Apple**Directions**

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APPLE NEWS

Gil Amelio Resigns; Jobs Assumes Expanded Role

We received word of significant changes to Apple's Board of Directors and a new partnership with Microsoft after we went to press. For specific details on the announcements, please see **http://product.info.apple.com/pr/ press.releases/1997/q4/970806. pr.rel.board.html** *or* **http://product.info. apple.com/pr/press.releases/1997/q4/ 970806.pr.rel.microsoft.html.** *To hear Steve Job's opening keynote address at Macworld Expo/Boston in RealAudio, please see* **http://www.apple.com/home/news/ macworld97/keynote.html.**

—The Editors

On July 16, Apple announced that Dr. Gilbert F. Amelio had resigned as chairman of the board and chief executive officer and that another top executive, Ellen Hancock, executive vice president of Technology, would also be leaving the company. Apple cofounder and strategic advisor Steve Jobs will assume an expanded role as a key advisor to Apple's board and executive management team.

Amelio is Apple's third chief executive to resign in four years. Formerly chairman, president, and chief executive officer of National Semiconductor Corporation, Amelio joined Apple's board of directors in November 1994. On February 2, 1996, Amelio succeeded Michael Spindler as chief executive officer. During his 18 months as Apple's chief executive officer, Amelio led Apple's efforts during a

STRATEGY MOSAIC

Sequoia— Mass Storage for Tomorrow and Beyond

By Gregg Williams,
Apple Directions *staff*

Any way you look at it, the Hierarchical File System (HFS) in use on Mac OS–based computers today has had a long and fruitful life. Designed 12 years ago (which is like *centuries* in the fast-lane life of personal computers), HFS is now being used to manage 2 GB hard disks—which are more than 100 times larger than the 20 MB hard drives for which HFS was originally designed—and it manages quite nicely, thank you!

Still, today's volume formats—including HFS and the FAT32 format used on computers that run Windows—are showing their age. Chances are, if you have a 2 GB HFS volume that's full (*volume* meaning a portion of a storage device that is formatted to contain files), roughly a third of the volume is wasted space. This is largely because each small file on that volume—including short documents, fonts, alias files, and so on—takes up at least 32K of storage, whether it needs it or not! In addition, Mac OS–based computers are being used today in ways that approach HFS's limits in terms of file size (multimedia and digital editing, for example) and the maximum number of files per volume (file servers and other solutions that require the storage of large numbers of files). And if HFS's limitations are being approached today, then—gulp!—what about tomorrow?

Fortunately, Apple engineers have been tracking this situation and have a solution: a

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Sequoia

new volume format, code-named *Sequoia,* that will solve the immediate problems of HFS and give the users of both Mac OS- and Rhapsody-based computers a volume format that is more than ready to meet the challenges ahead.

This article describes how Sequoia is an improvement over HFS and explains how it will be delivered to customers and developers. If the software you've developed interacts heavily with the file system, be sure to read the "What You Can Do Now" section on page 4—you'll want to update your software by the time Sequoia becomes available.

Addressing the Limits of HFS
As I mentioned earlier, the HFS volume format has led a long and useful life, but it's beginning to show its age. The sections that follow show the most important limitations of HFS and describe how the Sequoia volume format will overcome them. For a quick comparison of the two volume formats, see "A Comparison of the HFS and Sequoia Volume Formats" on page 4.

Reducing Wasted Disk Space
To understand why large HFS volumes waste so much space, you need to know only one fact: *Regardless of how small they are, files stored on HFS volumes take up at least a fixed amount that is proportional to the volume's size, and that fixed amount is too large for the volumes commonly in use today.* Under HFS (and its predecessor, MFS, or Macintosh File System), a volume is divided into (at most) 65,536 equal storage areas, called *allocation blocks.* Each file you put on disk uses at least one allocation block, and more blocks as the file gets larger. (Applications and some documents use at least *two* blocks, one for the data fork and one for the resource fork.) More important, if a file doesn't entirely fill an allocation block, the unused portion can't be used elsewhere.

When HFS was first invented, the amount of wasted disk space was so small it didn't matter—remember, HFS was first used on 800K floppy disks—but the amount of waste increased as hard disks got bigger. Today, a one-character text file takes up 8K on a 500 MB hard disk, 16K on a 1 GB disk, 32K on a 2 GB disk, and so on. Worse yet, once you get to a certain disk size—around 4 GB for most users—you can double the size of your hard disk and not be able to store that many more disk files! (The reason for this is that the larger disk has allocation blocks that are twice as big and the amount of disk space wasted almost equals the increase in the volume's size.)

The solution that many people use today—partitioning a hard disk into multiple, smaller logical volumes—is inconvenient now and will become more so as larger hard disks become available. Sequoia will provide a much better solution by allowing a volume to have a higher maximum number of allocation blocks (up to 4.29 billion, as opposed to 65,536 for HFS). This means allocation block sizes will be much smaller, resulting in less wasted space and the ability to move to larger volume sizes without wasting significant amounts of storage.

How much smaller? It depends. The factors of average file size, volume size, allocation block size, volume usage efficiency, and file access time are interrelated. For example, if you have too many blocks on a volume, you waste less space, but disk access is slow; also, if your files are very large, then smaller blocks save little space. Because of these variables, setting the block size is more of an art than a science.

With Sequoia, the creator of a disk-formatting utility (that is, Apple or a third-party developer) is able to set the allocation block size. The formatting routines built into the Sequoia-based Mac OS will set the block size based on the volume size, with block sizes ranging from 0.5K for volumes up to 256 MB, 1K for volumes between 256 MB and 512 MB, 2K for volumes between 512 MB and 1 GB, and 4K for volumes over 1 GB. (Apple may change the final numbers, but you get the

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idea.) Third-party developers may, of course, offer utilities that give customers more choices or make more sophisticated decisions about selecting a volume's block size.

Increasing Disk Limits

Multimedia, the Internet, and other common arenas for computer use are also straining the limits of HFS. The largest file that HFS can handle is 2 GB, a limit that is being pushed by such tasks as digital video editing, which already generates multimegabyte movie files. In addition, the maximum number of files that HFS can store on a single volume is substantially fewer than 65,536 (the maximum number of blocks on an HFS volume). The Sequoia volume format relaxes these limits to numbers that will be sufficient for the foreseeable future, allowing the creation of files larger than 2 GB and a theoretical maximum of over two billion files, although customers and developers will not immediately have access to these features. (See "Sequoia Timetable for Mac OS," on page 4, for details.)

Filename Improvements

When MFS was invented, the world was used to filenames like BULPATPR.TXT—the classic "eight-dot-three" names of MS-DOS. The ability to have filenames like "bulletin for Pat's party, v1.1" (long names with spaces and punctuation in them!) was, at the time, revolutionary. Now the current market demands more, which is where Sequoia enters the picture.

One problem is that, in the arena of filenames, the competition has temporarily trumped Apple. Both Windows 95 and Windows NT allow filenames of up to 255 characters. Java™ software stores its classes by their filenames, and Java class names can easily exceed 31 characters. For these and other reasons, the Sequoia volume format will support filenames of up to 255 characters.

To be wholly accurate, I should say that Sequoia will support filenames of up to 255 *Unicode* characters, and there are several reasons for that, including support for Java (which allows filenames to be Unicode strings) and non-Roman filenames.

There's a little history behind the reason for Sequoia using Unicode to provide international filename support. Because MFS was designed when computers were used primarily in the United States and Europe, filenames were based on the Roman alphabet. In addition, the operating system's filename

comparison routine doesn't distinguish between uppercase and lowercase characters. This is rarely an issue in English and other Roman scripts, but it can cause problems in non-Roman scripts. For example, Japanese and Chinese words are stored as the equivalent of two Roman characters. This leads to numerous situations where the HFS file comparison routine interprets four *different* words as being identical, which increases the probability that two different filenames will mistakenly be considered identical.

Another problem with HFS is that it stores filenames as a string of bytes that is encoded by a given script system (for example, Japanese). If that filename is then read by a Mac OS computer running a different script system (say, English), it will be interpreted and displayed by that script system, perhaps in a different way. This can lead to filenames that look like gibberish and sort unpredictably compared to filenames that were stored using the currently active script.

In Sequoia, these problems go away. By storing filenames in Unicode, which accurately represents characters and ideograms in most of the major languages of the world, Sequoia filenames can be in any Unicode-supported language, and software can easily and accurately compare filenames. In addition, since every character in every language supported by Unicode has a specific numeric value, Unicode filenames in different languages will sort in a reasonable manner.

Sequoia and Rhapsody

Sequoia will be the preferred volume format for Rhapsody (which will be able to read and write HFS volumes but not boot from them). HFS will continue to be supported on both the Mac OS and Rhapsody for floppy disks, other volumes under 2 MB, and CD-ROMs, but Apple expects users of both operating systems to migrate to Sequoia.

Sequoia contains a number of features that the Rhapsody operating system requires, including efficient support for large volumes and a large number of files per volume, and great international support. A number of markets in which Rhapsody will play a part—including publishing, new media (multimedia), Internet, and web authoring—will benefit from these Sequoia features. In addition, Sequoia contains features added expressly to meet Rhapsody's needs, including file-system enhancements needed to support a

UNIX®-based operating system. (Rhapsody is based on a Mach microkernel integrated into BSD 4.4 UNIX.)

As for availability, Apple expects to deliver the Sequoia volume format for Rhapsody with the Unified Release (due in mid-1998).

Planning for Expansion in Sequoia

Support for *metadata,* descriptive information about a file that is not part of the file itself, is an important addition to the Sequoia volume format. As Apple engineers create new file-related technologies, they often need to store metadata for a file or folder (for example, information on who is allowed to access a folder's contents). Under HFS, Apple engineers were often forced to store metadata separate from the file itself, an inelegant solution that occasionally led to synchronization problems between a file and its metadata.

Apple engineers designed Sequoia to be more easily extensible by adding an attribute file to each Sequoia volume for storing metadata. The software that accesses Sequoia volumes is written so that a file's metadata automatically stays with the file when it is moved, renamed, or deleted.

Solving a Compatibility Issue

If a computer running a pre-Sequoia version of the Mac OS were to try to mount a pure Sequoia volume (for example, a removable cartridge), it would incorrectly interpret the volume as unreadable. Since this would lead to an unacceptable user experience ("Oh no— all my data's gone!"), Apple devised a way to prevent this.

Apple's solution is to have the Mac OS's built-in formatting software create a special HFS "wrapper" volume when the user asks it to format a volume in the Sequoia format. This HFS-wrapped Sequoia volume is a true HFS volume that contains two things: a Sequoia volume (which takes up most of the volume's capacity), and an automatically created Read Me text document that explains what software the user must install to access the Sequoia volume's data. This solution will lead to an acceptable user experience for the user of a pre-Sequoia version of the Mac OS: The user will mount the volume and be presented with instructions on how to access the volume's full content. If Sequoia support is present, system software ignores the wrapper and shows the user the Sequoia volume.

A Comparison of the HFS and Sequoia Volume Formats

	HFS	Sequoia
Efficiency of data storage	Progressively inefficient as size of volume increases (because of maximum of 65,536 allocation blocks per volume)	Much more efficient because higher number of allocation blocks per volume (4,294,967,296) allows use of smaller allocation block size
Maximum file size	2 GB (2^{31} bytes)	1.84×10^{19} bytes (2^{64} bytes—over 8.5 billion times larger than HFS file size)
Maximum number of files per volume	Substantially fewer than 65,536	Theoretically, up to the number of allocation blocks (4,294,967,296); easily accommodates millions of files
Filename comparisons	Inaccurate with multiple or non-Roman scripts (such as Arabic, Hebrew, Japanese)	Accurate because Unicode-based filenames can be compared exactly
Filename length	31 characters (Roman)	255 characters (Unicode)
Metadata	Must be stored outside the file	Can be stored with the file

The first Sequoia release for Mac OS will allow customers to create HFS volumes and HFS-wrapped Sequoia volumes only. As Sequoia becomes more established and customers are more aware of Sequoia volumes, a later release of the Mac OS may allow customers to create "pure" Sequoia volumes as well.

Sequoia Timetable for Mac OS

To address the needs of customers who must use large volumes efficiently and a large number of files per volume, Apple is making the Sequoia volume format available to customers as soon as possible. However, all of the benefits of this new volume format will not be available immediately. The following paragraphs describe when these benefits will be available.

Apple recently distributed its first developer version of Sequoia for the Mac OS. It is available to any member of the Macintosh Developer Program or the Apple Media Program (AMP) who has signed the nondisclosure form needed to join the Apple Technology Seeding Program. If you're already a member of the seeding program, you have received instructions on how to retrieve the Sequoia seed; if you're not, go to http://devworld.apple .com/seeding/software_seeding_FAQ.html for details on joining.

Soon, Apple plans to release an update for Mac OS 8 that will include support for Sequoia

volumes. Customers using this updated version of system software will be able to format hard disks as either HFS or HFS-wrappered Sequoia volumes; by using the Sequoia volume format, they will be able to put more than 32,000 files on a volume and use the space on large volumes more efficiently.

Now and in the immediate future, you will continue to use the current File Manager routines to manipulate the file system, and your products will access both HFS and Sequoia volumes correctly without any extra work on your part. Following the release of the Sequoia-enabled version of Mac OS 8, Apple plans to release a new API (application programming interface) to allow the creation of files greater than 2 GB. Apple is also investigating support for developer access to metadata and 255-character Unicode filenames.

What You Can Do Now

If your application interacts with files only through the standard file input and output routines (StandardGetFile, StandardPutFile, and related routines), you probably won't have any incompatibilities with Sequoia. However, if your application interacts with the file system more directly, you should definitely download the developer release of Sequoia (for details, see "Sequoia Timetable for Mac OS" on this page), read the docu-

mentation, install the Sequoia software, test your software, and give Apple your feedback. If your software needs to be updated to work correctly with Sequoia volumes, you should be prepared to release updates or new versions of your products.

Obviously, if you sell software that interacts heavily with the file system—including backup, repair, compression, and other utility programs—you will need to update it to support Sequoia volumes. However, even if this is not the case, the existence of Sequoia may invalidate some assumptions your software makes. Here are three situations that may force you to update your software:

• Your software uses certain file-related undocumented low-memory globals and vectors.

• Your software assumes anything about the format of a volume (for example, the allocation block size, the number of blocks in a volume, or the maximum block size of a file).

• Your software assumes that a non-HFS volume must be an MFS volume (as some older products still do).

You should also subscribe to Apple Developer News (a weekly e-mail newsletter from Apple) to get the latest information on Sequoia and other developer-related subjects. To do so, send an e-mail message to requests@thing1.

info.apple.com; in the body of the message, type the string "subscribe adirections".

Conclusions

The Sequoia volume format is the future of mass storage on Apple's platforms. Though it will not replace the HFS volume format, which is still needed on both platforms, Sequoia will increasingly become the predominant volume format.

Although most of Sequoia's benefits will be immediately available under Rhapsody, some Sequoia benefits will not be available at first on the Mac OS platform. The first release of Sequoia will enable Mac OS customers to put more files on a volume and more efficiently use large hard disks—especially those over 2 GB.

All in all, Sequoia is good news for anyone who uses a lot of disk storage—or creates software that does. It enables Apple's development platforms—Mac OS and Rhapsody—to provide a strong foundation for the hard disks and software solutions that customers will demand in the years to come. ♣

APPLE NEWS

Amelio Resigns

difficult time for the company and guided Apple through several important milestones, including the creation of one of the strongest product lineups in the history of the company and the introduction of a new operating system strategy.

Previously, Michael Spindler replaced John Sculley as CEO in 1993. During Spindler's tenure, the company experienced a number of achievements, including the development of Apple's RISC-based technology and the smooth transition of the entire Macintosh product family to the PowerPC microprocessor.

Until a new chief executive is hired to replace Amelio, Fred Anderson, executive vice president and chief financial officer, will assume additional responsibilities for the company's day-to-day operations.

Anderson, 51, assumed his current position at Apple in March 1996, after four years at Automatic Data Processing (ADP), where he was vice president and chief financial officer. In his position at ADP, he oversaw the controller, treasury, internal audit, tax, investor relations, real estate, and facilities functions. He joined ADP in August of 1992 when the company reported revenues of $1.9 billion. ADP now has annual revenues in excess of $3 billion.

In addition to Fred Anderson, Apple's current executive management team includes
• Guerrino De Luca—executive vice president, Marketing
• Dave Manovich—executive vice president, Worldwide Sales and Service
• Jack Douglas—senior vice president, general counsel, and secretary
• Jim McCluney—senior vice president, Operations

• Jon Rubinstein—senior vice president, Hardware Engineering
• Avie Tevanian—senior vice president, Software Engineering

Apple has selected Heidrick & Struggles, a global executive search firm that specializes in CEO assignments, to direct the search.

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Apple Reports Third Fiscal Quarter Results

Apple announced financial results for its fiscal 1997 third quarter, which ended June 27, 1997. Revenues for the quarter were $1.7 billion, compared to $1.6 billion in the quarter that ended March 28, 1997, and $2.2 billion in the quarter that ended June 28, 1996. International sales accounted for 53 percent of total revenues in the current quarter.

Gross margins for the quarter were 20.0 percent, compared to 18.9 percent in the March quarter and 18.5 percent in the year-ago quarter.

Apple recorded a net loss for the quarter of $56 million, or $(.44) per share, compared to a net loss of $708 million, or $(5.64) per share, in the March quarter and a net loss of $32 million, or $(.26) per share, in the year-ago quarter. The loss from operations was $60 million, representing a significant sequential improvement from the loss from operations of $186 million—excluding charges for restructuring and the write-off of in-process research and development—for the March quarter. Apple's loss from operations in the year-ago quarter was $116 million.

Operating expenses for the current quarter were $408 million, down $81 million from

the March quarter—excluding charges for restructuring and the write-off of in-process research and development—and down $111 million from the year-ago quarter.

"The company continues to progress with its restructuring initiatives, as is evidenced by the significant sequential decrease in operating expenses," said Apple CFO Fred Anderson. "As anticipated, we experienced sequential revenue growth, largely on the strength of our high-end Macintosh products and robust education market sales.

"Our financial goals are to continue to reduce operating expenses and to return the company to profitability," said Anderson. "Though we do not expect to return to profitability in our fourth fiscal quarter, Apple's management team is focused sharply on that objective. We are encouraged by our customers' and developers' positive responses to our product lineup and operating system roadmap. We eagerly await the expected launch of Mac OS 8 later this month, which we believe will provide our customers with a significantly improved user experience, enhanced performance and stability, and outstanding multimedia and Internet integration."

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Rave Reviews for Mac OS 8

Early opinions are in and it's thumbs-up for Mac OS 8. Industry press response to Mac OS 8—Apple's major system software upgrade—has been extremely positive. Mac OS 8 "offers plenty to cheer about," wrote Franklin Tessler in *Macworld* magazine.

According to Don Crabb, *MacWEEK* columnist, "Mac OS 8 promises to be the most reli-

able Mac OS since version 2.0 that shipped about a million years ago (in computer years). I've been using the prereleased version since the first alpha version was distributed to a few developers back in January. And frankly, it's been more reliable—even in alpha form—than any Mac OS I've used in years."

Henry Bortman echoed the same thoughts in *MacUser.* "The unthinkable is about to occur: Apple is about to deliver two major Mac OS releases—on schedule—within six months," he wrote. "As promised, Apple shipped Mac OS 7.6 in January 1997, and—also as promised—in July 1997, it will ship Mac OS 8. . . . This new release is chock-full of goodies. And it's stable: The beta version of Mac OS 8 we tested crashed less frequently than the release version of Mac OS 7.6."

For Alan Stafford in *Mac Home Review,* the Mac OS's number-one change was its "looks," and he added, "That's better than it sounds, however, as the way the Finder (the Mac's basic desktop) works is predicated on its graphical appearance. Apple has revamped the Finder substantially, giving it a slick new appearance and a number of new features that could prove to be very convenient in your everyday work."

In another article, this time for the *Chicago Sun-Times,* Don Crabb wrote, "Mac OS 8 has a multithreaded native Finder. That means its user interface application, the Finder, is much faster and much less prone to crashing than any previous version, especially when running on a Power Macintosh or Power Mac clone. In my tests, Mac OS 8 is near–rock solid. I had nearly none of the usual system crashes I have come to expect from both my Mac and Windows PC these days. The multithreaded part means you can launch simultaneous Finder tasks, such as multiple file copying, and they all run very quickly."

Sporting a dramatically improved user experience and the most complete and easy-to-use Internet services, Mac OS 8 is faster, more efficient, friendlier, and more capable than any Macintosh operating system in history.

In the United States, Mac OS 8 shipped on schedule in late July 1997. It will run on any 68040 or PowerPC processor–based Mac OS computer that has 12 or more megabytes of physical memory.

For more information on Mac OS 8, see Apple's Mac OS web site at http://www.macos .apple.com/macos8/.

You can read the early press reviews at the following web sites:

• Herb Bethoney, "Apple Gilds the Mac OS Lily," *PC Week*—http://www8.zdnet.com/ pcweek/reviews/0616/16macos.html

• Don Crabb, "Mac Operating System Demonstrates Maturity," *Chicago Sun-Times,* July 10, 1997—http://www.suntimes.com/ output/crabb/crabb15.htm

• Alan Stafford, "Beta Report: 8 IS GREAT," *Mac Home Review*—http://www.machome .com/Features/MacOS8.html

• Henry Bortman, "Apple Picks Up the Tempo," *MacUser*—http://www4.zdnet.com/ macuser/mu_0897/firstlook/apple.html

• Franklin N. Tessler, "Mac OS 8 Preview," *Macworld*—http://www.macworld.com/ features/macos8.preview.html

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AppleScript and Apple Events to Be Included in Yellow Box

Loyal AppleScript and Apple events fans will be happy to hear that Apple will incorporate these technologies into the Rhapsody operating system. Both technologies will be built into Rhapsody's Yellow Box, the object-oriented environment for developing cross-platform applications.

AppleScript Product Manager Sal Soghoian added, "AppleScript and Apple events are here to stay. They are being integrated fully into the Yellow Box. Right now we're working on the core Apple event structure and related issues. Our plans for the AppleScript scripting language are to keep the Yellow Box implementation as close to the current version as possible, in both syntax and functionality. Naturally, given the difference in operating system structures, some changes and adaptations may occur—but we'll work to make the transition as smooth as possible."

For more details, see Clifford Colby's article in the June 12 edition of MacWEEK News at http://www8.zdnet.com/macweek/mw_1124/ nw_script.html.

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MacHack '97 Developer Issues Posted

At the twelfth annual MacHack developer conference, attendees sifted through 51 issues to come up with the following list of top ten concerns and hopes for Apple and its technologies. For more information, you can visit the MacHack web page at http://www.machack .com/TopIssues/index.html.

MacHack: 1997 Top Issues List

1. *Ensure that the Mac user experience has a high degree of polish.* Don't lose sight of the importance of a very high level of polish and attention to detail in the Mac user experience.

2. *Fight efforts to regulate cryptography.* Take a public stand against all efforts to regulate data encryption.

3. *Improve the Apple Developer World web site.* Make DevWorld fast, reliable, complete, and easy to use—a model for the industry.

4. *Incorporate cryptography into Apple's operating systems.*

5. *Fold Open Transport–style capabilities into Rhapsody networking.* Deliver Open Transport–level user experience in Rhapsody networking and communications (dynamic switching of protocol stacks, and so on).

6. *Organize developer documentation and bring it up-to-date.* Keep developer documentation constantly up-to-date, well organized, and accessible.

7a. *Distribute more sample code for new technologies.*

7b. *Revive and invest in Mac OS developer tools.* Invest in Mac OS developer tools (MPW, MacApp, MacsBug).

8. *[Editor's note: Item 8 was eliminated because there was a tie for seventh place.]*

9. *Offer an affordable academic/developer hobby program.*

10a. *Make the Mac the preferred Java development platform.*

10b. Tune the Mac OS to take full advantage of PowerPC performance.

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Apple's Ultra-Light PowerBook 2400c to Ship With Mac OS 8

Apple recently announced that the PowerBook 2400c will ship in August with Mac OS 8 preinstalled on the system. This announcement, which represents a slight delay in the U.S. availability of the PowerBook 2400c, was based on input from a majority of PowerBook customers who indicated they would prefer to purchase the new computer with the latest operating system release. The PowerBook 2400c was originally scheduled to be released in the United States at the end of July with Mac OS 7.6.

The high-end PCI-based PowerBook 2400c, which has been shipping since May in Japan, was designed by Apple with collaboration from IBM Japan as part of an OEM (original equipment manufacturer) agreement and is exceeding all initial expectations in that market. The PowerBook 2400c targets mobile professionals who require a lightweight yet powerful portable computing solution.

The PowerBook 2400c will be available in one configuration: with a 180-MHz 603e processor, 256K level 2 cache, 16 MB of RAM, 1.3 GB IDE hard drive, 10.4-inch active-matrix diagonal color display, two PC Card slots, built-in 16-bit stereo sound recording and playback, and built-in ports for 16-bit video output, ADB, SCSI, serial, and FDD connectors. The computer comes with an external floppy disk drive and a lithium-ion battery for longer use. The Power-Book 2400c measures 10.5 by 8.4 by 1.9 inches, and it weighs just 4.4 pounds.

In addition to the preinstalled Mac OS 8 operating system, the PowerBook 2400c comes configured with a variety of productivity, communication, and compatibility software. This software includes ClarisWorks productivity applications, Apple Remote Access for easy connection to a desktop or network from a remote location, and Apple Location Manager. All of this preinstalled software will also be available with the PowerBook 2400c on CD-ROM.

The PowerBook 2400c is expected to be available in the United States by mid-August for an estimated retail price of U.S. $3,500.

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CA and Apple to Integrate Next-Generation Object-Oriented Multimedia Solutions

Apple and Computer Associates International (CA) recently announced plans to integrate CA's Jasmine object database and multimedia authoring environment with Apple's Yellow Box, a key component of Rhapsody.

Jasmine combines a pure object database with a powerful multimedia development system. It supports all the features that give object-oriented databases their power, such as inheritance, instance-level and class-level properties, instance methods, and class methods. Jasmine class libraries fully manage multimedia data, including graphics, animation, audio, and full-motion video. An SQL class library permits Jasmine to access and update legacy data.

CA and Apple plan to work together to make Yellow Box interact with the Jasmine environment, simplifying the process of building cross-platform, object-oriented applications. Corporate developers could then use Rhapsody to construct Jasmine applications that could be deployed on a variety of computing platforms, including Mac OS, Windows 95, Windows NT, and UNIX, as well as Rhapsody.

Both Jasmine and Yellow Box support 100% Pure Java applications using the standard libraries that run on any Java Virtual Machine. Together, the two products will provide even more comprehensive solutions for constructing the next generation of object-based multimedia applications. "While CA offers pure object solutions, and a full spectrum of mission-critical infrastructure software, Apple brings leadership in object technologies, personal computing, and next-generation operating systems," said CA chairman and CEO Charles B. Wang. "Corporate developers depend on a variety of products, particularly in this new era of Internet application development. Yellow Box offers these developers additional choices and unique technologies such as QuickTime and WebObjects for sophisticated multimedia and Internet application development."

Yellow Box developers will benefit from the comprehensive object-oriented environment and database capabilities of Jasmine, along with its scalable, mission-critical deployment characteristics. The native support for multimedia objects for Jasmine—such as video, audio, pictures, and text—make it the ideal platform for tomorrow's applications.

Jasmine developers will benefit from many of the technologies that continue to give Apple an edge in the computer industry, such as QuickTime. Developers could also leverage the tremendous depth of experience and industry leadership Apple exhibits in the areas of graphics development, PostScript™ imaging, virtual reality, and color-matching technology. "The Macintosh has long been recognized as a premiere multimedia authoring environment," Wang said. "With its recent acquisition of NeXT Software, Apple is poised to take a leadership role in the next generation of object-oriented computing. The Jasmine–Yellow Box integration will allow Macintosh developers to use Apple's advanced Rhapsody computing platform to construct Jasmine applications for a variety of computers, operating systems, and problem domains."

For more information on CA, visit its web site at http://www.cai.com.

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CA and Apple to Enable System Management Through Unicenter TNG

Computer Associates International (CA) and Apple announced that they are working together to enable enterprises to manage Apple systems—including Mac OS and Rhapsody—using CA's Unicenter TNG management solution. For the first time, users will be able to manage their entire information technology (IT) infrastructure from Mac OS desktops using Unicenter TNG's Java-based web browser interface.

Unicenter TNG is a fully integrated solution that enables organizations to manage all IT resources, encompassing heterogeneous networks, systems, applications, and databases. It provides comprehensive end-to-end enterprise management for TCP/IP, SNA, IPX/SPX, and DECnet networks and for 40 platforms, including desktops, Windows NT, UNIX, AS/400, NetWare, and mainframe environments.

CA will enable Unicenter TNG to monitor the same parameters on Mac OS systems as it does on other platforms, including processor and memory utilization, file and disk usage, and drive failures. Apple supports CA's Unicenter TNG object model for IT resource management. Apple expects Rhapsody to provide customers with an environment that delivers industrial-strength performance, stability, and new classes of software for computing into the next century, while preserving customer investment in hardware and software. Customers in markets such as print publishing, multimedia, Internet/intranet web authoring, corporate application development, and higher education and engineering/scientific will quickly benefit from the advantages of moving to the Rhapsody platform.

For more information on CA, visit its web site at http://www.cai.com.

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Apple Boosts Performance of Popular PowerBook 1400 Computers

Apple recently announced performance improvements to its PowerBook 1400 series of notebook computers, including processors that will range from a dual-scan display version of the 133-MHz to a higher performance model with a 166-MHz PowerPC 603e processor, larger internal hard drives, and faster CD-ROM drives.

PowerBook 1400 Series
The new PowerBook 1400 series offers three different configurations. At the high end, Apple is offering a 166-MHz model with an active-matrix display. A 133-MHz, active-matrix model is now offered as the midrange configuration, and the performance of the PowerBook 1400

New PowerBook 1400 Configurations: Estimated Retail Prices

	PowerBook 1400cs/133	PowerBook 1400c/133	PowerBook 1400c/166
Estimated U.S. price	$2,500	$3,000	$3,500
Processor	133 MHz	133 MHz	166 MHz
RAM	16 MB	16 MB	16 MB
Hard drive	1.3 GB	1.3 GB	2.0 GB
1.4 MB floppy disk drive	Yes	Yes	Yes
Color display	Dual-scan	Active-matrix	Active-matrix
CD-ROM	8x	8x	8x
Level 2 cache	128K	128K	128K

Prices are U.S. estimates only. Prices and availability of the systems may vary among resellers and by country.

entry-level model has been boosted from 117 MHz to 133 MHz and includes a dual-scan display. All configurations in the PowerBook 1400 series use the PowerPC 603e processor. In addition to higher performance, the improved PowerBook 1400 series offers larger hard disks—ranging from 1.3 GB to 2 GB (up from 750 MB and 1 GB, respectively)—and 8x-speed CD-ROM drives. All configurations of the PowerBook 1400 now offer a 128K level 2 cache.

PowerBook 1400 Features
The PowerBook 1400 series features 16 MB of memory, two PC Card slots, and 16-bit stereo sound with a built-in speaker. The PowerBook 1400 series also comes with built-in infrared technology for easy, wireless file sharing with similarly equipped systems. A versatile expansion bay on the PowerBook 1400 provides a variety of storage options available from Apple or third-party vendors, including a floppy drive, CD-ROM drive, additional hard drive, magneto-optical drive, and Iomega Zip drive. A flip-up keyboard provides quick and easy access to two different types of expansion slots on the logic board, allowing you to easily customize the system according to your individual needs: A memory expansion slot on the logic board accommodates stackable memory cards, and an internal expansion slot accommodates additional capabilities such as Ethernet networking or support for an external monitor (video-out).

Preinstalled Software
All new PowerBook 1400 models come configured with Mac OS 7.6 or Mac OS 7.6.1 and a variety of productivity, utility, communication, and compatibility software. All preinstalled software is the full retail version and is included with the PowerBook on CD-ROM. This software includes ClarisWorks for word processing, drawing, database, communications, and spreadsheet tasks; Claris Organizer for tracking schedules and contacts; Apple Internet Connection Kit software, including Netscape Navigator™, Claris Emailer Lite, Fetch, NCSA Telnet, and NewsWatcher; Apple Remote Access for easily connecting to a desktop or network from a remote location; and Macintosh Easy Open and DataViz Easy Open translators for reading and writing PC-formatted floppy disks and PC-formatted files.

Also preinstalled is Apple Location Manager, software that makes it easy to move your PowerBook from one location to another without having to spend a lot of time manually reconfiguring your computer. Apple Location Manager allows you to specify settings for capabilities such as networking, printers, time zone, file sharing, sound, frequently used applications, and even extensions. Once a location is set up, you simply select that location and the system recognizes your preferences for that environment.

The enhanced PowerBook 1400 configurations are expected to be available by the time this issue of *Apple Directions* goes to print,

and they'll replace previous PowerBook 1400 configurations. Estimated U.S. retail pricing for the new configurations of the PowerBook 1400 series is shown in the table on page 8.

■ ■ ■

Parametric Technology to Port Pro/REFLEX to Rhapsody

Parametric Technology (PTC), a leading supplier of software tools in the CAD/CAM/CAE industry, recently announced that it has signed a porting agreement with Apple to port the Pro/REFLEX A/E/C object-oriented modeling system to Rhapsody. PTC's decision to port its Pro/REFLEX to Rhapsody marks the first time the software company has developed for an Apple platform. In its press release, PTC said its decision was "based on Apple's market-share strength."

PTC's Pro/REFLEX software is an object-oriented modeling package that provides functionality for fully coordinated project modeling, including 2D drafting, 3D modeling, drawing production, inherent coordination, fully dynamic model movement in all views, element creation, interference or clash detection, and a range of data exchange capabilities.

For more information on PTC, visit its web site at http://www.ptc.com/.

■ ■ ■

Apple and CodeFab Enter WebObjects Training Agreement

Apple and CodeFab—a member of the Apple Enterprise Alliance Program and provider of high-performance interactive web solutions—announced an agreement to deliver training programs on Apple's WebObjects web development platform. As a training provider for WebObjects, CodeFab will create and deliver courses on the WebObjects product line; the company will have training rights in the New York City area and the opportunity to conduct private classes in North America.

In addition to CodeFab, other Apple-certified WebObjects training providers include Agiliti (Minneapolis area) and Tensor (Dallas/Fort Worth area). For information on class schedules and costs, see the WebObjects course schedule (http://enterprise.apple.com/Training/OpenEnroll/Schedule.html).

For more information on CodeFab, visit its web site at http://www.CodeFab.com/.

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Apple Lowers Prices on Power Macintosh and Performa Computers

Apple announced that it has reduced prices to resellers on selected computers in the Power Macintosh 6500 and Macintosh Performa 6400 series. Effective July 12, 1997, this move cuts prices on these popular computers by up to U.S. $300.

Introduced in April 1997, the Power Macintosh 6500 series consists of systems ranging in speeds from 225 to 300 MHz. Each system includes accelerated multimedia features, built-in Internet access capabilities, and advanced video capture, edit, and publishing options.

The Power Macintosh 6500 series matches world-class power with competitive prices. The Power Macintosh 6500 mini-tower systems are equipped with powerful integrated hardware and software components. Each comes with a minimum 256K level 2 cache (512K is standard on the 6500/275 and 6500/300 systems), 32 MB to 64 MB of memory (expandable to 128 MB); a 3 GB or 4 GB hard drive, 16-bit CD-quality stereo sound with SRS surround sound and integrated dual-mode subwoofer, and Iomega Zip drives. The ATI RAGE II graphics acceleration chip provides video and graphics performance previously seen only in high-end systems. The 6500 series features advanced multimedia functionality that includes accelerated QuickTime and QuickTime MPEG, accelerated QuickDraw and QuickDraw 3D, and accelerated video capture.

Other standard features include 2 MB of video memory to support millions of colors on most 17-inch monitors, a built-in 12x-speed CD-ROM drive, a built-in 33.6-Kbps modem for fast "single-click" connectivity to the Internet, and advanced telephony capabilities such as digital voicemail and send/receive fax. Each

system also comes with keyboard, mouse, and high-quality software bundles. Monitors are sold separately.

The Macintosh Performa series combines PowerPC processor technology and affordability and are designed for families at home, individuals in small businesses, and college-bound students. The 6400/200 features the PowerPC 603e RISC processor, with memory expandable to 136 MB and a spacious hard drive for increased storage capacity.

Additionally, the 6400/200 Video Editing Edition adds advanced multimedia features such as video capture, creation, and publishing with the award-winning Avid Cinema video-editing solution. This computer is an excellent choice for users who demand high performance with many built-in capabilities.

For more information on pricing and availability, see the press release at http://product.info.apple.com/pr/press.releases/1997/q4/970712.pr.rel.price.html.

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Apple's Server Solution to Include Tango Enterprise and Butler SQL

EveryWare Development has reached a software distribution agreement with Apple to bundle the intranet application development tool Tango Enterprise, as well as the relational database management system Butler SQL, with the Apple Internet Server Solution (AISS). AISS, which is one of three available software solutions for Apple's Workgroup Server family, addresses the unique demands of the web server market by combining award-winning software from industry-leading Internet developers with Apple's powerful new workgroup servers.

Tango Enterprise is a development tool for creating dynamic web-based applications for the Internet or corporate intranets. Tango's visual development environment allows web developers to rapidly develop and deploy sophisticated web applications that are integrated with databases. Tango Enterprise will integrate two of the most popular Mac OS databases: Claris's FileMaker Pro and EveryWare's Butler SQL. Tango Enterprise will also

work with all other ODBC-compliant databases, including Oracle, Informix, SQL Server, Sybase, Access, and DB2.

More information on AISS is available at http://www.servers.apple.com/papers/inetguide/text/aiss.html. For more information on EveryWare's server products, visit the company's web site at http://www.everyware.com.

■ ■ ■

Newton, Inc. to Upgrade Networking Capabilities

Newton, Inc. recently announced that it's enhancing its network connectivity for Newton-based devices such as the MessagePad 2000 and the eMate 300 with the release of Newton Internet Enabler (NIE) 2.0. NIE 2.0, which includes new Ethernet connectivity capabilities, will enable you to integrate Newton-compatible devices into existing campus and enterprise Local Area Network (LAN) environments.

Newton, Inc. has been working closely with market-leading partners, such as Farallon, a networking expert (see "Newton Selects Farallon as Strategic Networking Partner" on this page), and Proxim, a health-care wireless solutions expert, to provide complete connectivity solutions for users. "As part of our strategic relationship with Newton, Inc., Farallon will be providing Ethernet PC Card support for the eMate and the MessagePad 2000 in conjunction with the introduction of NIE 2.0," said Georganne Benesch, vice president of the LAN division at Farallon.

The added Ethernet capability of NIE 2.0 is also an important development for health-care customers. Working with Proxim, Newton, Inc. now has an extremely cost-effective intranet-based offering for the health-care market. "We are pleased to be working closely with Newton, Inc. as it rolls out this capability to health-care customers," noted Proxim's vice president of Sales and Marketing, Brian Button.

NIE 2.0, which will be available during the third quarter of 1997, will be bundled with

Newton devices. You can also obtain it through the Newton, Inc. web site (http://www.newton.apple.com/product_info/SW/nie/nie.html).

For more details on this announcement, see the complete Newton press release at http://product.info.apple.com/pr/press.releases/1997/q4/970701.pr.rel.newton.html.

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Newton Selects Farallon as Strategic Networking Partner

Newton, Inc., a wholly owned subsidiary of Apple, has announced that Farallon Communications will develop Ethernet PC Card drivers for Newton-based devices such as the eMate 300 and MessagePad 2000. The Ethernet PC Card drivers will be available in conjunction with the September release of Newton Internet Enabler (NIE) 2.0 and will enable users to connect their eMate and MessagePad devices directly to Ethernet networks. Farallon is the only vendor to provide PC Cards that can be used in a Newton-based device, a PowerBook, and a PC Notebook.

More details on Farallon's Ethernet cards are available at http://www.farallon.com.

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Apple Researchers Release New Multi-media Authoring Tool

Apple recently released a free, unsupported prototype of SK8 (pronounced "skate"), a new multimedia authoring tool, as well as SK8's Macintosh Common Lisp source code, for developers who would like to use the tool for product development and prototyping.

Developed in Apple's research laboratories in 1990, SK8 has been used in conducting advanced research on authoring tools and their use, as well as for prototyping new ideas

and products. SK8 is designed to facilitate rapid prototyping, support cross-platform development, and provide output to multiple run-time environments, including Java. SK8 can be used to create rich media tools and titles simply and quickly. It features a fully dynamic prototype-based object system, an English-like scripting language, a general-purpose graphics system, and a full-featured development interface.

SK8 technology has been seeded to more than 100 sites for evaluation purposes. It has been used for prototyping and developing a wide range of applications, including Cocoa, Apple's multimedia authoring tool for children. You can download this software and its documentation at http://sk8.research.apple.com/sk8/sk8.html.

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Apple Agrees to Java-Centered Mobile Computer Specification

The IDG News Service recently reported that "nearly a dozen vendors have agreed on a set of standards for mobile network computers, a definition that will encompass devices ranging from smart cell phones to handheld computers."

Apple, Fujitsu, Hitachi, IBM, Mitsubishi, Netscape Communications, Nokia Mobile Phones, Oracle, Sun Microsystems, Toshiba, Digital Equipment Corporation, Matsushita, Psion, and NEC are among the companies endorsing the specification. This "Mobile NC Specification," which relies on the Java programming language, includes standards for Smartcards, the Open Card Framework, teleconferencing, network attachments, and various peripheral attachments. You can find the entire list of specifications at http://www.internet.ibm.com/computers/networkstation/os/open.html. ♣

CD HIGHLIGHTS

Reference Library Edition, September 1997

This month we've rebuilt the Utilities folder. Updates to the folder include Disinfectant 3.7.1, Disk Copy 6.1.3, Drive Setup 1.3, HyperCard Player 2.3.5, HyperCard Update 2.3.6 (including the HyperCard stack for Mac OS 8), and Macintosh CD-ROM Setup 5.3.2.

In addition to the Utilities updates, we've included Windows versions of QuickDraw 3D 1.5.2 and QuickTake (DOS 1.4 MB format), the July and August editions of *Apple Directions,* and the following new and revised files for September.

Enhanced Macintosh PowerBook 1400 Developer Note

This folder features a developer note for the latest model of the PowerBook 1400 computer, a faster version of the previous PowerBook 1400. This developer note compares the new model with its earlier counterparts, describing only the changes and new features.

The latest PowerBook 1400 model includes the following changes: higher processor speed, a built-in second-level (L2) cache, a larger internal disk, a faster built-in CD-ROM drive, an upgraded system ROM to support the 166-MHz clock speed, and version 7.6.1 of the Mac OS.

GXGraphics 1.1.6

The GXGraphics 1.1.6 extension encompasses the QuickDraw GX graphics and line-layout capabilities without QuickDraw GX printing. The new 1.1.6 extension replaces the older 1.1.3 version and fixes minor "cosmetic" bugs.

Instrumentation SDK 1.0.5

The Instrumentation SDK 1.0.5 is a powerful tool for "instrumenting" your code for performance analysis. By adding extra code to your program, you can use this software development kit to gather information about how your program executes—including how many times routines are called, what other routines are called, and how much time routines take to execute.

Interfaces & Libraries

This package contains the most recent released versions of interfaces and libraries for Mac OS development. The folder contains AIncludes, AStructMacs, CIncludes, PInterfaces, RIncludes, Runtime Libraries for Power Macintosh, libraries and interfaces required to run MPW and CFM-68K Additions, and Libraries and Debugging Libraries, as well as other development-related files.

Load PCI Driver

The Load PCI Driver utility allows PCI driver writers to load and unload 'ndrv' resources without having to restart.

TradDriverLoaderLib 1.0b5

This package contains a number of routines that are helpful in installing traditional Mac OS device drivers (of type 'DRVR'). TradDriverLoaderLib mimics the API (application programming interface) of the PCI DriverLoaderLib library as much as possible, which makes TradDriverLoaderLib easier to use in an environment supporting both PCI native drivers (of type 'ndrv') and traditional Mac OS drivers.

—The Developer CD Team

Internet Resources

• Mac OS 8 information—http://www.macos .apple.com/macos8/
• Herb Bethoney, "Apple Gilds the Mac OS Lily"— http://www8.zdnet.com/pcweek/reviews/0616/ 16macos.html
• Don Crabb, "Mac Operating System Demonstrates Maturity"—http://www.suntimes.com/ output/crabb/crabb15.htm
• Alan Stafford, "Beta Report: 8 IS GREAT"— http://www.machome.com/Features/MacOS8 .html
• Henry Bortman, "Apple Picks Up the Tempo"— http://www4.zdnet.com/macuser/mu_0897/ firstlook/apple.html
• Franklin N. Tessler, "Mac OS 8 Preview"— http://www.macworld.com/features/macos8 .preview.html

• Clifford Colby's article on AppleScript and Apple events in Rhapsody—http://www8.zdnet.com/ macweek/mw_1124/nw_script.html
• MacHack list of top ten issues—http://www .machack.com/TopIssues/index.html
• Computer Associates International—http:// www.cai.com
• Parametric Technology—http://www.ptc.com/
• WebObjects course schedule—http:// enterprise.apple.com/Training/OpenEnroll/ Schedule.html
• CodeFab—http://www.CodeFab.com/
• Pricing and availability of Power Macintosh and Performa computers—http://product.info.apple .com/pr/press.releases/1997/q4/970712.pr.rel .price.html
• Apple Internet Server Solution—http://www .servers.apple.com/papers/inetguide/text/aiss .html

• EveryWare Development—http://www .everyware.com
• Newton Internet Enabler—http://www.newton .apple.com/product_info/SW/nie/nie.html
• Press release on Newton network connectivity—http://product.info.apple.com/pr/press .releases/1997/q4/970701.pr.rel.newton.html
• Farallon—http://www.farallon.com
• SK8—http://sk8.research.apple.com/sk8/ sk8.html
• Mobile computer specification—http://www .internet.ibm.com/computers/networkstation/os/ open.html
• Apple Technology Seeding Program— http://devworld.apple.com/seeding/software_ seeding_FAQ.html

Apple**Directions**

Business

Business Feature 1996 U.S. Macintosh User
Profile Study
Business Feature Two Apple User Studies Reveal
Demographic Trends

1996 U.S. Macintosh User Profile Study

Data to Help You Plan Your Future Products

The results of Apple's 1996 U.S. Macintosh User Profile Study reveal a number of substantial changes in Apple's user profile and customer computer usage since the first installed base survey was completed in 1989. The 1997 study—which focuses primarily on PowerPC processor–based models—is close to being completed in the field, and we hope to have the information to you in an upcoming issue of *Apple Directions.* For more information on the population of the survey, see the article on page 14.

Since the last user profile in 1994, two dominant factors have influenced the characteristics of the Macintosh installed base: growing sales of Power Macintosh computers—which now represent 17 percent of the U.S. installed base—and the popularity of the Internet. These and other factors have significantly contributed to the following major installed base findings:

• Internet use has soared from 6 percent to nearly 40 percent between 1994 and 1996.

• Sharing remains prevalent, but the number of users per Macintosh continues to decline.

• The rate of CD-ROM drive connection has more than doubled in the last two years.

• Modem ownership has grown significantly, due largely to after-market purchases.

• Cross-platform solutions are growing in importance.

The 1996 installed base survey represents U.S. Macintosh systems shipped between January 1990 and December 1995, or a total of 9,249,000 active Macs. The study included a random sample of 2,166 registered Macintosh users, who were surveyed by phone and sent a configuration-checking software disk. The response rate for the survey was an outstanding 83 percent.

Macintosh Users Are Active on the Internet

The biggest change in computer usage since the last Macintosh User Profile Study in 1994 has been the growth in Internet access. In 1994, just 6 percent of Macintosh users were accessing the Internet. In 1996, the number is nearly 40 percent and growing rapidly.

Online Services and Internet Usage

Most Macintosh Internet users (40 percent) access the Internet through online services, with 80 percent of these online service users accessing through America Online or CompuServe. Thirty-five percent of Macintosh Internet users are accessing through university or school systems. About a quarter (25 percent) of Internet users use an Internet service provider, and about 10 percent use a business or government network.

Internet use varies widely by market segment, with users in higher education leading the way at 61 percent. People in larger companies generally have greater access to the Internet than those in smaller companies—almost half of large business users (46 percent) access the Internet, as opposed to only 26 percent of small business users. Of home and home business users, 40 percent access the Internet. K–12 has the lowest Internet access rate, with just 23 percent.

Time Spent on the Internet

According to the study, Macintosh users spend an average of about 3 hours per week on the Internet. In higher education, that average rises to 3.5 hours, and the K–12 average falls to 2.8 hours. Thirty percent of Macintosh Internet users spend 5 or more hours per week on the Internet. At present, only 10 percent of Macintosh Internet users have accessed the Internet for more than three years. Sixty percent of Macintosh Internet users are "newcomers," having accessed the Internet for less than one year.

User Satisfaction and Internet Issues

Macintosh user satisfaction with the Internet is relatively high, with 84 percent of consumer users and 79 percent of business users reporting they are somewhat or very satisfied. This proportion goes up to almost 90 percent for users who access the Internet more than five hours per week.

Sharing Remains Prevalent

Another noteworthy trend to emerge from the Macintosh installed base survey is that while computer sharing remains prevalent, the number of users per Macintosh continues to decline steadily. In 1991 there were, on average, six users per Macintosh. That number decreased to four users in 1993 and three users in 1994. Currently, there are two users for every Macintosh. While the number of users per Macintosh is on the decline, the number of Macs per user in on the increase. More than half of all Macintosh customers use more than one Macintosh.

Most Macs Are Used by More Than One Person

Fifty-eight percent of all Macintosh computers in the installed base are used regularly by more than one person, a number that has remained constant since 1990; however, the number of users per machine has declined.

Broken out by market segments, Macintosh computers in K–12 and the home market are shared the most—75 percent of Macs in K–12 and 61 percent of home and home business Macs are shared by more than one person. In K–12, the average number of users per Macintosh is eight, a decline from ten users per Macintosh in 1994.

Within product segments, not surprisingly, Macintosh LC computers, which are found more frequently in the K–12 market, are shared 71 percent of the time, usually with three users per machine. At the other end of the spectrum, only 47 percent of Power Macintosh computers and 36 percent of PowerBook computers are shared.

Use of Multiple Computers Increases
The study reveals that a high percentage of Macintosh users (75 percent) regularly use another Macintosh computer in addition to their Macintosh. More than half (57 percent) of all users use more than one Macintosh, up from 39 percent in 1993. The increase in multiple Macintosh usage was first seen in 1994 and was fueled by heavy PowerBook sales during 1993 and 1994.

Graphics-Intensive Segments
Log the Most Hours
On average, a Macintosh in the installed base is used 20 hours per week, with general productivity tasks accounting for about half that time. The graphics-intensive segments log the most hours on their Macintosh computers, with web-page designers and publishers using their Macs about 40 hours a week. Interestingly, among key users in the web-page segment, only nine of these 40 hours are actually spent designing web pages; the balance is spent on a variety of related tasks, including accessing the Internet, online services, and e-mail, and doing graphics and multimedia-related tasks.

Home (excluding home business) users log the fewest total hours at 14 hours per week, while medium business (100 to 999 employees) users log the most time at 32 hours per week. K–12 and higher education users average just over 25 hours per week.

Explosive Growth in CD-ROM and Modem Connection Rates
Three distinct trends in Macintosh system configuration emerge from the 1996 installed base survey: CD-ROM penetration has more than doubled in the Macintosh installed base since 1994; modem ownership has grown significantly to 51 percent; and disk storage has quintupled since 1994.

CD-ROM Growth
CD-ROM penetration has more than doubled in the Macintosh installed base, growing from 19 percent in 1994 to 44 percent in 1996. This surge is led by the K–12 market, where penetration has reached 55 percent, and the home market, where it has reached 48 percent.

Two-thirds of CD-ROM drives come preinstalled. Of those that are purchased separately, most of them are bought after the purchase of the computer system. Forty percent of users said that their CD drive's speed is 2x, while 15 percent said the speed is 4x. A full 40

percent, however, said they do not know the speed of their drive.

Modem Growth
According to the study, modem penetration has also shown substantial growth—from 28 percent in 1993 to 51 percent in 1996. ISDN modems register 2 percent penetration overall, with the highest penetration at about 7 percent in medium and large business and in higher education. Less than 1 percent of home-based Macintosh computers are connected to ISDN modems, while 62 percent are equipped with regular modems. In K–12, 26 percent have regular modems, while in business the number is 50 percent.

More than half of the modems are bought separately or after the purchase of the system. This is especially true in the home market but less so in business and education. About 40 percent of the modems are designed to run at a speed of 14,400 bps, with another 20 percent designed to run at 28,800 bps. The K–12 segment has a disproportionate number of 2400-bps modems (22 percent).

The proportion of Macintosh users with multiple phone lines at home is 29 percent. For users in the home business market, that number rises to 56 percent. When asked if they have a line dedicated to modem use, 58 percent of those who have a second line indicated that they do.

About one-third of Macintosh computers are on a local area network (LAN). This is highest, of course, in large business, where the number is 75 percent. The proportion for K–12 is 45 percent, while the lowest number of Macs connected to LANs is found in the home (12 percent).

Memory and Disk Storage
Because Macs continue to be shipped with larger and larger amounts of memory and disk storage capacity, the average configuration has grown to 11 MB memory/414 MB disk storage in 1996, compared with 8 MB/80 MB in 1994.

Power Macintosh computers have an average memory/disk storage configuration of 24 MB/1.1 GB (of the 1.1 GB, 520 MB are free). The average is brought up for Power Macs by the PowerPC 604 processor–based systems, which average 71 MB/3.6 GB. Systems with PowerPC 601 and 603 chips average about 20 MB/1 GB. For PowerBook computers, the average configuration is 10 MB/230 MB, with 100 MB free on the disk.
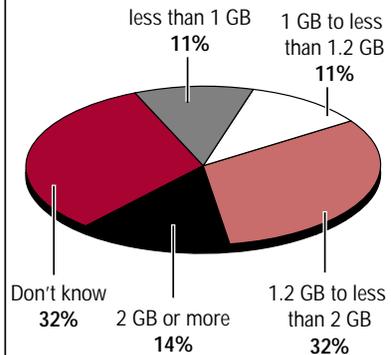
Memory Configuration of New Macintosh Computers

Don't know **18%**
8–12 MB **4%**
16 MB **37%**
65+ MB **7%**
33–64 MB **12%**
25–32 MB **17%**
18–24 MB **4%**
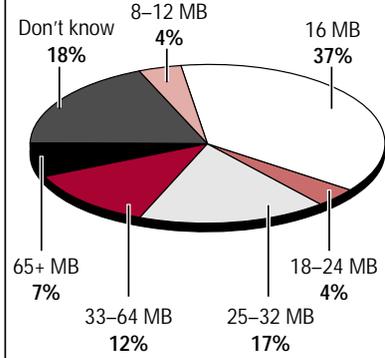
Base: 988 Macintosh computers purchased between October and December 1996

(Percentages do not add to 100 percent because of rounding errors.)

Hard Disk Storage in New Macintosh Computers

less than 1 GB **11%**
1 GB to less than 1.2 GB **11%**
Don't know **32%**
2 GB or more **14%**
1.2 GB to less than 2 GB **32%**

Base: 988 Macintosh computers purchased between October and December 1996

The study reveals that virtual memory is in use in 34 percent of Macintosh computers. This figure is highest in small business, at 45 percent, and lowest in K–12, at 25 percent. In higher education, virtual memory is in use in 31 percent of Macs. Seventeen percent of Macs have RAM Doubler installed. Again, the percentage is lowest in K–12, at 8 percent, and highest in small business, at 31 percent.

The percentage of Macintosh computers with multiple hard drives is 18. In medium and large business, this number approaches 50 percent, while in small business, it drops to 25 percent. In the home it is 11 percent.

Cross-Platform Compatibility Is a Hot Topic and Getting Hotter

The 1996 U.S. Macintosh User Profile Study reveals that cross-platform compatibility continues to be a hot topic for Macintosh users. The study's key findings focus on three specific areas of importance with respect to compatibility for Macintosh users: dual usage, editing files, and running applications.

Macintosh and PC Usage Continues to Rise

Thirty-two percent of the U.S. installed Macintosh base currently uses a Windows/Intel platform ("Wintel") PC in addition to a Macintosh. This is up slightly from 29 percent in 1994. Of these dual users, 35 percent run DOS, 51 percent use Windows 3.1, and 16 percent use Windows 95.

According to the study, the heaviest dual use is in the medium and large business markets, where 56 percent of Macintosh customers are also using a Wintel machine. Users in

the scientific/technical and web-page authoring segments are most likely to use both a Macintosh and a PC (38 percent). A third of these users have a PC running Windows 95 alongside their Macintosh. Typically, dual platform use in most segments is driven by applications that are not available on the Macintosh platform.

Editing Files is of Primary Importance

The results of the study show that users seek three basic levels of cross-platform compatibility: reading files, editing files, and running applications.

Reading PC files is regarded as necessary, but not sufficient, for most compatibility seekers. The ability to edit PC files, on the other hand, is rated as more important by Macintosh users than the ability to actually run PC applications. And, indeed, results show that many more Macintosh users are editing PC files than running PC applications.

For 43 percent of users, it is "extremely," "very," or "somewhat" important to be able to modify PC files on their Macintosh computers. The percentages in individual markets are as follows:

- Scientific/technical—64 percent
- Large business—64 percent
- Higher education—49 percent
- Small business—46 percent
- Publishing—41 percent
- Home—39 percent
- K–12—37 percent

Applications—such as Word to Word—are the most popular way for Macintosh users to read and edit PC files.

Small Portion of Macintosh Users Run PC Applications

Being able to run PC applications is important to 30 percent of the installed base—but this figure reflects far more Macintosh users than are able to actually run them. Only 9 percent of users actually manage to run PC applications, with the highest number (17 percent) being in large business.

The study shows that even with the ability to run PC applications, these users do so only 9 percent of the time. This drops to 5 percent in large business and increases to 15 percent in K–12. ♣

⬛ **BUSINESS FEATURE**

Two Apple User Studies Reveal Demographic Trends

Results from two 1996 Apple user surveys—the October–December 1996 U.S. Recent Buyer Survey and the 1996 U.S. Macintosh User Profile Study, which is described in more detail on page 12—reveal a number of noteworthy trends, probably the most interesting of which is that the gender gap between male and female Macintosh users has narrowed, as the females continue to close the gap. Women now make up 43 percent of the U.S. Macintosh customer base, and close to 50 percent of new Macintosh customers are female.

The U.S. Recent Buyer Survey

The October–December 1996 U.S. Recent Buyer Survey—a quarterly survey of recent Macintosh customers—reveals that first-time buyers, compared to repeat buyers, are more likely to be computer novices, younger, less educated, less affluent, and female. First-time

female buyers continue to make gains over their male counterparts.

According to the survey findings, first-time Macintosh buyers constitute the greatest percentage of computer novices, while repeat buyers tend to be intermediate or expert users. While first-time Macintosh buyers are pretty evenly split between males and females, Macintosh replacers are more likely to be male.

As might be expected, first-time Macintosh buyers are somewhat younger than repeat buyers. First-time Macintosh buyers are also more likely to have minor children at home.

Repeat buyers are more educated than first-time buyers; they're more likely to have continued their education beyond high school and more likely to hold graduate degrees. Possibly related to their higher educational achievements, repeat buyers also reported higher annual household incomes.

The 1996 U.S. Macintosh User Profile Study

The key demographic highlights from the 1996 U.S. Macintosh User Profile Study—a study of U.S. Macintosh systems shipped between January 1990 and December 1995—show a steady decrease in the gender gap (as does the October–December 1996 U.S. Recent Buyer Survey). The two studies diverge on the subject of age, education, and affluence. According to the user profile study, the average Macintosh user tends to be older, more highly educated, and, overall, very affluent.

Gender

The user profile study reveals that the gender gap has narrowed significantly since 1989. Female users currently represent 41 percent of the installed base, up from 28 percent in 1989. Conversely, male users have dropped from 72 percent in 1989 to 59 percent in 1996.

The highest percentage of female users use 680x0 Macintosh computers. Males, on the other hand, predominantly use PowerBook or PowerBook Duo computers (68 percent) and Power Macintosh computers (66 percent).

As for market segments, males are the primary users in medium and large business (70 percent), small and very small business (69 percent), home and home business (62 percent), and higher education (61 percent). K–12 represents the only segment in which females are the predominant users (67 percent). (Very small business is defined as 1 to 19 employees, small business is under 100 employees, and medium-to-large business is over 100 employees.)

Age
Since 1989, there seems to have been a graying of the Macintosh customer base, from an average age of 38 years in 1989 to 42 years in 1995. Within the Macintosh product family, users of Power Macintosh and PowerBook/PowerBook Duo computers are the youngest, with an average age of 40 years. The youngest market segment is medium and large business, with a mean age of 39 years. K–12 has the oldest users, with an average age of 43 years.

Income
According to the study, Macintosh users are affluent, with a median household income of $58,110. This is significantly higher than the 1994 U.S. median household income of $32,264. More than one out of every four users has a household income of $75,000 or higher. Of the Macintosh product lines, the one with the highest-income users is the PowerBook/PowerBook Duo line ($75,900).

By a wide margin, medium and large business users have the highest income of all segments ($74,400), while small and very small business users have the second highest level of income at $68,700. Users in the home and home business markets are very close to the installed base mean income ($66,000). Both education segments have lower income levels: higher education has the lowest at $60,100, followed by K–12 at $64,200.

Education
Macintosh users have historically been well educated and seem to have become even better educated over the past five years. More than three-quarters (78 percent) of Macintosh users have at least a college degree, compared to 72 percent in 1991. This is significantly higher than the 1993 U.S. population average, where only 22 percent of adults had a college or postgraduate degree.

PowerBook/PowerBook Duo users are the most educated, with 86 percent having earned an undergraduate or postgraduate degree.

Not surprisingly, users in both the higher education (89 percent) and K–12 (85 percent) segments have at least a college degree. Home and home business users are the least educated, but a full 74 percent have a college degree or postgraduate degree.

Household Composition
The study reveals that the average number of members in a household where a Macintosh is in use is three. Households where PowerBook/Duo and Power Macintosh computers are in use have a lower average number of members—2.5 persons and 2.7 persons, respectively.

New Macintosh Customer Demographics

	First-time buyers	Repeat buyers
Base: October–December 1996 buyers (988 total)	330	658
Computer background		
Novice	40%	15%
Intermediate	46%	56%
Expert	14%	29%
Age		
Under 25 years	11%	6%
25–34 years	27%	20%
35–44 years	26%	29%
45–54 years	19%	30%
55+ years	15%	15%
Mean	*40.2%*	*42.9%*
Children at home	47%	39%
Educational level		
High school	12%	7%
Some college/vocational	19%	18%
College degree	26%	25%
Attended graduate school	9%	10%
Completed graduate degree	31%	40%
Annual household income		
Less than $25,000	7%	4%
$25,000–$34,999	14%	12%
$35,000–$49,999	22%	18%
$50,000–$74,999	23%	25%
$75,000–$100,000	8%	12%
More than $100,000	8%	12%
Did not specify	18%	18%
Mean	*$54,000*	*$61,000*
Gender		
Male	52%	57%
Female	48%	43%

Percentages may not add to 100 percent because of incomplete answers or rounding .

Apple**Directions**

Macintosh Product Family Profiles
Compared to other Macintosh users, Power Macintosh users tend to be male, younger, and are found more often in small business, primarily in the graphics and publishing segments. PowerBook/Duo users tend to be male, younger, better educated, have much higher income, and are found more often in large business.

Macintosh Market Segment Profiles
Home and home business users reflect the general demographics of the installed base.

Users in the small and very small business segments tend to be male and have higher income. Medium and large business users are mostly male, are the youngest, and have the highest income of all the market segments. K–12 users are mostly female (the only segment in which this is the case), are the oldest, have lower incomes, and are better educated than the average Macintosh user. Higher education users are mostly male, have the lowest income, and have the highest proportion of postgraduate degrees. ♣