

III. Alternative Platform-Level Technologies, Especially Internet Browsers and Java, Threaten Microsoft's Operating System Monopoly

A. Middleware technologies have the potential to reduce the applications barrier to entry and facilitate operating system competition

51. The applications barrier to entry, as explained, is the result of a chicken and egg problem: An operating system cannot attract a sufficiently large set of applications to challenge Windows without a large installed base with which to attract ISVs, and cannot obtain a large installed base without a large and attractive set of applications.

ii. See supra Part II.B.3; ¶¶ 23-32.

52. Middleware technologies -- principally Internet browsers and Java, which are designed to run on top of an operating system -- threaten to facilitate the creation of competition to Windows by reducing the importance of Windows APIs and thereby eroding the applications barrier to entry.

i. Chris Jones described in an August 1995 e-mail: "We are so dominant in all other aspects of the market that we can never be displaced by a full frontal assault. However, when we do leave a hole in our strategy, there are many companies eager to move in and try to leverage this hole to grow into our other businesses. And they have: you only have to browse the Web to realize that NetScape, Sun, Apple, Adobe, and MacroMedia are establishing a presence. The real threat to our business is solutions like Java, which present a different programming model than Windows and take developer and content provider mind share. This platform offering is quickly evolving, with two key players moving forward with their offerings and evangelism. In addition to Java, NetScape has announced an interface for plugging in different document types, while in turn Apple is building a programmable browser using OpenDoc. The Result -- People Aren't Writing to Our Interfaces. The solutions people have implemented today do not benefit Windows uniquely -- they work on all platforms equally well. More importantly, these solutions are being driven by other companies rather than our own -- specifically, NetScape and Sun. Without an alternative to this platform we will lose control of a critical segment of the developer (and customer) market." GX 523, at MS98 0103658.

- ii. Paul Maritz testified: “If a middleware product provides a set of APIs to software developers that makes them more productive and enables them to create better software products, the value of any underlying operating system will, of course, be greatly reduced.” Maritz Dir. ¶ 236.
- iii. Dr. Warren-Boulton testified that a competitive threat to Microsoft’s operating system monopoly is less likely to come from other operating system products than from extensions to complements of Windows that also can serve as platforms to which ISVs write applications programs . . . The wide dissemination of the complement among PC end users means that application developers can reach a broader base of potential customers by writing to it than by writing to an operating system that competes directly with Windows 95/98 and starts with very low market penetration and installed base." Warren-Boulton Dir. ¶¶ 65-66; see also Schmalensee Dir. ¶ 136; Tevanian Dir. ¶ 46.

B. The widespread use of non-Microsoft Internet browsers threatened to erode the applications barrier to entry and Microsoft’s monopoly power

1. The nature of the browser threat

53. Internet browsers, including Netscape Navigator, possess three key middleware characteristics that make them threats to Microsoft’s operating system monopoly in ways that traditional operating systems, without middleware assistance, are not.

53.1. First, by contrast to traditional operating system competitors to Windows, Internet browsers can gain (and have gained) widespread usage based on their value as a complement to Windows, without having first to compete against Windows as a substitute.

- iv. Dr. Warren-Boulton testified: "Although a PC operating system cannot successfully compete against Microsoft’s operating systems without first overcoming formidable barriers to entry, the situation is different for a product (*e.g.*, browsers or Java technology) that is both initially a complement from an end user perspective and a potential substitute for the Windows 95/98 platform to which applications developers can write. Because applications written to such a complement are compatible with Windows, their developers can sell their applications to users of the Windows operating system. Eventually, a sufficient number of such applications may become available to support an alternative platform to

Windows. " Warren-Boulton Dir. ¶ 65; see also Warren-Boulton, 12/1/98am, at 67:19 - 68:8.

53.1.1. With the advent of widespread popular use of the Internet in 1994-95, browser products became a widely-used complement to Windows. Netscape Navigator emerged as the browser market leader and quickly attracted a large installed base of users.

- i. As Netscape CEO James Barksdale testified: "The commercial release of Netscape Navigator 1.0 occurred on December 15, 1994. By the end of the second quarter of 1995, Netscape had collected over \$10 million in revenue generated by the browser alone. By the end of 1995, Netscape had collected approximately \$45 million in revenue from browsers," (Barksdale Dir. ¶ 18) had "over 70 percent market share for Internet clients and had distributed 15 million browsers around the world through a variety of channels including ISPs, OEMs, and resellers as well as over the Internet." Barksdale Dir. ¶ 66.
- ii. James Clark, founder and former Chairman of Netscape, testified that Netscape attained an "85 percent market share." Clark Dep., 7/22/98, at 39:3-9 (DX 2562).

53.1.2. Netscape enjoyed early success with its innovative browser.

- i. Barksdale testified that Netscape Navigator "hid the technological complexities of the Internet from the end user. Its introduction into the marketplace had a profound effect; the product was an immediate and huge success precisely because of its ease of use and its ability to bring so much new multimedia information to the consumer." Barksdale Dir. ¶ 12; see also Schmalensee, 6/23/99pm, at 47:23 - 48:3.
- ii. In a presentation in April 1996, Microsoft Senior Vice-President Brad Silverberg made clear that Netscape and Sun "are smart, aggressive, and have a big lead. This is not Novell or IBM we are competing with." GX 40 (emphasis in original).
- iii. Indeed, in May 1996 Mr. Gates had made clear to Microsoft's top executives his impressions of Netscape as a strong competitor: "During this Thinkweek I had a chance to play with a number of

Netscape products. This reinforced the impression that I think all of us share that Netscape is quite an impressive competitor. They are moving at full speed.” GX 41, at MS6 6012952.

53.2. Second, because Internet browser products, including Netscape Navigator, expose APIs to which ISVs can write, Internet browsers can serve as a “platform” for other software used by consumers.

i. Gates recognized that Netscape Navigator exposed APIs:

Gates Dep., 8/27/98, at 54:4-12 (DX 2568A) (sealed); see also Gates Dep. (played 12/2/98am), at 21:25 - 22:18.

- ii. As Apple’s Avadis Tevanian explained: “Internet-related technologies such as browsers are important in the development of future software platforms which could operate ‘on top’ of different operating systems. These software platforms could be used to run various applications such as programs that display, edit, manipulate and transmit various types of content.” Tevanian Dir. ¶ 45.
- iii. Microsoft’s James Allchin testified that middleware products such as browsers running on top of a conventional operating system can serve as a platform for other software. Allchin Dir. ¶ 35; Dertouzos Dep., 1/13/99, at 427:18 - 428:4; Slivka Dep., 1/13/99, at 712:21 - 715:6.
- iv. Allchin acknowledged that browser products such as Netscape’s expose “certainly hundreds, maybe thousands” of APIs to application developers without being included in any operating system. Allchin, 2/3/99pm, at 10:1; see also Maritz, 1/25/99pm, at 29:22 - 30:19 (distinguishing Netscape’s browser from browser “shells” built on top of Internet Explorer in that Netscape’s browser had the capability of developing into an alternative platform); GX 489, at MS6 6000311 (“Navigator/NetOne provides a new API set -- in near/medium term, Navigator provides the volume platform for ISVs & Corps to target.”).
- v. Barksdale testified that Netscape sought to “allow people to build applications on top of our browser using what is called the NSAPI, the Netscape Application Programmer Interface,” Barksdale , 10/27/98am, at 73:11-25. As a result, “the browser is not only useful for browsing the Web but also can serve as a platform for the development of all sorts of

network-centric software applications, such as online-banking software products. These network-centric applications, in essence, sit on top of the browser and take advantage of its Web-oriented functionality.” Barksdale Dir. ¶ 15; see also Colburn Dir. ¶ 8; Andreessen Dep. (played 12/1/98am), at 63:22 - 66:1; Clark Dep., 7/22/98, at 44:25 - 46:16 (DX 2562); Schell Dep., 9/15/98, 103:17 - 104:22 (DX 2562).

- vi. Professor Fisher testified: "Netscape's browsers contain their own set of APIs (as well as a set of Java APIs) to which applications developers can write applications. As a result, applications can be developed that will run on browsers regardless of the underlying operating system." Fisher Dir. ¶ 84; see also Warren-Boulton Dir. ¶ 69; Warren-Boulton, 11/23/98pm, at 34:12 - 35:13.

53.3. Third, Internet browsers, including Netscape Navigator, have been ported to multiple operating systems, thereby enabling application developers to write cross-platform applications using browser APIs. Applications written for the browser will run on multiple operating systems.

- i. Dr. Tevanian described the importance of Internet-oriented platforms, including browsers: “Importantly, applications written for such platforms would be able to run on any computer that has the software platform, regardless of the underlying operating system.” Tevanian Dir. ¶ 45.
- ii. As Professor Fisher summarized: “The browsers produced by Netscape run on many different operating systems, including Windows, the Apple Macintosh operating system, and various flavors of the UNIX operating system.” Fisher Dir. ¶ 83; GX 13 (listing 22 operating systems on which Netscape Navigator runs); see also Schmalensee, 6/21/99am, at 20:10 - 21:7 (explaining how the Web and the browser serve as a platform).
- iii. Microsoft’s Paul Maritz, among others, recognized that Netscape’s browser represented an alternative platform to which ISV’s may write cross-platform programs. Maritz, 1/25/99pm, at 28:7-11; see also McGeady, 11/9/98pm, at 56:4-25 (describing Maritz’s comments to Intel about how Netscape’s browser posed a “cross-platform threat”).
- iv. Andreessen testified “that because Navigator or Communicator tend to support more operating system platforms, it's easier to write a cross-platform application.” Andreessen Dep., 7/15/98, at 165:11 - 166:6

(DX 2555); see also Clark Dep., at 7/22/98, 48:21 - 49:21 (DX 2562) (explaining that Netscape's objective was "to provide a computer- and operating system-independent layer for applications that were network based to be developed").

- v. Dr. Warren-Boulton testified: "The issue is not Netscape as a stand-alone alternative to Windows. The issue is . . . the existence of an independent browser industry supporting cross-platform standards in encouraging a set of applications which is large enough so that someone will provide a platform." Warren-Boulton, 11/23/98am, at 80:8-13.

54. Internet browsers, in particular Netscape Navigator, thus posed a threat to Microsoft's operating system monopoly because they threatened to reduce the applications barrier to entry; in the words of Bill Gates, non-Microsoft browsers threatened to "commoditize" Windows.

- i. Bill Gates, "The Internet Tidal Wave," May 26, 1995. GX 20, at MS98 01128763.
- ii. Barksdale summarized the threat posed by Netscape to Microsoft's Windows monopoly: "These innovations arising from the development of browser technology, particularly Navigator, were eventually noticed at Microsoft. The possibility of a vast library of applications written in Java or other OS-neutral languages coupled with independent user interfaces and platforms, such as those provided by Navigator, posed a serious threat to the Windows monopoly." Barksdale Dir. ¶ 85.
- iii. As Barksdale pointed out, given the APIs, whether extensive or limited, exposed by Netscape Navigator, the "big threat" to Microsoft "would be that if developers began developing for the browser and because it was across these 19-some platforms as I mentioned, it then has the potential that OEM's could put different types of operating systems on their machines because the other programs and applications out in the general market would be able to run on top of the browser and not be particular as to which operating system was installed with the PC." Barksdale, 10/27/98pm, at 4:19 - 5:9; see also Barksdale, 10/27/98am, at 74:10-16 (explaining that if Netscape's browser were successful, it could potentially "marginalize or commoditize the platform characteristics of the operating system beneath it").
- iv. Professor Fisher testified: "To the extent that browsers support applications independent of the operating system, they could erode the applications

programming barrier to entry that protects Microsoft's monopoly in operating systems." Fisher Dir. ¶ 82; Fisher Dir. ¶¶ 85-86, 90 (collecting internal MS documents; citing GX 354, GX 473, GX 510, GX 1016); Fisher, 1/12/99pm, at 68:20 - 69:2 (explaining that OS and Java threaten to facilitate a substitute's entry).

55. Non-Microsoft browsers posed an especially serious threat because network-based computing in general, and the Internet in particular, quickly blossomed into a very important way users employ their PCs; if Microsoft were unable to control the standards and interfaces that are central to network-based computing, other firms could develop rival platforms using those standards and interfaces and would be able to challenge the applications barrier to entry.

- i. In his May 1995 memo, "The Web is the Next Platform," Microsoft's Ben Slivka wrote that "we should be extending the web with as many Microsoft technologies as possible, even if we have to modify those technologies in ways not original [sic] intended by their designers." He concluded: "If Microsoft doesn't enhance the Web, there is a nightmare scenario where an OS-neutral Web platform arises, and then a company like Matsushita or Siemens could come out with a \$500 'Web Box' that runs web applications (with no need for Windows, or MS-DOS compatibility, or Intel compatibility), and consumers make the obvious choice between a \$2000 Windows PC and the \$500 Web Box. Say good-bye to Windows." GX 21, MS98 0102397.
- ii. A June 1996 Microsoft marketing report, "Winning @ Internet Content," states: "The rise of the Internet has been driven by the success of a series of 'platforms' that utilize these protocols at their core and provide a set of APIs for ISVs to develop on top of. By far the most successful platform to date has been Netscape's, with Netscape Navigator on the browser and Netscape Suite Spot on the server. The core threat for Microsoft is the potential for this platform to abstract the Win32 API. For example, if Netscape continues its success in getting ISVs and ICVs to develop applications for Netscape's client/server Api's, these API's could be the most important API's in the future, putting Win32 and Microsoft's platform position in jeopardy." GX 407, at MS6 5005709.
- iii. See also infra Part VII.D.

2. Microsoft recognized the threat that Internet browsers, in particular Netscape Navigator, posed to its operating system monopoly

56. Microsoft recognized that Internet browsers not controlled by Microsoft could threaten its monopoly by eroding the applications barrier to entry.

56.1. The contemporaneous documents show that Microsoft's executives recognized the browser threat and developed their business strategy to respond to it.

- i. In a May 26, 1995, memo entitled "The Internet Tidal Wave," Gates announced to the rest of Microsoft that he assigns "the Internet the highest level of importance. In this memo I want to make clear that our focus on the Internet is critical to every part of our business. The Internet is the most important single development to come along since the IBM PC was introduced in 1981. It is even more important than the arrival of the graphical user interface (GUI)." Gates identified "a new competitor 'born' on the Internet" -- Netscape. "Their browser is dominant, with 70% usage share, allowing them to determine which network extensions will catch on. They are pursuing a multi-platform strategy where they move the key API into the client to commoditize the underlying operating system." GX 20, at MS98 0112876; see also GX 16; GX 17; GX 336, at MS7 007443; Gates, 1/13/99, at 460:15 - 461:10, 407:9-18 (Gates stated that Netscape was "creating a product that would either reduce the value or eliminate demand for the Windows operating system if they continued to improve it and we didn't keep improving our product.")
- ii. McGeady described what Microsoft executives, including Mr. Gates, told Intel about its view of Netscape in 1995: "If you begin to get a few leading-edge application developers that are developing for the Netscape environment, then that makes that environment that much more attractive both for end users and for other applications developers. And so more applications developers come to up [sic] which brings more users to it and more application developers, that's the positive feedback loop. That's what he wanted to prevent happening, that kind of a feedback loop which everyone seeks in this industry . . . If independent software developers began to write applications or plug-ins that worked directly with the browser, then, first of all, they may not--they may no longer write them to work directly with Windows, but more importantly, then Netscape begins to be the one who is setting--who is defining those application programming interfaces we discussed earlier, and Netscape then is much more in control of the rate of innovation and the kinds of innovations that

happen for those applications, and Microsoft is, correspondingly, less in control.” McGeady, 11/9/98pm, at 59:22 - 60:11; see also McGeady, 11/9/98pm, 57:10 - 58:8; GX 279, at MS CID 00077 (Notes of an August 2, 1995 meeting with Mr. Gates).

- iii. Maritz wrote in May 1995 to other senior Microsoft executives that “we all agree . . . that the Internet represents a big threat/opportunity to our current businesses” and that “Priority #1 is to not lose control of key interfaces and protocols that applications/titles use. O’Hare needs to evolve into an extensible client that encourages ‘online applications’ to take full advantage of Windows and other MS assets.” GX 148. Maritz, 1/28/99am, at 56:20 - 57:1 (Maritz explaining that Navigator is a threat to Windows “if more and more application programs get their services from Navigator and not from Windows, the perceived value of Windows is going to decline, and the ability to have those applications moved to other platforms will also be increased”); see also GX 503, at MS6 6008248.
- iv. In his May 1995 memo, “The Web is the Next Platform,” Ben Slivka wrote that “The Web is an application platform (complete with APIs, data formats, and protocols) that threatens Windows -- many corporate developers and ISVs could develop and deliver their solutions more quickly, to a wider audience, with the Web than they can with Windows or MSN as it exists today.” GX 21, at MS98 0102395; see also GX 329; GX 399, at MS98 0103343 (Ben Slivka wrote: “The Web could make Windows irrelevant in the next few years.”); GX 521, at MS98 0103337; Slivka Dep., 1/13/99, at 724:1-8 (Slivka testified: “You know, whether it was Navigator 1 or Navigator 2 or Navigator 3, the point was not that that thing as it stood then would immediately kill Windows. . . . The point was that that thing could grow and blossom and provide an application development platform which was more popular than Windows.”).
- v. Brad Chase described in an April 1996 planning memo how Microsoft would lose “the Internet platform battle” if it did not increase consumer usage of Internet Explorer: “The industry would simply ignore our standards. Few would write Windows apps without the Windows user base. . . .” GX 39, at MS6 5005720. He goes on to say that, “Netscape is already entrenched in our markets all over the world. The situation today is scary.” GX 39, at MS6 5005724 (emphasis in original); see also GX 510, MS7 004127 (Chase warned that competing Internet browsers could eventually “obsolete Windows”); GX 59 (Chase observed in April 1997 that “IE share is critical. Without it, we lose the desktop, which translates to Windows and Office revenue over time.”); GX 828, MS98 0118367 (In March 1998, Chase notes:

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(sealed); GX 40, at MS6 6005550 (Silverberg writes: “Our competitors are trying to create an alternative platform to Windows.”); GX 407, at MS6 5005716; GX 475.

- vi. In a May 1997 Internet Explorer 5 Planning document, Chris Jones analyzed Netscape’s approach as follows: “Netscape Communicator defines a new platform, taking advantage of the lessons learned from Visual Basic, Visual C++, Java and Web content. They are completely focused on turning their applications framework (HTML, object model, scripting, and JFC) into the primary way developers deliver Internet-centric applications.” GX 494, at MS7 004614. Mr. Jones also testified that “as soon as the internet came around . . . it was clear that you could take and create something that extended and enhanced what was on the internet and a set of services that are HTML and create an alternate environment that wouldn't need Windows anymore, that would abstract away all the value that Windows provided and make it just a general purpose--to quote a Netscape vice-president--partially debugged device drivers. And boy, you know, I'm not in the business of shipping partially debugged device drivers.” Jones Dep., 1/13/99, at 574:24 - 575:22, 578:2-14 (“If you mean did we think that the Netscape browser was a platform threat, the answer to that question is yes because the services that it provided were compelling alternatives to the services on Windows.”).
- vii. Microsoft’s Yusuf Mehdi agrees that “having users use our software . . . is an important goal for us to defend the Windows market share and provide a platform for those developers to write to. And to the extent at that Netscape would have a more popular platform that people wrote to and used instead, that would be a threat to the business for the Windows business for Microsoft.” Mehdi Dep., 1/13/99, at 637:14 - 638:22.
- viii. As Dr. Warren-Boulton summarized: “Microsoft clearly regarded Netscape, particularly initially, as a direct threat to its operating system in the sense that Netscape might, in fact become . . . a complete and direct competitor.” Warren-Boulton, 12/1/98am, at 42:14-20; see also Warren-Boulton Dir. ¶ 87 (collecting quotes from Microsoft personnel, citing GXs 20, 39-40, 503, 510).

56.2. At trial, Microsoft’s witnesses acknowledged that Netscape Navigator posed a competitive threat to Windows because it provided an application platform that threatened to erode the applications barrier to entry.

- i. Dean Schmalensee testified that “Netscape apparently envisioned pursuing a middle ware strategy to compete with Windows. Netscape Navigator relied on APIs in Windows and in that sense was an application. In addition to expanding its features, Netscape promoted its client products as ‘platforms,’ and encouraged ISVs to write to them by providing APIs and other ‘hooks,’ and offered services and software tools . . .” Schmalensee Dir. ¶ 137; Schmalensee, 1/13/99pm, at 33:21 - 34:5 (agreeing Netscape and Java are threats to Microsoft because applications written to those platforms “can be run cross-platform”); Schmalensee, 1/13/99pm, at 35:5-14 ; Schmalensee, 6/21/99am, at 23:10-19 (“I believe that Netscape was a potential platform competitor, and Java was certainly by -- was and is, by any definition, an actual platform competitor.”).
- ii. Allchin agreed that Netscape's browser posed a platform threat to Windows. Allchin, 2/1/99pm, at 55:22; Allchin, 2/1/99pm, at 60:23-25 (conceding that the "web application platform" was a threat to Windows and that integrating the browser into Windows was a response to that threat); Allchin, 2/1/99pm, at 60:3-4 ("they were a platform competitor, absolutely"); Allchin, 2/3/99pm, at 8:20-22 (discussing GX 47: "by this time it was obvious to me that Netscape was certainly adding enough APIs, that that was the competitor to Windows."); Allchin, 2/3/99pm, at 9:1-8, 10:9-15, 28:12-15.
- iii. Maritz stated that he considered Netscape both an actual platform competitor, “in terms of how people could structure applications,” and a “potential” platform competitor. Maritz, 1/26/99am, at 28:13-23; Maritz, 1/26/99am, at 30:4-6 (Microsoft’s “initial concerns about Netscape focused on their ability to expose API’s and their ability to expose new facilities to web pages.”); Maritz, 1/25/99pm, at 26:20 - 27:19 (“During the first half of the calendar year 1995,” Microsoft came to believe that “Netscape was becoming a platform . . . that other software could depend upon, and they were extending it’s capability as a platform. And one of the natures of a software platform is that it exists to enable other software and if the other software is depending upon your competitor’s platform, even if it’s running on top of your own platform, over time the value of the platform can become diminished . . .”).

C. Cross-Platform Java also presented a middleware threat to Microsoft’s operating system monopoly

57. Cross-platform Java is another middleware technology that has the potential to erode the applications barrier to entry by gaining widespread usage of APIs without competing directly against Windows as an operating system.

1. The nature of the Java threat

58. James Gosling and others at Sun Microsystems developed Java in significant part to provide developers a choice between writing cross-platform applications and writing applications that depend on a particular operating system.

58.1. Java consists of a series of interlocking elements designed to facilitate the creation of cross-platform applications, *i.e.* applications that can run on multiple operating systems.

- i. Gosling testified: "The Java technology is intended to make it possible to develop software applications that are not dependent on a particular operating system or particular computer hardware A principal goal of the Java technology is to assure that a Java-based program -- unlike a traditional software application -- is no longer tied to a particular operating system and hardware platform, and does not require the developer to undertake the time-consuming and expensive effort to port the program to different platforms. As we said in the Preface to *The Java Programming Language*, 'software developers creating applications in Java benefit by developing code only once, with no need to 'port' their applications to every software and hardware platform.' . . . Because the Java technology allows developers to make software applications that can run on various JVMs on multiple platforms, it holds the promise of giving consumers greater choice in applications, operating systems, and hardware. The Java technology has the potential not only to free individual consumers from concern about whether the software they want to run is supported by a given operating system, but also to permit corporations and Internet users more easily to mix different types of computing systems across a network." Gosling Dir. ¶¶ 20-29(b); see also Gosling, 12/3/98am, at 6:3-6.
- ii. Gosling stated this theme in internal documents as early as August 1995: "The issue of making developers CPU and OS independent is that they can port to Sun or to Windows. . . . Sun's or any alternate CPU company

(MIPS and SGI) key to success is apps. Apps are the key to volume. Java allows developers to decrease their dependence on Intel and Microsoft." DX 1285; see also DX 2012, at SUN 87 001685 ("Sun is attempting to establish Java as a viable computing platform which is hardware and operating system independent.").

- iii. In his June 1999 rebuttal testimony, Dean Schmalensee recognized "Java is used for a wide range of things. It's how my son first learned computer programming. It's used to run on a wide array of platforms. That, of course, is one of its most important selling features from Sun." Schmalensee, 6/23/99pm, at 50:5-11.
- iv. As the District Court for the Northern District of California found: "Sun's JAVA Technology comprises a standardized application programming environment that affords software developers the ability to create and distribute a single version of programming code which is capable of operating on many different, otherwise incompatible, system platforms and browsers. Most computer systems implement platform-dependent programming environments, such as Microsoft's Win32 programming environment. Programs created to run on a particular platform will not function on a different platform. Thus, a software developer must choose the platforms for which it will develop and support different versions of the same program. Sun's platform-independent JAVA Technology, which can be implemented on many different system platforms and browsers, obviates the need for creating and supporting different versions of the same program." Sun Microsystems, Inc. v. Microsoft Corp., 999 F. Supp. 1301, 1302 (N.D. Cal. 1998).

58.1.1. Java provides ISVs a programming language with which to write applications. Java also includes a set of "class libraries," a collection of programs written in Java, that offer APIs that ISVs can use to develop software applications.

- i. Microsoft's Paul Maritz summarized the different aspects of Java: "Java, the programming language; Java the virtual machine, which you need to execute Java programs; and then there's this collection of other programs written in Java, which I call the Java classes. And it's that collection of software that is being put forward by Sun, and that Netscape has announced their intent to cooperate with Sun, that forms another body of middleware that I am concerned about." Maritz, 1/26/99am, at 18:22 - 19:23.

- ii. As the District Court for the Northern District of California summarized: “The Java programming environment allows software developers to create a single version of program code that is capable of running on any platform which possesses a compatible implementation of the Java runtime environment. The Java programming environment comprises (1) Sun's specification for the Java language, (2) Sun's specification for the Java class libraries and (3) the Java compiler.” Sun Microsystems, Inc. v. Microsoft Corp., 21 F. Supp. 2d 1109, 1112 (N.D. Cal. 1998).

58.1.2. The Java programming environment also provides software developers a Java “virtual machine” (JVM) that, when ported to different operating systems, serves as the “host” or “adaptor” to which programs written in the Java language can be run, independent of the underlying operating system. Together, the Java class libraries and virtual machine are often referred to as the “Java runtime environment” (JRE).

- ii. As Gosling explained, Java makes it much easier for ISVs to develop platform-independent software because Java programs "need not run by interacting with a particular operating system's APIs. Instead, they typically interact with a Java virtual machine ('JVM'), which is an intermediate software layer that translates the Java-based program for the particular operating system and hardware platform that the Java virtual machine runs on. In essence, the Java-based program views the JVM as an operating system, and the operating system views the JVM as a traditional application . . . once a JVM is developed for a software platform, if the JVM is fully compliant with the Java specifications, . . . it should run most Java-based programs without the need to recompile or otherwise modify the programs. . . . Such programs thus have the potential to run on any PC, other type of computer, or even devices not traditionally thought of as computers (such as cellular telephones), provided that the machines have compatible JVMs installed on them.”; see also Gosling Dir. ¶¶ 24, 25, 28; Gosling, 12/2/98am, at 55:5-11 (any Java program, if written properly and properly compiled into bytecodes, should run equivalently on any properly-designed and implemented Java virtual machine, regardless of the underlying platform is); Gosling, 12/10/98pm, at 21:8-14 (describing the JVM as an adaptor).

- ii. Sean Sanders, an executive with Novell Corporation, testified: “The Java virtual machine is essentially yet another software layer that allows people to run Java-based applications and to help them -- provide them the tools that they could use to yet build and develop and to -- for optimization of any other Java applications that they might want to develop.” Sanders Dep., 1/13/99, at 188:18 - 189:15.
- iii. The District Court for the Northern District of California described the Java architecture as follows: “Sun's JAVA Technology is a so-called ‘class-based’ language in that its functionality is determined by the Java classes available to the programmer. Therefore, new functionality requires developing new Java classes. Programs written in the Java programming language are compiled into intermediate instructions called bytecodes or Applets. These bytecodes or Applets are then ‘interpreted’ by another computer program which emulates a hypothetical CPU called the Java Virtual Machine. The Java Virtual Machine translates the Applets into instructions understood by the specific computer CPU on which the Java Virtual Machine is running. Therefore, a specific interpreter or virtual machine is needed for each computer CPU on which the Java program is run.” Sun Microsystems, Inc. v. Microsoft Corp., 999 F. Supp. 1301, 1302-03 (N.D. Cal. 1998) (citations omitted.).

58.2. Because Java offers alternative APIs, applications written using standard Java programming tools and class libraries can run on any operating system for which there is a Java virtual machine. The widespread adoption of a cross-platform Java programming environment could reduce computer users’ dependency on the Windows operating system.

- i. As Gosling explained: “As more new Java-based programs are developed, distributed and used, new operating systems may be developed to take advantage of the existing body of Java-based software. In other words, potential developers of new operating systems and hardware platforms need not be deterred by the absence of platform-specific programs for their new systems, so long as there is a JVM available to enable existing Java programs to run on the systems. This may give new operating systems and hardware platforms a chance to compete in markets previously dominated by a particular vendor.” Gosling Dir. ¶ 29; Gosling, 12/10/98pm, at 28:20 - 29:2 (“Once the APIs that developers develop to are ones that are

realized on many different operating systems, then those operating systems can compete with Windows. And that would lead to sort of a lesser -- lesser role for Windows in that they would have to compete with these operating systems on the merits of the operating system rather than on the lock that tends to be inherent in the APIs and the binary compatibility.”).

- ii. Soyring explained IBM’s rationale for supporting Java: “Primarily because the value that it provides to IBM’s customers and the value it provides to IBM. As you probably know, IBM has a variety of operating systems, primarily four different ones. Many of our customers have many of these different -- several -- one or more of these operating systems installed. It’s less expensive for them and less time-consuming for them to be able to buy one application or one software product that they can buy, maintain, and support but run it on different operating system platforms.” The success of cross-platform Java would enhance the ability of other operating systems “to compete.” . . . What drives demand for the sales of operating systems is the availability of applications. And if there is a large install base of Java that’s consistently implemented, what it does is create an economic opportunity for commercial software developers to be able to develop a commercial software application using Java and then make it available to sell and be run on many different operating systems rather than just on one.” Soyring, 11/18/98pm, at 54:8 - 55:10; see also Soyring Dir. ¶ 28 (“The Java technology from Sun is designed to allow Java-compatible application programs to run on a wide variety of different hardware and operating systems. This would provide users with the benefits of increased number of applications and would reduce the cost of ISVs of developing applications for multiple operating systems. This characteristic of Java also has the potential to undermine the Windows application advantage . . .”).
- iii. Barksdale testified that “the cross-platform benefits of Java, allowed for the development of software applications that were directed more to the Internet than to the desktop, and thus had the potential to serve as a partial substitute for the Windows OS as a development platform.” Barksdale Dir. ¶ 15; see also Sasaki Dep. (played 12/16/98pm), at 31:24 - 32:7 (explaining that Java has the potential to level the playing field among operating systems).
- iv. Dean Schmalensee readily acknowledged that cross-platform Java technology poses a competitive threat to Windows by potentially rendering underlying operating systems less significant: “Sun’s Java poses potentially serious competitive implications for Windows. . . . If Java achieves its advocates ambitions, operating systems would become less

important in the marketplace, and the important standards would come to be determined by Sun, which vigorously defends its control over the Java language.” Schmalensee Dir. ¶¶ 141-142; see also Warren Boulton, 11/19/98pm, 31:8-12 (concluding “an increasing number of users may be able to simply do without Windows entirely”).

2. Microsoft recognized the Java threat

59. Microsoft understood the threat Java posed to its monopoly power. Java offered ISVs the ability to create a robust set of cross-platform applications that might reduce the applications barrier to entry.

59.1. Java provided software developers with a platform to create applications that could run on different operating systems and hardware platforms.

- i. Eubanks testified: “One of the great things with Java is that when you create a Java application, it will run on any machine that has a Java virtual machine.” Eubanks, 6/16/99am, at 68:11-20.
- ii. Gosling, whose responsibilities include working with numerous application developers and who himself has a career of experience as a developer, made clear that Java’s theme of “‘write once, run anywhere’ was terrifically attractive to developers. Developers want this more than just about anything you can imagine.” Gosling, 12/3/98am, at 32:10-12.
- iii. Soyring testified: “‘Write once run everywhere’ . . . has been the holy grail of programming for many years to be able to write an application once and then run it on many different operating systems or hardware platforms, and we find that Java is a technology that most closely approaches this by a long distance versus any other technology, and we have been able to successfully demonstrate with a set of our clients that it is possible using the Java technology to write an application once, compile it once and then run that exact same code on a variety of different operating systems, giving our customers the choice to choose different operating systems and different hardware platforms.” Soyring, 11/18/98pm, at 51:18 - 52:6; see also Sanders Dep., 1/13/99, at 186:20 - 187:3 (stating that Java “provides the benefit of an application-running environment that would allow people to run applications independent of any kind of operating system or cpu type of restraints they may currently be facing”).

- iv. Barksdale testified that “Java allows software developers to write cross-platform applications that will run on any operating system, increasing consumer flexibility and ease of use, while reducing development costs associated with writing an application and then porting it to run on various different operating systems The Java programming technology solves the platform dependency problem that has so long plagued software development. Programs written in Java can be run on any platform that has a Java virtual machine and Java class libraries, which Navigator does.” Barksdale Dir. ¶¶ 15, 83.

59.2. Microsoft recognized, and continues to recognize, the competitive threat that Java poses to Windows by providing an attractive cross-platform programming environment that could erode the applications programming barrier to entry.

- i. Dr. Warren-Boulton summarized the evidence of Microsoft’s perception of the competitive threat posed by Java: “Microsoft has, almost from the beginning, recognized that the clearest threat to that monopoly power is the emergence of Java technologies combined with an independent browser market. Their response to that threat has been to attempt to take that technology, and instead of making it multi -- cross-platform, has been to transform that technology into a technology that is Windows-specific so as to prevent the emergence of a large stock of applications that could be used on any operating system” Warren-Boulton, 12/1/98am, at 19:24 - 20:8.
- ii. Dr. Fisher, similarly, summarized the evidence that Microsoft treated Java as a significant competitive threat to Windows. Fisher Dir. ¶¶ 204-207.

59.2.1. Microsoft executives have throughout the past four years treated cross-platform Java as a serious threat to Microsoft’s operating system dominance.

- i. In a June 1996 e-mail to Microsoft executive staff, Paul Maritz focused on the need to “fundamentally blunt Java/AWT momentum and to re-establish ActiveX and non-Java approaches as a viable strategy for structuring software.” The reason Mr. Maritz provided for this objective was to “protect our core asset Windows -- the thing that we get paid \$’s for. While Java per se is not the problem, if everything & everybody moves to Java as a language, then it will be so much more easy for AWT to become

the API, and Windows is damaged.” GX 42, at MS6 6010347 (emphasis in original); see also GX 473, at MS6 6006237 (“Java. Gaining as scripting language . . . Class libraries define ‘API.’ Becoming the ‘brand’ for software components.”); GX 504, MS98 0169096 (Maritz writing that: “Java. Sun’s goal is: -- Java class library/runtime = new OS API -- leverage this new API to replace Windows by JavaOS.”).

- ii. In August 1996, Bob Muglia wrote: “When a Java developer writes to AWT, they are writing to Sun APIs, and their application can be easily run on competitive platforms.” GX 466, at MS6 5003781; see also Muglia, 2/26/99pm, 10:5 - 11:22 (by offering an alternative platform, Sun could get developers to write to the Java platform and not to Windows, and therefore the applications that they wrote would not be focused on Windows).
- iii. In September 1996, Adam Bosworth sent Bill Gates and others an e-mail discussing Java. Bosworth noted, “I think it is important to understand that Java is not just a language. If it were just a language, it would not be a threat to us. We would and could easily just build the best implementation of this language and be done. It is, however, much more. It is an alternative to COM. . . . Java is on Unix and requires no dealing with setup, install, de-install, or anything else. Thus it is really easy to understand how a system for dynamically authoring Web pages on the server that depended upon Java objects rather than COM ones would have wider appeal.” Gates responds: “This scares the hell out of me. Its still very unclear to me what our OS will offer to Java client applications code that will make them unique enough to preserve our market position. Understanding this is so important that it deserves top priority.” GX 983, MS7 032895.
- iv. In January 1997, an internal Microsoft analysis described the “platform challenge” posed by Java: “possible emergence of a set of APIs and underlying system software that lead to a lesser or no role for Windows.” GX 51, MS7 005534.
- v. In a February 1997 e-mail to Jim Allchin, Mr. Gates again addressed the cross-platform threat posed by Java: “What will we have that the Java Runtime will not have? . . . The fact is that applications can be run on the server against an HTML client. . . . Most applications will have very little client code in the future. . . . The fact is there will be lots of machines where HTML/some level

of Java is all they will have in common. Cheap devices and old PCs will be like this. It makes it very easy for people to think they should just program to this. . . . Lets work together to find the solution to this. I can say I am more scared than you are but that is not what will help us figure out where we should go.” GX 475; see also GX 590 (Gates writing: “Java is the biggest threat to us and I certainly shouldn't be doing Apple events unless we are getting some help from us on this.”).

59.2.2. Microsoft’s witnesses in this litigation conceded that Java presented a significant potential threat to Windows.

- i. Gates testified repeatedly that he perceived Java to be a threat to Windows: Gates Dep., (played 12/2/98am), at 22:19 - 23:1. Gates stated: “we did think of” Java APIs “as something that competed with us for the attention of ISV's in terms of whether or not they would take advantage of the advanced features of Windows.” Gates Dep. (played 12/2/98am), at 24:15-22; see also Gates Dep., 8/27/98, at 90:12-19 (DX 2568).
- ii. Muglia also testified that Microsoft considered Java a serious cross-platform threat: ““Although Java was a new and unproven technology, Microsoft took Sun's claims seriously. . . . Sun has adopted a business strategy that seeks to transform the Java programming language into a full operating environment and software development platform. A key requirement of Sun's strategy is delivering on its WORA claim -- that programs written in Java, to the Java development platform, will run without modification on any underlying platform for which there is a JVM.” Muglia Dir. ¶¶ 8, 10; see also Muglia, 2/26/99pm, at 4:8-18 (Muglia believed in 1995 and 1996 that Java represented a serious threat to Microsoft’s operating system business); Muglia, 2/26/99pm, at 7:2-19 (explained that the cross-platform threat consisted of the JVM and Java class-libraries) ; Muglia, 2/26/99pm, at 9:3-21 (explained that: “what they were trying to do was get developers to write to that alternative platform. So, even if -- even if a developer wrote a Java program and that program runs on Windows, even in the case where it runs on Windows, it's not written to Microsoft's programming interfaces. So when I said slide in their platform, what I meant is that they could, in essence, make what everything else that our platform did irrelevant, thus enabling to replace Windows and make it obsolete, so to speak.”).

- iii. Maritz also testified: “If successful, software developers could write programs to run on Sun’s technology, and neither Windows nor any other operating system would provide significant value to customers.” Maritz Dir. ¶ 243; Maritz, 1/26/99am, 20:23 - 21:3 (the Java foundation classes posed a potentially serious platform threat); Maritz, 1/28/99am, 59:10 - 60:17, 62:3 - 63:17 (Maritz explained Java is a form of middleware. Sun’s goal was to provide most of the OS services through the Java runtime. The browser and Java have the potential to serve as a virtual operating system.).
- iv. Dean Schmalensee also acknowledged the cross-platform threat Java poses to Windows: “Sun would like ISVs to write pure Java so that their applications can run anywhere, in principle. Microsoft would like ISVs to design applications that would run on Windows. It matters to those companies what choice the ISV makes, assuming it’s a good application.” Schmalensee, 6/22/99pm, at 23:23 - 24:7.
- v. Slivka also testified regarding the Java threat: “my recollection was that this cross-OS Java platform stuff that we were attempting to do with AFC, he [Bill Gates] was very unhappy with that.” “He thought that was a big threat to Windows.” Slivka Dep., 9/4/98, at 367:13 - 369:3 (DX 2591); see also, Slivka, 1/13/99, at 735:13 - 736:4 (“All this comes back to Windows and the threat, you know, Sun's very direct threat to our Windows platform, and the success of Windows on the client. So, this seemed like if the library space fragmented, the ‘write once, run anywhere,’ I guess, actually is what Sun called it, that would be a lot less probable . . . I guess the end was to protect the Windows franchise, not to defeat the ‘write once, run everywhere.’”).

D. The threats to Microsoft’s monopoly posed by Internet browsers and Java are mutually reinforcing, and they could be essential to the emergence of other platform-level threats to Microsoft’s operating system monopoly

60. The competitive threats posed by non-Microsoft Internet browsers and cross-platform Java are, to a significant degree, interdependent.

60.1. Dissemination of Java virtual machines and Java runtime environments not controlled by Microsoft hinges in significant measure on the widespread distribution of non-Microsoft Internet browsers.

60.1.1. Industry witnesses recognize that Internet browsers are the principal distribution vehicle for Java Virtual Machines and JREs and that, because Microsoft distributes only its own (as will be discussed below, non-cross-platform) implementation of the JRE with its browser, Netscape Navigator was the principal distribution vehicle for cross-platform Java.

- i. IBM's John Soyring testified that Netscape has been a significant distributor of Java virtual machines: "Netscape is a very high-volume distribution vehicle for Java virtual machines on operating systems other than OS/2." Soyring, 11/18/98am, at 89:8-12; see also Soyring Dir. ¶¶ 28 ("The reason this relates to browsers is that Netscape Navigator has been the prime distribution vehicle for Sun's Java technology while Internet Explorer contains the Microsoft version of Java.").
- ii. Barksdale testified that "the widespread distribution of Netscape Navigator facilitated widespread distribution of the Java programming language developed at Sun Microsystems." Barksdale Dir. ¶ 15; see also Sasaki Dep. (played 12/16/98pm), at 31:6-8; 32:8-11.

60.1.2. Microsoft, both in contemporaneous documents and through its witnesses at trial, recognized that Internet browsers are essential to distribute JVMs and Java class libraries and, in particular, that Netscape was the principal distribution vehicle for a cross-platform Java runtime environment.

- i. Muglia acknowledged at trial that Netscape has been "one of the largest volume distributors of JVMs." Muglia Dir. ¶ 15.

- ii. Maritz conceded that Netscape, in May and June 1995, “was an important distribution vehicle for Java APIs.” Maritz, 1/26/99pm, at 59:21 - 60:6; Maritz, 1/26/99am, at 30:10 - 31:2.
- iii. Documents written by Maritz in 1997 expressly link Netscape and Java as a threat. GX 52, MS7 003270 (January 1997 Microsoft presentation identifies as a “Scenario: Emergence of a new API” and notes that “Sun AWT provides base cross-platform API” and further, that “Navigator/NetOne provides: additional API’s” and “a volume platform for ISVs & Corps to target, since runtime gets shipped with Navigator”); GX 113; GX 514, at MS7 007509 (“If we look further at Java/JFC as being our major threat, then Nscap is the major distribution vehicle.”).

60.2. Conversely, the ability of Internet browsers to supply an attractive set of APIs is enhanced by the viability of cross-platform Java APIs. The browser and Java APIs sets can together provide the foundation for developers seeking to write cross-platform applications, particularly network- and Internet-oriented applications.

- i. Contemporaneous Microsoft documents describe the interdependence of competitive browser and Java products. E.g., GX 466, at MS6 5003781 (“Without question, the Java platform API’s have surpassed the Macintosh as the #2 platform for software development. In concert with this, Netscape has its own offering of platform API’s called Netscape One which is also built on Java. Collectively, these two initiatives represent the most serious threat to our core Windows business which Microsoft has seen in years. The Windows franchise is fueled by application development which is focused on our core APIs. When a developer writes an application to AWT, even if they are using Windows and Visual J++, they are not supporting our platform. Instead, they are furthering Sun’s momentum, potentially opening up the opportunity for our competitor to slide in its own operating system offering.”); GX 485, at MS6 5005195 (“The Internet challenge is critical as Netscape, Sun and others try to build a non-Microsoft platform alternative.”).
- ii. Gosling also summarized how browsers and Java technology together can be particularly significant for Internet-oriented applications: "Because the Java technology is particularly useful for running software that is downloaded over a network, such as the Internet, we adapted the Java technology to work in conjunction with web browsing programs known as

‘browsers.’ . . . Java technology in essence permits certain software programs to run within browsers. Java-based programs can be downloaded from the Internet or other network to a user’s computer without regard to what operating system or hardware is installed.” Gosling Dir. ¶¶ 34-35.

- iii. Dr. Warren-Boulton also explained that competitive browsers may over time competitive browsers tend to threaten the Windows monopoly more as a complement to, and distribution vehicle for, Java, rather than as an independent platform in its own right. Warren-Boulton, 12/1/98am, at 42:7 - 43:10; see also Warren-Boulton, 11/19/98am, at 48:13-24 (Java an implicit complement to browsers).

61. Because of the growing importance of network computing (over the Internet and otherwise), Internet browsers and Java in combination posed a serious threat to the applications barrier to entry.

- i. See infra Part VII.D; ¶¶ 398-400.

62. The success of cross-platform browser and Java products could also facilitate innovation in new forms of computer hardware.

- i. As Professor Fisher explained: “Similarly, browsers could reduce the power of the operating system monopoly by facilitating the expansion of network computing, in which users with ‘thin clients’ use a network to access applications residing on a server computer rather than hosting the application on the PC itself.” Fisher Dir. ¶ 87.
- ii. In an April 1997 Memo entitled “Preserving the desktop paradise,” Brad Chase commented that Netscape and Sun might not only reinvigorate operating system software competition, but also facilitate the success of low-cost hardware: “Our competitors are still hard at work trying to obsolete Windows. More people than ever now believe they will. Netscape and Sun endeavor to commoditize the OS and drive developers to adopt their technologies and APIs. This is more true today than ever and these technologies are precisely those that may make the NC viable.” GX 512, at MS7 004149; see also DX 1490, at MS7 007476 (identifying network computer as a “competitive threat”).

- iii. Maritz also focused on the potential for new hardware development, facilitated by browser and Java, in his trial testimony. Maritz Dir. ¶¶ 31, 259 (“impending competition from so-called ‘network computers’”).
- iv. As Microsoft’s Ben Slivka stated in his deposition, a “nightmare scenario is that the web grows into a rich application platform in an operating-system neutral way, and then a company like Siemens or Matsushita comes out with a \$500 ‘WebMachine’ that attaches to a TV.” Slivka Dep., 1/13/99, at 712:6-11 (commenting on GX 1016).
- v. AOL’s Barry Schuler also testified that

In order to achieve that,

159:12 - 160:4 (DX 2810A) (sealed).

Schuler Dep., 5/5/99,