consumer demand, thereby slowing the roll-out of integrated service.

AOL, *Comments, Transfer of Control*, *supra* note 51, at 11.

[97] *See Goldman Sachs, America Online/Time Warner, supra* note 54, at 14, 17.

> AOL Time Warner is uniquely positioned against its competitors from both technology and media perspectives to make the interactive opportunity a reality. This multiplatform scale is particularly important from a pricing perspective, since it will permit the new company to offer more compelling and cost effective pricing bundles and options than its competitors. Furthermore, AOL Time Warner will benefit from a wider global footprint than its competitors" ". . .[W]e believe the real value by consumers en masse will be not in the "broadband connection" per se, but rather an attractively packaged, priced, and easy-to-use service that will bundle broadband content as an integral part of the service.

[98] AOL, *Comments, Transfer of Control, supra* note 51.

[99] *See* Jonathan Krim, *FCC Rules Seek High-Speed Shift; Phone Firms Would Keep Cable Rights,* WASH. POST, Feb. 15, 2002, at E1 (on the higher cost of addressing problems *ex post*).

[100] AOL, *Comments, Transfer of Control*, *supra* note 51, at 9-10.

[101] *See* Merrill Lynch, AOL *Time Warner, supra* note 54, at 38 ("If the technology market has a communications aspect to it, moreover, in which information must be shared [spreadsheets, instant messaging, enterprise software applications], the network effect is even more powerful."); Bernstein, *Broadband!, supra* note 54, at 26: "Thus, if the MSOs can execute as they begin to deploy cable modem services in upgraded areas, they have a significant opportunity to seize many of the most attractive customers in the coming broadband land grab. These customers are important both because they represent a disproportionate share of the value and because they are bell weathers for mass-market users."

[102] Shapiro & Varian, INFORMATION RULES, *supra* note 44.

[103] *See* Hausman, et al., *Residential Demand for Broadband*, *supra* note 52, at 164. "Due to the nature of network industries in general, the early leader in any broadband Internet access may enjoy a "lock-in" of customers and content providers – that is, given the high switching costs for consumers associated with changing broadband provider (for example, the cost of a DSL modem and installation costs), an existing customer would be less sensitive to an increase in price than would a prospective customer."

[104] *See* generally Hausman, et al., *Residential Demand for Broadband, supra* note 52, at 136-48; Bernstein, *Broadband!*, *supra* note 54, at 8; *AT&T Canada*, *supra* note 156, at 12. "AT&T Canada notes that narrowband access facilities are not an adequate service substitute for broadband access facilities. The low bandwidth associated with these facilities can substantially degrade the quality of service that is provided to the end customer to the point where transmission reception of services is no longer possible."

[105] Amended Complaint of the Dep't of Justice at 6, U.S. v. AT&T Corp., 2000 WL 1752108 (D.C. Cir. 2000) (No. 1:00CV01176), *available at* http://www.usdoj.gov/atr/cases/indx4468.htm.

[106] *AT&T Canada*, *Comments of AT&T Canada*, *supra* note 50, at 12.

> The cost of switching suppliers is another important factor which is used to assess demand conditions in the relevant market. In the case of the broadband access market, the cost of switching suppliers could be significant, particularly if there is a need to adopt different technical interfaces or to purchase new terminal equipment for the home or office. Given the fact that many of the technologies involved in the provision of broadband access services are still in the early stages of development, it is unlikely that we will see customer switching seamlessly form one service provider to another in the near-term.

[107] *Northnet, An Open Access Business Model*, *supra* note 55.

[108] David Clark and Rosemary Blumenthal, *Rethinking the Design of the Internet: The End-to-End Argument vs. The Brave New World*, TELECOM. POLICY, August 10, 2000, at 24.

[109] While Earthlink pointed out that the "nondisclosure provisions have an adverse impact on the ability of the market to operate freely and on the ability of government agencies to evaluate the competitiveness of the market," it was others who actually released the agreement.

[110] AT&T has sued and threatened to sue every local jurisdiction that required open access and withheld investment in those areas. Time Warner pulled the plug on Disney and threatened to extract full subscriber value from Disney for every customer it lost when Disney offered to give satellite dishes to the public. AOL threatened to sue Prodigy for the economic harm it caused AOL when Prodigy hacked into AOL's instant messaging service.

[111] High Tech Broadband Coalition, Cable Modem Proceeding.

[112] The agreement was reached with AT&T shortly before the Comcast AT&T merger closed.

[113] *A New Model for AOL May Influence Cable's Future*, NEW YORK TIMES, August 26, 2002, at C.1; Dan Gilmore, *AOL Capitulates, Gives Up Struggle for 'Open Access'*, SAN JOSE MERCURY NEWS, September 1, 2002.

[114] Jim Hu, *AOL's Unrequited Cable Love*, CNET NEWS.COM, January 26, 2004.

[115] The Federal Communications Commission has been presented with a mountain of specific evidence of anticompetitive behavior by wire owners. Notwithstanding the grant of entry into long distance, many of these problems still afflict the provision of DSL service, as recent testimony in Texas (the second state in which an incumbent RBOC was granted entry) attest; see *Response of Onramp*, TEN QUESTIONS TO BEGIN THE COMMITTEE'S INQUIRY INTO STATE BROADBAND POLICY, Committee on State Affairs, April 3, 2002 (Hereafter Onramp); *Response of Cbeyond, Inc.,"* TEN QUESTIONS TO BEGIN THE COMMITTEE'S INQUIRY INTO STATE BROADBAND POLICY, Committee on State Affairs, April 3, 2002 (hereafter, Cbeyond); *Response of IP Communications*, TEN QUESTIONS TO BEGIN THE COMMITTEE'S INQUIRY INTO STATE BROADBAND POLICY, Committee on State Affairs, April 3, 2002 (hereafter IP Communications); *Response of Hometown Communications*, TEN QUESTIONS TO BEGIN THE COMMITTEE'S INQUIRY INTO STATE BROADBAND POLICY, Committee on State Affairs, April 3, 2002 (hereafter Hometown); *Response of Texas CLEC Coalition*, TEN QUESTIONS TO BEGIN THE COMMITTEE'S INQUIRY INTO STATE BROADBAND POLICY, Committee on State Affairs, April 3, 2002 (hereafter TxCLEC); *Reply Comments of the California ISP Association, Inc., FURTHER NOTICE OF PROPOSED RULEMAKING IN THE MATTER OF THE COMPUTER III REMAND PROCEEDINGS: BELL OPERATING COMPANY PROVISION OF ENHANCED SERVICES; 1998 BIENNIAL REGULATORY REVIEW – REVIEW OF COMPUTER II AND ONA SAFEGUARDS AND REQUIREMENTS*, Federal Communications Commission, CC Docket NO. 95-20, 98-10, April 30, 2000 (hereafter, CISPA, 2001b); *Reply Comments of the Texas Internet Service Providers Association*, .FURTHER NOTICE OF PROPOSED RULEMAKING IN THE MATTER OF THE COMPUTER III REMAND PROCEEDINGS: BELL OPERATING COMPANY PROVISION OF ENHANCED SERVICES; 1998 BIENNIAL REGULATORY REVIEW – REVIEW OF COMPUTER II AND ONA SAFEGUARDS AND REQUIREMENTS, Federal Communications Commission, CC Docket NO. 95-20, 98-10, April 30, 2000 (hereafter, TISPA, 2001a); *Reply Comments of the Commercial Internet Exchange Association, .FURTHER NOTICE OF PROPOSED RULEMAKING IN THE MATTER OF THE COMPUTER III REMAND PROCEEDINGS: BELL OPERATING COMPANY PROVISION OF ENHANCED SERVICES; 1998 BIENNIAL*

Regulatory Review – Review of Computer II and ONA Safeguards and Requirements, Federal Communications Commission, CC Docket NO. 95-20, 98-10, April 30, 2000 (hereafter, CIX, 2001a); *Comments of the Information Technology Association of America*, *In the Matter of Review of Regulatory Requirements for Incumbent LEC Broadband Telecommunications Services*, Federal Communications Commission, CC Docket No. 01-337, March 1, 2002 (hereafter ITAA, 2002).; *Comments of the IP Communications Corporation*, *In the Matter of Review of Regulatory Requirements for Incumbent LEC Broadband Telecommunications Services*, Federal Communications Commission, CC Docket No. 01-337, March 1, 2002 (hereafter IPCommunications, 2002); *Comments of the Public Service Commission of the State of Missouri*, In the Matter of Review of Regulatory Requirements for Incumbent LEC Broadband Telecommunications Services, Federal Communications Commission, CC Docket No. 01-337, March 1, 2002 (hereafter MOPSC, 2002); *Joint Comments of NASUCA, et al.*, In the Matter of Review of Regulatory Requirements for Incumbent LEC Broadband Telecommunications Services, Federal Communications Commission, CC Docket No. 01-337, March 1, 2002 (hereafter NASUCA, 2002); *Comments of Ad Hoc Telecommunications Users Committee*, In the Matter of Review of Regulatory Requirements for Incumbent LEC Broadband Telecommunications Services, Federal Communications Commission, CC Docket No. 01-337, March 1, 2002 (hereafter Ad Hoc, 2002); *Comments of the New Mexico Information Professionals Association of America*, In the Matter of Review of Regulatory Requirements for Incumbent LEC Broadband Telecommunications Services, Federal Communications Commission, CC Docket No. 01-337, March 1, 2002 (hereafter NMIPA, 2002); *Comments of Cox Communications, Inc.*, In the matter of Appropriate Framework for Broadband Access to the Internet Over Wireline Facilities, Universal Service Obligations of Broadband Providers, Computer III Remand Proceedings: Bell Operating Company Provision of Enhanced Services; 1998 Biennial Regulatory Review – Review of Computer II and ONA Safeguards and Requirements, Federal Communications Commission, CC Docket NO. 02-33, 95-20, 98-10, May 3, 2002 (Hereafter Cox, 2002); *Comments of BrandX.*, In the matter of Appropriate Framework for Broadband Access to the Internet Over Wireline Facilities, Universal Service Obligations of Broadband Providers, Computer III Remand Proceedings: Bell Operating Company Provision of Enhanced Services; 1998 Biennial Regulatory Review – Review of Computer II and ONA Safeguards and Requirements, Federal Communications Commission, CC Docket NO. 02-33, 95-20, 98-10, May 3, 2002 (Hereafter BrandX, 2002); *Comments of the New Hampshire ISP Association*, In the matter of Appropriate Framework for Broadband Access to the Internet Over Wireline Facilities, Universal Service Obligations of Broadband Providers, Computer III Remand Proceedings: Bell Operating Company Provision of Enhanced Services; 1998 Biennial Regulatory Review – Review of Computer II and ONA Safeguards and Requirements, Federal Communications Commission, CC Docket NO. 02-33, 95-20, 98-10, May 3, 2002 (Hereafter NHISP, 2002); *Comments of Ruby Ranch Cooperative Association*, In the matter of Appropriate Framework for Broadband Access to the Internet Over Wireline Facilities, Universal Service Obligations of Broadband Providers, Computer III Remand Proceedings: Bell Operating Company Provision of Enhanced Services; 1998 Biennial Regulatory Review

– Review of Computer II and ONA Safeguards and Requirements, Federal Communications Commission, CC Docket NO. 02-33, 95-20, 98-10, May 3, 2002 (Hereafter Ruby Ranch, 2002); *Comments of Earthlink, Inc*., In the matter of Appropriate Framework for Broadband Access to the Internet Over Wireline Facilities, Universal Service Obligations of Broadband Providers, Computer III Remand Proceedings: Bell Operating Company Provision of Enhanced Services; 1998 Biennial Regulatory Review – Review of Computer II and ONA Safeguards and Requirements, Federal Communications Commission, CC Docket NO. 02-33, 95-20, 98-10, May 3, 2002 (Hereafter Earhtlink, 2002); *Comments of U.S. LEC Corp*., In the matter of Appropriate Framework for Broadband Access to the Internet Over Wireline Facilities, Universal Service Obligations of Broadband Providers, Computer III Remand Proceedings: Bell Operating Company Provision of Enhanced Services; 1998 Biennial Regulatory Review – Review of Computer II and ONA Safeguards and Requirements, Federal Communications Commission, CC Docket NO. 02-33, 95-20, 98-10, May 3, 2002 (Hereafter US LEC, 2002); *Comments of Big Planet, Inc.*, In the matter of Appropriate Framework for Broadband Access to the Internet Over Wireline Facilities, Universal Service Obligations of Broadband Providers, Computer III Remand Proceedings: Bell Operating Company Provision of Enhanced Services; 1998 Biennial Regulatory Review – Review of Computer II and ONA Safeguards and Requirements, Federal Communications Commission, CC Docket NO. 02-33, 95-20, 98-10, May 3, 2002 (Hereafter Big Planet, 2002); *Joint Comments of Cbeyond and Nuvox*, In the Matter of Review of Regulatory Requirements for Incumbent LEC Broadband Telecommunications Services, Federal Communications Commission, CC Docket No. 01-337, March 1, 2002 (hereafter CBeyond, 2002).

[116] Steven J. Vaughn-Nichols, *DSL Spells Trouble for Many ISPs*, Smart Reseller, February 24, 1999.

[117] Onramp, *supra* note 115, at 16-17.

[118] ITAA, *supra* note 115, at 11; DirecTV, *supra* note 115, at 8-10.

[119] Onramp, *supra* note 115, at 5-6; NMIPA, *supra* note 115 at 5.

[120] TISPA, *supra* note 115, at 18.

[121] IURC, *supra* note 115, at 14; Utah ISP, *supra* note 115,at 8, 9; ISPC, *supra* note 115,at 7; IAC, *supra* note 115,at 9; AOL, *supra* note 115,at 6, 8; AdHoc, *supra* note 115,at 26; ITAA, *supra* note 115,at 13, 15.

[122] TISPA, *supra* note 115,at 27.

[123] TISPA, *supra* note 115, at 33.

[124] Onramp, *supra* note 115, at 14.

[125] ITAA, *supra* note 115, at 10-11; CISPA, *supra* note 115, 2001a, at 27-28.

[126] TISPA, *supra* note 115, at 17.

[127] Cox, *supra* note 115, at 6.

[128] IURC, *supra* note 115, at 5; TXPUC, *supra* note 115, at 14; NYDPS, *supra* note 115, at 7; Utah ISP, *supra* note 115, at 13, 15; ISPC, *supra* note 115, at 11; IAC, *supra* note 115, at 9; AdHoc, *supra* note 115, at 27; ITAA, *supra* note 115, at 16.

[129] CISPA, Reply, *supra* note 115, at 7.

[130] Onramp, *supra* note 115, at 3.

[131] TISPA, *supra* note 115, at 21, New Edge, *supra* note 115, at 6; Brand X, *supra* note 115, at 2, DirectTV, *supra* note 115, at 8; CIX, *supra* note 115, at 8.

[132] Telephone companies achieve the margin difference by offering high volume ISPs massive volume discounts that aggregate business across state lines, without any cost justification for such a discount (see TISPA, *supra* note 115, at 37; MPIPA, *supra* note 115, at 5; ITAA, *supra* note 115, at 21; DirectTV, *supra* note 115, at 9, CSIPA, *supra* note 115, at 16).

[133] Onramp, at 3, citing CFO Stephenson.

[134] Todd Spangler, *Crossing the Broadband Divide*, PC MAGAZINE, February 12, 2002 (noting pricing and service quality problems); Brian Ploskina, and Dana Coffield, "Regional Bells Ringing Up Higher DSL Rates," *Interactive Week*, February 18, 2001; Yale Braunstein, MARKET POWER AND PRICE INCREASES IN THE DSL MARKET (July 2001).

[135] Press accounts give detailed estimates of major ISPs. The number of subscribers to independent ISPs is put at 500,000 to 600,000 in a market that is in the range of 10,000,000 to 12,000,000, see Forrester.com/ER/Press/Release/0,1769,655,00.html; ISP-Planet.