Windows NT Port Monitors
for HP JetDirect-Connected Printers

Microsoft provides several port monitors under Windows NT 4.0 that can be used to print to HP JetDirect-connected printers. HP also provides port monitors through various print management utilities such as HP JetAdmin and HP Web JetAdmin.

This technical brief will compare the features of port monitors available in Windows NT 4.0 used for printing to HP JetDirect-connected printers (see Figure 1).

What is a Port Monitor?

A port monitor is responsible for the communication between the spooler and the printer. A port monitor controls the I/O port to which the physical printer is connected. It delivers the print job to the printer, and communicates the status of the print job and the device.

When examining the major components used in printing under Windows NT 4.0, the printing process begins when the application creates the print job, and ends when the port monitor sends the print job to the printer.

The port monitors available under Windows NT 4.0 to print to HP JetDirected-connected printers are:
- HP JetDirect Port
- HP Standard Port
- Microsoft LPR Port
- Hewlett-Packard Network Port

The following topics will be discussed for each port monitor:
- Installation
- Protocols
- Device Status
- Printer Driver Compatibility
- HP JetDirect Configuration
- Performance

HP JetDirect Port

HP JetDirect Port is a port monitor provided through the HP JetAdmin printer management and configuration software. The HP JetAdmin installer provides options to just install the port monitor, or to install the entire HP JetAdmin product. HP JetAdmin is the only method of obtaining the HP JetDirect Port Monitor.

Once the port monitor has been installed, ports can be created to printers using any of the following techniques:
- Select **Add Port** while using the Microsoft Add Printer Wizard, or by changing ports through a **Printer Properties** page
- Select **Add HP JetDirect Printer** from the **HP JetAdmin Utilities** section on the Windows NT Start Menu

Protocols
HP JetDirect Port can use either the TCP/IP or IPX protocol to create a print path to an HP JetDirect-connected printer.

When configured for TCP/IP, the HP JetDirect Port performs raw TCP/IP (port 9100) printing to HP JetDirect-connected printers. This means when a print job is sent to a printer through HP JetDirect Port, a TCP connection is created with a destination port number of 9100 (and 9101, 9102 for a 3-port JetDirect device).

Note: The source port is chosen by the NT operating system, and typically falls in the range of 1000-5000.

Device Status
HP JetDirect Port uses SNMP polling to gather status information for standard printer MIB (RFC 1759) compliant printers. For example, if something goes wrong on the printer while sending a print job (e.g. out of paper), the HP JetDirect Port Monitor will effectively report that condition.

HP JetAdmin, which installs the HP JetDirect Port Monitor, also contains an optional HP Desktop Status utility that allows up to 8 HP JetDirect Port
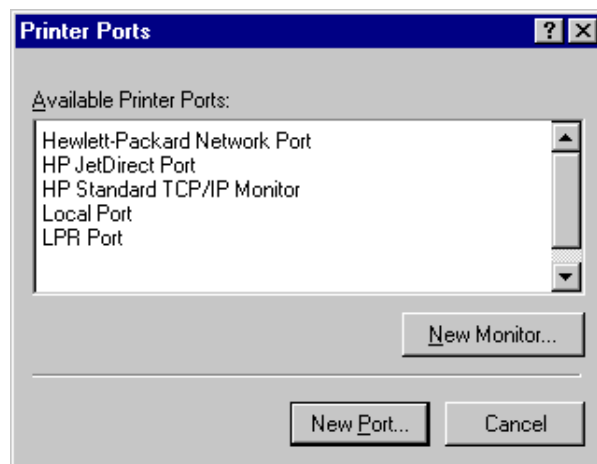

Figure 1

configured printers to appear as icons on the Windows NT 4.0 task bar (see Figure 2). These icons change colors (green, yellow, red) to represent the current status of the printer. Green means the printer is in good status and ready to print. Yellow means there is a warning condition, but printing can still occur without intervention (e.g. toner low) or by fixing the condition remotely (e.g. offline). Red means there is a printer error that prevents printing. By clicking on these icons, extended status information about the printer can be obtained, and modification of the printer settings can occur.

Figure 2

Printer Driver Compatibility
Many recent printer drivers, such as the HP LaserJet 4000 or 5000, contain features that rely on the shared HP JetAdmin / HPJetDirect Port architecture. Such features include:

- *Update Now* button under the **Properties, Configure** tab of the driver
- HP Toolbox

Since these drivers rely on the HP JetAdmin architecture, these features of the drivers are only available for HP JetDirect Port.

HP JetDirect Configuration
If HP JetDirect Port is configured to use IPX, no prior HP JetDirect configuration is necessary.

If HP JetDirect Port is configured to use TCP/IP, the HP JetDirect device must be configured with valid TCP/IP parameters before printing can occur through the port. The user interface for creating an HP JetDirect Port does allow for configuration of the TCP/IP address, subnet mask, and default gateway if they are currently unconfigured for the HP JetDirect device.

If the TCP/IP address has changed for a printer configured to use HP JetDirect Port for TCP/IP (such as in a DHCP environment), jobs submitted to this printer will still print without requiring reconfiguration of the port. HP JetDirect Port will determine that the TCP/IP address has changed, and will perform another discovery to locate the printer based on its MAC address. Once the new TCP/IP address is determined, the information is saved in the registry for that particular port, and the print job resumes printing.

Performance
Since HP JetDirect Port is a subset of HP JetAdmin, it uses the same underlying architecture as HP JetAdmin. Even if only the HP JetDirect Port is chosen to be installed during an HP JetAdmin installation, the entire set of HP JetAdmin architecture core files are also installed, creating a rather large footprint on the machine where installed. The reliance upon the HP JetAdmin architecture also causes HP JetDirect Port to consume more system resources than the other port monitors mentioned in this paper. The HP Desktop Status component of HP JetAdmin uses more resources because it is continually polling up to 8 devices simultaneously for status information.

Due to the rather large footprint and the amount of resources consumed, HP JetDirect Port is not recommended in situations where a large number of ports are required on a single server. HP JetDirect Port has performed reliably in tests of less than 100 ports on a single NT 4.0 server. Naturally, the amount of available resources on a particular machine directly corresponds to the number of HP JetDirect Ports that should be created on that machine before performance degradation occurs.

HP Standard Port

HP Standard Port is a port monitor provided through the following printer configuration/management utilities:

- HP Web JetAdmin
- HP Install Network Printer Wizard

Once the HP Standard Port Monitor is installed, ports can be created to printers through either of the following techniques:

- Run the HP Install Network Printer Wizard from the HP JetDirect CD-ROM, which automatically creates a printer and port
- Select *Add Port* while using the Microsoft Add Printer Wizard, or by changing ports through a **Printer Properties** page
- Use HP Web JetAdmin to "push" a print path to a local or remote Windows NT machine

Note: The HP Standard Port Monitor is only installed on a machine after a successful printer creation in either the HP Install Network Printer Wizard or HP Web JetAdmin. For example, just installing HP Web JetAdmin itself does not install the HP Standard Port Monitor. A printer must be installed through HP Web JetAdmin in order for the HP Standard Port Monitor to be installed on the machine where the printer was installed.

Protocols
HP Standard Port can be configured to use either the TCP/IP or the IPX protocol to create a print path to an HP JetDirect-connected printer, depending upon the method in which the port monitor was installed. If HP Standard Port was installed through HP Web JetAdmin, TCP/IP is the only available protocol. If HP Standard

Configure HP Standard TCP/IP Port Monitor

Port Settings

Port Name: lj4000_std

Host Name or TCP/IP Address: 15.62.43.164

Protocol
- ● Raw
- ○ LPR

Raw Settings

Port Number: 9100

LPR Settings

Queue Name:

☑ SNMP Status Enabled

Community Name: public

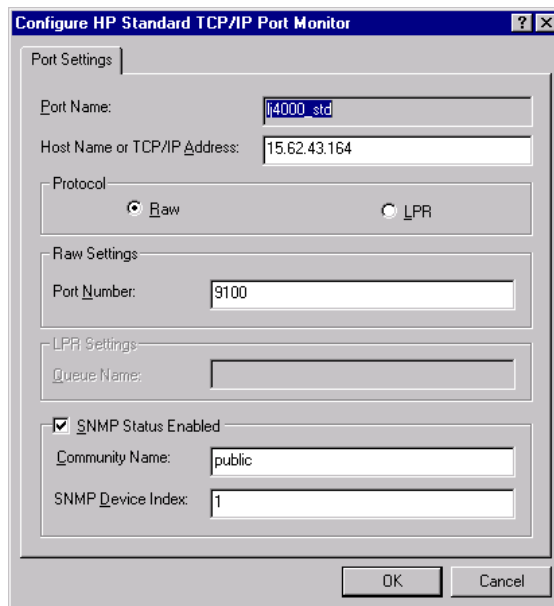SNMP Device Index: 1

OK   Cancel

Figure 3

Port was installed through the HP Install Network Printer Wizard, either TCP/IP or IPX can be used to create a printer and port.

HP Standard TCP/IP Port can perform either raw TCP/IP (port 9100) or simplified LPR printing to HP JetDirect-connected printers (see Figure 3).

For raw (port 9100) printing, when a print job is sent to a printer through HP Standard TCP/IP Port, a TCP connection is created with a destination port number of 9100 (and 9101, 9102 for a 3-port JetDirect device).

For LPR printing, when a print job is sent to a printer through HP Standard TCP/IP Port, a TCP connection is created with a destination port number of 515. This technique differs from the Microsoft LPR Port in that it is a simplified LPR Port, meaning it only supports printer implementations of LPR. A machine running an LPD service, e.g. UNIX box, cannot be designated as the

destination using the HP Standard TCP/IP Port. Only LPD capable printers can be destinations for print jobs using the HP Standard TCP/IP Port implementation of LPR.

Device Status
HP Standard Port uses SNMP polling to gather status information for standard printer MIB (RFC 1759) compliant printers. For example, if something goes wrong on the printer while sending a print job (e.g. out of paper), the HP Standard Port Monitor will effectively report that condition.

Printer Driver Compatibility
Some features of newer printer drivers, such as the *Update Now* button on the HP LaserJet 4000 or 5000, will not function with the HP Standard Port. These features rely solely on the architecture of HP JetAdmin and HP JetDirect Port.

HP JetDirect Configuration
If HP Standard Port is configured to use IPX, no prior HP JetDirect configuration is necessary.

If HP Standard Port is configured to use TCP/IP, the HP JetDirect device must be configured with valid TCP/IP parameters, and TCP/IP must be enabled, before printing can occur through the port. If the HP JetDirect device is unconfigured for TCP/IP, the IP address, subnet mask, and default gateway can be configured while creating the HP Standard Port only if HP Web JetAdmin is being used to create the printer and port.

If the TCP/IP address has changed for a printer configured to use HP Standard TCP/IP Port (such as in a DHCP environment), a WINS server will be queried to determine the new TCP/IP address. If a WINS server does not exist, or cannot provide new information about the printer, then the port will have to be reconfigured. A rediscovery based upon the MAC address will not be performed as it is for HP JetDirect Port.

Performance
The HP Standard Port Monitor consists of very few files when installed, thus creating a very small footprint. Since it also does not have to rely on other components or architectures, such as the HP JetAdmin architecture that HP JetDirect Port uses, it is able to consume very few system resources. The low overhead and small footprint of the HP Standard Port make it a very efficient port monitor.

HP Standard Port has performed reliably in tests of 500 or more ports created on a single NT 4.0 server. Therefore, it can be highly recommended in situations where a large number of ports are required on a single server.

Port Monitor Converter
A utility named *portswap.exe* exists to make converting HP JetDirect Ports into HP Standard Ports, and vice-versa, a very simple task. This utility provides a simple user interface for quick and easy conversion, especially

in cases where a large number of ports require conversion. The utility merely converts the registry entries from one type of port to the other, eliminating the need to recreate the ports. This saves valuable time and effort, especially if many ports require conversion.

The *portswap.exe* utility, and its corresponding readme file *portswap.txt,* can be downloaded from the following ftp site:

ftp://ftp.hp.com/pub/networking/software/

LPR Port

Microsoft LPR Port, or Line Printer Port, is a port monitor that Microsoft provides with Windows NT 4.0.

LPR Port is enabled once the Microsoft TCP/IP Printing Service is enabled under Windows NT 4.0.

Once LPR Port is enabled, ports can be created to printers by selecting *Add Port* while using the Microsoft Add Printer Wizard, or by changing ports through a **Printer Properties** page.

Protocols
LPR Port sends print jobs over the TCP/IP protocol only to an LPD service running either on the same machine or another computer, which in turn sends the job to the printer. Windows NT supplies an LPD service when the TCP/IP Print Services are installed.

Creating an LPR Port involves entering either a print server name or a TCP/IP address followed by a printer or print queue name (see Figure 4). The print server can be any of the following:

- UNIX computer
- Windows NT computer
- Windows for Workgroups computer with 3rd party LPD

- Network adapter, such as an HP JetDirect device or LPD capable printers

This differs from the LPR configuration of the HP Standard TCP/IP Port, which can only direct print jobs to LPR capable printers.

For printing to HP JetDirect devices directly, the print server name is the HP JetDirect device itself. It can be entered as either an IP address or a hostname.

The LPR standard is published as RFC 1179, and Windows NT supports TCP/IP printing as documented in RFC 1179. However, Windows NT 4.0 has added enhancements to support the most popular and requested options. One such enhancement is increasing the possible source ports that LPR Port can use.

Windows NT 4.0 uses a source port number between 512 and 1023, and a destination port number of 515 when sending print jobs to printers configured for LPR Port.

Device Status
LPR does not allow the passing of detailed error status information back to the host. Rather, when something goes wrong on the printer, such as being out of toner or having a paper jam, LPR would report a single generic error condition.

Printer Driver Compatibility
Some features of newer printer drivers, such as the *Update Now* button on the HP LaserJet 4000 or 5000, will not function with LPR Port.

These features rely solely on the architecture of HP JetAdmin and HP JetDirect Port.

HP JetDirect Configuration
To print through LPR Port, the HP JetDirect device must be configured with valid TCP/IP parameters. If the HP JetDirect device is unconfigured, the IP address cannot be configured while creating the LPR Port for that device.

If the IP address changes on a printer configured for LPR Port (such as in a DHCP environment), the spooler service must be stopped and restarted in order for enumeration of the port to occur. This means that print jobs sent to an LPR Port configured printer where the IP address has changed will hang until the spooler service is stopped and restarted.

Performance
LPR Port is contained entirely within the Windows NT 4.0 operating system with no third party files being required. The limited status information and small footprint of LPR Port make it a very efficient port monitor.

HP is not aware of a limitation to the number of LPR Ports that can be created on a single server.

Hewlett-Packard Network Port

Hewlett-Packard Network Port is a port monitor that Microsoft provides with Windows NT 4.0.

Hewlett-Packard Network Port

Add LPR compatible printer

Name or address of server providing lpd:

Name of printer or print queue on that server:
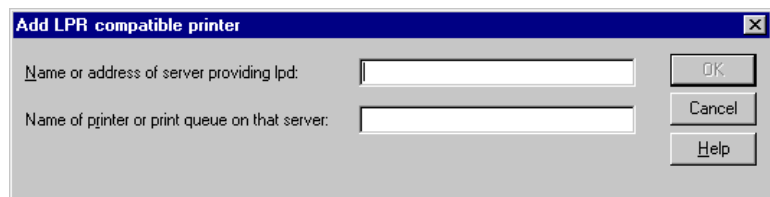
OK
Cancel
Help

Figure 4

becomes enabled when the DLC protocol is enabled under Windows NT 4.0.

Once Hewlett-Packard Network Port is enabled, ports can be created to printers by selecting **Add Port** while using the Microsoft Add Printer Wizard, or by changing ports through a **Printer Properties** page.

Protocols

Hewlett-Packard Network Port uses the DLC protocol to print to HP JetDirect-connected printers.

The DLC protocol is bridgeable, but not routable. This means that if a Windows NT print server is on one physical subnet, and the HP JetDirect-connected printer is on another physical subnet, the server cannot send jobs to the printer if the subnets are separated by a router. If the printer and server subnets are joined by a bridge, the server can then send print jobs to the printer.

Job-Based vs. Continuous

Hewlett-Packard Network Ports can be configured as either job-based or continuous. This setting affects all ports at once.

With a job-based connection, a print server connects to the HP JetDirect device, sends a print job, and disconnects when the job is finished printing. This enables other print servers to connect and print.

With a continuous connection, a print server connects to the HP JetDirect device and maintains the connection until either the print server or HP JetDirect device is rebooted, preventing other servers from connecting.

Job-based would be recommended in most cases to minimize scenarios where the printer is monopolized by a single connection.

Device Status

Hewlett-Packard Network Port supports bi-directional communications, and can provide status information about a printer through the data stream of the print job itself. A feature called "Advanced Job Status" must be enabled on the Hewlett-Packard Network Port to support this feature.

Printer Driver Compatibility

Some features of newer printer drivers, such as the Update Now button on the HP LaserJet 4000 or 5000, will not function with Hewlett-Packard Network Port. These features rely solely on the architecture of HP JetAdmin and HP JetDirect Port.

HP JetDirect Device Change

Hewlett-Packard Network Port uses the MAC address of the HP JetDirect device when creating a port. Print jobs sent to a Hewlett-Packard Network Port configured printer where the HP JetDirect device has changed will hang until the port is recreated with the MAC address of the new device.

Performance

Hewlett-Packard Network Port is contained entirely within the operating system with no third party files being required. Also, it is very easy to install a printer using Hewlett-Packard Network Port since no configuration of the HP JetDirect device is required. The small footprint and ease of setup of Hewlett-Packard Network Port make it a very efficient port monitor.

HP is not aware of a limitation to the number of Hewlett-Packard Network Ports that can be created on one server.

Summary

Port monitors are responsible for the communication between the spooler and the printer. When printing to HP JetDirect-connected printers, there are various port monitors in Windows NT 4.0 from which to choose. Knowing the advantages of each port monitor will make the decision of choosing a port monitor much easier. A matrix has been provided (see Figure 5) to help quickly compare one port monitor to another.

	HP JetDirect Port	**HP Standard Port**	**LPR Port**	**HP Network Port**
How to Obtain	HP JetAdmin	HP Web JetAdmin	Microsoft NT 4.0	Microsoft NT 4.0
		HP Install Network Printer Wizard		
Protocols	TCP/IP (raw) IPX	TCP/IP (raw and LPR) IPX	TCP/IP	DLC
Device Status	Detailed via SNMP	Detailed via SNMP	Limited	Limited
	Optional HP Desktop Status Utility for enhanced status reporting			
HP JetDirect Configuration	No configuration of HP JetDirect required for IPX	No configuration of HP JetDirect required for IPX	HP JetDirect device must be configured for TCP/IP	No configuration of HP JetDirect required for DLC
	AllowsTCP/IP parameters to be configured on HP JetDirect while creating port	Allows TCP/IP parameters to be configured on HP JetDirect while creating port (if HP Web JetAdmin is used to create port)	Does not allow TCP/IP parameters to be configured on HP JetDirect while creating port	
	If IP address changes on HP JetDirect, no reconfiguration of port required	If IP address changes on HP JetDirect, no reconfiguration of port required (with valid WINS or DNS)	If IP address changes on HP JetDirect, no reconfiguration of port required if spooler is stopped and restarted	If HP JetDirect device is replaced, port must be reconfigured
Performance	Higher resource utilization	Lower resource utilization	Lower resource utilization	Lower resource utilization
	Large footprint	Small footprint	Small footprint	Small footprint
	Not recommended for a large number of ports on a single server (Tested for less than 100)	Recommended for a large number of ports on a single server (Tested for 500+)	No HP known limit to number of ports on a single server	No HP known limit to number of ports on a single server
	Print to remote networks	Print to remote networks	Print to remote networks	Not routable, cannot print across routers

Figure 5