
Mac OS X Printing System Overview

Printing



2006-02-07



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Introduction to Mac OS X Printing System Overview

Note: This document was previously titled *About the Mac OS X Printing System*.

The Mac OS X printing system provides a flexible and powerful new printing environment for Macintosh developers. The architecture makes it much easier for application developers to support printing in their applications and for printer vendors to write printer drivers and extend printing dialogs. The Mac OS X printing system has a number of advantages over the printing system used in Mac OS 8 and 9, including the following:

- The printing system uses Quartz 2D for rendering and conversion services. Quartz 2D supports a resolution-independent PDF drawing model which allows applications to print high-quality, color-managed output on all classes of raster and PostScript printers.
- Sheets allow you to open more than one printing dialog at the same time and to send more than one print job to a printer queue.
- Printing dialogs can be customized with printing dialog extensions. This means you don't need to completely replace the standard printing dialogs to provide users with application-specific or printer-specific features. The Page Setup dialog can be extended by application developers, while both printer vendors and application developers can extend the Print dialog.
- Printer modules replace printer drivers. Printer modules are easier to write than printer drivers, as much of the code that has to be in a driver is now taken care of for you in Apple-supplied I/O modules and other parts of the printing system.
- The printing application programming interface (API) includes robust support for Carbon applications. Carbon developers can write one application that can run in Mac OS X as well as in Mac OS 8 and 9. Cocoa developers support printing by using Cocoa objects and methods. Cocoa methods call through to the Carbon Printing Manager API.

If you are a developer who plans to write an application that supports printing in Mac OS X, you should read this document before you start to write your code. You should also read this document if you plan to write any type of printing plug-in, such as a printing dialog extension or printer module.

Organization of This Document

The chapters in this document cover the following topics:

- [“Mac OS X Printing System User Interface”](#) (page 9) describes the user interface of the printing dialogs and the Print Center application.
- [“Mac OS X Printing Architecture”](#) (page 23) outlines the components of the printing architecture and describes how the printing system keeps track of print job information.
- [“Developing Software”](#) (page 29) provides information on the software you can develop for the Mac OS X printing system and gives pointers to documentation and sample code to get you started.

See Also

The following documents provide information on the procedural C APIs available for printing in Mac OS X:

- *Carbon Printing Manager Reference* describes the C API for supporting printing and PDF creation in an application.
- *Printing Plug-in Interfaces Reference* describes the various callback interfaces that Mac OS X printing plug-ins implement in Carbon.
- *Ticket Services Reference* describes the C API used by printer modules and PDEs to communicate printing information to the system.

Mac OS X Printing System User Interface

The Mac OS X printing system's user interface provides a consistent, easy-to-use environment for performing printing-related tasks such as locating local and networked printers, configuring new printers, choosing printers, and managing print jobs.

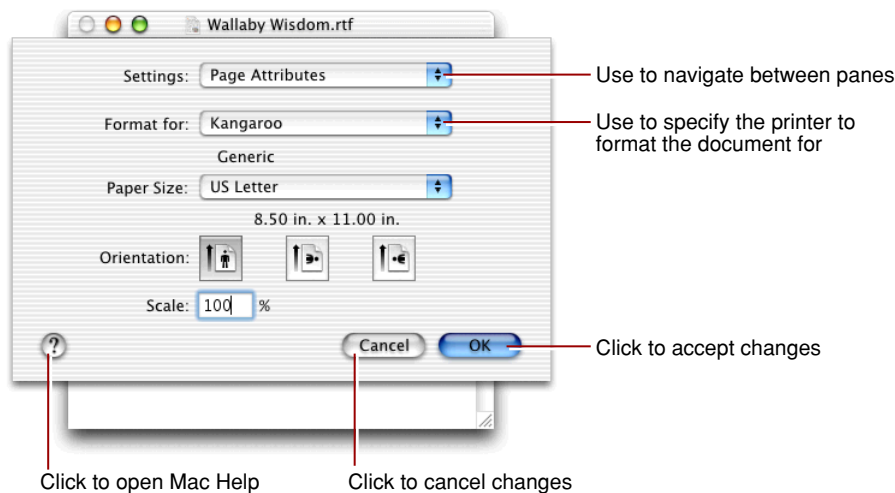
The printing system's user interface consists of the following components:

- Page Setup dialog. Allows the user to specify the format of the document to be printed.
- Print dialog. Allows the user to specify the parameters of a print job and to print a document on a specified printer.
- Simplified Print Dialog. Frees the user from the need to specify the parameters of a print job by providing the user with a set of printing presets.
- Print Center. Allows the user to locate, select, and configure available printers, and to determine the status of print jobs associated with each printer.

The printing system's user interface includes a number of important improvements in both ease-of-use and stability relative to the Mac OS 8 and 9 printing model. The Mac OS 8 and 9 Chooser is replaced in Mac OS X by Print Center, which combines many of the features of the Chooser and desktop printing into a single, integrated interface. Print Center is an application separate from the Finder, which eliminates the need for the Finder to support the printing interface and improves system stability. Mac OS 8 and 9 desktop printers are eliminated; users now organize their printer selections in lists. The Page Setup and Print dialogs are standardized for all printers and are easily extensible to allow for third-party customization.

The Page Setup Dialog

The Page Setup dialog appears when the user chooses Page Setup from the File menu. The printing system provides a standard Page Setup dialog for all printers, but application developers can customize the dialog by writing a printing dialog extension. (See *Extending Printing Dialogs* for information on creating a custom dialog.) The standard Page Setup dialog in Mac OS X has two panes—Page Attributes and Summary. [Figure 1-1](#) (page 10) shows the Page Attributes pane and [Figure 1-3](#) (page 11) shows the Summary pane.

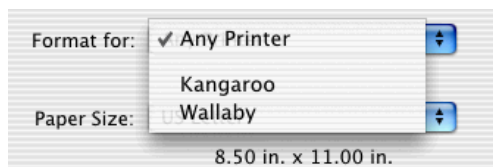
Figure 1-1 The Page Attributes pane in the Page Setup dialog

The **Page Attributes pane** displays page format options—paper size, paper orientation, and scaling. The printing system uses these settings to calculate the imageable area to which the application can draw a page. The available paper sizes are determined by the printer that’s selected in the “Format for” pop-up menu.

Note: The Page Setup dialog in Figure 1-1 and Figure 1-3 is shown as a sheet. A **sheet** is a modal dialog attached to a specific document or window, ensuring that the user never loses track of the window to which the dialog applies. The ability to keep a dialog attached to its pertinent window enables users to take full advantage of the Mac OS X window layering model. In Mac OS X, document-modal dialogs should always be displayed as sheets. Although sheets are available only in Mac OS X, it is possible to write a Carbon application that displays a printing dialog as a sheet in Mac OS X and as a modal dialog in Mac OS 8 and 9. The sample code in *Supporting Printing in Your Carbon Application* shows how to do this.

The “Format for” pop-up menu (shown in Figure 1-2 (page 10)) specifies the **formatting printer**. The formatting printer supplies the paper sizes from which the user can choose and provides the printing system with the page rectangle associated with each paper size.

It’s important to keep in mind that the formatting printer does not specify the **destination printer**—that is, the printer to which the document is printed. The destination printer is specified in the Print dialog, which by default is the default printer in Print Center. The user can change the destination printer in the Print dialog, but changing the formatting printer in the Page Setup dialog does not change the destination printer.

Figure 1-2 Printers in the “Format for” pop-up menu

The default formatting printer is Any Printer—a generic printer. The “Format for” pop-up menu also includes the names of all printers the user has added to Print Center. (You’ll find out more about adding printers in “Print Center” (page 19).) Figure 1-2 shows two specific printers named Kangaroo and Wallaby in addition to the generic Any Printer.

The default formatting printer, Any Printer, provides standard paper sizes with margins set to ensure that the imageable area for each paper size is well within the area to which most printers can print. Any Printer is the best choice as the formatting printer for a document that may be printed to different printers.

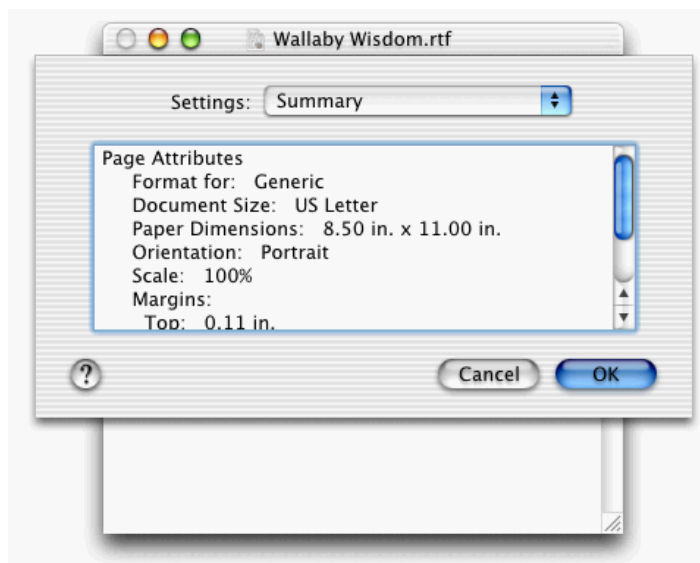
A specific printer should be chosen as the formatting printer only when the document must use the imageable area defined by a specific printer or to select sheet sizes that are not available for the default Any Printer. For example, choosing a specific printer is necessary when a document must be printed to a printer that prints to the edge of a sheet or to a custom paper size.

If the user changes the formatting printer, the printing system attempts to match the paper size shown in the Paper Size menu to a paper size provided by the newly chosen formatting printer using these rules:

- The printing system looks for a matching paper size. For example, if US Letter is shown in the pop-up menu, the printing system looks for paper sizes of 8.5 by 11 inches.
- If there is more than one matching paper size, the printing system chooses the matching paper size whose page rectangle matches most closely.
- If there are no matching paper sizes, the printing system adds the current paper size to the Paper Size pop-up menu as an item named Other.

The **Summary pane** of the Page Setup dialog (shown in Figure 1-3) provides a textual list of all of the currently selected page setup options. For example, the Summary pane in the Figure 1-3 shows information for US Letter paper with dimensions 8.5 by 11 inches, portrait orientation, and 100% scaling. The pane also shows the margins that enclose the **imageable area**—that part of the image the printer can draw without the image being clipped.

Figure 1-3 The Summary pane in the Page Setup dialog



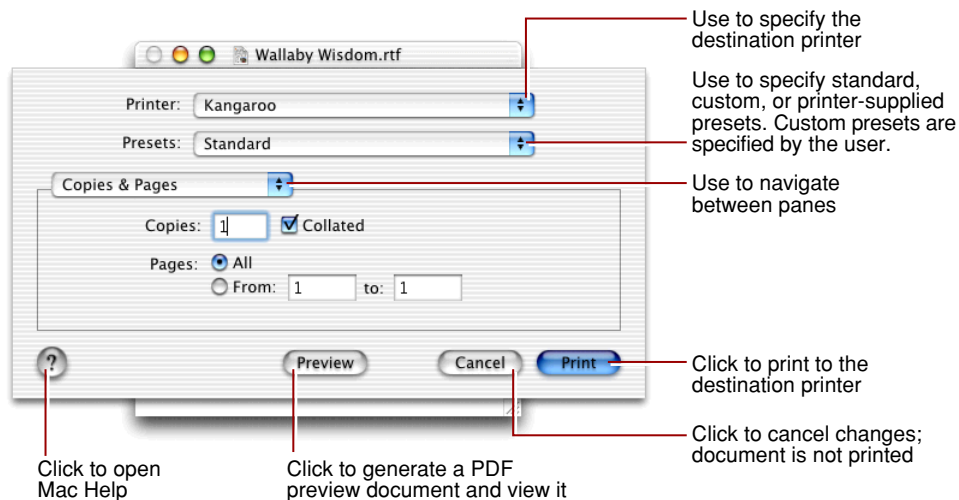
The Print Dialog

The Print dialog appears when the user chooses Print from the File menu. The Print dialog has several Apple-provided panes and can be extended to allow for third-party customization. The number of panes the user sees in the Print dialog and the specific information in each pane vary depending on the specific printer model, whether the printer supports PostScript, and whether there is any developer customization of the Print dialog. The panes can be categorized as follows:

- Panes for standard printing features. Apple provides five panes that are available for all printers in Mac OS X—Copies & Pages, Layout, Output Options, Duplex (only for printers with this feature), and Summary. These panes display the features available for any print job and are independent of the application and printer driver.
- Panes for PostScript printers. Apple's PostScript printer driver provides three panes for PostScript printers—Paper Feed, Error Handling, and Printer Features.
- Custom panes. Application and printer module developers can create custom panes for the Print dialog by writing a printing dialog extension.

The Print dialog has a number of items that are always available regardless of which pane is displayed. These items are called out in Figure 1-4. At the top of the dialog is the Printer pop-up menu. When the user first opens the Print dialog, the pop-up menu shows the default printer—the printer currently selected in Print Center. The Printer pop-up menu contains a list of all printers that have been added to Print Center. When the user chooses to print a document, the printer selected in the Printer pop-up menu is the destination printer.

Figure 1-4 The Print dialog (Copies & Pages pane)



The Presets pop-up menu may contain standard, printer-supplied, or user-defined presets. Presets specify a collection of settings in the various panes of the Print dialog.

The pane pop-up menu is set to Copies & Pages in Figure 1-4. This menu allows users to navigate from one pane to another in the Print dialog.

The four buttons at the bottom of the Print dialog—?, Preview, Cancel, and Print—also appear regardless of which pane is open. If the user clicks ?, the Help Viewer application opens to a printing help page in Mac Help. If the user clicks Preview, the printing system creates a PDF document of the print job and displays the PDF document. If the user clicks Cancel, changes made to the pane are ignored and the Print dialog closes. If the user clicks Print, the print job is sent to the destination printer. For the dialog shown in Figure 1-4, the destination printer is Kangaroo.

The rest of this section describes the Apple-provided panes. For information on writing custom panes see *Extending Printing Dialogs*.

Standard Panes for All Printers

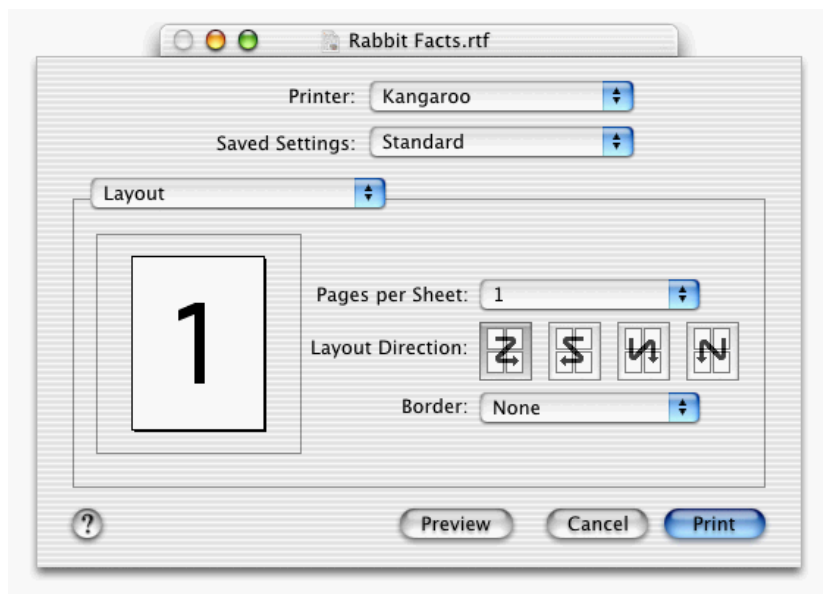
In Mac OS X, Apple provides the following panes for all printers. Each is described in this section.

- Copies & Pages
- Layout
- Output Options
- Duplex
- Summary

The **Copies & Pages** pane, shown in Figure 1-4 (page 12), lets the user set the number of copies and the range of pages to be printed. Users can specify whether copies should be collated.

The **Layout** pane shown in Figure 1-5 provides settings for the number of pages per sheet and the type of border on a page. For multiple pages per sheet, the user can also specify the layout direction—left to right then top to bottom, top to bottom then left to right, and so forth.

Figure 1-5 The Layout pane in the Print Dialog



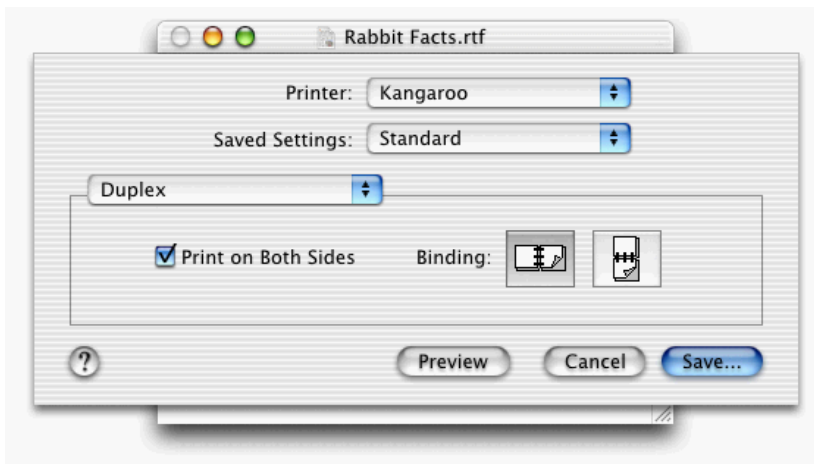
The **Output Options pane**, shown in Figure 1-6, is available for any printer and provides the option to save a print job as a PDF file or a PostScript file instead of sending it to a printer. The PostScript option is available only in Mac OS X version 10.1 and later, and only if the destination printer is a PostScript printer.

Figure 1-6 The Output Options pane in the Print dialog

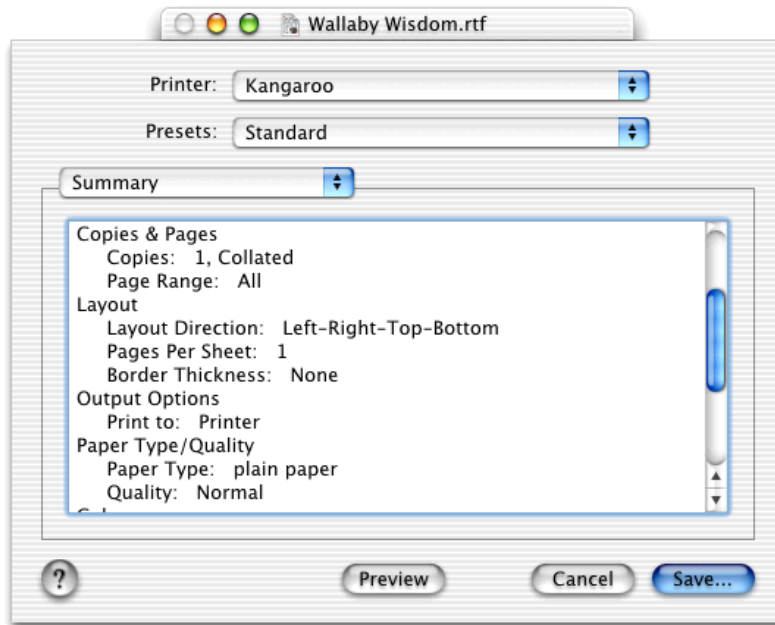


The **Duplex pane**, shown in Figure 1-7, is available only for printers that provide the option to print on both sides of a sheet. If duplex is available, users can specify a binding option. Binding determines whether the image on the second side of a sheet is flipped.

Figure 1-7 The Duplex pane in the Print dialog



The **Summary pane** in the Print dialog, shown in Figure 1-8, displays a list of the currently selected printing options along with information that could be useful for troubleshooting.

Figure 1-8 The Summary pane in the Print dialog

Standard Panes for PostScript Printers

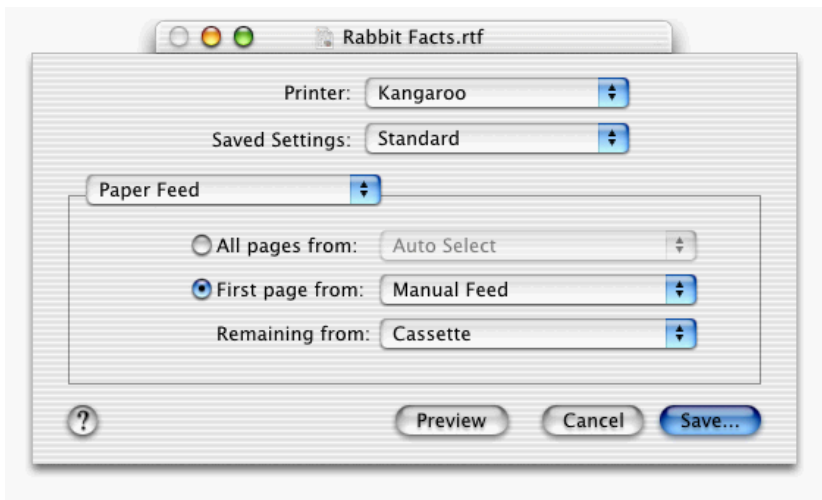
In Mac OS X, Apple provides the following panes for PostScript printers. Each is described in this section.

- Paper Feed
- Error Handling
- Printer Features

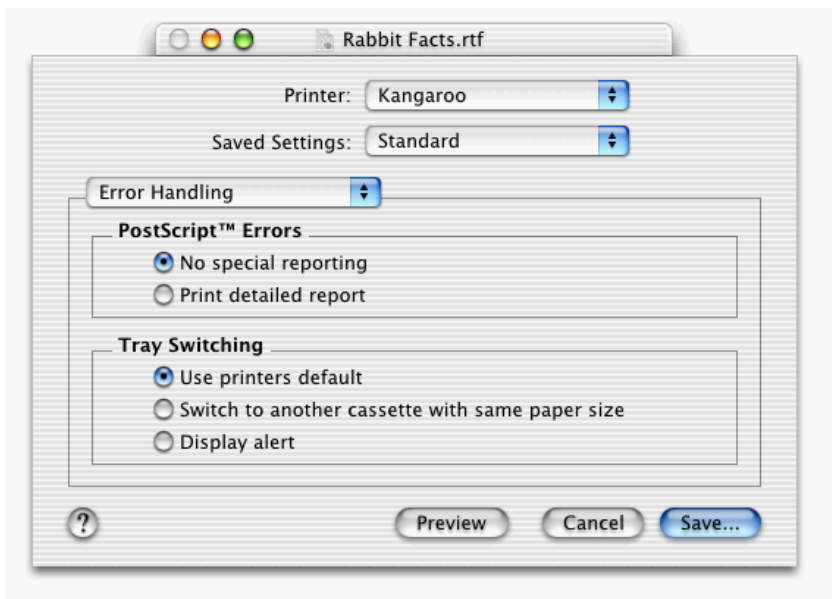
The printing system uses information from the PostScript printer description (PPD) file to populate many of the PostScript-specific features in these panes. (See *Using PostScript Printer Description Files* for more information on PPD files.)

Note: Printer module developers can create Paper Feed and Error Handling panes for non-PostScript printers by writing a printing dialog extension. If you choose to do so, you should create a user interface consistent with the user interface provided by Apple for the PostScript printer Paper Feed and Error Handling panes. For more information see *Extending Printing Dialogs*.

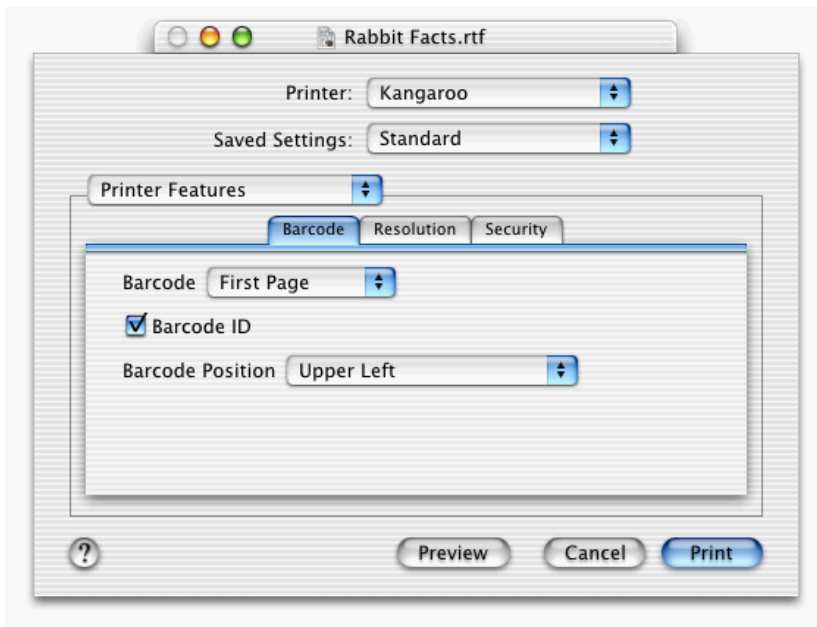
The **Paper Feed pane** is shown in Figure 1-9. Users who choose to print all pages from the same paper tray can either choose a specific paper tray or choose Auto Select. If the user chooses Auto Select, the printer selects a paper tray to match the paper size. Alternately, users can choose to print the first page from one paper tray and the remainder of the pages from another. For example, the user may want to print the first page on cover stock that's loaded in one tray and the remaining pages on standard paper that's loaded in a different tray.

Figure 1-9 The Paper Feed pane in the Print dialog

The **Error Handling pane**, shown in Figure 1-10, lets the user specify the actions to take when certain errors occur. One setting determines how PostScript errors are handled and the other specifies to which tray to switch when the selected paper tray is empty.

Figure 1-10 The Error Handling pane in the Print dialog

The **Printer Features pane** contains any user interface feature specified in a PostScript printer description (PPD) file that isn't a feature in the standard panes described previously or in a custom pane, as long as the feature is defined in the manner specified in *Using PostScript Printer Description Files*. A sample pane is shown in Figure 1-11 (page 17).

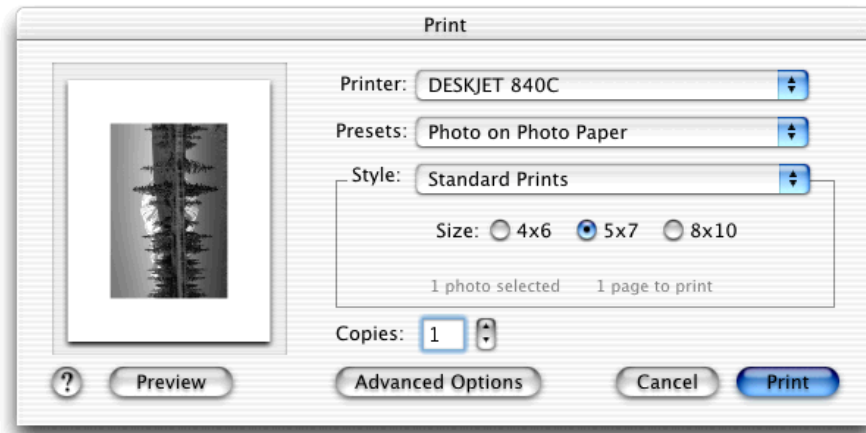
Figure 1-11 A sample Printer Features pane

The Mac OS X printing system constructs the Printer Features pane using a number of rules for organizing and laying out the pane. For example, features are organized within the Printer Features pane under tabs, as shown in Figure 1-11. Tabs are labeled sequentially as Features 1, Features 2, and so forth, unless the PPD file defines the features in groups. Then, the tabs are labeled with the group name. The features in Figure 1-11 are defined in the PPD file in three groups—Barcode, Resolution, and Security. See *Using PostScript Printer Description Files* for a complete list of the rules used by the printing system to construct the Printer Features pane.

The Simplified Print Dialog

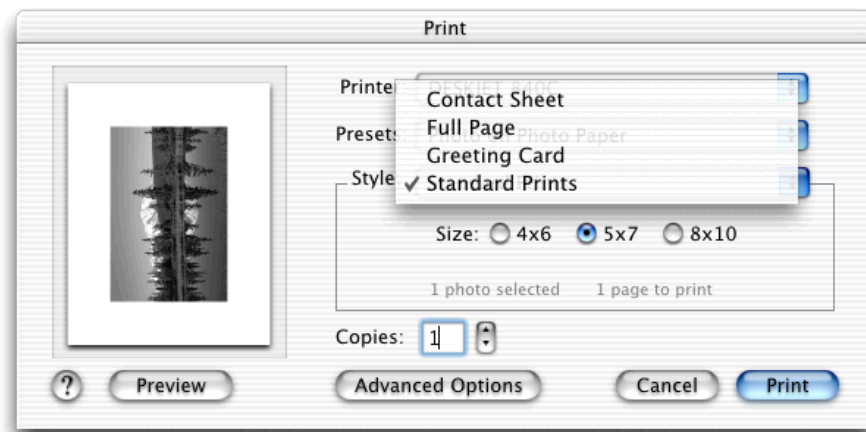
A simplified version of the Print dialog, shown in Figure 1-12, was introduced in Apple's iPhoto application. The simplified Print dialog reduces the need for users to navigate to different panes in the Print dialog to make settings for paper type, resolution, and so forth. When the user chooses an option in the Presets menu, the print settings associated with that preset are set automatically. If more advanced settings are needed, the user can access the standard Print dialog by clicking the Advanced Options button in the simplified Print dialog.

Figure 1-12 The simplified Print dialog



In addition to choosing presets, users can also use the simplified Print dialog to choose a printer and set the number of copies. The Style pop-up menu and settings shown in Figure 1-13 are application-specific. The Style choices provided by the iPhoto application determine the layout and orientation of images. The Style settings below the Style pop-up menu change depending on the menu item chosen by the user. The Style box in Figure 1-13 shows sizes for standard prints because the Standard Prints option is selected in the Style pop-up menu.

Figure 1-13 The Style pop-up menu



The Presets menu in Figure 1-14 shows some common options for printing photographs. Options in the Presets menu are populated from entries in a printing presets file provided for a specific printer module. Apple supplies presets files for a number of printer modules. Developers can supply printing presets files for their printer modules even if Apple has already provided presets files for them. A developer-supplied presets file takes precedence over an Apple-supplied presets file for the same printer. *Creating Printing Presets for iPhoto* provides printer vendors with details on creating and installing a presets file for a printer module.

Figure 1-14 Some common presets for printing photographs

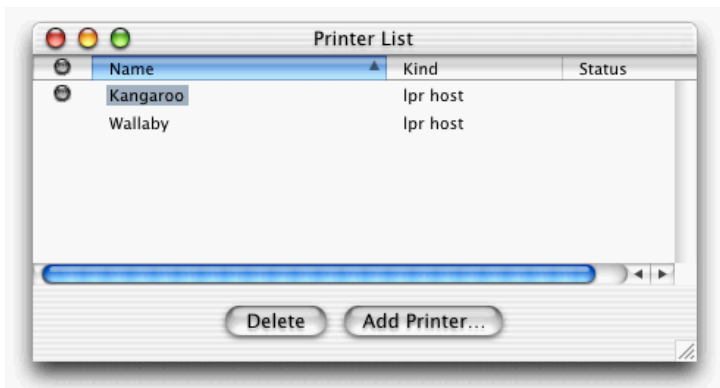
Print Center

Print Center is an application that allows the user to locate and select printers, as well as control and obtain status for print jobs. It is the main user interface for printing once the application completes its drawing process for the job. This section discusses Print Center in detail and covers the following topics:

- opening Print Center
- adding printers to Print Center
- managing print jobs
- viewing printing status

Opening Print Center

The Print Center application icon appears in the Dock. (The application is located in `/Applications/Utilities/`.) Although users may open Print Center from the Dock, they can also open Print Center by choosing `Edit Printer List` from the Printer pop-up menu in the Print dialog. When the user opens Print Center, the Printer List dialog shown in [Figure 1-15](#) (page 20) appears. Users can click `Add Printer` if they want to use a printer other than those listed in the Printer List dialog.

Figure 1-15 The Printer List window in Print Center

A gray button to the left of a printer name indicates that the printer is the default printer. In Figure 1-15 Kangaroo is the default printer. A user can change the default printer by clicking a printer name, then choosing Make Default from the Printers menu.

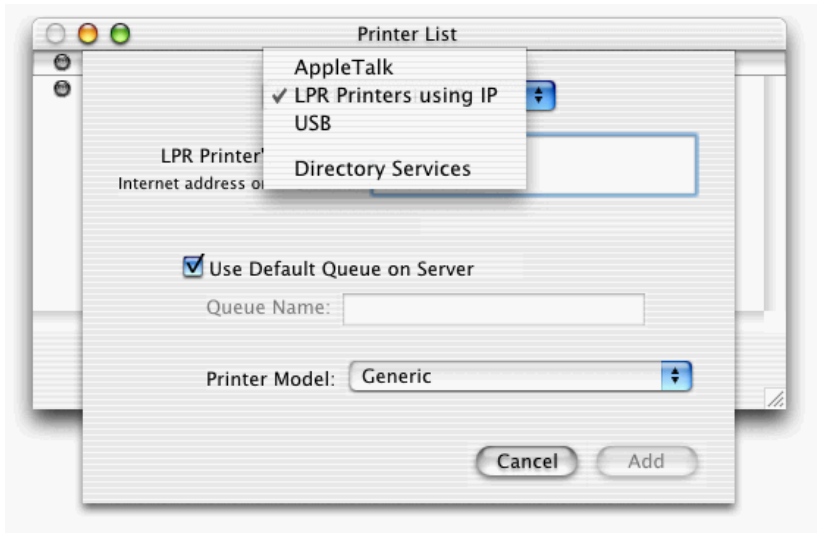
Adding a Printer

Clicking Add Printer in the Printer List window opens the sheet shown in Figure 1-16 (page 21). To add a printer, the user must first choose a connection type—AppleTalk, LPR, USB, and so forth. When the user chooses a connection type other than LPR, Print Center displays a list of available printers for the connection type.

When the user double-clicks a printer to add it to the list of printers, Print Center gets the selected printer address, icon, and printer model information from the printer browser module. Print Center then uses this information to create a new printer queue and add the printer to the list.

To add an LPR printer that uses IP, the user must enter the printer's DNS host name or IP address and should select the appropriate model from the Printer Model pop-up menu. The user can optionally provide a queue name for an LPR printer.

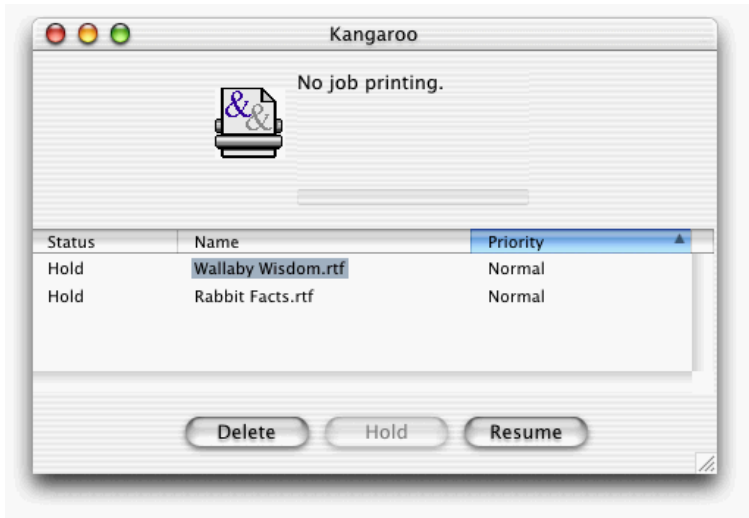
The Generic printer model shown in the pop-up menu in Figure 1-16 is the default choice for LPR printers. It's best for users to choose a specific printer model from the menu rather than Generic because printer-specific features are not available in the Print dialog when Generic is selected.

Figure 1-16 List of connection types in Print Center

Unlike LPR printers, which have a unidirectional interface, AppleTalk and USB printers can respond to queries from the printing system. For AppleTalk and USB printers, users can choose Auto Select from the Printer Model pop-up menu. Auto Select causes the printing system to query the printer for its model information. The printing system uses the model information to find a matching PostScript printer description file for the appropriate localization. This ensures that printer-specific features are available in the Print dialog.

Managing Print Jobs

A user can look at and manipulate the print jobs for a printer by opening Print Center and double-clicking the printer name in the Printer List window. A window that lists the jobs assigned to the printer opens, similar to what's shown in [Figure 1-17](#) (page 22). A user can hold or delete a job or resume a job that's currently on hold, as long as it's a job created by the user. The printer's queue can be stopped temporarily by choosing Stop Queue from the Queue menu. Note that this stops printing only from the printer queue created on the user's computer.

Figure 1-17 A list of print jobs for a printer named Kangaroo

Viewing Status Information

When an application prints, the printing system creates a print job and sends it to a printer queue. When the print job reaches the queue, the Print Center icon appears in the Dock. The Print Center icon animates to show status and error information. Figure 1-18 shows two states of the Print Center icon. The icon on the left displays the number of the page that is currently being printed. The icon on the right indicates an error. The user can click the Print Center icon to obtain more information about the error or the status of a print job.

Figure 1-18 The Print Center icon in two different states

Mac OS X Printing Architecture

The Mac OS X printing architecture consists of a number of modules that work together to

- Present all printing user-interface elements
- Accept raw drawing commands from applications and spool the data to be printed
- Render print jobs to the destination printer

Each component of the printing architecture is designed to do a particular printing task. For example, a printer browser looks for available printers of a specific type (LPR, AppleTalk, USB, and so forth) while Print Center provides the user interface through which the user can choose printers and monitor printer activity. This specialization makes it possible for parts of the printing system to achieve new functionality or be extended by Apple in the future. Some components can be extended by developers. (See [“Developing Software”](#) (page 29) for more information.)

Developers can leverage existing components and concentrate their coding efforts on specific needs. For example, printer vendors need only to write code that specifies the data format needed by the printer, processes the converted data, and handles printer status and error conditions. Developers use an Apple-provided converter to provide data in their specified format and an Apple-provided I/O module to communicate the data to the printer. Leveraging the existing converter and I/O modules makes writing a printer module easier than writing a printer driver for Mac OS 8 and 9.

The rest of this chapter describes the Mac OS X printing architecture in detail and provides an overview on how information about a print job is tracked by the printing system. When you have read this chapter, you should see [“Developing Software”](#) (page 29) for resources to get you started developing software for the printing system.

Printing Architecture Components

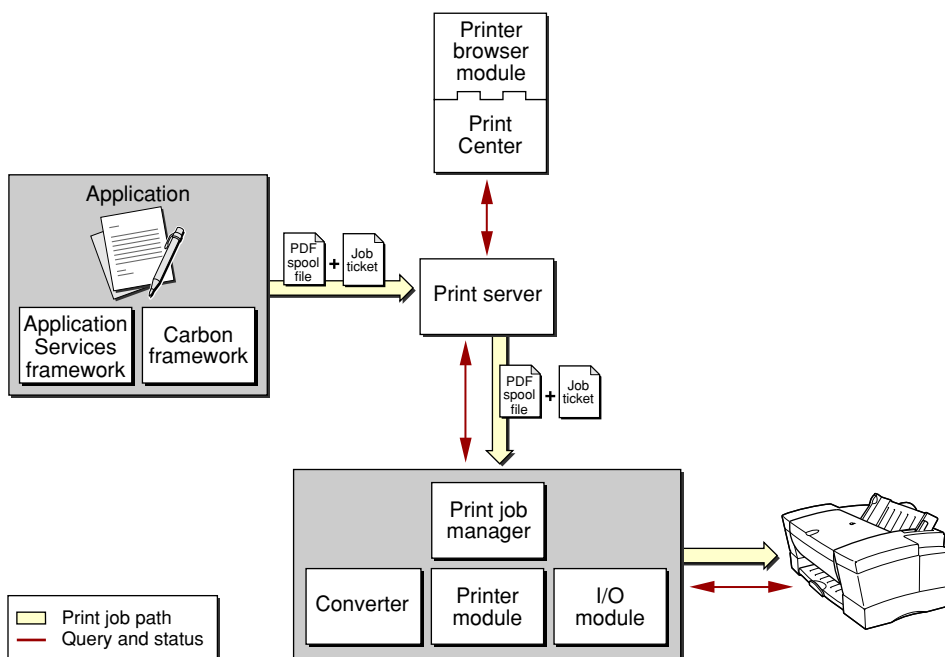
The Mac OS X printing architecture is shown in [Figure 2-1](#) (page 24). Conceptually, the components of the printing architecture can be divided into three categories: application, server, and printer.

- Application components are the Application Services and Carbon frameworks. These define the base printing application programming interface (API). Cocoa sits on top of the base API; Cocoa methods call through to the printing API defined in the Application Services and Carbon frameworks.
- Server components include the print server, the Print Center application, and printer browser modules. The print server holds print jobs until they can be printed. Print Center provides the user interface to the print server, and printer browser modules discover printers that can be added to Print Center.
- Printer components consist of four modules that work together to prepare and communicate a print job to a specific printer—print job manager, converter, printer module, and I/O module.

Note: A **print job** consists of the drawing commands that describe a document and the settings that control and track the printing of a document once a print job has been added to a printer's queue. A print job starts as a series of drawing commands from an application, then is converted by the printing system to a portable document format (PDF) spool file and a job ticket. A **spool file** is a temporary disk file used to store the document's drawing as it travels through the printing system to the printer.

Each component is discussed in more detail in the sections that follow.

Figure 2-1 Mac OS X printing architecture



Application Components

In Mac OS X, the printing application programming interface has two parts—the Application Services framework and the Carbon framework. Carbon applications need to link to one or both of these frameworks to call the functions available in the printing API. Cocoa applications need to link to the Application Kit, which in turn links to the appropriate printing frameworks.

Note: If you are developing a BSD UNIX command-line tool that does not require a user interface, you need only to link to the Application Services framework as the Carbon framework contains only those functions related to displaying and handling printing user-interface elements.

Applications draw each page of the document to be printed and provide the printing system with all page format and print settings for the print job. The printing system can receive drawing commands from an application in several ways. Cocoa applications use the Cocoa drawing routines. Carbon applications commonly use QuickDraw but can use Quartz 2D if they want to take full advantage of Mac OS X's graphics capabilities.)

The printing system creates a spool file from the drawing done by the application. Portable document format (PDF) is the standard spool file format, but PICT with PostScript is supported for backward compatibility with those applications that must generate their own PostScript when printing to PostScript printers.

Server Components

The server components consists of the print server, the Print Center application, and printer browser modules. The print server accepts print jobs from applications and holds each print job in a queue until the specified printer is available to print the job. The Print Center application is the user interface to the print server, and can be used to view and manage print jobs in the printer queue. Print Center also reports status, including errors, should any occur. Printer browser modules look for available network and local printers, then provide the list of available printers to Print Center for display to the user. See [“Print Center”](#) (page 19) for detailed information on adding printers and managing print jobs.

Printer Components

Four modules work together to prepare and communicate a print job to a specific printer—print job manager, converter, printer module, and I/O module. The print job manager accepts print jobs from the print server and then mediates among the three other modules (converter, printer module, and I/O module) to get the job printed on a specific printer.

A converter is an optional module that converts a document description from one document format to another. The print job manager determines how to convert the data properly for the chosen printer and configures the converter appropriately. A converter also retrieves the correct color profiles for standard ColorSync color matching during the rendering or conversion of the print data. In general, a converter takes PDF data and converts it to another output format such as raster or PostScript.

Printer modules (the analogues to printer drivers in Mac OS 8 and 9) are typically created by printer vendors to support a particular printer or printer family. The printer module determines, at runtime, the type of data it needs to produce the correct output on the printer. It communicates its needs to the print job manager, which uses the necessary converters to get the print data in the correct format. The printer module finishes processing the converted print data before it goes to the printer and also handles printer status and error conditions.

An I/O module provides a way to communicate with printers using a standard interface for a transport type. The module establishes a connection with a device, sends print data and commands to the device, receives status information from the device, and closes the connection at the appropriate time. I/O modules have limited or no knowledge of data formats, control commands, or printer capabilities. The modules simply pass through data.

Apple supplies I/O modules for LPR, USB, and AppleTalk. For those I/O types, printer vendors should use Apple’s I/O modules to communicate with their devices rather than develop new ones. (See [“Supporting Printers”](#) (page 31) for more information on developing I/O modules.)

Communicating Print Job Information

There are two types of containers used to communicate information related to a print job—printing objects and printing tickets. Printing objects are used by applications; printing tickets are used by the printing system and printing plug-ins (such as a printer module or printing dialog extension).

Printing objects are opaque data structures used by applications to hold information about a print job. The two primary printing objects are the page format and print settings objects. The **page format object** stores information about how pages of a document should be formatted, such as paper size and orientation. The **print settings object** stores information from the Print dialog, such as page range and number of copies as well as other information about how the job should be printed on the destination printer. The printing system instantiates each object with default settings provided by the default formatting printer (for the page format object) and the default printer (for the print settings object).

The application uses accessor functions from the printing application programming interface to obtain and set values in these objects. The Page Setup and Print dialogs display information from these objects to the user. When the user modifies a setting in a printing dialog, the printing system writes the modified value to the appropriate object.

Tickets are opaque data structures used by the printing system, printer modules, and printing dialog extensions to communicate information about a print job. Applications do not, and should not, use tickets directly. The printing objects used by applications provide a view of the ticket data that shows only those items essential to the application.

You can skip the rest of this chapter if you are an application developer and you do not plan to write a printing dialog extension. You should read the rest of this chapter if

- you plan to write a printing dialog extension for your application
- you are a printer vendor

Tickets

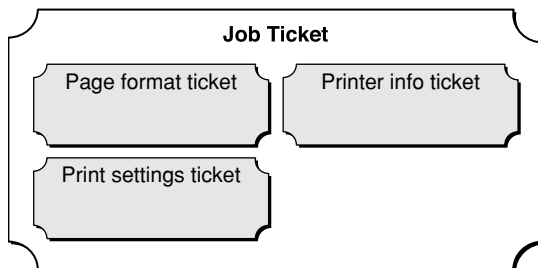
Tickets contain a number of individually accessible items that describe how to print a print job. Tickets do not contain the actual document data that is to be printed; the document data is in the spool file. Tickets created for a print job record various settings as the job progresses through the printing system. There are a variety of tickets used by the printing system, including the following:

- job
- page format
- print settings
- printer info
- converter setup
- paper info
- list

Note: Although each ticket is named for the kind of information it contains, all tickets are of the same data type—`PMTicketRef`.

A **job ticket** refers to the top-level ticket used for a print job. Although the job ticket may contain high-level information about the print job, the job ticket's primary content consists of other tickets. Figure 2-2 shows a job ticket that contains page format, print settings, and printer info tickets. (The job ticket, like all tickets, is an opaque object. It may contain references to other tickets and not the actual ticket objects.)

Figure 2-2 A job ticket that contains page format, printer info, and print settings tickets



The **page format ticket** describes the application's drawing environment, including its resolution, scaling, orientation, paper size, and page size. The page format object used by an application is the analogue to the page format ticket. Page format data is typically saved by applications with the user's document.

The **print settings ticket** contains the user's Print dialog selections and any items set by the application to further refine the output produced on the printer. The print settings object used by an application is the analogue to the print settings ticket.

The **printer info ticket** is created by the printer module to describe features and settings of the destination printer. Information in this ticket is used by the printer module and the printing dialog extension associated with the printer module. The printer info ticket also describes the printer to the rest of the printing system. It includes such data as the printer's name, color capability, native resolution, and all other device-specific features.

Note: Once it has been created by the printer module, nothing can modify the printer info ticket. It is a ticket of fixed values, unaffected by user action, and indicates the printer's capability, not its current state.

The **converter setup ticket** is used to convey control information from the printer module to the print job manager (which may add information to the ticket) and then to the converter. The converter setup ticket is constructed by the printer module to control the functioning of the converter and can set such things as resolution, band size, and pixel format. For example the printer module uses the converter setup ticket to configure the converter to generate raster data at a particular bit depth for a specified color space.

The **paper info ticket** contains a complete description for a single paper—Letter, Legal, A4, B5, and so forth—available from the printer module. The paper info ticket describes the paper sheet size and printable page area available to an application.

A **list ticket** contains a list of other tickets along with key-value pairs relevant to the list. Any type of ticket can be stored in the list. A list ticket is particularly handy to group paper info tickets. For example, if you are writing a printer module, you must add a list ticket to the printer info ticket to specify the paper sizes supported by your printer.

About the Data in Tickets

Data are always stored in tickets as key-value pairs using Core Foundation (CF) data types. Apple defines keys for the most common printing options and will likely add more keys in the future. Developers can define their own custom keys for those options not already defined in the application programming interface, but should do so only after checking the options defined by Apple's keys. See *Ticket Services Reference* for a list of the current keys.

Ticket values can be any of the following Core Foundation data types:

- CFArray
- CFBoolean
- CFData
- CFDate
- CFDictionary
- CFNumber
- CFString

Developing Software

There are a number of ways the Mac OS X printing system can be used by your application or extended with software you create. Carbon, Cocoa, and BSD UNIX developers can add printing support to their applications. Carbon and Cocoa developers can add application-specific features to the Page Setup or Print dialog. Printer vendors can write printer modules to support their printers. They can also provide custom panes for the Print dialog to support printer-specific features. This chapter provides information on how to get started developing software that uses the Mac OS X printing system.

Supporting Printing in an Application

The Mac OS X printing system provides a collection of system software functions that you can use to print to any type of supported printer from Carbon, Cocoa, and BSD UNIX applications. This section provides information on what you need to do for each type of application to support printing.

The Carbon Printing Manager, by definition, consists of these header files:

- `PMApplication.h`
- `PMCore.h`
- `PMDefinitions.h`

The header files are split between the Application Services and Carbon frameworks, and contain the functions and data types that support printing from an application, regardless of development environment (Carbon, Cocoa, or BSD UNIX). How your application accesses the Carbon Printing Manager depends on the development environment.

Carbon applications typically use functions and data types from all three header files, so these applications need to link to the Application Services and Carbon frameworks. Carbon applications can print in Mac OS 8 and 9 with existing printer drivers and in Mac OS X with new printer drivers. If you want to develop an application that can print in Mac OS 9 as well as Mac OS X, it must be a CFM application and you need to link to CarbonLib version 1.1 or later. CarbonLib is the Mac OS 9 extension that contains the Carbon Printing Manager API.

Before you implement printing in a Carbon application you should consult these documents:

- *Supporting Printing in Your Carbon Application*
- *Carbon Printing Manager Reference*

After you install the Mac OS X Developer Tools CD, you can find sample code in this directory:

```
/Developers/Examples/Printing/App/
```

Cocoa applications use Cocoa objects and methods to support printing. Cocoa application link to the Application Kit which calls through to the Carbon Printing Manager. If you develop a Cocoa application, you can also call Carbon Printing Manager functions directly.

Cocoa developers can consult these documents for more information

- *Printing Programming Topics for Cocoa*
- *Carbon Printing Manager Reference*, if you plan to call this API directly.

After you install the Mac OS X Developer Tools CD, you can find sample code in this directory:

```
/Developers/Examples/AppKit/TextEdit/
```

Faceless BSD UNIX applications use functions and data types from `PMCore.h` and `PMDefinitions.h`, which are part of the Application Services framework, so this is the framework to which you need to link. BSD UNIX applications do not need the printing functions from the Carbon framework, as these functions support the printing dialog interface.

BSD UNIX developers can consult *Carbon Printing Manager Reference* for documentation on the functions and data types in `PMCore.h` and `PMDefinitions.h`.

Extending Printing Dialogs

In Mac OS X, Apple supplies Print and Page Setup dialogs that can be displayed to the user from Carbon and Cocoa applications. The panes in these dialogs contain the most common features needed by printers and applications, eliminating the need for most developers to provide printing dialogs.

You may need to write a printing dialog extension if you are a printer vendor and your printer provides features not supported in the Apple-provided Print dialog. Application developers may also need to support application features that are not supported in the Apple-provided Page Setup and Print dialogs.

Carbon application developers can extend a Print or Page Setup dialog by writing a printing dialog extension. For more information see these documents:

- *Extending Printing Dialogs*
- *Printing Plug-in Interfaces Reference*
- *Ticket Services Reference*

Cocoa application developers can extend a Print or Page Setup dialog by providing a custom view and using the `setAccessoryView:` method. For more information on adding an accessory view to a printing dialog, see *Printing Programming Topics for Cocoa*.

Printer vendors can extend the Print dialog by writing a printing dialog extension so the dialog supports printer-specific features when your printer is selected by the user. The custom pane you supply is displayed in the Print dialog regardless of whether the calling application is developed using Cocoa or Carbon. For more information see these documents

- *Extending Printing Dialogs*
- *Printing Plug-in Interfaces Reference*

- *Ticket Services Reference*

Supporting Printers

Printer vendors must supply a printer module for each printer or family of printers they want to support in Mac OS X. Printer modules replace the printer drivers used in Mac OS 8 and 9. A printer module is easier to write than a Mac OS 8 and 9 printer driver. A printer module does not need to take care of spooling or imaging. It needs only to receive data passed to it, in the format specified by the printer module, send the data to the printer using an I/O module, and handle any errors generated by the printer.

If you need to write a printer module, you should contact Apple Developer Technical Support and see these documents:

- *Printing Plug-in Interfaces Reference*
- *Ticket Services Reference*

After you install the Mac OS X Developer Tools CD, you can find sample code in this directory:

```
/Developer/Examples/Printing/Printer/
```

It is possible for developers to write two other types of plug-ins that are used by the printing system—I/O modules and printer browser modules. An I/O module implements support for a printer's transport type. Apple supplies a number of I/O modules for developers to use, so you typically do not need to write an I/O module. A printer browser module extends the Print Center application by adding support for users to set up printers that use printer connection methods such as USB and AppleTalk. Apple supplies printer browser modules that support USB, AppleTalk, and Directory Services, so in most cases you should not need to write a printer browser.

If you think you do need to write an I/O module or printer browser, you should contact Apple Developer Technical Support for more information. Before you write any code, check to see if Apple plans to revise an existing module or create a new one that addresses your needs. You should also plan to obsolete any custom module you create in the case that Apple revises its modules to meet your needs.

Document Revision History

This table describes the changes to *Mac OS X Printing System Overview*.

Date	Notes
2006-02-07	Added cross references to related documentation and changed the title from "About the Mac OS X Printing System."
2002-12-11	Updated formatting.
2002-03-01	First version of this document. The information in this document replaces information about the printing system that was published previously in <i>Inside Mac OS X: System Overview</i> .

REVISION HISTORY

Document Revision History

Glossary

band A horizontal strip from an image. For raster printing, the image corresponding to the page raster is broken into strips of manageable size.

Carbon Printing Manager A collection of system software routines that can be used by a Carbon application. It replaces the Mac OS 8 and 9 [Printing Manager](#).

context A pointer to a custom data structure that contains state information shared among the functions in a printing dialog extension.

converter A module used by the printing system to convert a document description from one document format to another.

Copies & Pages pane A pane in the Print dialog that lets the user set the number of copies and the range of pages to be printed.

current printer The printer displayed in the Printer pop-up menu when the user opens the Print dialog. In Mac OS X, it is the printer that is currently selected in Print Center. In Mac OS 9, it is the printer that is currently selected in the Chooser.

destination printer The printer to which a print job is sent. This is the printer displayed in the Printer pop-up menu when the user clicks Print in the Print dialog.

dialog A window designed to elicit a response from the user.

dpi Dots per inch in the x and y directions; used to measure the resolution of a screen or printer. The higher the value, the finer the detail of the image.

Duplex pane A pane in the Print dialog (available for some printers) that provides the option to print to both sides of a sheet of paper.

Error Handling pane A pane in the Print dialog that lets the user specify the actions to take when certain errors occur.

factory A function in a printing plug-in that returns a pointer to an instance of the requested [interface](#).

formatting printer The printer displayed in the “Format for” pop-up menu in the Page Setup dialog. The default formatting printer is the generic Any Printer. The printing system provides default page and paper sizes for this printer.

graphics port A drawing environment defined by a `GrafPort` record for QuickDraw or a `CGContextRef` for Quartz 2D. The drawing environment contains all the information needed to translate drawing operations from bits in memory to the appropriate destination format (onscreen pixels, PDF, PostScript).

instance A data structure used to provide access to a programming interface at runtime. An instance consists of a pointer to the interface function table, and private data that defines the current state of the instance.

interface The calling conventions by which a client accesses a service. An interface provides a level of abstraction that hides the implementation details of the service from the client.

imageable area The part of the paper to which the printer can draw without the image being clipped.

I/O module A module used by the printing system to provide a way to communicate with a printer using a standard interface for a transport type.

job ticket The top-level ticket used for a print job. See also [ticket](#).

keywords In a PostScript printer description file, keywords are used to describe a printer. Main keywords describe a printer's features, such as page size (`*PageSize`) and font (`*Font`). Option keywords describe the options associated with a feature, such as `Letter` and `Legal` for `*PageSize`.

localization The process by which a user interface is adapted to meet the language, cultural and other requirements of a specific geopolitical place or area.

Layout pane A pane in the Print dialog that lets the user set the number of pages per sheet and the type of border on a page.

op code In the old Printing Manager, a value passed to a function that determines how the function should operate. These are not used in the Carbon Printing Manager. Accessor functions are used instead.

Output Options pane A pane in the Print dialog that provides an option to save a print job as a file.

Page Attributes pane A pane in the Page Setup dialog that allows the user to set page format options—paper size, paper orientation, and scaling.

page format object An opaque data type used by the printing system to store information from the Page Setup dialog, such as paper size and orientation.

page formatting A description of how the pages of a document should be printed; page formatting includes such information as page and paper sizes.

page rectangle The rectangle marking the boundaries of the printable area on a page. The upper-left corner of the page rectangle always has the coordinates (0,0). The coordinates of the lower-right corner define the rectangle for the maximum imageable area attainable on the given printer; these coordinates are specified by the units used to express the resolution of the printing graphics port. For example, the lower-right corner of a page rectangle used by the PostScript LaserWriter printer driver for an 8.5- by 11- inch U.S. letter page is (552, 730) at 72 dpi.

Page Setup dialog A dialog—usually displayed by an application in response to the user choosing the Page Setup command—that allows the user to specify

the printing options (such as the paper size and the printing orientation) used by an application to format a document.

pane A named user interface, displayed inside a dialog window, that represents the settings for a group of closely related features.

Paper Feed pane A pane in the Print dialog that lets the user specify the printer trays from which a print job should be printed.

paper rectangle The rectangle that describes the size of a piece of paper on which a page is printed. This rectangle is defined in the same coordinate system as the [page rectangle](#). Thus, the upper-left coordinates of the paper rectangle are typically negative and its lower-right coordinates are greater than those of the page rectangle.

PDF Portable document format. For more information see *PDF Reference*, available from the Adobe website: <http://partners.adobe.com/>

picture comment A command or data used for special processing by output devices, such as printer drivers. Picture comments are usually stored in the definition of a picture or are included in the drawing an application does when printing.

PostScript printer description (PPD) file A text file, created by a printer vendor, that contains keywords and other information to specify features, options, and settings for a specific printer.

Print Center An application that allows users to locate and select printers, and control and obtain status for print jobs.

Print dialog A dialog—usually displayed by an application in response to the user choosing the Print command—that solicits printing information from the user, such as the number of copies to print and the range of pages to print.

print job The drawing commands that describe a document and the settings that control printing the document and keep track of it once the job has been added to a printer's queue.

print loop The sequence of function calls that set up and execute the printing of a document in an application.

printer browser A module used to discover specific types of printers, such as USB or LPR printers.

Printer Features pane A pane in the Print dialog that contains any user interface feature specified in a PostScript printer description (PPD) file that isn't already a feature in Apple-provided panes or a developer's custom pane.

printer module A printing plug-in that renders the graphics content in a print job for output to a specific model or family of printers. Printer modules are created by printer vendors to support a particular printer or printer family.

printer queue A temporary holding area for print jobs waiting to be printed.

printing dialog A window provided by the printing system to elicit a response from the user. See [Page Setup dialog](#); [Print dialog](#).

printing dialog extension A printing plug-in that implements one or more panes in a printing dialog.

Printing Manager A collection of system software routines that can be used by a Classic application to print from the Macintosh computer to any type of connected printer. This has been replaced by the [Carbon Printing Manager](#).

printing presets Printer-specific collections of settings for the Print dialog. Printing presets are provided by Apple or printer vendors to reduce the need for users to navigate to different panes in the Print dialog. Presets are defined for a specific printing task, such as printing a photo on glossy photo paper.

printing plug-in A stand-alone code module—packaged as a Core Foundation plug-in—that adds functionality to the Mac OS X printing system.

printing session object An opaque data type used by the printing system to store information that's needed by the page format and print settings objects, such as default page format and print settings values.

print settings Information that controls the execution of a print job on a specific printer; print settings include such information as the number of copies, number of pages per sheet, and print quality settings.

print settings object An opaque data type used by the printing system to store information from the Print dialog, such as number of copies, number of pages per sheet, and print quality.

resolution The degree of detail at which a device such as a printer or a screen can display an image. Resolution is usually specified in dots per inch, or [dpi](#), in the x and y directions. The higher the value, the finer the detail of the image.

sheet A dialog attached to a specific window, ensuring that the user never loses track of the window to which the dialog belongs.

spool file A temporary disk file used by an application to store data; generally used to save memory.

Summary pane A pane in the Page Setup and Print dialogs that provides a textual list of the currently selected options for that dialog.

sync In a printing dialog extension, a procedure that maintains the correspondence between the current user interface settings and their recorded values in a job ticket.

ticket An opaque data structure used by the printing system, printer modules, and printing dialog extensions to communicate information about a print job. Tickets are usually named for the type of information they contain, such as page format ticket and paper info ticket.

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