

# Printing Improvements

Windows 95 offers several changes in how printing is handled by Windows. The goals are to address requests made from our customers and from independent software and hardware vendors. We aimed to make improvements in three major areas:

- u Improved performance.

Windows 95 has a new 32-bit printing architecture which supports preemptive multitasking and improves overall performance.

- u Making it even easier to use.

Printing is easier now because of improvements made to the user interface in Windows 95. Windows 95 also features Plug and Play support for installing new printers.

- u Improved integration of network printing.

Network printing integration is better because of Windows 95 has extended the local printing architecture to the network environment. In addition, Windows 95 ties together installation enhancements to shared network printers.

This section of the Guide describes the printing architecture used in Windows 95 and discusses the different areas where printing has been improved over Windows 3.1.

## Summary of Improvements over Windows 3.1

The primary improvements in printing for Windows 95 are:

- u New 32-bit Print subsystem modeled after Windows NT providing smooth background printing
- u Increased printing performance by decreasing time needed to return control to application through the use of enhanced metafile (EMF) spooling
- u Support for over 800 different printer models (versus over 300 for Windows 3.1) through the development of new printer mini-drivers
- u Support for PostScript Level II printers
- u Spooling of MS-DOS-based application print jobs along with Windows-based applications and solves conflicts when MS-DOS and Windows-based applications try to print at the same time
- u Image color matching support providing better WYSIWYG between color in images displayed on-screen and color generated on an output device
- u Deferred printing for mobile computer users, allowing users to print while undocked and not connected to a printer, then automatically starting print job once docked into a docking station
- u Simplified printer driver installation, configuration, ease of use, and ease of support, through new consolidated user interface
- u System support for new bi-directional printers and ports providing improved I/O performance with new fast parallel ports (ECP) and error status reporting
- u Better integration of network printing support including point-and-print support for automatic installation of printer drivers from Windows 95, Windows NT, or Novell NetWare servers
- u Plug and Play support for printers for simpler installation and configuration

## 32-bit Print Subsystem

Windows 95 features a 32-bit Print subsystem that includes a multi-threaded, preemptive spooler architecture providing improved printing performance, smoother background printing, and quicker “return to application” time once 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.

## 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 consolidates the spooler functionality into a single architecture.

### u The new spooler provides smooth background printing.

In Windows 3.1, Print Manager passed a fixed amount of information down to the printer, whether the print was ready to receive it or not. If the printer wasn't ready to receive more data, the system would be suspended until the printer was ready. Unlike Print Manager, the Windows 95 spooler passes data to the printer only when the printer is ready to receive more information. This helps to reduce what often seemed like "jerkiness" when printing documents with Windows 3.1 Print Manager.

### u The new spooler provides quick "return to application" time.

Due to the smooth background printing, made possible by the new 32-bit print subsystem, Windows 95 spools enhanced metafiles (EMF) when printing from Windows-based applications rather than raw printer data to result in quicker return to application time. Once spooled, the EMF information 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.

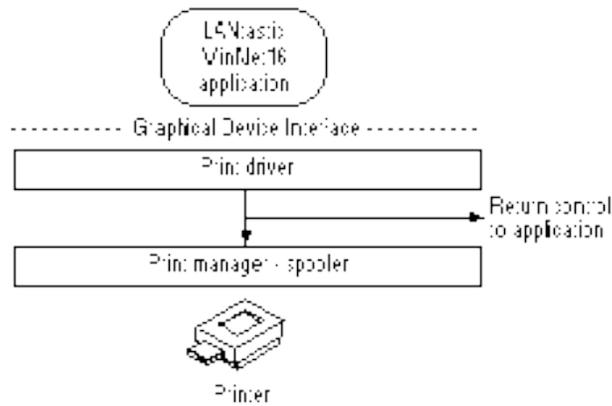
### u The new spooler is much more powerful and flexible.

It allows the user 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 printing via a queue.

## Enhanced Metafile Spooling

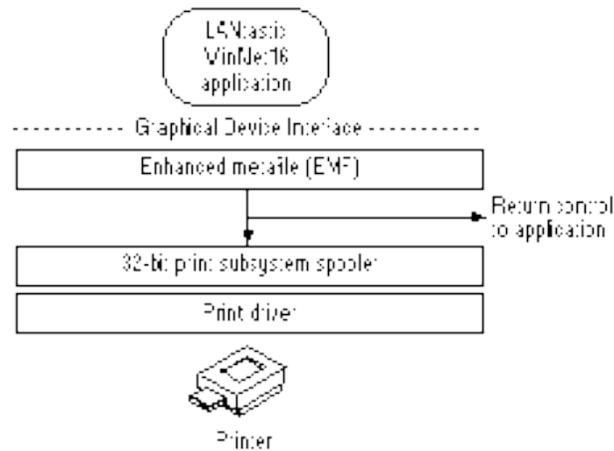
EMF spooling results in quicker "return to application" time for returning control to the user after initiating a print job in a Windows-based application (Win16 or Win32).

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. The improvements present in Windows 95 result in great printing performance over Windows 3.1.



**Figure 1. Spooler Relationship to Printing 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. The interpretation of print information for printers was the most time-consuming operation in the print process. PostScript printers were not impacted by this as the printer driver sends high-level Page Description Language (PDL)-based information to the printer rather than raw image data, where it was interpreted by the printer itself. Users of non-PostScript printers saw a delay in “return to application” time under Windows 3.1 once the print job was initiated while the GDI print API calls are processed by the printer driver. Once 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. Background printing under Windows 3.1 often seemed choppy.



**Figure 2. Spooler Relationship to Printing in Windows 95**

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 would contain a command to draw a rectangle with the given dimensions, that should be filled in solid, with the color black. Once 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 results in control being returned to the user in significantly less time than having to wait for the print calls to be fully interpreted by the printer driver directly.

## Improved Printing Support for MS-DOS–based Applications

Windows 95 improves on support for printing from an MS-DOS–based application in the Windows environment over that provided by Windows 3.1 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 applications could not take advantage of the Windows–based spooling functionality offered by Print Manager, and 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 the print issues in Windows 3.1 by incorporating the functionality for an MS-DOS-based application to spool directly to the 32-bit print spooler in Windows 95. This support is integrated into a print spooler virtual device, which takes the output destined for a printer port and first places it in the print spooler before sending the data to the printer. This functionality works with all existing MS-DOS-based applications, and results in quicker “return to application” through the use of the spooling mechanism. While MS-DOS-based applications do not benefit from EMF spooling, which is supported only for printing from Windows-based applications, users won’t encounter device contention issues, but will benefit from smoother background printing and from improved printing performance in Windows 95. The print spooling functionality for use with MS-DOS-based applications is automatically installed and configured and handling is transparent to the user.

## 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, which are stored on their local computers. This feature is handy for users working in a location away from the printer, and for users in the office who temporarily lose printer connections because of network or printer problems, for example. Mobile users can create print jobs from Windows-based applications (Win16 or Win32 applications) or MS-DOS-based applications while on the road, then print on a physical printer once reaching home or office. Items not immediately printed are held in the print queue until the user reconnects to a printer.

## Image Color Matching Support

Windows 95 includes Image Color Matching (ICM) support, enabling applications to offer better consistency between the color of images displayed on the screen and the color of images generated by an output device.

Using technology licensed from Kodak, Windows 95 will include image color matching (ICM) support for display, printer, and scanner devices. ICM provides consistent (predictable) color rendering from input, through monitor preview, to output. Applications that utilize ICM functionality enables portability of color information across applications that manipulate the graphic information, across users to provide consistent use of colors, and across platforms allowing color information to be easily moved to different systems where the ICM technology has been implemented.

Image color matching support in Windows 95 provides the following benefits to application vendors, which in turn result in benefits to users:

- u Easily enable color-aware applications
- u Allows for color *What You See Is What You Get* (WYSIWYG)
- u Provides for consistent color output across devices

Since Windows 3.1 did not provide ICM support as part of the operating system or in an external driver, image color matching support was implemented in a proprietary manner by an application vendor—the burden was on the application vendor to properly map colors generated on 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 vendors 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 in device-dependent form to specific hardware devices. The operating system will then do 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*, which represents the color properties of a monitor, printer, or scanner device. The profile format used by the ICM support in Windows 95, is the result of an industry consortium called *InterColor 3.0* and is made up of many industry hardware vendors (including Kodak, Microsoft, Apple Computer Inc., 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 ICM properties of output and display devices.

## Installing and Configuring a Printer

The first thing you will notice when looking at printer support in Windows 95 are some changes to the user interface. Print Manager and the Print icon in Control Panel are gone. Gone also is the confusion of which tool to use when you wanted to manage a print job, install a new printer, create a queue, or perform some other task related to printing. Windows 95 consolidates the printer and printing functions into a single location called the Printers Folder.



**Figure 3. Printers Folder**

The Printers Folder provides the user easy access to adding a new printer, configuring an existing printer, and managing print jobs.

### Easy New Printer Setup

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

#### **u 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.

### u New Device Installation wizard

Windows 95 includes support for wizards that walk the user through the printer installation process. Installing a printer is now even easier under Windows 95, whether that printer is connected to the local PC, or shared on another PC on the network. Figure 4 shows the process that the Printer Installation wizard uses for installing a printer.



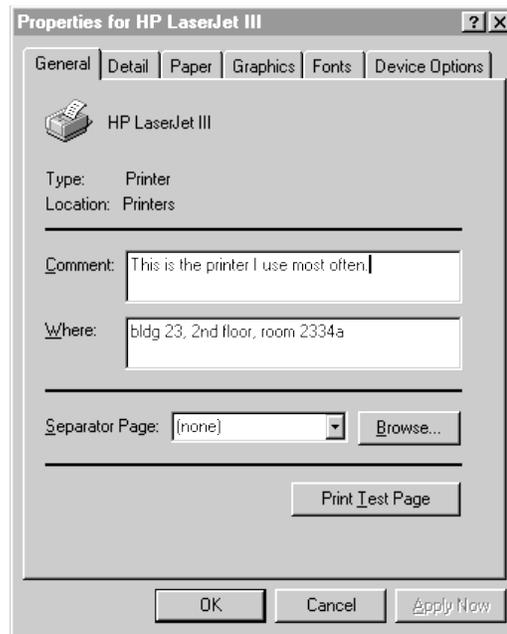
**Figure 4. Printer Installation Wizard walks user through installing a printer**

### u Connecting to a Network Printer—"Point and Print" Printing

Windows 95 makes it easy for users to connect to and use a printer shared on another Windows 95 PC, a Novell NetWare server, or a Windows NT Server. If a user connects to a printer shared on another Windows 95 PC, Windows 95 will automatically copy and install the proper driver for the shared printer from the remote Windows 95 PC. Windows 95 also supports installing the appropriate printer drivers on a Novell NetWare server or Windows NT Server for automatic downloading and installation of the printer driver. This allows users to simply connect to the remote printer and once the drivers have been copied from the network and installed on the local Windows 95 PC, begin printing. Network point and print printing is discussed in the Networking section of this guide.

## Configuring a Printer

Configuring a printer in Windows 95 is also greatly simplified over Windows 3.1. All printer configuration is consolidated into a single property sheet for the printer, and can be accessed from the Printers folder. The property sheet provides common access to printer parameters such as the printer port (or network path) 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 5. Sample Properties for the Hewlett-Packard LaserJet III Printer**

To further simplify printer configuration, Windows 95 will support bi-directional communications between compatible printers (e.g., HP LaserJet 4 models, and printers using PostScript connected to the PC via a serial cable or using a bi-directional printer such as HP LaserJet 4 models) and printer ports, allowing Windows 95 to query the characteristics and configuration options directly from the printer. This allows the printer driver to be automatically configured to exactly match the configuration of the printer including the amount of memory installed, the paper options available, and fonts installed in the printer.

## Managing Print Jobs

Managing print jobs is improved in Windows 95 over the capabilities offered by Print Manager in Windows 3.1 and Windows for Workgroups. Improvements provided in Windows 95 include:

### u Direct Integration with the User Interface in Windows 95

The Printers folder serves as the centralized location for interacting or configuring with printer devices. Switching to Details view will show additional information about the number of jobs presently residing in the printer. Opening the given printer will show 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.

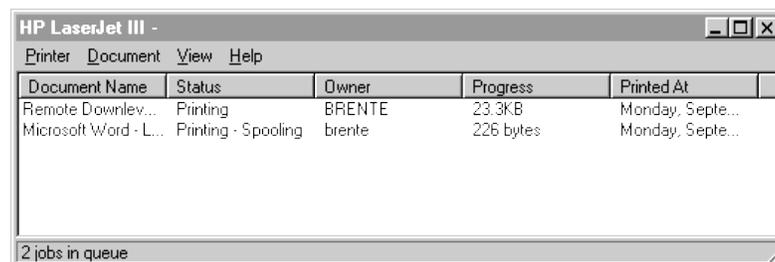


Figure 6. Detailed Remote Print Queue Status

### u Ability to Manage Print Jobs Locally and Remotely

Under Windows 95, a user has the ability to pause or cancel printing of print jobs residing in a remote print queue on a PC running Windows 95. Under Windows for Workgroups, for example, a user needed to physically walk over to the remote PC to cancel any printing operations. In addition, if you are given administrator access to the remote Windows 95 PC that is sharing a printer, you have the ability to remotely manage and administer the print queue with the same UI and functionality available for a locally connected printer. It is no longer necessary to walk over to the remote machine where the queue resides, in order to terminate print jobs or to resume the printer if an error occurs.

## Network Printing Improvements

Windows 95 provides improved support over Windows 3.1 for printing in a networked environment. These enhancements include:

### **u Network point-and-print functionality**

Under Windows 95, 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 down from the remote computer and configured on the local Windows 95 computer. This simplifies the printer installation process, and ensures that the proper printer driver is installed to match the remote printer.

### **u Remote Administration of Print Jobs**

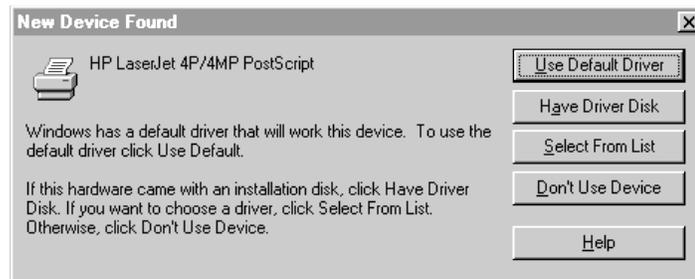
Windows 95 provides full remote administration of print jobs for shared printers on another computer running Windows 95. With the appropriate access privileges, these operations include the ability to hold a print job, cancel a print job, or resume printing when the print queue is paused.

More information about network printing enhancements present in Windows 95 is provided in the Networking section of this guide.

## Plug and Play Support

Installing and configuring printers in Windows 95 is greatly simplified over Windows 3.1. As with other components of the Windows 95 system, setting up a new printer in Windows 95 benefits from Plug and Play capabilities. Windows 95 detects Plug and Play compatible printers that return device ID values as described in the IEEE 1284 Specification through bi-directional parallel communications. Bi-directional parallel communications with the printer will also aid in the query of other physical attributes of the device.

Windows 95 detects a Plug and Play printer in one of several ways—when Windows 95 is first installed on a user's PC, during the boot cycle each time Windows 95 is started, or when a user explicitly requests a detection to be made.



**Figure 7. New Device Found Dialog Box Showing Detection of Plug and Play Printer**

Plug and Play for printers works this way:

When Windows 95 is first installed on a user's PC and when Windows 95 starts up, the Plug and Play detection code attempts to identify a printer connected to a bi-directional communications port. If the printer connected is not presently configured in the Windows 95 system, the user is asked as to 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 new 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 printer is not recognized by the Windows 95 system, the user is prompted to insert a disk containing the printer driver provided by the printer manufacturer.

## Examples of Plug and Play-Compatible Printers

While there will be much broader support and demand for Plug and Play printers at the time Windows 95 ships, several printers on the market today provide varying degrees of Plug and Play awareness. For example, the Hewlett-Packard LaserJet 4 models (4L, 4Plus, 4P, 4MP, 4MPlus, and 4ML, 4si), LexMark 4039 and 4039+, and ValueWriter 600, which are presently shipping are Plug and Play peripherals.

## Try It!



Mouse

To see how the improvements made to printing support in Windows 95 will help users that print from MS-DOS and Windows-based applications, you've got to try it!

### Quick Return to Application Time

To demonstrate the improved quick return to application time for printing from MS-DOS or Windows-based applications, try the following:

- u Under Windows 3.1, start Print Manager. Turn off background printing if supported by your application (for example, Word for Windows version 6.0). Print from your application - how long did it take before control was returned? Perform the same task under Windows 95—how long did it take before control was returned?
- u Quick return to application time is also evident when printing from MS-DOS-based applications. Try printing from an MS-DOS-based application under both Windows 3.1 and Windows 95—how long did it take before control was returned?

### Spooling from an MS-DOS-based Application

In addition to providing quick return to application time when printing from MS-DOS-based applications, print jobs generated by MS-DOS-based applications show up in the print queue on Windows 95 and can be manipulated like print jobs from Windows-based applications. To see this, try the following.

- u Pause the print queue in Windows 95 for your printer and then print from an MS-DOS-based application and note that it shows up in the print queue.

### Plug and Play Support

To try Plug and Play support for printers with Windows 95, connect one of the supported Plug and Play printers to your computer before starting Windows 95. Supported printers include the Hewlett-Packard LaserJet 4 models (4L, 4Plus, 4P, 4MP, 4MPlus, and 4ML, 4si), LexMark 4039 and 4039+, and ValueWriter 600. During the boot process for Windows 95, the Plug and Play printer will automatically be detected and will prompt you to install the appropriate printer driver.