The Developer Business Report December 1997

AppleDirections

CONTENTS

NEWS

TECHNOLOGY

APPLE NEWS

Apple Ships Developer Release of Rhapsody

Just eight months after Apple combined its superior ease-of-use and functionality with NeXT Software's innovative technology, Apple released an early version of its next-generation operating system, code-named *Rhapsody.* The Rhapsody Developer Release—which shipped in October to more than 10,000 software developers worldwide—is intended to allow software developers to begin creating the applications that will run on the new operating system.

Rhapsody brings new and exciting opportunities for software developers and is expected to complement Mac OS in Apple's overall operating system strategy. While Mac OS will move forward as Apple's volume operating system, delivering market-leading ease of use, multimedia, and Internet integration, Rhapsody will be initially targeted at server and high-end desktop applications.

Avie Tevanian, senior vice president of Software Engineering, said, "Apple has made tremendous progress in shipping a developer version of Rhapsody only eight months after the Apple and NeXT software teams were first integrated. With the Rhapsody Developer Release, this team has delivered a powerful software development environment to the entrepreneurial companies and individuals who will create new classes of application software for Apple customers in business and education."

Apple is delivering Rhapsody first on the Power Macintosh platform, Apple's strategic PowerPC processor–based hardware platform. At this time, the Developer Release will run on select PowerPC processor–based models, including Power Macintosh 8500, 8600, 9500, and 9600 computers. As Rhapsody

please turn to page 6

STRATEGY MOSAIC

Apple's Hardware Comeback

By Gregg Williams,
Apple Directions *staff*

Power Mac G3 Shows Great Design, Planning

If you have compared Apple (as many have done) to a large ship that should be altering its direction, I have only one thing to say: It's nice to see the scenery change. Last month, I talked of Apple's successful new direction for the Mac OS, which started in 1996 but became apparent only with the introduction of Mac OS 8 last July. This month, I have a similar story to tell, of how Apple has been working for quite some time to turn its hardware story around, with the results becoming visible only a few weeks ago.

The Power Macintosh G3 line of computers, announced on November 10, represents an extremely positive change to the "scenery" of Apple's computer lineup. Apple chose the "G3" name to highlight the fact that all the computers in this product line use a powerful new third-generation PowerPC processor. You can read the technical summary on page 4 to get the details of what the Power Macintosh G3 line of modular desktop and tower computers (code-named *Gossamer*) delivers, but the purpose of this article is to show how the Power Macintosh G3 line reflects the Apple spirit of creativity and innovation.

In particular, the strengths of the Power Macintosh G3 line result from Apple's pursuit of the following three goals:

- Maximizing performance while lowering costs
- Simplifying Apple's computer lineup through a single design that spans a range of computers

please turn to page 3

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EDITOR'S NOTE

Developer Support—Coming Soon to a Desktop Near You

When I joined Apple in early 1988, one new workplace technology that I found waiting for me was AppleLink e-mail. I thought it was wonderful; it gave me reliable access to *everybody* I needed to talk to—within Apple, that is. I still had to use the telephone and the U.S. mail to communicate with the rest of the world.

Fast-forward almost exactly ten years: Now I have Internet access—e-mail, the World Wide Web, and FTP—and all the developers that Apple needs to talk to have it, too. The pace of action and response in the computer industry has accelerated accordingly, and the printed word—though noble and in many cases preferable—is no longer sufficient for doing business. Print has neither the bandwidth, the responsiveness, nor the *reach* needed to be the primary communication vehicle between Apple and the worldwide developer community.

For these reasons—as well as the need to do business in a more cost-effective way—Apple Developer Relations (ADR) is taking the final step in moving from printed to electronic media to communicate with you. This is the last issue of *Apple Directions*—effective immediately, we will continue to communicate to you through e-mail (primarily in the form of Apple Developer News), the World Wide Web (the Developer World web site), and CD-ROM (the Developer CD series). These communication vehicles are just a part of the various services and products from Apple that help you in your development efforts, including numerous Apple web sites, direct technical support, and prerelease access to upcoming Apple software.

Advantages

With this move to electronic communication, we are planning to changing both what and how we communicate with you. Our goal is to serve you better, in the following ways:

• *Convenience.* Through e-mail, web pages, FTP sites, and CD-ROMs, all content will be delivered to your computer desktop, where it will be immediately useful—you can access the most important material immediately, store other material (or parts of it) for reference and later use, and discard the rest. Apple Developer News, the primary vehicle that we will use to alert you to items of interest, will be delivered to your e-mail in-box automatically. The Developer CD, if you subscribe to it (through membership in an Apple Developer Program), will come to you automatically each month. You can access Developer World whenever you wish. With these resources in hand, what you access will be entirely up to you. We recognize that you want to read some materials away from the computer—reading in bed, in the bathroom, and while commuting are the most often reported examples—so we plan to make as many materials as possible printable for your convenience.

• *Immediacy.* We'd like to say that electronic distribution will result in faster-than-instant access—but it still takes time to create, review, format, and distribute materials. Still, the delay in getting prepared materials to you will be measured in days, not weeks or months, and these materials will be more useful to you because of the quicker delivery. With this move to electronic distribution, Apple hopes to eliminate the dissatisfaction some developers expressed with the inherent delays of printed communications.

• *Efficiency.* Your time is at a premium, so we want to do everything we can to communicate more information in less time—you'll spend less time looking for the information that is truly valuable to you and more time using it. For example, we're working to make Apple Developer News entries briefer, with pointers to more details for those who want them. Shortening each entry will enable us to deliver more news to you without taking more of your time.

• *Accessibility.* One of our greatest frustrations with paper communications was our inability to get them to everyone who wanted them (for reasons of both logistics and cost). With electronic distribution, this problem goes away! Apple Developer News, the Developer World web site, and FTP access to files from Apple are free to anyone who has Internet access. (In addition, other services—

including access to prerelease software and the Developer CD series—are available to Apple Developer Program members.) We are also aware that some developers don't have reliable web access; to serve them, we'll be putting key content onto the Developer CD to ensure that everybody worldwide can stay informed.

Deliverables

Here are the vehicles that we are using, now and in the future, to communicate with you:

• *Apple Developer News.* This weekly e-mail (mailed to you each Friday) will be the primary vehicle that Apple Developer Relations will use to alert you to new resources and news.

• *The Developer World web site* (**http://devworld.apple.com**). This site will continue to be the clearinghouse for the latest and most complete developer-related news, information, and resources from Apple.

• *The Developer CD series.* These CDs will continue to deliver documentation, development tools, system software, and the Mac OS SDK (a multidisc collection of Mac OS software development kits). In addition, the Developer CD will include archived news and other content for members without access to Developer World.

• *Developer Technical Support.* Thousands of developers get direct code-level support from DTS engineers through e-mail. Check the benefits list of the Apple Program you belong to for details.

• *The Apple Corporate web site* (**http://www.apple.com**). Don't forget this important Apple web site. In addition to providing additional Apple news, this site also points to product information, software updates and other forms of technical support, and more.

• *The Apple Technology Seeding Program.* This program, available free to members of any Apple developer program, enables members to obtain prerelease versions of key Apple technologies (including Rhapsody). See **http://devworld.apple.com/seeding/software_seeding_FAQ.html** for details.

From time to time, we'll deliver special articles that will focus on specific technologies and products. Look for pointers to these reports in future issues of Apple Developer News.

What You Should Do

To keep up-to-date on Apple-related development, you need to do three things:

• Subscribe to Apple Developer News (if you aren't already a member). It's free, it won't fill up your in-box (only one e-mail a week, with occasional supplements for late-breaking news), and you can "unsubscribe" at any time (not that you'll ever want to!).

You can subscribe to Apple Developer News in one of two ways. If you have web access, you can subscribe by filling out the form at **http://survey.info.apple.com/subscribe/subscribe.html**. Otherwise, you can subscribe by sending an e-mail message to requests@thing1.info.apple.com with the string "subscribe adn" in the subject or body of the message.

• Explore and use the Developer World web site. By familiarizing yourself with this site's contents and structure, you'll be more able to get the information you need quickly and easily. Also, you can read both current and back issues of Apple Developer News from the Developer World home page (**http://devworld.apple.com**).

• If you're not already a member of an Apple Developer Program, become one. For information on membership benefits and enrollment, go to **http://devworld.apple.com/worldwide/wwprograms.html**.

All of us in Apple Developer Relations are very excited about the possibilities of serving you electronically, and we're hard at work implementing our first steps in this direction. See you in Apple Developer News!

Gregg Williams
ADR Programs Group

STRATEGY MOSAIC

Hardware Comeback

continued from page 1

• Meeting marketplace demands faster and at lower cost by using a leveraged design and configuration model

The rest of this article will examine how the Power Macintosh G3 line meets these goals.

Maximizing Price/Performance Advantage

The single strongest influence on the design of the Power Macintosh G3 line was the goal of maximizing the computers' price/performance ratio—a bottom-line desire to maximize the value to the customer by offering more computing power for less money. (This in turn delivers more value to you, by making more computing "horsepower" available to your applications.)

The rest of this section will examine the major elements that maximize the Power Macintosh G3 computers' price/performance advantage. While you're reading this section, keep one important fact in mind: that the performance of the Power Macintosh G3 line is due as much to the interaction of elements as it is to the elements themselves.

The PowerPC G3 Processor

The PowerPC G3 (formerly code-named *Arthur* and named the PowerPC 750 processor) is the newest member of the PowerPC processor family. Apple will be using 233-MHz and 266-MHz versions of the processor, though the Power Macintosh G3 line is designed to handle faster processors.

Being a third-generation processor design, the PowerPC G3 processor inherently offers more processing power for a given price. However, one aspect of its design deserves special mention: The PowerPC G3 is the first PowerPC processor that contains features that speed the execution of Mac OS software.

The PowerPC G3 processor is optimized for the Mac OS. Apple, IBM, and Motorola engineers did extensive tests using real-world applications running on the Mac OS to determine how they could make the PowerPC G3 run the Mac OS and its software faster at a given clock speed. These tests helped determine such things as the size of the internal L1 (level 1) data and instruction caches, the design of the on-chip L2 (level 2) cache controller, the number of integer arithmetic units, the design of the instruction-fetch pipeline

Power Macintosh G3 Features

Here is a summary of the hardware features of the Power Macintosh G3 line of computers.

Microprocessor
- PowerPC G3 microprocessor running at 233 MHz or 266 MHz.

Memory
- None soldered on the main logic board; a minimum of 32 MB supplied with every system.
- Expandable to 196 MB on modular desktop models, 384 MB on tower models.
- Uses industry-standard SDRAM (synchronous dynamic RAM) packaged as DIMMs (dual in-line memory modules).

ROM
- 4 MB on one 160-pin DIMM (dual in-line memory module).

Cache
- 512 KB L2 (level 2) cache on processor/cache module.

Video display modes supported on built-in monitor port
- 640 by 480, 800 by 600, and 832 by 624 at 32 bits per pixel; 1024 by 768, 1152 by 870, 1280 by 1024, and 1600 by 1200 at 16 bits per pixel.
- 2 MB of industry-standard SGRAM (synchronous graphics RAM) frame buffer on the main logic board; video memory can be expanded to 4 MB or 6 MB.
- 67-MHz local graphics memory bus.

Graphics
- Built-in 2D and 3D hardware graphics acceleration using the ATI 3D RAGE II+ graphics controller.
- Software support through QuickDraw 3D and QuickDraw 3D RAVE (rendering acceleration virtual engine) APIs (application programming interfaces).

Digital video support
- Built-in YUV and MPEG (Motion Pictures Experts Group) scalers.

Personality slot
- Supports basic personality card (audio input and output, connector for modem) and an AV Personality Card (audio and video input and output, connector for modem).

Video input/output
- AV Personality Card configurations allow video input and output through RCA or S-Video connectors.

Sound
- All personality card configurations support 16 bits/channel stereo input and output, external jack for sound input, optional front jack for headphones, rear jack for stereophonic speakers, and one built-in speaker.

Remote control for computer power on/off
- Infrared (optional for AV Personality Card configurations).

Hard disks
- One internal ATA (AT Attachment) hard disk with 4 GB or larger capacity. A SCSI bus for additional internal SCSI devices, and an external SCSI port for additional SCSI devices.
- Supports PIO (programmed input/output), single-word DMA (direct-memory access) and multiword DMA data transfers.

Expansion bay (enclosure-dependent)
- The modular desktop enclosure has two bays that allow addition of internal 3.5-inch SCSI devices.
- Tower enclosure supports the addition of either 5.25- or 3.5-inch SCSI devices.

Floppy disk
- One internal 1.4 MB GCR SuperDrive.

CD-ROM drive
- Internal 24x-speed ATAPI (AT Attachment Packet Interface) CD-ROM drive.

Zip drive
- Optional 100 MB SCSI Zip drive in internal expansion bay.

Processor bus
- 64-bit wide, 66 MHz, supporting split address and data tenures.

Standard Macintosh I/O ports
- Two serial ports, 10BaseT RJ-45 Ethernet port, a SCSI port, and an ADB port.

GeoPort
- Supported on both the modem and printer ports.

Modem slot
- 112-pin connector accepts an optional modem interface. The interface is a subset of the type of communications slot found in the Power Macintosh 4400, 5500, and 6500 computers. It is strictly a modem interface and does not carry the PCI signals as the Comm-Slot II does. (The PCI signals were previously used to support an optional Ethernet card. This is not needed on Power Macintosh G3 computers, which have a built-in Ethernet port.)

PCI card expansion slots
- These slots accept three 12-inch PCI cards—three 15-watt cards or two 25-watt cards.

Power switch
- Soft power controlled from keyboard and infrared remote control.

Voltage switch on modular desktop enclosures
- Allows manual selection of either 115 for voltages of 100–130 V or 230 for voltages of 200–230 V.

Fan speed control
- Thermally controlled; fan speed varies to minimize temperature and fan noise.

Energy saving
- Sleep, startup, and shutdown scheduling can be controlled with an Energy Saver control panel.

and the size of its buffer, and the design of the processor's branch-prediction algorithms.

The L2 Backside Cache

Increasing processor speed is not the only way to increase a computer's speed. This is certainly the case with the Power Macintosh G3 line, where overall performance is the result of multiple factors, not just an increase in processor clock speed. The Apple engineers I spoke to said that the design and size of the L2 backside cache in the Power Macintosh G3 computers make a major contribution to the performance of the Power Macintosh G3 computers.

As you may know, a cache is an area of dedicated memory that holds the numeric values (instructions and/or data) that the processor has recently accessed. The utility of a cache comes from two factors: first, that values recently accessed by the processor have a better-than-average chance of being accessed again; and second, that the processor can access the cache faster than main memory. Most processors today include instruction and data L1 caches, which are accessed extremely quickly. Most computer designs add a second, external cache (called the L2 cache), which additionally increases the average speed of processor access.

Originally, L2 caches communicated with the processor at the same speed as the system bus—usually 40 MHz to 50 MHz. Recent computers (including the Power Macintosh 8600 and 9600 families) use an *inline cache,* which connects to the processor at a speed twice that of the system bus.

The PowerPC G3 processor includes circuitry to control a *backside cache,* which connects to the processor at even higher speeds than an inline cache can. By changing the voltages at certain PowerPC G3 pins, the PowerPC G3 sets the speed of the backside cache (that is, the speed of communication between the processor and the cache) to a set ratio compared to the processor speed. The PowerPC G3 processor can set the cache ratio to five different values: 1:3 (slowest), 1:2.5, 1:2, 1:1.5, or 1:1 (fastest). This means that, for example, the backside cache connected to a 300-MHz PowerPC G3 communicates with the processor at 150 MHz if the ratio is 1:2, 200 MHz if the ratio is 1:1.5, and 300 MHz if the ratio is 1:1. The first Power Macintosh G3 models run at 233 MHz and 266 MHz and use a 1:2 ratio, resulting in backside caches that run at 116.5 MHz and 133 MHz, respectively.

66-MHz System Bus

The system buses of the Power Macintosh G3 models just announced run at 66 MHz, up from a maximum of 50 MHz on previous Apple Macintosh computers. (The system architecture can support bus speeds up to 79 MHz.) Because of the size and speed of the backside L2 cache, the increase in system bus speed is not as important to overall data throughput as it used to be. Still, the faster system bus should contribute to the overall speed of the Power Macintosh G3 computers. Apple's first-ever use of SDRAM (synchronous dynamic RAM) enables the Power Macintosh G3 computers to access main memory faster through the 66-MHz system bus without incurring latency delays.

Hardware 2D and 3D Graphics Acceleration

The Power Macintosh G3 line uses an ATI 3D RAGE II+ graphics accelerator chip to speed up drawing. This chip accelerates all QuickDraw 3D calls and selected QuickDraw calls (for example, scrolling and region-fill operations). To ensure that the RAGE II+ chip has enough memory to work with, the standard 2 MB of SGRAM (synchronous graphics RAM) can be expanded to 6 MB.

Judicious Use of Industry Standards

When you're trying to lower costs, the use of industry-standard components and procedures always comes to mind—but it's not always the right decision. In the case of the Power Macintosh G3 computers, Apple engineers made the switch only when they could do so and maintain the quality levels associated with Apple-branded products. With the exception of the first two items below, the following examples of adopting industry standards are new to the Power Macintosh G3 line:

- *PCI (Peripheral Component Interconnect) card expansion slots.*
- *ATA (AT Attachment) internal hard disk.* It should be noted that the Power Macintosh G3 computers contain an internal SCSI bus, which enables users to add internal SCSI hard disks.
- *An internal 24x-speed ATAPI (AT Attachment Packet Interface) CD-ROM drive.*
- *SDRAM (synchronous dynamic RAM).*
- *SGRAM (synchronous graphics RAM).*
- *ATX power supply.* This is the most commonly used power supply in Intel-based PCs. One Power Macintosh G3 model uses an unmodified ATX power supply, while another uses a modified ATX power supply built to Apple's specifications.
- *Mini-ATX logic board form factor.* The Power Macintosh G3 line uses a logic board that is the same size as the mini-ATX form factor used by many Intel-based PCs.

Simplifying Apple's Computer Lineup

The Power Macintosh G3 line uses a single logic board design that can be modified to provide a variety of configurations that will cover the low-to-middle range of Apple's Power Macintosh product family (roughly the U.S. $1500 to $3500 price range). In fact, Apple expects to transition about 80 percent of its Power Macintosh family to the Power Macintosh G3 line sometime in 1998. This line will eventually replace multiple Power Macintosh models.

This change will result in a number of benefits for everybody. Customers will see a simplified computer lineup from Apple and be able to buy more products that are more reliable because they are more thoroughly tested. Since all the Power Macintosh G3 models use the same logic board, you will have one testing effort instead of five. Apple will see a number of benefits, which I'll cover in the next section.

Leveraged Design and Configuration Model

Though Apple's emphasis on an increased price/performance ratio and implementing a simplified computer lineup are important aspects of the Power Macintosh G3 line, I believe this section of the article gives the best indication of Apple's new, more sophisticated approach to its hardware business.

The phrase *leveraged design and configuration model* summarizes a number of things Apple has done in the design of the Power Macintosh G3 line to reduce its costs, avoid duplication of effort, and leverage one design to meet a variety of situations. These efforts fall into the categories that follow.

One Logic Board, Multiple Products

I mentioned this topic in the previous section, but now let's look at it from Apple's point of view. Apple has obviously saved a lot of time and money by designing one computer instead of multiple computers to span the U.S. $1500 to $3500 price range. Apple's use

of the mini-ATX logic board form factor lowers its costs and increases the number of manufacturing plants worldwide that it can choose from. In addition, anything Apple has done or will do to the Power Macintosh G3 design (additional testing, for example, to increase system reliability) will be leveraged across multiple products.

Configurable Design to Meet Changing Markets

The only way that the Power Macintosh G3 design can cover such a large fraction of the Power Macintosh product family is through its ability to be configured in a variety of ways. More important, these configuration options make it possible for Apple to build a "different" computer late in the manufacturing process or, if necessary, to reconfigure already built computers if Apple finds it has a surplus of one model and back orders for another.

I can't tell you how impressed I am by this aspect of the Power Macintosh G3 design. No one in the computer industry has a crystal ball that will accurately forecast customer demand, and this configurable design—coupled with Apple's continuing efforts to shorten the manufacturing "pipeline" and harness manufacturing economies of scale—will help Apple to deliver the right product in the right quantities to customers when they want it.

The Power Macintosh G3 design includes the usual memory configuration options, but "widened" to fit the range of the price points and intended uses that this product line encompasses—namely, 32 MB to 384 MB of main memory, and 2, 4, or 6 MB of video memory. The Power Macintosh G3 line includes numerous other options; see the box on page 4 for details.

Two particular areas of configuration that deserve mention are the processor/cache module and the internal "personality" slot. The Power Macintosh G3 logic board does not have its processor and cache soldered to it. Instead, the processor and its backside cache are manufactured as a single module that plugs into the logic board. This design decision makes it easy for Apple to change the processor speed, cache size, and processor-to-cache ratio of a given Power Macintosh G3 computer either during or after its manufacture.

The second area of configuration is the logic board "personality" slot, which can be fitted with one of two Apple-designed "personality cards." Both cards contain the Power Macintosh G3 computer's audio input and output functions. One of these cards, called the *AV Personality Card,* contains extensive video input and output functions, as well as a connector for a modem card.

Forward-Looking Design

The Power Macintosh G3 design will probably save Apple time and money through design elements that solve potential future problems without changing the logic board. One such design element is the positioning of the Macintosh system ROM in a socketed DIMM (dual inline memory module) rather than soldered on the logic board itself. If, sometime in the future, Apple needs to change the computer's ROM, it can do so at minimal expense and without having to change the logic board.

The second design element of interest here is the access of the audio input and output circuitry through the personality slot. If the circuitry is in both personality cards, one might ask, why not just put it on the logic board? It turns out there's a good reason for not doing so. Apple engineers have found that certain changes to a computer's design during its evolution have necessitated changes to the audio circuitry—which has meant (in past designs) changing the logic board. By putting the audio circuitry on both the personality cards, Apple engineers have anticipated a potential problem and built a solution into the Power Macintosh G3 design that, again, preserves the integrity of the logic board.

Conclusions

As I said at the beginning of this article, it's nice to see the scenery change. This has been a tumultuous year for Apple, without a lot of visible innovation in Apple's computer lineup—until the release of Mac OS 8 in July. Now, with the introduction of the Power Macintosh G3 line of computers (which will continue to grow and improve in 1998), the hardware innovation that began back in 1996 has finally come into public view. Innovation at Apple? It's still happening, and you'll see more of it in the future. ♣

APPLE NEWS

Apple Ships Developer Release of Rhapsody

continued from page 1

matures, the new operating system is expected to run on all Macintosh systems shipped from early 1997. Apple plans to introduce developer releases of Rhapsody for PC Compatibles and Yellow Box for Windows later this year. Customer releases are planned for 1998.

For full details on Apple's operating system strategy, visit Apple's operating system web page at **http://www.macos.apple.com/**, or read Gregg Williams's November Strategy Mosaic column, "Apple *Is* the Mac OS," at **http://devworld.apple.com/mkt/informed/appledirections/nov97/stratmosaic.html**.

The developer release of Rhapsody is available worldwide to members of Apple's Developer Program who have joined the Apple Technology Seeding Program, as well as Apple Enterprise Software customers and members of the Apple Enterprise Alliance Program. If you would like to get the Rhapsody Developer Release, read the instructions at **http://devworld.apple.com/rhapsody/rhapdev/rhapsody.html**.

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Rhapsody Gets Positive Response From Seeded Developers

Software developers seeded with an early version of the Rhapsody Developer Release have given the new operating system a big thumbs-up. Here's what some of these developers had to say about their experiences developing for the Rhapsody platform:

• *AAA+ Software.* "Using Rhapsody and the tools we built on top of it," said Werner Staringer, founder of AAA+ Software, "we are

now able to develop apps on Rhapsody and deploy them on Windows NT without any compiling or linking under Windows. For us, Rhapsody on the Mac is a dream come true."

• *Anderson Financial Systems.* Gregory H. Anderson, founder and CEO, commented: "For software developers, Rhapsody offers the enormous benefit of deploying dynamic, full-featured applications across multiple platforms with a single set of source code. For end users involved with content creation, the advantage of running a unified imaging model—PostScript™ on all output devices, including the screen—is equally compelling. Our PasteUp page layout and WriteUp word processing applications already demonstrate why graphics and publishing professionals will find Rhapsody to be an attractive proposition."

• *Caffeine Software.* "OpenStep and Rhapsody are the most advanced development tools I have ever used," said Stan Jirman, president. "TIFFany, our high-end image processor, was developed for Rhapsody in record time compared to other products. Once when asked to give a demo on Windows NT, about ten hours before the demo, I just recompiled and it worked. Try to do this with any other development environments. TIFFany's unmatched feature set was to a good part made possible by the Rhapsody operating system, which allows the programmer to focus only on what makes his application unique."

• *Dantz Development Corporation.* Richard Zulch, chief technology officer, had this to say about Rhapsody: "Rhapsody's biggest strength is the overall elegance of the underlying operating system and the way threads, processes, memory, and concurrent I/O come together. Rhapsody's infrastructure makes it considerably easier to develop high-performance software than with other platforms."

• *Omni Development.* "Without Rhapsody, there would be no OmniWeb," said Wil Shipley, president. "The Yellow Box toolkits have in effect written 90 percent of our code for us, so we can concentrate on writing the parts of our app that are different from every other app, rather than spending our time fighting with the windowing system or writing the same data structures over and over. Rhapsody not only provides the best class library in existence, it also provides a framework for organizing applications as they are being written, keeping even huge apps manageable. Rhapsody enables small teams to create world-class applications."

• *P & L Systems.* Managing Director Paul Lynch stated, "Rhapsody gives us the power to quickly develop robust, commercial-grade applications on systems with unparalleled ease of use, and deploy with equal facility on Macintosh, the web, or Microsoft operating systems. Mesa, the leading Rhapsody spreadsheet, would have been impossible to develop on any other platform."

• *Stone Design Corporation.* "The ease, elegance and integration of the Rhapsody Development environment make it the first truly cross-platform deployment system," said Andrew Stone, CEO of Stone Design. "Create, our next-generation drawing app, leverages on this rich set of objects and performs identically under Windows as on Rhapsody, compiled using the same source tree. This conclusively proves to me that the Yellow Box delivers today what other systems only promise to deliver tomorrow."

• *VVI Data Control Specialists.* According to John Brilhart, chief technical officer, "Apple's Rhapsody is unique in that it is fast, robust, and scales both in terms of performance and deployment base. Rhapsody also has first-class rapid application development (RAD) capabilities built into it. VVI-DCS has combined those features with our OpenGraph software to provide compelling and unique data reporting RAD solutions. OpenGraph is currently being used by our customers to monitor billions of dollars worth of products across the globe. Because of Rhapsody's cross-platform capabilities we can now offer that same market-proven OpenGraph software to nearly all modern desktop computers. The combination of so many exceptional advantages is made available only with Apple's Rhapsody."

• *Yrrid Incorporated.* "Using Rhapsody, Yrrid can happily focus on its own technologies and deploy on Rhapsody, Windows NT or 95, and soon Mac OS, in addition to server solutions on Solaris and HP-UX," enthused Christopher Lloyd, chief technical officer of Yrrid. "Because Yrrid is confident of Rhapsody and its success, it has made a serious investment by bringing its robust terminal emulation software to Rhapsody."

• *Metrowerks.* Although Metrowerks is not included with the Rhapsody Developer Release CD, it will be delivering Rhapsody products shortly. Metrowerks' president and chief technology officer, Greg Galanos, had this to say about Rhapsody: "We're extremely pleased with Apple's progress on Rhapsody and excited about the new opportunities that Rhapsody will provide Apple developers. We're working closely with Apple to provide Metrowerks CodeWarrior and Metrowerks Latitude technologies for Rhapsody and will deploy the first version of Latitude for Rhapsody as well as our Rhapsody-hosted PowerPC compiler tools almost simultaneously with the introduction of the Rhapsody Developer Release."

Apple Reports Fourth Fiscal Quarter Results

Apple recently reported results for its fourth fiscal quarter, which ended September 26, 1997. For the quarter, Apple's revenues were $1.6 billion, a decrease of 30 percent from the fourth quarter a year ago and a sequential decrease of 7 percent from the quarter that ended June 27, 1997. International revenues represented 42 percent of the quarterly total. Gross margins were 20 percent, compared to 22 percent in the year-ago quarter and 20 percent in the June 1997 quarter.

Apple reduced recurring operating expenses to $353 million in the fourth quarter, compared to $505 million in the year-ago-quarter and $408 million in the June quarter.

Also included in the current quarter's results were a $62 million charge to increase the company's restructuring reserves, and a $75 million write-off for the purchase of the Mac OS license from Power Computing Corporation.

Apple's net loss for the quarter was $161 million, compared with a net profit of $25 million in the same quarter a year ago. Without the charges related to restructuring and the Power Computing transaction, Apple's net loss for the quarter would have been $24 million, a sequential improvement from the $56 million net loss posted in the June quarter.

"Apple's fourth fiscal quarter was marked by sweeping changes, from the resignation of our CEO to the installation of new board members to significant developments in our marketing programs and industry relationships," said Apple Chief Financial Officer Fred Anderson. "Amidst this change, we've continued to make excellent progress with our restructuring initiatives, having reduced quarterly operating

expenses of a recurring nature by an additional $55 million since the June quarter.

"The July introduction of Mac OS 8 has resulted in record sales, covering two million seats [units sold] to date," added Anderson. "Our U.S. education business contributed over half a billion dollars in revenues during the quarter, and we saw sequential improvement in both business and consumer sales in the United States. However, we were disappointed by sluggish demand outside the United States, particularly in Japan.

"We remain focused on our primary goal of returning Apple to sustainable profitability," said Anderson. "Our goal for fiscal 1998 is to continue to reduce Apple's break-even point through a combination of further expense reductions and gross margin improvements."

Apple's fourth fiscal quarter revenues were $7.1 billion, a 28 percent decrease from the prior year. The net loss for the year was $1.0 billion, compared with a net loss of $816 million in fiscal 1996. Included in the fiscal 1997 loss were restructuring charges of $217 million as well as $450 million in write-offs related to the acquisition of NeXT Software and the purchase of the Mac OS license from Power Computing Corporation.

For the year, international revenues accounted for 50 percent of Apple's net sales, compared to 52 percent in fiscal 1996.

You can read the complete press release at **http://product.info.apple.com/pr/press.releases/1998/q1/971015.pr.rel.q497.html**.

■ ■ ■

Apple Mirrors Microsoft's Support Policies

Apple recently announced that it is changing its support policies to mirror Microsoft's more closely. The new policies are effective immediately and include free support on the web (**http://www.info.apple.com/**), free support from Apple's automated phone response system, free phone support for the first 90 days of ownership, and fee-based phone support at U.S. $35 per call after the first 90 days of ownership.

Most of Apple's technical support calls are software-related and are requests for assistance about known issues. The combination of the web and automated phone response support options will allow customers quick access to Apple's well-documented answers to these frequently asked questions at no charge.

■ ■ ■

Apple Introduces Power Macintosh 233-MHz Processor Upgrade Kit

Apple recently introduced the Power Macintosh 233-MHz Processor Upgrade Kit, which allows selected Power Macintosh and Workgroup Server models to be upgraded to a faster PowerPC microprocessor and faster cache module. The kit can dramatically improve the overall performance of these systems by as much as 158 percent (approximate results based on Apple internal testing with MacBench 4.0).

The processor upgrade kit consists of a card designed to replace the processor card in many previous Macintosh and Workgroup Server models. This card contains a 233-MHz PowerPC 604e processor. Also included in the kit are a 256K level 2 cache module designed to work effectively with this processor and an auxiliary fan and grounding clip. The auxiliary fan and grounding clip are not required to upgrade most systems.

For more information on system requirements and pricing and availability, see the press release at **http://product.info.apple.com/ pr/press.releases/1998/q1/971010.pr.rel.233upgrade.html**.

■ ■ ■

Apple Launches Brand Advertising Campaign

Apple launched its first major brand advertising campaign in several years with a new 60-second television commercial in the United States during the network premier of *Toy Story* on ABC's *Wonderful World of Disney.*

The new campaign, "Think Different," honors many of the creative geniuses who have changed the world in this century, including Albert Einstein, Mahatma Gandhi, Pablo Picasso, Martin Luther King, John Lennon, Ted Turner, Martha Graham, Jim Henson, Thomas Edison, Alfred Hitchcock, Richard Branson, Muhammed Ali, Maria Callas, Frank Lloyd Wright, and Amelia Earhart.

The Think Different campaign is the first work by Apple and TBWA Chiat/Day in over a decade. Their previous collaboration produced many award-winning ads, including the now-legendary "1984," voted the best ad of all time by advertising professionals. The campaign includes television and print advertising, billboards, wall paintings, bus shelters, bus wraps, and posters.

A complete copy of the press release is available at **http://product.info.apple.com/pr/press.releases/1997/q4/970929.pr.rel.adcampaign.html**.

■ ■ ■

Apple Unveils ColorSync 2.5

Apple recently announced ColorSync 2.5, the latest version of its color-management architecture for the Mac OS. ColorSync is the color-management workflow standard from Apple that provides essential tools for fast, consistent, and accurate desktop color calibration, proofing, and reproduction in all areas of the graphic, publishing, and printing industries. It continues to be available with the Color Matching Method (CMM) codeveloped with Linotype-Hell.

"The enhancements in ColorSync 2.5 are the direct result of our customers' input," said Jim Gable, vice president of Software Marketing at Apple. "The new capabilities of ColorSync 2.5, such as the Monitor Calibration Framework, multiprocessor support, and the integration of ColorSync with AppleScript, are proof of Apple's dedication to enabling our publishing customers to achieve even greater success with ColorSync."

Here are some of the new features of ColorSync 2.5:

• *Improved ease of use through the Monitor Calibration Framework.* The Monitor Calibration Framework provides a plug-in architecture that allows third-party developers to have their own monitor calibration software recognized by the Mac OS Monitors

& Sound control panel. Apple also provides a default monitor calibration tool that will enable users to easily calibrate and profile their monitors.

• *Improved performance due to multiprocessor support.* ColorSync 2.5 offers multiprocessor support to optimize the speed of color conversions, thereby minimizing the delays inherent in working with large image files.

• *Increased productivity resulting from AppleScript and profile management enhancements.* ColorSync support of AppleScript enables users to automate repetitive tasks associated with color management. Common ColorSync operations on images, such as matching, proofing, and embedding, can now take place in the background. ColorSync profile management enhancements provide greater flexibility and performance when users store and access ColorSync profiles. For example, with ColorSync 2.5, users can create subfolders and aliases within the ColorSync Profile folder.

• *Enabling extras to ship with ColorSync 2.5.* In addition to a rich set of new features, ColorSync 2.5 includes software and utilities that help customers adopt ColorSync color-management solutions easily. The list includes Kodak's Color Matching Module (CMM), ColorSync Photoshop Plug-ins 2.0, Press Profiles, ColorSync Savvy ColorPicker, and sample ColorSync scripts.

More information on Apple's ColorSync line is available at **http://colorsync.apple.com**.

■ ■ ■

Apple's ColorSync Technology on Future Version of Internet Explorer for Mac OS

Apple recently announced plans to integrate its ColorSync technology into a future version of Microsoft Internet Explorer for Mac OS. Integrating ColorSync APIs (application programming interfaces) into Microsoft Internet Explorer for Mac OS will deliver Internet users a more reliable and accurate representation of color on the web.

With this integration, users will no longer need to install browser plug-ins to ensure color fidelity on the Internet. By extending color management to the web, the market for ColorSync-enabled software applications will likely expand and create new business opportunities for content-creation professionals. The technology will allow for the creation of new web commerce sites where the customer perception of color is a critical sales tool.

Jeff Martin, senior director of Apple's Design and Publishing Marketing, said, "Today's announcement builds upon Apple and Microsoft's strategic relationship by bringing industry-leading color-management technology to the Internet. By integrating ColorSync APIs into Internet Explorer for Mac OS, Apple and Microsoft will extend the reach of current ColorSync-enabled applications and deliver the technology creative professionals need to create Internet sites—particularly in the area of web commerce—that require professional-level color management. Apple and Microsoft are working together to make sure consumers can trust color on the web."

For more information on Apple's ColorSync technology, visit the web site at **http://colorsync.apple.com**.

■ ■ ■

IKON Announces ColorSync Training Courses Codeveloped With Apple

Apple and IKON Color Group, an IKON Office Solutions company, have codeveloped a series of training courses for Apple's ColorSync technology. The courses, which have been developed for IKON's sales force and customers and Apple VARs and resellers, will provide hands-on experience of the value of color management. The materials developed for this activity are also to be used at color-management courses at leading graphic arts educational institutions around the United States.

For information on how to register for classes, see the entire press release at **http://product.info.apple.com/pr/press.releases/1997/q4/970929.pr.rel.ikon.html**.

■ ■ ■

Apple Agrees to Java-Centered Mobile Computer Specification

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

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

■ ■ ■

Apple Streamlines Channel Policies

Apple recently announced channel policy and program changes designed to increase Apple advocacy among channel resellers, improve the customer experience, reduce channel inventory, and bring more profitable revenues to both Apple and its resellers. Consistent with these changes, Apple will allow more authorized resellers to buy directly from Apple by lowering the minimum purchase required and will provide greater flexibility by offering its complete product assortment (except products specific to the education market) to all resellers. Additionally, Apple will strengthen the channel force with more than 100 additional sales and support representatives focused on communication, forecasting, training, and channel advocacy.

The most significant change in Apple's move to a closer, more direct relationship with its resellers is the lowering of its direct purchase volume bar to $2 million annually on December 15, 1997. The current volume

requirements are $20 million for dealers and $5 million for retailers to purchase directly from Apple. Members of the ARA as well as other channel partners see this as a positive move for Apple.

Apple also announced a series of other policy changes designed to improve the inventory positions of both Apple and its channel partners, provide quick turnaround time, and support flexible configuration management. These changes include Apple's move to a four-week price-protection policy, a revised product returns policy, the streamlining of its product assortment, and a reduction in its Apple-Fund allowance.

For more information, see the press release at **http://product.info.apple.com/pr/press.releases/1997/q4/970926.pr.rel.channel.html**.

■ ■ ■

Apple Launches New Promotion and Lowers Pricing Across Product Lines

Apple turned up the heat on product sales this fall by offering a variety of benefits, including cash-back rebates, to customers who purchase selected portable, desktop, and peripheral products between October 11, 1997, and January 16, 1998. The Add-on Take-off promotion offers cash back to customers who purchase selected systems when paired with any Apple monitor. By adding on to the system purchase, the customer takes off additional savings on each item.

In conjunction with this promotion, Apple is also reducing prices on Apple PowerBook 3400 and Power Macintosh 8600 series of personal computers in the United States and Canada, effective October 11. This aggressive move cuts prices on the current systems by up to U.S. $1,000.

For more details on the new promotion, visit **http://www.apple.com/promo**.

■ ■ ■

AppleShare IP 5.0.2 Supports Mac OS 8, WebSTAR API

Apple recently announced availability of the latest version of its server software, AppleShare IP 5.0.2, which supports the newly introduced Mac OS 8, the new version of AppleShare Client 3.7.2, and StarNine's WebSTAR API. New to the software bundle is the addition of Mac OS 8, which includes Open Transport 1.2, as well as the addition of NetCloak from Maxum, which allows customers to extend functionality of the AppleShare IP web server. Also included is an updated version of Open Door Networks LogDoor, which provides a sophisticated real-time display of server activity. Both NetCloak and LogDoor applications utilize the WebSTAR API and enhance AppleShare's overall web server functionality.

Designed to offer a complete productivity server solution for small business or corporate users at the departmental and workgroup level, AppleShare IP 5.0.2 combines traditional file sharing using TCP/IP and AppleTalk, with File Transfer Protocol (FTP) capabilities, a POP3/SMTP mail server, an HTTP web server, and an AppleTalk print server—providing users with a one-stop productivity solution for shared information and resources. Users are equipped with all the core technologies needed to exploit the power of the Internet, including web page design, e-mail, remote management, proxy services, Windows connectivity, and web site usage analysis.

AppleShare IP 5.0.2 requires an Apple Power Macintosh or Workgroup Server with a PowerPC 601, 604, or 604e microprocessor; Macintosh System 7.6 or later (Mac OS 8 is recommended); Open Transport 1.1.2 or later (version 1.2 is included with Mac OS 8); a minimum of 32 MB of memory; a minimum of 10 MB of available hard disk space; and a CD-ROM drive. AppleShare IP 5.0.2 is backward-compatible with previous AppleShare servers to provide services for both Mac OS and Windows clients and is compatible with previous versions of the Mac OS Workstation client.

Customers who currently own AppleShare IP 5.0 can download AppleShare IP 5.0.2 from the web at **http://appleshareip.apple.com**. (This version of the update does not include the LogDoor and NetCloak software or the Mac OS 8 system software.) AppleShare IP 5.0 owners in the United States can also order an AppleShare IP 5.0.2 Update CD for a nominal fee. For more information, see the press release at **http://product.info.apple.com/pr/press.releases/1998/q1/971029.pr.relappleshare.html**. ♣

CD HIGHLIGHTS

Reference Edition, December 1997

Since this is the last issue of *Apple Directions,* you're also reading the last CD Highlights column. In the future, you can tell what's new each month by looking in the What's New folder at the root level of the Developer CD. The rest of this column tells you about the new items on this month's CD.

Balloony

This third-party, public-domain tool produces a template for building Balloon Help into your application. You provide your existing application or resource file, and the tool produces Rez source text for all of your dialog and menu resources. You can then edit and compile this file under MPW, CodeWarrior, or any other tool that compiles ".r" files. Balloony requires System 7.

C/F Registration Requests

This HyperCard stack enables you to register creator and file type IDs for your applications and will alert you if the creator ID has already been reserved (as of October 15, 1997). Note, however, that it is possible that the creator type you request may have been requested by someone else after the cutoff date for this stack.

Macintosh PowerBook 2400c Developer Note

This document describes the Macintosh PowerBook 2400c, which is available only in Japan and the United States. It compares the PowerBook 2400c with the PowerBook 3400, which is electrically similar.

Enhanced Power Macintosh 8600 and 9600 Developer Note

This document describes the enhancements that set the Power Macintosh 8600/250, 8600/300, 9600/300, and 9600/350 apart from the earlier models. Besides the higher clock speeds, these computers have 1 MB inline caches, larger hard disk drives, faster CD-ROM drives, and built-in Zip disk drives.

Power Macintosh G3 Developer Note

This document describes the hardware architecture of the new Apple Power Macintosh G3 family of computers. It defines the changes introduced in the logic board design that developers need to be aware of to design compatible memory and I/O expansion modules. It also lists all of the features and capabilities of the possible hardware configurations that the new architecture supports, as well as the design of the new modular desktop and tower enclosures.

ATA Software Guide

This new version, Working Draft 02, includes updated definitions and corrections in the sections that deal with the parameter block structures used by the functions that call the ATA Manager. The information in the note supports version 1 through version 4.1.1 of the ATA Manager and supersedes all previous drafts of this document.

DIMM Config&Interleave v1.1

This utility displays memory size, bank configuration, and interleave status for each DIMM slot of the PCI-based Mac OS computer it's running on. You can use this utility to detect whether DIMMs have been installed properly. DIMM Config&Interleave runs only on PCI-based Mac OS computers that use the Hammerhead memory controller chip, such as the Power Macintosh 7300, 7500, 7600, 8500, 8600, 9500, and 9600 models.

This package includes source code so that you can incorporate the code into your own program.

WebObjects Developer Guide

This document provides in-depth information on how to use the WebObjects Framework to create web-based applications. It describes in detail what happens during the WebObjects event loop (called the *request-response loop*), describes methods you can use to override the default processing during the request-response loop, and discusses advanced topics, including how to provide a custom state-storage solution for your WebObjects application.

File Synchronization 1.1

The File Synchronization control panel allows you to set up and manage multiple copies of files in different folders. For example, if you maintain files on a mobile computer and copy those files to a desktop computer, you may find this control panel useful. It will automatically copy more recent files based on modification date, can display what will copy without actually copying it, and can run automatically or under user control.

Note: *This tool is for developer use only and is not meant for the general public; do not distribute it to others. It works only on computers running Mac OS 8.*

MacApp & ACS R13 Update 2

The MacApp & ACS Release 13 Update 2 folder contains a complete release of the MacApp product. It incorporates software bug fixes and documentation changes made to Release 13 since it was released earlier this year. Update 2 is a complete replacement for MacApp & ACS Release 13—there is no need to incorporate the changes in Update 2 using an incremental process into your current MacApp Release 13. Most of the changes occurred in the Apple Class Suites (ACS)—in fact, the entire Pattern and Network suites have been replaced.

A new suite, Java, provides support for embedding a Java™ applet within a view. In addition, sockets support has been added to the Network suite. These additions have not been certified by testing to meet our "final" quality requirements, so you should use them at your own risk.

A long-promised Sizers sample application, which demonstrates the sizing behaviors, has been added to the A–Z folder within the Examples folder. (Size determiners will probably be removed from MacApp in the future and replaced with sizers.) This example will be enhanced in the

future but is sufficient to demonstrate the power of sizers. You will also find a new sample that demonstrates the use of Apple Guide in the H folder within the A–Z folder.

Rhapsody_OpenStep_Docs

This folder contains new and revised Rhapsody documentation. If you're bothered by the fact that some of these documents contain the word *OpenStep,* don't worry—all OpenStep documentation applies to Rhapsody! Here are summaries for all the documents in this folder.

• *Discovering OPENSTEP: A Developer Tutorial* provides an introduction to OpenStep programming on Rhapsody. It guides you through the creation of three applications of increasing complexity. Along the way, it explains concepts and illustrates aspects of Objective-C, OpenStep classes, the development environment, and programming techniques. A short appendix offers a summary of object-oriented programming.

Note: This version of the tutorial contains new material, corrections of all reported bugs, and screen shots of the Rhapsody development environment. This is a preliminary document, and the authors are very interested in hearing any comments or reports of problems. Please send feedback to TechPubsFeedback@group.apple.com.

• *Object-Oriented Programming and the Objective-C Language* is an introduction to the principles of object-oriented programming in OpenStep and the official description of the Objective-C language.

• *Appkit Reference* is the complete reference for the classes, protocols, functions, and types of the Application Kit. The Application Kit provides the elements of a graphical user interface, as well as basic application behavior.

• *Foundation Reference* is the complete reference for Foundation classes, protocols, functions, and types. Foundation is the heart of every Rhapsody application; it provides basic object behavior, memory management, strings, collections, operating-system services, and object distribution and persistence.

• *Topics in OPENSTEP Programming* contains detailed discussions of the concepts behind the Foundation Kit, the architecture of the text system, and the unique services functionality that allows applications to easily share functionality.

• *Developer Tools and Techniques* explains how to program in the OpenStep development environment. It covers topics such as creating and managing a project, composing a graphical user interface, and making a custom subclass.

Note: *This book was originally written for the OPENSTEP Enterprise 4.2 release. Although it contains much useful information, it does not accurately reflect the Rhapsody development environment.*

• *Developer Tools Reference* contains reference documentation for the compiler, debugger, preprocessor, assembler, and other tools used in the Rhapsody development environment.

• *Release Notes* describes new features, known problems, bug fixes, and late-breaking information for the current Rhapsody release. Of particular interest is the *Java Yellow Box APIs* release note, which points to alpha reference documentation for the Java APIs (application programming interfaces) of the Application Kit and Foundation.

SnapshotSample1.0b4

Snapshot Sample is a tiny application that shows how to grab the icon positions for all the files on the desktop and later restore those icon positions. This is useful for programs, including games, that switch resolutions on the fly, thereby wreaking havoc on the user's desktop icons.

Virtual User 2.5.1

Virtual User is the primary tool used by Apple to perform integration, compatibility, and user-perceived performance testing. Virtual User 2.5.1 is a "fat" application that is compatible with Mac OS versions from 6.0.5 through 8.0. Virtual User 2.5.1 adds a built-in script debugger. This debugger allows you to set breakpoints, examine variables, and step through a Virtual User script as it is executing. It also adds Mac OS 8 compatibility, support for the Test Tools Apple event suite, and new image-location services. It runs on a Macintosh IIfx or later model, with at least 8 MB of memory and System 7 (System 7.5 or later preferred).

TEC 1.2.1 Release

The Text Encoding Converter enables you to add access to Unicode and other character encodings to your applications; it also provides text-conversion services between Macintosh character data and all major character sets used on the Internet.

—The Developer CD Team

Internet Resources

• Apple's operating system web page—http://www.macos.apple.com/
• November Strategy Mosaic, "Apple *Is* the Mac OS"—http://devworld.apple.com/mkt/informed/appledirections/nov97/stratmosaic.html
• Rhapsody Developer Release—http://devworld.apple.com/rhapsody/rhapdev/rhapsody.html
• Apple's fourth fiscal quarter results—http://product.info.apple.com/pr/press.releases/1998/q1/971015.pr.rel.q497.html
• Apple support—http://www.info.apple.com/
• Power Macintosh 233-MHz Processor Upgrade Kit—http://product.info.apple.com/pr/press.releases/1998/q1/971010.pr.rel.233upgrade.html
• Apple's new brand advertising campaign—http://product.info.apple.com/pr/press.releases/1997/q4/970929.pr.rel.adcampaign.html
• Apple's ColorSync technology—http://colorsync.apple.com
• ColorSync training courses—http://product.info.apple.com/pr/press.releases/1997/q4/970929.pr.rel.ikon.html
• Java-centered mobile computer specification—http://www.internet.ibm.com/computers/networkstation/os/open.html
• Channel policy and program changes—http://product.info.apple.com/pr/press.releases/1997/q4/970926.pr.rel.channel.html
• Add-on Take-off promotion—http://www.apple.com/promo
• AppleShare IP 5.0.2—http://appleshareip.apple.com http://product.info.apple.com/pr/press.releases/1998/q1/971029.pr.rel.appleshare.html
• Apple Developer World web site—http://devworld.apple.com
• Apple Corporate web site—http://www.apple.com
• Apple technology seeding program—http://devworld.apple.com/seeding/software_seeding_FAQ.html
• Apple Developer News subscription form—http://survey.info.apple.com/subscribe/subscribe.html
• Apple Developer Program membership—http://devworld.apple.com/worldwide/wwprograms.html