Network Effects in the Microsoft Case

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Abstract

The internal Microsoft documents made public in the antitrust trial have a great deal of information about how the firm views industry equilibrium, enough to attribute to the firm a clear theory. Not distant or abstract but an immediate and pragmatic guide to decision making, the firm's theory is nonetheless fully articulated and analytically stated. In this paper, I first examine the relationship between economic theories of network effects and Microsoft's theory of the computer software and Internet industries. Many of the positive elements of the more formal theory are quite clearly present in the internal analysis: positive feedback, lock-in, first mover advantages, installed base effects, high inertia in established networks but low inertia in new ones, indeterminacy of equilibrium, and the importance of strategic choices about compatibility and incompatibility. Interestingly, however, Microsoft also has several lines of analysis which have not been central in the literature; many of these have to do with three linked areas the literature has largely neglected, (a) management of network effects systems and (b) the mechanisms by which lock-in ends, and (c) multiple partial overlapping clusters of network effects. Some of the ways in which they analyze familiar theoretical ideas suggest that we have not yet understood the way theory will matter in the market place; practice may have outrun theory here. I second examine the relationship between network effects theory and the *Microsoft* lawsuit, an undertaking full of surprises.

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While I served in the Antitrust Division of the United States Department of Justice and continue, at this writing, to consult to the Division, this paper does not represent the opinion or policy position of the Division but only my own view.

1) Introduction: Microsoft's Internal View of N/W Effects

Network effects, positive feedback, lock in, and related concepts have been an important part of industrial organization theory in recent years.[1] They are also phenomena, a part of technical and managerial life in the industries, such as computers, software, computer networks, the Internet-based industries, and telecommunications, where external economies are first-order drivers of market outcomes. The unique perspective offered by the Microsoft internal documents brought to light in the antitrust case gives us an opportunity to examine the relationship between the theory and the marketplace. Microsoft is a very analytical firm, and thinks of itself as involved in complex strategic games involving many outside agents. Accordingly, many of the documents take as their focus the industry, not the firm, and many of them are quite explicitly theoretical (if not in a formal, abstract way.) While the documents of a single firm can only be limitedly useful in addressing welfare economics questions, they have a good deal of material that helps address the positive question of the correspondence between the theory and reality – where reality means, operationally, the Microsoft-eye-view of reality.[2]

Microsoft's views of network effects and lock in can be most clearly seen in these documents with regard to the browser and to operating systems, for the largest number of documents bear on those two.[3] Looking at both of those also affords us the opportunity to examine Microsoft's theory from two very distinct perspectives. Microsoft is the beneficiary of a positive feedback loop that reinforces the position of its Windows operating system. The positive feedback loop in browsers, however, went to Netscape, and Microsoft found itself on the outside looking in.[4] Any softheadedness about how equilibrium works is likely to disappear when we examine this perspective. Accordingly, I shall spend most of my time on these two loci of network effects, and only briefly visit some others, such as the Office applications suite and the Java divided applications development framework.

In what follows, the main positive feedback loops will have the following common elements. The loop will flow back and forth between two groups of nonstrategic actors, "developers" and "users." Developers – of applications programs for operating systems, of content for web sites, of programs that run on web sites, etc. -- will

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[1] Surveyed in David and Greenstein (1990), Katz and Shapiro (1994), and Economides (1999), among other places.

[2] I shall look almost exclusively at Microsoft documents, though the trial brought other firms' documents to light as well, in smaller volume. I shall examine other firms' thinking primarily when looking at aspects of the theory that turn on asymmetric information. My methods point about welfare economics is that it is hard to filter the self-serving out of any firm's documents.

[3] While Microsoft's attorneys would argue that there is no such thing as a browser, and that Microsoft's "internet browsing technologies" were merely part of its operating system, no one inside the company ever thought such a silly thing, and the documents contain two rich and separate veins of material about network effects in browsers and in operating systems. I shall endeavor to keep my partisan remarks in footnotes like this one until we reach section 5).

[4] At every stage, Microsoft was convinced that it would lose the browser war if all it did was make a better browser, price it cheaper, and market it heavily. Only after a long campaign of anticompetitive acts did it succeed in thwarting the browser threat. This is the first example of the promise I made in fn. 3.

want to spread fixed cost of development over a large volume of use. Users value the number, variety, or quality of developers' output. In between the users and developers lies an interface standard layer which may be entirely proprietary (Windows), open (HTML for browsers) or partially (or temporarily) open and partially proprietary (HTML and extensions)[5]. The interface standard layer permits developers to interact with it through an Applications Programming Interface ("API") and connects to users through a User Interface ("UI")[6].

Any layer that has both wide usage and an API is called a "platform," in Microsoft parlance. Accordingly, there is a Windows platform, a Browser platform, a Lotus Notes Platform, a Java platform, etc. The positive feedback loop arises because developers choose a standard not only for its native technological qualities as a development environment, but also for the extent to which it is used, while users choose products that embody the standard not only for their standalone qualities but also for the degree to which developers enhance it. In the typical nomenclature of the economic theory of network effects, these are "indirect" network effects.[7] Since users and developers sink platform-specific investments, the network effects are dynamic, offering a role for expectations, for strategy, and for inertia. When strategic actors sponsor platform-defining technologies, this situation leads to a very rich set of theoretical issues, especially when multiple strategic actors contend for the same platform-leading position.

The next sections ((2) and 3))are a very happy time for economic theory. Most of the main elements of the theory are present. External economies leading to multiple possible equilibria in the long run are a core concept in Microsoft's thinking – the browser war could have tipped to either Netscape standards or Microsoft ones. At early stages, the path to a long run equilibrium is open to strategic influence. But at late stages, positive feedback plus the tendency of many nonstrategic agents, developers and users both, to have made sunk investments specific to a particular platform make it very hard to change. Compatibility over time is extremely important, as a result. Along the path to a selecting a long run equilibrium, coordination is a complex activity involving expectations, volumes of communication among the to-be-coordinated actors, and the bargaining and other problems that come with coordination games under imperfect information. All of these elements are remarkably clear in the documents.

The theory falls short of fully capturing Microsoft's view of the issues on some trivial dimensions and two very important ones, as we shall see in section 4). Trivially, life is far more complex than abstract theory, and in the world there is a great deal of managing and coordinating wrapped around the abstractions of equilibrium. More profoundly, Microsoft, as the proprietor of a locked-in *de facto* standard, Windows, is intensely interested in the circumstances by which lock in can end. This is a part of the

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[5] I use "open" here to mean "open on both sides of the interface," which is not universal usage: Microsoft calls the Windows PC "open" because anyone can make a computer that runs Windows or an application that runs on Windows, though only they can make Windows.

[6] Sometimes the user interface is labeled as a GUI, a shell, or a client. Not all platforms include a UI; some use the UI of other products.

[7] In contrast to "direct" network effects where users directly value other users (e.g., in telephony, I value you being connected to the phone network if I want to call you.) See Katz and Shapiro (1994) and Liebowitz and Margolis. There are probably also some "direct" network effects in platform software (I ask you to help me figure out what is wrong with my computer . . .) and there is certainly some individual user and individual developer sunk costs that make switching platforms costly.

theory that has not gotten very much attention at all, and an important one for the world. Much of Microsoft's thinking on this, and the computer industry's generally, has to do with vertical disintegration. The mechanism by which a firm controlling a lock in situation can lose that control have largely to do with the behavior of vertically disintegrated complements. That reveals another (positive) shortcoming of existing theory, its focus on situations in which there is only a single "platform layer" (usually called "hardware" in the theory.) One of the very important elements of the computer business is the presence or absence of separate, partially overlapping loci of positive feedback and lock in. These two gaps may or may not offer interesting avenues for the theory to develop, but they are first-order phenomena not captured by existing theory.

Finally, I examine the relationship between the theory and the antitrust case, as opposed to the theory and the industry. While the theory has a lot to say about the industry, it did not play a central role in the case, and did not at all play the role usually attributed to it.

2) Browser Positive Feedback Loops

Microsoft came late to the Internet, and found that Netscape Navigator and open Internet connectivity protocols like HTML were quickly being established as *de facto* standards. Individual users liked the Navigator browser, individual user switching costs were high, and Navigator had by far the highest share in browser usage. A large number of web sites were designed to be used with Navigator or with the open standards Navigator supported, and, as Navigator's and the web sites' technological complexities increased, the extent of this dependency was increasing. The likely market outcome, as seen from Microsoft's perspective, was tipping to a Netscape-centric (or open, non-Microsoft-centric) standard in browsers. This would result in vertical disintegration and divided technical leadership, with operating system interface standards controlled by Microsoft and PC to Internet connection standards either controlled by another firm (Netscape, most likely) or set in an open way. Since this outcome was competitively and strategically undesirable to Microsoft[8], the firm set out to ensure that Internet connection standards would come under its own proprietary control. The main vehicle for this would be Microsoft's own browser, Internet Explorer ("IE"). The struggle between a Navigator-based standard and an IE-based one would come to be known as the "browser war," beginning in the spring of 1995, when Microsoft realized the importance of the Internet, and continuing until Netscape's collapse in 1998.

It is unlikely that one will ever find a more perfect correspondence between theory and fact than in Figure 1 with its nice positive feedback graphic.[9] This is a slide

[8] Microsoft viewed these developments as good for its customers and bad for it. See extensive quotes in Bresnahan (2001). Paul Maritz, third in command at Microsoft summarized the problem from the perspective of standards setting by asking, "which is worse, an open [standard] or one controlled by someone else?" **cite xxx.**

[9] The entire document containing Figure 1, like all the documents referenced in this paper, may be found on the web. This one is Government Exhibit 488 from the trial and can be found at http://www.usdoj.gov/atr/cases/exhibits/488.pdf In what follows I shall use the notation "GX 488" as a shorthand.

GX 488 is a 137 page presentation reviewing marketing plans for Internet Explorer 3, Webmasters, and ActiveX , and Figure 1, which is the seventh page, is the backbone theory slide for the presentation and serves to organize what follows.

from a browser and Internet marketing plan presentation. The problem for Microsoft in this area, as the speaker has just shown, is Netscape's "Market share, defacto standard." That is, the speaker bases his analysis on a "platform API battle" which Microsoft was at this point losing. At this point in the presentation, he turns to how Microsoft can turn this around:

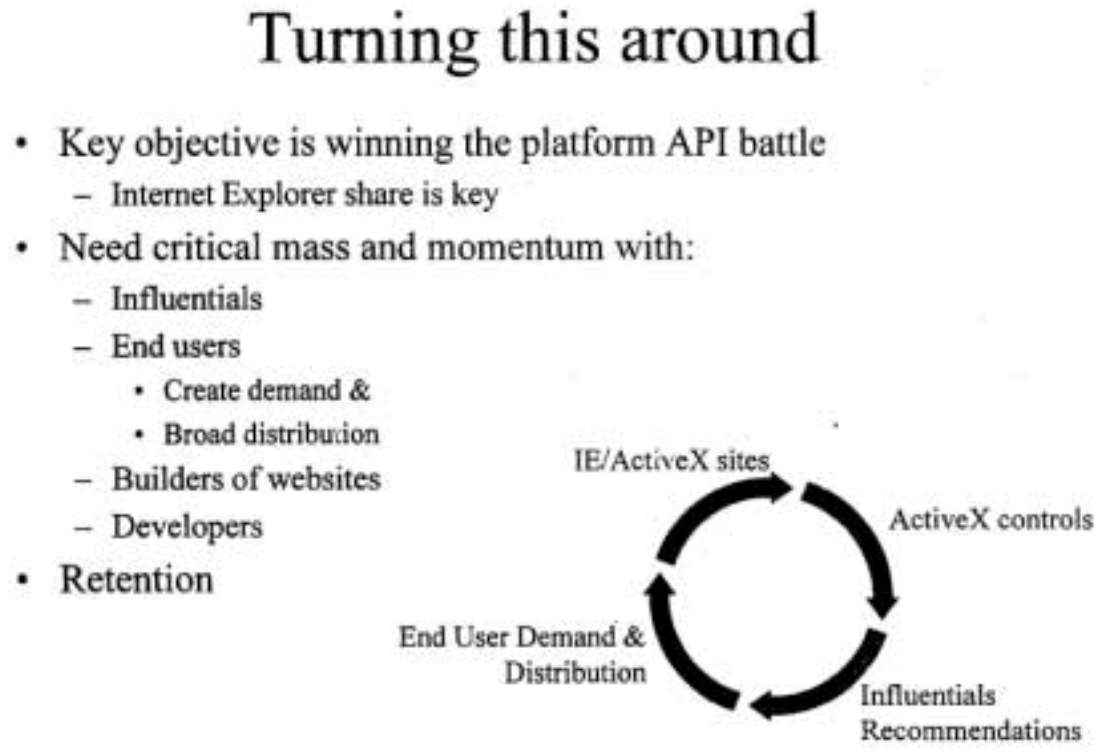


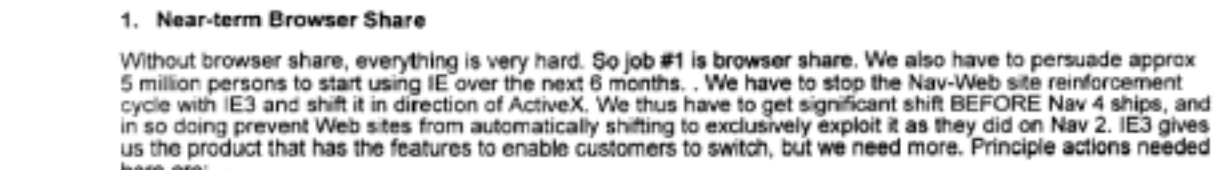
Figure 1

The positive feedback loop that the speaker would like to get going passes through end user demand for IE, and through websites that might be based on Microsoft technologies (IE/ActiveX/ActiveX controls).[10] It also passes through "influentials" – people who influence the technology decisions of others. Note that the speaker's conclusions closely follow the core logic of an indirect network effects theory. To win the platform API battle, market "share is key." To get that share, one needs "critical mass and momentum" with end users, where "broad distribution" will lead to supply by developers and by builders of web sites. One also needs "critical mass and momentum" on the developer / web site side. Getting "critical mass and momentum" leads to the positive feedback cycle graphically shown.

The strategic problem being addressed here is that same positive feedback is already occurring in non-Microsoft technologies. That cycle might be labeled: End User Demand => Netscape Sites => Java => Influentials => End User Demand. Developers making websites and applications that run on them were focused on Java and Navigator standards and APIs, and end users were using Navigator. The presenter is writing at a time when Microsoft is very far behind in browser market share and the resulting positive feedback cycle is beginning to move toward a non-Microsoft equilibrium. It has not yet gotten there, however, so there is still an opportunity to steer the positive feedback cycle toward Microsoft technologies rather than outside ones. Whatever you call that – indeterminacy of equilibrium and "tipping" are the main two labels in the theoretical literature – it is a centerpiece of Microsoft's thinking.

Of course, the world is more complex than any theory – the "influentials" who play a large role in Microsoft's practical plan don't arise in the theoretical literature – but this does not mean that the theory is not highly useful. Indeed, Microsoft used the basic insights of the theory as an analytical backbone while connecting them to the world in direct, pragmatic, operational ways.

At all levels, Microsoft thought about the problem as one of breaking the positive feedback cycle working for Netscape. In a June, 1996 email to a senior group of executives in Windows and Internet areas, Paul Maritz, number three in the company, wrote about "key issues related to Internet & Windows businesses that we have to address" (GX 42)[11]. At several junctures, he worries about the "reinforcement cycle" as you can see in Figure 2:



1. **Near-term Browser Share**

Without browser share, everything is very hard. So job #1 is browser share. We also have to persuade approx 5 million persons to start using IE over the next 6 months. . We have to stop the Nav-Web site reinforcement cycle with IE3 and shift it in direction of ActiveX. We thus have to get significant shift BEFORE Nav 4 ships, and in so doing prevent Web sites from automatically shifting to exclusively exploit it as they did on Nav 2. IE3 gives us the product that has the features to enable customers to switch, but we need more. Principle actions needed

Figure 2

[10] "ActiveX Controls" were (at this time) small computer programs that can run inside (among other larger programs) a browser. They permit website developers to add such features as displaying complex documents (multimedia, databases) in the user's browser. More generally, ActiveX is a Microsoft brand name variously applied to technologies developers use for media, web, etc.

[11] See footnote 9 to see how to find the whole document on the web.

In his detailed analysis, Mr. Maritz is very worried that web site "collaboration and community features" such as "publish pages" "host threaded discussions" "view collections of messages" "have a look at what others have said about this page, etc." will become very popular, take root and become an interface standard under the control of Netscape. As a result he writes in the same document of the need to slow Netscape down:

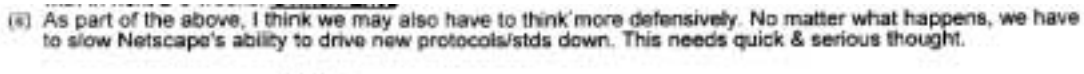

(s) As part of the above, I think we may also have to think more defensively. No matter what happens, we have to slow Netscape's ability to drive new protocols/stds down. This needs quick & serious thought.

Figure 3

Mr. Maritz had formed this view quite early. In an April 1995 document entitled "Netscape as Netware" (we shall return to that evocative (to a computer nerd) analogy below) (GX 498) he worries about a "feedback loop [that] drives Netscape market share higher (as content providers encourage its use) to the point where Netscape can go 'proprietary')" and thinks that this would be the bridge to future competition against Microsoft. He thus argues "We should not allow any one Web client to get to high volume. This means (i) not letting a vacuum open up, and (ii) ensuring that we get broad distribution for our Web client."

All of Microsoft's senior management team agreed about the problem of tipping to a Netscape standard. James Allchin, in (GX 489), "Navigator/NetOne provides a new API set -- in near/medium term, Navigator provides the volume platform for ISVs & Corps to target."[12]

Bill Gates, having spent the better part of a week thinking about Microsoft / Netscape competition, sent a six page memo about that "impressive competitor" in April '96 (GX 41). He finishes with the problem of finding some "Gravity" for Netscape since "Given the positive spiral that Netscape is experiencing what could possibly slow them down?" (p. 6.) Mr. Gates is, of course, no stranger to positive feedback or to the indeterminacy of equilibrium, having written eloquently about them in connection with the standard defining the IBM PC (and Microsoft's operating system).[13]

Why are they sure that the tipping is going against them? Having done some market research, the speaker in Figure 1 does a systematic review of available measurements.[14] He reports that browser market share is much higher for Netscape than Microsoft[15], that vastly more web sites link to Navigator than to IE (mostly suggesting a download) that the developers of web sites are a new audience and "MS' influence over this audience is weak" as 74% optimize their site for Navigator, only 7% for IE. Thus the positive feedback loop is going for open standards / Netscape standards, not Microsoft ones.[16]

Brad Chase, in a long 1996 presentation called "How to get to 30% [Browser] Share in 12 Months," (GX 684) suggests a number of practical steps to move the network

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[12] He refers to the two important classes of applications developers, Independent Software Vendors and Corporations (for use by employees).

[13] See Gates (1995).

[14] A late slide reviews all the available metrics and data sources.

[15] Again, see footnote 9 to see how to access this specific document on the web.

[16] One plus for his side is that many more developers already write for Microsoft APIs; unfortunately, however, not Web ones (cf. "Retention" in Figure 1) so they need a way to migrate applications developers to Microsoft web technologies before they migrate to open or Netscape ones. We shall return to this theme.

effects from open/Netscape technologies to Microsoft ones. He sketches out the key elements of the positive feedback loop.[17] For example, he takes the perspective of "Publishers and Content Developers" and notes that the advantage to Netscape comes because "We [Netscape] will continue to be the share leader / 80% of users run Navigator" while from the perspective of "Consumers / Home Users" "All interesting sites support Netscape" which is "The Internet Standard Browser." For both audiences, an advantage of Navigator is that it is "cross platform," that is, runs on any kind of computer. To move the positive feedback loop, Chase suggests radical action. On the user side, this includes, famously and chillingly, "The Internet is part of Windows. We will bind the shell to the Internet Explorer, so that running any other browser is a jolting experience" (p. 7) and[18]

Get New Users. The best way for us to gain share is to make sure users get Internet Explorer by default in all channels before their first connection. *We need to make it financially profitable for OEM's, IAP's, and online services to distribute or promote our browser.* This means leveraging assets that Netscape doesn't have; the Windows box, hardware OEM's, and our MDA agreements.

Figure 4

More generally, Chase in GX 465 offers the basic layout of Microsoft's overall view of how to win platform battles.

2. GOALS AND STRATEGY

We have won platforms battles before. To make history happen again, we must make the industry embrace Internet Explorer and Active-X

- establish a significant installed base of users (browser share is starting point),
- sell the benefits of our platforms to the content developers[2],
- convince the influential webmasters' to switch to our standards and promote them, reach the producers,
- help the traditional developers (ISVs and corporate developers) write to the ActiveX platform, so they develop the rich base of Web applications and controls that establishes the value of the platform,
- "activate" our partners to create a supportive environment of partners - able to sell, integrate and support our solutions and 3rd party ActiveX technology.

The approach is the same for the Internet and the Intranet.

Figure 5

There are three reasons I ask you to look at Figure 5 (all three points appear in a large number of documents.) The first thing to note is the basic strategic structure. To win a platform battle, one attempts to move all the different external agents in the direction of one's own standards. Some classes of external agents to be moved are viewed as fundamentally nonstrategic, such as end users or developers. This corresponds to the typical assumption in the theory that such agents are atomistic and followers, while the platform sponsors behave strategically. Other classes of external agents are here viewed as strategic actors, an issue to which we shall return. Second, note that there are a large number of management tools to influence external agents – coordination in the world is achieved at least in considerable part by management. Third, note that Mr.

[17] Chase brings more kinds of economic actors into the positive feedback loop, such as corporations developing intranets (where the same buyer is both user and developer) and independent software vendors (whom he distinguishes from content providers.)

[18] The unfamiliar acronyms here: "IAP" is "Internet Access Provider" and "MDA" is "Market Development Agreements" – the discounts to computer manufacturers (OEMs) used to reward those who pushed IE rather than Netscape.

Chase' argument is fundamentally inductive, and that he uses the past as example for the future. This is an important theme in Microsoft's thinking. Microsoft shows no sign of having been influenced by the academic development of the theory. Clearly, they worked it out for themselves[19] (Mr. Gates has a strong role as chief theorist.) Thus correspondences between Microsoft's theory of how the industry work and economists' provide a testing ground for they positive predictive value of our theory.

a) Timing Issues

One of the fundamental issues in the literature is about the possibility of influencing network effects at different stages of their development. One core idea is that it is easier to influence the direction of a positive feedback loop, at least one where there are coordination costs or individual-follower sunk costs, at some stages more than at others. Given the importance of timing and the importance of network effects in Microsoft's core businesses, it is no surprise that they have an elaborate doctrine of this. Mr. Gates, in his (1995) book, gets quickly to the most important strategic conclusion, which he writes largely about the IBM PC: equilbrium was indeterminate at an early stage, but IBM got there and set the standard, later equilibrium was far harder to change, timing was very important. Some of the internal documents expand on this theme in an interesting way.

In a meditative exchange between Mr. Myrhvold and Mr. Gates about the Internet in 1994 (meditative because they had not yet realized that the 'net was a competitive issue for Windows, they were analizing it in relationship to Microsoft's online service, MSN) Nathan Myhrvold in DX 386 wrote:

> The weakness is precisely the point you make about the difficulty of having extensions happen in a compatible way. In the last couple of years we have seen a lot of new protocols and programs sweep the Internet - the time it took everybody to swing around to Mosaic was stunningly fast - but this is because it was expanding into a vacuum. The helter skelter world of protocol du jour is perfectly suited for email (where it does not matter much) or user contributed content, because in each case the content is ephermal and is quickly replaced. When you start to assume lots of rich content and transaction services you start to act a lot more like the PC market - standards change slowly, ISV buy in is important, there is value to being a kingmaker funding major new work and evangelizing it etc. That is a role which we can play.

Figure 6

The "you" is Mr. Gates. Note that Mr. Myrvold thinks that it is easy to establish "protocols and programs" early – because they are "expanding into a vacuum." Later it gets much harder and more inertial "more like the PC market -- standards change slowly." Note that the key change, in Mr. Myrvold's view, comes when the nature of the nonstragic follower's use of a standard changes from the "ephemeral and quickly

[19] Indeed, many of the elements of positive feedback, network effects, and lock in had been clear to IBM not long after that firm invented the computer platform in 1964. See Bresnahan and Greenstein (1999). PC industry participants generally, and Mr. Gates in particular, understand these analytical lines in a deeper and more strategic way than did IBM, however.

replaced" to something more complex and involving more commitment "buy in" from them.

Figure 7

Microsoft does, not, by the way, make these analyses for their intellectual interest. One reason is to rally the troops; another reason is to allocate resources within the firm, yet another reason is to make difficult product and alliance decisions. Consider these summaries by Brad Silverberg, leader of the Internet Platforms and Tools Division at an April, 1996 Division Meeting (GX 40) as "They are smart, aggressive, and have a *big lead.* This is not Novell or IBM we are competing with." Later "The world has changed" in that "Customers have alternatives: we are *behind.*" (Emphases in original.) Brad Chase (April 1996 planning memo) notes "Netscape is already entrenched in our markets all over the world. The situation today is scary." GX 39 Why be scared? Brad Chase FY98 Planning Memo "Preserving the Desktop Paradise" 4/97 clearly thought that the browser war was going to end with lock in to one standard or the other.

We need your help to drive IE and OE usage with focused budgets and efforts in all Customer Units. As Netscape and we approach our respective 4.0 launches we both have a great opportunity to create a significant shift in the installed base. We will not have this opportunity again.

Figure 8

There are really interesting actionable implications of the theory, which lead to important decisions. Mr. Gates, in GX 41 (cited above) conjectures that it may be easier to catch Netscape outside the United States, because the positive feedback cycle is less far along.[20] Mr. Chase (GX 465) operationalized.

2.1. FY 96 - FY 97 Goals

1. Browser share : 35% market share in the US. Other countries should have higher goals. Countries where Netscape is not active yet should aim for 80% share.

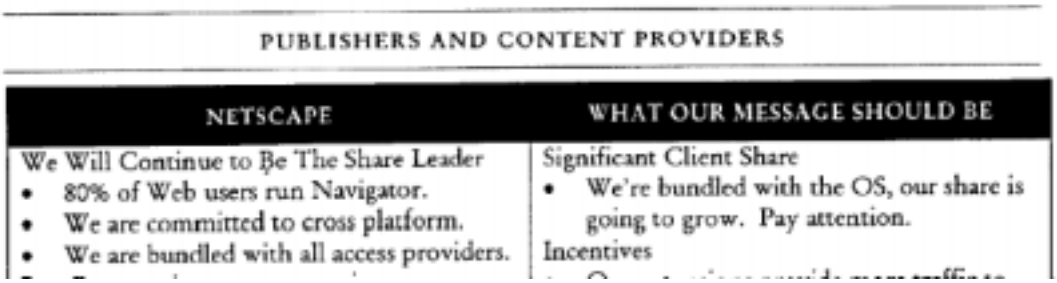
b) Expectations Important under Indeterminate Tipping

One of the key elements of positive feedback theory is the possibility of multiple equilibria of the long run, static coordination game and the resulting role for dynamics in selecting the equilibrium. While the literature has largely emphasized the welfare economics of "path dependence," there is an important positive implication here as well, concerning the formation of expectations before the system has fully tipped to any of the possible LR equilibria.[21] This has an immediate and practical role in Microsoft's theory of managing positive feedback and tipping.

We looked at GX 684, Brad Chase' "How to get to 30% [Browser] Share in 12 Months," above. Chase clearly thinks that expectations are important – and can be managed – , as you can see from what he puts first in his proposal on dealing with "publishers and content providers" in Figure 9, where he contrasts Netscape and Microsoft marketing messages to that audience.

[20] This interesting remark leads to a standing effort to "out-localize" Navigator and some frustration on Microsoft's part when Netscape turns out to be good at non-English version.

[21] See Dranove et al (1999) for an econometric examination of expectations and "vaporware."



PUBLISHERS AND CONTENT PROVIDERS

NETSCAPE	WHAT OUR MESSAGE SHOULD BE
We Will Continue to Be The Share Leader • 80% of Web users run Navigator. • We are committed to cross platform. • We are bundled with all access providers.	Significant Client Share • We're bundled with the OS, our share is going to grow. Pay attention. Incentives

Figure 9

Microsoft did send out this message[22], and it was picked up in the broader marketplace. After having been briefed about a Microsoft presentation at an influential Silicon Valley venture capitalist's offices, Mike Homer of Netscape wrote in an email:

> "M/S thinks that with a client competitive with Netscape's (doesn't even have to be better or equal, just comparable) and IE bundled into every Win95 desktop from Q4 1996 on, it ultimately wins the client war (that's 3-4MM more browser seats every month!). . . . And by winning the client war, M/S secures dominance for ActiveX and marginalizes Java. That is the Microsoft endgame for the Internet client market as far as I can tell."

Kumar Mehta of Microsoft thought the message had been received in corporations and by webmasters by March 1997 (in GX 205) "from all our research with IS [corporate Information Systems] and web professionals we know that they eventually expect us to win the browser war because Ie [sic] will be bundled with the operating system and they will have no real reason to purchase navigator."

All of that discussion is about efforts to influence expectations of small, strategic follower actors. One could go into some depth about the technology of managing that influence, and especially the importance of expectations and ideas in that management. In particular, the phrase "developer mindshare," which refers to developers thinking about which platforms might be suitable for their applications recurs steadily, into Microsoft's developer tools businesses, or into the verb "evangelize," which refers to platform sponsors' efforts to inform and convince developers about their standards and technology. (Microsoft spends a good deal of time measuring developer mindshare and has literally thousands of employees working in developer relations.) I think, however, that for present purposes this is simply another juncture at which the theory corresponds to the world complexly but directly.

Let us therefore turn to external agents whom it is not appropriate to view as passive and nonstrategic. Here is a far more interesting quote from an email inside AOL (GX 38) at the time, January 1996, when Microsoft was at the height of its campaign to convince the industry that, despite appearances, the equilibrium would later tip from Netscape to Microsoft. Microsoft encouraged the strategically important AOL to believe this story, but the two firms were in the middle of negotiations of how much Microsoft was going to pay AOL to help in the effort to tip.[23] Note that the author (David Cole of AOL) believes that tipping means the end of Netscape, a correct forecast.

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[22] The message inherits the unlawful nature of the bundle itself, but that is not an important point at this juncture.

[23] The email is interesting for the light it throws on that effort, as Mr. Gates is reported to have delivered "a characteristically blunt query. How much do we need to pay you to screw Netscape?? ('this is

5) Interesting to note the contradiction between their claim of manifest destiny re: winning the internet software battle, and their eagerness to bring us into their fold. In terms of timing--we are absolutely of greater value to them post-Netscape, as a decision to shift from Netscape after a public alliance is even better that a pre-emptory strike today (deployment issues aside). Msft is clearly feeling vulnerable over the next year so.

. . .

9) The essential NS proposition is that they get out of the online services business and we get behind their struggle for survival. Thus, a stable partnership. From time to time NS fails to recognize this. A delay in our negotiations may help them to understand.

Figure 10

I find these remarks particularly interesting for what they tell us about the economics of negotiation to tip – that is, to coordinate toward a LR equilibrium -- among strategic players who are incompletely informed. First off, AOL, a strategic player, is being quite careful to make its own assessment of the likelihood of tipping, rather than listening only to Microsoft's or Netscape's. Paragraph 5) (of Figure 10) clearly argues that Microsoft's theory is belied by their actions – the very fact that they are negotiating suggests that they need AOL! Second, the strategic third party, AOL, is playing the two potential standard setters off against one another, and their analysis of the other firms' incentives, circumstances, and truthfulness is highly sophisticated.[24] Third, they believe that delay and expectations in negotiations interact, in a way familiar from the theory of strikes (para 9 (of Figure 10)). Fourth, and perhaps most interesting, they think that there is a complex interaction between the actions of strategic players and others' beliefs in the coordination game among all players. Look at para 5) (of Figure 10): "A decision to shift from Netscape" later, after supporting Netscape, is better for Microsoft than "a pre-emptive strike today", even though a later shift is worse in terms of direct impact on shares ("deployment issues aside") because of what the later shift signals.

Reading documents like this should lead positive economists to exhibit more fondness for information-theoretic approaches to coordination and bargaining.[25]

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your lucky day.')." Gates ultimately paid through the nose, putting an AOL icon on the Windows desktop, which at this stage of the negotiation he said was "sacrosanct" (p. 2).

In paragraph 5) "their" is "Microsoft's" and in 9) "NS" is "Netscape."

[24] Charles Ferguson, another interesting pragmatic theorist of network effects, writes interestingly of this in his 2000 book.

[25] Particularly those who like rational expectations equilibrium concepts. Here is what Microsoft was thinking internally, which is not all that far from AOL's guess: (Mr. Slivka in 1/96) GX xxxx

Summary: If AOL gets it's logo in Windows box, they will use our technology. For me, it's obvious that having AOL on our side (as opposed to Netscape's side) is worth this cost -- we get folks who have been very successful marketing to consumers endorsing our technology. That gives us AOL, CIS, and MSN selling our client technology -- just like we had Compaq and IBM in the early MS-DOS days. Having AOL steer there 4-5 million customers to Netscape is a scary thought.

c) Lock in and Sources of Continuing Advantage

Our theories tend to cleanly distinguish between individual user sunk costs and network effects and coordination problems as sources of lock in. Industrialists don't get to make assumptions, of course, so Microsoft and Netscape had to deal with the actual situation of the browser, which involved some of each of these elements. This complexity is well illustrated by Microsoft's later internal discussions about strategies to win the browser war, centering on their analysis of the impossibility of winning by making their own browser more attractive to consumers. At these stages, the discussion often has less to do with the theory of the industry and more to do with the simple practicalities of attempting to build market share when far behind in a tipping race.

Kumar Mehta, in a March 1997 email entitled "ie data" (GX 204) responding to the question about whether IE should be tied to what became Windows 98, summarizes "all the IE research we have done" (primarily consumer market research by survey.) He writes that "80% of those who do not use IE say that they have no plans to switch to it. which means that if we take away IE from the o/s most nav [Navigator] users will never switch to us." Clearly, Mehta is using a single-user switching cost model, at least in part, and sees a small installed base as a real strategic problem.[26]

Christian Wildfeuer, writing at about the same time about the results of focus groups of Microsoft's most inframarginal end user customers, early adopters of Windows 95, summarized the same issue in this way[27]:

> "Most of our IEUs [individual end users] were Navigator users. They said they would not switch, would not want to download IE 4 to replace their Navigator browser. . .. . To make them switch away from Netscape, we need to make them to [sic] upgrade to Memphis [Windows 98.] . . . <u>We need to strengthen our key asset and our key brand which is Windows to win the internet war on the desktop side.</u> . . . . convert the Navigator installed base and eclipse Netscape's browser market share leadership. But if we rely on IE 4 alone to achieve this, we will fail." (emphasis in original)

Around the same time, the more senior Mr. Allchin questions the possibility, even with a "totally competitive" browser offering, that IE would be chosen in the marketplace:

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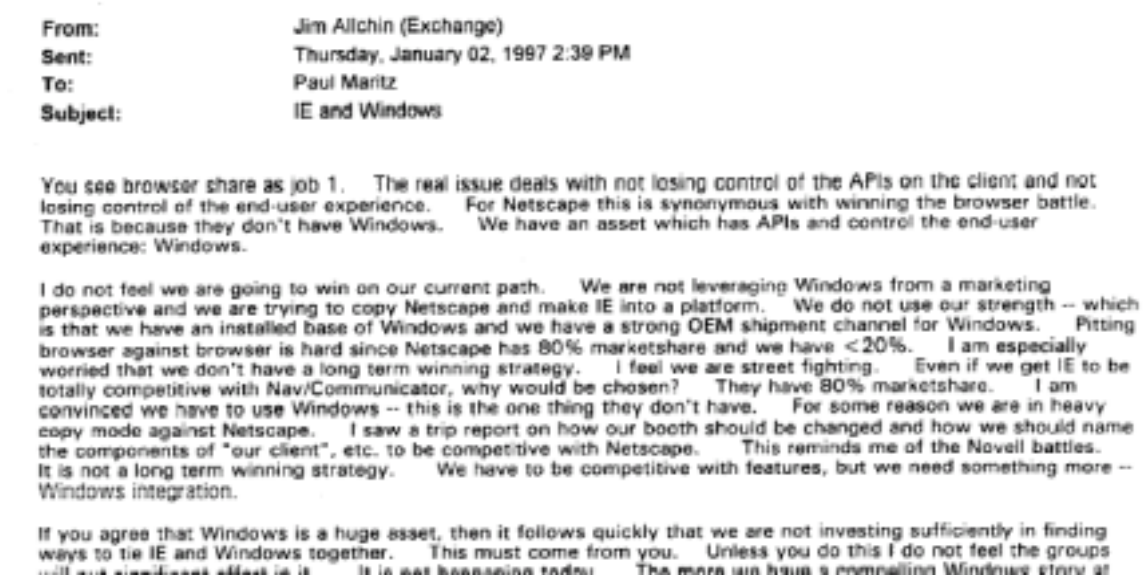
[26] Jonathan Roberts agrees and uses the same theoretical frame in GX 205 "the only real chance IE has of getting them to switch is thru a new pc, an OS upgrade, or a new ISP kit."

[27] By "IEUs" he means Individual End Users, by "Memphis" the OS version that became Windows 98, by "NT 5" the OS version that became Windows 2000, and by NC the Network Computer.



From: Jim Allchin (Exchange)
Sent: Thursday, January 02, 1997 2:39 PM
To: Paul Maritz
Subject: IE and Windows

You see browser share as job 1. The real issue deals with not losing control of the APIs on the client and not losing control of the end-user experience. For Netscape this is synonymous with winning the browser battle. That is because they don't have Windows. We have an asset which has APIs and control the end-user experience: Windows.

I do not feel we are going to win on our current path. We are not leveraging Windows from a marketing perspective and we are trying to copy Netscape and make IE into a platform. We do not use our strength -- which is that we have an installed base of Windows and we have a strong OEM shipment channel for Windows. Pitting browser against browser is hard since Netscape has 80% marketshare and we have <20%. I am especially worried that we don't have a long term winning strategy. I feel we are street fighting. Even if we get IE to be totally competitive with Nav/Communicator, why would be chosen? They have 80% marketshare. I am convinced we have to use Windows -- this is the one thing they don't have. For some reason we are in heavy copy mode against Netscape. I saw a trip report on how our booth should be changed and how we should name the components of "our client", etc. to be competitive with Netscape. This reminds me of the Novell battles. It is not a long term winning strategy. We have to be competitive with features, but we need something more -- Windows integration.

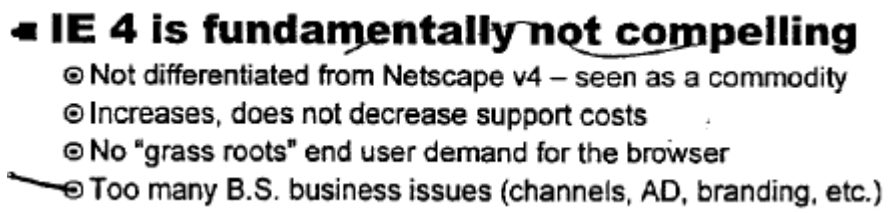
If you agree that Windows is a huge asset, then it follows quickly that we are not investing sufficiently in finding ways to tie IE and Windows together. This must come from you. Unless you do this I do not feel the groups

Figure 11

Note that Mr. Allchin uses a marketwide analysis, rather than a single-user switching cost model, when he draws the conclusion that IE must be tied to Windows to eclipse Navigator, working from a model in which an 80% market share product will persist in that position even against a better alternative.

Mr. Chase, in GX 39, offers an interesting network effect theory linking individual user lock in and network effects. He recognizes that new users will be easier to attract than existing, Netscape customers, but sees the existing base of Netscape users as "influentials" who cannot be ignored by Microsoft.[28] He reports that it has been hard to get users to switch from Netscape; most switchers have instead come from "second-class" browsers. His solution is <u>not</u> to make the browser itself better, but instead "the best way to make people switch browser is to make sure that they have to, in order to get the best content" – don't move the chicken, move the egg.

The general consensus inside Microsoft, late in the browser war, was that the entrenched position of Netscape could not be overcome. Bill Koszewski wrote in "Browser Marketing FY99" May '98 (GX 173)[29]



- **IE 4 is fundamentally not compelling**
  - Not differentiated from Netscape v4 – seen as a commodity
  - Increases, does not decrease support costs
  - No "grass roots" end user demand for the browser
  - Too many B.S. business issues (channels, AD, branding, etc.)

Figure 12

[28] He is not, I think, using "influentials in the same sense as Figure 1, but in a contagion-theory sense of adoption of technology.

[29] Similarly, a February 1998 "Business Outlook for Platforms-Desktop" presentation reports "Key customer feedback" on Internet Explorer: "Many customers see MS and NS as parity products; no strong reason to switch." GX 428.

At trial in 1999, Cameron Myrhvold**,** Vice President, Microsoft's Internet Customer Unit, spoke to Microsoft's reasoning with regard to contracting practices with Internet Service Providers: "we did specifically ask that ISPs distribute Internet Explorer by itself when they distributed Internet Explorer, so that we would not lose all of those side-by-side user choices." [30] Mr. Roberts again (GX 355) "Customer feedback … if they are de coupled, then Navigator has a good chance of winning. In a browser battle, victory will go to the incumbent."

3) OS Positive Feedback loops

The indirect network effects locking in the Windows *de facto* standard are long established and powerful. Lock in to the OS monopoly is a fact of life in Microsoft business discussions. Chris Jones, in GX 494, writes of the "traditional operating system competitors (Apple, OS/2, and UNIX)" that "there is simply no chance that we will lose sales because of lack of feature parity with those traditional products." Brad Chase, in his memo "Winning the Internet Platform Battle" of April, 1996 (GX 39) writes that Microsoft needs a "significant user installed base" to attract developers to either IE or Windows. Without that: "The industry would simply ignore our standards. Few would write Windows apps without the Windows user base." Mr. Jones again, in GX 523, writes that "We are so dominant in all other aspects of the market that we can never be displaced by a full frontal assault." Positive feedback is the essence of that. Earlier, in 1994, thinking about the last "full frontal assault" on Windows' position, that of OS/2 wrote (GX 465)[31] "large vendors like Corel, WordPerfect, and MicroGraphix have announced they are abandoning OS/2, it appears inevitable the OS/2 applications market is going to shrink more. . . . . So aside from a few native OS/2 applications, going forward the only applications available to OS/2 users will be today's MS-DOS and 16-bit Windows applications. Since these apps most likely won't be updated once Windows 95 launches, over time the experience of the OS/2 user will become akin to eating a steady diet of stale bread. . . . .there isn't a clear future for OS/2 users".

Here is Mr. Maritz, in the 1997 Platform plan, writing about a threat to Windows at that time, the Network computer:

[30] This is from the trial transcript of 2/10/99am, p. 62. Trial transcripts may be found at several places on the Web, including Microsoft's web site http://www.microsoft.com/presspass/trial/transcripts/default.asp.

[31]) **xxx this can't be 465, find reference**

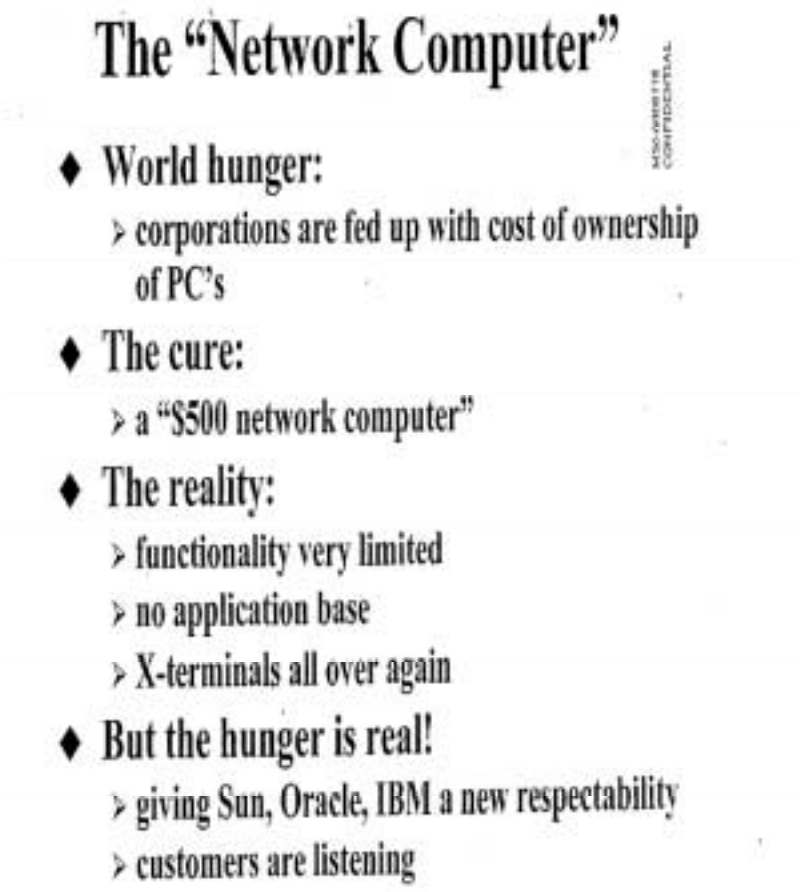


Figure 13

One important point of Figure 13 are that Mr. Maritz sees real limitations in his own product, Windows, from a customer perspective. To emphasize this, he attributes to his customers a "real" desire to escape from the weaknesses of Windows, characterizing it as "End World Hunger." The external threat, the network computer, has two weaknesses, it is less functional and it has no "base" of applications, i.e., it is on the outside of the persistent network effects enjoyed by Windows. It does not seem to me to be appropriate to conclude from Figure 13 alone that the NC is a more efficient technology that is locked out by the network effects – that would involve parsing the relative importance of the persistent network effects and the differences in functionality.[32] But the importance of the network effects means that the mechanism by which customers can influence Microsoft's behavior, is voice, not exit. They cannot realistically switch to an NC, but they can complain to Mr. Maritz.[33] Thus, as a result of the entry barrier resulting from the network effects, we do not have a market test of the propositions that the NC is superior or inferior.[34]

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[32] In general, I think it has been a terrible mistake of the network effects literature to focus on such welfare counterfactuals. They are too difficult to undertake reliably and convincingly.

[33] Microsoft indeed made efforts to reduce Windows "cost of ownership" through a number of initiatives.

[34] With this somewhat more muted welfare economics, I am far more comfortable. It is also the welfare economics called for by antitrust law, as we shall see below.

It is worth understanding just a bit how the lack of applications for new competitors for the OS and the existing commitments of applications developers to Windows plays out. Here is Mr. Chase on the subject in March 1998. (Gx 828)

> "If we lose the developers, we will ultimately lose the platform. Our goal is to build a community of developers and web professionals that emotionally and economically value Microsoft, our products, platform, and tools. Competition is aware that 'our' developer community is a key MS asset and are working [to] divert developers from Windows." His "key metrics for this goal" include ">90% of developers targeting Windows" and ">80% of Java developers writing native Windows Applications."

In a sense, the key words here are "our" and "asset" – Mr. Chase clearly views the developer body as potentially mobile, but having considerable commitment to Windows. The platform-specific sunk costs of developers make them behave inertially and are a valuable strategic asset for Microsoft – that is a nice way, Mr. Chase, to link strategic entry deterrence theory and network effects theory

a) Business People's Inductive Methods

Many Microsoft employees analogized the browser to the OS in thinking through how the new "platform battle" – the browser war -- would play out.

Here is Mr. Mr. Slivka in a long presentation "The web is the next platform" 5/95 (GX 21):

> Now, the UNIX model is one possible way to see the Internet evolving -- several companies start from a good idea, but go in their own proprietary directions and thus are unable to achieve the true leverage of an open, common standard that enables a large market of products. It is possible that if Microsoft forges ahead with it's current MSN plan (BlackBird, OLE everwhere, COM/DCOM, etc.), and only pays the Internet lip service, we may "pull a Windows" and end up dominating the online world. All of these other players will spend all of their time bickering about IETF standards and shipping incompatible extensions, and the Internet will end up a mish-mash of incompatible solutions.
>
> On the other hand, it is also possible that some company will "pull a Windows" by taking a leadership position of enhancing the Web -- this is certainly the strategy that Netscape is pursuing! We have to assume that at least some of our competitors have figured out how Windows won, and are trying to recreate that strategy on the Web.

Figure 14

Andrew Wright, writing in June 1996, made the following interesting positive feedback analogy. Early Windows was not much of a product, but its "promise of a new way of computing and improved productivity generated momentum and ISV loyalty, which has transformed it into one of the most successful franchises in business history." He looks at the then-WWW, and finds that the analogy is precise. While not much of an applications environment at the time, it clearly had the capability of growing into one.

Here is Mr. Chase in GX 512, using an induction to illuminate the issues.

> **GOALS AND STRATEGY**
>
> We have won platforms battles before, we know what we have to do. We know that we need a very large installed base for our platform (browser and email client share) and we need to drive the adoption of the platform by developers (content developers, corporate developers, solution developers....) so they build content and applications on it.

Figure 15

Mr.Maritz (in GX 498) used a perhaps even more apropos historical analogy, for it caught not just the single-platform issues but also the idea of a separate cluster of network effects interacting with, but distinct from, Windows:

Netscape as Netware[1]

The title to this is a little over-stated, but it is a significant worry.

[1] The analogy here is that the major sin that Microsoft made with Netware was to let Novell offer a better (actually smaller & faster, with simpler protocol) client for networking. The got to critical mass and can now evolve both client and server together. Hence we had and still have a really hard time displacing Novell at the server.

In fact, I am still of the opinion that we will not really deliver a really telling blow against Netware until we make some significant user-visible, client-side feature that Novell would have trouble matching in their servers. One of the reasons why I remain such a fanatic OFS believer.

Figure 16

Note the precision of Mr. Maritz' argument: the problem with Netware was that it achieved "critical mass" at an interface (between client and server) and that as a result Microsoft will "have a really hard time displacing" them. Mr. Gates in the Internet strategy day keynote picked up that same analogy of Netware, pointing out that the "market was overwhelmingly a Netware market" and pointing the way to how that might end, a topic to which we shall turn in a moment.

- In every way, the networking market was overwhelmingly a Netware market, and only by providing the same kind of performance and a real ease of sliding one of our servers in and not changing the redirectors and not having to do new things with the security scheme, only by that kind of embrace and extend were we able to get to a position where now Windows NT, although still at lower volume than Netware, is gaining share on a very rapid basis.

What is interesting to me is how analytical these guys can be even though they use inductive methods. Something for economists to learn here?

4) Punctuated Equilibrium and Vertical Disintegration:

Dynamical network effects theory has emphasized the transition from an early period of technological uncertainty to a period of in which choices are not reversed. Using the abstraction and focus that is one of economic theory's strong points, much work writes as if the resulting structures are permanent and irreversible at the later stages, having been costlessly malleable at the early stages. Sensible efforts to use the theory positively would, of course, view that implication in a slightly less stylized way, and take the implication to be that the system moves from a rather more malleable state to a less malleable one.[35] If the costs of moving a locked-in equilibrium are large but not infinite,

[35] A remarkably small subset of users of the theory manages to make this elementary leap. Apparently serious scholars write that the theory is rejected whenever a coordinated change in the economy occurs. Fax machines are a common "carrier" for this argument for "direct" n/w externalities, and automobiles and gasoline stations for the "indirect" one. The existence of these things, now, proves that the economy cannot ever have been in a situation where bringing them into existence would involve

then there will be a great deal of persistence, perhaps punctuated by periods of change when an innovation large enough to overcome the lock in arrives.[36] Microsoft, as we have just seen, clearly understood the persistence part; we now turn to their analysis of the mechanisms by which such persistence may end. While an economic theory may or may not sensibly include "arrival of large innovations" within the scope of the endogenous objects, positive economics and pragmatic business people forming strategies need to think about such things. Microsoft does, of course. There is clearly an extension to the theory (perhaps too obvious to write down? But as we shall see, quite rich) which is already in use in practice.[37]

In what follows, I shall go beyond received network effects theory in order to capture Microsoft's thinking about these areas. The unifying theme in all of this section is vertical disintegration. Specifically, Microsoft's thinking extends to the apparently general equilibrium case of two complementary products, each with its own partially separate, partially overlapping, indirect network effects.[38]. They,as the computer industry does in general, view the situation with more vertical disintegration of leadership as far more competitive than the situation with less. This is how they saw, looking forward, Windows and the browser, or, looking back, Windows and Netware. This larger model (for Microsoft uses it the way we use models) has four main roles that I have attempted to explicate below. First, it explains the sources of disruptive change that might end lock in from a given cluster of network effects. Second it explains why Microsoft thought that a vertically disintegrated structure was so undesirable. If there are partially overlapping clusters of network effects, one might seek to "span" or "abstract" the other – that is, to reduce the importance of positive feedback and lock in to the other. This same model, in some extremely sophisticated uses by Microsoft, also serves as a guide to strategic interaction with other players to make sure one's own technology embedding a set of network effects is not spanned and abstracted, and to guide spanning and abstracting assaults on others' platforms should they come into existence, (especially in their early period where the indirect network effects may be malleable.)

The next four subsections take up these four linked ideas.

a) Disruptive Change

Any theory of the end to positive feedback cycles and breaking out of lock in needs to posit some kind of change that is important enough to break the cycle. Disruptive technical change is one obvious candidate, or cumulated technical change that

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overcoming coordination problems. The error, of course, comes from uncritically and literally looking at the theory's stylized "permanent" and "infinitely costly" and not seeing the underlying "persistent" and "costly." Finite costs can be social costs, and delayed innovation can be a loss even if not delayed forever.

[36] See Bresnahan and Greenstein (1999) for an effort to explain the (low) frequency of platform shifts in computing along these lines.

[37] The circumstances ending lock in are a stepchild in the literature. Shy (1999) has an analysis of a series of temporary lock ins, and Bresnahan and Greenstein (1999) has an inductive analysis of the process of ending lock in in computer platforms. I know of no other treatments – perhaps this conference will enlighten me!

[38] Shane Greenstein and I (1999) called this "divided technical leadership" of a platform and noted its competition-enhancing structure. I (1999) pointed out that the addition of new complementary layers can add new opportunities for divided technical leadership and thus to restart that kind of competition. The Microsoft theory, like mine and Shane's, has vertical disintegration of leadership positions as more competitive whether buttressed by indirect or direct (e.g., Wordperfect's) network effects.

crosses a sufficient threshold to be important enough to break the lock in. Microsoft has thought about this a lot, and learned the first lesson of the "Arrow effect" for incumbent monopolists very well. Microsoft seeks to anticipate and control disruptive change, knowing that the continuation of its position calls for it to control the technologies that might obsolete the platforms at the heart of its existing network effects. Microsoft, accordingly, has a standing policy of participating, at least at a low level, in all of the technologies that might be the source of the disruption, so as to avoid unpleasant surprises.

The Internet, however, grew up being used for things far from Microsoft's main markets, and was genuinely irrelevant for at least its first twenty years. The early stages of the commercialization of the Internet were not all that commercial, taking place in laboratories and universities. Thus the Internet was able to build up considerable technical momentum, though it had no important connection to ordinary PC consumers. Several junior Microsoft employees saw the more end-user oriented trend in the Internet in 1994 as potentially relevant to the PC business, but despite a substantial meeting with Mr. Gates in Spring 1994, the company did not focus on the importance of this particular disruptive change until a year later. What happened in the interim was that Netscape, a startup founded by the young inventor of the browser and some much more experienced technology business people, got a huge head start. Navigator, introduced in late 1994, was an instant success, and well on the way to dominating the browser market (there were some existing freeware, etc., products) and in a clear position to "preempt"[39] Microsoft's browser before it even made it to the market.

Many, many Microsoft internal documents talk about this disruptive surprise and how important it is to change one's thinking to deal with it. One interesting metaphor is the browser as a "Trojan horse" – it appears to be a nice application running on Windows, but there are surprises in it. Another interesting metaphor is "change the rules."[40]

Of all these documents, the most telling is a May 1995, memo from Mr. Gates (GX 20) entitled "The Internet Tidal Wave." Mr. Gates opens his memo by saying "Our vision for the last 20 years can be summarized in a succinct way." The vision is one of indirect network effects among users and developers of applications on a single PC. That vision has now been obsoleted by events. "The Internet is the most important single development to come along since the IBM PC was introduced in 1981" even more important than the graphical user interface.

> "The PC analogy is apt for many reasons. The PC wasn't perfect. Aspects of the PC were arbitrary or even poor. However, a phenomena [sic] grew up about the IBM PC that made it a key element of everything that would happen for the next 15 years. Companies that tried to fight the PC standard often had good reasons for doing so but they failed because the phenomena [sic] overcame any weaknesses that resisters identified."

While the Internet has been growing out in nerdy communities for a long time "Most important is that the Internet has bootstrapped itself as a place to publish content. . . . positive feedback loop . . ." Then, at the very end, Mr. Gates writes "The Internet is a

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[39] In the words of Thomas Reardon, Microsoft employee who negotiated with Netscape.

[40] Mr. Muglia, August 1996: "'97 Tools Vision" "The Internet has changed the rules and opened up opportunities for new competitors."

tidal wave. It changes the rules. It is an incredible opportunity as well as incredible challenge."

The essence of Mr. Gates' analysis is disruptive change that comes from outside. Note, however, how sophisticated his argument is. First off, the disruptive change comes from a complement to PCs, not a substitute. Second, ordinary technical change in computing and telecommunications is converted into disruptive change when it gets its own positive feedback cycle going.[41] The underlying theory, familiar in the economic literature underlying this paper in general but highly interesting in this application, is one in which positive feedback in new areas leads to very rapid complementary developments, just as in old areas it can lead to lock in. The analogy to the success of the PC/Windows is used to direct Microsoft employees not to "resist" the "phenomena [sic]" of positive feedback around the Internet, even though they might have "good reasons" for that . . .in a metaphor that is striking as way to summarize the managerial implications of network effects, the company must align itself with the tidal wave and control it rather (opportunity) rather than resist it (challenge.)

Microsoft thought that its monopoly in PC operating systems was unassailable from any direct assault. The network effects associated with Windows as a platform were enough to assure that. Further, assaults based on disruptive change from the other main layers within the existing PC industry were foreseeable and under control. Computer manufacturers had been rendered toothless by making their product a commodity, though they remained a distant threat. Novell, while still annoyingly independent as a networking company, was in a weak strategic position. Intel was the most worrisome potential source of disruption, but a known and containable one. Disruptive change in existing PC applications markets was unlikely to be the source of new competition, as the nearly universally distributed applications, "personal productivity applications" like word processing and spreadsheets, were dominantly sold by Microsoft.[42] The application that brought disruptive change was fundamentally from the outside, "born on the Internet" as Mr. Gates wrote.

b) Vertical Disintegration and Competition

Based on its knowledge of the history of the PC industry, Microsoft analyzed the threat to its position posed by the Internet in a sophisticated way The problem was a piece of platform-level software, the browser, outside Microsoft's strategic control. Microsoft viewed the existence of a second, partially overlapping network effects system –

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[41] In another interesting document, GX 336, Mr. Gates writes "Netscape's strategy is to make Windows and the Apple Macintosh operating system all but irrelevant . . . hoping that its browser will become a de facto platform for software development, ultimately replacing Windows as the mainstream." Why might a complement be able to do that? "the widespread adoption of the Internet is a sea-change." (emphasis added) Note that he writes that it is not some new technical development, but adoption, that is the sea-change. I agree, which is why I write that it is the commercialization of the Internet that was the disruptive change.

Relatedly, Mr. Gates in his Internet Strategy Day keynote address expects his engineers to easily criticize the 'net "in terms of pure technology." But he points out that it has critical mass of users and content, so that "any weaknesses or limitations it has almost become strength, because you get thousands of companies jumping in to fix those problems, viewing it as a commercial opportunity."

[42] Office itself was a secure monopoly buttressed by network effects, especially with control of the most important other layer from the perspective of an application, the operating system, under Microsoft's control.

Netscape's Browser and/or Sun's Java as the core of one system, its own Windows as the core of another – as competitive. Let us now look at their thinking on that. In a way, this is the core of the "general equilibrium" extension they have made to network effects theory.

What was frightening to Microsoft about the independent browser were a series of important market and technical features. First, once it was clear that the Internet was an important complement to a large number of PC users, the browser was going to be very widely distributed, nearly ubiquitous. Second, the browser had the possibility to come between the operating system and applications, that is, to be "middleware." A user could, for example, have access to an application running on the web somewhere rather than on his own PC. With some technical progress, the clumsiness of that kind of access that was visible in early 1995 might be reduced, and running applications "in the browser" might become popular (as might designing 'net-centric applications like email and IM "for the browser.") [43]

Those first two features were relevant in the discussion of the browser wars, above. Here the third element of the browser becomes quite relevant. Navigator was a "cross platform" piece of middleware. It ran, not only on Windows, but also on other kinds of "client" computers. If applications came to be written "for the browser" they would run, not only on Windows, but also on Macintoshes and on various cheap UNIX variants, or even on whole new kinds of computers. This prospect was very alarming to Microsoft. The browser might "abstract" Windows, by spanning multiple kinds of PC. That would reduce the role of Windows as the center of the indirect network effects, in the first instance. It would permit competition from other operating systems running on Intel processors, or from other kinds of hardware – as long as they could run a browser and as long as the user could get the applications she wanted "in the browser." To make matters worse, if the browser itself could not become the applications development environment that "abstracted" Windows in this way, the very widely distributed Netscape browser might serve as a distribution vehicle for something that did – Java was the obvious candidate.

The core of Microsoft's worry about the browser <u>as an enabler of competition for Windows</u> came from this spanning and abstracting.

Much can be learned of their thinking from the time, in spring 1995, when

A new competitor "born" on the Internet is Netscape. Their browser is dominant, with 70% usage share, allowing them to determine which network extensions will catch on. They are pursuing a multi-platform strategy where they move the key API into the client to commoditize the underlying operating system. They have attracted a number of public network operators to use their platform to offer information and directory services. We have to match and beat their offerings including working with MCI, newspapers, and other who are considering their products.

One scary possibility being discussed by Internet fans is whether they should get together and create something far less expensive than a PC which is powerful enough for Web browsing. This new platform would optimize for the datatypes on the Web. Gordon Bell and others approached Intel on this and decided Intel didn't care about a low cost device so they started suggesting that General Magic or another operating system with a non-Intel chip is the best solution.

[43] Mr. Maritz, alarmed, in GX 490 summarized these two features: "Netscape: The first "middleware" layer to have end-user momentum".

Microsoft grew aware of the potential Browser threat and turned to deal with it.[44] Mr. Gates' Internet Tidal Wave memorandum stated the nature of the problem in clear terms (my emphasis in the figure).

Mr. Gates sees Netscape's innovation as bad for Microsoft through enabling operating system and hardware competition. His analysis is predicated on vertical disintegration: only the dominant position of the non-Microsoft browser will permit external control over "network extensions." His concern is that the browser is "multi-platform" i.e., runs on many operating systems, so that it might "commoditize the underlying operating system." The consequence is a reduction in entry barriers "Internet fans" might "create something far less expensive than a PC which is powerful enough for Web browsing."

This focus on vertical disintegration drew, once again, on the inductive tradition of the theorizing we have seen from Microsoft. They were so sure that a platform technology that spanned and abstracted Windows would increase the competitiveness of Windows' environment because they had seen the operating system span and abstract the IBM PC. They knew, from that experience and many others in the PC business, that real threats could be encouraged by complements to their product. They viewed the World Wide Web in general and the browser and java in specific as dangerous developments precisely because they had platform potential and were outside their strategic control.

Mr. Gates was basing his analysis upon the work of many Microsoft employees in the Internet area. Ben Slivka (1995) wrote an influential memo with "a lot of material" in the same time period entitled "The Web is the Next Platform." Here is the beginning and a bit from Ch.1:

The Web is the Next Platform
5/27/95, bens (version 5)

Note: I've included a lot of material in this memo. If you don't have time to read it all, please be sure to read at least the first 4 chapters.

Table of Contents

[44] Some Microsoft employees had, of course, been aware of Internet technologies before this time, as the Internet had been in use, primarily in noncommercial contexts, for over two decades. It was, however, the commercialization of the Internet at the hands of entrepreneurs like the founders of Netscape that brought it to Microsoft's, and the world's, attention.

My nightmare scenario is that the Web grows into a rich application platform in an operating system-neutral way, and then a company like Siemens or Matsushita comes out with a $500 "WebMachine" that attaches to a TV. This WebMachine will let the customer do all the cool Internet stuff, plus manage home finances (all the storage is at the server side), and play games. When faced with the choice between a $500 box (RISC CPU, 4-8Mb RAM, no hard disk, ...) and a $2KPentium P6 Windows machine, the 2/3rds of homes that don't have a PC may find the $500 machine pretty attractive!

The following attributes of the Web are paramount:

1. Server-side information and *interactive applications* are key (the viewer is just enabling technology)
2. Universal data formats and viewers enable the web to grow in richness and power -- the Web is a platform that no one controls and everyone can enhance.

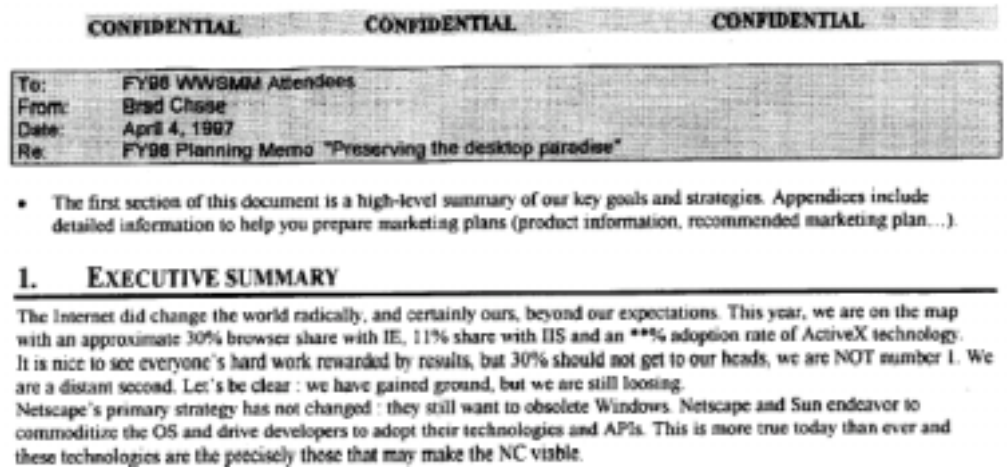
Figure 17

There are several key messages in Mr. Slivka's memo. Note that he underlines Mr. Gates' analysis of the mechanisms by which competition from the WWW might be problematic. He has a "nightmare scenario" related to the possibility of "operating system-neutral" developments – spanning and abstracting leading to loss of product differentiation and of entry barriers.[45] Mr. Slivka is concerned that, since "no one controls and everyone can enhance" the Web, an era of Microsoft control of standards setting could come to an end.

It was not only the possibility of competition from a newer, cheaper, home computing device that had Microsoft officials concerned. In a planning memo titled "Preserving the Desktop Paradise,"[46] Brad Chase (1997) (GX 512) agreed with others that the strategic goal of Netscape was to "obsolete Windows" and to "commoditize the OS." At this somewhat later date, however, Chase is concerned about customers at work as much as home, for he is concerned that the developments in Java and the browser are "precisely those that make the NC viable." We saw above that successful entry by the NC was partially blocked by lack of features, partly by lack of applications. Entry and success of the NC are, as Chase makes clear, contingent on the success of some kind of cross-platform middleware such as the Browser or Java, which would permit development of applications that could be more easily ported from Windows to NC. Note also that, even at this late date, Mr. Chase refers back to the disruptive nature of the commercialization of the Internet to open his analysis:

[45] The nightmare is only a nightmare for Microsoft, however, as customers – he is obviously thinking about customers using their computer at home -- gain tremendously from new competition ushered in by operating system neutrality, getting the computer they want for one quarter of the current price.

[46] Oddly titled if the industry were perfectly competitive, don't you think?



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To: FY98 WWSMM Attendees
From: Brad Chase
Date: April 4, 1997
Re: FY98 Planning Memo "Preserving the desktop paradise"

- The first section of this document is a high-level summary of our key goals and strategies. Appendices include detailed information to help you prepare marketing plans (product information, recommended marketing plan...).

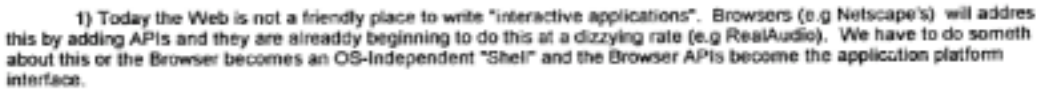
1. EXECUTIVE SUMMARY

The Internet did change the world radically, and certainly ours, beyond our expectations. This year, we are on the map with an approximate 30% browser share with IE, 11% share with IIS and an **% adoption rate of ActiveX technology. It is nice to see everyone's hard work rewarded by results, but 30% should not get to our heads, we are NOT number 1. We are a distant second. Let's be clear : we have gained ground, but we are still loosing.
Netscape's primary strategy has not changed : they still want to obsolete Windows. Netscape and Sun endeavor to commoditize the OS and drive developers to adopt their technologies and APIs. This is more true today than ever and these technologies are the precisely those that may make the NC viable.

Figure 18

Many, many more Microsoft employees saw the potential for the positive feedback surrounding the Internet, if there were an independent browser, to move in a direction to "abstract" Windows and therefore "obsolete" its standard-setting role.

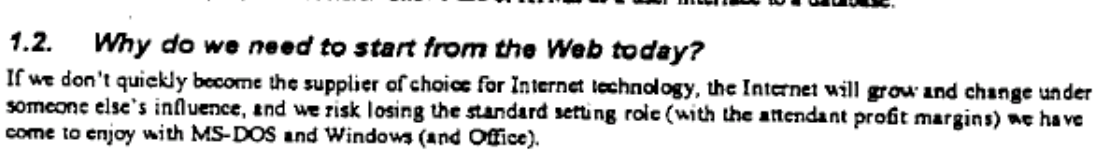
Here is Mr. Rashid, head of research, in April 1995 on how the browser might rapidly move in that direction.[47] GX 521



1) Today the Web is not a friendly place to write "interactive applications". Browsers (e.g Netscape's) will addres this by adding APIs and they are already beginning to do this at a dizzying rate (e.g RealAudio). We have to do someth about this or the Browser becomes an OS-Independent "Shell" and the Browser APIs become the application platform interface.

Mr. Maritz: "if more and more application programs get their services from Navigator and not from Windows, the perceived value of Windows is going to decline, and the ability to have those applications moved to other platforms will also be increased."

Mr. Slivka, in "The Web is the Next Platform," (cited above) GX 39, is unwilling to have any vertical disintegration within the various platform layers as they lead to opportunities for competition. It is quite clear that the WWW is a threat to Microsoft's ability to unilateral ability to set standards, which Mr. Slivka sees as a source of profitability, and that part of the problem is that the Web is open. Note that he believes that Microsoft must become "the supplier of choice for Internet technology." Failing that, the key to the profitability of the company will be lost, for they will risk losing the standard setting role they have in operating systems and in Office:



1.2. *Why do we need to start from the Web today?*

If we don't quickly become the supplier of choice for Internet technology, the Internet will grow and change under someone else's influence, and we risk losing the standard setting role (with the attendant profit margins) we have come to enjoy with MS-DOS and Windows (and Office).

Figure 19

The importance of vertical disintegration for entry and long run competition is illustrated by other kinds of internal Microsoft analyses as well, such as those related to pricing Windows. Joachim Kempin (1997) asks, in a heading about a Windows pricing

[47] Many, many . Mr. Wright GX 407 "core threat for Microsoft is the potential for this platform to abstract the Win32 API." Mr. Slivka again GX 399 4/95 "slightly extreme view of the ability of the Web to make Windows irrelevant, but it [is sic] worthwhile to ponder this possible future"

plan "Who can derail this plan and MSFT counter tactics." Among the "who" are no current vendors of other operating systems for PCs or other horizontal substitutes – no mention of the Macintosh, of Be, or of Linux. Sun (only) is mentioned under the "OS competitor" heading, but as one that would have to enter by way of Java, so that "for the next 2-3 years the barriers are huge for them."

The threats Kempin considers, but discards as not actually constraining Microsoft, are all threats of potential entry in to the OS business sponsored by or undertaken by firms in other layers. One is from an "OEM coalition" – current complementors / customers who might "fund a competing effort (say in India)." Other potential sponsors include an ISV, Netscape, and Intel, the microprocessor manufacturer, or a Netscape-Intel-Compaq coalition. Kempin thinks that all of these are unlikely threats, however, because they would have to get over the great "inertia" created by customer investments in "training, infrastructure and applications in windows [sic] computing." But they are the closest threats he can adduce to the Windows monopoly. Kempin's pricing analysis assumes (with some foundation, as anyone who has met firms in the other layers will attest) that firms in the layers around Microsoft are adequately annoyed with the way Microsoft has been handling the Windows monopoly that they might sponsor a potential entrant or become potential entrants themselves. Vertical disintegration is critical to Kempin's argument that there is a -- small -- threat of entry from the existing complementors; his assessment of the small size of the threat turns on the inertia associated with lock in to Windows network effects.

Mr. Maritz, Group Vice President, Platforms, and third in command at Microsoft, spoke in court to the issue of how a complement in the present could become, with suitable developments, a substitute in the future.[48]: Even though middleware, of which the Netscape browser is an example "is not, in itself, an operating system. It relies on a [sic] underlying operating system, but it takes on many of the functions of an operating system." Despite this distinction between Browser/middleware and operating system, "Netscape was becoming a platform ... that other software could depend upon, and they were extending its capability as a platform. And one of the natures of a software platform is that it exists to enable other software and if the other software is depending upon your competitor's platform, even if it's running on top of your own platform, over time the value of the platform can become diminished ... ." Note the very explicit pointing to the competition from the next layer over. "Even if it [the browser] is running on top of your own platform, over time the value of the platform [Windows] can become diminished."

Mr. Slivka talked about the same kinds of issues in his deposition.[49] "So the point is not that the little tiny Web browser, you know, whether it was Navigator or Navigator 2 or Navigator 3, the point was not that that thing as it stood then would immediately kill Windows. . . . The point was that that thing could grow and blossom and provide an application development platform which was more popular than Windows."

Chris Jones farther down in IPM (523) no "full frontal assault" we have already seen. But the opportunity to have Windows be abstracted by a web-oriented applications development platform is problematic. And that is the bottom line for Microsoft; external control of platform-capable software is highly troubling to them.

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[48] Maritz testimony, 1/25/99pm.
[49] Slivka Deposition., 1/13/99..

i) Java

While we have not spent a great deal of time on Java, it is worth noticing that Microsoft employees used the same framework, especially emphasizing vertical disintegration as a mechanism for breaking lock in and thus permitting entry. Here is Mr. Maritz on the *future* of the Java threat in Maritz GX 490 (97 platform plan) Note that here he sees that the potential entrant into the operating systems business that is enabled by Sun's Java is Sun's OS. This is one of the two main forms of argument about why vertical disintegration permits entry. In the other main form, which we saw above, entry is itself vertically disintegrated, so the entrant OS and spanning layer might be from different firms.

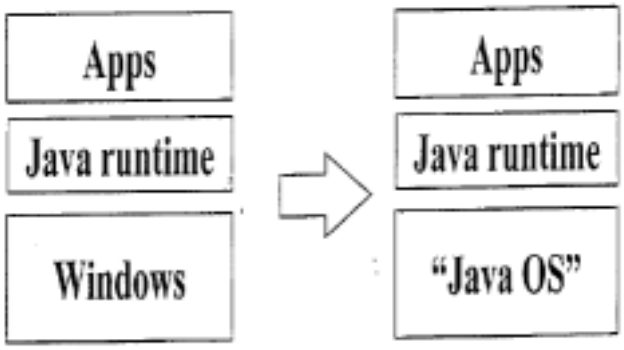


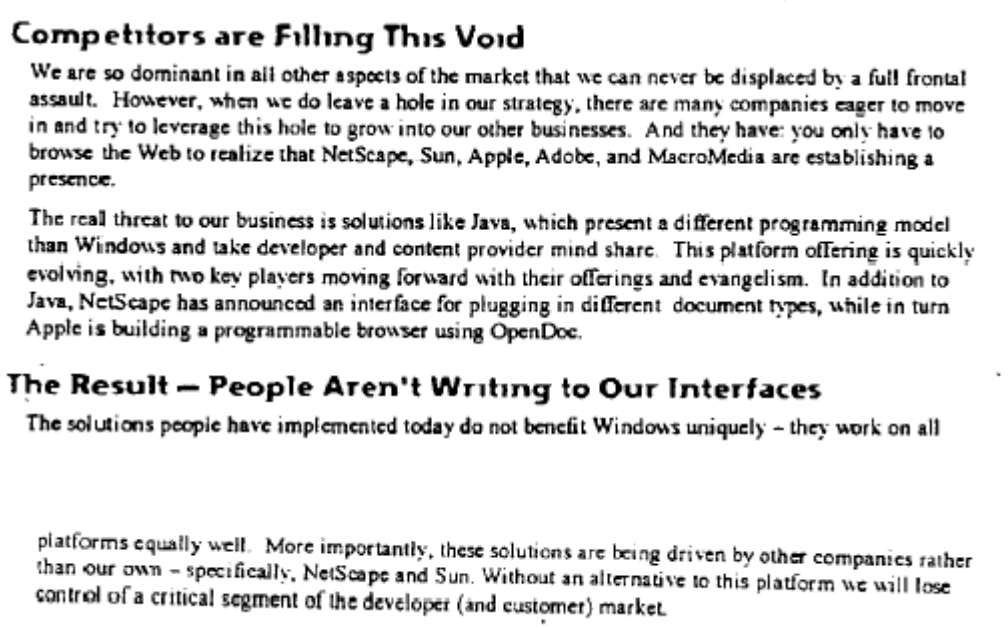
Figure 20

Here is Mr. Maritz in GX 42 on why to avoid a vertically disintegrated Java.

The need here is to fundamentally blunt Java/AWT momentum and to re-establish ActiveX and non-Java approaches as a viable strategy for structuring software, in doing protect our core asset Windows - the thing that we get paid $'s for. While Java per se is not the problem, if everything & everybody moves to Java as a language, then it will be so much more easy for AWT to become the API, and Windows is damaged.

Figure 21

Mr. Muglia, August 1996 "'97 Tools Vision" memo to Developer Tools Division wrote that when the focus of applications development moves away from Microsoft's APIs to others, this contributes to the momentum of the outside platform, possibly leading to new competition by "potentially opening up the opportunity for our competitor to slide in its own operating system offering."



Competitors are Filling This Void

We are so dominant in all other aspects of the market that we can never be displaced by a full frontal assault. However, when we do leave a hole in our strategy, there are many companies eager to move in and try to leverage this hole to grow into our other businesses. And they have: you only have to browse the Web to realize that NetScape, Sun, Apple, Adobe, and MacroMedia are establishing a presence.

The real threat to our business is solutions like Java, which present a different programming model than Windows and take developer and content provider mind share. This platform offering is quickly evolving, with two key players moving forward with their offerings and evangelism. In addition to Java, NetScape has announced an interface for plugging in different document types, while in turn Apple is building a programmable browser using OpenDoc.

The Result – People Aren't Writing to Our Interfaces

The solutions people have implemented today do not benefit Windows uniquely – they work on all

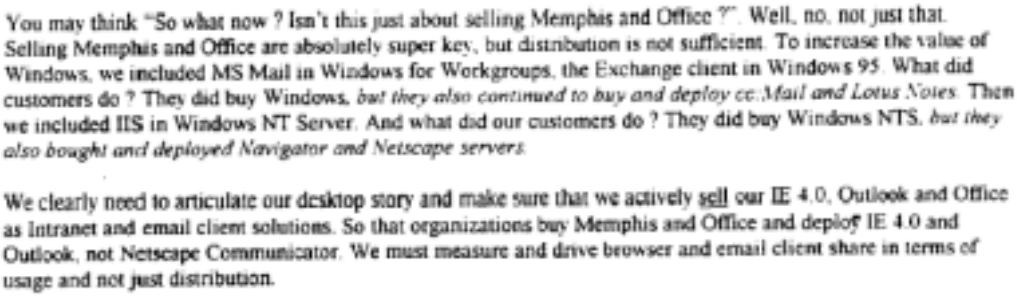
platforms equally well. More importantly, these solutions are being driven by other companies rather than our own – specifically, NetScape and Sun. Without an alternative to this platform we will lose control of a critical segment of the developer (and customer) market.

Figure 22

As you can see, Mr. Muglia does not want to leave "a hole in our strategy" because he thinks that this permits entry into Microsoft's existing businesses. Let us now turn to the breadth of that remark.

ii) Total Control of All Platform Layers

Brad Chase FY98 Planning Memo "Preserving the Desktop Paradise" 4/97 (GX512) any vertical disintegration at platform level is bad for Microsoft. His *emphasis* (in Figure 23) refers to the tendency of customers, come circumstances, to use some technologies other than Microsoft's instead of becoming all-Microsoft shops.



You may think "So what now ? Isn't this just about selling Memphis and Office ?". Well, no, not just that. Selling Memphis and Office are absolutely super key, but distribution is not sufficient. To increase the value of Windows, we included MS Mail in Windows for Workgroups, the Exchange client in Windows 95. What did customers do ? They did buy Windows, *but they also continued to buy and deploy cc:Mail and Lotus Notes*. Then we included IIS in Windows NT Server. And what did our customers do ? They did buy Windows NTS, *but they also bought and deployed Navigator and Netscape servers*.

We clearly need to articulate our desktop story and make sure that we actively sell our IE 4.0, Outlook and Office as Intranet and email client solutions. So that organizations buy Memphis and Office and deploy IE 4.0 and Outlook, not Netscape Communicator. We must measure and drive browser and email client share in terms of usage and not just distribution.

Figure 23

This is, in fact, a theory, applied with suitable alterations in a large number of distinct factual situations. It is not just the disruptive and surprising "Trojan horse" examples of browser and Java that Microsoft wants to bring under its own control, but in general vertical disintegration of the platform space is to be avoided. We have already seen the discussion of Novell Netware in the same framework. Mr. Slivka was very clear about the issue in "The Web is the Next Platform" (GX 1016) writing Microsoft must "be

the product supplier of choice for all key existing Web technologies – clients, servers, and publishing tools, at a minimum."

c) Converters? Spanning! The Decision to be Cross-Platform

Microsoft's thinking about partially overlapping clusters of network effects is an important nexus for investigating compatibility decisions.[50] There are two important strategic ideas here, a defensive one, reviewed in this subsection, about how to deal with an externally controlled technology which threatens to span and abstract Windows, and an offensive one, which appears in the next subsection.

Both the defensive strategic idea and the attacking strategic idea build on a simple point about the behavior of the nonstrategic, follower actors, such as users and developers. The nonstrategic actors are going to be fundamentally ambivalent about a platform; on one side, they value continuity because they have sunk costs specific to the platform. So they tend to stay with the familiar, and like familiar platforms to evolve predictably and sedately. On the other side, the nonstrategic actors often feel the chafing of being locked-in, and would like to be liberated from it. They would especially like to be liberated from it in a compatible way, that is, a way that does not break with their existing sunk costs. This is a very simple point, highly familiar from either industry history or the theory.

When we put this basic point in the general equilibrium context of two partially overlapping indirect network effects clusters, we get a much richer structure that leads to two interesting Microsoft strategic doctrines. On the defensive side, a problem Microsoft had to deal with was that nonstrategic actors liked the cross-platform nature of Navigator and Java. This was viewed, in the user and developer's eyes, as a positive feature of those technologies. And why not? A cross-platform browser is better than a monoplatform one; one can look at web pages and run web applications (such as they were) without constraint of checking the underlying OS[51]. "Write once, run everywhere" is obviously a positive feature of Java for a developer. Cross-platform is a plus because it is the removal of a constraint. Hence Microsoft's defensive doctrine. When worried about being spanned and abstracted by a cross platform complement, take away the advantage by making your own version and making it be cross-platform. The lovely phrase "enough x-platform to be competitive" in GX 52 (Figure 24), captures this perfectly. Thus Microsoft set out to have its browser and it's Java virtual machine run on other kinds of computers, like Macs and UNIX boxes. Indeed, in one of the more memorable moments of the browser war, they compelled Apple to heavily favor IE over Navigator.[52] The point is to take away a selling point -- cross platform capability.

Not surprisingly, this kind of strategy puts a certain amount of stress on a firm that thinks of itself as in the platform-management business. It takes careful management to make sure that ones own offering is truly cross-platform, for Microsoft engineers and

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[50] The theory has spent a good deal of time on decisions about compatibility in competitive situations, and on the role of "converter" technologies – those which permit a user or developers who have made sunk investments specific to a platform to take advantage of those investments while using another platform

[51] See, among many, many such references, the discussion in GX 233. Some of the discussion is quite subtle. See, e.g., GX 503, where ISPs want a cross-platform browser (because their customers do).

[52] A slightly odd behavior if IE was an operating system improvement, don't you think?

managers will have both the knowledge and strategic predilection for "Windows first." Partly this stress is reduced by simply managing it, partly by organization to keep people with very different goals (platform building and cross-platform spanning) from sitting next to one another, and partly by promising oneself that the cross-platform phase is temporary -- it will only last as long as competitively necessary (more on this in a moment.)

Here's one from GX 52 about the early part

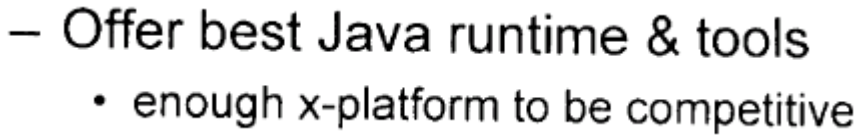

Figure 24

Once a technology has been offered for a while in a cross platform way, the strategic reasons for that will become less important, notably after the externally controlled technology has lost any real momentum to span and abstract Windows. At that juncture, plenty of voices will be raised to remove or make far less important the cross-platform feature. Mr. Allchin, in GX 475, offered a strongly worded version of this "it's time to go back to Windows" argument.

d) Converters? Spanning! Embrace and Extend

Now, let us turn to the offensive doctrine, called "embrace and extend." If there is a nascent indirect network effect building around an externally controlled technology, Microsoft will wish to ensure that it ultimately controls it. "Embrace and extend" means make your own version which is fully as functional as the outside technology, and in some ways ("extensions") even a little bit better (sometimes the "better" is only on Windows.)[53]. Then there is no reason for the nonstrategic actors to use the outside version, and perhaps even a bit of a reason to use the Microsoft variant. Again, the strategy takes advantage of the ambivalence on the nonstrategic actors' part.

Now, "embrace and extend" doesn't work very well against a canny, inventive external actor (like Netscape.) They will keep adding their own extensions, making the embrace difficult. But it works quite well against consortia, universities, and the like, and tolerably well against outside agents who, for some reason, are "open" with their standard setting.

Mr. Gates Internet strategy day keynote speech suggests that either they or Netscape will embrace and extend open Internet standards.

[53] More generally, this strategy could almost fully embrace rather than fully – if nonstrategic actors are making tradeoffs, the Microsoft version could be somewhat less functional than the outside technology and the strategy still works.

So the Internet, the competition will be kind of, once again, embrace and extend, and we will embrace all the popular Internet protocols. Anything that a significant number of publishers are using and taking advantage of we will support. We will do some extensions to those things.

This is exactly what Netscape does. They support all the standard protocols, but in the case of things like frame sets or tables or what was called light script, they chose to make extensions. Now, those extensions can be cloned by someone else. Likewise, all the extensions that we make will be clonable by other people. And so you get the interesting question, will it be a case where everybody's tied in doing these things, in which case you've got about zero value, or will one party or another be ahead in this?

Figure 25

Mr. Gates, in DX 400, put this in a very interesting way. He wanted to "make Microsoft products the cornerstone of [anyone's] internet access strategy." He views the problem as one in which the "key here is to find places where Microsoft can set *de facto* standards without competing with the existing standards bodies." He was writing, in April 1994, at a time when he thought the Internet was run by "standards bodies" like the IETF, a bit simpler to deal with than Netscape.

Mr. Slivka in "The Web is the next platform" argues for embracing and extending the Web:

At a high-level, this is very clear. We should support all of the key internet standards and become key suppliers of Internet technology to all comers. In parallel, we should be extending the web with as many Microsoft technologies as possible, even if we have to modify those technologies in ways not original intended by their designers. If we look at the reasons for our success with Windows, certainly one important aspect was the quality of our development tools and the support we give our ISVs.

I think a key focus for...

Figure 26

He was hardly alone in this call.[54] Mr. Maritz, in GX 490, made same point about the browser. "Embrace and extend" meant "Implement all Netscape Features" and "Offer new Differentiated features." – interestingly, on both Windows and Mac (cross-platform embrace and extend!) When communicating this message to programmers, Mr. Chase (in the GX 684 document we saw above) emphasized the need to "clone all the features they have today, plus new ones they will add between now and our next release." "We have to get serious about extending and owning HTML as a format, and in the process leverage our existing assets to get ahead." Mr. Maritz wrote (in GX 503) that the strategic point was to "Get control of, then leverage the programming model" used by developers.

e) Equilibrium problems

Once one has embraced and extended, then there is every opportunity to guide the developer body toward Windows-specific variants. Why not make it easier for them to do what you want, which is develop for Windows? xxxx called this "embrace, extend, and then turn the crank."[55] Interestingly, the defensive strategy ends the same way. Once the outside threat is blunted (and the temporary period of cross-platform supply is often an important part of that) and one has the undivided attention of developers and users,

[54] Cf. GX 148, from May '95, which summarizes the Internet strategy in this way.
[55] Outsiders call this strategy "embrace, extend, extinguish."

why, it is time to steer them back to Windows. One can even continue to offer "cross platform" versions, as a courtesy to old customers. The technology simply works better, and is released earlier, for Windows.[56]

This raises two very interesting analytical points: rational expectations and determinacy. Since the endgame is, in both strategies, not one in which developers and users get the combination of liberation and continuity that the intermediate stages seem to promise, why do these strategies work in RE equilibrium? Don't they know that supply is only going to be open and cross platform as long as it feels compelled to be? It appears that the strategies that I have described have an element of equilibrium opportunism in them. How can that be right? Second, in a partially overlapping set of two or more indirect network effect systems, what permits one firm to embrace and extend, and the other not to be embraced and extended?

The RE question cannot be satisfactorily answered without attributing to the nonstrategic users and developers some fundamental limitation. My natural modeling tendency would be to say that these agents are smart and foresighted, but that there is an externality. All the followers would have to act together to defeat the strategy, and that would be prohibitively expensive to coordinate -- indeed, the plausible mechanism to coordinate such a thing is to have a non-follower (strategic) agent build a set of technologies that lead the positive feedback that coordinates the collective action. Here is a very interesting (Gates / Myhrvold) discussion of the subject in 1994 (Hors de combat, they thought at the time.. The meditative flavor here comes because they thought that the Internet was of limited competitive significance.) Mr. Myrhvold (DX 386)

> Content developers will try to remain platform neutral, tool neutral and format neutral, and for the most part they will fail. Once people start to compete they will increasingly become platform and tool specific if there is any advantage in doing so. This includes both the computing platform (i.e. Windows) and also the online service environment, such as how you do pointers (URLs, monikers...), billing and anything else which winds up being embedded in your content/service in a serious way. This will create a new inertia in changing standards.

Figure 27

The essence of the argument here is that developers are not only hard to coordinate because they are separate; they are to some degree in competition with one another. Thus they will follow their own individual best responses. Further, time matters to developers – they need to gain "any advantage" in developing now. Mr. Myrhvold thinks that only a "large player who can create something significantly new and evangelize it successfully" can lead to a new standard.[57] Efforts of the smaller players to have technologies develop the way they like "for the most part . . .will fail."

As in any large social system, there are certain limits on the ability of platform leaders to exploit followers, and thus limit to the model of Microsoft as leader, users and

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[56] Mr. Gates wrote, after Microsoft had been undertaking cross-platform development for a while, that it was time to remind developers that cross platform development has disadvantages as well as advantages and to lead them back toe Windows.

[57] It would be interesting to learn if he still believes now that the large player must be commercial, after the open source movement demonstrated some positive features. In any case, his view of the nonstrategic actors as followers is unlikely to have changed.

developers as atomistic, nonstrategic followers. In some circumstances, outsiders act outside their own individual self-interest, coordinating on strategies that matter for the leaders. For example, a Microsoft team was sent off to find out about Netscape's revenue sources, with the goal of knowing enough to put the firm out of business.[58] They reported back "Sorry this took quite some time . . . . Customers/ISPs don't want to talk about it because they all know we are out to get them [Netscape]." Relatedly, there is a strong tendency among many developers to prefer open standards even when their self-interest is as described in Figure 27. Computer people use the label "religion" to describe this behavior.

Now the question of who embraces and extends whom is an even more interesting one. In a competitive race, it has no -- can have no -- set answer. But in the game of old, established Windows against upstart Navigator, the core of the answer would be fleetness against "gravity" (in Mr. Gates useful phrase, above.) That is my last positive topic, to which we now turn.

f) Extension of the n/w effects

As it worked out, Microsoft's efforts to embrace and extend the protocols by which the Internet connects to PCs was successful in the marketplace, and the possibility that Internet technologies would span and abstract Windows was blunted. We didn't get (a) competition in OS (b) a serious effort to replace Windows in the OS or even (c) separate control of browser network effects so that there might be, later on, efforts at (a) or (b). Instead, we got control of both browser and operating system network effects by the same firm. Why did it go that way and not the other way? The essence of Microsoft's strategy in dealing with the challenges brought to it by the commercialization of the Internet was twofold. First, slow down the momentum that might have led to external control of Browser standards and/or divided applications standards by thwarting the widespread distribution, use, and development of technologies such as Navigator and Java.[59] With that momentum thwarted, Microsoft had enough time to build its own offerings for the Internet.

The second part of Microsoft's strategy had a simple part and a complex part. The simple part is related to the theory in a fairly direct way, and I will simply state it rather than investigate it carefully. Microsoft bought a browser, improved it over time, gave it away to consumers, and bullied or bribed an enormous number of industry participants (computer manufacturers, Internet service providers, etc., etc.) to push it even if their customers would have rather had Navigator, and ultimately worked very hard to make it a "jolting experience" for end users to use anything else.[60] The obvious point here is that if one is behind and wants to be tipped-to, one needs to have an offering, as well as to slow down the momentum and avoid being tipped-from. The end-user side of that called for all those marketing and strategic moves to, in the early stages, keep IE usage at a high enough market share so that the market would not tip to Navigator, and, in the later stages, to drive up IE usage so as to accelerate the tip to it.

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[58] To "cut off their air supply" in Paul Maritz' colorful phrase.

[59] Many of the mechanisms by which it accomplished that slowing down of competitors are, and should be, highly illegal. This paper has spent little time on that issue, but it is an important one in the broader context. See Salop (1999), Bresnahan (2001), and sources cited therein.

[60] This campaign of mixed legality, cf. sources in fn 59.

The less obvious part of Microsoft's strategy involved the developer side. As we have seen, standard Microsoft doctrine of platform strategy calls for influencing both sides, users and developers, of the indirect network effects. Microsoft set out to get developers to use its Internet technologies by "migrating" them slowly from Windows technologies to Windows+Internet technologies. The network effects in Windows were extended to include (Microsoft) Internet technologies. How this works out tells us something more about Microsoft's view of the appropriate theory of the industry when there is the possibility of two separate platform layers that might span and abstract one another. Microsoft seeks to avoid that outcome because of its competitive ramifications. The same outcomes tell us something else about Microsoft's views on the pace of technical change in computing. They strongly favor incrementalism over distruptive change. Part of the reason is that in a system of incremental change only, the advantage goes to the incumbent, which resolves the indeterminacy I flagged in the last section.

Mr. Gates, in 1996, (GX 336) thought "an important benefit of Microsoft's strategy is that it preserves the tremendous investments that people and companies have made in computer hardware, software, and training." He points to "more than 150 Million users of Windows, 5 million people developing windows software . . . more than 1,000 companies supply[ing] component software."[61]

Mr. Chase further thought that the lock in could be extended from the OS to the browser

> What does this mean for the customer ? It means you can keep your existing hardware and software - you can use your existing skills and knowledge…. And reap all the benefits of the Net with only minor incremental efforts while protecting your existing investments. This is true whether you are an end-user, MIS manager, business decision maker or developer, whether you want to create a commercial or non-commercial Web site, or an Intranet…
>
> Netscape/Sun require a blank sheet, start it all over again approach.

Figure 28

As did Chris Jones in the Internet Planning Memo (GX 523) – he talks about "keeping" and "leveraging" rather than building new momentum:

> the shell to kernel to user and GDI.
>
> **Keep Developer Mind Share**
>
> The second real benefit here is that we provide a path for developers which keeps them writing to Windows API's. There is a need in the marketplace for services which help to deliver this class of documents and applications – by investing in our platform we can define how Windows developers "go Internet" the Microsoft way.
>
> **Leverage Our Existing Evangelism and Investment**
>
> Visual Basic is the most popular language ever. OLE controls have been, and will continue to be, the big push for the Developer division moving forward. By delivering a true "runtime" version of these two pieces, we will attract a new class of developers to Windows centric solutions. In addition, because this solution scales from runtime to "Office-style" controls, we can leverage our existing tools and ISV education, and deliver a story which no other company can match.

Figure 29

We have already seen GX 684 with its contrast of Netscape "messages" to various market constituencies and recommendations of how MSFT should respond. Here is a key page about marketing to Independent Software Developers:

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[61] Many thought this. Mr. Muglia August '96 "'97 Tools Vision" "our Internet strategy brings with it the adoption of a key integration technology. That technology is of course COM and we can built upon it as the basis for our overall tools vision."

ISV'S

NETSCAPE	WHAT OUR MESSAGE SHOULD BE
The Internet Requires Dramatic Change • Totally new paradigm, everyone needs to rethink their investments. • Netscape understands this problem, we can help you rewrite your applications. Scripting • Safe and interpreted is the way to go. • LiveScript and Java are open foundations for everyone. Platform Specific • Platform specific code is bad, cross platform is better. • Take your existing applications and move them cross-platform. Plug-Ins • Simple *and* designed for Internet problems. • OLE is too complex, not open.	Leverage • Every investment you make in Internet Explorer (OCX, DocObj, etc) is leveraged in the most popular Windows products (Office, VB, VC, Windows Shell). Development Tools • Use the tools you want to, and the language you want to. Open Scripting and OLE controls will support you. • Your existing tools (VC, VB) help you move. Migration • You don't have to rewrite your application if you don't want to. Easy to migrate to the Internet on Win32. • HTML is just another format. We're the company who helps you bring your formats to the Web.

Figure 30

Notice how strongly continuity and the developer's past investments and sunk costs (Microsoft side) are contrasted to change (Netscape side.) Microsoft's advantages are headlined as inertial – "Leverage" of existing investment, existing "Developtment Tools" "will help you move" this is a "Migration" not a revolution. The same themes – contrast continuity (Microsoft) vs. radical change (Netscape) are reiterated in the "corporations" (meaning developers of in-house applications) slide. Rather than "changing the way" you do things, the Internet "is only a part of what you do today." Microsoft's solution "Works best with your existing products" – Office, Mail systems, Development tools.

Mr. Slivka, in "The Web is the Next Platform", GX 21 offers a theory of this (once again that inductive method!) drawing on experience in the operating system and local area network (Netware again!) markets

> When I reflect on some of our previous "big bang" efforts -- OS/2 and LanMan -- the key mistake we made was not to focus on compatibility enough. With OS/2 (where I spent my first 5.5 years at Microsoft, working primarily on MS-DOS compatibility), we didn't support **all** MS-DOS applications, and we didn't support **any** MS-DOS device drivers, and we didn't even multi-task MS-DOS applications until IBM shipped OS/2 2.0. Regardless of all the cool, sexy features in OS/2 (multi-tasking, better graphics API, memory protection), it was not a no brainer upgrade from MS-DOS -- customers had to **give something up** in order to switch to OS/2: their existing software! Only with Windows 95 (where we have focused on compatibility to an amazing extent) are we finally going to enable to move customers away from MS-DOS.
>
> With LanManager, the compatibility point was Novell Netware. We told customers they had to toss their existing Novell networks in order to run LanMan **and** they would have to accept slower performance from LanMan file servers vs. their existing Netware servers. So, not only did LanMan have the OS/2 albatross hanging around it's neck, it also was not a no-brainer upgrade from Novell. With Windows NT and Windows 95 embracing Netware, we're finally starting to gain some ground here.

Figure 31

The striking thing about this theory is the degree to which it thinks that disruptive technical change is a bad idea. Mr. Slivka believes, and Microsoft set out to accomplish, a smooth and continuous migration to Windows+Internet. At no stage should a developer or a customer ever make an incompatible move, all change should come by way of compatible improvements. This doctrine is the key to a longstanding mystery about Microsoft, how can a firm so full of technically gifted people do so little raw innovation[62]. The answer appears to lie in Microsoft's view of the wisdom of disruptive technical change, not in their capabilities to undertake it.

The strategy for implementing this is summarized in this very simple and abstract statement in the marketing review document we looked at back in Figure 1 (Gx 488)

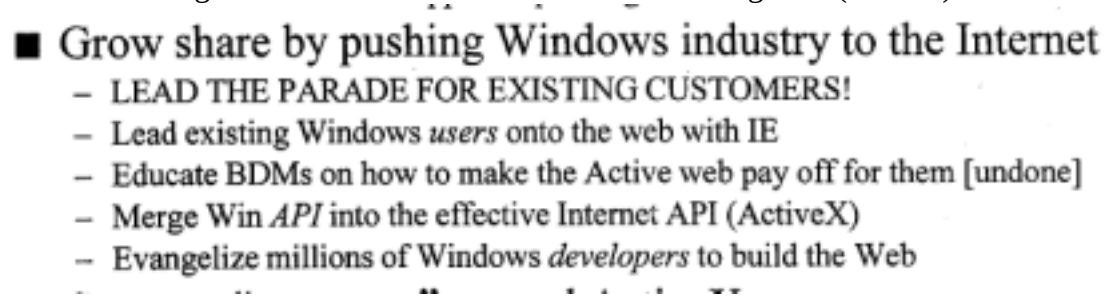
- Grow share by pushing Windows industry to the Internet
  - LEAD THE PARADE FOR EXISTING CUSTOMERS!
  - Lead existing Windows *users* onto the web with IE
  - Educate BDMs on how to make the Active web pay off for them [undone]
  - Merge Win *API* into the effective Internet API (ActiveX)
  - Evangelize millions of Windows *developers* to build the Web

Figure 32

After slowing down the hare with "gravity," the tortoise may, at his leisure, migrate the existing cluster of network effects into a new technological area.

5) Relationship to Antitrust Case

One of the standing concerns of the network effects literature has been the possibility of "lock in" to inefficient allocations.[63] The idea which commenters on *Microsoft,* the antitrust case, have drawn from the literature is that the case, which is clearly related to the economics of networks, must have at its core an assertion somehow related to lock in. The market "must" be locked in to an inefficient Windows monopoly, for example, where it might have chosen another, superior technology.[64] In the context of Microsoft, this would mean that the motivation for policy intervention is that the economy is locked in to a bad standard – Windows – and that the point of the antitrust case would be to liberate the economy from that lock in. A number of engineers and

[62] A standing mystery in the engineering literature, which frequently poses the question as "why can't Microsoft innovate?" Microsoft is a very effective incremental improver and commercializer of software, and those are very important economic tasks in this industry. The engineers are asking more about initiating new and innovative ideas, and they point out that Microsoft has been more of a follower and less of a leader in that domain. It appears incorrect to think of this as Microsoft "can't" do this. It's a management doctrine; they think disruptive technical change is a bad idea (Whether only for their position or for the industry in general remains to be seen.)

[63] A related set of dynamical welfare economic topics has been addressed in the literature as well. These include the possibility of excess inertia, a concept closely related to lock in, and its opposite, excess momentum toward change.

[64] Or, in a slightly more dynamical version of the same story, the market "must" have excess inertia as a result of the network effects that keep the equilibrium standard lodged in Windows. Thus, for example, it "must" be true that the market "should" have switched to the Network Computer, or OS/2, etc.

economists have joined the debate about the antitrust case from that perspective – on both sides.[65]

This is absolutely not the economic story behind *Microsoft*, nor could it be under American antitrust law. That law draws a fundamental distinction between monopoly, which is legal, and monopolization, which is not. In the law, monopoly means approximately what it means in economics – substantial market power resulting from something that permits exclusion of competitors.[66] "Monopolization" means more – it means (a) possessing monopoly power and (b) obtaining or maintaining monopoly power by means other than competing on the merits. Typically, the logical test for "other than competing on the merits" is actions that are profitable only through removing or softening competitors, not through their direct impact on demand. These are called (more or less synonymously) "predatory" or "exclusionary" or "anticompetitive" acts.[67]

The deep economic reason why monopoly, alone, should legal is that there are many efficient monopolies. A firm may be able to exclude rivals by having a better product, or by investing early in a first-mover-advantage context, or by other means. Note, however, that this welfare economics argument about outcomes is not where antitrust law draws the distinction. "Monopolization" isn't "having an inefficient monopoly." The boundary, instead, is a process one. Monopolies become illegal monopolization when obtained or maintained by a process involving anticompetitive acts.[68]

As a result of this fundamental tenet of antitrust law, the government did not – could not – challenge the legitimacy of the Windows monopoly. The core "monopoly

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[65] Engineers write from this perspective reliably. But they are not the only ones. See, e.g., Bittlingmayer (1999) who writes ". . . We might get stuck, in theory, with an expensive, inferior operating system that is immune to competitive forces. Some economists have indeed proposed an important role for lock-in generating 'market failure,' and in particular market failure that is remediable through the instrument of antitrust." The market share leaders in this particular error must be Liebowitz and Margolis, however, for they have undertaken an enormous program of research examining the question of whether software markets (including, more recently operating systems) are locked into "bad" outcomes. Passing for today on the quality of their evidence on this point, it is simply irrelevant to the case.

Another very common form of argument is to make the error in quotes. For example, Muris (1999) is perfectly correct to answer his title question, "Is Heightened Antitrust Scrutiny Appropriate for Software Markets?" because of network effects with a "No," (network effects play the role of an entry barrier and a reason to deny distribution to an entrant, familiar unheightened antitrust scrutiny elements.) Yet he attributes to an enormous number of authors the view that the Microsoft case should be brought to end inefficient lock in, including Paul Krugman and Brian Arthur.

Not all observers make this error. While they had criticized the "use and abuse" of this new theory in an earlier paper, Lopatka and Page (1999) for example, while defending Microsoft's practices as efficient, correctly note that "network effects . . .create entry barriers in the market for operating systems" which is the main role they play in the case.

[66] See, e.g., Areeda and Hovenkamp (1996) for a definition. It needn't mean "no substitutes" at all, of course.

[67] Areeda and Hovenkamp (1996) define monopolization analytically as the union of monopoly power plus '"behavior that not only (1) tends to impair the opportunities of rivals, but also (2) either does not further competition on the merits or does so in an unnecessarily restrictive way"'.

[68] While there is a relationship between this process definition and economic outcomes (see Ordover and Willig and Saloner and Ordover for efforts to make the relationship close) they are not the same. The courts have adopted the process definition rather than an outcomes one in order to have a law that can be meaningfully enforced, rather than because of any conviction that the process definition is better in substance.

maintenance" legal theory was that Microsoft had a legitimate monopoly in operating systems circa 1995, but that the commercialization of the Internet unleashed competitive forces that might have ended or substantially reduced the importance of that monopoly by about now (late 2000) if Microsoft had not blocked the competitive process. Thus the core of the monopolization claim is that Microsoft, an established (legal) monopolist, saw the commercialization of the Internet as highly likely to increase competition in its core markets. (We saw some parts of this assessment in Section 4)b), above.) Microsoft was unable to block the wide distribution of innovative Internet technologies outside its own control by competing against them. (We saw much of Microsoft's assessment of that in section 2), above.) Microsoft did block that widespread distribution by exclusionary acts (which we have not spent much time on in this paper.) "Established monopolist fears competition resulting from new technologies, thwarts distribution of the technologies by anticompetitive means" – antitrust law does not need any new economic theory to figure that one out.

The network effects theory does have a relationship to *Microsoft*, but it is not that obvious one. (So much of industry equilibrium is determined by the same objects as the theory that there must be some relationship.) The first part of the relationship is the closest to received theory, and the least important. Network effects in the operating systems market provide a barrier to entry. The Windows monopoly is highly valuable, and Microsoft was willing to pay to preserve it. (See discussion of the positive issues related to this in section 3), above.) This relationship is not very important because theory played a small role in showing that there are in fact entry barriers into the operating system monopoly, and no theory whatsoever was needed to show that Microsoft wanted to preserve the Windows monopoly. Nonetheless, it is true that the underlying theory of entry barriers defending the Microsoft monopoly in *Microsoft* was an indirect network effects theory, relabeled as the "applications barrier to entry." What is important in the case is not that we might have permanently locked into Windows, a bad standard, but rather that, when things changed and Windows might have been augmented or replaced by forces outside Microsoft, that Microsoft was in a position to block that new competition.[69]

The second relationship is slightly more important to the case. Microsoft saw two main threats to its monopoly as a result of the commercialization of the Internet, cross-platform Java (cross-platform: runs on PC or Mac or Linux or etc.) and Netscape's browser. Microsoft sought to prevent widespread distribution of these innovative technologies. Network effects in the browser market were part of Microsoft's thinking. They sought to slow down the process of convergence to a Netscape Navigator standard or to an open standard outside Microsoft's control. Related network effects for applications divided between your PC and servers on the Internet were part of Microsoft's thinking on why to slow down the process of convergence to a cross-platform Java standard. (See discussion of the positive issues related to browser standards in section 2), above.) But the specifics of Microsoft's thinking played little

[69] Relatedly, entry barriers into browsers are buttressed by network effects, so that Microsoft's current browser monopoly is unlikely to be reversed by entry – an entrant will find itself in the position of the Microsoft employees quoted in section 2)c) – unable to win by having a better product against an entrenched incumbent – and no entrant will have a monopoly operating system to tie its browser to.

role in the lawsuit; their conclusion that these new technologies were a threat and the anticompetitive character of their blunting of that threat were what mattered legally.

Which leads me to the third role that network effects and lock in – but not received theory – played in the case. That was the possibility that disruptive change in a complement might be the force that ends lock in to a standard. (see sections 4)a), 4)b), above) The commercialization of the Internet looked to market participants, including Microsoft, as a big enough piece of disruptive change to possibly end or heavily modify the existing structure of positive feedback. That was prevented by Microsoft's anticompetitive acts. Here both practice (Microsoft didn't wait for an academic theory to tell it to block those developments) and policy (the law condemns such blocking though the theory hasn't gotten there yet) have outrun theory. Exactly that thing which the theory had not yet reached is the most important part of the case. It is a huge irony that many observers think that the case was speculative because it was "based in" the theory.

6) Conclusion

What I have tried to do in this paper is bring forward those remarks by the business people – mostly candid remarks with a strategic or managerial purpose – that illuminate the theory. This has done two interesting things, and another thing, perhaps worth remembering, that is of less immediate import to the development of the theory. The first interesting thing is that an extraordinary number of the issues raised in the parts of modern economic theory that bear on an attempt to collaboratively tip a marketplace play a substantial role in the businesspeople's thinking and acting. I refer here not only to the positive feedback and lock in economics, but also to the economics of imperfect information in bargaining, to theories of leadership as selection of equilibria, and to the impact of asymmetric information in a coordination game (or bargaining game.) Wow!

Second, in several ways, and here I do emphasize narrowly the positive feedback and lock in stories, practice is richer and more thoughtful than theory. In particular, practice has had to deal with the general equilibrium problem of multiple, partially overlapping clusters of positive feedback. This leads to some important ideas, at least in practice, having to do with why vertical disintegration (of the platform space) is more competitive in network industries and to very complex doctrines of technology strategy.

The third lesson, and one that we should try to remember all the time, is that all the objects we put into neat boxes for purposes of analytical clarity in theory won't go there in the world.

Finally, let me say that while I admire the craft and analytical thinking one finds in the Microsoft documents, and find their ideas highly useful in informing my positive thinking about network effects and lock in theory, no one should confuse that with normative admiration for what they accomplished. All that brilliance was spent to slow down the rate of technical change resulting from the commercialization of the Internet so as to give Microsoft, imitator not inventor, enough time to ponderously take proprietary control of it.

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