
Mac OS Business Case

*“Our results show a clear correlation between
Macintosh usage and higher revenues.”*

– Michael Moon, Director
Executive Education Programs
GISTICS, Inc.

12/29/97

Researched and written by
Impact Technical Publications

Special Thanks

We are indebted to GISTICS, Inc. for their research. Visit them on the Internet at:
<http://www.gistics.com>

The quote by Michael Moon on the title page is from *NewMedia*. [Source 9.]

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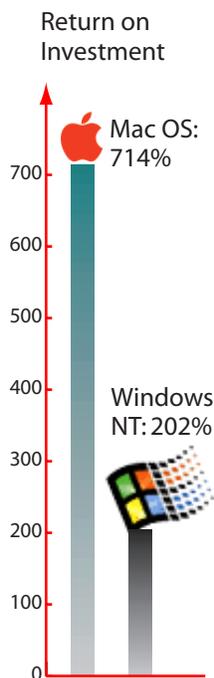
EXECUTIVE SUMMARY

This business case presents the findings of four research studies comparing Mac OS (the Macintosh operating system) with Windows NT, Windows 95, and Windows 3.1. The research studies conclude that Mac OS users:

- Produce significantly more revenue than Windows users
- Require less training and cost less to support than Windows users

This business case also examines:

- The enabling technology that delivers the benefits of Mac OS
- The strategic advantage that Mac OS provides to users and the organizations in which they work



Productivity

GISTICS, Inc., a technology-focused research and consulting firm, conducted a study of 30,000 media professionals at 10,000 media-producing firms. The study, published in 1997, found a wide difference in net profit between creative professionals using different computing platforms. [Source 1.]

“Mac-using creative professionals produce, on average, \$14,488 more net profit than Windows users.”

The study showed that the return on investment (ROI) over three years for a PowerPC Mac OS computer is 714%, compared to 202% for a Windows NT computer.

FIGURE 1. Mac OS delivers 3.5 times the ROI of Windows NT.

In 1996 Evans Research Associates studied 150 people who regularly used both Macintoshes with System 7.5 and PCs with Windows 95. [Source 3.]

In the study, the response to the question “Which system allows you to be more creative” was two to one in favor of Mac OS. The dual-platform users in the study rated Mac OS higher than Windows 95 in overall ease of use by a margin of more than two to one.

Mac OS users are loyal to the platform because it lets them be more productive and achieve higher profits.

Training and Support

The GISTICS study found that media professionals who use Mac OS save \$4,950 on training and support costs annually.

Similarly, the Evans Research Associates study found that dual-platform users favored Mac OS for ease of learning by a wide margin. Three out of every four dual-platform users – 78% – rated Mac OS “very good” to “excellent.” Only 29% of those users gave Windows 95 the same ratings.

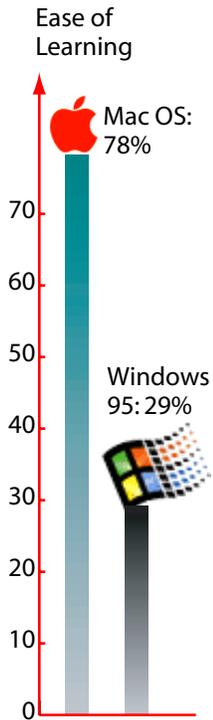


FIGURE 2. Dual-platform users prefer Mac OS.

In 1995, Gartner Group Consulting Services analyzed technical support costs in 67 medium to large organizations with 312,000 desktop computers. [Source 4.] They found that Macintosh computers cost 25% less to support than Windows systems.

The Single-Platform Myth

Gartner Group's analysis of technical support costs in 67 organizations revealed that Macintosh computers are less expensive to support regardless of their percentage within the overall mix of personal computers. [Source 4.]

In addition, Gartner Group found that none of the organizations – even those with 100% Windows computers – exhibited the characteristics of a single-platform computing environment. Windows platforms vary not only in operating environments but also in compatibility of hardware from different vendors. Gartner Group concluded that every Windows environment is heterogeneous.

FIGURE 3. A typical “Windows” organization has multiple platforms.



Enabling Technology

The technology upon which Mac OS is built, together with the consistency and design excellence of its software applications, make Mac OS easy to learn and economical to support.

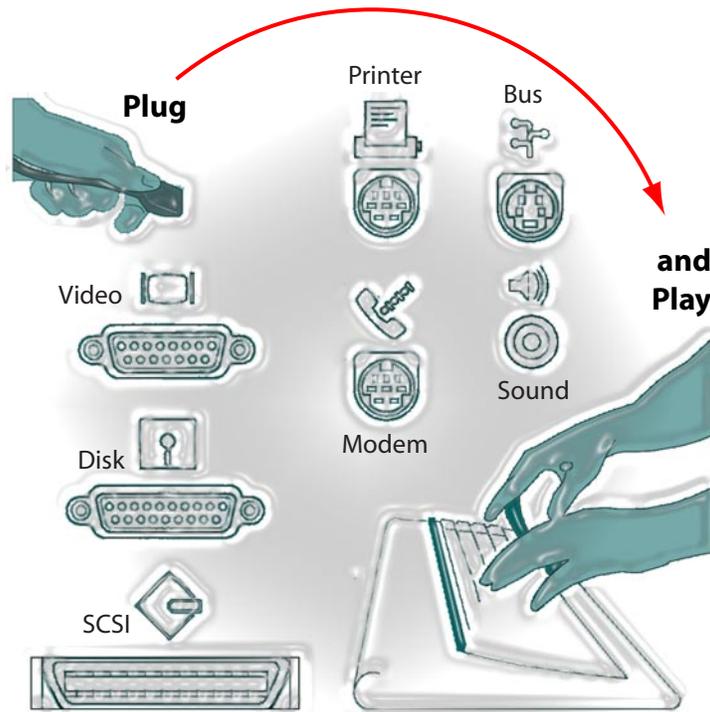
Analysts often compare Mac OS and Windows operating environments on a task-by-task basis or on the speed with which users can perform tasks with equivalent hardware. This is a production-oriented approach, and it does not take into account the degree to which the operating system provides an environment that facilitates creativity and problem-solving.

Mac OS facilitates creativity and problem-solving through hardware integration, resource integration, and application design consistency.

Hardware Integration

Mac OS hardware integration lets users add peripherals, install device drivers, and set up resource-intensive applications easily. In contrast, Windows users who do not purchase their computers and peripherals at the same time often deal with incompatibilities by purchasing new equipment.

FIGURE 4. Standard ports let Mac OS users plug and play.

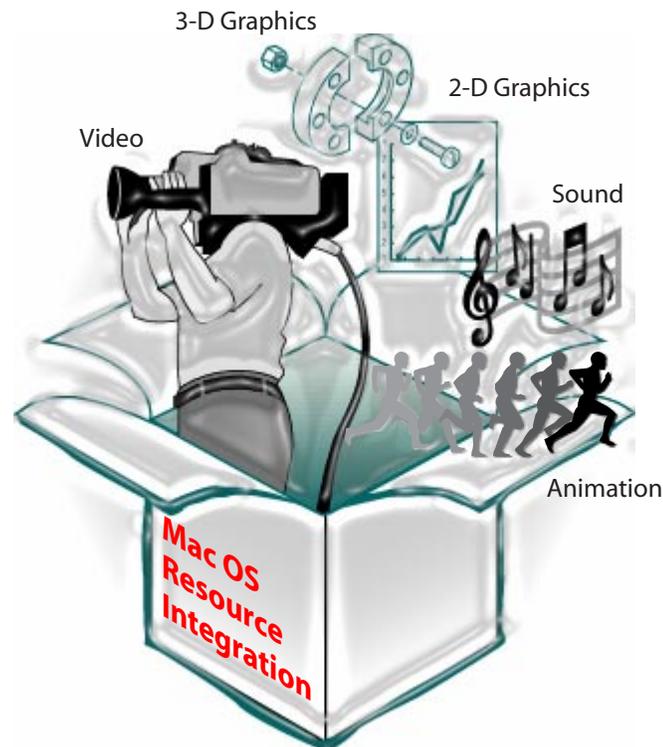


Resource Integration

Creative work involves integrating a wide variety of components from many different sources. As hardware becomes more powerful, applications create new, data-intensive objects with sound, video, animation, and 3-D graphics. To take full advantage of these new objects, users must be able to work with

the objects in other applications. Through resource integration at the OS level, Mac OS makes exchanging resources between applications easy. Easy exchange of data between applications makes it easier for Mac OS users to work with more software tools.

FIGURE 5. Creative work integrates data-intensive objects.



Application Design Consistency

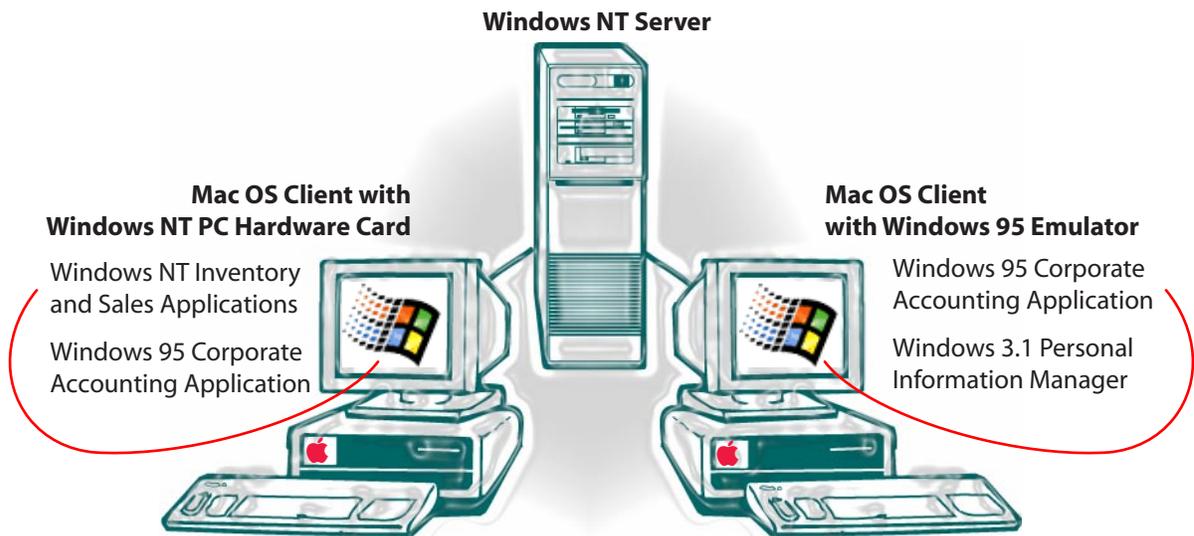
Software applications for the Mac OS platform have a tradition of design consistency. Mac OS software applications follow a comprehensive design language. All Mac OS software applications share a common style of graphical user interface (GUI) and common methods of user interaction. Because of this consistency, learning one Mac OS software application "pre-trains" users on other Mac OS software applications. As users learn the conventions of the GUI and the methods of interaction, they take advantage of that knowledge to learn new software applications for new technologies quickly.

Windows Connectivity

Mac OS computers connect easily to Windows computers.

- All Mac OS computers can exchange data with Windows.
- Mac OS computers can run Windows software applications using either a PC-compatibility hardware card or a Windows emulator.
- Mac OS computers can serve as clients on many different Windows networks.

FIGURE 6. Mac OS computers can run Windows NT, 95, and 3.11.



The Next-Generation OS

Apple Computer's next-generation operating system, code-named Rhapsody, combines Mac OS enabling technology – including integrated hardware on the PowerPC platform, integrated resources, and application design consistency – with high performance and powerful object-oriented technology. Rhapsody enables the rapid development of a new generation of software applications and provides new tools for corporate computing.

Strategic Advantage

A Mac OS computing environment lets an organization use new technology to achieve strategic advantage over its competitors in the marketplace.

According to the Software Publishers Association (SPA), Mac OS users buy twice as much software as Windows users. [Source 8.] By working with more software tools, Mac OS users can take better advantage of current technologies. They can use the best features of one tool in combination with the best features of other tools.

Not surprisingly, the GISTICS study found that Mac OS users are three times more likely to be early adopters of new technologies than their Windows colleagues are.

Although the high return on investment for Mac OS computers is compelling, a desktop computing platform's influence extends beyond the immediate return on investment. Because Mac OS users adopt new technologies early and because they work with more software tools, Mac OS users have more resources with which to do innovative new work. When an organization's creative professionals work with the Mac OS computing platform, the organization can take strategic advantage of new technologies, and it can quickly achieve critical goals in a dynamic and highly competitive marketplace.

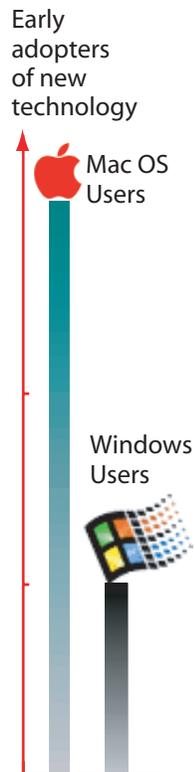


FIGURE 7. Mac OS users are early adopters of new technologies.

PRODUCTIVITY

Two research studies comparing Mac OS to Windows conclude that Mac OS users produce significantly more revenue than Windows users and are much more creative.

More Revenue and Higher Return on Investment

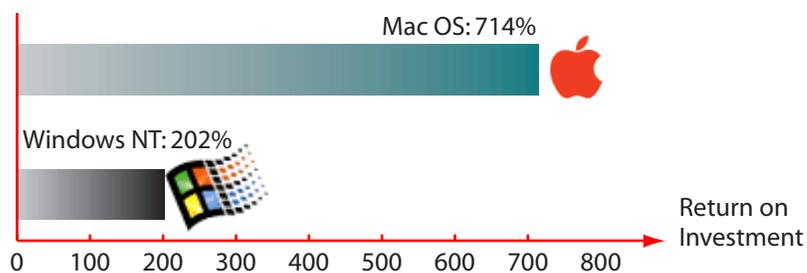
GISTICS, Inc., a research and consulting firm that investigates critical success factors for rapid adoption of new technology and return-on-investment for complex technical systems, studied 30,000 media professionals at 10,000 media-producing firms. The study's findings reveal that Mac OS has a strong impact on revenue:

“A Macintosh-using creative professional produces \$26,441 more annual revenue and \$14,488 more net profit (per person) than a Windows user of comparable skill engaged in similar work.”

Macintosh versus Windows ROI Tech Brief™, GISTICS, Inc. [Source 1.]

The study reports that the return on investment (ROI) over three years for a new PowerPC Mac OS computer is 714%, compared to 202% for a Windows NT computer. See [Figure 8](#).

FIGURE 8. Mac OS computers deliver higher return on investment.



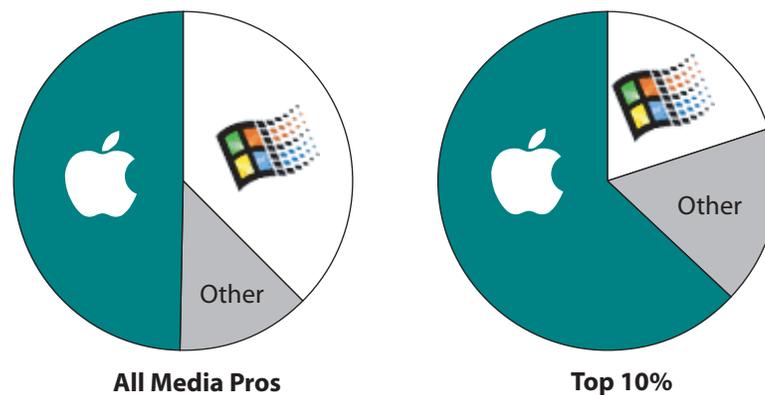
The ROI analysis included the following types of work:

- Animation
- CD-ROM publishing
- General creativity
- Desktop publishing
- Digital photography
- Digital video
- Executive management
- Training
- Web authoring

Platform usage reported in the study was 49.8% Mac OS, 37.6% Windows (3.X, 95, and NT), and 12.6% other (Unix and OS/2).

Among “best practice” users – those with earnings in the top 10% – platform usage changed dramatically: 63% Mac OS, 20% Windows, and 17% other.

FIGURE 9. Top-earning media pros use Mac OS.



GISTICS collected its data on 30,000 subjects by surveying creative professionals, authoring-tool customers, and industry trade associations. In addition, GISTICS analyzed three years of time reports from 400 Mac OS users and 400 Windows users in production environments.

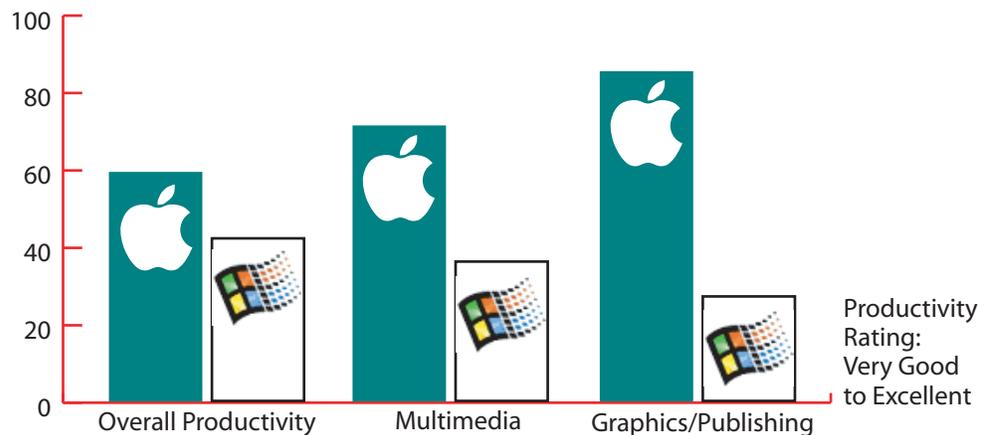
Greater Productivity

In 1996 Evans Research Associates studied 150 people who regularly used both Macintoshes with System 7.5 and PCs with Windows 95 in business, at home, and for education. [Source 3.]

In each of the following categories, these dual-platform users rated the Macintosh with System 7.5 very good to excellent much more often than they rated PCs with Windows 95 very good to excellent.

- Overall productivity
- Multimedia
- Graphics and publishing

FIGURE 10. Users are more productive with Mac OS.

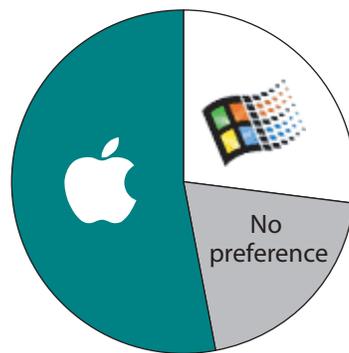


As Figure 10 shows, the Mac OS advantage widens dramatically in the more creative categories: multimedia and graphics/publishing.

A Better Environment for Creativity

When the Evans Research Associates study asked its dual-platform users which system allowed them to be more creative, the users responded two to one in favor of the Mac OS (53% to 27%, with 20% indicating no preference). See Figure 11.

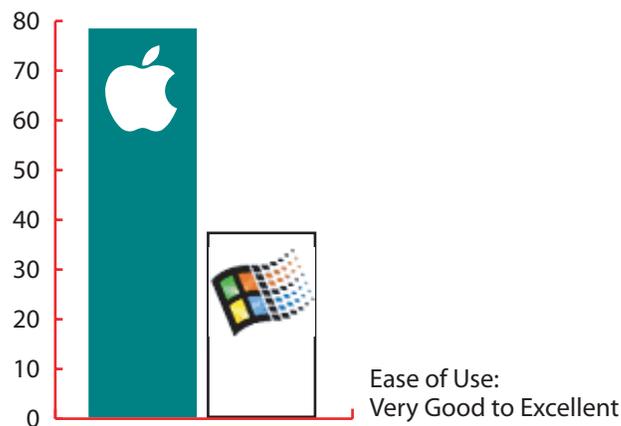
FIGURE 11. Mac OS lets users be more creative.



Dual-platform users

For creativity to flourish, users must be able to work with tools quickly and intuitively. Not surprisingly, Mac OS out-scored Windows 95 in ease of use by a margin of more than two to one (78% to 37%). See Figure 12.

FIGURE 12. Mac OS supports creativity through ease of use.



TRAINING AND SUPPORT

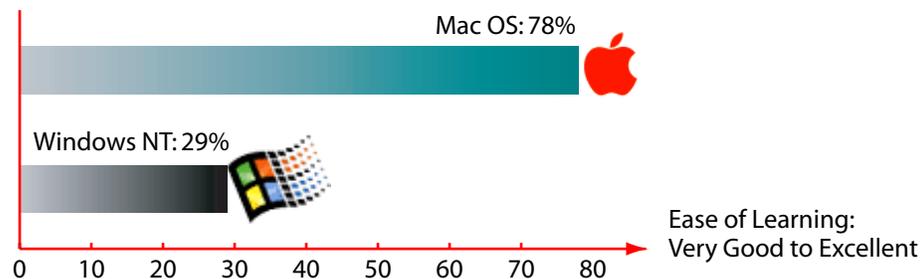
One of the reasons why media professionals who use Mac OS generate more revenue is because they save \$4,950 on training and support costs annually. Along with this finding, the GISTICS study notes:

“Mac-using professionals spent far more hours per week – 19 vs. 13 – in actual, billable authoring time; Windows’ users spent more of their time tied up in activities such as training, support, data communications, and file management.”

Ease of Learning

In the Evans Research Associates study of 150 people who regularly used both Macintoshes with System 7.5 and PCs with Windows 95, users favored the Macintosh for ease of learning by a wide margin; 78% rated the Mac very good to excellent; only 29% rated Windows 95 very good to excellent. See Figure 13.

FIGURE 13. Users find learning easier with Mac OS.



Lower Support Costs

In 1995, Gartner Group Consulting Services analyzed technical support costs in 67 medium to large organizations. Their survey included 312,000 desktop computers with Macintosh and Windows operating systems. Gartner Group found that Macintosh computers cost 25% less to support than Windows systems. [Source 4.]

According to *Macworld* columnist David Pogue, citing figures by Dataquest:

“The average cost to develop and support Windows programs is 50% higher (per dollar of revenue) than for the Mac.”

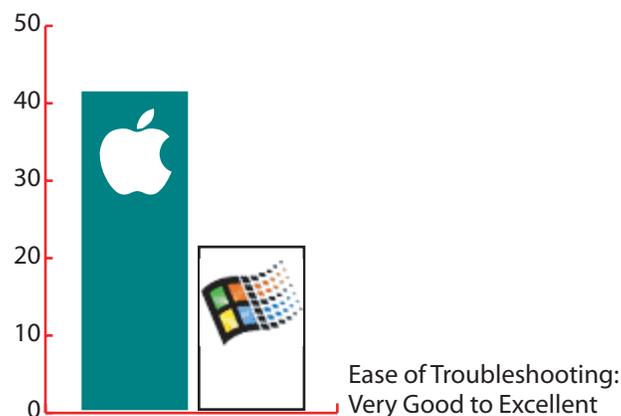
“Clip-’n’-Save Apple: The Numbers Nobody Knows,” *Macworld*, July, 1996. [Source 8.]

A study of Mac OS and Windows 95 by Norris and Wong Associates, a technology consulting firm, showed that Mac OS has a superior architecture and its application software has far fewer interdependencies. The report concluded: “These benefits will translate into significant cost and productivity benefits for Macintosh users.” [Source 2.]

Efficient Troubleshooting

In the Evans Research Associates study, 41% of all dual-platform users rated “ease of troubleshooting” for the Macintosh with System 7.5 very good to excellent. Half as many users (21%) gave Windows 95 the same ratings.

FIGURE 14. Users rate troubleshooting easier with Mac OS.



THE SINGLE-PLATFORM MYTH

In their analysis of technical support costs in 67 medium to large organizations, Gartner Group Consulting Services found that:

- An organization with dual Mac OS and Windows platforms does not incur additional support costs.
- Support costs are based on the platform.

Windows systems cost more to support than Macintosh systems regardless of the percentage of each in the organization. [Source 4.]

Figure 15, based on data from Gartner Group's study, shows that Mac OS users cost less to support – regardless of their percentage within the overall mix of personal computer users. The more Mac OS users, the greater the savings in support costs. Environments with 100% Mac OS users are 25% less expensive to support than environments with 100% Windows users.

FIGURE 15. Mac OS users cost less to support.

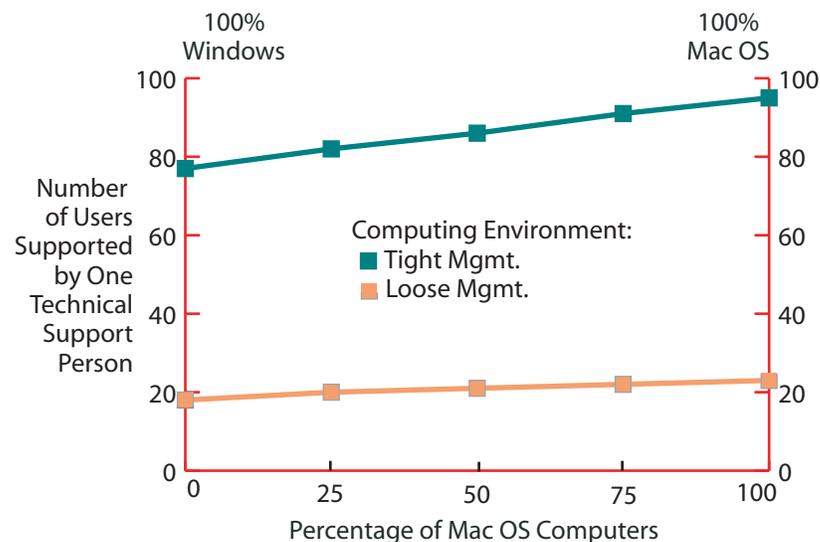


Figure 15 shows that one technical support person can support 77 Windows users or 95 Mac OS users in a tightly managed computing environment. In a loosely managed environment, one technical support person can support 18 Windows users or 23 Mac OS users.

Better Support for Knowledge Workers

Because of the higher costs associated with Windows computers, Gartner Group's study recommended redeploying Windows systems for data entry and other straight-forward production work. The study warned that deploying Windows systems for knowledge workers increases the risk of higher technical support costs.

Heterogeneous Windows Environments

In their study, Gartner Group found that none of the 67 organizations – even those with 100% Windows computers – exhibited the characteristics of a single-platform computing environment. Gartner Group concluded:

“Every environment is heterogeneous, and Windows environments are more heterogeneous than Macintosh environments.”

Technical Support Costs and Dual-Platform Desktops: Managed Diversity. [Source 4.]

Organizations with Windows computers use multiple generations of Windows platforms from different hardware vendors. Computers have different processor boards, BIOS, add-in cards, and communication ports.

Changing from one Windows computing environment to another requires relearning previously-acquired skills. Relearning these skills is as much a part of changing between heterogeneous Windows environments (Windows 3.x, 95, and NT) as it is changing between Windows and Mac OS environments. Shortly after the release of Windows 95, a technology consultant remarked:

“Having already been competent in troubleshooting Windows 3.1 problems and having developed the ability to identify and fix specific problems, I have been unable to consistently troubleshoot and specifically fix Windows 95 problems.”

Maintenance Comparison: Macintosh vs. Windows 95, Norris and Wong Associates. [Source 2.]

Contrast this with the migrations of Mac OS from System 6 to System 7, from the 86X architecture to the PowerPC architecture, and from System 7 to System 8. Because Mac OS emphasizes consistency, compatibility, and ease of use, major changes to Mac OS do not require retraining.

ENABLING TECHNOLOGY

The technology upon which Mac OS is built, together with the consistency and design excellence of its software applications, make Mac OS the most productive, easiest to learn, and least expensive to support desktop operating system.

Analysts often compare Mac OS and the various Windows operating environments on a task-by-task basis or on the speed with which users can perform tasks with equivalent hardware. This is a production-oriented approach, and it does not take into account the degree to which the operating system provides an environment that facilitates creativity and problem-solving.

The next three sections examine how Mac OS facilitates creativity and problem-solving through:

- Plug-and-play hardware integration on [page 24](#)
- Resource integration on [page 28](#)
- Application design consistency on [page 32](#)

This section examines how Mac OS shields users from operating system complexity and separates applications from the OS.

Shielding Users from Complexity

Mac OS shields users from complexity at all levels of the OS. Mac OS places a graphical user interface (GUI) between users and the internal workings of the OS. Each piece of OS software has a graphical representation. This GUI makes it much easier for users to understand what all the components of Mac OS do. For example, a Mac OS user specifies settings for the operating environment by opening a Control Panel object or by choosing operating preferences from within an application. The application stores these preferences in a preferences file in the *Preferences* folder within the *System* folder. When problems occur, removing or updating an application-specific OS software component is the usual solution.

Windows operating environments have a GUI between users and the uppermost level of the OS, but access to the much of the complex internal workings of Windows operating environments is through a character-terminal interface. When problems occur, users may have to fix them by typing data directly into files such as SYSTEM.DAT, USER.DAT, WIN.INI, SYSTEM.INI, CONFIS.SYS, COMMAND.COM, and AUTOEXEC.BAT. Errors when typing commands and parameter values in system files in any of the Windows operating environments can cause irreparable damage and force a user to reformat a hard disk, reload Windows, and reload all application software and files.

FIGURE 16. In Windows, complexity lies just below the surface.

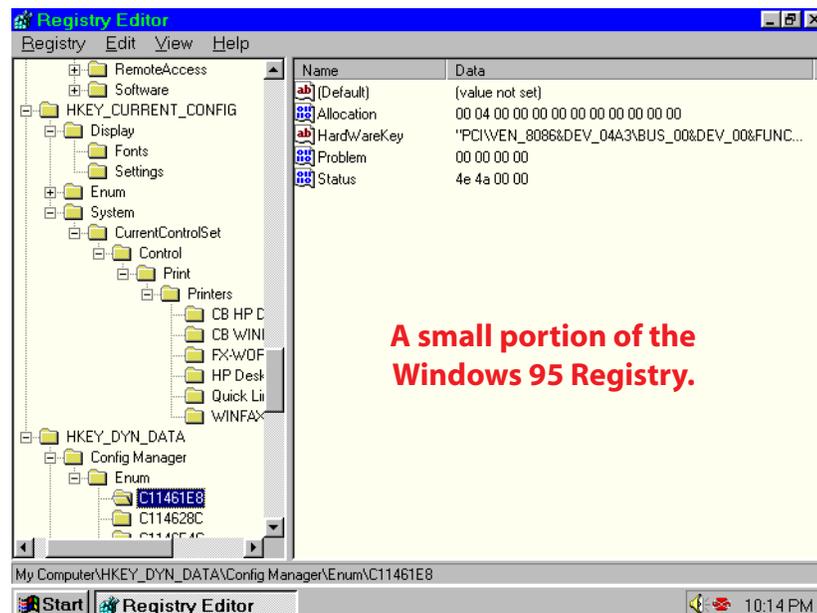


Figure 16 shows a small portion of the Windows 95 Registry. If the installation process for an application places data that conflicts with another application in the Registry, a user may be unable to correct the problem.

“It is far from easy to find and identify which Registry entries apply to any particular application or to determine their significance.”

Maintenance Comparison: Macintosh vs. Windows 95, Norris and Wong Associates. [Source 2.]

Separating Applications from the Operating System

Mac OS keeps applications separate from each other and from the operating system to keep conflicts between applications to a minimum.

Installing Applications on Mac OS

The installation of Mac OS applications may add files such as system extensions and control devices to the operating system and make changes to application-specific files, but the process doesn't make changes to general OS files that are shared by multiple applications. This maintains the integrity of applications and prevents one application from replacing data required for another application. At worst, system extensions and control devices may conflict with each other. The user can solve the conflict by removing the file that is causing the problem.

“With the Macintosh, the user can almost always reinstall the system or any given application without having to change much else.”

Maintenance Comparison: Macintosh vs. Windows 95, Norris and Wong Associates. [Source 2.]

Installing Applications on Windows

On the other hand, the installation of Windows applications may add application-specific files, make changes to application-specific files, and make changes to general OS files (such as the Registry files, SYSTEM.DAT and USER.DAT) that are shared by multiple applications. If the changes in any of the shared OS files conflict with the needs of other applications, restoring the previous state of the OS file may be difficult or impossible. Users may have to reinstall Windows and all the application and data files. In some situations, users may even have to reformat their hard disks.

“Because applications keep needed information in system files, reinstalling the system may cause applications to fail and need to be reinstalled themselves.”

Maintenance Comparison: Macintosh vs. Windows 95, Norris and Wong Associates. [Source 2.]

Windows 95 and Continuously Degraded System Performance

John C. Dvorak, writing in *PC Magazine Online* about Windows 95, remarks: "Microsoft has created an operating system that encourages sloppy practices and continuously degraded performance." [Source 12.] Earlier in the article, he complains that "Machines get clogged with weird programs and DDLs which the operating system cannot sort out. I won't even mention the performance-clogging Registry, with entries long since forgotten and impossible to remove." He continues.

"The major problem with clogged systems is that there is no easy way to correct the problem. I'd advise you to back up everything, reformat the disk and reinstall Windows 95. But once you've done that, none of the programs run anymore without complete reinstallation from their master disks, which you've usually scattered around. This situation is not acceptable."

"Personal Computing: The Thrill Is Gone," John C. Dvorak, *PC Magazine Online*, April 21, 1997. [Source 12.]

Users who run only a few Windows applications may suffer relatively little system degradation, but users who work with many different Windows applications are much more likely to encounter software conflicts and continuously degraded system performance.

HARDWARE INTEGRATION

Mac OS is integrated with hardware to a degree not possible on Windows systems. This integration makes it much easier to add peripherals, install device drivers, and set up resource-intensive applications – in short, to use a variety of hardware and software tools to explore new ideas and solve problems.

Macintosh hardware comes with a several different ports that are add-ons for most PCs. While these ports increase the initial cost of a Macintosh computer compared to a Windows PC, the ports serve an important and cost-effective purpose: they standardize the interface between the computer and its peripherals, making plug and play a reality.

On Mac OS computers, standard hardware interfaces include ADB (Apple Desktop Bus), serial, and SCSI (Small Computer System Interface) ports. Ethernet is standard on most business computers. Peripheral manufacturers for Macintosh computers make sure their peripherals can connect to one of these built-in ports. Users with Mac OS computers simply plug in the peripherals and work with them.

Plug and play lowers the **overall cost** of Mac OS computers and contributes to the much better three-year return on investment sited on [page 14](#).

In Windows environments, “plug-and-play” is a marketing slogan. Windows users who do not purchase their computers and peripherals at the same time often deal with incompatibilities by purchasing new equipment.

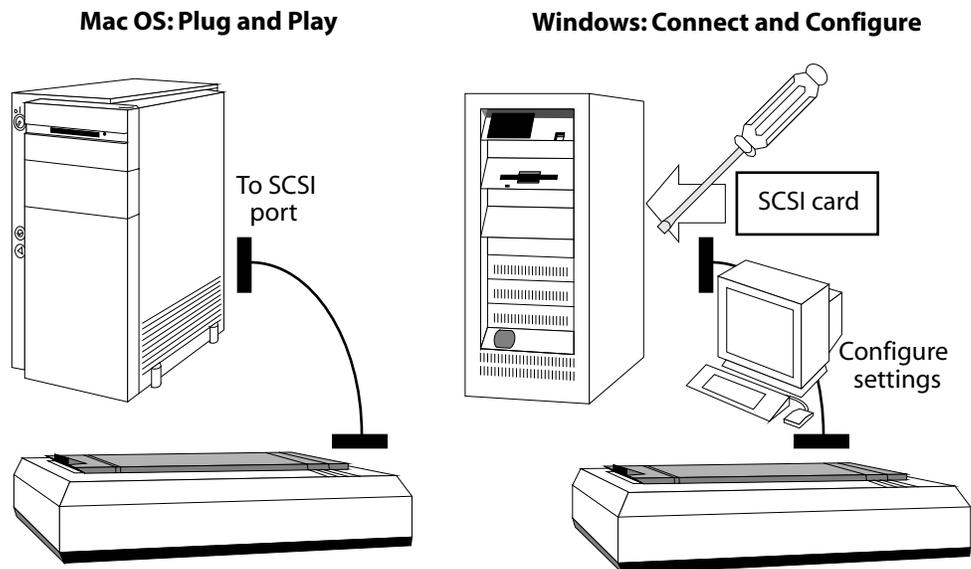
Support for New Products and Return on Investment

The initial cost of a computer, like the initial cost of any capital expenditure, is one component of the overall return on investment. Hardware integration on the Mac OS platform contributes to Mac OS computers’ superior return on investment. As hardware costs continue to drop, more and more work will involve products that integrate hardware and software. Mac OS computers with their hardware and software integration are best positioned to take advantage of these new products.

Plug-and-Play Peripherals

The built-in SCSI port on a Mac OS computer enables plug and play. As the left side of Figure 17 shows, a user plugs a peripheral into the SCSI port, installs any required drivers, and starts working with the peripheral. With the SCSI port, the user can plug in up to seven devices: hard drives, removable drives, optical drives, CD-ROM drives, CD recorders, scanners, and so on.

FIGURE 17. Mac OS computers' SCSI ports let users plug and play.



On a PC, the SCSI port is not standard. PC users may have to purchase a SCSI card and configure it.

PC users have no guarantee that the PC hardware, Windows operating environment, SCSI card, and peripheral will work together. If they do, the cost of the time required to configure the card and install the device driver may exceed the cost of the peripheral itself.

The right side of Figure 17 shows the typical Windows PC scenario: “connect and configure” precedes “plug and play.” A Windows user will most likely have to pop open the computer’s case, connect a SCSI card, set DIP switches, and reconfigure the Windows operating environment.

Serial versus Parallel Ports

Mac OS computers built since the mid-1980s have serial ports for two-way transmission of data. Originally designed for communicating with printers and modems, the serial ports also support digital cameras, microphones, and other devices. Users with Mac OS computers can typically connect printers and other serial devices within a few minutes.

In contrast, the parallel port on many Windows PCs supports one-way communication only. While newer Windows PCs include a parallel port for two-way communication, Windows users often don't know which type of parallel port their computer has and which type of parallel port their printer requires. They may spend hours, days, or even weeks trying to connect a computer to a printer with the appropriate cable and software driver.

Plug-and-Play Input Devices

The Apple Desktop Bus (ADB) port offers another example of plug and play. Manufacturers of input devices for Mac OS computers must interface with the ADB port, which supports multiple devices. As a result, Mac OS users can connect several input devices into one port. If a user wants to add a graphic tablet to the two standard ADB devices – the keyboard and mouse – the user plugs it into the ADB chain. The ADB port lets users choose how they want to interact with the computer – an important part of creative work.

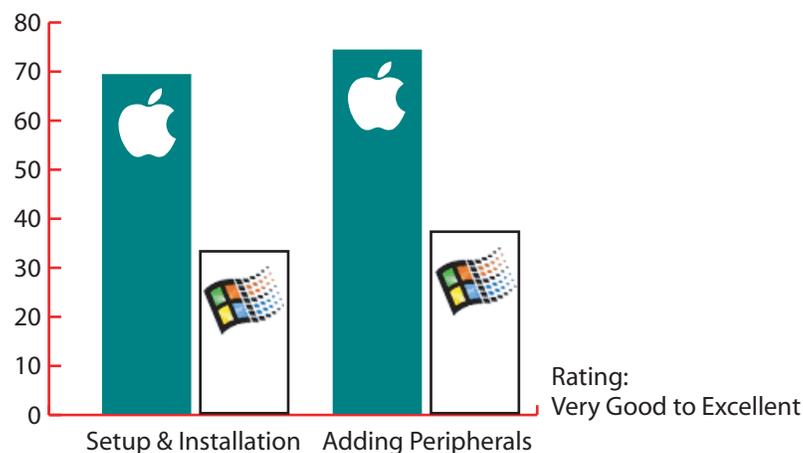
Plug-and-Play Networking

Mac OS and Ethernet bring plug-and-play functionality to high-speed networking. Most Mac OS business computers built since the early 1990s have a built-in Ethernet connections such as 10-Base T connectors. These built-in connectors combined with user-friendly Mac OS networking make 10 Mbps (megabit per second) Ethernet networks quick and economical to set up and administer. Networking hardware is also available for faster networks such as 100-Base T. In addition, Mac OS supports dynamic allocation of network addresses on both Ethernet and LocalTalk. This special networking feature makes it easy for users to configure and run their own Mac OS networks.

Mac OS Plug and Play: Simple and Quick Product Setup

For ease of setup and installation as well as ease of connecting peripherals, the dual-platform users in the Evans Research Associates study rated Macintosh/System 7.5 very good to excellent twice as often as they rated PCs/Windows 95 very good to excellent. [Source 3.]

FIGURE 18. Mac OS makes it easy to set up and connect peripherals.



Financial Penalty from Nonintegrated Hardware and OS

With Windows systems, nonintegrated hardware and operating environments may make new products difficult or impossible to install. Problems are much more likely to occur with innovative new software and hardware tools than with new releases to basic production and accounting products.

For example, when *NewMedia* magazine reviewed new digital editing hardware and software, the reviewers could not get the Windows products to run on their multimedia PCs. They had to obtain new machines to review the products. In contrast, the Mac OS products – including those in beta testing – ran on their current hardware. Not surprisingly, the reviewers had a much easier time installing and operating the Mac OS products. [Source 10.]

Even upgrading a simple “plug-and-play” modem can crash Windows. The fix may require an expensive, time-consuming process of technical support calls, extensive debugging, and replacing incompatible cards. [Source 13.]

RESOURCE INTEGRATION

Creative work – whether in desktop publishing, graphics, multimedia, or scientific research – involves integrating a wide variety of components from many different sources. Two-dimensional and three-dimensional graphics, color and gray-scale images, vector and raster file formats, relational and hierarchical data, text, fonts, sound, video, animation, and more. As hardware becomes more powerful, applications create and manipulate new, data-intensive objects. To take full advantage of these new objects, users must be able to work with the objects in other applications. For complex projects and innovative new work, integration is critical.

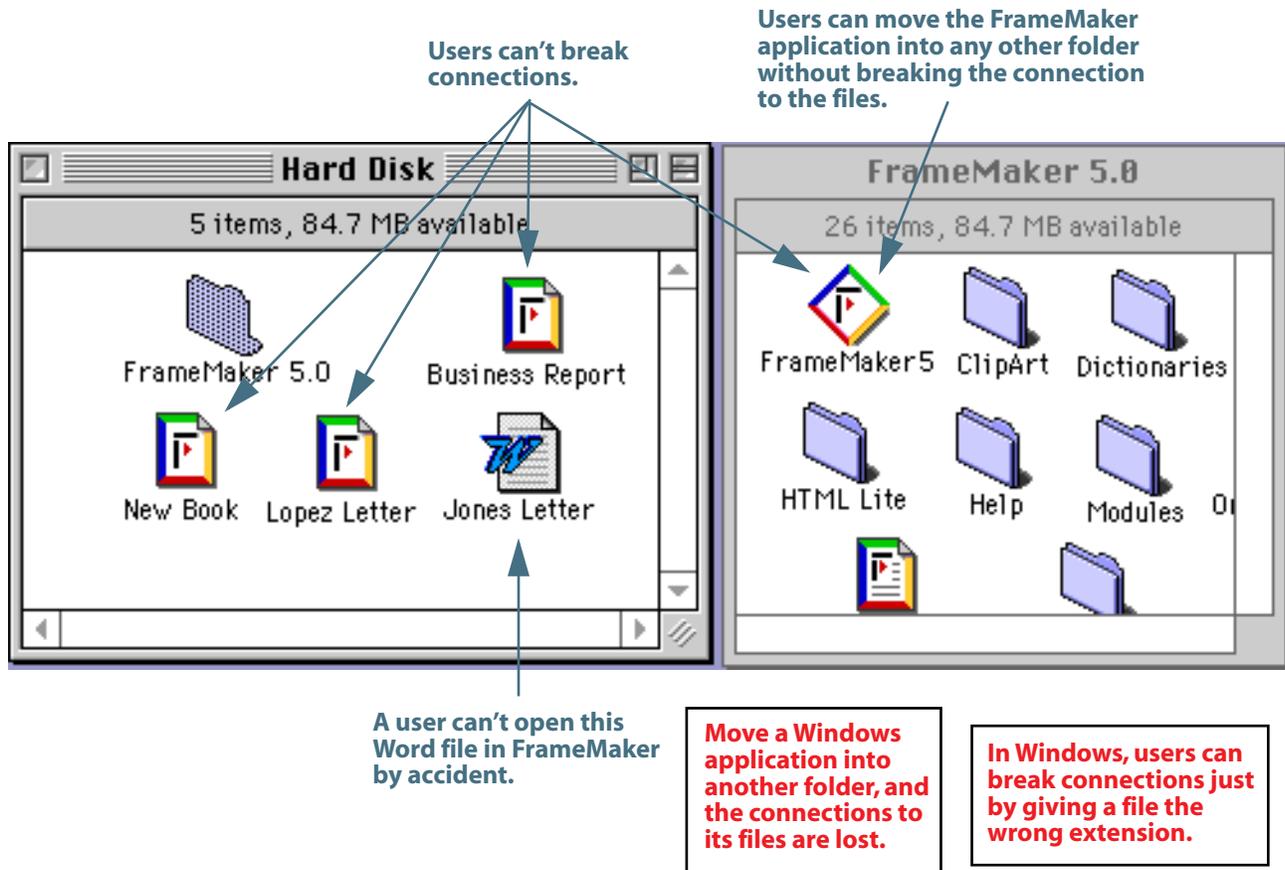
To move objects between applications easily and intuitively, an operating environment must integrate as many resources as possible at the OS level. Mac OS excels at resource integration. This section examines resource integration in four major areas: files and applications, display and printing, multimedia, and sound and speech.

Integrated File and Application Resources

All Mac OS files contain information about the file type and *creator* (that is, the application used to create or update a file). With this information, Mac OS knows which application created a file and can launch it automatically whenever a user clicks the file. The extension (if any) to the file name is irrelevant. Moving the application program, the file, or both anywhere on the user's computer or the server to which the user is connected has no effect. The user is still able to launch the application by clicking the file.

In contrast, Windows operating environments identify files by the extensions to their file names. If two applications recognize the same extension – for example, .DOC – a user who opens a file with the wrong application can crash the application. Moving an application or renaming any portion of the directory path to an application can break the link between the application and its files.

FIGURE 19. Mac OS connects files to their applications.



As Figure 19 shows, integrated file and application resources are key to both Mac OS ease of use and component integration. If a user works with only a few applications, the user may not lose a great deal of productivity to Windows' awkward system of connecting files to applications. But when a Windows user works with many different software tools, the user pays a much greater penalty. Lack of file and application integration at the OS level is one reason why "Windows' users spend far more of their time tied up in activities such as... file management." (See quote on [page 16.](#))

Integrated Display and Printing Resources

Mac OS integrates many display and printing resources including color management, PostScript printing, and three-dimensional graphics.

Color Management

Color management is important for efficient, accurate delivery of content to imagesetting service bureaus, to the latest generation of economical color printers, and for online display via the World Wide Web, Adobe Acrobat, and other formats. Both productivity and quality improve when a computing platform provides consistent color from input devices through display and manipulation on computer monitors to output devices. Color management is built into Mac OS along with automated color correction and separation. Mac OS also provides integrated support for monitors and display cards.

PostScript Printing

The original and easiest-to-use platform for PostScript printing, Mac OS is the standard for professional print publication. With easy to use networking (both Ethernet and LocalTalk) and two-way communication between computer and printer, PostScript printing is effortless on Mac OS.

Three-Dimensional Graphics

Today 3-D graphics are expanding from high-priced specialist software to economical general application software. While professionals who work extensively with specialist 3-D applications will make time to negotiate their steep learning curves, creative professionals in other fields are much more likely to require an easy-to-learn software product with easy-to-use interfaces between that product and the applications that use its output.

Mac OS integrates three-dimensional graphics at the OS level through QuickDraw 3D, which lets users create and render 3-D graphics. By providing 3-D graphics resources, Mac OS makes this rapidly expanding technology available in a consistent format to any application. QuickDraw 3D's standard file format, 3DMF, can hold component, lighting, texture, and sight-line information. Users can cut and paste this information between applications in much the same manner as they cut and paste 2-D graphics.

Integrated Multimedia Resources

Multimedia is integrated into Mac OS through the QuickTime Media Layer (QTML), which consists of QuickTime, QuickDraw 3D (see the previous section), and QuickTime VR. QuickTime lets users create, play, and manage multimedia files. QuickTime VR is a virtual reality tool that lets users interact with panoramas and objects. The OS-level integration of these technologies lets users cut and paste multimedia data between applications. Mac OS provides a multimedia “Scrapbook” program that stores 3-D objects and video as well as text, graphics, and sounds.

By supporting multimedia content integration, these features make Mac OS the platform of choice for video work. As *NewMedia* magazine points out: “Video integration is much more difficult under Windows than on a Mac.” [Source 10.]

Integrated Sound and Speech Resources

Mac OS has integrated sound capabilities, and audio hardware has been standard on Macintosh computers since 1984. Sound applications make efficient use of integrated sound resources, and users do not have to deal with incompatible hardware and software.

In contrast, Windows operating environments have multiple standards for sound and multiple sound cards. Each combination requires a different driver; incompatibilities abound.

Not surprisingly, many musicians and audio editors favor Mac OS. When *Rolling Stone* magazine surveyed 15 musicians, they found that 11 of those musicians worked exclusively with Mac OS computers. [Source 6.]

Mac OS has built-in speech recognition and speech synthesis. As hardware becomes more powerful, speech capabilities are entering the world of low-cost, general-purpose software tools. Mac OS’ integrated speech resources enable developers to build advanced speech-based software applications that will run on Mac OS computers without additional hardware costs.

APPLICATION DESIGN CONSISTENCY

“For me, the most important thing is to set up an environment that makes it okay to try things and explore.”

David Kelley, Professor, Design Division, Mechanical Engineering Department, Stanford University. [Source 14.]

Software applications for the Mac OS platform have a long-standing tradition of design consistency. This section examines both the tradition and its benefits, which include an environment that makes exploration easy.

Design Language for Application Development

Mac OS software applications follow a comprehensive design language that has evolved from user interface guidelines developed for the original Macintosh and first published as *Human Interface Guidelines: The Apple Desktop Interface* by Apple Computer in 1987.

The Mac OS design language includes a graphical user interface (GUI) with standard menu items and icons as well as functions such as cutting, copying, and pasting between applications by means of a “clipboard.” The design language specifies both the appearance and behaviors of the GUI objects. Through these specifications, which now include text, 2-D and 3-D graphics, sound, and video, the Mac OS human interface guidelines encourage an object-oriented approach to programming Mac OS software applications.

The Macintosh Toolbox – thousands of ready-to-use program instructions for user interactions and other basic software tasks – helps software developers write applications that follow the human interface guidelines. The Macintosh Toolbox also discourages software developers from coding applications that do not follow the guidelines. Extra code is often required when a developer does not use a routine in the Macintosh Toolbox.

Mac OS human interface guidelines are the driving force behind the unparalleled Mac OS ease of use discussed on [page 15](#). When applications

developed on other platforms arrive on Mac OS, they may not meet the Mac OS human interface guidelines. But few applications that sidestep the guidelines find favor with Mac OS users. In contrast, applications developed on the Mac OS platform are often successful on Windows platforms as soon as the Windows environments have the capabilities to support them.

Consistency among Applications

All Mac OS software applications, regardless of what they do and who created them, share a common style of graphical user interface (GUI) and common methods of user interaction. Because of this consistency in the user interface to software applications, learning one Mac OS software application “pre-trains” users on other Mac OS software applications. As users learn the conventions of the GUI and the methods of interaction, they take advantage of that knowledge to learn new applications for new technologies quickly. As a result, they can learn and work effectively with more software applications.

“Designers can help users to transfer patterns of use by consciously and consistently understanding and applying a design language across a family of product offerings. People can then take advantage of the resulting similarities in how products are used, often without any conscious relearning.”

“Design Languages,” John Rheinfrank and Shelley Evenson, in *Bringing Design to Software*, Terry Winograd. [Source 14.]

The “pattern transfer” built into Mac OS software applications contributes to the ease-of-learning benefit discussed on [page 16](#).

Progressive Disclosure

Progressive disclosure is another basic design principle reinforced by Mac OS human-interface guidelines and supported by a long-standing tradition in the Mac OS developer community. Using progressive disclosure, an application shows a user only the information relevant to a specific task. When a user completes a task, the application replaces the previous information with new information relevant to the new task.

Progressive disclosure can also support users with multiple skills. An application shows basic information associated with a task to a beginning user. At the user's request, the application discloses advanced options for the same task. This technique makes software easier to learn.

In contrast, DOS, the predecessor to the Windows operating environments, did not emphasize progressive disclosure. It began as a character-terminal interface with a set of commands available at all times. DOS users had to memorize the commands or consult the product's documentation.

Financial Penalty for Design Inconsistency

Given the learning difficulties inherent in a character-based environment, organizations should not be surprised that Windows users do not demand software applications that are easy to learn and easy to use. Unfortunately, both higher training and support costs and lower productivity accompany users' lower software standards.

WINDOWS CONNECTIVITY

As this business case has shown, creative professionals with Mac OS computers are significantly more productive than their Windows counterparts, and they require significantly less training and support – regardless of the percentage of Mac OS computers within an organization.

At times, however, these creative professionals require access to Windows-only applications. This section examines Mac OS connectivity to the heterogeneous world of Windows computers.

- All Mac OS computers can exchange data with Windows.
- Mac OS computers can run Windows software applications using either a PC-compatibility hardware card or a Windows emulator.
- Mac OS computers can serve as clients on many different Windows networks.

Data Exchange with Windows

All Mac OS computers built in the 1990s can exchange data with Windows computers by reading and writing DOS-format files. The Macintosh floppy disk drive reads and writes to both double-density and high-density DOS floppy disks, and Mac OS can read DOS files it receives by modem or over a network.

The standard Mac OS compression utility, Stuffit, can decompress files in many different formats, including Zip files. Several shareware utilities can compress files in Zip format for exchange with Windows computers.

Many of the standard multi-platform software applications create binary-compatible files. A user can take a binary-compatible file produced in a Windows software application and open it in the Mac OS version of the application, make changes, save the file, write it to DOS format, and open the revised file with the Windows version of the application.

File Translation

Mac OS includes Macintosh Easy Open, a utility that translates files from one format to another and opens them with appropriate software applications. Because Mac OS keeps track of all applications loaded on a Mac OS computer, including those available on a server, Macintosh Easy Open knows what combinations of translators and available software applications can open a file. If Macintosh Easy Open finds multiple combinations, it prompts the user to make a selection.

In addition to the translators built into Macintosh Easy Open, many Mac OS software applications import and export data in a variety of formats, and several third-party software companies provide translators that convert files from one format to another.

Support for Windows Software

Mac OS computers can run Windows software with either a PC-compatibility hardware card or emulation software. Both choices let Mac OS users access Windows-only software, including corporate accounting, inventory, sales, personnel, and networking applications, and work with data from these applications in the more creative and productive Mac OS application environment.

These hardware and software options let Mac OS computers run:

- Windows NT
- Windows 95
- Windows 3.11
- OS/2

PC-Compatibility Hardware Card

Several companies offer PC-compatibility hardware cards with Intel processors or x86 processors from other companies. The software included with the cards lets users switch between Windows and Mac OS as well as cut and paste between Windows and Mac OS applications. Performance averages 80-90% of PC-compatible computers with equivalent processors.

Emulation Software

Connectix Corporation and Insignia Solutions offer inexpensive software products that emulate various Windows operating environments, support PC networks, and provide access to Mac OS peripherals.

Virtual PC supports any operating system that runs on the Intel Triton chip set, including Windows NT, 95, and 3.11, OS/2, and OpenStep. VirtualPC comes with either Windows 95 or Windows 3.11 pre-installed, and it lets users cut and paste from Mac OS to Windows applications.

Insignia Solutions' products – SoftWindows 95 Version 4.0 and SoftWindows 3.0 – run Windows 95 and Windows 3.1, respectively. Both products come with their version of Windows pre-installed. Users can cut and paste in either direction between Windows and Mac OS applications.

The software emulators from both companies are *scalable*, that is, faster Mac OS computers with more memory run the emulators faster than slower computers with less memory do. For example, SoftWindows 95 Version 4.0 runs more than twice as fast on a 200-MHz PowerMac as on a 100-MHz PowerMac. Upgrading a Mac OS computer with a faster processor or more memory upgrades the performance of the Windows software emulator. Emulator performance, although well below a comparable Intel processor, is satisfactory for occasional Windows use. The user retains all the benefits of the Mac OS computing environment.

Networking Support for Multiple Protocols

Mac OS computers make excellent clients in a client/server architecture because they fit into many different computing environments, including Windows NT Server and Novell NetWare.

Mac OS uses Open Transport for networking and communications. The modern Open Transport architecture supports multi-protocol networking, including TCP/IP, OSI, DECnet, SNA, IPX, and AppleTalk. For example, a user can simultaneously connect to networks running TCP/IP and DECnet. Open Transport makes multi-protocol networking transparent to users.

THE NEXT-GENERATION OS

Apple Computer's next-generation operating system, code-named Rhapsody, combines Mac OS enabling technology – including integrated hardware on the PowerPC platform, integrated resources, and application design consistency – with next-generation operating system technology.

Rhapsody is not an OS struggling to achieve professional-caliber typography and color management. Rhapsody is an advanced, high-performance OS with multitasking, symmetrical multiprocessing, and multithreading. Rhapsody's object-oriented software development environment facilitates the rapid development of a new generation of software applications with ground-breaking new multimedia capabilities. Rhapsody also provides new tools for corporate and distributed computing.

Already released to software developers, Rhapsody is scheduled for general release in mid 1998. This section highlights a few of Rhapsody's many features.

Display and Printing

Rhapsody builds on the superior PostScript printing capabilities of Mac OS with a Display PostScript graphics engine. Display PostScript provides "what-you-see-is-what-you-get" (WYSIWYG) functionality across hardware devices. Users can work with files while viewing them in PostScript format. This helps ensure that the viewed image matches the printed output.

Internet

Rhapsody's WebObjects technology lets developers quickly build applications with integrated multimedia that communicate over the World Wide Web to users on any computing platform. Combined with Rhapsody's integrated support for Internet mail, messaging, security, and database services, WebObjects extends the boundaries of Internet publishing, and it is an excellent tool for developing applications for electronic commerce.

Object-Oriented Technology

Rhapsody offers software developers – and ultimately users – the benefits of object-oriented software development with reusable software components. These benefits include high productivity, fast time to market, improved software stability, efficient software maintenance, and easy integration with other applications. Through applications developed with reusable components, companies can respond quickly to dynamically changing markets.

Corporate and Distributed Computing

Rhapsody's object-oriented software development environment provides corporations with the ability to rapidly prototype and develop applications. In addition, Rhapsody provides high-level application programming interfaces (APIs) that let developers build distributed software applications without writing time-consuming low-level code for networking operations.

Support for Mac OS Software Applications

Rhapsody runs Mac OS software applications in a copy of Mac OS hosted on the core Rhapsody OS. Most software applications run as fast in the Rhapsody-hosted copy as they do on the current release of Mac OS. At the same time, the core Rhapsody OS provides better stability and improved memory management to Mac OS applications. By running a copy of Mac OS, Rhapsody lets users – and software developers – upgrade their applications to Rhapsody at their own pace.

Sources of Information about Rhapsody

Providing detailed information about the wide-ranging new capabilities built into Rhapsody is beyond the scope of this business case. For more information about Rhapsody, visit these Web sites:

- <http://charlotte.acns.nwu.edu/jln/wwdc97.html> [Source 5.]
- <http://macos.apple.com/macos/releases/rhapsody/yellowbox.html> [Source 7.]

STRATEGIC ADVANTAGE

“Staying on top of new technology and learning how to recognize and incorporate it into an organization must be an ongoing effort – no different from research and development or marketing.”

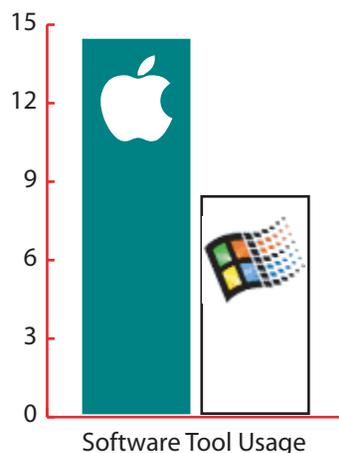
Reengineering the Corporation, Michael Hammer and James Champy. [Source 15.]

This business case has examined how Mac OS lets users be more creative and productive, and it has shown that organizations spend less to train and support Mac OS users. These are strong arguments in favor of a Mac OS computing environment for creative professionals and knowledge workers. But even more important is the strategic advantage that a Mac OS computing environment gives an organization by letting it use new technology to achieve strategic advantage over its competitors in the marketplace.

Taking Advantage of Current Technologies

According to the GISTICS study, Mac OS media professionals work with more software tools – an average of 14.3 tools per user – than Windows media professionals, who work with 8.3 tools per user. [Source 1.]

FIGURE 20. Mac OS users work with more software tools.



Statistics from the Software Publishers Association (SPA) support this finding. According to the SPA, Mac OS users buy twice as much software as Windows users. [Source 8.] This revealing statistic is *not* for media professionals. It is for *all* users of desktop computers.

By working with more tools, Mac OS users can take better advantage of current technologies. They can use the best features of one tool in combination with the best features of other tools. This lets users escape from the vendor-centered “suite” of software tools, which encourages users to stay within the limited capabilities of the suite’s tools and, in so doing, limits users’ creativity.

Adopting New Technologies

To take advantage of new technologies, users must explore new software tools. To quickly become productive using new tools, users need:

- Computer hardware that supports the full range of software and peripherals within an operating environment
- An operating environment that enables tools to exchange information
- Software that provides consistency across applications

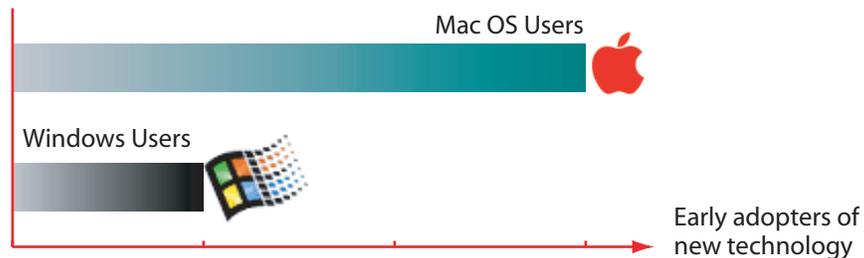
Adopting new technologies quickly provides a major financial benefit. The GISTICS study found that the users of a technology whose incomes are in the top 10% upgrade their computers almost twice as fast as the other 90%.

The GISTICS study also found that Mac OS users are much more likely to adopt new technologies than their Windows colleagues.

“As a percentage of all users by platform, Mac users have 3.1 times more early adopters than the Windows sector. Their increased appetite for and pursuit of productivity gains translate into a significant productivity advantage over Windows users.”

Figure 21 shows this thought-provoking finding graphically.

FIGURE 21. Mac OS users are early adopters of new technologies.



Not surprisingly, the GISTICS study found that Mac OS users spend more time learning about new software applications, investigating the latest peripherals, and experimenting with enhanced work flow and studio management practices – in short, they spend more time staying on top of new technology.

The Windows operating environments raise significant barriers to adopting new technologies. The GISTICS study drives home this point, too.

“Windows users pay high penalties for experimentation – learning new applications and exploring new system configurations. In such environments, Windows platforms require several hours, if not days, to rectify a system fault caused when installing or de-installing new software or hardware.”

Early Adopters: Mac OS Users on the Internet

A very prominent example of new technology is the Internet. For a long time, Mac OS users have had a large impact on the Internet. In 1995, when Mac OS users accounted for 8.5% of all personal computer users, those same Mac OS users accounted for 19% of all Internet users. The remaining 81% of Internet users included both Unix workstation and Windows users.

[Source 11.] A Mac OS user was 2.5 times more likely to use the Internet than a Windows user.

Among users creating content for the Internet, the Mac OS presence is even greater. According to *Web Week* magazine (volume 2, issue 15, 1996):

“The Macintosh is the number one platform for World Wide Web authoring with 64% market share among U.S.-based professional Web-site design firms.”

Mac OS: Technology for Profitability and Future Success

The impact of a desktop computing platform extends far beyond the initial cost of the hardware and software.

As this business case has shown, a desktop computing platform influences:

- A user’s ability to work creatively and productively
- An organization’s ability to maximize its return on investment in both computing equipment and labor

Although the research by GISTICS on three-year return on investment is compelling (see [page 12](#)), a desktop computing platform’s influence extends beyond the immediate return on investment in hardware and software.

Because Mac OS users spend more time learning new software tools (see [page 42](#)) and less time on training, support, and maintenance (see [page 16](#)), they are better able to explore new ideas. By exploring new ideas and learning from them, Mac OS users are better able to innovate – to make the changes necessary to ensure productive and profitable work in the future.

Through their employees’ innovations, organizations are better able to take strategic advantage of new technologies to achieve critical goals in a dynamic and highly competitive marketplace.

In short, Mac OS increases an organization’s chance of long-term success while it helps the organization’s most creative employees realize their full potential.

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