



Workstation
Server
Enterprise

Managing Printing

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About Chapter 6

This chapter covers printing from A to Z. It begins with a discussion of Windows NT printing terminology, and then quickly moves to the print process, and then to creating and connecting to a printer.

Chapter 6 explores configuring printer properties extensively. You'll learn how to assign a separator page; how to assign forms to paper trays; and how to use Windows NT printer security to assign printer permissions to users and groups, to audit a user or group's printer usage, and to take ownership of a printer. Other topics discussed in this section include printing to multiple ports (printer pools), scheduling printers, setting printer priorities, and sharing printers.

Finally, this chapter concludes with a practical section on troubleshooting common printing problems.

This chapter includes two hands-on labs. In the first lab, you become familiar with the Windows NT Printers folder and create and share a local printer. In the second, you install and configure Microsoft TCP/IP Printing.

No matter which of the three Windows NT 4.0 Microsoft Certified Professional exams you're preparing for, you'll want to be sure to read this chapter. This chapter covers printing objectives for all three exams.

Printing Terminology

Before you can fully understand printing with Windows NT, you should first understand a few terms.

In Windows NT, the term *printer* does not represent a physical device that produces printed output. Rather, a printer is the software interface between the Windows NT operating system and the device that produces printed output.



If you are used to working with a different operating system, such as NetWare or UNIX, you may be used to thinking of what Windows NT calls a printer as a combination of a print queue (or print spooler) plus a driver for the device that produces printed output.

If you aren't used to working with another operating system, feel free to ignore this note, because it may just be confusing at this point.

In Windows NT, the term *print device* refers to the physical device that produces printed output — what is more commonly referred to as a “printer.”



Be sure that you know the Windows NT printing terminology cold. Otherwise, you may become confused when taking the exams.

Remember: a *printer* is software, and a *print* (or *printing*) device is hardware. Beat this into your head with a large wooden mallet!

Now that you have a grasp of the Windows NT printing terminology, you're ready to move on to the nuts and bolts of printing in Windows NT.

Windows NT Printing Overview

This section examines the process of printing in Windows NT. It also explains, in detail, the most commonly used print monitors.

The Print Process

Perhaps the easiest way to understand the Windows NT print process is to follow the steps that occur when a document is printed from an application in Windows NT.

1. A user at a Windows NT computer starts the print process from an application, such as Word, usually by selecting Print from the File menu. This action creates the print job. (A print job is all of the data and commands needed to print a document.)
2. The application hands off the print job to the *Graphics Device Interface* (GDI). (In Windows NT 4.0, the GDI is a kernel mode component.)
3. The GDI initiates a request to the driver for the print device.
4. The driver for the print device converts the application's output (the print job) into either a Windows NT *enhanced metafile* (EMF) or into a RAW format. (The RAW format is ready to print, as is, and no further processing is required.) The driver then returns the converted print job to the GDI.

5. The GDI hands off the print job to the Windows NT spooler.
6. The Windows NT spooler determines whether the print device is managed by the computer that initiated the print job, or by a network-connected computer.

If the print device is managed by the local computer (the computer that initiated this print job), the spooler copies the print job to a temporary storage area on the computer's hard disk.

If the print device is managed by a network-connected computer, the spooler hands off the print job to the spooler on the network-connected computer. Then that spooler copies the print job to a temporary storage area on that computer's hard disk.

7. Once the spooler has copied the file to temporary storage, the print job is handed off to the local print provider on the computer that has the print job spooled to its hard disk.
8. The local print provider initiates a request to the print processor to perform any additional conversions needed on the file, such as from EMF to RAW. (When a print device receives a print job, it always receives it in the RAW format.) The print processor then returns the converted print job to the local print provider.
9. The local print provider adds a separator page to the print job (if it's configured to do so) and then hands off the print job to the print monitor.
10. The print monitor communicates directly with the print device and sends the ready-to-print print job to the print device.
11. The print device produces the printed document.

Figure 6-1 graphically illustrates the steps in the Windows NT print process. Notice that the spooler routes the print job to the local hard disk if the print device is managed by the local computer, and routes the print job to the spooler on the network-connected computer if the print device is managed by the network-connected computer.

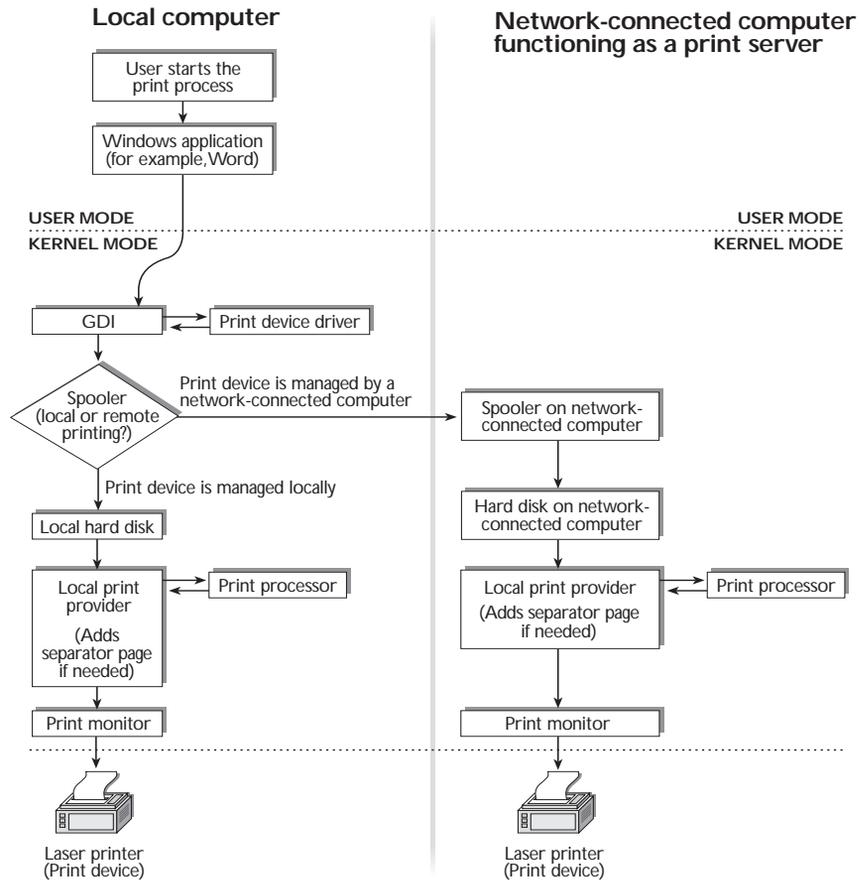


FIGURE 6-1 The Windows NT print process

Using EMFs in network printing

Using Windows NT *enhanced metafiles* (EMFs) can significantly increase the performance of printing across a network for the following reasons:

- Windows NT creates an EMF faster than it can create a RAW format file.
- Windows NT splits the overhead of the print process between the local computer (which creates the EMF) and the network-connected computer (which converts the EMF to the RAW format).

This means that the user who creates the print job experiences faster printing than if the RAW format file was created locally on the user's computer.

Creating and Connecting to Printers

There are two ways to install and configure a printer in Windows NT: you can either create a printer, or you can connect to a shared network printer.

Creating a printer involves installing and configuring all of the drivers needed to use a locally managed print device. Connecting to a shared network printer involves installing and configuring all of the drivers needed to use a print device that is managed by another computer on the network. You can either connect to a shared network printer by using the Add Printer Wizard in the `Printers` folder, or you can use drag-and-drop printing to connect to a shared network printer.

Both creating a printer and connecting to a printer are called “adding a printer,” because both processes use the Add Printer Wizard.

Steps to Create a Printer

This section explains the steps involved in creating a printer in Windows NT by using the Add Printer Wizard.

TO CREATE A PRINTER IN WINDOWS NT, FOLLOW THESE STEPS:

1. Open the `Printers` folder. You can do this in any of the following four ways:
 - Select `Start` > `Settings` > `Printers`
 - Double-click `My Computer`, and then double-click the `Printers` folder
 - Select `Start` > `Programs` > `Windows NT Explorer`, and then click the `Printers` folder in the `All Folders` list box
 - Select `Start` > `Settings` > `Control Panel`, and then double-click the `Printers` icon in `Control Panel`
2. Double-click the `Add Printers` icon.
3. The `Add Printer Wizard` dialog box appears. To create a printer, select `My Computer`, and click `Next`.
4. Select a port in the `Available ports` list box. If the port you want to use is not listed, click the `Add Port` command button and follow the directions given. Click `Next`.

Figure 6-2 shows the Available ports list box within the Add Printer Wizard. Notice that the LPT1: port is highlighted and selected.



FIGURE 6-2 Selecting a port for a print device

5. Select the appropriate manufacturer and print device model, and click Next.

Figure 6-3 shows the Manufacturers and Printers list boxes.

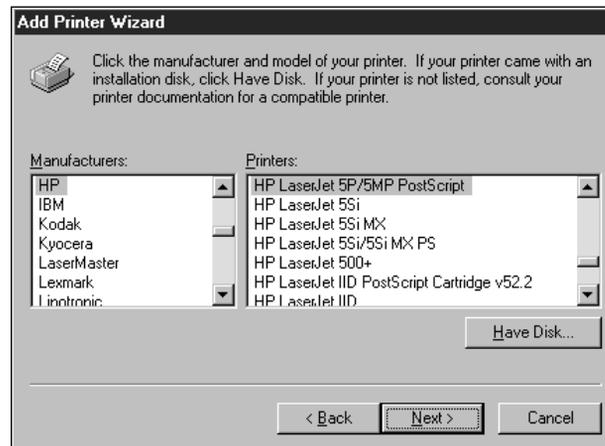


FIGURE 6-3 Selecting a print device's manufacturer and model

6. Type a printer name, or accept the default. Click Next.
7. Choose whether to share the printer. (You can share or stop sharing the printer later if you change your mind. More information is presented in the "Sharing a Printer" section later in this chapter.) Click Next.
8. Choose whether to print a test page. Click Finish.

You can modify a printer's properties any time after the printer is created by right-clicking the printer's icon (in the `Printers` folder), and then selecting `Properties` from the menu that appears.



concept link

See Lab 6.8 at the end of this chapter for a hands-on exercise in creating a printer.

Steps to Connect to a Printer

This section explains the steps involved in connecting to a Windows NT shared network printer using the Add Printer Wizard.

TO CONNECT TO A WINDOWS NT SHARED NETWORK PRINTER, FOLLOW THESE STEPS:

1. Open the `Printers` folder. (Select `Start` > `Settings` > `Printers`.)
2. Double-click the `Add Printers` icon.
3. The `Add Printer Wizard` dialog box appears. To connect to a printer, select `Network printer server`, and click `Next`.
4. In the `Connect to Printer` dialog box, do one of the following:

In the `Printer` text box, type in a complete path to the network printer to which you want to connect, in the form of `\\server_name\printer_name`.

Or, use the browse list in the `Shared Printers` list box to select the network printer to which you want to connect.

Figure 6-4 shows the `Connect to Printer` dialog box. Notice that when a network printer is selected in the `Shared Printers` list box, the `Add Printer Wizard` places the full path to the network printer in the `Printer` text box.

Then click `OK`.

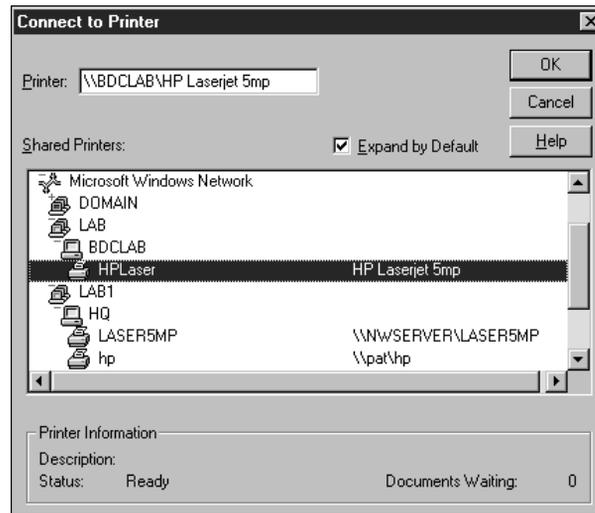


FIGURE 6-4 Connecting to a network printer



When you connect to a shared network printer on a Windows NT computer, your local Windows NT computer automatically copies the necessary printer drivers from the Windows NT computer that hosts the shared printer. If the Windows NT computer that hosts the shared printer does *not* have printer drivers for your version of Windows NT or for your hardware platform (such as Intel, DEC Alpha, MIPS R4000, or PowerPC), then Windows NT prompts you to install printer drivers as the next step in this process.

5. In the Add Printer Wizard dialog box, choose whether you want this printer to be your default printer. Click Next.
6. Click Finish. You are now connected to a shared network printer.

Using drag-and-drop printing to connect to a printer

Drag-and-drop printing is an easy way to connect to a shared network printer, because drag-and-drop printing requires less user interaction than using the Add Printer Wizard interactively.

To use drag-and-drop printing to connect to a shared network printer, you must first use My Computer to locate a file that you want to print. Then use Network Neighborhood to locate the shared network printer (or NetWare print queue) that you want to use.

Figure 6-5 shows two windows open on the desktop. Note that one window shows the shares that are available on a network computer named Bdc1ab, and that the other window contains files in the Windows folder. (If you prefer, instead of using My Computer and Network Neighborhood, you can accomplish the same thing by opening two copies of Windows NT Explorer, and then tiling the windows.)

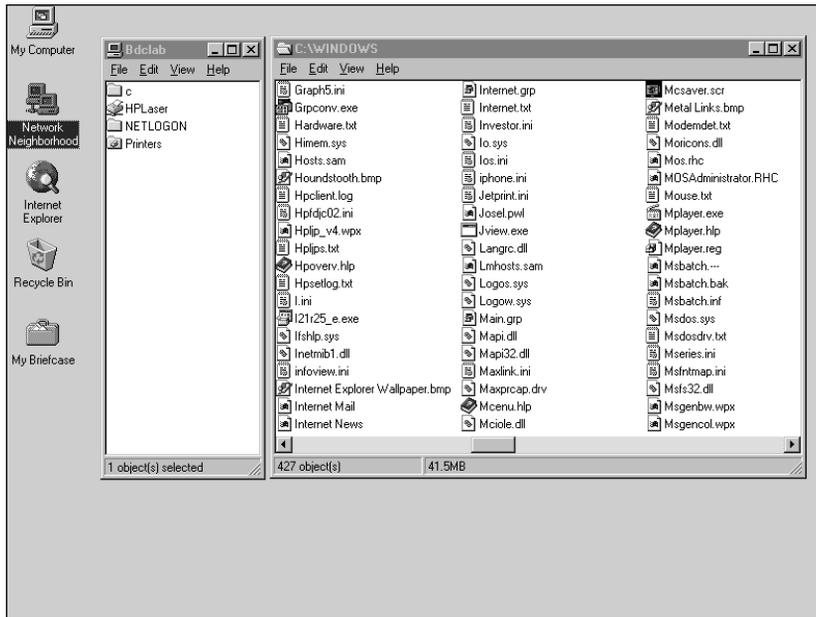


FIGURE 6-5 Preparing for drag-and-drop printing

To connect to the shared network printer and print your document, drag the file from the open window and drop it on the shared network printer in the other window.

Figure 6-6 shows a document being dropped on the shared printer.

Windows NT displays an information dialog box, which is shown in Figure 6-7. The essence of the dialog box message is that Windows NT must connect to the shared network printer and install drivers on your local Windows NT computer before the document can be printed.

If you click No, Windows NT automatically cancels your print job. If you click Yes, Windows NT automatically connects to the shared network printer, installs local printer drivers, opens the application the document was created in, prints the document, and closes the application.

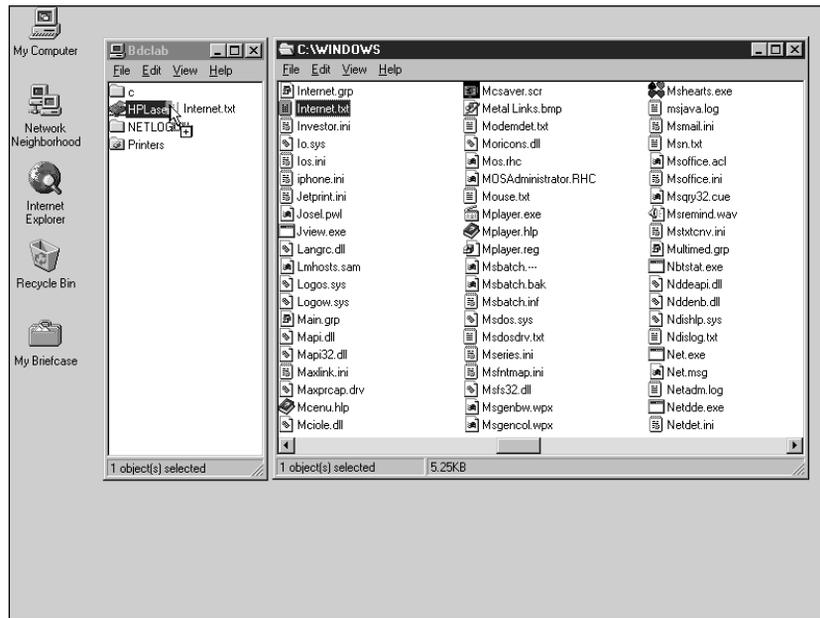


FIGURE 6-6 Dragging and dropping a document on a printer

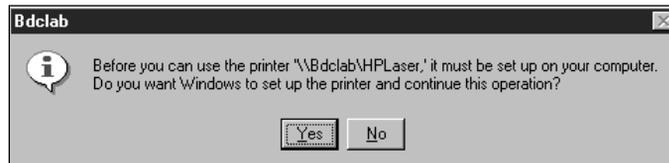


FIGURE 6-7 Instructing NT to install local drivers for a shared network printer

If you click Yes and the Windows NT computer that hosts the shared network printer does *not* have printer drivers for your version of Windows NT or for your hardware platform (such as Intel, DEC Alpha, MIPS R4000, or PowerPC), or if you are dragging and dropping a document to a NetWare print queue, then Windows NT prompts you to select and install appropriate printer drivers before it completes the drag-and-drop printing.

note Drag-and-drop printing requires that the printer on which you are dropping files be configured as your default printer. Also, drag-and-drop printing often produces inconsistent results (for example, the process may complete normally, but the document will

not print). Sometimes repeating the process will cause everything to work correctly. Sometimes a printer is created in your `Printers` folder, and sometimes not. Maybe drag-and-drop printing's inconsistencies will be fixed in one of the future service packs for Windows NT 4.0.

Print Monitors

Print monitors are software components that run in kernel mode. In Windows NT, print monitors send ready-to-print print jobs to a print device, either locally or across the network. Print monitors are also called *port monitors*.

When you create a printer, you select the port to which the print device is connected. Each port is associated with one specific print monitor.

This section discusses the most commonly used print monitors. All of the print monitors listed in this section are available in both Windows NT Workstation and Windows NT Server.

Localmon

The *Localmon print monitor* sends print jobs to print devices that are connected to hardware ports on a local Windows NT computer (local hardware ports include LPT1: and COM1:).

Localmon is the only print monitor that is installed by default during the installation of Windows NT. All other print monitors require that you install additional Windows NT services and/or protocols.

Hpmon

The *Hpmon print monitor* sends print jobs to a network print device via a Hewlett-Packard JetDirect adapter. The HP JetDirect adapter may either be installed in the print device, or function as a separate external unit.

Hpmon uses the DLC protocol to communicate with HP JetDirect adapters. Most HP JetDirect adapters support multiple protocols, including: TCP/IP, IPX, AppleTalk, and DLC. However, Hpmon can only communicate by using the DLC protocol.

The DLC protocol is a non-routable protocol. A Windows NT computer that uses Hpmon can only communicate with HP JetDirect adapters that are located on the same network segment. In other words, the DLC protocol will not be forwarded by a network router to another network segment.

If your network supports bridging, however, you can use DLC to communicate to an HP JetDirect adapter on any network segment that is connected by a bridge.

The Hpmon print monitor is not installed by default during the installation of Windows NT. Hpmon is installed automatically when you install the DLC protocol. You must install DLC before you can connect to an HP JetDirect adapter using Hpmon.

TO CREATE A PRINTER THAT USES HPMON, FOLLOW THESE STEPS:

1. Install the DLC protocol on your computer. (If you need more information on how to do this, refer to the section on "Installing and Configuring Protocols and Services" in Chapter 4.)
2. Open the Printers folder. (Select Start > Settings > Printers.)
3. Double-click the Add Printers icon.
4. The Add Printer Wizard dialog box appears. To create a printer, select My Computer, and click Next.
5. In the Available ports list box, click the Add Port command button.
6. In the Printer Ports dialog box, click the Hewlett-Packard Network Port. Figure 6-8 shows the Printer Ports dialog box. Notice that the Hewlett-Packard Network Port is selected. Click New Port.

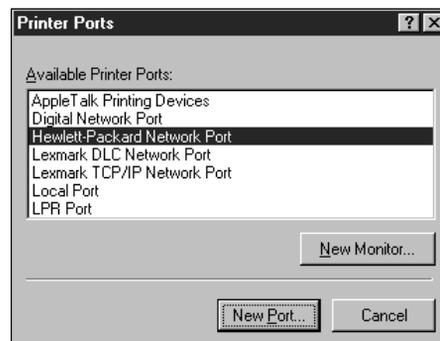


FIGURE 6-8 Adding an Hpmon port

7. The Add Hewlett-Packard Network Peripheral Port dialog box appears. In the lower Card Address list box, double-click the MAC address of the HP

JetDirect adapter you want to use. The Add Printer Wizard then places this address in the upper Card Address text box. In the Name text box, type a name for the Hpmon port that will be associated with the HP JetDirect adapter you selected.

Figure 6-9 shows the Hewlett-Packard Network Peripheral Port dialog box. Note that the Hpmon port is named after its association with an HP JetDirect adapter. Click the Timers command button.

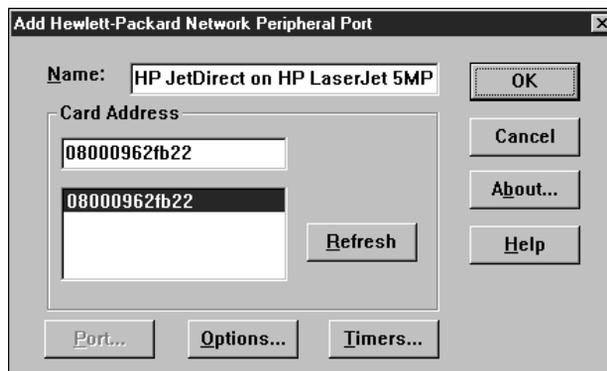


FIGURE 6-9 Selecting and configuring an Hpmon port

8. The HP Network Peripheral Port Timers dialog box appears. Choose either a *Job Based* or *Continuous* connection.

If you choose *Job Based*, all computers on the network will be able to access the HP JetDirect adapter for printing, because the connection to the HP JetDirect adapter is dropped after each print job. (Only one computer can have a DLC connection to the HP JetDirect adapter at any given time.)

If you choose *Continuous*, Hpmon will monopolize the HP JetDirect adapter and no other computer on the network will be able to use DLC to access the HP JetDirect adapter for printing.

Figure 6-10 shows the HP Network Peripheral Port Timers dialog box. Notice that *Continuous Connection* is the default selection. Click OK.

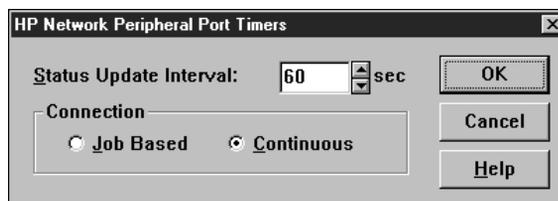


FIGURE 6-10 Selecting Job Based or Continuous connection

9. Click OK in the Add Hewlett-Packard Network Peripheral Port dialog box.
10. Click Close in the Printer Ports dialog box.
11. The Add Printer Wizard dialog box, shown in Figure 6-11, reappears. Note that the Hpmon port that you have added is highlighted and selected in the Available ports list box. Click Next.



FIGURE 6-11 Hpmon/HP JetDirect port added to available ports list

12. Select the appropriate manufacturer and print device model, and click Next.
13. Type in a printer name, or accept the default. Click Next.
14. Choose whether to share the printer. (You can share or stop sharing the printer later if you change your mind.) Click Next.
15. Choose whether to print a test page. Click Finish.



in the
real world

Selecting between a job-based and continuous connection requires some careful planning and consideration.

If a printer isn't shared and you select a continuous connection, only a single user will have access to the HP JetDirect adapter for printing. In this situation, you should generally select a job-based connection.

However, if you share the printer that is associated with the Hpmon port, selecting a continuous connection can make sense. This computer will then function as a print server and manage all print jobs sent to the shared printer. In this situation, all computers

on the network that have access to the shared printer, in effect, will have access to the HP JetDirect adapter for printing.

AppleTalk

The *AppleTalk print monitor* sends print jobs to network print devices that support the AppleTalk protocol. The AppleTalk protocol is normally associated with Apple Macintosh computers.

Before you can connect to an AppleTalk print device, you must install the AppleTalk protocol (on a Windows NT Workstation computer) or Services for Macintosh (on a Windows NT Server computer).

AppleTalk is a routable protocol. A Windows NT computer that uses the AppleTalk print monitor can communicate with any AppleTalk print device on any segment of a routed AppleTalk network.

TO CREATE A PRINTER THAT USES THE APPLE TALK PRINT MONITOR, FOLLOW THESE STEPS:

1. Install the AppleTalk protocol if you are using a Windows NT Workstation computer. Or, install Services for Macintosh if you are using a Windows NT Server computer. (If you need more information on how to do this, refer to the section "Installing and Configuring Protocols and Services" in Chapter 4.)
2. Open the Printers folder. (Select Start >> Settings >> Printers.)
3. Double-click the Add Printers icon.
4. The Add Printer Wizard dialog box appears. To create a printer, select My Computer, and click Next.
5. In the Available ports list box, click the Add Port command button.
6. In the Printer Ports dialog box, click AppleTalk Printing Devices.

Figure 6-12 shows the Printer Ports dialog box. Notice that AppleTalk Printing Devices is selected. Click New Port.

7. When the Available AppleTalk Printing Devices dialog box appears, highlight the AppleTalk print device you want to use.

Figure 6-13 shows the Available AppleTalk Printing Devices dialog box, with an HP LaserJet 5P selected. Click OK.

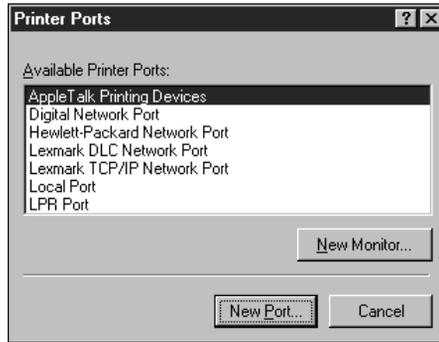


FIGURE 6-12 Adding an AppleTalk port



FIGURE 6-13 Selecting an AppleTalk print device

8. A dialog box appears asking if you want to *capture* this AppleTalk print device.

If you choose to capture an AppleTalk print device, it is the same as choosing a continuous connection (discussed in the previous section, “Hpmon”). The AppleTalk print monitor will monopolize the connection to the AppleTalk print device, and no other computer on the network will be able to access the AppleTalk print device. In addition, the AppleTalk print monitor instructs the AppleTalk print device not to advertise itself on the network. This is called *hiding*.

If you choose not to capture an AppleTalk print device, it is the same as choosing a job-based connection (discussed in the previous section, “Hpmon”). All computers on the network will be able to access the AppleTalk print device for printing, because the connection to the print device is dropped after each print job. Only one computer can connect to an AppleTalk print device at any given time.

Click Yes or No.

9. Click Close in the Printer Ports dialog box.
 10. The Available ports list box reappears with your newly created AppleTalk port highlighted and selected. Click Next.
 11. Select the appropriate manufacturer and print device model, and click Next.
 12. Type in a printer name, or accept the default. Click Next.
 13. Choose whether to share the printer. (You can share or stop sharing the printer later if you change your mind.) Click Next.
 14. Choose whether to print a test page. Click Finish.
-

TCP/IP

The *TCP/IP print monitor* sends print jobs to network print devices that both support TCP/IP and function as *line printer daemon* (LPD) print servers. TCP/IP and LPD are normally associated with UNIX computers.



note *Daemon* is a UNIX term. A UNIX daemon performs the same function as a Windows NT service. Basically, a UNIX daemon is a program that runs in the background and performs an operating system service.

Line printer daemon (LPD) is the print server software used in TCP/IP printing. The client print software used in TCP/IP printing is called *line printer remote* (LPR). To connect to a TCP/IP print server that uses LPD, use a TCP/IP print client that uses LPR.

Before you can connect to a TCP/IP print device, you must install TCP/IP and the Microsoft TCP/IP Printing service on your Windows NT computer.

In addition, to share printers on a Windows NT computer as TCP/IP printers, you must also start the TCP/IP Print Server service. The TCP/IP Print Server service is configured for manual startup by default, so you should configure this service to start automatically.

TCP/IP is a routable protocol. A Windows NT computer that uses the TCP/IP print monitor can communicate with any TCP/IP print device on any segment of a routed TCP/IP network.

TO CREATE A PRINTER THAT USES THE TCP/IP PRINT MONITOR, FOLLOW THESE STEPS:

1. Install TCP/IP and the Microsoft TCP/IP Printing service. Optionally, you can configure the TCP/IP Print Server service to start automatically if you want to share your printers as TCP/IP printers. (If you need more information on how to do this, refer to the section “Installing and Configuring Protocols and Services” in Chapter 4.)
2. Open the Printers folder. (Select Start > Settings > Printers.)
3. Double-click the Add Printers icon.
4. The Add Printer Wizard dialog box appears. To create a printer, select My Computer, and click Next.
5. In the “Available ports” list box, click the Add Port command button.
6. In the Printer Ports dialog box, click LPR Port. (The Lexmark TCP/IP Network Port displayed in this dialog box is for use *only* with Lexmark TCP/IP print devices, and requires you to install additional software.)

Figure 6-14 shows the Printer Ports dialog box. Notice that LPR Port is selected. Then click New Port.

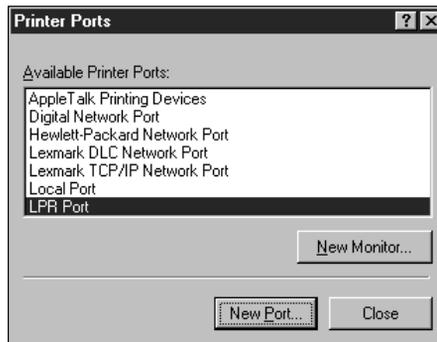


FIGURE 6-14 Adding an LPR port

7. In the Add LPR compatible printer dialog box, type the host name or IP address of the computer or device that provides the LPD service for the print device you want to use. Depending on your network configuration, this could be the host name or IP address of a UNIX computer, a Windows NT computer, or an HP JetDirect adapter that supports TCP/IP printing. In addition, type in the name of the printer or print queue on the computer or device providing the LPD service.

Figure 6-15 shows the Add LPD compatible printer dialog box. Notice the IP address of the device providing the LPD service (in this case, an HP JetDirect adapter) and the name of the printer have been entered. Click OK.

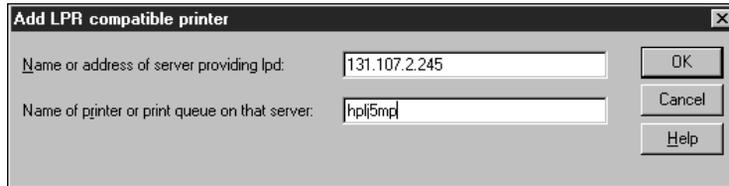


FIGURE 6-15 Configuring an LPR port

8. In the Printer Ports dialog box, click Close.
9. The Add Printer Wizard dialog box, shown in Figure 6-16, reappears. Note that the LPR port that you created is displayed in the form of *IP_address:printer_name*, and is highlighted and selected in the Available ports list box. Click Next.



FIGURE 6-16 LPR port added to available ports list

10. Select the appropriate manufacturer and print device model, and click Next.
11. Type in a printer name, or accept the default. Click Next.
12. Choose whether to share the printer. (You can share or stop sharing the printer later if you change your mind.) Click Next.
13. Choose whether to print a test page. Click Finish.



NetWare

The *NetWare print monitor* sends print jobs to a print queue on a Novell NetWare server. The NetWare server then sends the print job from the print queue to the print device.



tip

A *print queue* is the NetWare term for a shared printer. A NetWare print queue is designed to handle print jobs that are ready to send to the print device, and that need no additional conversion or formatting.

Before you can connect to a NetWare print queue, you must install NWLink IPX/SPX Compatible Transport on your Windows NT computer. In addition, on Windows NT Workstation computers, you must install *Client Service for NetWare* (CSNW); and on Windows NT Server computers, you must install *Gateway Service for NetWare* (GSNW).

NWLink IPX/SPX Compatible Transport is a routable protocol. A Windows NT computer that uses the NetWare print monitor can communicate with any NetWare server on any segment of a routed NetWare network.

TO CONNECT A WINDOWS NT COMPUTER TO A PRINTER THAT USES THE NETWARE PRINT MONITOR, FOLLOW THESE STEPS:

1. Install NWLink IPX/SPX Compatible Transport on your Windows NT computer. In addition, install Client Service for NetWare (on a Windows NT Workstation computer) or Gateway Service for NetWare (on a Windows NT Server computer), as appropriate. (If you need more information on how to do this, refer to the section "Installing and Configuring Protocols and Services" in Chapter 4.)
2. Open the Printers folder. (Select Start ► Settings ► Printers.)
3. Double-click the Add Printers icon.
4. The Add Printer Wizard dialog box appears. To connect to a printer, select Network printer server, and click Next.
5. In the Connect to Printer dialog box, do *one* of the following:

In the Printer text box, type in a complete path to the NetWare print queue you want to connect to, in the form of
`\\Netware_server_name\print_queue_name`

Or use the browse list in the Shared Printers list box to select the NetWare print queue to which you want to connect.

Figure 6-17 shows the Connect to Printer dialog box. Notice that a NetWare print queue is selected. Then click OK.

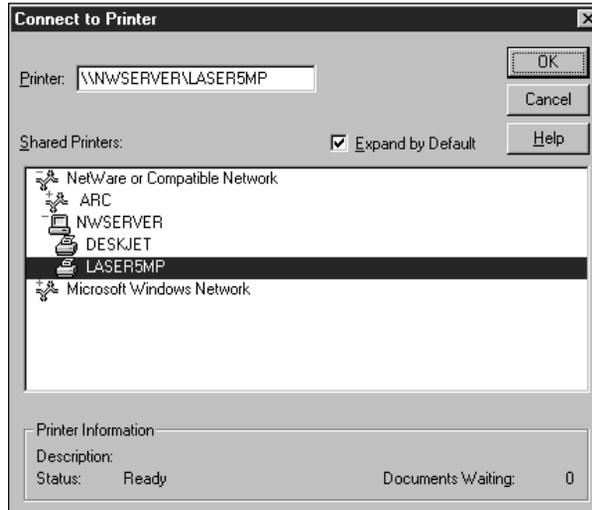


FIGURE 6-17 Connecting to a NetWare print queue

6. A warning message appears, indicating that the server on which the NetWare print queue resides doesn't have the appropriate printer driver installed. Click OK to install a printer driver on your Windows NT computer.
7. Select the appropriate manufacturer and print device model, and click OK.
8. A dialog box appears asking if you want this printer to be your default printer. Click Yes or No, as appropriate, and then click Next to continue.
9. Click Finish. You are now connected to a NetWare print queue.

Configuring Print Server Properties

A *print server* is a computer (or network device) that manages print jobs and print devices. The Windows NT Spooler service performs many of the functions of a print server. You can configure several of the Spooler service's properties (which Windows NT calls *print server properties*) including the spool folder, forms, and ports.

TO ACCESS THE PRINT SERVER PROPERTIES DIALOG BOX IN WINDOWS NT WORKSTATION OR WINDOWS NT SERVER, FOLLOW THESE STEPS:

1. Select Start > Settings > Printers.
 2. Then select File > Server Properties in the Printers dialog box.
-

The following sections explain how you can configure each of the print server properties.

Changing the Spool Folder

The *spool folder* is used by the Windows NT Spooler service as a temporary storage area for print jobs waiting to be sent to a print device. The default location for the spool folder is `<winntroot>\System32\Spool\Printers`.

If the partition that contains the spool folder does not have enough free space to store print jobs, you may experience print job failures. On a busy Windows NT Server computer with multiple shared printers, for example, you might need between 25MB and several hundred megabytes of free space for the spool folder, depending on the number, type, and size of print jobs that are spooled on this server.

If you experience print job failures due to a lack of free space for your spool folder, you can specify that a different folder on another partition (that has more free space) be used as your spool folder.

To change your spool folder, click the Advanced tab in the Print Server Properties dialog box. Then, edit the contents of the Spool Folder text box. You can specify any folder in any partition as your spool folder, in the format of `Drive_letter:\Folder\Subfolder`.

Figure 6-18 shows the Advanced tab in the Print Server Properties dialog box. Note the default spool folder location, and the additional options that you can configure on this tab.

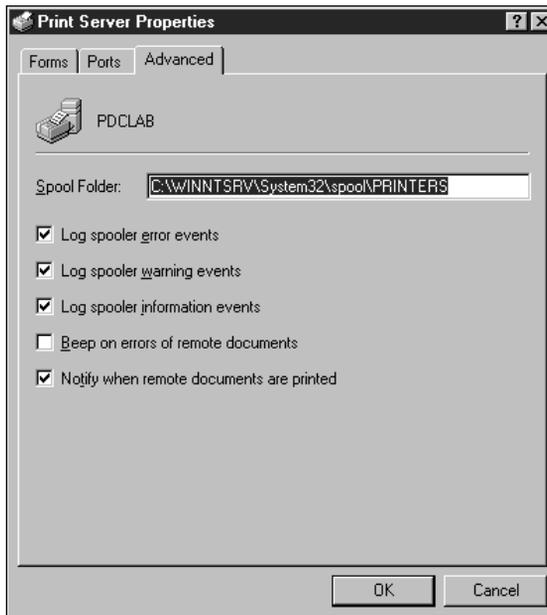


FIGURE 6-18 Configuring advanced print server properties



Many a network administrator has changed the spool folder on a Windows NT computer, only to find out that users can no longer print to shared network printers on this computer.

To solve this problem, the administrator must assign permissions so that all users who print to any shared printer on the Windows NT computer have the Change permission to the spool folder. Users that don't have the Change permission to the spool folder won't be able to print to any shared network printer on the Windows NT computer. (Permissions are covered in detail in Chapter 12.)

Creating Forms

You can create forms on the Forms tab in the Print Server Properties dialog box. Options that you can configure include form name, paper size, and printer area margins.

Once you've created a form, you can assign that form to a paper tray on a printer. (Assigning a form to a paper tray is covered later in this chapter.) Once a form is assigned to a paper tray, documents that specify that form are automati-

cally printed using that paper tray. This process can be helpful in managing document printing on a network.

For example, suppose a company wants to print all documents that require company letterhead from a specific paper tray. When a user wants to print a document using letterhead paper, the user can select the letterhead form (in the Printer Properties dialog box) in any Windows application when the user creates a print job. Using the Windows NT form capabilities enables the user to print a document on letterhead without necessarily knowing which paper tray in the print device contains the company's letterhead.

Some network administrators create a separate printer for each form and paper tray assignment to ease administration and to enable users to select forms in a more obvious manner.

To create a form, click the Forms tab in the Print Server Properties dialog box. Highlight any existing form in the Forms list box, select the check box next to Create a New Form, and then edit the name of the form, as well as the paper size and printer area margins to meet your new form's specifications. Then click the Save Form command button. The new form is added to the Forms list box, and the old form is not changed or deleted.

Figure 6-19 shows the Forms tab in the Print Server Properties dialog box. Notice that a form called *Letterhead* has been created and now appears in the Forms list box.

Managing Ports

You can use the Ports tab in the Print Server Properties dialog box to add, delete, and configure ports. (As you recall, creating and configuring ports by using the Add Printer Wizard was discussed in the "Print Monitors" section earlier in this chapter.)

The capabilities of the Ports tab in the Print Server Properties dialog box are identical to those in the Add Printer Wizard with one exception: ports can only be *deleted* from the Ports tab in the Print Server Properties dialog box.

Figure 6-20 shows the Ports tab in the Print Server Properties dialog box. Notice the Delete Port command button.

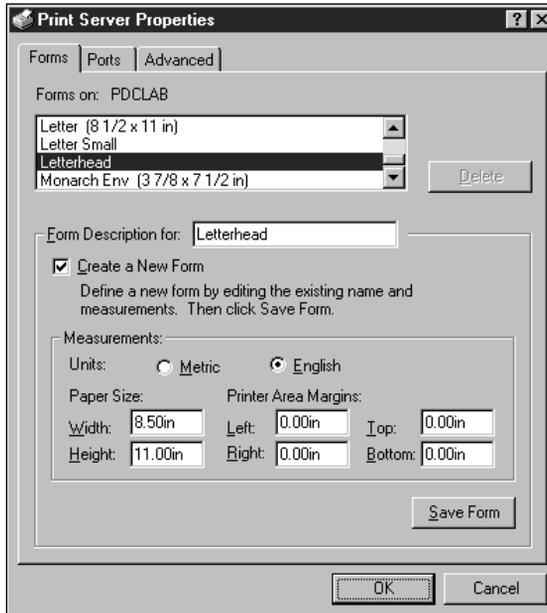


FIGURE 6-19 Creating forms

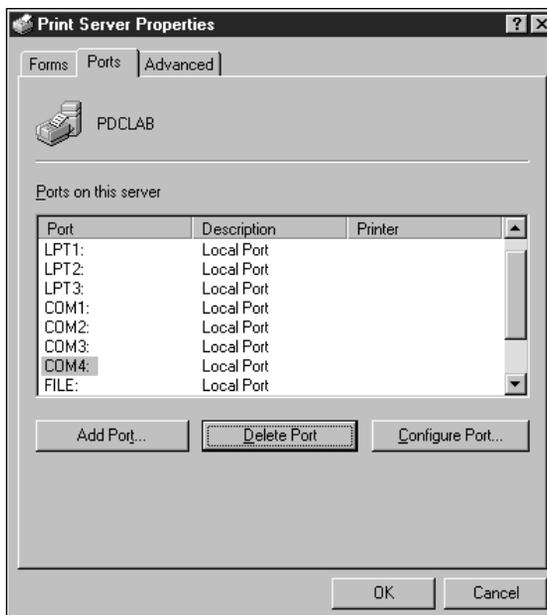


FIGURE 6-20 Managing ports

Configuring Printer Properties

In Windows NT you can configure options for a printer in the printer's Properties dialog box. This dialog box is printer specific, and is titled *Printer_name* Properties.

TO ACCESS THE PROPERTIES DIALOG BOX FOR A PRINTER, FOLLOW THESE STEPS:

1. Select Start > Settings > Printers.
2. In the Printers dialog box, right-click the printer you want to configure.
3. Then select Properties from the menu that appears.

The following sections explain how you can configure printer properties, including assigning a separator page, assigning forms to paper trays, printer security, printing to multiple ports (printer pools), scheduling printers and setting printer priorities, and sharing a printer.

Assigning a Separator Page

You can configure Windows NT so that a *separator page* is printed at the beginning of every document. Using separator pages at the beginning of print jobs enables users to locate their print jobs at the print device easily. Separator pages are sometimes called *banner pages*.

You can assign a separator page to a printer by using the Properties dialog box for your printer. To do this, click the Separator Page command button on the General tab in your printer Properties dialog box. In the Separator Page dialog box, type in the full path of the separator page file you want to assign to your printer; or click the Browse command button and double-click the separator page file you want to assign from the Separator Page dialog box. Then click OK in the Separator Page dialog box, and exit the Properties dialog box for your printer.

Figure 6-21 shows the Separator Page dialog boxes. Notice that there are three default separator page files shown: Pcl.sep, Pscript.sep, and Sysprint.sep. The Pcl.sep separator page file switches a dual language

print device to PCL printing, and causes a separator page to be printed at the beginning of each print job. The `Pscript.sep` separator page file switches a dual language print device to PostScript printing, but does *not* cause a separator page to be printed at the beginning of each print job. The `Sysprint.sep` separator page file causes a separator page to be printed at the beginning of each print job, and is only compatible with PostScript print devices.

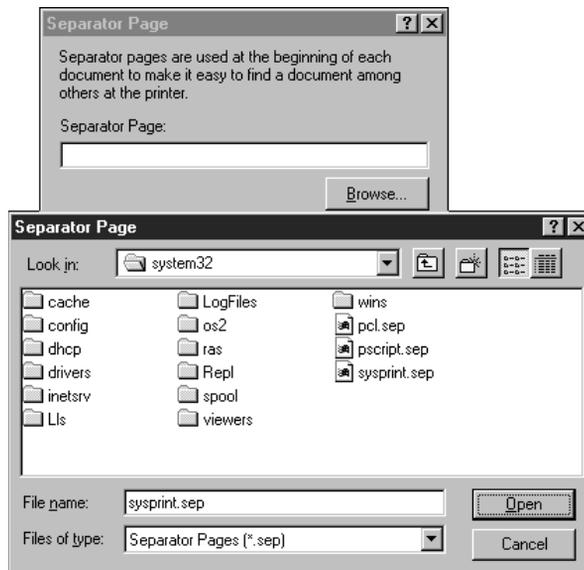


FIGURE 6-21 Assigning a separator page to a printer

You can create additional separator page files by editing an existing separator page file and saving it with a different name.



concept link

For detailed information on editing separator page files and using custom separator pages, search for “Separator pages, printing” in NT Books Online (Start > Programs > Books Online – available on Windows NT Server only).

Assigning Forms to Paper Trays

As discussed in the section on “Creating Forms” section earlier in this chapter, assigning forms to paper trays can be helpful in managing document printing on a network, because once a form is assigned to a paper tray, print jobs that specify that form are automatically printed using that paper tray.

To assign a form to a paper tray, select the Device Settings tab in the Properties dialog box for your printer. Highlight the paper tray to which you want to assign the form, and then select the form you want to assign to this paper tray from the Change Tray Setting list box. Click OK.

Figure 6-22 shows the Device Settings tab in the Properties dialog box for my printer, an HP LaserJet 5MP. Notice that the letterhead form is now assigned to Tray 1.

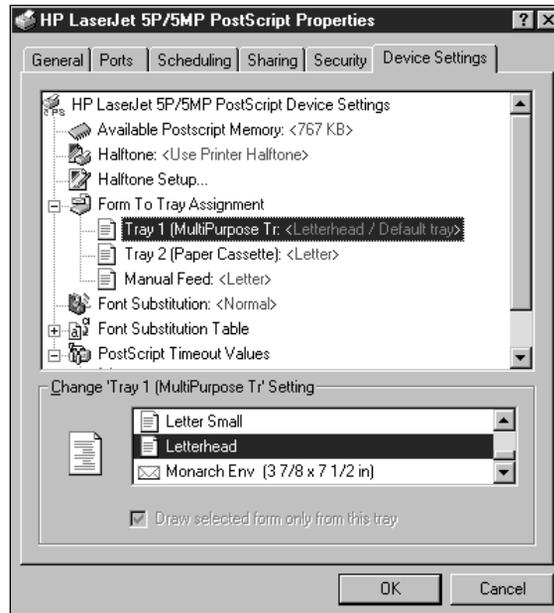


FIGURE 6-22 Assigning a form to a paper tray

Printer Security

You can use Windows NT printer security to control access to a printer by assigning printer permissions to users and groups. Printer security is configured on the Security tab in a printer's Properties dialog box. In addition, you can take ownership of a printer and configure Windows NT to audit printer usage in this dialog box.

Figure 6-23 shows the Security tab in a printer's Properties dialog box. Note the Permissions, Auditing, and Ownership command buttons.

The next sections discuss printer permissions, auditing printers, and taking ownership of a printer.



FIGURE 6-23 The Security tab in a printer's Properties dialog box

Printer permissions

Printer permissions control which tasks a user can perform on a specific printer. Table 6-1 lists and describes the Windows NT printer permissions.

TABLE 6-1 WINDOWS NT PRINTER PERMISSIONS

<i>PRINTER PERMISSION</i>	<i>DESCRIPTION AND FUNCTIONALITY</i>
No Access	A user or group that has the No Access permission cannot access the printer.
Print	The Print permission allows users to create print jobs, and also to delete their own print jobs.
Manage Documents	The Manage Documents permission allows users to pause, restart, delete, and control job settings for all print jobs. The Manage Documents permission does not allow a user to print to the printer.
Full Control	A user or group that has the Full Control permission can do everything that a user with the Manage Documents and Print permissions can do, and can also assign printer permissions, delete printers, share printers, and change printer properties.

You can assign printer permissions to users and groups. User and group permissions are additive. In other words, if a user has the Print permission, and a group that the user is a member of has Full Control, then the user has Full Control.

There is one exception to this rule. If a user, or any group that a user is a member of, has the No Access permission, then the user's effective permission is always No Access. For example, a user may have the Full Control permission, but a group that the user is a member of may have the No Access permission. The user's effective permission is No Access, and the user cannot access the printer.



concept link

For more information on user and group accounts, see Chapter 7.

To assign printer permissions to users and groups, click the Permissions command button on the Security tab in the Properties dialog box for the printer you want to configure. Figure 6-24 shows the default printer permissions assigned to a newly created printer in the Printer Permissions dialog box. Note that by default the Everyone group has the Print permission, which effectively enables all users to create and delete their own print jobs on this printer.

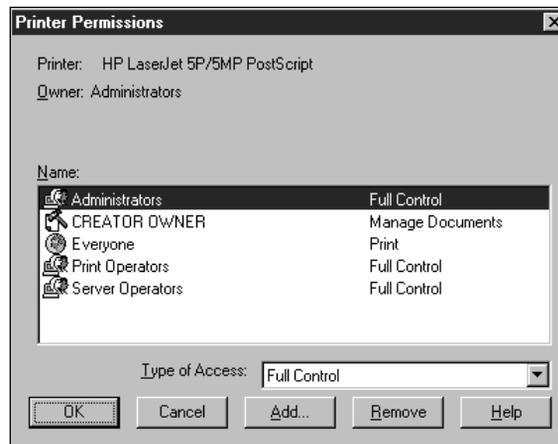


FIGURE 6-24 Assigning printer permissions

To modify permissions in this dialog box, highlight a user or group, and then select the permission you want to assign to this user or group from the Type of Access drop-down list box. Then click OK, and click OK in your printer's Properties dialog box.

To add a user or group to the Name list box, click the Add command button in the Printer Permissions dialog box. The Add Users and Groups dialog box appears. Select the user(s) and/or group(s) you want to add, then click the Add command button. Then click OK to return to the Printer Permissions dialog box. Click OK, and click OK in your printer's Properties dialog box.

To remove a user or group from the Name list box, highlight the user or group and press Delete. Then click OK. Click OK in your printer's Properties dialog box.

Auditing printers

You can use your printer's Properties dialog box to configure Windows NT to audit a user or group's usage (and/or attempted usage) of a printer. Only members of the Administrators group can configure auditing on a Windows NT computer.

When auditing is enabled, Windows NT adds an entry to the security log in Event Viewer every time an audited user or group exercises (and/or attempts to exercise) an audited permission on a specific printer. To gain a better understanding of auditing printers, how about a walk through the process of configuring printer auditing?

Auditing printers is accomplished in two parts: first, auditing is enabled in User Manager for Domains (or in User Manager on Windows NT Workstation); second, printer auditing is configured in a specific printer's Properties dialog box.

The following sections explain how to perform these tasks.

TO ENABLE AUDITING IN USER MANAGER, FOLLOW THESE STEPS:

1. Select Start ► Programs ► Administrative Tools (Common) ► User Manager for Domains (or User Manager on a Windows NT Workstation computer).
2. In the User Manager dialog box, select Policies ► Audit.
3. The Audit Policy dialog box appears. Select the radio button next to Audit These Events. Then select the events you want to be audited. You *must* select the Success and/or Failure check boxes for File and Object Access to audit printer events.

Success auditing means that Windows NT will report successful attempts to complete the task or event listed.

Failure auditing means that Windows NT will report unsuccessful attempts to complete the task or event listed.

Figure 6-25 shows the Audit Policy dialog box. Note that the radio button next to Audit These Events is selected, and that the Success and Failure check boxes for File and Object Access are checked. Click OK.



FIGURE 6-25 Enabling auditing of file and object access

4. Exit User Manager for Domains (or User Manger).

TO CONFIGURE PRINTER AUDITING, FOLLOW THESE STEPS:

1. Select Start >> Settings >> Printers.
2. In the Printers dialog box, right-click the printer you want to configure.
3. Then select Properties from the menu that appears.
4. Click the Security tab in your printer's Properties dialog box.
5. Click the Auditing command button.
6. The Printer Auditing dialog box appears. You must add the user(s) and/or group(s) you want to audit for this printer to the Name list box. To do this, click the Add command button.
7. The Add Users and Groups dialog box appears. Select the user(s) and/or group(s) you want to add, and then click the Add command button. Then click OK to return to the Printer Auditing dialog box.
8. The user(s) and/or group(s) you added are now listed in the Name list box. Select the Success and/or Failure check boxes for the print events you want to audit. You *must* select at least one event for print auditing to occur. Figure 6-26 shows the Printer Auditing dialog box. Notice that the check boxes for Success and Failure auditing of Print events are selected for the Everyone group. Click OK.
9. Click OK in your printer's Properties dialog box. Auditing of print events is now enabled and configured.

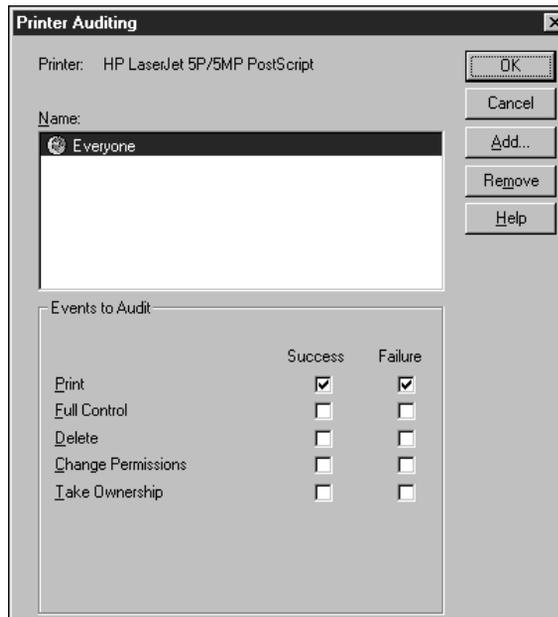


FIGURE 6-26 Configuring print events to audit

To view the events generated by printer auditing, select **Start > Programs > Administrative Tools (Common) > Event Viewer**. In the Event Viewer dialog box, select **Log > Security**. A list of audited events is displayed. You can double-click any event for a detailed description of the event.



Auditing printers can generate a significant number of entries in the security log. I recommend you don't use printer auditing unless you have a specific need to do so.

Taking ownership of a printer

The owner of a printer has special status — an owner can assign printer permissions for that printer to any user or group, even if the owner has the No Access permission to that printer. A printer can have only one owner at any given time.

There are two ways to become an owner of a printer: either by creating the printer, or by taking ownership of the printer. By default, the user that creates a printer is the owner of that printer (unless the person who creates a printer is a member of the Administrators group, in which case the Administrators group is

the owner of that printer). Only certain users can take ownership of a printer. You must either be a member of the Administrators group or have the Full Control permission to take ownership of a printer.

So why would you ever want to take ownership of a printer? Well, assume that a user on your network (I'll call him Fred) who has the Full Control permission to a printer has inadvertently taken ownership and removed *all* users' printer permissions for that printer. As a result of Fred's faux pas, the network administrator — that's you — (and every other user) now have no permissions for the printer. To be able to resolve the problem and assign yourself and other users permissions to the printer again, you need to first take ownership of the printer.

The process of taking ownership is fairly straightforward. First, log on as Administrator. (You must log on as the user that wants to become the new owner of the printer. Normally this is the administrator, but it can be any user with the Full Control permission to that printer.) In the `Printers` folder, right-click the printer you want to take ownership of, then select Properties from the menu that appears. If you have no permissions to the printer (such as in the previous example), a dialog box appears, indicating that you do not have access to this printer, and that only the Security tab will be displayed. Click OK. On the Security tab, click the Ownership command button. A warning dialog box appears, indicating that you do not have permission to view the current owner, but that you may have permission to change it. Click Yes. The Owner dialog box, shown in Figure 6-27, appears.

Click the Take Ownership command button. Then click OK on the Security tab of the printer's Properties dialog box. You are now the new owner of the printer, and can assign printer permissions for that printer.

Printing to Multiple Ports (Printer Pools)

When a printer has multiple ports (and multiple print devices) assigned to it, this is called a *printer pool*. Users print to a single printer, and the printer load-balances its print jobs between the print devices assigned to it.

A printer pool is a useful tool when *both* of the following criteria are met:

- All print devices assigned to the printer use the same print device driver. (Usually, this means that identical print devices are used.)
- All print devices assigned to the printer pool are located physically close to each other.

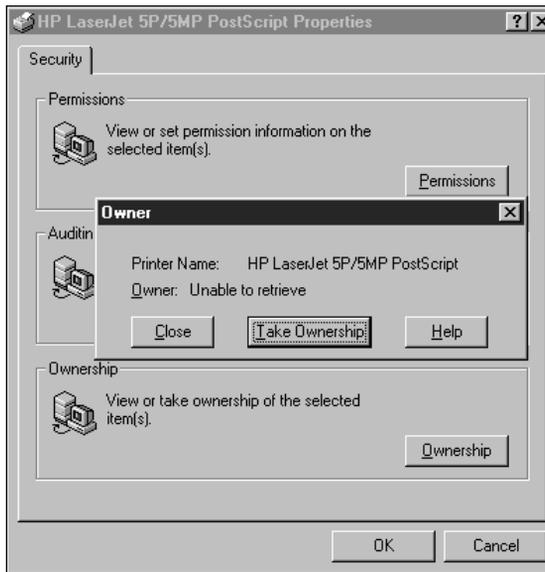


FIGURE 6-27 Taking ownership of a printer



A printer pool can be a good solution when the desired number of printed pages is more output than one print device can produce. When you implement a printer pool, I recommend you use two or more identical print devices, located next to each other. A printer pool is definitely *not* useful if the print devices are located at opposite ends of a building, because users would have to check both locations to find their print jobs.

To configure multiple ports (and their associated print devices) as a printer pool, first create a printer. Then, from the `Printers` folder, right-click this printer and select `Properties` from the menu that appears. Click the `Ports` tab of the printer's Properties dialog box. On the `Ports` tab, click the check box next to "Enable printer pooling". Then select at least one additional port from the `Port` list box. Figure 6-28 shows the Properties dialog box for a printer that has been configured as a printer pool. Notice that three ports have been selected, and that the check box next to "Enable printer pooling" is checked.

When a user prints to a printer pool, the print job is sent to the first listed print device in the `Port` list that is not busy printing another print job. The entire print job is sent to the same port (print device). In a printer pool the print spooler — not the user — determines to which print device the print job will be sent.

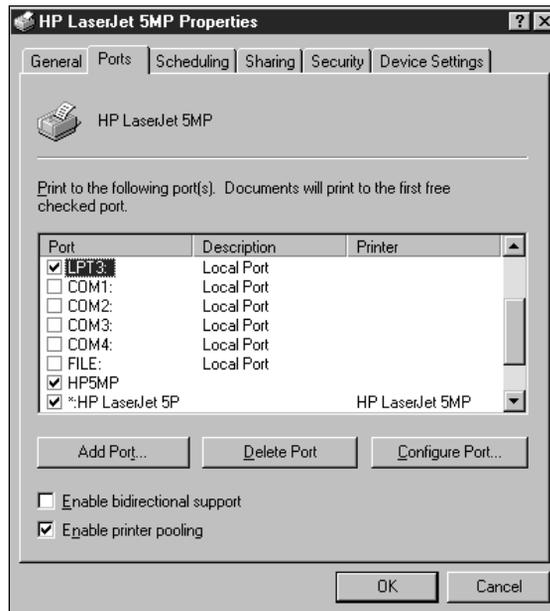


FIGURE 6-28 Creating a printer pool

Scheduling Printers and Setting Printer Priorities

Scheduling printers and setting printer priorities are two techniques you can use to help manage the flow of print jobs on your Windows NT network. I will discuss both of these approaches in the following sections.

Scheduling printers

Scheduling a printer means assigning the hours a specific print device is available for use by a specific printer. When scheduling a printer, the hours of availability apply only to the print device, not to the printer. This means that users can print to the printer at any time during the day, and the printer then spools the jobs to the hard disk. However, the print jobs are only sent to the print device during the print device's hours of availability. (If you decide to schedule a printer, be sure to reserve plenty of hard disk space to spool print jobs while they wait for the print device to become available.)

So why would you want to schedule a printer? Well, suppose you are the network administrator for a small, twenty-computer network. The owner of the company recently bought a laser print device for network printing, and doesn't

want to spend any more money on print devices. One of the employees occasionally generates a print job that is five to six hundred pages long. This report ties up the one available printer for a long time, frustrating other employees. The large reports are for archival and reference purposes, and are not needed immediately.

You solve the problem this way: first, you create a second printer that prints to the laser print device. Then you schedule the new printer so that it only sends print jobs to the print device during nonbusiness hours. You instruct the employee who creates the large print jobs to use the new printer for the large print jobs. The result is that the employee can generate large print jobs at any time without inconveniencing other employees. The large print jobs are spooled to the hard disk, and then sent to the print device during nonbusiness hours. (Make sure to stock the print device with plenty of paper just before leaving for the evening!)

To schedule a printer, right-click the printer in the `Printers` folder and select `Properties` from the menu that is displayed. Then select the `Scheduling` tab from the printer's `Properties` dialog box. To set the available hours, click the radio button next to `From` and set the times in the spin boxes next to `From` and `To`.

Figure 6-29 shows the `Scheduling` tab in the `HP LaserJet 5MP Properties` dialog box. Note that the available hours are from 9:00 p.m. to 5:00 a.m. Print jobs sent to this printer will only be sent to the print device during these non-business hours.

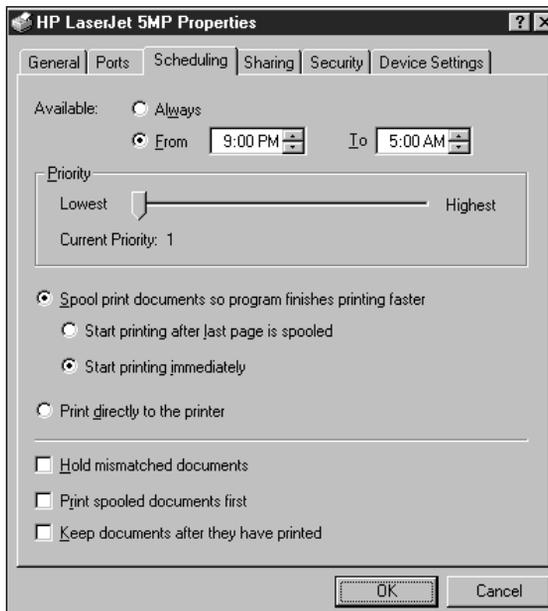


FIGURE 6-29 Scheduling available hours for a print device

Setting printer priorities

When more than one printer sends print jobs to the same print device, setting printer priorities may be useful. If two printers are configured to use the same print device, and you configure one of these printers to have a higher priority than the other printer, then all print jobs from the higher priority printer will be sent to the print device before any print jobs from the lower priority printer are sent.

The highest printer priority is 99, and the lowest printer priority is 1. All printers have a priority of 1 by default.

Here's one situation in which setting printer priorities could be beneficial: Suppose you have two printers on a Windows NT Server computer that both send print jobs to the print device connected to LPT1:. One printer is named *sales*, and the other printer is named *managers*. Figure 6-30 shows the *sales* and *managers* Properties dialog boxes. Notice that both printers are configured to use LPT1:.

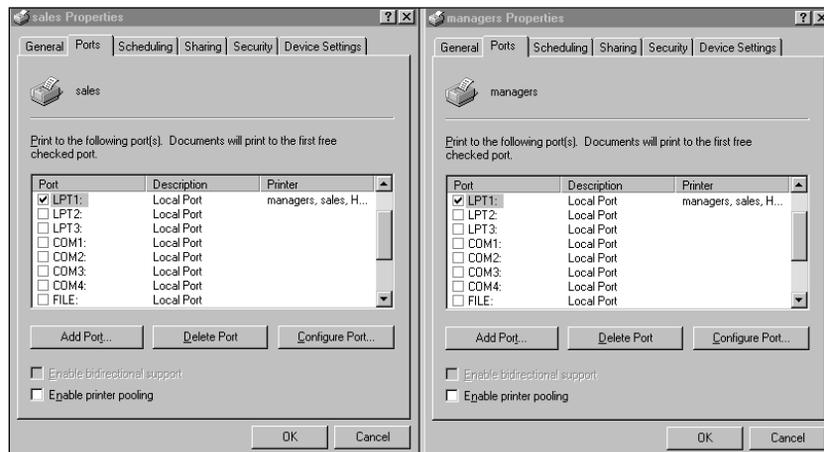


FIGURE 6-30 The *sales* and *managers* printers

The managers at this company, who think their work is more important than everyone else's, tell you — the network administrator — that they want their print jobs printed before anyone else's.

So what's a network administrator to do? You decide to configure printer security so that everyone can use the *sales* printer, but only members of the Managers group can use the *managers* printer. Then you set the priority on the *managers* printer to a value higher than one. Once this is done, the managers' print jobs will take priority. Suppose that there are one hundred print jobs waiting to print in the

sales printer, and a manager sends a print job to the *managers* printer. The current print job from the *sales* printer will finish printing, then the manager's print job will be printed, even though there are one hundred other print jobs in the *sales* printer that were generated before the manager's print job.

Figure 6-31 shows the Scheduling tab in the Properties dialog boxes for both the *sales* and *managers* printers. Notice that the *sales* printer is set to a priority of 1 (lowest), and that the *managers* printer is set to a priority of 99 (highest).

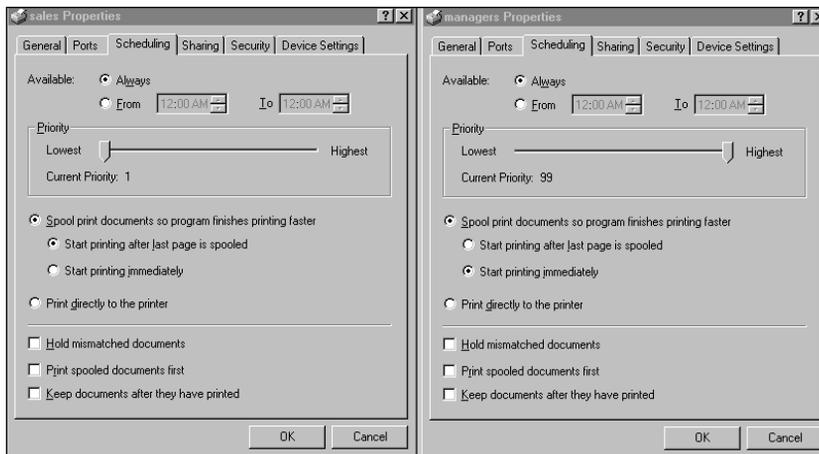


FIGURE 6-31 Printer priorities for the *sales* and *managers* printers

Also notice in Figure 6-31 that the “Start printing after last page is spooled” option is selected for the *sales* printer. This means that print jobs sent to the *sales* printer are not sent to the print device until the *entire* print job has been received by the spooler. Finally, notice that the “Start printing immediately” option is selected for the *managers* printer. This causes print jobs sent to the *managers* printer to be sent to the print device as soon as the spooler *starts* receiving the print job. This setting gives the managers another subtle speed advantage over those who use the *sales* printer.

Sharing a Printer

The purpose of sharing a printer on a Windows NT computer is to enable users of other computers on the network to connect to and to send print jobs to the shared printer. The computer that hosts the shared printer is called a *print server*. The

print server performs all of the spooling, print job management, scheduling, and sending of the final print jobs to the print device.

When you share a printer on your Windows NT computer, the types of computers on the network that can access your shared printer are somewhat dependent upon the protocols and services installed in your computer.

When you install Windows NT, Microsoft Windows Networking is installed by default. If you have not installed any other services and you share a printer on your computer, only computers that support Microsoft Windows Networking can access the shared printer.

If you installed Microsoft TCP/IP Printing *and* started the TCP/IP Print Server service (which is installed with Microsoft TCP/IP Printing), and you share a printer on your computer, then computers that support Microsoft Windows Networking and computers that support TCP/IP printing (such as UNIX computers) can access the shared printer.

If you have installed Services for Macintosh on a Windows NT Server computer and you share a printer on your computer, then computers that support Microsoft Windows Networking and Macintosh computers can access the shared printer. Services for Macintosh can only be installed on a Windows NT Server computer, not a Windows NT Workstation computer.



concept link

For more information on sharing printers in a Macintosh environment, see the section “Sharing AppleTalk printers in Windows NT” later in this chapter.

Microsoft TCP/IP Printing and Services for Macintosh both include components that enable you to share printers. These components are called *print server services*. If you have more than one print server service installed and started on your Windows NT computer, and then you share a printer, the printer is shared on *all* running print server services installed on your computer.

Installing printer drivers for shared printers

When you share a printer on a Windows NT computer, Windows NT permits you to install alternate printer drivers for other versions of Windows NT and Windows 95. You can also install alternate printer drivers for other Windows NT hardware platforms, such as MIPS R4000, PowerPC, and DEC Alpha.

Installing these drivers enables users of Windows NT and Windows 95 computers on your network to automatically download and install the appropriate printer drivers for their operating systems/hardware platforms when they connect to the shared printer. The advantage of being able to install these alternate printer drivers on a shared printer is that the network administrator is spared the time-consuming task of manually installing printer drivers on every computer on the network.

To install alternate drivers on a shared printer, click the Sharing tab in the shared printer's Properties dialog box. Then select the alternate drivers for the operating systems/hardware platforms you want to install. Click OK when you are finished. Windows NT prompts you for the source media and path for each alternate driver you select.

The source media is your Windows NT Server or Workstation compact disc if you are installing alternate printer drivers for NT 4.0. If you are installing alternate drivers for another version of Windows NT, such as NT 3.51, the source media is the Windows NT Server or Workstation (version 3.51) compact disc. The path is the appropriate platform subdirectory, such as `\I386`, `\MIPS`, `\PPC`, or `\Alpha`.

When installing alternate printer drivers for Windows 95, a more complex task is indicated. First, copy all of the operating system files from the Windows 95 source media (the `Win95` folder on the Windows 95 compact disc) to a folder on your Windows NT computer. Then, in this folder on your Windows NT computer, expand all of the CAB files.



concept link

For more information on how to expand Windows 95 CAB files, refer to the Windows 95 product documentation and help files.

When Windows NT prompts you for the source media for the Windows 95 alternate printer drivers, type the path to the folder that contains the expanded Windows 95 source files.

Figure 6-32 shows a shared printer, named *managers*, with alternate printer drivers for Windows 95 and Windows NT 4.0 *x86* highlighted. The *x86* indicates that printer drivers for Intel-based computers that run Windows NT 4.0 will be installed.

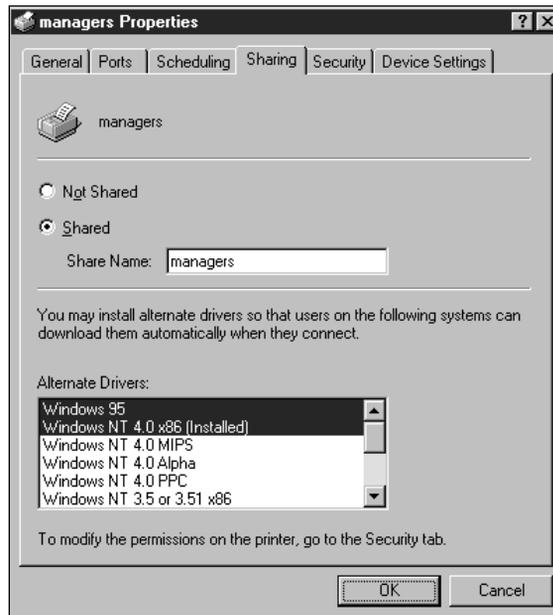


FIGURE 6-32 Installing printer drivers for multiple operating systems

Sharing AppleTalk printers in Windows NT

When a Windows NT Workstation computer that has the AppleTalk protocol installed on it shares a printer, the printer is *not* accessible from Macintosh computers on the network, because Windows NT Workstation does not have any AppleTalk print server capabilities.

This means that if you capture an AppleTalk print device on a Windows NT Workstation computer, and then share the associated printer, Macintosh computers on the network cannot access the AppleTalk print device nor the shared printer. The Macintosh computers can't access the AppleTalk print device, in this situation, because the AppleTalk print monitor has captured (and hidden) the print device. The Macintosh computers can't access the shared printer because Windows NT Workstation is not capable of sharing a printer as an AppleTalk printer.

When a Windows NT Server computer that has Services for Macintosh installed on it shares a printer, the printer *is* accessible from Macintosh computers on the network, because Windows NT Server has full AppleTalk print server capabilities.

Shared printers on a Windows NT Server computer that has Services for Macintosh installed advertise themselves to Macintosh computers on the network as Apple LaserWriters. (An Apple LaserWriter is the original laser print device for Macintosh computers. All Macintosh computers have built-in drivers for the Apple LaserWriter.) This means that a Macintosh computer does not need special drivers to access the shared printer. Windows NT Server converts the PostScript print jobs it receives from Macintosh computers into RAW format print jobs for the print device.

Troubleshooting Common Printing Problems

Printing problems can occur on a Windows NT network for several reasons. Some of the most common printing problems involve users who do not have the permissions they need to access the printer, or users who have the Full Control permission or the Manage Document permission accidentally deleting documents that belong to other users. A good first step, when troubleshooting printer problems, is to ensure that users have appropriate printer permissions.

Table 6-2 lists some common printing problems, their probable causes, and recommended solutions.

TABLE 6-2 TROUBLESHOOTING PRINTING PROBLEMS

<i>PROBLEM</i>	<i>PROBABLE CAUSE/RECOMMENDED SOLUTION</i>
Print jobs are not being sent from the printer to the print device. A print job with a size of 0 bytes is at the top of the print job list for the printer. Other documents are also listed in the print job list, and users can still send print jobs to the printer. There is plenty of free space on the partition that contains your spool folder.	The most likely cause of this problem is a stalled print spooler. Stop and restart the Spooler service, and printing should resume.

continued

TABLE 6-2 (continued)

PROBLEM	PROBABLE CAUSE/RECOMMENDED SOLUTION
<p>No print events are listed in the security log in Event Viewer. You recently configured success auditing for print events in the Properties dialog box for the printer. Several days have passed, and hundreds of documents have been printed.</p>	<p>The most likely cause of this problem is that the success option for auditing file and object access has not been configured in User Manager for Domains (or User Manager). Auditing of printers requires that auditing of file and object access be configured. To resolve the problem, configure the necessary options in User Manager for Domains (or User Manager).</p>
<p>A printer that uses the Hpmon print monitor has stopped sending print jobs to its assigned print device.</p>	<p>This problem usually occurs when another computer on the network is configured to use Hpmon to connect to the print device by using a continuous connection. If you want more than one printer to be able to access a print device by using Hpmon, configure a job-based connection for all printers.</p>
<p>You are unable to connect a Windows NT computer to a print device that uses TCP/IP and LPD.</p>	<p>Of the many possible causes for this problem, the most common is an incorrect configuration of a TCP/IP parameter on either the Windows NT computer or on the print device that uses TCP/IP and LPD. Ensure that the IP address, subnet mask, and default gateway parameters on <i>both</i> the Windows NT computer and the print device that uses TCP/IP and LPD are set correctly.</p>
<p>You experience a paper jam in the middle of an important print job. You want to reprint the entire print job, but it is not possible to reprint the job from the application that created it because you deleted the document after you created the print job.</p>	<p>The cause of the paper jam is not important here, but being able to reprint the entire print job is. To solve this problem, I recommend that you:</p> <ol style="list-style-type: none"> 1. Immediately double-click the printer in the <code>Printers</code> folder. 2. The Printers dialog box appears. Select <code>Document > Pause</code>. This pauses the print job. 3. Clear the paper jam at the print device. 4. Select <code>Document > Restart</code> to reprint the entire print job.

PROBLEM**PROBABLE CAUSE/RECOMMENDED SOLUTION**

You receive spooler messages indicating that your print job has been spooled with a size of 0 bytes. Figure 6-33 shows a sample error message of this type.

(Do *not* select Resume from the Document menu, because this will only print the print job from wherever the printer jammed to the end of the document, and the pages jammed in the print device will very likely be lost.)

The most probable cause of this problem is that the partition that contains the printer's spool folder does not have enough free space to print the document in question. You should delete some files from this partition, or move the spool folder to a different partition that has more free space.

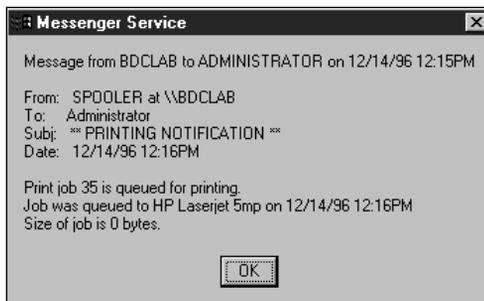


FIGURE 6-33 Spooler error message



While troubleshooting is sometimes an art, it is more often a methodical, step-by-step process. If you do not quickly see the cause of your problem, I recommend you check all permissions, as well as hardware and software configuration parameters. Be careful here—it's easy to bypass a configuration parameter that looks correct at first glance but has a small error in it. Be very detail-oriented and methodical when troubleshooting, and you will probably resolve most of the problems you encounter in short order.

Key Point Summary

Chapter 6 introduced many key Windows NT printing topics.

- It is important to have a solid grasp of Windows NT printing terminology, not only for fully understanding printing in NT, but also for passing the Microsoft Certified Professional exams. A *printer* is the software interface between NT and the device that produces printed output. A *print (or printing) device* is the physical device (hardware) that produces the printed output.
- The *print process* begins with the user at an NT computer creating a print job within an application, such as Word. The application then hands off the print job to the *Graphics Device Interface* (GDI). The GDI initiates a request to the driver for the print device. The driver for the print device converts the print job into either a Windows NT *enhanced metafile* (EMF) or into a RAW format. The driver returns the converted print job to the GDI. The GDI hands off the print job to the Windows NT spooler, which determines whether the print device is managed locally or by a network-connected computer. If the print device is managed by the local computer that initiated this print job, the spooler copies the print job to a temporary storage area on the local computer's hard disk. If the print device is managed by a network-connected computer, the spooler hands off the print job to the spooler on the network-connected computer. Then that spooler copies the print job to a temporary storage area on that computer's hard disk. The print job is then handed off to the local print provider on the computer that has the print job spooled to its hard disk. The local print provider calls the print processor to perform any additional necessary conversions. Then the print processor returns the ready-to-print print job to the local print provider. The local print provider adds a separator page to the print job (if it is configured to do so) and then hands off the print job to the print monitor. The print monitor communicates directly with the print device, and sends the ready-to-print print job to the print device, which finally produces the printed output. You may want to refer back to Figure 6-1, which shows a graphical illustration of the Windows NT print process.
- There are two ways of installing and configuring a printer in Windows NT: you can either *create a printer* or *connect to a shared network printer*. Both creating a printer and connecting to a printer are called "adding a

printer,” because both processes use the Add Printer Wizard in the Printers folder. You can also connect to a printer by using drag-and-drop printing.

- *Print monitors* (also called port monitors) are software components that send ready-to-print print jobs to a print device, either locally or across the network. Each port is associated with one specific print monitor. The most commonly used print monitors are Localmon, Hpmon, AppleTalk, TCP/IP, and NetWare.
- The *Localmon print monitor* sends print jobs to print devices that are connected to hardware ports on a local Windows NT computer. It is the only print monitor that is installed by default during the installation of Windows NT.
- The *Hpmon print monitor* sends print jobs to a network print device via an HP JetDirect adapter. Although HP JetDirect adapters typically support a variety of protocols, Hpmon uses only the DLC protocol to communicate with HP JetDirect adapters. The DLC protocol is a non-routable protocol, although it does support bridging. You must install DLC before you can connect to an HP JetDirect adapter using Hpmon. When you configure an Hpmon port, you must choose between a job-based and a continuous connection. A *job-based connection* enables all computers on the network to access the HP JetDirect adapter for printing, because the connection to the HP JetDirect adapter is dropped after each print job. A *continuous connection* causes Hpmon to monopolize the HP JetDirect adapter, and no other computer on the network is able to access the HP JetDirect adapter for printing.
- The *AppleTalk print monitor* sends print jobs to network print devices that support the AppleTalk protocol. The AppleTalk protocol is usually associated with Apple Macintosh computers. Before you can connect to an AppleTalk print device, you must install the AppleTalk protocol (on a Windows NT Workstation computer) or Services for Macintosh (on a Windows NT Server computer). AppleTalk is a routable protocol.
- The *TCP/IP print monitor* sends print jobs to network print devices that both support TCP/IP and function as *line printer daemon* (LPD) print servers. TCP/IP and LPD are often associated with UNIX computers. LPD is the print server software used in TCP/IP printing, and *line printer remote*

(LPR) is the client print software used in TCP/IP printing. Before you can connect to a TCP/IP print device, you must install TCP/IP and the Microsoft TCP/IP Printing service on your Windows NT computer. In addition, you must start the TCP/IP Print Server service to share printers as TCP/IP printers. TCP/IP is a routable protocol.

- The *NetWare print monitor* sends print jobs to a print queue on a NetWare server. The NetWare server then sends the print job from the print queue to the print device. Before you can connect to a NetWare print queue, you must install NWLink IPX/SPX Compatible Transport on your Windows NT computer. In addition, on Windows NT Workstation computers, you must install Client Service for NetWare; and on Windows NT Server computers, you must install Gateway Service for NetWare. NWLink IPX/SPX Compatible Transport is a routable protocol.
- A *print server* is a computer (or network device) that manages print jobs and print devices. The *Windows NT Spooler service* performs many of the functions of a print server. You can configure several of the Spooler service's properties (which Windows NT calls print server properties), including the spool folder, forms, and ports, by using the Print Server Properties dialog box. If you experience print job failures due to lack of free space on the partition where your spool folder is located, you can specify that a different folder on another partition (that has more free space) be used as your spool folder.
- You can use the Properties dialog box for a specific printer to configure numerous options for the printer, including: assigning a separator page, assigning forms to paper trays, printer security, printing to multiple ports (printer pools), scheduling printers and setting printer priorities, and sharing a printer.
- There are four Windows NT *printer permissions* that control which tasks a user can perform on a specific printer. A user or group with the *No Access* permission cannot access the printer. The *Print* permission allows users to create and delete their own print jobs. The *Manage Documents* permission allows users to pause, restart, delete, and control job settings for all print jobs, but does not allow a user to print to the printer. A user or group that has the *Full Control* permission can do everything a user with the Print and Manage Documents permissions can do, and in addition, can assign

printer permissions, delete printers, share printers, and change printer properties. User and group permissions are additive, with the exception of the No Access permission. *If a user, or any group that a user is a member of, has the No Access permission, then the user's effective permission is always No Access.*

- Windows NT can be configured to audit a user or group's usage (and/or attempted usage) of a printer. Auditing printers is accomplished in two parts: first, auditing is enabled in User Manager for Domains or User Manager; and second, printer auditing is configured in a specific printer's Properties dialog box. You *must* select the Success and/or Failure check boxes for File and Object Access (in User Manager for Domains or User Manager) in order to audit print events.
- The owner of a printer can assign printer permissions for that printer to any user or group, even if the owner has the No Access permission. A printer can have only one owner at any given time. There are two ways to become an owner of a printer: either by creating the printer, or by taking ownership of the printer.
- When a printer has multiple ports (and multiple print devices) assigned to it, this is called a *printer pool*. Users print to a single printer, and the printer load-balances its print jobs between the print devices assigned to it.
- *Scheduling a printer* means assigning the hours that a specific print device is available for use by a printer. *Setting printer priorities* (giving one printer a higher priority to a print device than another printer) can be useful when more than one printer sends print jobs to the same print device. Scheduling printers and setting printer priorities are two techniques you can use to help manage the flow of print jobs on your Windows NT network.
- The purpose of *sharing a printer* is to enable users of other computers on the network to connect to and to send print jobs to that printer. The computer that hosts the shared printer is called a print server. When you share a printer on your Windows NT computer, the types of computers that can access your shared printer are dependent upon the protocols and services installed in your computer. If you have more than one print server service installed on your Windows NT computer, and then you share a printer, the printer is shared on all running print server services installed on your computer.

- When you share a printer on a Windows NT computer, Windows NT permits you to install *alternate printer drivers* for other versions of Windows NT and Windows 95, and also for other Windows NT hardware platforms, such as MIPS R4000, PowerPC, and DEC Alpha. Installing these alternate drivers enables users of Windows NT and Windows 95 computers on the network to automatically download and install the appropriate printer drivers for their operating systems/hardware platforms when they connect to the shared printer. This process spares the network administrator from having to manually install printer drivers on every computer on the network.
- AppleTalk printers can be shared in Windows NT. When a Windows NT Server computer that has Services for Macintosh installed on it shares a printer, the printer is accessible from Macintosh computers on the network. However, when a Windows NT Workstation computer that has the AppleTalk protocol installed on it shares a printer, the printer is not accessible from Macintosh computers, because Windows NT Workstation does not have any AppleTalk print server capabilities.
- Printing problems can occur on a Windows NT network for several reasons. Troubleshooting recommendations for printer problems include: ensuring that users have the permissions they need to access the printer, making sure configuration parameters are correctly set, and using a methodical, step-by-step troubleshooting process.

Applying What You've Learned

Now it's time to regroup, review, and apply what you've learned in this chapter.

The questions in the following Instant Assessment section bring to mind key facts and concepts. In addition, the troubleshooting exercise in the Review Activity section gives you a chance to solve common Windows NT printing problems.

The hands-on lab exercises will really reinforce what you've learned, and provide you the opportunity to practice some of the tasks tested by the Microsoft Certified Professional exams.

Instant Assessment

1. What is a *printer* in Windows NT terminology?
2. What is a *print device* in Windows NT terminology?
3. Which component in the Windows NT print process determines whether the print device is managed by the local computer that initiated the print job or by a network-connected computer, and routes the print job accordingly?
4. Fill in the blanks: There are two ways to install and configure a printer in Windows NT: you can either _____ a printer or _____ a shared network printer.
5. What is the Windows NT term for software components that send ready-to-print print jobs to a print device?
6. Which print monitor sends print jobs to network print devices that both support TCP/IP and function as LPD print servers?
7. What two things must you install on your Windows NT computer before you can connect to a NetWare print queue by using the NetWare print monitor?
8. Which print monitor sends print jobs to a network print device via an HP JetDirect adapter?
9. What are the characteristics of a job-based connection?
10. What are the characteristics of a continuous connection?
11. Which print monitor uses only the DLC protocol to communicate?
12. If you experience print job failures due to lack of free space on the partition where your spool folder is located, what can you do to resolve the problem?
13. Which Windows NT printer permission, when combined with other permissions, overrides and takes precedence over all other printer permissions?
14. What are the four Windows NT printer permissions?
15. When auditing a printer, what must you select, in User Manager for Domains or User Manager, in order to audit print events?
16. What are the two ways to become an owner of a printer?
17. Which Windows NT printing term is defined as a printer having multiple ports (and multiple print devices) assigned to it?

18. What is the purpose of sharing a printer?
19. What is the advantage of being able to install printer drivers for alternate operating systems/hardware platforms on a shared printer on a Windows NT computer?

T/F

20. The DLC protocol is a non-routable protocol that supports bridging. _____
21. AppleTalk, TCP/IP, and NWLink IPX/SPX Compatible Transport are routable protocols. _____
22. When a Windows NT Workstation computer that has the AppleTalk protocol installed on it shares a printer, the printer is not accessible from Macintosh computers on the network, because Windows NT Workstation doesn't have any AppleTalk print server capabilities. _____



concept link

For answers to the Instant Assessment questions see Appendix D.

Review Activities

The following activity tests your ability to troubleshoot common Windows NT printing problems.



Workstation
Server
Enterprise

Windows NT printing troubleshooting exercise

For each of the following problems, explain what you think are the possible causes of the problem, and what course of action you would take to resolve the problem.

Problem 1 Halfway through a print job you discover that the print device's paper tray contains letterhead paper, and you need your document printed on white paper. You want to reprint the entire job, but you have already deleted your document from the spreadsheet application you were using.

Problem 2 Several days ago you configured success and failure auditing for print events in the Properties dialog box for your printer. However, no print events are listed in the security log in Event Viewer, even though at least two hundred documents have been printed since you configured auditing.

Problem 3 When you attempt to print a document in a word processing application, an error message is displayed, indicating that your print job has been spooled with a print job size of 0 bytes.



concept link

For answers to the Review Activity see Appendix D.

Hands-on Lab Exercises

The following hands-on lab exercises provide you with practical opportunities to apply the knowledge you've gained in this chapter about managing printing.

Lab 6.8 *Creating and sharing a local printer*



Workstation
Server
Enterprise

The purpose of this lab is to familiarize you with the Windows NT `Printers` folder and its user interface, and to provide you with the skills necessary to create and share a local printer.

To begin this lab, boot your computer to Windows NT Server.

There are two parts to this lab:

Part 1: Creating a local printer

Part 2: Sharing a local printer

Part 1: Creating a local printer

1. Select Start > Programs > Windows NT Explorer.
2. Highlight (single-click) the `Printers` folder in the All Folders list box. (You might have to scroll down to find this folder.)
3. Double-click the Add Printer icon in the Contents of 'Printers' list box.
4. The Add Printer Wizard appears. Ensure that the radio button next to My Computer is selected. Click Next.
5. Select the check box next to LPT1: in the Available ports list box. Click Next.
6. If you have a print device, select your print device's manufacturer from the Manufacturers list box, and then select your print device's model from the Printers list box. Then click Next. (If you don't have a print device, accept the defaults in the Add Printer Wizard dialog box and click Next.)
7. Type a name for the new printer in the text box, or accept the default name that Windows NT presents. (If your computer has any additional printers installed, you are presented with another option to configure: Select the radio button next to Yes if you want this to be your default printer. Otherwise, select the radio button next to No.) Click Next.

8. Ensure that the radio button next to Not shared is selected in the Add Printer Wizard dialog box. Click Next.
9. In the Add Printer Wizard dialog box, select the radio button next to Yes to print a test page. Click Finish.
10. Windows NT copies files. (Respond to any prompts requesting the location of your Windows NT source files.)
11. A dialog box appears indicating that the printer test page is completed. Click Yes.
12. The printer is now created. The Windows NT Explorer dialog box reappears. (If you do not have a print device connected to LPT1, an error message eventually appears, indicating that there was an error printing the test page and that the print device is not ready. Click Cancel.) Continue on to Part 2 to share the printer.

Part 2: Sharing a local printer

1. In the Windows NT Explorer dialog box, with the Contents of 'Printers' list box displayed on the right, right-click the printer you just created. Select Sharing from the menu that appears.
2. A dialog box with your printer's properties appears. Select the radio button next to Shared. Edit the text box next to Share Name to read: **My Shared Printer**. (Don't type the period at the end.) Don't select any alternate drivers at this time. Click OK.
3. A warning message appears (because the share name you typed is longer than eight characters and has spaces in it) indicating that the share name you entered may not be accessible from MS-DOS workstations. Click Yes.
4. The Windows NT Explorer dialog box reappears. In the Contents of 'Printers' list box, right-click your printer. Select Properties from the menu that appears.
5. In your printer's Properties dialog box, click the Security tab.
6. Click Permissions.
7. In the Printer Permissions dialog box, notice the default permissions for a newly created printer. Click OK.
8. The Printer Permissions dialog box reappears. Click OK. Exit Windows NT Explorer.



Workstation
Server
Enterprise

Lab 6.9 *Installing and configuring Microsoft TCP/IP printing*

The purpose of this lab is to give you hands-on experience in installing and configuring Microsoft TCP/IP Printing.

Begin this lab by booting your computer to Windows NT Server.

There are two parts to this lab:

Part 1: Installing Microsoft TCP/IP printing

Part 2: Configuring Microsoft TCP/IP printing

Part 1: Installing Microsoft TCP/IP printing

1. Select Start ► Programs ► Windows NT Explorer.
2. Click Control Panel in the All Folders list box on the left. In the Contents of 'Control Panel' list box on the right, double-click Network.
3. The Network dialog box appears. Click the Services tab.
4. On the Services tab, click the Add command button.
5. The Select Network Service dialog box appears. Click Microsoft TCP/IP Printing in the Network Service list box. Click OK.
6. A Windows NT Setup dialog box appears, requesting the location of Windows NT source files. Type the path to your Windows NT source files on your Windows NT compact disc (for example, d:\i386) and place your Windows NT compact disc in your CD-ROM drive. Click Continue.
7. Windows NT copies the files to your hard drive. The Services tab reappears. Click Close.
8. Several dialog boxes appear while Windows NT configures the new network service. When the Network Settings Change warning dialog box appears, click Yes to restart your computer.

Part 2: Configuring Microsoft TCP/IP Printing

1. Select Start ► Programs ► Windows NT Explorer.
2. Click Control Panel in the All Folders list box on the left. In the Contents of 'Control Panel' list box on the right, double-click Services.
3. Select TCP/IP Print Server from the Service list box. Click the Startup command button.
4. In the Startup Type section of the Service dialog box, select the radio button next to Automatic. Click OK.
5. The Services dialog box reappears. Click the Start command button.

6. A Service Control dialog box appears, indicating that Windows NT is attempting to start the service. The Services dialog box reappears. Notice in the Status column that the TCP/IP Print Server service is started. Click Close.
7. The Windows NT Explorer dialog box reappears. Exit Windows NT Explorer. Microsoft TCP/IP Printing is now installed and configured.