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AppleDirections

Apple News

Apple Releases PowerPC Processor–Based PowerBook Computers

New Technology Designed to Retake the Lead

Apple Computer, Inc., recently announced a complete renewal of its Apple PowerBook line of computers. The Macintosh PowerBook 5300 and PowerBook Duo 2300 series are Apple's first notebook computers to employ the PowerPC 603e RISC processor; the new PowerBook 190 series offers the performance of the previously top-of-the-line 68040 processor–based PowerBook 500 series at a more affordable price. In addition, Apple announced upgrade kits enabling PowerBook Duo 200 and PowerBook 500 series customers to upgrade their systems with 100-MHz PowerPC 603e processors.

Apple expects the technically advanced PowerBook 5300, PowerBook Duo 2300, and PowerBook 190 systems, all of which employ larger screens and the new trackpad pointing device instead of the current trackball, to help it retake the lead in the fiercely contested market for laptop computers. The *Wall Street*

Strategy Mosaic

PCI—The Future of Macintosh Expansion

By Gregg Williams, Apple Directions *staff*

Imagine being the world's greatest automobile mechanic and making a hobby out of improving your favorite car. You add a new engine, better brakes, luxury seats—and pretty soon, you realize that you've got a brand new car, and it's *hot!*

Something very much like that is happening to the Macintosh (and Mac OS) platform. Apple has already replaced the Motorola 680x0 processor with the PowerPC processor. OpenDoc and, later, Copland will enable developers to do much more with software. But it may not have occurred to you that Apple Computer, Inc., has just replaced another fundamental building block that has been with the Macintosh since 1987—the NuBus™ expansion bus architecture.

NuBus has served the Macintosh community well in the past eight years, but it can no longer keep pace with the demands of the market for digital video, high-speed networking, and other real-world solutions. Apple engineers have been searching for a successor to NuBus and have decided on one that should take Mac OS–based computers into the next decade.

The solution that Apple chose is the PCI (Peripheral Component Interconnect)

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Doing What's Right

A few changes—good ones—have been made recently at Apple in response to direct criticism and feedback from developers. I'm telling you about them because I want you to realize that Apple is listening to you and trying to do the right thing.

First, Apple Senior Vice President Dave Nagel recently formed a new Developer Relations organization, led by a vice president reporting directly to him. This is the first time that Apple's developer support infrastructure has reported in at such a high level; remember, Dave reports directly to Michael Spindler. It's a signal of just how seriously Apple takes its commitment to you and other developers. The new organization includes Developer Support under Shirley Stas, Developer Press under Dennis Matthews, Developer Evangelism under Ford Johnson, and European Developer Services under David Krathwohl.

Don't just take my word for it. Apple Fellow Guy Kawasaki had a lot to say about the new group in a recent interview. He was asked whether he was "in denial" about the lingering perception "that Macintosh is losing support from developers." Here's his answer:

I can be accused of many things but not denial. My momma used to tell me "When nine people tell you you're drunk, catch a cab." Apple is catching a cab. We've gotten some messages, including the one about developer support, in a big way.

There's a new attitude—more aggressive and forceful and competitive. And there's a realization that a huge part of Apple's success hinges on taking care of developers. We've reorganized the major functions of developer support into one organization managed by Shirley Stas.

Shirley and I have been empowered to catalyze change and encourage Apple to take the risks necessary to ignite the development of more great software. We report directly to Dave Nagel—this is the highest position that Developer Services has ever reported to in the history of Apple.

Attitudes all around Apple are changing. We are more honest and up front with developers. We are more open to enabling developers to lead us into areas we haven't explored. We'll make sure that the coolest apps come out on the Mac platform first. We will grovel to our established developers, seduce the brightest and best young programmers, and even pick off Mac "atheists" here and there.

We are committed to doing what's right for developers, and giving them the resources and information they need.

This last comment brings me to the second change I want to tell you about: The prices of just about all of Apple's important developer materials have just gone down, again directly in response to your complaints.

For example, a one-year subscription to *Apple Directions* now costs $49, half of what you used to pay for it. The Developer Mailing, which includes *Apple Directions* and the Developer CD, has been reduced from $250 to $149.

Here are some other significant reductions:

• Newton Developer Mailing: $149 (reduced from $200)

• Apple Multimedia Program Mailing: $300 (reduced from $400)

• New subcriptions to E.T.O (Essentials, Tools, Objects): $795 (reduced from $1095)

• E.T.O renewals: $250 (reduced from $400)

The new prices should save most of you a goodly sum, money you can spend on more important things (like overtime for your programmers, human interface design, usability testing, and so on). For a complete list of reductions, get in touch with APDA and ask for the latest catalog. (For information on how to do so, see "APDA Ordering Information" on page 32.)

I can hear some of you saying, "Gosh, he works at Apple, and I bet he gets paid to say stuff like that." That's true, but I think you'll agree that these changes are very positive steps as far as Apple's commitment to developers go. Write me and let me know what you think; my e-mail address is dreyfus.p@applelink.apple.com.

Paul Dreyfus
Editor

IndustryWatch: News & Perspective

Enough to Make a Grown Man Cry

Windows 95: The Problems Begin

The hype is over, and the world had adjusted to Microsoft paying a reported $12 million (!) to use the Rolling Stones' song "Start Me Up" in Windows 95 ads. Now customers are settling in to discover just what Windows 95 has in store for them. Yes, it provides significant improvements over the previous release. It also provides a boat-load of problems.

Customers' problems fall into three main areas:

• *Hardware.* Most customers will have to buy more memory and larger hard drives to truly take advantage of the Windows 95 feature set. Microsoft recommends 8 MB of memory and a 486 or Pentium microprocessor to run Windows 95. According to Computer Intelligence InfoCorp, only about 39 percent of PCs currently being used meet these minimum configuration requirements. About 36 percent of the PC installed base will need a memory upgrade to run Windows 95 well; the remaining 25 percent have a 286 or slower microprocessor and need a new microprocessor to run Windows 95 at all. Many Windows users will also need new hard drives to accommodate the nearly 70 MB required for a complete installation.

• *Incompatible applications.* According to Microsoft, of the 1600 or so top DOS/Windows applications, about 200 don't run under Windows 95. Microsoft promises to release the list of these applications "soon." The list is expected to include disk utilities, virus checkers, applications that directly access the printer, and others.

• *Difficulty of upgrading.* Early reports indicate that Windows 95 is difficult to install over existing DOS/Windows setups. Users receive many error messages, and some peripherals don't work under Windows 95.

The first day Windows 95 went on sale, Microsoft's help line was jammed to the point that many callers encountered busy signals as operators assisted early customers with problems in these and other areas.

Implications/Opinions: Of course a product release as hyped as Windows 95—the *Wall Street Journal* says that press coverage of it exceeded 3 million words in July and August alone—is going to meet with disappointment. Also, any time you sell as many copies of your new product the first day of release as Microsoft did on August 24, your help line is going to be bombarded. Finally, there's no doubt that Windows 95 will sell in great quantity. Microsoft's hype campaign has been so effective that, according to the *Wall Street Journal,* a teenager in Cambridge, Massachusetts, spent the money he'd been saving for an electric guitar on Windows 95, saying, "I feel really dumb buying it, but it's one of those media things. . . . My dad wouldn't buy it for me because he thinks it will have too many bugs." Also according to the *Journal,* a hospitalized 57-year-old writer left her bed to buy it, even though she admitted, "This is the dumbest thing I've ever done."

Those points don't diminish the fact that new customers' problems will make many others hesitant to move from DOS and Windows 3.x to Windows 95, especially in the corporate environment. You can expect Windows 95 to be greeted by a spate of mixed reviews, urging users not to jump immediately on the bandwagon. For a sample, you might enjoy Philip Robinson's review in the August 20 *San Jose Mercury News,* in which he advises customers to wait, saying, "Don't be hustled into shelling out for what is, so far at least, something between a utility program and a work-in-progress." (You can find the *Mercury News* on the World Wide Web at http://www.sjmercury.com.)

While PC users hesitate, Apple Computer, Inc., will be acting fast and as powerfully as possible to dramatize the advantages of the Macintosh computer. Make sure you read last month's Strategy Mosaic to find out how Apple will be taking advantage of the situation. You can help by continuing to publicize Macintosh advantages within your company and your customer base. For information to help your efforts, Apple has prepared a series called "Windows 95 vs. Macintosh Updates," which you can find on the World Wide Web at http://www2.apple.com/whymac/.

P6 Performance Woes: Confusion in the PC Market?

Prototype computers based on Intel's next-generation P6 processor perform more poorly than expected when running Windows 95, according to a variety of recent press reports. *PC Week,* for example, said in its August 21, 1995, issue that ". . . even the maximum performance increases [for the P6] . . . fall far short of the near 100 percent performance increase that Intel originally predicted for the P6 over an identically clocked Pentium." Tests performed by *PC Week*'s and *PC Magazine*'s test labs showed that 133-MHz P6 systems didn't exhibit major performance improvements over 133-MHz Pentium PCs unless they ran 32-bit applications on a 32-bit operating system. Even then, performance enhancements were only in the 20 percent range.

P6 prototypes show even less improvement when running 16-bit PC DOS/Windows software, including Windows 95, which, despite Microsoft's claims to its being a 32-bit operating system, still includes significant chunks of 16-bit code. (See the technical note on page 4.) One report claimed that the P6/Windows 95 systems run Windows applications only about 10 percent faster than a Pentium-based system running at the same clock speed.

Intel itself, in data reported in the July 31, 1995, issue of *Microprocessor Report,* admits that P6 systems running 16-bit Windows 3.1 perform 16 percent *slower* than Pentium systems with the same

clock speed. According to Intel's own calculations, P6 systems running Windows 95 outperform equivalent Pentium systems by 25 percent, while Windows NT P6 systems provide a 50 percent performance boost over Pentium-based computers. An Intel spokesperson stated that because the P6 was designed to take advantage of 32-bit operating systems and applications, it won't deliver full performance under Windows 95.

(*Technical note:* In the above discussion, "16-bit code" is actually a convenient way of referring to older software that "makes heavy use of certain features of the x86 architecture, specifically segment writes, partial register operations, and unaligned data accesses," according to *Microprocessor Report.* Apparently, 16-bit code that avoids these techniques, and that hasn't been written in x86 assembly language, runs well on the P6 processor, but a great deal of DOS/Windows software—including portions of Windows 95—use these techniques frequently.)

Implications/Opinions: The lack of 32-bit software to run on the P6 will hamper its performance, even if PC manufacturers put a low price tag on systems based on the chip.

That P6 systems, at least initially, won't live up to the high performance claims made by Intel comes as no surprise; Intel's performance claims were based on SPECint ratings, not on actual performance of the systems running applications. However, it looks to us that the P6 may not be accepted by the mainstream computing market as quickly or easily as it originally appeared. Just as it was unrealistic to expect huge numbers of customers to migrate to PowerPC processor–based Power Macintosh systems until there was a significant base of "native" RISC software, PC customers aren't likely to buy P6 systems to run old, slow software.

When will the PC software base migrate from 16-bit to 32-bit? It doesn't appear that this will happen quickly. According to the July 31, 1995, issue of *Electronic News,* Intel's P6 division general manager, Michael Fister, said, "At introduction, we will have 100 applications that are 32-bit. A year later, there will be 100 more."

By comparison, you and your colleagues released nearly 600 native RISC Power Macintosh applications within a year of the first Power Macintosh shipment. Currently, there are more than 925 native Power Macintosh applications shipping worldwide.

We also think it's possible, even likely, that Intel's transition from Pentium to P6 will add confusion to the PC side of the personal computer market. Since P6-based machines don't receive a significant performance boost under Windows 95, customers for the P6 systems will likely be driven to purchase Windows NT. Windows customers already face a potentially difficult and costly upgrade path with Windows 95, as mentioned earlier. With the availability of P6 hardware in early 1996, the same customers will have to consider yet another operating system upgrade—to Windows NT—if they want to get the most out of their new hardware. Out of that confusion, the true 32-bit Mac OS and your Power Macintosh applications will continue to shine as the most powerful and easy-to-use personal computing solution on the market.

Positive Macintosh Reports in the Wintel Press

Two magazines that usually focus on developments in the PC/DOS/Windows world have recently had very positive things to say about Apple and the Macintosh computer.

PC Week recently said that the Power Macintosh 9500/133 computer outperformed the Gateway Pentium/133 by a significant margin. In the June 19, 1995, issue, the magazine said, "The Power Mac 9500 was twice as fast as the Gateway in all Photoshop tests but one, and even there, bested the Pentium PC by 58 percent. In addition, for the first time a Macintosh performed better than a PC in our Excel Macro test . . . ." The editors went on to say that "with performance surpassing the best of the high-end Pentium-based PCs—even in mainstream applications—and compatibility with many current (and cheaper) PC components, the 9500 could be a serious alternative to new Windows 95 machines."

A study by Computer Intelligence InfoCorp (CII), also reported in *PC Week,* shows that the Macintosh computer led the PC industry in repeat purchase and brand loyalty ratings in 1994. The Macintosh computer came in first among all three user groups CII studied, namely business users, self-employed users, and home users. You can find a report based on the study at *PC Week*'s World Wide Web site (http://www.ziff.com/~pcweek/). You might also want to take a look at CII's home page at http://www.compint.com/.

Another study, this one by *PC World,* came to a similar conclusion: More Macintosh customers say they'd be repeat purchasers than those buying other computers. *PC World* editors wrote in the June 1995 issue: "Nine out of ten Apple owners responding said they'd buy another machine from the company based on service received, while more than 80 percent of the Compaq, Dell, and HP users would gladly become repeat customers."

Implications/Opinions: These developments reinforce what we said in the previous items: It's fortuitous for all of us that the PC press is starting to report positive Macintosh news at a time when upgrading to Windows 95 is likely to create rising tensions and frustrations for Wintel customers. As Apple's press and media campaign continues, folks on the PC side of the fence can expect to hear more and more about the Macintosh platform's advantages—just as they're facing a potentially troublesome upgrade.

Yet Another Microsoft OS?

Amid all the reports of Microsoft's Windows 95 extravaganzas around the world, perhaps you missed what happened in Hong Kong. According to an eyewitness report that reached us through Apple's Far East office, scantily clad women greeted the press and other attendees at the song and dance revue held in the city's Times Square. The proceedings culminated with 12 dancers in leotards prancing around while holding large jigsaw puzzle pieces. As they assembled the pieces, it seemed that the completed puzzle would spell *Windows 95;* according to our eyewitness, "As the jigsaw took shape, it became apparent to those watching that they were in fact witnessing the global launch of a piece of software called Mindows 95."

Implications/Opinions/Wisecracks: You can start We up. ♣

PCI

continued from page 1

expansion bus architecture. It's a big decision—and one we will all have to live with for a half-decade or longer. This article explains what PCI is and why it's a good choice for both Apple and Apple developers.

What Is PCI?

Some people have expressed uncertainty over what, exactly, PCI is. Is it a bus? A certain kind of slot? Or is it something entirely different? Actually, PCI is a specification for a high-performance expansion bus architecture. It was originally developed by Intel, which released it to a standards organization called the PCI Special Interest Group (SIG). The PCI SIG has nine voting members representing over 400 companies that have general-member status; this organization oversees the specification and evolution of the PCI bus. Apple has been a voting member in the PCI SIG for the last two years and has been very active in influencing the evolution of PCI (Intel is a permanent voting member). The PCI specification, currently version 2.1, defines both the electrical characteristics of the PCI bus and the type of connector used.

Why PCI? Two reasons, the first of which is *speed.* PCI enables workstation-class solutions on personal computers—for example, broadcast-quality digital video, multiple video streams, high-speed ATM (Asynchronous Transfer Mode) networking, 3D acceleration, and high-speed disk arrays. PCI is roughly three times faster than NuBus: PCI has a theoretical maximum data transfer rate of 132 MB/second, as compared to NuBus's 40 MB/second.

(Actual rates are proportionately slower for both bus architectures.)

The PCI 2.0 options implemented by the industry today include

- 32-bit wide data path
- 33-megahertz (MHz) PCI clock
- 3.3-volt or 5.0-volt signaling environment
- 32-bit, 5.0-volt signaling connector

The second reason for Apple's adoption of PCI is *standardization.* PCI is an industry standard, and Apple believes that the Mac OS platform will benefit greatly from adopting the PCI architecture.

Apple's Stake in PCI

Apple sees the adoption of PCI slots as a critical step in the evolution of the Mac OS platform through the end of this decade—and one that Apple is managing quite nicely. Apple shipped its first PCI-based Macintosh computers, the Power Macintosh 9500/120 and 9500/132, last June (see the story on page 1 of the July 1995 issue of *Apple Directions*). In August, Apple added lower-cost PCI-based computers: the Power Macintosh 7200/75, 7200/90, 7500/100, and 8500/120 (see the story on page 1 of the September 1995 issue of *Apple Directions*).

Years ago, Apple would not have been able to adopt an industry standard without "improving" it a bit and, by doing so, making the version that it used just another Apple-specific technology. Apple has learned its lesson here, and its implementation of PCI in its new PCI-based Power Macintosh computers complies completely with the PCI 2.0 standard, ensuring that these computers will reap the full benefits of PCI.

And what are the benefits of PCI? They include the following:

- *More powerful computers.*

As stated earlier, PCI will enable Power Macintosh with PCI computers to provide workstation-class solutions at a fraction of the cost.

- *Less expensive computers.* PCI will allow Apple and its licensees to offer Mac OS–based computers at a lower price than was possible with NuBus. Apple is already doing so: The Power Macintosh 7200/75 includes a 75-MHz PowerPC 601 processor, three PCI slots, 8 MB of memory, and a quadruple-speed CD-ROM drive—all for a price of around $1700 in the United States. (The Apple press release quotes a price range of $1699 to $1749.)

This price for a Power Macintosh 7200/75 is very competitive with similarly configured 75-MHz Pentium systems. (For example, the September 1995 issue of *PC World* rated the Dell Dimensions XPS P75 as one of the best low-budget computers available—number 8 out of 20—and gave its full-system price, including monitor and keyboard, as $2112.) An independent testing agency, Competitive Assessment Services, happened to benchmark the Power Macintosh 7200/75 against the exact same Dell computer and found the Power Macintosh 7200/75 to be, overall, 24 percent faster—and 62 percent faster on graphics and publishing applications.

Why am I taking so much space to make this point? Primarily, to prove that Apple's claim of "cheaper, better" does indeed stand up to scrutiny. (The higher-end Power Macintosh with PCI computers show even better performance for roughly the same price as equivalent Pentium computers.) But there's a second reason for making this comparison: it shows how PCI helps make Apple truly competitive with competing Intel-platform personal computers, which is a key component of Apple's campaign to gain

market share for Mac OS–based computers.

- *More choices for users.* By switching to PCI (and being truly PCI-compatible), Apple expects to leverage off the popularity of the existing PCI market and the lower cost of PCI cards. This is already happening; over 40 PCI cards from 36 vendors are currently available, and many more are expected by the end of 1995. PCI vendors currently include well-known PCI companies such as 4-Sight, ATI Technologies, Crosfield Electronics, Diamond Multimedia Systems, Distributed Processing Technology, Hermstedt GmbH, ICG, Linotype-Hell AG, Matrox Graphics, miro Computer, Scii, and Spectra Systems.

Current PCI vendors can sell to the Mac OS market simply by adding a Mac OS software driver to their product. In this way, the developers of specialized cards who have found the NuBus market too small or the technical side of developing for NuBus too complex will be more likely to bring their PCI solutions to the Mac OS platform. In addition, vendors can design new PCI cards that include drivers for the Mac OS, Windows, and perhaps other operating systems, all on the card's ROM.

Users will benefit from PCI by having more solutions available—and at lower cost. For example, NuBus graphics acceleration cards usually cost over $1000, but equivalent PCI cards start at $350.

Keeping a Differentiated Platform

The industry-standard nature of PCI does not prevent Apple from innovating and providing superior products. Here are some of the ways in which Power Macintosh with PCI computers provide more to users:

- *Faster PCI.* Intel-based personal computers (PCs) tie the PCI

chips' frequency to the processor's frequency, so many PCs are not running PCI at its top speed of 33 MHz. Furthermore, because of the 33-MHz frequency ceiling, increasing your processor's speed can actually decrease PCI performance on Intel PCs. For example, a 100-MHz Pentium-based computer runs its PCI chips at 33 MHz, but if you upgrade the computer to a 120-MHz Pentium processor, PCI is forced to run at a slower rate—30 MHz! (The explanation is tricky; send me e-mail if you want the details.)

PCI-based Power Macintosh computers run PCI on a separate bus at a constant 33 MHz. Not only does this always give users the highest PCI performance possible, it also allows Apple to create new, faster computers (as well as allowing users to upgrade) without worrying about the effect of changing the processor clock speed on PCI performance.

• *Better plug-and-play capability—and more.* Open Firmware is a cross-platform standard (IEEE 1275) for booting PCI cards in an OS-independent environment. Apple has adopted Open Firmware in conjunction with PCI, which gives better plug-and-play capability to PCI-based Power Macintosh computers than Windows-based computers can deliver.

Here's the difference: The unique PCI ID required on every PCI card identifies only the PCI chip set used, not the card itself—so multiple PCI cards have the same PCI ID. The result? The best that Windows 3.1 can do is say, "Here are five PCI cards that might be yours. Which one do you want to try?" (Unfortunately, I don't have any word on whether Windows 95 can do better than this.)

The Mac OS identifies PCI cards flawlessly. If a PCI card has a ROM chip in it, it must have an Open Firmware name property, which is unique to the card itself. (Windows 95 doesn't support

Open Firmware, so it can't solve the problem this way.) If the ROM has a Mac OS driver in it, that gets loaded; otherwise, system software uses the Open Firmware name property to ensure that the proper driver (in the Extensions folder) gets loaded.

If the PCI card doesn't have a ROM chip, information in the PCI chip set may constitute a card-unique ID, which (to make a long story short) makes plug-and-play services happen correctly. If that isn't the case, the card vendor must ensure that its driver code, which is loaded as an extension, checks for some unique characteristic of its card and, based on what it finds, either loads itself or exits without loading anything. (Whew!)

But there's more to Open Firmware than just facilitating plug-and-play capability for PCI. Open Firmware makes it possible for Apple and other vendors to offer computers that give users a choice of operating systems at startup time. You will see Mac OS computers that support multiple operating systems in the CHRP (Common Hardware Reference Platform) time frame—late 1996—or maybe sooner.

• *Better bridging.* Though this is a technical point, it is an example of how Apple works hard to make its computers as easy to use as possible. The PCI architecture is limited to a "bridge" of four slots. Multiple bridges can be connected, but cards not on the main bridge must be addressed differently.

On the Intel-based personal computer side, this means that the user may have to load a different driver for a card depending on which slot the user plugs the card into (which in turn means potential confusion to the user). PCI-based Power Macintosh computers, on the other hand, use a Mac OS service called the *Name Registry* to ensure that the same

driver always works with a PCI card, regardless of where it is plugged in.

Power Macintosh With PCI in 1996
Apple has some PCI-related enhancements due to roll into PCI-based Power Macintosh computers in 1996. It will implement PCI 2.1, which is really just a refinement and a clarification of the PCI 2.0 standard. (Not only is PCI 2.1 backward-compatible, PCI 2.1 cards will work correctly in PCI 2.0–compliant Power Macintosh computers.) The only important news is that there is, really, no news: PCI 2.0 is the standard for the next few years, and there's no reason to wait for PCI 2.1 before developing PCI cards.

In addition, the new implementation of PCI is expected to improve the implementation of bridges and the speeds of read operations—from approximately 45 MB/second to over 80 MB/second—and target (processor-to-card) operations—from approximately 40 MB/second to over 90 MB/second.

The Future of PCI
By late 1996, both customers and solution vendors will want higher throughput, and the members of the PCI SIG are already talking about how to evolve PCI. The eventual goal is a 66-MHz PCI bus (doubling today's standard frequency for PCI) that is 64 bits wide (doubling the size of today's PCI bus).

However, 64-MHz, 64-bit PCI is too big a step to take at once, so two possible interim steps are 66-MHz, 32-bit PCI and 33-MHz, 64-bit PCI. Both methods promise a theoretical maximum data transfer rate of 264 MB/second, but each has its advantages and disadvantages.

66-MHz, 32-bit PCI
To understand the trade-offs of 66-MHz, 32-bit PCI, you have to

understand two things: first, that most PCI cards today use what is known as *5-volt signaling* and either 0.65-micron (μ) or 0.8μ chip technology. Going to 66 MHz forces a transition to 3.3-volt signaling and 0.5μ chip technology. Second, you must also understand that a PCI card is said to be a *universal* card if it can use either 5-volt signaling or the more expensive 3.3-volt signaling.

Given that background, here are the advantages of 66-MHz, 32-bit PCI:

• It makes the transition to 66-MHz, 64-bit PCI easier, because it forces the industry to adopt 3.3-volt signaling now rather than later.

• 0.5μ chips are smaller and use less power.

And here are the disadvantages:

• To work in 66-MHz, 32-bit PCI slots, existing 33-MHz cards must either be universal or use only 3.3-volt signaling—and even then, such cards would slow the entire bus down to 33 MHz.

• 66-MHz, 32-bit PCI necessitates following stricter PCI bus-loading guidelines. (At double the frequency, the bus has half as much time to get useful work done, and bus transitions need to settle as quickly as possible.)

• 66-MHz, 32-bit PCI would require new computers to be manufactured with both old (33-MHz, 32-bit PCI) and new (66-MHz, 32-bit) PCI slots to ensure backward compatibility with existing PCI cards.

33-MHz, 64-bit PCI
33-MHz, 64-bit PCI would use a two-part connector, with the first part identical to the ISA connector used today. Here are the advantages of this architecture:

• Existing 32-bit PCI cards, including those that use 5-volt signaling, would continue to work. (They would plug into the

first part of the two-part connector, leaving the second part of the connector empty.)

• New 64-bit PCI cards would work correctly in existing 33-MHz, 32-bit PCI computers. (This is a requirement of the PCI 2.0 specification.)

• New computers could have only one kind of PCI connector (the 64-bit connector) and still be able to accept both 32-bit and 64-bit PCI cards. (However, computer vendors might still have both kinds of slots, just to save on the cost of the connectors.)

33-MHz, 64-bit PCI has the following disadvantage:

• The extra 32 bits of the 64-bit PCI bus would necessitate the use of the more expensive Bump Grid Array (BGA) chip packaging. (However, if 33-MHz, 64-bit PCI does become the next step, BGA packaging could drop in price.)

66-MHz, 64-bit PCI

Customers will eventually want simultaneous access to multiple high-bandwidth services, and by the end of the decade, the technology should be in place to deliver them through a 66-MHz, 64-bit version of PCI—and that's where the PCI SIG members see PCI heading. 66-MHz, 64-bit PCI will deliver a theoretical maximum of 528 MB/second.

66-MHz, 64-bit PCI is also where PCI will end. According to various engineers, PCI can't be expanded past this point; the industry will have to go to a new bus architecture to get greater bandwidth. But you shouldn't have to worry about that until around 2002—which happens to be seven years from now, a time span roughly equal to that of NuBus. (Coincidence? We think not.)

Influencing the Future of PCI

For the moment, though, the question is, which is to come next—66-MHz, 32-bit PCI, or 33-MHz, 64-bit PCI? When asked, "Which of these two versions of PCI does Apple think is the best one?" Apple engineers replied in a way that shows how Apple is changing: "We'll go with whatever the industry decides."

"Whatever the industry decides" is, more accurately, what the members of the PCI SIG decide. And since Apple is a member, this gives you an opportunity to influence the future of PCI. If you have any strong feelings about whether PCI should evolve to 66-MHz, 32-bit PCI or 33-MHz, 64-bit PCI, please contact Apple at APPLE.PCI.

The Future Is PCI

If you're an expansion card developer, this is Apple's message to you: PCI costs less, lets you do more, and allows you to sell to a wider audience—and you should start designing for PCI now.

If you develop any kind of software that needs high bandwidth, be aware that PCI will enable you to provide workstation-class solutions that are impossible today.

If you're any other kind of developer, you may not need to do anything differently, but it doesn't hurt for you to know that PCI is a solid, responsible choice for a new expansion bus architecture. It means more sales of faster Mac OS–based computers at lower prices—which will help make you and your company more profitable. ♣

PowerBook Computers

Journal said that ". . . by all accounts [the] nifty machines are certain to sell briskly," and DataQuest forecasts that Apple will sell 1 million PowerBook systems in the next 12 months.

Response to the new systems was immediate and positive. According to the *Wall Street Journal,* "Analysts say the machines are elegant and lightweight, with advanced features that draw Apple at least even on the technological front with its laptop rivals." One analyst—Kimball Brown, vice president of mobile computing at DataQuest—said about the new systems, "Some of their features surpass all competitors in the portables industry. The way Apple has

integrated infrared into its products, their exceptional battery life, and industrial design are all excellent. . . . These notebooks should be in huge demand."

The rest of this article introduces you to the new systems. Complete information about them can be found on the Internet's World Wide Web at http://www.info.apple.com/gomobile/; for detailed technical specifications, see the new Macintosh developer notes included on this month's edition of the Developer CD and at the Apple FTP site on the Internet (get address). This month's CD Highlights includes a description of the developer notes; see page 11.

PowerBook 5300 Family: Power, Expandability, Wireless Communications

The PowerBook 5300 models are the highest-performance PowerBook computers ever; if you're a developer of PC cards or

peripherals, the new systems will provide additional customers for your products. (For details, see "Expandability Through PC Cards and Expansion Bay" on page 8.) Highlights of the powerful computers include the following:

• the PowerPC 603e processor for running new "native" applications—such as complex graphics, page layout, and sophisticated presentation programs—that couldn't run on a notebook before

• the largest screen offered yet with PowerBook systems—with an optional 10.4-inch dual-scan or active-matrix color display

• an open design for the easy addition of innovative cards and peripherals

• easy wireless file sharing, through built-in infrared communications

• long battery life

Built around 100-MHz and 117-MHz PowerPC 603e RISC

processors, the PowerBook 5300 series offers users desktop-level PowerPC processor performance in a compact, portable package that's a full inch smaller, and nearly a pound lighter, than Apple's previous top-of-the-line PowerBook 500 series. PowerBook 5300 configurations start as low as U.S. $2,200.

By comparison, leading PC notebook vendors in this price range often use slower, older processors—for example, 486DX2 and 486DX4 chips running at speeds between 50 MHz and 75 MHz; higher-end Pentium-based machines usually start at prices well over U.S. $3,000.

Designed to meet the needs of business and higher-education customers, all configurations of the PowerBook 5300 come with a minimum of 8 MB of memory, expandable to 64 MB; either a 9.5-inch grayscale display or a 10.4-inch dual-scan or active-matrix color display; and either a 500

MB, 750 MB, or 1.1 GB internal hard drive. All configurations ship with advanced, lithium-ion batteries, with an estimated battery life of three to five hours of continuous working time per charge.

Expandability Through PC Cards and Expansion Bay

The expandability options of the PowerBook 5300 line offers hardware developers opportunities to sell existing PC cards to new customers. Additionally, you can develop new peripheral devices that connect through a new hardware feature, the PowerBook expansion bay.

The PowerBook 5300 line provides a wide range of expansion options through two Type II–size PC card slots, or one Type III–size slot for PC card–based high-speed modems,

networking cards, hard drives, and other solutions. Because Apple's PC card slots are fully compliant with version 2.1 PC Card and Socket Services, any of your PC cards that are 2.1-compliant—including those you've previously sold to the PC market—will work with the Power-Book 5300 models without any additional setup by the user as long as they include a Macintosh driver.

In addition, a user can customize a PowerBook 5300 system by removing the unit's floppy disk drive from the PowerBook expansion bay and replacing it with a variety of peripheral devices, including additional hard drives, magneto-optical removable media drives, and internal AC power adapters. The expansion bay uses a standard IDE connector for the

addition of hard drives and magneto-optical removable media drives. Internal power lines enable the addition of AC power supplies and other devices. Customers who want the lightest configuration possible can remove the floppy drive and replace it with the PC Card Storage Tray, which holds four Type II or two Type III PC cards and ships with the new PowerBook systems. With the tray installed, customers save 0.4 pounds, dropping the overall weight to between 5.5 and 5.8 pounds.

Easy-to-Use Wireless Networking With Apple IR File Exchange

The PowerBook 5300 models also are the first PowerBook computers to employ infrared technology, enabling customers

to make wireless file transfers using the AppleTalk network system. With Apple IR File Exchange, PowerBook 5300 systems can automatically locate and wirelessly connect to compatible, infrared-equipped computers and then conduct data transfer at the full LocalTalk speed of 230.4 kbs. Apple's infrared hardware is compliant with the IrDA infrared standard, and Apple is working on an IrDA-compliant software implementation for the future.

To make connecting to networks easy, Apple has teamed with Farallon Computing to create a desktop infrared receiver, the Farallon AirDock, that makes any desktop Macintosh computer a wireless network station. By using the AirDock, PowerBook 5300 customers can have full access to all of their network devices, including printers, servers, and Internet access, exactly as if they were on a wired network—without plugging in a single cable.

PowerBook 5300 Availability and Price

The PowerBook 5300 series, which ships with a variety of pre-installed utility, communication, compatibility, and game software, is already available worldwide. Pricing for the new systems is shown in the table "PowerBook 5300, 2300, 190, and Upgrade Pricing" on this page.

PowerBook 2300: The Smallest, Lightest PowerBook Computers

The PowerBook Duo 2300c brings to the subnotebook market the performance of the same 100-MHz PowerPC 603e processor used in the PowerBook 5300 family. The newest PowerBook Duo uses the same award-winning form factor as earlier models, and it's compatible with previous PowerBook Duo 200 series docks and peripherals. In

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PowerBook 5300, 2300, 190, and Upgrade Pricing

Model	Display; memory	Price range (U.S. only; prices vary elsewhere)
PowerBook 5300	Grayscale; 8/500 MB	$2,199–$2,299
PowerBook 5300cs	Dual-scan color; 8/500 MB	$2,799–$2,899
PowerBook 5300cs	Dual-scan color; 16/750 MB	$3,499–$3,699
PowerBook 5300c	Active-matrix color; 8/500 MB	$3,699–$3,899
PowerBook 5300c	Active-matrix color; 16/750 MB	$4,499–$4,699
PowerBook 5300ce	Active-matrix color; 32 MB/1.1GB	$6,499–$6,799
PowerBook Duo 2300c	Active-matrix color; 8/750 MB	$3,499–$3,699
PowerBook Duo 2300c	Active-matrix color; 20 MB/1.1 GB	$4,499–$4,699
PowerBook 190	Grayscale; 4/500 MB	$1,649–$1,699
PowerBook 190	Grayscale; 8/500 MB	$1,849–$1,899
PowerBook 190cs	Dual-scan color; 8/500 MB	$2,199–$2,299
PowerBook 190 Logic Board Upgrade Kit with PowerPC 603e processor		$1,199–$1,299
PowerBook 500 series expansion board upgrade with PowerPC 603e processor		$699–$749
PowerBook Duo 200 series logic board upgrade with PowerPC 603e processor		$1,199–$1,299

addition to its RISC processor, the new Duo models incorporate a larger display than previous models—a 9.5-inch active-matrix color display—into a system that weighs less than five pounds.

PowerBook Duo 2300 models ship with 8 MB or 20 MB of memory, expandable to 56 MB, and either a 750 MB or a 1.1 GB hard drive. The centered trackball employed by current models has been replaced by the improved Apple trackpad pointing device, which gives customers more precise control.

The new PowerBook Duo systems also ship with pre-installed software, including eWorld (which includes a World Wide Web browser) and password security, and will be available worldwide in mid-October. See the table "PowerBook 5300, 2300, 190, and Upgrade Pricing" (page 8) for expected pricing.

PowerBook 190 Family: Performance and Affordability

Offering performance, features, and expandability available with the previous top-of-the-line PowerBook 500 series, the new PowerBook 190 and 190cs computers will carry price tags starting as low as U.S. $1,649.

Employing the same design and form factor as the PowerBook 5300 series, including the trackpad and optional 10.4-inch screen, the PowerBook 190 series computers support many of the same industry-standard features as the new 5300 models. Built-in PC card slots, capable of holding two Type II–size PC cards or one Type III–size PC card, gives customers a wide variety of communication and expansion options, including the same PC cards that can be used by PowerBook 5300 customers. Similarly, PowerBook 190 customers will be able to expand their systems by removing the computer's floppy disk drive and

plugging peripheral devices into its expansion bay.

PowerBook 190 and 190cs models include a 66/33-MHz Motorola 68LC040 processor and a 10.4-inch, dual-scan color or 9.5-inch, passive-matrix grayscale display. They ship with either 4 MB or 8 MB of memory and a 500 MB hard disk drive.

Customers will be able to upgrade their systems to RISC performance with an optional logic board that includes a Power-PC 603e processor. Eventually, other upgrades will be available, including a 10.4-inch active-matrix color display, which requires the PowerPC upgrade, lithium-ion batteries, infrared communication technology, and video output.

PowerBook 190 and 190cs models, which will also include pre-installed software, will be available worldwide by mid-October. Expected prices are shown in the table on page 8.

PowerPC Upgrades for PowerBook 500 and PowerBook Duo 200 Series Systems

In announcing the revamped PowerBook line, Apple also announced 100-MHz PowerPC 603e processor upgrade options for current Apple Macintosh PowerBook Duo 200 and Power-Book 500 series customers. PowerBook Duo 200 systems can be upgraded with a logic board kit, while the PowerBook 500 upgrade involves an expansion board upgrade.

Both upgrade cards come with 8 MB of memory, leaving the RAM slot open on upgraded PowerBook systems. Customers can then increase their systems' memory by simply having their existing memory expansion cards transferred to the slot when the upgrade is installed. Customers can also purchase new memory cards at the time of the upgrade, expanding memory to a maximum of 56 MB for PowerBook

Duo 200 models and 40 MB for PowerBook 500 models.

The upgrades need to be installed by qualified Apple service providers; they'll be available beginning in mid-October. For prices, see the table on page 8.

Macintosh DOS Compatible Systems Can Maintain Both Windows 3.x and Windows 95

Apple's Software Quality Assurance team has determined, based on test results from running Microsoft's official Windows 95 System Compatibility Tests, that the following cross-platform Macintosh systems are compatible with Windows 95 when configured with a minimum of 8 MB of RAM for the Windows 95 environment:

• Power Macintosh 6100/66 DOS Compatible

• Macintosh LC 630 DOS Compatible

• Macintosh Performa 640CD DOS Compatible

• DOS Compatibility Card for Power Macintosh 6100 and Performa 6100 Series

Not only will these systems run Windows 95, they'll also provide one marked improvement over PCs: They'll enable users to easily switch between Windows 95 and Windows 3.x. Most PCs won't let customers maintain both versions of Windows on the same system.

Macintosh DOS-compatible systems have always given customers the ability to create separate drive containers on their systems. This feature lets customers

maintain their current Windows 3.1 environment in one drive container, while installing Windows 95 in another one on the same computer; they can select either drive container as the start-up drive through the PC Setup control panel.

New Power Macintosh Computers Outperform Pentium

Here's the latest in the benchmark wars: Apple Computer's newest Power Macintosh systems outperformed Windows computers based on equivalent clock-speed Pentium processors by up to 44 percent overall, according to a study recently completed by Competitive Assessment Services (CAS).

The application-level benchmarks included 10 different applications measured on 58 different tasks. The applications used were Microsoft Excel, Word, and Fox-Pro, ClarisWorks from Claris, Wolfram Research's Mathematica, Macromedia Freehand, Fractal Design Painter, FrameMaker from Frame Technology Corporation, Deltagraph Professional from DeltaPoint, and Ashlar Vellum.

An analysis of the CAS report on the new Power Macintosh systems revealed that, overall, the Power Macintosh 7200, 7500, and 8500 were 24, 30, and 44 percent faster, respectively, than the Pentium-based systems running at the same clock speed.

The report also revealed that, on the graphics and publishing applications tested,

• the Power Macintosh 7200/75 was 62 percent faster than the 75-MHz Pentium-based PC tested

• the Power Macintosh 7200/90 was 58 percent faster than the 90-MHz Pentium-based PC tested

• the Power Macintosh 7500/100 was 71 percent faster than the 100-MHz Pentium-based system tested, and was 55 percent faster than the 120-MHz Pentium-based processor tested

• the Power Macintosh 8500/120 was 80 percent faster than the 120-MHz Pentium-based processor PC tested

These tests were conducted before Windows 95 became available and so were conducted using Windows 3.1 or Windows 3.11 for Workgroups (using the operating system pre-installed on each computer). However, tests conducted by *PC World* on a beta version of Windows 95 showed that both Excel 5.0 and Word 6.0a ran slower (on both 8 and 16 MB computers) under Windows 95 than under Windows 3.1. (See the August 1995 issue of *PC World,* page 113.)

For more information, you can find an Apple press release, "Newest Power Macs Trounce Pentium PCs," on the Worldwide Web at the following location: http://www.info.apple.com/pr/library/1995/august.html.

Netscape Adopts QuickTime, QuickTime VR in Strategic Agreement

Last month, Apple Computer, Inc., and Netscape Communications Corp. announced a strategic agreement in which the two companies will share technology to enhance Internet access for customers.

Under the agreement, Netscape will adopt selected Apple technologies to enhance the overall Internet experience for customers. Netscape has agreed to incorporate QuickTime and QuickTime VR into future releases of Netscape Navigator. Netscape's adoption of Quick-Time and QuickTime VR will make it easier for people to use various types of multimedia data through Netscape Navigator and will strengthen the positions of Apple's technologies as industry standards for video, sound, and music (QuickTime) and virtual reality scenes (QuickTime VR). Netscape also plans to enhance its Apple Macintosh offering through AppleScript and Macintosh Drag and Drop support.

Apple will distribute its Netscape Navigator network-navigation software as part of the Apple Internet Connection Kit. In addition, Apple has incorporated Netscape's Internet registration service into the Apple Internet Dialer, a key feature of the Apple Internet Connection Kit. The Apple Internet Dialer makes it easy for users to get connected with an Internet service provider of their choice.

The Mac Speaks Back

Apple Computer, Inc., recently released a new version of its PlainTalk technology, version 1.4, which includes three components: English Speech Recognition, English Text-to-Speech, and Mexican-Spanish Text-to-Speech. In addition to providing out-of-the-box benefits for customers, PlainTalk 1.4 gives developers opportunities to add high-quality speech (English or Mexican-Spanish) to their 680x0 or PowerPC processor–based applications.

Apple's text-to-speech technology is one of the most sophisticated available, and offers a variety of voices that range from the best quality in the industry, to the most efficient in size and speed, to the most fun and entertaining. There are 22 different voices, and all are created through synthesis. True speech synthesis means there are no recorded sound bytes to take up valuable disk space and RAM. Game developers, educational software developers, and CD-ROM developers can have any amount of text read aloud from their applications using Apple's text-to-speech technology, with a small, fixed amount of space taken up on the CD.

Apple's text-to-speech technology comes in four versions:

• MacinTalk 2—for any Mac OS–compatible computer running System 6.0.7 or later

• MacinTalk 3—for any 33-MHz 68030 (or faster) or PowerPC processor–based Mac OS–compatible computer running System 7.0 or later

• MacinTalk Pro—for any 68040 or PowerPC processor–based Mac OS–compatible computer running System 7.0 or later

• MacinTalk Español Mexicano—for any 68020 (or faster) or PowerPC processor–based Mac OS–compatible computer running System 7.0 or later

An example of a product that uses text-to-speech well is Scholastic's Wiggleworks™ for the Macintosh, a consumer education title that reads stories to children while the text and images are displayed on the screen, and allows the children to add their own text, which the program will read aloud.

Apple is now also providing text-to-speech for Mexican-Spanish. This new product allows CD-ROM discs, educational software, and any other application that takes advantage of the technology to be read aloud in Spanish with a Latin American accent. Apple continues to synthesize many more languages, and will provide Chinese, French, Italian, and Japanese in the future.

Applying Speech to Applications

Apple's text-to-speech technologies can be easily incorporated into third-party applications with the use of Apple's Speech Manager APIs (application programming interfaces). In most cases this can be done with just a few lines of code, resulting in more inexpensive applications on the market with this powerful text-to-speech ability.

The Speech Recognition Manager is expected to be available later this year. PlainTalk 1.4 English Speech Recognition runs on a PowerPC processor–based Mac OS–compatible computer to work.

Where to Find PlainTalk 1.4

PlainTalk 1.4 software and Speech Manager documentation aare available in the the Developer CD Series. On the August 95 Tool Chest CD, the pathname is Dev.CD Aug 95 TC:New System Software Extensions: PlainTalk Speech Technologies.

You can also find PlainTalk 1.4 on the World Wide Web, using the address ftp://ftp.info.apple.com/Apple.Support.Area/Apple.Software.Updates/%21Hot_Downloads/PlainTalk_1.4.1/ . ♣

Technology

CD Highlights

System Software Edition, October 1995

This month's Worldwide System Software folder contains U.S. and Worldwide versions of System Software 7.5.2 for the Power Macintosh 7200, 7500, 8500, and 9500 computers. Some points to remember to make your installer experience a happy one:

• To create floppy disks from the disk images, use the Disk Copy 4.2 or ShrinkWrap 1.4.2 applications in the Utilities folder. To create net install folders on your desktop, use the DropDisk 1.0b5 or ShrinkWrap 1.4.2 applications.

• The installer program for these versions of system software must determine at run time the type of computer it is installing the software on; therefore, you must run the installer on the appropriate computer, even if you are installing on a drive that is not the current startup drive.

• U.S. system software can be found in the Worldwide System Software folder under English, U.S.

• The "•common disks" folder contains disk images common to the PowerPC 7200/9500 and PowerPC 7500/8500 folders. Do not install from this folder (you can't anyway, as it contains no Install 1 disks); install from the images in the PowerPC 7200/9500 or PowerPC 7500/8500 folders.

Some of the more observant of you will notice that this disc is still not bootable; we're working with our vendors to make sure future discs will consistently start up most Macintosh computers and CD-ROM drives. We hope to have this in place for the January 1996 CD.

Here are some of the other new and revised items this month.

Developer Notes Update 10/95

Included here are developer notes for several new products: The AppleVision 1710AV Display, the Apple AV architecture, the Macintosh PowerBook 190 and 5300 computers, the Macintosh PowerBook Duo 2300c computer, the Macintosh PowerBook Processor

System Software Edition

Card Upgrade Kit with PowerPC 603e for the PowerBook 500 series of computers, and the Personal Computer Memory Card International Association (PCMCIA) expansion card interface.

GXifier 1.1

The GXifier automatically adds tables to existing TrueType fonts that allow those fonts to be used more effectively with applications that support GX typography. The 1.1 version adds support for more scripts, and adds more information automatically to fonts.

This package requires QuickDraw GX. The document About the GXifier can be opened in SimpleText if QuickDraw GX is installed. The GXifier only works with True-Type fonts in the Roman, Arabic, Hebrew, Cyrillic, Devanagari, Traditional Chinese, and

Simplified Chinese script systems. Other scripts will be supported in future versions.

PowerTalk Access Modules

This package contains sample code and tools for creating PowerTalk and PowerShare service access modules (SAMs). These samples are essentially half-gateways for the PowerTalk and PowerShare application programming interfaces (APIs); you must supply the other half, which you write for the service API of choice. The sample code is not completely functional, but provides a good starting place for development of a service access module.

The package contains sample code for the three types of service access modules:

• CSAMs (catalog SAMs)

• PMSAMs (personal messaging SAMs)

• SMSAMs (server messaging SAMs)

Please be aware, however, that the package has several shortcomings:

• It contains seed-quality code. You bear the responsibility for complete testing of derived products.

• This sample code does not cover all of the functionality of the SAM API.

• Optimization trade-offs between memory and performance have not been implemented.

• The package does not produce a PowerPC "native" version; however, it does use the latest universal headers.

• The tools may be awkward to use.

This Old Interface

By Peter Bickford

Having just moved into my first real house, I've become a bit—well, I guess *obsessed* is the proper word—with all things house-related. In fact, my twice-a-day trips to Home Depot have led at least one cashier to suggest direct-depositing my paycheck there. I wound up digging and jack-hammering a 20-foot-long trench around the side of my house so I could get that elusive third phone line I'd always dreamed of. And yes, after buying out all the dual coaxial jacks in two different Fry's Electronics stores, my new house now has Ethernet access from all the upstairs rooms. Not that I own two computers with Ethernet that could talk to each other—I just fell prey to the homeowner's obsession of "keeping up with the Joneses." Unfortunately, the "Joneses" I sit next to are the Networking group here at Apple, about half of whom seem to have ISDN or T1 lines running directly to their home networks.

The other homeowner's obsession is "fix 'em up" shows, the grand trinity of which are *Hometime, The New Yankee Workshop,* and *This Old House. Hometime* features a far-too-perky couple whose favorite way of kicking back together is mixing a few tons of concrete and laying down a building foundation. *The New Yankee Workshop* stars Norm Abrams ("Norm!") whose little workshop contains more high-tech laser sights and bizarre machinery than were ever built for the "star wars" defense program. My favorite, however, is *This Old House,* where the host shows how a little clever remodeling can transform a dilapidated tar-paper shack into a luxury condominium. In honor of this show, I wanted to use this month's column to give some advice on transforming your old, clunky interfaces into sleek, easy-to-use ones that will make your customers beam with pride and your competitors die of jealousy.

Repair, Remodel, or Renovate?

As you begin to plan the next version of your product, it's a good time to look at the old version with fresh eyes. Pretend you haven't been dedicating the last year or two of your life to this project, and try to picture how the product looks to a new user. What are its essential strengths? Where is it confusing or annoying to use? Most important, what are its fundamental weaknesses? This is a good time to gather the opinions not only of team members, but also of potential customers (who can see flaws that are "hidden in plain sight" from more experienced users) and expert reviewers (who can help diagnose underlying design problems).

The goal of this review is to come up with a list of places where the interface could be improved. For now, don't worry what the rationale for the current implementation was, or what technical problems stand in the way of fixing the interface. Be brutally honest in compiling your list of problems—as brutally honest as a customer or a magazine reviewer would be. The key is not to defend the previous design, only to ask, "How can we make it better?"

Next comes the second reality check. With the list of problems in hand, ask how much can be done given the constraints of time and budget. Decide what the scope of your redesign effort should be. Do you want to simply repair a few glitches, do a major remodeling job on specific problem areas, or do a full renovation of the human interface? Whichever way you go, it's best to be up-front about it now. If marketing is set on a beta version two months from now, you won't be able to explore new paradigms in human-computer interaction. Being realistic about the trade-offs of product quality, time, and resources now will save everyone a lot of frustration later on. It also lets the interface designer choose a plan of attack that has a chance of succeeding on some level, rather than having to constantly back up and change course.

Interface Repair—Getting Visible Results for Little Effort

When you go to sell your house, chances are your real estate agent will present you with a list of simple repairs you can do to make the house much more attractive to buyers. These usually begin with giving the house a fresh coat of paint, clearing away debris from the front yard, cleaning and uncluttering rooms, and so on. When I was looking at houses a month or two ago, it was amazing how much difference these little touches could make in houses that were otherwise structurally identical.

You can get a similar effect with a new version of your application by practicing a little interface repair. Start by holding a two- or three-hour interface review, with a particular emphasis on finding inconsistencies with the Macintosh human interface guidelines or between one part of the program and the next. Use the Human Interface Checklist, which you can find in Appendix C of *Macintosh Human Interface Guidelines,* to find problem areas. Run a mechanical resource checker such as SoftPolish to find misspellings, bad button placements, nonstandard Command-key combinations, and so on. In a few days, you can often find and fix a hundred or more little annoyances that cumulatively add up to major trouble for your interface.

You can also make a big impact by cleaning out deadwood features and buttons from your program. Follow the 80/20 rule (20 percent of your program's features constitute 80 percent of the use; the other 80 percent are only used 20 percent of the time) to decide which features are important for people to be able to use easily, and which can be relegated to less obtrusive areas of the interface (or better, omitted entirely). Unclutter menus and dialog boxes by weeding out low-value options and buttons, or integrating them more completely into your program's overall design.

Finally, when you're done spring cleaning your program's feature set, work with a good visual designer to fix any graphically confusing

areas of your interface and possibly give it a cleaner, more unified look. In doing so, it's a good idea to remember some other real estate agent advice and keep the decor understated and neutral. The whizzy black 3D treatment that you use today will look hopelessly outdated tomorrow. Stick with the classics and let people concentrate on using your application rather than gaping at your button designs.

Interface Remodeling—Major Attacks on a Few Bad Problems
None of us (OK, there was this one weird guy I knew . . .) concentrate the bulk of our attention on the bathrooms when buying a house. Usually, we're too busy checking out the yard, the living room, or whatever feature of our current residence is making us the craziest. I, for instance, had been fretting over the two-prong outlets where we lived and refused to look at homes without grounded wiring. Meanwhile, my wife, who is sensitive in these matters, made sure that there were enough rooms so that she could have her own home office without having to share it with 8,000 comic books. Any inspection of kitchens and bathrooms generally consisted of making sure they existed.

But kitchens and bathrooms are actually some of the most frequently used areas of a house, and any slight defects in them become big headaches over time. Make the cabinets in the kitchen too low, and there won't be enough space for your appliances underneath them. Make them too high, and shorter folks will have to stand on a chair to get to the upper shelves. A clumsy layout may leave you bumping into things or having to shut drawers in order to open the refrigerator. Although these sort of problems are invisible when you move in, they cause kitchen and bathrooms to be the most common parts of a home for you to rip out, rethink, and remodel later.

The same can be done with human interfaces. If you listen in on your customer support lines, you'll often find that just a few features of your program are causing the majority of your calls. If this is the case, you'll want to concentrate your redesign effort on rethinking these features. A classic design approach works well here, where you identify the problem by talking to users, work through a number of possible solutions with the engineering team, then prototype and test them on users until you find one that really works.

Remodeling is more costly than doing simple repairs, both in terms of time and resources. As a result, it's critical that the remodeled design gets to the heart of the user's problems without causing new ones. Don't just show your users screen shots and believe them when they mutter "everything looks fine to me." All that means is that the new design seems to fix the one problem they had been sore about in the old system. Have users work with prototypes so they can get a feel for the reworked feature in the context of doing their daily work. Only that way will you have

some assurance that you won't be ripping this same code out in the next version.

Renovation—Cracks in the Foundation
Conscientious repair and the occasional feature renovation should carry you through most of a well-designed product's life. There may come a time, however, when you decide that the best way to save your program's interface is to burn it down and try again.

Needless to say, this decision should not be made lightly. Unless your interface has been spectacularly unsuccessful, it will have a number of loyal users who have gone through the trouble of learning the current interface, and who will have to unlearn or relearn behaviors in a new interface. A complete renovation should only be undertaken when either there are deep problems with basic functions of your application, or when technology has changed to an extent that your product's architecture is going to cause it grave trouble in the future.

One renovation in progress here at Apple is OpenDoc. More than a decade after the genesis of the Macintosh computer, application development was in crisis. To accommodate customers' demands for various features, many mainstream applications had turned into monoliths, unwieldy in size and impossible to maintain. Without some great change, the trend toward bigger, slower, and more complex applications seemed unstoppable.

In this case, what was required was to lay a whole new foundation. OpenDoc switches the basic user focus from applications to documents. Instead of users trying to find the right tool with all the features they'd ever need, then doing their work from within that tool, OpenDoc lets users create documents, then freely bring in whatever tool they need in order to work with a certain type of content in that document. As a result, users can choose their favorite graphic editor to create graphics, a text editor to work with text, a video editor to edit video, and no longer worry about finding some gargantuan dinosaur of a program that attempts to do all of these at once.

Renovations are costly. They require a huge amount of thought and resources if they're to be done right. For the interface designer, they're a course of very last resort. But sometimes, as in the case of OpenDoc, they're the difference between watching your house crumble around you, and taking a risk and building a foundation for the future.

Till next time,
Doc

Peter Bickford is a proud new homeowner and member of Apple-Soft's Human Interface Design Center. He can be reached by AppleLink at THE.DOKTOR, unless he's out wandering through Home Depot in search of some house thing.

QuickDraw 3D–The Future Is (Virtually) Here

By Bob Megantz

In the personal computer user experience of the future, three-dimensional graphics will be used as commonly as two-dimensional graphics are today. Whether customers use design or scientific software, desktop publishing applications, games, or any of a number of other kinds of software, they will increasingly expect—if not demand—the "virtual reality" feel that 3D provides. QuickDraw 3D, Apple's open, cross-platform 3D graphics technology, is the foundation for adding 3D graphics capabilities, with relative ease, to your existing applications and for developing new 3D graphics applications.

QuickDraw 3D will open new markets both for Apple Computer, Inc., and for you, among customers who have never used 3D technology and among high-end graphics users. Mass market applications such as word processors, spreadsheets, and games can use QuickDraw 3D–based graphics in the same way they currently use 2D graphics. You can also use QuickDraw 3D to create high-end CAD/CAM and film and broadcast applications that are less expensive for you to create, are more focused, and run on less-expensive hardware that the competition—that is, current top-of-the-line products that require powerful (and expensive) workstations.

Apple has combined the best of both worlds—an exciting, powerful 3D architecture and an easy adoption curve. You can easily get the QuickDraw 3D software or plenty of information on it; for several sources of information, see the box "Where to Find QuickDraw 3D and Related Information" on page 18.

As promised, QuickDraw 3D has an adoption curve that's easy

to take. Here's what you should be doing with QuickDraw 3D:

• First, if your application creates or uses 3D objects, add the ability to import and export 3D objects in QuickDraw 3D's 3D metafile (3DMF) format. This gives you the ability to participate in this new market as quickly and inexpensively as possible.

• Second, if your application supports documents, it should support the QuickDraw 3D Viewer, which allows an application to display a 3D object for the user to manipulates. (Doing so is simple and requires the use of only five QuickDraw 3D calls.)

• Third, if your application does 3D rendering, you should modify it to use the QuickDraw 3D interactive renderer. Not only will your users get a richer 3D experience, they can also speed your application up (without any modifications on your part) by adding a graphics accelerator card.

• Fourth, if you're building a 3D application from scratch, you should use the full QuickDraw 3D API (application programming interface). In this way, you'll be building a cutting-edge product that you can port to the Windows market with minimal effort.

QuickDraw 3D for Power Macintosh and Windows

QuickDraw 3D is the first API designed specifically to require and take advantage of the Power-PC processor, and it demonstrates the expanded capabilities made possible by the transition to RISC. Just to give one example, QuickDraw 3D takes advantage of the PowerPC processor's floating-point performance to deliver fast interactive rendering.

QuickDraw 3D is shipping with Power Macintosh computers, and you can license it for any products that need it. By the end of this year, Apple estimates that 90 percent of all Macintosh computers shipped will be Power Macintosh models, which means that there will soon be a large installed base for QuickDraw 3D applications. In addition, Macintosh Quadra and Performa machines can be upgraded to Power Macintosh capabilities, and other 680x0

computers can use the Quick-Draw 3D 3DMF file format.

Equally important, you'll be able to create QuickDraw 3D applications for both the Power Macintosh and Windows platforms next year when Apple releases QuickDraw 3D for Windows. Apple is committed to establishing QuickDraw 3D as an open industry standard, has published the full QuickDraw 3D API and the specification for the 3DMF file format, and will not charge royalties for its use.

All of these factors create a powerful incentive to use Quick-Draw 3D, and Apple expects to see plenty of applications and related products for sale in the near future. In fact, many developers have already announced or are currently working on Quick-Draw 3D–based products.

So what is QuickDraw 3D, and what makes it so special?

The QuickDraw 3D Architecture

The QuickDraw 3D architecture supplies a standard set of 3D operations; see the figure "The

The QuickDraw 3D architecture. This simplified functional diagram of QuickDraw 3D shows those parts that can be customized by developers.
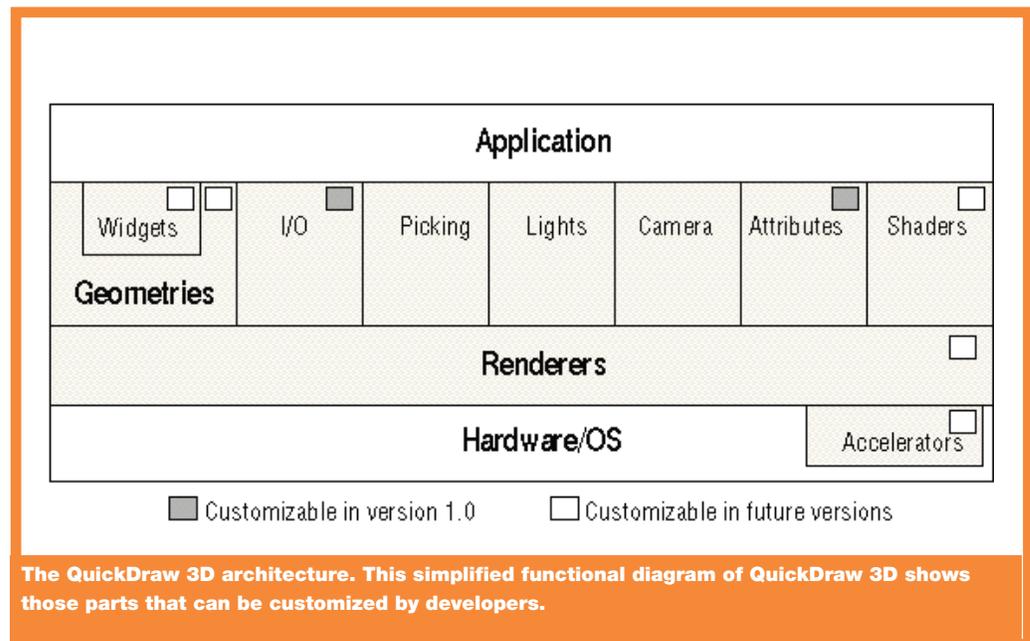
QuickDraw 3D architecture" (page 14) for an overview. When you create an object, it's often easiest to start with one or more standard shapes, such as boxes, that you then modify as needed. QuickDraw 3D includes a complete set of these 3D shapes, called *geometries,* including shapes you can use to create more complex objects. To change an object's shape, you can rotate it, scale it, or perform any of a number of other "transforms"; QuickDraw 3D has the capability to transform objects in a number of useful ways.

3D graphics designers rely on an application's tools to create, alter, and assemble objects or to place objects in a scene. The QuickDraw 3D user interface, which you use to access and control these tools, applies consistent standards and guidelines to the tools, making these elements an extension of the Macintosh interface. These tools,

known as *widgets,* attach to an object so that the user can interactively change the scene—for example, by modifying the type of lighting used or by moving the object's position. Selecting an object automatically attaches the appropriate widgets, and widget functions are represented on the screen by symbols known as *handles*. (For example, a lighting widget might look like a tiny light with a beam to indicate the direction and type of light used.)

The QuickDraw 3D user interface applies consistent standards and guidelines to widgets and other interface elements, making them an extension of the Macintosh interface. Apple provides a QuickDraw 3D user interface toolkit so you won't have to reinvent common elements and can apply your 2D interface knowledge to 3D applications—which helps both you and your customers. In addition, a QuickDraw 3D application can use a wide variety

of input devices, allowing the user to input object shapes in 3D using devices such as 3D trackballs, pressure-sensitive tablets, or 3D scanners.

Once you have created an object, you can change its appearance in a number of ways. You can shine any of several types of lights on the object, and the lights can interact with ("illuminate") the objects and scenes in different ways, representing different levels of quality and computational complexity. (In future versions of QuickDraw 3D, you'll be able to implement your own light and illumination algorithms.) You can also choose one of QuickDraw 3D's "cameras" to determine how the 3D objects in a scene are projected onto a 2D plane from whatever perspective you desire. Finally, you can use QuickDraw 3D's shaders to add an inherent quality, such as that of metal or wood, and to apply an overall "look," such as shininess or dull-

ness, to the object. This information is also passed to the Quick-Draw 3D application.

Once a 3D object has been created, QuickDraw 3D's renderer converts its mathematical representations of 3D geometry to 2D pixels on the screen, incorporating lighting, object characteristics and look, and the camera perspective chosen. You can use either QuickDraw 3D's interactive renderer, which quickly produces in real time a solid representation of the object that you can manipulate and edit, or a standard wireframe renderer, which shows just the framework of the object without a lot of the details. Quick-Draw 3D has been designed so that some material properties are added to an object by its shaders, while others are implemented by the renderer. In the near future, you will be able to utilize special-purpose plug-in shaders and renderers, once they're available, to add additional control of how the scene is rendered.

Rendering 3D objects can require lots of computation, so QuickDraw 3D allows you to add an accelerator card to help with the calculations and speed up the process. Furthermore, hardware graphics acceleration is transparent to your application—because of QuickDraw 3D's design, your 3D code automatically runs faster as soon as the user plugs in a graphics acceleration card. The QuickDraw 3D Acceleration Layer (QAL) plug-and-play hardware accelerator manager provides for a wide variety of accelerator cards, whose capabilities range from simple (for games) to powerful (for animation or graphic design).

Features currently available in accelerator cards include Gouraud shading, which allows you to improve an object's color by interpolating the colors along the edges of each triangle in a typical object, as well as texture mapping, which allows you to
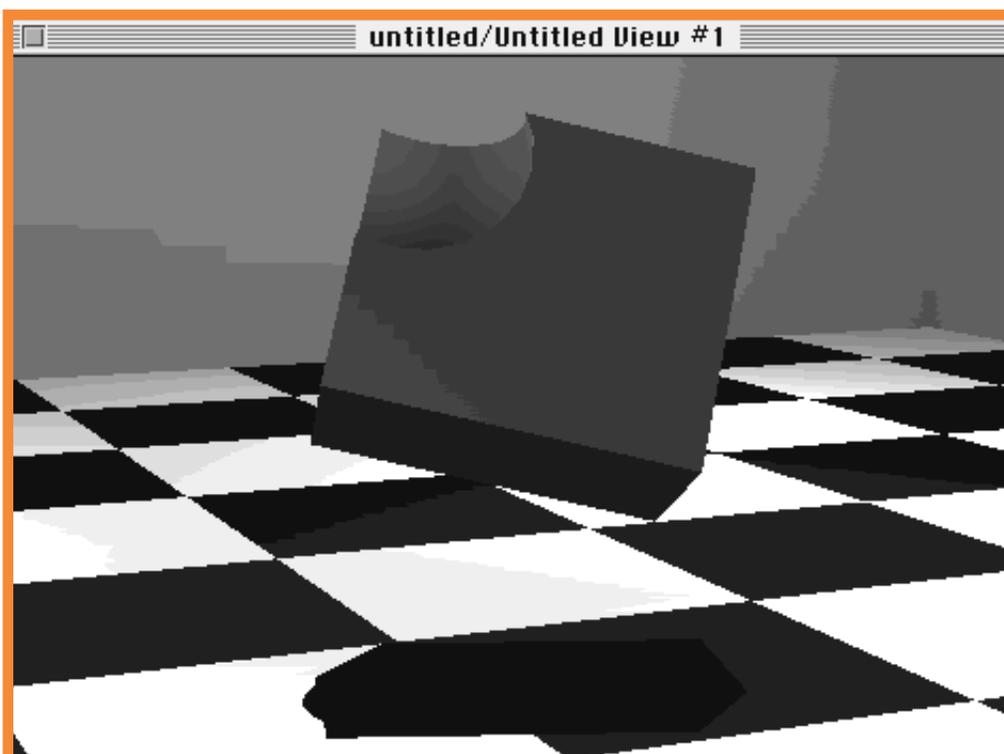
An example of Constructive Solid Geometry (CSG). When a hardware accelerator is present, the QuickDraw 3D interactive renderer can support CSG, which allows geometric objects to be "added" and "subtracted." The object pictured here is a cube that has part of a sphere subtracted from it.

apply a picture to a surface, resulting in more visually complex objects without increasing the complexity of the object itself. Another feature, anti-aliasing, lets you smooth the edges of lines to prevent jagged images. You can also make objects transparent, controlling the transparency of each color and the overall degree of transparency separately.

When hardware graphics acceleration is present, QuickDraw 3D also supports Constructive Solid Geometry (CSG), which lets you control the interaction of two or more objects—for example, drilling a hole in an object or fusing two objects together. (See "An example of Constructive Solid Geometry" on page 15 for an example of a solid created using CSG.) In addition, QuickDraw 3D applications can utilize parallel processing using multiple processors for fast rendering of large and complex scenes.

The 3DMF Format
One of the barriers to the widespread use of 3D has been the inability of customers to use 3D objects outside the program that created them. (Imagine the

Macintosh platform without the ability to cut and paste text or graphics from one program to another.) Apple hopes that one of the major contributions of QuickDraw 3D to the computer industry will be its 3D metafile (3DMF) format, which should make 3D objects more widely usable.

QuickDraw 3D data is shared using QuickDraw 3D's 3DMF format, which allows 3D objects created by one application to be used by other applications. The 3DMF format is platform-independent; it specifies objects, their properties, and properties of the scene that contains them (including orientation, lighting, camera, texture, shading, and custom data). The file format preserves all object properties exactly as created by the user in either text or binary formats.

If your application doesn't support a QuickDraw 3D feature (such as a particular object geometry), you can use an alternate representation (a different geometry). You can also extend and customize 3DMF files, and the file will retain all custom data regardless of whether other applications support the custom data.

Here's an important fact: Although QuickDraw 3D requires the PowerPC processor, you should support the 3DMF file format even if your application is 680x0-based. Why? Because that way, your application can still contribute to and benefit from the QuickDraw 3D world by its ability to import and export 3D objects in the 3DMF format.

The QuickDraw 3D Viewer
As Gregg Williams pointed out in his August 1995 Strategy Mosaic (page 8), "If your software supports documents, it should also be able to select, cut, copy, and paste all the data types (pictures, text, sound, movies, and 3D objects)." Apple sees 3D graphics as a differentiating technology for the Mac OS platform, and the 3D data type must be usable wherever it makes sense. Fortunately, the QuickDraw 3D Viewer makes it easy for you to support the 3D data type—you need learn only five new calls to implement a 3D Viewer.

The 3D Viewer provides a simple method for displaying 3D objects stored in 3DMF files or in memory, together with a set of controls permitting limited user interaction with the models. You can add the 3D Viewer to an existing application (one developer did it in a weekend) without implementing the full QuickDraw 3D API.

In the screen shown in "A sample 3D Viewer window," you use the controller strip at the bottom of the 3D Viewer window to manipulate the location and orientation of your point of view. Going from left to right, the first button, called the *camera angle button,* lets you choose different camera angles from a pop-up menu. You use the second button, called the *distance button,* to move the object closer or farther away. The third button, called the *rotate button,* has two modes, one that provides rotation in the

plane being viewed and another that allows spherical rotation of the object (the "virtual sphere interface"). You use the last button, called the *zoom button,* to move the object to a new location in the picture area. If you want, you can add a mark or "badge" to alert users that they are looking at a 3D object that they can manipulate, not a static 2D image.

What Makes QuickDraw 3D Special?
QuickDraw 3D development was driven by customer demand. The figure "How customer and developer requirements drove the design of QuickDraw 3D" (page 17) tells an important story. Apple chose the architecture and features of QuickDraw 3D so that you can produce applications that users want—applications that allow users to create, manipulate, and incorporate 3D graphics into documents and presentations as easily as they can with today's 2D graphics.

Apple made sure that QuickDraw 3D is a technology that makes sense for you as well. This meant that, for example, Apple had to deliver not only a 3D graphics technology but also a set of human interface guidelines, which would free you from the burden of devising a human interface. In addition, Apple made sure that QuickDraw 3D will, in fact, offer you new business opportunities; for details, see the section "How Will QuickDraw 3D Be Used?" later in this article.

By eliminating many of the most common obstacles found in current 3D graphics applications, QuickDraw 3D moves 3D graphics from the domain of highly specialized artists and equipment to average users and personal computers. Because it creates standards for 3D graphics and makes 3D applications easier to use, it will generate more user interest; users will be more inclined to use 3D graphics in all

A sample 3D Viewer window. The four buttons in the controller strip at the bottom of the window allow you to control your view of the 3D object.

How customer and developer requirements drove the design of QuickDraw 3D. Apple designed QuickDraw 3D to deliver a 3D architecture that met customers' needs. In the process, Apple made sure that QuickDraw 3D made sense for developers, too.
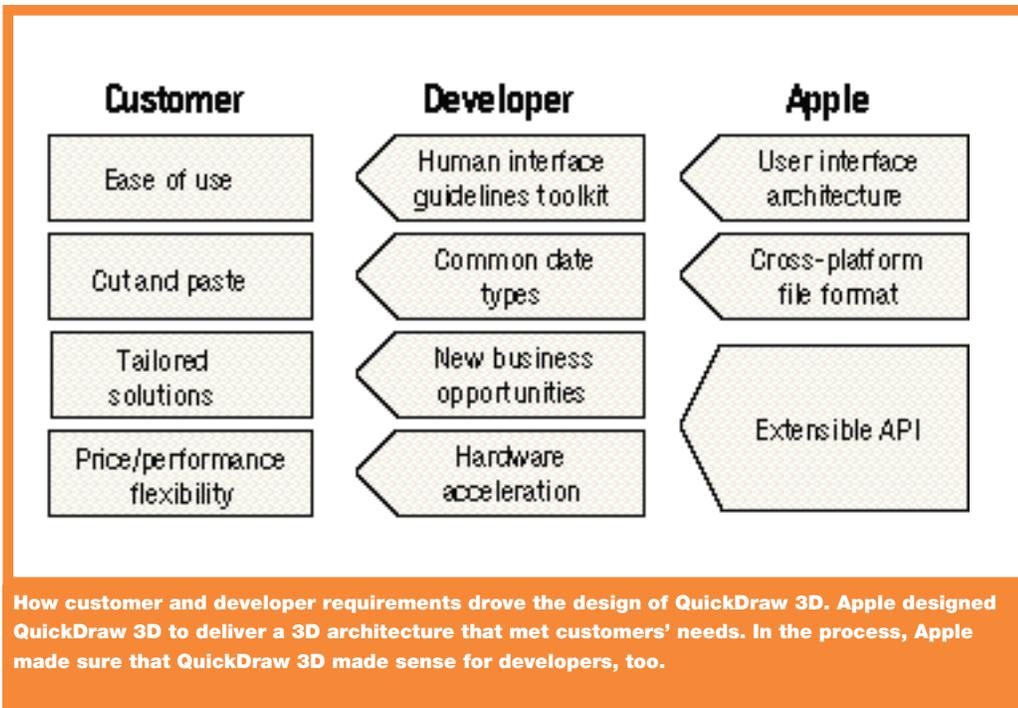
of their applications rather than only in special situations.

With QuickDraw 3D, Apple is providing you with a foundation for making 3D graphics ubiquitous. QuickDraw 3D includes the capabilities required by experienced users with sophisticated needs, while the 3D Viewer library allows you to provide users with more basic 3D features—such as the ability to view and manipulate 3D graphics—to less sophisticated users. QuickDraw 3D's user interface is easy to use, yet it provides a high level of performance by allowing users to manipulate actual objects rather than the less-detailed wireframe representations used in most current 3D graphics technologies. Artists and other experienced users know how much more natural it is to work in the real world; realistic object manipulation will help make 3D graphics attractive to more users.

Many current 3D graphics products are expensive and complex, with poor user interfaces and limited portability. Developers often make this situation worse by providing more features

and complexity in an attempt to differentiate their products. But QuickDraw 3D's modular and open architecture reduces the cost of adding 3D graphics to your applications, thereby allowing you to develop smaller, less-expensive products focused on more specialized applications and targeted at specific markets. (You can read more about Apple's market strategy for QuickDraw 3D in the next section.)

Customers will in turn be able to buy less-expensive software with features that more closely match their needs and that will be easier to master. In addition, because QuickDraw 3D greatly eases the effort associated with developing 3D applications, smaller developers can create marketable applications that were previously impossible because of the investment required. The result will be cutting-edge applications that will differentiate you from your competition and result in increased profitability.

One company that benefited from QuickDraw 3D's ease is Microspot, developer of 3D World, an entry-level 3D modeling

application for visual design. According to Robin Landsbert, Microspot's development team "ambassador," the team was so impressed after attending a QuickDraw 3D presentation by Apple that they "completely scrapped two years worth of rewriting the new version of the application and started again. After only six months of coding with QuickDraw 3D, we were already miles ahead." Landsbert goes on to add that "our impression of QuickDraw 3D is that it is extremely fast and powerful, and with its future extensibility it will provide third parties an opportunity to greatly improve upon it. Technical support from Apple was excellent, and working with the alpha and beta code showed that Apple's design was thorough and the code was very stable right from the start."

While you'll find QuickDraw 3D relatively easy to implement, if you follow Apple's human interface recommendations, you'll find that customers will be able to use QuickDraw 3D graphics with the same ease that they're used to with other Macintosh technolo-

gies. Even novice users will be able to easily paste editable 3D graphics into their 2D applications and then manipulate them in an intuitive and consistent way; experts, using QuickDraw 3D's fast interactive renderer, will be able to work directly with 3D art as they do currently with 2D art.

The QAL plug-and-play hardware accelerator manager, described earlier, will allow your unmodified applications to run faster when the user plugs in a hardware accelerator card. Accelerator cards optimized for a given application (for example, a simple, inexpensive card for games or a more powerful card for CAD/CAM applications) will be available from Apple and other vendors.

Apple has designed the QuickDraw 3D API to be extensible so that you can add your own value to the technology in future versions that support plug-in features. For example, you could develop custom shaders for texturing or illumination, or custom widgets for the user interface.

Apple implemented QuickDraw 3D as a Code Fragment Manager (CFM) shared library. A CFM library is a piece of code that can be shared by different applications after being loaded into memory. Once QuickDraw 3D is installed, applications can access it through the Macintosh Toolbox by relying on the Code Fragment Manager.

How Will QuickDraw 3D Be Used?
The market for 3D applications is still relatively small because of the cost (for both software and hardware) of 3D graphics capability, the high levels of expertise required, and the limited penetration of 3D graphics into the overall graphics markets. As shown in the figure "Increasing the market for 3D" (page 18), current 3D graphics products address a few markets in the middle of the

pyramid, leaving others, both above and below, unexploited. Apple is providing QuickDraw 3D to allow you to open up the graphics market both above and below the CAD/CAM, multimedia, and graphics arts segments currently addressed.

How will QuickDraw 3D widen the market for 3D? First, Quick-Draw 3D will improve performance, ease-of-use, and interoperability of applications targeted at current 3D markets. Cost-effective applications running on relatively inexpensive computers whose features are optimized for specific tasks will provide a much larger universe of users with capabilities that are currently only available to experts using workstations.

The larger portion of the graphics arts market, as well as the desktop publishing, general productivity, and game markets in the lower section of the pyramid, will gain access to 3D features when you use QuickDraw 3D to add 3D capability to your applications that currently support 2D graphics. This will start with a migration down further into the graphic arts market, but will continue into other markets as well.

(Though at the bottom of the pyramid, the games market represents an immediate opportunity for extensive use of QuickDraw 3D.) As mentioned earlier, Apple expects that many applications will begin by supporting the 3DMF file format and the Quick-Draw 3D Viewer first.

One reason 3D graphics has been less than popular with mass market customers is that they haven't had the modeling expertise (or the time or desire) to create 3D objects. Instead, they've relied on clip art libraries, most of which don't offer 3D graphics. The 3DMF file format standard will make it possible to develop 3D "clip art" much more easily than before. In fact, some of you have already announced products that are essentially made up of 3DMF-compliant clip art. As 3D clip art libraries proliferate, you can expect to see far more widespread use of 3D graphics among mass market customers.

QuickDraw 3D's advanced features, together with plug-in renderers that will soon be available, will help promote its use in applications targeted at the higher-end CAD/CAM and the film and broadcast markets. Future

versions will allow users to place objects in a scene with higher precision so that, for example, two objects that touch each other will precisely retain their relative positions when rotated or when the camera position is changed. A future version of QuickDraw 3D will support Boolean operations (like cutting holes in objects) and provide higher-order geometries to allow users to more easily create large and complex objects and scenes.

It will also be possible to extend the QuickDraw 3D library of technologies by providing custom geometries that are most useful in high-end CAD/CAM applications—an opportunity for you if you develop for the CAD/CAM market. Building advanced CAD/CAM applications based on QuickDraw 3D technology

will make the Power Macintosh a prime target platform for high-end workstation modeling applications.

One developer we talked to is already taking advantage of the extensibility of QuickDraw 3D. Spatial Technology provides ACIS solid modeling technology that is licensed to over 140 companies worldwide, including Autodesk, Inc. (makers of the industry-standard AutoCAD program). According to Dick Sower, founder and CEO of Spatial, "Spatial Technology and Apple are working together to ensure that Apple developers have access to world-class 3D modeling tools. We will be providing complete QuickDraw 3D support throughout our suite of tools, and we feel that QuickDraw 3D represents a very large opportunity in the 3D modeling market."
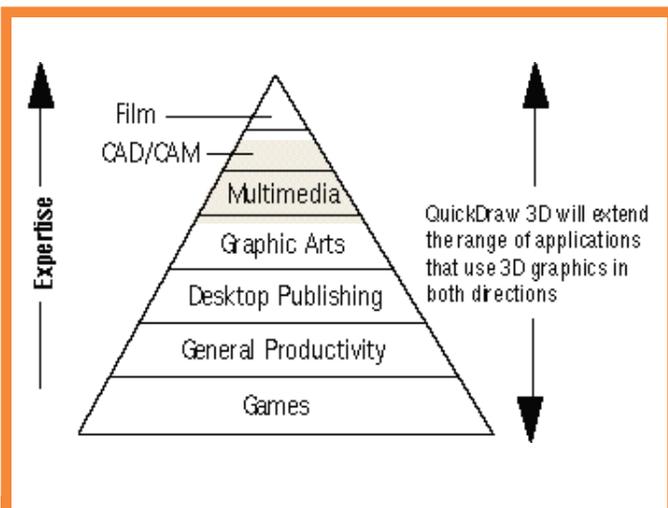

Increasing the market for 3D. The more expertise that 3D graphics requires, the fewer the opportunities for using it. QuickDraw 3D promises to make 3D technology more commonplace in markets both "above" and "below" today's markets for 3D.

Where to Find QuickDraw 3D and Related Information

• If you have a PowerPC processor–based Mac OS computer and 16 MB of memory, you can download the QuickDraw 3D software and sample programs from the Internet. To get the software, overview and marketing information, or technical data, connect to location http://www.info.apple.com/qd3d/. You can also get information through FTP using the address ftp://sam.austin.apple.com/Apple .Support.Area/QuickDraw3D/.

• The reference book for QuickDraw 3D is *3D Graphics Programming With QuickDraw 3D,* by Apple Computer, Inc. (Addison-Wesley, $39.95 in the United States). Not only does it tell you how to use QuickDraw 3D, an attached CD contains the software, various tools, and the API in both QuickView (for users of the Macintosh Programmer's Toolbox Assistant) and Adobe™ Acrobat formats. If you don't have Internet access, this book is one sure way to get QuickDraw 3D.

• Apple's quarterly programming magazine, *develop,* has articles on QuickDraw 3D in issues 22 ("QuickDraw 3D: A New Dimension for Macintosh Graphics") and 23 ("The Basics of QuickDraw 3D Geometries"). You can find these articles on the September Reference Library Edition of the Developer CD and on the World Wide Web (at location http://www.info.apple.com/dev/develop.html).

• If you would like a white paper entitled "Apple QuickDraw 3D—A Technology Overview," send your request by e-mail to quickdraw.3D@applelink.apple.com.

QuickDraw 3D will help the Macintosh platform move into new graphics markets—both at the high end and at the low end—because of the advantages it provides over current solutions. First and foremost, QuickDraw 3D provides a more natural, intuitive medium that facilitates and simplifies many tasks, making QuickDraw 3D applications useful to a greater number of people. For example, in an application that uses QuickDraw 3D, an object is created just once; lighting, perspective, and other appearance details can be easily changed later with little additional effort. Redrawing or rephotographing objects from different angles or with different lighting is no longer necessary. Also, as mentioned earlier, you can create QuickDraw 3D applications that are tailored to a specific market. These targeted, cost-effective applications will open up markets unavailable to current 3D applications.

QuickDraw 3D Integration

You can utilize the various components of QuickDraw 3D in your applications individually or together. This flexibility allows you to immediately provide some of QuickDraw 3D's benefits and move to full utilization when you are able. The steps toward complete adoption of QuickDraw 3D, from easiest to most difficult, are explained below.

The first step is to support the 3DMF file format. This means that all of your current and future applications that use 3D graphics—both 680x0-based and PowerPC processor–based—should be able to read and write 3DMF files. Large numbers of applications that support 3DMF and widespread availability of 3DMF-encoded data will rapidly establish 3DMF as a 3D file format standard.

Apple has supplied a parser for translating common file formats to the 3DMF format. In addition,

you may need to translate the 3D representation used by the 3DMF format to the one used internally by your existing application. For example, the 3DMF format defines a sphere by its center and radius, while your application might define a sphere by three points on its surface. Depending on the extent of the differences, you may need a couple of days to support the 3DMF format in an existing application.

Next, modify your existing 2D applications to support the 3D Viewer. The 3D Viewer is easy to implement; only five function calls are required. Once you provide 3D Viewer support, your users can paste 3D objects into their documents and manipulate them.

Next, you should also modify your existing 3D applications to support the interactive renderer. This will greatly improve an application's performance by allowing real-time manipulation of the actual objects rather than the simple bounding boxes (which simply show the position of the object) or wireframe models (which don't show any material

attributes) with which users are currently forced to interact. You can implement the interactive renderer as a subset of the QuickDraw 3D API; you'll get QAL support as well. However, you won't be able to take advantage of QuickDraw 3D's human interface improvements in this scenario, so you should also keep your products up-to-date by planning to support the full QuickDraw 3D API—for example, at the next major product revision.

Finally, new 3D applications—especially PowerPC processor–compatible games—should of course take full advantage of QuickDraw 3D by providing core architecture support and using Apple's user interface guidelines.

QuickDraw 3D Uses: Some Concrete Ideas

QuickDraw 3D can be used in just about any type of application; your imagination is really the limit. An obvious application for QuickDraw 3D technology, of course, is games.

Pangea Software's Gerbils! demo (see the "Gerbils!" screen shot) is a good example of how

QuickDraw 3D's capabilities can be put to use in games. Gerbils! is a "rodent-coaster" game, in which you make and change tracks that a gerbil runs on, knocking off other rodents along the way. Pangea started out in 1987, developing games for the Apple IIGS. The company's Mac OS games include Firefall Arcade (published by Inline Software) and Power Pete (published by MacPlay).

Brian Greenstone of Pangea describes his experience with QuickDraw 3D: "I was absolutely amazed at just how quickly I was able to get the first prototype of Gerbils! up and running. My contact at Apple came over to my apartment and handed me a Gerbils! design spec, a QuickDraw 3D manual, and the libraries. Working only a few hours a day, within four days I had a small section of track being displayed with the camera running down it. Within two weeks I had basic track editing, and within one month the whole program was basically up and running.

"QuickDraw 3D was unbelievably easy to pick up and get going with. About the only thing I had
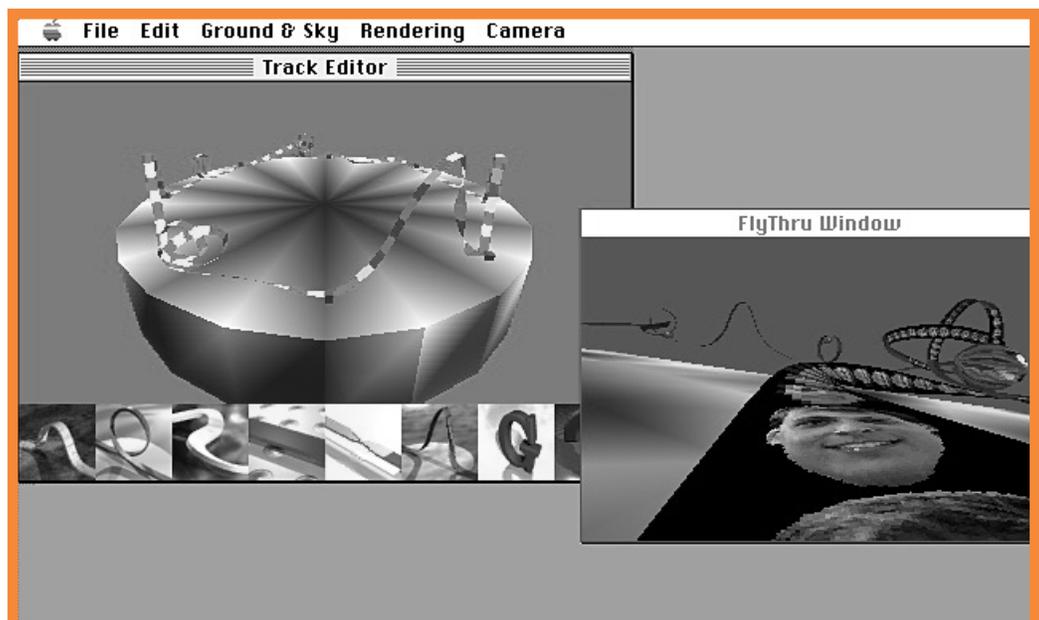
Gerbils! Brian Greenstone of Pangea Software said QuickDraw 3D enabled him to create this real-time game in a month (including the learning curve for QuickDraw 3D).

Early QuickDraw 3D Adoption

Company/product	3DMF	Viewer	Renderer	Full use	Comments
3D Labs, Inc./GLINT					3D graphics accelerator chip
Artifice, Inc./ DesignWorkstop				y	
auto•des•sys, Inc./FormZ	y		planned		
Byte by Byte Corp./ Sculpt	y		y		
Electric Image, Inc./ Electric Image Animation System	y		y		
Fractal Design Corp./ Poser	y				
Graphisoft R&D Software Development Ltd./ ArchiCAD 4.55	y				
Graphisoft, Inc./ MiniCad 6	y		planned		
Hash, Inc./ Animation Master 3.0	y		y		
HSC Software Corp./ unnamed products	y				
Kandu Software/ Cadmover for Power Macintosh	y				CAD file-translation package
Linker Systems/ The Animation Stand	y				Will render models into animation frames
Macromedia/ Extreme 3D	y		y		
Macromedia Digital Arts Group/ Freehand	y		y		Support through add-in software module
MacPlay/ Descent				y	Game
Matrox Graphics, Inc./ Matrox Graphics Accelerator					64-bit PCI graphics accelerator card
Model Masters L.L.C./ Model Monger	y				Professional 3D clip art
Microspot USA, Inc./ unnamed product	y			y	3D design, modeling, and visualization application
Radius/ unnamed 3D hardware	y				
Ray Dream, Inc./ Ray Dream Designer	y		y		
SketchTech, Inc./ Upfront	y		y		
Specular International/ Infini-D	y		y		
Strata, Inc./ StudioPro and Vision 3D	y		y		Adds support for Web browsing
Syndesis Corp./ InterChange (for Windows)	y				3D object file translation for Windows file formats
Valis Group/ PixelPutty Solo	y				3D modeler and animation program
Vertigo Technology, Inc./ Vertigo 3D Media Authoring Software	y		y		
Viewpoint DataLabs International, Inc./ unnamed products	y				Broad range of 3D clip art
Vibro-Acoustic Sciences, Inc./ AutoSEA	y		y		Vibro-acoustic analysis tool
Virtus Corp./ Virtus Walkthrough Pro and Virtus VR	y				
YARC Systems Corp./ The SCREAMER			y		QuickDraw 3D display system using RISC coprocessor and GLINT chip

to write was the code for generating a 3D spline [for the track]—QuickDraw 3D has calls built in for doing pretty much everything else." Brian goes on to say that "QuickDraw 3D is the best version 1.0 of anything Apple has ever released. It's amazingly fast considering what it does, and the hardware acceleration is equally impressive. It brings a Power Mac 9500 pretty darn close to low-end SGI performance for a fraction of the cost."

Another hot area for Quick-Draw 3D development is on the Internet's World Wide Web, where 3D Web browsers may provide an exciting market opportunity for some of you. In general, you'd create a 3D Web browsers that make navigation through a Web site much more evocative and interesting. For example, a user might "walk" down a hallway with pictures on the walls. Clicking a picture could move the user to a new location—for example, the Web page of the museum in which the picture is located. To implement 3D Web browsers, you can use viewers and helper applications that use QuickDraw 3D as the playback engine and the 3DMF file format for the objects users view at a Web site.

Current and Future Plans for QuickDraw 3D

QuickDraw 3D was released on August 8th, and is available to everyone. Apart from a nominal licensing fee for distributing the API, no royalties are charged for using QuickDraw 3D. You'll find a complete SDK with full API documentation at Apple's QuickDraw 3D Web site (http://www.info .apple.com/qd3d/). QuickDraw 3D is currently shipping with the PCI-based Power Macintosh 8500, 7500, and 7200 computers and will be available in stand-alone Mac OS packages.

Several dozen companies have announced that they will support QuickDraw 3D. (Check the QuickDraw 3D Web page for complete and up-to-date listings. See also the table on page 20.) QuickDraw 3D accelerator cards have been announced by Apple, YARC Systems, Radius, Matrox, and Newer Technologies. Apple will provide a QuickDraw 3D implementation for the Windows platform in 1996; once that happens, QuickDraw 3D–based graphics will be viewable by the vast Windows market, and you'll be able to port your QuickDraw 3D–based applications to run on PCs as well as on Power Macintosh computers.

Future versions of QuickDraw 3D, currently planned for release next year, will include several new features. First, Apple will provide support for plug-in renderers and shaders and supply additional object geometries. As explained earlier, these additional features will help make your QuickDraw 3D applications useful and popular for both less- and more-sophisticated customers than are currently using 3D technology.

In addition, Apple will supply a user interface toolkit that will make it even easier for you to put QuickDraw 3D to work in your applications. The QuickDraw 3D preview renderer, another new feature, will help make the process of working in 3D more natural by allowing fast, high-quality object preview with sophisticated lighting and shading prior to the final render.

3D for Free
As it so often does, Apple is putting an entirely new technology—QuickDraw 3D—in your hands. By preventing you from having to reinvent the wheel, Apple is giving you new capabilities without burdening you with the costs of designing, maintaining, and promoting the underlying technology. All you have to do is use it!

The developers who have used QuickDraw 3D so far are very excited by the possibilities it opens up. Remember, too, that Apple is depending on you to implement QuickDraw 3D in the ways described at the beginning of this article. Doing so ensures that you will have a state-of-the-art product and that the Mac OS remains the state-of-the-art platform for personal computing. ♣

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Special thanks to Apple Developer Technical Support Engineer Nick Thompson for his help in preparing this article.

OpenDoc Human Interface FAQs

Selecting, Implementing Tool Bars and Palettes, Embedding, and Scripting

By Kerry Ortega, Geoff Schuller, Dave Curbow, and Elizabeth Dykstra-Erickson, OpenDoc Human Interface Team

This month, we're covering several questions about OpenDoc's behavior when multiple parts are involved, the mechanics of bringing content into and out of an OpenDoc document, and scripts that are tied to an OpenDoc part. There should be something for everyone here.

Q: I'd like to be able to select content within different parts of the document at the same time. For example, I want to select a word in a text part, an oval in a drawing part, a clock part, and a complete drawing. Will I be able to do this in OpenDoc?
A: That depends. The content you're describing could all be part of a continuous multiple selection, if the containing part's content model allows that; or, it could be a discontinuous selection. Discontinuous multiple selections can be made only within a single part, not among multiple parts.

OpenDoc doesn't allow discontinuous selection across part boundaries, because all parts do not provide the same commands, and consequently it would be difficult for the user to predict

what will happen to the selection. Because of this, OpenDoc displays only the menus of the active part; it supports menu switching, rather than menu sharing.

If the user attempts a selection that crosses part boundaries, OpenDoc displays the menus of the parts' container (that is, the next hierarchical level up), which may or may not support the commands the user wants to invoke.

There are several alternatives to the above and we considered many during the design of Open-Doc. Here is one example of an alternative that we felt would not be successful, along with why we felt it was problematic: Allow users to select content from multiple kinds of parts and show the *intersection* of the applicable commands in the menus. In order to do this, OpenDoc would have to determine what kind of parts and what kind of content were selected, and then determine which commands would apply to *all* of them. This results in a significantly reduced set of commands that could be used on the selected parts. This seriously constrains what the user can do to those parts, and thus is far from optimal.

Another problem that could occur is that, while several different parts might have certain commands in common, a single command might produce a different effect when applied to different kinds of content. For example, if

the user selects a music staff and a graphics object and invokes the command Scale, that command could very well produce a different effect on each type of content: The music staff might play a musical scale, and the graphics object might change its relative size. Imagine the kinds of unexpected behavior this problem might create.

For these reasons, we decided against this approach and decided to limit the user's selection to a single content/part kind. We think this, along with the menu switching capability, will clarify to the user what commands are available.

Q: I'd like to have a universal tool bar that contains standard tools that apply to content for all different kinds of parts. For example, I'd like to use the same paint bucket tool to change colors in my paint part and my word processor part. Will OpenDoc let me do this?
A: This is an interesting idea, but OpenDoc does not provide a facility like this. There are different ways of interpreting what you've asked. As described above, menus switch as a part becomes active. Likewise, tool palettes, rulers, and so on also switch, so it isn't possible to use the same tool in different parts. However, if you are simply suggesting that it would be nice to have a standard

set of tool icons across different part editors—that's certainly possible.

A related issue is reusing the same tool palette but having the tools within that palette change according to the part that is active. For example, a part editor developer may decide to reuse a "standard" tool, such as a text tool or a paint bucket tool. Reuse assists users in predicting the behavior of the tool and gives them the perception of universality that doesn't cost developers anything to provide. (In fact, this decreases your development time.) The OpenDoc human interface guidelines encourage you to reuse functionality from other editors so that you don't have to create it all yourself. (For details, see page 16 of the May 1995 issue of *Apple Directions.*)

We aren't delivering any code to support multiple parts sharing the same palette in release 1.0, but because many people have expressed interest in this, we are considering it for the future.

Q: My text part does not support embedded parts. If other text is pasted or dropped into it, the content is merged. But what should I do when a user copies some text that contains embedded parts, and then pastes this into my text part? Should my editor paste in the text, ignoring the other "nontext" parts, or should it refuse to paste anything?
A: We encourage you to support embedding to maximize data transfer and to minimize user confusion. However, if you are unable to support embedding, you must be able to handle pasting data in special ways and inform users of the implications.

Consider the following example: A user copies some text and graphics from a text part and pastes it into an e-mail part. Depending on how the e-mail
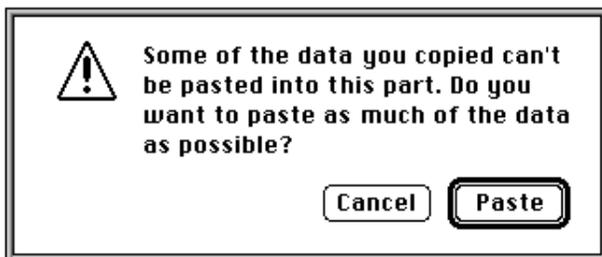
editor handles the information it gets from the Clipboard, typically some of the content will be pasted and some of it will be lost. When the text part's Copy command is invoked, it copies the selected content to the Clipboard in several different formats. One of the formats is "text without graphics," which the e-mail part can accept. Then, when the user pastes the content into the e-mail part, the "text without graphics" data is pasted in and the other nontext data is ignored.

Similarly, when your part editor copies content onto the Clipboard, one of the formats it should supply is "content minus any embedded parts." Thus, parts that don't support certain types of data will be able to receive as much of the copied data as possible during a paste operation. The objective is to allow the user to transfer as much data as possible during a copy-paste operation.

If you are unable to support embedding, you may want to display the embedded content as being of type NoPart, which causes a gray box to appear until the relevant editor is available or the user translates the part. The gray box alerts users to the fact that your editor could not display some of the pasted content. An alternative is to notify the user that only some of the content can be pasted. In this case, we suggest using the alert shown below.

Q: What should happen when a user copies non-OpenDoc content into an OpenDoc document and vice versa?
A: A key goal of the OpenDoc user experience is something we call "round-trip integrity." By this we mean that content being moved from one place to another should not be altered unnecessarily. For example, dragging any content into an OpenDoc document should not alter the content after it is dropped. The intent is

⚠ Some of the data you copied can't be pasted into this part. Do you want to paste as much of the data as possible?

[Cancel] [[Paste]]

A "Some data can't be pasted" alert box.

that the user should be able to drag it back out to the Finder and the content that is dropped will be identical to the original.

In other words, if the user copies a drawing document from the Finder into an OpenDoc document, the drawing content inside the OpenDoc document should contain all the content and properties from the original drawing document. For example, all of the contents (in all of the stored representations) should be preserved, as well as the name of that drawing, the kind of the content, the last editor used to edit that drawing, and so on.

There is one exception to this rule, which occurs in the case of merged content. If a drawing is copied into a drawing part, the contents of the drawing are merged into the destination part instead of being embedded in it. In this case, the destination part uses only one of the content representations; any others are discarded. In addition, the properties of the original drawing document are not preserved, because the drawing is now part of its new home and will inherit the appropriate properties of the containing document. It has a new identity!

Another important aspect of the data interchange issue has to do with a part's *kind,* which is one format (or "representation") of a part's content. A *standard kind* is a data format widely used among traditional applications— for example, "styled text" is understood by many word processors. It is important that your editor not arbitrarily change a standard kind to an OpenDoc-specific kind.

For example, let's assume that SurfWriter 1.0 is a traditional application and SurfWriter 2.0 is an OpenDoc part that allows embedding. When the user drags SurfWriter 1.0 content into an OpenDoc document, your

SurfWriter 2.0 part editor should not automatically change the content's kind to SurfWriter 2.0 just because it's now residing in an OpenDoc part. Leave the content's kind alone! That way, the user can later extract the content (whose kind is SurfWriter 1.0) and give it to someone who doesn't have OpenDoc.

The representation and kind of the part should only be changed when the user has made some change that absolutely cannot be handled by the old representation. For example, when the user embeds another part into our example SurfWriter 1.0 part, its representation and kind must be changed to one that supports embedding—because the Surf-Writer 1.0 representation does not support embedding. After this, the kind cannot be changed back, because to do so would require removing the embedded part.

One final note on kinds: The user has control over the content's kind. In the Part Info dialog box, the part's kind is shown in a pop-up menu. All kinds that the editor supports—for example, SurfWriter 1.0 and 2.0—will be in that list, as well as a mechanism for translating to other kinds. The user may change to any supported kind. Of course, the kinds available in the pop-up menu may change over time. For example, if you look back at our previous example, once the part's kind has been changed from SurfWriter 1.0 to 2.0, the SurfWriter 1.0 kind would no longer be found in the pop-up menu.

Q: My part has several different tool palettes and rulers. Where should I initially place these?
A: Our human interface guidelines suggest pinning to the upper left. Therefore, place your main palette in the upper left of the screen. When the user's

system has multiple screens, place the palette on the same screen as the document window it supports. The most important considerations for placement of tools are proximity to content, flexibility of placement, and reachability. In other words, users should be able to easily associate the tool with the content it modifies. The user should also be able to change the location of the palette (and the system should remember the new location). Finally, the user should be able to hide and show the palette, dismiss it (using a close box), and recover it (using a menu command).

If the document contains several parts that use the same part editor, the palettes should be positioned in the same spot on the desktop, regardless of which part is active. The palette should not be affixed directly to a part— this is an inefficient use of screen real estate and would cause unnecessary repainting of the document when another part becomes active. Positioning your tool palette *inside* your part not only artificially increases the size of your part, but can obscure content within your part or cause content in the container to reflow. This would violate the WYSIWYG principle.

When your part is the root part and your editor supports a ruler, place that ruler at the top of the window. When the part is inactive it should still display the ruler, since the user may find it useful when looking at the placement or content of embedded parts.

If a ruler is necessary for a part that is embedded, you can use overlaid frames if the container supports them (in this case, an overlaid frame would be a ruler that appears just above the embedded part), but in certain situations this solution doesn't work well. In these situations, we recommend that you create a floating window to contain the

ruler, and place the window so that it is adjacent to the relevant side of the part (the ruler could be horizontal, vertical, or both, depending on the content model). Further, users should be able to dismiss rulers.

We appreciate any comments you have on this topic; you can send them to the address OpenDoc-Interest@CILabs.org.

Q: How do I attach scripts to OpenDoc parts?
A: Scripting allows customization of the interface. We expect that most users will experience scripting indirectly, by using documents created from commercially available stationery that contains embedded scripts. For example, in filling out an electronic medical form, a user might be unaware that an embedded script is invisibly validating data as it is entered. Nonetheless, we want you to know how scripting works in OpenDoc and what kinds of user interfaces you should support in order to allow scripts to be added to parts.

Conceptually, scripts may be attached either to the part as a whole or to some intrinsic content *within* the part (for example, text fields, menu commands, command buttons, radio buttons, pop-up menus, or other controls and graphics objects). Any part may have a script property associated with it, and the script may be attached in many ways, which will be explained later.

If a part editor supports attaching scripts to its intrinsic content, the intrinsic content—a text field, for example—has no script property in which to store the script because it is only one element of the part itself (which can have its own script property). Still, the user interface for the intrinsic content's script should be similar to that used for attaching scripts to embedded parts, and there should be no difference between

editing the script of a part and editing the script of a part's intrinsic content.

There are several ways that a user can attach scripts to parts. One way is the required user interface method and the others are alternative methods. The required method involves the Part Info dialog box. A user can create and edit a part's script by selecting the part, choosing the Part Info command from the Edit menu, and clicking the Settings button. This opens the script for this part and allows the user to edit it. Please be aware that, as the part developer, you are responsible for adding the Settings button to your part's Part Info dialog box.

One optional method for attaching a script to a part is through menu commands. When a part is activated, its menus are displayed and, if your part supports scripting, you can add commands to your part's menus that provide direct access to its script editor. You may also provide keyboard shortcuts, such as the Command-Option-click shortcut that HyperCard uses, to provide direct access to your part's script editor. Another optional method for adding a script to a part is through the drag-and-drop feature. For example, if the user drags and drops an OSA (Open Scripting Architecture) script file onto a button part, the button part editor should copy the contents of the script into the button's script property. ♣

CD Highlights

PT/PS Products Guide
The *PowerTalk/PowerShare Products Guide* starts with a description of the technology and how it provides solutions for communication and collaboration. Following that is a complete catalog of PowerTalk and PowerShare applications.

QuickTime 2.1
The QuickTime system software extension enables you to integrate video, graphics, sound, sprites, text, music, and animation into documents. By providing a standard way for all Mac OS programs to control these multimedia elements, QuickTime makes them easier to use. QuickTime 2.1 includes support for smoother video, sprite animation, CD-ROM AutoStart, 16-bit audio compression, and MPEG. It also includes the capabilities of the Apple Multimedia Tuner.

You can find more information on QuickTime at Apple Computer's QuickTime site on the World Wide Web. The site address is http://quicktime.apple.com.

This package also contains version 3.1 of the Sound Manager. The Sound Manager 3.1 software consists of
• the Sound Manager system software extension
• a new version of the Sound control panel

Available since the introduction of the Macintosh II in 1987, the Sound Manager is Apple's digital audio software solution that allows any application to play and record sounds using the built-in sound hardware found on Macintosh computers. Sound Manager 3.0, released in 1993, added support for 16-bit CD-quality audio, redirection of sound to third-party hardware cards, and plug-in audio compression/decompression software (codecs).

Sound Manager 3.1 adds two new audio codecs, significant performance increases on the Power Macintosh line of computers, and asynchronous alert sounds. It is completely backward-compatible with previous versions of the Sound Manager.

Snippets Update
This folder contains four new snippets from Virginia (Ginny) McCulloh of Apple Developer Technical Support.
• *GetOwnerGroup.* This sample demonstrates how to determine the owner and group of a directory (folder). It's really a modification of Brian Bechtel's and C.K. Haun's "Select Folder w/ Gray files" sample; instead of reporting the vRefNum and the parID in a dialog box, it reports the owner name and group name of the directory. This sample requires Think C 7.0.x or MPW 3.3.x.
• *IconUtilCheck.* This snippet shows how to determine whether the icon utilities are available. According to technical note OV-16, *Inside Macintosh: More Macintosh Toolbox* specifies that the gestaltIconUtilitiesAttr 'icon' Gestalt selector (in the GestaltEqu files) can be used to determine whether the icon utilities are present under System 7, but this selector was not implemented until system software version 7.1.2. This snippet determines whether the the utilities are present by using the TrapAvailable code to check for the _IconDispatch (0xABC9) trap. The TrapAvailable code is presented in Volume VI of *Inside Macintosh,* and as sample code in many of the snippets on the Developer CD. This sample runs under Think C 7.0.4, CodeWarrior 6, and MPW 3.3.1 with the universal headers.
• *PowerMacOr68K.* This snippet shows how to determine whether your application is running on a Power Macintosh or on a 680x0-based Macintosh, and shows how to determine exactly which type of processor is running. It also works around an off-by-one error with gestaltNativeCPUType. This sample runs under Think C 7.0.4, CodeWarrior 6, and MPW 3.3.1 with the universal headers.
• *ShadingWinds.* This little application includes code for detecting whether a window has been rolled up by WindowShade. This code runs under Think C 7.0.4 and MPW 3.3.1 with the universal headers.

Coming Next Month
I'll try to ship the much-requested new version of SWAt, as well as the usual new and revised tools, utilities, and sample code.

Alex Dosher
Developer CD Leader

Business & Marketing

Apple Guide—Intelligent Help for Your Business

By Kris Newby

As your software or hardware grows in complexity, so does the burden of providing your customers with support and training. The natural reaction to this complexity is "up-sizing." To educate customers on new features, you end up adding pages to your manuals. To guide customers through complex procedures, you end up adding technical support people. But if you're beginning to think that there's a better, more economical way to support your customers, it may be time to take a closer look at Apple Guide, the Mac OS technology for creating intelligent help systems.

Apple Guide is the first *active-assistance* help engine to be integrated into a personal computer. When we speak of active assistance, we're referring to Apple Guide features that enable users to accomplish tasks with minimal direction. Apple Guide help systems are able to anticipate user preferences and needs. And they can actively lead users through the steps required to complete desired tasks. With Apple Guide technology, you're able to do more than create electronic reference manuals—you're able to create electronic *teachers.*

Beyond the benefits that Apple Guide provides your customers, Apple Guide offers a number of

developer advantages. If you're an application developer, Apple Guide can reduce your support costs, lower manual printing costs, and improve customer satisfaction. If you're a custom developer, Apple Guide opens up new business opportunities to create client-specific training and help products. This article provides an overview of these business benefits, an extensive list of Apple Guide resources (on page 28), and testimonials from some of your colleagues who are putting Apple Guide to good work.

Apple Guide's Task-Oriented Approach

Before releasing Apple Guide, Apple Computer, Inc., conducted more than three years of research and analysis on the kind of help people need while working on computers. From these studies, Apple designers formulated these conclusions:

• Most computer users don't read user manuals from cover to cover—they use them when they're unable to perform a desired task.

• Frustration is compounded when users can't quickly locate answers to questions within traditional documentation.

• Users prefer answers to computer-related questions to be presented in concise steps.

• Interactive, context-sensitive help systems can provide more

immediate answers to computer-related problems, improving a user's experience.

These findings led Apple to focus its efforts on creating a help system in which answers to task-related questions are presented in discrete steps. This is different from the traditional approach to writing documentation—where procedures are buried within feature-focused chapters or sections. A task-oriented approach lets users electronically find a quick answer to a question such as, "How do I download stock quotes into a graph?" rather than having to search through multiple feature-focused chapters, such as "Creating Graphs" and "Downloading Online Information." Apple believes this approach is fundamentally more useful to users—though it's often harder to develop, since it requires more research to anticipate users' needs and behavior.

Originally, Apple Guide was designed as a dedicated Mac OS help system. But as enthusiasm for the technology spread, Apple Guide's scope expanded to its current configuration—that of a general-purpose help engine accessible by all developers. Having this help technology available as a consistent, easy-to-use, platform-wide standard is expected to further improve the overall Macintosh user experience.

Intelligent Features

Danny Goodman, co-author of *Danny Goodman's Apple Guide Starter Kit,* sums up the importance of Apple Guide: "By far the greatest benefit of this technology is the level of integration it offers between an application (or solution) and its online help/tutorial system. This system doesn't just display flash cards atop applications—users clearly sense that the help system is watching what they're doing. Perceptive users will recognize this as the dawn of an intelligent system that won't let users make mistakes."

Apple Guide's architecture consists of three parts: a system software extension that installs at startup, a Faceless Background Application (FBA) that loads when help is invoked, and one or more application-specific help databases that a guide designer creates using an Apple Guide authoring tool such as Guide Maker. Here are some of the unique features that make Apple Guide particularly well suited to helping computer users:

• *Context sensitivity.* This Apple Guide feature enables a help system to detect where a user is working in a program and whether or not this user has completed a specified task. It can

also check a user's Macintosh model, so that a user only receives instructions for features available on that model. The benefit of this feature is that users are only presented relevant topics when help is invoked.

• *Interactivity.* Apple Guide's interactivity enables help systems to respond to users' actions by coaching them through the next step in a process or by notifying them when they've incorrectly executed a step. One of the most popular interactive features is the "coach" mark. Developers can use these animated circles, X's, underlines, and arrows to direct users' attention to screen areas. As a guide developer, you have the ability to mark either static or dynamic interface objects, enabling you to interactively lead a user through a series of steps.

• *Multimedia content delivery.* In cases where a picture (or sound) "is worth a thousand words," graphics, QuickTime movies, or audio can be launched from an Apple Guide panel.

• *The Huh? button.* Apple Guide delivers answers to specific questions in a succinct format, but users can click the Huh? button at the bottom of a Guide panel to get more information on a given topic.

Apple Guide technology was created so that you could add simple guides to most applications without having to make any core code changes. Any application that uses the Macintosh Toolbox according to *Inside Macintosh* guidelines will automatically support basic Apple Guide capabilities such as Help menu visibility, panel linking, coach marks, and context checks. You just have to place an Apple Guide database file in the same folder as an application. If you want to write guides that provide more complex assistance, you may have to change parts of your application code to support specific Apple Guide features. (For technical details on how to begin using Apple Guide, see the article "Giving Users Help With Apple Guide" in *develop,* Issue 18, June 1994, and the other resources listed on page 28 of this article.)

Apple Guide Business Benefits

Your customers are the first-tier beneficiaries of a well-designed Apple Guide help system. They'll gain access to a help interface that they're familiar with, and they'll be able to find answers to common questions faster than they would using traditional user manuals. And this, in turn, should help your business reduce support costs and improve customer satisfaction.

For companies who take full advantage of Apple Guide's rich feature set, the benefits are correspondingly greater. You may be able to reduce manual printing and shipping costs. You can use your Apple Guide support as a competitive marketing advantage. And if you're a custom software developer, Apple Guide can provide you with new development services to offer your customers. (See "Apple Guide Business Benefits" on this page for an overview of Apple Guide features and benefits.)

In addition, developers are just beginning to explore the creative potential of this relatively new technology, and over the next few months, you'll see an increasing number of clever Apple Guide implementations come to market. For example, Purdue University's biology department has created an Apple Guide–based interactive training tool that takes students through the dissection of frog and chicken embryos. Route 66 Geographic Information Systems, a Dutch company that is also based in Silicon Valley, was able to localize their route planning application's help system into three languages in only nine days. Learning Systems in Colorado Springs ships an Apple Guide help system with their multimedia authoring tool, Scene Slate. And they use Apple Guide instructional panels to annotate their QuickTime-based tutorial. (For more ideas on creative uses of Apple Guide, see the "Apple Guide Solution Ideas" box on page 27.)

In the next sections of this article, we've included descriptions of how Apple Guide is being used by four different types of developers: a commercial software developer, a hardware developer, an in-house developer, and a Macintosh prepress service provider. These Apple Guide developers also discuss why they chose this technology and how it helps their businesses.

Intuit's Intuitive Help System

Intuit is not only the number-one publisher of personal finance software, but its flagship products, Quicken and MacInTax, include two of the best built-in help facilities on the market today. Intuit hopes to increase its competitive lead in this area by shipping a new Apple Guide help system with the next version of Quicken for Macintosh.

What initially drew the Quicken team to Apple Guide technology was the promise that it would save in-house programming resources. Quicken's proprietary help system had grown so large that the technical publications group was having trouble

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Apple Guide Business Benefits

Feature	Benefit
System-wide integrated help engine	Provides consistent user help interface with Mac OS and applications, and faster user learning curve
Task-oriented, question-driven system	Reduces technical support calls by addressing frequently asked questions
Interactive, context-sensitive support	Provides faster answers to questions, improved customer satisfaction, product differentiation
Paperless help solution	Reduces manual printing, assembly, and shipping costs
Media integration of graphics, audio, and QuickTime movies	Delivers better help, improves customer satisfaction
Assistance for multiple applications, without modification of application core code	Presents opportunity for third-party or in-house guide creation
Active-assistance business opportunity	Differentiates and positions your company as a leader in intelligent systems

persuading in-house programmers to maintain and extend it. So when Leigh Chapman, a senior technical writer at Intuit, previewed Apple Guide's rich feature set, he jumped at the chance to move to this Apple-maintained technology.

"Apple Guide is a big win for our department," says Chapman. "It enables us to provide our customers with a help system that is better supported and has more features."

Because Intuit's approach to writing instructional materials was already task-centered, as opposed to feature-centered, the move to Apple Guide's question-and-answer format was relatively easy. In preparation for this transition, team members revised their existing help system to include frequently asked customer questions. Working closely with the Quicken technical support group and guideWorks, a company in Monte Sereno, California, that

specializes in intelligent assistance solutions, they compiled and categorized questions and answers within a database. Then they moved them over to their Apple Guide system.

"Using this approach, we knew that we'd answered the questions that were most important to our customers," says Chapman. "And we found we were able to use words that made sense to them, rather than forcing them to learn our corporate terminology. For example, we found that many users didn't understand what we meant by reconciling accounts—most think of this task as *balancing checkbooks.* We expect that Apple Guide's question-and-answer format will eliminate or shorten many support calls."

The Quicken team also found they could reuse much of their existing manual content by transferring text from FrameMaker to Microsoft Word for editing. They

then used Claris XTND to bring this edited text into Guide Maker. They've also added a digital audio track that enables users to have instructions read aloud.

"One of the biggest advantages to using Apple Guide over our old help system is its context-sensitivity," says Chapman. "Apple Guide can sense where in a program a user is working and call up appropriate help topics. Next year we'll also save printing costs, because we'll be able to remove step-by-step instructions from our manuals, replacing these with pointers to our help system."

Microtech's Drive to Reduce Costs

Microtech International, a mass storage device company located in East Haven, Connecticut, is using Apple Guide technology to reduce technical support and product costs.

"Within the next twelve months, we hope to eliminate our hard-copy manuals by placing most of our user information in an Apple Guide help system," says Dominic Rapini, Microtech's director of marketing. "By shipping this information inside our drive system folders, we'll save thousands of dollars in printing and shipping costs."

This 50-person hardware company was also quick to recognize another advantage to using Apple Guide: It provides a convenient, low-cost way to deliver information that will encourage customers to buy more drives. Within its Apple Guide help system, Microtech will be working with the guideWorks organization to add step-by-step instructions for setting up RAID systems (for writing data to multiple drives simultaneously); advice on buying storage for video production; and ordering information for other products in the Microtech line.

Apple Guide is also helping Microtech reduce calls to its sup-

port center. It's providing customers with tips and tricks for setting up SCSI-based storage systems, as well as an escalation path for troubleshooting problems. Rapini adds, "You can't get the type of active assistance that Apple Guide provides from the other electronic documentation readers on the market.

"What I like best about Apple Guide is that I can put a wealth of information into the system folder on a drive, and it becomes part of the computer system's built-in help system," says Rapini. "Drives may move from office to office, but our customers will always know where to find product information. And even though upfront Apple Guide development costs are fairly high, we'll come out ahead because of reduced technical support and product costs, and improved customer satisfaction."

Guiding Pharmacists Through 70,000 Products

Last fall, Bergen Brunswig, one of the largest pharmaceutical distributors in the United States, sent new Macintosh LC 575 computers, along with their Accu-Source™ CD ROM–based product catalog, to their 3,000 pharmacy customers.

This California-based pharmaceutical distributor finds itself in a surprising role—that of a Mac OS software developer—because the custom software that it creates helps sell more products. Not only does Bergen Brunswig's Accu-Source™ system offer pharmacists a fast way to check stock and order any of 70,000 products, but it provides the company with detailed product information and a search function for evaluating generic drug alternatives. Making the most of the productivity software that ships with its Macintosh LC computers, Bergen Brunswig also sends customers ClarisWorks templates for pharmacy shelf signs.

Apple Guide Solution Ideas

Apple Guide technology can be used for more than just creating question-and-answer help systems. Because of its unique active-assistance features and its ease of use, a wide variety of computer users are employing Apple Guide to build everything from university tutorials to employee procedures. Here are just a few ideas on ways to use Apple Guide.

• a more attractive, reliable delivery mechanism for the information typically delivered in Read Me and What's New text files

• a facility for teaching short cuts to power users

• a help system that enables users to load different categories of help topics according to experience level or specialty (for example, spreadsheet users could specify whether a business accounting or home finance help database should be installed)

• a menu that asks new users if they'd like the help system to step them through a few key startup tasks

• a troubleshooting checklist for users to complete before they call technical support

• a step-by-step training tool that walks employees through the filling out of electronic company forms, such as expense reports and purchase orders

• integrated help facilities for any custom Excel spreadsheet, or for any Claris FileMaker, ACI 4D, or FoxPro database

• a help button in your application alert or dialog boxes that takes users directly to relevant Apple Guide instructions

One of the product champions behind AccuSource™ is Bergen Brunswig's vice president of R&D, Jim McLaughlin. When McLaughlin first saw a pre-release version of Apple Guide, he said definitively, "I want it." Soon after, he recruited guideWorks, a guide development consultant, to add an Apple Guide database to AccuSource™.

Bergen Brunswig, with the help of Apple Guide, is now able to provide pharmacists with services above and beyond those of competitors. Taking advantage of the Macintosh LC 575 computers' built-in multimedia capabilities, the company has embedded QuickTime movies into its Apple Guide database to explain specific aspects of the company's products and ordering system. For example, pharmacists are able to launch a QuickTime movie in Apple Guide that shows them how to connect their hand-held stock-checking devices to a Macintosh. To help offset the costs of this system, Bergen Brunswig sells ad space, in the form of screen savers and QuickTime movies, to pharmaceutical manufacturers.

The indexing and search capabilities of the system also help the company bridge the terminology gap between pharmaceutical manufacturers and pharmacists, providing cross-references to the plethora of pharmaceutical brand names, chemical names, and generic alternatives. And as the

Apple Guide Resources

Books and Articles

• "Giving Users Help With Apple Guide," *develop,* Issue 18, June 1994. This is a technical overview on how to add Apple Guide to your application.

• *Apple Guide Complete: Designing and Developing Onscreen Assistance* by Apple Computer, Inc.; Addison-Wesley, ISBN: 0-201-48334-3; $39.95. For beginning and advanced guide developers, *Apple Guide Complete* is a book and CD-ROM package that provides everything you need to successfully produce guide files, including Guide Maker, the software you use to build and test guide files.

• *Real World Apple Guide* by Jesse Feiler; M&T Books, ISBN: 1-55851-429-5; $39.95. This "getting started" book includes everything you need to create your own Apple Guide help systems, including a CD-ROM containing Guide Maker and other tools. It comes with examples of Apple Guide help for HyperCard stacks, 4D databases, WordPerfect, Microsoft Word, and other programs, along with tips on creating customized Apple Guide applications with MPW, MacApp, CodeWarrior, and Think C. To order, call 800-488-5233.

Authoring Tools

• *Danny Goodman's Apple Guide Starter Kit* by Danny Goodman and Jeremy Joan Hewes; Addison-Wesley, ISBN: 0-201-48349-1; $34.95. This self-contained "getting started" book and disk package includes a graphical development tool, Apple Guide Starter (a full-functioning demo of this tool is available at http://www.guideworks.com). Apple Guide Starter automates guide creation by giving you Apple Guide windows in which you can write content, specify coach marks, attach "Huh?" buttons, and more. The program then generates the GuideScript text and compiles the guide database with the included Guide Maker Lite program. The book features expert advice about guide design, planning, and organization from a member of Apple's Instructional Products group.

• *Guide Composer.* This new Apple Guide authoring tool from StepUp lets you enter your guide content in the same windows that your users will see. There's no guide script syntax to learn—guide files are automatically compiled using Apple's Guide Maker Lite (shipped with Guide Composer). Guide Composer allows you to add AppleScript scripts, buttons, pictures, sounds, coach marks, and custom code to your panels. For more information, download a free demo at ftp://mirror.apple.com//mirrors/Info-Mac.archive/dev/guide-composer-demo.hqx or visit StepUp's Web site at http://rampages.onramp.net/~stepup.

Training Classes

• *Creating Apple Guide Help Systems.* In this Developer University class, you can learn how to develop an Apple Guide database from start to finish. The next class will be held on November 6–8 at Developer University's Cupertino facility. For additional class dates, a detailed course description and outline, or registration, call 408-974-4897 or visit the Web site http://www.info.apple.com/dev:developer university.

• *Intro to Apple Guide Development.* This class, sponsored by the Apple Business Consortium, is designed to help developers evaluate adding Apple Guide to their services and to provide attendees with enough information to begin creating simple guides. For more information, call 800-681-4636 or 408-366-8330.

Online Resources

• *eWorld.* Use the path Macintosh Development Forum:Technical Discussions:Category—Apple Guide.

• *AppleLink BBS.* Follow the path Developer Support:System 7.5 Talk:Apple Guide Discussion.

• *Apple Developer Services Web page.* You'll find this page at the location http://www.info.apple.com/dev/developerservices.html.

• *Apple Developer Services FTP site.* Use the address ftp://ftp.info.apple.com.

• *guideWorks Web page for Apple Guide.* The site address is http://www.guideworks.com/.

• *Anarchie Guide.* For an amusing example of a guide, check out this companion help system for the shareware Internet tool, Anarchie, created by Quinn the Eskimo "down under." See the Web site http://redback.cs.uwa.edu.au/quinn/www/softwaredevelopment.html.

• *Apple Guide Internet mailing list.* Send a message to listserv@list.peter.com.au containing the message "subscribe apple-guide <lastname firstname>", replacing <lastname firstname> with your actual name.

• *The Apple Guide Custom Solution Sampler CD.* You can obtain this sampler through the Apple Solution Provider Network mailing and the Apple Developer Services FTP site.

• *Apple Evangelism Overview.* This presentation is designed for consultants and MIS managers trying to decide if they want to add Apple Guide to their services. To order an electronic version of the presentation, send an e-mail message to jghiii@apple.com.

AccuSource™ customer base grows, McLaughlin anticipates that Bergen Brunswig's new Apple Guide system will help keep 800-number support costs under control.

Summing up his thoughts on Apple Guide, McLaughlin says, "Apple Guide is a strategic technology for providing our customers with better service. When people start seeing these types of user-aware help systems, I think they're going to start clamoring for them."

A Prepress Training Tool

For Midwest Litho Arts, a busy electronic prepress shop running around the clock in Des Plaines, Illinois, training new employees and integrating new procedures into its operations were proving to be increasingly difficult tasks. With Apple Guide, the company found a fast, easy, and consistent way to put its shop procedures online for training and reference.

Dennis Harper, Electronic Systems Coordinator at Midwest Litho Arts, used Apple Guide to develop a simple online procedure for converting a Photoshop file to an EPS/JPEG compressed file. This guide gives step-by-step instructions for making this conversion. Approximately 30 to 40 Macintosh color technicians use this guide, as do new employees undergoing training.

"This was my first Apple Guide, and I developed it as part of an eight-hour training session I attended on the technology," says Harper. According to Harper, it took him three hours to get this first guide up and running. He believes future guides will take approximately thirty minutes, depending on the complexity of the procedure.

For the Photoshop conversion guide, Harper initially created a word-processing document describing the various steps of

the process. Then, he pasted text from this document into a template provided in the Apple Guide authoring tool, Guide Maker. "It was all very easy," says Harper.

Previously, an employee wanting to know how to complete a certain shop procedure had to thumb through a manual three inches thick. "This was a

time-consuming process and, honestly, most trainees would just ask another employee. This cut into production time," explains Harper.

New employees have to be trained on shop applications, and this training is time-intensive and difficult to keep consistent because of multiple work shifts. "Apple Guide provides us with more consistency in training. Now every batch of new employees is taught the procedures in exactly the same way. And it saves us a lot of time. We can put the procedure online once, and it's there for future reference," says Harper.

Harper plans to put 20 to 30 more procedures online in the near future. He also plans to work on Apple Guides for his clients, so that they can better prepare materials to send to prepress.

The Learning Curve

There's a bit of pain that comes with getting up to speed on any new technology, and Apple Guide is no exception. New guide developers have to learn Apple Guide conventions and may even have

to change core software code to support complex Apple Guide features. The time and effort required for your specific project is highly dependent on the current state of your technical documentation and the level of assistance you wish to provide. If you're a company that has already laid the groundwork for a task-

> ## "Perceptive users will recognize [Apple Guide] as the dawn of an intelligent system that won't let users make mistakes."
> ### —Danny Goodman

oriented help system, your transition will be relatively easy. If, on the other hand, you have a more traditional set of technical documentation, allow for more development lead time.

The good news for anyone interested in Apple Guide is that development is rapidly getting easier, as Apple refines this technology and as more third-party developers create tools for it. In addition to Apple's own authoring tool, Guide Maker, two new graphical user interface authoring tools—*Guide Composer* and *Danny Goodman's Apple Guide Starter Kit*—make guide development significantly easier for designers unfamiliar with programming techniques. And for those of you who want to get a jump start using this technology, there's a growing number of Apple Guide consultants available for hire. (See the "Apple Guide Resources" box on page 28 for more information on these products and services.)

Looking Ahead

Apple Guide 2.0, which will ship by the end of 1995, will include

speed improvements and backward compatibility through System 7.0. This backward compatibility will enable you to amortize guide creation costs across a larger installed base and provide your existing customers with another reason to upgrade. Apple Guide will also support OpenDoc, enabling developers to create custom guides that can be dropped into applications created by other developers.

Taking the long view, the real importance of Apple Guide is that it's the first step toward active-assistance computing. With each new release of the Mac OS, Apple will provide you with more tools that help you build intelligence into your applications. And by doing everything you can to support Apple Guide today, you'll be able to provide your customers with the best possible help system and be all the more ready to take advantage of active-assistance technologies as they're released. ♣

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Listings

Developer University Schedule

Apple Computer's Developer University (DU) courses provide "how-to" instruction in all aspects of programming the Macintosh computer. With course offerings on a broad range of subjects, from PowerPC and OpenDoc to Newton and MacApp, Developer University (DU) will give your engineers the information they need to build Macintosh and Newton software using the latest Apple technologies.

The following is the schedule of DU course offerings for the remainder of 1995. Courses marked with an asterisk (*) are held in Portsmouth, New Hampshire. All other classes are held at the Apple R&D Campus in Cupertino, California.

September

Programming OpenDoc $1200	9/18–9/20
*Scripting with AppleScript** $600	9/18–9/19
Multimedia Development with QuickTime VR $1500	9/26–9/28

October

Programming with OpenDoc Development Framework $1600	10/2–10/6
Object-Oriented Fundamentals $1500	10/9–10/13
Programming OpenDoc $1200	10/16–10/18
Writing Reusable Code $900	10/16–10/18
Newton Programming: Essentials $1500	10/23–10/27
Programming QuickDraw 3D $1000	10/23–10/25
QuickStart Mac OS Programming $1500	10/23-10/27
Macintosh Debugging Strategies & Techniques $900	10/30–11/1
Scripting with AppleScript $600	10/30–10/31

November

Creating Apple Guide Help Systems $1200	11/6–11/9
Multimedia Development with QuickTime VR $1500	11/7–11/9
PowerPC BootCamp $1200	11/6–11/9
Apple Events/AppleScript Programming $1500	11/13–11/17
Programming OpenDoc $1200	11/13–11/15
Programming with OpenDoc Development Framework $1600	11/13–11/17
Advanced C++ $1200	11/27–12/1

December

Programming with QuickDraw 3D $1000	12/4–12/6
QuickStart Mac OS Programming $1500	12/4–12/8
Multimedia Development with QuickTime VR $1500	12/12–12/14
Newton Programming: Essentials $1500	12/11–12/15
Programming OpenDoc $1200	12/11–12/13
Scripting with AppleScript $600	12/11–12/12

To register for a class or to get a complete course description by fax, call the Developer University Registrar at 408-974-4897.

Course descriptions can also be found electronically at the following locations:

AppleLink:	Developer Support:Developer Services:Apple Information Resources:Developer Training: Developer University
eWorld:	Computer Center:Apple Customer Center:Apple Developer Services:Developer Information: Developer University
Internet:	http://www.info.apple.com/dev

The Internet Page

This feature is devoted to informing you about where you can go on the Internet for online information about Apple Computer, Inc.; its products, technologies, and programs; Mac OS and Newton programming; and other subjects that pertain to the business of computer product development.

You'll find this feature particularly helpful when you view it at the Apple Directions *Web page (located at http://www.info.apple.com/dev/). There, all the names of the locations listed in this article are linked to the sites themselves; clicking the names will take you directly to the relevant Internet location. We'll update this feature every month, based both on what Apple is doing on the Internet and on your feedback.*

Apple Sites

This section describes Web sites maintained by Apple Computer.

http://www.info.apple.com/dev/
This site contains the Apple Developer Services and Products page, and is probably the most important World Wide Web page for you. Not only does it contain the online version of *Apple Directions,* and *develop,* the Apple Technical Journal, but this page also links you to a variety of other sites that give you access to the gamut of Apple's online developer support services.

http://www.apple.com/
This site contains the Apple Computer home page, with links that will eventually let you get to just about all the other Internet sites maintained by Apple, even the ones listed separately here. If you visit the Apple Developer Services and Products page first, you can get to the Apple Computer home page, with links that will eventually let you get to just about all the other Internet sites maintained by Apple, even the ones listed separately here.

http://www.austin.apple.com/macos/
This is the Mac OS Web site. You can go here for the latest information on the Mac OS, including details about Copland, white papers on new Mac OS technologies, marketing and strategic information, and software updates, examples, demos, documentation, tools, and other items to help you develop new Mac OS products.

http://www.info.apple.com/opendoc/
This is the site of Apple's OpenDoc home page, featuring Developer Depot, where you can find the latest OpenDoc release, documentation, and tools, and Developer Showcase, from which you can download and sample actual OpenDoc parts!

http://www.info.apple.com/qd3d/
Apple's QuickDraw 3D home page contains everything you need to know about QuickDraw 3D (QD3D), including QD3D applications you can "test drive," listings of developers who support QD3D with links to their Web pages, and thorough developer information.

http://www.info.apple.com/powermac/powermac.html
http://www.info.apple.com/ppc/ppchome.html
These are two useful sites for information about Power Macintosh computers.

http://quicktime.apple.com
This site contains the QuickTime Continuum page with news and technical and marketing information about QuickTime. This page focuses on hot new QuickTime developments, which means that much of its content is currently dedicated to QuickTime VR.

http://qtvr.quicktime.apple.com
This is the location of the QuickTime VR page, which includes not only information about how QuickTime VR works and how you can get started programming with it, but also QuickTime VR movie samples, which you can view by downloading the QuickTime VR player from the page.

http://www.info.apple.com/gx/gx.html
This site contains the QuickDraw GX home page.

http://www.apple.com/documents/otherappleservers.html
This is the site of the Apple Internet Servers page. Once you've exhausted the obvious Web sites just listed, this page will give you ideas about where else to go on the Internet to find the information you need. This page includes lists of other Web sites as well as Gopher and FTP sites.

Non-Apple Sites

We can't guarantee the information the following sites contain, since they're not created by Apple, but we think you'll find them useful and interesting—even entertaining.

http://home.mcom.com/home/internet-search.html
This site contains the Internet Search page, which gives you access to InfoSeek, Lycos, and WebCrawler, three excellent Web search engines. If you use Netscape, you can reach this location just by clicking the Net Search button.

http://www.class.com/MacTech/URLs.html
This site contains a useful list from MacTech magazine of Internet locations on a variety of subjects, most of them pertaining to the technical aspects of Mac OS development.

http://www.freepress.com/myee/ultimate_mac.html
This site contains the ULTIMATE Macintosh page, including more Mac OS information and software than you could possibly imagine exists. We think you'll particularly enjoy the software archives and games sites, from which you can download real-live software and play with it.

http://www.cs.brandeis.edu/~xray/mac.html
Nathan's Everything Macintosh page is another treasure trove of Macintosh information; it contains a thorough listing of Apple and other corporate sites that pertain to Mac OS development as well as games, e-mail mailing lists, periodicals, a listing of FTP sites, software archives, and even Apple II information. Also visit Nathan's home page at World Wide Web location http://www.cs.brandeis.edu:80/~xray/, which includes the so-called Comprehensive Image Map of Everything, a graphical index of

the World Wide Web complete with hypertext links to hundreds of other locations.

http://www.cilabs.org/
The location of the CI Labs home page, which contains a great deal of OpenDoc content.

http://rever.nmsu.edu/elharo/faq/vendor.html
The Macintosh Vendor Directory, a directory of companies that make and sell products for the Macintosh computer.

http://www.metrowerks.com/
This is Metrowerks's Web site, with information about its CodeWarrior PowerPC development tool.

http://www.hotwired.com/
Not much about Apple here, but we thought you'd have fun at the *Wired* magazine Web site. Before you get in, you have to go through a fairly simple (no-UNIX-required) registration protedure.

http://www.nisus-soft.com/~nisus/
The location of the Nisus Software home page, which we list partly because of its clever layout. The page looks like a Macintosh desktop; clicking the icons on the desktop takes you to Nisus's various Web postings. Just for fun, click the Trash icon and see where you end up! ♣

Know of a particularly useful site? Whether it's a Web page, an FTP site, or a newsgroup, let us know about it and we'll consider adding it to this feature next month. Send your suggestions to a.directions@apple.applelink.com.

New This Month
These are World Wide Web locations that we've just become aware of; many are new this month to the Internet.

http://www.apple.com/whymac/
The source for official Apple ammunition to fight the war against Windows 95. This site was set up by Michael Mace and Apple's Platform Marketing Group to broadcast the Macintosh advantages and to provide the Apple community with the information it will need to counter the Microsoft marketing machine. You'll be especially interested in the series of Windows 95 vs. Macintosh Updates, prepared in the wake of the Windows 95 release.

http://www.info.apple.com/gomobile/
This site contains complete information about Apple's just released PowerPC processor–based PowerBook computers and the full line of Apple mobile computing solutions.

http://www.info.apple.com/dev/thirdparty/third_party.html
Apple Fellow Guy Kawasaki set up this Web page to list your hardware and software products. Fill out the form located at the site to add your products; that way, everybody on the 'net can find out about what you're up to.

http://www.info.apple.com/dev/evangelism/powertalk/powertalk.html
Apple's PowerTalk home page, with resources for PowerTalk programmers.

http://www.guideworks.com/
This non-Apple site is the location of the guideWorks home page; it contains so much information about Apple Guide that you can think of it as the Apple Guide home-away-from-home page. Includes the latest Apple Guide updates, authoring tools, frequently asked questions, books, training, and developer support.

http://www.astro.nwu.edu/lentz/mac/programming/tools.html
This non-Apple site is a terrific source for Apple and non-Apple Macintosh programming tools.

http://west.ucd.ie/
The Web site for University College Dublin—WEST (Web Educational Support Tools), winner of the recently announced Apple Enterprise Awards in the Client/Server—Education and Government category. Information about their work, and demos of their software, are contained at this site.

http://ohlala.atg.apple.com/
In your copious free time, log on to this site for a peek inside Apple. This is the home page of Oh La La!, the cafe located just inside the main entrance of Apple's R&D Campus. It contains a live video feed so that Apple employees can check the length of the line before heading over for an espresso or a latte. (Who knows, if you log on at the right time, you just may catch a glimpse of *Apple Directions* Editor Paul Dreyfus taking a coffee break with *develop* Editor-In-Cheek Caroline Rose.)