EXHIBIT 3

UNITED STATES DISTRICT COURT

DISTRICT OF MARYLAND

NOVELL, INCORPORATED, Plaintiffs, vs. MICROSOFT CORPORATION Defendant.	MDL Docket No. 1332

Reply Report of Roger G. Noll

My name is Roger G. Noll, and I reside in Palo Alto, California. I previously submitted an expert report in this litigation.[1] My prior report contains my qualifications, including reports and testimony in connection with other recent litigation.

ASSIGNMENT

The plaintiff in this matter has asked me to review the *Expert Report of Kevin M. Murphy* (henceforth *Murphy Report*), submitted on behalf of the defendants, for the purposes of ascertaining whether any of the information and analysis in this report causes me to alter any of the analysis or conclusions in my prior expert report. In the process of working on this assignment, I have also reviewed the *Confidential Expert Report of John K. Bennett* (henceforth

1. *Declaration of Roger G. Noll,* henceforth *Noll Report*.

Bennett Report) and the *Expert Report of R. Glenn Hubbard* (henceforth *Hubbard Report*). Finally, I have reviewed the documents and exhibits cited by Dr. Murphy, plus other documents that are referenced in footnotes in this reply report and the attached Appendix of additional materials considered. I continue to rely on the materials that I reviewed in writing my earlier report. In preparing this report, I have been assisted by economists at ApplEcon and Bates White. Because the depositions of the defendants' experts have not yet been taken, I reserve the right to amend my analysis and conclusions as more information becomes available.

SUMMARY AND CONCLUSIONS

Having reviewed the *Murphy Report* and the evidence that it cites, I find no reason to alter the conclusions in the *Noll Report*. The most important conclusions in my original report are as follows: (1) x86 operating systems constitute a relevant product market, and graphic user interfaces (GUI), browsers, word processors, spreadsheet software, relational database software, presentation software and groupware that run on Microsoft's x86 operating systems all are sold in distinct relevant product markets; (2) Microsoft enjoys market power in all of the relevant markets, and increased its market power in these markets after the release of Windows 95; (3) middleware and office productivity applications that compete with Microsoft's corresponding products, by reducing the applications barrier to entry, constituted a threat to Microsoft's market power in x86 operating systems; and (4) Microsoft engaged in anticompetitive behavior to eliminate this threat, including both technical and marketing/public relations acts that disadvantaged competing middleware and applications vendors, including Novell.

Although Professor Murphy rarely expresses agreement with anything in the *Noll Report*,

if silence is a guide we agree on much of the content of my original report. Professor Murphy does not criticize the methods that I employ to define relevant markets, detect market power, or differentiate between improved efficiency and anticompetitive conduct as sources of market power. In particular, Professor Murphy expresses no disagreement with the following points in the *Noll Report*: (1) a valid economic analysis of the products that are part of a PC system must take into account complementarities among products, vertical competition among components of PC systems, economies of scale, and network effects; (2) market definition is based on identifying groups of products that are close substitutes, and valid indicators of substitutability are unique functionality, independent demand, and distinctive production; (3) regardless of how relevant markets in this case are defined, Microsoft enjoys substantial market power in x86 operating systems, graphic user interfaces (GUI), browsers, word processors, spreadsheets, groupware and other middleware and applications that are bundled into either Windows or Microsoft Office, and Microsoft's market power in all of these markets increased during the period at issue in this litigation.

The *Murphy Report* does not address most of the evidence in the *Noll Report*. The narrow focus of Professor Murphy's analysis arises from instructions that he was given by Microsoft's attorneys about the scope of this litigation, which leads him to conclude that much of my report is irrelevant.[2] For the most part, his remaining criticisms of my analysis take the form of asserting that I did not take some economic principle or evidence into account, and that when this material is incorporated into the analysis, my conclusions are invalidated. The main body of this report explains why I disagree with Professor Murphy on these issues. Here I briefly

2. See footnote 1 of the *Murphy Report*, p. 1.

summarize the key points.

Analytical Framework

Professor Murphy sets forth three conditions that he asserts that I must satisfy in order to establish that "Microsoft should be found liable in this case."[3] The essence of his framework is that I must show that Microsoft's conduct towards WordPerfect and Quattro Pro during the 18 month period that Novell owned them by itself reduced competition in the market for x86 operating systems and, if these actions had such an effect, that they did not produce offsetting efficiency benefits.

The purpose of Professor Murphy's framework is unclear. I assume that Professor Murphy is not offering testimony on what issues, as a matter of law, are included and excluded from the case. Perhaps Professor Murphy is attempting to characterize the content of a proper antitrust economic analysis of the liability issues in this case under the assumption that the instructions from the attorneys properly limit the scope of a valid antitrust analysis. Regardless of its purpose, his analytical framework is not a valid application of antitrust economics. As a result, Professor Murphy adopts a standard for what his report must accomplish that is not useful for establishing that Microsoft's behavior in the relevant markets for applications and middleware did not harm competition in x86 operating systems. Even if the *Murphy Report* showed that the *Noll Report* did not satisfy his three conditions, that would be insufficient to show that Microsoft's actions caused no anticompetitive harm in the market for x86 operating systems. Whereas I disagree with the other details of his analysis that implement his analytical

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3. *Murphy Report*, p. 13.

framework, this reason alone is sufficient for me to conclude that his report does not and can not undermine the analysis and conclusions in the *Noll Report*.

One source of disagreement between Professor Murphy and me arises from differences in the products that we analyzed. Professor Murphy was instructed by Microsoft's attorneys to focus on WordPerfect, Quattro Pro and the suite that contained them.[4] I have been instructed by the attorneys for the plaintiff that this case includes Presentations, Paradox, GroupWise and other products, some of which were not sold to Corel in March 1996, and that I should analyze whatever products and markets I believe are necessary to conduct a valid economic analysis of the issues that are raised in the *Complaint*.

The plaintiff alleges that Microsoft's anticompetitive conduct affected these products, and continued to do so after the Corel transaction. To the extent that Microsoft's behavior affected other products that were part of the threat to Microsoft's monopoly power in x86 operating systems, these products must be included in a valid economic analysis of the liability issues in this case. Obviously economists can not resolve conflicting instructions, but we can explain how a difference in instructions affects an economic analysis of the case and the conclusions that one would derive from that analysis.

Professor Murphy's analytical framework contains two fundamental errors of economic analysis regardless of which products are in the case. First, he focuses exclusively on harm to Novell as if that were the same as harm to competition. Second, he argues that Microsoft's actions had pro-competitive benefits, but he does not apply the appropriate economic criteria for

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4. Professor Murphy does not fully follow these instructions as he does discuss GroupWise and Netscape Navigator in part of his report, even though he believes they are irrelevant.

determining whether these benefits provide a business justification for Microsoft's conduct.

A valid economic analysis of whether conduct is anticompetitive focuses on its effect on competition, not on a particular firm. Usually a focus on a competitor is an error made by a plaintiff's expert, but in this case the mistake was made by the defendant's expert. Whereas the damages suffered by Novell hinge on showing that Microsoft's actions caused Novell to lose business, a valid economic analysis of whether Microsoft's conduct was anticompetitive requires examining whether the competitive process, not just Novell, was harmed. If Microsoft's conduct that is alleged in the *Complaint* had many targets, a valid economic analysis must assess whether this conduct harmed competition in applications and middleware markets that threatened to reduce Microsoft's market power in x86 operating systems.

The economic issues that are relevant to establish harm to competition are: (1) whether a group of applications and middleware products, some of which were produced by Novell, collectively constituted a threat to Microsoft's monopoly power in x86 operating systems, notwithstanding whether any one such product by itself constituted such a threat; (2) whether Microsoft engaged in anticompetitive behavior in the markets for these products, including but not limited to behavior that affected Novell; and (3) if these products did threaten Microsoft's operating system monopoly and Microsoft did engage in anticompetitive conduct in these markets, whether this anticompetitive behavior, taken as a whole, harmed competition in x86 operating systems.

Even if the harm to a single competitor was insufficient to reduce competition in the market for x86 operating systems, the cumulative effect of Microsoft's anticompetitive behavior still could have harmed competition. Moreover, even if the damages that Novell can recover for

conduct affecting WordPerfect and Quattro Pro are restricted to the period that Novell owned these products, assessment of the harm to competition arising from this conduct is not so restricted because this harm does not depend on which firm sells which products, and could have taken place after Novell's exit from the market. Hence, Professor Murphy's conditions are too narrow to be useful in determining whether Microsoft's conduct in applications and middleware markets harmed competition in x86 operating systems.

Professor Murphy also offers an incomplete statement of the economic criteria for determining whether conduct that harms competition has a reasonable business justification. In antitrust economics, anticompetitive conduct has a reasonable business justification only if two conditions are established: (1) consumers received benefits from the conduct that outweighed the anticompetitive harm and (2) these procompetitive benefits were reasonably connected to the conduct that produced anticompetitive harm. Professor Murphy does not attempt to measure or even to provide empirical evidence that consumers received procompetitive benefits, so that on the basis of his report one cannot determine whether the benefits exceed the harm. Professor Murphy ignores the second condition in that he does not show that the specific conduct by Microsoft at issue in this litigation benefitted consumers. As a result, Professor Murphy's framework, even if he had implemented it completely and precisely, is inherently incapable of determining whether Microsoft had reasonable business justifications for its conduct.

In summarizing his conclusions, Professor Murphy offers three over-arching opinions.[5]

Professor Murphy's first general opinion is that Microsoft's conduct against Novell did not, by itself, harm competition in the market for x86 operating systems, and much of the

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5. *Murphy Report*, pp. 4-9.

conduct that I examine is irrelevant because that conduct was not aimed at Novell. This opinion depends on the validity of Professor Murphy's analytical framework: whether only conduct directed at WordPerfect and Quattro Pro during the period that Novell owned these products is relevant to determine liability in this case, and whether knocking out Novell's products in these markets, by itself, would have reduced the threat to Microsoft's operating system monopoly. If the appropriate framework for an economic analysis is the overall impact of Microsoft's conduct on competition in the operating system market, then this opinion is irrelevant.

Professor Murphy's second general opinion is that Microsoft's conduct with respect to Novell benefitted consumers, and his third general opinion is that all of Novell's lost sales were due to the inferiority of its products and its overall business strategy. While I addressed Professor Murphy's second opinion in the Noll Report, and Dr. Warren-Boulton addressed Professor Murphy's third opinion in his report, I discuss both issues here and demonstrate that Professor Murphy's conclusions are incorrect.

Market Definition

Professor Murphy disagrees with my definitions of the relevant markets. He thinks that GUIs are part of the operating system, that browsers are not a distinct relevant product market, and that suites, not their components (including word processors and spreadsheets), may be the appropriate relevant product market for office productivity applications. Professor Murphy does not state why the methods for defining relevant markets in the *Noll Report* are invalid. which facts that are used in applying these methods are incorrect or incomplete, or what additional facts were not taken into account that alter the analysis. Professor Murphy does not offer his own

methods for identifying relevant markets. Instead, his section on market definition[6] consists of a series of assertions that he is right and I am wrong.

Professor Murphy makes some factual assertions, but these are incorrect. The most important are that since 1995 "no commercially significant operating system has been distributed without a GUI" and that there is "little historical precedent" for the notion that GUIs are cross-platform products, as opposed to being designed for a specific operating system.

Professor Murphy's first assertion is incorrect because it ignores Linux, which has been more successful than two of the three products that Professor Murphy cites as operating systems that always come with a GUI. Moreover, Professor Murphy's claim ignores the fact that the primary reason that the vast majority of x86 operating systems are shipped with a GUI is that Microsoft has 95 percent of this market, and achieved that share by bundling Windows 4.0 and MS DOS 7.0 in Windows 95. The latter act, which had no efficiency justification and reversed a plan to issue these products separately, effectively eliminated DR DOS and OS/2 from the x86 operating system market, both of which supported prior versions of Windows.

Professor Murphy's second assertion also is factually incorrect. Prior to the introduction of Windows 95, every commercially significant GUI that ran on an x86 operating system with the exception of Presentation Manager for OS/2 was cross-platform, including Windows until Windows 4.0 was bundled into Windows 95. But even if Professor Murphy's statement were correct, it does not imply that GUIs are not a separate product. If several GUIs were written only for one operating system, these GUIs still would compete for customers who use that operating system. For example, today several GUIs run on Linux. In fact, many middleware and

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6. *Murphy Report*, pp. 9-13.

applications products run only on Windows, but that does not make these products part of the market for x86 operating systems.

Regarding my conclusion that browsers are a relevant product market, Professor Murphy offers two critiques: the Court of Appeals in *U.S. vs. Microsoft* did not agree and the *Noll Report* does not offer any analysis that is not contained in *U.S. v. Microsoft*. Notwithstanding that Professor Murphy does not accurately characterize the decision of the Court of Appeals, I disagree that my section on market definitions contains nothing new about browsers or, more generally, about the proper methods for distinguishing among markets for software products. Indeed, seventeen pages of the *Noll Report* are intended to fill the gap left by the government's case in defining relevant software markets.[7] Professor Murphy simply does not discuss this section, let alone prove that it contains nothing that was not in the government's case.

Finally, in disagreeing with my analysis of the relevant markets for office applications suites, Professor Murphy notes that "there was little competition among the individual components of suites after 1995,"[8] from which he concludes that different applications products must not be sold in separate markets. An equally accurate statement is that there was little competition in suites after 1995 because Microsoft had monopolized them. Because office productivity applications are monopolized, one must go beyond the strategic decisions of the monopolist to define the relevant product markets.

To summarize, Professor Murphy's discussion of market definition offers neither economic analysis nor facts that would be pertinent to a valid economic analysis of the product

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7. *Noll Report*, pp. 54-71.

8. *Murphy Report*, p. 13.

markets at issue in this litigation. As a result, I find no reason to alter any of the analysis or conclusions on market definition issues that are contained in the *Noll Report.*

Sources of Market Power

Professor Murphy offers three general reasons for disagreeing that Microsoft obtained, extended or maintained market power in x86 operating systems by the conduct alleged by the plaintiff. First, Professor Murphy believes that cross-platform applications can not threaten the market power of a dominant operating system. Second, Professor Murphy believes that regardless of Microsoft's conduct Novell did not succeed because it offered inferior products and made bad decisions. Third, Professor Murphy believes that Microsoft's conduct was procompetitive.

Professor Murphy's reasoning regarding the first point is that no applications have sufficient penetration to threaten a dominant operating system.[9] His evidence is that the support for OS/2 by Lotus and WordPerfect failed to make OS/2 successful. The analytical argument is incorrect because the issue of cross-platform applications is about the cumulative effect of many applications, not just a few. The example is unpersuasive because OS/2 was two years behind Windows 3.x in features, and had been undermined by Microsoft's undelivered promise to IBM to write part of OS/2. The claim is not that cross-platform applications can cause an inferior operating system to be successful. In fact, DR DOS was successful in the early 1990s and put considerable competitive pressure on Microsoft.

Professor Murphy claims that Microsoft office productivity applications were superior to

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9. *Murphy Report*, pp. 19-21.

their competitors' products. Professor Murphy claims that WordPerfect was not successful on any GUI platform, and that independent product reviews favored Microsoft.[10]

Professor Murphy is incorrect when he asserts that WordPerfect was never successful on a GUI platform. Professor Murphy's examples of poor performance on GUIs are drawn from the 1980s, when GUIs were not important, and the early 1990s, when competitors were delayed about two years in creating applications for Windows because Microsoft had misled them about its commitment to OS/2. The relevant issue here is WordPerfect's performance on Windows 3.1 just before the release of Windows 95, and in this period WordPerfect both sold well and received favorable reviews. Likewise, in 1993 WordPerfect 5.2 for OS/2 accounted for nearly half of word processor sales for that platform and was favorably reviewed.

Professor Murphy states that Microsoft's exclusionary agreements did not harm Novell and, in any case, were procompetitive.[11] Professor Murphy does not mention the implications for Novell of the actions against Netscape. Because Navigator was distributed with PerfectOffice, Microsoft's restrictions on the content of the boot screen for Windows 95 affected the ability of Novell to use the OEM distribution channel. Professor Murphy claims that the OEM channel is unimportant for applications, but at the time that Novell owned WordPerfect, Quattro Pro and PerfectOffice, it sought to expand distribution through OEMs.

Professor Murphy defends minimum commitments, prepaid balances and Market Development Agreements as not harming Novell and benefitting consumers. The arguments he puts forth to advance this position mischaracterize the nature of these contract provisions.

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10. *Murphy Report*, pp. 70-75.

11. *Murphy Report,* pp. 32-41.

Professor Murphy also asserts that MDAs induced OEMs to invest in making their products work better with Microsoft's products, but he provides no examples of such investments or empirical analysis of how OEM investment was affected. The only support for Professor Murphy's claims is Exhibit 6 to the *Murphy Report*. This exhibit contains neither analysis nor facts; it simply lists assertions about the beneficiaries of some provisions of the MDAs without identifying the actual requirements of those provisions. Professor Murphy's argument regarding MDAs is based on the assumption that the relevant product market is PC systems (hardware, operating system, applications), that this systems market is best served by a vertical integrated monopoly firm, and that the benefit of MDAs is that they mimic the outcome under vertically integrated monopoly[12]. This chain of arguments not only lacks empirical support, but was offered by Microsoft and rejected by the courts in *U.S. v. Microsoft.*

Professor Murphy makes the sweeping claim that the optimal pricing policy for Microsoft is to charge every OEM a fixed fee and let them put Microsoft software on as many computers as they want with no additional charge.[13] This conclusion makes sense only if the optimal market structure for operating systems is a complete monopoly. Professor Murphy's efficiency rationale ignores the fact that consumers are harmed by monopoly prices and the absence of product differentiation and innovative competition if a product market is a monopoly.

Professor Murphy defends Microsoft's practice of tying products because tying allows integration, facilitates coordinated development of software products, and allows end-users to avoid having to install separate copies of programs. These reasons all stem from his assumption

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12. *Murphy Report*, pp. 38-40.

13. *Murphy Report*, pp. 40-1.

that the optimal structure of the PC industry is a vertically integrated monopoly. Professor Murphy defends bundling Internet Explorer and Windows 95 on this ground, even though he offers no facts or economic analysis that was not made by Microsoft's experts in *U.S. v. Microsoft*. Professor Murphy simply ignores the vast amount of evidence that in the period at issue here, the Microsoft products that were bundled in Windows 95 and Microsoft Office were in any meaningful sense integrated or the result of joint development.

Professor Murphy dismisses most of the allegations of bad acts by Microsoft as irrelevant because they did not affect Novell during the 18 months that it owned WordPerfect. Some of these are downright silly, such as the denial of the Windows 95 logo and the failure to support background printing. According to Professor Murphy, the products that were affected by these acts were released after Novell sold WordPerfect to Corel. Professor Murphy fails to take into account the effect on the value of these products to Corel, and hence the sales price, that was due to these acts, both of which occurred during the period of Novell ownership.

Professor Murphy also rejects the conclusion that the withdrawal of namespace extensions was anticompetitive because, in his view, it was not important, with the proof being that Novell dropped it and others did not use it. Professor Murphy believes that software vendors could have used the namespace extension APIs even though they were withdrawn. This claim ignores two facts: namespace extension APIs were never fully documented, so that one could not complete development of their use, and in any case independent software vendors risk complete loss of functionality of their products if they use APIs that have been withdrawn and might be fully removed in future releases of the operating system.

Professor Murphy does not believe that Microsoft's behavior regarding MAPI was

anticompetitive, but his discussion mischaracterizes the issues associated with MAPI and indicates a lack of familiarity with what MAPI does, why it was developed, and how it was implemented. His analysis misses the point that the industry sought a common standard, implemented in the operating system, that would enable messaging client and server software to be compatible, regardless of the identity of the vendors of either product. Microsoft promised Novell and other software vendors that it would produce messaging APIs that served this function, and in fact it did – but then it bundled them with its own messaging client, not the operating system. Professor Murphy's discussion simply misses this essential point.

The remainder of this report discusses all of these issues as well as others in greater detail, and provides the basis for my conclusion that the *Murphy Report* does not provide any reason for me to alter my prior analysis.

AREAS OF AGREEMENT

A substantial portion of my original report is devoted to explaining the economics of the computer industry and the principles and methods of antitrust economics. Professor Murphy does not criticize or even mention these sections of my original report. If Professor Murphy's silence fairly can be interpreted as an absence of significant disagreement, we apparently agree on the following issues.

The Economics of PC Systems

My original report contains a 12 page section entitled "The Economics of PC Systems."[14]

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14. *Noll Report*, pp. 12-24.

I have not found any reference to this section in the *Murphy Report*,[15] but Professor Murphy does make some of the same points that are contained in this section without referencing my report or noting that we agree on these matters. Thus, I infer that Professor Murphy and I are broadly in agreement about this material. Because they are relevant to subsequent analysis, some salient conclusions from this section are as follows.

A PC system – a personal computer and software that runs on it – is comprised of a set of complementary products, by which is meant that an increase in quality or reduction in price of one type of product causes an increase in the demand for other types of products that are part of the PC system. In addition, many components of a PC system, including the microprocessor, operating system, middleware and applications, exhibit network effects, by which is meant that one user benefits if other users use compatible products. For platforms, as the number of users of a platform rises, software developers have a greater incentive to create software that is supported by that platform. For applications, the network effect arises from the value to users of sharing files and working collaboratively. Network effects are the source of the applications barrier to entry, by which is meant the greater demand for an operating system that arises from having a large number of complementary applications that run only on that operating system.

The competitive process in this industry includes horizontal competition between products that are close substitutes (such as two operating systems) and vertical competition, whereby a product that performs one group of functions will add functions that overlap the functions of products that otherwise are not substitutes. For example, a middleware product may

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15. Footnote 109 in the *Murphy Report* cites page 21 of my report, but this page reference appears to be a typographical error as Professor Murphy's discussion surrounding this footnote is about bundling, which is not mentioned on page 21.

compete with an operating system by exposing applications programming interfaces (APIs) and encouraging software developers to use the middleware product as a platform.

Vertical competition by middleware against a dominant operating system does not take the form of the former actually substituting for the latter, and so does not imply that the two products are in the same relevant market. Middleware threatens the operating system in two ways.[16] The first threat arises if the middleware product is cross-platform (that is, it works on more than one operating system), in which case middleware can eliminate the applications barrier to entry by extending the network effect of applications programs to users on multiple operating systems. The second threat arises if middleware APIs introduce new functional features for applications developers that can be exploited on an old operating system. In this case middleware can eliminate the need to upgrade the operating system. This phenomenon arose when Microsoft incorporated new operating system functionality into Windows 286, 386, 3.0 and 3.1, which enabled users to take advantage of advanced features by upgrading their version of Windows without having to upgrade MS DOS.

Professor Murphy largely repeats my analysis and conclusion about the implications of these features of PC systems with respect to the optimal behavior of a profit-maximizing firm that sells only operating systems. In particular, we agree that, due to complementarities, vertical competition, network effects, economies of scale, and the applications barrier to entry, an operating system vendor has an incentive to cooperate with software vendors in developing new

16. For a discussion of these features of middleware, see the *Alepin Report*, pp. 55-56.

applications in order to increase the demand for the operating system.[17]

Professor Murphy does not discuss a second implication of this analysis, which is that a dominant operating system vendor (one with more than half of the market) has a disincentive to cooperate with a *cross-platform* applications vendor because the latter, if it is successful on the dominant platform, can reduce the applications barrier to entry and thereby increase competition from other operating systems. When Microsoft's applications and middleware compete with other cross-platform products, Microsoft has an incentive to use its control over the operating system to degrade the quality of competing products, regardless of the type of application: Netscape Navigator, Lotus Notes, or Novell WordPerfect and GroupWise. Jeff Raikes, the President of the Microsoft Business Division, perceived that the most important benefit from achieving dominance in applications was that it would "widen the 'moat'" provided by the applications barrier to entry, thereby protecting its x86 operating systems monopoly.[18]

Professor Murphy also does not discuss a third implication of this analysis, which is that it provides an economic test for whether an action by an operating systems vendor is

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17. Professor Murphy incorrectly states that my analysis is "internally inconsistent" because I ignore this effect. *Murphy Report,* pp. 21-3. His argument is that if WordPerfect is so important that it can influence the competitive outcome in operating systems, Microsoft has an incentive to make WordPerfect operate well on Windows. My argument is not inconsistent. Since 1995 whether WordPerfect is successful has depended on how well it works on Windows 95 and its successors. If Microsoft can degrade WordPerfect on the dominant system, WordPerfect stops being a cross-platform threat. Then, if Microsoft offers a reasonable substitute (Word) that works only on Windows, network effects in applications assure that it will retain its dominance in x86 operating systems.

18. "If we own the key 'franchises' built on top of the operating system, we dramatically widen the 'moat' that protects the operating system business. . . .We hope to make a lot of money off these franchises, but even more important is that they should protect our Windows royalty per PC. . . .And success in those businesses will help increase the opportunity for future pricing discretion." Bates Nos. MS-PCA1301178-81 at 80.

anticompetitive. Acts by an operating system vendor that reduce the performance of complementary products and hence the demand for the operating system are anticompetitive. This test was applied in *U.S. v. Microsoft*, where the court concluded that Microsoft hard harmed consumers by damaging Netscape. "Microsoft has harmed even those consumers who desire to use Internet Explorer, and no other browser, with Windows 98. To the extent that browsing-specific routines have been commingled with operating system routines to a greater degree than is necessary to provide any consumer benefit, Microsoft has unjustifiably jeopardized the stability and security of the operating system. Specifically, it has increased the likelihood that a browser crash will cause the entire system to crash and made it easier for malicious viruses that penetrate the system via Internet Explorer to infect non-browsing parts of the system."[19]

Professor Murphy simply ignores this test in his analysis.

Market Definition

About 36 pages of my original report[20] address the issue of defining the relevant markets at issue in this litigation. Professor Murphy does not agree with me that (1) operating systems, browsers and graphic user interfaces constitute separate product markets and (2) that the components of office applications suites, not the suites themselves, are relevant product markets. I discuss our differences on these issues elsewhere in this report.

Notwithstanding these differences, Professor Murphy does not express disagreement with

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19. "Findings of Fact," paragraph 174, *U.S. v. Microsoft*.

20. *Noll Report*, pp. 24-71.

my description of the appropriate methods in antitrust economics for defining relevant markets. Professor Murphy does not criticize my description of the principle of substitution as the core element of market definition in antitrust economics, nor my identification of functional uniqueness, independent demand, and distinctive production as relevant characteristics for ascertaining whether products are in different product markets. Nor does he dispute any of the facts in my report that are used to apply these concepts in order to ascertain whether any two products are economic substitutes. Finally, Professor Murphy does not describe or make use of any other method of economic analysis for defining relevant markets that is missing from my report. Thus, I infer that we agree on the approach that economists should use for defining relevant markets and the facts in the *Noll Report* about the products at issue here. The puzzle is to identify why, using the same methods and facts, we could reach different conclusions about the proper definition of the relevant markets. I discuss this puzzle elsewhere in this report.

If the absence of discussion implies agreement, Professor Murphy apparently does not disagree that the relevant markets that contain operating systems for x86 microprocessors and applications that run on Microsoft's operating systems do not contain products of the same type that run only on other platforms, primarily due to switching costs and porting costs. The only important implications of this conclusion are that the Apple Macintosh operating system was not in the same relevant market as Microsoft's operating systems until 2006, when Apple switched from Motorola/IBM Power PC microprocessors to x86 microprocessors, and that middleware and applications programs that do not run on a Microsoft operating system are not in the same relevant market as corresponding software products that do run on a Microsoft operating system.

Market Power

Eleven pages of my original report[21] discuss whether Microsoft has market power in the relevant markets for x86 operating systems and certain applications software markets. This section sets forth the methods economists use to determine whether a firm has market power, and then applies these methods to the products that are sold by Microsoft. The empirical content of this section is that Microsoft has very high market shares, enjoys substantial barriers to entry, and earns profits in excess of a competitive return on investment in operating systems and office productivity applications, regardless of the precise definition of the relevant markets in which these products are sold.

The implications of this analysis are as follows. First, Microsoft had monopoly power in operating systems and GUIs during the period at issue in this litigation as well as several years before and after. Second, the relevant markets for office productivity applications were concentrated and Microsoft was the leading firm immediately before and during the period at issue in this litigation. Third, Microsoft's market power in the markets for x86 operating systems and office productivity applications increased substantially after the introduction of Windows 95. After 1995, Microsoft acquired monopoly power in office productivity applications and browsers, and became the only commercially significant vendor in x86 operating systems and GUIs. These conclusions for the most part are not affected by whether the relevant market for operating systems, GUI and browsers is a single product market or three separate markets, except that Microsoft's monopoly position in browsers occurred several years after it obtained monopoly power in x86 operating systems and GUIs. These conclusions also do

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21. *Noll Report*, pp. 71-82.

not depend on whether specific office productivity applications or suites are the proper definition of the relevant market for these products.

Professor Murphy makes only one mention of my analysis of market power, which is in the context of the browser market.[22] Because he does not discuss any of the other analysis and conclusions in this section, I infer that we have no substantial disagreements on these issues. With respect to browsers, Professor Murphy states that he disagrees with my conclusion that Microsoft had market power in browsers in 1996 because at that time Microsoft's market share in browsers was only nine percent and because the Court of Appeals did not agree that the government had proved that barriers to entry in browsers were sufficiently high that the market could be profitably monopolized. In fact, there is no conflict between Professor Murphy and me on this issue. I did not conclude that Microsoft had market power in browsers in 1996.

My conclusion was that Microsoft obtained market power in the browser market later as a result of anticompetitive conduct against Netscape. This conduct included acts that sought to cut off Netscape's distribution channels. One of those distribution channels was Novell, which distributed Netscape Navigator with PerfectOffice. One benefit to Microsoft from a reduction in the sales of PerfectOffice was that it assisted Microsoft in taking over the browser market.

Regarding barriers to entry in browsers, neither the government nor the Court of Appeals had information about the evolution of browsers after the settlement of *U.S. vs. Microsoft*. As discussed in the *Noll Report*, Microsoft dominated the browser market at the time of the settlement, but since then several other products (including Firefox, which is an open-source version of Netscape's browser) have taken a substantial share of browser use away from

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22. *Murphy Report*, p. 12.

Microsoft. These facts support the conclusion that an important barrier to entry in the browser market before 2003 was Microsoft's anticompetitive conduct, and that this barrier to entry did give Microsoft market power in browsers.

Sources of Market Power

Nearly all of the disagreements between Professor Murphy and me about facts, economic methods and conclusions pertain to the 75 pages of my report[23] that address sources of market power. Elsewhere I discuss our disagreements, but despite these disagreements there also is much about which that we apparently agree.

First, Professor Murphy does not express disagreement with my characterization of the sources of market power (superior efficiency and anticompetitive acts) and of the method for distinguishing between them, which is whether consumers, on balance, were harmed or benefitted. We also agree that Microsoft has two types of assets – intellectual property rights and the reputation of the company for providing reliable software products – that are sources of market power that are in the category of efficiency. And we agree that in product markets having the characteristics of the markets at issue in this litigation (in particular, scale economies and network effects), all successful firms must have some market power. The issue then is to assess whether Microsoft obtained, enhanced or maintained market power in operating systems due to the efficiency characteristics of its products or anticompetitive acts. Although Professor Murphy attributes all of Microsoft's market power to efficiency effects, the opposite is not the case – I do not attribute all of Microsoft's market power to anticompetitive acts.

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23. *Ibid.*, pp. 82-157.

The areas of agreement between us on the sources of Microsoft's market power pertain to the features of Microsoft products that would confer some market power on Microsoft even in the absence of anticompetitive behavior. In particular, Microsoft could not have *leveraged* the market power that it enjoyed from its innovations in GUIs and components of the operating system that were contained in a sequence of Windows products beginning with Windows 286 in the absence of the market power that was created by these innovations. Likewise, we agree that many Microsoft software products – MS DOS, Windows GUI, Internet Explorer, Word, Excel, Power Point, and various Microsoft groupware products – would have enjoyed commercial success in the absence of anticompetitive acts by Microsoft to create, increase or maintain market power. Instead, our disagreement is over whether quality alone explains Microsoft's monopoly power in these products in the mid 1990s and afterwards. Elsewhere I explain the basis for my disagreements with Professor Murphy over whether anticompetitive acts increased or maintained Microsoft's market power in these products during the mid-1990s.

ANALYTICAL FRAMEWORK

Professor Murphy sets out a "framework" for undertaking an antitrust economic analysis of the issues in this litigation and asserts that in order to show that Microsoft is liable for engaging in anticompetitive conduct against Novell, I must establish three points:[24] (1) Novell's office productivity applications "had the potential to impact competition in the PC operating system market;" (2) Microsoft's conduct "directly harmed" Novell's office productivity applications and "did not have offsetting procompetitive benefits;" and (3) the harm to Novell

24. *Murphy Report*, p. 13.

from the acts in (2) was sufficient "to cause a reduction in PC operating system competition."

At the outset, the purpose of this framework is not clear to me. As a legal matter, I do not believe that Professor Murphy and I are entitled to characterize what the plaintiff in an antitrust case must prove to establish liability. As an economist, I disagree that his three conditions accurately characterize the economic analysis that is necessary to establish that Microsoft's conduct with respect to Novell caused anticompetitive harm. As noted above, Professor Murphy states that he has been instructed that the only products at issue in this case are WordPerfect, Quattro Pro, and the office suite that contains them. Perhaps the framework is intended to describe the content of a valid economic analysis of Microsoft's conduct if only Microsoft and Novell were participants in the relevant markets for the middleware and applications software at issue in this litigation, but even under this assumption the framework is incomplete.

One important difference between Professor Murphy and me arises from the instruction that Microsoft's attorneys gave him, which was to restrict his analysis to WordPerfect, Quattro Pro and the suite that contained them during the period that Novell owned them and to ignore all of the other applications and middleware that Novell distributed. I was given no such instruction, and was told specifically that the products at issue in this case include both Paradox relational database software and Presentations presentation software, both of which Novell sold separately as well as in a suite, and Novell's groupware product, GroupWise, which was not sold to Corel. Obviously economists can not resolve a legal conflict over which products and conduct are in or out of a case. Nevertheless, economists are qualified to point out that, due to network effects and complementarities, a valid economic analysis of Novell's threat to Microsoft can not ignore any potentially important applications and middleware that Novell distributed.

Novell offered a wide array of applications and middleware products, including GroupWise, AppWare, PerfectFit and other software development tools. Novell was integrating its office productivity applications into its GUI (Corsair) and browser (Ferret), and its office productivity applications into its network operating system.[25] Novell distributed Netscape Navigator with its products and built the functionality of its products in part on Navigator and Java. This array of products, including Navigator, made Novell a greater threat to Microsoft's monopoly power in operating systems than would have been the case had Novell only distributed WordPerfect, Quattro Pro and the suite that contained them.[26] The *Alepin Report* discusses each of these other products and their relationship to Novell's office productivity applications, demonstrates their relationship to and potential effect on Microsoft's operating system, and documents Microsoft's recognition that the combination of these products and technologies posed a threat to its operating system monopoly.[27]

The significance of my disagreement over Professor Murphy's analytical framework is that, in my opinion, Professor Murphy has set the bar too low for rebutting the analysis in the *Noll Report*. In particular, Professor Murphy's framework implies that if Microsoft engaged in a series of anticompetitive acts that eliminated 1000 tiny firms that collectively threatened its

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25. Prior to Novell's decision to distribute Netscape, Bill Gates observed the integration of Novell's office productivity applications into Ferret, perceived that Novell's development efforts in this direction were important, and concluded that Novell's products (including its "shell that includes a WWW browser with some APIs") demonstrated "the importance of our shell integration." Shortly afterward, Gates decided that Microsoft would not document namespace extensions. (See *Alepin Report*, pp. 90-91.) Given the importance of Netscape Navigator as a browser and a platform, the integration of Novell's applications with Navigator posed a greater threat to Microsoft than did Novell's integration with its own browser.

26. *Noll Report*, p. 89.

27. *Alepin Report*, pp. 56-79.

operating system monopoly, each of the 1000 prospective plaintiffs against Microsoft would be required to show that it alone could have threatened the Microsoft monopoly but-for the harm that it suffered. In antitrust economics, actions are anticompetitive if they harm the competitive process; harm to a specific competitor is relevant to determining whether competition was harmed, but so is harm to other competitors because only if competition in general has been harmed can conduct maintain or increase the market power of the firm that engages in it. In a 1000-firm market, the harm to any one competitor would not cause harm to competition, but that is irrelevant to ascertaining whether the entire pattern of conduct against all 1000 firms caused anticompetitive harm.

The preceding example leads to Professor Murphy's conclusion that neither Novell's office applications products nor any other vendor's cross-platform applications constitute a threat to the market power of a dominant operating system.[28] Professor Murphy distinguishes the threat from Netscape/Java and from cross-platform applications on two grounds: Netscape/Java had much higher penetration on desktops and exposed a far greater array of APIs than the products of any particular applications vendor. Professor Murphy claims that the theory I put forth was that "a single application or even a suite of applications had the potential to overcome the applications barrier to entry."[29] Consequently, according to Professor Murphy, I must show "that Novell's OPAs are sufficiently important to PC operating systems' success to have affected competition in the PC operating system market."[30]

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28. *Murphy Report*, pp. 17-31.

29. *Ibid.*, p. 19.

30. *Ibid.*, p. 18.

I disagree with these statements because they commit a fallacy of decomposition. The argument in the *Noll Report* is that Novell was among a group of vendors that produced cross-platform applications and that, in collaboration with Netscape, was providing a platform that other software vendors could use to create cross-platform applications.[31] Collectively, these products threatened the applications barrier to entry.[32] If no single cross-platform application vendor was sufficiently important to threaten the dominant operating system vendor, it does not follow that collectively all cross-platform applications vendors could not pose such a threat.

The threat posed from Netscape/Java was not, as Professor Murphy states, "that they were cross-platform applications."[33] Instead, the threat was that Netscape/Java was cross-platform middleware that exposed APIs that applications vendors (like Novell) could use to create high-quality cross-platform applications more easily. The Netscape/Java threat was *not* the browser *per se*, as Microsoft realized when Microsoft tried to make a deal with Netscape. Microsoft offered to refrain from competing with Netscape in return for Netscape's agreement not to expose APIs that would support cross-platform applications.[34] The threat posed by Netscape was that it, in combination with other middleware, would lead to the creation of more cross-platform applications (like those of Novell). Thus, even Netscape's browser, *by itself,* posed no threat to Microsoft. The threat arose from the prospect that Netscape, along with other middleware, would open the flood gates for software vendors to write to APIs exposed by non-

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31. *Noll Report*, pp. 88-89.

32. "Findings of Fact," paragraphs 69-78, 93, 411-2.

33. *Murphy Report*, p. 19.

34. *Noll Report*, pp. 108-109.

Microsoft products, and thereby to become cross-platform.

The nature of the PC system industry creates another problem for Professor Murphy's framework. When products are complements and exhibit network effects, the harm to one firm spills over to harm others. Examining anticompetitive conduct on a product-by-product basis leads to an understatement of the harm to competition arising from anticompetitive conduct.

For example, as discussed in the *Noll Report*, Novell served as a distribution channel for Netscape Navigator.[35] Professor Murphy claims that office productivity applications are not a "natural distribution method" for middleware (such as Netscape) because no single vendor has enough presence on PCs to give any middleware product enough penetration to become an attractive platform for other applications.[36] This conclusion is another erroneous implication of Professor Murphy's analytical framework, which requires that each product have enough presence by itself to threaten Microsoft.

In the mid 1990s, PerfectOffice was an important distribution channel. The Court of Appeals found that Microsoft's conduct in 1997 to induce Apple not to distribute Netscape's browser was anticompetitive.[37] In 1998, Apple sold 5.35 million copies of the Mac OS,[38] which is the size of the distribution channel that was choked off by Microsoft's conduct with respect to Apple. The total unit shipments of word processors for 32-bit versions of Windows in 1998 was

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35. *Noll Report*, p. 92.

36. *Murphy Report*, p. 28.

37. *United States v. Microsoft Corp.*, 253 F.3d 34 (D.C. Cir. 2001), pp. 72-74.

38. Bates Nos. MS-PCA2235711-58 at 18.

51 million.[39] If the loss of market share by WordPerfect due to Microsoft's anticompetitive conduct exceeded 10 percentage points, the effect of this conduct on the distribution of Netscape's browser was roughly the same as the effect of Microsoft's conduct with respect to Apple. In fact, the decline in WordPerfect's share between 1994 and 1998 was much larger.

The fact that Novell served as one of several important distribution channels for Netscape Navigator illustrates two important points. The first is that the harm to competition arising from Microsoft's conduct against Novell is not limited to the effect on Novell. This conduct also harmed Netscape. The second is that the period in which anticompetitive conduct could cause harm to competition is not limited to the period that Novell owned WordPerfect. The harm to competition in the x86 operating system market from substantially reducing sales of Novell's office productivity applications continued for years after Novell sold WordPerfect to Corel.

The core issue in an antitrust economic analysis of the issues in this litigation is whether Microsoft engaged in behavior that eliminated the threat to its monopoly power in operating systems from office productivity applications and middleware in general, not just from Novell. Some of Microsoft's conduct was general in that it affected all competitors (an example is exclusionary contracts), but Microsoft documents state that another strategy was to identify products that Microsoft regarded as threats, to find the vulnerability of each product, and to take actions to attack the vulnerability of each product.[40] Novell was an important producer of products that Microsoft perceived as a threat, but was not the *only* such player and surely did not

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39. *PC Word Processing Software Markets Review & Forecast, 1998-2003*, IDC#18984 (May 1999).

40. *Noll Report*, p. 87.

produce *all* such products – for example, it never did distribute Ferret, but instead distributed Navigator along with other products.

Based on the preceding discussion, I conclude that Professor Murphy's first and third conditions are stated too narrowly. The correct statement of the first condition is whether office productivity software *and middleware,* including products in these categories that were produced by vendors other than Novell, collectively constituted a threat to Microsoft's monopoly power in x86 operating systems. The correct statement of the third condition is whether the acts that harmed Novell and other vendors of applications and middleware enabled Microsoft to maintain or increase its monopoly power in x86 operating systems.

Professor Murphy's second condition is an incomplete statement of the requirements in antitrust economics for determining whether anticompetitive behavior has a "reasonable business justification." In antitrust economics, conduct that reduces competition is not anticompetitive if two conditions are satisfied: (1) consumers derived benefits from the conduct that exceed the harm that they experienced due to the reduction in competition, which implies that the conduct increased efficiency and led to lower prices and/or higher product quality, and (2) the benefits to consumers were reasonably connected to and the result of the conduct that caused anticompetitive harm. Professor Murphy's second condition is incorrectly stated for two reasons. First, he does not attempt to assess the magnitude of the procompetitive benefits, which means that his analysis is insufficient to permit a balancing of the harms and benefits of Microsoft's conduct. Second, he does not address whether the consumer benefits that he identifies were caused by the conduct that was anticompetitive. Instead, he makes arguments at a high level of generality, such as the claims that long-term contracts can induce more

investment in a business relationship, or the failure to document APIs can be beneficial.

I conclude from the preceding analysis that the *Murphy Report*, because of the economic invalidity of its analytical framework, is not a valid application of antitrust economics to the issue of whether Microsoft's behavior with respect to products in the relevant markets in which Novell competed harmed competition in the market for x86 operating systems. Whereas I do not agree that Professor Murphy has proven that the acts against Novell alone had no effect on competition for x86 operating systems, even if he had established this point, I would regard his analysis as irrelevant because it answers the wrong question. Consequently, for this reason alone the *Murphy Report* could not cause me to revise my conclusion that Microsoft's behavior in the relevant markets for applications and middleware harmed both competition in the market for x86 operating systems and Novell's position in some relevant markets for applications and middleware that collectively posed a threat to Microsoft's monopoly in x86 operating systems.

The narrow focus of Professor Murphy's analytical framework renders irrelevant two of the three opinions that he highlights at the beginning of his report. Professor Murphy's first opinion is that "PC operating system competition would not have been enhanced if Novell's OPAs [office productivity applications] had been more successful on the Windows platform."[41] Even if this statement were true, it is does not imply that Microsoft's acts against Novell were not part of a broader pattern of anticompetitive conduct that reduced the extent to which vendors of applications and middleware collectively could reduce Microsoft's market power in x86 operating systems.

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41. *Murphy Report,* p. 4. As an aside, Professor Murphy repeatedly uses the phrases "PC operating system competition" and "PC operating system market," both of which are imprecise because the relevant market at issue here is the market for x86 operating systems.

Professor Murphy's second opinion states that the conduct that I allege is anticompetitive "did not cause anticompetitive harm to Novell's OPAs" and "did not prevent Novell's OPAs from becoming a threat to PC operating system competition."[42] He then explains that this opinion is derived from the fact that "much of the conduct" that I discuss "was not directed at Novell's OPAs and had no impact on Novell's OPA business." The factual premise of this statement is true: I do discuss anticompetitive behavior that affected other products that either competed with or were complements of Novell products for the purpose of demonstrating that Microsoft's actions against Novell were part of a broad pattern of conduct. The anticompetitive conduct at issue here is a concerted business strategy which encompassed many acts that had a common effect: to prevent applications and middleware products from creating an alternative platform for applications vendors that would destroy the applications barrier to entry and thereby would undermine Microsoft's monopoly power in the market for x86 operating systems.

MARKET DEFINITIONS

Professor Murphy offers the following summary criticism of my market definitions.

> "I find that some of the market definitions proffered by Professor Noll do not provide a useful basis for analysis or are irrelevant in this case. I comment here only on those that I find most troubling

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42. *Murphy Report*, p. 6. This opinion also states that the conduct that I examine benefitted consumers, which I discuss elsewhere. I assume that Professor Murphy meant something other than what he wrote in the second part of the quotation, since neither the plaintiff nor the defendant claims that Novell was "a threat to PC operating system competition." Instead, I assume that Professor Murphy meant to say that Microsoft's actions did not prevent Novell's applications products from increasing competition in the x86 operating system market.

> and accept the market definitions that do not pose significant obstacles to a reasonable analysis."[43]

To begin, I did not "proffer" market definitions. I undertook a valid antitrust economic analysis of the reference products in this litigation and reached conclusions that were based on this analysis. Professor Murphy does not criticize my method or analysis; instead, he simply disagrees with my conclusion.

I also have no idea what he means by stating that my market definitions "do not provide a useful basis for analysis." Market definitions are not useful only if they are incorrect, and they are incorrect only if the method that was used to identify relevant markets is invalid or the facts that are used to apply the method are incorrect or incomplete. Because Professor Murphy does not attack either my method or my facts, he has no basis for rejecting my market definitions, and no basis for concluding that my definitions are not useful.

Professor Murphy's conclusion that some of my market definitions are not relevant is based in part on his instructions that the only products at issue in this case are operating systems, word processors, spreadsheets, and suites that contain these applications. These definitions are deemed irrelevant by attorney instruction, not by economic analysis. But even if the only relevant product markets were those that contained the products that were examined by Professor Murphy, the analysis of other products is not irrelevant for two reasons.

First, a proper market definition analysis must determine which products are not in the market as well as which are in it. The motivation for some of my market definition analysis was to determine which products were in the market for word processors and spreadsheets, and

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43. *Murphy Report*, p. 9.

whether suites were a separate relevant market. This analysis would have been incomplete had it not included an analysis of other applications and middleware products.

Second, because this case focuses on the effects of applications and middleware on the market for x86 operating systems, a valid economic analysis of the connection between applications and middleware markets and competition in the market for operating systems can not be restricted to a one vendor of applications and middleware. The demise of the applications barrier to entry and vertical competition, which threatened Microsoft's monopoly in x86 operating systems, pertain to a variety of products that *collectively* create alternative platforms for future developers of applications and middleware. As explained above, if Microsoft could not have maintained and enhanced the applications barrier to entry and prevented effective vertical competition in applications and middleware markets by knocking out only two products produced by one firm, an economic analysis that was restricted to those products would reach an incorrect conclusion about whether Microsoft's pattern of conduct caused anticompetitive harm.

Operating Systems

Professor Murphy rejects my separation of the "PC operating system market into two separate markets, one for character-mode PC operating systems and one for graphical-user interfaces (GUIs)."[44] Professor Murphy's characterization of my market definition is imprecise; my definition of the relevant market (and the market definition that was adopted in *U.S. v. Microsoft*) is not the market for "PC operating systems," and in particular it explicitly excludes the Apple Macintosh operating system. Professor Murphy than offers five reasons for his

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44. *Murphy Report*, p. 10.

conclusion that these products do not constitute two separate relevant product markets.[45]

"a) Since 1995, no commercially significant PC operating system has been distributed without a GUI."

This statement is factually incorrect. The second leading x86 operating system is Linux, and Linux is not bundled with a GUI. Linux users can chose among several different GUIs.[46] Linux is more successful than two of the three products other than Windows that are cited by Professor Murphy (Sun Solaris and IBM OS/2),[47] and the third product he mentions (Apple Macintosh) was not in the relevant market for x86 operating systems until 2006.[48]

Professor Murphy's factual errors are not the principal problem with this statement. Professor Murphy would have been correct had he said that nearly all users of personal computers that contain an x86 microprocessor use an operating system that is bundled with a GUI. The reason is that the relevant market for x86 operating systems is virtually monopolized by a single product, Windows, which bundles an operating system and a GUI. This fact hardly proves that my market definition is incorrect. Instead, the post-1995 outcome in the x86 operating system market is the result of Microsoft's decision not to release Windows 4.0 and MS DOS 7.0 as separate products. According to technical experts and internal Microsoft documents,

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45. *Ibid.*, pp. 10-12.

46. KDE and GNOME are among the most popular GUIs for Linux. See "Desktops: KDE vs Gnome," *Linux Reviews*, at linuxreviews.org/software/desktops/.

47. From 1991 to 2005, IDC reports OS/2 sold 15.6 million units, all non-Linux flavors of Unix on x86 sold 0.6 million units, and Linux sold 18.9 million licenses. Sources: as listed in Table 3 of *Noll Report*, MSPCAIA000000293738-61, and MSPCAIA000000298990-9000.

48. Arik Hesseldahl and Peter Burrows, "Apple Completes Intel Switch," *Business Week*, August 8, 2006, at www.businessweek.com/technology/content/aug2006/tc20060807_773580.htm.

these products were in no meaningful way integrated, just as Windows and Internet Explorer were in no meaningful way integrated when they were bundled.[49] Microsoft's decision not to release separate GUI and OS products was a marketing decision that was intended to eliminate competition in x86 operating systems from DR DOS (which for the preceding seven years had supported Windows and competed with some success against MS DOS)[50] and to increase the applications barrier to entry against OS/2 (which had a GUI but also supported Windows so that it could also support applications that were written to Windows APIs, such as Microsoft Office).

> "b) "...[S]ince the spread of powerful GUIs for PCs, the distribution and sale of GUIs separate from character-based OSs has been the exception, not the rule. The provision of Windows separate from MS DOS is best regarded as a transitory phenomenon that allowed the industry (and users) to make the transition from character-based to GUI-based PC operating system products while maintaining a high degree of backward compatibility."

The first sentence simply repeats that assertion that because Microsoft monopolizes the market for x86 operating systems and bundles its GUI with its operating system, the proper

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49. *Noll Report*, pp. 114-116. See also "Technical Expert Report of Andrew Schulman" in *Comes vs. Microsoft*, pp. 6-7.

50. I understand that in this litigation Novell is precluded from claiming injury from Microsoft's anticompetitive conduct against DR DOS; however, to the extent that Professor Murphy implicitly attributes the demise of DR DOS to the natural competitive process (in this case, the failure to develop its own GUI and incorporate it into DR DOS), I must reference the cause of the demise of DR DOS to rebut his claims. For a more complete discussion of the attack of Microsoft on DR DOS and the reasons that Microsoft bundled Windows 4.0 and MS DOS 7.0 into Windows 95, see my expert report in *Comes vs. Microsoft*.

product definition must be the bundled product. This assertion is not derived from an economic analysis of the market in which these products are sold, and does not mention, let alone discuss, the fact that when Windows was a separate product, it was purchased by consumers who also purchased operating systems other than MS DOS. Regarding the second sentence, many users decided that the "transition" they preferred was to a GUI running on a non-Microsoft operating system. This transition was followed by a second transition that was forced by Microsoft – from DR DOS and OS/2 to the MS DOS component of Windows 95.

> "c) Competition was between PC operating system products or combinations of products, some of which had GUIs and some of which did not. The evolution of PC operating systems, driven by technological advances and consumer demand, clearly favored GUI-equipped PC operating systems."

I find no economic content in this statement. The *Murphy Report* provides no evidence that any of these assertions about technology, demand and the nature of competition are true. Professor Murphy seems to believe that if a large fraction of consumers who purchase an x86 operating system also purchase a GUI, it must be the case that these products are in the same relevant market. Of course, this belief is wildly incorrect as a matter of economics. This argument implies that combinations such as cereal and milk, tea and sugar, audio players and audio recordings, and shoes and socks are in the same market because almost everyone who buys the first also buys the second.

To prove that operating systems and GUIs are part of the same product market requires more than noting that people who buy one also buy the other. One also needs to show that, in the absence of bundling, people would buy each product from the same vendor if each were

available at prices that, when summed, roughly equaled the price of the bundled product. Professor Murphy has not shown this, and he has simply written off as a "transition" the decade before 1995 when many consumers did not buy a GUI or bought a GUI and an x86 operating system from separate vendors without offering any evidence at all that this interpretation of history is correct, and without directly confronting the evidence that Microsoft bundled its GUI and its operating system because in doing so it could increase its monopoly power in the latter.

> "d) Even when sold separately, GUIs have almost always been intended to work with a specific PC operating system. The notion that GUIs freely can be mixed and matched with several character-based PC operating systems has little historical precedent."

This statement by Professor Murphy is factually incorrect. Windows ran on DR DOS and OS/2 for many years. Probably Microsoft "intended" that Windows would be run almost exclusively on MS DOS, and part of Microsoft's strategy in developing Windows 3.0 and later versions was to create roadblocks to running Windows on DR DOS.[51] Regardless of Microsoft's intention, Windows ran on other operating systems until it was bundled in Windows 95.

Even if Professor Murphy's statement were true, the conclusion that is drawn from it has no basis in economics. His statement, if true, would not prove that GUIs and x86 operating systems are in the same market. As pointed out in the *Noll Report*, a wide variety of applications

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51. Microsoft's strategy to stop customers from running Windows on DR DOS is discussed at length in my expert report in *Comes vs. Microsoft,* pp. 119-124. Again, this discussion is relevant because Professor Murphy makes an assertion about the "intended" platform for a GUI. Microsoft clearly "intended" to undermine the use of Windows 3.x on other operating systems, as revealed by its licensing policies and the "detect DR DOS" code that, if it found that Windows was running on DR DOS, warned the user that Windows was not intended to run on DR DOS.

run on only one operating system, which is the source of the applications barrier to entry. This fact does not establish that these applications also are part of the same relevant product market as the operating system on which they run. Likewise, many video games run on only one of the three primary game computers (Nintendo, Play Station and X-Box), but that does not cause the relevant product market for game machines to include all the games that run only on that device.

> "e) ...operating systems consist of several components, one of which is a user interface [citing Ronald Alepin]. There is no reason to believe that this user interface must be character-based... User interfaces are necessary parts of operating systems, and technological innovation and market forces have led them to evolve from character-based interfaces to GUIs."

Once again, Professor Murphy's statement is too sweeping and so leads to ridiculous conclusions about the scope of the relevant market for x86 operating systems. All operating systems enable users to interact directly with the operating system to tell the computer which program to run. Many middleware and applications products, including PerfectOffice during the period that it was owned by Novell, also contain interfaces that enable users to issue commands to the operating system indirectly through these programs, yet no one would claim that interface shell of PerfectOffice was part of the operating system.

The more fundamental problem with this statement is that it, too, contains no economic analysis or relevant facts. For example, exactly what are the "technological innovations and market forces" that cause my approach to market definition to produce incorrect conclusions? And precisely what are the relevant principles in antitrust economics that enable one to use economic analysis to determine which "components" in an operating system are really part of the

operating system rather than separate products (for example, are the computer games Battleship, Pinball and Solitaire part of the operating system, and if not, why)? Professor Murphy does not say and offers no guidelines about why "technological innovation and market forces" have not caused the proper definition of an operating system to evolve to incorporate literally everything that is currently bundled in Windows.

The preceding five points represent the entire substance of Professor Murphy's conclusions about the relevant market that contains x86 operating systems. He does not criticize my methods or challenge my facts, he offers no other economic methods for identifying relevant markets, and he asserts facts that are either incorrect or unrelated to the methods that economists use to define markets. Thus, his discussion is irrelevant to whether GUIs and x86 operating systems are in the same relevant product market.

Browsers[52]

I can not tell whether Professor Murphy disagrees with my conclusion that browsers are a separate relevant product market. His brief critique of my analysis of browsers makes three points that are characterized as "issues associated with [my] claim."[53] These issues are: (1) whether such a product market exists is irrelevant to this case; (2) in *U.S. v. Microsoft* the Court of Appeals found that the government had not established that browsers were in a separate

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52. Professor Murphy incorrectly identifies this product as "web browsers." While one important use of browsers is to access files on the Internet, that is not their only function, and to imply that their use is limited to Internet browsing is misleading. For example, browsers expose APIs that applications programmers can use to access functions of the operating system.

53. *Murphy Report*, p. 12.

product market from operating systems, and "Professor Noll performs no analysis that browsing software constitutes a separate market for antitrust purposes;" and (3) Microsoft had no market power in browsers at the time that Novell owned WordPerfect and so its actions affecting browsers could not have harmed Novell before Novell sold WordPerfect to Corel.

The first and third points are closely related, and are derived from Professor Murphy's instructions from Microsoft's attorneys and the framework that he developed on the basis of these instructions. The relevance of browsers to an economic analysis of the effects of Microsoft's conduct are obvious in two ways. First, Novell served as a distribution channel for Netscape, so that if Microsoft was successful in substantially reducing sales of PerfectOffice, it also would choke off an important distribution channel for Navigator/Java, which in turn was regarded by Microsoft as a serious threat to Microsoft's monopoly power in x86 operating systems. Second, the combination of PerfectOffice and Navigator exposed APIs that offered a platform for independent software vendors to write cross-platform applications that were accessed on the GUI shell of PerfectOffice, rendering Microsoft's operating system invisible to the user.[54] Thus, the collaboration between Netscape and Novell made browsers highly relevant to addressing the harm to competition, if not solely to Novell, arising from Microsoft's conduct.

The relevance of browsers to this case does not hinge on whether Microsoft enjoyed market power in browsers in the period that Novell owned WordPerfect. During the period that Novell owned WordPerfect, Microsoft saw Netscape as a serious threat.[55] As discussed in the

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54. *Noll Report*, p. 109.

55. "Microsoft was concerned with middleware as a category of software; each type of middleware contributed to the threat posed by the entire category. At the same time, Microsoft focused its antipathy on two incarnations of middleware that, working together, had the potential

Noll Report, after attempting unsuccessfully in 1995-6 to compete with Netscape on the merits, Microsoft pursued anticompetitive conduct to drive Netscape from the market.[56] Part of the strategy for eliminating the Netscape/Java threat was to choke off the Netscape's distribution channels. One of these distribution channels was Novell, so one means of harming Netscape was to reduce sales of PerfectOffice. The fact that Internet Explorer's share of browser installations and use skyrocketed from nine percent in 1996 to over 80 percent by 2000 is clear evidence that Microsoft's anticompetitive conduct regarding Netscape succeeded.

Professor Murphy is correct that the Court of Appeals did not uphold the finding of the district court in *U.S. v. Microsoft* that browsers are a separate relevant market. Of course, the Court of Appeals also did not find that browsers are part of the relevant market for operating systems. Instead, the Court of Appeals ruled that the government's tying claim against Microsoft did not hinge on the definition of the market that contained browsers.[57]

I do not understand the basis for Professor Murphy's claim that I offer no analysis about browsers other than the content of the government's case. I agree with the Court of Appeals that the government did not present a full economic analysis of the principles for defining all of the relevant markets associated with software that runs on an x86 PC, which is why I devoted several pages of my original report to developing such a framework and applying it to a variety of applications and middleware products. Perhaps Professor Murphy's version of the *Noll*

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to weaken the applications barrier severely without the assistance of any other middleware. These were Netscape's Web browser and Sun's implementation of the Java technologies." "Findings of Fact," paragraph 68.

56. *Noll Report*, pp. 119-123.

57. *United States v. Microsoft Corp.*, 253 F.3d 34 (D.C. Cir. 2001), p. 95.

Report is missing pages 54 through 71, which he does not reference. This section uses the principle of substitution to identify tests of whether software products are in the same market. These tests are based on technical features (function and production) and economic variables (price correlation and independence of demand). These tests are then applied to browsers.

To summarize, the *Noll Report* makes the following points: (1) the function of browsers differs from the functions of the operating system and other middleware; (2) browsers are produced separately from other software products in that they are not meaningfully integrated with the operating system and that most are produced by companies that do not produce operating systems; (3) browsers are distributed separately from operating systems at the same price (namely, zero); and (4) browsers have independent demand (some businesses block the use of Internet Explorer because they do not want their employees surfing the Internet, some consumers who own a PC that runs on Windows never use a browser, and since the settlement of *U.S. v. Microsoft*, many users even today download and regularly use a non-Microsoft browser even though Internet Explorer remains bundled with Windows). In my opinion these facts are sufficient to justify the conclusion that browsers are a separate product market. Professor Murphy does not show that the Findings of Fact in *U.S. v. Microsoft* make all of these points (because they do not – for example, the Findings of Fact can not possible refer to the evolution of browsers since the settlement), and he does not challenge either my methods or my facts, just my conclusions. Thus, I find no reason to alter my conclusions about relevant markets.

Office Productivity Applications

Professor Murphy also devotes one paragraph to the relevant markets for office

productivity applications.[58] Although he does not explicitly state that he disagrees with my analysis of the relevant markets in applications, I assume that he believes that the three sentences that follow his summary of my analysis constitute a refutation of my analysis and conclusions.

Professor Murphy's three sentences on office productivity applications state the following. Professor Murphy first observes that separate sales of office productivity applications fell below 20 percent of all such sales after 1995. From this fact he concludes that "there was little competition among the components of suites after 1995." He then opines that "suites and their components could not have been relevant antitrust markets for this case after Novell sold WordPerfect to Corel in March 1996."

The first sentence is factually correct, but it proves that there was substantial independent demand for the components of office suites during the period that Professor Murphy believes is at issue in this case, which ends only three months after 1995. Moreover, the second sentence could just as easily have been written that there was little competition among suites since Microsoft accounted for nearly all sales of suites as well as their components after 1995.[59] The point is that, regardless of the cause, Microsoft dominated office productivity applications after the release of Windows 95, and as a result one can not derive any useful information about market definition from the fact that a monopolist chose to bundle its products, causing nearly all customers to buy a bundle rather than individual components. Indeed, as stated in the *Noll Report*, one could not obtain some of the components of Microsoft Office except as part of the

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58. *Murphy Report*, p. 13.

59. *Murphy Report*, Exhibit 3, shows that Microsoft had 89.2 percent of suite revenue in 1996 and 94.5 percent in 1997. See *Noll Report*, Table 3, for shares of the individual applications.

bundle. This fact does not establish that these products would not have constituted separate relevant product markets had office productivity applications not been monopolized.

Professor Murphy's third sentence states that conditions after March 1996 are irrelevant. Again, this conclusion\ flows from his instructions from Microsoft's attorneys, not from an economic analysis. Even if office productivity applications are irrelevant to this case after March 1996, information about these markets before and after Novell was a seller in them may be useful for defining relevant markets and analyzing competition in these markets. Even if the harm to Novell is limited to 18 months before March 1996, the harm to competition arising from anticompetitive acts against Novell and other office productivity products can persist long after this deadline, and so is relevant to assessing the harm to competition from Microsoft's conduct.

Summary of Market Definitions

Professor Murphy's discussion of market definitions contains many factual errors and mischaracterizes products, the decision in *U.S. vs. Microsoft*, and the *Noll Report*. More importantly, it contains absolutely no discussion about how economists identify relevant markets or how the facts fit in to a proper economic analysis of market definition.

The implications of the lack of economic content in this section go beyond simply identifying proper relevant markets. Without proper market definitions, one cannot understand how the competitive process played out in the markets for the products at issue in this litigation, or how it would have played out had Microsoft behaved differently. Without an understanding of relevant markets, one can not properly determine whether a firm has market power, let alone whether the market power that a firm possesses was achieved by anticompetitive means.

To illustrate this point by simple analogy, without a principled basis for knowing that cheese is not in the relevant market for x86 operating systems, one can not conclude that conduct that knocks all other operating systems out of the market is anticompetitive, for one has no basis for concluding that increased cheese production will not substitute for all of the lost sales of competing operating systems. Professor Murphy makes no error that is this silly, but the point of this example is still valid. Unless one has a principled method for identifying which products compete, one can not determine whether conduct harmed the competitive process. Professor Murphy's discussion of market definition reveals no in-depth understanding of the nature of economic competition among components of PC systems, which implies that he has no basis for concluding whether any of Microsoft's conduct was anticompetitive.

SOURCES OF MARKET POWER

Professor Murphy's disagreements with the *Noll Report* about whether Microsoft's conduct towards Novell caused anticompetitive harm fall into three categories. First, Professor Murphy argues that Novell's products, and cross-platform applications more generally, do not threaten the market power of a dominant operating system. Second, Professor Murphy argues that the lack of success of the products that were sold by Novell arose from inferior product quality product and poor business decisions. Third, Professor Murphy argues that the conduct about which Novell complains was procompetitive.

The Threat of Cross-Platform Applications

The discussion of Professor Murphy's framework deals with some of Professor Murphy's

argument that every cross-platform applications vendor is insufficiently important to constitute a threat to Microsoft's dominance in operating systems. I will not repeat my disagreement with Professor Murphy on this issue here. Instead, I will focus on arguments that Professor Murphy puts forth that do not appear to depend on this framework.

Professor Murphy uses the history of OS/2 to demonstrate that popular applications programs can not determine the outcome of competition between operating systems.[60] The essence of the argument is that WordPerfect and Lotus, the leading word processing and spreadsheet vendor, respectively, in the late 1980s, favored OS/2 over Windows as a platform for their applications, yet Windows won. "If the measures taken by WPC and Lotus aimed at moving competition away from Windows were unsuccessful in influencing PC operating system outcomes in the late 1980s and early 1990s, ... there is little reason to believe that a more successful version of PerfectOffice would have influenced PC operating system outcomes after Novell had acquired WordPerfect in 1994."[61]

I have many disagreements with Professor Murphy about this section of his report other than that it represents an application of an erroneous analytical framework. These disagreements are all based on the analysis in the *Noll Report*, which I will briefly repeat here.[62]

The cornerstone of Professor Murphy's analysis is that he does not believe cross-platform applications and middleware actually are a threat to a dominant operating system.[63] Professor

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60. *Murphy Report*, pp. 19-21. The *Hubbard Report*, pp. 6-14, contains the same argument.

61. *Murphy Report.*, p. 20.

62. *Noll Report*, pp. 145-151.

63. Professor Murphy believes that in *U.S. vs. Microsoft* "the government's economic theory rested in part on the premise that Netscape and Java offered a unique opportunity... to overcome

Murphy acknowledges the applications barrier to entry, but he does not carry the use of this concept to its natural conclusion. If the monopoly power of a dominant operating system is preserved by the applications barrier to entry, a substantial reduction in the applications barrier to entry intensifies competition among operating systems that are already in the market, enables entry to occur, and thereby causes the monopoly power of the dominant operating system to fall. Operating system competition depends on the presence of cross-platform applications and middleware than enable end-users to select among competing operating systems without incurring large switching costs. Today, because PCs are ubiquitous and so many users are invested in Microsoft Office, a new operating system would face monumental entry barriers. In 1994, before Microsoft Office was so dominant, when Lotus and Novell offered cross-platform applications, and when much of the growth in networked PC penetration lay in the future, cross-platform middleware and applications offered an opportunity for a competing x86 operating system. Professor Murphy does not refute this argument because he does not address it.

Professor Murphy's analysis of the OS/2 history is based on assumptions about the state of the industry in the 1980s that are incorrect. For starters, Windows 1.0 was in no meaningful sense a "platform" for applications. The first version of Microsoft Word for Windows was not released until November 1989, and it was written for Windows 2.1, not Windows 1. Moreover,

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the applications barrier to entry" but that "post-trial marked evidence... indicates that neither Netscape nor Java had the ability to serve as a platform for general purpose applications." *Murphy Report*, p. 17. This characterization of the government's economic theory is not correct, for the government's initial proposed relief – placing Microsoft's applications and operating systems divisions in two separate companies – makes no sense if the only hope for competition is offered by Netscape and Java. But the important point is that these remarks reveal that Professor Murphy does not believe that Microsoft's position in the operating system market depends on the applications barrier to entry.

in the late 1980s the choice between Windows and OS/2 was not a choice about whether to work with Microsoft.[64] OS/2 was a joint venture between IBM and Microsoft in which Microsoft was responsible for components of OS/2 that software vendors would need to rely upon in writing applications that took advantage of the most recent advances in x86 microprocessors.

Microsoft's public position until 1991 was that OS/2 would replace Windows/MS DOS as the primary platform for applications that made use of a GUI. As explained in the *Noll Report*, around January 1989, Microsoft decided not to bring the partnership with IBM to fruition, to put the advanced operating system functions that were planned for OS/2 into Windows, and to write office productivity applications to run on Windows instead of OS/2. This decision was kept secret from IBM, WordPerfect, Lotus and other independent software vendors.

With the release of Windows 3.0 in May 1990 (incorporating advanced features that were promised for OS/2), Lotus and WordPerfect reallocated development effort to write products for Windows, but exactly as Microsoft had forecast, they faced substantial cost and delay in catching up. For approximately two years after the release of Windows 3.0, Microsoft office productivity applications, reflecting their head start, were of better quality and became the leading products on Windows. Nevertheless, despite Microsoft's head start, WordPerfect captured more than 30 percent of Windows word processor sales in 1992, shortly after WordPerfect for Windows was released. Meanwhile, because Microsoft had not lived up to its commitments regarding OS/2 and in 1991 resigned from the partnership, OS/2 2.0 was not released until April 1992, two years after Windows 3.0.

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64. The analysis of the whether the success of OS/2 was related to applications as a threat to a dominant operating system is based on the *Noll Report*, pp. 145-51.

Professor Murphy interprets this history as proving that cross-platform applications can not determine the outcome of a competition between operating systems. The condition under which this claim would be valid is that the competing platforms and the competing applications were released at roughly the same time. A customer wanting applications that took advantage of protected mode functionality had no choice but to buy Windows 3.0 and Microsoft Office until WordPerfect, Lotus and IBM caught up with Microsoft's products.

Whereas I believe that the conduct by Microsoft during this period relating to OS/2, some of which is discussed in the *Noll Report* and more of which is discussed in my report in *Comes vs. Microsoft*, was anticompetitive,[65] for purposes of this discussion the cause of the success of Windows from the release of Windows 286 through the release of Windows 3.1 is irrelevant to the point at issue here. Regardless of the reason, Windows products from 286 through 3.1 offered features that no competing product could offer. As a result, Windows became ubiquitous. Had WordPerfect, Lotus and other software vendors not been misled about whether to write applications to OS/2 or Windows, OS/2 still would not have succeeded because it was not an effective competitor. Hence, this episode proves nothing about the effectiveness of cross-platform products in overcoming the applications barrier to entry and thereby reducing the market power of a dominant operating system if the latter faces a strong competitor.

The Quality of Competing Applications

Professor Murphy claims that the fall in the market shares of WordPerfect and other

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65. For example, Microsoft made extensive use of anticompetitive contracts to foreclose IBM from the OEM channel. See pp. 74-82 of my report in *Comes vs. Microsoft*.

Novell office productivity applications was due to their inferiority, largely due to bad decisions about placing their products in a GUI-based environment.[66] The essence of Professor Murphy's argument is that WordPerfect and its competitors never made products that were successful on a GUI platform and that were as good as Microsoft's products. The basis for these conclusions is some information about market shares and product reviews. The problem with the information presented by both Professor Murphy and Professor Hubbard is that it is selective and not appropriately organized to reflect other conditions in the market.

The first issue is the success of competing products on Windows. All of the economists on both sides, although they disagree about the cause, agree that the competitors to Microsoft Office did poorly in the early 1990s, after the release of Word for Windows in late 1989 and Windows 3.0 in early 1990. These competitors spent about two years catching up. The key issue is whether they succeeded in producing high-quality products that were serious competitors to Microsoft's office productivity applications by the time Windows 95 was introduced.

Professor Murphy claims that according to "reviewers in the trade press, the relevant Microsoft applications generally have been superior to the offerings of competitors since the early 1990s,"[67] based on a "systematic review" of ten major computer industry magazines from the late 1980s to the late 1990s.[68] He summarizes this review by stating that Microsoft wins most of the heads-to-head comparisons and awards for applications software.

One problem with Professor Murphy's approach to summarizing the reviews is that it

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66. *Murphy Report*, pp. 70-75. The *Hubbard Report*, pp. 10-24, makes the same point.

67. *Murphy Report*, p. 74.

68. *Ibid.*, p. 75.

does not distinguish among time periods and platforms. As discussed elsewhere, applications competitors were disadvantaged in the early 1990s because they were delayed in writing products for Windows. Consequently, Microsoft dominated product reviews at this time because the primary focus of reviewers was performance on the Windows 3.x platform. For the purpose of assessing the effect of Microsoft's conduct when Novell owned WordPerfect, the most relevant reviews are those that took place just before and just after the release of Windows 95.

Professor Murphy also does not take into account the relationship of ratings to release dates, and the phenomenon of "leapfrogging" that is common in software markets.[69] The point is that during a period in which competition is robust, the winner of most reviews is whichever product was most recently released. Thus, after Microsoft's competitors overcame their delay in writing to Windows in the early 1990s, the expected result of these reviews is that older products lose to newer ones.

Under my direction, economists at Bates White searched seven of the publications (excluding *Byte, InfoWorld and PC Magazine* because in the time at hand we could not locate all of them in the relevant years) that were reviewed by Professor Murphy for the period 1993 through 1996 to determine whether his survey was complete in this period and whether his characterization of the results was accurate.

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69. Product reviews discuss leapfrogging. One review states: "In the case of Quattro Pro 5.0 for Windows, you get what must be considered the most well-rounded spreadsheet on the market—at least at this stage of the leapfrog game." (Christopher O'Malley, "New Standards for Spreadsheets," *Computer Shopper*, December 1993, p. 392.) As Excel 5.0 is about to be released, another review notes, "During the past few months Lotus 1-2-3 and Quattro Pro have been playing leapfrog. Now it's Microsoft's turn to join in. The beta version of Excel 5.0 has upped the ante, leaving the competition behind once again." (James E. Powell, "Truly Awesome Ease of Use," *Windows Magazine*, November 1993, p. 100.)

Exhibit 1 to this report presents all of the reviews in seven magazines from January 1993 through December 1996. As the exhibit shows, we found that in the seven magazines that we searched, Professor Murphy excluded more reviews than he included. We also found that Novell's products did very well prior to the release of Windows 95, but poorly afterward. The number of "wins" (including ties) for Novell and Microsoft products, not counting reviews that are based on prior reviews (to avoid double counting), from January 1993 through August 1995 (when Windows 95 was released) is as follows: word processors – Microsoft 7 and Novell 8; spreadsheets – Microsoft 16, Novell 10. Suites were not reviewed until November 1993, and Professor Murphy missed positive reviews of PerfectOffice in *PC Computing* and *PC Week* between November 1994 and August 1995[70] as well as positive reviews of SmartSuite in *PC Week*[71] and Microsoft Office in *PC Week* and *PC Computing*.[72] Although Microsoft Office won more reviews than the others, the margin was not large, and the products that were owned by Novell were strong competitors. At the time Windows 95 was released four magazines had reviewed suites within the preceding few months, and the results of the most recent of those reviews were two wins for Microsoft and two wins for Novell.[73] These reviews support the

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70. Ron White, "Suite Dreams Are Made of This," PC Computing, November 1994, 85 and Herb Bethoney, "PerfectOffice: Sweet suite," PC Week, January 1995.

71. Jim Louderback, "Suite Success: Better to Avoid the Dogs than to Select Stars," *PC Week*, November 1993, p. 160.

72. *Ibid.* and "MVP Applications: Suites," *PC Computing*, December 1994, 158.

73. In their most recent 1995 reviews, *PC Computing* and *PC Week* had PerfectOffice ranked first, while *Computer Shopper* and *Home Office Computing* had Microsoft Office ranked first. (Wendy Taylor, "The A-List," *PC Computing*, August 1995; Herb Bethoney, "PerfectOffice: Sweet Suite," *PC Week*, January 1995; Gregg Keizer and Wayne Kawamoto, "Package Deals, Software Suites," *Computer Shopper*, February 1995; and Emerson Andrew Torgan, "Suite Success," *Home Office Computing*, March 1995.)

characterization of them in the *Noll Report*, which is that regardless of the history of Novell's office productivity applications on Windows in the early 1990s, by 1995 there was no substantial qualitative difference between Microsoft's and Novell's products.

Professor Murphy makes the broader claim that Novell's and Lotus's office productivity applications were failures on platforms that included GUIs, using the Macintosh as an example.[74] The focus of Professor Murphy's discussion is the 1980s; he does not carry forward his analysis to the period when Novell owned WordPerfect. WordPerfect for Macintosh 2.0 was released in January 1991 and received highly favorable reviews.[75] In October 1993, WordPerfect 3.0 for Macintosh was released, and also met with favorable reviews.[76] Version 3.5, released in September 1995, won the Mac User Editor's Choice Award.[77] Meanwhile, Word 6.0 (1994) and 6.0.1 (March 1995) for Macintosh were not well received because the program was slow and required too much memory.[78]

When Microsoft released Windows 3.0, WordPerfect shifted development from OS/2 to Windows, seeking to create a strong product for Windows and then worry about finishing its

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74. *Murphy Report*, pp. 70-74.

75. See *Computer Reseller News*, January 21, 1991; *Mac User,* June 1, 1991, and *Computer Shopper*, August 1, 1991.

76. See *InfoWorld*, August 30, 1993, and December 6, 1993, and *Computer Reseller News*, December 6, 1993.

77. "WordPerfect 3.5 for Macintosh Wins 1995 MacUser Editor's Choice Award for Processing Applications," *PR Newswire*, January 3, 1996.

78. "War of the Words: Five Word Processing Packages Reviewed," *MacUser*, April 1, 1995; "Word 6.0 Survives Fiasco," *Macworld*, December 1995.

product for OS/2.[79] In July 1993, WordPerfect released version 5.2 for OS/2, its first OS/2 product that was written to the Presentation Manager GUI.[80] The product was well-reviewed for its file management features and for taking good advantage of the OS/2 shell.[81] In 1993, WordPerfect accounted for 45 percent of word processor sales for OS/2, second to 52 percent for Word.[82] WordPerfect was not a failure on OS/2.

Professor Murphy suggests that the appropriate test for whether Microsoft's conduct towards Novell in connection with Windows 95 is responsible for the fall in the market shares of Novell's office applications products is how Novell's products and their predecessors fared on other GUI platforms. Once one disregards the damage to WordPerfect from being late to Windows 3.0, the result of this test is clear. WordPerfect did well on Windows, Macintosh and OS/2 in the period immediately before the release of Windows 95. There is no basis for Professor Murphy's claim that during the time of Novell's ownership the office productivity applications in PerfectOffice were inferior products.

Net Benefits to Consumers

Professor Murphy offers the opinion that Microsoft's conduct toward Novell was not

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79. Thomas Quinlan, "WordPerfect Places Windows before OS/2," *MIS Week*, June 4, 1990; Joel Shore, "WordPerfect Pins Hopes on GUI-Based Products," *Computer Reseller News*, November 19, 1990..

80. "WordPerfect Corp. Ships WordPerfect 5.2 for OS/2," *Business Wire*, July 26, 1993.

81. Anne Lent, "Top Software for Windows and OS/2," *Byte*, November 1, 1993. This article also says that Word is better than WP 5.2 for Windows, but that WordPerfect 6.0 is likely to catch up.

82. *The Word Processing Software Markets Review & Forecast: DOS, Windows, OS/2, & Macintosh*, IDC #8430, March 1994, Bates Nos. NWP0000042825-75.

anticompetitive because it did not harm Novell and delivered benefits to consumers.[83] The basis for this conclusion is in separate discussions of specific acts by Microsoft.

Exclusionary Agreements

Professor Murphy observes that much of my discussion of exclusionary agreements did not apply to Novell and/or occurred outside of the 18-month window of Novell ownership of the applications software that it had acquired from WordPerfect and Borland.[84] I will not repeat again why I do not accept Professor Murphy's "Framework for Analysis." I will note two examples that illustrate why restricting the analysis of exclusionary agreements to Novell products leads to the exclusion of information that is relevant to a valid economic analysis of Novell's fate in the markets for office productivity applications in which it participated.

First, Professor Murphy would ignore the exclusionary conduct regarding Netscape. Novell had decided to make use of APIs exposed by Netscape Navigator in its office productivity applications, and was distributing Navigator with its products. Had Netscape taken up Microsoft's offer to divide the market, Novell clearly would have been harmed by the loss of Navigator as a platform.

Second, Professor Murphy ignores the exclusionary conduct with respect to Lotus prior to the merger of WordPerfect and Novell. This conduct, and the conduct to prohibit OEMs from loading Navigator onto PCs containing Windows, became relevant when Novell acquired WordPerfect because Novell sought to market PerfectOffice through the OEM channel. As I

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83. *Murphy Report*, pp. 6, 31-65.

84. *Murphy Report*, p. 32.

point out in my report, OEMs knew through their experiences with Microsoft over Lotus that distributing PerfectOffice risked retaliation from Microsoft.[85] Moreover, if OEMs could not load Navigator, PerfectOffice could not include Navigator if it was sold through an OEM.

Professor Murphy is not correct in asserting that all of the exclusionary contracts that I cited did not apply to Novell products because they either occurred after March 1996 or did not apply to any of Novell's office productivity applications. My report discusses the nature and importance of the boot screen restrictions in the Windows 95 license, which applied to Netscape Navigator, Novell PerfectOffice, and any other software product that sought to be the "home" (desk-top environment) for an end-user.

Professor Murphy also claims that licensing restrictions and exclusionary contracts for OEMs were irrelevant because neither Novell nor other office productivity applications vendors used the OEM channel.[86] As I stated in the *Noll Report*, this characterization of the distribution of office productivity applications was inaccurate for Lotus and for Novell at the time Windows 95 was released.[87] Professor Murphy's view notwithstanding, my report cites evidence from as early as 1992 that Microsoft sought to choke off the OEM channel for other applications and middleware vendors, cites a Microsoft document that identifies Borland and WordPerfect as two of the targets, and provides details about choking off Lotus.[88] Whereas OEMs had not been an important distribution channel for WordPerfect Corporation, one must bear in mind that Novell

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85. *Noll Report*, p. 100.

86. *Murphy Report*, pp. 35-6.

87. *Noll Report*, pp. 96-100.

88. *Noll Report*, p. 97.

and IBM, when they acquired PerfectOffice and SmartSuite, respectively, were operating systems vendors. IBM intended to distribute SmartSuite with OS/2, and Novell intended to distribute office productivity software with DR DOS and its network operating system. Thus, to state that because office productivity applications had not been distributed extensively through OEMs in the past, OEMs were unimportant when Windows 95 was released is simply incorrect.

Professor Murphy asserts that there is no evidence that Windows prices were higher for firms that shipped competing applications and middleware products during his 18-month liability window.[89] If no firm failed to comply with the restrictions, there can be no evidence one way or the other about the price of Windows for non-complying firms. But one firm did refuse to go along – IBM – and it did pay higher prices for Windows.[90] My example of a firm that bowed to the pressure rather than face contract cancellation was Compaq. Professor Murphy says I ignore testimony from a former Compaq executive that Compaq did not fail to buy SmartSuite because of fear of reprisal from Microsoft.[91] I did cite a Compaq executive and the "Findings of Fact" stating the opposite.[92] Professor Murphy may find the person he cites more credible than the person and the court in *US v. Microsoft* that I cite, but to say that I present "no evidence" if false.

Professor Murphy argues that Microsoft's prepaid balance system had no anticompetitive effects.[93] He argues that the commitment is met once an OEM has sold a sufficient number of

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89. *Murphy Report*, p. 36.

90. *Noll Report*, p. 100, and "Findings of Fact," paragraphs 122, 130.

91. *Murphy Report*, p. 36.

92. *Noll Report*, p. 99-100.

93. *Murphy Report*, p. 36-7.

PCs, so that the restriction has no effect on which software the OEM installs. My discussion of prepaid balances and minimum purchase commitments cites evidence that minimum commitments were high, frequently not reached, extended only if the customer signed another contract with still more commitments, and intended to exclude competitors.[94]

Professor Murphy also argues that even if minimum purchase commitments could not be met, they are harmless analogs to rollover minutes on cell phones that, in any case, a competitor could overcome by giving the OEM the same credit for leftover prepaid balances.[95] Professor Murphy's analysis here simply is not correct as a matter of elementary economics.

The idea that Novell and others could simply absorb the prepaid balance is nonsense in that it requires that a competitor reimburse its customer for products it already has purchased from Microsoft but that the customer has not yet used and can not use unless the customer agrees to buy still more Microsoft products. If Professor Murphy's argument were correct, no long-term contract could ever be regarded as anticompetitive because a competitor could always simply buy out the restrictive provisions. Professor Murphy's "solution" to the problem of anticompetitive restrictions ignores the fact that reimbursement of unmet contractual obligations constitutes a significant financial barrier to entry that has no basis in the true cost of entering the market. Finally, the generalization of Professor Murphy's argument would be that if a firm that is harmed by anticompetitive conduct can overcome that conduct by simply spending money or giving away its product, the conduct caused no anticompetitive harm. Once again, professor Murphy's sweeping assertion leads to ridiculous conclusions.

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94. *Noll Report*, pp. 100-106.

95. *Murphy Report*, p. 37.

The cell phone analogy is false for many reasons.

First, cell phone customers can choose from several pricing menus that combine different monthly charges, free minutes per month, and charges for extra minutes of use. OEMs were not selecting from such a menu: they were forced to pay a high fixed fee to obtain a license to distribute Microsoft's products, with no options.

Second, a customer who accumulates a large number of rollover minutes clearly has revealed that extra minutes are of no value (they are both free and unused), so that giving them up by switching cell phone vendors is no sacrifice, and need not be reimbursed by the new vendor. By comparison, Microsoft software is an input to a final product, so its use during the contract period is governed by how many computers the OEM can sell. Unspent prepaid balances may deliver no benefit today, but that does not mean that they deliver no benefit tomorrow, when more computers can be sold. By comparison, a consumer who over a two-month cell-phone contract accumulates a large number of unused minutes is likely to find those minutes equally useless in the future.

Third, the cost structure of cell phone service differs from the cost structure of software production. In cell phones, most capital investment by the service provider is proportional to the number of subscribers, whereas in software there is no significant incremental investment to add an OEM to a vendor's distribution system. Thus, cell phone pricing is not a valid efficiency benchmark for evaluating software pricing to OEMs.

Professor Murphy claims that Microsoft's exclusionary contracts are procompetitive.[96] He begins his analysis by asserting that consumers select platforms (hardware and software) on

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96. *Murphy Report, pp. 38-41.*

the basis of relative cost. "Success in the marketplace depends on whether a platform offers consumers an attractive combination of hardware, PC operating system software, and applications."[97] This statement makes sense only if the relevant market is a PC system, as Microsoft has argued in the past and, as I discuss at length in my report,[98] was rejected in *U.S. v. Microsoft*.[99] Professor Murphy then argues that the most efficient way to coordinate the components of a PC system is vertical integration. Failing this, exclusionary contracts do the trick by fulfilling the "need for platform coordinating activities." The value of MDAs (and other exclusionary contracts) is that "they induced OEMs to make investments that increased the value to consumers of the Windows platform."

There is simply no theoretical or empirical basis for any of these claims. Professor Murphy cites his Exhibit 6 as showing how MDAs benefit consumers. This exhibit asserts benefits to consumers and ISVs, but it provides no facts or economic analysis to support those assertions, and neither does the main body of the report. Moreover, the characterizations of the provisions of the MDA are incomplete and misleading. For example, the issues with respect to what Professor Murphy labels anti-piracy, Windows logo, and standard Windows interface requirements reside in the details of the requirements with respect to the ability of an OEM to sell competing products. My original report did not come out against protecting against piracy, permitting the use of the logo on the basis of whether a product actually runs on the operating system, and matching hardware to the requirements of the operating system. Instead, my report

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97. *Murphy Report*, p. 38.

98. *Noll Report*, pp. 40-54.

99. "Findings of Fact," paragraph 20.

explains how MDAs went beyond any legitimate business purpose by imposing anticompetitive restrictions on OEMs for the purpose of protecting Microsoft's monopolies in operating systems and office productivity applications.[100]

MDAs were about marketing and promotion and about *not* promoting software products from other vendors, and the purpose was to guarantee Microsoft a large *share* of each OEM's sales of software. Professor Murphy *assumes* that if an OEM sells competing software products on its personal computers, the software will work less well on that OEMs PC. His report provides absolutely no evidence that (1) an OEM must make substantial investments in its PC hardware to support the software that it loads onto its PCs, (2) competition among OEMs is insufficient to induce the required amount of such investment, and (3) MDAs in fact led to an increase in this investment. For example, if his assertion were true, there would be evidence that Microsoft products perform poorly on IBM PCs because IBM also sells SmartSuite, and that the performance of Microsoft products on Dell computers deteriorated when, after the settlement of *U.S. v. Microsoft*, Dell began distributing Corel's WordPerfect Office. Moreover, Professor Murphy *asserts* without evidence that one OEM's commitment to Microsoft causes spillover benefits to other OEMs who sell Microsoft products. I am not aware of any plausible mechanism whereby Hewlett Packard's distribution of Windows lowers the cost or raises the quality of Dell PCs that run on Windows, and Professor Murphy does not cite a single example of how this could be or was true.

Finally, Professor Murphy defends per system/per processor licenses and high minimum purchase agreements on the grounds that the marginal cost of selling a copy of software is

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100. *Noll Report*, pp. 102-6.

effectively zero, so that a price structure in which Microsoft charges a fixed fee and the OEM sells as many as it wants at that fee is efficient.[101] The implication of Professor Murphy's claim is that in any industry with a high fixed cost and low marginal cost, the most efficient industry structure always is monopoly. Examples include not only software, but semiconductors, publications, and pharmaceuticals. Moreover, if consumers in their infinite perversity should support more than one product in any such market, a dominant firm is perfectly entitled to use its market power to eliminate the remaining competition because doing so saves society the wasted fixed costs of the other products.

Professor Murphy's analysis of efficiency in x86 operating systems is not an example of the application of economics to the issue of the optimal structure of the software market. My original report contains a discussion of the issue of high fixed costs and low marginal costs, along with other features of information products.[102] Professor Murphy's discussion overlooks two key points that are important in assessing the efficiency of a price structure and a system of contracts that enforces that price structure: the price effects of competition, and the consequences of product differentiation.

Efficiency is not just about costs, but also about consumer welfare. As a simple example, in the economics of industrial organization, the Nash-Cournot model is commonly used to analyze imperfectly competitive industries. If marginal cost is zero and if the monopoly price of the product is P, then the Nash-Cournot theory predicts that under duopoly the price will be P/2. Imagine that P = 300, which is roughly the price of Windows and Microsoft Office when sold

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101. *Murphy Report*, pp. 40-1.

102. *Noll Report*, pp. 19-21.

pre-installed by an OEM. Imagine also that costs equal 17 percent of revenues, which is roughly the case for Microsoft's operating system and office productivity products. If a second firm enters, costs double, but according to the Nash-Cournot model price falls to $150. In the new regime costs are now approximately 68 percent of revenues, implying that both firms still are highly profitable, but consumers are far better off. This example illustrates why it is economic folly to focus solely on costs, and ignore consumer welfare, in trying to identify the optimal market structure and price system for an information product.

Product differentiation provides another reason that the optimal market structure is not a single monopoly provider. One reason that markets for products with high fixed costs and low marginal costs are not monopolies is that firms compete on the basis of the details of the design and performance of their products. Costs would be minimized if there were one national newspaper, or one social networking web site, or one drug for treating high cholesterol. But competition in these markets produces a variety of products, sometimes catering to differences in tastes or requirements, and sometimes reflecting "leapfrogging" in technological innovation. Both phenomena apply to software. In the discussion of reviews of office productivity software, two points were clear. First, different people prefer different products because they place different values on different product features. Second, the most recent version of a product from any leading vendor usually contains some features that the others do not have (leapfrogging) and must create in order to remain competitive. Sacrificing product variety to achieve minimization of fixed costs also sacrifices the welfare of consumers who prefer the product that is eliminated and who would benefit from continuing innovative competition.

Tying

Professor Murphy argues that tying of Microsoft products had procompetitive benefits.[103] The benefits he recites are as follows: (1) increase functionality, (2) eliminate need for separate copies of programs, (3) coordinate development, (4) avoid need to operate with other software, (5) market evidence: all products are tied, including web browsers. I have discussed some of these points elsewhere, and I will not repeat that discussion here. Suffice to say that with respect to browsers, Professor Murphy's argument has been rejected. The reason is worth considering here. In *U.S. v. Microsoft* the court concluded as follows:

> "Microsoft has harmed even those consumers who desire to use Internet Explorer, and no other browser, with Windows 98. To the extent that browsing-specific routines have been commingled with operating system routines to a greater degree than is necessary to provide any consumer benefit, Microsoft has unjustifiably jeopardized the stability and security of the operating system. Specifically, it has increased the likelihood that a browser crash will cause the entire system to crash and made it easier for malicious viruses that penetrate the system via Internet Explorer to infect non-browsing parts of the system."[104]

Professor Murphy offers no new evidence or argument on the issue of tying. He asserts that bundled Microsoft products are integrated and co-developed (the first and third items

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103. *Murphy Report*, pp. 43-7.

104. See "Findings of Fact," paragraph 174.

above), which at the time that Windows 95 was introduced was false. Professor Murphy does not offer any examples of integration that would refute the statements of Microsoft executives that MS DOS 7.0 and Windows 4.0 were not integrated. He also does not give any examples of how Microsoft Office was integrated at the time, and in fact the components could not have been, given that substantial sales of Word and Excel as stand-alone products still were being made. Moreover, as explained in the *Alepin Report*, the ability to move among applications is an operating system function, not a property of the applications themselves. In writing my expert reports, for example, I simultaneously use software from different vendors, such as by copying Excel tables into WordPerfect documents.

Professor Murphy is correct that bundling software may eliminate the need for separate copies of MS DOS and Windows, but since nearly all sales of operating systems and graphic user interfaces are through the OEM channel, this point is largely irrelevant. Moreover, if consumers prefer to obtain software from different vendors and are willing to suffer the inconvenience of installing two separate programs rather than one, why does Professor Murphy's observation trump their preference? In fact there is no valid reason that it should.

Finally, avoiding the need to operate with other software is hardly a benefit for an operating system vendor. Operating systems are useless if they do not operate with other products. As Professor Murphy observes, an operating system vendor, even a monopoly, has two reasons to facilitate competition in applications. The first is to facilitate product differentiation and innovation in applications, which increases the demand for operating systems. The second is to avoid an applications monopoly, which would reduce the profitability of an operating systems monopolist. The only circumstances under which a dominant operating

system vendor has a reason to ignore this incentive are when the vendor also dominates an applications market and wants to preserve or to extent its market power, or when the vendor fears that cross-platform applications are undermining the vendors market power in the operating system. In these circumstances, failure to cooperate is anticompetitive because its purpose is to reduce competition, not to compete more effectively on the basis of the merits of the product.

Technical Allegations

Professor Murphy rejects the conclusion that the alleged technical "bad acts" by Microsoft were anticompetitive conduct.[105] Some are rejected because they were not aimed at Novell, which is yet another applications of his narrow "Framework for Analysis." There is no reason to repeat here why I disagree with Professor Murphy on this issue.

Namespace Extensions

According to professor Murphy, Novell was not harmed by the withdrawal of support for namespace extensions in Windows 95. He gives the following reasons: (1) Novell could have used the undocumented APIs anyway; (2) Novell would have been delayed anyway due to its continued use of "legacy" file dialogs; (3) Novell discontinued development features that used namespace extensions after Microsoft withdrew support; and (4) no other applications used them. None of these reasons justify the conclusion that the withdrawal of support for namespace extensions did not harm Novell.

Professor Murphy's suggestion that Novell could have used the namespace extension

105. *Murphy Report*, pp. 47-53.

APIs anyway is incorrect on two counts. First, namespace extensions were not completely developed and documented, and to complete software development that used these APIs required documentation of additional APIs.[106] Second, as Microsoft's technical expert, Professor Bennett, states, an independent software vendor would be unwise to use APIs that the operating system vendor will not support.[107] One reason that vendors should not use such APIs is that Microsoft could change them just for the purpose of breaking competing applications that use them.[108]

The delay Novell suffered due to its legacy dialogs was real, but was another example of the same technical bad act. Novell was using namespace extensions to write its dialogs.[109]

The final two points (Novell abandoned its work and others did not use the capability) does not prove that namespace extensions were unimportant. If no sane vendor would use withdrawn APIs, then these APIs will not be used for further development regardless of their potential utility. As cited in my report, Microsoft executives stated why namespace extensions were withdrawn and not supported: because Novell was using them in more creative ways than Microsoft was. Finally, Novell planned to use namespace extensions for important features of its office applications software, including dialogs and the file finder.[110]

MAPI

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106. *Deposition of Satoshi Nakajima*, February 24, 2009, pp. 13-24.

107. *Bennett Report*, pp. 23-4.

108. See Bates No. MS980103243.

109. *Deposition of Adam Harral*, December 12, 2001, pp. 15-16.

110. *Alepin Report*, pp. 87-91.

MAPI refers to Messaging API, which supports groupware products. Professor Murphy claims that Microsoft's conduct regarding MAPI harmed neither Novell nor consumers.[111]

Professor Murphy does not accurately characterize the acts by Microsoft that were anticompetitive. The issues are not, as Professor Murphy states, that MAPI was bundled with Windows or that Microsoft required an icon to be installed on the boot screen.[112] Instead, the issue is that Microsoft bundled MAPI with Microsoft Exchange Client and required the installation of Exchange Client, which then placed its icon on the desktop.[113] These are not trivial distinctions. MAPI belonged in the Windows operating system, not in Microsoft's messaging software that faced competition from Lotus and Novell. Forcing consumers to install Microsoft Exchange Client to obtain MAPI functionality harmed competition by undermining competition in messaging software. Because Professor Murphy mischaracterizes the issue, his analysis is largely irrelevant.

The section of the Murphy Report on MAPI contains several technical allegations about MAPI. I understand that Mr. Alepin will deal with these in his reply report, so I will not duplicate this analysis here.

Professor Murphy also makes several economic assertions pertaining to his conclusion that Microsoft's MAPI conduct did not harm Novell. First, he states that the competitors could have used another standard (VIM) or could have created their own extensions. This argument misses the point, which is that Microsoft had made a commitment to software vendors that it

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111. *Murphy Report*, pp. 62-6.

112. *Murphy Report*, p. 62.

113. *Noll Report*, 122-4, 136-8.

would incorporate into its operating system features to support multiple messaging products. These vendors sought interoperability, which could not be achieved as easily if there were multiple messaging standards. Professor Murphy notes that Microsoft's MAPI extensions benefitted consumers because they improved communication between Microsoft's messaging client and server. Other vendors sought the same thing: improved communication between client and server software from different vendors, which was the goal of having a single standard. Microsoft promised this standard, and then did not deliver.

Finally, Professor Murphy argues that breaking GroupWise with the release of Outlook 97 created no harm to Novell because GroupWise enterprise customers simply could have delayed the adoption of Outlook 97 until GroupWise became compatible again. For this claim to make sense, Professor Murphy would have to be able to show that GroupWise customers would not have been harmed by implementing such a delay. Professor Murphy does not do so, and does not discuss the feasibility of such a strategy, given that the incompatibility was unexpected and not discovered until enterprise customers installed Outlook 97 and found that they could no longer send or receive e-mail or use other features of GroupWise. Professor Murphy does not provide any evidence that these enterprises could have switched back to an earlier version of MAPI with little or no cost.

Even if Professor Murphy had shown these things, he ignores another effect of Microsoft's actions: harming the reputation of GroupWise as able to work well with Windows. The fact that Microsoft's unannounced changes to MAPI broke GroupWise was known publicly.[114] Microsoft persistently created incompatibilities between its software and competing

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114. *Alepin Report*, pp. 139-141.

software products, then successfully used those incompatibilities to persuade customers to avoid non-Microsoft products.[115] Customers care less about precisely which company is to blame if their software stops working than about which software is not going to stop working. By persistently breaking other vendors' products, Microsoft builds its own reputation as the only source of applications and middleware that works on the Windows platform.

Procompetitive Undocumented APIs

Professor Murphy makes the claim that the failure to document APIs or the withdrawal of documentation of an established API can be procompetitive.[116] By this he means two things. First, if some set of APIs can do harm to the operating system or other programs, or are just inefficient in the functions they perform, not documenting them and warning that they are likely to be removed or dramatically altered is beneficial because it enables software vendors to avoid using them. Second, some APIs connect features within the operating system, and access to them is not intended or desirable for applications.

These statements are unexceptional. The relevant question is whether the technical bad acts at issue here fall into this category. Professor Murphy does not offer any evidence that the issues regarding API documentation can be resolved by the arguments he puts forth. He quotes a Microsoft executive as expressing joy that no further effort will be required for namespace extensions, but this quotation hardly proves that the feature did not have value – it just shows that the executive has been relieved of some work effort. He also quotes a Microsoft executive

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115. See my report in *Comes vs. Microsoft*, pp. 119-123.

116. *Murphy Report*, pp. 52-3.

about the possibility that namespace extensions were flawed and a threat to the operating system, but this claim is belied by the fact that Microsoft itself used these APIs.[117]

Background Printing and Windows 95 Logo

The issue of background printing refers to the reliance of Novell on Microsoft's promise to enable Novell office productivity applications to continue to use an innovative method for handling printing that had been developed by WordPerfect. The Windows 95 logo issue is the enforcement against Novell of the requirement that its applications run on Window NT in order to use the Windows 95 logo as an indicator that the product was designed for Windows 95. Professor Murphy dismisses both of these acts as irrelevant because by the time WordPerfect for Windows 95 was released, the product was owned by Corel.

Both acts harmed Novell because the value of the suite of products that Novell sold to Corel was undermined by them. An elementary principle in economics is that the value of an investment is determined by the expected future returns from that investment. Corel knew that it could not use the logo with PerfectOffice and new that WordPerfect would be delayed and of lower quality due to the withdrawal of namespace extensions amd the failure of Microsoft to deliver operating system support for WordPerfect background printing. Had Microsoft not committed the technical bad acts, Novell would have released its office productivity applications for Windows 95 on time, and without the denial of the logo, Novell would have been able to promote these products as designed for Windows 95. Had Novell done so, the products that

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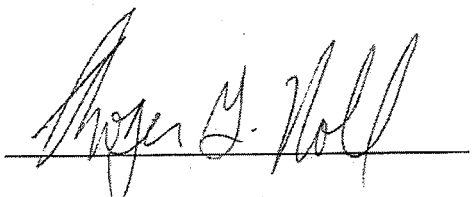
117. The technical value of namespace extensions, and the invalidity of the claim that there was a technical reason to withdraw them, is discussed in the *Alepin Report*, pp. 95-7.

were sold to Corel would have been more valuable because they would have been more timely and of higher quality.

CONCLUSION

For two fundamental reasons Professor Murphy's report does not cause me to alter the opinions that I expressed in my original report. First, Professor Murphy's analytical framework is too narrow to permit a valid economic analysis of the issues raised in this litigation. Second, very little of Professor Murphy's report contains economics. For the most part, his report contains unsupported and frequently incorrect factual assertions and highly general statements of economic principles that are too sweeping to be valid or that can not be applied to the issues in this case without much more evidence and analysis, which he does not provide.

I declare that the foregoing is true to the best of my knowledge and belief. Executed at Palo Alto, California, on July 24, 2009.



Roger G. Noll

Additional Documents Considered

In addition to the documents specifically cited in this report, my previous report in this case, and my previous declaration in *Comes v. Microsoft*, I considered the following documents in this report.

Bates Numbered Documents

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FLAG0106267

IBM07510138374

MS-PCA 1454537

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Exhibit 1a: Winning Word Processors[1]

Microsoft/ Novell Version	Date	Home Office Computing	PC Computing	Windows Sources	Computer Shopper	Windows Magazine	PC World	PC Week
	Jan-93	Ami Pro 3.0						
	Feb-93							
	Mar-93							
	Apr-93							
	May-93							
	Jun-93							
	Jul-93							
	Aug-93		Ami Pro 3.0					
	Sep-93							
Word 6.0, WP 6.0	Oct-93							
	Nov-93		Word 6.0					
Windows 3.11	Dec-93		~WordPerfect 6.0					
	Jan-94	WordPerfect 6.0						
	Feb-94			Word 6.0		Word 6.0 & WordPerfect 6.0		
	Mar-94		WordPerfect 6.0			Word 6.0, Ami Pro 3.01 & WordPerfect 6.0	Word 6.0	
WP 6.0a	Apr-94							
	May-94							
	Jun-94	Word 6.0						
	Jul-94							
Word 6.0c	Aug-94							
	Sep-94							
WP 5.2+	Oct-94							
WP 6.1	Nov-94							
	Dec-94		~WordPerfect 6.0a					
	Jan-95	Word 6.0						
	Feb-95					WordPerfect 6.1 & Ami Pro 3.1		
	Mar-95					WordPerfect 6.1		
	Apr-95							
	May-95							
	Jun-95		** Word 6.0					
	Jul-95		** Word 6.0					
Windows 95, Word 95	Aug-95		** Word 6.0					
	Sep-95		Word 95					
	Oct-95		** Word 95					
	Nov-95		** Word 95					
	Dec-95		~Word Pro 96					
	Jan-96	Word 7.0	** Word Pro 96					
	Feb-96		** Word Pro 96			WordPerfect 6.1 & Word Pro		
	Mar-96	Word 95 & Word Pro 96	** Word Pro 96			** WordPerfect 6.1	Word 95	
	Apr-96		** Word Pro 96			** WordPerfect 6.1		
	May-96		Word 95			** WordPerfect 6.1 [2]		
	Jun-96		** Word 95			** WordPerfect 6.1		
	Jul-96		** Word 95			** WordPerfect 6.1		
	Aug-96		** Word 95			** WordPerfect 6.1		
	Sep-96					** WordPerfect 6.1	Word 7.0	
	Oct-96					** WordPerfect 6.1		
	Nov-96		** Word 95			** WordPerfect 6.1		
	Dec-96					** Word 7.0		

~ MVP award for the preceding year
** Award that relies on previous review
Gray highlights indicate reviews that Murphy missed.
Table does not include reader's choice/ best buy/ buyer survey awards since Professor Murphy did not consider those.

Exhibit 1b: Winning Spreadsheets

Microsoft/ Novell Version	Date	Home Office Computing	PC Computing	Windows Sources	Computer Shopper	Windows Magazine	PC World	PC Week
	Jan-93	Excel 4.0					Excel 4.0 & Quattro Pro 1.0	
	Feb-93			Excel 4.0 & Quattro Pro 1.0	Excel 4.0	Excel 4.0 & Quattro Pro 1.0		
	Mar-93			Excel 4.0a				
	Apr-93							
	May-93							
1-2-3 4.0	Jun-93						Lotus 1-2-3 4.0	
	Jul-93							
	Aug-93							
QP 5.0	Sep-93							
	Oct-93				Lotus 1-2-3 4.0			
	Nov-93		Quattro Pro 5.0					
Windows 3.11, Excel 5.0	Dec-93		Excel 5.0; ~Quattro Pro 5.0				Excel 5.0	
	Jan-94			Excel 5.0				
	Feb-94					Quattro Pro 5.0 & 1-2-3 4.0	Excel 5.0 & Quattro Pro 5.0	
	Mar-94							
	Apr-94					Excel 5.0, 1-2-3 4.01 & Quattro Pro 5.0		
	May-94	Excel 5.0			Excel 5.0			
	Jun-94							
	Jul-94							
1-2-3 5.0, Excel 5.0c	Aug-94							
QP 6.0	Sep-94							
	Oct-94							
	Nov-94							
	Dec-94		~Excel 5.0					
	Jan-95	Quattro Pro 6.0						
	Feb-95					Excel 5.0; Excel 5.0, Quattro Pro 6.0, & 1-2-3 5.0		
	Mar-95							
	Apr-95							
	May-95							
	Jun-95		** Excel 5.0					
Excel 7.0	Jul-95		** Excel 5.0					
Windows 95, Excel 95	Aug-95		** Excel 5.0					
	Sep-95		Excel 95					
	Oct-95		** Excel 95					
	Nov-95		** Excel 95					
	Dec-95		~Excel 95					
	Jan-96	Excel 7.0	** Excel 95					
	Feb-96		** Excel 95					
	Mar-96		** Excel 95			** Excel 95		
	Apr-96	Excel 7.0	** Excel 95			** Excel 95		
	May-96		** Excel 95			** Excel 95		
	Jun-96		** Excel 95			** Excel 95		
	Jul-96		** Excel 95			** Excel 95		
	Aug-96		** Excel 95			** Excel 95		
	Sep-96					** Excel 95	Excel 7.0	
	Oct-96					** Excel 95		
	Nov-96		** Excel 95			** Excel 7.0		
	Dec-96					** Excel 7.0		

~ MVP award for the preceding year
** Award that relies on previous review
Gray highlights indicate reviews that Murphy missed.
Table does not include reader's choice/ best buy/ buyer survey awards since Professor Murphy did not consider those.

Exhibit 1c: Winning Suites

Microsoft/ Novell Version	Date	Home Office Computing	PC Computing	Windows Sources	Computer Shopper	Windows Magazine	PC World	PC Week
Windows 3.1, MS Office 3.0	1992							
	Jan-93							
	Feb-93							
	Mar-93							
	Apr-93							
Borland Office 1.0	May-93							
	Jun-93							
	Jul-93							
	Aug-93							
SmartSuite 2.1	Sep-93							
MS Office 4.0	Oct-93							
	Nov-93							SmartSuite 2.1
Windows 3.11	Dec-93							
Borland Office 2.0	Jan-94							
	Feb-94							MS Office 4.0
MS Office 4.2	Mar-94							
	Apr-94				MS Office 4.2			
	May-94			MS Office 4.2			MS Office 4.2	
	Jun-94							
	Jul-94							
	Aug-94							
MS Office 4.2c	Sep-94							
	Oct-94							
	Nov-94		PerfectOffice 3.0					
Perfect Office 3.0	Dec-94		~ MS Office					
	Jan-95	MS Office 4.3						Perfect Office 3.0
	Feb-95				MS Office			
	Mar-95	MS Office						
	Apr-95							
	May-95							
	Jun-95		** PerfectOffice 3.0					
	Jul-95		** PerfectOffice 3.0					
Windows 95, MS	Aug-95		** PerfectOffice 3.0					
	Sep-95		MS Office 95		MS Office 4.2 & PerfectOffice 3.0 [3]			
	Oct-95		** MS Office 95					
	Nov-95		** MS Office 95					
	Dec-95		* MS Office 95					SmartSuite 96
	Jan-96	MS Office	** MS Office 95					
	Feb-96		** MS Office 95			MS Office 95		
	Mar-96		** MS Office 95			** MS Office 95		
	Apr-96		** MS Office 95			** MS Office 95		
	May-96		** MS Office 95			** MS Office 95	MS Office 95	
	Jun-96	MS Office 7 & WP Suite 95	** MS Office 95			** MS Office 95		
	Jul-96		** MS Office 95			** MS Office 95		
Corel Office	Aug-96		** MS Office 95			** MS Office 95		
	Sep-96					** MS Office 95	MS Office 95 & WP Office 7	SmartSuite 96
	Oct-96					** MS Office 95		
	Nov-96		** MS Office 95			** MS Office 97		
	Dec-96					** MS Office 97		

~ MVP award for the preceding year
** Award that relies on previous review
Gray highlights indicate reviews that Murphy missed.
Table does not include reader's choice/ best buy/ buyer survey awards since Professor Murphy did not consider those.

Exhibit 1 Notes:

1. The selection criteria for inclusion in Exhibit 1 are the same criteria Prof. Murphy used in creating his Appendix C: Reviews of Applications. Gray highlights indicate reviews that Prof. Murphy should have included according to his criteria, but which were left out of his tables. Exhibit 1 does not include reader's choice/ buyer survey awards since Murphy did not consider those. Additionally, we noted MVP awards for the preceding year using "~" and awards that rely on previous reviews using "**"
2. In this May 1996 *Windows Magazine* review[1], WordPerfect scores 5.0 and Word scores 4.0. Prof. Murphy ranked Word first but this analysis assigns the win to WordPerfect.
3. This September 1995 *Computer Shopper* review[2] refers to an "Editors' Top 20 picks" article. No clear winner is identified, but Prof. Murphy ranks Microsoft Office first. This analysis considers it a tie between Microsoft Office 4.2 and PerfectOffice 3.0.

[1] "Winlab Reviews Recommended," *Windows Magazine*, May 1996, 168.
[2] "Computer Shopper Direct Hits: The Editors' Top 20," *Computer Shopper,* September 1995, 184.