

Printing with NetWare for Macintosh

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This Application Note explains ways of printing to Apple ImageWriter and LaserWriter printers on a Novell network running NetWare for Macintosh. After an overview of how Macintosh printing works, it describes installation and configuration issues for the NetWare for Macintosh VAPs (v2.x) and the NetWare for Macintosh print service NLM (v3.x). Question and answer sections give additional information about the extended printing features of NetWare for Macintosh v3.01 and limitations to current NetWare for Macintosh printing functionality.

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Introduction

The purpose of this Application Note is to supply functional information about AppleTalk printing, and specifically about NetWare for Macintosh print services. This AppNote covers:

- Events involved in printing a Macintosh document directly to an ImageWriter or LaserWriter
- Events involved in printing a document to NetWare for Macintosh v2.2 and v3.x print queues
- Issues surrounding the extended printing features of NetWare for Macintosh v3.01
- Limitations to current NetWare for Macintosh printing functionality

Macintosh Printing

Printing from a Macintosh computer is a fairly simple process for the user. Any printer attached to a LocalTalk network is accessible to all Macintoshes on that network, as long as they have the correct printer driver installed. Printer drivers are typically installed along with the Macintosh operating system.

The Macintosh Chooser is used to select a specific printer. The user simply opens the Chooser and selects the appropriate printer driver. The Chooser displays a list of printers in the current zone for the user to select from. Once the user has made his or her choice, all jobs will be sent to the chosen device until a new choice is made. Jobs can be directed to print either through their application or through the Macintosh Finder's "Print" option.

Types of Macintosh Printers

There are two standards for Macintosh printing supported by NetWare for Macintosh: the ImageWriter family and the LaserWriter family. Apple includes drivers for both printer types with the Macintosh System software.

The ImageWriter Family. ImageWriters are dot matrix printers belonging to the original Macintosh printer family. Apple includes two printer drivers for the ImageWriter. Each driver gives a different option for connectivity.

The standard ImageWriter driver is selected to print to an ImageWriter attached directly to the Macintosh's printer port, as shown in Figure 1. This arrangement gives only the directly-connected Macintosh access to the printer.

Figure 1: Selecting an ImageWriter attached directly to the Macintosh.

By inserting the AppleTalk option card, an ImageWriter can also be connected to an AppleTalk network. The option card enables the ImageWriter to respond to the Chooser's Name Binding Protocol (NBP) lookups for services on the network. This allows multiple Macintoshes to share the printer. (Node IDs are dynamic in AppleTalk, so names are used to consistently identify devices. NBP is used to locate devices and services on a network and bind the names to their current node IDs.)

To access a networked ImageWriter, a user selects the AppleTalk ImageWriter driver (shown in Figure 2 as "AppleTalk I...") rather than the standard ImageWriter driver.

Whereas the standard driver simply gives the option of sending the print job data to the printer or modem port of your Macintosh, the AppleTalk driver does an NBP lookup for all devices of the chosen type on the network. It then returns a list of all available ImageWriters on the network for the user to choose from.

Figure 2: Selecting an ImageWriter attached to an AppleTalk network.

The AppleTalk driver also provides the means for the ImageWriter family to be serviced by a NetWare for Macintosh print queue. NetWare for Macintosh queues can service an ImageWriter that is attached to the network through LocalTalk or attached to a NetWare server via a serial connection. A NetWare for Macintosh queue servicing an ImageWriter would show in the Chooser as another device to select from in the list of ImageWriters.

The LaserWriter Family. The current LaserWriter family of printers consists of the following models:

- LaserWriter
- LaserWriter Plus
- LaserWriter IISC
- LaserWriter IINT
- LaserWriter IINTX
- Personal LaserWriter LS
- Personal LaserWriter NT

These printers differ based on the type of microprocessor they contain, how much memory (ROM and RAM) is included, and ROM features. All but two include a PostScript interpreter. (The LaserWriter IISC and the Personal LaserWriter LS use standard QuickDraw bit imaging. When this AppNote refers to LaserWriters, it means only the PostScript LaserWriters.)

In conjunction with NetWare for Macintosh, LaserWriters are accessed through a connection to an AppleTalk network. All LaserWriters come with a built-in AppleTalk port to allow them to attach as nodes to a LocalTalk network. A LaserWriter can also be connected through an RS-232 serial link.

The LaserWriter printer driver allows users to select from available LaserWriters on the network via the Chooser. A list of LaserWriters in the current zone is displayed for the user to select from, as shown in Figure 3.

Figure 3: Selecting a LaserWriter attached to an AppleTalk network.

How Printing Works on the Macintosh

In the Macintosh environment, a number of components work together to send a document to the appropriate printer. Figure 4 illustrates these components.

Applications. Macintosh applications use QuickDraw to describe their documents for printing. QuickDraw provides the Macintosh with all of its text and graphics abilities for both screen and print output. Anything you can see on the screen can be drawn in an offscreen buffer to be sent to a printer. When a user selects a job to print, QuickDraw works with the Font Manager to create a document

description, which is then sent to the Printing Manager.

Figure 4: The Macintosh print process relies on several components that work together to get the job to the printer.

Printing Manager. The Printing Manager is designed to provide device independence to Macintosh applications. It provides applications a high-level interface for interpreting QuickDraw commands and a low-level interface to access the printer driver. The Printing Manager accepts a document description via QuickDraw commands, determines the appropriate printer driver to use, then sends the description on to the driver.

Printer Driver. The printer driver generates a print dialog box used to define the specifics of a particular job. This box will vary based on the driver in use. Figure 5 shows a print dialog box for the LaserWriter print driver.

To send a job, the printer driver establishes a connection with the appropriate printer. If the selected printer is an ImageWriter, bit images created by QuickDraw are sent directly to the printer. If the selected printer is a LaserWriter, the printer driver must translate QuickDraw to PostScript.

Figure 5: Sample print dialog box for the LaserWriter driver.

For LaserWriter printing, the driver first asks the printer if it has the same Laser Prep file that the originating Macintosh has in its System Folder. The Laser Prep file informs the printer of shortcuts used by the LaserWriter driver in the QuickDraw/ PostScript interpretation.

If necessary, the Macintosh will "initialize" the printer by sending it the current Laser Prep file. (Apple recommends that all Macintoshes sharing a particular LaserWriter use the same version of the Laser Prep file. In this way, users can avoid complications that may arise from the printer being reinitialized frequently.)

The LaserWriter driver also checks the fonts used in a document. The driver queries the printer for a font list at the beginning of every job. (If the printer is a LaserWriter IINTX that uses a SCSI hard disk for storing fonts, these fonts will be included in the font list as well.)

The driver then creates a temporary font cache to store the retrieved list. When a new font comes up in the document being printed, the driver checks this font cache to be sure the printer has the needed font. If the cache does not contain the needed font, the driver searches the local disk to see if the font file is stored there. If it is available, the file will be downloaded to the printer. If the driver does not find the needed font file, it sends a bit-mapped version of the font to the printer.

Printing with the NetWare for Macintosh VAPs

NetWare for Macintosh v2.2 adds two pieces to the Macintosh printing process. First, it provides a queuing mechanism that allows multiple Macintoshes and PCs to send their jobs to the printer and return to work as quickly as possible. Second, it provides a print server to take the jobs from the server-based queue and send them to the printer in a designated order.

These two mechanisms are added to the NetWare v2.x server using a set of Value-Added Processes (VAPs) that are loaded on top of the operating system to provide a gateway into its services. The VAPs necessary for supporting AppleTalk printing include:

- The AppleTalk Queue Services VAP (AQSVAP) for queue services
- The AppleTalk Print Services VAP (APSVAP) for taking the jobs from the NetWare queue and sending them to the printer.

The appropriate combination of transport VAPs for your system is also required. The transport VAPs in NetWare for Macintosh v2.2 include ATALK, ATALK2, AARP, and AARP2. These provide the interface between the printing VAPs and the LAN card drivers. Figure 6 illustrates the path a print job takes through the NetWare for Macintosh VAPs and queue en route to the printer.

Figure 6: With NetWare for Macintosh v2.x, jobs travel to printers through the VAP communication processes.

As seen in Figure 6, a print job directed to a Macintosh VAP queue is received from the network by an AppleTalk LAN card driver. Each AppleTalk LAN driver is serviced by either an ATALK VAP (if the network is running AppleTalk Phase I) or an ATALK2 VAP (if the network is running AppleTalk Phase II), and the appropriate AARP or AARP2 VAP.

The ATALK VAP looks at the job and recognizes that it is addressed to a VAP queue. It passes the job on to the AQSVAP, which places it in the appropriate queue. APSVAP polls each queue for jobs and then forwards them back through the transport VAPs addressed to the network printer.

Macintosh VAP Installation

The NetWare for Macintosh VAPs are installed by affirming their installation in the NetWare v2.2 INSTALL program. When the server comes up for the first time after making this selection in INSTALL, the AUTOCFG VAP runs. AUTOCFG copies the necessary VAPs (including AQSVAP and APSVAP) for your server's configuration into the SYS:SYSTEM directory of the server.

Configuration Files

AUTOCFG also creates a numbered folder containing several files that provide printer configuration information for the VAPs. These

files include ATPRINT.SET, ATPRINT.TYP, and BANNER.DPS. The user provides the configuration information for each printer and the queue that will service it at the server console command line.

Here is a description of the NetWare for Macintosh v2.2 configuration files, how they are configured, and what they are used for.

ATPRINT.SET. This file is created on any NetWare for Macintosh print VAP host. It provides the print VAPs on that host with information about the queues they service. The ATPRINT.SET file contains the following entries:

- The name of the server the queue resides on
- The bindery ID number of the queue
- The names of any printers that accept jobs from that queue
- The name of the zone(s) the printer(s) serviced by that queue reside in

It also contains a queue status entry, indicating the current state of the queue.

The ATPRINT.SET file is maintained in a binary format, so its contents are not easily accessible to the administrator for review. Entries are made to this file in two ways. When you use server console commands to create a queue on the host server or to attach a queue to a printer, the appropriate entries are made in ATPRINT.SET. When you use MACSETUP to create queues on the VAP host or on target servers and attach them to the appropriate printers, corresponding information is logged in the ATPRINT.SET file.

For example, suppose a VAP host is configured to support two local queues and two queues on additional target servers, each servicing a different queue. The ATPRINT.SET file for the VAP host would contain information similar to the following:

Server Name	Bindery ID	Servicing Printer Name	Zone Name	Queue Status
Host server	00012456	Sales LW	Zone A	Enabled
Host server	00012787	Admin IMG	Zone B	Enabled
Target Server 1	00203984	Mrkt LW	Zone C	Enabled
Target Server 2	03040567	Eng LW	Zone D	Enabled

If any of the configuration information in this file is incorrect, the VAPs will be unable to send jobs from the queue to the appropriate printer.

Queue Status Settings. The ATPRINT.SET file contains an entry in which queue status bytes can be set. These settings are read by the VAPs using the queue to find out what the current state of the queue is.

Five queue status settings are possible:

- **Enabled.** This is the default setting for every queue. It indicates that the queue is available to put jobs in and has a print server currently attached and sending jobs to a printer

- **Pending.** This is a temporary state set while the VAPs are checking the availability of a queue. This is usually set when the VAPs are first coming up.
- **Down.** This status indicates that the target file server on which the queue resides has gone down.
- **Closed.** This status is set if the queue has been deleted via the PCONSOLE utility. It indicates that the queue still exists, but is not available to be serviced correctly.
- **Disabled.** This is rarely set. An internal error is required for the queue to enter this state.

ATPRINT.TYP. This file resides on all the VAP target servers. It provides the print VAPs attaching to that target with information regarding the type of printer a queue services. The entries in this file include a printer type and a queue name. Printer type refers to the type used by AppleTalk's NBP to find services on the network.

For example, the ATPRINT.TYP file that corresponds with the previous ATPRINT.SET configuration might look like this:

Queue Name	Printer Type
Queue A	LaserWriter
Queue B	ImageWriter
Queue C	LaserWriter II NT
Queue D	LaserWriter II NTX

BANNER.DPS. This is a static file copied verbatim from the NW-Mac diskette to the SYS:SYSTEM directory of every VAP host. It is used to generate a banner page on the LaserWriter when printing from a PC, if required by a particular print job. Its format is PostScript code, which can be typed out for review if desired.

*.FNT Files. A *.FNT file is created when the query command is used to send a font query to the printer. The VAPs were not designed to send a font query to the printer to create the font cache before each job. Instead, the query command is used to create font files on the server.

When a print job is sent, the VAPs scan this file to see if a needed font is resident at the printer or if it needs to be downloaded. The query command should be run at the console every time printer fonts are added or removed from a printer serviced by a queue.

*.PRS Files. These files are also used by the VAPs to send print jobs. They contain versions of the Apple PostScript dictionary. Each time a new Laser Prep file is used, the printer asks to have the associated PostScript dictionary downloaded for the print job. The VAPs must have the correct dictionary available to send to the printer when it asks for it.

When a job is initially sent to the queue, AQSVP checks to see if it has the current PostScript dictionary. If it does not, AQSVP requests the dictionary from the Macintosh and creates a new *.PRS file to store it in.

What the VAPs Do

When a NetWare file server comes up after having the NetWare for Macintosh print service VAPs installed, a number of things take place. First, AQSVAP and APSVAP load at the system console. While loading, the server allocates memory for them and links them with the NetWare operating system to provide a gateway for AppleTalk print services.

The following sections describe what AQSVAP and APSVAP do once they are loaded and linked at the server.

AQSVAP

AQSVAP is a spooler which advertises as a LaserWriter or ImageWriter on the network and accepts print jobs from Macintoshes. When a Macintosh opens the Chooser and selects a particular zone in which to look for a LaserWriter device, AQSVAP answers. The Mac user can then select the advertised queue name just as if it were an actual printer. When the user sends a print job, AQSVAP puts it into the VAP queue.

Before this can happen, however, AQSVAP must be configured correctly. When AQSVAP comes up, it first logs into the host server using an AppleTalk bindery object type 83 (unknown type). This connection is necessary to access the configuration files on the host server.

AQSVAP then reads the ATPRINT.SET file to discover which queues to put jobs in and where the queues are located (which target server). It also checks queue status bytes. AQSVAP makes a connection to each server/queue found in ATPRINT.SET. If necessary, it also makes a connection to any target servers to access queues residing there. AQSVAP uses the IPX protocol to perform this type of login across the network.

It is possible for one VAP host to have queues on up to eight target servers. If AQSVAP is unable to attach to the server where a queue resides, it will return a login error (usually "AQSVAP: login failure").

Once the connection to a target is made, AQSVAP reads the ATPRINT.TYP file on that target to find the type of printer the queue will be emulating.

After gathering the necessary information from the configuration files, AQSVAP broadcasts itself out all network interfaces as the configured printer types, representing any published queues it is servicing. This is called an NBP register.

At this point, AQSVAP can respond to Chooser lookups as a LaserWriter in the appropriate zone. The Macintosh establishes an AppleTalk Printer Access Protocol (PAP) session with AQSVAP. The Mac interacts with the VAP to provide job data and information to convey the fonts and the version of PostScript dictionary that will be used for the job.

APSVAP

APSVAP is a print server that polls the AppleTalk queues and sends print jobs to an AppleTalk-attached LaserWriter. These print jobs can be sent either from a Macintosh (through AQSVAP and the Chooser)

or from a DOS machine (through NetWare's CAPTURE or NPRINT commands).

When APSVAP first comes up, it logs into the host server as an AppleTalk bindery object type 83 (unknown type). It declares itself to be a print server to the host file server and then reads the ATPRINT.SET file to get the names of any target servers and queues residing there.

APSVAP logs into any target server with an AppleTalk queue as an undefined AppleTalk user. It then makes attachments through that connection to every queue it needs to service, declaring itself as a print server of type AppleTalk.

APSVAP uses the ATPRINT.SET file to retrieve information regarding the name and location of printers that service its queues. APSVAP then sends NBP lookups onto the network in the appropriate zone for the printers it expects to find there. This lookup process may take up to 30 seconds per printer per cable.

If a printer is not found, APSVAP returns an error to the console (usually "APSVAP: Printer *printername* is not currently on-line"). When the expected printer sends an NBP reply to APSVAP, the VAP responds with a font list query to the printer to determine what fonts the printer has resident. The appropriate .FNT file is then created and associated with the queue for that printer.

APSVAP polls each of the queues it services every few seconds to look for print jobs. When a job is found, APSVAP reads ATPRINT.SET to find the information necessary to send a job. It establishes an AppleTalk PAP session with the printer and forwards the job to the printer. An open session is maintained between APSVAP and the printer until the job is fully printed.

PostScript-defined commands are used to trigger the conversation between APSVAP and printer to request or pass information such as the current PostScript dictionary or a needed font. Any LaserWriter-compatible printer should be able to use basic PostScript to print a job received from APSVAP.

When the VAP Host is a Router

AQSVAP and APSVAP can both reside on an external router (or an external bridge, to use the terminology of versions prior to NetWare v2.2). This configuration is valuable to offload printing from the server CPU's processing burden.

In this configuration, the VAPs target one or more file servers to create queues. As always, the queues reside on the file server. However, all print job processing is done by the VAPs on the router.

Configuration Files

In an environment where the VAP host is an external router rather than a file server, different files are used to configure the Macintosh print VAPs.

#.SET. This file performs the same functions as the ATPRINT.SET file described earlier. Each router chooses a primary host file server on which to store its own #.SET file. The number represented by "#" in the filename is randomly generated by the router and corresponds to an entry in the ATPRINT.CFG file stored on the router. This method is used in place of having a single ATPRINT.SET file, since a single target server may have multiple VAP host routers targeting it. The various sets of VAPs must have a way to determine which of the many .SET files belongs to them.

ATPRINT.CFG. This file resides on the each router running the VAPs. It is used to direct the VAPs to the correct #.SET file on the primary host server. The entries in the ATPRINT.CFG file include the name of any target servers and a randomly generated number that corresponds to a .SET file created on the primary host server.

For example, suppose you have two routers running the NetWare for Macintosh VAPs, and each one targets the same two servers for print queues. Files similar to the following will be created.

Router 1's ATPRINT.CFG file contains the following information:

```
server a    00017890
```

Router 2's ATPRINT.CFG file contains the following information:

```
server a    00889933
```

Server A has two .SET files, one for each router. The first file is named 00017890.SET and contains the configuration information for Router 1:

Server Name	Bindery ID	Servicing Printer Name	Zone Name	Queue Status
Server A	00012456	Sales LW	Zone A	enabled
Server B	00012787	Admin IMG	Zone A	enabled

The second file, 00889933.SET, contains the configuration information for Router 2:

Server Name	Bindery ID	Servicing Printer Name	Zone Name	Queue Status
Server A	00203984	Sales LW	Zone A	enabled
Server B	03040567	Eng LW	Zone A	enabled

All other configuration files will be located and formatted the same, regardless of whether the VAP host is a file server or an external router.

Print functionality is also the same, except that no print queues reside on a router VAP host. They all reside on target file servers. AQSVP and APSVP provide the same functionality for the target queues irrespective of the VAP host's functionality as a server or router.

Because all queues reside on target servers, you must run the MACSETUP program to configure queues and attach them to printers. This cannot be done from the router console.

PCONSOLE and NetWare for Macintosh VAPs

The NetWare PCONSOLE utility can be used in conjunction with the NetWare for Macintosh v2.2 VAPs to view queue and print job information. PCONSOLE lists NetWare for Macintosh queues in the same queue list as the standard NetWare print queues.

However, most of the administrative tasks you can do in PCONSOLE for the standard NetWare print queues should *not* be performed on a NetWare for Macintosh print queue. PCONSOLE has no way to specify the printer type associated with Macintosh queues. It also has no way of understanding that Macintosh printers reside on an AppleTalk network in a specific zone. For these reasons, PCONSOLE cannot be used to create a NetWare for Macintosh Queue. This must be done in the MACSETUP program or from the server console command line via the CREATE command.

When viewing information about NetWare for Macintosh queues, the currently attached server should always show as "AppleTalk" for each queue. If no currently attached server is displayed for a NetWare for Macintosh queue, no jobs sent to that queue will be printed. You may have to delete and recreate the queue.

For each Macintosh queue, there should also be a print queue user named "AppleTalk" with an unknown type. This queue user represents the connection that enables Macintosh users to place jobs in the queue. If it is not present, the NetWare for Macintosh queues will not be able to service any jobs.

Questions and Answers About Macintosh VAPs

Here are the answers to some questions commonly asked about using the NetWare for Macintosh printing VAPs with NetWare v2.x.

Q. What configurations are supported for connecting Macintosh printers to a NetWare network for use with the NetWare for Macintosh VAPs?

A. Several configurations are possible, depending on what other network hardware you have installed.

Once way is to add a LocalTalk card to the file server or external router. In this configuration, any Macintoshes residing on the same LocalTalk network have direct access to the printer and the Macintosh queue. Macintoshes and PCs on other LANs connected to

the server or router must print via NetWare for Macintosh queues.

A third-party bridge or router can also be used to provide a LocalTalk connection to your current topology, as shown in Figure 7. Usually in this configuration, all Macintoshes have direct access to the printer as well as to the queues. PCs must use the queues.

Figure 7: You can connect an AppleTalk printer to the network through a third-party router.

A number of third-party hardware and software products can provide this attachment. Price and functionality vary greatly among the different products, so it is a good idea to investigate different vendors to find exactly what you need. Some commonly used products include:

- Apple Internet Router (Apple Computer, Cupertino, CA)
- FastPath (Shiva Corp., Cambridge, MA)
- Liaison (Farallon Computing, Emeryville, CA)
- EtherPrint (Dayna Communications, Salt Lake City, UT)
- NetWay (Tri-Data Systems, Santa Clara, CA)

Q. In DOS printing, a common configuration is to attach the printer to a serial or parallel connection on the file server or a DOS workstation. Does NetWare for Macintosh v2.2 support this configuration?

A. The NetWare for Macintosh VAPs do not support this configuration for printing. Support for this configuration is available with the NetWare for Macintosh v3.01 NLM.

If the printer you are trying to use is an HP LaserJet, there is another option for getting your Macintosh jobs to print to it in this configuration. Insight Development (Emeryville, CA) has created a product called "Mosaic for Macintosh." It provides a new printer driver for the Macintosh that allows the Mac to send jobs to an HP LaserJet attached to a serial or parallel port of a NetWare server or DOS workstation functioning as a print server. The driver uses HP's Printer Control Language (PCL) rather than the PostScript page description language. Insight can be reached at (415) 652-4115.

Q. Officially, Novell supports only Apple printers with the NetWare for Macintosh VAPs. I have a third-party printer that can attach to an AppleTalk network and my Macintoshes are able to print to it directly. Will the NetWare for Macintosh VAPs work with this printer?

A. Any printer that can emulate a LaserWriter on an AppleTalk network should be able to service NetWare for Macintosh print queues. A large number of people have successfully integrated the VAPs with third-party printers that emulate LaserWriters.

Q. The NetWare for Macintosh print queues can service print jobs

sent from DOS machines as well as Macintoshes. What is necessary to enable this functionality?

A. Included with NetWare for Macintosh are printer definition files (PDFs) for the LaserWriter and the ImageWriter. If the VAPs are set up so that Macintoshes can print, only a few additional steps are needed to support DOS printing. First, run PRINTDEF to import the printer definition file and define any needed print forms. Then run PRINTCON to define an appropriate print job configuration. DOS users can then specify this configuration in CAPTURE or NPRINT to direct DOS print jobs to the queue.

Q. I have heard about a utility for the Macintosh print VAPs called Mac Del. What is it and where can I get a copy?

A. The Mac Del utility was developed as an aid in resolving bindery-related problems associated with the Macintosh VAPs. It can be run on any VAP host or target to remove all printing-related AppleTalk bindery objects on that server. This program is one of the most useful tools available for dealing with Macintosh VAP printing problems. It gives the user the ability to remove any existing print configuration and reconfigure from scratch. It should be run, along with the NetWare BINDFIX utility, whenever any printing-related bindery object becomes suspect. Associated problems include:

- The inability to attach a print server to a queue
- A queue inadvertently deleted via PCONSOLE
- VAPs unable to log in to a target when the target is up and has available connections

Mac Del is available on NetWare in NOVA Library 8 and is accompanied by a README file containing instructions for use.

Printing with the NetWare for Macintosh NLM

On a NetWare v3.11 server, NetWare for Macintosh v3.0 and v3.01 provide print services through the AppleTalk Print Services (ATPS) NLM. When loaded at the server console, ATPS allows Macintosh, DOS, OS/2, Windows, and UNIX users to print to AppleTalk-connected printers. Macintoshes select an ATPS queue in the Chooser just as they would select a direct printer connection. DOS and OS/2 users can submit jobs to ATPS by using the CAPTURE and NPRINT commands. Windows users can print to ATPS queues through native Windows queue support. UNIX users can print to NetWare for Macintosh queues via NFS Print.

Figure 8 illustrates how printing works with ATPS queues.

Figure 8: With ATPS, Macintosh, DOS, Windows, and OS/2 users can all print to Macintosh queues.

Also, in NetWare for Macintosh v3.01, ATPS queues can be serviced by the NetWare PSERVER program. This capability allows jobs to be sent to a printer that is directly attached to the server via a serial or parallel connection, or to a printer connected to a PC workstation running RPRINTER.

ATPS Installation and Configuration

For the most part, ATPS is self-configuring in a basic installation. When it is loaded for the first time, it automatically creates its print server, ATPS_PSRVR, and a queue user, ATPS_QUSER. All Macintosh users submit print jobs to the queue through the Chooser and ATPS_QUSER. (DOS clients do not use ATPS_QUSER. This function is included in the CAPTURE and NPRINT commands.)

ATPS_PSRVR polls the queues and passes any jobs it finds from a queue to the appropriate printer. A single configuration file, ATPS.CFG, is used to create ATPS queues and define the printers that will service them. ATPS automatically creates a queue for you by prepending "NW" to the name of any printer entered in the configuration file. If you prefer a unique queue name, you can specify a name in ATPS.CFG.

ATPS services print jobs using Apple's Printer Access Protocol, PostScript, and, in the case of the ImageWriter, byte stream. Any printer that supports these standards can be serviced by the ATPS NLM.

How ATPS Initializes Print Services

When ATPS is loaded on a server for the first time, a number of events take place to initialize the print queues and prepare the print server. The first thing ATPS.NLM does is to locate the ATPS_information bindery object. This object stores the location of the ATPS directory. If ATPS does not find this bindery object, it creates one, and also creates the default ATPS directory under SYS:SYSTEM (SYS:SYSTEM\ATPS).

ATPS then checks to see if it was loaded with any options on the command line.

- "LOAD ATPS -D" lets the administrator specify a directory other than the default of SYS:SYSTEM in which to create the ATPS queue directory in. This option is useful if the SYS volume has limited space, since ATPS will store all print jobs spooled to its queues in the ATPS directory. If the SYS volume is relatively small, there may not be enough disk space to spool a large number of print jobs concurrently.
- "LOAD ATPS -V" puts ATPS in verbose mode. This creates an ATPS console screen and directs informational messages about ATPS to the screen. Verbose mode is extremely helpful in diagnosing problems with ATPS. The informational messages report the current activities of ATPS, plus any PostScript errors returned from the printer. Understanding these messages helps determine whether a printing problem is related to the ATPS queues, the printer, or the print job itself.

Note: When the ATPS console is on, all ATPS messages are

recorded in the system log file. If you don't want to view these messages in the log file, turn off the ATPS console when it's not in use.

The ATPS.CFG File

ATPS services are configured through creation of a simple text file called ATPS.CFG that typically resides in the SYS:SYSTEM directory on the server. When ATPS is loaded at the console, it relies on the information included in this file to create and identify the desired network queues and attach them to the appropriate printers. Figure 9 shows an example ATPS.CFG file.

Figure 9: The ATPS NLM is configured through a text file named ATPS.CFG file.

```
"LaserWriter:AppleTalk Zone"    -o "LaserWriter Q"
-o Serial_Q    -wb    -l    -f    applwnt
"LaserWriter II:Printer Zone"    -o PrintQ
```

The following sequence of events is performed for each line in the ATPS.CFG file.

First, ATPS checks for the correct syntax on the line in the ATPS.CFG file. The minimum acceptable configuration for a particular line must include the name of the printer that will service any jobs. Other configuration information should be supplied as necessary or desired. If anything in the line is incorrect, ATPS quits execution and returns an error indicating where the problem is.

If the line is entered correctly, ATPS sets up an information structure for the queue. This structure contains the NBP address of the spooler and the printer, flags indicating any special configuration options chosen, and information about the state of the spooler.

ATPS Console Screen Example

Here is a sample of what you might see on the console screen when bringing up ATPS in verbose mode for the first time (using the ATPS.CFG file shown in Figure 9).

```
1 > ATPS:  using directory SYS:SYSTEM\ATPS
2 > ATPS:  1.....LaserWriter Q
3 > ATPS:  creating queue LaserWriter Q
4 > ATPS:  logging in as ATPS_QUSER
5 > ATPS:  attaching print server to queue LaserWriter Q
6 > ATPS:  getting an initial list of the printer's fonts
7 > ATPS:  NBP registering spooler LaserWriter Q
```

If the ATPS directory does not exist, ATPS creates it. In this directory, the NLM creates all its queues and the files they will use, including printer font lists and copies of any Laser Prep files used through its queues. Line 1 of the ATPS screen shows that ATPS will be using the directory SYS:SYSTEM\ATPS.

Line 3 indicates the queue being created. Two print server bindery objects are created to service the queue: ATPS_PSRVR and ATPS_QUSER (if they don't already exist). Both ATPS_PSRVR and ATPS_QUSR log in to the server to service the ATPS queues.

The same print server and queue user bindery objects service all queues created with ATPS. You can see the queue user and print server logging in to the server and attaching to the queue in lines 4 and 5 of the sample ATPS console screen.

The Fonts List

If the printer supports PostScript, the next step in initializing print services is to query the printer for a list of its fonts. This is the first time ATPS attempts to contact the printers that will service its queues. If ATPS cannot find a printer that will be servicing the queue, ATPS -V will show an error of "ATPS: Can't find printer *prntername*, retrying."

There are a number of reasons why ATPS may be unable to locate the printer. Some of the most common reasons include not using the correct printer name or zone name, or not having the printer online when bringing up ATPS. ATPS will continue to do periodic lookups for the printer as long as it is off-line.

ATPS maintains a font list in the queue directory for each printer it services. This list is stored in files called PRNTR1.FNT, PRNTR2.FNT, and so on, for each list required. When a Macintosh sends a job to the queue, it expects the queue to know whether or not the fonts used in the job are resident on the printer (see "How Printing Works on the Macintosh" earlier in this AppNote). If the font list changes because fonts have been added or removed, use the ATPS QUERY command to update the font file for any given printer.

Once ATPS has the printer's font list, it prepares to advertise the queue on the Macintosh network by registering the spooler via NBP and opening a PAP server listening socket (SLS). This socket is responsible for listening on the network for requests for service. If the "-n" option has been set in ATPS.CFG, the SLS will be initialized to accept the appropriate number of print jobs simultaneously.

Once the spooler has registered with NBP, the Macintosh should be able to see it on the network through the Chooser. If a queue fails to register, it will not be visible to the Macintoshes.

Queuing a Job to an ATPS Print Queue

The Macintosh initiates its connection with the ATPS queue, as it does with any printer, by selecting the appropriate device driver and zone in the Chooser. This action displays a list of available printers and queues of this device type residing in the selected zone. The Macintosh stores the selected information as a resource in its printer driver.

Figure 10 illustrates the main steps involved in sending a job to an ATPS print queue from a Macintosh client.

Figure 10: Queuing a job with ATPS.

When an application or the Finder is used to print, the Macintosh client establishes a PAP session with the queue by using the resource information stored by the printer driver. If the queue has a connection available, it responds positively to the PAP session request and the print dialog begins.

The maximum number of jobs a queue will accept at a time is set to a default of 10. You can change this number by using the "-n" flag on the queue's configuration line in ATPS.CFG. You can set this flag so that the queue can accept a maximum of 50 jobs at a time. If the maximum number of jobs is already being spooled to a queue, the Macintosh will see a status of "busy." When a connection becomes available, the queue accepts the new PAP connection.

ATPS creates a file for every print job in the queue directory. Each job contains data to inform the print server how to handle it. ATPS initializes a print job structure to store and use this job information as the job is being queued and sent to the printer. The print job structure contains information such as the number of copies to be printed, whether the file should be preceded by a banner page or not, and the name of the user printing the job.

Print job data is written to the file in the queue. If it is a PostScript job, ATPS responds to the appropriate queries from the client. ATPS responds to a font list query with the last font list obtained from the printer, either when the queue was initialized or when the ATPS query command was last executed.

A ProcSet query is used to determine if the printer is initialized with the same version of the Laser Prep that the Macintosh client is using. When ATPS receives this query, it checks to be sure that the current version of the Laser Prep file is stored in the queue directory. If the current Laser Prep file is not in the queue directory, ATPS requests it from the Macintosh and stores it in the queue directory. Any other PostScript queries are answered with the default PostScript Document Structuring Convention response.

After the entire job has been placed in the queue folder to be sent to the printer, the PAP connection is closed. This closes both the PAP socket in use and the queue file. The print job is now ready to be picked up by the ATPS print server (or by PSERVER) and sent to the printer.

How ATPS Services Jobs in the Queue

ATPS print server polls the queue every few seconds to see if there are any jobs waiting to be serviced. When it finds a job in one of its queues, ATPS opens a PAP connection to the printer configured to service that queue.

If the job is being sent to a LaserWriter, ATPS checks to see what version of Laser Prep file the job was sent with. If the printer is not initialized with the same version of Laser Prep, ATPS reinitializes the printer and downloads the correct version.

ATPS checks the print job structure to see if this job has requested a banner page. If it has, the appropriate banner is printed. After the banner prints, the actual job data is sent to the printer.

Communication with the Printer

ATPS monitors the printer for its current status and any error messages that are returned. Any errors detected during the printing are returned to the NetWare Message Service, which attempts to return the error to the user that sent the job. If a user wishes to receive this error notification on the Macintosh that sent the original job, the user must be logged in to the current server and must have the Notify init loaded. (The Notify init is provided with the NetWare for Macintosh utilities.)

If the error returned is related to job data (such as a PostScript error), ATPS reports it and either continues to print the job or aborts it, based on the available data. If a printer hardware error is returned (such as printer out of paper), ATPS reports it and waits to continue printing until the error is corrected.

ATPS uses a setting in the print job structure to determine how many times the data for a particular job should be sent to the printer. When the appropriate number of copies have been sent, ATPS closes the job file and the connection to the printer. The job file is removed from the queue. The ATPS print server begins to poll that queue for the next serviceable job.

Servicing the Queue with PSERVER

The v3.01 release of NetWare for Macintosh introduced the capability to print from a Macintosh to a PostScript printer attached to the serial or parallel port of a NetWare file server or a DOS workstation. This functionality was made possible by designing a mechanism through which PSERVER could successfully service an ATPS queue.

ATPS services consist of a front end and a back end. The ATPS front end provides the advertisement of queues on an AppleTalk network and spools jobs it receives to the appropriate queue files. It also communicates with a Macintosh sending a print job as though it were the printer. It responds to inquiries for font and Laser Prep file information with information based on the actual printer configuration acquired by the ATPS back end.

The ATPS back end includes the processes that poll the queues for jobs, remove them from the queues, and send them to the appropriate printers. ATPS gathers this information by querying the printer (just as a Macintosh preparing to send a job would) and storing the received information on the server.

To enable PSERVER to service a queue, you must disable the back end of ATPS when creating the queue. ATPS is disabled on the queue configuration line in the ATPS.CFG file. PSERVER is then set to service the queue through PCONSOLE. (It is also possible to configure a queue to be serviced by both PSERVER and ATPS. In this configuration, you would not disable the ATPS back end.)

Communication with the Printer

PSEVER polls its queues every few seconds to look for jobs that need to be sent to the printer. When it finds a job to print, PSEVER checks the status lines of the connection to the printer. If the printer's status is on-line, PSEVER removes the job from the queue and sends it in a data stream to the printer.

PSEVER monitors printer status lines to determine if there are any errors. It is able to return only limited error codes to the user or administrator. It is not able to return the specific PostScript errors or printer status information that ATPS returns.

A Macintosh printing to a LaserWriter requires an interactive dialog between the device sending the print job and the LaserWriter. As we have discussed, the primary interaction takes place in determining the available fonts on a printer and the version of Laser Prep file the printer is currently initialized with.

If a document requires the use of fonts that are not resident at the printer, the Macintosh needs a way to determine which fonts it needs to send with that job. If the Macintosh and the printer have different versions of the Laser Prep file, the Macintosh must have a way to send its current version to reinitialize the printer before it can send a print job. As a print server, ATPS was designed to include this communication over an AppleTalk network. However, this two-way communication is not available over a serial or parallel connection, so with PSEVER it is necessary to send the information in other ways.

Laser Prep File. When PSEVER is used to direct a job to a serial or parallel connection, ATPS provides two options that can be used to get the correct version of Laser Prep file to the printer. In the first method, you flag the queue to send a copy of the current version with every print job. Although this requires putting additional overhead on the printer, it is the most reliable method for getting the correct data to the printer.

The second method is to install the same version of LaserWriter driver on all Macintoshes that will be using a particular printer. Once the Laser Prep file is downloaded it will not be necessary to send it again (unless the printer is rebooted), assuming everyone continues to use the same version.

Fonts. Printer fonts also require special handling in this configuration. Pserver is not able to obtain a font list directly from the printer in the same way ATPS can. If the printer in use is an Apple LaserWriter or HP LaserJet supporting only the standard set of fonts for that printer, there are generic font lists provided.

These lists are stored in the SYS:SYSTEM\NW-MAC\FONTS directory and include APPLW, APPLWNTX, APPLWNT, APPLWPLS, and HPLASER. The appropriate filename is included on the ATPS configuration line for each queue that requires it.

If the printer is supporting fonts beyond these basic configurations, it is necessary to create a custom font list for that printer. A PostScript file called FONTLIST.PS is included with ATPS. If this file is sent to a PostScript printer with an NPRINT command, it causes the printer to

generate a listing of all resident fonts. This list should then be entered line for line into a text file and stored in the NW-MAC\FONTS directory in a file having an extension of .FNT. The font list can then be specified for use by the ATPS queues to communicate available fonts to the Macintosh when it is spooling a print job.

Questions and Answers about the ATPS NLM

Q. What general error conditions and resolutions should I be aware of for installing and maintaining a NetWare for Macintosh v3.0 print services?

A. If a Macintosh can spool jobs to an ATPS queue, but printing the jobs consistently generates PostScript errors, it may be that the copy of the Laser Prep file stored on the server is damaged. This can be fixed by canceling the current job, deleting the appropriate DICTARY.* or *.PRS file from the ATPS directory, and resending the print job. This causes the Laser Prep file to be resent from the Macintosh. Thus a clean file is created on the server.

One of the most common reasons ATPS is unable to locate a printer is that the printer name entered in the ATPS.CFG file is not exactly what the printer thinks its name is. This becomes especially difficult to track down when there are hidden spaces before or after the printer name. One reliable method to check a printer name for leading or trailing spaces is to select the printer in the Chooser. Then select "Print" or "Print Directory" from the File menu to see a print dialog box. The name of the printer appears in quotes at the top of this box. If there is a space between the first or last letter and the quotation marks, there is a space in the printer name.

Q. What patches are available for problems in the v3.0 print services?

A. The ATPS print server may not be able to connect with some third-party printers. The symptoms are that an ATPS queue attempting to service one of these printers is never advertised although the printer is visible in ATCON and is accessible from the Macintosh directly. The printer status shows as "printer busy, status idle." ATPS uses a zero-second wait to get the next connection to the printer. Some third-party printers will never service a zero-second wait. A patch called PAPFIX3 is available on NetWare to resolve problems of this type for v3.0. The problem is resolved in v3.01.

Any printer transaction requiring more than 255 AppleTalk Transaction Protocol (ATP) transactions will cause errors with v3.0. This could be generated by printing a file over 1MB in size or getting a font list that includes over 255 fonts. A patch called PAPFIX1 is available on NetWare for v3.0. The problem is resolved in v3.01.

Q. Are NetWare for Macintosh print services compatible with System 7 printing?

A. NetWare for Macintosh print queues can service jobs printed under the System 7.0 LaserWriter driver. Here are some recommendations for functioning in this configuration.

If one Macintosh is using the System 7 LaserWriter driver, all Macintoshes on the network should be upgraded to that driver. In earlier driver versions, the Laser Prep file was a separate file residing in the System Folder. In v7.0, the PostScript dictionary is included in the LaserWriter driver itself. If you are running NetWare for Macintosh v3.0 or earlier, include the following step in setting up printing under System 7. Initialize the printer with the v7.0 dictionary file by sending the first print job directly from a Macintosh to the printer, rather than through the queue. Any subsequent jobs may be sent directly or through the queue.

Q. The NetWare for Macintosh print queues can service print jobs sent from DOS machines as well as Macintoshes. What is necessary to enable this functionality?

A. Included with NetWare for Macintosh are printer definition files for the LaserWriter and the ImageWriter. After setting up the NLMs so that Macintoshes can print, all you need to do is run PRINTDEF to import the printer definition file and define any needed forms. Then run PRINTCON to define a print job configuration. CAPTURE and NPRINT, along with the DOS application's printer drivers, can then be used to send jobs to the queue.

A common problem encountered in enabling DOS printing to the Macintosh queues is that, once submitted to the queue, the print job never prints. This can happen if a text job (such as a screen print) is sent to a queue through a PostScript job. If you want to print a non-PostScript job, be sure to configure and use a Diablo 630 print job. Not all PostScript printers support Diablo 630 mode, so check with the printer vendor.

Shipping with NetWare for Macintosh v3.01 are updated *.PDF files that support PostText modes. They are APLASER2.PDF for Apple LaserWriter printers, and PSTSCRPT.PDF for third-party PostScript printers. These convert a text file into PostScript so the LaserWriter can print the text file without using Diablo 630 mode. These *.PDF files are also posted to CompuServe's NetWare (NOVA, Library 16) and can be configured through PRINTCON and PRINTDEF in much the same manner as Diablo 630 mode is configured.

Other oversights that will result in a failure to print include:

- Not using the "print header = 255" command in the DOS workstation's SHELL.CFG file
- Setting a printer to "reinitialize" mode in a PRINTCON job configuration
- Attempting to print under Windows without the XMSNETx shell

Q. What new features are included in the v3.01 update to NetWare for Macintosh print services?

A. In v3.0, all ATPS queues are advertised in the same internal AppleTalk zone on the server. Starting with v3.01, the user can

specify multiple zone names for the internal AppleTalk network and can select which of these zones queues will be advertised in.

In v3.0, Macintosh users can see their print jobs submitted to a queue through the NetWare Desk Accessory. However, they must be designated as "Queue Operators" to perform any administration on their jobs. In v3.01, users can hold, continue, or remove jobs they submit to a queue without being Queue Operators, as long as they are logged into the server and designated as "Queue Users."

In v3.01, administrators can "hide" printers, thus forcing users to print to queues rather than directly to printers.

In v3.01, administrators can regulate printing by requiring users to log in to the file server to send a print job. In addition, the administrator can regulate exactly who can print to the queue with the "Queue User" property.

In v3.0, there is a one-to-one mapping of printers to print queues. In v3.01, a single queue can be serviced by multiple printers.

In v3.01, ATPS queues can be serviced by PSERVER to send Macintosh print jobs to a PostScript printer attached directly to a PC. This printer can be attached directly to the file server via a serial or parallel connection, or it can reside on a remote PC workstation running RPRINTER. Some third-party print servers can also be configured to service ATPS print queues.

