Carbon: An Essential Element of Mac OS X

One of the things that makes Mac OS X unique is its integration of five separate application runtime environments: Carbon, Cocoa, Classic, Java, and BSD. Never before has an operating system offered developers so many options. This series of articles will give you the information you need to make an informed decision as to which of these environments is right for your application on Mac OS X. This month, I'm going to talk about Carbon and what it offers you as a Macintosh developer.

A Brief History of Carbon

Carbon represents the evolution of the Mac OS API, from a single-user, cooperatively scheduled system, to a modern multi-user system with memory protection and preemptive multitasking. Carbon sprang from Apple's desire to provide a gentle migration path for developers, while at the same time delivering all the performance, features, and reliability that Mac OS X has to offer. About 70 percent of the classic Mac OS APIs are fully supported, and Carbon adds many new APIs specifically to take advantage of Mac OS X.

What Diamonds Are Made Of

Carbon offers a wealth of features to support and accelerate your Mac OS X development efforts. Whether you're new to the platform, or an old-timer, here are some of the reasons why you'll find Carbon a solid foundation for your software product:

- *Broad Language Support*
  Apple provides interfaces, compilers, and tools for Carbon programming in C and C++, while other languages such as BASIC and FORTRAN are offered by other tool vendors.
- *Excellent Tools*
  As we covered in last month's article, *Tools for the Trade*, you can choose from a range of excellent tools including Metrowerks CodeWarrior, Real Software's REALbasic, Absoft Pro Fortran, and Apple's own IDE combo, Project Builder and Interface Builder.
- *Choice of Frameworks*
  The two most popular object-oriented application frameworks for Macintosh are now Carbonized: MacApp (part of Apple's suite of C++ frameworks) and Metrowerks PowerPlant (version 2.1 or later). Basing your application on one of these frameworks can greatly simplify your work.
- *Support for Mac OS 9*
  Because the majority of Carbon APIs are also supported on Mac OS 9, Carbon provides a solution to the problem of how to move forward with Mac OS X while continuing to support those people who are going to wait a bit longer to upgrade. If backward compatibility is important for your product, you can create a single binary that will run on any version of the Mac OS, from Mac OS 8.1 through Mac OS X.

Getting Started

If you're starting from scratch, and you want to program in C or

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ADC Programs and Mac OS X

As Steve Jobs, Apple's CEO, announced at Macworld San Francisco in January, Mac OS X will be released on March 24, 2001. All ADC Members who receive a monthly mailing will be automatically sent Mac OS X and the Mac OS X Developer Tools on CD-ROM upon release.

If you are getting your hardware or software products ready for Mac OS X, be sure to take advantage of our numerous ADC Member Discounts for Cocoa and Carbon porting, Aqua integration, driver development services, and more. Mac customers will be looking for hardware and software products that are built for Mac OS X – make sure yours are ready! For the complete list of all ADC Member Discounts, please see:

http://developer.apple.com/business/

For more information about ADC Programs, please see:

http://developer.apple.com/membership/

Mark Turner is the Carbon Technology Manager in Apple Worldwide Developer Relations. When he's not Carbonizing code, he enjoys carbonizing hamburgers on the grill and spending time with his family. He can be reached at turner@apple.com.

C++, you should really consider basing your Carbon application on a framework like PowerPlant or MacApp, which provide for rapid development and easy maintenance. These frameworks can also make it easier to port your code to or from the Microsoft Win32 API, if that's a consideration for you. REALbasic and Absoft Pro Fortran also offer cross-platform solutions.

For an excellent introduction to Carbon programming, grab a copy of *Moon Travel Tutorial: Creating a Carbon Application.* This little gem takes you through the entire process of building a pure Carbon app—one that doesn't rely on any legacy technologies. You'll also learn how to use Apple's Project Builder IDE, and see how easy it is to design your menus, controls, dialogs, and windows using Interface Builder. You can download it from:
http://developer.apple.com/techpubs/macosx/Carbon/pdf/ MoonTravel.pdf

The best place to begin exploring Carbon is the Carbon Developer home page, where you'll find links to the latest Carbon software development kits, documentation, tools and other resources:
http://developer.apple.com/macosx/carbon/

If you've already got a Macintosh application that you haven't yet Carbonized, it's time to get started! One of the great things about Carbon is that you can adopt it incrementally. The basic steps necessary to get an application up and running on Mac OS X typically take just a few days, but to completely Carbonize a large application you should expect to spend a month or more, especially if you need to support Mac OS 9 or prior versions.

The ease of Carbonizing an existing application is directly related to how closely you've followed Apple's recommended programming practices in the past, the degree to which you've adopted recent APIs such as Navigation Services and the Appearance Manager, and whether your code already compiles using the latest Universal Interfaces. If your code base is up-to-date, and you're not relying on undocumented data structures or unsupported features, adopting Carbon is relatively simple.

Before changing a line of code, however, you should run your application through Carbon Dater, Apple's Carbon compatibility tester. Available on the Carbon Developer web site, Carbon Dater is a helpful tool that examines your application and issues a report listing all the Mac OS functions you're using that need to be updated for Carbon compatibility. For example, if you're calling InvalRect, the report will explain that the function is not supported in Carbon, and recommend that you use InvalWindowRect instead.

With the Carbon Dater report as your guide, you can begin the Carbonization process by searching your sources for unsupported functions and replacing them with their Carbon equivalents. While I can't cover the entire Carbonization process in detail here, you'll find a complete description in the *Carbon Porting Guide*, which you can download from here:

http://developer.apple.com/techpubs/macosx/Carbon/pdf/ CarbonPortingGuide.pdf

Even if you're not porting, I recommend reading the Carbon Porting Guide for its overview of new Carbon technologies, optimization strategies, and instructions for building Carbon applications using CodeWarrior, Project Builder, and the Macintosh Programmer's Workshop (MPW). *Technical Note 2003: Moving Your Code to Mac OS X,* is another great resource. It highlights all the major considerations for developers transitioning from classic Mac OS to Carbon, and provides pointers to additional documentation on the web:
http://developer.apple.com/technotes/tn/tn2003.html

Once your application is Carbonized, you'll want to make sure it looks great on Mac OS X. This means putting the polish on your interface by giving it an Aqua tune-up. The Aqua Human Interface Guidelines contains all the specifications and recommendations for designing Aqua-compliant applications and icons:
http://developer.apple.com/techpubs/macosx/SystemOverview/ AquaGuidelines.pdf

An Investment in the Future

Carbon is more than just a porting tool. It's a full-featured API that

Project Builder Tips & Tricks

• To get a pop-up menu containing all the functions in your source files, select "Index Project" from the Project menu. This also enables definition searches from the batch find panel. And, the counterpart button (the third button from the right in the navigation bar) becomes a pop-up menu that shows files that are imported by or dependent on the current file.

• The inspector panel, available from the Project menu, can be used to modify more than one file at a time. For instance, if you want to set the tab width for a number of files all at once, select them in the Groups and Files pane, bring up the Inspector, change the tab width, and hit return.

• To set a breakpoint on a line of code, just click in the column to the left of that line of code. Clicking again enables and disables the breakpoint. To remove the breakpoint, drag it off the column. You can also move a breakpoint to a different line by dragging it.

• To rename a file or group, option-click its name from the Groups and Files pane.

New Mac OS X Related Releases

The following software is available from the Download Software area of the ADC Member Site at:
http://connect.apple.com/

• CarbonLib 1.2.5b2 SDK
The latest prerelease version of the CarbonLib 1.2.5 software development kit provides all the files needed to begin Carbon development.
http://connect.apple.com/

• OpenGL SDK 1.2
This software development kit is for adding OpenGL support to your application. This implementation provides several features and performance enhancements.
http://developer.apple.com/opengl/downloads.html

Developer Documentation
The following new and updated documentation is available to help you on your way to successful Mac OS X application and peripheral development at:
http://developer.apple.com/techpubs/

• Q&A QA1000 - Gathering system information under Traditional Mac OS

• SAMPLECODE - Graphics 3D: Carbon SetupGL
• SAMPLECODE - Graphics 3D: OpenGL Movie
• SAMPLECODE - Platforms and Tools: Project Builder: Cocoa_With_Carbon_or_C++
• SAMPLECODE - Networking: OTStreamLogViewer
• SAMPLECODE - Networking: OTClassicContext
• SAMPLECODE - Devices and Hardware: Drivers: TradDriverLoaderLib

Mac OS X: An Overview for Developers
This 10-page PDF highlights the benefits of Mac OS X technologies to developers.
http://developer.apple.com/macosx/

Fatbrain's Apple Developer Library
The following four titles have been added to the Apple Developer Library, the ADC's print-on-demand series of titles located at:
http://www1.fatbrain.com /apple/

• Carbon Porting Guide for Mac OS X
• Inside WebObjects: WebObjects Overview
• Inside Mac OS X: Kernel Environment
• Inside Cocoa: Object-Oriented Programming and the Objective-C Language

Upcoming Seminars and Events

For more information on Apple developer events please visit the developer Events page at:
http://developer.apple.com/events/

Training and Seminars

Programming with Cocoa
Taught by Aaron Hillegass at the Big Nerd Ranch, Ashville, NC and Atlanta, GA. Five-day classes are taught on developing web-based and Mac OS X applications.
http://www.bignerdranch.com/when.html

Developer Related Conferences
Game Developer Conference, San Jose, CA
March 20-24
For 15 years, the Game Developers Conference (GDC) has been the independent and unbiased forum where game development professionals from around the world gather to share ideas and build the skills essential to creating the next generation of interactive entertainment. Apple will be exhibiting at this year's conference.

Worldwide Developers Conference (WWDC) 2001, San Jose, CA
May 21-25
Register now for Apple's Worldwide Developers Conference 2001, which takes place in San Jose, California from May 21-25. ADC Premier members receive a free pass to the conference, ADC Select members receive discounts for early registration, and ADC Student members can apply for a scholarship to attend for free! For schedules and other details check out:
http://www.apple.com/developer/wwdc2001/.

If you missed last year's conference, a great way to get ready for WWDC 2001 is to purchase our five volume WWDC 2000 Conference Sessions on DVD-ROM. This set contains over 80 hours of detailed technical information from WWDC 2000 and is deeply discounted for ADC Members. Additional information on this product can be found at:
http://developer.apple.com/products/

MacHack Conference, Dearborn, MI
June 21-23
MacHack, in its sixteenth year, remains centered around cutting edge software development. MacHack's uniqueness derives from the informal feel and the LIVE coding that occurs around-the-clock during the conference.
http://www.machack.com/

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provides a solid foundation for serious ongoing development. Apple is working hard to make sure Carbon has everything you need to write world-class applications, now and in the future.

Mac OS X, with its killer graphics and superior performance, presents an opportunity for you to revitalize or even reinvent your application. Your goal should be more than simply getting your code running on Carbon—it should be to create a compelling new product that takes advantage of everything Mac OS X has to offer.

When you're finished, be sure to let Apple know about your product, so we can list it on the "Built for Mac OS X" web page located in the Mac Products Guide (MPG):
http://submit.macsoftware.apple.com/usupdate/upindex.html

Until Next Time

With Mac OS X shipping on March 24, the demand for native applications will be huge. Carbon is one way to bring your Mac OS X product to market quickly. Future articles will cover Cocoa, Java, and other options for Mac OS X development.

Whatever path you choose, Apple's Worldwide Developer Relations team is here to help. For technical support, visit http://developer.apple.com/products/techsupport/. Better yet, sign yourself up on the Carbon Development discussion list (carbon-development@lists.apple.com). This list is monitored by Apple technology managers, engineers, and your fellow developers from around the world. It's a great place to get answers or share your knowledge, and it's free. To sign up, go to http://lists.apple.com and search for Carbon Development. See you there!

Discounts on Mac OS X Migration

Bring Your Apps to Mac OS X

With Mac OS X Public Beta here, and the commercial release just over the horizon, Mac developers everywhere have a huge need for Carbon and Cocoa application porting, Aqua user interface implementation, and driver development services. Several high-quality software engineering firms, in association with the Apple Developer Connection, are offering these services at very attractive discounts to all ADC Select and Premier members.
http://developer.apple.com/mkt/macosxmigration.html

End-User Tech Support

We all know how expensive and time consuming it is to set-up and maintain a comprehensive customer tech support department. To support developers in their migration to Mac OS X, 877MacTank has designed an exclusive and affordable tech support staffing program for ADC Premier and Select members.
http://developer.apple.com/mkt/mactank.html

Did You Know?

Much of Apple's technical documentation is geared toward helping Carbon application developers. To see the scope of this documentation, check out the Carbon documentation suite on the Web at:
http://developer.apple.com/techpubs/macosx/Carbon/carbon.html

Here you will find the "Inside Carbon" suite of API documentation for the nearly 100 Carbon-compatible managers, organized by topic. This documentation includes Carbon inclusion status, per-function release availability, and porting notes to help you modify your legacy Mac OS code for functions that aren't supported. Some documents also describe concepts and include sample code to help you revise your legacy Mac OS applications for Carbon and to create new Carbon applications. You'll also find at the Carbon documentation site a number of relevant programming guides, such as "Aqua Human Interface Guidelines," "Carbon Porting Guide," and "Moon Travel Tutorial: Creating a Carbon Application."

The Carbon documentation suite is also available on the Mac OS X Developer CD. When you install the Developer package, you can also access this documentation from the Developer Help Center using the Help Viewer application.

If you have legacy Macintosh applications that you wish to port, be sure to use the Carbon Dater tool. Carbon Dater produces an HTML report customized for your application. The report lists function calls and code usage that you may need to change, and offers the latest documentation to help you make those changes. Although the Carbon documentation site provides a link to Carbon Dater, the tool itself is not included on the Developer CD.

Carbon Tips & Tricks

The Apple Developer Connection web site titled Carbon "Tips & Tricks" is dedicated to sharing special techniques for debugging and building Carbon applications.
Visit us at:
http://developer.apple.com/macosx/carbon/tipsandtricks.html