



AppleDirections

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Apple News

Apple Announces Preliminary Q2 '96 Results

Investor Hopes Buoyed

On March 27, 1996, Apple Computer, Inc., Chairman and Chief Executive Officer Dr. Gilbert F. Amelio announced that he expects the company to post a loss of approximately \$700 million in the second fiscal quarter of 1996 (or Q2 '96, January through March).

Dr. Amelio's candor was greeted favorably by Wall Street and industry analysts. Investors responded by bidding up Apple stock over 5 percent the day after the announcement. While pointing out that the company has considerable work ahead, analysts quoted in the March 29 *Wall Street Journal* called the move "bitter but much needed medicine that would clear up much of the company's troubles." In the April 1 online edition of *MacWeek*, Rick LePage said "Amelio's action is the first honest step in stanching the hemorrhaging of the Mac platform." Additionally, market analysts at Dataquest said the announcement shows that Apple is "doing the right things."

The text of Dr. Amelio's statement follows.

After my first couple of months on the job, I feel that it's time for me to provide an update please turn to page 9

Strategy Mosaic

Mac OS Licensing Takes Off

What's in It for You, and for Apple

By Paul Dreyfus, Apple Directions staff

With the recent decision of Motorola to license the Mac OS and build Mac OS-compatible computers—and its ability to sublicense the Mac OS to other manufacturers—there's no question that the efforts of Apple Computer, Inc., to license the Mac OS have taken off. As a result, the benefits of Mac OS licensing for developers have become more specific, and more tangible. This month, I thought I'd give you a progress report on Apple's Mac OS licensing program, and describe what's in it for you as well as for Apple.

So as not to keep you in suspense, I'll first summarize how Apple licensing is improving the business of Mac OS development. Of course, the basic idea behind licensing is to increase the number of customers—and potential revenues—for your products. This is great, in and of itself, but it's only the tip of a large iceberg.

By increasing the potential for revenues, Apple's licensing also gives you and your colleagues more reason to innovate, thereby giving customers still more reasons to buy Mac OS systems. This in turn boosts platform market share even more, giving you yet more reason to innovate. At some point, the market share—innovation reaction reaches critical

please turn to page 6

AppleDirections

Volume 4, Number 5

Apple Directions, the monthly developer newsletter of Apple Computer, Inc., communicates Apple's strategic, business, and technical directions to decision makers at development companies to help maximize their development dollar. It is published by the Apple Developer Periodicals group within Apple's Developer Press.

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Editor's Note

Copland Blitz

If you've been paying close attention to *Apple Directions* lately, you might have noticed a subtle trend beginning to emerge. Last month's Strategy Mosaic was called "Looking Forward to the Copland User Experience;" this month, a good part of the Technology section is taken up with "Multitasking Under Copland," which starts on page 19. The connection, of course, is Copland: For at least the next several issues, we're going to tell you a lot about the next-generation Mac OS in honor of its first full-fledged developer release, expected to take place at the Worldwide Developers Conference May 13-17.

I'm pointing this out because I want to be sure you take advantage of this (still) early chance to learn about Copland. The first customer release isn't expected until late this year, which gives you time to plan for it and, perhaps more important, to adopt its technologies in the next release of your product.

Adoption of Copland is vital from a technological standpoint. If the Mac OS platform is truly to take its great technical leap forward, if your Mac OS applications are to continue to maintain their state-of-the-industry sheen, you need to learn about Copland now and start working with it as soon as possible.

It's also vital from a business point of view. Lately, you've probably joined me in reading with some chagrin that overall Mac OS software sales decreased last year in the United States and Canada, according to the Software Publishers Association (SPA). SPA data indicates that North American Mac OS software sales dropped from \$1.23 billion in 1994 to \$1.05 billion in 1995, a year-to-year dip of 14 percent. That literally reversed the previous year's results: Mac OS sales increased more than 18 percent from 1993 to 1994, 2 percent more than overall industry sales.

Market research experts say that huge gains in a platform's software sales can be the result of a major technology upgrade, while declines can result when there are no significant enhancements for a period of time. I think the SPA numbers support that

observation: In 1994, the year after Power PC processors became ubiquitous in the Macintosh product line, Mac OS software sales grew dramatically. The next year, with no major system upgrade, sales dropped. Similarly, in 1995, the year of Windows 95, sales of Windows software grew dramatically, according to SPA data.

If history is any indicator, Mac OS software sales should again turn skyward in the coming months. At the beginning of the year, Apple took one technical giant step with the introduction of OpenDoc; by the end of the year, it will make another when it ships Copland. Key, of course, to an upward turn for Mac OS software sales is your adopting those new technologies.

We've been providing a great deal of OpenDoc coverage to smooth your path in adopting it; now, we're doing the same with Copland. Judging from how readers are using the *Apple Directions* on-line edition, our "Copland Blitz" should be welcome; the Strategy Mosaic we published way back in June 1995, "Copland: Technology for Customers' Sakes," is currently one of the most-read articles at our Web site. To help you get ready for the blitz of Copland information, we'd recommend that you reread it, if you haven't done so recently. You can find it on the Web at the following location:

<http://dev.info.apple.com/appledirections/jun95/newsstratmos.html>

PS: Please Copy Me!

We've had a variety of requests from readers for us to provide additional copies of *Apple Directions* for you to distribute to other interested people in your company. While we're figuring out the best way to do this, I just wanted to remind you that you can make as many photocopies of the newsletter as you wish. Our purpose is to spread the word about Apple's strategic, business, and technology directions to as widely as possible; so, please, copy this newsletter and give it to your friends.

Paul Dreyfus
Editor

AppleWatch

WWDC Session Overview

This year's Worldwide Developers Conference (WWDC), to be held May 13–17 at the San Jose Convention Center, is fast approaching. If you haven't registered yet, we urge you to do so; we don't think you want to miss out on meeting with more than 5,000 of your Apple developer colleagues and receiving the latest technical and business information from Apple Computer, Inc.

Conference planners recently posted a partial list of session titles at the WWDC Web site, along with a preliminary schedule of when the nine conference tracks will take place. We're reprinting them here so you can see what will be covered, and when.

There's still time to register; for information on how to do so, send e-mail to WWDCREG@cmi.carlson.com, or visit the WWDC Web site, which also contains updates about the conference schedule; for the site's location, see "Internet Resources for This Issue" on page 40.

The conference will contain three general types of sessions: technical development, skills development and training opportunities, and business development. The core purpose of the conference is to cover technical issues regarding the Mac OS, hardware, and software, although other topics will be covered as well. The conference is divided into nine separate tracks; the general schedules for the tracks, as well as conference registrations, feedback sessions, and the Vendor Expo, are shown in the chart "WWDC 1996 tracks" on page 4. Lists of the sessions that constitute seven of the tracks follow.

Track: Copland

Among the expected highlights of WWDC 1996 is the DR1 release of Copland, the next major version of the Mac OS. In support of that release, topics in the Copland track will cover all aspects of the system, ranging from the user experience and text/imaging to the run-time model as it applies to application, extension, driver, and server developers. Sessions will also detail compatibility and adoption strategies to help in effective product planning. The sessions are as follows:

- Copland Technology Update
- Copland Human Interface
- Decline and Fall of the Event Loop
- Copland Run-Time Model
- Copland Application Services
- Copland Server Services
- Copland Extension Services
- Copland Text

- Copland Graphics and Printing
- Copland Configuration Management
- Copland I/O Overview
- Mass Storage I/O
- Video I/O
- Sound I/O
- User Input
- Network I/O
- Working With Copland DR1
- Copland Help Services
- Copland Content Management
- Technical Transition to Copland
- Copland Component Software
- Copland Business Opportunities/Comarketing
- Copland Visual Appearance

Track: OpenDoc

At this year's WWDC, attendees will learn everything from the basics of OpenDoc programming to advanced concepts. OpenDoc sessions will also focus on the Internet, providing developers with an overview of how to write components that leverage Cyberdog, Apple's OpenDoc-based Internet client. Other topics will include multiplatform support, OpenDoc integration with Copland, development tools, and how component software creates new business opportunities. The OpenDoc track sessions are as follows.

OpenDoc Technology

- The Business of Software Components
- How to Componentize Your Software
- OpenDoc and Copland
- Getting Started With OpenDoc
- Advanced OpenDoc Tips and Tricks
- Cross-Platform OpenDoc
- OpenDoc and Distributed Objects

OpenDoc and the Internet

- Cyberdog Unleashed
- Cyberdog: Building Internet Components
- Adding Internet to Your Application
- Building Custom Interfaces Using Cyberdog

Feedback Forums

- OpenDoc Feedback Forum
- Cyberdog Feedback Forum

Track: Communications

Communications and collaboration capabilities for individuals, work-groups, and enterprises are a core component of the Macintosh platform. With the explosive growth of the Internet as a pervasive communications medium, Apple and developers are well positioned to deliver

May Apple Directions Online

May's *Apple Directions* will be available by April 15 at the following locations:

AppleLink path—Developer Support:Developer Services:Periodicals:Apple Directions

Internet—<http://dev.info.apple.com/appliedirections/adtoc.html>

Tracks	Sun	Mon	Tues	Wed	Thur	Fri
Copland						
OpenDoc						
Internet						
Tools						
Multimedia Authoring						
Interactive Media						
Communications & Collaboration						
Systems Hardware						
Business Development						
Vendor Expo						
Feedback Forums						
Registration						

WWDC 1996 tracks. This chart shows the days each track will take place at this year's WWDC.

communications solutions that address today's market demands. This track will focus on the communications and Internet platform technologies that will allow developers to make the most of these new opportunities. Covered in this track will be Apple's Internet strategy plus detailed reviews of Apple's latest communications APIs (application programming interfaces), including Cyberdog, Open Transport, server software, Remote Access, and more. Specific APIs, the relationship of these technologies to the Copland architecture, and implementation strategies will be discussed. The sessions are as follows:

- Cyberdog Unleashed
- Cyberdog: Building Internet Components
- Adding Internet to Your Application
- Building Custom Interfaces Using Cyberdog
- Internet Development Tools
- Migrating to Open Transport
- Open Transport: The Road to Copland
- Open Transport, PCI and High-Performance Data Links
- Mail and Directory Services for Copland
- FutureShare API
- GeoPort Roadmap
- Macintosh Telephony Architecture
- ARA Opportunities

Feedback Forums

- Open Transport Feedback Forum
- Apple and the Internet Feedback Forum
- FutureShare Feedback Forum
- Cyberdog Feedback Forum

Track: Interactive Media

The opportunities for the creation of tools and playback software to enable rich media both at the desktop and on the Internet are dramatically expanding. Apple's new Interactive Media Group will discuss these opportunities and present an integrated technical strategy for developing multimedia tools and applications. Technical directions, priorities, and implementation approaches will be presented for technologies such as QuickDraw 3D, QuickTime, QuickTime VR, QuickTime Conferencing,

and Speech. The integration of these technologies with each other and the requirements for Internet and Copland compliance will also be discussed. The Interactive Media track sessions follow.

QuickDraw

- QuickDraw 3D
- QuickDraw 3D Overview Session
- QuickDraw 3D RAVE
- Extending QuickDraw 3D
- 3D on the Internet

QuickTime

- QuickTime Technologies Update
- QuickTime VR Revealed
- The QuickTime Music Architecture
- Multiplatform QuickTime

QuickTime Conferencing

- QuickTime Conferencing: Technical Directions
- QuickTime Conferencing on the Internet

Speech

- Speech Recognition Manager API
- Customizing Speech Synthesis

Games Development

- The Business of Macintosh Games
- Apple Games Part 1: Overview and Direction
- Apple Games Part 2: Draw Technologies
- Apple Games Part 3: Input Technologies
- Apple Games Part 4: Sound Technologies
- Apple Games Part 5: Network Technologies

Pippin

- Pippin Overview
- Pippin Under the Hood

Feedback Forums

- QuickDraw 3D Feedback Forum
- QuickTime Feedback Forum
- Speech Technologies Feedback Forum
- Games Technologies Feedback Forum
- Sound and MIDI Feedback Forum

Track: System Hardware

This track will detail Apple's vision for the Macintosh and Newton hardware platforms at a time when customers are focusing increasingly on solutions, the Common Hardware Reference Platform (CHRP), and Mac OS compatibles. It will provide technical information to help developers exploit Apple technology directions in coming desktop, portable, and server systems and Newton-based devices. Specific topics will include PowerPC optimization, hardware I/O, multiprocessing, porting to Power Macintosh, interfaces (PCI and PCMCIA), FireWire, QuickTime Conferencing, and QuickTime hardware acceleration, as well as feedback forums hosted by Apple hardware product managers and engineering managers. The following are the System Hardware track sessions.

Desktop

- PowerPC Optimization
- Hardware I/O
- Multiprocessing
- Cross-Platform Hardware Strategies

Mobile

- PowerBooks and PCI
- PCMCIA and CardBus

Servers

- Macintosh Servers
- Apple's New Network Server

Newton

- Developer Introduction to Newton 2.0
- Macintosh Applications and Newton PDAs
- Internet Connectivity With Newton 2.0

Imaging

- Developing Print Drivers Using QuickTime GX
- Flash Point/Digital Cameras

Feedback Forums

- Desktop Strategy
- CHRP Reference Designs
- Server Strategy
- LaserWriter
- Newton

Track: Development Tools

Tools are clearly a critical component to successful implementation of any application strategy. Throughout the agenda there will be sessions from both Apple and third-party developers on key Macintosh development tools. Focus will be placed on tools for Copland, OpenDoc, and Internet development. The general programming sessions will cover tools for application performance analysis and tuning, debugging, and shared library techniques. Topics will also include scripting tools, visual development, and database APIs. Other sessions will focus on cross-platform development and porting tools and methodologies. The Development Tools track sessions are as follows.

Copland Tools

- Copland Tools Overview

Internet Development Tools

- Java Programming on the Macintosh
- CGI Development Tools
- Tools for Dynamic Web Applications
- Web Development: The Next Generation

OpenDoc Development Tools

- Developing OpenDoc Components Using ODF
- Application and Container Development With MacApp
- Integration of OpenDoc Comp. With Denali

General Programming Tools

- Tuning Your Code for Performance
- Debugging Tips and Techniques
- Application Frameworks
- Shared Libraries in System 7 and Copland
- E.T.O. Present and Future

Cross-Platform Development Tools

- Porting Windows Applications to Macintosh
- Developing for Macintosh and Windows
- Linux on Power Macintosh

Scripting and Database Development

- Scripting and Database Development
- Oracle Power Objects
- Database Engines for Your Applications

Multimedia Tools

- Multimedia Tools Overview
- Apple Media Tools
- HyperCard 3.0: The Next Generation

Feedback Forums

- Core Tools Feedback Forum
- Frameworks Feedback Forum
- Internet Tools Feedback Forum

Track: Business Development

Developing successful applications requires more than APIs and tools. It requires an understanding of the market and developing an effective business plan to match the market. Based upon developer requests, this year's agenda will provide developers with insight into these considerations. Areas of focus will be on market opportunities for Apple products and the technologies critical to those markets, developing a successful business plan, strategies for raising capital, and project specification, management, and analysis. The following sessions are in this track.

Business Development

- Developing a Marketing Plan
- How to Successfully Raise Capital
- Preparing Your Business Plan
- Growing Your Business
- Managing Large Software Projects

International

- WorldScript and the Internet
- Localization Tools
- Input Methods (Chinese, Japanese, Korean)

By the time you read this, a complete agenda with session descriptions is expected to be available at the WWDC Web site; look for its location in "Internet Resources for This Issue" on page 40. ♣

Strategy Mosaic

Mac OS Licensing

continued from page 1

mass, and the Mac OS platform truly takes off, something all of us in the Macintosh community are working toward.

There are other tangible benefits for Mac OS developers, as well. I'll return in greater detail to some of these items later; briefly, here are some of the other ways the recent flurry of Apple licensing activities can benefit your business. It will do the following:

- Guarantee the longevity of the Mac OS platform: I thought I'd mention this given the current habit of folks in the press and analyst community to predict the demise of the Macintosh computer. Do you really think that's going

to happen anytime soon with Motorola and its sublicensees committed to making Mac OS–based, PowerPC processor–based systems, not to mention Apple's current determination to expand the platform on its own? In other words, Apple's Mac OS licensing assures that your investment in Mac OS products today will continue to pay off tomorrow, and in the years to come.

- Help you introduce your products into new geographic markets. Some of Apple's licensees will be forging into areas—such as the Far East (other than Japan)—where computers are still a relatively new commodity. Motorola's first Mac OS sublicensee, Nanjing Power Computing Ltd, has committed to building Mac OS–compatible systems for consumers and educational customers in China. (For

more about this, see the news story on page 13.) These licensees want to work with you to localize current products—or develop new ones—for those markets. I'll say more about this later.

- Give you bundling and comarketing opportunities with the manufacturers of new Mac OS–compatible systems.

- Offer you opportunities to develop whiz-bang technology solutions with a Mac OS licensee interested in creating special technologies for special markets.

To begin to make these last three possibilities real, this year's Worldwide Developers Conference (WWDC) will include a track for licensees and prospective licensees. They'll be in San Jose—at the same time as the 5,000-plus developers attending the event—to learn everything they can about the Mac OS, albeit in separate sessions, and to learn about the Macintosh developer community. If you attend this year's WWDC, you'll have the chance to meet and talk technology, and business, with licensees. Apple hopes this will be the beginning of a variety of beautiful relationships. (See the box on this page to find out how you can meet with licensees at this year's WWDC.)

These are all opportunities that wouldn't exist were it not for Apple's licensing activities of the past year and a half. I'll turn now to what's actually happened on the Mac OS licensing front, why Apple is so committed to continued licensing efforts, and some potential future directions.

Mac OS Licensing: The First Phase

The first companies to license the Mac OS were Power Computing, Radius, and Pioneer, who announced their intentions to manufacture Mac OS–compatible systems soon after Apple decided to begin licensing the OS in September 1994. Power Computing

focused its efforts at selling Mac OS–compatible systems to consumers, Radius concentrated on high-end publishing and graphics customers, and Pioneer targeted the rapidly growing Japanese market. Soon after, DayStar Digital licensed the Mac OS and began to manufacture its Genesis MP systems, high-end graphics computers employing multiple PowerPC processors.

In November 1995, Taiwan's UMAX Data Systems signed up to make Mac OS–based computers aimed at the Far East market. Then in January 1996, UMAX took over Radius's Mac OS–based systems business and began to manufacture Mac OS–compatible computers for the United States, as well.

These companies' efforts collectively embodied the first phase of Apple's Mac OS licensing strategy, which called for licensees to manufacture Mac OS–based systems running on Apple proprietary hardware designs. Under the terms of these agreements, the licensees essentially cloned Apple's hardware designs item by item. DayStar Digital enhanced Apple's designs by basing the Genesis MP system on multiple PowerPC processors and then working with Apple on a multi-processor API (application programming interface) to enable applications to take advantage of multiple processors. However, much of the Genesis MP hardware design came directly from Apple.

Phase Two: Apple Letting Go

The release of the Common Hardware Reference Platform (CHRP) specification in November 1995 heralded the beginning a second phase of Mac OS licensing. CHRP, referred to for a time as the PowerPC Platform, is the specification for building PowerPC processor–based computers devised jointly by Apple, IBM, and Motorola. CHRP systems will be able to run a variety

Working With Mac OS Licensees

If you're interested in working directly with companies manufacturing Mac OS–compatible systems, there are several ways you can get going today. First, if you're not yet familiar with the Common Hardware Reference Platform (CHRP) specification for building PowerPC processor–based computers on which many future licensees' efforts will be based, visit the CHRP Web page. For its address, see "Internet Resources for This Issue" on page 40. If you want to start working with licensees, you can take one or more of the following steps:

- Meet with prospective and announced licensees at this year's Worldwide Developers Conference, to be held May 13–17 in San Jose. To find out how to do this, send e-mail to Patrick Sweeney at Apple (sweeney.p@applelink.apple.com).

- Contact the Motorola Computing Group (MCG) to find out how you might work with them to develop products for Chinese and other Far Eastern markets; the MCG contact person is Mr. Ron Rogers (e-mail rcr@phx.mcd.mot.com; phone 602-438-5637).

- Contact UMAX to find out about other opportunities in the Far East; the contact person is Mr. Alpha Tsai. You can reach him at e-mail address alpha.tsai@smtp.umax.com.tw, phone (886-2) 517-0055 (340), or fax (886-2) 517-2017.

- Contact DayStar Digital to obtain a copy of the Multiprocessing API software development kit, if you'd like your software to be able to take advantage of the presence of multiple Power PC processors on the same Mac OS system; send e-mail to dmethven@daystar.com.

of operating systems, including the Mac OS, Windows NT, AIX, and Solaris. "Phase two" licensing represents a significant amount of letting go for Apple, since these second phase licensees will design their own hardware based on CHRP instead of having to narrowly limit themselves to Apple's proprietary designs.

Apple has several reasons for opening its licensing policies. In trying to attract major hardware manufacturers to the platform, Apple realized that no big companies (and probably few small ones) want to depend on Apple for hardware designs. Conversely, Apple doesn't want to have to provide hardware support for a burgeoning number of licensees. Ideally, Apple hopes that its phase two licensees will design CHRP computers and ship them with the Mac OS independently of Apple, although Apple will continue to certify all Mac OS-compatible systems.

Apple also expects that the proliferation of new hardware designs for Mac OS-compatible systems will bring variety and technological innovation to the platform. This will provide users more choice from among a variety of suppliers; it will also challenge Apple to innovate and stay ahead of the field. And, it should provide still more reasons for customers to purchase Mac OS systems.

The Significance of Sublicensing

Apple has also recently confirmed its commitment to open licensing by granting Motorola the right to sublicense the Mac OS. This represents a further significant loosening of control on Apple's part. Previously, companies could only work with Apple if they wanted to license the Mac OS; now, Motorola can grant its own licenses to manufacture Mac OS-compatible systems without prior consent from Apple. In addition to distributing the Mac OS on its own systems,

Motorola can sign anyone they wish to license the Mac OS. The only condition is that Motorola must supply the logic boards, or the complete hardware systems, used by the sublicensees for their Mac OS-compatible computers. It's expected that similar sublicensing will be part of future licensing agreements.

Apple's motivation behind sublicensing and the subsequent proliferation of Mac OS-compatible manufacturers is that, with a greater number of companies making CHRP systems, there will also be additional suppliers of parts. This will make it easier for Apple to get parts for its own Mac OS computers, and potentially alleviate some of the historic part shortages that have made it difficult for Apple manufacturing to keep pace with demand.

A second motivation is to spur innovation in hardware design. If licensees sign with Motorola to obtain the rights to build Mac OS-compatible systems, they'll have to obtain their hardware designs from Motorola, as well. The situation between Motorola and its Mac OS licensees will be comparable to that between Apple and its phase one licensees. This will keep the pressure on Motorola to come up with interesting, innovative CHRP-based hardware in order to attract licensees; incidentally, it will put pressure on Apple to do the same.

By opening the field to new hardware designs and new players, Apples furthers its goal of expanding the Mac OS platform's share of the personal computer market, thereby providing you with a more robust business opportunity for Mac OS-related products. Apple's goals for the numbers it expects its licensees to sell have always been aggressive: Anticipating phase two, Apple projected that its licensees would sell 1 million Mac OS-based systems by the end of 1997;

with increased emphasis on licensing as part of Apple's corporate strategy, estimates now range as high as twice that.

Mac OS Licensing Design

Even though Apple will be encouraging its phase two licensees to design and manufacture their own CHRP systems, economic necessity dictates that Apple will continue to make proprietary hardware designs available for manufacturers of Mac OS-compatible computers as the transition to phase two becomes complete. As happens with most hardware platforms, CHRP systems will tend to be more expensive at first, then drop in price as volumes ramp up and manufacturers learn how to reduce costs.

Needless to say, some licensees, if not all, will want to manufacture true low-end systems retailing for significantly less than the first CHRP systems. Eventually, CHRP components will come down in price as production volumes increase; until then, Apple will make available what it calls the Mac OS Licensing Design, or MLD, to fill the needs of licensees who want to provide inexpensive Mac OS-compatible computers. The MLD will be based on Apple hardware designs

that employ relatively inexpensive components and that are comparatively easy to build.

What Apple Stands to Gain

Perhaps I've used a bit too much rose coloring in painting the picture of Mac OS licensing activities up to this point, emphasizing Apple's altruistic intentions toward the Mac OS development community. There are also plenty of reasons for Apple to be in the licensing game quite apart from what it does for you. Keep in mind, though, that there had better be a lot of benefit for Apple, or it wouldn't have sufficient reason to be committed to licensing the Mac OS.

First off, the financial upside alone is worth Apple's trouble of making a serious, committed effort to broadly license the OS. Unlike manufacturing and selling its own Mac OS computers, which generates average gross margins in the 20 to 25 percent range, Apple's licensing activities result in nearly 80 percent margins over the short term.

If a licensee sells a Mac OS-compatible system, the royalties Apple receives for the OS and its proprietary hardware designs amount to less than the amount

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Apple receives from selling one of its own systems. However, because there's much less overhead and R&D attached to licensing the OS, in comparison to designing, manufacturing, and selling its own proprietary systems, Mac OS licensing can be a highly profitable business for Apple. This is especially true if licensees can sell great volumes of Mac OS-compatible systems.

Apple does have overhead expenses for its licensing operation, and for continued hardware support for licensees that use the MLD, or earlier Apple proprietary hardware designs. Additionally, some of the revenues obtained from licensing are needed for ongoing engineering—that is, the development of Apple technologies for licensees—as well as marketing and sales to support licensing operations.

However, much of the investment in the Mac OS and Macintosh hardware designs—the “products” being sold by Apple's licensing group—was made years ago, and/or absorbed by other product efforts at Apple. Along the way, Apple has spent more than the personal computer manufacturing industry average on research and development to continue to give the Macintosh computer its technological advantage. As a result, one might argue that Mac OS licensing finally allows Apple to reclaim at least part of what it's contributed to improving the experience of using personal computers.

In addition to royalties from the core OS and hardware designs, Apple makes money from the licensing of other Mac OS technologies—for example, AppleSearch—that aren't licensed freely. (There is no licensing fee or royalty for a variety of Mac OS technologies—such as QuickTime, QuickTime VR, Apple Guide, and Macintosh Drag and Drop—although you're required

to sign a licensing agreement with Apple to include them with your products.)

Apple also stands to gain financially by selling Apple-branded monitors, printers, and other peripherals, whether they're sold to licensees for cost plus a licensing fee, or to customers buying at retail. Over time, Apple's own peripheral business has made a significant contribution to Apple's financial success; with a larger Mac OS market share, this contribution will be even greater.

Of course, the biggest potential win for Apple is the same as yours: the Mac OS platform reaching its critical mass. When it began licensing the OS, Apple as much as admitted it couldn't reach that point on its own; now, with Motorola and the other licensees in the fold, and with the potential addition of many other sublicensees, that big win seems more attainable.

The Near Future: New Markets

What are the next steps that will get us all to the point where the platform truly takes off? Initially, perhaps the most promising are the activities of licensees to boldly go where Apple has yet to establish a significant presence. The current focus is on the Far East, where many experts expect the fastest growth in the personal computer industry in the next several years.

Apple, of course, is excited that Mac OS licensees will be looking for customers where Apple hasn't looked before, where they won't have to compete with Apple and with the Wintel platform. If you're interested in entering new markets, these activities potentially hold tangible, immediate benefit for you, since at least some of the licensees want to work directly with you to develop software products for the new markets.

The Motorola Computer

Group (MCG), the division of Motorola responsible for manufacturing Mac OS-compatible systems, will be working hard to sell computers in the People's Republic of China (that is, mainland China). Through sublicensee Nanjing Power Computing Ltd., MCG hopes to build a significant presence in the consumer and education markets there. Further, to be sure there are localized hardware and software products to work with its Mac OS-compatible systems, MCG plans to throw considerable resources into working with developers to take their products into the Chinese market. If you're interested in being among these developers, you can contact MCG directly. See the box on page 6 for information on how to do so.

UMAX, the company that took over the Radius license, plans to take the same approach in Taiwan and other Far East countries, and they also want to work with you and your products. Again, see the just-mentioned box for a contact point at UMAX.

Subsystems and Cross-Platform Potential

Another near-term future direction for licensing is in the area of subsystems. Apple is contemplating working with hardware vendors who can develop subsystems that will help Mac OS and CHRP computers perform specialized tasks, sometimes for specialized markets. Most significantly, Apple expects there will be a major opportunity across many market segments for licensees to market cross-platform subsystems that let Mac OS computers run Windows 95.

Apple itself is currently looking into the feasibility of manufacturing cross-platform subsystems and can't share the specific data about how great an opportunity cross-platform subsystems present. However, to give you an idea of the impact such a subsystem might make, last year Apple mar-

ket research established that its Power Macintosh 6100 DOS Compatible computers, which include both a PowerPC processor to run Mac OS and an Intel 486 chip to run Windows, proved very attractive to Wintel customers.

More than half the buyers of such cross-platform systems came from the ranks of existing DOS/Windows users, or first-time computer buyers, and, significantly, customers participating in the study spent three-fourths of their system usage time in the Mac OS environment. (For more about the study, see “Power Macintosh 6100 Attracting Customers From DOS/Windows Platform” in the August 1995 issue of *Apple Directions*.) Subsequent Apple research indicates that, when given the choice, current Windows users would greatly prefer a system that runs both Mac OS and Windows 95 concurrently to a system that runs only one of those operating systems.

(Keep in mind that such cross-platform systems are different from CHRP systems, since they can run two operating systems concurrently on their dual processors; the Mac OS will always be present and available to users, even when they're running another operating system. Although CHRP systems will potentially be able to run multiple operating systems, they'll only be able to start up with one at a time on their single PowerPC processor.)

The Low-End Transition

None of the above is to suggest there aren't challenges ahead. Apple must, of course, dig itself out from the losses it's incurred lately, and return to profitability. (See the news story on page 1 about Apple's Q2 '96 results.) To do so, Apple has indicated that it will endeavor to sell higher-priced systems in the future with higher gross margins, such as the CHRP systems, and leave lower-margin, low-end

systems to licensees. Note that Apple has not said it's getting out of consumer computing, as has been rumored; instead, it will design and manufacture consumer systems of higher value that, presumably, can carry a higher margin.

The challenge here is for licensees interested in selling inexpensive systems to provide the kind of volume needed at the low end of the personal computing market. If Apple gets out of this end of the business too quickly, and a licensee isn't up to speed, there could be a shortage of low-end systems and unmet

demand; if, on the other hand, Apple stays in too long, there could be a glut of products on the market. Neither situation would be favorable, for either Apple or licensees.

However, according to Apple's licensing group, there's huge interest in low-end Mac OS computer manufacturing among a variety of firms in the Far East, and especially Taiwan. While UMAX is the only announced licensee in this group, Apple expects a number of qualified manufacturers to step up to the challenge of taking over the low-end, high-volume

Mac OS computer business. This will allow Apple to remain in the vanguard of the Mac OS platform, designing and selling Macintosh systems with increasingly innovative technologies that lead the platform ever upward.

Mac OS Platform Fusion I'll leave you with the image of the theoretical fusion reactor. Up to a certain point, fusion reactors require huge investments of material to make relatively small amounts of energy. However, thanks to superconduction and a variety of other recently discovered physical

principles, at a theoretical point, the fusion reaction takes off and becomes so efficient that it seemingly makes energy with very little investment in resources.

Apple currently intends to turn the Mac OS platform into a kind of fusion reactor. True, selling significantly greater numbers of Mac OS systems will never be as cost-free as the theoretical fusion reaction. But, with the right mixture of licensees' efforts and continued innovation from Apple and the developer community, increasing platform market share will become far easier and faster. ♣

Apple News

Q2 '96 Results

continued from page 1

on Apple. As has been widely noted, the market for personal computers is unsettled.

We find ourselves facing three major challenges. First, we anticipate that revenues and unit shipments will be substantially below the levels of last year's second quarter. Secondly, the slowdown in sales relative to our initial forecasts will contribute to sizable charges related to inventory valuation adjustments. Finally, as we've mentioned before, we will incur significant restructuring charges in order to realign the company for the future.

These factors will contribute to an anticipated second fiscal quarter net after-tax loss of around \$700 million, more than half of which will be related to inventory write-downs and about a quarter of which will be related to restructuring charges. The inventory write-downs and restructuring charges are critical first steps in orchestrating the comeback of the company.

I'm confident at this point

that I know what the problems are and that they are fixable. The strategic and operating plans we are currently developing will enable us to build upon Apple's fundamental strengths and competitive position, reinforce our customer appeal, and realize the company's long-term earnings potential. We plan to aggressively address these issues and take the necessary corrective actions. We will begin to articulate our plans by early May.

I'd also like to add that I'm greatly encouraged by the expressions of support I've received over the past two months from thousands of Apple customers, business partners, developers, and employees around the world who share our commitment to successfully meeting our current challenges and achieving a great future.

Dr. Amelio's statement is a preliminary summary of Apple's second quarter results, based on partial information and management assumptions. Apple will discuss details of its actual financial results when it issues its second quarter earnings during the third week of April. *Apple Directions* and *Apple Directions*

Express will let you know the actual Q2 '96 results, as well as more specifics about Dr. Amelio's plans for the company, as soon as they're available.

Apple Ships Multimedia, Internet

Game SDK

With the first release of its new games software development kit over the World Wide Web, Apple Computer, Inc., is showing that

it's taking games seriously.

Called Apple Game Sprockets, the software development kit (SDK) can be used to create advanced multimedia and Internet-enabled games for Mac OS PowerPC processor-based computers. Using this SDK, all Mac OS-compatible games can feature real-time 3D graphics, 3D sound, Internet support, speech recognition, and input device/monitor control. You'll be able to create games that stand out in the market by exploiting the power and capabilities of Power Macintosh systems.

“What We Have Here Is a Failure to Communicate.”

Not anymore. With Apple Directions Express, you get instantaneous, regular business news straight from Apple to your e-mail in-box.

Apple Directions Express is the online business bulletin from Apple Computer, Inc. It's a biweekly summary of up-to-the-moment news from Apple for busy computer industry professionals, and includes pointers to other locations for details.

Subscribe by sending e-mail to adirections@thing1.info.apple.com. In the Subject field, type the string "subscribe <your real name>".

"Games represent a key market segment where Apple can leverage its traditional strengths in multimedia technology," said Heidi Roizen, vice president of Developer Relations at Apple. "Game Sprockets will enable developers to easily add exciting new features to their titles that showcase the Macintosh platform. We firmly believe that our unique technology—combined with dedicated developer support—will give Macintosh customers the best new games on any platform."

Apple Game Sprockets is a set of APIs (application programming interfaces) designed to work seamlessly with other Apple multimedia technologies such as QuickTime, QuickTime VR, QuickTime Conferencing, and QuickDraw 3D. It includes the final release of QuickDraw 3D RAVE (Rendering Acceleration Virtual Engine), a multiplatform technology that enables game developers to incorporate plug-and-play 3D acceleration hardware. (See related news story on page 13.) The SDK is available royalty-free from Apple's Web site. (See "Internet Resources for This Issue" on page 40 for the location.)

Using Apple Game Sprockets, a game could be given additional realism and excitement with the addition of real-time 3D graphics and 3D stereo sound that reacts to the player's location and movement. A new interface can help you implement advanced joystick features in your games. By using the SDK, you can also build in speech recognition, videoconferencing, and animation, and you can make it possible for the game to be used by multiple players over the Internet.

"The business of making great games is a classic example of evolution—you get cooler quickly, or you get left behind," said Ben Calica, senior product manager of game technologies at Apple. "Our job is to provide developers with unique, game-centric technology

that shows off the power of the Macintosh by helping them create the hottest titles on the market. For most developers, the Macintosh versions of their games are already the best on any platform—now we want to help them widen the gap even further with Game Sprockets."

The current Apple Game Sprockets SDK includes the following modules:

- NetSprocket, an Internet connectivity and multiplayer gaming API
- SoundSprocket, a 3D sound and Sound Manager API
- InputSprocket, a digital joystick control and input device API
- DrawSprocket, a multiple buffering/display control API
- SpeechSprocket, a speech-recognition API
- QuickDraw 3D RAVE, Apple's new fast multiplatform 3D graphics API

Technical details for each of the APIs follow.

NetSprocket

NetSprocket provides standard, customizable user interface elements for configuration and login as well as for hosting games across the network. A simple set of routines allows messages to be singlecast, multicast, or broadcast to other computers. A theoretical maximum of 2 billion users can simultaneously use NetSprocket across a broadband connection.

NetSprocket also provides transparent access to Internet-oriented game play and multiplayer gaming. This API uses Open Transport for TCP/IP, AppleTalk (with support for LocalTalk, EtherTalk, or Token Talk), and modem communication access. It's possible for gamers to use multiple protocols in a single session with minimal overhead. (A total of 28 bytes per player are used for the message header). NetSprocket also supports the

creation of groups for broadcast of data to specific users across the network.

SoundSprocket

SoundSprocket incorporates a standardized API for accessing both traditional sound functions and new 3D sound technologies developed by Apple. For 3D sound, the listener and each sound channel are given specific positions and velocity vectors in a virtual audio space. These positions are changed during game play, along with the sounds themselves, to give the impression of spatiality and movement.

The signal processing, taking advantage of the capabilities of the PowerPC processor, simulates Doppler Effect, distance attenuation, environmental reverberation, and spatial positioning. The 3D effect may be effectively presented over speakers or headphones; it's also fully integrated with QuickDraw 3D camera position features, which enables sound to "follow" the player in 3D space.

InputSprocket

InputSprocket provides a compact API through which games can communicate with drivers for analog or digital joysticks and other game-oriented input devices. It also provides user interface elements that allow players to override the default control options. InputSprocket also allows mouse, keyboard, and multiple input device support.

DrawSprocket API

DrawSprocket allows you to use multiple (that is, double or triple) buffering on the Macintosh computer for smooth display of graphic images. DrawSprocket achieves multiple buffering by using the best option available on the user's system—either true double buffering in hardware, page flipping, or efficient memory copies; it can also use the traditional

CopyBits routine. A game does not need to be aware of the hardware specifics to use this feature. DrawSprocket also allows users to configure display resolution or color depth without leaving the game environment (that is, without using the Sound and Displays control panels).

SpeechSprocket

Based on Apple's PlainTalk technology, this API helps you write high-quality speech recognition into game titles.

QuickDraw 3D RAVE

RAVE enables software to transparently access 3D graphics accelerators for maximum speed and throughput while also providing exceptional 3D rendering speed. RAVE lets you leverage your existing rendering technologies—a key issue if you're seeking to differentiate your product. RAVE is shipping now for Power Macintosh and Microsoft Windows 95, with a Windows NT version due in April 1996.

Game developers interested in learning more about Apple Game Sprockets should e-mail Mark Gavini, Macintosh games evangelist, at gavini@apple.com. Product marketing information may be obtained from Ben Calica, senior product manager, at calica@apple.com. For more information about home entertainment solutions, contact Yves Martin, manager for home entertainment solutions at martin.y@applelink.apple.com.

Apple Bases Ad on Developers' Testimonials

It's nice to know that Apple Computer, Inc., is relying on some opinions that really matter.

The company recently designed an advertisement based

on the endorsements of some prominent Macintosh developers. The ad appeared in the *Wall Street Journal*, the *New York Times*, *USA Today*, and a variety of other newspapers.

Above the tag line "Apparently, we're not the only ones who think 56 million users constitutes more than a niche," Apple ran the following quotes:

Corel is excited about the business prospects we see for supporting the Macintosh platform. Over the next few months, we will be releasing CorelDRAW for the Mac, as well as continuing to enhance OfficeSuite and our many other products for the Mac. We think the Mac will play a major role in our future.

—Michael Cowpland, president and CEO, Corel Corp.

Macintosh was there for the first communications revolution that transformed traditional publishing. I believe it will be one of many important tools for Internet and multimedia publishing and Quark will continue to develop software for our customers who rely on Macintosh technology.

—Tim Gill, chairman and senior vice president of Research and Development, Quark, Inc.

The Macintosh has always been—and will continue to be—a critical component of the Notes cross-platform strategy. We will continue to keep it at full parity with our Windows client platforms.

—Jeff Papows, executive vice president and chief operating officer, Lotus Development Corp.

Intuit views the Macintosh as a key platform for our consumer and small business software products. As the developer of top-selling Macintosh applications such as Quicken, MacinTax, and

QuickBooks, Intuit is fully committed to the Macintosh.

—Scott Cook, chairman, Intuit

Microsoft has just introduced the award-winning Microsoft Internet Explorer for the Macintosh, and is hard at work on great new versions of Microsoft Office, Microsoft FrontPage, and many other titles. We're also committed to continued interoperability between Windows NT Server and the Macintosh. Since 1984, Microsoft has been committed to its Macintosh customers and the Macintosh platform. We look forward to introducing a significant number of new and improved products as we continue our second decade on the Mac.

—Bill Gates, chairman and CEO, Microsoft

For all aspects of information publishing, Adobe and our customers prefer the Macintosh. The Mac's ease of setup and use distinguish it among personal computers. Adobe will enthusiastically support the Mac with our applications now and in the future.

—Dr. John E. Warnock, chairman and CEO, Adobe Systems Inc.

America Online got its start with Macintosh, and we continue to make significant investments to serve the 1 million Mac members we now have. When we release AOL 3.0 later this year, it will be clear to all that the 'Mac is back' at AOL!

—Steve Case, chairman and CEO, America Online Inc.

Macromedia and Apple have worked together for ten years to develop the market for graphics, multimedia and video. The Macintosh continues to excel as a leading platform for creative professionals worldwide. Macromedia is committed to the Macintosh and the millions of customers

that depend on it.

—Bud Colligan, chairman, president, and CEO, Macromedia

At Edmark, the Macintosh is an important platform thanks to its wide use in both the home and education markets. We are committed to developing high quality educational software for the Mac, and have a very exciting summer and fall season of new products. We look forward to its continued success.

—Sally Narodick, CEO, Edmark

Brøderbund Software remains strongly committed to the Macintosh platform. Over the years we have delivered many exciting and market-leading products for Macintosh and it is an important component of our strategy today. The Macintosh provides a quality experience that matches up well with the quality we always strive to deliver to our customers.

—Doug Carlston, CEO, Brøderbund Software, Inc.

Leadership in the software industry requires a strong commitment to cross-platform support. Oracle will continue to invest in

supporting the Apple platform to further our position as the world's leading supplier of information management software.

—Larry Ellison, chairman and CEO, Oracle Corp.

Apple Moving on the Internet Front

Apple Computer, Inc., recently made several moves to bolster the presence of its computer platforms and technologies on the Internet. Appointing Larry Tesler as the company's vice president of Internet platforms, the company also announced its support of the Moving Worlds Virtual Reality Modeling Language (VRML) 2.0 proposal, and joined the World Wide Web (or "W3") consortium.

Tesler New Internet VP In his new role, Mr. Tesler—a PC-industry pioneer and Apple's chief scientist—is responsible for research and development of products and technologies designed specifically for the Internet. In addition, Mr. Tesler will work with the company's other technology teams to ensure that

“And that's all we have to say about that.”

Apple Directions Express is concise and to the point, saving you the time it would take to pore over a variety of sources to stay up-to-date with Apple. Pointers to Internet locations make it easy to get more detail.

Apple Directions Express is the online business bulletin sent directly to your e-mail in-box from Apple Computer, Inc. It's a biweekly summary of up-to-the-moment news from Apple for busy computer industry professionals, and includes pointers to other locations for details.

Subscribe by sending e-mail to adirections@thing1.info.apple.com. In the Subject field, type the string "subscribe <your real name>".

their products provide the best possible Internet experience. Mr. Tesler will also work with other Internet companies and standards organizations to increase the availability of ease-of-use technologies for all Internet users. Finally, he will help coordinate the many Internet-related platform activities currently underway throughout Apple.

Mr. Tesler will oversee three organizations within Apple's worldwide research and development division: Internet Products Business Development, which forges Apple alliances with other Internet companies around technologies, products, and standards; Internet Engineering, which develops Internet-specific products such as the Apple Internet Connection Kit, the Apple Internet Server Solution, and Cyberdog; and the Internet Program Office, which coordinates Internet-related technology projects throughout the company to ensure consistency with stated strategy and effectiveness of execution.

Apple Supports Moving Worlds VRML 2.0 Proposal
Apple joined Netscape Communications Corporation and Silicon Graphics, Inc., in endorsing Moving Worlds, a proposal for the VRML 2.0 Internet 3D graphics standard. Additionally, Apple said it would contribute its QuickDraw 3D metafile format (3DMF) technology to the Moving Worlds initiative.

The three companies are developing a new binary file format for Moving Worlds based on 3DMF. Apple's contribution of 3DMF technology to the Moving Worlds effort will enable higher compression, file streaming, and faster parsing of 3D objects and virtual worlds across the Internet.

Moving Worlds is an open, cross-platform specification for dynamic 3D environments on the Internet. The Moving Worlds architecture allows 3D data sets

to be scalable for viewing on a variety of computer systems, from personal computers to powerful 3D graphics workstations. The development of Moving Worlds has been an open and collaborative process led by Silicon Graphics and endorsed by over 50 companies. The proposal has recently been submitted to the VRML Architecture Group.

The QuickDraw 3D metafile format is a cross-platform file format that supports Mac OS, UNIX®, and Windows systems. 3DMF technology will be used as an object-oriented, binary "wrapper" in the Moving Worlds VRML proposal. 3DMF technology will bring increased performance through faster parsing and faster downloads via smaller file sizes, as well as making it possible to stream Moving Worlds content.

Another key part of the technology agreement is the Netscape Live3D™ framework, which already implements the proposed Moving Worlds VRML 2.0 specification. Netscape Live3D enables industry-standard VRML graphics to be easily integrated into the Netscape™ software platform. Live3D enables Netscape Navigator™ to deliver distributed, interactive 3D spaces with text, images, animation, sound, music, and video. In addition to providing a high-performance VRML 2.0 viewer, Live3D extends Netscape's Java™, JavaScript™, and plug-in interfaces to make it easy to develop distributed 3D applications on the Netscape Navigator platform.

Apple Joins W3 Consortium

Providing the reasons behind Apple's joining the World Wide Web (W3) Consortium, Apple Internet VP Larry Tesler said, "We plan to contribute specifications for user interface technologies that will enrich the text, graphics, and multimedia experience of

Web users. Further, Apple's goals are similar to those of the W3 Consortium: to offer open, cross-platform technologies that enrich and extend the value of the World Wide Web for all users."

W3 is an international standards organization established to ensure that the World Wide Web realizes its full potential as a universal resource of network-accessible information. The W3 Consortium—run by the Laboratory for Computer Science at the Massachusetts Institute of Technology and affiliated with other complementary international standards organizations—develops common technology standards for the World Wide Web. It works with a wide range of organizations to produce specifications and reference software that can be used by all users of the Web. All software officially contributed to the W3 Consortium is made available to the public for general use.

Macintosh Continues to Dominate Publishing Industry

Underscoring the significance of the Macintosh publishing market, a study released in March 1996 found that four out of every five computers used for U.S. professional publishing jobs are Macintosh systems.

In a study undertaken for Apple Computer, Inc. in August 1995, Griffin Dix Research Associates—a research firm based in Berkeley, California—looked at five segments of the "for-profit" publishing industry in the United States, namely advertising, graphic design, printing, publishing, and

prepress services. The study determined that Macintosh computers are used for 80 percent of color publishing jobs in those industries. At medium-to-large sites with more than five employees, the share of Macintosh systems jumps to over 85 percent.

"With more than 600,000 Macintosh systems being used to design, retouch, or produce color publications or advertisements in the United States, we wanted an independent analyst to take a look at Apple's market share and the ROI [return on investment] those Macintosh sites were experiencing," said Lisa Wellman, director of Apple's Publishing and Media Markets group. "Griffin Dix confirmed much of what we and many of our publishing customers have known for years—Macintosh is the platform of choice in a for-profit environment and pays for itself much faster than an expensive proprietary system."

The survey also showed that among those who had replaced proprietary systems in the past 12 months, 45 percent replaced them with Macintosh systems, 45 percent with other proprietary systems, and 5 percent with UNIX workstations. None replaced a proprietary system with a Windows-based PC. (Proprietary systems were identified in the questionnaire as "not off-the-shelf computers, costing \$15,000 or more that use UNIX or operating systems other than Macintosh or Windows".)

Here are some of the other conclusions offered by Griffin Dix:

- 80 percent of all respondents said Macintosh systems are the most cost-effective platform for color publishing and advertising.

- The return on investment from Macintosh systems is estimated to be nearly seven times higher than that of proprietary systems.

- In all sites surveyed, 90 percent use at least one Macintosh for color publishing jobs.

- 74 percent of all color separations done in the five surveyed industries are carried out on Macintosh systems. (Ad agencies do 88 percent of their in-house color separations on Macintosh computers).

- The estimated total value of Macintosh systems used for producing color print publications in these U.S. industries, including displays, graphics cards, and drivers, is nearly \$4.5 billion.

- The return on investment from Macintosh systems is estimated to be nearly seven times higher than that of proprietary systems and over six times higher than that of "off-the-shelf" UNIX workstations.

A summary of the report, along with more information about Griffin Dix, can be found at Apple's Web site. (For the location, see "Internet Resources for This Issue" on page 40.)

QuickDraw 3D

RAVE API Enables Fast 3D Graphics

If you develop games or other 3D-intensive software, you—and your customers—are going to love Apple's recently announced QuickDraw 3D RAVE (Rendering Acceleration Virtual Engine) technology for Mac OS, Windows 95, and Windows NT systems.

RAVE—the foundation technology used in QuickDraw 3D—is an optimized hardware abstraction layer that lets you code directly to 3D hardware for maximum performance and also provides specific functionality for software rendering and texture mapping. Both Mac OS and Windows software that supports this cross-platform API (application programming interface) can gain access to the power of 3D graph-

ics accelerator cards that include special RAVE drivers. You'll be able to revise your existing software products to take advantage of the new API by using the RAVE software development kit (SDK).

RAVE lets you write highly optimized, fast 3D software for all major personal computer platforms. It lets you maintain differentiation in software while maintaining fine control of 3D hardware and existing high-performance rendering engines. It provides plug-and-play 3D acceleration, regardless of whether you use QuickDraw 3D or simply the RAVE API.

RAVE allows for a wide range of unique 3D operations, including

- high-resolution texture mapping at up to 4000 x 4000 pixels
- Z-buffering, to accelerate performance with less memory overhead
- 3D displays of SVGA and higher resolution
- 4 bit/pixel to 32 bit/pixel textures

Apple is currently working with 16 leading graphics board and chip vendors who have endorsed RAVE, including 3DFX, 3DLabs, alt drivers, ATI, Brooktree, Cirrus Logic, Daystar Digital, Diamond Multimedia, ELSA, Matrox, Newer Technology, Number Nine Visual Technology, PillowSoft, Radius, Rendition, and S3. Working with the RAVE driver developer kit (DDK), they'll build support for the API into their hardware products. With the combination of RAVE-enabled software and new 3D graphics boards, customers will experience real-time, workstation-quality 3D graphics on both Power Macintosh systems and Windows-based PCs.

Apple shipped the Mac OS RAVE API as part of the Apple Game Sprockets SDK. (See related news story on page 9.) Both Windows 95 and Windows NT versions are expected by the middle of the year. The API will be

available on all supported platforms with no licensing fees.

Game developers interested in RAVE should contact Mark Gavini, Macintosh game evangelist, at gavini@apple.com. Other software or hardware vendors should contact Shawn Hopwood, QuickDraw 3D evangelist, at s.hopwood@applelink.apple.com. Additional details about RAVE and other Apple 3D technologies may be found at the Apple QuickDraw 3D Web site; for the location, see "Internet Resources for This Issue" on page 40.

Apple and Motorola Join Forces In China

Apple Computer International Ltd.—a division of Apple Pacific—and Motorola, Inc., recently announced joint strategies to develop the market for Power PC processor-based computers in China, with a significant focus on education. The two companies will focus on developing the Chinese market through strategic relationships with members of the Chinese hardware and software industries. Also, Nanjing Power Computing Ltd., Motorola Computer Group's joint venture with Panda Electronics Group in China, will start production of Mac OS compatible PowerPC desktop systems later this year.

Apple and Motorola are cooperating to spur the development of curriculum software tuned to meet the needs of Chinese teachers and students in primary and secondary schools. Motorola and Apple will both contribute to the software development program by providing Power PC microprocessor-based Macintosh systems for content development, as well as development training and support.

Apple plans to work with

China's National Center for Audio Visual Education to create multimedia resources for use in teaching a wide range of subjects, including social sciences, languages, mathematics, and Chinese culture. Separately, Apple is working with several universities that specialize in training teachers to instruct teachers on how to create curriculum software on Macintosh computers.

"We are committed to increasing Mac OS market share growth and to offering more supplier choice for Chinese users in education and at home," said Dr. Kenneth Kin, vice president and director of Asia Pacific/ Japan Operations for Motorola Computer Group (MCG). "China represents a huge educational PC market opportunity: In 1995, there were more than 200 million Chinese children between the ages of 5 and 14. The Mac OS is the world's preferred platform for learning, and Panda will be able to support the low-cost education and home markets with systems assembled in Nanjing."

MCG reiterated that Nanjing Power Computing Ltd., its joint venture with Panda Electronics Group in China, will start production of Mac OS-compatible computers later this year. The move follows last month's announcement of MCG's agreement with Apple to license the Mac OS. MCG is the first licensee to be able to sub-license the Mac OS with its motherboards and private-label systems. For more about Apple's licensing, see this month's Strategy Mosaic, starting on page 1.

In addition to its work with native Chinese hardware and software developers, MCG is also encouraging developers from around the world to localize their products for the growing Chinese market. If you're interested in working with MCG to take your products to China, see the contact listed in the box on page 6 of this issue. ♣

Technology

CD Highlights

Tool Chest Edition, May 1996

A gross inaccuracy makes an appearance on the back cover of our Developer CD for the second month in a row. The Speech Recognition Manager went through three versions while the CD was being prepared, and the version we ended up with is 1.5b6. The eagerly awaited System 7.5 Update 2.0, which was too late for April's disc, arrives this month, along with several localizations of System 7.5.3 for PCI-based Macintosh computers. Thanks to several of your requests (and to moderator Francois Pottier) I have restored the C.S.M.P. Digests, which will be updated on succeeding Tool Chest editions. And, in addition to updates to the Disk I/O Performance Tools and new versions of HyperCard Player and Macintosh CD-ROM Setup, here is the rest of this month's new and revised stuff.

Apple Guide 2.0.2 Update

This folder contains the installer for Apple Guide 2.0.2, an update to Apple Guide 2.0. There have been two minor bug fixes; see the document Apple Guide 2.0.2 Dev Rel Notes for details.

C.S.M.P. Digests

This digest is a collection of article threads from the comp.sys.mac.programmer internet newsgroups. It is designed for people who read the newsgroups sporadically and want an archive of the discussions. The C.S.M.P. Digest is moderated by Francois Pottier (pottier@clipper.ens.fr).

Note: This is *not* an Apple product. It is provided on an "as is" basis. Apple is not responsible for any problems you may encounter in its use.

Display Manager SDK v1.1

This development kit has all the information you'll need to begin taking advantage of the Display Manger API (application programming interface). The Display Manager 1.0 API was first introduced with the Power Macintosh in Macintosh System 7.1.2 and subsequently shipped in Systems 7.5 and 7.5.1. Version 2.0 of the Display Manager is included in system software later than version 7.5.1 and is also available as a system extension that is backward-compatible to System 7.1. The development kit includes licensing information for the Display Manager extension to make it as easy as possible for you to create and ship Display Manager-aware applications.

Drive Utilities v1.1

This package contains the disk-repair utility Disk First Aid 7.2.2, as well as Drive Setup 1.0.4, a program that lets you partition, initialize, and update fixed and removable disks.

PartMaker 4.3

PartMaker consists of DTS sample code that illustrates a software project delivery tool. It's based on AppsToGo (which is also DTS sample code). PartMaker makes it easy for you to globally rename project source files, resources, and resource types. Using the tool's import facility, you can archive software projects, and you can compile and link new software projects correctly the very first time by simply pressing a single button. PartMaker's code base can work with the Symantec, Metrowerks, and MPW development environments.

Snippets

This folder contains code samples developed by Macintosh DTS.

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- *Disable Power Off Key.* This code snippet, which you can find in the Devices folder, is an extension demonstrating how to disable the Power key from turning off the computer.

- *CustomGet unresolved alias.* This sample, found in the Files folder, demonstrates how to let the user choose an alias file when opening files from a dialog box. The code essentially intercepts the pseudo-item sfHookOpenAlias in a CustomGetFile hook function and transforms sfHookOpenAlias into getOpen, causing the dialog box to behave as if the user had clicked the Open button. The code also intercepts the item number of a checkbox added to the dialog item template in order to allow the user to choose whether to resolve aliases. Finally, when CustomGetFile returns, the code calls DebugStr to let you know what happened.

- *Launch Me.* This code snippet, found in the Processes folder, shows how to make one application launch another application when both applications can't be open at the same time because of memory limitations. This approach does not fragment memory the way closing one application and opening a second one does.

- *Sound Input.* The SoundInputSample snippet, found in the Sound folder, demonstrates the right way to set up the Sound Input driver to record sound. In the past, developers have assumed that the state of Sound Input was always the same. Because newer Macintosh models—especially the PowerPC processor-based ones—may have different settings, it's important AATo set up Sound Input correctly each time you use it.

- *SoundConvert.* SoundConvert, also in the Sound folder, demonstrates some of the

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OpenDoc Human Interface FAQs

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

Paradigm-Shift Issues, Installing Editors, and More

Recently, there were several questions about the OpenDoc user interface in the OpenDoc Interest Group. We think you'll want to know about the OpenDoc topics these questions address.

Q: The other day I was showing OpenDoc to some users with moderate experience, and they were very confused by several aspects of the user interface. They weren't aware of the whole concept of stationery, so they couldn't understand how to start up a new "application." They said, "I want to write a memo; where is the OpenDoc word processor?"

A: Our studies show that people learn the stationery concept after very little training. What users have to do to start using OpenDoc isn't much different from what they do in today's application model.

On the other hand, users do have to learn about stationery somehow. Here's what we're doing to help. We will provide a tutorial to cover the basic concepts of OpenDoc, including stationery. In addition, OpenDoc will support Apple Guide 2.1, which can be used by your editors to provide help for your parts. Apple Guide includes such topics as "How do I create a document?"

However, the first exposure your users will have to stationery will be through Read Me files and other documentation you provide. You may want to include the

following paragraph in your documentation. (Of course, you'll have to modify the picture to match your product.)

Stationery:
You use stationery to open a new document (by double-clicking the stationery icon) and to add a part to a document (by dragging the stationery icon into the document). You can find stationery in the Stationery folder inside your hard disk. A stationery icon looks like this:



TextEdit stationery

Finally, your Read Me file should tell your users to see Apple Guide for more details.

Q: Why don't editors behave more like applications? For example, I want to double-click an editor to create a new document.

A: In OpenDoc, editors are more like extensions than applications. Because of this difference, we designed the icons of editors to look more like those of extensions. Users don't expect to double-click an extension like QuickTime to start a QuickTime movie viewer. In fact, when an extension is double-clicked, it doesn't launch anything; instead, it displays a message explaining that it is a system extension that adds capabilities to the system. Our OpenDoc editors have a similar message, but a bug in some versions of the system sometimes interferes with it being displayed.

The most important thing to remember is that part editor icons are system files that users should never have to work with just as users never work with system

extensions except during installation or deinstallation.

Instead, the user interface to OpenDoc parts is through stationery. When explaining to users the analogy between using applications and using parts, tell them that double-clicking a stationery icon is like double-clicking an application icon. Typically, users don't need to take any direct actions with editors. This is why it's important that part developers provide an installer—so that users don't have to confront editors.

A key advantage of stationery is that it allows you to provide some useful initial content. For example, you could provide "time card" stationery that actually contains a text part and a spreadsheet part, perhaps with a database connection part linked to the spreadsheet. So, in this case, there isn't a single editor that corresponds to the time card but a collection of editors. The stationery saves the user the time and effort of creating a standard template of different parts each time they want to create a time card.

Users or system administrators can also create their own task-specific stationery. For example, a company's letterhead stationery might contain a page layout part, a graphic part, and a text part. Because of this additional capability, we believe stationery is a very powerful design component that allows users to go far beyond double-clicking an editor icon.

Q: Users don't seem to grasp the idea that these are compound documents containing multiple part editors. What can be done about this?

A: The user doesn't need to understand that there are multiple parts being displayed and edited by multiple part editors. All the user needs to know is, "If I

want to work on the spreadsheet cell, I just click in it."

Our studies show that the concept of activation is less important than that of selection—in effect, activation is really a by-product of the object/action model. For example, suppose the user wants to boldface some text. The user must first select the text (the object) and then choose the Bold command (the action) from the menu. Selecting the text causes the text part to become active; the active part editor then shows all the applicable tools to the user. In today's GUI (graphical user interface) system, users must learn how to select—not how to activate—to use any system. So don't try to explain the compound-document model; just explain to the user how to get things done: they must select what they want to work on first.

Q: For users, Macintosh Drag and Drop is very difficult to use on 14-inch monitors. They spend a lot of time moving windows around and scrolling to put documents in place. So why is it such an important part of OpenDoc?

A: Macintosh Drag and Drop is an accelerator that users like a lot, but it isn't the only method of copying or moving content. Copy and paste operations are still available. Users can also insert entire documents into the current document by means of an Insert command. In addition, Copland will add new features—spring-loaded folders and pop-up windows—that will make the drag-and-drop behavior more useful on small monitors. (For details, see "Looking Forward to the Copland User Experience" on page 1 of the April 1996 issue of *Apple Directions*.)

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Human Interface

Doin' Time at Macworld

By Peter Bickford

Once upon a time there was a young programmer named Brad. Brad worked for a multimedia company in the heart of Silicon Valley, where he was considered something of a *wunderkind*. Sometimes it seemed that only Brad truly fathomed all the nuances of video compression algorithms, double-buffered sound playback, and optimized bit-blitting schemes that were the bone and muscle of his company's products. Brad was good at his job, and he knew it. In fact, over time he began to believe that he was the only one who really understood his company's products at all.

As the months went by, Brad grew more vocal in team meetings, voicing opinions on every aspect of the product design. Pouring great energy into his work, he began redesigning dialog box after dialog box, invented a full iconic language for user interaction, and coined several dozen new terms to describe the new interface elements he had created. Eventually, the products Brad was involved with grew to resemble the 112-function pocket calculator that Brad brought to meetings to intimidate the other participants. When the marketing lead uttered concern over whether his designs would be appropriate for the people the company was selling to, Brad would scoff, issuing forth a stream of technical reasoning to the effect that his proposals were the only grossly non-stupid design possibilities. "Users," he opined, "will catch on as soon as they see how logical it all is."

One day, the rest of the project team came to work very early so as to avoid Brad, who was a notorious night owl. As one, they marched over to the office of Brad's manager and stated their demands, most of which involved Brad's head on a platter with an apple or other suitably large object stuffed in his mouth. Brad's manager, however, was a wise and gentle man. He knew that Brad was not truly evil—just a bit out of touch with customers' needs. And he knew just what to do to get Brad back in line.

When Brad came to work later that morning, he received a surprise announcement: He had just been appointed to road-test the new product design at the upcoming Macworld show in San Francisco.

The Glassy-Eye Test

"No problem," Brad replied cheerfully. After all, this way he could finally point out the really cool parts of the program, which those dweebs in marketing were always skipping over.

Macworld came, and Brad was ready. Resplendent in his company polo shirt, he welcomed the onrush of the crowd to his demo station. A middle-aged man clutching a free *MacUser* bag was the first to approach. "So that's the new version of MegaMovieMaker Interactive," he noted. "Tell me about it."

"It's really great!" Brad gushed. "This is only a prototype, but already the rendering engine has been fully optimized with 604 instruction scheduling in mind to give full-screen 30-fps n-gon constructions across the entire system! This is coupled with a groundbreaking user interface that is generations ahead of the competition.

For instance, let's say you want to make a new movie. First, you enter construction mode by toggling the System State controller . . ."

"Oh," the man replied, looking suddenly uncomfortable. "Isn't there just some sort of New Movie menu command or something?"

Brad gave the man a pitying look before launching into his explanation of how MegaMovieMaker Interactive (M³I as he called it) had gone beyond all need of old-fashioned menus and had instead incorporated a pure, object-modeled state machine. Brad went on like this for some time, but the man's eyes had grown glassy almost immediately. Eventually he stumbled away to another booth and was lost in the crowd.

Brad's first several hours on the floor continued as they had begun, with eager prospective customers transformed within seconds into shambling zombies destined for someone else's display. Eventually, one of the "marketing dweebs" took pity on Brad and offered some advice. "Look, you're here to gather information, not to make the sale. Just tell 'em what it does, then let 'em play with it. Let them ask questions, and when you answer, watch their body language and listen to what they say."

Moments later, a hip-looking woman wearing a glow-in-the-dark Light Software button appeared at Brad's station. "So what does this do?" she asked.

Almost by reflex, Brad began to list the technical specifications of the product, but the marketing dweeb managed to insert his elbow into Brad's ribs just in time. Brad caught himself and answered "It's an application that lets you create your own movies. It's got a lot of the power that you'd find in Hollywood production systems, but it's a lot easier to use." He watched for her eyes to glaze over as had the hundreds before hers. To his elated surprise, they remained focused. "Sounds cool. What's this leopard icon?" she inquired, pointing at Brad's carefully crafted movie playback control.

The marketing dweeb left Brad with a knowing smile. The rest of the day was an educational one for the young *wunderkind*. He learned that busy multimedia authors have trouble picking up the semantics of a new iconic command language. For that matter, he learned that designing intelligible icons was a great deal harder than it had seemed. He also discovered that most of the people interested in his product seemed to own smaller, slower computers than he did; that they were confused when too many windows were open at once; and that they had disturbingly little interest in many of Brad's favorite features—including the three-dimensional fever graph of available system stack and heap space, which overwrote the area previously used by the menu bar. This was particularly disappointing for Brad, since it was one of his personal favorites, and it had not been trivial to implement!

That night, Brad skipped both the Metroworks and Symantec parties and locked himself up in his hotel room to recode the prototype. The next morning, a bleary-eyed Brad began demonstrating Mach II of his prototype. Forty-six demos, twenty-four hours, sixteen cans of Jolt, and one large pineapple pizza later, Mach III was

ready. And so it continued throughout the convention. But by the fifth day, something amazing had happened: The army of zombies that had previously been seen streaming away from Brad's demo station had largely disappeared. More telling, Brad found that he was having to dodge one question with greater and greater frequency: "Wow! So when does it ship?"

Trial by User

As I sum up the moral to the Story of Brad, forgive me if I sound like a sports commentator: Victory in the marketplace relies on doing the things that will put you ahead, and not doing the things that will sink you. As in politics, sometimes winning is a matter of making sure you don't lose.

Successful human interface design has the same dimensions to it. First, you have to use all the skills at your disposal to create a clear, elegant, and attractive interface. No guidelines, formulas, or cookbook approach can tell you how to go from a blank screen to an interface design that addresses the special needs of your target users. This is the realm of skill, experience, and inspiration. And, as with any creative endeavor, the more you practice at it, the better the results are likely to be.

The other part of human interface design, however, is what makes it science as well as art. Human interface designs can be tested. One design can be shown to be more effective than another. More importantly, by trying your designs out on the people who will be using them, you can discover problems with your interfaces before they become problems for your customers. Good interface testing can keep you from losing.

This is not to say that user testing software does not have its shortcomings. It's hard to pick appropriate sample groups, devise reasonable user tasks, or know which portions of the interface should be tested in the first place. User testing also gives you only yes/no answers: Some part of the interface is working well or it's a potential problem. Testing can't tell you what to do to make it better; all you can do is take another shot at the design and test it again.

The main problem with user testing, however, is that it simply isn't done enough. Project teams get too busy, schedules get too tight, or it's just not considered that important until after you ship a product and start hearing from unhappy users. This is why I'd encourage engineers not only to observe or conduct user tests, but also to spend some time fielding technical support calls, or—yes—even doing booth duty at Macworld for a few days. If you keep your eyes and ears open, these experiences can give you a wealth of information on what users expect from your products. At the very least, they give you a way to get it right the next time, if you didn't get it right the first time.

*Till next time,
Doc*

And speaking of next time: In 30 days I'll be taking a look inside the best-tested programs on the market. I'm speaking, of course, of video games. Doc gets out his roll of quarters and heads to the arcades to explore "Addictive Interfaces: Interface Secrets of Successful Video Games."

Send your letters, comments, or interface questions to machi@apple.com.

CD Highlights

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new features of Sound Manager 3.2. The application allows you to read AIFF and AIFC sound files and convert them to any combination of sample rate, sample size, number of channels, and format/compression type.

- *Fill Memory.* This snippet, in the Testing & Debugging folder, is a debugging aid. It fills its memory partition and verifies that it does not get changed. This allows you to confirm that your application doesn't write into the memory space of other applications.
- *strlist.* This snippet, from the Text folder, is a string list library. See the file "strlist.txt" for details.

Speech Recognition Manager

This folder contains version 1.5b6 of Apple's new Speech Recognition Manager. This is beta software and documentation—it's not yet ready for wide distribution or release in products. When completed, version 1.5 of the Speech Recognition extension will embody the first officially supported developer release of the Speech Recognition Manager. See the document READ ME FIRST! for details.

Input from early adopters of Apple's speech recognition technology has greatly improved the Speech Recognition Manager API. If you find bugs in the extension or documentation, please report them in the

Apple Bug Reporter stack. Include the version information in the problem description and send it to apple.bugs@applelink.apple.com.

System 7.5 Update v2.0

System 7.5 Update 2.0 is a set of system software enhancements that improves the reliability and performance of all computers running Macintosh System 7.5, 7.5.1, or 7.5.2. You can install System 7.5 Update 2.0 even if you did not install Macintosh System 7.5 Update 1.0. See the file Installing This Update for details.

Worldwide System Software Update

This folder contains 11 localized versions of System 7.5.3 (PCI only), a system software release that's customized to run on specific PCI-based Macintosh desktop systems. This version of System 7.5.3 is qualified to run on the Power Macintosh 7200, 7500, 8500, and 9500 series of desktop computers. System 7.5.3 (PCI only) is a full system software release that can be installed on a PCI-based Macintosh computer whether or not a System Folder exists. This system software is only available to customers with new PCI-based Macintosh computers.

*Alex Doshier
Developer CD Leader*

OpenDoc FAQs

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Q: What some users miss the most is using a tool bar with different data types to create new content. How can we address this issue in OpenDoc?

A: As in the application world, tool palettes can be used to add new content. We encourage developers to continue to provide tool palettes in OpenDoc with the following difference: Instead of reimplementing common function in the code, your part editor should use any part editors that perform the same function and are already present on the user's system. For example, a draw editor usually needs to have a tool for creating text. Instead of the developer providing the text support, the tool just creates a text part and uses the default text part. (For more details, see the OpenDoc Q&A in the May 1995 issue of *Apple Directions*.)

Q: The launch time for OpenDoc is very slow. Users usually close documents once they finish using them; after they close the last OpenDoc document on the screen and then open a new one, they have to watch the OpenDoc startup screen for several seconds.

A: We agree! Faster launching is a high priority for us, and the engineers are working on this.

Q: OpenDoc isn't visually different or appealing. Although it is supposed to cause a revolution, it's visually the same as before. So, you have almost the same screens as normal applications but with slightly different rules. How are users going to know that OpenDoc is giving them something they can't get from traditional applications?

A: If OpenDoc were dramatically different from today's applications, users would have problems adapting to it. We did not intend OpenDoc to *look* different; the design of OpenDoc focused on allowing you to build different and better applications. There are visual clues, of course, that the user is working with OpenDoc parts; the process menu will show an OpenDoc part icon when a part is active, and the special OpenDoc border for activation is also a very visible clue. In addition, OpenDoc will use Copland's new visual design. Just a note—be careful about using nonstandard controls, menus, and windows, because they may not be visually compatible with Copland.

Q: Users have problems getting away from the application-oriented way of thinking. They used to think in terms like "I've saved my memo in Word" or "That document was in Excel." Having documents that are independent of particular applications is confusing. Actually, many users save their files in folders with names like "Word documents," "ClarisWorks documents," and so on. Isn't this going to get in the way of user acceptance of OpenDoc?

A: We don't think so—our studies show that existing users quickly learn OpenDoc. Part of the reason for the confusion you are seeing is that there are no real part editors available today. Most of the sample part editors on the DR4 version of OpenDoc don't completely follow the OpenDoc HI guidelines. So right now, chances are you haven't seen how OpenDoc is supposed to work. Apple's own OpenDoc parts should be out soon, and they can be used as benchmarks for good HI design.

Q: What happens when users stop using an editor or they

install a new version of an editor? If users are not supposed to see editors, won't the editors just collect in the Editors folder long after users stop using them?

A: Yes, that is possible. So, we suggest that you provide a way to deinstall your editor so that the Editors folder doesn't become overloaded. For installation over a previous version, consider asking users if they want to keep the old version before the installation process removes it. Some users may need this feature.

We are aware of dependencies between editors and are looking at clean ways of deinstalling. At the earliest, we will probably have a solution to this problem by the time of the Copland release.

Q: We are currently developing our software as OpenDoc parts, but I'm concerned about some of these editor management issues. While I agree with many of the philosophical reasons for treating editors similarly to system extensions, there are practical ramifications that present problems. In particular, the OpenDoc design is oriented toward a single fixed hard-drive system, and that doesn't scale well to other scenarios. For example, I have an internal and an external hard drive. Mostly, I start up from the internal drive, but occasionally I start up from the external drive. My applications are always available regardless of which hard drive I start up from—which is not necessarily true with OpenDoc. Forcing users to install all software in the System Folder of each bootable disk is a serious restriction on their ability to customize their workspaces.

A: We considered the very issues you bring up. The standard

OpenDoc installation will work fine for most users, but you're describing a "power user" situation. Fortunately, it turns out that OpenDoc has a solution for it as well. According to the *OpenDoc Programmer's Guide* (page 633),

[you must] install part editors and part viewers in the Editors folder, which may be either in the System Folder on the user's startup volume or on the root of any mounted volume. . . .

According to this statement, you may have an Editors folder at the root level of an external volume or a server—and you don't have to have a System Folder on each external volume or server just to accommodate OpenDoc. In your situation, the solution would be to move the Editors folder to the root level of either hard disk, so that OpenDoc will be able to access the Editors folder regardless of which volume you start up from.

Your installer script (you are creating an installer script for your product, aren't you?) should allow the user to choose which volume to install your editors on. The installer script should default to installing your editors on the system startup volume, in the Editors folder (which is located within the System Folder). However, if the user chooses another volume for your editors, the script should install them in an Editors folder at the root of that volume.

That's all for this month. We look forward to hearing from you and giving others an opportunity to learn from your experiences! If you don't have the *OpenDoc Programmer's Guide*, you can find an Adobe Acrobat version on the OpenDoc DR4 CD or on the World Wide Web. (See "Internet Resources for This Issue" on page 40.) ♣

Multitasking Under Copland

Part 1: How Copland Performs Preemptive Multitasking

By Tony Francis

Copland—the next major version of the Mac OS being rewritten almost completely in native PowerPC code—will introduce a variety of major architectural innovations to Macintosh system software. Among the most significant change will be that, for the first time, Mac OS-based software will have access to preemptive multitasking services.

In general, System 7 was designed primarily to manage the central processing unit (CPU) through simple, singular tasks, although it allows limited multitasking to take place. For example, System 7 provides for cooperative multitasking, which takes place when software makes a `WaitNextEvent` call and surrenders control of the CPU to another task. Additionally, by using vertical blanking interrupts (VBLs), small, repetitive tasks can employ preemptive multitasking to a limited extent under System 7.

With Copland, the Mac OS will perform preemptive multitasking. No longer will one task have to depend on the “good will” of another task—that is, the second task’s surrender of control—to gain access to the CPU. While preemptive tasks execute, the file system, networking, and device input/output (I/O) will remain available, letting users do more than one thing at a time.

The Copland Toolbox will remain a cooperative multitasking environment, where the Finder and your System 7 applications will run. With Gershwin—the major Mac OS release after Copland—the Toolbox itself will become fully preemptive.

Apple’s engineers designed Copland with a cooperative Toolbox to assure compatibility with existing applications.

Were Copland to provide complete preemptive multitasking, today’s applications wouldn’t work. Instead, Apple is giving you time to get used to the idea of preemptive multitasking and an operating system with multiple address spaces. With Copland, you’ll be able to isolate certain parts of your software’s code as tasks that can execute preemptively in protected memory spaces—tasks such as copying data or transferring files over a network.

The rest of this article provides a detailed technical look at Copland multitasking. The article is excerpted from the forthcoming Apple Press/AddisonWesley book Copland Revealed by Tony Francis, a long-time technical writer in Apple’s Developer Press and author of numerous titles in the Inside Macintosh series. This month’s installment explains multitasking under Copland; the second part, which we’ll publish in next month’s issue, will describe multithreading.

• • •

A multitasking operating system allows multiple programs to execute in a simultaneous or nearly simultaneous manner. Copland, unlike previous versions of the Mac OS, performs preemptive multitasking—that is, Copland actively controls moment-to-moment program access to the CPU. Through the use of a cooperative scheduling policy for cooperative programs, Copland also allows System 7 applications to run efficiently in this preemptive multitasking environment.

Preemptive multitasking makes efficient use of the computer. For example, the user can

continue working even while background operations—such as e-mail transactions, automated file backups, and complex image-rendering calculations—are taking place. This type of system performance translates to improved user productivity.

To the user, it appears that multitasked operations take place simultaneously. Actually, a CPU can execute only one operation at a time, but the Copland microkernel interleaves the execution of these operations so quickly that it looks as if they’re happening simultaneously. For example, between the time that a user selects a paragraph of text and chooses the Copy command, the microkernel may have instructed the CPU to execute a network I/O operation, perform part of a statistical calculation, or execute several system operations. (As you’ll see in Part 2 of this article, Copland is also designed to support simultaneous task execution on computers with multiple CPUs, although this support is not available in the operating system’s initial release.)

Key Terms and Concepts

Preemptive multitasking is the ability of an operating system to allocate multiple tasks’ access to the CPU and other operating system services, thereby allowing multiple programs to execute in a nearly simultaneous manner. The Copland microkernel provides

the mechanisms for preemptive multitasking.

A *task* is the basic unit of program execution in Copland. A task is always associated with a process, and several tasks can be associated with a single process. Whenever any task within a process is eligible for execution, the microkernel preemptively schedules the task for execution along with all other eligible tasks. Tasks that are temporarily ineligible for execution are said to be *blocked*.

A *process* is an instance of a program at execution time. A process is characterized by a set of one or more tasks and the memory and other operating system resources allocated to those tasks. (Copland uses processes for tracking and reclaiming these resources.)

Preemptive scheduling is the policy by which the microkernel allocates all eligible tasks moment-to-moment access to the CPU. The microkernel uses a set of well-defined rules to schedule which task should execute at any given time. Following these rules, the microkernel can suspend the execution of one task and resume the execution of another. Preemptive scheduling is necessary for preemptive multitasking. To synchronize access to the cooperative services and provide compatibility for System 7 applications in this preemptively scheduled environment, Copland also

Planning for Copland Multitasking

To begin to take advantage of Copland’s multitasking capabilities in your software products, consider whether any of your code that performs processing unrelated to the user interface can be implemented as a server program. Such an implementation will increase system efficiency and may be usable by multiple cooperative programs.

employs a scheduling policy called *cooperative scheduling* (defined below). Because Copland is committed to backward compatibility with System 7, it is tied to using System 7 *cooperative multitasking*. Copland must also use certain essential services, such as the Mac OS Toolbox, that depend on being accessed cooperatively; these are called *cooperative services*. Because every Copland application that users see must have a visible human interface, such applications must have a component, called a *cooperative program*, that uses cooperative services. However, the value of creating a Copland application comes from the fact that a cooperative program can create and communicate with multiple, preemptively scheduled tasks, each of which may run in its own separate, memory-protected address space that participates in preemptive multitasking. By placing as much functionality in tasks as possible and using a cooperative program only for interacting with users, Copland applications

will be more stable and offer better performance than today's applications running System 7.

Cooperative scheduling is the policy by which the Process Manager schedules program access to the Copland cooperative services. The Process Manager allows the main task of no more than one cooperative program to be eligible for execution at any time. In this way, every call to a cooperative service can execute to completion without interruption. Cooperative scheduling rotates eligibility among the main tasks of cooperative programs so that each can, in turn, be preemptively scheduled with all other tasks in the system.

A *main task* is the first task created by the microkernel for a process. The main tasks for cooperative programs can safely use Copland cooperative services, whereas all other tasks in Copland must use only reentrant services. (A *reentrant service* is a Copland operating system facility that can be used concurrently by several pieces of code. Examples include

the microkernel and the file system.) You can design a program so that when it becomes instantiated as a process, it contains multiple tasks.

Major Points of Interest

To let the user make the most productive use of the computer, the microkernel will preempt the execution of one task and start or resume the execution of a more urgent task. For example, the microkernel might interrupt the execution of a file compression program to let a multimedia program prepare video data for immediate on-screen play. At the next opportune time, the microkernel resumes execution of the file compression operation.

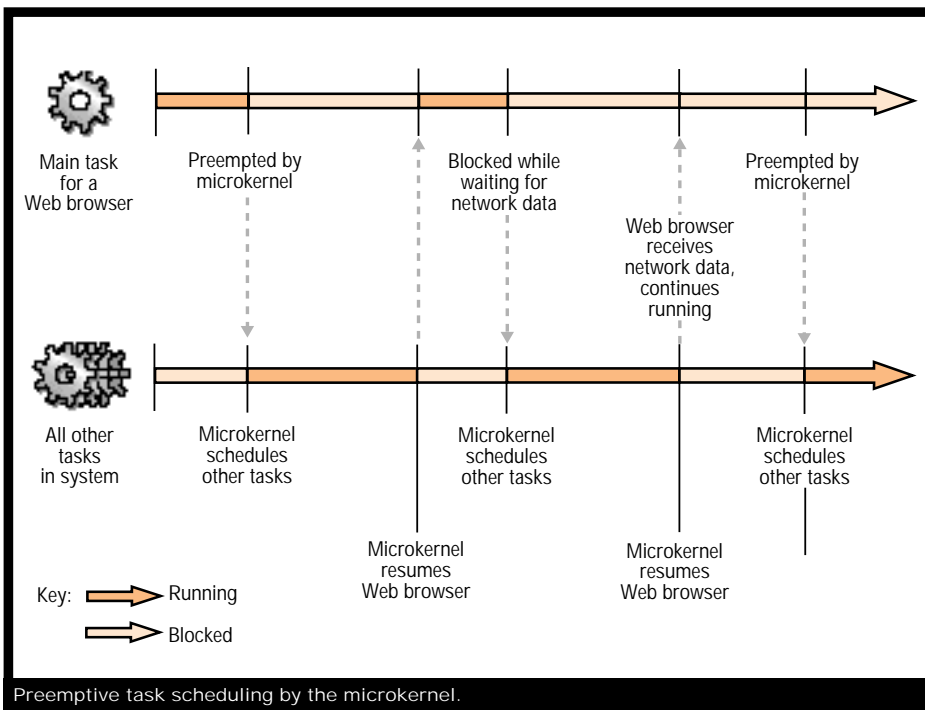
Preemptive multitasking also makes efficient use of the CPU by keeping it as busy as possible. For example, because the CPU executes instructions faster than I/O devices transfer data, the microkernel will interrupt the execution of a program that is waiting for data to come off a disk. The operating system then schedules other

operations for execution, keeping the CPU busy even while the program is waiting for data from the disk. When that data becomes available, the microkernel reschedules the program for execution. Even while the microkernel continually suspends and resumes task execution to keep the CPU busy, the operating system remains highly responsive to users.

Although previous versions of the Mac OS provide mechanisms by which applications can share the CPU, Copland is the first Mac OS to offer a preemptive multitasking environment—that is, one in which the operating system can preemptively suspend one task in order to allow others to execute. Previous versions of the Mac OS employ a type of multitasking called *cooperative multitasking*. In the cooperative multitasking environment of System 7, applications cooperate by yielding control of the CPU to one another—no part of System 7 actively preempts application control of the CPU.

In the cooperative multitasking environment, you must program task scheduling into your software. It's impossible for you to anticipate the scheduling priorities that will exist on any system when your program is actually running. The Copland microkernel, however, does know from moment to moment what demands are being made of the computer, and the microkernel preemptively schedules task execution according to the priority of these demands.

Copland uses cooperative scheduling to serialize access to cooperative services. (Because cooperative scheduling simulates the cooperative multitasking of System 7, OpenDoc parts and System 7 applications are automatically compatible with this cooperative scheduling policy.) Enforced by the Copland Process Manager, cooperative scheduling makes only one task at a time eligible to call the cooperative

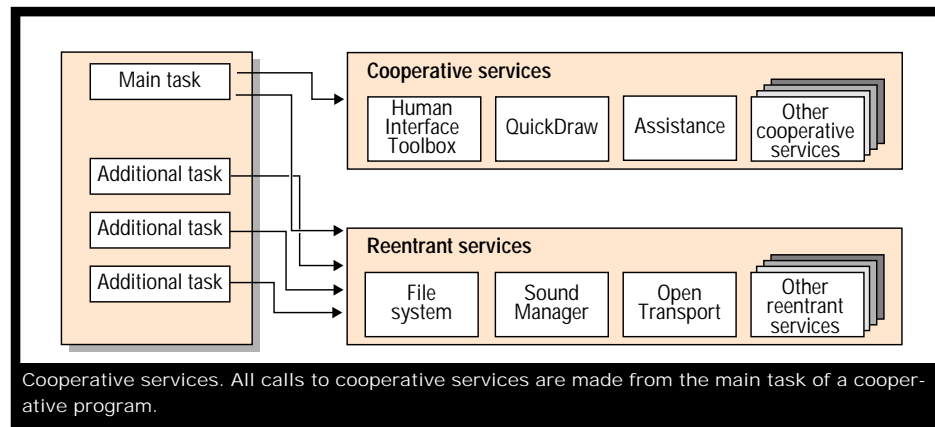


services, thus preventing one program from preempting another program's call to such a service. The task made eligible for execution by the Process Manager is preemptively scheduled with other eligible tasks across the system, such as tasks for *server programs* (programs that run in their own protected address spaces) and for the operating system itself.

As you'll learn in Part 2 of this article, you can design multiple threads of execution into your software products to increase system efficiency and user responsiveness. A multithreaded program is structured into parallel operations, each of which gets access to the CPU. This feature allows a user to continue working within an application without waiting for the application to complete lengthy operations. For example, a scientific simulation application could create one thread that handles user interaction and another thread that performs intensive statistical calculations in the background. The user can continue to interact with the program even while it's performing statistical calculations. The microkernel interleaves the execution of multitasked operations so quickly that it looks as if they're happening simultaneously.

Processes and Tasks

In Copland, a task is the basic unit of program execution; it performs a sequence of programmatically defined operations. When launched, every program has at least one task, called its *main task*. The main task of a video-effects editing program, for example, might present an interface that allows the user to select from or create a variety of transitional effects when sequencing video tracks. A process may incorporate other tasks as well; for a video-effects editing program, a second task may be employed to write



and read video data to and from a hard disk.

As Copland defines it, a process is a passive entity—that is, a process is not executable. Instead, it is the tasks associated with a process that are executable. In order to be executed, every task requires various operating system resources, such as a set of processor registers and memory areas for storing its temporary data. All of the resources allocated to a task are packaged by the microkernel into a process, which the operating system uses to track these resources.

When a program is launched—for instance, when a user double-clicks its icon—the operating system prepares the program code for execution, allocates memory for the code and its temporary data, and places the code and data into memory areas within an address space. In this way, the program becomes instantiated as a process. Every task gets its own stack and set of CPU registers. However, if a process contains more than one task, all tasks in the process initially share the same dynamic storage memory area, in which the tasks save such temporary data as data structures and global variables.

Different kinds of programs, when launched, cause the creation of different kinds of processes. When a cooperative program is launched, the operating system

instantiates a process for it within the address space shared by all cooperative programs. When a server program (which has no direct interaction with users) is launched, the operating system creates a new address space and instantiates a process for the server program within that address space.

When a process is terminated (as when a user quits an application), the operating system releases all of the resources related to that process—an improvement over System 7, which leaves various system resources in memory if the application using them is abnormally terminated, such as when a programming error within an application causes it to crash.

Task Scheduling

After creating a process, the operating system schedules its tasks for execution. At any time, the Process Manager allows the main task of only one cooperative program to be eligible for execution, thereby synchronizing access to the cooperative services. This and all other eligible tasks are then scheduled preemptively by the microkernel according to its priority-based scheduling algorithms.

The microkernel preemptively schedules moment-to-moment access to the CPU among all eligible tasks. When it determines that an eligible task should execute,

the microkernel gives it access to the CPU by suspending the currently executing task. This transition point, where the currently executing task is suspended and the execution of a different task is undertaken, is called a *context switch*. During a context switch, the microkernel saves the execution state of the suspended task and replaces it with the execution state of the task about to execute.

Not all tasks are eligible for execution. Tasks that are not eligible for execution are said to be *blocked* on some condition, such as the completion of a synchronous I/O operation. When a task is blocked on some event and that event occurs, the task becomes eligible for execution again. Whenever an existing task becomes blocked, the microkernel sends another task to the CPU for execution.

Scheduling Policies

Many tasks can be eligible for execution, but the CPU can execute only one task at a time. The microkernel determines which task gets to be executed. The first criterion for making this determination is priority. The task with the highest priority is given execution precedence.

You must assign priorities to your program tasks. The following list shows the priority levels for tasks and the types of

programs to which these priorities are typically assigned.

- *First priority: real-time tasks, such as those for sound playback and video capture.* These tasks are given the highest priority. Because of the time-critical nature of a real-time task, it executes until it's blocked, and it immediately resumes execution as soon as the task becomes eligible again. Very few developers assign this level of priority to their tasks.

- *Second priority: operating system tasks, such as those for the I/O system and the Process Manager.* Only real-time tasks have higher priority. Because operating system tasks generally execute for such short durations, the CPU spends very little time executing the tasks at this priority level.

- *Third priority: server program tasks.* The CPU spends

much of its time executing tasks at this priority level.

- *Fourth priority: the main tasks of cooperative programs.* The Process Manager cooperatively schedules all main tasks so that no more than one is ever eligible for execution.

- *Fifth priority: additional tasks created for cooperative programs.* You will generally assign these tasks a lower priority than you'll assign to your main tasks. In some circumstances, however, you may assign a higher priority—such as the priority for a server program—to a cooperative program's additional tasks. For example, if a cooperative program uses an additional task to perform critical data I/O, the additional task may be assigned a higher priority than the main task. Such a task would spend most of its time waiting for I/O operations to

complete, so it wouldn't degrade the user responsiveness of the cooperative program's main task, yet the additional task's higher priority would ensure that it quickly gets the small amount of execution time needed to initiate the next I/O operation.

- *Sixth priority: lowest-priority tasks.* These tasks generally get to execute only when there are no other eligible tasks. For example, a task with this priority might be used to perform automated file backups when the user is away from the computer.

A task with one of the two highest levels of priority—for example, a real-time task or a system task—always executes until it's blocked, even if another task with equal priority becomes eligible. If there are no eligible tasks at one of the two highest levels of priority, the task with the next highest priority on the system is given precedence to execute on the CPU. Apple engineers are currently tuning scheduling algorithms so that the highest-priority task is given access to the CPU somewhat less than 100 percent of the time (unless the task is a real-time or system task, both of which always get full access to the CPU). This scheduling approach prevents a task from starving all lower-priority tasks from execution. Apple intends to refine these algorithms based on the performance of programs running on prerelease versions of Copland.

According to their priorities, then, the microkernel shuffles eligible tasks on and off the CPU. This is illustrated in the figure on page 20, where CPU time for the main task of a World Wide Web browser program is indicated by the shaded portions of the time line at the top of the figure. The CPU time allotted to all other tasks in the system is illustrated by the shaded portions of the bottom time line. At the beginning of the time represented in this figure,

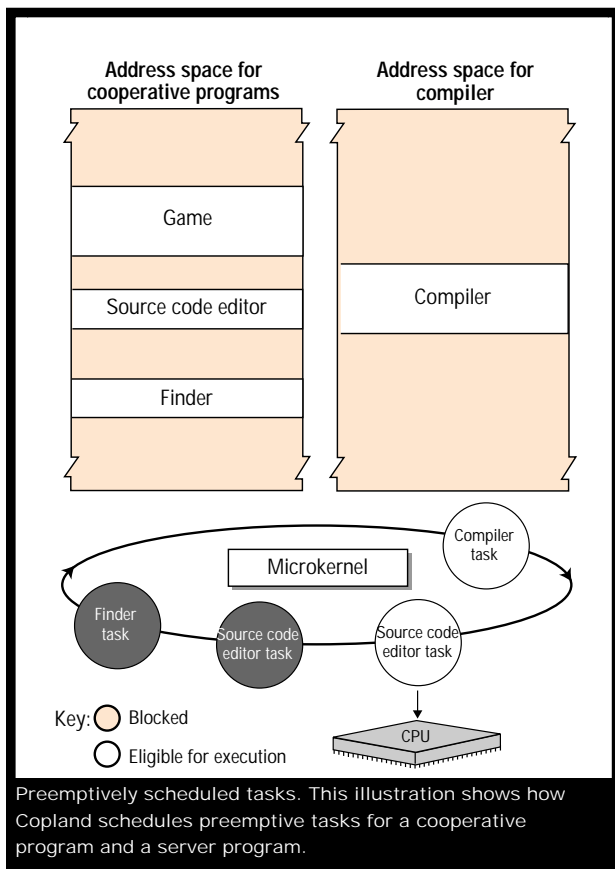
the browser's main task has the highest priority and hence executes. As soon as a task with a higher priority becomes eligible, the microkernel preempts the main task and performs a context switch to allow the higher-priority task to run. When the main task of the browser has the highest priority again, the microkernel performs another context switch and resumes execution of the browser's main task. If this task becomes blocked waiting for the arrival of data from the network, the microkernel performs another context switch and allows the task with the next highest priority to execute. When the network data becomes available to the browser's main task, the task becomes eligible, and the microkernel schedules it once more for execution.

For tasks below the top two priority levels, the microkernel uses a type of scheduling called *time slicing* to allow tasks of equal priority to share CPU time. In this scheduling policy, when multiple tasks have the same priority, and that priority becomes the highest priority on the system, the microkernel allows each task to execute for an internally specified time interval called a *time slice*. When a time slice expires, the microkernel switches to the next task with the same priority.

Cooperative Scheduling

The Process Manager coordinates scheduling for the main tasks of all cooperative programs. From among all the main tasks on the system, the Process Manager allows no more than one at a time to be eligible for execution. The microkernel preemptively schedules this task for execution. By rotating eligibility among the main tasks of all cooperative programs, the Process Manager gives each the opportunity to execute.

Cooperative services support the Copland graphical user interface and maintain compatibility



Preemptively scheduled tasks. This illustration shows how Copland schedules preemptive tasks for a cooperative program and a server program.

with applications written for System 7. Because they are not reentrant, cooperative services must complete the request from one task before receiving another. Otherwise, data could be corrupted when one task preempts another. For example, suppose one program has called the Human Interface Toolbox to create a window. The Human Interface Toolbox must finish creating that window before receiving any more requests to create windows; otherwise, window-creation operations will fail.

To synchronize calls to its cooperative services, Copland defines an environment for cooperative scheduling, so called because programs cooperate to safely schedule access to these services. For programs to cooperate in this environment, you need only ensure that calls to these services are made exclusively from the main tasks of your cooperative programs.

When a cooperative program is launched—for instance, when a user double-clicks its icon—the Process Manager instantiates a process for that program within the address space shared by all other cooperative programs, and the operating system creates a main task for the newly instantiated process. An OpenDoc part, by comparison, doesn't have a main task. Instead, OpenDoc creates a main task for every OpenDoc document when it's opened by the user. For every OpenDoc document, all part editors run within the main task of that document.

Interactive programs with only one task, such as System 7 applications, automatically cooperate to ensure safe access to the cooperative services, and the OpenDoc environment automatically ensures safe access to these services from OpenDoc parts. As explained in Part 2 of this article, you can incorporate multiple threads of execution within a

cooperative program by creating additional tasks. If you're an OpenDoc developer, you can also create additional tasks for your OpenDoc parts. As shown in the figure on page 21, the cooperative services are called exclusively from a cooperative program's main task. The main task and all additional tasks can call the reentrant services.

Whereas the microkernel preemptively schedules the execution of all eligible tasks, the Process Manager allows the main task for only one cooperative program to be eligible for execution at a time. For example, the moment the user interacts with an e-mail application—for example, by selecting a menu command—the main tasks of all other cooperative programs become blocked, and the Process Manager makes the main task of the e-mail application eligible for execution. By permitting only one cooperative program to be eligible for execution at a time, the Process Manager ensures that all calls to the cooperative services are serialized.

The Blocking of Main Tasks

Whenever there are no user actions or system occurrences for a cooperative program to respond to, the main task for that program becomes blocked. A user action, for example, might be the selection of a command from that program's menu, and a system occurrence might, for instance, entail the transmission of data to that program from a server program.

The main task of a cooperative program designed for Copland blocks its own execution whenever it has no user or system events to respond to. A System 7 application with no events to respond to becomes blocked by the Process Manager as soon as the application calls a routine yielding its use of the CPU. If no user or system

events are pending for any cooperative programs, all main tasks may become blocked.

The figure on page 22, shows a server program (in this case, the compiler, running in its own address space) that compiles code created with the source code editor. Because the Process Manager coordinates execution only for the main tasks of cooperative programs, it does not block the compiler task, so it's eligible for execution. (Even if the compiler task were created as an additional task for the source code editor and not as a server program, the result would be the same: The Process Manager could not block the compiler task from execution.)

In this example, the source code editor has been assigned a higher priority than the compiler, so the microkernel allows the source code editor to continue to execute. However, if the source code editor were to become blocked along with the other cooperative programs (as if, say, all were waiting for events), then the compiler would begin executing. Or if another task, such as a system task, with a higher priority were to become eligible, the microkernel would preempt the source code editor and allow the higher-priority task to execute.

Summary

For increased system efficiency, Copland performs preemptive multitasking. This allows the CPU to remain as busy as possible regardless of whether the user is interacting with any applications. The microkernel uses priority-based scheduling algorithms to determine which task gets immediate access to the CPU: The more urgent the task, the sooner it gets execution time.

Not all tasks are eligible for execution. For example, a task waiting for a file I/O operation to complete will become blocked so

that the CPU can immediately begin executing some other task. When the file I/O operation completes, the previously blocked I/O task becomes eligible for execution again.

To synchronize access to the cooperative services, the Process Manager allows no more than one main task from among all cooperative programs to be eligible for execution. The main tasks of all other cooperative programs become blocked. By permitting only one cooperative program to be eligible for execution at a time, the Process Manager ensures that all calls to the cooperative services are serialized. For an application to operate in this cooperatively scheduled environment, you need only ensure that calls to the cooperative services are made exclusively from the main task of the program. System 7 applications and OpenDoc parts are automatically compatible with this cooperative scheduling policy. ♣

Tony Francis has been a technical writer in Apple's Developer Press group for ten years. He has contributed to numerous books in the Inside Macintosh series and was lead writer for IM: Imaging With QuickDraw, IM: Devices, and Advanced Color Imaging on the Mac OS. Copland Revealed, the book from which this article was adapted, will be published by Apple Press and Addison-Wesley in June 1996.

Business

Developer Outlook

Interactive Music and the Apple Media Tool— Five Case Studies

By Kris Newby,
Apple Directions staff

There are a surprising number of computer programmers who are also accomplished musicians, but until recently, the professions of music and computer science have been mutually exclusive. The gap between these professions is closing fast, however, as the prevalence of microprocessors and multimedia blurs the line between musical instruments and computers. This "harmonic convergence" has also been hastened by the fact that the music and multimedia industries have chosen CD-ROM as their primary content delivery medium.

In the last few years, a handful of mixed audio/multimedia CDs have shipped, and this "media duet" has sparked the imagination of both industries. Musicians see multimedia as a way to augment their music. Record companies view computer media and Internet connections as a means of promoting additional titles and artists. And multimedia developers see the interactive music market as a new creative frontier and business opportunity.

"I can see a time when every audio CD ships with some amount of interactive content," said Rich Shupe of Fischer Multimedia Arts in New York City. "With the availability of the Blue

Book standard and inexpensive multimedia tools, you have a great business model for creative developers."

To that end, both the music and software industries are in the process of creating a standard data format that would enable audio CD and computer CD-ROM players to use the same discs, without burdening consumers with special software or procedures. These CDs are generically referred to as *enhanced CDs*. One promising enhanced CD standard is the Blue Book CD Extra standard, which is being jointly developed by Phillips, Sony, Microsoft, and Apple Computer, Inc. (For more information about these formats, see the AMP Web site, listed in "Internet Resources for This Issue" on page 40.)

Another obstacle slowing the interactive music market is the lack of a business model that works for both industries and consumers. Today most record and software companies have radically different content development timelines, cost structures, and distribution channels. What's more, the record industry is a mature business with an established set of business rules and protocols, and the emerging multimedia business has virtually no set rules.

Apple obviously has a vested interest in accelerating this market

to *tempo allegro*: More than 70 percent of all computer-using musicians use Macintosh computers (according to Apple internal research), and Apple would like to better serve this audience. But Apple's desire to succeed in this market is also good news for all multimedia developers, because it means Apple will be shipping

more technologies that make it easier for you to integrate music, video, and graphics into your titles.

At a system level, Mac OS technologies such as QuickTime, the QuickTime Music Architecture, QuickTime VR, and the Sound Manager are making it faster and easier to develop high-quality, cross-platform interactive music

Apple Media Tool at a Glance

Apple Media Tool (AMT). Winner of MacUser magazine's 1993 "Best New Multimedia Product" Eddy Award, this product is an object-based, cross-platform multimedia development tool that uses a screen-map storyboard metaphor. It allows users to quickly and easily drop QuickTime VR, QuickTime movie, PICT, text (RTF), and sound files into a storyboard, then add interactivity using a visual, no-scripting interface. Version 2.0 includes more than 30 new features, including QuickTime VR support, variable run-time bit depths, custom color palettes, flip-book animation, and hypertext linking. AMT features and projects can be customized with the Apple Media Tool Programming Environment. Titles created with these products can be distributed royalty-free.

Apple Media Tool Programming Environment (AMTPE). This object-oriented language and application framework allows programmers to customize features of the Apple Media Tool authoring environment and add functionality to interactive projects created with Apple Media Tool. All code written with this product compiles for both Macintosh and Windows platforms. The new 2.0 version includes an expanded Apple Media Language class library, incremental compiling and linking of Apple Media Language code, improved and faster debugging facilities, and enhanced documentation written from an AMTPE developer's perspective.

content. Looking at business support, Apple's Interactive Music Track program is organizing tools, resources, and events to help you get started in this business. And finally, Apple's easy-to-use multimedia authoring tools, the Apple Media Tool and the Apple Media Tool Programming Environment, are helping you reduce the time and cost required to create interactive music CDs. (For a description of these tools, see the box on page 24.)

To help you explore this emerging market, we profiled five successful interactive music developers who are using the Apple Media Tool to create multimedia titles for musicians such as Bob Dylan, B.B. King, and the Rolling Stones. For each interview, we asked these developers to share their business philosophies, creative approaches, and project management strategies for a specific CD project. Whether you're actively interested in interactive music or you're just considering

adding music to your multimedia title, you'll find a variety of marketing and project tips within each interview to help you develop titles better and faster.

Using the Apple Media Tool to "Flash Back" to the Sixties

*Graphix Zone
Irvine, California*

Graphix Zone is a multimedia firm that develops and markets interactive CD-ROM titles. In the interactive music arena, they're best known for their Prince Interactive and Bob Dylan: Highway 61 Interactive titles. To create media-rich, game-like titles such as these, they use the Apple Media Tool and the Apple Media Tool Programming Environment because of the ease with which the tools allow multiple teams of artists and programmers to work together.

Media samples:

- <http://www.gzone.com>
- <http://www.zdnet.com/cschopper/nuggets/9505/rev3.htm>

• • •
Try explaining the significance of Bob Dylan's music to a high school student, and you'll probably receive a bored stare. But place that same student in front of an interactive music CD-ROM that artfully integrates Dylan's music, film clips, interviews, recording out-takes, and lyrics, and you have an effective means of communicating why this minstrel and his music played such an important role in the United States during the turbulent 1960s.

This is the philosophy behind Graphix Zone's new interactive music title, *Bob Dylan: Highway 61 Interactive*. Titles such as this show how interactive music can provide musicians and record companies with much more than a way to "repurpose" old songs—it can provide them with a richer

medium for conveying a musician's history, music, and messages.

For Graphix Zone, *Highway 61* has not only been a creative success, but a commercial success as well. Using the Apple Media Tool and the Apple Media Tool Programming Environment, Graphix Zone's team of writers, artists, and programmers were able to work in parallel to construct this media-rich retrospective in just six months. This approach appears to have paid off: *Highway 61* was recently named "One of the Ten Best CD-ROMs of All Time" by *BYTE* magazine, and to date, it has sold more than 80,000 copies.

Building Highway 61

Highway 61 began with several brainstorming sessions involving creative people from Graphix Zone and Dylan's team. After in-depth discussions about Dylan's career, interface symbols were developed: A coffee cup image became a "hot button" that takes users back to Greenwich Village cafés where Dylan performed in the sixties and seventies; an electric guitar button calls up a library of Dylan's lyrics; and an old microphone button transports viewers to Dylan's old recording studio.

For each of five content areas, Graphix Zone formed creative teams that included a writer, a 3D artist, and a 2D artist. Two programmers provided support to all the teams. The Dylan representatives supplied the team with raw content, such as all the original takes of the song "Like a Rolling Stone," and a photographer was sent to New York to take pictures of Dylan's early studio and performance sites.

"In a project like this, preproduction is the key," said Sean Dunn, technical manager at Graphix Zone. "What worked best for us was to use a Claris Filemaker Pro database for defining each



MediaX's title, *On the Road with B.B. King*, has some nice creative touches, such as specially commissioned oil paintings that represent different chapters in B.B. King's life.

content area. Then, we transferred this information over to the Apple Media Tool, where we developed the title's basic layout, inserted placeholder media objects, and defined basic interactivity. As the project progressed, we used the Filemaker Pro database to track tasks."

Once the planning process was underway, the Apple Media Tool became the development foundation for *Highway 61*. The two programmers were able to access Apple Media Tool to build in the interactivity specified by the creative teams. These programmers used the Apple Media Tool Programming Environment to create custom cursors, transitions, and a dynamic loading-and-unloading utility to enhance performance. They used IMA compression (the 4-to-1 audio compression standard defined by the International Multimedia Association) to store as much audio on the CD-ROM as possible. And with the help of Andy Hong from Art Technology Group, they created an ambient music facility that enabled QuickTime movies to play, without interruption, across screens.

Media Tool Advantage: Code Reuse
"Highway 61 was created in six months from start to finish," said Dunn, "and this was quick for a title of this complexity. One of the great things about Apple Media Tool was that 90 percent of the unique code that we wrote for the *Prince Interactive* title was reusable in the *Highway 61* title. The only thing we had to add was a new media database—our custom feature modules were easily ported. Also, Media Tool's media browser (the map-like visual interface that lets you place media and define interactivity) really speeds up the development process. Media maps were easily created by our writers and interpreted by

our artists. It was then a piece of cake for the programmers to put more complex interactivity together.

"We chose to use the Apple Media Tool over other tools for several reasons. First, the Apple Media Language is fast, and code created with it is more robust than the code written with competitive scripting languages. Also, developing cross-platform titles is much easier with Apple Media Tool: If you write all your code in the Apple Media Tool Programming

Media Tool lets us reuse code, allows media sharing between cross-platform versions, manages media well, and is very fast and reliable."

Interactive Music Toolbox Hardware

- Power Macintosh 8180 with 40 MB of RAM

Software

- Adobe™ Photoshop
- Adobe Illustrator
- Apple Media Tool
- Apple Media Tool Programming

"In just eight days, we used Apple Media Tool to create 115 MB of interactive content to complement the Rolling Stones' 59.5 minutes of music."

—Mark Waldrep, president, AIX Entertainment

Environment (without writing in C), it takes about ten minutes to port your content over to the Windows platform.

Version 2.0: The Times, They Are A-Changin'
 Graphix Zone is using version 2.0 of the Apple Media Tool for *Nixon*, another biographical title set in the sixties. So far, they like the fact that this version runs faster, has a smaller memory footprint, and speeds up development time because of the programming environment's new incremental compiler and linker. They also like the new media-handling interface and added audio capabilities.

In recalling his experience with the Apple Media Tool and programming environment, Dunn said, "We couldn't have created the *Prince* and *Highway 61* titles with any other available tool. We appreciate that Apple

Environment

- Autodesk 3D Studio
- Claris Filemaker Pro
- Equilibrium DeBabelizer
- QuickTime
- Specular Infini-D

Graphix Zone: Apple Media Tool Benefits

- *Efficiency.* The intuitive media browser enables multidisciplinary creative teams to work efficiently in parallel on different parts of a project.

- *Extensibility.* Custom code modules created in the programming environment can be reused in future projects.

- *Development speed.* The intuitive media browser and programming language enable shorter development cycles.

- *Easy cross-platform deployment.* It's simple to port a Mac OS version to Windows, and both versions can share media.

An "Enhanced" Business Model for Developing Music CDs

AIX Entertainment
 Los Angeles, California

AIX Entertainment specializes in the production of enhanced music CDs. Last year they created multimedia content for 40 CDs, using a custom software solution that enables them to place computer-readable media on CDs without inconveniencing audio users. AIX uses the Apple Media Tool to quickly and inexpensively develop cross-platform content for enhanced CDs.

Media samples:

- <http://www.itrax.com>
- <http://quicktime.apple.com/aix2.html>

• • •

Mark Waldrep, founder and president of AIX Entertainment, claims to have a better model for running an interactive music company. Given his track record, it's hard to argue with his premise: In 1995 his multimedia firm produced more enhanced CDs than all his competitors combined (40), and his team worked on the best-selling enhanced CD of the year (the Rolling Stones' *Stripped*).

How did AIX do it? Waldrep attributes his success to a business model that's appealing to record companies, and to the Apple Media Tool, the multimedia authoring tool that enabled him to quickly create cross-platform content.

The "Enhanced Liner Note" Model

Waldrep spun off AIX Entertainment from Pacific Coast Sound Works, a traditional recording studio, when he recognized the market potential of creating

enhanced CDs. By putting multimedia content into the unused portion of audio CDs, record companies could add value to audio CDs and sell them to the growing number of computer users. In order to get a jump on this new market, AIX created their own customer-friendly "pregap" CD solution, called *i-trax*. (Pregap or "track 0" solutions are software algorithms that allow you to place multimedia data in an expanded area before audio track 1 of a CD. This is the most popular format for enhanced CDs, since it requires no special hardware or drivers.)

Because AIX entered the interactive music business from the recording side of the business, the firm took a different approach than many of their multimedia competitors did.

Mark Waldrep, AIX's president, explained: "My philosophy behind interactive music is that the business model won't work if record companies have to spend U.S. \$100,000 to \$500,000 to add multimedia to their CDs, then have to retail it above \$22.98 to cover costs. While this approach is commonplace in the computer game world, it's absolutely impractical in the world of records.

"We develop enhanced CDs that are graphically interesting but limited in scope. I call this approach the 'enhanced liner note' model, because it provides music fans with the category of information that used to be printed on the paper liners of long-play records—lyrics, backstage photos, and so on. We typically charge record companies \$5,000 to \$20,000 for projects that take a week to ten days to complete. We add value to the audio CDs at a cost that doesn't bump up the retail price, and at a risk level that doesn't threaten a studio's release date. We use existing videos and mostly 2D graphics, rather than expensive, time-con-



In just eight days, AIX Entertainment was able to use Apple Media Tool to add multimedia content to the Rolling Stones's *Stripped* audio CD.

suming 3D graphics. I know that some developers look down on this simple model, but to stay in business, the numbers have to work."

Waldrep's first commercial success was Walt Disney Records' *Rhythm of the Pridelands*. On this enhanced i-trax CD, AIX added the 40 MB "Hakuna Mataka" animated video to the beginning of the CD. Disney didn't have to raise the retail price of the title, and because it included multimedia content, they were able to distribute it through alternative retail channels such as Fry's Electronics and CompUSA. "Because of this title's value-added content," said Waldrep, "Disney sold thousands of additional copies. In fact, I've heard that customers would pick up audio-only copies in traditional record stores, and shop clerks would suggest that they go to Fry's to buy the multimedia version at the same price."

How the Rolling Stones Got Satisfaction

Waldrep routinely turns around projects such as *Pridelands* in a week, because of the ease with which he can develop screen templates and interactivity using the Apple Media Tool. His methodology is best illustrated by looking at the work he did on the Rolling Stones' *Stripped* CD, which has sold nearly a million copies to date.

"In the fall of 1995, Virgin Records asked us if we could add a quick-and-dirty promotional video clip to the Rolling Stones' upcoming *Stripped* audio CD," said Waldrep. "They wanted the clip to persuade fans to buy *Voodoo Lounge*, a full-blown interactive CD-ROM title with a seven-figure development budget. They told us we had eight days to complete it, and that they could only supply us with a *Voodoo Lounge* videotape and nine color photocopies.

"Because of the short lead time, the Virgin Records representative told me to think about the project for 24 hours," said Waldrep. "So, I went home, boot-ed up my Macintosh, and created a prototype with the Apple Media Tool overnight. When I showed the clients the prototype in the morning, they thought it was incredible, and I won the bid. Then I had seven more days to finish the job."

Waldrep's group then used the Apple Media Tool, the nine color photocopies, and the videotape to build the interactive segment of the CD. They created four main screens, four music screens, four lyric screens for each of the title's 14 music tracks, six video clips, some backstage and catalog material, and an ad for the Stones' Web site. With the meager content provided, they had to get creative about reusing visuals. For example, they used band member Keith Richards's pendant as a hot

button that brings up the rehearsal videos. To speed up the approval process, AIX sent the latest version of the title on the Concord each night, so the Rolling Stones could review it the next day.

"In just eight days, we used Apple Media Tool to created 115 MB of interactive content that complemented the Rolling Stones' 59.5 minutes of music and generated additional sales for the *Voodoo Lounge* CD. The entire project was done *without* programmers."

Point-and-Click Interactivity

Waldrep summarized what he likes about the Apple Media Tool: "I previously used other multimedia authoring tools, but after I tried Apple Media Tool, I realized that its point-and-click interactivity, visual navigation, and media browser would let me create enhanced CDs faster. My products tend to have commonality that lets me cut and paste media elements from screen to screen. Because of the media reuse capabilities of Apple Media Tool, my turnaround time is phenomenal. For instance, I recently completed an entire heavy metal enhanced CD for BMG in the same time it took a colleague to port an existing title created with a different tool from the Macintosh to Windows.

"I wouldn't even begin to promise a deliverable in a week unless I was absolutely confident that Apple Media Tool was going to successfully port my projects over to the Windows environment."

Interactive Music Toolbox Hardware

- Macintosh Quadra 800 with 40 MB of RAM
- Sony CDW-900 "one-off" CD burner

Software

- Adobe Illustrator
- Adobe Photoshop
- Adobe Premiere

- Apple Media Tool
- Audio Extractor (custom)
- Equilibrium DeBabelizer
- Sonic Solutions
- Pixar Typestry
- Radius VideoVision Studio
- Ray Dream Designer

AIX Entertainment:

Apple Media Tool Benefits

- *Quick prototyping.* Point-and-click interactivity and media

offers them the reliability they need to create quick-turnaround, leading-edge enhanced CDs on time and on budget.

Media samples:

- <http://quicktime.apple.com/qtmusic.html>

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Pacific Advanced Media Studio (PAMS) is a virtual tightrope walker when it comes to developing

recording, sound mixing, video clips, and promotional pictures, but they haven't yet figured out how interactive media fits into the overall scheme. Because of this lack of understanding, we have to adapt heavily to their existing processes. This means we typically only get a week to create an interactive presentation. While this limits what we can do today, we know that each time we develop a successful new title, it will be a little easier to ask for more time and money next time around."

Managing "Boom Crash" Schedules

PAMS's first enhanced CD project was for the group gf4, a foursome of Australian pop singers. Using a custom track 0 solution (which they now market as "ActiveAudio trackZero"), they created an interactive collection of the group's biographies, MTV-style videos, and interviews.

Since they completed this title, they've streamlined their processes and developed an extensive library of Apple Media Tool-based media assets and routines, all of which help them work more quickly on new projects. The firm's music experience has also earned them a reputation for producing titles with high-quality audio and video. (PAMS compresses straight audio files in 16-bit or IMA formats.) In the last year, their ability to work within tight record-company schedules—sometimes creating titles in as little as a week—has won them several large international contracts.

Seeing Is Believing

PAMS is currently working on a full-scale interactive CD-ROM for Air Supply, an Australian band that's also well known in the United States and Asia. For this assignment, PAMS was asked to capture the essence of this group's recent

"What I like best about Apple Media Tool is the video performance that we can get from it."

—Mike Fronzek, creative director, PAMS

placement enables AIX to create rough prototypes in about a day.

- *Ease of use.* AIX can create high-quality multimedia content without having to hire programmers.

- *Media reuse.* Media objects and screens can easily be reused to speed up development.

- *Reliable cross-platform porting.* Moving a Macintosh-based project to the Windows platform is fast and reliable.

The Interactive Music Balancing Act: Innovation vs. Risk

Pacific Advanced Media Studio Crows Nest, Australia

Pacific Advanced Media Studio (PAMS), a leading Australian multimedia developer, was one of the first firms to use a "pregap" (or "track 0") technology to place mixed media on a commercial audio CD. PAMS uses the Apple Media Tool and programming environment because it

interactive music titles: They've learned to maintain a delicate balance between innovation and the risk associated with leading-edge markets and technologies. The multimedia tools that help them do this are the Apple Media Tool and Apple Media Tool Programming Environment: The easy-to-use, reliable Media Tool provides them with a safety net, and the programming environment enables them to continually raise their design standards to new heights.

Over the last two years, PAMS has developed nearly a dozen enhanced CDs for Australian and Pacific Rim record companies, including titles for well-known Australian groups such as Boom Crash Opera and Mental as Anything. This firm's previous experience on the music side of the business has really helped them understand how to market their services to record companies.

PAMS's creative director Mike Fronzek discussed his observations on this business: "Record companies have a fixed production chain that accommodates

Southeast Asia tour on an interactive CD-ROM. Stepping through the process of creating this title shows how much PAMS relies on the visual media-mapping capabilities of Apple Media Tool 2.0 to keep production running smoothly.

"The first thing we do on a project like this is to create a working prototype with Apple Media Tool," said Fronzek. "We sketch up screen ideas, scan them into the computer, and drop the scanned images into Apple Media Tool as screen placeholders. We then begin linking screens together in our media map. With the Air Supply project, we took this prototype to the record company for an early creative review."

Fronzek added, "One development team worked on the entire Air Supply title. This team included a couple of screen-building artists, a group devoted to capturing video, a video sampling and processing person, a 3D modeler,

and a programmer. We typically hold a team meeting every other morning, then spend the following day-and-a-half assembling final screens. We tend to use Apple Media Tool for the prototyping and screen assembly, and our nontechnical people try to do as much screen linking as possible before the project is handed over to our programmer. The programmer then adds custom features to Apple Media Tool."

Media Tool Advantage: Video Performance

"What I like best about Apple Media Tool," said Fronzek, "is the video performance that we can get from it. I think it's superior to any of the other tools that are out there. We also like the fact that it lets our users play our content directly off a CD—users don't have to load files onto a hard drive before they can play it."

Another thing PAMS likes about the Apple Media Tool is its screen-based visual prototyping. "Assem-

bling prototypes is fast, and it's easy to swap out old visual placeholders as needed," said Fronzek. "We appreciate this unique feature of Apple Media Tool."

In evaluating Apple Media Tool 2.0, Fronzek added, "What I really like about the new version is the hypertext linking, rich text format, and QuickTime VR "virtual reality" capabilities. Version 2.0's ambient music feature is also nice, because it lets us offer more musical continuity across screen transitions."

Interactive Music Toolbox Hardware

- Power Macintosh 7500

Software

- Adobe Illustrator
- Adobe Photoshop
- Adobe Premiere
- Apple Media Tool
- Apple Media Tool Programming Environment
- Avid VideoShop
- Claris Filemaker Pro
- Macromedia Director

- Macromedia SoundEdit 16
- MovieShop (from Apple's QuickTime CD)
- Digidesign SoundDesigner

PAMS: Apple Media Tool Benefits

- *Low-risk innovation.* The Apple Media Tool Programming Environment lets programmers add custom features to Apple Media Tool.

- *Visual prototyping.* Drag-and-drop media elements and interactivity enable fast prototyping.

- *Video performance.* AMT supports high-quality, cross-platform QuickTime movies.

- *Continuous soundtracks.* Version 2.0 now supports continuous sound across screens.

A Multimedia Tool for a Composer's Repertoire

*Inspired Arts
Irvine, California*

Inspired Arts is a small multimedia consultancy with a diverse set of clients, ranging from entertainment to retail companies. This firm uses the Apple Media Tool to rapidly transform the work of creative teams into enhanced and cross-platform CD-ROMs.

Media samples:

- http://inspiredarts.com/aa_iatheco.html

• • •

"A songwriter friend came to my house on a Thursday night with a demo tape and asked me if I could create an interactive presentation for him to show to a Nashville record company the next day," said Kevin Kent, president of Inspired Arts. "So I snapped a few digital pictures of him sitting at my grand piano, along with a couple nice perspective shots of piano keys and



Using Apple Media Tool, Kevin Kent of Inspired Arts created this enhanced CD for the Highway 101 country-western band in just three weeks.

wires. Then I loaded his music and photos into Apple Media Tool, quickly designed some buttons, and added one of his audio tracks to an in-house QuickTime movie. In just four hours, I sent him on his way with a great promotional presentation."

Like most small business owners, Kent is a jack-of-all-trades. And though Kent happens to be proficient at more trades than your average businessman—he is a trained composer, plays multiple musical instruments, and manages international operations of a software company as his "day job"—the one thing that he isn't is a programmer. So how can he run a thriving multimedia business with more than 20 CD projects in his portfolio?

"Apple Media Tool," said Kent. "When I first saw it, I adopted it wholeheartedly, because I realized its potential to produce multimedia products quickly and effectively without programming hangovers."

The "Inspired" Business Model

"My business philosophy is simple," said Kent. "I only take jobs that I know I can make money on, and Apple Media Tool and QuickTime help me do this. I also rely on eight subcontractors whom I know I can trust."

A good example of Kent's development approach can be seen with an enhanced CD project he just finished for Willow Tree Records and Highway 101, a country-western band based in Nashville, Tennessee. This enhanced CD project included about 60 screens, 12 songs, 20 narrations, and more than 20 QuickTime movies, and he completed it in just three weeks.

"Willow Tree, Highway 101, and their management were completely technophobic, and they had no idea what they wanted on the enhanced CD," said Kent. "They came into my office with a

box full of photographs, some lyric files in a PC-text format, and a Hi-8 videotape of the band performing."

So as soon as the client left, Kent went to work. His schedule went something like this:

- *Tuesday.* He air-expressed the videotape and photos for overnight digital conversion to his QuickTime guru, Kevin Monahan in Santa Cruz. A few hours later, he got a panicked call from Monahan, who told him that the whole video had a sepia tint. Kent told him to filter out as much color as he could. Then he turned a bad situation into a feature by adding an old-fashioned frame around the sepia movies, giving them a "Wild West" look. Later that day Bill Copland from ProCD picked up photos to convert them to a Kodak Photo CD format.

- *Wednesday.* Kent's team started organizing and loading image files onto his computers. The images were then enhanced with edge effects and Photoshop treatments.

- *Thursday.* The team selected images and edited down the video. A Photoshop expert started the layering process for menus and main screens. Kent used 3D modeling tools to create background screens.

- *Friday.* A simple main screen metaphor of a scenic winding country road was chosen; a Photoshop artist started building on it, adding a "Highway 101" sign and houses with band members' pictures mapped to the sides of the buildings. Media elements were dropped into Apple Media Tool as they were completed, and Kent started defining interactivity and building a media map. The team worked until 3:00 A.M.

- *Saturday.* In the morning they continued to work on the alpha version; the Willow Tree executive producer showed up

for a review in the afternoon. They showed her the main menu design, the credit page, and a background design for each band member, with interactivity operational. She couldn't believe how much they'd done in just four days. She selected the final images and QuickTime movies for inclusion.

For the next two weeks the team refined the title and prepared it for cross-platform compatibility and final duplication. The producer decided to change a half dozen of the music tracks during the last week of the project, but because of the ease in which they could substitute media elements with the Apple Media Tool, they still completed the project on schedule.

Other Artistic Endeavors
"I don't know of any technology other than Apple Media Tool that allows me to create quality interactive content as efficiently and profitably," said Kent. "Using this tool, I can bid my projects competitively, because I know I won't have to charge clients to learn a new technology."

A creative artist at heart, Kent has also done a fair amount of experimenting with the Apple Media Tool. He's self-published *The California Project*, a title that features the paintings of fine artist Jim Talmadge with his original music in the background. A Japanese company bought 3,000 copies of this title for distribution at Macworld Japan before it was even completed. Kent likes to do one internal project for every two outside ones because it keeps the creativity flowing—as well as the cash flow.

Kent is currently working on *The Spike and Mike Sick and Twisted Animation Film Festival* CD-ROM. For this project he's playing with the new "flip-book" technology built into the 2.0 version of the Apple Media Tool.

Kent states, "The flipbook memory requirements are so small that you can really go wild with screen activity. It outperforms sprite animation every time, especially if you save your PICT images as QuickTime still shots."

His next big project will further leverage his business model and experience with the Apple Media Tool: He's building an affiliate label software company that will develop enhanced CD titles.

Interactive Music Toolbox

- Hardware**
- Power Macintosh 6100, 7100, 8100, and 8500 computers with 48 MB of RAM
 - Kodak digital camera
 - Hi-8 and Beta SP video decks
 - Radius Studio Vision
 - Photo CD

Software

- Adobe Photoshop (with many filters)
- Adobe Premiere and After Effects
- Apple Media Tool
- Digidesign Sound Designer
- Equilibrium DeBabelizer
- QuickDraw 3D
- QuickTime VR
- Stratus VideoPro
- VideoFusion

Inspired Arts: Apple Media Tool Benefits

- *Ease of use.* AMT enables nontechnical people to create sophisticated multimedia content without having to learn programming.

- *Quick prototypes.* Fast prototyping capabilities let developers get early concept approvals from clients.

- *Customization.* Users can customize Apple Media Tool features for their unique purposes.

A Rosetta Stone for Collaborating Musicians, Artists, and Programmers

MediaX
Santa Cruz, California

MediaX is a versatile multimedia firm that's best known for their elaborate, thoughtful interactive music CD-ROM discs, *On the Road with B.B. King* and *Queensrÿche: The Promised Land*. MediaX uses the Apple Media Tool as a "Rosetta stone" that helps artists and programmers communicate and work together on complex multimedia projects.

Media samples:

- <http://bbking.mca.com/>
- <http://www.emirec.com/qryche/>

• • •

Interactive music is a field in which three very different types of professionals—musicians, visual artists, and programmers—have to work together. Typically, the members of these professions have radically different working styles, skill sets, and jargons. For instance, ask a musician for a "gig," and he'll think you want to book a performance date. Ask a programmer for a "gig," and he'll hand you a toaster-sized 1-giga-byte hard disk drive.

It's often the task of Matt MacLaurin and Gaben Chancellor, founders of MediaX, to figure out how to get these diverse professionals to work effectively together on multimedia projects.

Observed MacLaurin, "Your typical software project is complex enough without having to deal with a bunch of fussy programmers and artists. Neither group wants to learn the other's language and tools, so we turned to the Apple Media Tool as a 'Rosetta stone' that helps them communicate and work together."

MacLaurin's background in the computer game business is very much evident in the interactive music CDs he's produced. The newly released *Queensrÿche: The Promised Land* CD-ROM has the feel of a *Myst*-like adventure game, as it takes users through the fantasy worlds of each band member. MediaX's other well-known title, *On the Road with*

B.B. King, takes users on a virtual ride in B.B. King's 1944 "Big Red" Aerocoach tour bus to explore different aspects of this blues musician's life. There are some nice creative touches in this title, such as the oil paintings that Chancellor commissioned to represent different chapters in B.B. King's life. (This title recently received the coveted "Awesome"

rating from *New Media* magazine.)

Managing "Promised Land" Processes
MacLaurin's "audition" for the *Promised Land* CD would probably be more aptly described as a "rock-and-roll fantasy." Queensrÿche, a Seattle-based rock-and-roll band, had heard about

Apple Interactive Music Resources

Apple Computer has a number of resources, tools, and technologies targeted at making interactive music developers successful. Here are a few of them.

- *Interactive Music Track (IMT)*. The Apple Multimedia Program (AMP) has a special option, the Interactive Music Track (IMT), designed to help musicians, record labels, and interactive developers with interactive music projects. AMP members who specify this option receive additional market information, technical updates, advice on authoring tools, third-party discounts, and other information that relates to interactive music. The IMT is also a key source for information on enhanced CD formats, Apple's new interactive music tools, and Apple-sponsored music events. (You can obtain more information from the AMP Web site listed in "Internet Resources for This Issue" on page 40.)

- *Apple Interactive Music Toolkit*. This spring, IMT members will be able to beta-test a tool that allows interactive music developers to quickly and easily author enhanced CDs that comply to the Blue Book standard. This tool, which is used in conjunction with Apple Media Tool, includes facilities to help you create enhanced CDs, synchronize music with lyrics on a computer screen, and create custom CD controls. This toolkit is compatible with the widely used Astarte Toast 3.0 mastering software.

- *The Enhanced CD Fact Book*. AMP's Interactive Music Track recently commissioned *The Enhanced CD Fact Book*, the first comprehensive exploration of the new enhanced CD format. This book, which you can download from the AMP Web site, examines many of the technical solutions that have been employed to create enhanced CDs and discusses the new Blue Book enhanced CD format. This "must-have" book for interactive music developers also includes interviews with key industry figures, tips on how to work with record labels, recommended hardware configurations for enhanced CD authoring, and a directory of interactive music resources and events.

- *Multimedia Music and Sound Studio*. This book (ISBN 0-679-76191-8) by Jeff Essex expertly blends technical data with a how-to approach, providing developers with a one-stop source for successfully integrating music, narration, and sound effects into any application.

- *The QuickTime Music Architecture*. QuickTime 2.2, which will ship in spring 1996, includes enhancements to the QuickTime Music Architecture (QTMA) that will enable title developers to enhance and customize their music content more easily. With the first version of QTMA, Apple made it easy for computer users to work with MIDI music by providing a software synthesizer and a library of Sound Canvas instruments licensed from Roland. The enhanced QTMA will allow music and synthesizer developers to deliver their own custom software synthesizers, instruments, and libraries of musical instruments through QuickTime. Title developers can use these components to embellish their content with music and create a distinctive aural experience. In addition, QuickTime 2.2 enables musical information to be routed to external MIDI devices, effects processors, and drum machines, simplifying the process of routing complex MIDI data between diverse MIDI devices. (You can obtain more information from the Web site listed in "Internet Resources for This Issue" on page 40.)

MacLaurin through the EMI Records grapevine, because of a multimedia presentation that he gave EMI in 1994. Out of the blue, he was invited up to the group's San Juan Islands recording studio to discuss an upcoming interactive CD-ROM project. After an all-night session of brainstorming and computer games, MacLaurin won the project.

To create *Promised Land*, MacLaurin brought together sound editors, musicians, 2D and 3D artists, an art director, an asset manager, a director, a producer, a writer, a team designer, three programmers, and several software testers. The challenge in developing a complex title such as this, with its 3000 different scenes and 9000 works of art, was keeping the 16 team members working in harmony—and on the right file versions.

"Our whole approach was centered around media asset management," said MacLaurin. "To help manage the project, we used a Filemaker Pro database with links to Apple Media Tool. Anytime anyone created something useful for the project, we checked it into the database and assigned it a version number, scene location, and responsible person. That way, if anyone had a question about any part of the project,

it could be answered by the database. This approach required a lot of discipline up front, but later in the project, when we had upwards of 20,000 media assets, we really appreciated how much easier it was to track versions and approvals.

"We found that Apple Media Tool provided us with a great way for nontechnical people to specify what they were trying to do with scenes. Artists could learn it right away and get their scenes roughed out quickly. Apple Media Tool served as a forum in which the artists and programmers could meet on their own terms. Then, our programmers could use the artists' information to create custom features in Apple Media Tool Programming Environment.

"*Promised Land* is the biggest project that we've done in Apple Media Tool, and what I really liked about it was the access to its internal architecture, so we could optimize areas of the project—such as the memory allocation and screen loading—if we didn't like the playback performance. With other tools, a project might seem like it's going fine, until you find out it's way too big, too slow, and too late to change. With Apple Media Tool, we can optimize the project at any time in the process."

Looking to the Future

As a creative medium, interactive music is still in its formative stage. The music business is still trying to define the role of interactive CDs, and in many ways, it's waiting for the hardware (that is, multimedia set-top boxes) to catch up.

MacLaurin recently discussed his thoughts on where the interactive music business is headed: "We were lucky that B.B. King and Queensrÿche took a deep personal interest in our interactive CDs. If the musicians aren't really adding value to an interactive CD, then it starts to feel like a sales piece. To me, it makes sense to treat enhanced CDs like the liner notes that used to come with the old long-play vinyl records. When you bought the first press of a vinyl record, it was nice to sit down with headphones, pull out a big sheet of lyrics, and just listen. I think music CDs will take off when the business moves from a self-conscious high-tech approach, to a more personal, engaging approach."

Interactive Music Toolbox

- Hardware**
- Power Macintosh computers
- Software**
- Adobe Illustrator
 - Adobe Photoshop

- Adobe Premiere
- Apple Media Tool
- Apple Media Tool Programming Environment
- Claris Filemaker Pro
- Equilibrium DeBabelizer
- MPW

MediaX:

Apple Media Tool Benefits

- *Collaboration.* The Apple Media Tool's ease of use promotes collaboration between artists and programmers.
- *Efficient media management.* By linking the Apple Media Tool with a database, teams can efficiently track large numbers of media assets.
- *Ease of optimization.* Using its object-oriented programming language, programmers can optimize and extend projects created with the Apple Media Tool. ♣

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Listings

Developer University Schedule

Developer University (DU) offers a broad range of Mac OS and Newton programming instruction through hands-on classes and self-paced training products. Classes are offered in Cupertino and through selected third-party trainers. The following is a list of upcoming DU course offerings, including when and where they're offered and how much they cost.

Classroom Courses

Apple Events/AppleScript Programming

5 days/\$1,200

May 6–10, Cupertino

Creating Apple Guide Help Systems

4 days/\$1,200

May 6–9, Cupertino

Creating OpenDoc Parts

5 days/\$1,500

May 20–24, Cupertino

June 17–21, Cupertino

Multimedia Development with QuickTime VR

3 days/\$900

May 21–23, Cupertino

June 18–20, Cupertino

Newton Programming: Essentials 2.0

5 days/\$1,500

May 20–24, Cupertino

June 17–21, Cupertino

Newton Programming: Converting to 2.0

5 days/\$1,500

May 6–10, Cupertino

June 3–7, Cupertino

Programming with MacApp

On demand—call DU Registrar at 408-974-4897 for more information.

Programming with QuickDraw GX

4 days/\$1200

On demand—call DU Registrar at 408-974-4897 for more information.

Programming with QuickDraw 3D

3 days/\$900

May 20–22, Cupertino

QuickStart Mac OS Programming

5 days/\$1,500

June 3–7, Cupertino

Scripting with AppleScript

2 days/\$600

June 10–11, Cupertino

Self-Paced and Online Courses

Intermediate Programming: 7.5 Topics

Self-paced

Introduction to PowerPC

Online

Introduction to PowerTalk

Online

Introduction to RISC Technology

Online

Programmer's Introduction to PowerPC

Online

Programmer's Introduction to RISC and PowerPC

Self paced, online

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 Developer Services:Developer Information:Developer University

Internet—<http://dev.info.apple.com/du.html>

America Online—Computing:Computing Forums:Development:Mac Development Q&A:Developer University ♣

It Shipped!

The following 96 Macintosh products were entered into the It Shipped! database between February 15 and March 15, 1996. Congratulations to all of you with new shipping products! Nearly 300 have been entered into the database since Apple reinstated the program in late 1995.

The It Shipped! database is used by Apple employees when they prepare advertising, collateral, and white papers and when they help customers find computing solutions; it's also broadcast to key industry publications. For more information about It Shipped!, visit the It Shipped Web page at the following location:

<http://dev.info.apple.com/itshipped.html>

To enter your Macintosh product in the database, use the form located at the following Web site:

<http://dev.info.apple.com/thirdparty/submission.html>

You must also send a copy of the product to Apple at this address:

Apple Computer
1 Infinite Loop, M/S 301-1ES
Cupertino, CA 95014
USA

Developer	Product	Version
Absoft Corporation	Absoft F77 SDK v4.2 for Power Mac	4.2
Absoft Corporation	IMSL FORTRAN Math & Stat Libraries v3.0	3
AGD Studio	Scan Express Calculator	2
BCDL	Sans-Faute/Grammaire	2.06
Brookline Software	PrinterSwitch	1
Bungie Software	Marathon 2: Durandal	n/a
Creative Engineering	MacRoad	3.95
Cyberian Software	BaseMap v1.0.2	1.0.2
DeskTop Laboratories, Inc.	The Science ToolBox	n/a
DeskTop Laboratories, Inc.	The Virtual Scientist	n/a
Diamante Software, Inc.	HomeStuff Personal Inventory Manager	2
Edmark Corporation	Imagination Express Destination: Castle	1
Edmark Corporation	Imagination Express Destination: Neighborhood	1
Edmark Corporation	Imagination Express Destination: Ocean	1
Edmark Corporation	Imagination Express Destination: Rain Forest	1
Edmark Corporation	KidDesk Family Edition	1.0.1
Edmark Corporation	Millie's Math House	2
Edmark Corporation	Thinkin' Things: Collection 3	1
Edmark Corporation	Trudy's Time & Place House	1
EveryWare Development Corp.	Tango	1.5
Falcon Software, Inc.	Exploring Chemistry	1
FirstClass NV	Tailor for Macintosh 1.0GX	1.0GX
GDT Softworks Inc.	PowerNexus	1
GDT Softworks Inc.	PowerPlot	2
GDT Softworks Inc.	PowerPrint	3.0.1
GDT Softworks Inc.	PowerPrint/LT	1.01
GDT Softworks Inc.	PrintExtras	1
GDT Softworks Inc.	StyleScript	2
Global Software Development	Photobot	n/a
Gradient Technologies, Inc.	Mac-DCE	1.1
Headbone Interactive, Inc.	AlphaBonk Farm	2
Headbone Interactive, Inc.	Elroy Goes Bugzerk	1.2
Headbone Interactive, Inc.	Pantsylvania	1
Hi Resolution	MacAdministrator	1.1
HyperMac Software	BSA Troop Tracker v4.01	4.01

Developer	Product	Version
HyperMac Software	World Miles	n/a
Informatie	Exact voor Macintosh AE	5.5A
Inroads Interactive	Multimedia Bugs	1
Interactive Media Corporation	Special Delivery 2.1 Web helper application	1
Interstudio S.r.l.	Nonio C 6.0	6.0
KACHII SOFT Corporation	KACHII Meetings Manager	2.0.0
MacEssentials	AccountMaster Chiropractic	2
MacEssentials	AccountMaster Dental Laboratory	2
MacSourcery	CineMac for Director	1.1.1
MacSourcery	CineMac for QuickTime	1.1.1
Maxum Development Corporation	NetCloak	2
Maxum Development Corporation	PageSentry	1.1
Men & Mice	QuickDNS Pro	1.1
Mesa Graphics	TextTerm+Graphics	1.05
Michael L. Weasner	ExAminer 1.4	n/a
MicroMat Computer Systems	TechTool Pro	1.0.1
MicroNet Technology, Inc.	MicroNet 2.6GB Rewritable Optical Drive	n/a
MicroNet Technology, Inc.	MicroNet Array2000J	n/a
MicroNet Technology, Inc.	MicroNet DataDock Express	n/a
MicroNet Technology, Inc.	MicroNet DataDock Removable Storage System w/ Cross-Platform File Sharing	n/a
MicroNet Technology, Inc.	MicroNet Internal Advantage Jaz 1000	n/a
MicroNet Technology, Inc.	MicroNet SB40DLT	n/a
Neptune Systems	AlarmBook 2.0	2
Neptune Systems	Sniffer Dog v1.3	1.3
NETGEAR, a Bay Networks Company	EN308 8 Port 10Base-T Ethernet Hub	n/a
New Mexico Software, Inc.	Code Cryptor	1.3
Newer Technology	NUpowr	n/a
NovaLogic, Inc.	Comanche Mac	1
nth degree software	Proteus	2
Oracle	Developer/2000	n/a
Pacific Coast Software	SiteCheck	1
Pacific Coast Software	SiteEdit	1
Parasoft, TX	MacWebCam	1.0.7
PEMD Education Group, Ltd.	Think For Yourself	n/a
PEMD Education Group, Ltd.	World Bank Data CD-ROM	1995
PictureWorks Technology, Inc.	PhotoEnhancer Plus	2
Pierian Spring Software	CampOS Math	1
Project Multi Media Ltd	Power Presentations	1
Rodus International Corp.	CDmatica	1.1
Rodus International Corp.	Grades	n/a
Rodus International Corp.	Photomatica	n/a
Sheridan Software	Form-It	n/a
Sheridan Software	Score-It	5.2
Sheridan Software	Stitch-It	5.6
Software North	MacFERRET	2.1.6
SQE Services Ltd.	PageMill Guide PGS	1

Developer	Product	Version
Stairways Software Pty Ltd.	IC to PC Exchange	1
Symbolic Sound Corporation	Kyma 4.1 Sound Design Workstation	4.1
Tanner Research	L-Edit	6
Tarkvara Design	Interloq: Software for Cooperative Thinking	1.0.3
The Mac-Barcode Company	Walk-About DataGrabber for the Newton Platform	1.02
ThinkSpace Inc.	Map Version: 1.0	1
Trilobyte Software	PowerBar Pro 2.5	2.5
Uni Software Plus	Voodoo	1.7
WATNET Technologies Inc.	Waterloo MacJANET	4.2
Windy Hill Productions	Menlo the Frog - A Musical Fairy Tale	1.1
World Software Corporation	WorldWrite 3.0	3
Zavala Computer Consulting	Tx Practice Manager	1
Zero Divide Software	METER v1.1b	1.1b

The Apple 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://dev.info.apple.com/appledirections/adtoc.html>). 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 locations. 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 lists World Wide Web sites maintained by Apple Computer.

Apple Developer Services and Products

<http://dev.info.apple.com/>

The main page for Apple Computer's developer services, including back issues of *Apple Directions*.

Apple Directions Express List Server

<http://dev.info.apple.com/appledirections/adexpresscurrent.html>

Apple Directions Express is our biweekly e-mail digest of business news and information from Apple, sent to you over the Internet and posted at this Web site. It includes pointers—live links at our Web site—to other sources for more detailed information. Subscribe by sending e-mail to adirections@thing1.info.apple.com. In the subject field, type the string "subscribe <your real name>".

Guy Kawasaki's EvangeList List Server

All the good news about Apple platforms that Guy can find. For information on how to join, send an e-mail message to macway-request@solutions.apple.com for an automatic reply. (Any message will work.)

Guy Kawasaki's Semper.fi List Server

A two-way list server that encourages communication between developers and Apple. We suggest you subscribe to the digest version; to do so, send a

message to listproc@solutions.apple.com. In the body of the message, type "set semper.fi mail digest".

Key Apple Developer Relations Contacts

<http://dev.info.apple.com/adrcontacts.html>

Intended mostly for use when standard Apple feedback mechanisms aren't working.

Apple FTP Sites

<http://dev.info.apple.com/ftpmain.html>

[ftp://ftp.info.euro.apple.com/Apple.Support.Area/Developer_Services](http://ftp.info.euro.apple.com/Apple.Support.Area/Developer_Services)

Go to these sites to download Apple software and documentation; the second site is a mirror site of the main location, maintained specifically for European developers.

Development Tools

<http://devtools.apple.com/>

Listings of Apple and third-party development tools and a variety of technical documentation and white papers.

Apple Computer

<http://www.apple.com/>

The Apple Computer home page.

Apple Forever

<http://www2.apple.com/appleforever/>

Regular updates about the company and special communications from Apple executives.

Mac OS

<http://www.info.apple.com/macoss/>

Go here for the latest information on the Mac OS.

Technotes

<http://dev.info.apple.com/technotes/Main.html>

Contains all Technotes—new and old—as well as author’s guidelines for contributing your own technical notes.

Apple Pacific

<http://www.info.apple.com/pacific/>

Contains information about Apple offices and developer support in the Pacific region, including Japan, Australia, and Latin America.

Apple Europe

<http://www.euro.apple.com/>

The front door for information about Apple activities—including developer services—in Europe.

Apple International Developer Services and Products

<http://dev.info.apple.com/intl.html>

Contains the current list of international Apple Developer Services locations and contacts.

Apple Software Licensing

<http://dev.info.apple.com/swl/swl.html>

Official information on whether you need a license from Apple and how to obtain one.

Newton

<http://dev.info.apple.com/newton>

Includes information about Newton 2.0 and Newton Toolkit 1.6.

OpenDoc

<http://www.opendoc.apple.com/mainpage.html>

The place to go for the OpenDoc 1.0 SDK and OpenDoc sample parts.

Third-Party Products

<http://dev.info.apple.com/thirdparty/>

Fill out the form located at this site to add your products to this list.

It Shipped!

<http://dev.info.apple.com/itshipped.html>

The home page for the It Shipped! program.

Apple Multimedia Program

<http://www.amp.apple.com>

Includes information about Apple’s multimedia technologies as well as a searchable database of multimedia developers.

The Macintosh Advantage

<http://www.apple.com/whymac/>

Dedicated to showing why Mac OS–based systems are better than PCs running Windows 95. This site details Apple’s new contest that will recognize the best Macintosh-hosted Web sites.

Macintosh PowerBook and Mobile Computing

<http://www.info.apple.com/gomobile/>

Complete information about PowerBook computers.

PowerTalk

<http://dev.info.apple.com/evangelism/powertalk/>

Resources for PowerTalk programmers.

QuickDraw 3D

<http://www.info.apple.com/qd3d/>

Everything you need to know about QuickDraw 3D.

Power Macintosh

<http://www.info.apple.com/powermac/powermac.html>

<http://www.info.apple.com/ppc/ppchome.html>

Two useful sites for information about Power Macintosh computers.

QuickTime

<http://quicktime.apple.com>

News and technical and marketing information about QuickTime.

QuickTime VR

<http://qtvr.quicktime.apple.com>

You can find samples of QuickTime VR products here, as well as information on how Apple’s virtual reality technology works and how you can incorporate it into your multimedia products.

QuickDraw GX

<http://www.info.apple.com/gx/gx.html>

Look here for information on QuickDraw GX as well as links to other non-Apple sites.

Apple Education

<http://www.info.apple.com/education>

Use online forms located at this site to request product specifications, information about the Apple Education Series (bundled products), and technical support from Apple engineers.

Macintosh Application Environment

<http://www.mae.apple.com>

Contains a sample of the Macintosh Application Environment (MAE), software that lets UNIX workstations run Macintosh applications.

Pippin

<http://support.info.apple.com/pippin/>

Contains technical information about designing products that will work with Apple’s PowerPC processor–based, low-cost CD playback device.

QuickTime Live!!

<http://live.apple.com>

Apple's site for showing multimedia broadcasts of live entertainment, including images, videos, sound, and QuickTime VR.

Apple Internet Servers

<http://www.apple.com/documents/otherappleservers.html>

Includes lists of other Apple 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.

Dr. Gil Amelio

<http://www.natsemi.com:80/profit/gil.html>

The Web page of Apple's new CEO and chairman.

Macintosh Speech Recognition

http://www.vannevar.com/Mac_SR

As described by its owner, "a showcase for Mac speech recognition tips, tricks, and software."

Ambrosia Cafe

<http://www.ambrosiasw.com/cafe.html>

Yet another "everything you want to know about the Macintosh" page.

Apple Developers Listing

<http://www.amsys.co.uk/applelinks.html>

Links to the Web pages of hundreds of Apple platform developers.

The Hartsook Letter

<http://www.hartsook.com>

Excerpts from *The Hartsook Letter*, written by long-time Macintosh market analyst Pieter Hartsook.

Natural Intelligence

<http://www.natural.com/>

Information about Natural Intelligence's tools and solutions, including Roaster and Roaster Professional.

Macintosh Vendor Directory

<http://rever.nmsu.edu/elharo/faq/vendor.html>

A directory of companies with products for the Macintosh computer.

Brad's WebSTAR/MacHTTP

<http://www.ape.com/webstar/>

A database of all the Macintosh computer-based Web sites that the owner of this site can find—so far nearly 1,000 entries strong.

Macintosh Programming Tools

<http://www.astro.nwu.edu/lentz/mac/programming/tools.html>

A terrific source for Apple and non-Apple Macintosh programming tools.

OpenDoc Part Ideas

http://www.eng.uci.edu/~sroussey/NetVision/software/od_parts/

A repository of OpenDoc software, as well as ideas for software that could be implemented as OpenDoc components.

CI Labs

<http://www.cilabs.org/>

Provides a great deal of OpenDoc content.

MacTech Magazine

<http://www.mactech.com>

Contains *MacTech Magazine's* list of Internet locations for Mac OS developers.

Nathan's Everything Macintosh Page

<http://www.cs.brandeis.edu/~xray/mac.html>

A virtual treasure trove of Macintosh information, as its name implies.

Digitool (Macintosh Common Lisp)

<http://www.digitool.com/>

Contains information on the Macintosh Common Lisp (MCL) product line.

The Ultimate Macintosh Page

http://www.freepress.com/myee/ultimate_mac.html

Contains more Mac OS information and software than you could possibly imagine exists.

guideWorks

<http://www.guideworks.com/>

The Apple Guide home-away-from-home page.

The QuickDraw GX Fan Club

<http://www.ixmedia.com/quickgx/quickgx.html>

<http://www.ixmedia.com/quickgx/subscribe.html>

The first site includes information designed to encourage the use and development of QuickDraw GX; the second provides addresses of two e-mail lists for receiving updates about QuickDraw GX.

PC Fairy Tales

<http://www.icsi.net/~crfrank/newpcTales2.toc.html>

Information to help debunk common Macintosh myths.

Metrowerks

<http://www.metrowerks.com/>

Find out about Metrowerks' CodeWarrior PowerPC development environment.

Pictorius

<http://www.pictorius.com>

Contains information about Pictorius Prograph CPX and Peregrine, its visual application client/server database programming environment.

User Group Connection

<http://www.ugconnection.org/vendors/vendors.html>

Resources and services for marketing your products to Apple's most influential and enthusiastic users: user groups.

The Complete Conflict Compendium

<http://www.islandnet.com/~quill/c3data.html>

A listing of all Macintosh computer software conflicts and cures known to the site's owners.

MacSciTech

<http://www.macscitech.org/>

The home page of MacSciTech, the association for scientific/engineering/technical Macintosh users.

MacHack

<http://www.machack.com/>

Find out about the annual MacHack hackers conference.

Macintosh Help Wanted

<http://www.memphisweb.com/mathew/default.html>

<http://www.memphisweb.com/nammac/deault.html>

Need to find programmers and others to work on developing Macintosh products? Go to these locations for help.

New This Month/From Our Readers

This list contains Internet "stuff" (for lack of a more descriptive term) we've just become aware of, thanks to *Apple Directions* readers inside and outside Apple. Know of a particularly useful site? Whether it's a Web page, a list server, 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@applelink.apple.com.

Always Apple

<http://always.apple.com/>

Developed by a group of Apple employees in their copious free time to give loyal Apple customers a place to congregate on the Web. The site focuses on candid customer input, live chats, and good news about Apple.

Apple Developer Catalog

<http://www.devcatalog.apple.com/>

The Apple Developer Catalog is now online; check it out! It's a great way to view and order development tools, technical resources, training products and information if you're developing applications and solutions for Apple platforms.

Apple Competitive Information

<http://support.info.apple.com/competitive/competitive.html>

Information comparing Mac OS computers favorably with Wintel PCs; mostly compares Mac OS systems with Windows 3.1-based machines, but also includes some competitive data about Windows 95.

Apple Solution Professionals Network (ASPN)

<http://support.info.apple.com/aboutapple/aspn.html>

Download the latest directory of consultants who specialize in Macintosh solutions.

Apple Tech Info Library

<http://til.info.apple.com/til/til.html>

Apple's official technical support database—updated daily—with over 12,000 articles on all aspects of Apple products, past and present.

"Ask Apple" Tech Support FAQs

<http://support.info.apple.com/askapple.faqs/askapplehome.html>

Frequently asked questions about Apple systems, and their answers.

MacintoshOS.com

<http://www.MacintoshOS.com>

A non-Apple site intended primarily for users, with news, shareware, online discussions, and a particularly useful history of Macintosh computers all the way back to the original Macintosh 128K system.

Mac QC Links

<http://www.seapine.com/qclinks.html>

Information about Macintosh quality-control software and services with links to sites where you can find tools for testing and debugging Macintosh software. If you develop Macintosh testing tools and services, you can have your product/service considered for listing at this site. Also, if your Web page lists Macintosh developer products and sites, the Mac QC Links site can include a link to your page. To submit your product/service for listing or to request a link to your page, send e-mail to macqc@seapine.com.

Yahoo

<http://www.yahoo.com>

The well-known Internet directory and search engine. Yahoo is currently trying to strengthen its listing of Macintosh-related Web pages; if you run one, or know of one, go to this site and search to see if Yahoo already includes the page you'd like to list. If not, click the Yahoo category to which your page belongs; then click the "add URL" icon at the top of the screen, and follow the instructions that appear.

Polymorphic E-zine

<http://www.webcom.com/icog/polymorphic/index.html>

A new online magazine about Macintosh programming, focusing in particular on Pascal and C/C++.

Cult of Macintosh

<http://www.utu.fi/~jsirkia/mac/>

This is the site of another "everything Macintosh" compendium of information for Macintosh lovers.

Quinn's Human Interface Subtleties

<http://redback.cs.uwa.edu.au/Quinn/WWW/HumanInterfaceSubtleties.html>

Lists the many human interface subtleties that continue to make the Macintosh user experience richer and easier.

Gradient—DCE for the Macintosh

<http://www.gradient.com/>

Contains information about Gradient's Mac-DCE product, an implementation of OSF DCE Secure Core functionality for Macintosh clients.

Mac*Chat Newsletter

<http://www.cts.com/browse/xxltony>

An online newsletter directed primarily at Macintosh customers to help them make the best use of their Macintosh systems. To subscribe, send e-mail with the string "SUBSCRIBE MACCHAT" in the body of the message to listserv@vm.temple.edu.

DayStar Digital

<http://www.daystar.com/DayStarHome2.html>

Contains information about DayStar's PowerPC upgrade cards and their newly released Mac OS-compatible Genesis MP media-publishing workstation.

Pages That Use QuickTime VR

<http://www.bmwusa.com/ultimate/roadster/z3downloads.html>

Take the new BMW Z3 roadster for a QuickTime VR test drive.

<http://pathfinder.com/time/special/baseball>

Shows the 1995 World Series in QuickTime VR.

<http://sfasian.apple.com>

View a QuickTime VR version of an exhibit of Mongolian art.

<http://www.honda.com/cars/odyssey/>

See QuickTime VR interiors of Honda Motor Company's new car models.

<http://www.interart.net/>

Real estate tours of actual, for-sale properties.

Internet Resources for This Issue

News

- CHRP Web site—<http://chrp.apple.com>
- Worldwide Developers Conference (WWDC) Web site—

<http://wwdc.carlson.com>

- Apple's Web site for games—

<http://www.dev.apple.com/games>

- Publishing industry study by Griffin Dix—

<http://www.media.apple.com/research/pubnums.html>

- QuickDraw 3D Web site—

<http://www.info.apple.com/qd3d>

Technology

- OpenDoc Programmer's Guide—

<http://www.opendoc.apple.com/dload/documentation.html>

Business

- Graphix Zone media samples—

<http://www.gzone.com>

<http://www.zdnet.com/cschopper/nuggets/9505/rev3.html>

- AIX Entertainment media samples—

<http://www.itrax.com>

<http://quicktime.apple.com/aix2.html>

- Pacific Advanced Media Studio media samples—

<http://quicktime.apple.com/qtmusic.html>

- Inspired Arts media samples—http://inspiredarts.com/aa_iatheco.html

- MediaX media samples—

<http://bbking.mca.com/>

<http://www.emirec.com/qryche/>

• Apple Multimedia Program's Interactive Music Track (IMT) Web site—<http://www.amp.apple.com/program/imt.html>

- Information on the QuickTime Music Architecture (QTMA)—

<http://quicktime.apple.com>

Mac vs. UNIX Web Server Performance

<http://www.netdreams.com/net.dreams/papers/theTest.html>

Contains a server performance comparison between a Power Macintosh computer and a Sun SPARC workstation, both being used as Web servers. Guess which system wins?

Nisus Software

<http://www.nisus-soft.com/~nisus/>

Click on the Trash icon at this site and see where you end up! ♣

Apple Developer Catalog Order Information

To place an Apple Developer Catalog order from within the United States, contact Apple Developer Catalog at 800-282-2732; in Canada, call 800-637-0029. For those who need to call the U.S. office from abroad, the number is 716-871-6555. You can also reach us by AppleLink at APDA or by e-mail at APDA@applelink.apple.com. The Apple Developer Catalog is also available online on the Web at the following location:

- <http://www.devcatalog.apple.com/>