

CHAPTER 11

Printing

In Windows 95, several changes have been made to the way printing is handled to address requests from customers and independent software and hardware vendors.

The improvements focus on the following three major areas:

- **Better performance.** Windows 95 has a new 32-bit printing architecture that supports preemptive multitasking and improves overall performance.
- **Easier.** Improvements in the UI in Windows 95 make printing easier, and Plug and Play support makes installing new printers easier.
- **Better integration of network printing.** Windows 95 has extended the local printing architecture to the network environment and ties together installation enhancements to shared network printers.

This chapter describes the printing architecture used in Windows 95 and discusses the areas where printing is improved over Windows 3.1.

Summary of Improvements over Windows 3.1

The primary improvements in printing for Windows 95 are the following:

- A new 32-bit print subsystem modeled after the subsystem in Windows NT, providing smooth background printing
- Increased printing performance through the use of enhanced metafile (EMF) spooling, which decreases the time needed to return control to the application
- Support for over 800 different printer models (versus over 300 for Windows 3.1) through the development of new printer mini-drivers
- Support for PostScript Level II printers
- Spooling of MS-DOS-based application print jobs along with those of Windows-based applications, with conflict resolution when MS-DOS and Windows-based applications try to print at the same time
- Image color matching support, which provides better WYSIWYG between color in images displayed on screen and color generated on an output device

- Deferred printing for mobile computer users, allowing users to issue the command to print while undocked and not connected to a printer, so that print jobs will be automatically started when the computer is docked into a docking station
- Simplified printer driver installation, configuration, ease of use, and ease of support through a new, consolidated user interface
- System support for new bidirectional printers and ports, providing improved I/O performance with fast parallel ports (ECP) and error status reporting
- Better integration of network printing support, including Point and Print support for the automatic installation of printer drivers from Windows 95, Windows NT Server, or Novell NetWare servers
- Plug and Play support for printers, simplifying installation and configuration

The 32-Bit Print Subsystem

Windows 95 features a 32-bit print subsystem that includes a multithreaded, preemptive spooler architecture and provides improved printing performance, smoother background printing, and quicker return to the application after a print job is initiated by a user in an application. The architecture of the print subsystem is compatible with the Windows NT 3.1 print subsystem.

The 32-Bit Preemptive Spooler

In Windows 3.1, print spooling functionality was handled by Print Manager and was supported by code in several different Windows components. In Windows 95, the print spooler is implemented as a series of 32-bit virtual device drivers and the spooler functionality is consolidated into a single architecture, with the following benefits:

- **Smooth background printing.** In Windows 3.1, Print Manager passed a fixed amount of information to the printer, whether or not the printer was ready to receive the information. If the printer wasn't ready, the system would be suspended until it was ready. Unlike Print Manager, the Windows 95 spooler passes data to the printer only when the printer is ready to receive it. This strategy helps reduce the "jerkiness" often experienced when printing documents with Windows 3.1 Print Manager.
- **Quick return to the application.** Because of the smooth background printing made possible by the new 32-bit print subsystem, Windows 95 spools enhanced metafiles (EMFs) rather than raw printer data when printing from Windows-based applications, resulting in a quicker return-to-application time. After it is spooled, the EMF is interpreted in the background by the printer driver, and output is then sent to the printer. For more details, see the following "Enhanced Metafile Spooling" section.
- **More power and flexibility.** The new architecture allows users to select printer attributes on a per-printer basis, instead of requiring global printing attributes as in Windows 3.1. For example, each printer can have a different separator page and the option of printing direct via a queue.

Enhanced Metafile Spooling

EMF spooling results in a quicker return-to-application time and hence quicker return of control to the user after a print job is initiated in a Windows-based application (Win16 or Win32).

Before discussing how EMFs fit into the printing architecture used by Windows 95, it is worth reviewing how print jobs are handled by Windows 3.1, because the improvements in Windows 95 result in much better printing performance than in Windows 3.1.

In Windows 3.1, all interpretation of print API calls were handled by the Windows printer driver *before* the information was spooled to Print Manager, as shown in Figure 70. The interpretation of print information for printers was the most time-consuming operation in the print process. Users of PostScript printers were not impacted by this process because the printer driver sends high-level Page Description Language (PDL)-based information to the printer, rather than sending raw image data that must be interpreted by the printer itself. However, users of non-PostScript printers experienced a delay in returning to their applications after a print job was initiated, while the GDI print API calls were processed by the printer driver. After the output image file was created by the printer driver, the Print Manager spooler took over, and control was returned to the user's application. As a result, background printing under Windows 3.1 often seemed jerky.

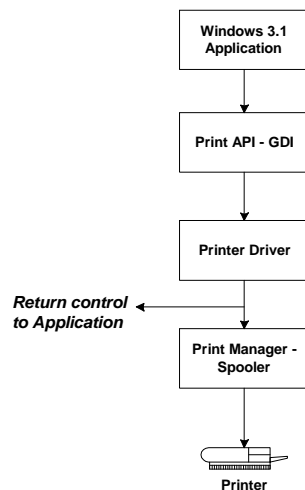


Figure 70. The spooler's relationship to printing in Windows 3.1

Windows 95 greatly improves the return-to-application time by spooling high-level command information generated by the GDI print API, collectively referred to as an enhanced metafile, rather than spooling raw printer data generated by the printer driver. For example, if a document contains a solid black rectangle, the EMF contains a command to draw a rectangle with the given dimensions that should be solidly filled with the color black. After the EMF is created, control is returned to the user, and the EMF file is interpreted in the background by the 32-bit print subsystem spooler and sent to the printer driver. This process, which is shown in Figure 71, results in control being returned to users in significantly less time because they don't have to wait for the print calls to be directly interpreted by the printer driver.

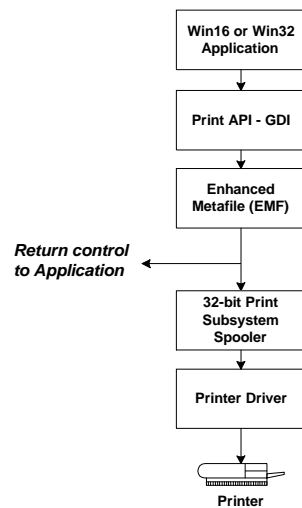


Figure 71. The spooler's relationship to printing in Windows 95

Try It!

Test the Quicker Return-to-Application Time

1. Under Windows 3.1, start Print Manager.
2. Turn off background printing if it is supported by your application—for example, Word for Windows version 6.0.
3. Print from your application, noting the time it takes for control to be returned to you.
4. Perform the same task under Windows 95, again noting the time it takes for control to be returned to you.
5. Print from an MS-DOS–based application under both Windows 3.1 and Windows 95, and again note the return-to-application time.
6. Compare the above.

Support for MS-DOS–Based Applications

Windows 95 improves on the support provided by Windows 3.1 for printing from an MS-DOS–based application in the Windows environment by allowing MS-DOS–based applications to spool print jobs to the 32-bit print subsystem spooler. With Windows 3.1, users printing from MS-DOS–based applications could not take advantage of the Windows–based spooling functionality offered by Print Manager, and they encountered device contention issues when trying to print from MS-DOS–based applications at the same time as printing from Windows–based applications.

Windows 95 addresses these printing problems by incorporating the functionality for an MS-DOS–based application to spool directly to the 32-bit print spooler. This support is integrated into a print spooler virtual device, which takes the output destined for a printer port and places it in the print spooler before sending the data to the printer. The print spooler is automatically installed and configured and its handling is transparent to users. It

works with all existing MS-DOS-based applications and results in a quicker return-to-application time. Although MS-DOS-based applications do not benefit from EMF spooling, which is supported only for Windows-based applications, the print spooler mechanism means that users won't encounter device contention issues and will benefit from smoother background printing and improved printing performance.

Try It!

Spool from an MS-DOS-Based Application

1. In Windows 95, pause the print queue for your printer.
2. Print from an MS-DOS-based application. Notice that print jobs generated by MS-DOS-based applications show up in the print queue and can be manipulated just like print jobs from Windows-based applications.

Support for Deferred Printing

To benefit mobile computer users, the print subsystem in Windows 95 features support for deferred printing. This capability allows users not connected to a printer to generate print jobs that are stored on their local computers. Items not immediately printed are held in the print queue until the computer is connected to a printer. Using this feature, mobile users can create print jobs from Windows-based applications (Win16 or Win32) or MS-DOS-based applications while on the road and then print on a physical printer when they return to the office. This feature is also handy for users in the office who temporarily lose printer connections because of network or printer problems.

Image Color Matching Support

Using technology licensed from Kodak, Windows 95 provides Image Color Matching (ICM) support, enabling applications to offer greater consistency between the color of images displayed on the screen and the color of images generated by an output device. ICM support is included for display, printer, and scanner devices.

ICM provides consistent (predictable) color rendering from input through monitor preview to output. With ICM functionality, color information is portable across applications that manipulate the information; across users, providing consistent use of colors; and across platforms, allowing the information to be easily moved to different systems in which ICM has been implemented.

ICM support in Windows 95 provides the following benefits to application developers, which in turn result in benefits to users:

- Makes enabling color awareness in applications easy
- Allows for color
- Provides consistent color output across devices

Because Windows 3.1 did not provide ICM support as part of the operating system or in an external driver, this support was implemented in a proprietary manner by application developers, and the burden was on the developers to properly map the colors generated by a display device to the colors generated by a printer device. Windows 95 simplifies this

process by including ICM support as part of the operating system, allowing application developers to integrate ICM functionality into their applications and thus take advantage of this new system service.

To provide support for device-independent color matching, colors used in applications are tied to international (CIE-based) colorimetric standards rather than specific hardware devices. The operating system does the appropriate color transformations to map the device-independent color representations to the colors supported by the physical device.

The key to ICM support is the use of a profile that represents the color properties of a monitor, printer, or scanner device. The profile format used by the ICM support in Windows 95 is the work of InterColor 3.0, an industry consortium made up of many industry hardware vendors—Kodak, Microsoft, Apple Computer, Sun, and Silicon Graphics, among others—and industry standard-setting bodies. The InterColor 3.0 efforts provide for a consistent cross-platform color standardization process that will result in industry-wide standards for defining the ICM properties of output and display devices.

Installing and Configuring a Printer

Unlike Windows 3.1, Windows 95 has no Print Manager and no Print icon in the Control Panel. Gone also is the confusion about which tool to use for managing print jobs, installing new printers, creating queues, and performing other tasks related to printing. Windows 95 consolidates the printer and printing functions into a single Printers folder, shown in Figure 72. The Printers folder provides easy ways of adding new printers, configuring existing printers, and managing print jobs.



Figure 72. The Printers folder

Easy Printer Setup

Windows 95 makes it easy to install new printers by supporting the following installation mechanisms:

- **Plug and Play printer detection.** For Plug and Play printers, Windows 95 will automatically detect the printer at installation time or during the boot process. The Plug and Play detection code will prompt the user for the appropriate driver files if they are not resident in the Windows directory.
- **The Add Printer Wizard.** Windows 95 provides a wizard that walks users through the printer installation process. Whether the printer is connected to the local PC or shared on another PC on the network, installing it is easier than ever before. Figure 73 shows the Printer Installation Wizard's first dialog box.



Figure 73. The Add Printer Wizard, which walks users through the printer installation process

- **Point and Print printing.** The Point and Print feature enables users to quickly connect to and use a printer shared on another Windows 95 PC, a Windows NT Server, or a Novell NetWare server. When users connect to a shared printer, Windows 95 automatically copies and installs the correct driver for the shared printer from the remote Windows 95 PC, the Windows NT Server, or the Novell NetWare server. They can then simply begin printing.
- Point and Print printing is discussed in more detail in Chapter 9, “Networking.”

Configuring a Printer

Configuring a printer in Windows 95 is much simpler than in Windows 3.1. All printer configuration is consolidated onto a single property sheet for the printer that can be accessed from the Printers folder. As shown in Figure 74, the property sheet contains all printer parameters, such as the printer port (or network path) that the printer is connected to, the paper options for the printer, the fonts built into the printer, and device options specific to the printer model.

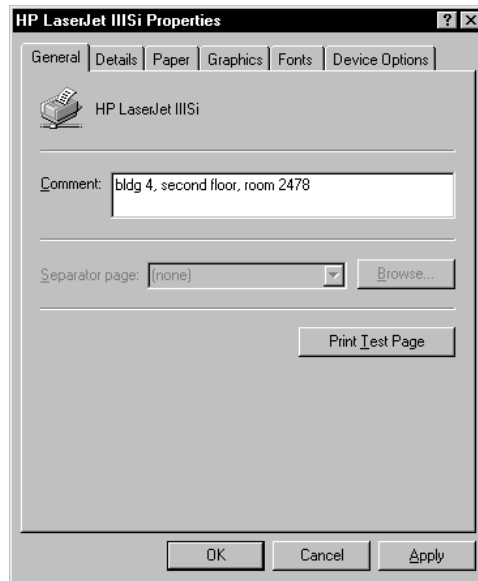


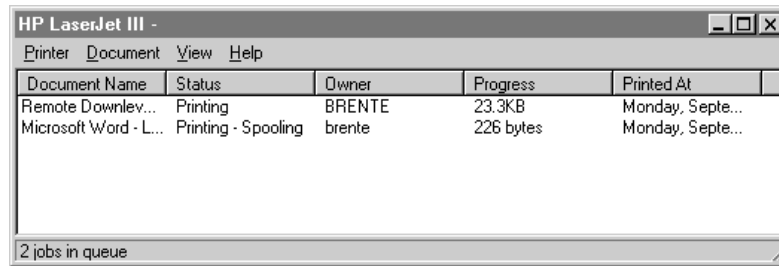
Figure 74. The property sheet for the Hewlett-Packard LaserJet III Si printer

To further simplify printer configuration, Windows 95 supports bidirectional communications between compatible printers and printer ports. With this functionality, Windows 95 can query the characteristics and configuration options directly from the printer and can automatically configure the printer driver to exactly match the configuration of the printer, including the amount of memory, the paper options, and the fonts installed in the printer.

Managing Print Jobs

Windows 95 provides better print job management capabilities than Print Manager does in Windows 3.1 and Windows for Workgroups. Improvements provided in Windows 95 include the following:

- **Direct integration with the UI in Windows 95.** The Printers folder serves as the centralized location for interacting with or configuring with printer devices. Opening a printer window and switching to Details view, as shown in Figure 75, displays detailed information about the contents of active print jobs or jobs that are waiting in the queue, including the name of the document, the status of the document, the owner of the document, when the document was submitted to the print queue, the number of pages in the document (when printing, the status of the print job down to the page that is being printed is displayed), the size of the document, and the priority of the print job.



The screenshot shows a window titled "HP LaserJet III" with a menu bar containing "Printer", "Document", "View", and "Help". Below the menu bar is a table with the following data:

Document Name	Status	Owner	Progress	Printed At
Remote Downlev...	Printing	BRENTE	23.3KB	Monday, Septe...
Microsoft Word - L...	Printing - Spooling	brente	226 bytes	Monday, Septe...

At the bottom of the window, it says "2 jobs in queue".

Figure 75. A Details view of a remote print queue's status

- Local and remote management of print jobs.** With Windows for Workgroups, users had to physically walk over to a remote PC to cancel a printing operation on that PC's shared printer. With Windows 95, it is no longer necessary to walk over to the PC where the queue resides to terminate print jobs or resume the printer if an error occurs. Users can pause or cancel the printing of print jobs residing in a remote print queue on a Windows 95 PC. Users with administrator access to a Windows 95 PC that is sharing a printer can remotely manage and administer the print queue with the same UI and functionality available for a local printer.

Network Printing Improvements

Windows 95 provides better support than Windows 3.1 for printing in a networked environment. The enhancements include the following:

- Network Point and Print functionality.** Users can print to a shared network printer connected to a computer running Windows 95, Windows NT Advanced Server, or Novell NetWare and have the appropriate printer driver automatically copied from the remote computer and configured on the local Windows 95 computer. Point and Print simplifies the printer installation process and ensures that the correct printer driver is installed for the remote printer.
- Remote administration of print jobs.** Windows 95 provides full remote administration of print jobs for printers shared on computers running Windows 95. With the appropriate access privileges, operations such as holding a print job, canceling a print job, and resuming printing when the print queue is paused can be performed remotely.

More information about network printing enhancements in Windows 95 is provided in Chapter 9, "Networking."

Plug and Play Support

Installing and configuring printers in Windows 95 is much simpler than in Windows 3.1. As with other components of the Windows 95 system, setting up a new printer benefits from the Windows 95 Plug and Play capabilities. Using bidirectional parallel communications, Windows 95 detects that a Plug and Play-compatible printer is connected to the PC (see Figure 76) by means of a returned device ID value, as described in the IEEE 1284 Specification. Bidirectional parallel communications with the printer also enable Windows 95 to obtain information about other physical attributes of the device.

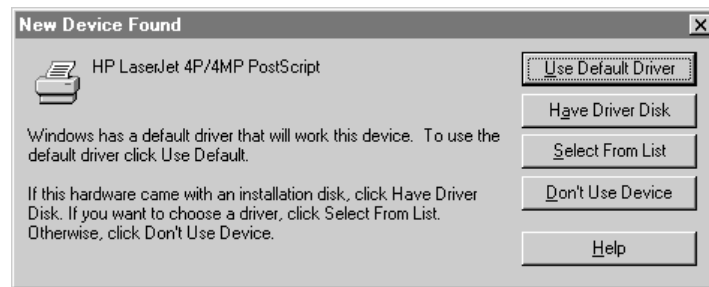


Figure 76. The New Device Found dialog box, showing detection of a Plug and Play printer

Windows 95 detects a Plug and Play printer in one of three ways: when Windows 95 is first installed on a PC, each time Windows 95 starts, or when a user explicitly requests that a detection be made. When Windows 95 is first installed on a PC and when Windows 95 starts, a Plug and Play printer connected to a bidirectional communications port attempts to identify itself by sending its detection code. If the connected printer is not presently configured in the Windows 95 system, the user is asked whether the printer should be installed. If the user says “Yes” and the appropriate printer driver is already present on the system, Windows 95 automatically installs and configures the driver for the printer. If the printer driver is not already present, Windows 95 prompts the user for the appropriate Setup And Installation disk for Windows 95. If the system doesn’t recognize the printer, Windows 95 prompts the user to insert a disk containing the printer driver provided by the printer manufacturer.

Try It!

Test Plug and Play Support

1. Connect a Plug and Play printer to your computer before starting Windows 95. Supported printers include the Hewlett-Packard LaserJet 4 models (4L, 4Plus, 4P, 4MP, 4MPlus, and 4ML, 4si), the LexMark 4039 and 4039+, and the ValueWriter 600.
2. Start Windows 95. During the boot process, notice that the system automatically detects the Plug and Play printer and prompts you to install the appropriate printer driver (if not already present).

