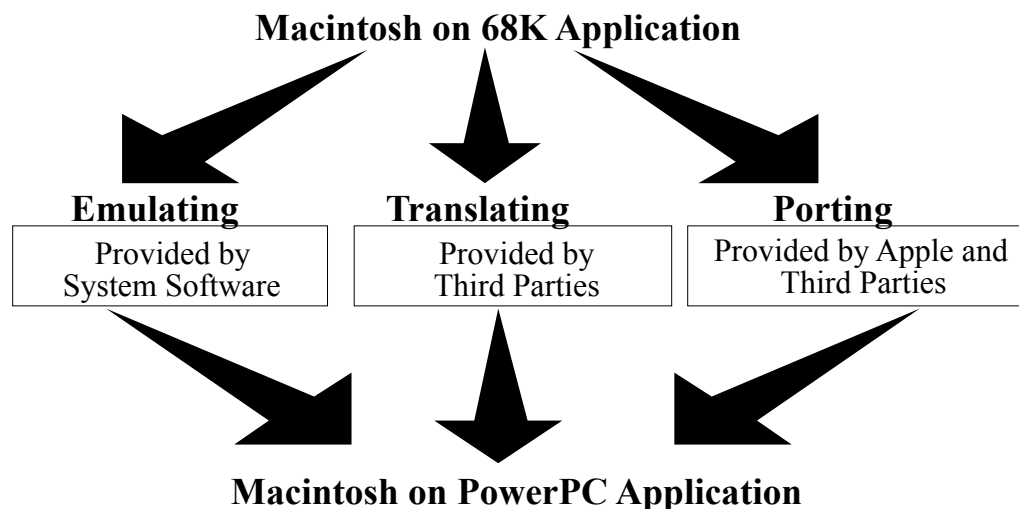**Press Backgrounder**

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Developer Road Map:
Migrating to Macintosh on PowerPC

In the first half of 1994, Apple Computer, Inc. plans to introduce the first Apple® Macintosh® computers based on the PowerPC™ RISC microprocessor. These new systems are intended to enable significant performance increases and new capabilities. This backgrounder summarizes the three paths Macintosh application developers can take to migrate their applications to the PowerPC-based Macintosh platform: emulation, translation, and porting. In addition, this document describes the development tools, from Apple and third parties, designed to support these various paths.

The developer tools supplied by Apple and third parties are designed to enable the delivery of a rich and diverse offering of new and existing applications running native on Macintosh on PowerPC.

Figure 1: Three Developer Paths to Macintosh on PowerPC

Macintosh on 68K Application

Emulating	**Translating**	**Porting**
Provided by System Software	Provided by Third Parties	Provided by Apple and Third Parties

Macintosh on PowerPC Application

Emulation: No Modification Required; 68040 Performance

By taking the first path, emulation, developers need not alter or modify their existing 680x0-based application for it to run on PowerPC-based Macintosh systems—it will run automatically via emulation. This compatibility of 680x0-based applications is made possible through an LC68040 (no floating point unit) software emulator that will be an intrinsic element of the system software of PowerPC-based Macintosh systems. Depending on the application, customers can expect their off-the-shelf 680x0-based applications to run on their PowerPC-based Macintosh at speeds comparable to a 68040-based Macintosh. This emulation capability will allow Macintosh users to run their favorite Macintosh applications on their new PowerPC-based Macintosh systems, even if the application vendor is not yet marketing a native PowerPC version of the application, thereby protecting both developers' and users' investment in software.

To underscore Apple's commitment to compatibility, the company invited developers attending the Worldwide Developers Conference in May 1993 to try their current applications on prototype PowerPC-based Macintosh systems.More than 90 percent of the 600 third-party products ran without any compatibility problems. Apple plans to continue to test compatibility through product introduction by hosting compatibility labs at developer events worldwide and by making prototype Macintosh on PowerPC systems available for testing in Apple compatibility labs worldwide.

Translation: Native Performance

The second developer path to Macintosh on PowerPC is translation. This option falls between emulation and porting on the migration continuum, offering developers native performance significantly exceeding that available through emulation, but not the ability to take advantage of new features such as speech recognition, text-to-speech, sound, telephony, video, 3D rendering and animation, and complex modeling and analysis, which would require porting. Developers selecting this path can choose from several third-party translation tools to translate their existing 680x0-based Macintosh applications to run native on PowerPC-based Macintosh systems.

Third-party tools developers are creating 680x0-to-PowerPC assembly-language translators, semi-automatic 680x0-binary-to-PowerPC-binary translators, and translators of Pascal and Object Pascal to C and C++. Assembly-language translators convert 680x0 assembly-language source files to PowerPC assembly language. The resulting PowerPC assembly-language source is then assembled using an assembler for the PowerPC processor. Binary translators convert, semi-automatically, a 680x0 Macintosh application—without source—to a version that will execute on the Macintosh on PowerPC.

Currently announced third-party translation tools for Macintosh on PowerPC include the following:

• PortAsm from Micro-A.P.L, a 680x0-to-PowerPC assembly-language translator.
• FlashPort from Echo Logic, a semi-automatic 680x0-binary-to-PowerPC-binary translator.
• p2c from Sierra Software Innovations, a translator of Pascal and Object Pascal to C and C++.

Porting: Native Performance; Added Features

The third developer path to Macintosh on PowerPC is porting. By porting their applications to the Macintosh on PowerPC, developers can take advantage of the native performance of the PowerPC processor as well as new Macintosh on PowerPC features enabled by the increased performance of the PowerPC processor. Both Apple and third parties plan to provide developers with the tools

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required to recompile existing 680x0-based Macintosh applications to execute directly on PowerPC-based Macintosh computers, and create new Macintosh applications specifically targeted for the Macintosh on PowerPC platform.

Apple is concentrating on providing tools for developers who are using C and C++, the languages used by most developers today. Apple plans to provide the tools required by the developer using C and C++ to port their application to Macintosh on PowerPC via the Macintosh on PowerPC Software Development Kit (SDK). In addition, Apple is supporting third-party developers who are creating tools that complement those provided by Apple.

Macintosh on PowerPC SDK: The Apple-Provided Solution

The Macintosh on PowerPC SDK is a transitional development environment for the PowerPC-based Macintosh platform. It is designed to enable early adopters to bring their applications to the Macintosh on PowerPC at or near the time of the introduction of PowerPC-based Macintosh systems. The Macintosh on PowerPC SDK will provide developers with a 680x0-based Macintosh cross-development environment for the Macintosh on PowerPC. The familiar MPW® (Macintosh Programmer's Workshop) development environment, hosted under System 7, will be the foundation of this cross-development environment.

Using the Macintosh on PowerPC SDK, developers will be able to develop native applications for the Macintosh on PowerPC using a 680x0-based Macintosh. In this environment, developers will be able to edit, compile, and link their applications on a 680x0-based Macintosh, and execute and debug the resulting applications on a PowerPC-based Macintosh.

The Macintosh on PowerPC SDK will include the following:

• C and C++ cross compiler for the Macintosh on PowerPC.
• PowerPC cross assembler.
• PowerPC cross linker.
• MacApp® for the Macintosh on PowerPC.
• A remote source-level and machine-level debugger for the Macintosh on PowerPC.
• Interface files and libraries for the Macintosh on PowerPC.
• Tools and documentation to ease the transition to an MPW-based development environment for users of Symantec's Think C.
• Additional tools to assist in porting 680x0-based Macintosh applications to the PowerPC-based Macintosh.
• Sample code illustrating how to port a 680x0-based Macintosh application to the Macintosh on

PowerPC.
• Electronic documentation.

In addition to providing the Macintosh on PowerPC SDK, Apple is working aggressively with Symantec Corp. on a native development environment for the Macintosh on PowerPC, which will be available after Apple begins customer shipments of PowerPC-based Macintosh systems, allowing developers to use new PowerPC-based Macintosh systems for development.
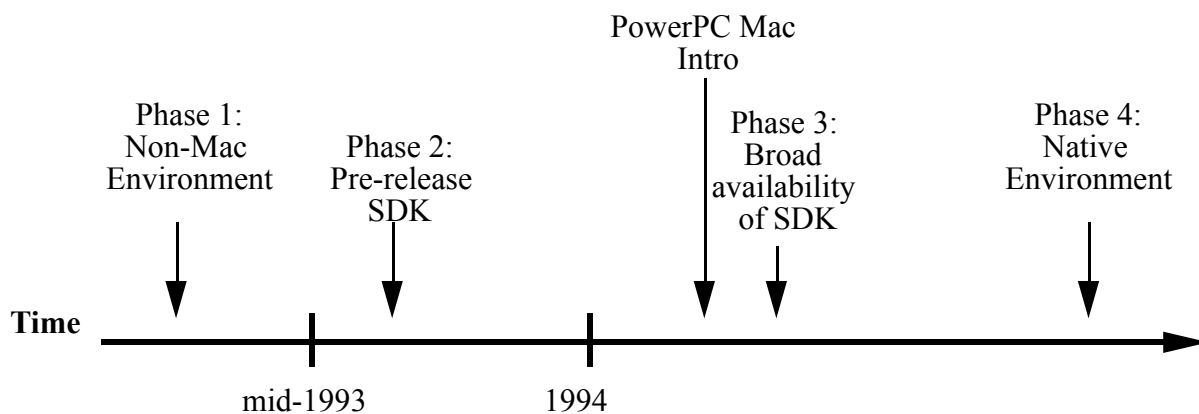
Phased Delivery of Porting Tools

Wide availability of the Macintosh on PowerPC SDK is planned for the third phase of a four-phase tools-delivery strategy for porting applications to the Macintosh on PowerPC. The phases are as follows:

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Figure 2: Four Phase Porting Tools Timeline

Phase 1: Highly Limited; Non-Macintosh Hosted Environment. The first phase is currently underway and involves participation of a very small number of software vendors who are working closely with Apple to port their applications to Macintosh on PowerPC using a cross-development environment hosted on an IBM RS/6000 workstation. This environment was created for early software development in the PowerPC program and is no longer available.

Phase 2: Limited Access to Pre-release Development Environment. The second phase of applications porting will include several hundred Macintosh applications developers worldwide, who will use the 680x0 Macintosh-hosted cross-development environment, provided by the pre-release version of the Macintosh on PowerPC SDK, to port their applications to pre-production PowerPC-based Macintosh systems. This second phase of porting will include early adopters of the Macintosh on PowerPC platform who wish to bring their applications to the PowerPC Macintosh at or near the time of introduction. Apple anticipates beginning this phase in late summer 1993.

Phase 3: Broad Availability of Macintosh on PowerPC development environment.
The third phase of tools delivery—wide availability of the Macintosh on PowerPC SDK—will follow the introduction and customer shipment of PowerPC-based Macintosh computers,

scheduled for the first half of 1994. The Macintosh on PowerPC SDK will be made available to developers worldwide. Pricing and availability will be announced at a later date.

Phase 4: Native Development Environment. Following the first customer shipments of the PowerPC-based Macintosh computers, a native development environment will be available. The native development environment is being jointly developed by Apple and Symantec. This development environment, along with Bedrock—the cross-platform application framework jointly developed by Apple and Symantec—will provide developers with powerful, flexible, and easy-to use development tools for the Macintosh on PowerPC. Using the native development environment, developers will be able to use a single PowerPC-based Macintosh system for the entire development process from editing, compiling, and linking, to executing and debugging.

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