Recently, both Apple Computer and IBM have introduced products based on the PowerPC™ microprocessor. The PowerPC microprocessor is a result of collaboration between three industry leaders: Apple, IBM, and Motorola. This cooperative project was announced in 1991. The project's goal was to advance the evolution of the personal computer in five major areas:

- PowerPC – Apple, IBM, and Motorola agreed to develop a family of RISC microprocessors.
- Interoperability – IBM and Apple agreed to work together to ensure that Macintosh® computers work smoothly with large, networked IBM enterprise systems. This involves products in networking and communication.
- PowerOpen® – IBM and Apple agreed to co-develop a new version of the UNIX® operating system that takes advantage of the strengths of the PowerPC microprocessor.
- Kaleida – A new company called Kaleida was created to work on new standards for multimedia products.
- Taligent – A new company called Taligent was created to develop an object-oriented operating system.

While there have been advances in all of these areas, the announcement of the Power Macintosh has focused industry attention on the PowerPC chip. (Note: Microprocessors are often referred to as 'chips' or 'computer chips'.)

The PowerPC microprocessor

The term PowerPC describes a family of microprocessors that may be used in a variety of computers. Apple Computer has introduced a series of computers based on this microprocessor which they will call Power Macintoshes™. IBM computers that contain the PowerPC microprocessor will be part of the RS6000 series. The RS6000 series is a high-end UNIX product. The Power Macintosh, on the other hand, is intended as a broad-based consumer product. For the purpose of the graphic arts industry, the Power Macintosh is likely to have a greater immediate impact.

The PowerPC microprocessor uses RISC (Reduced Instruction Set Computing) technology. RISC is often compared to CISC (Complex Instruction Set Computing).[1] The benefits of RISC versus CISC have been debated for some time now. Many feel that RISC technology is the wave of the future. Up until recently RISC technology had primarily been used on high-end workstations and servers, but also in some PostScript printers and RIPs (Raster Image Processors). For example the Linotype-Hell Vulcan RIP uses an Intel i960 CA RISC microprocessor. However CISC technology is widespread and is the basis of Intel's Pentium™ microprocessor.

[1] As implied by their name, CISC processors contain a variety of complex instructions. RISC processors, on the other hand, contain only frequently-used simple instructions. When a complex instruction is needed, a RISC processor builds it from a combination of simpler instructions. RISC increases performance by accelerating the execution of the most frequently used instructions.

These are the four planned PowerPC microprocessors:

- 601 – This microprocessor is available and shipping in Power Macintoshes like the 6100, 7100, and the 8100 as well as in the IBM RS6000 Series. It is used in the initial mid-range and high-end Macintosh system offerings.

- 603 – This microprocessor will offer performance similar to the 601 in a lower-power, lower-cost design that will make it suitable for high-volume desktop Macintosh and portable computers like the PowerBook®.
- 604 – This processor will eventually replace the 601, and allow better performance in mid-range and high-end Macintoshes.
- 620 – Later on (1995 or so), this processor will offer premium performance for high-performance workstations and servers.

The Power Macintosh

Apple claims that the new Power Macintosh will provide significant performance increases while preserving compatibility with existing Macintosh applications and peripherals. Apple also claims that this increase in performance will allow capabilities that are not currently available on the desktop. (Developers will be able to develop more advanced applications that take advantage of this additional power.) Despite these changes, the new line of computers will still be Macintoshes, and, they will use System 7. (This means that users already familiar with System 7 will require no extra re-training.) Older Macintosh applications will still run on the Power Macintosh, but they will run in emulation mode. New applications specifically designed for the PowerPC will run in native mode at faster speeds. (See section below called *Emulating or running 'native'* for more information.) Apple says that the Power Macintoshes will support nearly all printers, network cards and other hardware. They will share data and coexist on a network with older Macintoshes. Finally, Apple plans to introduce these products initially as mid-range and high-end models.

Floating point

One advantage of RISC processors is their ability to handle floating point calculations. Floating point notation is a way of representing very large or very small numbers with an exponent. The floating point is actually the decimal point. For example, the number 1,000,000,000 could also be written as 1E9 (where E designates the exponent) or 1×10^{9}. In the same way .0000001 could be shown as 1E-7 or 1×10^{-7}. Floating point math uses this kind of notation.

Some microprocessors cannot do floating point math. This is why you hear so much about math chips, math coprocessors, numeric coprocessors, floating point coprocessors or floating point units (FPU). An FPU speeds up math calculations and along with it many graphic functions. Apple stresses that floating-point calculations are needed for sophisticated graphics, communications, and video applications. Apple claims that 3D rendering and CAD (Computer-Aided Design or Computer-Assisted Design) could see performance increases as high as tenfold. This is one reason why the Power Macintoshes will be important for the graphic arts.

Emulating or running 'native'

Initially, three models of the Power Macintosh will be based on the the PowerPC 601 microprocessor. These devices will be referred to as the 6100, the 7100, and the 8100. The Power Macintoshes will run (through emulation) a version of Apple's System 7. Software applications that are written for 680x0 Macintoshes[2] should run perfectly on a Power Macintosh at speeds comparable to a Macintosh Quadra 605 or 700. The real benefit will come when applications are written specifically for the PowerPC chip. Applications that do this will be considered 'native'. So far about twenty vendors have promised to develop PowerPC native applications. (This list includes all of the standard desktop publishing software manufactures including Aldus, Adobe, and Quark.)

Native applications are predicted to run 2 to 8 times faster on a Power Macintosh than their 680x0 versions running on a Quadra 950.

[2] The shorthand 680x0 is used to describe the 68000 family of microprocessors which were designed by Motorola for use in Macintosh computers. This includes the 68000, 68020, 68030, and the 68040.

Because of this new native PowerPC mode, software application vendors may choose to supply software in a variety of ways:

- As separate 680x0 and PowerPC packages.
- As packages that contain both 680x0 and PowerPC versions.
- As 'fat binary' which includes a smart installer that will install the correct version on the target device. In 'fat binary' mode some vendors may allow installation of both versions on a hard drive so that the software application will run on any Macintosh to which the hard drive is attached.

LinoColor 3.3

Linotype-Hell demonstrated a beta version of LinoColor™ 3.3 running on a Power Macintosh at the recent Seybold Seminars 94 in Boston. Scheduled for release in July 1994, LinoColor 3.3 color management software has been implemented in native mode to take full advantage of the Power Macintosh. The Power Macintosh will also boost the performance of Linotype-Hell's MacCTU, a high-end color computer for the Macintosh in the form of a NuBus™ accelerator card. (MacCTU stands for Macintosh Color Transformation Unit.) The MacCTU handles compute-intensive color space transformations, image processing and retouching functions within LinoColor.

The rapid implementation on the Power Macintosh platform is the result of Linotype-Hell's close cooperation with Apple. As a preferred partner and member of the Worldwide Publishing Consortium initiated by Apple CEO Michael Spindler, Linotype-Hell has been an active participant in Apple's Inside Track development cooperation program. Linotype-Hell is one of a limited number developers world-wide that Apple chose to be seeded with advanced Power Macintosh units.

BridgIt and Vulcan

Linotype-Hell customers, faced with purchasing decisions on new Macintoshes have started asking the following two questions:

- Can the BridgIt® RIP operate in one of the new Apple Power Macintoshes?
- Can the Vulcan RIP operate in one of the new Apple Power Macintoshes?

At the time of publication, testing for the BridgIt and Vulcan RIP software has not been completed in a Power Macintosh. However, the Power Macintosh system software has a 68040 emulator built in so that applications not yet re-written in PowerPC native code can be used. This mode will cause the application to run at about the speed of a Macintosh Quadra® 605 or 700 for comparison purposes.

Harlequin, the developer of the BridgIt software, intends to re-write the BridgIt software in native PowerPC code. This update will be available later on this year as a limited release for those people using Power Macintoshes. It will not run on older 680x0 Macintoshes nor is it expected to be functionally different.

Linotype-Hell is also planning to port the Vulcan RIP software to the PowerPC platform. When complete, this version will not run on any of the 680x0 Macintoshes.

The first Power Macintoshes are a hybrid of what the present Macintosh is and what the Power Macintosh ultimately will be. This means that most of the newly released Power Macintoshes still utilize the NuBus™ configuration for slot expansion.[3] Future versions of the Power Macintosh will support the PCI bus (PCI stands for peripheral component interconnect). The PCI bus is much faster than NuBus (data transfer rates of 132MB/sec on PCI compared to 8 MB/sec data transfer rate on NuBus). The connector system will also be completely different.

[3] The Power Macintosh 6100 doesn't have a NuBus slot, but it does have a PDS (Processor Direct Slot). NuBus cards may be purchased for its PDS.

Logic board upgrades

Apple will offer logic board upgrades for some current Macintosh models. Logic board upgrades provide a complete upgrade to all features of the new PowerPC processor–based Macintosh computers. Logic board upgrades will be provided for the following Macintosh models:

- Macintosh Quadra 840AV, 800, 660AV, 650, 610
- Macintosh Centris® 660AV, 650 and 610
- Macintosh IIvx, IIvi, and Performa™ 600
- Apple Workgroup Servers 60, 80, and 95

In addition, Apple will offer a lower cost processor upgrade that includes a PowerPC 601 microprocessor, and the same ROM used in the new PowerPC processor–based Macintosh computers. This processor upgrade will be available for the following models:

- Macintosh Quadra 950, 900, 800, 700, 650, 610
- Macintosh Centris 650 and 610

Conclusion

Linotype-Hell is excited by the introduction of the PowerPC, and we expect that Apple's Power Macintosh will usher in a new era of high-level performance in computer publishing. On top of that, Linotype-Hell is poised to take advantage of the speed and power of the Power Macintosh in products like LinoColor 3.3. In the future, products like BridgIt and Vulcan will also take advantage of the capabilities of the PowerPC microprocessor.

However, many key desktop publishing programs will not be available in PowerPC native mode until the summer of 1994. Also occurring in the summer of 1994 is an anticipated upgrade to Apple's system software. System 7.5 will improve the performance of software applications running in emulation mode on a Power Macintosh.

Therefore at the current time (May of 1994), users running emulated mode applications on a Power Macintosh will not see all of the anticipated benefits of the PowerPC microprocessor (particularly for those already using a Quadra 700 or better). Despite this, the technology shows great promise. Many users will be tempted to purchase a Power Macintosh now, if only to roadtest the technology before putting it into production mode later this year.

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