



- ▶ Professional
- ▶ Server
- ▶ Directory Services

## EXAM OBJECTIVES

### Professional ▶

#### Exam 70-210

- Connect to local and network print devices.
  - Manage printers and print jobs.
  - Control access to printers by using permissions.
  - Connect to an Internet printer.
  - Connect to a local print device.
- Monitor, configure, and troubleshoot I/O devices, such as printers, scanners, multimedia devices, mouse, keyboard, and smart card reader.

### Server ▶

#### Exam 70-215

- Monitor, configure, troubleshoot, and control access to printers.

### Directory Services ▶

#### Exam 70-217

- Publish resources in Active Directory.

# Managing Printing

# 12

**T**his chapter covers printing in a Windows 2000 environment from A to Z. I'll begin with a discussion of Windows 2000 printing terminology, and then explore the print process. Then I'll explain how to add and connect to printers, how to share a printer, and how to configure printer and print server properties. I'll also cover how to manage print jobs and give you some tips for troubleshooting common printing problems. If it concerns Windows 2000 printing, you'll find it in this chapter.

## *Chapter Pre-Test*

1. In Windows 2000 printing terminology, what is a printer?
2. Which Windows 2000 printing term is defined as a printer that has multiple ports (and multiple print devices) assigned to it?
3. What are the three Windows 2000 printer permissions?
4. Which Windows 2000 printer permission, when combined with other permissions, overrides and takes precedence over all other printer permissions?
5. If you experience print job failures due to lack of free space on the volume where your spool folder is located, what can you do to resolve the problem?

## Printing Terminology

Before you can fully understand printing with Windows 2000, you need to understand a couple of basic terms.

In the terminology associated with Windows 2000, the term *printer* does not represent a physical device that produces printed output. Rather, a printer is the software interface between the Windows 2000 operating system and the device that produces the 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 2000 calls a printer as a combination of a print queue (or print spooler) plus a driver for the device that produces printed output.

In Windows 2000, the term *print device* (or *printing device*) refers to the physical device that produces printed output — what is more commonly referred to as a “printer.”



### EXAM TIP

Be sure that you know the Windows 2000 printing terminology cold. Otherwise, you may become confused when taking the exams. Remember: a *printer* is software, and a *print device* (or *printing device*) is hardware. Beat this into your head with a large wooden mallet!

Now that you have a grasp of basic Windows 2000 printing terminology, you're ready to move on to the nuts and bolts of printing in Windows 2000.

## Windows 2000 Printing Overview

This section explains how Windows 2000 processes print jobs from the time the user selects Print in an application until the paper comes out of the print device. It also explains how enhanced metafiles (EMFs) are used in the network printing process.

### The Print Process

Perhaps the easiest way to understand the Windows 2000 print process is to follow the steps that occur when a document is printed from an application in Windows 2000.

1. A user at a Windows 2000 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).
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 2000 enhanced metafile (EMF) or into the 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 2000 spooler.
6. The Windows 2000 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 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.
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 converting from EMF to RAW. (Print jobs are always sent to the print device 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 12-1 graphically illustrates the steps in the Windows 2000 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.

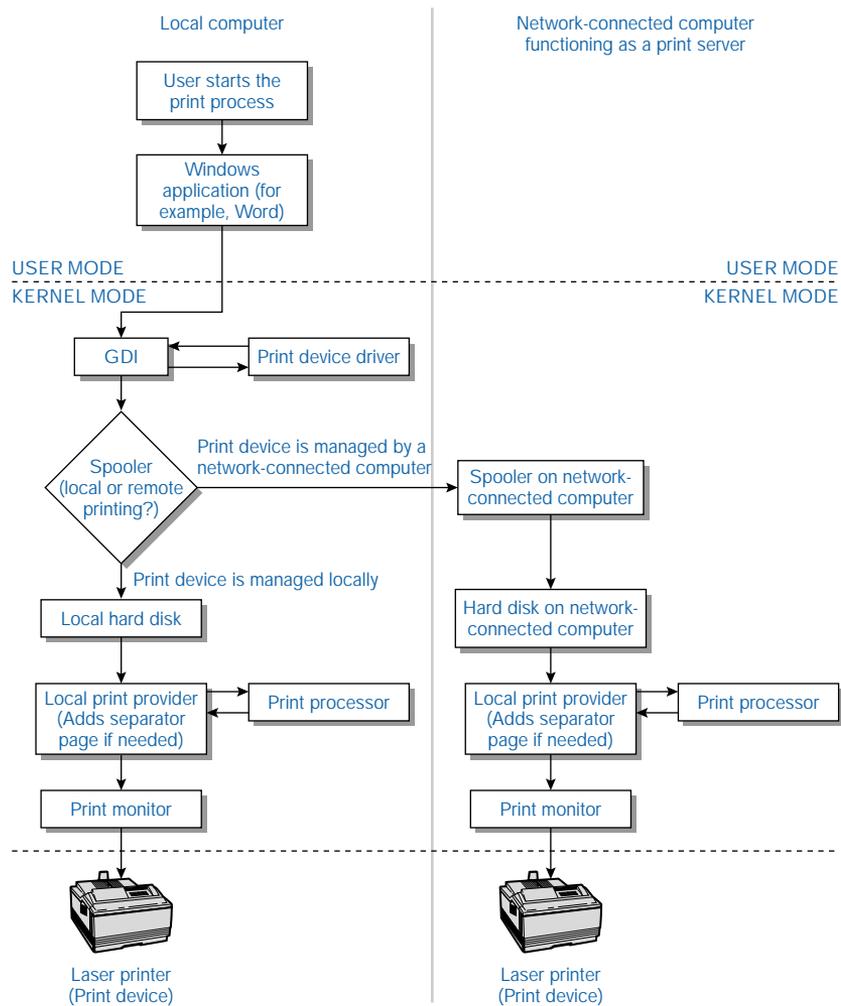


FIGURE 12-1 The Windows 2000 print process

## Using EMFs in Network Printing

A Windows 2000 *enhanced metafile (EMF)* is an intermediate printing file format created by a Windows 2000 client computer when it prints to a shared network printer on a Windows 2000 computer. An EMF requires less processor time to produce than a RAW file, and is smaller in size than a RAW file for the same print job. Using Windows 2000 EMFs can significantly increase the performance of printing across a network because:

- Windows 2000 creates an EMF faster than it can create a RAW format file.
- Windows 2000 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 at the local computer experiences faster printing when EMFs are used than if the user's computer creates a RAW format file.



### TIP

All client computers that use any operating system other than Windows 2000 send print jobs to Windows 2000 printers using the RAW format.

## Adding and Connecting to Printers

Before you can print on a Windows 2000 computer, you must first add a printer. There are two types of printers you can add: local printers and network printers.

Adding a local printer involves installing and configuring all of the drivers needed for the Windows 2000 computer to use the print device, and associating the print device with a local port, such as LPT1:. In most cases you use the Add Printer Wizard in the `Printers` folder to add a local printer.

Adding a network printer involves installing and configuring all of the drivers needed to use a print device managed by another computer on the network, and associating this print device with a UNC path to the network printer. To add a network printer, you can either use the Add Printer Wizard in the `Printers` folder, or you can use Internet Explorer to connect to a network printer that supports the Internet Printing Protocol (IPP). Adding a network printer is often referred to as “connecting to a printer.”

You must be a member of either the Administrators or Power Users built-in local group to add a printer on a Windows 2000 computer that is not a domain controller. You must be a member of either the Administrators or Print Operators built-in local group on a domain controller to add a printer on a domain controller.

In the next sections I'll explain how to add Plug and Play printers, how to add other local printers, how to add printers on a remote computer, and how to connect to shared network printers and Internet printers.

## Adding Local Plug and Play Printers

Adding a local Plug and Play printer is fairly straightforward. The actual steps used to add a local Plug and Play printer depend on whether you're adding a USB or a non-USB Plug and Play printer.

### Adding USB Plug and Play Printers

Adding a local USB (which stands for universal serial bus) Plug and Play printer is one of the easiest tasks you'll probably ever perform on a Windows 2000 computer. USB print devices are connected to a Windows 2000 computer by using a USB cable that is plugged into a USB port on the computer. Almost all computers that have a Pentium II or later processor have a USB port.

USB print devices are easy to add because when you connect and power on the device, Windows 2000 automatically detects it, and automatically starts the Found New Hardware Wizard.

## STEP BY STEP

### ADDING A LOCAL USB PLUG AND PLAY PRINTER

1. Power on the print device and connect it to the Windows 2000 computer's USB port.
2. Windows 2000 detects the new device and displays a Found New Hardware dialog box. Eventually, Windows 2000 starts the Found New Hardware Wizard. Click Next.
3. The Install Hardware Device Drivers screen is displayed, as shown in Figure 12-2. Notice that the specific print device being added is displayed.

## STEP BY STEP

Continued



FIGURE 12-2 Installing device drivers for a USB print device

Select one of the two options on this screen:

- ▶ **Search for a suitable driver for my device (recommended):** This is the default option, and should be selected when you want Windows 2000 to automatically search for and install the appropriate drivers for the device you're adding. This option is the best choice for 99 percent of all situations.
- ▶ **Display a list of the known drivers for this device so that I can choose a specific driver:** This option should only be selected when you want to manually select the driver Windows 2000 will use for this device.

Click Next.

4. On the Local Driver Files screen, specify where you want Windows 2000 to search for appropriate drivers for the new print device. The wizard will search the Windows 2000 driver database on your computer's hard drive and any other additional locations you select, including: floppy disk drives, CD-ROM drives, a location you specify, and Microsoft Windows Update. The default additional search locations are floppy disk drives and CD-ROM drives. Select the appropriate check boxes and click Next.
5. The Driver Files Search Results screen appears. If the wizard located a suitable driver for the device, the screen indicates that "Windows found a driver for this device." Click Next.
6. On the Completing the Found New Hardware Wizard screen, click Finish.
7. Windows 2000 adds the printer and returns you to the desktop.

## Adding Non-USB Plug and Play Printers

Because Windows 2000 supports Plug and Play, you would think that adding any Plug and Play printer would cause Windows 2000 to automatically detect the device and automatically start the Found New Hardware Wizard. After all, it works like that in Windows 95 and Windows 98. But no, you must manually start the Add Printer Wizard to add a local Plug and Play printer that uses a parallel port on a Windows 2000 computer (this includes most non-USB Plug and Play printers).

### STEP BY STEP

#### ADDING A LOCAL NON-USB PLUG AND PLAY PRINTER

1. Open the **Printers** folder. (Select Start ⇨ Settings ⇨ Printers.)



#### TIP

You can also access the **Printers** folder in Windows Explorer or Control Panel.

2. In the **Printers** folder, double-click Add Printer.
3. The Add Printer Wizard begins. Click Next.
4. The Local or Network Printer screen appears, as shown in Figure 12-3. Notice the check box next to “Automatically detect and install my Plug and Play printer,” and that this check box is selected by default. Click Next.

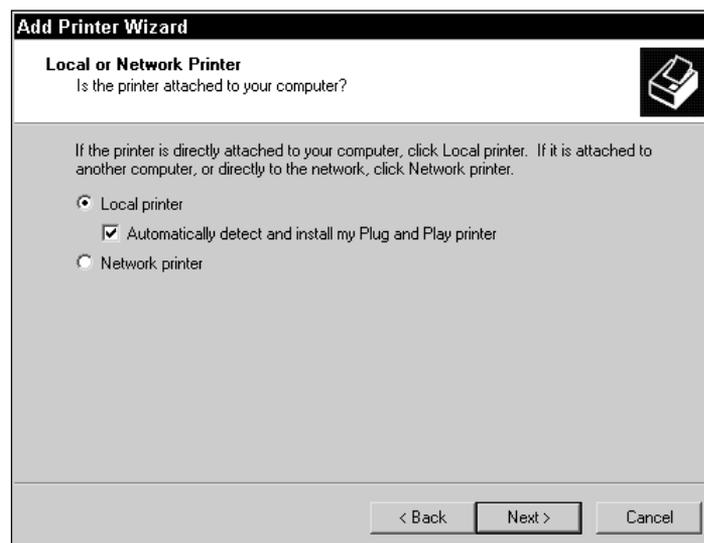


FIGURE 12-3 Installing a non-USB Plug and Play printer

## STEP BY STEP

Continued

5. A Found New Hardware dialog box is displayed. Then, the New Printer Detection screen appears, indicating that a Plug and Play printer was detected and installed, and asking you if you want to print a test page. Choose Yes or No, and click Next.
6. On the Completing the Add Printer Wizard screen, click Finish.
7. If you chose to print a test page in Step 5, a dialog box is displayed asking if the test page printed. Click OK.
8. The new printer you just added is displayed in the **Printers** folder. Close the **Printers** folder.

## Adding Other Local Printers

Occasionally you may need to add a local printer that isn't Plug and Play.

Or, you may need to add a printer for a print device that is connected directly to the network (or that uses an HP JetDirect adapter or similar device to connect to the network). When a print device is connected directly to the network, Windows 2000 treats the device as a local, rather than a network, device.



### EXAM TIP

Make sure you know when to add a *local* printer and when to add a *network* printer. For the purposes of adding a printer, only shared printers on other Windows-based computers and NetWare servers are considered network printers. All other printers and print devices, even those connected directly to the network, are considered local printers.

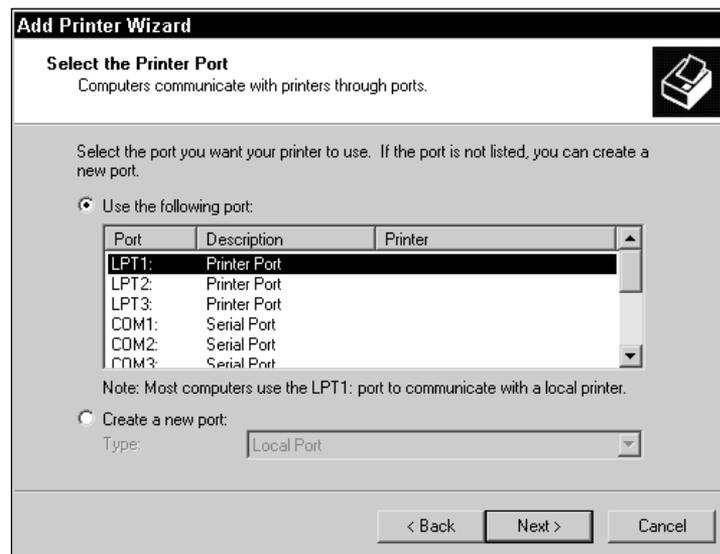
To add these kinds of printers, you also use the Add Printer Wizard in the **Printers** folder. The process is similar to adding a local non-USB Plug and Play printer, only more manual configuration is required to accomplish the task.

Use the following general steps to add a non-Plug and Play local (or a directly connected network) printer. If you want to add an HP (DLC) printer, a standard TCP/IP printer, a UNIX printer, or an AppleTalk printer, see the sections that follow for additional information and tips.

## STEP BY STEP

### ADDING A LOCAL PRINTER

1. Open the **Printers** folder. (Select Start ⇨ Settings ⇨ Printers.)
2. In the **Printers** folder, double-click Add Printer.
3. The Add Printer Wizard begins. Click Next.
4. The Local or Network Printer screen appears. Ensure that the check box next to “Automatically detect and install my Plug and Play printer” is cleared. Click Next.
5. The Select the Printer Port screen appears, as shown in Figure 12-4. Notice that LPT1: is the default selection.



**FIGURE 12-4** Selecting a port for a print device

Select the port that the print device is connected to from the list.

If the port you want to use is not displayed, select the “Create a new port” option, and select the type of port you want to create from the Type drop-down list box. Then follow the instructions presented on-screen to create the new port.

Click Next.

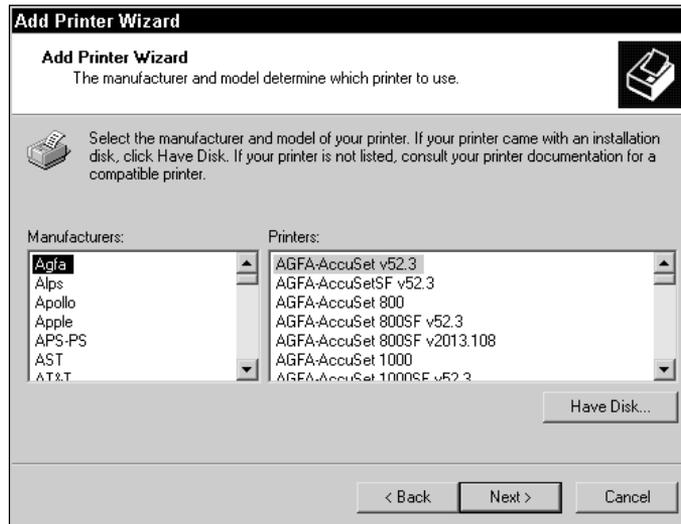
6. The Add Printer Wizard screen is displayed, as shown in Figure 12-5.
 

Select your print device’s manufacturer from the list on the left. Then select the print device’s model from the list on the right.

If your print device does not appear in the list, and you have drivers for the device (either on a floppy disk, CD-ROM, or downloaded from the Internet), click Have Disk and follow the instructions on-screen.

## STEP BY STEP

Continued



**FIGURE 12-5** Selecting a print device's manufacturer and model

Click Next.

7. On the Name Your Printer screen, either accept the default name displayed for this printer, or type in a different name in the "Printer name" text box. Also choose whether you want this printer to be the default printer for all Windows-based programs on this Windows 2000 computer. Click Next.
8. On the Printer Sharing screen, choose whether or not to share this printer.
 

If you're adding a printer on a Windows 2000 Professional computer, the default selection is "Do not share this printer." If you're adding a printer on a Windows 2000 Server computer, the default selection is "Share as:"

If you choose to share the printer, either accept the default name displayed for the shared printer, or type in a different name in the "Share as" text box. Click Next.
9. If you chose to share the printer in Step 8, a Location and Comment screen appears on which you can describe the location and features of the printer you're adding. All entries on this screen are optional. Enter information as appropriate and click Next.
10. The Print Test Page screen is displayed. Select Yes to print a test page, or select No to skip printing a test page. Click Next.
11. On the Completing the Add Printer Wizard screen, click Finish.
12. If you chose to print a test page in Step 10, a dialog box is displayed asking if the test page printed. Click OK.
13. The new printer you added is displayed in the **Printers** folder. Close the **Printers** folder.

## Adding an HP (DLC) Printer

Occasionally you may need to add a printer for an older Hewlett-Packard print device that is directly connected to the network (or that uses an HP JetDirect adapter to connect to the network) and that does not support TCP/IP printing. Windows 2000 considers this type of printer to be a local printer.

Before you can add this kind of printer on a Windows 2000 computer, the DLC protocol must be installed. If you didn't choose to install the DLC protocol when you installed Windows 2000, you can use the `Network and Dial-up Connections` folder (in Control Panel) to install the DLC protocol.



### CROSS REFERENCE

I'll cover how to use the `Network and Dial-Up Connections` folder in detail in Chapter 15.

When you use the Add Printer Wizard to add an HP (DLC) printer, you must assign the printer to a Hewlett-Packard Network Port. To do this, select the "Create a new port" option on the Select the Printer Port screen, and select "Hewlett-Packard Network Port" from the Type drop-down list box.

When you create the new Hewlett-Packard Network Port, you'll be asked to select a card address (MAC address) for the HP JetDirect adapter used by the print device you're adding. If you have more than one HP JetDirect adapter on your network, you'll need to know which one is connected to the print device you're adding.

One last item you might want to consider when adding this kind of a printer is whether the printer will use a Job Based or Continuous connection. This option is configured by clicking Timers in the Add Hewlett-Packard Network Peripheral Port dialog box, and then selecting the appropriate option button.

The default setting is *Continuous*, which, if accepted, causes this Windows 2000 computer to monopolize all DLC connections to the HP JetDirect adapter, and permits only this computer to connect to the HP print device using the DLC protocol. If more than one computer must connect to the HP JetDirect adapter using DLC, select a Job Based connection. A *Job Based* connection permits all Windows 2000 (and Windows NT 4.0) computers on the network that have the DLC protocol installed to access the HP JetDirect adapter for printing.

## Adding a Standard TCP/IP Printer

On most of today's corporate networks, the majority of print devices used are directly connected to the network. In addition, nearly all of these print devices support TCP/IP printing. When you add a printer for this type of print device, you add a local printer, even though the print device is directly connected to the network.

When you need to add a new printer of this type, you don't need to install any additional protocols because the TCP/IP protocol is installed by default during the installation of Windows 2000.

When you use the Add Printer Wizard to add a standard TCP/IP printer, you must assign the printer to a standard TCP/IP port. To do this, select the "Create a new port" option on the Select the Printer Port screen, and select "Standard TCP/IP Port" from the Type drop-down list box. After you do this, the Add Standard TCP/IP Printer Port Wizard starts. This wizard prompts you to enter several informational items, including:

- A printer name (or IP address) of the internal or external network adapter that the print device is connected to
- A name that Windows 2000 will use for the standard TCP/IP port you're creating
- The parallel port that this print device is connected to (if the network adapter you specify is external to the print device and has more than one parallel port)

## Adding a UNIX Printer

You may need to add a printer for a UNIX print device that is physically connected to a UNIX computer on your network. When you add a printer for this type of print device, you add a local printer, even though the print device is directly connected to a UNIX computer on your network.

There are a couple of UNIX terms you should probably know: LPD and LPR. *LPD* stands for line printer daemon, and is the print server software used by UNIX computers. *LPR* stands for line printer remote, and is the client software used to access LPD printers.

Before you can add a UNIX printer on a Windows 2000 computer, Print Services for Unix must be installed. (Adding a UNIX printer also requires that TCP/IP be installed, but it's installed by default, so you shouldn't have to add it.) If you didn't choose to install Print Services for Unix when you installed Windows 2000, you can use the Add/Remove Programs application (in Control Panel) to install Print Services for Unix.

When you use the Add Printer Wizard to add a UNIX printer, you must assign the printer to an LPR port. To do this, select the “Create a new port” option on the Select the Printer Port screen, and select “LPR Port” from the Type drop-down list box. After you do this, Windows 2000 prompts you to provide the name (or IP address) of the UNIX server that the print device is connected to and the name of the print queue on that UNIX computer that is associated with the print device you’re adding.

### Adding an AppleTalk Printer

Occasionally, you may need to add a printer for an Apple print device that is either connected directly to the network or shared by a computer on the network that supports AppleTalk printing. The terms *Apple* and *AppleTalk* are normally associated with Apple or Apple Macintosh computers. When you add an AppleTalk printer, you add a local printer.

Before you can add an AppleTalk printer on a Windows 2000 computer, the AppleTalk protocol must be installed. If you didn’t choose to install the AppleTalk protocol when you installed Windows 2000, you can use the `Network and Dial-up Connections` folder (in Control Panel) to install the AppleTalk protocol.

When you use the Add Printer Wizard to add an AppleTalk printer, you must assign the printer to an AppleTalk Printing Devices port. To do this, select the “Create a new port” option on the Select the Printer Port screen, and select “AppleTalk Printing Devices” from the Type drop-down list box. After you do this, Windows 2000 prompts you to select a specific AppleTalk print device from a list it displays.

Before you can finish adding an AppleTalk printer, you must choose whether or not to capture the AppleTalk print device. If you choose to capture the print device, it’s the same as choosing a Continuous connection when adding an HP (DLC) printer. The Windows 2000 computer 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. If you choose not to capture an AppleTalk print device, it’s the same as choosing a Job Based connection when adding an HP (DLC) printer. All Windows 2000 (and Windows NT 4.0) computers on the network that have the AppleTalk protocol installed will be able to access the AppleTalk print device for printing.

## Adding a Printer on a Remote Computer

You don't have to be logged on interactively at a Windows 2000 computer to add or manage a printer on that computer. You can use Windows Explorer to access the `Printers` folder on a remote computer, and then use the Add Printer Wizard in the remote computer's `Printers` folder to add a printer on the remote computer.

### STEP BY STEP

#### CONNECTING TO THE PRINTERS FOLDER ON A REMOTE COMPUTER

1. Start Windows Explorer. (Select Start ⇨ Programs ⇨ Accessories ⇨ Windows Explorer.)
2. In the left pane, click the + next to My Network Places. Click the + next to Entire Network. Click the + next to Microsoft Windows Network. Click the + next to the domain or workgroup that contains the computer on which you want to add a printer. Click the + next to the computer on which you want to add a printer. Highlight the `Printers` folder.
3. The contents of the `Printers` folder on the remote computer appear in the right pane. To start the Add Printer Wizard on the remote computer, double-click Add Printer. Follow the instructions presented earlier in this chapter to add a printer.

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Once you connect to the `Printers` folder on a remote computer, you can use it to manage printers on the remote computer in the same way you use the `Printers` folder on your local computer to manage printers.

## Connecting to Shared Network Printers

When you want to configure a Windows 2000 computer to use a print device that is connected to and shared by a Windows-based computer or NetWare server on your network, you'll need to connect to a shared network printer. This process is also called adding a network printer.

Before you add a network printer, you need to configure the Windows 2000 computer on which you're adding a network printer so that it can

communicate with the other computer on the network that hosts the shared printer:

- If the computer that hosts the shared printer is a Windows-based computer (Windows 2000, Windows NT, Windows 95, or Windows 98), you must ensure that the Windows 2000 computer you're configuring and the computer that hosts the shared printer have at least one network protocol in common. Network protocols include the Internet Protocol (TCP/IP), the NetBEUI protocol, and the NWLink IPX/SPX/NetBIOS Compatible Transport protocol. To add a protocol on a Windows 2000 computer, use the `Network and Dial-up Connections` folder (in Control Panel).
- If the computer that hosts the shared printer is a Novell NetWare server that uses the IPX protocol, you must ensure that the Windows 2000 computer you're configuring has the NWLink IPX/SPX/NetBIOS Compatible Transport protocol and Gateway (or Client) Service(s) for NetWare installed. If you need to install this protocol or service, use the `Network and Dial-up Connections` folder (in Control Panel).
- If the computer that hosts the shared printer is a Novell NetWare server that uses only the TCP/IP protocol, you must ensure that the Windows 2000 computer you're configuring has the TCP/IP protocol and Novell's Windows 2000 client software installed. (Because TCP/IP is installed by default on Windows 2000 computers, you shouldn't have to add it.) To install the Novell client software on a Windows 2000 computer, follow the product instructions.

Once your Windows 2000 computer is configured to communicate with the computer that is hosting the shared network printer, you're ready to connect your Windows 2000 computer to the shared network printer. In other words, you're ready to add a network printer.

## STEP BY STEP

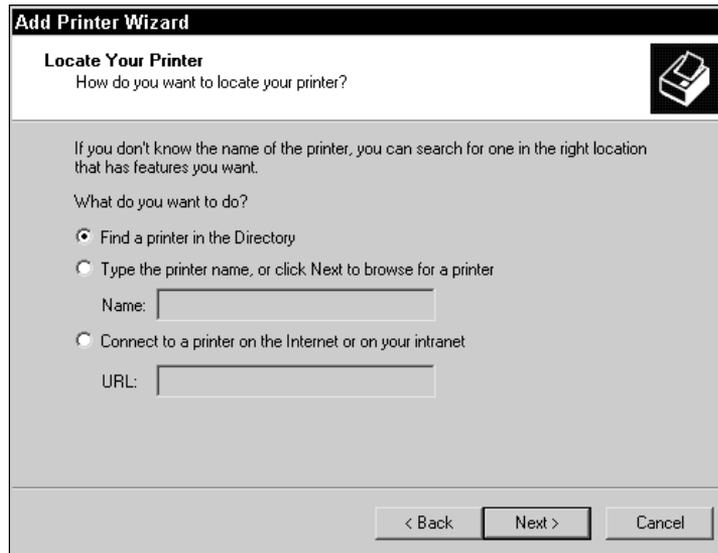
### ADDING A NETWORK PRINTER

1. On the Windows 2000 computer, open the `Printers` folder. (Select `Start` ⇨ `Settings` ⇨ `Printers`.)
2. In the `Printers` folder, double-click `Add Printer`.

## STEP BY STEP

Continued

3. The Add Printer Wizard begins. Click Next.
4. The Local or Network Printer screen appears. Select the option next to “Network printer.” Click Next.
5. The Locate Your Printer screen appears, as shown in Figure 12-6.

**FIGURE 12-6** Locating a shared network printer

On this screen, you specify how you want Windows 2000 to locate the shared network printer you're adding. The options you can select from are:

- ▶ **Find a printer in the Directory:** Select this option if you want to have Windows 2000 search Active Directory for the shared network printer. If you select this option (which is the default setting), you can use the Find Printers dialog box to search Active Directory for the printer.
- ▶ **Type the printer name, or click Next to browse for a printer:** Select this option if you want to specify a UNC path to the shared network printer, or if you want to browse the network for this printer. If you select this option, you can select the shared network printer from a browse list.
- ▶ **Connect to a printer on the Internet or on your intranet:** Select this option if you want to specify a URL for an Internet printer. (I'll cover connecting to Internet printers more in the next section.) Browsing is not supported for this option.

Select the appropriate option, and click Next.

## STEP BY STEP

Continued

6. If the computer that hosts the shared network printer you're adding does not have drivers for the print device that are supported by Windows 2000, Windows 2000 prompts you to install drivers on the local Windows 2000 computer to enable it to print to the shared network printer.  
If this Connect to Printer warning dialog box does *not* appear, skip to Step 8.  
If this Connect to Printer warning dialog box appears, click OK and continue.
7. In the Add Printer Wizard dialog box, select the shared network print device's manufacturer from the list on the left. Then select the print device's model from the list on the right.  
If the shared network print device does not appear in the list, and you have drivers for the device (either on a floppy disk, CD-ROM, or downloaded from the Internet), click Have Disk and follow the instructions on-screen.  
Click Next.
8. On the Default Printer screen, choose whether the network printer you're adding will be the default printer for all Windows-based programs on this Windows 2000 computer. Click Next.
9. On the Completing the Add Printer Wizard screen, click Finish.
10. The network printer you just added is displayed in the **Printers** folder. Close the **Printers** folder.

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## Connecting to Internet Printers

An *Internet printer* is a printer that is published (made available) on a Web server for the purpose of making the printer available to client computers on the Internet, client computers on your company's intranet, or both. Publishing a printer on a Web server is just another method of making a printer available to end users. Think of an Internet printer as a printer that is shared by a Web server.

When you share a printer on a Windows 2000 computer that has Internet Information Services installed, Windows 2000 automatically shares the printer as an Internet printer at the same time. You can access Internet printers on a Windows 2000 computer at `http://Server_name/Printers`. In this URL, *Server\_name* can be either the Windows 2000 computer's name or FQDN.

Client computers communicate with Internet printers by using the Internet Printing Protocol (IPP). Because this protocol is a component of both Internet Information Services and Internet Explorer, you don't need

to install this protocol on either your client computers or on the Web server that hosts the Internet printer.

Assuming that the Web server that hosts the Internet printer has the appropriate printer drivers installed for your client operating system, there are no prerequisites (other than the TCP/IP protocol and Internet Explorer, both of which are installed by default during the installation of Windows 2000) that must be met before you can connect your Windows 2000 client computer to an Internet printer.

There are basically two ways to connect to an Internet printer:

- You can use the Add Printer Wizard to add a network printer, select the “Connect to a printer on the Internet or on your intranet” option, and specify a URL for an Internet printer. You must know the exact URL to use this method. (Browsing is not supported.) URLs for Internet printers are often long and cryptic.
- You can use Internet Explorer to connect to an Internet printer. This is the simplest method to connect to an Internet printer.

Because I covered how to use the Add Printer Wizard to add a network printer in the previous section, I’ll show you how to connect to an Internet printer by using Internet Explorer now.

## STEP BY STEP

### USING INTERNET EXPLORER TO CONNECT TO AN INTERNET PRINTER

1. On your Windows 2000 desktop, double-click Internet Explorer.
2. In the Address text box, type the URL of the **Printers** folder on the Web server that hosts the Internet printer you want to connect to (such as `http://Server01/Printers`) and press Enter.
3. Internet Explorer connects you to the **Printers** folder on that computer and displays a list of available Internet printers, as shown in Figure 12-7. Notice that each Internet printer’s status and number of print jobs waiting is displayed. Click the name of the Internet printer to which you want to connect.
4. Internet Explorer displays the management Web page for the printer you selected in Step 3, as shown in Figure 12-8. Notice the View, Printer Actions, and Document Actions menus in the left pane.  
To connect to this printer, click Connect in the Printer Actions menu in the left pane.
5. Windows 2000 installs any necessary drivers for the associated print device and connects your computer to the shared Internet printer. This printer is added to the **Printers** folder on your Windows 2000 computer.

## STEP BY STEP

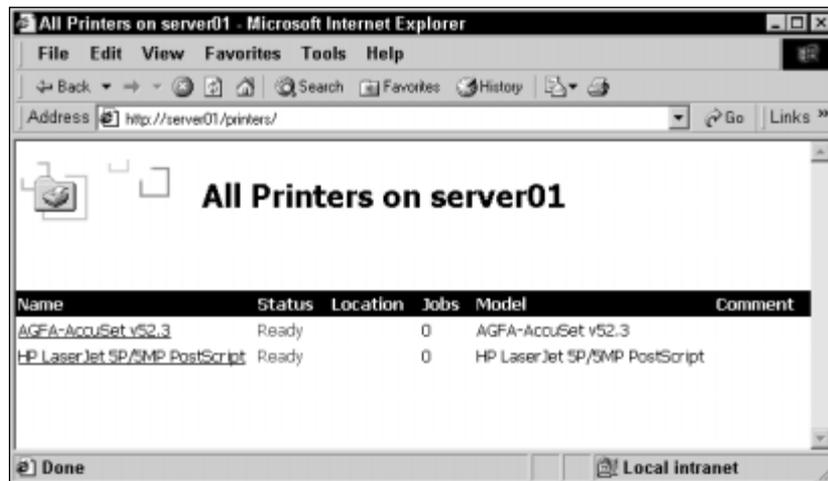
*Continued*

FIGURE 12-7 Viewing shared Internet printers

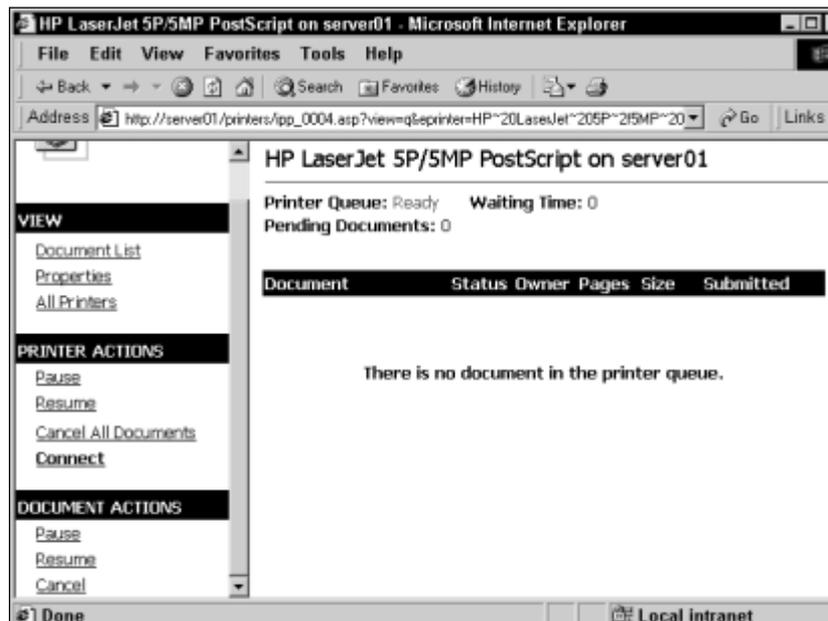


FIGURE 12-8 Viewing the management console of an Internet printer

- To print to this printer, select this printer (in any Windows-based application) in the same manner you would select any other printer. Close Internet Explorer.

Windows 2000 computers aren't the only computers that can connect to and use Internet printers. You can also use Internet Explorer on Windows NT, Windows 95, and Windows 98 computers to connect to Internet printers.



#### EXAM TIP

Spend all the time you need to become thoroughly familiar with connecting to Internet printers. Because this task is a stated objective (on the Professional exam) and because it's a new feature for Windows 2000, this topic is sure to be tested.

## Sharing a Printer

The purpose of sharing a printer on a Windows 2000 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 a Windows 2000 computer that is a member of a Windows 2000 domain, by default, the printer is automatically published in Active Directory at the same time. Of course, you can choose not to publish a printer in Active Directory when you share it by clearing the appropriate check box on the Sharing tab.

When you share a printer on your Windows 2000 computer, the types of computers on the network that can access the shared printer are somewhat dependent upon the protocols and services installed in the Windows 2000 computer.

When you install Windows 2000, the File and Printer Sharing for Microsoft Networks service is installed by default. If you have not installed any other services and you share a printer on your Windows 2000 computer, only computers that have client software for Microsoft networks can access the shared printer.

If Internet Information Services (IIS) is installed on your Windows 2000 computer, when you share a printer on that computer, Windows 2000 automatically shares the printer as an Internet printer at the same time. Windows-based computers that have Internet Explorer installed can access shared Internet printers.

If Print Services for Unix is installed on your Windows 2000 computer and you have started the TCP/IP Print Server service (which is automatically installed with Print Services for Unix), when you share a printer on your Windows 2000 computer, two kinds of computers can access this shared printer: computers that have client software for Microsoft networks, and computers that support TCP/IP printing (such as UNIX computers).

If Print Services for Macintosh is installed on your Windows 2000 Server computer, when you share a printer on that computer, two kinds of computers can access this shared printer: computers that have client software for Microsoft networks, and Apple or Apple Macintosh computers. Print Services for Macintosh can only be installed on Windows 2000 Server and Advanced Server computers.

If more than one print server service (such as File and Printer Sharing for Microsoft Networks, Print Services for Unix, and so on) is installed and started on your Windows 2000 computer, when you share a printer on that computer, the printer is shared on all running print server services installed on the computer.

Now that you're up to your eyeballs in lots of printer sharing rules, allow me to show you how to share a printer on a Windows 2000 computer. Printers are shared on a Windows 2000 computer in that computer's `Printers` folder.

## STEP BY STEP

### SHARING A PRINTER, PUBLISHING IT IN ACTIVE DIRECTORY, AND INSTALLING ADDITIONAL PRINTER DRIVERS

1. Open the `Printers` folder. (Select Start ⇨ Settings ⇨ Printers.)
2. In the `Printers` folder, right-click the printer you want to share, and select Sharing from the menu that appears.
3. The printer's Properties dialog box appears with the Sharing tab on top, as shown in Figure 12-9.

To share the printer, select the "Shared as" option. Then, either accept the default name for the shared printer or type in the name you want to use for this shared printer.

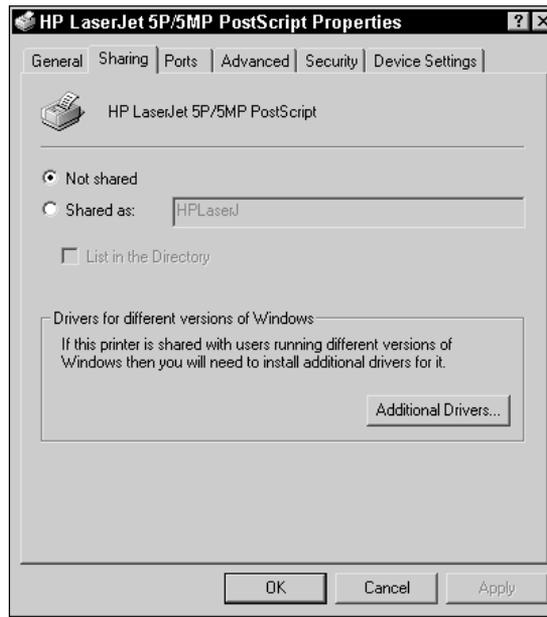


#### TIP

I recommend you use intuitive names for shared printers so that end users can easily identify each shared printer's type, capabilities, and, when appropriate, location.

## STEP BY STEP

Continued

**FIGURE 12-9** Sharing a printer

If your Windows 2000 computer is a member of a Windows 2000 domain, the “List in the Directory” check box is automatically selected when you share a printer. If you don’t want to publish this shared printer in Active Directory, clear this check box.

If you have client computers on your network that don’t run Windows 2000, and if these client computers will print to this shared printer, you may want to install additional drivers to support these client’s operating systems.

If you don’t want to install additional drivers, click OK. Windows 2000 shares the printer. Close the **Printers** folder, and stop here.

If you want to install additional drivers, click Additional Drivers.

4. The Additional Drivers dialog box appears, as shown in Figure 12-10. Notice that the only check box selected is the box next to Intel Windows 2000.

Select the check box next to each processor and operating system combination that is used by client computers on your network that will print to this shared printer. Click OK.

5. If prompted, insert the appropriate operating system compact disc(s) that contain the additional printer drivers and click OK.

## STEP BY STEP

Continued



## TIP

The Intel drivers for Windows NT 4.0, Windows 95, and Windows 98 are contained on the Windows 2000 product compact disc.

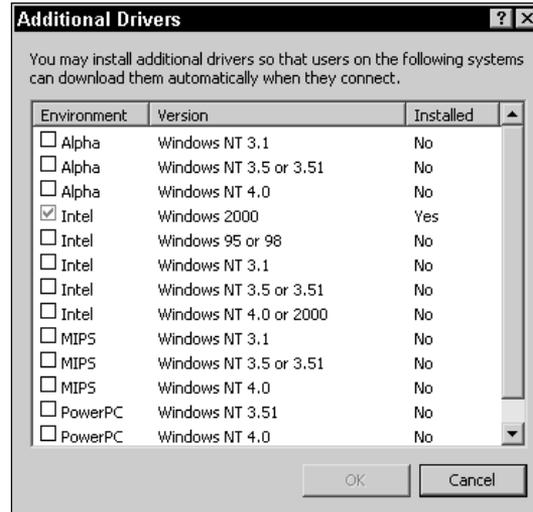


FIGURE 12-10 Installing additional drivers

6. In the printer's Properties dialog box, click Close.
7. Close the `Printers` folder.

## Configuring Printer Properties

In Windows 2000 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, where *Printer\_name* stands for the name of the selected printer.

A printer's Properties dialog box is accessed through the `Printers` folder on a Windows 2000 computer, as the following steps explain.

## STEP BY STEP

### ACCESSING A PRINTER'S PROPERTIES DIALOG BOX

1. Open the **Printers** folder. (Select Start ⇨ Settings ⇨ Printers.)
2. In the **Printers** folder, right-click the printer you want to configure, and select Properties from the menu that appears.
3. The printer's Properties dialog box appears.

---

In the following sections I'll explain how to perform many printer configuration tasks, including: configuring printer pools, scheduling printers, setting printer priorities, assigning a separator page, configuring printer permissions, and assigning forms to paper trays.

## Configuring 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.



#### IN THE REAL WORLD

A printer pool is a good solution when the desired number of printed pages is more output than one print device can handle. A printer pool is a bad idea 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.

## STEP BY STEP

### CONFIGURING PRINTER POOLING

1. Access the Properties dialog box of the printer you want to configure as a printer pool. (See the steps to do this in the previous section.)

## STEP BY STEP

*Continued*

2. In the Properties dialog box, click the Ports tab.
3. On the Ports tab, select the check box next to “Enable printer pooling,” and then select each of the ports that will be used in the printer pool. (For printer pooling to occur, a minimum of two ports must be selected.) Click OK.

Figure 12-11 shows a Ports tab of a printer that has been configured for printer pooling.

4. Close the **Printers** folder.

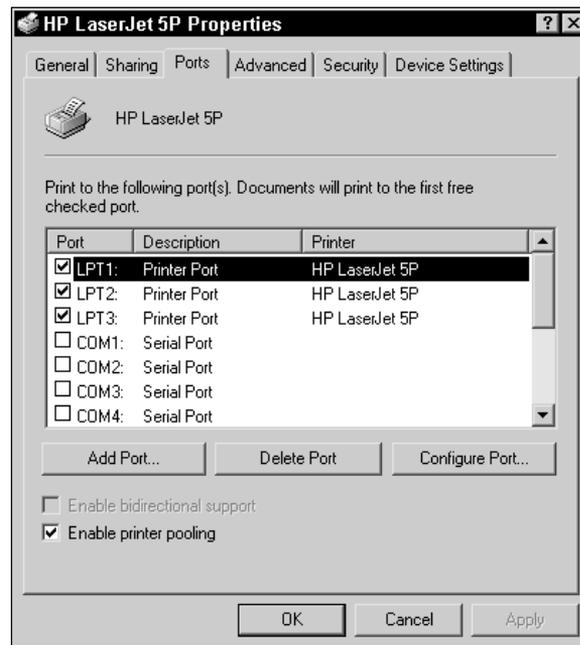


FIGURE 12-11 Printer pooling configured

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 (and therefore to the same print device). In a printer pool the print spooler — not the user — determines the print device to which the print job is sent.

## Scheduling Printers

Scheduling printers is a technique you can use to help manage the flow of print jobs on your Windows 2000 network. 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 (or night), and the printer then spools the jobs to the hard disk. However, the print jobs are sent to the print device only during the print device's hours of availability.



### CAUTION

---

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 that you're the administrator for a small network that has 20 Windows 2000 computers. 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 500 to 600 pages long. This report ties up the one available print device 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 by scheduling printers. 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.



### TIP

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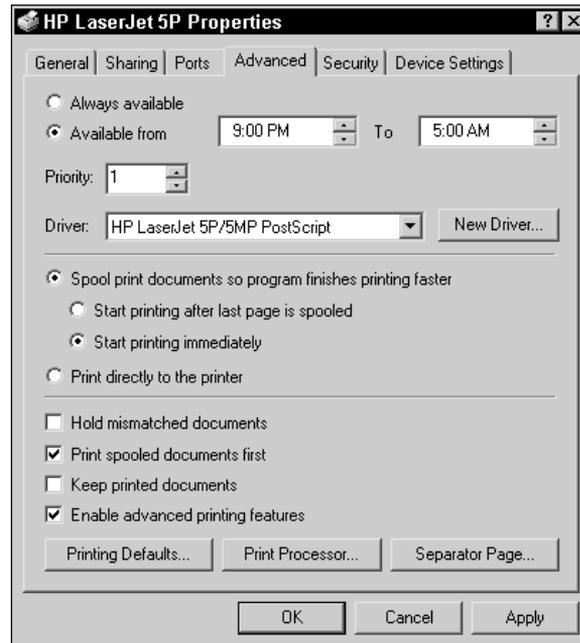
If you schedule printers to be available during nonbusiness hours, be sure the print device is stocked with plenty of paper at the close of business each day.

---

**STEP BY STEP****SCHEDULING PRINTERS**

1. Access the Properties dialog box of the printer you want to schedule. (See the steps in the “Configuring Printer Properties” section earlier in this chapter.)
2. In the Properties dialog box, click the Advanced tab.
3. On the Advanced tab, select the “Available from” option, and then configure the hours that you want the print device associated with this printer to be available. Click OK.

Figure 12-12 shows the Advanced tab after a printer has been scheduled. Notice that the printer is only available 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 nonbusiness hours.



**FIGURE 12-12** Scheduling a printer

4. Close the **Printers** folder.
- 

## Setting Printer Priorities

Another technique you can use to help manage the flow of print jobs on your Windows 2000 network is 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 an example of a situation in which setting printer priorities could be beneficial. Suppose you have two printers on a Windows 2000 Server computer that both send print jobs to the print device (an HP LaserJet) connected to LPT1:. One printer is named HPSales, and the other printer is named HPManagers.

The managers at your 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 HPSales printer, but that only members of the Managers group can use the HPManagers printer. Then you set the priority on the HPManagers printer to a value higher than 1. Once this is done, the managers' print jobs will take priority.

Suppose there are 100 print jobs waiting to print in the HPSales printer, and a manager sends a print job to the HPManagers printer. The current print job from the HPSales printer will finish printing, then the manager's print job will be printed, even though there are 100 other print jobs in the HPSales printer that were generated before the manager's print job.

## STEP BY STEP

### CONFIGURING PRINTER PRIORITY

1. Access the Properties dialog box of the printer for which you want to set printer priority. (See the steps in the "Configuring Printer Properties" section earlier in this chapter.)
2. In the Properties dialog box, click the Advanced tab.
3. On the Advanced tab, set the printer's priority number in the Priority spin box. Remember, the highest priority is 99, and the lowest is 1. Click OK.
4. Close the **Printers** folder.

## Assigning a Separator Page

You can configure a printer on a Windows 2000 computer 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*.



### IN THE REAL WORLD

Banner pages use a lot of paper, and are often not used for this reason. Make sure your users need banner pages before you enable them.

### STEP BY STEP

#### CONFIGURING A SEPARATOR PAGE

1. Access the Properties dialog box of the printer you want to generate separator pages. (See the steps in the “Configuring Printer Properties” section earlier in this chapter.)
2. In the Properties dialog box, click the Advanced tab.
3. On the Advanced tab, click Separator Page.
4. In the Separator Page dialog box, click Browse.
5. The next Separator Page dialog box appears, as shown in Figure 12-13. Notice the four files that end with a `.sep` extension. These are the premade Windows 2000 separator page files.

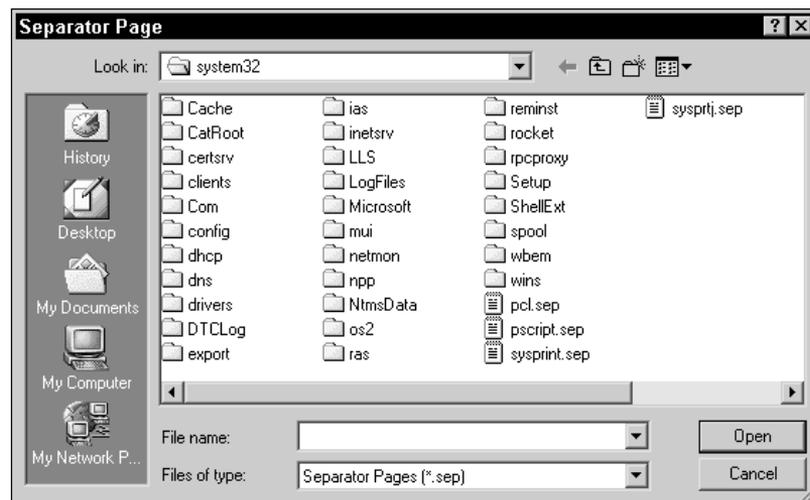


FIGURE 12-13 Assigning a separator page to a printer

## STEP BY STEP

Continued

The four separator page files you can select from are:

- ▶ **pcl.sep** This 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.
- ▶ **pscript.sep** This 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.
- ▶ **sysprint.sep** This separator page file switches a dual language print device to PostScript printing, and causes a separator page to be printed at the beginning of each print job.
- ▶ **sysprtj.sep** This separator page file switches a dual language print device to PostScript printing and selects the print device's Japanese fonts (if any), but does *not* cause a separator page to be printed at the beginning of each print job.

Double-click the separator page file you want to assign to the printer.

6. In the Separator Page dialog box, click OK.
7. In the printer's Properties dialog box, click OK.
8. Close the **Printers** folder.

## Configuring Printer Permissions

You can use Windows 2000 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.

Printer permissions control which tasks a user can perform on a specific printer. Table 12-1 lists and describes the Windows 2000 printer permissions, from most restrictive to least restrictive.

**TABLE 12-1 Windows 2000 Printer Permissions**

Printer Permission	Description and Functionality
Print	A user with this permission can connect to the printer and send print jobs to the printer. By default, the Print permission is assigned to the Everyone group.
Manage Documents	A user with this permission can pause, resume, restart, and delete print jobs sent to the printer. By default, members of the Creator Owner group are assigned the Management Documents printer permission. This enables users who create print jobs to manage their own print jobs.

Printer Permission	Description and Functionality
Manage Printers	A user with this permission can perform all tasks included in the Print permission. In addition, the user can pause, restart, and share the printer; can change spooler settings; can assign printer permissions (including the Manage Documents permission); and can change the printer's properties.

Printer permissions are specifically allowed or denied to individual users and groups. As Table 12-1 states, by default, the Print permission is allowed to the Everyone group. User and group printer permissions are additive, and typically, the *least restrictive* combination of printer permissions applies.

An exception to this rule occurs when a user or group is specifically denied a printer permission. If a user is denied a printer permission, or any group the user is a member of is denied a printer permission, then the user is denied that printer permission. A denied permission always overrides a corresponding allowed permission.

Printer permissions are set on a printer-by-printer basis. These permissions apply both when the printer is accessed over the network and when the printer is accessed from the local computer.

## STEP BY STEP

### ASSIGNING PRINTER PERMISSIONS

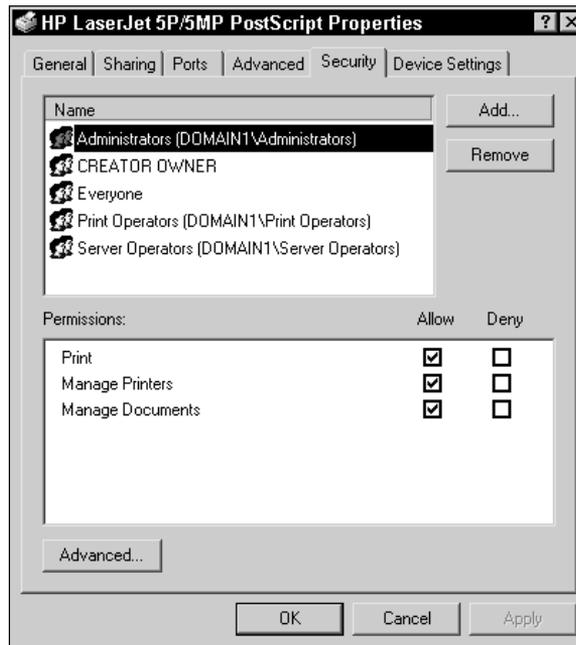
1. Access the Properties dialog box of the printer for which you want to assign permissions. (See the steps in the “Configuring Printer Properties” section earlier in this chapter.)
2. In the Properties dialog box, click the Security tab.
3. The Security tab appears, as shown in Figure 12-14. Notice the default printer permissions assigned to the Administrators group.

Also notice the Allow and Deny check boxes.

- ▶ **Allow:** When the Allow check box next to a specific printer permission is selected for a user or group, the user or group is granted the selected permission to the printer.
- ▶ **Deny:** When the Deny check box next to a specific printer permission is selected for a user or group, the user or group is specifically denied that permission to the printer, even if the user or group is allowed that permission through membership in another group.
- ▶ **Neither:** When neither the Allow or Deny check box next to a specific printer permission is selected for a user or group, the user or group is not assigned that permission to the printer.

## STEP BY STEP

Continued



**FIGURE 12-14** Assigning printer permissions

When a user or group is not listed in the Name box, the user or group has no permissions (and no access) to the printer unless the user or group is a member of a group that *is* listed in the Name box.

To *change* the printer permissions currently assigned to a user or group listed in the Name box, highlight the user or group, then select or clear the appropriate check boxes in the Permissions box.

To *remove* a user or group from the permissions list for the printer, highlight the user or group in the Name box, and click Remove.

To *add* a user or group to the Name box, click Add.

4. In the Select Users, Computers, or Groups dialog box, double-click each user and group you want to add. As you double-click each user or group, the user or group appears in the bottom portion of the dialog box. Click OK.

**STEP BY STEP***Continued*

5. On the Security tab in the printer's Properties dialog box, the users and groups you added appear in the Name box. Each user or group you added is automatically assigned the Print permission to the printer. To change the printer permissions of a user or group you added, highlight the user or group in the Name box, then select or clear the appropriate check boxes in the Permissions box. Click OK.
6. Close the **Printers** folder.

## Assigning Forms to Paper Trays

Assigning forms to specific paper trays can be helpful in managing document printing on a network. Once a form is assigned to a paper tray, print jobs that specify that form are automatically printed using that paper tray. This can be useful when users want a print job to be printed on an odd-sized or different color paper that is always kept in a particular paper tray. A key benefit of this feature is that users don't even need to know which tray contains the letterhead, legal size, or other specific paper they want to use — once they select a particular form (such as Legal), that print job will always be printed using paper from the assigned paper tray.

Windows 2000 has several built-in forms you can choose from. In addition, you can create your own custom forms, as I'll explain a bit later in this chapter.

**STEP BY STEP**

### ASSIGNING A FORM TO A PAPER TRAY

1. Access the Properties dialog box of the printer for which you want to assign a form to a paper tray. (See the steps in the "Configuring Printer Properties" section earlier in this chapter.)
2. In the Properties dialog box, click the Device Settings tab.
3. The Device Settings tab appears, as shown in Figure 12-15. Notice that by default the Letter form is assigned to each tray.

Highlight the tray to which you want to assign a particular form. Then, in the drop-down list box that appears, select the form you want to assign to this tray.

When you've finished assigning forms to paper trays, click OK.

## STEP BY STEP

Continued

4. Close the `Printers` folder.

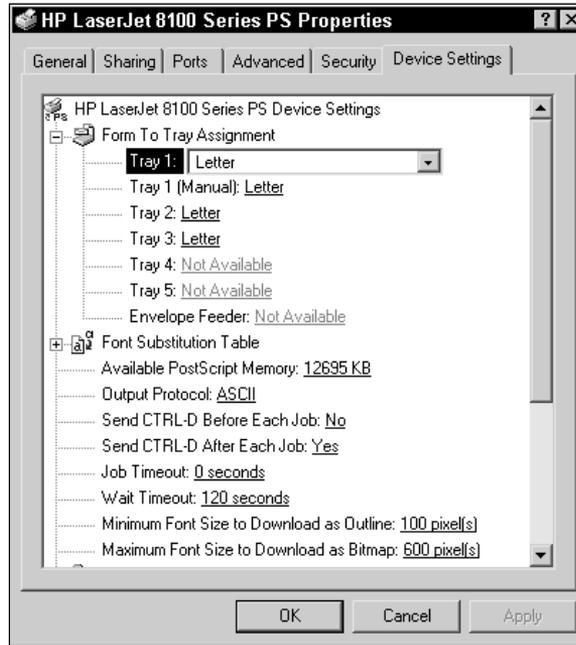


FIGURE 12-15 Assigning a form to a paper tray

## Configuring Print Server Properties

A *print server* is a computer that hosts a shared printer. The print server performs all of the spooling, print job management, scheduling, and sending of the final print jobs to the print device. The Windows 2000 service that performs many of the functions of the print server is the Print Spooler service.

You can configure several of a print server's properties. Print server properties are configured in the Print Server Properties dialog box, which is accessed from the `Printers` folder. In the following sections I'll explain how to create forms, manage ports, manage printer drivers, and change the location of the spool folder.

## Creating Forms

Windows 2000 offers several built-in forms. However, occasionally you may want to create your own custom 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 specific paper tray on a printer. (See the section earlier in this chapter on "Assigning Forms to Paper Trays.") Once a form is assigned to a paper tray, documents that specify that form are automatically printed using that paper tray.

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 intuitive manner.

### STEP BY STEP

#### CREATING A FORM

1. Select Start ⇨ Settings ⇨ Printers.
2. In the **Printers** folder, select File ⇨ Server Properties.
3. The Print Server Properties dialog box appears, with the Forms tab on top, as shown in Figure 12-16.

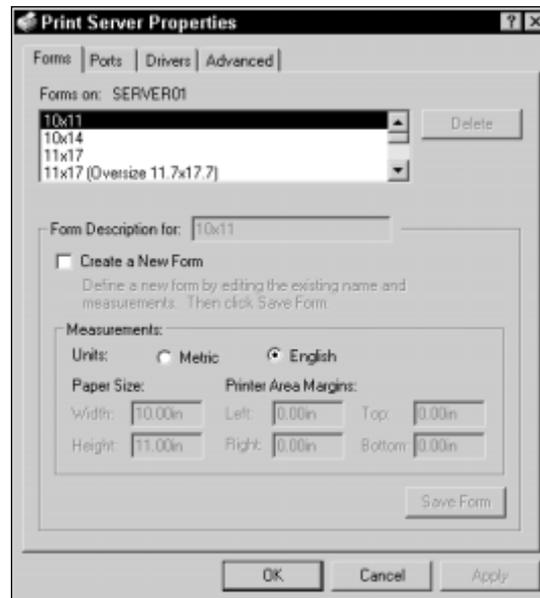


FIGURE 12-16 Creating a form

## STEP BY STEP

*Continued*

4. To create a new form, highlight an existing form in the “Forms on” list box that is similar to the form you want to create. Select the check box next to “Create a New Form.”

In the “Form Description for” text box, type in a name for your new form.

Modify settings in the Measurements section of this dialog box to meet your needs. You can select either metric or English measurements, and you can specify the form’s paper size and printer area margins.

When you are finished, click Save Form.

5. Windows 2000 creates the new form and adds it to the “Forms on” list box. Click Close.
6. Close the `Printers` folder.

---

You can also use the Forms tab to modify forms that you’ve created. However, you can’t modify the premade Windows 2000 forms.

## Managing Ports

You can use the Ports tab in the Print Server Properties dialog box to add, delete, and configure ports.

The capabilities of the Ports tab in the Print Server Properties dialog box are virtually identical to those of the Ports tab in a printer’s Properties dialog box.

## STEP BY STEP

### CONFIGURING, DELETING, AND ADDING PORTS

1. Select Start ⇨ Settings ⇨ Printers.
2. In the `Printers` folder, select File ⇨ Server Properties.
3. In the Print Server Properties dialog box, click the Ports tab.
4. The Ports tab appears, as shown in Figure 12-17. Notice the three command buttons: Add Port, Delete Port, and Configure Port.

**To configure a port**, highlight the port you want to configure, and click Configure Port. A port-specific dialog box is displayed, which will have different configuration options, depending on the port selected. Configure the port to meet your needs and click OK.

## STEP BY STEP

Continued

**To delete a port**, highlight the port you want to delete and click Delete Port. In the Delete Port dialog box, click Yes to delete the port.

**To add a port**, click Add Port.

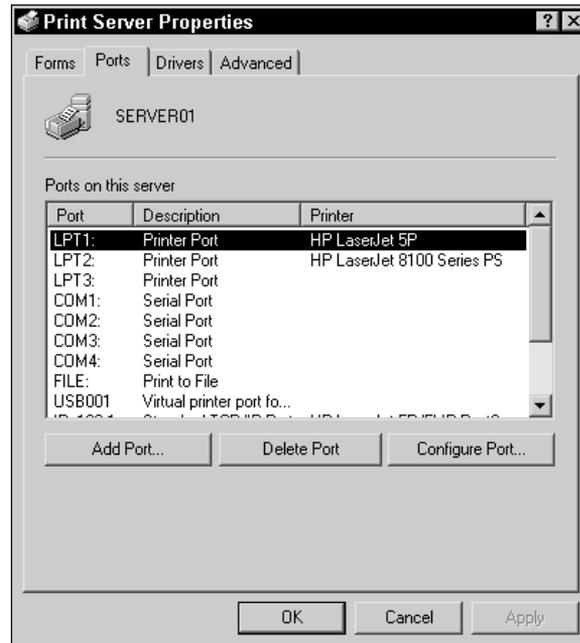


FIGURE 12-17 Managing ports



## TIP

Some ports can't be deleted. Windows 2000 displays a warning box when it is unable to delete the specified port.

- The Printer Ports dialog box appears, as shown in Figure 12-18. Notice the available port types listed. The port types displayed in this dialog box will vary, depending on the protocols and services installed on your Windows 2000 computer. Highlight the type of port you want to add and click New Port.
- Depending on the type of port you're adding, various wizard screens or dialog boxes may be displayed. Follow the instructions presented on screen to create your new port.
- The Printer Ports dialog box reappears. Click Close.
- In the Print Server Properties dialog box, click Close.
- Close the **Printers** folder.

## STEP BY STEP

Continued

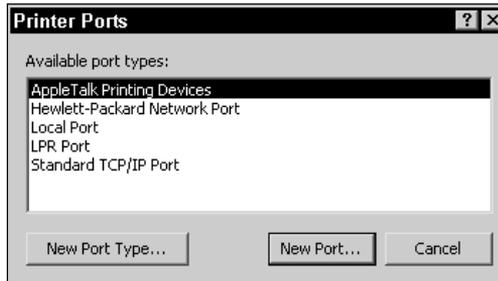


FIGURE 12-18 Adding a port

## Managing Printer Drivers

You can use the Drivers tab in the Print Server Properties dialog box to add, remove, update, and configure the properties of printer drivers on your Windows 2000 computer.

Figure 12-19 shows the Drivers tab. Notice the list of installed printer drivers.

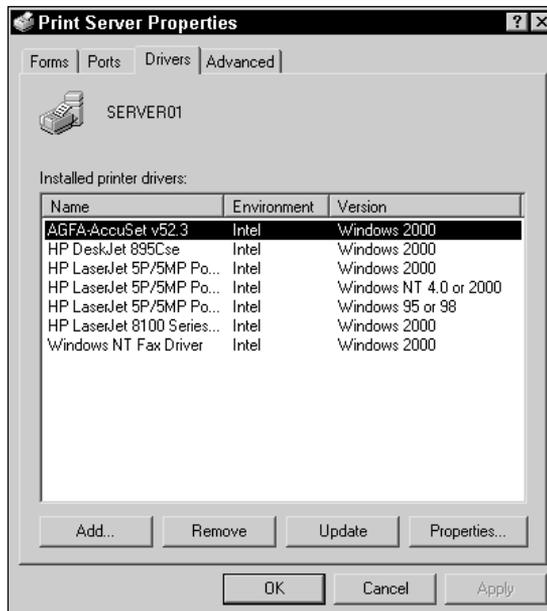


FIGURE 12-19 Managing printer drivers

The configuration options in this dialog box are straightforward. In addition, administrators typically don't use this tab often.

## Changing the Location of the Spool Folder

The spool folder is used by the Windows 2000 Print 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 `SystemRoot\System32\spool\PRINTERS`.

If the volume that contains the spool folder doesn't have enough free space to store print jobs, you may experience print job failures. On a busy Windows 2000 Server computer with multiple shared printers, for example, you might need between 25MB and several hundred MB 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 in the volume that contains your spool folder, you can specify that a folder on a different volume (that has more free space) be used as the spool folder.

If you move the spool folder to a volume that has more restrictive permission settings than the original volume, ensure that users are allowed at least the Modify NTFS permission to the relocated spool folder, or users may be unable to print. In addition, ensure that disk quotas are *not* enabled on the volume to which the spool folder has been moved, because disk quotas can also prevent users from being able to print.

### STEP BY STEP

#### CHANGING THE LOCATION OF THE SPOOL FOLDER

1. Select Start ⇨ Settings ⇨ Printers.
2. In the `Printers` folder, select File ⇨ Server Properties.
3. In the Print Server Properties dialog box, click the Advanced tab.
4. The Advanced tab appears, as shown in Figure 12-20. Notice the "Spool folder" text box.  
Type in a new location for the spool folder (over the default location) and click OK.
5. Close the `Printers` folder.

## STEP BY STEP

Continued

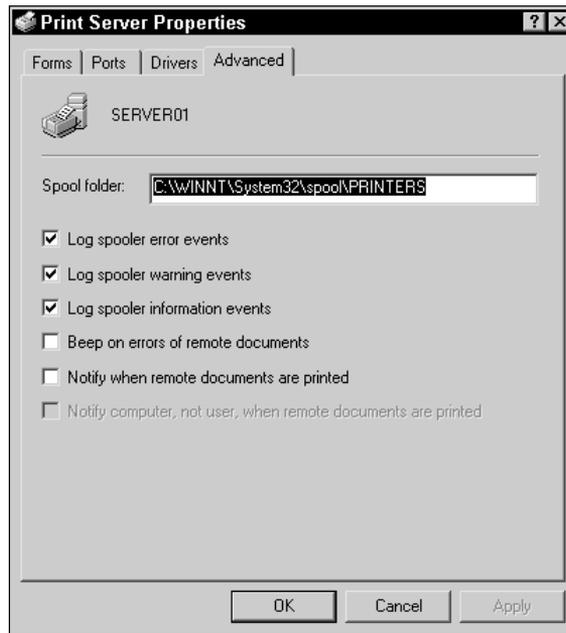


FIGURE 12-20 Changing the location of the spool folder

## Managing Print Jobs

Almost every network administrator has to give some thought to managing print jobs on a network. Printing is just one of those things that seems to consume a lot of administrator time and attention.

In Windows 2000, you can use the `Printers` folder to manage print jobs. You can also use Internet Explorer to manage print jobs. Finally, you can redirect print jobs to another print device if the original print device fails. I'll discuss how to perform these tasks in the sections that follow.

### Using the Printers Folder to Manage Print Jobs

You can use the `Printers` folder to manage print jobs that users have sent to printers. As you probably recall, printers are managed on a printer-by-printer basis.

To manage print jobs that have been sent to a printer, double-click the printer in the `Printers` folder. This action brings up the printer's dialog box. In this dialog box you can pause, resume, restart, and cancel (delete) print jobs. You can also set a print job's priority and schedule the time a print job may be printed.

Figure 12-21 shows a printer's dialog box. Notice the Document menu, and the various options it contains. Also notice the Status column. The status of a print job can sometimes be helpful when troubleshooting printers.

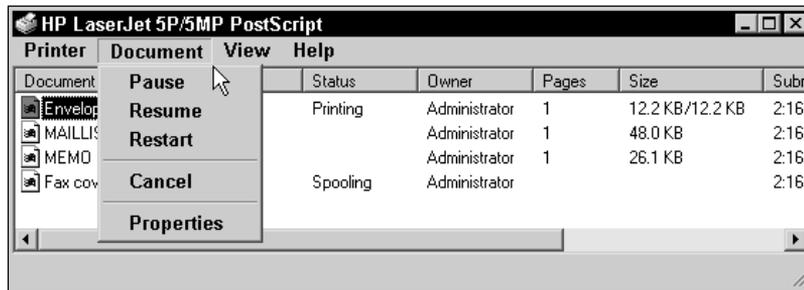


FIGURE 12-21 Managing print jobs

I want to discuss the difference between two of the options in the Document menu: Resume and Restart. When you select the Resume option, Windows 2000 will resume printing the print job from the point at which it was paused. Windows 2000 does *not* reprint the entire print job. When you select the Restart option, Windows 2000 reprints the entire print job.

## Using Internet Explorer to Manage Print Jobs

You can use Internet Explorer to manage print jobs that users have sent to an Internet printer. Internet Explorer makes it convenient to manage print jobs sent to printers that are hosted by remote computers, as well as print jobs sent to printers on the local computer.

The management tasks you can perform on print jobs in Internet Explorer are quite similar to those you can perform by using the printer's dialog box (in the `Printers` folder), with the exception of the Restart command, which is not available when using Internet Explorer to manage print jobs.

## STEP BY STEP

## USING INTERNET EXPLORER TO MANAGE PRINT JOBS

1. On your Windows 2000 desktop, double-click Internet Explorer.
2. In the Address text box, type the URL of the **Printers** folder on the Web server that hosts the Internet printer that has print jobs you want to manage (such as `http://Server03/Printers`) and press Enter.
3. In the All Printers on *Server\_name* dialog box, click the name of the Internet printer that has print jobs you want to manage.
4. Internet Explorer displays the management Web page for the printer you selected, as shown in Figure 12-22. Notice the list of print jobs and the various actions you can take in the Document Actions menu.

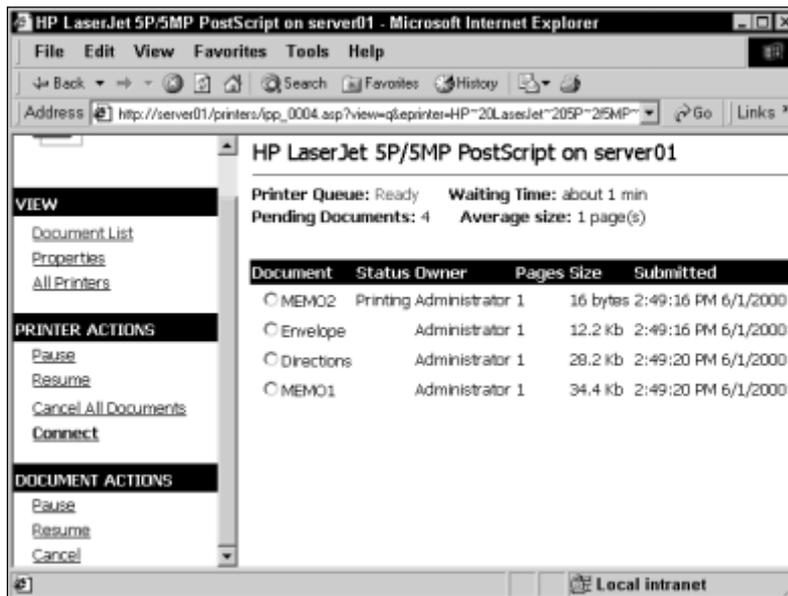


FIGURE 12-22 Managing print jobs on an Internet printer

To manage a print job, select the option button next to the print job (in the Document column), and then click the action you want to take from the Document Actions menu in the left pane.



## TIP

If you frequently need to manage documents for this printer, consider adding it to your Favorites in Internet Explorer.

5. When you're finished managing print jobs, close Internet Explorer.

## Redirecting Print Jobs to Another Print Device

When a print device fails on a network, it's not uncommon for a printer to have several print jobs waiting to be sent to that print device. If the print device can't be rapidly repaired, you'll probably want to redirect the waiting print jobs to another print device so that users can obtain their printed documents.

To successfully redirect print jobs to another print device, the device you redirect print jobs to must use the same printer drivers as the originally specified print device. This often means redirecting print jobs to an identical (or nearly identical) print device. You can redirect print jobs to any print device, but the printed output will probably be unusable unless the print devices use the same printer drivers.

### STEP BY STEP

#### REDIRECTING PRINT JOBS TO A DIFFERENT PRINT DEVICE

1. Open the **Printers** folder. (Select Start ⇨ Settings ⇨ Printers.)
2. In the **Printers** folder, right-click the printer that has the print jobs you want to redirect, and select Properties from the menu that appears.
3. In the printer's Properties dialog box, click the Ports tab.
4. On the Ports tab, select the port that is connected to the print device to which you want to redirect the printer's print jobs. (Windows 2000 clears the check box next to the original port.) Click OK.

Once a new port (and new associated print device) is selected, all waiting print jobs will be sent to the new print device.

5. Close the **Printers** folder.

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When the original print device is repaired and brought back online, you can repeat the preceding steps, this time selecting the port that is associated with the original print device. Print jobs will then be sent to the original print device.

## Troubleshooting Common Printing Problems

Printing problems can occur on a Windows 2000 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 Manage Documents permission accidentally deleting print jobs that belong to other users. A good first step, when troubleshooting printer problems, is to ensure that users have appropriate printer permissions.

Table 12-2 lists some common Windows 2000 printing problems, their probable causes, and recommended solutions.

**TABLE 12-2 Troubleshooting Windows 2000 Printing Problems**

Problem	Probable Cause/ Recommended Solution
A user reports that he is unable to print to a printer. You have specifically allowed the Print permission to this user for this printer.	The most probable cause of this problem is that the user is a member of a group that is denied the Print permission to the printer. Either remove the user from the group or remove the Deny – Print permission from the group.
You are unable to add a standard TCP/IP local printer on a Windows 2000 computer.	The most common cause of this problem is an incorrect configuration of a TCP/IP parameter on either the Windows 2000 computer or on the TCP/IP print device. Ensure that the IP address, subnet mask, and default gateway parameters are set correctly on both.
You experience a paper jam in the middle of printing an important print job. You want to reprint the <i>entire</i> print job, but it is not possible to reprint the job from the application because you deleted the document after you created the print job.	The cause of the paper jam isn't important here, but being able to reprint the entire print job is. To solve this problem, <i>immediately</i> double-click the printer in the <b>Printers</b> folder. Then pause the print job. Then clear the paper jam at the print device. Finally, select Restart in the printer's dialog box to reprint the entire print job. (Don't select Resume, because this option won't reprint the entire print job.)
Print jobs aren't 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.	The most likely cause of this problem is a stalled print spooler. Stop and restart the Print Spooler service, and printing should resume.

Problem	Probable Cause/ Recommended Solution
When users print to a printer pool, documents sent to one of the print devices in the printer pool are not printed correctly.	The most likely cause of this problem is that nonidentical print devices are being used in the printer pool. Remove the device that is not printing correctly from the printer pool, or replace the device with a print device that is identical to all other print devices in the printer pool.
An HP (DLC) printer has stopped sending print jobs to its assigned print device.	This problem usually occurs when another computer on the network is configured to use DLC 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 DLC, configure a Job Based connection for all printers.



## KEY POINT SUMMARY



This chapter introduced several important Windows 2000 printing topics:

- A printer, in Windows 2000 terminology, is the software interface between the Windows 2000 operating system and the device that produces the printed output. A print (or printing) device is the physical device that produces printed output – what is more commonly referred to as a “printer.”
- Before you can print on a Windows 2000 computer, you must first add a printer. There are two types of printers you can add: local printers and network printers. You can use the Add Printer Wizard in the Printers folder to add most printers.
- An Internet printer is a printer that is published on a Web server for the purpose of making the printer available to client computers on the Internet, client computers on your company’s intranet, or both. You can use the Add Printer Wizard or Internet Explorer to connect to an Internet printer.
- The purpose of sharing a printer on a Windows 2000 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.
- When you share a printer on a Windows 2000 computer that is a member of a Windows 2000 domain, by default, the printer is automatically published in Active Directory at the same time.

- You can configure options for a printer in the printer's Properties dialog box. This dialog box is accessed through the Printers folder. You can configure printer pools, schedule printers, set printer priorities, assign a separator page, configure printer permissions, and assign forms to paper trays in this dialog box.
- The three Windows 2000 printer permissions are Print, Manage Documents, and Manage Printers. Printer permissions are specifically allowed or denied to individual users and groups. User and group printer permissions are additive, and typically the least restrictive combination of printer permissions applies.
- You can configure several of a print server's properties. Print server properties are configured in the Print Server Properties dialog box, which is accessed from the Printers folder. In this dialog box you can create forms, manage ports, manage printer drivers, and change the location of the spool folder.
- There are several tools and techniques you can use to manage print jobs. You can use the Printers folder to manage print jobs. You can also use Internet Explorer to manage print jobs on Internet printers. Finally, you can redirect print jobs to another print device if the original print device fails.
- Printing problems can occur on a Windows 2000 network for several reasons. A good first step, when troubleshooting printer problems, is to ensure that users have appropriate printer permissions.

## STUDY GUIDE

This section contains several exercises that are designed to solidify your knowledge about Windows 2000 printing, and to help you prepare for the Professional, Server, and Directory Services exams:

- **Assessment questions:** These questions test your knowledge of the printing topics covered in this chapter. You'll find the answers to these questions at the end of this chapter.
- **Scenarios:** The situation-based questions in scenarios challenge you to apply your understanding of the material to solve a hypothetical problem. In this chapter's scenario, you are asked to troubleshoot various Windows 2000 printing problems. You don't need to be at a computer to do scenarios. Answers to this chapter's scenario are presented at the end of this chapter.
- **Labs:** These exercises are hands-on practice activities that you perform on a computer. The lab in this chapter gives you an opportunity to practice several basic Windows 2000 printing tasks.

### Assessment Questions

1. You want to add a printer on your Windows 2000 Professional computer that is connected to an HP JetDirect adapter that does *not* support TCP/IP printing. What should you install on your Windows 2000 Professional computer before you add the printer?
  - A. The DLC protocol
  - B. The NetBEUI protocol
  - C. Print Services for Unix
  - D. Client Service for NetWare
2. What must you do before you can publish a Windows 2000 printer in Active Directory?
  - A. Share the printer.
  - B. Install the NetBEUI protocol.
  - C. Install printer drivers for other operating systems.
  - D. Assign the Everyone group the Allow – Manage Documents permissions to the printer.

3. What must be installed on a Windows 2000 computer to make all of its shared printers available as Internet printers? (Choose two.)
  - A. Print Services for Unix
  - B. Internet Information Services (IIS)
  - C. The DLC protocol
  - D. The NetBEUI protocol
  - E. The TCP/IP protocol
4. Which tools can you use to manage printers on Windows 2000 computers? (Choose two.)
  - A. Internet Explorer
  - B. The Printers Folder
  - C. Computer Management
  - D. Internet Services Manager
  - E. Active Directory Users and Computers
5. Which tools can you use to connect to an Internet printer? (Choose two.)
  - A. Control Panel
  - B. Internet Explorer
  - C. The Add Printer Wizard
  - D. The Network and Dial-up Connections folder
  - E. Active Directory Users and Computers
6. Which Windows 2000 printer permission allows you to assign printer permissions?
  - A. Print
  - B. Manage Documents
  - C. Manage Printers
7. How can you redirect print jobs to a different print device?
  - A. Copy the print jobs from one printer to another printer.
  - B. Assign the printer to a port that is connected to a different type of print device.
  - C. Cancel all of the print jobs, then delete the printer. Create a new printer with the same name, and assign it to a different port.
  - D. Assign the printer to a port that is connected to another identical print device.

8. A print job with a size of 0 bytes is listed at the top of the print job list, and other print jobs in the print job list are *not* being sent to the print device. What should you do?
  - A. Delete the print job at the top of the print job list.
  - B. Pause the printer, then restart the printer.
  - C. Stop the Print Spooler service, then restart the Print Spooler service.
  - D. Delete the printer, then recreate the printer.

## Scenarios

The following scenarios provide you with an opportunity to apply the knowledge you've gained in this chapter about troubleshooting printing problems in a Windows 2000 environment. Printing problems can occur on a Windows 2000 network for several reasons. For each of the following problems, consider the given facts and answer these questions:

1. A user, JohnT, reports that he is unable to print to a printer on your Windows 2000 network. You specifically allowed JohnT the Print permission for this printer about a month ago.
  - a. What do you think is the most likely cause of the printing problem?
  - b. What course of action would you take to try to resolve the problem?
2. Several users report that when they print to a printer pool on a Windows 2000 Server computer, documents printed by one of the print devices in the printer pool are not printed correctly. The printed pages contain garbled, unreadable text.
  - a. What do you think is the most likely cause of the printing problem?
  - b. What course of action would you take to try to resolve the problem?

## Lab Exercises

The following lab is designed to give you practical experience working with printers in a Windows 2000 environment.

### Lab 12-1 Managing Windows 2000 Printing



- ▶ Professional
- ▶ Server
- ▶ Directory Services

The purpose of this lab is to provide you with an opportunity to practice numerous Windows 2000 printing tasks.

There are three parts to this lab:

- Part 1: Adding a Printer
- Part 2: Sharing, Publishing, and Configuring a Printer
- Part 3: Printing to a Printer and Managing Print Jobs

Begin this lab by booting your computer to Windows 2000 Server and logging on as Administrator.

#### Part 1: Adding a Printer

In this part, you add a local printer and connect to a local print device.

1. Open the `Printers` folder. (Select `Start` ⇨ `Settings` ⇨ `Printers`.)
2. In the `Printers` folder, double-click `Add Printer`.
3. The `Add Printer Wizard` begins. Click `Next`.
4. In the `Local or Network Printer` screen, ensure that the “`Local printer`” option is selected, and that the check box next to “`Automatically detect and install my Plug and Play printer`” is cleared. Click `Next`.
5. In the `Select the Printer Port` screen, highlight the `LPT3:` port and click `Next`.
6. In the `Add Printer Wizard` screen, select `Agfa` in the `Manufacturers` list box and select `AGFA-AccuSet v52.3` in the `Printers` list box. Click `Next`.
7. On the `Name Your Printer` screen, accept the default name displayed. Ensure that the `No` option is selected. Click `Next`.

8. On the Printer Sharing screen, ensure that the “Do not share this printer” option is selected. Click Next.
9. On the Print Test Page screen, ensure that the No option is selected, and click Next.
10. On the Completing the Add Printer Wizard screen, click Finish.
11. The new local printer you added is displayed in the `Printers` folder. Continue on to Part 2.

## Part 2: Sharing, Publishing, and Configuring a Printer

In this part, you share the printer you created in Part 1, and publish this printer in Active Directory. Then you schedule this printer and configure printer permissions for this printer.

1. In the `Printers` folder, right-click the AGFA-AccuSet v52.3 printer, and select Sharing from the menu that appears.
2. In the AGFA-AccuSet v52.3 Properties dialog box, select the “Shared as” option. Then, in the “Shared as” text box, type **AGFA**.  
Ensure that the check box next to “List in the Directory” is selected. This will cause the printer to be published in Active Directory.  
Click the Advanced tab.
3. On the Advanced tab, select the “Available from” option, and configure the printer’s available hours from 4:00 A.M. to 4:30 A.M. Click the Security tab.
4. On the Security tab, click Add.
5. In the Select Users, Computers, or Groups dialog box, double-click Mike Calhoun, the Information Services Manager. Click OK.
6. On the Security tab, select the Allow check boxes next to the Manage Printers and Manage Documents permissions, so that Mike Calhoun has all of the Windows 2000 printer permissions for this printer. Click OK.
7. Close the `Printers` folder.

## Part 3: Printing to a Printer and Managing Print Jobs

In this part, you use Internet Explorer to print to a printer, to connect to an Internet printer, and to manage print jobs sent to the Internet printer.

1. On your Windows 2000 desktop, double-click Internet Explorer.
2. In the Address text box, type **http://Server01/Printers** and press Enter.

3. Internet Explorer connects you to the `Printers` folder, and displays a list of available Internet printers. Select `File ⇨ Print`.
4. The Print dialog box appears. In the Select Printer box, select the AGFA-AccuSet v52.3 printer. Click Print.
5. In the Internet Explorer dialog box, select `View ⇨ Refresh`. Notice that there is now one print job for the AGFA-AccuSet v52.3 printer. Click the AGFA-AccuSet v52.3 printer.
6. Internet Explorer connects you to the management Web page for the AGFA-AccuSet v52.3 Internet printer.  
(If this printer was located on another computer, a `Connect` option would be displayed in the Printer Actions menu. Selecting this option would enable you to connect to the printer.)  
Notice the document that is waiting to be printed, and the information about that document that is displayed. Select the option button next to the document. In the Document Actions menu, click `Cancel`. You have just deleted this print job.
7. Close Internet Explorer.

## Answers to Chapter Questions

### Chapter Pre-Test

1. In Windows 2000 printing terminology, a printer is the software interface between the Windows 2000 operating system and the device that produces the printed output.
2. A printer pool
3. The three Windows 2000 printer permissions are Print, Manage Documents, and Manage Printers.
4. Any permission that is specifically denied, for example, Deny – Print, Deny – Manage Documents, or Deny – Manage Printers, always overrides the corresponding allowed permission.
5. You can specify that a different folder on another volume (that has more free space) be used as your spool folder.

## Assessment Questions

1. **A.** The DLC protocol must be installed to support HP JetDirect adapters that do not support TCP/IP.
2. **A.** Only printers that have been shared can be published in Active Directory.
3. **B and E.** You need to ensure that Internet Information Services (IIS) and TCP/IP are installed on a Windows 2000 computer if you want all of its shared printers to be advertised as Internet printers.
4. **A and B.** You can use Internet Explorer to manage Windows 2000 Internet printers, and you can use the `Printers` folder to manage all Windows 2000 printers.
5. **B and C.** You can use Internet Explorer or the Add Printer Wizard (in the `Printers` folder) to connect to Internet printers.
6. **C.** The Manage Printers permission allows you to assign printer permissions.
7. **D.** You need to assign the printer to a different port that is connected to the same type of print device.
8. **C.** You should use the Services tool in Computer Management to stop and then restart the Print Spooler service.

## Scenarios

1. The most likely cause of this problem is that JohnT is a member of a group that is denied the Print permission to this printer. Either remove JohnT from the group or remove the Deny – Print permission from the group.
2. The most likely cause of this problem is that nonidentical print devices are being used in the printer pool. Remove the device that is not printing correctly from the printer pool, or replace the device with a print device that is identical to (or at least uses the same printer drivers as) all other print devices in the printer pool.