IBM i
7.2

Printing
Advanced Function Presentation (AFP)

IBM

> **Note**
>
> Before using this information and the product it supports, read the information in "Notices" on page 95.

Contents

Advanced Function Presentation (AFP)

IBM® i has powerful printing and display functions. With Advanced Function Presentation (AFP) you can present information using overlays, bar codes, graphics, images, and more. IBM i supports a variety of powerful printing and presentation solutions.

This information illustrates some of the core IBM i printing functions, and helps you plan for and configure these functions.

Note: Read the "Code license and disclaimer information" on page 93 for important legal information.

What's new for IBM i 7.2

Read about new information for the Advanced Function Presentation (AFP) topic collection.

Color Management

Print Services Facility (PSF) is enhanced to provide color management support for IPDS printers. For more information, see "Color and grayscale printing using AFP" on page 10.

Data object resource access tables

PSF provides support for the use of Data Object Resource Access Tables for IFS-based resources. Color management resources can be specified in Data Object Resource Access Tables for AFP and non-AFP resources without changing an application. For more information, see "Resource directory management" on page 26.

Changes to the TrueType and OpenType fonts

- The font names of the TrueType and OpenType fonts provided in option 43 of the IBM i have changed. Support for the use of the old names is provided.
- More directories that contain these fonts can be specified by using environment variable QIBM_FONT_RESOURCES_PATH specified at either the job level or system level.

For more information, see TrueType and OpenType fonts.

Suppress message text in an email

PSF offers the capability to send emails without any text placed into the body of an email. For more information, see "Suppress message text in an email" on page 62.

PDF map generic support

Generic values can be specified for the User data and Form type selection criteria in a PDF map entry. For more information, see "Generic support for PDF map object selection criteria" on page 63.

Variable data taken from spooled file attributes

This function causes variable data to be inserted into the subject and body text of an email that is sent by PSF. The variable data can be taken from any of the following: User data spooled file attribute, the Form type spooled file attribute, mail tag that is specified on the User defined data spooled file attribute or the routing tag that is contained within spooled file data. For more information, see "Variable data taken from spooled file attributes" on page 62.

Preventing the copying of the spooled file attribute USRDFNOPT when respooling AFP

When the AFP respool function is done, PSF copies the User Defined Option (USRDFNOPT) spooled file attribute from the original spooled file to the new AFP spooled file. If the original spooled file is split into multiple respooled files, then each of the respooled files contains the USRDFNOPT spooled file attribute of the original spooled file. If you want to prevent the User Defined Option from being copied, you can do so. For more information, see "Preventing the copying of spooled file attribute USRDFNOPT when respooling AFP" on page 68.

Add user directories to PSF's Java class path

If your PDF user program starts a Java™ program, you can tell PSF the directory where the Java program can be found. PSF appends the directory to its class path. For more information, see PSF Mapping Exit Program.

How to see what's new or changed

To help you see where technical changes were made, the information center uses:

- The » image to mark where new or changed information begins.
- The « image to mark where new or changed information ends.

In PDF files, you might see revision bars (|) in the left margin of new and changed information.

To find other information about what's new or changed this release, see the Memo to Users.

Related reference
Infoprint Server for iSeries: User's Guide (G544-5775) PDF

PDF files for AFP

You can view and print a PDF file of this information.

To view or download the PDF version of this document, select Advanced Function Presentation (AFP).

You can view or download the related topic PDF Basic printing.

Saving PDF files

To save a PDF file on your workstation for viewing or printing:

1. Right-click the PDF file in your browser (right-click the link above).
2. Click the option that saves the PDF locally.
3. Navigate to the directory in which you want to save the PDF file.
4. Click **Save**.

Downloading Adobe Reader

You need Adobe Reader installed on your system to view or print these PDFs. You can download a free copy from the Adobe Web site (www.adobe.com/products/acrobat/readstep.html).

Related concepts
Related information for AFP

Product manuals, IBM Redbooks publications, Web sites, and other information center topic collections contain information that relates to the Advanced Function Presentation topic collection. You can view or print any of the PDF files.

AFP concepts

Use this information to understand how AFP works on IBM i.

Read these topics for an overview of the Advanced Function Presentation (AFP) and related concepts.

Related reference
AFP reference information
Look up information about PSF, such as the form definitions and page definitions included with your system, here.

Overview of AFP printing

AFP is an architecture-based system of hardware and software for creating, formatting, viewing, retrieving, printing, and distributing information using a wide variety of printer and display devices.

Advanced Function Presentation (AFP) is the original, integrated data stream on IBM i for generating fully composed pages of data. Traditional line-mode print applications compose a line at a time down the page (typically continuous form pages), whereas AFP composes the entire page before printing. In AFP, page elements such as text, images, bar codes, page segments, and overlays, can be specified in any order at any position in the page. This is called all points addressability.

Advanced Function Presentation data stream (AFPDS) is a printer-independent data stream that composes full pages within a document. Many of the page elements you can use with AFP are special objects called resources.

AFPDS

AFPDS files can be generated on IBM i as well as many other platforms. These operating systems can send AFPDS files to each other for printing on AFP-configured printers.

PSF

Print Services Facility (PSF) combines print data with resources to manage and control data transmitted to AFP printers. PSF accepts various data streams, transforms these data streams into the data stream required by each printer, and then transmits the data to the printer. PSF uses processing and printing options specified by the user and the installation during these processes. In addition, PSF does the following:

- Manages resources.
- Verifies part of the input data stream's syntax (the printer verifies the remainder of the syntax).
- Provides diagnostic aids, which provide information that can be used for problem analysis.
- Reports the status of a printer to the system operator.
- Provides accounting information.
- Provides error-recovery procedures for AFP printers. If a spooled file does not print due to a printer problem such as a paper jam, PSF retransmits the affected pages when the problem at the printer is corrected.

To use AFP support on IBM i, typically PSF must be installed. However, if the ASCII data stream is converted through Host Print Transform, you can use the AFP support without installing PSF.

Related concepts
AFP resources
Advanced Function Presentation (AFP) resource objects contain data and control information.

Determining whether PSF is required

You must install PSF if you use certain printers, use IBM i to print line or mixed-mode data, or use certain printer file parameters or DDS keywords.

Creating AFP data
There are several different ways to generate Advanced Function Presentation (AFP) data. You can use a printer file, DDS keywords, Infoprint Server, the AFP printer driver, or Advanced Function Printing Utilities.

Data streams

Advanced Function Presentation (AFP) applications can generate Advanced Function Printing data stream (AFPDS), line, or mixed (AFPDS and line) spooled files.

These applications can run on IBM i or on other platforms. IBM i can receive spooled files from other operating systems.

Line data

Line data is record-oriented readable text.

The generating application can partially format line data by doing one of these:

- Adding carriage control characters to the first column of each record
- Adding blank lines to adjust vertical positioning
- Using skipping and spacing controls (such as on an RPG output specification)

Line data is supported as a device type in the printer file commands through the DEVTYPE(*LINE) specification. The printer file commands follow:

- Create Printer File (CRTPRTF)
- Change Printer File (CHGPRTF)
- Override with Printer File (OVRPRTF)

For more information about line data, see the *AFP Programming Guide and Line Data Reference*, which can be found at the AFP Consortium (AFPC) website http://www.afpcinc.org (http://www.afpcinc.org).

Related concepts
Line and mixed data stream support
Use this information to understand how PSF supports line and mixed data on IBM i.

Mixed data

Mixed data is line data intermixed with AFPDS data.

Mixed data can also be called *AFPDSLINE data. Only certain AFPDS structured fields are allowed to be intermixed with line data. For more information about mixing line data and AFPDS structured fields, see the *AFP Programming Guide and Line Data Reference*, which can be found at the AFP Consortium (AFPC) website http://www.afpcinc.org (http://www.afpcinc.org).

Related concepts
Line and mixed data stream support
Use this information to understand how PSF supports line and mixed data on IBM i.

zSeries and z/OS data

IBM i can receive data from zSeries systems.

From an Advanced Function Presentation (AFP) perspective, data sent to IBM i from a zSeries system can be any of these:

- Print data (letters, documents, and so on)
  - Advanced Function Presentation data stream (AFPDS).
  - AFPDSLINE (or mixed data). AFPDSLINE is data that has a mixture of line data and AFPDS data.

– LINE (line data). Line data is data that has been prepared for printing on a line printer. Line data does not contain all placement or presentation information that is needed for printing on page printers.
- Resources

Note: In these topics, the term *zSeries* means zSeries and z/OS® unless otherwise stated.

AFP resources

Advanced Function Presentation (AFP) resource objects contain data and control information.

This information can be shared by different pages within a spooled file as well as different spooled files. Examples of resources are fonts, which define the characters used to print text, and page segments, which can include images and text.

Resources can be stored and accessed from within the operating system being used. By referring to the name of the stored resource, many data streams can share the same resources. For more information about resources, see the descriptions of the different resource types.

Related concepts
TrueType and OpenType fonts
There is extensive operating system support for TrueType fonts, and they are popular with PC applications. Consequentially, TrueType is probably the most prevalent font technology in the industry today. OpenType is an extension of the TrueType font format.

Resource libraries
Advanced Function Presentation (AFP) resource libraries group resources of the same type.

Ensuring that you have the necessary AFP resources
You need to determine what resources you need for your Advanced Function Presentation (AFP) application and ensure that they are stored in appropriate locations.

Related tasks
Printing data sent to IBM i from zSeries
PSF can print data that was generated on zSeries. This data might be AFP, AFPDSLINE (AFP data mixed with line data), or line data. The data might be sent to network files or directly to an output queue.

AFP fonts

A font is a collection of characters of a certain size, typeface, and type style. Advanced Function Presentation (AFP) fonts, also called Font Object Content Architecture (FOCA) fonts, are the standard fonts used for Intelligent Printer Data Stream (IPDS) output. AFP fonts are made up of a code page and a character set. All AFP fonts are encoded as either single-byte or double-byte fonts, depending on the language for which they are being used.

Each character in a font is identified by a 1-byte (single-byte) or a 2-byte (double-byte) code. The internal structure of fonts depends on whether the font is for a phonetic or a non-phonetic writing system. An example of a phonetic writing system is English. An example of a non-phonetic writing system is Kanji.

At least two resources are needed to make up a font: a font character set and a code page. The relationship between code pages and font character sets is illustrated in Figure 1 on page 6. A third resource, a coded font, can define a font by naming a font character set and a code page.

Font character set
This resource contains the patterns for each character in the font and associates an 8-byte character identifier with each pattern. This resource also contains descriptive information for the entire character set.

Code page
This resource associates code points with character identifiers within a font character set, each representing a character pattern. A code point is an 8-bit binary number representing one of 256 potential characters.

Coded font
This resource associates one or more code pages with the appropriate font character sets.
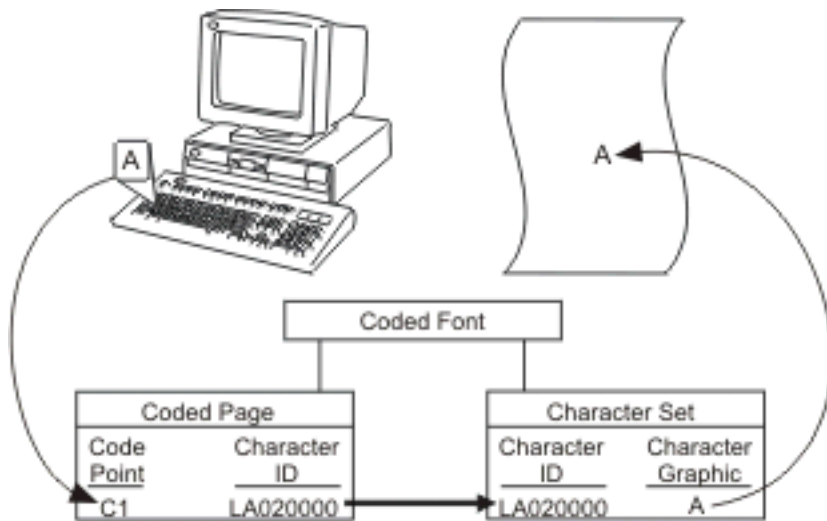
Figure 1. Translation of a keyboard character into a printed character

Related concepts

Obtaining AFP resources
There are many sources of Advanced Function Presentation (AFP) resources.

AFP font libraries
IBM supplies several AFP font libraries. In addition, you can create a library list that allows AFP to locate and use other fonts.

TrueType and OpenType fonts
There is extensive operating system support for TrueType fonts, and they are popular with PC applications. Consequentially, TrueType is probably the most prevalent font technology in the industry today. OpenType is an extension of the TrueType font format.

Related reference

Specifying an AFP font
There are many different tools you can use to specify Advanced Function Presentation (AFP) fonts in your document. Each tool has different capabilities.

How TrueType and OpenType fonts differ from AFP fonts
When using TrueType fonts, you will see differences in how the fonts are specified, managed, and installed when compared to Advanced Function Presentation (AFP) fonts.

Form definitions

A form definition is an Advanced Function Presentation (AFP) resource object that defines the characteristics of the physical form to be printed on.

Form definitions define these characteristics:

- Overlays to be used
- Position of page data on the form
- Rotation
- Duplexing
- Input drawer
- Formfeed type
- Print quality
- Number of copies of each page and the modifications that apply to each set of copies
- List of Color management resources (CMRs) that might be used

Whenever you are printing to a printer configured as AFP(*YES), a form definition is required. If you do not specify a form definition on the printer file, an inline form definition is built from the printer file parameters. If you specify a form definition, no inline form definition is built from the printer file parameters. In this case, if you send the data to an AFP printer, Print Services Facility (PSF) ignores some printer file parameters.

AFP-related form definitions can be:

- Provided with IBM i
- Created with the IBM Infoprint Designer for iSeries licensed program
- Downloaded from zSeries
- Included inline from zSeries
- Created automatically from printer file parameters

Related concepts

How page definitions, form definitions, and printer files interact
You can use a printer file to specify some of the same options as you can specify with a page definition and a form definition. This topic describes how PSF chooses an option when a printer file is used with a page definition and form definition.

Obtaining AFP resources
There are many sources of Advanced Function Presentation (AFP) resources.

Specifying a form definition
To use or identify a fully qualified form definition, specify a value in the FORMDF parameter with a CL command.

Related reference

Form definitions included with the operating system
This topic lists the form definitions that are provided with IBM i in library QSYS.

Object containers

Object containers are used to carry non-Object Content Architecture (OCA) objects in an Advanced Function Presentation (AFP) data stream.

Some such objects are Graphics Interchange Format (GIF) and Tagged Image File Format (TIFF) images. These non-OCA objects can be *wrapped* or *unwrapped*. Wrapped objects are carried in a Mixed Object Document Content Architecture (MO:DCA) envelope called an object container. Unwrapped objects are unaltered from their original form. If the object is to be carried in MO:DCA resource groups and interchanged, it must be wrapped.

Note: Print Services Facility (PSF) does not check an object container's contents. Therefore, it is up to the user to verify that the printer can handle the type of data in the object container. The Infoprint Server PDF subsystem works like a printer. For information about the types of images it can accept, see the *Infoprint Server for iSeries: User's Guide*.

Object containers, even though they contain non-OCA objects, are similar to other AFP resources in these ways:

- They can be mapped. A mapped resource is downloaded once per spooled file, no matter how many times the resource is referenced in the spooled file.
- They can be included on a page.
- They can be captured in the printer.

Using object containers has several benefits:

- You can reference several types of MO:DCA objects in a spooled file without having to include them in an overlay or page segment. These image types are image data, bar code data and graphics data.
- You can scale and rotate these objects. With page segments and overlays, you need to create one copy of the object in each orientation needed.

- You can include images larger than 16 MB in your output. If an image exceeds 16 MB, the image cannot be stored as a page segment object.
- Print applications can specify the use of non-OCA objects which refer to other non-OCA objects, such as color mapping tables (which are printer-resident). These are called *secondary resources*.
- Applications can use color objects with Intelligent Printer Data Stream (IPDS) printers.
- The IBM Infoprint Server for iSeries licensed program's PDF subsystem accepts object containers with certain types of images as input.

Related concepts

Obtaining AFP resources
There are many sources of Advanced Function Presentation (AFP) resources.

Specifying an object container
There are different ways to include object containers in your data, depending on your installation and how you want to use them.

Related information

Infoprint Server for iSeries: User's Guide (G544-5775) PDF

Overlays

Overlays, also known as electronic forms, are a collection of predefined data such as lines, shading, text, boxes, or logos. They can be merged with variable data on a sheet while a spooled file is being processed.

You can use the licensed program IBM Infoprint Designer for iSeries, the licensed program Advanced Function Printing Utilities, the licensed program IBM Infoprint Server for iSeries, or the Advanced Function Presentation (AFP) printer drivers provided for Microsoft Windows to create overlays on IBM i. Overlays can also be downloaded from other operating systems, such as zSeries.

When overlay data is received from the zSeries system, you place it in a data file. To convert the page overlay data to a format that can be used by IBM i, use the Create Overlay (CRTOVL) CL command.

Related concepts

Obtaining AFP resources
There are many sources of Advanced Function Presentation (AFP) resources.

Specifying an overlay
To use overlays, specify them in the front and back overlay parameters of the printer file being used with your application.

Related reference

Create Overlay (CRTOVL) CL command

Page definitions

Page definitions are resources that format and compose line data into logical pages.

A page definition contains printing controls that specify:

- Where data from each input record is to be printed
- Page size (height and width)
- Data fields that can be suppressed
- Print positions for line-data records containing carriage control characters
- Inline printing direction
- Number of lines per inch
- List of page segments that might be used
- List of overlays that might be used
- Record definitions
- Constant data to be printed

- List of Color management resources (CMRs) that might be used
- List of fonts that might be used

Whenever you are printing to a printer configured as AFP(*YES) and you are printing line or mixed data, a page definition is required. If a page definition is not specified on the printer file, an inline page definition is built from the printer file parameters.

If you specify a page definition and also specify line data or mixed data, no inline page definition is built from the printer file parameters. In this case, if you send the data to an Advanced Function Presentation (AFP) printer, Print Services Facility (PSF) ignores some print parameters.

Related concepts

How page definitions, form definitions, and printer files interact
You can use a printer file to specify some of the same options as you can specify with a page definition and a form definition. This topic describes how PSF chooses an option when a printer file is used with a page definition and form definition.

Obtaining AFP resources
There are many sources of Advanced Function Presentation (AFP) resources.

Specifying a page definition
To use or identify a fully qualified page definition, specify the PAGDFN parameter on a CL commands.

Related reference

Page definitions included with the operating system
This topic lists the page definitions that are provided with IBM i in library QSYS.

Page segments

Page segments are objects containing composed text and images that are prepared before formatting and included during printing.

For example, you might want to repeat constant data at different positions on a page or overlay. You might also want to repeat that data on different pages or overlays. You can do this by using a page segment. A company logo is an example of this type of data.

You can use the IBM Infoprint Designer for iSeries licensed program, the Advanced Function Printing Utilities licensed program, the IBM Infoprint Server for iSeries licensed program, or the Advanced Function Presentation (AFP) printer drivers provided with Microsoft Windows 2000 or Windows XP, to create page segments on IBM i. Page segments can also be downloaded from zSeries systems. The page segments must be stored in an accessible library.

When page segment data is received from the zSeries system, you place it in a data file. To convert the page data to a format that can be used by IBM i, use the Create Page Segment (CRTPAGSEG) command.

Related concepts

How page definitions, form definitions, and printer files interact
You can use a printer file to specify some of the same options as you can specify with a page definition and a form definition. This topic describes how PSF chooses an option when a printer file is used with a page definition and form definition.

Obtaining AFP resources
There are many sources of Advanced Function Presentation (AFP) resources.

Specifying a form definition
To use or identify a fully qualified form definition, specify a value in the FORMDF parameter with a CL command.

Specifying a page segment
A page segment object can be built into your application output in a number of ways.

Related reference

Create Page Segment (CRTPAGSEG) CL command
Form definitions included with the operating system

This topic lists the form definitions that are provided with IBM i in library QSYS.

Resources in the integrated file system

Print Services Facility (PSF) can process several types of Advanced Function Presentation (AFP) and non-AFP resources that are stored in the integrated file system. These are objects that are not stored within a page segment or overlay.

Following are the AFP resource types that can be stored in the integrated file system:

- Image Object Content Architecture (IOCA)
- Graphics Object Content Architecture (GOCA)
- Bar Code Object Content Architecture (BCOCA)
- Color Management Object Content Architecture (CMOCA)

All non-AFP resources are placed in the integrated file system. PSF processes any non-AFP resource that is specified. However, the actual support of non-AFP resources depends on the printer to which the data is being sent.

The Data description specifications (DDS) keyword AFPRSC is used to identify any resources stored in the integrated file system. For information about DDS keywords used with printer files, see the DDS for printer files topic in the Programming category. There are several benefits of using the AFPRSC keyword:

- You do not need to create objects as a page segment.
- You can use non-AFP resources.
- You can obtain objects from other operating systems and reference them without further modification. You do not need to create them into a page segment.
- Some applications generate AFP resources and write them to the integrated file system. PSF can access those resources without requiring you to create a page segment or overlay.

When referencing resources in the integrated file system, you must understand how the operating system searches for those resources. See the "Search order of library list" on page 51 topic for information.

Related concepts

Ensuring that you have the necessary AFP resources
You need to determine what resources you need for your Advanced Function Presentation (AFP) application and ensure that they are stored in appropriate locations.

Color and grayscale printing using AFP

Printing documents in full color or with high-quality black and white (grayscale) images is more complex than printing black and white or spot-color documents. Understanding some of the principles of color and grayscale printing and how various products can fit into color and grayscale solutions can help you integrate color and grayscale printing with your current operations or expand to implement new color workflows.

AFP color and grayscale solutions
You can assemble printing products in different configurations to support Advanced Function Presentation (AFP) color and grayscale printing, including configurations that use the AFP Color Management Object Content Architecture (CMOCA) to provide optimal performance and color accuracy in high-speed color printing.

Color printing without explicit color management

You can include color images or specify colors for AFP objects in your spooled files and send them to an AFP color printer. The color images and objects print in color, which is based on the default settings in your print server and printer.

If you like the colors that the default color management settings provide, or if it is not essential that you print in exactly the right colors, you probably do not need to implement a full color management solution.

However, if you want better control over the consistency and accuracy of your colors for devices, you might consider color management at some point in the future.

To understand some of the basic concepts about color printing, see:

- "Color printing concepts" on page 11
- "Grayscale printing concepts" on page 14

Resources included inline

Most often, print bureaus use document composition software to generate highly customized and personalized color output. AFP color management is largely built into the document composition tools that support their processes. The software puts all the resources that the printer needs into the spooled file and sends it to a print server. The print server sends the spooled file to the printer, and the printer uses the resources as appropriate.

By using this method, you know that the required resources, including the resources that are required for color management, are available for any spooled file that is sent to the printer. However, including all the resources can make the spooled file large, and moving large spooled files through your system might slow down system performance. Also, you might not be able to save resources that are downloaded with a spooled file on the printer so they can be reused without being downloaded later.

For more information about color printing, see:

- "Color printing concepts" on page 11
- "Color Management" on page 15

Resources stored and managed centrally

To take full advantage of the AFP CMOCA, you can store your color and image resources in a central resource directory, and your print system can manage those resources. This option optimizes system performance by:

- Creating some of the color management resources for you automatically
- Reducing the number of color conversion resources that the system creates at print time by generating link color conversion color management resources in advance
- Reducing the size of some images by removing embedded profiles when you store them, yet still retaining the association between the image and the profile
- Enabling you to mark resources as *capturable*, so they can be saved on the printer and used in other spooled files without being downloaded again

For an introduction to the full AFP CMOCA and how you might implement it, see:

- General information about color and grayscale printing and color management:
  - "Color printing concepts" on page 11
  - "Grayscale printing concepts" on page 14
  - "Color Management" on page 15
- "AFP Color Management" on page 17
- "AFP Resource Installer" on page 28

Color printing concepts
Color printing is significantly more complicated than black and white printing. If you understand some of the complexities, you can make the transition from black and white printing to grayscale or color printing more smoothly.

Color spaces and ICC profiles
Presentation devices, such as computer monitors and printers, create colors differently. Because of these differences, colors must be described differently for each device. The different methods of describing

colors are called *color spaces*. In addition, each device might have one or more International Color Consortium (ICC) profiles that are associated with it. ICC profiles are used when an image or another object is converted to the color space of a different device.

Each device has its own individual color space and range of colors that it can display or print. The color space specifies how color information is represented in an image when it is displayed on a particular device. As the image is passed from one device to the next, the color information about the image is converted from the color space of the source device to the color space of the destination device. Because color spaces do not exactly match between devices, some of the color information can be lost or modified in the conversion process.

A *color space* is a representation of the individual colors that can be combined to create other colors. The following are color spaces that are relevant to printing:

- RGB

  In an RGB color space, red, green, and blue light are combined in different amounts and intensities to create different colors. RGB colors are often specified as single-byte integers numbered from 0 through 255. You can specify 256 levels of intensity for each of the three colors. For example:

  – R=0, G=0, B=0 yields black
  – R=255, G=255, B=255 yields white
  – R=251, G=254, B=141 yields a pale yellow
  – R=210, G=154, B=241 yields a light purple

  Devices such as monitors, digital cameras, and scanners generally use RGB color spaces to describe colors. Two standard implementations of RGB color spaces are *sRGB*, which is most often used for web graphics, and *Adobe RGB (1998)*, which IBM recommends for graphics that are printed.

- CMYK

  In a CMYK color space, cyan (bright blue), magenta (bright red-pink), yellow, and black pigments are combined to create different colors. CMYK values are often represented as a percentage. The percentage represents the portion of a particular area of paper that is covered by ink or toner. For example:

  – C=0%, M=0%, Y=0%, K=100% yields black
  – C=0%, M=0%, Y=0%, K=0% yields a blank area on the page
  – C=1.6%, M=0%, Y=44.7%, K=.4% yields a pale yellow
  – C=17.6%, M=39.6%, Y=5.5%, K=5.5% yields a light purple

  Color printers use the CMYK color space; they are loaded with ink or toner in each color. When the printer places dots of the correct sizes next to and on top of each other on a page, your eye interprets them as the intended color.

  Implementations of the CMYK color space vary from printer to printer and from paper to paper. Because the original color space of most images is an RGB color space, it is best to leave images in an RGB color space so they retain their original characteristics. That way, your print server or printer has as much of the original color information as possible when it converts the images to the most appropriate CMYK color space for the printer and paper combination.

  If you save an image by using the CMYK color space, make sure that you either save an ICC profile for that color space or use a standard non-device specific CMYK color space like *SWOP* or *Coated FOGRA27* and associate the appropriate ICC profile with the image.

Note: Both RGB and CMYK values can be expressed in different ways. For example, in the PostScript DataStream, the values range from 0.0 to 1.0, while in some graphic arts programs they can be expressed in hexadecimal numbers or as percentages.

An *ICC profile* contains information for converting an image between a device-specific color space and a *device-independent color space*. A device-independent color space is a color space that does not depend on or relate to the characteristics of any particular device, but rather contains all colors for all gamuts. The

ICC identified a specific profile connection space (PCS) as the target device-independent color space for all ICC profiles.

You can use an input ICC profile to translate color data that is created on one device (such as a digital camera) into the PCS. Then, you can use an output ICC profile to convert from the PCS into the native color space of a different device (such as a printer). Converting images from one color space to another is process-intensive and can affect performance in your print system, although it is the best way to maintain consistent color for the devices in your system.

For more information, see "ICC Profiles" on page 16.

Gamut and rendering intent
Every device has a *gamut*, a range of colors or shades of colors that it can display or print. Some devices have larger gamuts than others; some devices have gamuts that are similar sizes, but that contain slightly different colors. When an image is created on a device with a gamut that is different from the printer, you can use a *rendering intent* to tell the printer how to adjust the colors that are outside the gamut of the printer.

The gamut of a printer is almost always significantly smaller than the gamut of a monitor, digital camera, or scanner. Images or graphics nearly always must be adjusted to print appropriately because some of the colors that they require might be outside the gamut of the printer.

A rendering intent tells the printer how to adjust the image when it encounters colors that it cannot reproduce. Each rendering intent has different benefits and trade-offs, so you can choose one based on how the print output should look.

For more information, see "Rendering intents" on page 16.

Color mixing and calibration
Four standard colors (cyan, magenta, yellow, and black) are blended to create all the colors in the gamut of a printer. A printer mixes colors by printing four layers of a page or an image, one in each color. If the printer registration is not set correctly, the images do not line up properly and the colors appear wrong. In addition, the printer must be calibrated to ensure that all its systems are functioning correctly and that it is in a known good state.

By using the color information that is described in its color space, each device determines the amount of cyan, magenta, yellow, or black to use. Dots of each color are printed in overlapping patterns that, when interpreted by your eyes, blend the colors appropriately. To ensure that the colors are created accurately, the color planes must be perfectly aligned. If they are not, you might see *moire patterns*, unintended patterns in the printed images, or poorly blended colors, which are especially noticeable on the edges of your images.

Color printers must be calibrated regularly, in some cases daily, to ensure that the colors they produce are consistent. In addition, follow the recommended printhead maintenance procedures and schedule to ensure that the printer operates optimally. Even when a printer is calibrated correctly, its gamut is much smaller than the gamut of any monitor, so images do not look the same when they are printed as they do when they are displayed on a monitor.

Halftones and tone transfer curves
Halftones are used to convert images (such as photographs, drawings, logos, or charts) from the continuous tones that you see on a monitor into a pattern of dots that a printer can put on paper. Tone transfer curves are used to modify the values of a particular color component and thus adjust the appearance of some of the colors. For example, you can apply a tone transfer curve to emphasize the brightest parts of an image.

Halftones and tone transfer curves are used with both color and grayscale images.

There are several different kinds of halftones, including clustered-dot, stochastic, and error diffusion. For simplicity, this discussion covers only clustered-dot halftones.

Clustered-dot halftones are characterized by:

• Line screen frequency

Line screen frequency is a measure of the resolution of a halftone, expressed in lines per inch (lpi). A low line screen frequency, such as 80 lpi, creates coarser images because they use larger halftone dots. A high line screen frequency, such as 150 lpi, can produce higher quality images by using smaller halftone dots.

- Halftone pattern

Halftone dots are printed in various shapes and patterns. For example, dots can generally be round, elliptical, or square, and they can be arranged in slightly different orientations. The halftone pattern also describes how the size of the dot is increased to cover a larger percentage of the total area and yield darker colors. Different patterns might produce better results for some print jobs.

- Rotation

Lines of halftone dots do not run parallel with the top or side of the paper because that could cause unintended patterns to emerge, resulting in lower quality output.

In addition, the dots for each of the four colors in a CMYK printer cannot all be printed at the same angle because they would overlap incorrectly and the colors would not appear as intended. Instead, the lines of dots are printed on the page at specific angles so your eye blends them appropriately.

For example, the black layer of an image might be printed so the lines of dots run across the page at a 45 degree angle to the top of the paper, while the cyan layer is printed so that its lines of dots are at a 105 degree angle to the top of the paper.

Tone transfer curves are most often used to offset the effects of dot gain. *Dot gain* is the tendency for printed dots to be larger than intended, often because of the way ink reacts with paper. If the ink soaks into the paper and spreads out, the resulting dot is much larger (and possibly much lighter in color) than the printer intended it to be. Tone transfer curves can increase or reduce the amount of ink that is used in proportion to the dot gain.

File size
Spooled files with color images in them can have a file size that is much larger than black and white spooled files. The larger file size can lead to longer processing times and increased traffic on your network.

Because color images must contain data about each layer of color, the file might contain three to four times more information than a grayscale file and over 24 times more information than a black and white file. In addition, ICC profiles are embedded in some file types (such as TIFF images). While ICC profiles by themselves might not be large, they do increase the size of an image. If you have only one image that is repeated throughout a spooled file, and if you construct your spooled file so the image is downloaded only once, the embedded profile is of little concern.

However, if you use various different images, each with an embedded profile, or if you construct your spooled file so that each image is downloaded every time that it appears, the embedded profiles can add unnecessary volume to the print job. If you plan to use a wide variety of color images, create or save them with the same color space so they all use the same ICC profile. You can also install color images in a resource directory so they can be reused.

Grayscale printing concepts
With grayscale printing, you can reproduce color images as high-quality black and white images by using many shades of gray to represent subtle variations in color and light. Printing solutions that produce high-quality grayscale output use color printing concepts with a black and white printer that supports them to achieve that effect.

Moving to grayscale printing might be a first step in a migration to full color printing. You can start to create color spooled files and print them on an existing printer until you are ready to invest in color printers. In addition, you can use a grayscale printer as a backup system for a full color printer.

Some color concepts are much less important in grayscale printing than they are in color printing:

- The gamut of a black and white printer is much smaller than the gamut of a color printer; essentially all the colors in an image must be adjusted.

- The rendering intent that you choose has little effect on the appearance of the image because the colors are already being changed significantly.
- Page registration is less important. Because the printer uses only one color, you do not have to line up the color planes to create the correct color.
- Paper characteristics have minimal effect on grayscale output; one output profile is usually adequate for all types of paper.

Other color concepts are more essential to grayscale printing.

Color spaces and ICC profiles

The color space of a black and white printer is much smaller than the color space of a color printer. Even so, printers that can print grayscale images have output ICC profiles, just like color printers. The ICC profiles for black and white printers map colors from the profile connection space (PCS) to shades of gray. Otherwise, the color conversion process is the same.

The spooled file should specify the appropriate input profile; if there is no input ICC profile, the printer uses a reasonable default. The printer has its own default ICC profile that is installed and available; it should be adequate for nearly all spooled files.

Halftones

Grayscale printers apply halftones to spooled files to print them; halftones enable the printer to produce many shades of gray and high-quality images. Generally, the most important characteristic to consider for halftones in grayscale printing is line screen frequency, expressed in lines per inch (lpi). Each printer supports a set of line screen frequencies natively; when you specify the wanted line screen frequency in a spooled file, the printer chooses the available line screen frequency that best matches it.

Tone transfer curves

Tone transfer curves are used in grayscale printing to adjust the amount of toner that is used at different levels of gray, thus adjusting the appearance of images. You can use the appearance value of a tone transfer curve in grayscale printing to indicate how much the tone transfer curve is to adjust the color values. Some sample appearance values are:

- Dark
- Highlight Midtone
- Standard

Color Management
Images, graphics, and photographs often appear different depending on the monitor or the printer you use. The colors that are printed by one printer might not match the colors that are printed on another printer, even if they came from the same source. If it is important that colors stay consistent from camera, scanner, or monitor to printer, you must use *color management* practices.

It is virtually impossible to accurately reproduce the colors that you see on your monitor on a printed page. Because printers typically have smaller color gamuts than other devices, some of the colors must always be adjusted when images are transformed for printing. With color management, you can control the adjustments so they are less noticeable than they might be if you use the default settings of your image creation software, print server, and printer.

Several factors play significant roles in color management, including ICC profiles, rendering intents, and paper characteristics.

ICC Profiles

The International Color Consortium (ICC) is an organization that establishes open standards for color management. These standards help products work together by identifying a device-independent color space and defining the elements of an ICC profile.

The device-independent color space that the ICC defined is called the profile connection space (PCS). The PCS is a color space large enough to include all the color gamuts of different input, display, and output devices. An ICC profile contains methods that map the colors that a device can create or display to the values of the corresponding colors in the PCS. The ICC profile can be used to convert an image from a device-specific color space to the PCS, or from the PCS to a device-specific color space.

Product manufacturers create ICC profiles that you can use with their devices. For example, if you take a photograph with a digital camera, you can associate the photograph with the ICC profile for your camera. Then, when you want to print that photograph, the color management system converts the color data from the camera into the PCS. The printer then uses its ICC profile to convert the photograph data from the PCS into its color space, and prints the photograph as accurately as it can.

For more information about the ICC, ICC profiles, and the PCS, see the ICC website: International Color Consortium (http://www.color.org).

Rendering intents

Rendering intents indicate what you want a printer to do with colors that are outside its gamut.

ICC profiles support these rendering intents:

- Perceptual

  If an image includes any colors that are out-of-gamut for the printer, the printer adjusts all the colors in the image, even the colors that are already in the gamut of the printer, so they are all in-gamut and maintain their color relationships to each other. The result is an image that is visually pleasing, but is not colorimetrically accurate. The perceptual rendering intent is useful for general reproduction of images, particularly photographs.

- Saturation

  If a spooled file includes colors that are out-of-gamut for the printer, the printer replaces the out-of-gamut color with the nearest color in the gamut. It also adjusts the in-gamut colors so that they are more vivid. Saturation is the least used rendering intent, but it is useful for business graphics, such as images that contain charts or diagrams.

- Media-relative colorimetric

  If a spooled file includes colors that are out-of-gamut for the printer, the printer substitutes the nearest in-gamut color; in-gamut colors are not adjusted. Colors that are printed on papers with different media white points might not match visually. The *media white point* is the color of the paper that the spooled file is printed on. For example, if you print an image on white paper, on off-white paper, and on blue paper by using the media-relative colorimetric rendering intent, the printer uses the same amount of ink or toner for each one and the resulting color is technically the same. However, the images might seem different because your eyes adjust to the color of the background and interpret the color differently. This rendering intent is typically used for vector graphics.

- Absolute colorimetric

  All colors are mapped by using the same method as the media-relative colorimetric rendering intent, however, all colors are adjusted for the media white point. For example, if you print an image on white paper, on off-white paper, and on blue paper by using the absolute colorimetric rendering intent, the printer adjusts the ink or toner that is used for each one. The resulting color is technically not same, but the images might look the same because of the way your eyes interpret them in relationship to the color of the paper. The absolute colorimetric rendering intent is typically used for logos.

Paper characteristics

The paper that you use has a significant impact on the colors that you see. Even if you use the same ICC profile and the same printer, printing on a different paper can result in a very different color appearance.

Colors can change from paper to paper, particularly if you change from coated to uncoated paper or from sheet-fed to continuous forms paper. The changes can be so noticeable that printer manufacturers generally test and certify papers with certain characteristics for use with their printers. They also create different ICC profiles for their printers that are based on paper characteristics. Some ICC profiles can be used for groups of papers that have similar characteristics.

When you load paper, you set certain paper characteristics on the printer. When the printer chooses the correct device-specific output profile to use, it takes the characteristics into consideration. The following are some paper characteristics considered.

- Media brightness

  The percentage of light that the paper reflects.

- Media color

  The color of the paper.

- Media finish

  The characteristics of the surface of the paper, such as: glossy, satin, or matte.

- Media weight

  The basic weight of the paper.

AFP Color Management

You can use various ways to print color data with Advanced Function Presentation (AFP). However, to implement an AFP color printing solution with full color management, you must use color management resources (CMRs). In addition, it is recommended that you install all of your color images as data objects and associate CMRs with them.

For more information about color management, see the descriptions of the different color management objects.

Color management resources

Color management resources (CMRs) are the foundation of color management in AFP print systems. They are AFP resources that provide all the color management information, such as ICC profiles and halftones, that an AFP system needs to process a spooled file and maintain consistent color from one device to another.

CMRs share some characteristics with other AFP resources, but are different in some important ways.

CMRs are similar to other AFP resources in these ways:

- CMRs can be associated with elements of a spooled file at various levels of the hierarchy. Normal hierarchy rules apply, so CMRs specified at lower levels override the CMRs at a higher level. For example, a CMR set on a data object overrides a default CMR set on a spooled file.

- CMRs can be included in a spooled file in an inline resource group and referenced in a form definition, page environment, object environment, or an include Object (IOB) structured field.

  Note: CMRs can vary in size from several hundred bytes to several megabytes. If your spooled file uses relatively few CMRs, including them in the spooled file might not have an impact on the performance of your system. However, if your spooled file uses more than 10 CMRs, the size of the spooled file can increase so much that file transfer rates and network traffic are affected.

- CMRs are stored centrally in the integrated file system, so you do not need to include them in every spooled file.

- For PSF to find CMRs, the paths that contain the CMRs must be specified in system environment variable QIBM_AFP_CMR_PATH.

CMRs are different from other AFP resources in these ways:

- You cannot copy CMRs into a directory as you can other AFP resources. To store CMRs in a directory, you must install them using an application such as AFP Resource Installer. For more information about the AFP Resource Installer, see "AFP Resource Installer" on page 28.
- CMRs and data objects must be stored in directories that have resource access tables (RATs). AFP Resource Installer creates the RAT when CMRs and data objects are installed. It is recommended that CMRs and data objects be installed in separate directories.
- CMR names are created when you install the CMR by using AFP Resource Installer and are UTF-16BE (CCSID 1200) encoded.

Related tasks

Search order of library list
Print Services Facility (PSF) uses the user library list and device library list to search for the AFP resources that you specify.

Color management resource types
Different situations call for different types of Color management resources (CMRs). Some CMRs are created by product manufacturers so you can download and use them, while others are created by your printer or other color management software. If you have the appropriate information, you can also create CMRs yourself.

Some CMRs are used to interpret input files (similar to the function performed by ICC input profiles), while others are used to prepare the final spooled file output for a specific printer (similar to the function performed by ICC output profiles). The following topics discuss the different types of CMRs.

Color conversion CMR
Color conversion CMRs are used to convert colors to and from the ICC Profile Connection Space (PCS), a device-independent color space. You can use them to prepare images for color or grayscale printing.

Color conversion CMRs are an essential element of any AFP color management system because they are ICC profiles encapsulated in AFP structures. The AFP structures add information that your color management system can use, but it leaves the ICC profile unaltered.

You can use color conversion CMRs to produce consistent colors on different devices. In a color system, they help ensure that the colors on your monitor are as close as possible to the colors that are printed. If you move the spooled file to a different printer, the colors are adjusted again to match the new printer.

In a grayscale system, color conversion CMRs map colors to appropriate shades of gray to produce high-quality black and white images.

Pass-through CMRs are color conversion CMRs that indicate that no color processing is done if the color space of the presentation device is the same as the color space of the CMR. Pass-through CMRs contain no data.

Related concepts

Instruction processing mode
CMRs with the instruction processing mode refer to processing that is done to prepare the resource for a specific printer, which uses a certain paper or another device. Generally, instruction CMRs refer to output data and are similar to ICC output profiles.

Link color conversion CMR
Link color conversion CMRs combine the processing information that is required to directly convert an image from the color space of an input device to the color space of the output device. Essentially, link color conversion CMRs replace a pair of color conversion CMRs.

Converting color images to and from the ICC Profile Connection Space (PCS) takes a significant amount of processing resources, in part because the process includes two conversions. Link color conversion CMRs combine the two conversions and make them more efficient. The printer can use the link color conversion CMR to convert colors directly from the color space of the input device to the color space of the output device with the same color fidelity they would have if the printer did both of the conversions. As a result, link color conversion CMRs can improve system performance.

The following are the two types of link color conversion CMRs:

- Link CMRs

  Link CMRs are unique. You cannot create a link CMR yourself and you do not include references to link CMRs in your spooled files. The print system creates and uses link CMRs automatically.

  If you use the AFP Resource Installer, link CMRs are generated automatically when you create or install a color conversion CMR. As a result, your resource directory always contains link CMRs for every combination of color conversion CMRs in audit (input) and instruction (output) processing modes. When link CMRs are created, AFP Resource Installer marks them as capturable, so the printer can save them to be used in other spooled files.

  If you do not use the AFP Resource Installer, your printer might create link CMRs when it processes spooled files. For example, if you send a spooled file to a printer that does create link CMRs, the printer controller looks at the audit color conversion CMRs that are specified. Then, the print controller looks at the link CMRs that it has available to find one that combines the audit color conversion CMR with the appropriate instruction color conversion CMR. If it does not find one, the print controller creates the link CMR and uses it. The print controller might save the link CMRs that it creates, but they can be removed during normal operation; for example, if the printer runs out of storage or is shut down. If the link is removed, the printer must create a new link CMR the next time it is needed.

  When a link CMR is created, the print system evaluates the conversion algorithms to and from the PCS. The system then combines the algorithms, so a data object can be converted directly from one color space to the other without actually being converted to the PCS.
- Device link CMRs

  Device link CMRs use an ICC device link profile to convert directly from an input color space to an output color space without reference to an audit-mode or instruction-mode CMR. An ICC device link profile is a special kind of ICC profile that is used to convert the input device color space to the color space of an output or display device. ICC device link profiles are not embedded in images.

  You can create, install, and uninstall device link CMRs yourself. Device link CMRs are referenced in the MO:DCA DataStream and take precedence over audit color conversion CMRs. A device link CMR specifies its own rendering intent, which is indicated in the header of the ICC device link profile. This rendering intent overrides any other rendering intent that is active.

  The biggest advantage of using device link CMRs is that they preserve the black channel (K component) of the input color space when converting from CMYK to CMYK.

Related concepts

Audit processing mode
CMRs with the audit processing mode refer to processing that was applied to a resource. In most cases, audit CMRs describe input data and are similar to ICC input profiles.

Instruction processing mode
CMRs with the instruction processing mode refer to processing that is done to prepare the resource for a specific printer, which uses a certain paper or another device. Generally, instruction CMRs refer to output data and are similar to ICC output profiles.

Link processing mode
CMRs with the link processing mode are used to link an input color space in the presentation data (sometimes defined by an audit CMR) to the output color space of the presentation device (sometimes defined by an instruction CMR). Only link and device link CMRs can be used in link processing mode.

Halftone CMR
Halftone CMRs carry the information that a printer uses to convert spooled files into a pattern of dots that it can put on paper. Halftone CMRs can be used with both color and grayscale spooled files.

Halftone CMRs generally specify the line screen frequency, halftone pattern, and rotation of the halftone that they carry. Device-specific halftone CMRs might also include the printer resolution.

A printer that uses AFP color management to print color or grayscale spooled files must use a halftone CMR to convert the spooled file into a format that the printer can reproduce in ink or toner. If a halftone CMR is not specified in the spooled file, the printer applies a default halftone CMR.

Note: Some printers have halftones that are applied by the print engine. As a result, the printer ignores halftone CMR requests.

You can associate device-specific halftone CMRs or generic halftone CMRs with spooled files:

- If you know which printer is printing the spooled file, you can associate a device-specific halftone CMR with the spooled file (or with AFP resources inside the spooled file). The printer uses the halftone CMR that you specify.
- If you do not know which printer is printing the spooled file, but you want to ensure that it uses a halftone CMR that has certain characteristics, such as a specific line screen frequency, you can associate a generic halftone CMR with the spooled file.

Because it is difficult to know which halftone CMRs would be the best ones to use for the current conditions on the current printer, it is recommended that you specify halftone CMRs generically. The printer can then choose the most appropriate CMR that it has available.

Related concepts

Generic halftone CMRs
You can use generic halftone CMRs when you want to choose one or more characteristics of the halftone CMR for a spooled file, but you do not know exactly which halftone CMRs are available.

Tone transfer curve CMR
Tone transfer curve CMRs are used to carry tone transfer curve information for an AFP spooled file. A tone transfer curve CMR is used to modify the values of a particular color component and adjust the appearance of some of the colors by increasing or decreasing the amount of ink that is used to emphasize or reduce the effects of dot gain on the final output.

Instruction processing mode
CMRs with the instruction processing mode refer to processing that is done to prepare the resource for a specific printer, which uses a certain paper or another device. Generally, instruction CMRs refer to output data and are similar to ICC output profiles.

Generic halftone CMRs
You can use generic halftone CMRs when you want to choose one or more characteristics of the halftone CMR for a spooled file, but you do not know exactly which halftone CMRs are available.

When a spooled file specifies a generic halftone CMR, the print server looks in the resource directory for halftone CMRs that match the printer device type and model. If the print server finds an appropriate CMR, it sends the device-specific halftone CMR to the printer with the spooled file. If the print server does not find an appropriate halftone CMR, it sends the generic halftone CMR to the printer.

If a spooled file arrives at the printer that is requesting a generic halftone CMR, the printer compares the requested characteristics with the available device-specific halftone CMRs. If there is a match, the printer uses the selected device-specific halftone CMR when it processes the spooled file. If there is no match, the printer uses the halftone CMR whose line screen frequency value is closest to the one requested.

The Color Management Object Content Architecture (CMOCA) defines several generic halftone CMRs, which cover the most common line screen frequencies and halftone types. A print server that supports CMOCA can interpret generic halftone CMRs if it has device-specific halftone CMRs available to it in a resource directory. If you use AFP Resource Installer, the generic halftone CMRs are installed in every resource library directory that you create and populate by using AFP Resource Installer.

The following topics contain information about the different types of generic halftone CMRs.

Related concepts

Halftone CMR

Halftone CMRs carry the information that a printer uses to convert spooled files into a pattern of dots that it can put on paper. Halftone CMRs can be used with both color and grayscale spooled files.

Indexed CMR
Indexed (IX) CMRs map indexed colors in the data to presentation device colors or colorant combinations.

Indexed CMRs provide rules about how to render indexed colors. Indexed CMRs apply to indexed colors that are specified by using the highlight color space. They do not apply to indexed colors found within PostScript or other non-IPDS data objects. For Indexed CMRs, both instruction and audit processing modes are valid. However, only indexed CMRs with an instruction processing mode are used; CMRs with an audit processing mode are ignored. The tags in the indexed CMR allow the CMR to use various color spaces in the descriptions. These color spaces can be grayscale, named colorants, RGB, CMYK, or CIELAB.

Tone transfer curve CMR
Tone transfer curve CMRs are used to carry tone transfer curve information for an AFP spooled file. A tone transfer curve CMR is used to modify the values of a particular color component and adjust the appearance of some of the colors by increasing or decreasing the amount of ink that is used to emphasize or reduce the effects of dot gain on the final output.

Like halftone CMRs, tone transfer curve CMRs are associated with spooled files specifically or generically. If they are specified generically, the print server looks in the resource directory for tone transfer curve CMRs that match the printer device type and model. If the print server finds an appropriate CMR, it sends the device-specific tone transfer curve CMR to the printer with the spooled file. If the print server does not find an appropriate tone transfer curve CMR, it sends the generic tone transfer curve CMR to the printer.

If a spooled file arrives at the printer that is requesting a generic tone transfer curve CMR, the printer compares the requested characteristics with the device-specific tone transfer curve CMRs that it has available. If there is a match, the print server or printer uses the selected device-specific tone transfer curve CMR when it processes the spooled file. If the printer cannot find a good match for the generic tone transfer curve CMR, it ignores the request and uses its default tone transfer curve CMR.

The Color Management Object Content Architecture (CMOCA) defines several generic tone transfer curve CMRs with different appearance values. The appearance values can be used to specify the dot gain the printer uses when your spooled file is printed.

Generic tone transfer curves can be used to select these appearance values:

- Dark

  The output is adjusted to show a dot gain of 33% for a 50% dot.

- Accutone

  The output is adjusted to show a dot gain of 22% for a 50% dot.

- Highlight Midtone

  The output is adjusted to show a dot gain of 14% for a 50% dot. This appearance might be used to emphasize the brightest part of an image.

- Standard

  The output is adjusted enough to account for the effects of dot gain, effectively counteracting the dot gain.

If you use AFP Resource Installer, it installs the generic tone transfer curve CMRs on your system automatically.

Related concepts
Halftone CMR
Halftone CMRs carry the information that a printer uses to convert spooled files into a pattern of dots that it can put on paper. Halftone CMRs can be used with both color and grayscale spooled files.

Instruction processing mode

CMRs with the instruction processing mode refer to processing that is done to prepare the resource for a specific printer, which uses a certain paper or another device. Generally, instruction CMRs refer to output data and are similar to ICC output profiles.

CMR processing modes
CMR processing modes tell the print system how to apply a CMR to the print data it is associated with. You specify a CMR processing mode whenever you specify a CMR, although not all modes are valid for all CMR types.

The following topics contain information about the different CMR processing modes.

Audit processing mode
CMRs with the audit processing mode refer to processing that was applied to a resource. In most cases, audit CMRs describe input data and are similar to ICC input profiles.

The audit processing mode is used primarily with color conversion CMRs. In audit processing mode, the CMRs indicate which ICC profile must be applied to convert the data into the Profile Connection Space (PCS).

For example, to take a photograph with a digital camera and then include the photograph in an AFP spooled file, you can use AFP Resource Installer to:

1. Create a color conversion CMR from the ICC profile of your camera.
2. Install your photograph in a resource directory.
3. Associate the color conversion CMR with the data object, indicating the audit processing mode.

Then, you create a spooled file that includes the data object. When the spooled file is processed, the system uses the color conversion CMR to convert the colors in the image into the PCS. The colors can then be converted into the color space of the printer that is printing it.

Related concepts
Link color conversion CMR
Link color conversion CMRs combine the processing information that is required to directly convert an image from the color space of an input device to the color space of the output device. Essentially, link color conversion CMRs replace a pair of color conversion CMRs.

Instruction processing mode
CMRs with the instruction processing mode refer to processing that is done to prepare the resource for a specific printer, which uses a certain paper or another device. Generally, instruction CMRs refer to output data and are similar to ICC output profiles.

Link processing mode
CMRs with the link processing mode are used to link an input color space in the presentation data (sometimes defined by an audit CMR) to the output color space of the presentation device (sometimes defined by an instruction CMR). Only link and device link CMRs can be used in link processing mode.

Instruction processing mode
CMRs with the instruction processing mode refer to processing that is done to prepare the resource for a specific printer, which uses a certain paper or another device. Generally, instruction CMRs refer to output data and are similar to ICC output profiles.

The instruction processing mode is used with color conversion, tone transfer curve, and halftone CMRs. In instruction processing mode, the CMRs indicate how the system must convert a resource so it prints correctly on the target printer. The manufacturer of your printer might provide ICC profiles or CMRs that you can use. Those ICC profiles and CMRs might be installed in the printer controller, included with the printer on a CD, or available for download from the manufacturer's website.

If you send a color AFP spooled file to a printer that supports AFP Color Management, color conversion and tone transfer curve CMRs in instruction processing mode can be associated with the spooled file. When the printer processes the spooled file, it applies the CMRs in this order:

1. Color conversion CMRs in audit processing mode to convert the resources into the ICC Profile Connection Space (PCS)

2. Color conversion and tone transfer curve CMRs in instruction processing mode to convert the resources into the color space of the printer
3. Halftone CMR in instruction processing mode to convert the job pages from their digital format into the pattern of dots that the printer can produce

In some cases, CMRs that are often used as instruction CMRs can be used as audit CMRs. For example, if you send a large spooled file to a high-speed printer, the images in the spooled file are converted into the color space of that printer by using a color conversion CMR with the instruction processing mode. However, if you must reprint part of the spooled file on a different printer, the system must convert the spooled file into the color space of the second printer. In that case, the color conversion CMR of the first printer is used in the audit processing mode to move the images back into the PCS. Then, the system uses a color conversion CMR of the second printer in instruction mode to convert the images into its color space.

Related concepts

Link color conversion CMR
Link color conversion CMRs combine the processing information that is required to directly convert an image from the color space of an input device to the color space of the output device. Essentially, link color conversion CMRs replace a pair of color conversion CMRs.

Color conversion CMR
Color conversion CMRs are used to convert colors to and from the ICC Profile Connection Space (PCS), a device-independent color space. You can use them to prepare images for color or grayscale printing.

Tone transfer curve CMR
Tone transfer curve CMRs are used to carry tone transfer curve information for an AFP spooled file. A tone transfer curve CMR is used to modify the values of a particular color component and adjust the appearance of some of the colors by increasing or decreasing the amount of ink that is used to emphasize or reduce the effects of dot gain on the final output.

Halftone CMR
Halftone CMRs carry the information that a printer uses to convert spooled files into a pattern of dots that it can put on paper. Halftone CMRs can be used with both color and grayscale spooled files.

Audit processing mode
CMRs with the audit processing mode refer to processing that was applied to a resource. In most cases, audit CMRs describe input data and are similar to ICC input profiles.

Link processing mode
CMRs with the link processing mode are used to link an input color space in the presentation data (sometimes defined by an audit CMR) to the output color space of the presentation device (sometimes defined by an instruction CMR). Only link and device link CMRs can be used in link processing mode.

Link processing mode
CMRs with the link processing mode are used to link an input color space in the presentation data (sometimes defined by an audit CMR) to the output color space of the presentation device (sometimes defined by an instruction CMR). Only link and device link CMRs can be used in link processing mode.

Whenever you install or uninstall audit or instruction color conversion CMRs in your resource directory by using AFP Resource Installer or a similar software product, the AFP Resource Installer automatically creates or deletes link CMRs for every combination of audit and instruction color conversion CMR.

When a spooled file calls for an audit-instruction combination, the print server checks the resource directory for a link CMR for that combination. If the print server finds an appropriate link CMR, it sends the CMR to the printer with the spooled file. Your printer can use the link CMRs whenever a spooled file indicates that it uses a particular combination of audit and instruction CMRs.

If you do not use AFP Resource Installer or a similar program to install your resources, your color printer must either create link CMRs while it processes your spooled files or convert the colors in your spooled files twice. The first conversion is from the original color space to the PCS and the second is from the PCS to the color space of the printer.

Related concepts

Audit processing mode
CMRs with the audit processing mode refer to processing that was applied to a resource. In most cases, audit CMRs describe input data and are similar to ICC input profiles.

Instruction processing mode
CMRs with the instruction processing mode refer to processing that is done to prepare the resource for a specific printer, which uses a certain paper or another device. Generally, instruction CMRs refer to output data and are similar to ICC output profiles.

Link color conversion CMR
Link color conversion CMRs combine the processing information that is required to directly convert an image from the color space of an input device to the color space of the output device. Essentially, link color conversion CMRs replace a pair of color conversion CMRs.

CMR creation and installation
Device manufacturers and groups that support AFP color standards create CMRs that you can use in your color printing systems. You can also create CMRs yourself, based on your needs.

The AFP Consortium, the group that defined the AFP Color Management Object Content Architecture (CMOCA), identified a set of color conversion CMRs that are most often used in audit processing mode. The set includes color conversion CMRs for common color spaces, such as:

- Adobe RGB (1998)
- sRGB
- SMPTE-C RGB
- SWOP CMYK

The standard CMRs are included with AFP Resource Installer, although they are not installed by default. You can install the standard CMRs that you plan to use. In addition, AFP Resource Installer automatically installs all the generic halftone and tone transfer curve CMRs in any resource directory you create.

Print vendors might have device-specific CMRs that can be downloaded from the company's website.

If you need more CMRs, you can create them using wizards that are provided in AFP Resource Installer. See online help for details about the wizard.

If you use AFP Resource Installer to create a CMR, the software automatically installs the CMR in a resource directory. You can also use AFP Resource Installer to install CMRs that you get from your printer manufacturer.

Data objects
Presentation data objects contain a single type of data (such as GIF, JPEG, PNG, and TIFF images) and can be used in your spooled files. These data objects can be placed directly in a page or overlay or can be defined as resources and included in pages or overlays. Using a data object as a resource is more efficient when that object is used more than once in a spooled file. Resources are downloaded to the printer once and referenced as needed.

Data objects can either be included inline with a spooled file or installed in a resource directory by using software such as AFP Resource Installer. If you install your data objects in a resource directory, you can associate color conversion CMRs with them. For more information about resource directories, see "Resource directory management" on page 26.

Related concepts

DDS AFPRSC keyword

Types of data objects
Image data objects can be stored in a number of different formats, including AFPC JPEG Subset, EPS, GIF, IOCA, PDF, PNG, and TIFF. These image types are device-independent so they can be used by different systems and still be interpreted consistently.

- AFPC JPEG Subset (JPEG)

AFPC (AFP Consortium) JPEG Subset files, formerly called JPEG File Interchange Format (JFIF) files, are bitmap image files that are compressed by using Joint Photographic Experts Group (JPEG) compression. As a result, AFPC JPEG Subset files are most commonly referred to as JPEG files. JPEG files most commonly use the file extension .jpg, but can also use .jpeg, .jpe, .jfif, and .jif. JPEG compression deletes information that it considers unnecessary from images when it converts them. JPEG files vary from having small amounts of compression to having large amounts of compression. The more an image is compressed, the more information is lost. If the image is compressed only once, there usually is no noticeable effect on the image. However, if the image is compressed and decompressed repeatedly, the effects of deleting information become more noticeable.

JPEG compression is commonly used for photographs, especially photographs that are transmitted or displayed on web pages. The compression makes the files small enough to transmit on a network efficiently, but leaves enough information that the image is still visually appealing.

- Encapsulated PostScript (EPS)

EPS is a PostScript graphics file format that follows conventions that Adobe Systems defined. EPS files support embedded ICC profiles.

- Graphics Interchange Format (GIF)

GIF files are bitmap image files that are limited to a palette of 256 RGB colors. Because of the limited color range that it can contain, GIF is not a good format for reproducing photographs, but it is generally adequate for logos or charts. GIF images are widely used on the internet because they are usually smaller than other image formats. GIF files use the file extension .gif.

- Image Object Content Architecture (IOCA)

IOCA is an architecture that provides a consistent way to represent images, including conventions and directions for processing and exchanging image information. The architecture defines image information independently of all data objects and environments in which it might exist and uses self-identifying terms; each field contains a description of itself along with its contents.

- Portable Document Format (PDF)

PDF is a standard file format that Adobe Systems developed. PDF files can be used and stored on various operating systems and contain all the required image and font data. Design attributes in a PDF are kept in a single compressed package.

Note: Single-page and multiple-page PDF files can be used as data objects in AFP spooled files.

- Portable Network Graphics (PNG)

PNG files are bitmap image files that support indexed colors, palette-based images with 24-bit RGB or 32-bit RGBA colors, grayscale images, an optional alpha channel, and lossless compression. PNG is used for transferring images on the internet, but not for print graphics. PNG files use the file extension .png.

- Tagged Image File Format (TIFF)

TIFF files are bitmap image files that include headers to provide more information about the image. TIFF files use the file extensions .tif or .tiff. TIFF files support embedded ICC profiles. If an ICC profile is embedded in a file, the characteristics of the input color space are known whenever the file is used; however, the profiles increase the file size. When you save a file in the TIFF format, you can use various compression algorithms.

Note: Single-image and multiple-image TIFF files can be used as data objects in AFP spooled files.

Not all printers support all types of data objects.

The embedded ICC profiles in EPS, JPEG, and TIFF files contain the information that a printer uses to convert colors in the image from an input color space into the Profile Connection Space (PCS). The input color space might be an industry-standard space or it can describe the color reproduction capabilities of a device, such as a scanner, digital camera, monitor, or printer.

Data object creation and installation

You can use a wide variety of software applications to create or manipulate images to include in spooled files. If you want to store them in central resource repositories, you can use AFP Resource Installer to install them.

The following topics contain information on how to create and install data objects.

Data object creation

Most types of data objects are images of some kind. They might be photographs that were taken with a digital camera, charts or diagrams that were generated by a software tool, or digital drawings that were created by using graphics software. Regardless of how images are created, you generally must manipulate them to include them in spooled files.

The following changes might be needed:

- Convert the image into a file type that is appropriate for printing. For example, the file types that many graphics applications (such as Adobe Illustrator, CorelDRAW, and Corel Paint Shop Pro) use to store images while you work on them are not appropriate for printing. To use images that you create by using any of those programs, you can save or export those files as a different file type, such as EPS, JPEG, or TIFF.

- Make sure that your image files are associated with an appropriate color space or input profile. Follow the instructions that are provided with your graphics software to set up color management, including installing and using ICC profiles for digital cameras and monitors, and customizing color management settings. The instructions should also explain how to change the color profile that an image uses and how to save an image with an embedded profile.

- See "Tips and best practices" on page 27 for tips on creating images and managing them as data object resources.

Related concepts

Tips and best practices
The following general guidelines about creating and managing images and other color resources can improve the performance of your AFP color printing system.

Data object installation

You can use AFP Resource Installer to install your images in a resource directory. AFP Resource Installer includes wizards that can guide you through the process of installing an image as a data object.

When you install an EPS, JPEG, or TIFF image with an embedded ICC profile by using AFP Resource Installer, you can choose how you want to handle the profile:

- Leave the profile in the file without creating a CMR.

- Leave the profile in the file, but also copy the profile and create a CMR from the copy. Associate the new CMR with the data object.

- Remove the profile from the file (to reduce the file size) and make the profile into a CMR. Associate the new CMR with the data object.

For more information about the AFP Resource Installer, see "AFP Resource Installer" on page 28.

Resource directory management

If you store CMRs and data objects in central resource directories, you must understand some of the characteristics of resource directories to make sure that your resources are available when and where you need them.

Resource directories that AFP Resource Installer creates use a resource access table (RAT) as the index of the resource directory. The index is stored as a file in the directory that it refers to. You must store CMRs in resource directories that use a RAT. It is recommended that you store data objects in resource directories that use a RAT as well.

When you use AFP Resource Installer to create a resource directory, it creates a RAT and stores it in the directory. When you install a CMR or data object, AFP Resource Installer updates the RAT with information

about the resource. When a print server looks in a resource directory for a resource, it first looks in the RAT to see whether the resource is listed.

The print server relies on the RAT; if it is incorrect, the print server cannot find resources in the resource directory. As a result, you must always use AFP Resource Installer to manage your resource directories, including to take the following actions:

- Add CMRs and data objects to a resource directory. Do not copy CMRs or data objects directly into the resource directories that AFP Resource Installer uses. If you copy CMRs or data objects into these resource directories, the RAT is not updated so the print server cannot use it to find the CMRs or data objects.
- Modify properties of data objects and CMRs listed in the RAT. Do not directly edit the RAT or any of the files in a resource directory. Do not replace an existing version of a CMR or data object with a new version by copying the new version directly into the resource directory; use AFP Resource Installer to update the resource.
- Install CMRs or data objects in a different resource directory or replicate a resource directory in a different location.

Do not copy CMRs or data objects from a resource directory and store them in another location.

For more information about completing these tasks, see the AFP Resource Installer help.

Tips and best practices
The following general guidelines about creating and managing images and other color resources can improve the performance of your AFP color printing system.
Related concepts
Data object creation
Most types of data objects are images of some kind. They might be photographs that were taken with a digital camera, charts or diagrams that were generated by a software tool, or digital drawings that were created by using graphics software. Regardless of how images are created, you generally must manipulate them to include them in spooled files.

Tips for images
To optimize the performance of your AFP color printing system, it is recommended that you follow some guidelines for creating and including images in spooled files.

When you want to use color images in your spooled files:

- Get the original electronic versions of images instead of scanning existing documents. Almost unnoticeable specks of color in the background of images that were scanned can greatly increase the size of the image. If you must scan an image, use an image-editing tool to clean up the background as much as possible.
- Save all images in the same standard color space so you need only one input profile for all of them. Adobe RGB (1998) is the recommended color space for images that are to be printed.
- Flatten multi-layer images (such as the ones you can create in graphics tools like Adobe Illustrator and Corel Paint Shop Pro) before you include them in spooled files. Unflattened images are large and more difficult to work with. Save a copy of the original image for future editing, but flatten the version that you include in your spooled file.

Tips for resources
To optimize the performance of your AFP color printing system, it is recommended that you follow some guidelines for managing color resources.

You can use AFP Resource Installer to provide the following functions:

- Install all the CMRs for your printer in a resource directory.
- Install the data objects that you use frequently in a resource directory.
- Mark the CMRs and data objects that are reused regularly as non-private, capturable resources so they can be saved on the printer and used for other spooled files without being downloaded every time.

Note: This option is not advisable for secure resources, such as signature files.

- Associate audit color conversion CMRs with data objects that require color management, so the embedded profiles can be removed from the image files.

AFP Resource Installer

AFP Resource Installer is a key element of an AFP color management system when resources are stored in central resource directories. You can use it to create, install, and manage color management resources (CMRs) and data objects for use in your system.

AFP Resource Installer is a Java application that you install on a Windows workstation. You can use it to install and work with fonts in addition to CMRs and data objects.

You can use AFP Resource Installer to:

- Create CMRs from existing data, including ICC profiles.

  You can use a wizard to guide you through the process.
- Install CMRs, fonts, and data objects in resource directories on the local system or on any system that you can access with FTP.
- Associate CMRs with data objects, so data objects can be reproduced accurately on different printers.

  In some cases, you can reduce the file size of your images by removing the embedded color profile from the file and using an associated CMR.
- Mark resources as capturable.

  Capturable resources can be captured and saved in the printer for use with other spooled files, which can help improve system performance. The print server queries the printer before it sends any resources; if the printer already has the resource, the print server does not need to send it.
- Mark resources as private.

  Private resources cannot be captured in the printer and must be downloaded with every spooled file that uses them. For example, you can mark signature files that are used for company checks as private for security reasons.

When you use AFP Resource Installer to install a color conversion CMR, the software automatically creates link (LK) CMRs between the new color conversion CMR and the existing color conversion CMRs. When a spooled file references the new CMR, the print server automatically downloads the link CMRs that match the target device type and model and sends them to the printer with the spooled file. If one of those link CMRs is appropriate, the printer can use it instead of having to spend extra time to create a link CMR.

Note: In order for PSF to use resources installed by AFP Resource Installer, you must add the resource directory path to the appropriate system-level environment variable:

- For CMRs, use QIBM_AFP_CMR_PATH.
- For data object resources, use QIBM_AFP_RESOURCES_PATH.

For more information about the AFP Resource Installer, see AFP Resource Installer
 (http://www.infoprintsolutionscompany.com/internet/ipww.nsf/vwwebpublished/swtp_afp-resource-installer_en).

TrueType and OpenType fonts

There is extensive operating system support for TrueType fonts, and they are popular with PC applications. Consequentially, TrueType is probably the most prevalent font technology in the industry today. OpenType is an extension of the TrueType font format.

The OpenType font format allows better support for international character sets and provides broader multiplatform support. The OpenType format allows both TrueType or Adobe Type 1 outline fonts to be packaged as a TrueType font. OpenType fully supports Unicode. Advanced Function Presentation data stream (AFPDS) accepts Unicode UTF-8 or UTF-16.

Related concepts

AFP fonts
A font is a collection of characters of a certain size, typeface, and type style. Advanced Function Presentation (AFP) fonts, also called Font Object Content Architecture (FOCA) fonts, are the standard fonts used for Intelligent Printer Data Stream (IPDS) output. AFP fonts are made up of a code page and a character set. All AFP fonts are encoded as either single-byte or double-byte fonts, depending on the language for which they are being used.

Obtaining AFP resources
There are many sources of Advanced Function Presentation (AFP) resources.

Specifying a TrueType or OpenType font
You can specify a TrueType font anywhere that you can specify an Advanced Function Presentation (AFP) font. You can also mix references to TrueType and AFP fonts. However, TrueType fonts are referenced differently than AFP fonts.

Purchasing fonts
IBM offers several different font products that you can purchase, depending on your needs.

Resource access tables

When you install a TrueType font with the AFP Resource Installer from Ricoh, the installer creates a resource access table (RAT). This table has a hard-coded name and is used to find fonts on your system.

For more information about the AFP Resource Installer, see AFP Resource Installer
 (http://www.infoprintsolutionscompany.com/internet/ipww.nsf/vwwebpublished/swtp_afp-resource-installer_en).

How TrueType and OpenType fonts differ from AFP fonts

When using TrueType fonts, you will see differences in how the fonts are specified, managed, and installed when compared to Advanced Function Presentation (AFP) fonts.

Note: In this topic, the term TrueType refers to both TrueType and OpenType fonts.

Table 1. Differences between AFP and TrueType or OpenType fonts

AFP fonts	TrueType fonts
AFP fonts are IBM i objects.	TrueType fonts are stream files in the integrated file system.
DDS keyword FNTCHRSET is used to select AFP fonts.	DDS keyword FONTNAME is used to select TrueType fonts.

Table 1. Differences between AFP and TrueType or OpenType fonts (continued)

AFP fonts	TrueType fonts
Print Services Facility (PSF) uses a defined search algorithm to search for AFP fonts. It searches the library list that is associated with the job for a matching font.	TrueType fonts reside in one or more of the following locations. • The directories that are specified in the QIBM_FONT_RESOURCES_PATH environment variable. • /QIBM/UserData/OS400/Fonts/TTFonts. This directory contains user fonts. • /QIBM/ProdData/OS400/Fonts/TTFonts. This directory contains IBM-supplied fonts. You can specify additional directories for user fonts by using environment variable QIBM_FONT_RESOURCES_PATH. One or more directories, which are separated by a colon, can be specified. When searching for fonts, the system looks to see whether there are any paths that are set in the environment variable QIBM_FONT_RESOURCES_PATH. If so, those paths are searched first. Then the UserData path is searched, followed by the ProdData path.
AFP fonts are created and managed using the font resource commands: CHGCDEFNT, CHGFNTRSC, CRTFNTRSC, DLTFNTRSC, DSPCDEFNT, DSPFNTRSCA, and WRKFNTRSC.	TrueType fonts have no IBM i management commands. Instead, the fonts are installed using the "AFP Resource Installer" on page 28. The generated resource access table resides in the /QIBM file system.
An AFP font is specified by using the *FNTRSC object name such as C0D0GT10.	TrueType fonts are specified using a font name such as Times New Roman.
AFP fonts can be substituted when the requested font is not available.	There is no font substitution with TrueType fonts.
An AFP font is marked as eligible for capture with the Change Font Resource (CHGFNTRSC) command.	TrueType fonts are marked as eligible for capture by the "AFP Resource Installer" on page 28.
PSF tries to capture AFP fonts only if the PSF configuration object specifies FNTCAPTURE(*YES).	PSF always tries to capture TrueType fonts.

Related concepts

AFP fonts
A font is a collection of characters of a certain size, typeface, and type style. Advanced Function Presentation (AFP) fonts, also called Font Object Content Architecture (FOCA) fonts, are the standard fonts used for Intelligent Printer Data Stream (IPDS) output. AFP fonts are made up of a code page and a character set. All AFP fonts are encoded as either single-byte or double-byte fonts, depending on the language for which they are being used.

Specifying a TrueType or OpenType font
You can specify a TrueType font anywhere that you can specify an Advanced Function Presentation (AFP) font. You can also mix references to TrueType and AFP fonts. However, TrueType fonts are referenced differently than AFP fonts.

Related reference

Specifying an AFP font

There are many different tools you can use to specify Advanced Function Presentation (AFP) fonts in your document. Each tool has different capabilities.

Resource libraries

Advanced Function Presentation (AFP) resource libraries group resources of the same type.

For example, a page segment library might contain images of the company logo in several different sizes.

Resource library lists

A resource library list specifies the libraries that are searched for the Advanced Function Presentation (AFP) resources needed to process a spooled file.

There are two types of resource library lists: user and device.

User resource library list
> Specifies what user libraries are searched when processing your spooled files. It might vary from user to user.

Device resource library list
> Specifies what libraries are searched when using a specific device, regardless of who is using the device. This list does not change from user to user but can vary from device to device.

There are several reasons to use library lists:

- You can ensure that the necessary libraries are actually in the library list that Print Services Facility (PSF) uses.
- They can improve performance when you specify only the libraries that need to be searched. For example, you can specify one set of libraries for a 240-pel printer and another set for a 300-pel printer.

When searching for resources, the user library list is searched first and then the device library list. The libraries are searched in the order listed. You can specify a user resource library list and a device resource library list in the PSF configuration object.

Related concepts
Ensuring that you have the necessary AFP resources
You need to determine what resources you need for your Advanced Function Presentation (AFP) application and ensure that they are stored in appropriate locations.

Related tasks
Search order of library list
Print Services Facility (PSF) uses the user library list and device library list to search for the AFP resources that you specify.

Receiving AFP resources from another system
When you receive Advanced Function Presentation (AFP) resource data from an operating system other than IBM i, you typically cannot change the resource. If you want to change the resource, it must be changed on the originating operating system and then resent to IBM i.

Printing data sent to IBM i from zSeries
PSF can print data that was generated on zSeries. This data might be AFP, AFPDSLINE (AFP data mixed with line data), or line data. The data might be sent to network files or directly to an output queue.

AFP font libraries

IBM supplies several AFP font libraries. In addition, you can create a library list that allows AFP to locate and use other fonts.

When a printer writer is started for an Advanced Function Presentation (AFP)-configured printer and a font is specified, the operating system searches in these locations:

1. User library list
2. IBM-supplied font libraries

The IBM-supplied font libraries are:

- QFNTCPL

  This library contains the AFP Compatibility Fonts. These are the fonts included with IBM i.

- Single-byte character set font libraries numbered QFNT01 through QFNT19 and double-byte character set font libraries numbered QFNT61 through QFNT69.

  These are the font libraries that support various IBM licensed programs on IBM i.

Any of the libraries in the previous list that are found are put in the library list of the job printing the spooled file. These libraries are then available to the device even if they were not in the library list of the user that created the spooled file. Also, if you have acquired additional font resources, you can store them in these IBM-supplied font libraries. Storing them in the IBM-supplied libraries provides widespread access to the font.

You can use a font that is not in one of the QFNT*xx* libraries. To do so, add the library containing the font to your library list when you create the spooled file.

For information about specifying a different font library list on a printer, see the Resource library lists topic.

To list the font libraries available on your system and the fonts in them, use the WRKFNTRSC command.

Related concepts
AFP fonts
A font is a collection of characters of a certain size, typeface, and type style. Advanced Function Presentation (AFP) fonts, also called Font Object Content Architecture (FOCA) fonts, are the standard fonts used for Intelligent Printer Data Stream (IPDS) output. AFP fonts are made up of a code page and a character set. All AFP fonts are encoded as either single-byte or double-byte fonts, depending on the language for which they are being used.

Ensuring that you have the necessary AFP resources
You need to determine what resources you need for your Advanced Function Presentation (AFP) application and ensure that they are stored in appropriate locations.

Related reference
Work with Font Resources (WRKFNTRSC) command

PSF configuration options

PSF allows you to specify printing options in several ways.

Print Services Facility (PSF) configuration objects allow you to enable print functions like Intelligent Printer Data Stream (IPDS) pass-through, IPDS-to-PDF transform support, printer sharing, and automatic system recovery. Printer files and resources such as form definitions and page definitions control the appearance of printed output.

Related tasks
Configuring PSF
You can configure Print Services Facility (PSF) by using the printer device description or by using a PSF configuration object.

PSF configuration objects

A Print Services Facility (PSF) configuration object lets you specify Intelligent Printer Data Stream (IPDS) printer customization options that you cannot specify elsewhere.

These are some of the print functions that you can enable or disable with a PSF configuration object:

- "IPDS pass-through" on page 33
- IPDS-to-PDF transform
- Session and IPDS dialog sharing

- "Resource library lists" on page 31
- "Automatic session recovery" on page 66
- Offset stacking and edge marking
- Public data authority for directories created by PSF

Related concepts

Specifying a PSF configuration object
Specify a PSF configuration object in the device description for the printer.

Enabling IPDS pass-through support
When IPDS pass-through support is enabled for a printer, all eligible files spooled to that printer are processed without conversion to AFPDS and to printer-specific IPDS.

Related tasks

Configuring PSF
You can configure Print Services Facility (PSF) by using the printer device description or by using a PSF configuration object.

Search order of library list
Print Services Facility (PSF) uses the user library list and device library list to search for the AFP resources that you specify.

IPDS pass-through

IPDS pass-through allows you to process some SCS and IPDS spooled files more efficiently.

Before printing, SNA character string (SCS) files are converted to Intelligent Printer Data Stream (IPDS) files. These are then converted to Advanced Function Presentation data stream (AFPDS), and then to printer-specific IPDS. Also, IPDS files are converted to AFPDS, then are converted to printer-specific IPDS. The final IPDS files have specific commands for your printer. You can choose to skip the conversion to AFPDS and to printer-specific IPDS. This is called IPDS pass-through. IPDS pass-through is specified on a PSF configuration object.

Specifying IPDS pass-through in the PSF configuration object allows only those spooled files eligible for IPDS pass-through to bypass the extra transforms. Those spooled files not eligible for IPDS pass-through are still transformed to AFPDS and then to printer-specific IPDS.

Figure 2 on page 34 shows the data stream origination, flow, and conversion for a spooled file when IPDS pass-through support is enabled.
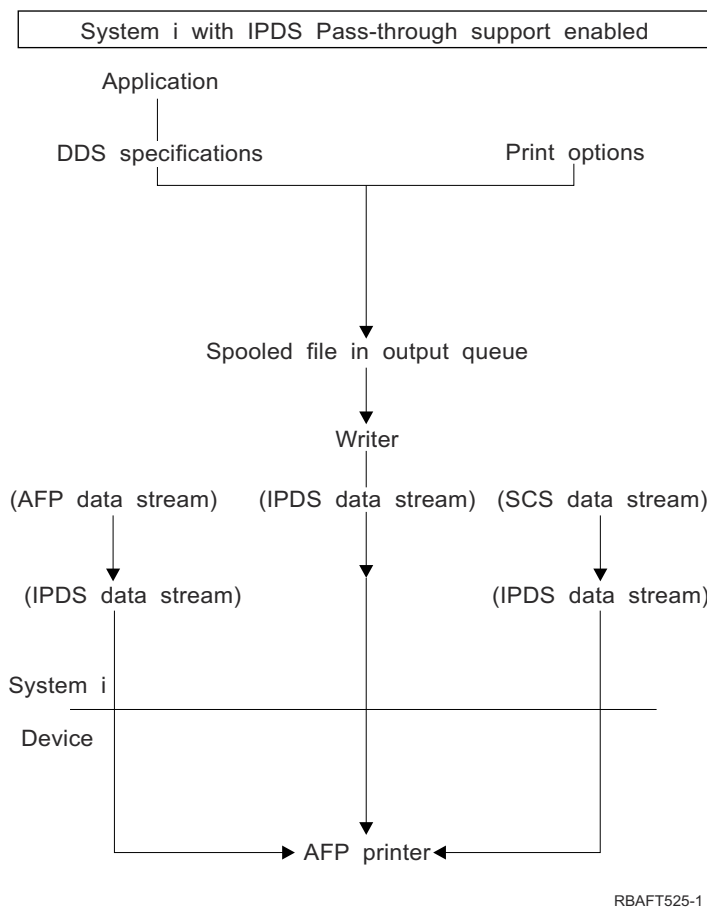
```
┌─────────────────────────────────────────────────────────┐
│      System  i  with  IPDS  Pass-through  support  enabled  │
└─────────────────────────────────────────────────────────┘
                Application
                    │
    DDS  specifications              Print  options
                    │                    │
                    └──────────┬─────────┘
                               │
                               ▼
                Spooled  file  in  output  queue
                               │
                               ▼
                            Writer
                               │
    (AFP  data  stream)   (IPDS  data  stream)   (SCS  data  stream)
         │                     │                      │
         ▼                     ▼                      ▼
    (IPDS  data  stream)                      (IPDS  data  stream)
         │                     │                      │
System  i│                     │                      │
─────────┼─────────────────────┼──────────────────────
Device   │                     │                      │
         │                     │                      │
         │                     ▼                      │
         └──────────►  AFP  printer ◄─────────────────┘

                              RBAFT525-1
```

Figure 2. Spooled file conversion with IPDS pass-through support

Consider using IPDS pass-through if one of these apply:

- You have applications that generate SCS or IPDS data streams when printing to an Advanced Function Presentation (AFP) printer.
- You are using applications such as the IBM Business Graphics Utility for IBM i licensed program, GDDM, or Virtual Print that do not support AFPDS.
- Your SCS or IPDS application does not contain any reference to overlays or to host font character sets.

Limitations of IPDS pass-through

These IPDS pass-through limitations determine whether a spooled file or printer is eligible for IPDS pass-through:

- Some SCS or IPDS spooled files are not eligible for IPDS pass-through. One such situation is when they contain special functions that require being transformed to AFPDS for the spooled file to print correctly.

  Spooled files that contain the following data or printer file attributes are not eligible for IPDS pass-through:

  – For SCS or IPDS data streams, the data stream contains Image Object Content Architecture (IOCA) or IM1.
  – For SCS or IPDS data stream, a front or back overlay was specified in the printer file.
  – For SCS data stream, IGCDTA(*YES) was specified in the printer file.
  – For SCS or IPDS data streams, MULTIUP with REDUCE(*NONE) was specified in the printer file.
  – For SCS or IPDS data stream, a form definition was specified in the printer file.
  – The EDGESTITCH or CORNERSTPL finishing operation is specified in the printer file.

If IPDS pass-through is specified but the spooled file is ineligible, a diagnostic message is sent and the spooled file is processed as usual. It is transformed to AFPDS and then to printer-specific IPDS.

- IPDS pass-through support is available for any IPDS printer that provides resident fonts. This is because the resident fonts referenced in the data stream must be mapped to the host fonts, which are downloaded to the printer. Therefore, IPDS pass-through support is not available for these IPDS printers: 3820, 3825, 3827, 3828, 3829, 3831, 3835, and 3900-001.

When a printer writer is started to an AFP(*YES) printer that does not support IPDS pass-through and IPDSPASTHR(*YES) is specified, a diagnostic message is sent. The spooled file is transformed to AFPDS and then to printer-specific IPDS.

Related concepts

Enabling IPDS pass-through support
When IPDS pass-through support is enabled for a printer, all eligible files spooled to that printer are processed without conversion to AFPDS and to printer-specific IPDS.

How page definitions, form definitions, and printer files interact

You can use a printer file to specify some of the same options as you can specify with a page definition and a form definition. This topic describes how PSF chooses an option when a printer file is used with a page definition and form definition.

Page definition and the printer file

When you specify a page definition on the printer file, some printer file parameters might be ignored when the spooled file is printed through Print Services Facility (PSF). For example, if you specify a page definition and also specify line data or mixed data, an inline page definition is not built. In this case, the following happens:

- If you send line data with a printer file to an Advanced Function Presentation (AFP) printer, PSF ignores these printer file parameters:
  - CDEFNT
  - CHRID
  - CPI
  - FNTCHRSET
  - FOLD
  - FONT
  - LPI
  - MULTIUP
  - PAGESIZE
  - PAGRTT
  - REDUCE
- If you send the line data with a page definition to a non-AFP printer with a device type of *LINE, the page definition parameter is ignored and the printer file parameters are used. The line data is converted to SNA character string (SCS) or Intelligent Printer Data Stream (IPDS).

Form definition and the printer file

When using a form definition, depending on the specifications given, some printer file parameters might be ignored when output is printed through PSF. For example, if you specify a form definition, an inline form definition is not built. In this case, if you send the line data with a form definition to an AFP device, PSF ignores these printer file parameters:

- BACKMGN
- CORNERSTPL

- EDGESTITCH
- FORMFEED
- FRONTMGN
- MULTIUP (N_UP)
- PAGRTT
- PRTQLTY
- REDUCE (N_UP)
- SADLSTITCH

However, if you send the line data with a form definition to a non-AFP printer with a device type of *IPDS or *SCS in this example, the form definition parameter is ignored and the printer file parameters are used.

When specifying a form definition, the values you specify on the printer file's DRAWER and DUPLEX parameters override those values specified in the form definition. To use the drawer and duplex values specified in the form definition, specify DRAWER(*FORMDF) and DUPLEX(*FORMDF) on the printer file.

Related concepts

Form definitions
A form definition is an Advanced Function Presentation (AFP) resource object that defines the characteristics of the physical form to be printed on.

Page definitions
Page definitions are resources that format and compose line data into logical pages.

Page segments
Page segments are objects containing composed text and images that are prepared before formatting and included during printing.

Specifying a form definition
To use or identify a fully qualified form definition, specify a value in the FORMDF parameter with a CL command.

Specifying a page definition
To use or identify a fully qualified page definition, specify the PAGDFN parameter on a CL commands.

Specifying a PSF configuration object
Specify a PSF configuration object in the device description for the printer.

Planning for AFP

Use this information to help plan how to use Print Services Facility (PSF) in your environment.

Before using Advanced Function Presentation (AFP), use these topics to help you get ready.

Determining whether PSF is required

You must install PSF if you use certain printers, use IBM i to print line or mixed-mode data, or use certain printer file parameters or DDS keywords.

The Print Services Facility (PSF) feature is required if your printer falls into one of these categories:

- Any TCP/IP attached IPDS printer.
- Any Twinax attached IPDS printer that uses PSF functions. See the lists of printer file parameters and data description specifications (DDS) keywords that require PSF.

PSF is also required in these situations:

- IBM i is used to print any line or mixed-mode data.
- You use any of the parameters listed below.

Printer file parameters that require PSF

- AFP characters (AFPCHARS)
- Back overlay (BACKOVL) (requires PSF when printing to a device with type *SCS)
- Corner staple (CORNERSTPL)
- Device type (DEVTYPE= *LINE, or *AFPDSLINE)
- Edge stitch (EDGESTITCH)
- Font resolution for formatting (FNTRSL)
- Front overlay (FRONTOVL) (requires PSF when printing to a device with type *SCS)
- IPDS pass-through (IPDSPASTHR)
- Multi-up (MULTIUP REDUCE(*NONE))
- Page definition (PAGEDEF)
- Saddle stitch (SADLSTITCH)
- Table reference characters (TBLREFCHR)
- User-defined data (USRDFNDTA ('AFPRESPOOL(*PRINT|*NOPRINT)'))
- User-defined data (USRDFNDTA ('IPDSPASTHR(*YES|*NO)'))
- User-defined data (USRDFNDTA ('MAILSENDER(*mail-sender-name*)'))
- User-defined data (USRDFNDTA ('MAILTAG(*mail-tag | e-mail address*)'))
- User-defined data (USRDFNDTA ('PDFENCRYPT(*STMF | *SPLF | *NOMAIL)'))
- User-defined object (USRDFNOBJ (*PSFCFG))
- User resource library list (USRRSCLIBL(*DEVD))

DDS keywords that require PSF

- Document Index Tag (DOCIDXTAG)
- End page group (ENDPAGGRP)
- Graphic data file (GDF)
- Invoke data map (INVDTAMAP)
- Start page group (STRPAGGRP)
- Staple (STAPLE)
- Z-fold (ZFOLD)

Installing PSF

This topic points to instructions for installing PSF and lists installation options.

To install Print Services Facility (PSF) , follow the instructions in the Installing, upgrading, or deleting IBM i and related software topic.

PSF options

There are three options associated with PSF. Depending on what you purchase, you will be issued a key for one of these options:

- 36: PSF 1–55 pages per minute license
- 37: PSF 1–100 pages per minute license
- 38: PSF Any speed license

Related tasks

Installing, upgrading, or deleting IBM i and related software

Ensuring that you have the necessary AFP resources

You need to determine what resources you need for your Advanced Function Presentation (AFP) application and ensure that they are stored in appropriate locations.

Resource objects contain data and control information that can be used by a printing job. Resources can be shared by different pages and different print data sets. Examples of resources are fonts, which define the characters used to print text, and page segments, which can include images and text. Resources can be stored and accessed from within the operating system being used. By referring to the name of the stored resource, many data streams can share the same resources.

Most resources should be placed in a library that is defined to your library list when you initially sign on the system. However, some resources, such as TrueType fonts and object containers, are stored in the integrated file system. True Type Fonts must be stored in specific directories but you can store object containers in any directory.

Related concepts

AFP font libraries
IBM supplies several AFP font libraries. In addition, you can create a library list that allows AFP to locate and use other fonts.

AFP resources
Advanced Function Presentation (AFP) resource objects contain data and control information.

Resources in the integrated file system
Print Services Facility (PSF) can process several types of Advanced Function Presentation (AFP) and non-AFP resources that are stored in the integrated file system. These are objects that are not stored within a page segment or overlay.

Resource library lists
A resource library list specifies the libraries that are searched for the Advanced Function Presentation (AFP) resources needed to process a spooled file.

Obtaining AFP resources
There are many sources of Advanced Function Presentation (AFP) resources.

Getting started with AFP

Use this information to help you get started using PSF by using AFP resources and creating AFP data.

Use the information in these topics to get started using Advanced Function Presentation (AFP).

Obtaining AFP resources

There are many sources of Advanced Function Presentation (AFP) resources.

Some of the resources are included with the system. You can download resources from another system, or they can come inline with the data that is to be printed. Form definitions, fonts, page segments, overlays, and page definitions are examples of resources that can come from another system. Additionally, you can create overlays and page segments yourself using the IBM Infoprint Designer for iSeries licensed program (5733-ID1). You can generate page segments and overlays from existing images using the IBM Infoprint Server for iSeries licensed program (5722-IP1).

Related concepts

AFP fonts
A font is a collection of characters of a certain size, typeface, and type style. Advanced Function Presentation (AFP) fonts, also called Font Object Content Architecture (FOCA) fonts, are the standard fonts used for Intelligent Printer Data Stream (IPDS) output. AFP fonts are made up of a code page and a character set. All AFP fonts are encoded as either single-byte or double-byte fonts, depending on the language for which they are being used.

Form definitions

A form definition is an Advanced Function Presentation (AFP) resource object that defines the characteristics of the physical form to be printed on.

Object containers
Object containers are used to carry non-Object Content Architecture (OCA) objects in an Advanced Function Presentation (AFP) data stream.

Overlays
Overlays, also known as electronic forms, are a collection of predefined data such as lines, shading, text, boxes, or logos. They can be merged with variable data on a sheet while a spooled file is being processed.

Page definitions
Page definitions are resources that format and compose line data into logical pages.

Page segments
Page segments are objects containing composed text and images that are prepared before formatting and included during printing.

TrueType and OpenType fonts
There is extensive operating system support for TrueType fonts, and they are popular with PC applications. Consequentially, TrueType is probably the most prevalent font technology in the industry today. OpenType is an extension of the TrueType font format.

Ensuring that you have the necessary AFP resources
You need to determine what resources you need for your Advanced Function Presentation (AFP) application and ensure that they are stored in appropriate locations.

Fonts provided by IBM i

IBM i AFP Compatibility Fonts is included free of charge in the IBM i base operating system.

AFP Compatibility Fonts can be installed as an option on any IBM i system. The fonts are downloadable 240-pel raster fonts and are installed in font library QFNTCPL.

The 240- and 300-pel versions of the AFP Compatibility Fonts are provided in the IBM AFP Font Collection for Workstations and OS/400® licensed product.

When your operating system was loaded, you chose to install or not install IBM-supplied fonts. If you did not install the fonts and now want to install them, see Installing, upgrading, or deleting IBM i and related software for instructions.

The compatibility set is provided to allow IBM i applications that use resident fonts to print on the 3820, 3825, 3827, 3828, 3829, 3831, 3835, and 3900 model 1 printers. The numeric font identifiers specified in the application are translated into one of the fonts in the compatibility set.

The AFP Compatibility Fonts feature includes both uniformly spaced and mixed-pitch type families at 240-pel resolution. These font families are included:

- APL
- Boldface
- Courier
- Document
- Essay
- Format
- Gothic
- Orator
- Prestige
- Proprinter Emulation
- Roman
- Script

- Serif

- Symbol Set

- Text

In addition to these 240-pel raster fonts, the compatibility set includes a number of code pages that are downloadable to printers. For use on printers that support outline fonts, the compatibility set also includes a Letter Gothic outline font that contains the euro symbol.

To determine the fonts that are available on your system, use the WRKFNTRSC command.

Related concepts
Purchasing fonts
IBM offers several different font products that you can purchase, depending on your needs.

Related tasks
Installing, upgrading, or deleting IBM i and related software PDF
Related information
Font Summary for AFP Font Collection (S544-5633) PDFThis publication describes the AFP Compatibility Fonts.

Purchasing fonts

IBM offers several different font products that you can purchase, depending on your needs.

IBM AFP Font Collection for AS/400, v3.1 (Program 5733-B45)
    IBM AFP Font Collection for i is the current and recommended AFP font product. It replaces IBM Infoprint Fonts for Multiplatforms (Program 5648-E77) and the IBM AFP Font Collection for Workstations and OS/400 (Program 5648-B45).

IBM Advanced Function Printing Fonts for AS/400 (Program 5769-FNT)
    This licensed program is only required for compatibility with older font technology.

IBM Advanced Function Printing DBCS Fonts for AS/400 (Program 5769-FN1)
    This licensed program is only required for compatibility with older font technology.

There are many sources of TrueType fonts. However, not all TrueType fonts are suitable for use in Advanced Function Presentation (AFP). In general, a TrueType font that is to be installed and referenced in an AFP system must be Unicode-enabled. A Unicode-enabled font has these characteristics:

- It must contain a Microsoft Unicode subtable that is identified by platform ID = 3 (Microsoft) and platform-specific encoding ID = 1 (Unicode, UTF-16).

- It must specify a full font name (Name ID 4) using the same encoding in the naming table.

The TrueType fonts included with IBM i and installed with option 43 Additional fonts are suitable for use in AFP.

Related concepts
TrueType and OpenType fonts
There is extensive operating system support for TrueType fonts, and they are popular with PC applications. Consequentially, TrueType is probably the most prevalent font technology in the industry today. OpenType is an extension of the TrueType font format.

Fonts provided by IBM i
IBM i AFP Compatibility Fonts is included free of charge in the IBM i base operating system.

Related information
IBM AFP Font Collection for i, V3.1

Creating AFP resources

There are several different ways to create the Advanced Function Presentation (AFP) resources that you need.

Creating page segments and overlays

There are several tools available for you to use to create page segments and overlays:

- The IBM Infoprint Designer for iSeries licensed program lets you design and create page segments and overlays and upload them to the iSeries.
- The IBM Infoprint Server for iSeries licensed program lets you create page segments and overlays from Joint Photographic Experts Group (JPEG), Graphics Interchange Format (GIF), and Tagged Image File Format (TIFF) images.
- The AFP Manager component of System i® Navigator lets you build a file on your system as a page segment or overlay. This file must already be in AFP resource format. This tool is useful for migrating AFP resources from other systems to the IBM i.
- The AFP printer driver creates AFP documents, overlays, and page segments from your Windows applications.

Creating page definitions and form definitions

Page definitions and form definitions are created automatically with Infoprint Designer when you create an overlay.

Receiving AFP resources from another system

When you receive Advanced Function Presentation (AFP) resource data from an operating system other than IBM i, you typically cannot change the resource. If you want to change the resource, it must be changed on the originating operating system and then resent to IBM i.

Follow these steps to receive an AFP resource from another system:

1. Place the received resource in a data file.
2. Start an System i Navigator session.
3. Expand **My Connections** (or your active environment).
4. If you do not have an AFP Manager icon, install AFP Manager as follows: Right-click **My Connections** (or your active environment) and select **Install Options** > **Selective Setup**.
5. Expand **Resources**.
6. Right-click the appropriate resource type and select **Import**.
7. Specify the name of the source file and the name and location for the new resource to be created.

Related concepts

Resource library lists
A resource library list specifies the libraries that are searched for the Advanced Function Presentation (AFP) resources needed to process a spooled file.

Sending data from zSeries to IBM i
Use these instructions to receive and print data and resources from zSeries systems to your IBM i.

Receiving resources and AFPDS data sent to network files
To make receiving resources and Advanced Function Presentation data stream (AFPDS) data as easy as possible, you should be aware of these points.

Sending data from zSeries to IBM i network files

The examples in this topic show how to send print data and resources from a zSeries system to an IBM i network file.

Receiving fonts from zSeries

Fonts can be downloaded to IBM i from zSeries systems.

Check your licensing agreements to see if they preclude the transfer of printer resources between operating systems.

Downloaded font resources cannot be altered by the IBM i operator. If changes need to be made to any font resources, the zSeries site must be notified.

When these font resources are received from the zSeries system, you place them in a data file. To convert these font resources to a format that can be used by IBM i, use the Create Font Resource (CRTFNTRSC) command.

3800 Printer font restrictions on IBM i

- You can receive data from a zSeries system that was generated to print on a 3800 printer using 3800 printer font character sets. However, IBM i does not support the 3800 printer and its font character sets. Therefore, you should not receive 3800 printer font character sets on IBM i.
- If you have Advanced Function Presentation (AFP) data that calls for a 3800 font and you have the 3800 printer font character sets on the system, IBM i tries to use them. You get an error when the data prints.
- Instead, download the 3820 printer font character sets from the zSeries system. When the data generated for the 3800 printer starts to print, IBM i substitutes the 3820 printer font character sets.
- The naming convention for 3800 printer font character sets is C1*xxxxxx*. The naming convention for 3820 printer font character sets is C0*xxxxxx*.

Related concepts

Sending data from zSeries to IBM i network files

The examples in this topic show how to send print data and resources from a zSeries system to an IBM i network file.

Related reference

Create Font Resource (CRTFNTRSC) CL command

Receiving AFP resources inline in the data stream

Advanced Function Presentation (AFP) resources can be part of the data received from another system, such as a zSeries system.

These resources can only be used in that data stream. They cannot be saved to your IBM i system in a data file and converted to an AFP resource.

Receiving resources and AFPDS data sent to network files

To make receiving resources and Advanced Function Presentation data stream (AFPDS) data as easy as possible, you should be aware of these points.

- Make sure you do not send line data or mixed data (AFPDSLINE data) to network files.
- The AFPDS files, as they exist on z/OS, are in variable-length record format. Make sure the z/OS site converts the AFPDS files to a fixed-length record format. If this is not done before sending the AFPDS files, large amounts of IBM i disk space are required. You need to reach an agreement with the z/OS site as to what fixed-length record format you will use; for example, 4000 bytes. AFPDS records longer than the fixed-length record size must be converted into multiple fixed-length records. Pad the last record with blank characters if necessary.
- Before receiving AFPDS files from z/OS, you should consider creating a fixed-length physical data file to hold the files from z/OS. The CL command to do this is Create Physical File (CRTPF).

  The length of the records in the physical data file should be the number that you and the z/OS site agreed to; for example, 4000 bytes.

When resource data is received from z/OS, convert the resources to a format that can be used by IBM i. These commands are in the "Creating AFP resources" on page 41 topic.

Creating a physical file

Many types of resources are sent to the IBM i system. Administratively, it is more convenient to store the different types of resources in separate physical files. That is, put all the font data in a physical file that contains only fonts, the overlay data in a physical file that contains only overlays, and so on.

This command creates a physical file that can receive resources and AFPDS data:

```
CRTPF FILE(MYLIB/MYFILE) RCDLEN(4000) MBR(*NONE) MAXMBRS(*NOMAX) LVLCHK(*NO)
```

Examples: Using the Work with Network Files (WRKNETF) and Receive Network File (RCVNETF) commands

Use the Work with Network Files (WRKNETF) and Receive Network File (RCVNETF) commands to receive, delete, browse, or submit (print) files.

This command lets you work with the network files for USR1 and prints the output with the job's spooled output. This command can only be issued by USR1, a member of the USR1 group, or a user with security officer authority.

```
WRKNETF USER(USR1) OUTPUT(*PRINT)
```

This command lets you work with the network files for all users and is written to the first member of the specified database file. If the file exists in a library on the library list, the existing file is used; otherwise, the file is created in library QGPL. If the file did not exist, or did not contain any members, a member with the same name as the file is added to the file. Otherwise, the first member of the file is cleared and used. Only a user with security officer authority can issue this command.

```
WRKNETF USER(*ALL) OUTPUT(*OUTFILE) OUTFILE(NETFILES)
```

This command receives the network file SCRIPT, member $REPORT, into a physical file named MYFILE in library MYLIB. The new member in MYFILE is $REPORT.

```
RCVNETF FROMFILE(SCRIPT) TOFILE(MYLIB/MYFILE) FROMMBR($REPORT)
```

Related concepts

Sending data from zSeries to IBM i
Use these instructions to receive and print data and resources from zSeries systems to your IBM i.

Related tasks

Printing data sent to IBM i from zSeries
PSF can print data that was generated on zSeries. This data might be AFP, AFPDSLINE (AFP data mixed with line data), or line data. The data might be sent to network files or directly to an output queue.

Receiving AFP resources from another system
When you receive Advanced Function Presentation (AFP) resource data from an operating system other than IBM i, you typically cannot change the resource. If you want to change the resource, it must be changed on the originating operating system and then resent to IBM i.

Related reference

Create Physical File (CRTPF) CL command
Receive Network File (RCVNETF) CL command
Work with Network Files (WRKNETF) CL command

Specifying AFP resources

When specifying an overlay, page definition, or page segment, you need to include the library that contains the resource in your library list.

If you have more than one overlay, page definition, or page segment with the same name, make sure the one you want to use is in the first library searched. Otherwise, you might specify the correct name, but get the wrong resource in your output. When PSF searches for resources, it searches the user library list first and then the device library list.

If you have a resource that many users need to access (fonts, for example), you might put that resource in a library that everyone can access. Some such libraries are those identified in the system values QSYSLIBL or QUSRLIBL.

Alternatively, if you have a resource to which you want to restrict access (signatures, for example), you might put it in a library that only certain users can access. If you own the library that the resources are stored in, you can grant access to that library with the Grant Object Authority (GRTOBJAUT) command.

Specifying a form definition

To use or identify a fully qualified form definition, specify a value in the FORMDF parameter with a CL command.

The following CL commands allow you to specify the FORMDF parameter:

- Create Printer File (CRTPRTF)
- Change Printer File (CHGPRTF)
- Override with Printer File (OVRPRTF)

You can specify a form definition with these device types:

- *AFPDS
- *AFPDSLINE
- *IPDS
- *LINE
- *SCS
- *USERASCII (If the data is ASCII XML, a page definition and form definition are required.)

When you specify output to an Advanced Function Presentation (AFP) printer but do not specify a form definition, an inline form definition is built from the printer file parameters. The inline form definition is then passed to Print Services Facility (PSF).

Depending on the specifications given, some printer file parameters might be ignored when output is printed through PSF.

To indicate an output bin for a form definition, specify the OUTBIN parameter on the printer file.

Use Change Spooled File Attributes (CHGSPLFA) to change the spooled file attributes for the form definition.

Related concepts

Form definitions
A form definition is an Advanced Function Presentation (AFP) resource object that defines the characteristics of the physical form to be printed on.

Page segments
Page segments are objects containing composed text and images that are prepared before formatting and included during printing.

How page definitions, form definitions, and printer files interact

You can use a printer file to specify some of the same options as you can specify with a page definition and a form definition. This topic describes how PSF chooses an option when a printer file is used with a page definition and form definition.

Related reference

Change Printer File (CHGPRTF) CL command

Create Printer File (CRTPRTF) CL command

Change Spooled File Attributes (CHGSPLFA) CL command

Grant Object Authority (GRTOBJAUT) CL command

Override with Printer File (OVRPRTF) CL command

Specifying a page definition

To use or identify a fully qualified page definition, specify the PAGDFN parameter on a CL commands.

The following CL commands allow you to specify the PAGDFN parameter:

- Create Printer File (CRTPRTF)
- Change Printer File (CHGPRTF)
- Override with Printer File (OVRPRTF)

You can specify a page definition with *LINE, *AFPDSLINE, or *USERASCII data.

Note: If the data is ASCII XML (*USERASCII), a page definition and form definition are required. After Print Services Facility (PSF) completes formatting, it converts the line data and page definition to Intelligent Printer Data Stream (IPDS).

When you specify a page definition on the printer file, some printer file parameters might be ignored when the spooled file is printed through PSF.

To change the PAGDFN spooled file attribute, use the Change Spooled File Attributes (CHGSPLFA) command.

Related concepts

Page definitions
Page definitions are resources that format and compose line data into logical pages.

How page definitions, form definitions, and printer files interact
You can use a printer file to specify some of the same options as you can specify with a page definition and a form definition. This topic describes how PSF chooses an option when a printer file is used with a page definition and form definition.

Related reference

Change Printer File (CHGPRTF) CL command

Change Spooled File Attributes (CHGSPLFA) CL command

Create Printer File (CRTPRTF) CL command

Override with Printer File (OVRPRTF) CL command

Specifying a PSF configuration object

Specify a PSF configuration object in the device description for the printer.

To use a Print Services Facility (PSF) configuration object, do these on either the Create Device Description (Printer) (CRTDEVPRT) or Change Device Description (Printer) (CHGDEVPRT) commands:

- Name the PSF configuration object on the User Defined Object (USRDFNOBJ) parameter.
- Specify AFP(*YES).

Example: In this example, the device named MYPRINTER is configured to reference the PSF configuration object MYPSFCFG. MYPSFCFG is in the library MYLIB.

```
CHGDEVPRT DEVD(MYPRINTER) AFP(*YES) USRDFNOBJ(MYLIB/MYPSFCFG *PSFCFG)
```

Any device description for an Intelligent Printer Data Stream (IPDS) printer specified as AFP(*YES) can use any PSF configuration object. PSF checks for a PSF configuration object when a writer is started.

Related concepts

PSF configuration objects
A Print Services Facility (PSF) configuration object lets you specify Intelligent Printer Data Stream (IPDS) printer customization options that you cannot specify elsewhere.

How page definitions, form definitions, and printer files interact
You can use a printer file to specify some of the same options as you can specify with a page definition and a form definition. This topic describes how PSF chooses an option when a printer file is used with a page definition and form definition.

Enabling IPDS pass-through support
When IPDS pass-through support is enabled for a printer, all eligible files spooled to that printer are processed without conversion to AFPDS and to printer-specific IPDS.

Related tasks

Configuring PSF
You can configure Print Services Facility (PSF) by using the printer device description or by using a PSF configuration object.

Related reference

Create Device Description (Printer) (CRTDEVPRT) CL command

Change Device Description (Printer) (CHGDEVPRT) CL command

Sharing print sessions
You can specify printer-sharing properties on the PSF configuration object. This lets you limit the amount of time that you have a connection to the printer, control when the session is released, control when a new session is started, and specify how many times PSF tries to connect to the printer.

Automatic session recovery
PSF can try to resume printing when a session has been unexpectedly ended by a device.

Specifying an overlay

To use overlays, specify them in the front and back overlay parameters of the printer file being used with your application.

Use one of these commands or keywords:

- **Override with Printer File (OVRPRTF)** command: Temporarily changes the printer file.
- **Change Printer File (CHGPRTF)** command: Permanently changes the printer file.
- **Change Spooled File Attributes (CHGSPLFA)** command: Changes the spooled file before printing.
- Data description specifications (DDS) **OVERLAY** keyword: For information about this keyword, see Printer files in the DDS topic of the Programming category.

Related concepts

Overlays
Overlays, also known as electronic forms, are a collection of predefined data such as lines, shading, text, boxes, or logos. They can be merged with variable data on a sheet while a spooled file is being processed.

Specifying a page segment
A page segment object can be built into your application output in a number of ways.

Related reference

Change Printer File (CHGPRTF) CL command

Change Spooled File Attributes (CHGSPLFA) CL command

Override with Printer File (OVRPRTF) CL command

Specifying an AFP font

There are many different tools you can use to specify Advanced Function Presentation (AFP) fonts in your document. Each tool has different capabilities.

Use the tool that best fits your needs. These tools are discussed in greater detail in other topics and related publications.

DDS

You can use keywords in your Data description specifications (DDS) application to specify fonts, including how they look and how they are placed. The example in "Example: Specifying a font" on page 48 uses DDS.

IBM Infoprint Designer for iSeries

This graphical tool lets you use menus to specify fonts and font properties, such as size and weight. You can also specify placement properties, such as alignment and orientation.

AFP printer driver

This device driver can be used to produce AFP documents, overlays, and page segments from Windows applications that support printing to AFP printers.

IBM Advanced Function Printing Utilities

You can specify fonts in the components of AFP Utilities.

Third-party applications

Several third-party applications exist that you can use to work with fonts in a document. Some such products are Papyrus, Elixir, Opus, StreamServe, and DOC1.

To determine the names of the fonts that are available on your system, use the WRKFNTRSC command.

Related concepts

AFP fonts

A font is a collection of characters of a certain size, typeface, and type style. Advanced Function Presentation (AFP) fonts, also called Font Object Content Architecture (FOCA) fonts, are the standard fonts used for Intelligent Printer Data Stream (IPDS) output. AFP fonts are made up of a code page and a character set. All AFP fonts are encoded as either single-byte or double-byte fonts, depending on the language for which they are being used.

Related tasks

DDS keyword finder

Related reference

Work with Font Resources (WRKFNTRSC) command

How TrueType and OpenType fonts differ from AFP fonts

When using TrueType fonts, you will see differences in how the fonts are specified, managed, and installed when compared to Advanced Function Presentation (AFP) fonts.

Example: Specifying a font

This example uses Data description specifications (DDS) keywords and RPG to specify TrueType and Advanced Function Presentation (AFP) fonts.

Related information

Infoprint Server for iSeries: User's Guide (G544-5775) PDF

iSeries Guide to Output (S544-5319) PDF

Specifying a TrueType or OpenType font

You can specify a TrueType font anywhere that you can specify an Advanced Function Presentation (AFP) font. You can also mix references to TrueType and AFP fonts. However, TrueType fonts are referenced differently than AFP fonts.

Note: In this topic, the term TrueType refers to both TrueType and OpenType fonts.

To specify a TrueType font in your document, use the Data description specifications (DDS) FONTNAME keyword to specify the TrueType font name. You can also use this keyword to specify other options, such as a code page.

Usage notes:

1. If you do not specify a code page with the TrueType font, IBM i assumes that the print data that uses this font is UTF-16.
2. The font name must match exactly, including the case, trailing blanks, embedded blanks, and so on.
3. You must ensure that your printer supports the specified font. If the printer does not support a requested font, processing stops. No substitution is done.

Note: Any TrueType font that is to be used with AFP must be Unicode-enabled. This means that the font must have these characteristics:

- It must contain a Microsoft Unicode subtable identified by platform ID = 3 (Microsoft) and platform-specific encoding ID = 1 (Unicode, UTF-16).
- It must specify a full font name (Name ID 4) using the same encoding in the naming table.

Related concepts

TrueType and OpenType fonts
There is extensive operating system support for TrueType fonts, and they are popular with PC applications. Consequentially, TrueType is probably the most prevalent font technology in the industry today. OpenType is an extension of the TrueType font format.

Related tasks

DDS keyword finder
Related reference

How TrueType and OpenType fonts differ from AFP fonts
When using TrueType fonts, you will see differences in how the fonts are specified, managed, and installed when compared to Advanced Function Presentation (AFP) fonts.

Example: Specifying a font

This example uses Data description specifications (DDS) keywords and RPG to specify TrueType and Advanced Function Presentation (AFP) fonts.

The document is followed by the DDS keywords used.

Using Fonts With DDS

The brown Fox jumped ABC123! ¤ #
Courier New, 20p
Code page 37
TrueType,   Outline

The brown fox jumped ABC123! ¤ #
Boldface
Character set C0S0BRTR, Code page T1V10037
Proportional, Host-Resident,   Raster

The brown fox jumped ABC123! ¤ #
Times New Roman, Italic, Bold, 18p
FGID 2311
Typographic, Printer-Resident,   Outline

The brown fox jumped ABC123] ¤ #
Times New Roman, Italic, Bold, 18p
Character set C0N500H0, Code page T1V10500
Typographic, Host-Resident,   Raster

The brown fox jumped ABC123] ¤ Ñ
Times New Roman, Italic, Bold, 18p
Character set CZN500,   Code page T1V10284
Typographic, Host-Resident,   Outline

The brown fox jumped ABC123] € #
Times New Roman, Italic, Bold, 18p
Coded font X0N51EHC
    Character set C0N500H0, Code page T1001148
Typographic, Host-Resident,   Outline

The brown fox jumped ABC123! ¤ #
Helvetica, Roman, Medium,24ph 10pw
FGID 2304   Code Page 37 (default)
Typographic, Host-Resident,   Outline

The brown fox jumped ABC123] ¤ #
Helvetica, Roman, Medium,48ph 10pw
Character set CZH200,   Code page T1V10274
Typographic, Host-Resident,   Outline

THE BROWN FOX JUMPED ABC123]   # ⌐ ♪ ¥
OCR-A
FGID 19   Code Page 37 (default)
Fixed Pitch, Host-Resident,   Raster

Figure 3. Document with several fonts

The fonts in the example have been specified using these DDS keywords. The line numbers below correspond to the numbering in the sample document.

```
Line 1:    FONT(2305 (*POINTSIZE 18)) COLOR(RED)
Line 2:    FONTNAME('Courier New' (*POINTSIZE 20)(*CODEPAGE T1V10037)) COLOR(GRN)
Line 3:    FNTCHRSET(C0S0BRTR T1V10037) COLOR(BLU)
Line 4:    FONT(2311 (*POINTSIZE 18)) COLOR(PNK)
Line 5:    FNTCHRSET(C0N500H0 T1V10500) COLOR(*RGB 50 50 75)
Line 6:    FNTCHRSET(CZN500 T1V10284 (*POINTSIZE 18)) COLOR(*RGB 75 20 40)
Line 7:    CDEFNT(X0N51EHC) COLOR(*CMYK 0 50 50 0)
Line 8:    FONT(2304 (*POINTSIZE 24 10)) COLOR(*CMYK 50 0 0 50)
Line 9:    FNTCHRSET(CZH200 T1V10274 (*POINTSIZE 48 10)) COLOR(TRQ)
Line 10:   FONT(19) COLOR(BRN)
Line 11:   FONT(420 (*POINTSIZE 18 50)) COLOR(RED) TXTRTT(270)
Line 12:   FONT(420 (*POINTSIZE 18 50)) COLOR(RED) TXTRTT(90)
```

Figure 4. DDS keywords used to create the sample document

Notes:

1. To determine the names of the font character sets and coded fonts that are available on your system, use the WRKFNTRSC command.

2. The TXTRTT keyword only works with fields, not constants.

3. The print data for lines 1 through 10 is constant text and was specified in the DDS source.

4. The print data for lines 11 and 12 is a data field that contains the printed text.

5. By using the code examples, you agree to the terms of the "Code license and disclaimer information" on page 93.

Related tasks

DDS keyword finder

Related reference

Work with Font Resources (WRKFNTRSC) command

Specifying an AFP font

There are many different tools you can use to specify Advanced Function Presentation (AFP) fonts in your document. Each tool has different capabilities.

Specifying a page segment

A page segment object can be built into your application output in a number of ways.

- Calling it in the printer file data description specifications (DDS)

- Referencing it in any overlay

- Placing it in a print application with the print format utility of the AFP Utilities licensed program

- Specifying it within a page definition or form definition

- Using it directly in Advanced Function Presentation (AFP) data streams

Related concepts

DDS for printer files

Page segments

Page segments are objects containing composed text and images that are prepared before formatting and included during printing.

Specifying an overlay

To use overlays, specify them in the front and back overlay parameters of the printer file being used with your application.

Creating AFP data

There are several different ways to generate Advanced Function Presentation (AFP) data. You can use a printer file, DDS keywords, Infoprint Server, the AFP printer driver, or Advanced Function Printing Utilities.

Specifying an object container

There are different ways to include object containers in your data, depending on your installation and how you want to use them.

With the AFPRSC keyword, you can reference a print resource stored in the integrated file system, including an object container.

You can specify at most 10 object containers per page of data. When using object containers, you must ensure that the device to which you send the data supports the type of object included. Also, the system searches for object containers differently than how it searches for other objects. The search method is described in the documentation of the Data description specifications (DDS) AFPRSC keyword.

Related concepts

Object containers
Object containers are used to carry non-Object Content Architecture (OCA) objects in an Advanced Function Presentation (AFP) data stream.

Related tasks

DDS keyword finder

Related information

iSeries Guide to Output (S544-5319) PDF

Search order of library list

Print Services Facility (PSF) uses the user library list and device library list to search for the AFP resources that you specify.

It is essential that you understand how IBM i searches for Advanced Function Presentation (AFP) resources. When you create a spooled file, the operating system saves the libraries in your library list. Within that list are the libraries that contain the resources used to create the spooled file.

Related concepts

Resource library lists
A resource library list specifies the libraries that are searched for the Advanced Function Presentation (AFP) resources needed to process a spooled file.

PSF configuration objects
A Print Services Facility (PSF) configuration object lets you specify Intelligent Printer Data Stream (IPDS) printer customization options that you cannot specify elsewhere.

DDS AFPRSC keyword

Color management resources
Color management resources (CMRs) are the foundation of color management in AFP print systems. They are AFP resources that provide all the color management information, such as ICC profiles and halftones, that an AFP system needs to process a spooled file and maintain consistent color from one device to another.

Related reference

Add Environment Variable (ADDENVVAR) CL command
Change Environment Variable (CHGENVVAR) CL command
Remove Environment Variable (RMVENVVAR) CL command
Work with Environment Variables (WRKENVVAR) CL command

Why you should use a library list

When specifying an overlay, page definition, or page segment, you need to include the library that contains the resource in your library list. If you have more than one overlay, page definition, or page

segment with the same name, make sure the one you want to use is in the first library searched. Otherwise, you might specify the correct name, but get the wrong resource in your output.

If you have a resource that you want many users to access (fonts, for example), put that resource in a library that everyone can access. For example, you might put it in a library identified in the system value QSYSLIBL.

Search order for resources that are not specified by the AFPRSC keyword

When the operating system searches libraries for the resources that are needed to print a spooled file, the user library list is searched first and then the device library list. By default, the operating system searches libraries in the following order:

1. System libraries

   These libraries are identified in system value QSYSLIBL. System libraries are available to all users; they are identified in your library list with a Type of SYS.

2. Current® library

   The current library is identified in your user profile as the value for the current library (CURLIB) parameter. In your library list, the current library has a Type of CUR.

3. User libraries

   User libraries are identified in system value QUSRLIBL or in a job description. In your library list, these libraries are identified with a Type of USR.

You can override the system library search list and specify a library search list for a particular device or user. To do the library search list, use a PSF configuration object. If you create a PSF configuration object, the defaults for the user and device library lists are the same as the library search described previously.

Search order for resources that are specified by the AFPRSC keyword

When you specify a resource by using the AFPRSC Data description specifications (DDS) keyword, the operating system uses a different method to search for that resource. Instead, it uses a search order that involves the environment variable QIBM_AFP_RESOURCES_PATH. The system searches the integrated file system for those resources as described in the AFPRSC topic.

The QIBM_AFP_RESOURCES_PATH environment variable

The QIBM_AFP_RESOURCES_PATH environment variable is used when the DDS keyword AFPRSC is used to specify objects in the integrated file system. This environment variable specifies the paths to search for the specified object.

To specify multiple paths in QIBM_AFP_RESOURCES_PATH, use a colon to separate them. For example, `/home/officers/signatures:/home/checkimages/2003` identifies two directories to be searched:

- `/home/officers/signatures` (This directory is searched first.)
- `/home/checkimages/2003` (This directory is searched second.)

The directories are searched in the order in which they are listed.

The `/QIBM/UserData/OS400/AFPresources` directory is created when IBM i is installed. It is always available and always the last directory searched if a resource is not found in any of the directories that are specified in QIBM_AFP_RESOURCES_PATH. If directories are not specified in the environment variable or the environment variable is not created, then `/QIBM/UserData/OS400/AFPresources` is the only directory searched. You do not need to specify the directory in QIBM_AFP_RESOURCES_PATH.

In V7R2, PSF might perform two searches for resources that are specified by the AFPRSC keyword. The first search consists of checking each directory for a Data Object Resource Access Table (DO RAT). If the resource is not specified in a DO RAT or you do not use DO RATs, then a search is made as in previous releases. You do not need to use a DO RAT except where your needs require one, such as if you want to associate a Color Management Resource with a resource without modifying your application.

You can use these CL commands to work with environment variables:

- Work with Environment Variables (WRKENVVAR)
- Add Environment Variable (ADDENVVAR)
- Change Environment Variable (CHGENVVAR)
- Remove Environment Variable (RMVENVVAR)

Search order for Color Management Resources

The QIBM_AFP_CMR_PATH environment variable is used to specify the directories which PSF searches for CMRs. PSF searches the directories in the QIBM_AFP_CMR_PATH environment variable after searching all inline resources included in the spooled file. For more information about CMRs, see "Color management resources" on page 17.

To specify multiple paths in QIBM_AFP_CMR_PATH, use a colon to separate them. For example, `/QIBM/UserData/CMRgroup1:/QIBM/UserData/CMRgroup2` identifies two directories to be searched:

- `/QIBM/UserData/CMRgroup1` (This directory is searched first.)
- `/QIBM/UserData/CMRgroup2` (This directory is searched second.)

The directories are searched in the order in which they are listed.

Creating AFP data

There are several different ways to generate Advanced Function Presentation (AFP) data. You can use a printer file, DDS keywords, Infoprint Server, the AFP printer driver, or Advanced Function Printing Utilities.

Creating AFP data by using a printer file

You can create AFP data on IBM i from applications using a printer file with the device type (DEVTYPE) parameter value set to *AFPDS.

Creating AFP data by using DDS keywords

You can create AFP data with Data description specifications (DDS) printing functions that are tailored for use with AFP.

Creating AFP data by using IBM Infoprint Server for iSeries

Infoprint Server has a Create AFP Data (CRTAFPDTA) command that lets you transform line (*LINE) or mixed (*AFPDSLINE) data into AFP (*AFPDS) data. It can also take an AFP file as input and generate an AFP stream file. It can index a document for viewing, archiving, or document retrieval. Optionally, it retrieves and packages the AFP resources that are needed for printing or viewing. Refer to the *Infoprint Server for iSeries: User's Guide* for instructions to use the CRTAFPDTA command.

Creating AFP data by using the AFP printer driver for Windows

The AFP printer driver creates AFP documents, overlays, and page segments from your Windows applications. For more information about the AFP printer driver or to download the printer driver, see the InfoPrint Solutions Company web site .

Creating AFP data by using IBM Advanced Function Printing Utilities

By using the IBM Advanced Function Printing Utilities (AFP Utilities) licensed program, you can create and print AFP data from an existing database file, merged with an overlay. For more information about this licensed program, see *AFP Utilities for iSeries: User's Guide* (S544-5349). This publication is available on the IBM Publications Center Web page at http://www.elink.ibmlink.ibm.com/public/applications/publications/cgibin/pbi.cgi.

Related concepts

Specifying a page segment
A page segment object can be built into your application output in a number of ways.

DDS for printer files
Related information
Infoprint Server for iSeries: User's Guide (G544-5775) PDF

Printing AFP data with PSF

You can use Print Services Facility (PSF) to print both AFP data that was generated on IBM i and data that was generated on a zSeries system and sent to IBM i.

Printing AFP data generated on IBM i

To print AFP data that was generated on IBM i, use an application program or the PRTAFPDTA command.

Follow these steps to generate and print Advanced Function Presentation data stream (AFPDS) data with Print Services Facility (PSF):

1. Create the AFPDS data.
2. Optional: Specify overlays.
3. Generate an AFPDS spooled file.

   Method 1: Use an application program. The application program that creates the data to be used with the overlays might need to be tailored so the printed output fits with the overlays you designed.

   Tailoring the program to fit the overlay is similar to tailoring the program to work with a preprinted form.

   Method 2: Use the Print AFP Data (PRTAFPDTA) command. If you have a database file that contains AFP data, use the PRTAFPDTA command to spool the file.

   If you want to use a prompt display with this command, type PRTAFPDTA and press F4 (Prompt).

   Notes:

   a. The PRTAFPDTA command prints AFPDS data. Any padding between the AFPDS structured fields must be X'40' or X'00'.
   b. When using the PRTAFPDTA command, do not override the DEVTYPE parameter on the system printer file, QSYSPRT.
   c. When using the PRTAFPDTA command, the form definition typically identifies the drawer to print from. An exception is when an Override with Printer File (OVRPRTF) command has been issued with a different drawer value. In this case, the drawer value is taken from the override command.

   Examples

   This command prints the first member in file MYFILE starting with page 2 and ending on page 6.

   ```
   PRTAFPDTA  FILE(MYLIB/MYFILE) STRPAGE(2)  ENDPAGE(6)
   ```

   This command prints the member $REPORT in file MYFILE using a form definition of F10101 and all available exception handling.

   ```
   PRTAFPDTA  FILE(MYLIB/MYFILE) MBR($REPORT)  FORMDF(F10101)  FIDELITY(*CONTENT)
   ```

   Note: By using the code examples, you agree to the terms of the "Code license and disclaimer information" on page 93.
4. Release the spooled file to a device with device type *AFPDS.

Related reference
Print AFP Data (PRTAFPDTA) CL command

Printing data sent to IBM i from zSeries

PSF can print data that was generated on zSeries. This data might be AFP, AFPDSLINE (AFP data mixed with line data), or line data. The data might be sent to network files or directly to an output queue.

There are different steps to print data sent to a IBM i host, depending on where it is sent to.
Related concepts
Receiving resources and AFPDS data sent to network files
To make receiving resources and Advanced Function Presentation data stream (AFPDS) data as easy as possible, you should be aware of these points.

AFP resources
Advanced Function Presentation (AFP) resource objects contain data and control information.

Resource library lists
A resource library list specifies the libraries that are searched for the Advanced Function Presentation (AFP) resources needed to process a spooled file.

Sending data from zSeries to IBM i network files
The examples in this topic show how to send print data and resources from a zSeries system to an IBM i network file.

Related tasks
Releasing a spooled file
Related reference
Print AFP Data (PRTAFPDTA) CL command

Printing data sent from zSeries to an IBM i network file

To print data that has been placed on an IBM i network file, follow these steps:

1. Receive the file to a library.
2. Use the Print AFP Data (PRTAFPDTA) command.

All resources must be processed this way.

Printing data sent from zSeries to an IBM i output queue

You can print data that has been placed on an IBM i output queue the same way you print any other spooled file. However, there are some considerations when having data placed directly on an output queue. If a printer is active for that output queue, spooled files placed directly into the output queue can be printed without the owner of the queue realizing it. To avoid this, try one of these possible solutions:

- Create a special user ID and a special output queue for that user ID. You can then sign on using that user ID and assign a printer to your output queue to print the spooled files.
- Make sure the output queue of the receiving user ID is held before the zSeries system sends the files.
- Use the End Writer (ENDWTR) command to end the printer assigned to that output queue before the zSeries system sends the file.

When data is sent from a zSeries system to an IBM i output queue and then printed, it follows this path:

1. zSeries system
2. Target IBM i host, identified by a node ID
3. Target output queue for the target user ID

    The target user ID must have access to the libraries containing the resources that the spooled file needs when it prints on IBM i.
4. Target printer

    Make sure that the printer you want to print the files on is assigned to the correct output queue. If any special handling of the printer is necessary (form choice, drawer selection, envelopes, and so on), it should be done before the files are sent.

Note: If you cannot find the spooled file on the output queue of the specified user ID, look in the QNFTP job log for messages. The QNFTP job runs under the QSNADS user profile.

Transforming IPDS data to PDF

IPDS-to-PDF transform support, also called the PDF subsystem, is an IBM Infoprint Server for iSeries function that lets you generate Portable Document Format (PDF) files or Advanced Function Presentation (AFP) files (for spooling only) from AFP, SNA character string (SCS), or Intelligent Printer Data Stream (IPDS) spooled files.

Intelligent routing is then used to route the output file. Intelligent routing is the ability to take the entire spooled file or any segment of the input spooled file and do any combination of these:

- Generate a PDF file and send it as an e-mail attachment.
- Generate a PDF file and store it as a stream file in the integrated file system.
- Generate a PDF file and spool it.
- Generate an AFP file and spool it.

Intelligent routing is controlled by values in a PSF configuration object and a mapping program.

Note: The Print Services Facility (PSF) transform interface supports an IPDS-to-PDF transform program that emulates a TCP/IP-connected IPDS 4028, 3812, or Infoprint 40 printer device.

An IPDS-to-PDF transform that can be used with PSF is provided in the IBM Infoprint Server for iSeries product. The transform converts IPDS controls and data into PDF files. The output PDF files include text, graphics, and image data, as appropriate. The transform also stores the mail tag in a comment statement in the PDF output. The mail tag is specified in the printer file's USRDFNDTA parameter or the STRPAGGRP Data description specifications (DDS) keyword. For detailed information about the IPDS-to-PDF transform (including the user exit program), see the *Infoprint Server for iSeries User's Guide*. To use the transform provided in Infoprint Server, PSF is not required.

A mapping program is a user exit program specified on the PSF configuration object's PDFMAPPGM parameter. You can do these and more with a mapping program:

- Interpret routing tags
- Specify the subject of an e-mail
- Add text to the beginning of an e-mail
- Specify the path to store the PDF stream file

If you are using a Simple Mail Transfer Protocol (SMTP) server to send the e-mail, it has additional capabilities, such as specifying carbon-copy (cc), blind-carbon-copy (bcc), and return-to e-mail addresses; specifying a file to use as the body of an e-mail; and specifying attachments.

These topics describe the main ways to access the PDF subsystem and how to specify that a PDF file is sent as e-mail:

Related information
Infoprint Server for iSeries: User's Guide (G544-5775) PDF

Transforming spooled files to PDF without manual setup

For operating systems later than V5R3, this method requires no setup. It is best for simple applications, such as a trial run of a billing application. The input spooled files can be transformed in only one way, not a combination.

Follow these steps to transform an Intelligent Printer Data Stream (IPDS), Advanced Function Presentation (AFP), or SNA character string (SCS) spooled file to Portable Document Format (PDF) automatically. This method is not available on operating systems earlier than V5R4. An Infoprint Server for iSeries license is required.
Related tasks
Configuring e-mail

Infoprint Server for iSeries: User's Guide (G544-5775) PDF

Prerequisites

1. If the PDF file will be sent as e-mail, make sure that IBM i is set up to send e-mail.

   For instructions on setting up IBM i to send e-mail, see the Configure e-mail topic.
2. Optional: Write your mapping program.

   Refer to the *Infoprint Server for iSeries User's Guide* for the format.

Transforming a spooled file to PDF

To transform a spooled file to PDF, do these steps:

1. Start a System i Navigator session.
2. Expand **My Connections** (or your active environment).
3. If you do not have an AFP Manager icon, install AFP Manager as follows:

   Right-click **My Connections** (or your active environment) and select **Install Options** then **Selective Setup**.
4. Expand **Basic Operations** and select **Printer Output**.
5. Right-click the output files you want to convert and select **Convert to PDF**.

   The Convert to PDF wizard opens.
6. Follow the instructions in the wizard.

Transforming spooled files to PDF with manual setup

This method requires varying levels of setup, depending on the complexity of the required output. This method gives you the most flexibility.

Prerequisites

1. Set up your PSF configuration object.

   The Print Services Facility (PSF) configuration object you use specifies what is done with the PDF file and other transform options.
2. Optional: Change the input file to create multiple output files or an indexed file.
3. Configure a device for PDF conversion.

Transforming a spooled file to PDF

To transform a spooled file, submit it to a printer that is set up correctly.

Setting up your PSF configuration object
Before you set up your Print Services Facility (PSF) configuration object, you need to decide what you want done with the output file after it is created.

It can be stored in a directory as PDF, placed on an output queue as Advanced Function Presentation (AFP) or PDF, or e-mailed as a PDF attachment.

Note: You must have system configuration authority (*IOSYSCFG) to create a PSF configuration object.

To create or change a PSF configuration object, follow these steps:

1. In System i Navigator, expand **My Connections** (or your active environment).
2. Expand **AFP Manager**.

   If you do not have an AFP Manager icon, install AFP Manager as follows: Right-click **My Connections** (or your active environment) and select **Install Options** then **Selective Setup**.
3. Create a new PSF configuration object or change one that already exists.

- To create a PSF configuration object, right-click the **PSF configuration objects** folder and select **New**.
- To change a PSF configuration object, expand the **PSF configuration objects** folder, right-click the PSF configuration object you want to change, and select **Configure**.

4. If you are creating a PSF configuration object, on the **General** page, specify a name.
5. On the **PDF Destinations** page, specify what you want done with the generated PDF files:

   - Select **Generate PDF**.
   - If you want the PDF files spooled to an output queue, select **Store as printer output**. You must also specify the library-qualified output queue. Click **Browse** to search for an output queue.
   - If you want the PDF files stored as a stream file in the integrated file system, select **Store as stream file**. You must also specify the stream file directory where you want the PDF file stored.
   - If you want the PDF files sent as e-mail, select **Send as electronic mail**.
   - For **Administrator address**, specify the e-mail address of the PDF administrator. Any PDF files that are not distributed correctly are attached (if possible) to an e-mail that is sent to this address. Your IBM i must be set up to send e-mail to use this option. If the specified address is on an IBM i, that IBM i must be set up to receive e-mail. For instructions about setting up your IBM i to send and receive e-mail, see the Configure e-mail topic.

6. If you selected **Send as electronic mail** or specified an **Administrator address**, specify the mail sender and, optionally, the mail server to use:

   - Specify the e-mail sender or click the arrow to select from a list. The e-mail sender must be enrolled in the system distribution directory.

     Use the Display Directory Entries (DSPDIRE) command to view the entry in the system distribution directory. If you have security administrator authority, you can change the Simple Mail Transfer Protocol (SMTP) information with the Work with Directory Entries (WRKDIRE) command.
   - If you want to specify the mail server to use, select **Advanced**. If you do not specify a mail server, the Send Distribution (SNDDST) command is used. Many of the options available through the mapping program require you to use an SMTP server.

7. On the **PDF Processing** page, specify any of these options to customize the PDF that is generated:

   - If you want the fonts to be included in the output file, select **Include PDF fonts inline**. This ensures fidelity when you print or view the file, but increases file size. This function only works with IP40240 or IP40300 device emulation.
   - If you want PSF to use the named groups defined in the input file, select **Generate multiple PDF files**.
     - If you want the file split at named group boundaries, select **Create separate PDF files**.
     - If you want one output file created with index tags at named group boundaries, select **Create single PDF file with index tags**.
   - In the **Device emulation type** field, specify the device that AFP should emulate.
   - Specify the paper size in printer drawers one and two of the device specified for **Device emulation type**.
   - Specify the library-qualified data queue where the PDF transform status messages should be posted. Click **Browse** to search for a library.
   - If applicable, specify the library-qualified **Mapping program**. Click **Browse** to search for a library. If you want to use a mapping object, select *IBMPGM.
   - If applicable, specify the library-qualified **Mapping object**. Click **Browse** to search for the mapping object.

8. Click **OK**.

For help with any field, select the field and press F1.

Related tasks
Configuring e-mail
Related reference
Display Directory Entries (DSPDIRE) CL command
Send Distribution (SNDDST) CL command
Work with Directory Entries (WRKDIRE) CL command

Changing the input file to create multiple output files or an indexed file

You can insert group tags into your data before it is transformed. This lets the transform generate one Portable Document Format (PDF) file for each group or insert an index tag at the beginning of each group.

The action taken depends on the value specified for the Multiple PDF Files (PDFMULT) parameter on the Print Services Facility (PSF) configuration object. You can also use group tags to send each group as e-mail to a different recipient. The group name is used as the index tag or mail tag when appropriate. For information about putting mail tags on the group tags, see the *Infoprint Server for iSeries User's Guide*.

You can use a utility such as Data description specifications (DDS) or the IBM Infoprint Server for iSeries Create AFP Data (CRTAFPDTA) command to insert group tags in your data. If you choose to specify groups, all of the data must be inside a group.

To use DDS to generate groups, use the STRPAGGRP and ENDPAGGRP DDS keywords.

To use CRTAFPDTA to generate groups, follow the instructions in the *Infoprint Server for iSeries User's Guide* to index your file. The value specified with **Select index for group names** (IDXGRP) is the group name.

Related information
Infoprint Server for iSeries: User's Guide (G544-5775) PDF

Configuring a device for PDF conversion

Set up your device for Portable Document Format (PDF) conversion the same way you set up a TCP/IP Intelligent Printer Data Stream (IPDS) printer.

You can have multiple IPDS-to-PDF printers active, but each must be configured as a different printer with a different port. Use the Create Device Description (Printer) (CRTDEVPRT) command to specify the following parameters:

Device description
   printer-name

Device class
   *LAN

Device type
   *IPDS

Device model
   0

LAN attachment
   *IP

Advanced function printing
   *YES

Port number
   xxxxx, the number must be unique for each printer.

Font
   printer font

Remote location
   127.0.0.1

User defined object

> **Object**
> *PSF-configuration-object-name*

> **Library**
> *PSF-configuration-object-library*

> **Object type**
> *PSFCFG

Sending the PDF file as email

A mapping program, a mapping object, or the Print Services Facility (PSF) configuration object specifies that an output Portable Document Format (PDF) file should be sent as email. A mail tag provides the email address.

To specify that an output PDF file is sent as email, you can set up a mapping program for e-mail. For instructions to set up a mapping program for email, see the *Infoprint Server for iSeries User's Guide*.

There are two ways to send the output file as email without using a mapping program:

- Specify PDFGEN(*MAIL) in the PSF configuration object.
- Use a mapping object.

After the PDF file creation, PSF retrieves the mail tag. The mail tag is on the printer file's User defined data (USRDFNDTA) parameter or the Start page group (STRPAGGRP) Data description specifications (DDS) keyword. If you do not specify an exit program, you must provide a valid e-mail address in the USRDFNDTA parameter or in the STRPAGGRP DDS keyword. PSF then electronically mails the output. It uses a Simple Mail Transfer Protocol (SMTP) server if one is specified in the PSF configuration object. If none is specified, it uses the Send Distribution (SNDDST) command.

Format of the printer file's USRDFNDTA mail information

The format of the mail information when it is specified in the printer file's USRDFNDTA parameter is:

```
USRDFNDTA('MAILTAG(80 bytes of text) MAILSENDER(10 byte name)')
```

The 80 bytes of text can contain a mail address or a tag. The mail exit routine converts tags into a mail address and an optional message. The MAILSENDER parameter is 10 bytes long and specifies the name of the user profile that is sending the file. This parameter overrides the PSF configuration object's PDFSENDER value.

Format of the STRPAGGRP mail tag

When you specify PDFMULT(*YES *SPLIT), the Name parameter of the STRPAGGRP DDS keyword can contain a mail tag. The mail tag can contain either a mail address or a tag. The mail exit routine converts tags into a mail address and an optional message. The STRPAGGRP name overrides a mail tag in the printer file's USRDFNDTA parameter.

Related concepts

Suppress message text in an email
You can specify specific message text that goes into the body of an email or you can have PSF use default text. You can also specify that no message text is to be added into the body of an email.

Variable data taken from spooled file attributes
You can use text that is taken from three spooled file attributes to be used in an email's subject and message text. This variable data can be used when PSF is obtaining subject and message text from either a PDF map object (segmented and non-segmented entries) or from the subject and message text that is specified with message PQT4133 in message file QPQMSGF.

Related tasks

Encrypting the PDF file

The PDFENCRYPT parameter on the User defined data (USRDFNDTA) parameter specifies whether to encrypt an output PDF stream file or spooled file and whether to send it as e-mail.

Related information

Infoprint Server for iSeries: User's Guide (G544-5775) PDF

Encrypting the PDF file

The PDFENCRYPT parameter on the User defined data (USRDFNDTA) parameter specifies whether to encrypt an output PDF stream file or spooled file and whether to send it as e-mail.

To encrypt the output PDF file:

1. Specify the e-mail distribution option in a PDF map object entry or segment.
2. Specify encryption values for the e-mail distribution option.
3. Specify the name of the PDF map object with parameter PDFMAP in the Print Services Facility (PSF) configuration object.
4. Specify the default IBM-supplied user program with parameter PDFMAPPGM in the PSF configuration object.
5. Specify the PDFENCRYPT parameter on the printer file's or spooled file's USRDFNDTA parameter.

   Values for the PDFENCRYPT parameter are:

   *NONE
   Encryption and e-mail distribution options are not specified at the spooled file level. The encryption values specified in a PDF map object are used. Specifying PDFENCRYPT(*NONE) is the same as not specifying PDFENCRYPT.

   A value of *NONE cannot not be specified with any other values. If other values are specified with *NONE they are ignored.

   *NOMAIL
   The e-mail is not sent. If this value is not specified, the e-mail is sent. Use *NOMAIL to encrypt a stream file or spooled file without sending an e-mail.

   *STMF
   The generated PDF file placed in a stream file is encrypted. If this value is not specified and a stream file is generated, the stream file is not encrypted. If the stream file distribution option is not specified, this value is ignored.

   *SPLF
   The PDF file placed in a spooled file is encrypted. If this value is not specified and a spooled file is generated, the spooled file is not encrypted If the spooled file distribution option is not specified, this value is ignored.

Examples

- To convert a spooled file to an encrypted PDF, send it as e-mail, and write it as an encrypted PDF to the integrated file system:

  1. Specify the stream file distribution option in the PDF map object entry or segment.
  2. Specify this parameter on the printer file or spooled file's attributes:

     ```
     USRDFNDTA('PDFENCRYPT(*STMF)')
     ```

- To convert a spooled file to an encrypted PDF and spool it as an encrypted PDF without sending it as e-mail:

  1. Specify the spooled file distribution option in the PDF map object entry or segment.
  2. Specify this parameter on the printer file or spooled file's attributes:

     ```
     USRDFNDTA('PDFENCRYPT(*SPLF *NOMAIL)')
     ```

- To convert a spooled file to an encrypted PDF, spool it as an encrypted PDF, and write it as an encrypted PDF to the integrated file system without sending it as e-mail:

    1. Specify the stream file distribution option in the PDF map object entry or segment.

    2. Specify the spooled file distribution option in the PDF map object entry or segment.

    3. Specify this parameter on the printer file or spooled file's attributes:

    ```
    USRDFNDTA('PDFENCRYPT(*NOMAIL *STMF *SPLF)')
    ```

- To convert a spooled file to an encrypted PDF, spool it as a PDF without encryption, and write it as an encrypted PDF to the integrated file system without sending it as e-mail:

    1. Specify the stream file distribution option in the PDF map object entry or segment.

    2. Specify the spooled file distribution option in the PDF map object entry or segment.

    3. Specify this parameter on the printer file or spooled file's attributes:

    ```
    USRDFNDTA('PDFENCRYPT(*STMF *NOMAIL)')
    ```

Related concepts

Sending the PDF file as email
A mapping program, a mapping object, or the Print Services Facility (PSF) configuration object specifies that an output Portable Document Format (PDF) file should be sent as email. A mail tag provides the email address.

Related reference

Change Spooled File Attributes (CHGSPLFA) CL command

Suppress message text in an email

You can specify specific message text that goes into the body of an email or you can have PSF use default text. You can also specify that no message text is to be added into the body of an email.

To specify that no message text be placed into an email, specify a value of *NONE any place that message text can be specified. The value *NONE must always be specified in uppercase.

- PDF map entry. Specify *NONE for the message text.
- User map program. Specify *NONE for the message text and 5 for the length of message text parameters.
- Message PQT4133. Change the message portion of the message to contain the value *NONE. The message portion of PQT4133 begins at the 23rd character. Active writers must be ended and restarted to retrieve the latest text. This text will be used by all writers as the default subject and message text.

Related concepts

Sending the PDF file as email
A mapping program, a mapping object, or the Print Services Facility (PSF) configuration object specifies that an output Portable Document Format (PDF) file should be sent as email. A mail tag provides the email address.

Variable data taken from spooled file attributes

You can use text that is taken from three spooled file attributes to be used in an email's subject and message text. This variable data can be used when PSF is obtaining subject and message text from either a PDF map object (segmented and non-segmented entries) or from the subject and message text that is specified with message PQT4133 in message file QPQMSGF.

Three variables can be specified in the subject and message text fields for which PSF substitutes the appropriate text. The following variables are supported.

- &UD&. This variable references the User data spooled file attribute.
- &FT&. This variable references the Form type spooled file attribute.

- &RT&. This variable references either the routing tag that is contained within spooled file data or the Mail tag that is specified on the USRDFNDTA spool file attribute.

Here is more information on the use of these variables.

- The variables must be specified in uppercase.
- The variables can be specified for the Subject and Message text of an email.
- If a variable is specified and the data to be used for that field is blank, the variable is removed. No data is substituted for the variable and the resulting string for the subject or message text is presented as if no variable was placed in it.
- If the subject or message text becomes longer than allowed, the text is truncated. Emails that are sent by SMTP do not have a limit for the message text.
- Trailing blanks are removed from the fields that provide the substitution text.
- There are no limits as to the number of times a variable can be specified in either the subject or message fields.
- When you specify a value for MAILTAG on spooled file attribute USRDFNDTA, the value for MAILTAG must not contain any blanks characters. If blanks are included, PSF does not use the MAILTAG value.

Example of using the variables

This example shows the use of the variables in a PDF map entry that specifies email distribution.

The email subject is: Your package to be delivered by &UD&

The Message text is: Your &RT& will be delivered within &FT& week(s).

The spooled file has the following values for the three attributes:

- The value for User data is FastMove. Variable &UD& refers to User data.
- The value for Form type is 1. Variable &FT& refers to Form type.
- The value for the User defined data is washing machine. Variable &RT& refers to User defined data.

When the email arrives at its destination, it has the following values.

- Subject of: Your package to be delivered by FastMove
- Message text of: Your washing machine will be delivered in 1 week(s).

Related concepts
Sending the PDF file as email
A mapping program, a mapping object, or the Print Services Facility (PSF) configuration object specifies that an output Portable Document Format (PDF) file should be sent as email. A mail tag provides the email address.

Generic support for PDF map object selection criteria

Generic values for the User data and Form type fields in a PDF map entry can be specified.

Generic values can be specified for the User data and Form type fields that are specified in a PDF map entry as selection criteria. The input screen in the PDF map entry is not updated to indicate that generic support is available for the User data and Form type fields. An error message is not issued when you specify generic values for these fields.

Configuring PSF

You can configure Print Services Facility (PSF) by using the printer device description or by using a PSF configuration object.
Related concepts
PSF configuration objects

A Print Services Facility (PSF) configuration object lets you specify Intelligent Printer Data Stream (IPDS) printer customization options that you cannot specify elsewhere.

Specifying a PSF configuration object
Specify a PSF configuration object in the device description for the printer.

Related reference
Create Device Description (Printer) (CRTDEVPRT) CL command
Create PSF Configuration Object (CRTPSFCFG) CL command
Change Device Description (Printer) (CHGDEVPRT) CL command

Configuring PSF by using a device description

To use PSF, you must specify AFP(*YES) in the printer device description.

Other parameters in the device description affect how PSF works with Advanced Function Presentation (AFP). For example, you can specify these options:

- The maximum number of print requests that can be queued for printers.
- Whether a file using AFP must be completely converted to IPDS before printing begins.
- How long to wait after a print request has been received before forcing the last pages of the output into the paper stacker. This is for continuous forms printers only.
- A default form definition to use.
- A PSF configuration object to use.

Configuring PSF by using a PSF configuration object

A PSF configuration object is an extension of the printer device description. You can use a PSF configuration object to specify device configuration options that you cannot specify with the device description. For example, with a PSF configuration object you can specify these:

- A library list for PSF to use to search for resources
- When PSF should release a session with a printer
- Whether to automatically take advantage of outline fonts
- Whether to generate Portable Document Format (PDF) output from the spooled file

To use a PSF configuration object, follow these steps:

1. Create a PSF configuration object by using the Create PSF Configuration Object (CRTPSFCFG) command or by using AFP Manager:
   a) Start an System i Navigator session.
   b) Expand **My Connections** (or your active environment).
   c) Expand **AFP Manager**.

      If you do not have an AFP Manager icon, install AFP Manager as follows: Right-click **My Connections** (or your active environment) and select **Install Options** then **Selective Setup**.
   d) Right-click **PSF configurations** and select **New**.
   e) Specify the options you want.

      For help on any page, press F1. Select **OK**.
2. Specify the PSF configuration object by following the steps in the "Specifying a PSF configuration object" on page 45 topic.

Managing PSF

After you configure Print Services Facility (PSF), you can continue to work with your AFP environment.

You can change the PSF configuration object and the printer files as necessary to manage PSF sessions.

Enabling IPDS pass-through support

When IPDS pass-through support is enabled for a printer, all eligible files spooled to that printer are processed without conversion to AFPDS and to printer-specific IPDS.

There are several ways to enable Intelligent Printer Data Stream (IPDS) pass-through support:

- Specify IPDSPASTHR(*YES) in the printer file.
- Specify IPDSPASTHR in the PSF configuration object and specify IPDSPASTHR(*DEVD) in the printer file.

  When IPDSPASTHR(*DEVD) is specified, PSF will first check whether IPDSPASTHR is specified in the printer file's USRDFNDTA parameter. It then checks for a value for IPDSPASTHR in the PSF configuration object that is specified in the printer device description, if one is specified. If there is no object that is specified in the printer device description, IPDS pass-through is ignored.

Related concepts

IPDS pass-through
IPDS pass-through allows you to process some SCS and IPDS spooled files more efficiently.

PSF configuration objects
A Print Services Facility (PSF) configuration object lets you specify Intelligent Printer Data Stream (IPDS) printer customization options that you cannot specify elsewhere.

Specifying a PSF configuration object
Specify a PSF configuration object in the device description for the printer.

Sharing print sessions

You can specify printer-sharing properties on the PSF configuration object. This lets you limit the amount of time that you have a connection to the printer, control when the session is released, control when a new session is started, and specify how many times PSF tries to connect to the printer.

Several parameters from the PSF configuration object and device description let you configure Print Services Facility (PSF) to share sessions with other PSF sessions or ASCII print drivers.

Notes:

1. PSF supports session sharing with TCP/IP-attached printers.
2. PSF supports session sharing with any printer attached to the PSF Direct licensed program.
3. PSF does not support session sharing with APPC-attached printers. If you want to use session sharing with these printers, either use their TCP/IP support, if available, or attach them to PSF Direct, if supported.
4. PSF does not support session sharing with twinaxial printers attached to local or remote workstation controllers. If you want to use session sharing with these printers, check if TCP/IP support is available.

Following are the parameters you need to consider for printer session and dialog sharing.

ACTTMR
Printer device description parameter that specifies how long (in seconds) that PSF waits for a printer to respond to an activation request. This applies to TCP/IP-attached printers only. PSF uses this timer only after a session has been opened with the printer.

No timers can influence the length of time that TCP/IP takes to wait for a response to a session start request. You can specify that PSF tries to start a session again after a failure of the session start request is detected. To do this, use the PSF configuration object RETRY parameter to specify how many times PSF should repeat the session start request.

ACTRLSTMR
PSF configuration object parameter that specifies the point at which the Release Timer (RLSTMR) is activated.

If you are using a non-impact continuous forms printer, do not set the PRTRQSTMR parameter in the printer device description to *NOMAX. If you set the PRTRQSTMR to *NOMAX, an operator

must perform a manual nonprocess runout (NPRO) at the printer. PSF will not release a session or Intelligent Printer Data Stream (IPDS) dialog until the last file sent to the printer is printed.

RESTRTMR

PSF configuration object parameter that specifies the amount of time to wait before the printer writer attempts to reestablish either a session or dialog. For example, if this value is set to 10, PSF activates the timer as soon as a session or dialog is released. After 10 minutes have elapsed, PSF checks for a spooled file with a status of RDY. If there is one, PSF tries to start a session or dialog with the printer in order to print the file. If a spooled file is not ready after the timer expires, PSF waits for a RDY spooled file to be placed on its output queue before attempting to start a session or dialog.

This timer is ignored if PSF has not been configured to release either a session or dialog. Use the ACTRLSTMR and RLSTMR parameters to configure PSF to release either a session or dialog.

RETRY

PSF configuration object parameter that specifies the number of additional attempts PSF makes to establish an APPC or TCP/IP session. When PSF is sharing a PSF directly-attached printer with other PSF sessions, you might want to set the value to *NOMAX. This specifies that PSF will continue trying to obtain a session. The default value for the RETRY parameter is 15.

The RETRY parameter is helpful for TCP/IP-attached printers in this situation: You want to share an AFCCU printer with more than three PSFs. A printer is temporarily unavailable when PSF tries to open a session with it. You might see this when PSF fails to start a printer session. One example of this is when PSF issues message PQT3603 with error code 22 or 15. The RETRY parameter specifies that instead of ending PSF should try again to open a session with the printer. PSF will try to open a session up to the number of times specified.

RETRYDLY

PSF configuration object parameter that specifies the number of seconds to wait between each additional attempt to establish a session. This parameter is used only when PSF is using an SNA attachment. The default value for the RETRYDLY parameter is 90.

RLSTMR

Timer set in the PSF configuration object. Its value is referenced by the ACTRLSTMR parameter. The default setting is *NOMAX, which means that PSF does not release the session or dialog with the printer until the writer is ended.

The value specified for parameter RESTRTMR determines when PSF reestablishes a session or a dialog.

Related concepts

PSF configuration objects
A Print Services Facility (PSF) configuration object lets you specify Intelligent Printer Data Stream (IPDS) printer customization options that you cannot specify elsewhere.

Specifying a PSF configuration object
Specify a PSF configuration object in the device description for the printer.

Related reference

CL commands for PSF configuration objects
There are several CL commands that you can the commands to use to create, change, display, and delete a PSF configuration object.

CL commands for device descriptions
There are several CL commands that you can to create or change a printer device description.

Automatic session recovery

PSF can try to resume printing when a session has been unexpectedly ended by a device.

A message is sent to the message queue when Print Services Facility (PSF) is performing automatic session recovery.

These PSF configuration object parameters support automatic session recovery.

AUTOSSNRCY

Automatic session recovery specifies whether PSF tries to resume printing when a session has been unexpectedly ended by a printer or other network device, such as a router. AUTOSSNRCY(*YES) also lets you power your printer off and on without ending PSF. If you plan to specify *YES, you should consider these values for other parameters in the PSF configuration object:

- For a TCP/IP connection, use RETRY or ACKFRQ.
- For an APPC connection, use RETRY, RETRYDLY, or ACKFRQ.

Note: When automatic session recovery takes place, pages might be printed when printing resumes.

ACKFRQ

Acknowledgment frequency specifies the frequency, in pages, with which PSF sends Intelligent Printer Data Stream (IPDS) acknowledgment requests to a printer. The acknowledgment request responses from the printer that contains information as to the status of pages that is sent to the printer. You might want to adjust this value if you are concerned about one of these issues:

- Losing a connection to a printer while spooled files are being printed
- Duplicate pages being printed

More frequent acknowledgment request responses provide more information about pages that have been printed. However, if you increase the frequency of acknowledgment requests (by specifying a lower value), you can slow the print process. You might need to experiment with different values in order to find one that is suitable for your environment.

Related concepts

PSF configuration objects
A Print Services Facility (PSF) configuration object lets you specify Intelligent Printer Data Stream (IPDS) printer customization options that you cannot specify elsewhere.

Specifying a PSF configuration object
Specify a PSF configuration object in the device description for the printer.

Related reference

CL commands for PSF configuration objects
There are several CL commands that you can the commands to use to create, change, display, and delete a PSF configuration object.

Disabling offset stacking and edge marking

PSF lets you disable offset stacking on cut-sheet printers and edge mark printing on continuous forms printers.

This PSF configuration object parameter supports disabling offset stacking and edge marking:

PSFDFNOPT (OFFSTACK)

PSFDFNOPT (OFFSTACK(*YES))
Specifies that there is no change to offset stacking and edge marking. That is, offset stacking and edge marking occurs between each spooled file. All offset stacking and edge mark changes specified in the form definition are honored. This is the default.

PSFDFNOPT (OFFSTACK(*NO))
Specifies that no offset stacking or edge marking is done. This includes the offset stacking and edge marking that is done between spooled files and through the form definition.

Specifying public data authority for directories created by PSF

PSF lets you specify the public data authority for any directories that PSF creates when a mapping program specifies that PDF files are to be written to the integrated file system. This ability applies to customer-written PDF mapping programs and to map objects.

This PSF configuration object parameter specifies public data authority:

PSFDFNOPT (PDFDTAAUT)

> **PSFDFNOPT (PDFDTAAUT(*INDIR))**
>> The authority for the directory to be created is determined by the directory it is to be created in. The directory immediately preceding the new directory determines the authority.
>>
>> A directory created in the root (/), QOpenSys, or user-defined file system is assigned the same public, private and primary group authority, authorization list, and primary group as the directory it is to be created in.
>>
>> A directory created in QDLS for a folder defaults to *EXCLUDE for a first level folder. If created in the second level or greater, the authority of the previous level is used.
>>
>> The QOpenSys and root (/) file systems use the parent directory Ifs Data Authority value. If the value *INDIR is specified, then PSF specifies the value *INDIR for the *PUBLIC object authority.

> **PSFDFNOPT (PDFDTAAUT(*RWX))**
>> The user can change the object and perform basic functions on the object except those limited to the owner or controlled by object existence (*OBJEXIST), object management (*OBJMGT), object alter (*OBJALTER) and object reference (*OBJREF) authorities. Read, write, execute (*RWX) authority provides object operational (*OBJOPR) and all data authorities.

> **PSFDFNOPT (PDFDTAAUT(*RW))**
>> The user can view and change the contents of an object. Read, write (*RW) authority provides *OBJOPR and data read (*READ), add (*ADD), update (*UPD) and delete (*DLT) authorities.

> **PSFDFNOPT (PDFDTAAUT(*RX))**
>> The user can perform basic operations on the object, such as run a program or display the contents of a file. The user is prevented from changing the object. Read, execute (*RX) authority provides *OBJOPR and data *READ and execute (*EXECUTE) authorities.

> **PSFDFNOPT (PDFDTAAUT(*WX))**
>> The user can change the contents of an object and run a program or search a library or directory. Write, execute (*WX) authority provides *OBJOPR and data *ADD, *UPD, *DLT, and *EXECUTE authorities.

> **PSFDFNOPT (PDFDTAAUT(*R))**
>> The user can view the contents of an object. Read (*R) authority provides *OBJOPR and data *READ authorities.

> **PSFDFNOPT (PDFDTAAUT(*W))**
>> The user can change the contents of an object. Write (*W) authority provides *OBJOPR and data *ADD, *UPD, and *DLT authorities.

> **PSFDFNOPT (PDFDTAAUT(*X))**
>> The user can run a program or search a library or directory. Execute (*X) authority provides *OBJOPR and data *EXECUTE authorities.

> **PSFDFNOPT (PDFDTAAUT(*EXCLUDE))**
>> The user cannot access the object. The OBJAUT value must be *NONE, if this special value is used. The value *NONE is not supported for PDDTAAUT.

> If you specify a value for PDDTAAUT that is not supported, PSF issues PQT0038 with reason code 5 and terminates. Message PQT0038 is: "Printer writer writer ended because of an error." Reason code 5 is: "Value not recognized."

Preventing the copying of spooled file attribute USRDFNOPT when respooling AFP

When the AFP respool function is done, PSF copies the User Defined Option (USRDFNOPT) spooled file attribute from the original spooled file to the new AFP spooled file. If the original spooled file is split into multiple respooled files, then each of the respooled files contains the USRDFNOPT spooled file attribute of the original spooled file. If you want to prevent the User Defined Option from being copied, you can do so.

If you want to prevent User Defined Options from being copied by PSF to the respooled files, you can do so in a way that is system-wide. Enter the following command.

```
CRTDTAARA DTAARA(QUSRSYS/QPSFVALS) TYPE(*CHAR) LEN(3) VALUE('NNN')  AUT(*USE)
```

PSF examines the third character of the data area to determine whether USRDFNOPT is copied. If the value of the third character is 'N', then USRDFNOPT is not copied. If the value is 'Y', any other character, or the data area does not exist, then PSF copies USRDFNOPT.

If you are currently using the QUSRSYS/QPSFVALS data area for another PSF function and want to turn off the copying of USRDFNOPT, you can do so by entering the following command.

```
CHGDTAARA DTAARA(QUSRSYS/QPSFVALS (3 1)) VALUE(N)
```

If you want to turn on the copying of USRDFNOPT, use the following command.

```
CHGDTAARA DTAARA(QUSRSYS/QPSFVALS (3 1)) VALUE(Y)
```

Line and mixed data stream support

Use this information to understand how PSF supports line and mixed data on IBM i.

Special characters control line positioning and fonts. Printer file parameters define the use of special characters and other printing options.

Related concepts
Line data
Line data is record-oriented readable text.

Mixed data
Mixed data is line data intermixed with AFPDS data.

Special characters used with line data

There are two types of special characters that can be used with line data; carriage control characters (CC) and table reference characters (TRC).

Carriage control characters affect the data's line positioning. A carriage control character can be represented as either American National Standard (ANSI) or machine code. You cannot use both ANSI and machine codes within a single data set. ANSI carriage control is a standard representation that is used with printers from many different manufacturers. See the American National Standard carriage control characters topic for the ANSI codes and their functions. Machine code control characters were defined by IBM; they correspond to channel command words issued by the operating system. See the Machine code carriage control characters topic for the IBM machine code values and functions.

There are differences in the conventions used by the IBM i operating system for ANSI and machine code line spacing. The IBM i convention for ANSI handles line spacing and then causes the line to be printed. The IBM i convention for machine codes causes the line to be printed and then performs the spacing action.

Table reference characters allow an additional byte at the beginning of a line. The byte indicates which coded font (specified on the AFPCHARS parameter) is used to print the line. Up to four coded fonts are specified on the AFPCHARS parameter. The table reference character contains a value of X'F0', X'F1', X'F2', or X'F3'. The value corresponds to the relative position of the required coded font in the list on the AFPCHARS parameter. If table reference characters are used, every data record must contain a table reference character. The printer file parameter Table Reference Characters (TBLREFCHR) specifies whether table reference characters are in the data.

If carriage control and table reference characters are used with the data, the table reference character follows the carriage control character. Both special characters precede the data. If carriage control bytes are not used, the table reference character is the first byte of the data record.

These graphics illustrate the valid forms of line data.

Data

Figure 5. Simple line data

TRC	Data

Figure 6. Line data with table reference characters

CC	Data

Figure 7. Line data with carriage control characters

CC	TRC	Data

Figure 8. Line data with carriage control characters and table reference characters

Related reference

American National Standard carriage control characters
This topic lists the American National Standard carriage control characters for line or mixed data. It also describes what each is used for.

Machine code carriage control characters
This topic lists the carriage control characters for line or mixed data in IBM machine code. It also describes what each character is used for.

Printer file parameters used with line and mixed data

There are several printer file parameters that can be used when working with line and mixed data. These parameters can all be specified on the Create Printer File (CRTPRTF), Change Printer File (CHGPRTF), and Override with Printer File (OVRPRTF) CL commands.

AFP characters (AFPCHARS)
This parameter identifies up to four 4-byte coded font names. The 4-byte names are concatenated to X'0'. The names identify the coded fonts that are needed when table reference characters are used in line or mixed data.

Control character (CTLCHAR)
This parameter specifies the type of control characters (American National Standards Institute (ANSI) or machine code) that are in the line or mixed data.

Convert line data (CVTLINDTA)
This parameter specifies whether line data is converted to Advanced Function Presentation data stream (AFPDS) before the data is spooled. A page definition specifies how the data is formatted.

DBCS character rotation (IGCCHRRTT)
For non-Advanced Function Presentation (AFP) printers, this parameter is used to rotate the double-byte character set (DBCS) data when line data is transformed to SNA Character Stream (SCS). For AFP printers, this parameter is ignored. Character rotation can be specified in the page definition.

DBCS characters per inch (IGCCPI)
For non-AFP printers, this parameter specifies the pitch of the DBCS data during transformation from line data to SCS. DBCS shift-out, shift-in (SOSI) characters cannot be transformed when going to an Intelligent Printer Data Stream (IPDS) printer. Mixed data cannot be transformed when going to an SCS or IPDS printer. For AFP printers, this parameter is ignored, as the pitch of the DBCS data is determined by the selected font.

DBCS SO/SI spacing (IGCSOSI)
This parameter indicates what action should be taken when SOSI characters are found in the data. If the data is mixed, the SOSI should be taken out and appropriate spaces inserted based on the value of this keyword.

Printer device type (DEVTYPE)
Use this parameter to place line data or mixed data onto the printer spool.

Table reference characters (TBLREFCHR)
This parameter indicates whether table reference characters (TRC) exist in the line or mixed data. If forms control characters are used with the data, the TRC follows the forms control character, but precedes the data bytes. If forms control characters are not used, the TRC is the first byte of the data record. If table reference characters are used, every data record must contain a TRC byte.

User-specified DBCS data (IGCDTA)
This parameter specifies whether the file processes DBCS data. If so, the user of a line or mixed data file must specify *YES to indicate that there are SOSI characters in the data.

Related reference
Change Printer File (CHGPRTF) CL command
Create Printer File (CRTPRTF) CL command
Override with Printer File (OVRPRTF) CL command

Considerations and restrictions when using line data or mixed data

In order to print line data, you might need to change an application or the printer file to generate control characters. You must be aware of the ways in which the parameters that specify page definitions and form definitions interact. You must remember that only a subset of DDS keywords is supported for line data. You must also remember that the SPOOL(*NO) parameter in the printer file is not valid for either line data or mixed data.

Application considerations for line data

To use line data, first determine whether your application generates an American National Standard control character in column 1 of your spooled output. If your application does generate an American National Standard control character as described, specify CTLCHAR(*FCFC) and DEVTYPE(*LINE) on the printer file.

If your application does not generate an American National Standard control character in column 1 of your spooled output, change your application to do so. To change your application, use a language or application construct (such as a SKIP or SPACE option on a COBOL WRITE statement), or make an RPG output specification. If your application cannot generate American National Standard control characters, specify CTLCHAR(*NONE) and DEVTYPE(*LINE) on your printer file. The operating system will use control information to generate machine code control characters in your data.

Specifying a page definition and form definition for line data

When using line data, you can specify various combinations of DEVTYPE(*LINE), PAGDFN, and FORMDF parameters on the printer file:

If you specify DEVTYPE(*LINE), PAGDFN and FORMDF
When you print to an Advanced Function Presentation (AFP) printer, Print Services Facility (PSF) uses the PAGDFN and FORMDF parameters to transform the data to Intelligent Printer Data Stream (IPDS).

When you print to a non-AFP printer, the PAGDFN and FORMDF parameters are ignored. The other parameters on the printer file are used and the line data is transformed to IPDS or SNA Character Stream (SCS).

If you specify DEVTYPE(*LINE) and FORMDF (no page definition)
When you print to an AFP printer, an inline page definition is built from the printer file parameters. PSF uses the form definition and the inline page definition to transform the data to IPDS.

When you print to a non-AFP printer, the FORMDF parameter is ignored. The other printer file parameters are used and the line data is transformed to IPDS or SCS.

If you specify DEVTYPE(*LINE) and PAGDFN (no form definition)

When you print to an AFP printer, an inline form definition is built from the printer file parameters. PSF uses the page definition and the inline form definition to transform the data to IPDS.

When you print to a non-AFP printer, the PAGDFN parameter is ignored. The other printer file parameters are used and the line data is transformed to IPDS or SCS.

If you specify DEVTYPE(*LINE) only (no page definition or form definition)

When you print to an AFP printer, an inline page definition and an inline form definition are built from the printer file parameters. PSF uses the inline form definition and the inline page definition to transform the data to IPDS.

When you print to a non-AFP printer, the printer file parameters are used and the line data is transformed to IPDS or SCS.

If you specify DEVTYPE(*AFPDSLINE)

The support for combinations of DEVTYPE(*AFPDSLINE), PAGDFN, and FORMDF are similar to DEVTYPE(*LINE) line data. However, you should be aware of these exceptions:

- The spooled file must be printed on an AFP printer. When you send data to a non-AFP printer, the data cannot be transformed to IPDS or to SCS.
- You are not required to specify a page definition or form definition with *AFPDSLINE data because they can be built inline. However, certain Advanced Function Presentation data stream (AFPDS) commands in the data stream (for example, Invoke Medium Map) might reference named structured fields in the page definition or form definition that do not match those in the inline page definition and form definition.

Supported DDS keywords for line data

Below is a list of Data description specifications (DDS) keywords that are supported for line data. If you use DDS keywords that are not included on this list while processing line data, they will be ignored.

- ALIAS
- BLKFOLD
- CCSID
- DATE
- DATFMT
- DATSEP
- DFT
- DLTEDT
- EDTCDE
- EDTWRD
- FLTFIXDEC
- FLTPCN
- IGCALTTYP
- IGCANKCNV
- INDARA
- INDTXT
- INVDTAMAP
- MSGCON
- PAGNBR
- REF
- REFFLD

- SKIPA
- SKIPB
- SPACEA
- SPACEB
- TEXT
- TIME
- TIMFMT
- TIMSEP

Printer file restrictions when using line data or mixed data

- Externally described printer files (DDS SUPPORT) support both line and mixed data device types.
- In the printer file, if you specify *LINE or *AFPDSLINE for device type, you cannot specify SPOOL(*NO). If you specify one of these combinations, Message CPD7341, indicating that the value SPOOL(*NO) is not valid with device type, is issued.

Sending data from zSeries to IBM i

Use these instructions to receive and print data and resources from zSeries systems to your IBM i.

Communication with the zSeries system is important to determine how the zSeries system sends data to your IBM i system. When data is sent from a zSeries system to your IBM i system, it can go directly to the output queue of a designated user ID. Alternatively, it can go into your network files.

Notes:

1. You can send print data to the output queue of a user ID only when your host zSeries RSCS/JES subsystem is connected to the VM or z/OS bridge on IBM i.

2. To send data to another IBM i or zSeries system, you can use the Send Network Spooled File (SNDNETSPLF) command.

If you are sending print data, it can be sent directly to an output queue of a specified user ID on the IBM i. Advanced Function Presentation data stream (AFPDS) data can go to your network files. However, you must then use the Print Advanced Function Printer Data (PRTAFPDTA) command to put the file on an output queue. If you are sending resources, the data must go into your network files.

Related concepts

Receiving resources and AFPDS data sent to network files
To make receiving resources and Advanced Function Presentation data stream (AFPDS) data as easy as possible, you should be aware of these points.

Related tasks

Receiving AFP resources from another system
When you receive Advanced Function Presentation (AFP) resource data from an operating system other than IBM i, you typically cannot change the resource. If you want to change the resource, it must be changed on the originating operating system and then resent to IBM i.

Sending print data from VM to the output queue of a user ID

The examples in this topic show two ways to send print data from VM to an IBM i output queue.

A z/VM® can issue a PRINT or a PSF command to place a file directly into an IBM i user's output queue.

Note: By using the code examples, you agree to the terms of the "Code license and disclaimer information" on page 93.

Example: Using the PRINT command

These commands place the file REPORTS LETTER A into the output queue of USERONE on IBM i with the node ID AS4002.

```
CP TAG DEV PRT AS4002 USERONE
CP SPOOL PRT TO RSCS COPY 1
PRINT REPORTS LETTER A (NOCC
```

These commands place the file REPORTS LISTING A into the output queue of USERONE on IBM i with the node ID AS4002.

```
CP TAG DEV PRT AS4002 USERONE
CP SPOOL PRT RSCS COPY 1
PRINT REPORTS LISTING A
```

Example: Using the PSF command

These commands place the line data spooled file into an IBM i. They use these variables:

Spooled file name:
　　reports letter a

User ID that owns the output queue:
　　userone

Target node ID:
　　is002

A page definition will be used when the data is printed. When using the PSF command, you must place the characters P1 in front of the page definition name. When using a form definition, you must place the characters F1 in front of the form definition name. This example uses a page definition named P1MYFORM.

```
TAG DEV PRT is002 userone
SPOOL PRT TO RSCS COPY 1
PSF reports letter a (PAGEDEF (P1MYFORM RESOURCE A))
```

Sending print data from z/OS to an IBM i output queue

The example in this topic shows how to use JCL commands to send print data from z/OS to IBM i.

These commands, when issued by z/OS, place the Advanced Function Presentation data stream (AFPDS) spooled file into the output queue of the specified user on IBM i. These commands are job control language (JCL) commands. Do not place a P1 (for PAGEDEF) or an F1 (for FORMDEF) in the instructions.

In the following example, a form definition named MYFORM is used. The user is userone and the node name is is002.

```
//INSTR          PROC        NODE='is002',USER='userone'
                             INFILE='dept265.userx.files(report)'
//SPOOL          EXEC         PGM=IEBGENER
//MYOUT          OUTPUT     DEST=NODE..USER,
                              COPIES=1,
                              FORMDEF=MYFORM
//SYSPRINT DD              SYSOUT=*
//SYSIN         DD          DUMMY
//SYSUT1     DD          DSN=&,DISP=SHR,DCB=(RECFM=FBA);
//SYSUT2     DD          SYSOUT=A,OUTPUT=*.MYOUT
// PEND
//STEP01       EXEC         PROC=INSTR
```

Note: By using the code examples, you agree to the terms of the "Code license and disclaimer information" on page 93.

Sending data from zSeries to IBM i network files

The examples in this topic show how to send print data and resources from a zSeries system to an IBM i network file.

Advanced Function Presentation (AFP) resources sent from an a zSeries system to an IBM i system must be sent to network files.

Note: AFP data can also be sent to network files. However, this is not the recommended way to send this data to an IBM i system. If you choose this method, you must use the Print Advanced Function Presentation Data (PRTAFPDTA) command to put the file on an output queue.

Sending resources and AFPDS data from VM to network files

When issued by a VM system, this command places the specified file into the network files of `userone` on an IBM i system named `is002`.

```
SENDFILE fonts resource a TO userone AT is002
```

Sending resources and AFPDS data from z/OS to network files

When issued by a z/OS system, this command places the specified file into a user's network files. The user is `userone` and the IBM i system is named `is002`.

```
TRANSMIT is002.userone DSNAME('system.afp.resources(font)')
```

Related concepts

Receiving fonts from zSeries
Fonts can be downloaded to IBM i from zSeries systems.

Related tasks

Printing data sent to IBM i from zSeries
PSF can print data that was generated on zSeries. This data might be AFP, AFPDSLINE (AFP data mixed with line data), or line data. The data might be sent to network files or directly to an output queue.

Receiving AFP resources from another system
When you receive Advanced Function Presentation (AFP) resource data from an operating system other than IBM i, you typically cannot change the resource. If you want to change the resource, it must be changed on the originating operating system and then resent to IBM i.

Related reference

zSeries parameters and corresponding IBM i printer file parameters
This topic briefly describes the zSeries printer parameters used on VM commands and z/OS JCL statements and indicates the equivalent IBM i printer file parameters.

AFP reference information

Look up information about PSF, such as the form definitions and page definitions included with your system, here.

This topic contains additional reference materials related to Advanced Function Presentation (AFP) printing.

Related concepts

Printer file parameter considerationsThis topic provides more detailed information about certain printer file parameters.
DDS for printer filesThis topic describes how to code the data description specifications (DDS) for printer files.

Related reference

Printing-related CL commandsThis topic lists CL commands that are related to printing.

Form definitions included with the operating system

This topic lists the form definitions that are provided with IBM i in library QSYS.

Table 2. IBM-supplied form definitions						
Name	**Across (inches)**	**Down (inches)**	**Presentation**	**Direction**	**Bin**	**Duplex**
F1A10110	1/6	1/6	Portrait	Across	1	No
F1A10111	1/6	1/6	Portrait	Across	1	Yes
F1A10112	1/6	1/6	Portrait	Across	1	Tumble
F1A10120	1/6	1/6	Portrait	Across	2	No
F1A10121	1/6	1/6	Portrait	Across	2	Yes
F1A10122	1/6	1/6	Portrait	Across	2	Tumble
F1C10110	1/6	1/6	Landscape	Down	1	No
F10101LA	0	1/2	Landscape	Across	1	No
F10101LD	0	1/2	Landscape	Down	1	No
F10101PA	0	1/2	Portrait	Across	1	No
F10101PD	0	1/2	Portrait	Down	1	No
F1OGL	0	0	Portrait	Across	1	No

Note: The IBM-supplied form definitions do not set the print quality for the 4224, 4230, 4234, and 4247 printers. You must set the print quality on the printer operator panel when using an IBM-supplied form definition.

Related concepts

Form definitions
A form definition is an Advanced Function Presentation (AFP) resource object that defines the characteristics of the physical form to be printed on.

Page segments
Page segments are objects containing composed text and images that are prepared before formatting and included during printing.

Page definitions included with the operating system

This topic lists the page definitions that are provided with IBM i in library QSYS.

Table 3. IBM-supplied page definitions			
Name	**Size of form**	**Orientation on page**	**Description**
P1A06462	8.5 x 11.0 inches	Portrait	Letter size. 6 lines per inch (LPI). 64 lines per page.
P1A08584 [1]	9.5 x 11.0 inches	Portrait	Continuous forms. 8 lines per inch (LPI). 85 lines per page.
P1A08682	8.5 x 11.0 inches	Portrait	Letter size. 8 lines per inch (LPI). 86 lines per page.

Table 3. IBM-supplied page definitions (continued)

Name	Size of form	Orientation on page	Description
P1B04963	8.5 x 14.0 inches	Portrait	Legal size. 6 lines per inch (LPI). 82 lines per page.
P1B08262	8.5 x 14.0 inches	Portrait	Legal size. 6 lines per inch (LPI). 82 lines per page.
P1B11082	8.5 x 14.0 inches	Portrait	Legal size. 8 lines per inch (LPI). 110 lines per page.
P1B06683	14.0 x 8.5 inches	Landscape	Legal size. 8 lines per inch (LPI). 66 lines per page.
P1C09182	8.27 x 11.69 inches	Portrait	Legal size. 8 lines per inch (LPI). 91 lines per page.
P1D08083	14.33 x 10.12 inches	Landscape	B4 Size forms. 8 lines per inch (LPI). 80 lines per page.
P1D08462	14.33 x 10.12 inches	Landscape	B4 size forms. 6 lines per inch (LPI). 84 lines per page.
P1D11382	10.12 x 14.33 inches	Portrait	B4 Size forms. 8 lines per inch (LPI). 113 lines per page.
P1J04964 [1]	12.0 x 8.5 inches	Landscape	Continuous forms. 6 lines per inch (LPI). 49 lines per page.
P1J06484 [1]	12.0 x 8.5 inches	Landscape	Continuous forms. 8 lines per inch (LPI). 64 lines per page.
P1L06464 [1]	14.88 x 11.0 inches	Landscape	Continuous forms. 6 lines per inch (LPI). 64 lines per page.
P1L08584 [1]	14.88 x 11.0 inches	Landscape	Continuous forms. 8 lines per inch (LPI). 85 lines per page.
P1V04863	8.27 x 11.00 inches	Portrait	Combined letter and A4 size forms. 6 lines per inch (LPI). 48 lines per page.
P1V06483	8.27 x 11.00 inches	Portrait	Combined letter and A4 size forms. 8 lines per inch (LPI). 64 lines per page.
P1V06683	8.27 x 11.00 inches	Portrait	Combined letter and A4 size forms. 8 lines per inch (LPI). 66 lines per page.

Name	Size of form	Orientation on page	Description
Table 3. IBM-supplied page definitions (continued)			
Name	**Size of form**	**Orientation on page**	**Description**
P1W120C2	8.27 x 11.00 inches	Portrait	Combined letter and A4 size forms using MULTIUP. 12 lines per inch. 120 lines printed per page. 2 logical pages printed on one physical page.
P1W12883	8.27 x 11.00 inches	Portrait	Combined letter and A4 size forms using MULTIUP. 8 lines per inch. 128 lines printed per page. 2 logical pages printed on one physical page.
P1W240F3	8.27 x 11.00 inches	Portrait	Combined letter and A4 size forms using MULTIUP. 15 lines per inch. 240 lines printed per page. 4 logical pages printed on one physical page.

1

    Can only be used with the 4224, 4230, 4234, and 4247 printers.

Related concepts
Page definitions
Page definitions are resources that format and compose line data into logical pages.

CL commands for PSF configuration objects

There are several CL commands that you can the commands to use to create, change, display, and delete a PSF configuration object.

The following table provides a brief description of each command. For information about specific parameters of the configuration object, see the online help. You can also use the AFP Manager component of System i Navigator to create, change, and delete a PSF configuration object.

Command	Description
Table 4. CL commands for PSF configuration objects	
Command	**Description**
Change PSF Configuration (CHGPSFCFG)	This command changes the PSF configuration object in the library specified on the command.
Create PSF Configuration (CRTPSFCFG)	This command lets you specify additional parameters for an Advanced Function Presentation (AFP) printer that are not supported in the Create Device Description (Printer) (CRTDEVPRT) command.
Delete PSF Configuration (DLTPSFCFG)	This command deletes a PSF configuration object from a specified library. If the PSF configuration object is found, it is deleted. If it is not found, a message is sent to the user indicating that the PSF configuration object cannot be found.
Display PSF Configuration (DSPPSFCFG)	This command lets you display or print the contents of a PSF configuration object.
Work with PSF Configuration (WRKPSFCFG)	This command lets the user work with all of the PSF configuration objects from the system libraries or the user libraries.

CL commands for device descriptions

There are several CL commands that you can to create or change a printer device description.

The following table provides a brief description about each command. For information about specific parameters of the configuration object, see the online help.

Table 5. CL commands for device descriptions	
Command	**Description**
Change Device Description (Printer) (CHGDEVPRT)	This command lets you change a device description for a printer device. Before you change a printer device description, it is recommended that you do these: • End the printer writer with the End Writer (ENDWTR) command. • Vary off the printer device with the Work with Configuration Status (WRKCFGSTS) command.
Create Device Description (Printer) (CRTDEVPRT)	This command lets you create a device description for a printer device. If you have a locally-attached Twinax device and the automatic configuration (QAUTOCFG) system value is *YES, the system will create printer device descriptions automatically.
Delete Device Description (DLTDEVD)	This command deletes a device description.
Display Device Description (DSPDEVD)	This command lets you display or print the contents of a device description.
Work with Device Descriptions (WRKDEVD)	This command lets a user display and work with device descriptions.

Related reference

Sharing print sessions
You can specify printer-sharing properties on the PSF configuration object. This lets you limit the amount of time that you have a connection to the printer, control when the session is released, control when a new session is started, and specify how many times PSF tries to connect to the printer.

Change Device Description (Printer) (CHGDEVPRT) CL command
Create Device Description (Printer) (CRTDEVPRT) CL command
Delete Device Description (DLTDEVD) CL command
Display Device Description (DSPDEVD) CL command
Work with Device Descriptions (WRKDEVD) CL command

zSeries parameters and corresponding IBM i printer file parameters

This topic briefly describes the zSeries printer parameters used on VM commands and z/OS JCL statements and indicates the equivalent IBM i printer file parameters.

Be aware of these special considerations when working with these zSeries (VM and z/OS) parameters:

FCB

If you specify the FCB parameter on VM or z/OS, IBM i uses the printer file of that name. IBM i uses the library list of the user receiving the spooled file to find the printer file. If the FCB parameter is not specified, the IBM i printer file QSYSPRT is used.

BIN and DUPLEX

The values for the DRAWER and DUPLEX parameters are taken from the printer file specified in the FCB parameter if both of these are true:

- The BIN and DUPLEX parameter values are not specified from VM and z/OS

- The form definition is not specified from VM or z/OS

If the FCB parameter is not specified, the DRAWER and DUPLEX values are set to *FORMDEF. This means that the values are taken from the form definition.

FORMDEF

If the form definition (FORMDEF) parameter is not specified from VM or z/OS, the IBM i form definition parameter is set to *DEVD, and *LIBL is used for the library. *DEVD means that the form definition used is the one specified in the device description for the printer you want to use.

These zSeries parameters are supported when a zSeries user sends data directly to the output queue of a user on IBM i.

The zSeries parameter is ignored when the data is printed on IBM i when both of these are true:

- The zSeries printer parameter is not one that is specified in this table.

- No matching or equivalent IBM i printer file parameter exists.

Table 6. VM parameters

zSeries printer parameter	VM commands	Function	IBM i printer file parameter
BIN	PSF	Specifies which drawer to take the paper from.	DRAWER
CC	PRINT, PSF	Specifies control characters.	CTLCHAR[1]
CHARS	SPOOL	Specifies a table of coded fonts.	AFPCHARS
COPY	SPOOL	Specifies the number of copies.	COPIES
DATACK	PSF	Specifies whether the printer blocks print positioning and incorrect character errors. Printers will always block these unless the printer file that is used to create the spooled file specifies *ABSOLUTE for fidelity.	
DEST	TAG	Specifies node and user ID.	

Table 6. VM parameters (continued)			
zSeries printer parameter	**VM commands**	**Function**	**IBM i printer file parameter**
DUPLEX	PSF	Specifies whether duplex printing is used.	DUPLEX
FCB	SPOOL, TAG	Specifies the printer file used.	FILE
FORM	SPOOL	Specifies the form type used.	FORMTYPE
FORMDEF	PSF	Specifies the form definition used.	FORMDF
PAGEDEF	PSF	Specifies the page definition used.	PAGDFN
PRMODE[2]	PSF	Specifies the device type, double-byte character data, processing shift-out, shift-in characters.	DEVTYPE, IGCDTA, IGCSOSI
TRC	PRINT, PSF	Specifies whether the data stream contains table reference codes.	TBLREFCHR

[1] To correctly print zSeries line data with first-character forms control, each channel value specified in the CTLCHAR parameter must have a unique line number associated with that channel value.

[2] Only PRMODE values of PAGE, LINE, SOSI1, SOSI2, and SOSI3 are supported. The supported PRMODE values translate to device types of *AFPDS, *LINE, or *AFPDSLINE. See Network Job Entry Formats and Protocols for more specific information.

Table 7. z/OS parameters			
zSeries printer parameter	**z/OS JCL statements**	**Function**	**IBM i printer file parameter**
CHARS	DD, OUTPUT	Specifies a table of coded fonts.	AFPCHARS
CONTROL	OUTPUT	Specifies line spacing	
COPIES	DD, OUTPUT	Specifies the number of copies.	COPIES
DATACK	OUTPUT	Specifies whether the printer blocks print positioning and incorrect character errors. Printers will always block these unless the printer file that is used to create the spooled file specifies *ABSOLUTE for fidelity.	
DCB=RECFM	DD	Specifies control characters.	CTLCHAR[1]

zSeries printer parameter	z/OS JCL statements	Function	IBM i printer file parameter
DEST	DD, OUTPUT	Specifies node and user ID.	
FCB	DD, OUTPUT	Specifies the printer file used.	FILE
FORMDEF	OUTPUT	Specifies the form definition used.	FORMDF
FORMS	OUTPUT	Specifies the form type used.	FORMTYPE
PAGEDEF	OUTPUT	Specifies the page definition used.	PAGDFN
PRMODE[2]	OUTPUT	Specifies the device type, double-byte character data, processing shift-out, shift-in characters.	DEVTYPE, IGCDTA, IGCSOSI
TRC	OUTPUT	Specifies whether the data stream contains table reference codes.	TBLREFCHR

[1] To correctly print zSeries line data with first-character forms control, each channel value specified in the CTLCHAR parameter must have a unique line number associated with that channel value.

[2] Only PRMODE values of PAGE, LINE, SOSI1, SOSI2, and SOSI3 are supported. The supported PRMODE values translate to device types of *AFPDS, *LINE, or *AFPDSLINE. See Network Job Entry Formats and Protocols for more specific information.

Related concepts

Sending data from zSeries to IBM i network files
The examples in this topic show how to send print data and resources from a zSeries system to an IBM i network file.

Related information

Network Job Entry Formats and Protocols PDF

American National Standard carriage control characters

This topic lists the American National Standard carriage control characters for line or mixed data. It also describes what each is used for.

Control character value (in hexadecimal)	Function
X'40' (blank)	Space one line, and then print (single spacing).
X'F0' (zero)	Space two lines, and then print (double spacing).
X'60' (dash)	Space three lines, and then print (triple spacing).
X'4E' (plus sign)	Suppress spacing, and then print (type over previous line).

Table 8. American National Standard carriage control characters and their functions

Control character value (in hexadecimal)	Function
X'F1'	Print the data at the line position defined as Channel 1 (by convention, the first line on a new page).
X'F2'	Print the data at the line position defined as Channel 2.
X'F3'	Print the data at the line position defined as Channel 3.
X'F4'	Print the data at the line position defined as Channel 4.
X'F5'	Print the data at the line position defined as Channel 5.
X'F6'	Print the data at the line position defined as Channel 6.
X'F7'	Print the data at the line position defined as Channel 7.
X'F8'	Print the data at the line position defined as Channel 8.
X'F9'	Print the data at the line position defined as Channel 9.
X'C1'	Print the data at the line position defined as Channel 10.
X'C2'	Print the data at the line position defined as Channel 11.
X'C3'	Print the data at the line position defined as Channel 12.

Table 8. American National Standard carriage control characters and their functions (continued)

Note: When American National Standard carriage controls are used, only the values that appear in this table are considered valid by Print Services Facility (PSF). PSF treats any other American National Standard carriage control value as not valid and uses single spacing to print any data on the line.

Related concepts
Special characters used with line data
There are two types of special characters that can be used with line data; carriage control characters (CC) and table reference characters (TRC).

Machine code carriage control characters

This topic lists the carriage control characters for line or mixed data in IBM machine code. It also describes what each character is used for.

Control character value (in hexadecimal)	Function
X'03'	No operation.
X'09'	Print, and then space one line (single spacing).
X'11'	Print, and then space two lines (double spacing).
X'19'	Print, and then space three lines (triple spacing).
X'01'	Print without spacing.
X'89'	Print the data, then skip to the line position defined as Channel 1 (by convention, the first line on a new page).
X'91'	Print the data, then skip to the line position defined as Channel 2.
X'99'	Print the data, then skip to the line position defined as Channel 3.
X'A1'	Print the data, then skip to the line position defined as Channel 4.

Table 9. Carriage control characters in IBM machine code and their functions

Table 9. Carriage control characters in IBM machine code and their functions (continued)	
Control character value (in hexadecimal)	**Function**
X'A9'	Print the data, then skip to the line position defined as Channel 5.
X'B1'	Print the data, then skip to the line position defined as Channel 6.
X'B9'	Print the data, then skip to the line position defined as Channel 7.
X'C1'	Print the data, then skip to the line position defined as Channel 8.
X'C9'	Print the data, then skip to the line position defined as Channel 9.
X'D1'	Print the data, then skip to the line position defined as Channel 10.
X'D9'	Print the data, then skip to the line position defined as Channel 11.
X'E1'	Print the data, then skip to the line position defined as Channel 12.
X'0B'	Space one line without printing.
X'13'	Space two lines without printing.
X'1B'	Space three lines without printing.
X'8B'	Skip to Channel 1 immediately (by convention, the first line on a new page).
X'93'	Skip to the Channel 2 position immediately.
X'9B'	Skip to the Channel 3 position immediately.
X'A3'	Skip to the Channel 4 position immediately.
X'AB'	Skip to the Channel 5 position immediately.
X'B3'	Skip to the Channel 6 position immediately.
X'BB'	Skip to the Channel 7 position immediately.
X'C3'	Skip to the Channel 8 position immediately.
X'CB'	Skip to the Channel 9 position immediately.
X'D3'	Skip to the Channel 10 position immediately.
X'DB'	Skip to the Channel 11 position immediately.
X'E3'	Skip to the Channel 12 position immediately.
Note: Print Services Facility (PSF) ignores these hexadecimal machine code carriage control characters and does not print lines containing them: X'02' through X'07', X'0A', X'12', X'23', X'43', X'63', X'6B', X'73', X'7B', X'EB', X'F3', and X'FB'. PSF treats any other carriage control value as not valid and prints any data on the line using single spacing.	

Related concepts
Special characters used with line data

There are two types of special characters that can be used with line data; carriage control characters (CC) and table reference characters (TRC).

Troubleshooting mapping problems

There are several ways to help you troubleshoot your PDF mapping programs.

Error message reason codes

The reason codes returned with error messages PQT4140 and PQT4151 can identify problems with PSF mapping programs.

The diagnostic spool file (PSFTRACE)

The diagnostic spooled file contains in-depth information about your mapping program. Use it with the reason code issued with message PQT4140 or PQT4151 to diagnose problems with your mapping program.

PSF automatically produces a spooled file called PSFTRACE whenever message PQT4140 or PQT4151 is issued, except when the reason code is 15 for PQT4140. The PSFTRACE spooled file lists the fields that PSF finds to be in error. You might get several diagnostic spooled files if there are several errors in the mapping program.

You can also request PSF to write a PSFTRACE spooled file that lists only the fields used by your mapping program. If you request a PSFTRACE spooled file and PSF also finds errors, it writes one spooled file with both sets of information: first the user-requested information and then the error information.

To find PSFTRACE, use the command WRKSPLF QSPLJOB. The spooled file has the same job number as the PDJ job (one of the three PSF jobs). If a file is respooled or segments within a spooled file are processed and the mapping program is called, the PSFTRACE dump of the mapping program interface is generated for the WTR job. Check for PSFTRACE after the writer has ended.

Requesting the diagnostic spool file

You can request PSF to write information passed to and received from a mapping program to a diagnostic spooled file called PSFTRACE.

To request the PSFTRACE file:

1. Create a data area. Enter this command:

```
CRTDTAARA DTAARA(QGPL/printer_device_name) TYPE(*CHAR) LEN(40) AUT(*ALL)
VALUE(X'E6E6D7C4E3D9C8D980000000000000008000000000000000003200000000000000000000000000000000')
```

   - The data area must be created before starting the printer writer.
   - The data area must be created in QGPL.
   - The name of the data area must match that of the printer device description being used for printing.
2. To verify the value in the data area, display the data area using *HEX representation:

   DSPDTAARA DTAARA(QGPL/*printer_device_name*) OUTFMT(*HEX)

   The data area must look like this:

```
E6E6D7C4E3D9C8D98000000000000000080000000000
0000000032000000000000000000000000000000000000
```

   The first eight characters of the value of the data area must be WWPDTRHR.
3. When you no longer need the PSFTRACE file, delete the data area. Enter this command:

   DLTDTAARA DTAARA(QGPL/*printer_device_name*)

Format of the diagnostic spool file

The first eight characters of each line in the diagnostic spooled file (PSFTRACE) describe the data that follows, except for lines that continue actual input or output data. Each line except data continuation lines has a time stamp.

If a keyword is marked **(hex offset)**, when the data following that keyword is hexadecimal, the hexadecimal offset of the data appears on the left. You can use these hexadecimal offsets to find specific fields.

The keywords that describe data are:

AFP OUTQ (hex offset)
Spooled File AFPDS Distribution format.

ATTACH (hex offset)
Attachments.

BCC (hex offset)
The specified BCC e-mail address.

BODY FIL (hex offset)
Body files.

CC (hex offset)
The specified CC e-mail address.

DIR PATH
The specified directory for files.

EXT AREA
Extension Area format.

INPUT (hex offset)
Mapping Program Input information format.

ISF FORM
Individual Stream File Information format.

MAP OBJ
The name of the PDF map object, if used.

MAP PGM
The library-qualified name of the mapping program.

MSG TEXT (hex offset)
Message text specified at an offset.

OFFSET
The offset at which the field in error is found in the mapping program. This value is written in decimal and hexadecimal.

OUTPUT (hex offset)
Mapping Program Output format.

PDF MAIL (hex offset)
The name of a PDF file attached to e-mail.

PDF OUTQ (hex offset)
Spooled File PDF Distribution format.

PUB AUT (hex offset)
The public authority of a PDF file written to the integrated file system.

QPQMAPEX, followed by a time stamp and then SN:
The value shown here is the sequence number of the PDF map entry used.

RC
The reason code from message PQT4140 or PQT4151. If the reason code is AA, FF or GG, a user requested this spooled file:

AA

The spooled file was written by the WTR job. Map programs requesting the respooling of AFP are called at this point.

FF

The spooled file was written by the PDJ job. Map programs are always called at this point.

GG

The spooled file was written by the WTR job. Map programs are called at this point when segments within a spooled file are processed. If a spooled file contains segments, PSF processes them when a PSF configuration object specifies PDFMULT(*YES *SPLIT).

RELEASE

The release of the operating system on which the trace was taken.

REPLYTO (hex offset)

The specified REPLYTO e-mail address.

SENDER

The sender of the e-mail.

SF FORM

Stream File format.

STMF (hex offset)

The name of the PDF file written to integrated file system.

SUBJECT (hex offset)

The subject of the e-mail.

TO (hex offset)

The specified TO e-mail address.

USR VALU

The value specified in the mapping program. Depending upon the field, this value can be either character or numeric (decimal and hexadecimal).

VALID

The valid values for the field in error.

Note: Formats (such as Spooled File AFPDS Distribution format) correspond to values in the mapping program template. For more information about any of these formats, see *Infoprint Server for iSeries User's Guide*.

Automatically generated PSFTRACE file

This is an example of a diagnostic spooled file (PSFTRACE) that PSF created because it detected an error in the mapping program.

The diagnostic spooled file contains this information:

- The name of the mapping program is QPQMAPEXIT. It is in library QSYS.

- The name of the map object is TEMA1. It is in library QGPL.

- The release on which this trace was taken is V6R1M0.

- The reason code issued with error message PQT4140 is 9, "When using SNDDST, all fields for specifying ReplyTo, CC, BCC, body files, attachments, and directory names must be 0."

- The input to the mapping program (Mapping Program Input Information format) is presented in hexadecimal representation. At the end of each line is the EBCDIC representation of the input. Not all characters can be displayed. Characters that cannot be displayed are represented by a period (.).

- An error was found in the mapping program in the Extension Area format at offset 00000012 (decimal) or 0000000C (hexadecimal). The value in that field is 00000448 (decimal) or 000001C0 (hexadecimal). To determine what field that is in the mapping program and what the appropriate values are, see the Mapping Program appendix in the *Infoprint Server for iSeries User's Guide*. In this case, the field is Offset to ReplyTo e-mail address. It has a value of 448 (decimal).

- Ten errors were found. Each error starts with the text 0FFSET.

- The valid value for all of these fields is 0.
- The output from the mapping program (Mapping Program Output format) is presented in hexadecimal representation. At the end of each line is the EBCDIC representation of the input. Not all characters can be displayed. Characters that cannot be displayed are represented by a period (.).
- The output from the Extension Area format is presented in hexadecimal representation. At the end of each line is the EBCDIC representation of the input. Not all characters can be displayed. Characters that cannot be displayed are represented by a period (.).

```
******** 10:59:17.724 *****************************************
MAP PGM  10:59:17.724 QSYS        QPQMAPEXIT
MAP OBJ  10:59:17.724 QGPL        TEMA1
RELEASE  10:59:17.725 V6R1M0
RC       10:59:17.725 09
INPUT    10:59:17.725
 000000  C4D3E3C4 C9D94040 4040D1D2 D3C1D940    40404040 F0F7F1F8 F1F4C4D3 E3C4C9D9    DLTDIR....JKLAR.....071814DLTDIR
 000020  40404040 00000001 40404040 40404040    40404040 40404040 40404040 40404040    ................................
 000040  40404040 40404040 40404040 40404040    40404040 40404040 40404040 40404040    ................................
 000060  40404040 40404040 40404040 40404040    40404040 40404040 40404040 40404040    ................................
 000080  40404040 40404040 40404040 40404040    40404040 40404040 40404040 40404040    ................................
 0000A0  40404040 40404040 40404040 40404040    40404040 40404040 40404040 40404040    ................................
 0000C0  40404040 40404040 40404040 40404040    40404040 40404040 40404040 40404040    ................................
 0000E0  40404040 40404040 40404040 40404040    40404040 40404040 40404040 40404040    ................................
 000100  40404040 40404040 40404040 40404040    40404040 40404040 40404040 40404040    ................................
 000120  404061D7 E2C6F4F0 F061F0F7 F1F9F7F0    61C4D3E3 C4C9D961 D1D2D3C1 D961F0F7    ../PSF400/071970/DLTDIR/JKLAR/07
 000140  F1F8F1F4 6DF0F0F0 F0F0F16D C4D3E3C4    C9D96DF0 F7F3F1F2 F0F0F96D F0F0F0F0    1814_000001_DLTDIR_07312009_0000
 000160  F0F14BD7 C4C64040 40404040 40404040    40404040 40404040 40404040 40404040    01.PDF..........................
 000180  40404040 40404040 40404040 40404040    40404040 40404040 40404040 40404040    ................................
 0001A0  40404040 40404040 40404040 40404040    40404040 40404040 40404040 40404040    ................................
 0001C0  40404040 40404040 40404040 40404040    40404040 40404040 40404040 40404040    ................................
 0001E0  40404040 40404040 40404040 40404040    40404040 40404040 40404040 40404040    ................................
 000200  40404040 40404040 40404040 40404040    40404040 40404040 40404040 40404040    ................................
 000220  40404040 40404040 40404040 40404040    40404040 40404040 40404040 40404040    ................................
 000240  40404040 40404040 40404040 40404040    40404040 40404040 40404040 40404040    ................................
 000260  40404040 40404040 40404040 40404040    40404040 4040F140 0000FFFF D1D2D3C1    ....................1.....JKLA
 000280  D9404040 40404040 40404040 40404040    C2D3C4C1 E2F6F140 912ED0B5 92E8C001    R...............BLDAS61.j...kY..
 0002A0  D1D2D7C4 C6404040 4040D8E4 E2D9E2E8    E2404040 E3C5D4C1 F1404040 4040D8C7    JKPDF.....QUSRSYS...TEMA1.....QG
 0002C0  D7D34040 40404040 5CE2E3C4 40404040    4040                                  PL......*STD......
OFFSET   11:05:39.349 EXT AREA  00000012 HEX:  0000000C
USR VALU 11:05:39.349 00000448 HEX:  000001C0
OFFSET   11:05:39.349 EXT AREA  00000016 HEX:  00000010
USR VALU 11:05:39.349 00000021 HEX:  00000015
OFFSET   11:05:39.349 EXT AREA  00000020 HEX:  00000014
USR VALU 11:05:39.349 00000000 HEX:  00000000
OFFSET   11:05:39.349 EXT AREA  00000024 HEX:  00000018
USR VALU 11:05:39.349 00000000 HEX:  00000000
OFFSET   11:05:39.349 EXT AREA  00000028 HEX:  0000001C
USR VALU 11:05:39.349 00000000 HEX:  00000000
OFFSET   11:05:39.349 EXT AREA  00000032 HEX:  00000020
USR VALU 11:05:39.349 00000000 HEX:  00000000
OFFSET   11:05:39.349 EXT AREA  00000036 HEX:  00000024
USR VALU 11:05:39.349 00000000 HEX:  00000000
OFFSET   11:05:39.349 EXT AREA  00000040 HEX:  00000028
USR VALU 11:05:39.349 00000000 HEX:  00000000
OFFSET   11:05:39.349 EXT AREA  00000044 HEX:  0000002C
USR VALU 11:05:39.349 00000000 HEX:  00000000
OFFSET   11:05:39.349 EXT AREA  00000048 HEX:  00000030
USR VALU 11:05:39.349 00000000 HEX:  00000000
VALID    11:05:39.357 0
OUTPUT   11:05:39.357
 000000  F1F00000 000000FF 0000001C D7938581    A2854099 85818440 A38889A2 40998597    10..........Please.read.this.rep
 000020  9699A340 82A840F1 F540C1A4 87A4A2A3    40404040 40404040 40404040 40404040    ort.by.15.August................
 000040  40404040 40404040 40404040 40404040    40404040 40404040 40404040 40404040    ................................
 000060  40404040 40404040 40404040 40404040    40404040 40404040 40404040 40404040    ................................
 000080  40404040 40404040 40404040 40404040    40404040 40404040 40404040 40404040    ................................
 0000A0  40404040 40404040 40404040 40404040    40404040 40404040 40404040 40404040    ................................
 0000C0  40404040 40404040 40404040 40404040    40404040 40404040 40404040 40404040    ................................
 0000E0  40404040 40404040 40404040 40404040    40404040 40404040 40404040 40404040    ................................
 000100  40404040 40404040 404040F1 0000013B    00000000 F0F0F0F0 00000000 000000      ...........1........0000.......
EXT AREA 11:05:39.357
 000000  00000070 000001AB 00000015 000001C0    00000015 00000000 00000000 00000000    ................................
 000020  00000000 00000000 00000000 00000000    00000000 00000000 00000000 00000000    ................................
 000040  00000000 00000000 00000000 00000000    00000000 00000000 00000000 000001D5    ...............................N
 000060  00000047 00000000 00000000 0000F0F0                                          ..............00
******** 10:59:17.744 *****************************************
```

User-requested PSFTRACE file

This is an example of a diagnostic spooled file (PSFTRACE) that PSF created because a user requested it.

The user-requested diagnostic spooled file contains only the information specified by a mapping program. In this example, a mapping program specifies almost all distribution options. All data is presented in hexadecimal representation. At the end of each line is the EBCDIC representation of the data. Not all characters can be displayed. Characters that cannot be displayed are represented by a period (.).

The diagnostic spooled file contains this information:

- The sequence number of the PDF map entry used is 2
- The mapping program is QPQMAPEXIT in library QSYS.

- The map object is TEST in library JKLAR.
- The release on which this trace was taken is V7R2M0.
- The reason code is listed as AA, FF or GG, which indicates that this information was user-requested.
  - AA indicates that the spooled file was written by the WTR job when processing a request to respool AFPDS.
  - FF indicates that the spooled file was written by the PDJ job.
  - GG indicates that the spooled file was written by the WTR job when processing a spooled file with segments to be split.
- The data in the various mapping program formats is displayed. The formats displayed depend on what the user requests. This example contains the following formats:
  - Mapping Program Input Information format
  - Mapping Program Output format
  - Extension Area format

    - Subject

    - Reply-to e-mail address

    - CC e-mail address

    - BCC e-mail address

    - Name of the PDF stream file written to the integrated file system

    - Name of the PDF file attached to the e-mail

    - Public authority for the PDF file
  - Spooled File PDF Distribution format
  - Spooled File AFPDS Distribution format
  - PDF Encryption format
  - Mail sender (found in the Extension Area format)
  - Stream File format
  - Individual Stream File Information format (a stream file to include in the body of the e-mail)
  - Stream File format
  - Individual Stream File Information format (a stream file to include as an attachment to the e-mail)

```
          12:49:04.591 BEFORE CALL TO MAP PROGRAM
          12:49:04.591   LENGTH OF INPUT INFORMATION 0722    , 000002D2 HEX
          12:49:04.591   LENGTH OF OUTPUT INFORMATION BUFFER 5000    , 00001388 HEX
          12:49:04.591   LENGTH OF OUTPUT INFORMATION AVAILABLE 0000    , 00000000 HEX
QPQMAPEX 12:49:04.592 SN: 00000002
          12:49:06.548 AFTER CALL TO MAP PROGRAM
          12:49:06.548   LENGTH OF INPUT INFORMATION 0722    , 000002D2 HEX
          12:49:06.548   LENGTH OF OUTPUT INFORMATION BUFFER 5000    , 00001388 HEX
          12:49:06.548   LENGTH OF OUTPUT INFORMATION AVAILABLE 0000    , 00000000 HEX
******** 12:49:06.548 **************************************
MAP PGM  12:49:06.548 QSYS       QPQMAPEXIT
MAP OBJ  12:49:06.548 JKLAR      TEST
RELEASE  12:49:06.548 V7R2M0
RC       12:49:06.548 FF
INPUT    12:49:06.548
 000000 D8D7C1C4 C5E5F0F0 F0C4D1D2 D3C1D940  40404040 F0F6F5F7 F6F3C5C5 E2F0F1F0   QPADEV000DJKLAR.....065763EES010
 000020 40404040 0000000A 9196A285 4B828199  99818281 A27C9985 86A48789 964B85A2   ........jose.barrabas@refugio.es
 000040 4B839694 40404040 40404040 40404040  40404040 40404040 40404040 40404040   .com............................
 000060 40404040 40404040 40404040 40404040  40404040 40404040 40404040 40404040   ................................
 000080 40404040 40404040 40404040 40404040  40404040 40404040 40404040 40404040   ................................
 0000A0 40404040 40404040 40404040 40404040  40404040 40404040 40404040 40404040   ................................
 0000C0 40404040 40404040 40404040 40404040  40404040 40404040 40404040 40404040   ................................
 0000E0 40404040 40404040 40404040 40404040  40404040 40404040 40404040 40404040   ................................
 000100 40404040 40404040 40404040 40404040  40404040 40404040 40404040 40404040   ................................
 000120 40404040 40404040 40404040 40404040  40404040 40404040 40404040 40404040   ................................
 000140 40404040 40404040 40404040 40404040  40404040 40404040 40404040 40404040   ................................
 000160 40404040 40404040 40404040 40404040  40404040 40404040 40404040 40404040   ................................
 000180 40404040 40404040 40404040 40404040  40404040 40404040 40404040 40404040   ................................
 0001A0 40404040 40404040 40404040 40404040  40404040 40404040 40404040 40404040   ................................
 0001C0 40404040 40404040 40404040 40404040  40404040 40404040 40404040 40404040   ................................
 0001E0 40404040 40404040 40404040 40404040  40404040 40404040 40404040 40404040   ................................
 000200 40404040 40404040 40404040 40404040  40404040 40404040 40404040 40404040   ................................
 000220 40404040 40404040 40404040 40404040  40404040 40404040 40404040 40404040   ................................
 000240 40404040 40404040 40404040 40404040  40404040 40404040 40404040 40404040   ................................
 000260 40404040 40404040 40404040 4040F240  0000FFFF D1D2D3C1                      ..................2.....JKLA
 000280 D9404040 40404040 40404040 40404040  C2D3C4C1 E2F6F140 911CE3C7 5EE61001   R..............BLDAS61.j.TG;W..
 0002A0 D1D2D7C4 C6404040 4040D8E4 E2D9E2E8  E2404040 E3C5E2E3 40404040 4040D1D2   JKPDF.....QUSRSYS...TEST......JK
 0002C0 D3C1D940 40404040 5CE2E3C4 40404040  4040                                 LAR.....*STD......
```

```
OUTPUT    12:49:06.548
 000000  F1F00000 000000FF 00000013 D7938581    A2854099 85A58985 A640A388 854081A3    10.........Please.review.the.at
 000020  A3818388 85844099 85979699 A34B4040    40404040 40404040 40404040 40404040    tached.report...................
 000040  40404040 40404040 40404040 40404040    40404040 40404040 40404040 40404040    ................................
 000060  40404040 40404040 40404040 40404040    40404040 40404040 40404040 40404040    ................................
 000080  40404040 40404040 40404040 40404040    40404040 40404040 40404040 40404040    ................................
 0000A0  40404040 40404040 40404040 40404040    40404040 40404040 40404040 40404040    ................................
 0000C0  40404040 40404040 40404040 40404040    40404040 40404040 40404040 40404040    ................................
 0000E0  40404040 40404040 40404040 40404040    40404040 40404040 40404040 40404040    ................................
 000100  40404040 40404040 404040F1 00000132    00000000 F1F1F0F0 00000000 000000      ...........1........1100.......
TO        12:49:06.549
 000000  8281A289 937CA381 97978195 A985854B    839694                                 basil@tappanzee.com
EXT AREA 12:49:06.549
 000000  00000070 000001A2 00000012 000001B4    00000015 000001E8 00000010 000001F8    .......s...............Y.......8
 000020  00000012 00000000 00000000 00000000    00000000 00000251 00000013 000001C9    ...............................I
 000040  0000001F 00000264 00000008 0000026C    00000131 00000000 00000000 0000020A    ...............%................
 000060  00000047 D9C4C5D5 C1D3C940 4040F0F0    00000131                               ....RDENALI...00
SUBJECT   12:49:06.549
 000000  C5A49996 40839389 9482A240 88898788    8599                                   Euro.climbs.higher
REPLYTO   12:49:06.549
 000000  A2A38597 8881957C A3819797 8195A985    854B8396 94                            stephan@tappanzee.com
CC        12:49:06.549
 000000  A3859999 81958385 7C818283 4B839694                                           terrance@abc.com
BCC       12:49:06.549
 000000  82999695 8396A27C 848595A5 85994B83    9694                                   broncos@denver.com
STMF      12:49:06.549
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Related information for AFP

Product manuals, IBM Redbooks publications, Web sites, and other information center topic collections contain information that relates to the Advanced Function Presentation topic collection. You can view or print any of the PDF files.

Manuals

- AFP Utilities for iSeries: User's Guide, S544-5349 (8683 KB)

- Font Summary for AFP Font Collection, S544-5633 (3773 KB)

- Infoprint Designer for iSeries: Getting Started, G544-5773 (551 KB)

- InfoPrint Font Summary, G550-1140 (1516 KB)

- Infoprint Server for iSeries: Introduction and Planning Guide, G544-5774 (635 KB)

- Infoprint Server for iSeries: User's Guide, G544-5775 (3829 KB)

- iSeries Guide to Output, S544-5319 (8836 KB)

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- IBM AS/400 Printing V, SG24-2160 (500 KB)

- IBM eServer™ iSeries Printing VI: Delivering the Output of e-business, SG24-6250 (760 KB)

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Web sites

- Ricoh: Software - IBM i (www.infoprintsolutionscompany.com/internet/ipww.nsf/vwWebPublished/ swtp_ibmi_en). This Web site describes all of the IBM i Advanced Function Presentation (AFP) products.
- AFP Consortium (AFPC) (www.afpcinc.org). The AFP Consortium is an open standards body consisting of hardware and software vendors which define and develop the AFP architecture. The latest information about the AFP data stream architecture, white papers, and presentations may be found on the AFP Consortium web site. Refer to the AFPC website for the latest versions of the following documents:
  - AFP Programming Guide and Line Data Reference
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