IEEE-ISTO
Industry Standards and Technology Organization
affiliated with the IEEE and the IEEE Standards Association

The Printer Working Group
Standard for the Internet Printing Protocol (IPP): Color and Imaging Attributes

Draft 0.1 for IEEE-ISTO 5100.8-2002, October 18, 2002

A Program of the IEEE-ISTO pwg

18 October 2002

IEEE
Industry Standards and Technology Organization (IEEE-ISTO)
445 Hoes Lane • P.O. Box 1331 • Piscataway, NJ 08855-1331, USA
Phone +1.732.981.3434 • Fax +1.732.562.1571 • http://www.ieee-isto.org

The Printer Working Group
Standard for the Internet Printing Protocol (IPP): Color and Imaging Attributes

Draft 0.1 for IEEE-ISTO 5100.8-2002, October 18, 2002

Abstract: This document specifies an extension to the Internet Printing Protocol/1.0 (IPP) [RFC2565, RFC2566] and IPP/1.1 [RFC2910, RFC2911]. This extension contains color and imaging attributes defined for submitting print jobs primarily to (but not limited to) production printers. The color Job Template attributes permit a user to control and/or override instructions in the document content to perform the following: control black overprinting, adjust color cast, lightness, saturation and contrast, specify source and destination color space translations, emulate the color output of other printers, control color image trapping, color rendering intent for text, graphics, or images, color depth, highlight color, and User defined Tone Reproduction Curves (TRCs). The imaging Job Template attributes control bleed edge printing, image aliasing, color effects mapping, page rotation, reference (large) images and control their fetching and cleanup, and control halftone screens. There is also a Printer Description attribute to indicate the colorants which are currently in use by the Printer.

This document is a draft of an IEEE-ISTO PWG Proposed Standard and is in full conformance with all provisions of the PWG Process (see ftp://ftp.pwg.org/pub/pwg/general/pwg-process.pdf). PWG Proposed Standards are working documents of the IEEE-ISTO PWG and its working groups. The list of current PWG projects and drafts can be obtained at http://www.pwg.org.

This draft is available electronically at: ftp://ftp.pwg.org/pwg/ipp/new_COLOR/pwg5100.8-D01-021018.pdf, .doc

After PWG approval, this document will be available electronically at:

ftp://ftp.pwg.org/pub/pwg/standards/pwg5100.8.pdf, .doc, .rtf

Title: The Printer Working Group Standard for the Internet Printing Protocol (IPP): Color and Imaging Attributes

About the IEEE-ISTO

The IEEE-ISTO is a not-for-profit corporation offering industry groups an innovative and flexible operational forum and support services. The IEEE-ISTO provides a forum not only to develop standards, but also to facilitate activities that support the implementation and acceptance of standards in the marketplace. The organization is affiliated with the IEEE (http://www.ieee.org/) and the IEEE Standards Association (http://standards.ieee.org/).

For additional information regarding the IEEE-ISTO and its industry programs visit http://www.ieee-isto.org.

About the IEEE-ISTO PWG

The Printer Working Group (or PWG) is a Program of the IEEE Industry Standards and Technology Organization (ISTO) with member organizations including printer manufacturers, print server developers, operating system providers, network operating systems providers, network connectivity vendors, and print management application developers. The group is chartered to make printers and the applications and operating systems supporting them work together better. All references to the PWG in this document implicitly mean "The Printer Working Group, a Program of the IEEE ISTO." In order to meet this objective, the PWG will document the results of their work as open standards that define print related protocols, interfaces, procedures and conventions. Printer manufacturers and vendors of printer related software will benefit from the interoperability provided by voluntary conformance to these standards.

In general, a PWG standard is a specification that is stable, well understood, and is technically competent, has multiple, independent and interoperable implementations with substantial operational experience, and enjoys significant public support.

For additional information regarding the Printer Working Group visit: http://www.pwg.org

Contact information:

IPP Web Page: http://www.pwg.org/ipp/
IPP Mailing List: ipp@pwg.org

To subscribe to the ipp mailing list, send the following email:
1) send it to majordomo@pwg.org
2) leave the subject line blank
3) put the following two lines in the message body:
subscribe ipp
end

Implementers of this specification are encouraged to join the IPP Mailing List in order to participate in any discussions of clarifications or review of registration proposals for additional names. Requests for additional media names, for inclusion in this specification, should be sent to the IPP Mailing list for consideration.

Contents

335

336 Tables

350

351 Figures

1 Introduction

This document specifies an extension to the Internet Printing Protocol/1.0 (IPP) [RFC2565, RFC2566] and IPP/1.1 [RFC2910, RFC2911]. This extension consists primarily of OPTIONAL Job Template attributes related (but not limited) to production printing. Table 1 contains color Job Template attributes (see Section 3) and Table 3 contains a Printer Description attribute (see Section 5) that REQUIRE a color Printer in order to support, and Table 2 contains imaging Job Template attributes (see Section 4) that do not REQUIRE a color Printer in order to support, although a color Printer MAY support any of them. See section 3.1 for an overview of the color Job Template attributes.

Table 1 - Summary of Color Attributes defined

Attribute Name (syntax)	Job Template attribute controls the:
adjust-contrast (integer(-100:100))	contrast adjustment
adjust-{cyan-red | magenta-green | yellow-blue} (integer(-100:100))	cyan/red, magenta/green, yellow/blue color cast adjustment
adjust-lightness (integer(-100:100))	color lightness adjustment
adjust-saturation (integer(-100:100))	color saturation adjustment
black-overprint (type2 keyword)	black overprint methods
color-depth-yyy (integer(2:MAX))	number of levels of colorant for colorant *yyy*
color-destination-profile-back (type3 keyword | name(MAX))	destination color space profile for the media back side
color-destination-profile-front (type3 keyword | name(MAX))	destination color space profile for the media front side
color-effects-type (type2 keyword)	rendering of a color document as color or monochrome-grayscale
color-emulation (type3 keyword | name (MAX))	emulation of a different color-printing device
highlight-colorant (type3 keyword | name(MAX))	color for the highlight colorant
highlight-colorant-mismatch (type3 keyword | name(MAX))	action to be taken when desired highlight colorant is not loaded
highlight-map (type3 keyword | name(MAX))	algorithm for mapping full color space to a color in highlight color space
highlight-map-color (type3 keyword | name(MAX))	color in full color space to be mapped to the highlight colorant
rendering-intent-{graphics | images | text} (type2 keyword)	rendering intent for graphics, images & text content
source-{cmy | gray}-{graphics | images | text} (name(MAX)), undefined-source-{cmy | gray}-{graphics | images | text} (name(MAX))	source color space profile for rendering graphics, images & text content, in either CMY color space or for grayscale data
source-{cmyk | rgb}-{graphics | images | text} (type3 keyword | name(MAX)), undefined-source-{cmyk | rgb}-graphics (type3 keyword | name(MAX))	source color space profile for rendering graphics, images & text content, in either CMYK or RGB color space
trapping (type2 keyword)	color trapping
trap-width-fast (integer(0:MAX))	number of pixels at each object boundary to be in the trapping region in the “fast scan direction”
trap-width-slow (integer(0:MAX))	number of pixels at each object boundary to be in the trapping region in the “slow scan direction”
trc (collection)	User Tone Reproduction Curves (TRC)

362 **Table 2 - Summary of Imaging Attributes defined**

Attribute Name (syntax)	Job Template attribute controls the:
anti-aliasing (type3 keyword)	anti-aliasing algorithm
bleed-edge-printing (type2 keyword)	control for printing to edges of the paper
halftone-{graphics | images | text} (type2 keyword | name(MAX))	halftone screens to be used by the Printer to render graphics, images & text content
opi-image-insertion (type2 keyword)	type of Open Prepress Interface (OPI) image insertion
opi-image-pre-scan (type2 keyword)	control to determine accessibility of referenced OPI images
page-rotation (type3 keyword | name(MAX))	rotation transformation of pages
resource-cleanup (type3 keyword | 1setOf name(MAX))	identification and deletion of any files not submitted with the job
resource-pre-scan (type2 keyword)	accessibility of, and optionally to gather, resources referenced by the job

363 **Table 3 - Summary of Color Printer Description Attributes defined**

Attribute Name (syntax)	Description
colorants-supported (1setOf (type3 keyword | nam(MAX))	colorants currently in use by the Printer

364

365 Many of these functions MAY be specified in a document format (PDL). In such cases, the user MAY request that
366 the application include these instructions as part of the document data when the document is generated, rather than
367 in the IPP protocol at print time. However, some applications are unable to support some of the functions. Also
368 some of these functions are not supported in some PDLs. Finally, in a production environment, the document may
369 be generated separately from being printed, in which case the end user or the production printer operator supplies
370 the instructions at print time, long after the document had been created.

371 2 Terminology

372 This section defines terminology used throughout this document.

373 2.1 Conformance Terminology

374 Capitalized terms, such as **MUST, MUST NOT, REQUIRED, SHOULD, SHOULD NOT, MAY, NEED NOT,** and
375 **OPTIONAL**, have special meaning relating to conformance as defined in RFC 2119 [RFC2119] and [RFC2911]
376 section 12.1. If an implementation supports the extension defined in this document, then these terms apply;
377 otherwise, they do not. These terms define conformance to *this document only*; they do not affect conformance to
378 other documents, unless explicitly stated otherwise. To be more specific:

379 **REQUIRED** - an adjective used to indicate that a conforming IPP Printer implementation MUST support the indicated
380 operation, object, attribute, attribute value, status code, or out-of-band value in requests and responses. See
381 [RFC2911] “Appendix A - Terminology for a definition of “support”. *Since support of each Job Template attribute is*
382 *OPTIONAL, the use of the term REQUIRED in this document means “REQUIRED if this OPTIONAL Job Template*
383 *attribute is implemented”.*

RECOMMENDED - an adjective used to indicate that a conforming IPP Printer implementation is recommended to support the indicated operation, object, attribute, attribute value, status code, or out-of-band value in requests and responses. *Since support of each Job Template attribute is OPTIONAL, the use of the term RECOMMENDED in this document means "RECOMMENDED if this OPTIONAL Job Template attribute is implemented".*

OPTIONAL - an adjective used to indicate that a conforming IPP Printer implementation MAY, but is NOT REQUIRED to, support the indicated operation, object, attribute, attribute value, status code, or out-of-band value in requests and responses.

2.2 Other Terminology

This document uses the same terminology as the following previous specifications with the same meaning:

- [RFC2911]: "client", "attribute", "attribute value", "keyword", "operation", "request", "response", "support", "Job Template attribute" (sections 4.2 and 3.1.3), and "Printer Object" (section 2.1) or more simply "Printer"
- [pwg-prod-print]: "collection", "Input-Document", "Output-Document", "rendered output"
- [pwg-prod-print-2]: "Document Creation Operations", "Job Creation Operations", "Precedence", "Production Printer", "Raster image", "RIP"

In addition, the following terms are defined for use in this document:

Term	Definition
AccuColor LUT	A Color translation look-up table (LUT) created using tools developed by the Digital Imaging Technology Center.
Blended-pictorial-and-graphic	A rendering intent defined by this document that is appropriate for mixed content page images consisting of pictorial and graphic objects.
B/W	A binary (i.e. 1 bit per pixel) monochrome page. A binary image can be simulated with a contone image path by using the contone values 0 and 255.
Calibration TRCs	The Tone Reproduction Curves (TRC) sets which are stored in the system as the result of calibration. These TRCs are applied to jobs in a manner transparent to the user - i.e. their use is automatic and can not be turned off or adjusted (aside from initiating a recalibration). The system will selectively apply one of these TRCs to each pixel of image data. See TRC and User TRC.
Choke	The area left when a part of the image is eroded slightly in order to apply trapping. See trapping.
CID	Configure Image Data. Provides configuration information for creating palettes and transmitting raster data in PCL5C [PCL].
CIE LAB	Also called CIE L*a*b*. Device independent color space used to represent color in terms of Lightness (i.e. L*), hue and chroma (i.e. "a" represents red-green and "b" represents yellow-blue). Developed by the Commission Internationale De l'Eclairage – color science standards body.
Color Adjustments	Simple, knob-type controls provided to the user for modifying or tweaking color output. For example, the following may be provided: Lightness, Contrast, Saturation, and Color Cast.
Color Space	A system for describing colors that is related to device color representation (e.g. gray scale, RGB for monitors, CMYK for output devices) or related to human visual perception (i.e. CIE LAB). Input devices (like scanners, digital cameras, and monitors) typically represent color in terms of additive components (Red, Green and Blue). Output devices (like printers) typically represent color in terms of a set of toner subtractive color components (Cyan, Magenta, Yellow and Black).
Color Translation Profile	Any profile which takes a 3 or 4 dimensional input space and transforms it into a different one, three, or four dimensional space. Examples include ICC profiles [ICC],

Term	Definition
	PostScript CSAs, and PostScript CRDs [postscript]. Note one-dimensional TRCs are not color translation profiles according to this definition.
CRD	Color Rendering Dictionary. This is a PostScript [postscript] resource which translates device independent color space into device dependent space. Analogous to a Destination ICC Profile [ICC].
CSA/CSD	Color Space Array/Color Space Dictionary. This is a PostScript [postscript] resource which translates device dependent color space into device independent color space. Analogous to a Source ICC Profile [ICC].
Destination ICC Profile	These profiles are used to convert PCS data to device dependent data targeted for a specific device [ICC]. These profiles are also known as Output profiles and provide the characterization of the output device which is usually the marker in the output device, but MAY be a display for proofing by the operator. Usually the Destination Profile is for the Output-Document. However, when proofing on the Printer's display, the Destination Profile is different for the display than for the marker.
DRI	Display Resolution Image - a 1/8 resolution image.
Emulation	The process of rendering a job such that the color content is consistent in appearance with a given standard (e.g. SWOP [SWOP]) within the limitation of the device.
gamut	The set of colors that a device can physically produce by combining primary colors (Red, Blue, Green or Cyan, Magenta, Yellow, Black, etc) within a given color space. The gamut of an input device (like a scanner or camera) might not typically exactly match the gamut of an output device (like a printer or offset press). When this occurs the printer usually uses some sort of gamut mapping strategy that enables it to transform a request for a color that it cannot physically produce into a color that it can produce.
Graphic	An object contained within the PDL master, described by one or more vectors.
Gray	A contone (i.e. 8 bit per pixel) monochrome page.
ICC	International Color Consortium [ICC]. Consortium of hardware and software vendors who banded together to produce a standard method (ICC Profiles) for describing and transferring color image information between applications and devices. The founding members of the consortium included: Adobe Systems Inc., Agfa-Gevaert N.V., Apple Computer, Inc., Eastman Kodak Company, FOGRA (Honorary), Microsoft Corporation, Silicon Graphics, Inc., Sun Microsystems, Inc., and Taligent, Inc (resigned).
Identity TRC	A TRC which would not modify the image data - i.e. after applying the TRC, the output data is equivalent to the input data.
LUT	Look Up Table. In this context it is a table which converts one color space to another by indexing into a table, finding values, and interpolating to find an output value.
Monochrome	A page that has a single separation. This separation will be sent to the IOT as the K plane.
OOR	Object-Optimized Rendering. A methodology that attempts to choose the rendering algorithm that will deliver the best image quality for a given object and IOT.
OPI	Open Prepress Interchange (OPI) [OPI]. OPI originated at Aldus, now part of Adobe. The OPI industry-standard convention defines how to embed instructions in a PostScript [postscript] output file to tell the output device where and how to merge the various text and graphics components of a page. OPI enables users to work with low-res preview images in their page-makeup programs, and keep the high-resolution graphic images close to the printer or imagesetter. This maximizes workstation productivity and minimizes network traffic to the print device. There are multiple versions of the OPI specification – 2.0 (released January 2000) and 1.3 (Official) - which define a set of Postscript comments for image substitution instructions. Search the Adobe partners web site for OPI to locate these specifications (i.e. at http://partners.adobe.com).

Term	Definition
OPI Broken reference	A condition where the information provided in OPI [OPI] comments, together with OPI environment information provided by the System Administrator, is not sufficient for the controller to locate and retrieve the referenced high-resolution image.
OPI consumer	An application which detects OPI [OPI] comments in a Postscript [postscript] data stream, and inserts high- resolution image data into the stream as specified by the comments.
OPI ImageFileName	Used in this document to refer to the OPI [OPI] comment which provides the full pathname of the low- resolution image. This can be either %ALDImageFileName (version 1.3 of OPI) or %%ImageFileName (version 2.0).
OPI ImageID	Used in this document to refer to the OPI [OPI] comment which provides an identifier or pathname for the high-resolution image. This can be either %ALDImageID (version 1.3) or %%MainImage (version 2.0).
OPI job	A Postscript [postscript] or PDF [PDF] job which contains OPI [OPI] comments.
OPI Prescan	Common Controller function of scanning for OPI [OPI] comments and attempting to locate referenced images. Serves to record resolved image paths, and identify broken references, prior to occupying the decomposer. Also includes a "gather" option, to collect images on local disk.
OPI producer	An application that writes OPI [OPI] comments - typically, a page layout program.
OPI server	Typically refers to software which provides an OPI [OPI] consumer, image repository management, and low-resolution image generation. Often acts as a forwarding print server; an intermediary between clients and print controller.
OPI Substitution	Common Controller's OPI [OPI] consumer function. Involves interpreting and processing all OPI comments, substituting high resolution images, and updating the PDL as necessary to process the images.
PCL	Printer Control Language (PCL) [PCL] with a number of versions called levels. PCL is a registered trademark of Hewlett-Packard Company.
PCS	Profile Connection Space. This is the internal ICC Profile [ICC] exchange space, which connects the source and the destination profiles. Defined as the CIE colorimetry which will produce the desired color appearance if rendered on a reference imaging media and viewed in a reference viewing environment.
PDF	Portable Document Format [PDF]. PDF relies on the imaging model of the PostScript® language to describe text and graphics in a device-independent and resolution-independent manner.
PDL	Page Description Language. A generic term for any printer language that controls a printer. such as PostScript™, PCL™, PDF, etc.
Production Printer	A Printer that produces large quantities of high quality output, that often requires operator participation to make decisions as to the choice of job and its parameters.
Profile Assignment	An association between a loaded ICC profile [ICC] and a paper stock. When rendering an image, the decomposer will select the profile assigned to the stock that the image will be printed on.
Profile Properties	Information about a loaded profile. For instance, profile type (profile specified), profile name (user specified) and profile color space (profile specified) are properties of an ICC profile [ICC].
PRI	Print Resolution Image - a 300 or 600 spi image.
Pure text	This rendering intent is appropriate for text, for example, similar to 'saturation', but with a bias towards no half-toning.
Sampled Image	A bitmap object contained within the PDL master and processed (i.e. decompressed) by the decomposer.
Separation	All of the scan lines for one of the **n** color planes. The separation format includes a Strip Offset Table and a separation header.
Source ICC Profile	An ICC profile [ICC] used to translate device dependent color data into PCS. These profiles define the behaviors of the source on which the color data was created, i.e.,

Term	Definition
	the behaviors of the Input Document. Examples of source profiles include Input and Display Profiles.
Spreads	The area expanded into when a part of the image is expanded slightly in order to apply trapping. See trapping.
SWOP	Specifications for Web Offset Publications [SWOP]. A standard widely adopted in the US for the web offset printing industry. The official standard specifies a single coated stock.
Trapping	Trapping is an image processing technique used to compensate for misregistration in the print engine. When color planes are not registered exactly with one another, white gaps and regions of shifted hue appear at object boundaries. Trapping will compensate for these image quality defects by using chokes (the part left when a region of an image is shrunk slightly) and spreads (the part affected when a region of an image that is expanded slightly into) filled with appropriate colors (derived from the edge colors) to mask the registration problems, resulting in better looking images.
TRC	Tone Reproduction Curve. A mathematical function that defines a mapping from input intensity values to output intensity values. The mapping covers the complete domain of input intensity values. Also know as Intensity Transfer Function.
TRC-set	A set of 4 TRCs; one each for C, M, Y and K separation.
User TRC	A TRC which is created by a user and may be applied to output images on a job, queue or page basis in addition to the Printer Calibration TRCs which are always applied (see Calibration TRC).

3 Color Job Template attribute definitions

This section defines color Job Template attributes related (but not limited) to production printing that REQUIRES a color Printer in order to support. However, as with all Job Template attributes, support by a Printer is an implementation decision.

3.1 Overview of the color attributes

In general, the color attributes are intended to provide support for color-managed printing based on ICC (International Color Consortium) specifications [ICC]. In addition, the color attributes provide for certain customization mechanisms at the job level, in recognition of the post-application print job corrections that may be required.

The color Job Template attributes fall in to the following categories which the Printer applies in the following order, typically:

1) Source interpretation of Color Spaces

2) Color adjustment (cast, contrast, lightness, saturation)

3) Output color rendering

    a) color effects (print color as monochrome-grayscale, etc.)
    b) emulation of another printing device
    c) destination color profiles
    d) rendering control for text, graphics, and/or images

4) Color separation control (black overprint, trapping)

5) Tone reproduction (TRC) adjustment

Note that each of the profile identification attributes (source, emulation, destination) requires that the identified profiles are separately accessible to the Printer receiving the job.

3.1.1 Source Interpretation

Extensive capabilities are provided to link job content with the appropriate ICC source profiles, so that the printer can control the interpretation of the incoming job content. See the "source-xxx" and "undefined-source-xxx" attributes in Section 3.13 of this specification. The source color space translation profile attributes are used to look up the identified source profiles. Source profiles can be selected individually for graphics (line work), text, and pictorial aspects of the job, and can be selected for each different source color encoding in the job. These source color space translation profile attributes can be specified by keyword, indicating a source color encoding, or by selection of a profile by name. Use of the source profile job attributes presumes that the user is supplied with a list of valid profiles from which to choose.

Documents in general may contain a mix of Defined Source Color Space objects and Undefined Source Color Space objects. Of particular note, with the "undefined-source-xxx" attributes, the user is able to identify default source profiles to use only for job content that does NOT contain embedded color translation transforms (e.g., CSA or ICC profiles). On the other hand, using the "source-xxx" attributes, the user-identified source color space translation profiles will override embedded source color translation transforms (e.g., CSAs or ICC profiles). In each case, the printer uses the source profile(s) to interpret the incoming job content, in preparation for rendering the job for printing.

3.1.2 Color Adjustment

The color adjustment attributes provide post-application job customization capabilities. The printer uses the color adjustment attributes to make adjustments to the image data after each source profile is applied. The color adjustment attributes are (a) the color cast adjustment attributes ("adjust-cyan-red", "adjust-magenta-green", and "adjust-yellow-blue"), (b) contrast adjustment attribute "adjust-contrast", (c) lightness adjustment attribute "adjust-lightness" and (d) color saturation adjustment attribute "adjust-saturation" (See Section 3.2). However, the color adjustment attributes differ from the "trc" attributes that can be applied later in the processing path in three key ways. First, their use, even when included in the job, will vary as a function of job content. Second, the data values associated with these attributes are arbitrary, and their interpretation will be printer dependent. Third, the color adjustments will be applied before the printer-specific color rendering transform.

3.1.3 Output Color Rendering

Several categories of attributes work together to determine the color rendering behavior in the printer.

3.1.3.1 Color Effects (print color as monochrome-grayscale, etc.)

The "color-effects-type" attribute (see Section 3.6) allows the user to override the color attributes of a job to create a monochrome output. The printer will use the value of the "color-effects-type" attribute to either override any separately selected color behavior – to produce a monochrome gray output, or to allow the color behavior to remain as specified by the other color attributes.

3.1.3.2 Emulation

Using the emulation profile attribute, the user identifies a single emulation profile (see "color-emulation" in Section 3.7), either through the use of a keyword identifying an emulation category (such as ‘swop’ [SWOP]), or by selection of a profile name from a list. Use of the emulation profile job attribute presumes that the user is supplied with a list of valid profiles from which to choose.

Emulation capabilities are fundamental to the use of any printer as a proofing device. There are two basic approaches to emulation. The first approach uses a custom destination profile that combines emulation and target printer characteristics into a single profile. Using this approach, the user selects EITHER the destination profiles, OR an emulation profile, NOT both. The second approach uses two profiles, an emulation profile AND a destination profile, sequenced in an ICC device emulation profile chain. The emulation profile characterizes the printer being emulated. The destination profile characterizes the target printer for the current output. In this case the user selects BOTH the emulation profile and the destination profile(s).

Using either approach, the printer will look up the identified emulation profile and apply it during the color rendering process to cause the output to 'emulate' the tone and color behavior of another printer.

3.1.3.3 Destination

With the destination profile attributes, the user can identify destination profiles (ICC standard format) individually for the back and front of the printed page (see "color-destination-profile-back" and "color-destination-profile-front" in Section 3.5). Use of the destination profile job attributes presumes that the user is supplied with a list of valid profiles from which to choose, or that the user wishes to ask the printer to determine the destination profile based on the Job Template or PDL requested media attributes. The printer will use the value(s) given in the destination profiles attribute(s) to select the destination profile(s). If the user does not supply any destination profile attributes, then the printer determines the destination profiles. The printer uses the selected destination profile(s) to apply printer-specific and media-specific color rendering to the job content.

Because the output color rendering attributes include both emulation and destination profile attributes, printers applying these attributes can generate both final and proofing job outputs. In addition, these color attributes allow for client-based or server-based color rendering, and for printer-based color rendering. Note that when a document is color-rendered for the target printer at the client or server, then the Source Interpretation, Color Adjustment, and Output Color Rendering (Color Effects Selector, Emulation Profile, Destination Profile, Rendering Controls) attributes will not be used by the Printer.

3.1.3.4 Rendering Control for Text, Graphics, and/or Images

In addition to the identification of destination and/or emulation profile(s), the user can also specify the rendering intent components to be used from those profiles. Rendering intent can be specified separately for graphics (line work), pictorial images and for text (see "rendering-intent-graphics", "rendering-intent-images" and "rendering-intent-text" in Section 3.12). The printer uses the rendering intent selections to determine which transform elements to use from the selected emulation or destination profile(s). Note that when an emulation profile and a destination profile are used in sequence in an ICC device emulation profile chain, the printer will use the rendering intent attributes to control the use of the emulation profile.

3.1.4 Color separation control (black overprint, trapping)

The color separation attributes provided are "black-overprint" and "trapping" (see Sections 3.3 and 3.14, respectively). These attributes allow the print job to override color separation control settings within the PDL that may not be appropriate for the particular printing situation.

3.1.5 User Color Tone Reproduction Curve (TRC) attributes

The User color tone reproduction curve (TRC) attributes (See the "trc" attribute in Section 3.17) provide a key job customization mechanism to support the post-application print job corrections that may be required. The Printer will apply these User TRC attributes to the printer-rendered CMYK color data as a final adjustment to job color saturation or contrast. Using the "trc-type" collection member attribute, the user can select TRCs that have been developed for a set of jobs and stored in a public repository, or can supply the TRC definitions with the job. These TRC attributes may be particularly useful when the desired tonal behavior for a document differs from the current printer calibration which is always applied.

All of these Job Template attributes controlling the various required profiles can also be specified as document overrides and all, except the TRC attributes, can be specified as page overrides.

3.2 Color adjustments

This section defines additional attributes that can be used to adjust output color within a document by changing various input color data values. See section 3.1.2 for an Overview of Color Adjustments.

The values of these color adjustment attributes are in the range -100 to 100 where -100 and 100 are arbitrary, implementation dependent minimum and maximum adjustment values that the printer is capable of. A value of 0 means no adjustment. A Printer that supports one of these attributes MUST support the full range from -100 to 100 for that attribute. Each Printer will have an implementation specific algorithm for converting the input values for these color adjustments to corresponding color corrections supported by that Printer.

When and where to apply these color adjustments is a printer implementation decision. A Printer MUST apply these adjustment values when processing a raw PDL document file. Whether or not a Printer also applies these adjustment values to a file saved in a print ready format for later reprint depends on implementation. Finally, whether or not the Printer can save these adjustments in the data stored in a print ready file and in any accompanying "job ticket" saved with the print ready file depends on implementation (see "job-save-disposition" in [pwg-prod-print-2]).

A Printer implementation may choose not to support these color adjustments for certain color spaces (see "Color Space" definition in Section 2.2). For example, a Printer implementation might choose to disable the color adjustments if the input is already represented in a standard color space (such as SWOP [SWOP]) or is represented in the printer's own native color space (such as device CMYK). In these cases, the adjustments might degrade rather than improve the output color and as a result the implementation MAY disallow them.

Given that these color adjustment values are not absolute, it will generally NOT be possible to guarantee that a job printed on one type of printer will produce the exact same output when printed with the same color adjustment values on a different type of color printer.

3.2.1 Color Cast Adjustments

These 3 independent attributes specify the color cast adjustment to the levels of primary colors that the Printer is to apply to the Input-Document. These integer values specify the changes along 3 axis: Red/Cyan, Blue/Yellow, and Green/Magenta, respectively. The result is an overall shift toward a color determined by the relative magnitudes and signs of the three values. A client might include zero, one, two or all three color cast adjustment values when submitting a job.

A color cast adjustment increases or decreases the amount of a selected color in the output while preserving lightness. If the values for the Cyan/Red, Magenta/Green, and Yellow/Blue attributes are the same, there will be no change in the output.

3.2.1.1 adjust-cyan-red (integer(-100:100))

This “adjust-cyan-red” Job Template Job attribute specifies the Cyan/Red color adjustment that the Printer MUST apply to the Input-Document. The Cyan/Red color cast adjustment shifts the color towards cyan or red.

Decreasing the "adjust-cyan-red" value to -100 indicates the maximum cyan color cast supported by the system is to be applied to the document. Increasing the "adjust-cyan-red" value to 100 indicates the maximum red color cast supported by the system is to be applied to the document.

A maximum cyan color cast will appear the same as a color cast with both maximum green and blue. Likewise a maximum red color cast will appear the same as a color cast with both maximum magenta and yellow.

3.2.1.1.1 adjust-cyan-red-default (integer(-100:100))

See [RFC2911] section 4.2 for the behavior of “xxx-default” Job Template Printer attributes.

3.2.1.1.2 adjust-cyan-red-supported (rangeOfInteger(-100:100))

See [RFC2911] section 4.2 for the behavior of “xxx-supported” Job Template Printer attributes.

3.2.1.2 adjust-magenta-green (integer (-100:100))

This “adjust-magenta-green” Job Template Job attribute specifies the Magenta/Green color adjustment that the Printer MUST apply to the Input-Document. The Magenta/Green color cast adjustment shifts the color towards magenta or green.

Decreasing the "adjust-magenta-green" to -100 indicates the maximum magenta color cast supported by the system is to be applied to the document. Increasing the "adjust-magenta-green" to 100 indicates the maximum green color cast supported by the system is to be applied to the document.

A maximum magenta color cast will appear the same as a color cast with both maximum red and blue. Likewise a maximum green color cast will appear the same as a color cast with both maximum cyan and yellow.

3.2.1.2.1 adjust-magenta-green-default (integer(-100:100))

See [RFC2911] section 4.2 for the behavior of “xxx-default” Job Template Printer attributes.

3.2.1.2.2 adjust-magenta-green-supported (rangeOfInteger(-100:100))

See [RFC2911] section 4.2 for the behavior of “xxx-supported” Job Template Printer attributes.

3.2.1.3 adjust-yellow-blue (integer (-100:100))

This “adjust-yellow-blue” Job Template Job attribute specifies the Yellow/Blue color adjustment that the Printer MUST apply to the Input-Document. The Yellow/Blue color cast adjustment shifts the color towards yellow or blue.

Decreasing the "adjust-yellow-blue" to -100 indicates the maximum yellow color cast supported by the system is to be applied to the document. Increasing the "adjust-yellow-blue" to 100 indicates the maximum blue color cast supported by the system is to be applied to the document.

A maximum yellow color cast will appear the same as a color cast with both maximum red and green. Likewise a maximum blue color cast will appear the same as a color cast with both maximum cyan and magenta.

3.2.1.3.1 adjust-yellow-blue-default (integer(-100:100))

See [RFC2911] section 4.2 for the behavior of “xxx-default” Job Template Printer attributes.

3.2.1.3.2 adjust-yellow-blue-supported (rangeOfInteger(-100:100))

See [RFC2911] section 4.2 for the behavior of “xxx-supported” Job Template Printer attributes.

3.2.2 adjust-contrast (integer (-100:100))

This “adjust-contrast” Job Template Job attribute specifies the contrast adjustment that the Printer is to apply to the Input-Document. Increasing the contrast value MUST increase the variation between light and dark areas of the Output-Document and decreasing the contrast value MUST decrease the variation between light and dark areas of the Output-Document.

A contrast value of -100 will cause the output to appear a solid midtone gray color, and a contrast value of 100 will cause the output colors to either use full color (the maximum is restricted by the system ink limit) or no color for each of Cyan, Magenta, Yellow, and Black. Depending on the content of the original image and the gamut of the print engine, the output for contrast value 100 may be the same as the output for a lower contrast value, and the output for contrast value -100 may be the same as the output for a higher contrast value.

Colors such as pastels that are below a threshold value will go to no color at full contrast, while a saturated color above the threshold value will be fully saturated. For example, the output of an image of a red apple on a pastel pink tablecloth with full contrast will appear as a red apple on a white tablecloth.

3.2.2.1 adjust-contrast-default (integer(-100:100))

See [RFC2911] section 4.2 for the behavior of "xxx-default" Job Template Printer attributes.

3.2.2.2 adjust-contrast-supported (rangeOfInteger(-100:100))

See [RFC2911] section 4.2 for the behavior of "xxx-supported" Job Template Printer attributes.

3.2.3 adjust-lightness (integer (-100:100))

This "adjust-lightness" Job Template Job attribute specifies the color lightness adjustment that the Printer MUST apply to the Input-Document that will affect the lightness of the Output-Document. Increasing the lightness value MUST cause the output to appear lighter and decreasing the lightness value MUST cause the output to appear darker.

A lightness value of -100 will cause the output to appear black, and a lightness value of 100 will cause the output to appear white. Depending on the content of the original image, the output for lightness value 100 may be the same as the output for a lower lightness value, and the output for lightness value -100 may be the same as the output for a higher lightness value.

3.2.3.1 adjust-lightness-default (integer(-100:100))

See [RFC2911] section 4.2 for the behavior of "xxx-default" Job Template Printer attributes.

3.2.3.2 adjust-lightness-supported (rangeOfInteger(-100:100))

See [RFC2911] section 4.2 for the behavior of "xxx-supported" Job Template Printer attributes.

3.2.4 adjust-saturation (integer (-100:100))

This "adjust-saturation" Job Template Job attribute specifies the color saturation adjustment that the Printer MUST apply to the Input-Document. Increasing the saturation value MUST cause the output to contain more vibrant colors, and decreasing the saturation value MUST cause the output to contain more pastel and gray colors.

A saturation value of -100 will cause the output to appear gray, and a saturation value of 100 will cause the output to have all bright colors. Depending on the content of the original image and the gamut of the print engine, the output for saturation value 100 may be the same as the output for a lower saturation value, and the output for saturation value -100 may be the same as the output for a higher saturation value.

3.2.4.1 adjust-saturation-default (integer(-100:100))

See [RFC2911] section 4.2 for the behavior of "xxx-default" Job Template Printer attributes.

3.2.4.2 adjust-saturation-supported (rangeOfInteger(-100:100))

See [RFC2911] section 4.2 for the behavior of “xxx-supported” Job Template Printer attributes.

3.3 black-overprint (type2 keyword)

This “black-overprint” Job Template Job attribute controls the printer-specific Black Overprint methods used by the Printer. See section 3.1.4 for an Overview of Color Separation Control, including both black overprint and Trapping.

Documents often have black text or other objects placed on or over colored backgrounds. Undesirable artifacts can occur as a printer deposits more (black or colored) colorant on a spot. The toners can mix improperly affecting the color produced. As the 'pile height' of the toner increases, the toner could become too thick and might streak in the fuser. Thicker toner deposits might not adhere to the paper or might possibly acquire too much or too little shine during the fusing process.

Some PDLs have means to control the algorithm used when black objects are applied to colored backgrounds. For example, the standard PostScript [postscript] rendering model attempts to fix these problems by removing the color plane data underneath black objects, producing white knockouts or holes into which the black objects are printed. In PostScript, setting the 'setoverprint' operator to 'false' or omitting the 'setoverprint' operator altogether causes the printer to remove background color data producing a knockout for the black object to be printed in. Setting the 'setoverprint' operator to 'true' causes the printer to print black data directly on top of background color planes. PCL [PCL] has an equivalent escape sequence that governs the transparency of objects printed on top of other objects. Some printers may have an alternate, algorithmic method for achieving the same effect.

While the default behavior of most PDLs is to avoid printing black on top of color by producing the white knockouts, there can be an undesirable effect: even the smallest amount of mis-registration can result in white or dark bands at the edges of the black objects. Therefore, this attribute is provided to enable the end user to control the black overprint methods applied within the Printer.

Standard keyword values are:

Keyword	Description
'black-overprint-off'	The Printer MUST not print black over color, i.e., causes the Printer to remove the color plane data underneath the black objects.
'black-overprint-on'	The Printer MUST print black on top of color.

If the Printer supports this attribute, it MUST support both values. If the Printer does not support this attribute, the behavior is implementation dependent.

3.3.1.1 black-overprint-default (type2 keyword)

See [RFC2911] section 4.2 for the behavior of “xxx-default” Job Template Printer attributes.

3.3.1.2 black-overprint-supported (1setOf type2 keyword)

See [RFC2911] section 4.2 for the behavior of “xxx-supported” Job Template Printer attributes.

3.4 color-depth-yyy (integer(2:MAX))

The color depth is the number of values allowable to describe the levels of colorant ‘*yyy*’ to be used on the Job.

This "color-depth-*yyy*" Job Template Job attribute specifies how many values per color component that the interpreter and printer MUST use, that is the color depth for colorant '*yyy'*. where '*yyy* is a value of the "colorants-supported" attribute (See description in section 5.1). For instance, if the "colorants-supported" attribute contains the values 'black' and 'red', then there will be two attributes named "color-depth-black" and "color-depth-red".

The valid values range from 2 to MAX. A "color-depth-*yyy*" of 2 (which is 1 bit per pixel) requires the printer to print each spot as black or white when *yyy* is 'black', and a color printer to use colorants at maximum or minimum density when *yyy* is not 'black'. Where *yyy* is black, a "color-depth-*yyy*" of 4 (2 bits per pixel) allows a black-and-white Printer to use 4 levels of gray. The value of this attribute does not prohibit the use of halftones to simulate intermediate gray or color levels. A high-end printer will usually have value depths of 256 (or 8 bits per pixel).

Supported values may be dependent on the specified "printer-resolution" and "media" attributes. For instance, a Printer may support printer resolutions of 600, 1200, and 1800 when using a "color-depth-*yyy*" of 2, but only support a resolution of 600 when using a "color-depth-*yyy*" of 4. Also, larger media sizes may not be supported at higher values of "color-depth-*yyy*". Although the "color-depth-*yyy*-supported" attribute contains all values that printer supports, the client may have to use a Validate-Job operation with the desired parameters to determine if the desired "color-depth-*yyy*" value is supported with the values given for other Job Template attributes. If "color-depth-*yyy*" is unsupported with the provided Job Template attributes, and the "ipp-fidelity" attribute is 'true', then the operation is rejected with a 'conflicted-attributes' status code. If "ipp-fidelity" is 'false', then the Printer may adjust one or more of the Job Template attributes (including "color-depth-*yyy*") so that the job will print.

3.4.1 color-depth-yyy-default (integer (2:MAX))

See [RFC2911] section 4.2 for the behavior of “xxx-default” Job Template Printer attributes.

Each '*yyy*' value of the "color-depth-*yyy*-default" (integer(2:MAX)) Printer attribute gives the value depth default of the related '*yyy*' value of the "colorants-supported" attribute.

3.4.2 color-depth-yyy-supported (1setOf integer (2:MAX))

See [RFC2911] section 4.2 for the behavior of “xxx-supported” Job Template Printer attributes.

Each '*yyy*' value of the "color-depth-*yyy*-supported" (1setOf (integer(2:MAX))) Printer attribute gives the list of supported value depths of the related '*yyy*' value of the "colorants-supported" attribute.

3.5 Destination Color Space Translation Profile attributes

Some media attributes affect output color quality. For example, different color adjustments must be made when processing a job that is being printed on white paper with a gloss coating as compared to off-white paper with no coating. These adjustments are accounted for by characterizing each individual media for the supported print engine, and these characterizations can be stored in the form of ICC profiles [ICC] or other color space translation profiles. Additionally, each object type (text, graphics, images) may have a different rendering intent (color interpretation, gamut mapping, and rendering) which would also be included in the profile. The profiles defined by this document each encompass six different rendering intents, four specified by the ICC (i.e., 'perceptual', 'saturation', 'relative-colorimetric'', absolute-colorimetric'), and two additional (i.e., 'pure-text', 'blended-pictorial-and-graphic') allowed by the color rendering intent attributes defined in this document (see the "rendering-intent-xxx" attributes described in Section 3.12). Output profiles are also termed Destination Profiles, because they control the color conversion during the output of data to a physical medium. See section 3.1.3.3 for an Overview of Destination in the context of other Output Color Rendering characteristics.

Once data has been transformed into Profile Connection Space (PCS) (see section 2.2 and the source color space translation profile attributes -- "source-xxx" and "undefined-source-xxx" -- described in Section 3.13), it is in a device independent space, defined by colorimetry. PCS is the internal ICC Profile exchange space, which connects the source and the destination profiles. This device independent data can then be transformed to the device dependent

space of the output (which could be a printer, another monitor, etc.) via the destination profile. The power of the ICC paradigm is that any input device can be connected to any output device with proper color rendition given proper input and output profiles.

For example, a user could create a document with RGB data. This RGB data would be passed down to the Printer and interpreted according to the selected (or embedded in the PDL) ICC source profile. Rendering of the data into the color space of the output device would then be performed through the Destination profile. Any input color space could be translated similarly, and once in PCS, the same Destination profile could be used for all.

A number of destination color space translation profiles MAY be pre-installed on the Printer, and the System Administrator will have the capability to expand the list of destination profiles by loading custom profiles, via mechanisms outside the scope of this document. Each installed profile will have an associated symbolic name and it is this list of symbolic names that will be made available for use in the protocol as the values of Job Template attributes. The intent of this functionality is to provide an option to the user to specify how to render a job by using one of the installed destination profiles.

For duplex jobs, the user will have the option of specifying the destination profile attribute for both the front and back sides of the media. This provides the capability to apply different profiles on each side of those media whose coating is different on the front and back sides.

Standard keyword values are:

Keyword	Description
'system-specified'	Printer uses some implementation-dependent algorithm to choose which destination profile to use. This algorithm SHOULD depend on the values of other Job Template attributes, such as "media" ([RFC2911] Section 4.2.11), "media-col" ([pwg-prod-print] Section 3.13), "color-emulation" (Section 3.7), and the Color Rendering Intent attributes described elsewhere (Section 3.12). Therefore, the Printer determines the value of the specific destination profile a posteriori.

If the client supplies either of the destination profile attributes with a 'keyword' or a 'name' value that selects a specific destination profile, that profile will be used on a per-side basis regardless of any job media attributes that may also be supplied. On the other hand, if the client supplies either of the destination profile attributes with a 'keyword' value that does not pre-selects a specific destination profile (such as 'system-specified'), then the Printer will determine the appropriate destination profile(s).

Note: There is no 'none' value defined for these attributes, because the Printer assumes the destination color space specified by its "color-destination-xxx-default" attribute value in the case where neither the Job nor the PDL contain any destination color space information. The "color-destination-xxx-default" Printer attribute MUST be defined (see [pwg-prod-print-2] Section 3.2). Installing Destination Color Space Profiles in the Printer is outside the scope of this document.

When the Printer's "color-destination-xxx-supported" attribute has only one value and the value of the Printer's "pdl-override-supported" attribute is 'guaranteed' (see [pwg-prod-print-2] Section 3.1), then the normal queue override semantics apply. If the system administrator wants to permit clients to avoid using the 'system-specified' value, the administrator MUST install at least one name destination profile and add its name to the Printer's "color-destination-profile-xxx" attribute values.

3.5.1 color-destination-profile-back (type3 keyword | name(MAX))

This "color-destination-profile-back" Job Template Job attribute specifies the keyword or name of the destination color space profile to be used on the back side of the output media.

If the Printer supports this attribute, the values supported depend on implementation and site policy. If the Printer does not support this attribute, the behavior is implementation dependent and the destination profile MAY be selected based on other attributes supplied by the client and/or occurring in the PDL, such as the "rendering-intent-xxx" attributes (see Section 3.12), the "media" (see [RFC2911] section 4.2.11), "media-col" ([pwg-prod-print] Section 3.13), and/or the "color-emulation" attribute (see Section 3.7).

3.5.1.1 color-destination-profile-back-default (type3 keyword | name(MAX))

See [RFC2911] section 4.2 for the behavior of “xxx-default” Job Template Printer attributes.

3.5.1.2 color-destination-profile-back-supported (1setOf (type3 keyword | name(MAX)))

See [RFC2911] section 4.2 for the behavior of “xxx-supported” Job Template Printer attributes.

3.5.2 color-destination-profile-front (type3 keyword | name(MAX))

This "color-destination-profile-front" Job Template Job attribute specifies the keyword or name of the destination color space profile to be used on the front side of the output media for both single-sided and double-sided documents.

Note to implementers: Since this attribute applies to the same side for double-sided documents as it does for single-sided jobs, the design of the paper path SHOULD be such that the odd pages of a double-sided document print on the same side as all the pages of a single-side document do. Otherwise, the operator will have to reverse the paper in the input tray when switching from single-sided to double-sided documents or the Printer will have to have two separate input trays loaded when the coating is different between the two sides in order to handle one-sided and two-sided documents without human intervention.

If the Printer supports this attribute, the values supported depend on implementation and site policy. If the Printer does not support this attribute, the behavior is implementation dependent and the destination profile MAY be selected based on other attributes supplied by the client and/or occurring in the PDL, such as the "rendering-intent-xxx" attributes (see Section 3.12), the "media" (see [RFC2911] section 4.2.11), "media-col" ([pwg-prod-print] Section 3.13), and/or the "color-emulation" attribute (see Section 3.7).

3.5.2.1 color-destination-profile-front-default (type3 keyword | name(MAX))

See [RFC2911] section 4.2 for the behavior of “xxx-default” Job Template Printer attributes.

3.5.2.2 color-destination-profile-front-supported (1setOf (type3 keyword | name(MAX)))

See [RFC2911] section 4.2 for the behavior of “xxx-supported” Job Template Printer attributes.

3.6 color-effects-type (type2 keyword)

This "color-effects-type" Job Template Job attribute indicates whether a color document should be rendered in full color or should be rendered using an algorithm that maps the full range of colors to alternate values, such as gray scale or monochrome. This capability allows a full color printer to print a color document in monochrome or grayscale or black and white as a way to save time, toner, or cost when proofing a document. See section 3.1.3.1 for an Overview of Color Effects in the context of other Output Color Rendering characteristics.

Standard keyword values are:

Keyword	Description
'color'	all color content of the document MUST be preserved and rendered in color.
'monochrome-grayscale'	the color content of the Input-Document should be identified and an implementation-dependent algorithm MUST be applied to map the document colors to various intensities of black and white.

758

759 If the Printer supports this attribute, it MUST support the 'color' and 'monochrome-grayscale' values. If a color Printer
760 does not support this attribute, the Printer MUST provide the 'color' behavior.

761 ### 3.6.1 color-effects-type-default (type2 keyword)

762 See [RFC2911] section 4.2 for the behavior of “xxx-default” Job Template Printer attributes.

763 ### 3.6.2 color-effects-type-supported (1setOf type2 keyword)

764 See [RFC2911] section 4.2 for the behavior of “xxx-supported” Job Template Printer attributes.

765 ## 3.7 color-emulation (type3 keyword | name (MAX))

766 This "color-emulation" Job Template Job attribute causes the Printer to emulate the output of a different color-printing
767 device. It is common to want to print a device dependent color document on a printer whose native response is
768 different than that for which the document was created. To provide correct color rendition, the Printer MUST emulate
769 the original target device. See section 3.1.3.2 for an Overview of Emulation in the context of other Output Color
770 Rendering characteristics.

771 It is important to distinguish between emulation and interpretation of color data. Emulation is the process of
772 rendering data for output. Interpretation is the process of correctly translating input color data into an intermediate or
773 output color space. Note that interpretation is concerned with understanding the input color space and translating it
774 properly (see the color adjustment attributes, "adjust-xxx", described in Section 3.2). Emulation, on the other hand,
775 deals strictly with rendering color data into the proper output color space (see the destination color space translation
776 profile attributes, "color-destination-profile-xxx", described in Section 3.5).

777 Standard keyword values are:

Keyword	Description
'none'	No emulation is applied in the printer; the Printer's native color information is used.
'swop'	Emulate the CMYK SWOP (*i.e. Standard Web Offset Press*) ink color gamut when printed on coated media (see [SWOP] for technical specifications and overviews).
'euroscale'	Emulate the European ink color gamut standard for offset presses when printed on coated media (European equivalent to the US SWOP standard [SWOP] – has been superseded by the FOGRA European Press Standard of the German Graphic Arts Research Institute).
'japan-color'	Emulate the color gamut of the combined/common Dinippon and Toyo Inks standard when printed on coated media.
'enhanced-swop'	Emulate a more saturated version of the CMYK SWOP [SWOP] color gamut when printed on coated media.
'euroscale-matte'	Emulate the color gamut of European inks placed on matte finish media.
'euroscale-uncoated'	Emulate the color gamut of European inks placed on uncoated media.

778

The various color standards from which the emulation keyword values are derived assume that output will be printed on coated stock unless specifically stated in the emulation keyword value. As a result, the swop, euroscale, japan-color and enhanced-swop keyword values don't contain the media coating/finish, but rather imply that the stock is coated.

If the Printer supports this attribute, it MUST support at least the 'none' value. If the Printer does not support this attribute, the behavior is implementation dependent.

3.7.1.1 color-emulation-default (type3 keyword | name(MAX))

See [RFC2911] section 4.2 for the behavior of "xxx-default" Job Template Printer attributes.

3.7.1.2 color-emulation-supported (1setOf (type3 keyword | name(MAX)))

See [RFC2911] section 4.2 for the behavior of "xxx-supported" Job Template Printer attributes.

3.8 highlight-colorant (type3 keyword | name(MAX))

This "highlight-colorant" Job Template Job attribute specifies the color of the toner that MUST be used by the Printer as the highlight color when printing the document in highlight color mode.

If the Printer supports the Printer Description Attribute "colorants-supported" (see Section 5.1), the values for "highlight-colorant-supported" MUST be included in the values for "colorants-supported".

This attribute affects input page images, and can be specified as a Document Override as well as a Page Override.

Some printers support a "highlight" color mode, in which shades of one color plus black are used to print the document. Highlight color printing typically is used to provide some color content to a document without the cost of full color support.

Highlight color printers are typically 2-color printers, although a full-color printer could be used to print in highlight mode.

Standard keyword values are shown in Table 4:

801 **Table 4 - Highlight colorant values**

Keyword	Description
‘red’	The highlight color should be red.
‘green’	The highlight color should be green.
‘blue’	The highlight color should be blue.
‘cyan’	The highlight color should be cyan.
‘magenta’	The highlight color should be magenta.
‘cardinal’	The highlight color should be cardinal.
‘royal’	The highlight color should be royal.
‘black’	The highlight color should be black.
‘yellow’	The highlight color should be yellow.
‘ruby’	The highlight color should be ruby.
‘violet’	The highlight color should be violet.
‘brown’	The highlight color should be brown.
‘none’	The Printer shall not use a highlight color.
‘other’	The highlight color is a custom color that does not have a predefined keyword value that represents it. The Printer maps the full color values from the source document to the highlight color based on the printer administrator's specification of the custom toner’s color characteristics.

802

803 ### 3.8.1 highlight-colorant-default (type3 keyword | name(MAX))

804 See [RFC2911] section 4.2 for the behavior of “xxx-default” Job Template Printer attributes.

805 ### 3.8.2 highlight-colorant-supported (1setOf (type3 keyword | name(MAX)))

806 See [RFC2911] section 4.2 for the behavior of “xxx-supported” Job Template Printer attributes.

807 ### 3.8.3 highlight-colorant-ready (1setOf (type3 keyword | name(MAX)))

808 This attribute differs from "highlight-colorant-supported" in that legal values only include the subset of "highlight-
809 colorant-supported" values that are physically ready for printing with no operator intervention required. The
810 "highlight-colorant-ready" attribute is useful for Printers where human intervention is required in order to change the
811 highlight color toner in order for a job to use certain "highlight-colorant" values. If all "highlight-colorant-supported"
812 values can be used without human intervention, a Printer NEED NOT implement the "highlight-colorant-ready"
813 attribute. If an IPP Printer supports "highlight-colorant-supported", it NEED NOT support "highlight-colorant-ready".
814 However, if a Printer supports "highlight-colorant-ready", it MUST support "highlight-colorant-supported".

815 ## 3.9 highlight-colorant-mismatch (type3 keyword | name(MAX))

816 This “highlight-colorant-mismatch” Job Template Job attribute specifies the action to be taken by the Printer if the
817 desired highlight colorant is not currently loaded on the printer.

818 Some printers support a “highlight” color mode, in which shades of one color plus black are used to print the
819 document. Highlight color printing typically is used to provide some color content to a document without the cost of
820 full color support.

821 Highlight color printers are typically 2-color printers, although a full-color printer could be used to print in highlight
822 mode.

823 Standard keyword values are:

Keyword	Description
'abort'	If the mismatch is detected at job creation, the Printer will reject the job creation request. If the mismatch is detected at the start of job processing, the Printer will abort the job.
'use-ready'	The Printer will use the highlight colorant that is currently loaded on the printer.
'hold'	The Printer will move the job to the 'pending-held' job state. In addition, the Printer MUST add the 'resources-are-not-ready' value to the job's "job-state-reasons" attribute. When the requested highlight colorant is loaded or the "highlight-colorant" Job attribute is modified to the loaded highlight colorant and there are no other resources not ready, the job will automatically become a candidate for processing (no Release-Job operation need be performed by a user or operator).
'stop'	The Printer will move the job to the 'processing-stopped' job state. The Printer MUST also move to the 'stopped' state, so that the operator can change the highlight colorant before the job produces output. When the requested highlight colorant is loaded or the "highlight-colorant" Job attribute is modified to the loaded highlight colorant and there are no other resources not ready, the Printer will be ready to resume. A Resume-Printer operation (or equivalent local operator action) SHOULD be performed. Once the Printer resumes, the job will automatically return to the 'processing' state. No Release-Job operation need be performed by a user or operator.

824

825 ### 3.9.1 highlight-colorant-mismatch-default (type3 keyword | name(MAX))

826 See [RFC2911] section 4.2 for the behavior of "xxx-default" Job Template Printer attributes.

827 ### 3.9.2 highlight-colorant-mismatch-supported (1setOf (type3 keyword | name(MAX)))

828 See [RFC2911] section 4.2 for the behavior of "xxx-supported" Job Template Printer attributes.

829 ## 3.10 highlight-map (type3 keyword | name(MAX))

830 This "highlight-map" Job Template Job attribute specifies the algorithm to be used for mapping colors defined in the
831 full color space to a color in the highlight color space.

832 This attribute affects input page images, and can be specified as a Document Override as well as a Page Override.

833 Some printers support a "highlight" color mode, in which shades of one color plus black are used to print the
834 document. Highlight color printing typically is used to provide some color content to a document without the cost of
835 full color support.

836 Highlight color printers are typically 2-color printers, although a full-color printer could be used to print in highlight
837 mode.

838 Standard keyword values are:

Keyword	Description
'pictorial'	This mapping is appropriate for photographic data. The color components of an image that match the map color are printed in a shade of the highlight colorant.
'presentation'	This mapping is appropriate for presentation graphics (such as pie charts, bar charts) that require distinct and saturated colors.
'object-based'	This mapping is appropriate for those pages with mixed content. The Printer uses different mapping algorithms on the different objects within a page, depending upon the type of object.
'color-to-highlight'	This mapping is appropriate when the hue of the colors do not need to be distinguished from one another, but distinguished only from black.
'exact-color'	This mapping is appropriate when the color specified by "highlight-map-color" needs to be distinguished from all other colors. Any color matching the "highlight-map-color" is printed in the highlight colorant and all other colors are printed in black.
color-tables'	This option uses preset color tables to perform the mapping.

839

840 **3.10.1 highlight-map-default (type3 keyword | name(MAX))**

841 See [RFC2911] section 4.2 for the behavior of "xxx-default" Job Template Printer attributes.

842 **3.10.2 highlight-map-supported (1setOf (type3 keyword | name(MAX)))**

843 See [RFC2911] section 4.2 for the behavior of "xxx-supported" Job Template Printer attributes.

844 ## 3.11 highlight-map-color (type3 keyword | name(MAX))

845 This "highlight-map-color" Job Template Job attribute specifies the color in the source document that is to be mapped
846 by the Printer to the highlight colorant when printing the document in highlight color mode. This value is used as an
847 input parameter to the highlight mapping algorithm (specified by the "highlight-map" attribute).

848 This attribute affects input page images, and can be specified as a Document Override as well as a Page Override.

849 Some printers support a "highlight" color mode, in which shades of one color plus black are used to print the
850 document. Highlight color printing typically is used to provide some color content to a document without the cost of
851 full color support.

852 Highlight color printers are typically 2-color printers, although a full-color printer could be used to print in highlight
853 mode.

854 Standard keyword values are the same as "highlight-colorant" (see Table 4 in section 3.8):

855 **3.11.1 highlight-map-color-default (type3 keyword | name(MAX))**

856 See [RFC2911] section 4.2 for the behavior of "xxx-default" Job Template Printer attributes.

857 **3.11.2 highlight-map-color-supported (1setOf (type3 keyword | name(MAX)))**

858 See [RFC2911] section 4.2 for the behavior of "xxx-supported" Job Template Printer attributes.

3.12 Color rendering intent attributes

These attributes provide a way to specify the rendering intent of a color document for text, graphics, and images. Depending on the intent of the color printing desired, the user can specify a preference for color rendering. See section 3.1.3.4 for an Overview of Rendering Controls for text, graphics and/or text in the context of other Output Color Rendering characteristics.

Note: In order to simplify the user interface, a client MAY display only one set of choices and supply all three attributes with the same values in a Job Creation request.

Standard keyword values for all 3 of these attributes are:

Keyword	Description
'saturation'	This rendering intent specifies that the saturation of pixels in the image is preserved; perhaps even at the expense of the accuracy of hue and lightness.
'perceptual'	This rendering intent specifies that the full gamut of the image is compressed or expanded to fill the gamut of the destination device. Gray balance is preserved, but colorimetric accuracy may not be preserved. Color relationships are preserved rather than colorimetric relationships.
'relative-colorimetric'	This rendering intent specifies color fidelity relative to the white point of the selected substrate.
'absolute-colorimetric'	This rendering intent specifies color fidelity in absolute colorimetric terms.
'pure-text'	This rendering intent is appropriate for text.
'blended-pictorial-and-graphics'	This rendering intent is appropriate for mixed content page images consisting of pictorial and graphic objects.
'automatic'	A rendering algorithm in the printer determines the selection of an appropriate rendering intent for each of the objects in the job, using the rendering intents available in the selected ICC profile(s) [ICC].

3.12.1 rendering-intent-graphics (type2 keyword)
3.12.2 rendering-intent-images (type2 keyword)
3.12.3 rendering-intent-text (type2 keyword)

These "rendering-intent-xxx" Job Template Job attributes provide a way to specify the rendering intent to be used by the Printer for xxx objects within a color document as indicated in the following table:

Table 5 - "rendering-intent-xxx" attribute name suffixes

Values of "-xxx" attribute name suffix	xxx object Description
-graphics	graphic / graphics objects
-text	text
-images	images

If the Printer supports this attribute, the values supported depend on implementation. If the Printer does not support this attribute, the behavior is implementation dependent.

3.12.3.1 rendering-intent-graphics-default (type2 keyword)
3.12.3.2 rendering-intent-images-default (type2 keyword)
3.12.3.3 rendering-intent-text-default (type2 keyword)

See [RFC2911] section 4.2 for the behavior of “xxx-default” Job Template Printer attributes.

3.12.3.4 rendering-intent-graphics-supported (1setOf type2 keyword)
3.12.3.5 rendering-intent-images-supported (1setOf type2 keyword)
3.12.3.6 rendering-intent-text-supported (1setOf type2 keyword)

See [RFC2911] section 4.2 for the behavior of “xxx-supported” Job Template Printer attributes.

3.13 Source color space translation profile attributes

When a document is created, many different objects are used as document content. In general these objects fall into one of the following categories: text, graphics, or images. Text objects are simply text entered into an application. Graphics objects can be vector graphics, such as pie charts, or more elaborate synthetic objects created via an application. Possible sources for image objects are scanners or digital cameras. See section 3.1.1 for an Overview of Source Interpretation.

Maintaining the color fidelity of these objects when transporting them between various input and output devices and applications is difficult because of differences in the way color is described and rendered in each device or application. Several methods have been devised for describing and translating color information between devices. Most rely on some form of profile file containing translation or look up tables that can be used to map a color value from one device to a comparable value for another device.

The International Color Consortium (ICC) was founded to try to devise a universally accepted format for specifying how to translate color information from an input device or source into the color space of an output device or destination. The method developed relies on "ICC Profiles" [ICC]. These profile files typically contain a set of tables that can be used to convert color data between a native device color space and a device independent color space (also called a Profile Connection Space - PCS). ICC profiles are usually categorized as either "Source" or "Destination" profiles. Source profiles translate color data from its current color space (such as one might have on a scanner, camera or monitor) to the specific device independent color space called ICC PCS. Destination profiles transform color data (see Section 3.1 of this specification, and the descriptions of the "color-destination-profile-xxx" attributes in Section 3.5) from the device independent color space ICC PCS to an output color space (such as the CMY or CMYK that one might have with a printer or offset press, or the RGB of the display monitor on the output device).

A number of Source Color Space Translation Profiles MAY be pre-installed on the Printer, and the System Administrator will have the capability to expand the list of source profiles by loading custom profiles via mechanisms outside the scope of this document. Each installed Source Color Space Translation Profile will have an associated symbolic name and it is this list of symbolic names that will be made available for selection as a Job Template attribute in a Job Creation or Document Creation operation and as Printer defaults and supported attributes.

The intent of providing these source color space translation Job Template attributes is to allow the user to program a job to use one of the installed source color space translation profiles to interpret the source color data in the submitted PDL file. In general documents may contain a mix of objects, some of which have associated source color space information, and some of which do not. An object with an associated source color translation transform (e.g., CSA or ICC profile) is said to have a Defined Source Color Space. An object with no associated source color translation transform is said to have an Undefined Source Color Space.

Two distinct sets of source color space translation profile attributes are provided. The "source-xxx" color space translation profile attributes are useful in situations where the user has a PDL file of indeterminate origin, which may contain unreliable source color translation transforms (e.g., CSAs or ICC profiles). The "source-xxx" color space translation profile attributes are also useful in situations where the user has a PDL file that contains no information

about the source color data, but the user knows which input device or source process was used to create the images within the PDL file. When the user specifies "source-xxx" attributes for particular object types (e.g., 'source-cmyk-graphics', 'source-rgb-images'), the printer MUST use those "source-xxx" color space translation profile Job Template Job attributes for all objects of that type. By definition, the "source-xxx" attributes have a higher precedence than any corresponding PDL instructions (see [pwg-prod-print-2] Section 3.2), as with any Job Template attribute. When the user specifies "source-xxx" attributes for a particular image object type, any PDL instructions for that object type MUST be ignored by the Printer.

Conversely, the "undefined-source-xxx" color space translation profile attributes are useful in situations where the user has a PDL file containing a mix of objects, some with *correct* associated source color translation transforms (e.g., CSA or ICC profiles) and some with no associated source color translation transforms. In this situation, the user should program the job using the "undefined-source-xxx" color space translation profile attributes. The Printer will then use the PDL-specified source color translation transforms for the Defined Source Color Space objects, and will use the "undefined-source-xxx" color space translation profile Job Template Job attributes for the Undefined Source Color Space objects. In other words, by definition these "undefined-source-xxx" attributes have applicability only where there are no corresponding PDL instructions. When any Defined Source Color Space object is encountered in the PDL, the Printer MUST ignore any corresponding "undefined-source-xxx" attributes.

For each "source-xxx" Job Template Job attribute that a Printer supports, it MUST also support the corresponding "undefined-source-xxx" Job Template Job attribute. However, for each "undefined-source-xxx" Job Template Job attribute that a Printer supports, it NEED NOT support the corresponding "source-xxx" Job Template Job attribute. If a client supplies both a "source-xxx" Job Template Job attribute and the corresponding "undefined-source-xxx" Job Template Job attribute, the Printer MUST ignore the corresponding "undefined-source-xxx" attribute.

Both the "source-xxx" and the "undefined-source-xxx" Job Template Job attributes have a higher precedence than the corresponding "undefined-source-xxx-default" Printer attribute (see [pwg-prod-print-2] Section 3.2). So if a client supplies either of these attributes in a Job Creation request, the client-supplied attribute will override the corresponding Printer's "undefined-source-xxx-default" value. Note: there are no "source-xxx-default" Printer attributes defined, only "undefined-source-xxx-default" attributes.

When the Printer's "undefined-source-xxx-supported" attribute has only one value and the value of the Printer's "pdl-override-supported" attribute is 'guaranteed' (see description of "pdl-override-supported" attribute in [pwg-prod-print-2] Section 8.2), the normal queue override semantics apply.

There is no 'none' value defined for the "undefined-source-xxx" attributes, because the Printer assumes the source color space specified by its "undefined-source-xxx-default" attribute value for a document that does not contain any source color space information. The "undefined-source-xxx-default" Printer attribute MUST be defined (see [pwg-prod-print-2] Section 3.2). Therefore, the client MUST NOT supply a zero-length name for the "undefined-source-xxx" Job Template Job attributes and the administrator MUST NOT configure a zero-length name as one of the supported values of the corresponding "undefined-source-xxx-supported" Printer attributes.

When the Printer's "source-xxx-supported" attribute has only one value and the value of the Printer's "pdl-override-supported" attribute is 'guaranteed' (see description of "pdl-override-supported" attribute in [pwg-prod-print-2] Section 8.2), then the normal queue override semantics apply. However, when a Printer supports only a single source profile and the administrator does NOT want to have the queue override semantics (that would override the document color source information), then the administrator MUST configure a zero length name as the second value of the corresponding "source-xxx-supported" Printer attribute.

Each “source-xxx” attribute defined in this section permits the user to select the source color space translation profile used to render a particular kind of object.

Some document format interpreters may not support some or all of the color profiles. In such cases, the profile is ignored. See the "document-format" operation attribute description in [RFC2911] for an explanation of Job Template attributes whose support MAY vary for different document formats.

968 **3.13.1 source-cmy-graphics (name(MAX))**
969 **3.13.2 undefined-source-cmy-graphics (name(MAX))**
970 **3.13.3 source-cmy-images (name(MAX))**
971 **3.13.4 undefined-source-cmy-images (name(MAX))**
972 **3.13.5 source-cmy-text (name(MAX))**
973 **3.13.6 undefined-source-cmy-text (name(MAX))**

974 These "source-cmy-xxx" and "undefined-source-cmy-xxx" Job Template Job attributes provide a way to specify the
975 symbolic name of the source color space profile to be used by the Printer in CMY color space for rendering xxx
976 objects within a color document as indicated in the following table. The former applies to the entire document and
977 the latter applies only to the parts that have no defined color space translation profile.

978 **Table 6 - "source-cmy-xxx" and “undefined-source-cmy-xxx” attribute name suffixes**

Values of "-xxx" attribute name suffix	xxx object Description
-graphics	graphic / graphics objects
-text	text
-images	images

979

980 **3.13.6.1 There are no source-cmy-xxx-default attributes**

981 There are no "source-xxx-default" Printer attributes defined, only "undefined-source-xxx-default" attributes.

982 **3.13.6.2 undefined-source-cmy-graphics-default (name(MAX))**
983 **3.13.6.3 undefined-source-cmy-images-default (name(MAX))**
984 **3.13.6.4 undefined-source-cmy-text-default (name(MAX))**

985 See [RFC2911] section 4.2 for the behavior of “xxx-default” Job Template Printer attributes. Also, see Section 3.13
986 above for a description of the relationships among the "source-xxx", "undefined-source-xxx" and "undefined-source-
987 xxx-default" attributes.

988 **3.13.6.5 source-cmy-graphics-supported (1setOf name(MAX))**
989 **3.13.6.6 source-cmy-images-supported (1setOf name(MAX))**
990 **3.13.6.7 source-cmy-text-supported (1setOf name(MAX))**
991 **3.13.6.8 undefined-source-cmy-graphics-supported (1setOf name(MAX))**
992 **3.13.6.9 undefined-source-cmy-images-supported (1setOf name(MAX))**
993 **3.13.6.10 undefined-source-cmy-text-supported (1setOf name(MAX))**

994 See [RFC2911] section 4.2 for the behavior of “xxx-supported” Job Template Printer attributes.

995 **3.13.7 source-cmyk-graphics (type3 keyword | name(MAX))**
996 **3.13.8 undefined-source-cmyk-graphics (type3 keyword | name(MAX))**
997 **3.13.9 source-cmyk-images (type3 keyword | name(MAX))**
998 **3.13.10 undefined-source-cmyk-images (type3 keyword | name(MAX))**
999 **3.13.11 source-cmyk-text (type3 keyword | name(MAX))**
1000 **3.13.12 undefined-source-cmyk-text (type3 keyword | name(MAX))**

1001 These "source-cmyk-xxx" and "undefined-source-cmyk-xxx" Job Template Job attributes provide a way to specify the
1002 symbolic name of the source color space profile to be used by the Printer in CMYK color space for rendering xxx
1003 objects within a color document as indicated in the following table. The former applies to the entire document and
1004 the latter applies only to the parts that have no defined color space translation profile.

1005 **Table 7 - "source-cmyk-xxx" and “undefined-source-cmyk-xxx” attribute name suffixes**

Values of "-xxx" attribute name suffix	xxx object Description
-graphics	graphic / graphics objects
-text	text
-images	images

1006

1007 The keyword values are similar to those defined for the “color-emulation” attribute (see section 3.7). Standard
1008 keyword values are:

Keyword	Description
'native-cmyk'	the CMYK color space of the target color printer.
'swop'	Emulate the CMYK SWOP (*i.e. Standard Web Offset Press*) ink color gamut when printed on coated media (see [SWOP] for technical specifications and overviews).
'euroscale'	Emulate the European ink color gamut standard for offset presses when printed on coated media (European equivalent to the US SWOP standard [SWOP] – has been superceded by the FOGRA European Press Standard of the German Graphic Arts Research Institute).
'japan-color'	Emulate the color gamut of the combined/common Dinippon and Toyo Inks standard when printed on coated media.
'enhanced-swop'	Emulate a more saturated version of the CMYK SWOP [SWOP] color gamut when printed on coated media.
'euroscale-matte'	Emulate the color gamut of European inks placed on matte finish media.
'euroscale-uncoated'	Emulate the color gamut of European inks placed on uncoated media.

1009

1010 The various color standards from which the emulation keyword values are derived assume that output will be printed
1011 on coated stock unless specifically stated in the emulation keyword value. As a result, the swop, euroscale, japan-
1012 color and enhanced-swop keyword values don’t contain the media coating/finish, but rather imply that the stock is
1013 coated.

1014 If the Printer supports these attributes, the values supported depend on implementation. If the Printer does not
1015 support these attributes, the behavior is implementation dependent.

1016 **3.13.12.1 There are no source-cmyk-xxx-default attributes**

1017 There are no "source-xxx-default" Printer attributes defined, only "undefined-source-xxx-default" attributes.

1018 **3.13.12.2 undefined-source-cmyk-graphics-default (type3 keyword | name(MAX))**
1019 **3.13.12.3 undefined-source-cmyk-images-default (type3 keyword | name(MAX))**
1020 **3.13.12.4 undefined-source-cmyk-text-default (type3 keyword | name(MAX))**

1021 See [RFC2911] section 4.2 for the behavior of “xxx-default” Job Template Printer attributes. Also, see Section 3.13
1022 above for a description of the relationships among the "source-xxx", "undefined-source-xxx" and "undefined-source-
1023 xxx-default" attributes.

3.13.12.5 source-cmyk-graphics-supported (1setOf (type3 keyword | name(MAX)))
3.13.12.6 source-cmyk-images-supported (1setOf (type3 keyword | name(MAX)))
3.13.12.7 source-cmyk-text-supported (1setOf (type3 keyword | name(MAX)))
3.13.12.8 undefined-source-cmyk-graphics-supported (1setOf (type3 keyword | name(MAX)))
3.13.12.9 undefined-source-cmyk-images-supported (1setOf (type3 keyword | name(MAX)))
3.13.12.10 undefined-source-cmyk-text-supported (1setOf (type3 keyword | name(MAX)))

See [RFC2911] section 4.2 for the behavior of “xxx-supported” Job Template Printer attributes.

3.13.13 source-gray-graphics (name(MAX))
3.13.14 undefined-source-gray-graphics (name(MAX))
3.13.15 source-gray-images (name(MAX))
3.13.16 undefined-source-gray-images (name(MAX))
3.13.17 source-gray-text (name(MAX))
3.13.18 undefined-source-gray-text (name(MAX))

These "source-gray-xxx" and "undefined-source-gray-xxx" Job Template Job attributes provide a way to specify the symbolic name of the source color space profile to be used by the Printer to translate grayscale data to L* intensity values for rendering xxx objects within a color document as indicated in the following table. The former applies to the entire document and the latter applies only to the parts that have no defined color space translation profile.

Table 8 - "source-gray-xxx" and “undefined-source-gray-xxx” attribute name suffixes

Values of "-xxx" attribute name suffix	xxx object Description
-graphics	graphic / graphics objects
-text	text
-images	images

3.13.18.1 There are no source-gray-xxx-default attributes

There are no "source-xxx-default" Printer attributes defined, only "undefined-source-xxx-default" attributes.

3.13.18.2 undefined-source-gray-graphics-default (name(MAX))
3.13.18.3 undefined-source-gray-images-default (name(MAX))
3.13.18.4 undefined-source-gray-text-default (name(MAX))

See [RFC2911] section 4.2 for the behavior of “xxx-default” Job Template Printer attributes. Also, see Section 3.13 above for a description of the relationships among the "source-xxx", "undefined-source-xxx" and "undefined-source-xxx-default" attributes.

3.13.18.5 source-gray-graphics-supported (1setOf name(MAX))
3.13.18.6 source-gray-images-supported (1setOf name(MAX))
3.13.18.7 source-gray-text-supported (1setOf name(MAX))
3.13.18.8 undefined-source-gray-graphics-supported (1setOf name(MAX))
3.13.18.9 undefined-source-gray-images-supported (1setOf name(MAX))

3.13.18.10 undefined-source-gray-text-supported (1setOf name(MAX))

See [RFC2911] section 4.2 for the behavior of “xxx-supported” Job Template Printer attributes.

1058 **3.13.19 source-rgb-graphics (type3 keyword | name(MAX))**
1059 **3.13.20 undefined-source-rgb-graphics (type3 keyword | name(MAX))**
1060 **3.13.21 source-rgb-images (type3 keyword | name(MAX))**
1061 **3.13.22 undefined-source-rgb-images (type3 keyword | name(MAX))**
1062 **3.13.23 source-rgb-text (type3 keyword | name(MAX))**
1063 **3.13.24 undefined-source-rgb-text (type3 keyword | name(MAX))**

1064 These "source-rgb-xxx" and "undefined-source-rgb-xxx" Job Template Job attributes provide a way to specify the
1065 symbolic name of the source color space profile to be used by the Printer in RGB color space for rendering xxx
1066 objects within a color document as indicated in the following table. The former applies to the entire document and
1067 the latter applies only to the parts that have no defined color space translation profile.

1068 **Table 9 - "source-rgb-xxx" and “undefined-source-rgb-xxx” attribute name suffixes**

Values of "-xxx" attribute name suffix	xxx object Description
-graphics	graphic / graphics objects
-text	text
-images	images

1069

1070 Standard keyword values are:

Keyword	Description
'sRGB'	sRGB mode according to the Default RGB color space defined in [IEC 61966-2.1]
'smpte-240m'	Interpret RGB according to standard 240m of the Society of Motion Picture and Television Engineers [SMPTE-240M].

1071

1072 If the Printer supports these attributes, the values supported depend on implementation. If the Printer does not
1073 support these attributes, the behavior is implementation dependent.

1074 **3.13.24.1 There are no source-rgb-xxx-default attributes**

1075 There are no "source-xxx-default" Printer attributes defined, only "undefined-source-xxx-default" attributes.

1076 **3.13.24.2 undefined-source-rgb-graphics-default (type3 keyword | name(MAX))**
1077 **3.13.24.3 undefined-source-rgb-images-default (type3 keyword | name(MAX))**
1078 **3.13.24.4 undefined-source-rgb-text-default (type3 keyword | name(MAX))**

1079 See [RFC2911] section 4.2 for the behavior of “xxx-default” Job Template Printer attributes. Also, see Section 3.13
1080 above for a description of the relationships among the "source-xxx", "undefined-source-xxx" and "undefined-source-
1081 xxx-default" attributes.

1082 **3.13.24.5 source-rgb-graphics-supported (1setOf (type3 keyword | name(MAX)))**
1083 **3.13.24.6 source-rgb-images-supported (1setOf (type3 keyword | name(MAX)))**
1084 **3.13.24.7 source-rgb-text-supported (1setOf (type3 keyword | name(MAX)))**
1085 **3.13.24.8 undefined-source-rgb-graphics-supported (1setOf (type3 keyword | name(MAX)))**
1086 **3.13.24.9 undefined-source-rgb-images-supported (1setOf (type3 keyword | name(MAX)))**
1087 **3.13.24.10 undefined-source-rgb-text-supported (1setOf (type3 keyword | name(MAX)))**

1088 See [RFC2911] section 4.2 for the behavior of “xxx-supported” Job Template Printer attributes.

3.14 trapping (type2 keyword)

This "trapping" Job Template Job attribute controls the color trapping applied by the Printer. See section 3.1.4 for an Overview of Color Separation Control, including both black overprint and Trapping.

Trapping is an image processing technique, well established in the commercial printing market, that is used to compensate for mis-registration of color planes in the print engine. When the C, M, Y and K color plane data are not registered exactly with one another, white gaps and regions of shifted hue appear at adjoining object boundaries. Trapping compensates for these image quality defects by eliminating or adding color pixels in the overlapping regions at object boundaries thereby minimizing the effects of the mis-registration.

A "choke" defines the color and width of the band of pixels eliminated at adjoining object boundaries. A "spread" defines the color and number of pixels added between two colored areas at adjoining object boundaries. A "sweep" is a smooth shading object, such as defined in PostScript 3 [postscript].

Standard keyword values are:

Keyword	Description
'off'	no trapping is applied.
'all'	trapping is applied to the edges of all text, graphics, images, and sweeps.

If the Printer supports this attribute, it MUST support both the 'off' and 'all' values. If the Printer does not support this attribute, the behavior is implementation dependent.

3.14.1.1 trapping-default (type2 keyword)

See [RFC2911] section 4.2 for the behavior of “xxx-default” Job Template Printer attributes.

3.14.1.2 trapping-supported (1setOf type2 keyword)

See [RFC2911] section 4.2 for the behavior of “xxx-supported” Job Template Printer attributes.

3.15 trap-width-fast (integer(0:MAX))
3.16 trap-width-slow (integer(0:MAX))

The “trap-width-fast” and “trap-width-slow” Job Template Job attributes control the color trapping applied by the Printer. See section 3.1.4 for an Overview of Color Separation Control, including both black overprint and Trapping.

Trapping is an image processing technique, well established in the commercial printing market, which is used to compensate for mis-registration of color planes in the print engine. When the C, M, Y and K color plane data are not registered exactly with one another, white gaps and regions of shifted hue appear at adjoining object boundaries. Trapping compensates for these image quality defects by eliminating or adding color pixels in the overlapping regions at object boundaries thereby minimizing the effects of the mis-registration.

A "choke" defines the color and width of the band of pixels eliminated at adjoining object boundaries. A "spread" defines the color and number of pixels added between two colored areas at adjoining object boundaries. A "sweep" is a smooth shading object, such as defined in PostScript 3 [postscript].

The “trap-width-slow” attribute specifies the number of pixels at each object boundary that will be within the trapping region in the “slow scan direction” (i.e. the direction perpendicular to the direction that the print engine’s output Raster Image System (ROS) writes pixels).

The “trap-width-fast” attribute specifies the number of pixels at each object boundary that will be within the trapping region in the “fast scan direction” (i.e. the direction parallel to the direction that the print engine’s output Raster Image System (ROS) writes pixels).

The “trap-width-slow” and “trap-width-fast” attributes are applicable on a job and page-override basis.

Trap width will be Printer implementation dependent.

3.16.1 trap-width-fast-default (integer(0:MAX))
3.16.2 trap-width-slow-default (integer(0:MAX))

See [RFC2911] section 4.2 for the behavior of “xxx-default” Job Template Printer attributes.

3.16.3 trap-width-fast-supported (rangeOfInteger(0:MAX))
3.16.4 trap-width-slow-supported (rangeOfInteger(0:MAX))

See [RFC2911] section 4.2 for the behavior of “xxx-supported” Job Template Printer attributes.

3.17 trc (collection)

The Printer applies User Tone Reproduction Curves (TRCs) to image data which has already been transformed to the output device's CMYK color space; thus modifying the printer's response to the rendered CMYK data. See section 3.1.5 for an Overview of User Tone Reproduction Curve attributes.

This "trc" Job Template Job attribute specifies the user selected TRCs to be used for the job. A User TRC is used to map input image intensity values to adjusted output intensity values. When dealing with 8 bit continuous tone data, the color intensity values for each color separation are specified as unsigned integer octets with values in the range from 0 to 255. Mapping all 256 possible intensity values of a single color separation requires a table that contains 256 octets. Mapping all possible values for all four color separations (i.e. C, M, Y and K) requires 1024 octets, 256 octets for each color separation.

User TRCs are independent of calibration TRCs; the effects of the two are additive. Calibration TRCs are stored in the system as a result of a calibration of the output device (by means outside the scope of this document) and are always applied, regardless of whether or not the client supplies User TRCs in the Job Creation request.

The client MAY supply TRCs either by name or by value. When the client elects to supply TRCs by name, the name references a User TRC file stored on the Printer's public TRC repository. When the client elects to supply TRCs by value the client MUST supply the intensity translation tables for all four color separations. Furthermore, the client MAY indicate whether a by value User TRC is to be stored permanently in the Printer's public TRC repository for use by other jobs in the future or is private and therefore is to be stored temporarily in the printer for reuse only within the context of this job. In either case, the by-value TRC becomes available for reference as soon as the Printer returns the response for the request that supplied the by-value TRC.

The list of permanently stored User TRCs in the Printer's public TRC repository is available to the client by querying the "trc-supported" attribute using the Get-Printer-Attributes operation. Clients cannot query the printer for the private TRCs for this or any job.

The Printer copies the "trc" (collection) attribute supplied by the client to the Job object as with any Job Template Job attribute and it may be queried (using Get-Job-Attributes – see [RFC2911]), and modified (using Set-Job-Attributes - see [ipp-set-ops]).

Member Attributes for the "trc" Job Template Attribute

Table 10 lists the member attributes of the "trc" Job Template Job attribute and specifies whether Clients MUST supply them in collection values and whether Printers MUST support them if supporting this collection attribute. The following sub-sections define these member attributes. Table 11 indicates which combinations the client MUST supply in order to get various Printer actions.

Table 10 - "trc" member attributes

Member Attribute Name	Attribute Syntax	Client Request	Printer Support
trc-type	type2 keyword	MAY	MUST
trc-name	name(MAX)	MAY	MUST
trc-cyan-data	octetString(256)	MAY	MAY
trc-magenta-data	octetString(256)	MAY	MAY
trc-yellow-data	octetString(256)	MAY	MAY
trc-black-data	octetString(256)	MAY	MAY

3.17.1 trc-type (type2 keyword)

This member attribute indicates the scope of the User TRC name. When specifying a TRC by named reference, this member attribute specifies whether the TRC can be found in the Printer's public TRC repository, or among this job's private TRCs. When specifying a TRC by value, this member attribute specifies whether the TRC is to be saved in the Printer's public TRC repository or stored as private to the job. TRCs saved in the Printer's public repository will be reusable in different jobs and will remain available until explicitly deleted by a user. Private TRCs will be reusable only within the context of the current job and will be deleted by the Printer when the job enters the Job History (see description of "job-state" in [RFC2911]).

If the client omits this member attribute, the Printer assumes (1) the 'private' value if the client supplied any by-value data attributes (see the descriptions of the "trc-xxx-data" attributes below), or assumes (2) the 'public' value otherwise. See Table 11 for the description of the semantics for combinations of the TRC type, name, and data attributes.

Standard keyword values are:

Keyword	Description
'no-user-trc':	The Printer MUST NOT apply a User TRC; the Printer still applies its calibration TRC.
'public':	The TRC name specified by the "trc-name" member attribute (see description of "trc-name" member attribute below) can be found (or should be saved) in the Printer's public TRC repository (the TRC is available for use in other jobs).
'private':	The TRC name specified by the "trc-name" member attribute (see description below) can be found (or should be saved temporarily) in the Printer's private TRC repository (the TRC is available for use only within the context of the current job).

The Printer MUST support this member attribute and the 'no-user-trc' value and one other value.

3.17.1.1 trc-type-supported (1setOf type3 keyword)

The "trc-type-supported" Printer attribute identifies the values of this "trc-type" member attribute that the Printer supports, i.e., the TRC name types supported.

3.17.2 trc-name (name(MAX))

This member attribute specifies the name of the User TRC. The client supplies this member attribute in order to: (1) to identify a User TRC in the Printer's Public TRC repository, (2) to store explicitly-supplied User TRC data in the Printer's public TRC repository, or (3) as a private TRC that is to be referenced within the job by a subsequent document submission request for this job.

If the client omits this member attribute, the client MUST supply some by-value data attributes (see the descriptions of the "trc-xxx-data" attributes below). See Table 11 for the description of the semantics for combinations of the TRC type, name, and data attributes.

3.17.2.1 trc-name-supported (1setOf name(MAX))

The "trc-name-supported" (1setOf name(MAX)) Printer attribute identifies the values of this "trc-name" member attribute that the Printer supports, i.e., the TRC names supported.

3.17.3 Color tone reproduction curve data attributes

These member attributes specify the actual data when the client is supplying the TRC by value. The client MUST supply all four of these member attributes if any are supplied. The value consists of four 256-octet strings, one for each of the four color separations: C, M, Y, and K, respectively.

If the client omits any of these member attributes, the client MUST supply the "trc-name" member attribute (described above). See Table 11 for the description of the semantics for combinations of the TRC type, name, and data attributes.

There are no corresponding "trc-xxx-data-supported" attributes, i.e., no way for the client to read back from the Printer the actual 256-octets curve data supported by the Printer.

3.17.3.1 trc-cyan-data (octetString(256))

This member attribute specifies the User TRC values for cyan.

3.17.3.2 trc-magenta-data (octetString(256))

This member attribute specifies the User TRC values for magenta.

3.17.3.3 trc-yellow-data (octetString(256))

This member attribute specifies the User TRC values for yellow.

3.17.3.4 trc-black-data (octetString(256))

This member attribute specifies the User TRC values for black.

3.17.4 Combinations of the member attributes

Table 11 shows the Printer's actions for all combinations of the member attributes.

1216 **Table 11 - Combinations of the "trc" member attributes**

"trc-type"	"trc-name"	"trc-data"	Printer Action
'no-user-trc'	supplied or not supplied	supplied or not supplied	Do not apply User TRCs, even if the PDL or Printer defaults specify a User TRC.
'public'	not supplied	not supplied	Ignore* – since no name or data are supplied there is nothing for the printer to reference.
'public'	not supplied	supplied	Ignore* – a name must also be supplied for a set of TRC data to be made public.
'public' or not supplied	supplied	not supplied	The name supplied is used to select TRC data from the Printer's public TRC repository to adjust output intensities.
'public'	supplied	supplied	The TRC data supplied is used to adjust output intensities; the name supplied is used to save the TRC data in the Printer's public TRC repository for reuse on future jobs if a TRC by that name does not already exist. If the supplied name is already in use, the Printer ignores* the supplied data.
'private' or not supplied	not supplied	not supplied	Ignore* – since no name or data are supplied there is nothing for the printer to reference.
'private' or not supplied	not supplied	supplied	The supplied TRC data is used to adjust output intensities then discarded when the current job enters the Job History (see description of "job-state" earlier in [RFC2911]).
'private'	supplied	not supplied	The name supplied is used to select TRC data from the Printer's private TRC repository to adjust output intensities. This combination is useful only if the client has supplied another private TRC with this job as a Job Template Job attribute or a previous document or page override attribute value for this job (see [ipp-override]).
'private or not supplied	supplied	supplied	The data supplied is used to adjust output intensities; the name supplied is used to save the TRC data temporarily as a private TRC for reuse later within the scope of the current job (only)

1217 ignore* - means ignore the client supplied "trc" (collection) attribute all together, return it in the Unsupported Attributes
1218 Group in the response, do not adjust output intensity values, and return the status code 'successful-ok-
1219 ignored-or-substituted-attributes'.

1220 ### 3.17.5 trc-default (collection)

1221 See [RFC2911] section 4.2 for the behavior of “xxx-default” Job Template Printer attributes.

1222 The member attributes for the "trc-default" Job Template Printer attribute are defined in Table 10. A Printer MUST
1223 support the same member attributes and values for this default collection attribute as it supports for the
1224 corresponding "trc" Job Template Job attribute.

1225 ### 3.17.6 trc-supported (1setOf type2 keyword)

1226 The "trc-supported" Job Template Printer attribute identifies the keyword names of the member attributes supported
1227 in the "trc" collection Job Template Job attribute, i.e., the keyword names of the member attributes in Table 10 that
1228 the Printer supports.

4 Imaging Job Template attribute definitions

This section defines additional imaging Job Template attributes related to production printing that do not REQUIRE a color Printer in order to support. However, a color Printer MAY support any of them.

4.1 anti-aliasing (type3 keyword)

This "anti-aliasing" Job Template Job attribute indicates the anti-aliasing algorithm that the Printer object MUST apply to the rendered output images. Curves and diagonal lines rendered below printer resolutions of about 300 dots/inch, can have a jagged appearance as a result of rasterization errors and artifacts. Typically, these anomalies can be masked by imaging a page at a higher resolution than the print engine supports, then sub-sampling the image back down to engine resolution. In the case of black lines, this operation results in the replacement of some edge pixels with gray pixels. The result is a curve or line that looks smooth since the grays and blacks are integrated by the human visual system. These techniques for smoothing rasterized lines are collectively known as "anti-aliasing". The precise algorithm is implementation dependent.

Standard keyword values are:

Keyword	Description
'none'	The printer MUST NOT apply an anti-aliasing algorithm to the rendered output.
'standard'	The Printer MUST apply an implementation defined anti-aliasing algorithm to the rendered output. This value is used for printers that have a single system specified default anti-aliasing algorithm.

If the Printer supports this attribute, it MUST support at least the 'none' and 'standard' values. If the Printer does not support this attribute, the behavior is implementation dependent.

4.1.1 anti-aliasing-default (type3 keyword)

See [RFC2911] section 4.2 for the behavior of “xxx-default” Job Template Printer attributes.

4.1.2 anti-aliasing-supported (1setOf type3 keyword)

See [RFC2911] section 4.2 for the behavior of “xxx-supported” Job Template Printer attributes.

4.2 bleed-edge-printing (type2 keyword)

This "bleed-edge-printing" Job Template Job attribute indicates that the printer should allow page image data to be printed to all edges of the paper, and print beyond the edges of the normal printable area (see Figure 1). It is assumed that the document data contains the image data to be placed in the bleed edge area, and that the “bleed-edge-printing” attribute only enables the image to be printed in an otherwise non-printable area. This ability to print to each edge of a sheet of paper, making it appear that the color(s) has run off one or more edges is called bleed edge printing.

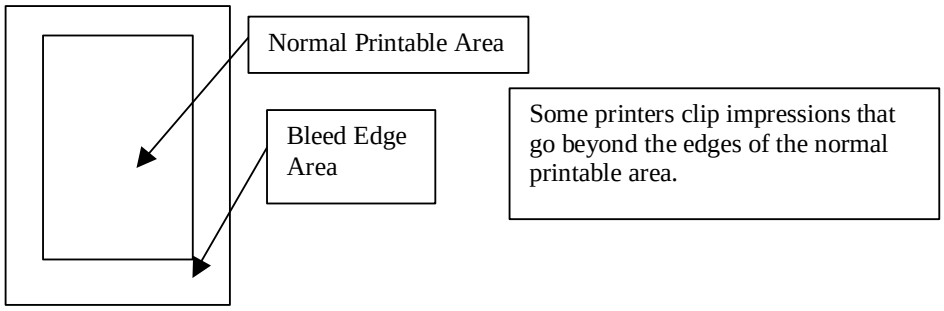


Figure 1 - Bleed Edge Area and Normal Printable Area

Standard keyword values are:

Keyword	Description
'none'	No bleed edge printing allowed.
'all'	Allow bleed edge printing to all edges.

If the Printer supports this attribute, it MUST support the 'none' and 'all' values. If the Printer does not support this attribute, the behavior is implementation dependent.

4.2.1 bleed-edge-printing-default (type2 keyword)

See [RFC2911] section 4.2 for the behavior of “xxx-default” Job Template Printer attributes.

4.2.2 bleed-edge-printing-supported (1setOf type2 keyword)

See [RFC2911] section 4.2 for the behavior of “xxx-supported” Job Template Printer attributes.

4.3 halftone-graphics (type2 keyword | name(MAX))
4.4 halftone-images (type2 keyword | name(MAX))
4.5 halftone-text (type2 keyword | name(MAX))

These "halftone-xxx" Job Template Job attributes provide a way to specify the halftone screens to be used by the Printer to render xxx objects within color or black and white documents as indicated in the following table:

Table 12 - "halftone-xxx" attribute name suffixes

Values of "-xxx" attribute name suffix	xxx object Description
-graphics	graphic / graphics objects
-text	text
-images	images

The Adobe Red Book indicates that “Halftoning is the process by which continuous tone colors are approximated by a pattern of pixels that can achieve only a limited number of discrete colors. … The input to the halftone function consists of continuous-tone, gamma corrected color components in device native color space. The output consists of

pixels representing colors the device can reproduce. … halftone functions… are based on the use of a halftone screen. … halftone screens are specified as frequency, angle, and spot function… A screen is defined by conceptually layering a uniform rectangular grid of halftone cells over the device pixel array. Each pixel belongs to one cell in the grid; a halftone cell usually contains many device pixels."

The screens available are implementation specific with different line frequencies, angles, and spot functions implied by each keyword value for each printer implementation.

Standard keyword values are:

Keyword	Description
'none'	Implies that no halftone-xxx screen should be applied to objects of type xxx. This is provided to enable a client to over-ride a Printer default value in situations where no halftoning is desired.
'low-frequency-dot'	Device dependent name for the lowest frequency dot screen available within the system.
'mid-frequency-dot'	Device dependent name for the dot screen with a frequency between the "low-frequency-dot" and "high-frequency-dot" screens available within the system.
'high-frequency-dot'	Device dependent name for the dot screen with a frequency between the "mid-frequency-dot" and "highest-frequency-dot" screens available within the system.
'highest-frequency-dot'	Device dependent name for the dot screen with the highest frequency available within the system.
'low-frequency-line'	Device dependent name for the lowest frequency line screen available within the system.
'mid-frequency-line'	Device dependent name for the line screen with a frequency between the "low-frequency-line" and "high-frequency-line" screens available within the system.
'high-frequency-line'	Device dependent name for the dot screen with a frequency between the "mid-frequency-dot" and "highest-frequency-dot" screens available within the system.
'highest-frequency-line'	Device dependent name for the line screen with the highest frequency available within the system.
'stochastic'	Device dependent name for a screen that uses random spot densities to render objects.
'150-dpi'	Device independent name for a screen that has a nominal frequency of 150 dots per inch.
'175-dpi'	Device independent name for a screen that has a nominal frequency of 175 dots per inch.
'200-dpi'	Device independent name for a screen that has a nominal frequency of 200 dots per inch.
'53-lpi'	Device independent name for a screen that has a frequency of 53 lines per inch.
'85-lpi'	Device independent name for a screen that has a nominal frequency of 85 lines per inch.
'106-lpi'	Device independent name for a screen that has a frequency of 106 lines per inch.
'171-lpi'	Device independent name for a screen that has a nominal frequency of 171 lines per inch.
'200-lpi'	Device independent name for a screen that has a nominal frequency of 200 lines per inch.
'300-lpi'	Device independent name for a screen that has a nominal frequency of 300 lines per inch.
'600-lpi'	Device independent name for a screen that has a nominal frequency of 600 lines per inch.

The halftone-xxx attributes are applicable on a job and page-override basis.

4.5.1 halftone-graphics-default (type2 keyword | name(MAX))
4.5.2 halftone-images-default (type2 keyword | name(MAX))
4.5.3 halftone-text-default (type2 keyword | name(MAX))

See [RFC2911] section 4.2 for the behavior of "xxx-default" Job Template Printer attributes.

4.5.4 halftone-graphics-supported (1setOf (type2 keyword | name(MAX)))
4.5.5 halftone-images-supported (1setOf (type2 keyword | name(MAX)))
4.5.6 halftone-text-supported (1setOf (type2 keyword | name(MAX)))

See [RFC2911] section 4.2 for the behavior of “xxx-supported” Job Template Printer attributes.

4.6 Insertion of Referenced Open Prepress Interface (OPI) Images

This section defines Job Template attributes that the client can supply to control access to and use of Open Prepress Interface (OPI) images referenced from within the PDL data of a document. These attributes are limited to images referenced via the industry-standard Open Prepress Interface (OPI) specification [OPI]. The OPI reference mechanism is specifically a PostScript [postscript] and PDF [PDF] capability and its exact operation is dependent on printer implementation. The OPI mechanism NEED NOT be available for other document-formats. In addition, a Printer MAY provide equivalent functionality using other conventions.

The OPI specification defines a collection of special PostScript comments that page layout applications can insert into a document PDL file as a way to improve layout and printing performance. In particular, OPI comments enable the layout application to create and use low-resolution proxy images in its operations. OPI comments provide information needed by the Printer to enable it to find and replace the proxy images with high-resolution images at document RIP/print time. The comments may also be used to define image manipulations that occurred during page layout which are to be applied in the Printer.

OPI comments are generated by "OPI Producers", which can include both page layout applications and special software which creates proxy (low-resolution) images. The comments are interpreted by "OPI Consumers" which insert the high resolution images (or the proxy image if the proxy image data was included in the PDL file) and update the PostScript as necessary to perform any specified image processing. The OPI Consumer role is very often performed by a specialized server that forwards jobs to a Printer. These Job Template attributes are provided so that an IPP Printer MAY be an OPI Consumer and perform the requested image substitution and processing operations.

In OPI, special comments provide the location of the high-resolution images to be used at print time. These referenced images are typically stored in a central repository. They may also be located at the client, on a disk that is local to or remotely mounted on the Printer, or on a separate image server on the network. The images within a single job could conceivably be stored in many different locations. Again, the exact location of the images referenced by OPI comments is an architectural decision that could be unique to each Printer implementation.

The syntax and semantics of the particular PostScript and PDF OPI comments are outside the scope of this document.

When using OPI, whether or not an OPI Producer includes low-resolution image data in the document file to be printed is implementation-dependent. If the low-resolution image data is not present in the document data and if the client specifies 'do-not-insert' for the "opi-image-insertion" attribute value, described in Section 4.6.1 (or the Printer's "opi-image-insertion-default" attribute is set to 'do-not-insert'), the job will print without any images (high or low resolution). White space (or whatever background the image was to be placed on) will appear where the referenced images should have been. If the OPI Producer does include the low-resolution image data in the PDL and if the client specifies 'do-not-insert' for the "opi-image-insertion" attribute value, the low-resolution images will appear in the printed output. In this case, it is assumed that the image will be properly scaled, rotated, clipped, etc. by the application (i.e. the IPP Printer only needs to perform image manipulations when substituting new image data). If the "opi-image-insertion" attribute value is set to 'insert' then any low-resolution image data included in the PDL file will, by OPI convention, be replaced by the referenced high-resolution image.

There are two potential disadvantages of image insertion while the document data is being decomposed (RIPped): 1) there may be references to images that are incorrect or are not accessible which could cause the job to fault, and 2) decomposition may be delayed while an image is being retrieved from a remote repository (i.e. across the network). If the IPP Printer is the critical resource in the customer's workflow, productivity may be impacted. The

"opi-image-pre-scan" Job Template Job attribute, described in Section 4.6.2, is defined to mitigate this risk to RIP performance.

Note: the "opi-image-insertion" Job Template Job attribute is restricted to OPI images, because no references to other types of images are designed to be optional, i.e., designed to allow the client to indicate whether or not to include them in the rendered output.

4.6.1 opi-image-insertion (type2 keyword)

This "opi-image-insertion" Job Template Job attribute indicates the type of OPI image insertion to be performed by the IPP Printer.

Standard keyword values are:

Keyword	Description
'insert'	At print time, OPI images referenced in the document file are retrieved, manipulated as specified, and inserted or substituted for those referenced in the document.
'do-not-insert'	At print time, OPI images referenced in the document are not retrieved, inserted or substituted for those in the document. The Printer ignores all OPI image insertion references.

If the Printer supports this attribute, it MUST support both values. If the Printer does not support this attribute, the behavior is implementation dependent.

This attribute MUST NOT affect other types of images, only OPI images.

If the Printer encounters any errors, it MUST continue to process all images. If the Printer is unable to access some images or is unable to fetch some images during pre-scan, then the Printer MUST report each such problem as a separate value in the Job's "job-detailed-status-messages" (1setOf text(MAX)) and "job-document-access-errors" (1setOf text(MAX)) Job Description attributes (see [RFC2911]).

Note: image insertion, such as OPI processing, can impact performance of the Printer significantly, depending on many factors. As with any Job Template attribute, the System Administrator can prevent usage by removing the 'insert' value from the Printer's "opi-image-insertion-supported" attribute. But see the description of the “opi-image-pre-scan” attribute below for another remedy to prevent performance degradation.

4.6.1.1 opi-image-insertion-default (type2 keyword)

See [RFC2911] section 4.2 for the behavior of “xxx-default” Job Template Printer attributes.

4.6.1.2 opi-image-insertion-supported (1setOf type2 keyword)

See [RFC2911] section 4.2 for the behavior of “xxx-supported” Job Template Printer attributes.

4.6.2 opi-image-pre-scan (type2 keyword)

This "opi-image-pre-scan" Job Template Job attribute indicates whether or not the Printer is to pre-scan the document data in order to validate that OPI [OPI] images referenced within the document are accessible and, optionally, to pull them to the Printer, before processing the job, i.e., before RIPping or marking.

Standard keyword values are:

Keyword	Description
'no-pre-scan'	Perform no pre-scan of the document data before processing the job.
'pre-scan'	Before processing the job, pre-scan the document data and validate that each OPI image exists and is accessible.
'pre-scan-and-gather'	pre-scan the document data and retrieve the referenced OPI images prior to processing the job. Note: It is an implementation decision whether the referenced OPI image files are inserted into the document data stream or are simply copied to the Printer's local disk.

If the Printer supports this attribute, it MUST support all three values. If the Printer does not support this attribute, the behavior is implementation dependent.

This attribute MUST NOT affect other types of images, only OPI images. See the "resource-pre-scan" attribute (described in Section 4.9) which pre-scans for non-OPI resources.

If the Printer encounters any errors, it MUST continue to process all image references. If the Printer is unable to access some images or is unable to fetch some images during pre-scan, then the Printer MUST report each such problem as a separate value in the Job's "job-detailed-status-messages" (1setOf text(MAX)) and "job-document-access-errors" (1setOf text(MAX)) Job Description attributes (see descriptions in [RFC2911]).

If Printer detects that the input spool is full, it will stop gathering images but continue to 'pre-scan'. The Printer will add a text value in the Job's "job-detailed-status-messages" (1setOf text(MAX)) attribute indicating that the spool space is full and the number of images that were successfully copied to the spool space.

Note: Users should be aware of the number and size of referenced OPI images when using the 'pre-scan-and-gather' option, which will copy all images to the input spool. In addition, users should not select the 'pre-scan-and-gather' option when clients have copied OPI images to the Printer's local disk prior to submitting the job, since that would cause the Printer to perform an unnecessary copy operation.

4.6.2.1 opi-image-pre-scan-default (type2 keyword)

See [RFC2911] section 4.2 for the behavior of “xxx-default” Job Template Printer attributes.

4.6.2.2 opi-image-pre-scan-supported (1setOf type2 keyword)

See [RFC2911] section 4.2 for the behavior of “xxx-supported” Job Template Printer attributes.

4.6.3 Combinations of "opi-image-insertion" and "opi-image-pre-scan" attribute values

Table 13 shows the combinations of values for the "opi-image-insertion" and "opi-image-pre-scan" attributes and the description of the effects of that combination.

1389 **Table 13 - Combinations of "opi-image-insertion" and**
1390 **"opi-image-pre-scan" attribute values**

"opi-image-insertion"	"opi-image-pre-scan"	Description
'do-not-insert'	'no-pre-scan'	Image references are ignored; the document is printed as if the printer did not support the feature. See note**.
'do-not-insert'	'pre-scan'	The PDL is pre-scanned, and the image references are validated but no insertion/substitution takes place. Any pre-scan errors are reported. See note**.
'do-not-insert'	'pre-scan-and-gather'	ILLEGAL combination. A client MUST NOT supply this illegal combination. If the client does supply this mal-formed request, the Printer MUST (depending on implementation) either (1) reject the request and return the 'client-error-bad-request' status code (see [RFC2911] section 13.1.4.1) or (2) ignore these attributes, return them in the Unsupported Attributes Group, and return the 'successful-ok-ignored-or-substituted-attributes' status code (see [RFC2911] section 13.1.2.2), independent of the value of the "ipp-attribute-fidelity" attribute supplied by the client.
'insert'	'no-pre-scan'	Images are retrieved and inserted/substituted at processing time without any pre-scan check.
'insert'	'pre-scan'	The PDL is pre-scanned and the image references are validated at that time. The images are retrieved, inserted/substituted at processing time.
'insert'	'pre-scan-and-gather'	The PDL is pre-scanned and the images are retrieved at that time. The images are inserted/substituted either during the pre-scan or at processing time. Note that the gathered images will persist along with the PDL data and will be removed when the PDL is removed when the job enters the Job History.

1391

1392 ** Note: in the OPI model, if the job is processed and printed, and if the PDL contains references with low-resolution
1393 image data included, this data is imaged. But, if the PDL contains references with no image data included, there will
1394 be white space (or whatever background the image was to be placed on) where the image was to be placed.

1395 ## 4.7 page-rotation (type3 keyword | name(MAX))

1396 This “page-rotation” Job Template Job attribute specifies a rotation transformation the Printer MUST perform on the
1397 affected input page images.

1398 NOTE: This transformation may result in a loss of data if any part of the image is rotated off the printable area.
1399 Additional values could be defined to include scaling the image to fit onto the printable area.

1400 The transformation specified by this attribute is applied to the specified page images BEFORE any transformations
1401 that may be specified by the “number-up” and/or “imposition-template” attributes. If any transformations are specified
1402 by the “number-up” or “imposition-template” attributes, those transformations would be ADDITIVE to the rotation.

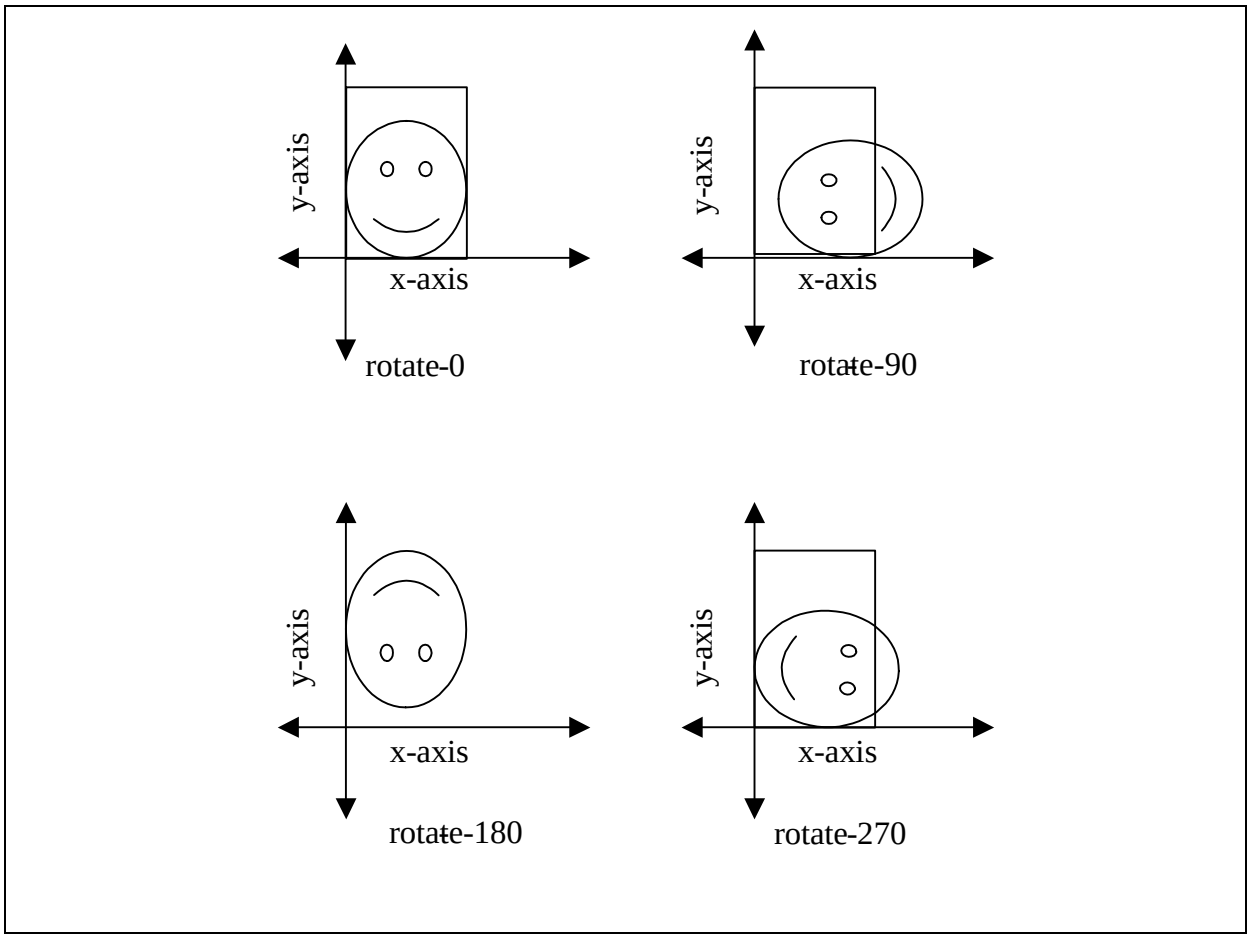
1403 This attribute affects input page images, and can be specified as a Document Override as well as a Page Override.

1404 Standard keyword values are:

Keyword	Description
'rotate-0'	No rotation or translation is performed on the image.
'rotate-90'	The page image is rotated +90 degrees (i.e., anti-clockwise) around its origin. When rotation is done, the rotated image is repositioned to align its lower left hand corner with the lower left hand corner of the original image. No scaling is performed, so the image may cropped if it exceeds the printable area.
'rotate-180'	The page image is rotated +180 degrees (i.e., anti-clockwise) around its origin. When rotation is done, the rotated image is repositioned to align its lower left hand corner with the lower left hand corner of the original image. No scaling is performed, so the image may cropped if it exceeds the printable area.
'rotate-270'	The page image is rotated +270 degrees (i.e., anti-clockwise) around its origin. When rotation is done, the rotated image is repositioned to align its lower left hand corner with the lower left hand corner of the original image. No scaling is performed, so the image may cropped if it exceeds the printable area.

1405

1406 Figure 2 illustrates each of the four values.



1407

1408 **Figure 2 – Page Rotation for each of the standard keyword values**

1409

1410 ### 4.7.1 page-rotation-default (type3 keyword | name(MAX))

1411 See [RFC2911] section 4.2 for the behavior of “xxx-default” Job Template Printer attributes.

1412 ### 4.7.2 page-rotation-supported (1setOf (type3 keyword | name(MAX)))

1413 See [RFC2911] section 4.2 for the behavior of “xxx-supported” Job Template Printer attributes.

1414 ## 4.8 resource-cleanup (type3 keyword | 1setOf name(MAX))

1415 This "resource-cleanup" Job Template Job attribute is used after job completion to tell the IPP Printer which files of
1416 any kind had been explicitly transferred to the Printer by means outside the job submission protocol before the job
1417 was submitted. The Printer MUST delete all files identified by this attribute when the Printer removed all document
1418 data from the job and moves from the Job Retention state to the Job History state (see [RFC2911] section 4.3.7.2)
1419 where it cannot longer be reprinted using Restart-Job (see [RFC2911]) or Reprocess-Job (see [ipp-admin-ops]). For
1420 example, one or more clients could have copied files containing images to the Printer's public file repository (local
1421 disk or mounted remote file system) using FTP and then a client submitted a job consisting of a PostScript
1422 [postscript] master document which contains document references to these copied files. As another example, the
1423 PostScript master document could reference files that reside on a disk which the Printer shares through NFS. In the
1424 latter case, the job submission client needs to be able to control using this attribute whether or not the Printer deleted
1425 such referenced files, since they may not be copies. This attribute MAY be used with any kind of temporary file, such
1426 as an image file, an OPI image file [OPI], a font, logo, etc.

1427 This attribute MUST NOT affect the deletion of temporary copies of files that the Printer gathers or pulls in order to
1428 process a job. The Printer MUST always delete such temporary files so that any such copying is transparent to the
1429 user. For example, the Printer MUST cleanup any copies of OPI files that it copies as a result of gathering the OPI
1430 images, either during pre-scan or while processing. As another example, if the Printer makes a copy of a document
1431 referenced by a Print-URI or Send-URI operation, the Printer MUST delete any such temporary copy when the job
1432 enters the Job History. The Printer MUST make no attempt to re-use any such temporary copies of OPI or
1433 documents in any subsequent job, since the data to which the reference is made may have been updated between
1434 jobs.

1435 Standard keyword values are:

Keyword	Description
'delete'	The Printer MUST delete all temporary copies of resources that have been referenced as part of job processing when the job enters the Job History.
'keep'	The Printer MUST retain all referenced resources that have been referenced as part of job processing, i.e., not delete them when the job enters the Job History.

1436

1437 If the Printer supports this attribute, it MUST support both values. If the Printer does not support this attribute, the
1438 behavior is implementation dependent.

1439 The name(MAX) syntax for this particular attribute is used to enable the job submission client to construct a list of
1440 files and directories that should be deleted when the job enters the Job History (see “job-state” description in
1441 [RFC2911]). These files and directories MAY reside on the IPP Printer or on a remotely mounted volume to which
1442 the printer has access. The security mechanisms for the client to delegate delete access rights to the Printer is
1443 beyond the scope of this document. However, the Printer SHOULD ensure that any such files or directories are ones
1444 that were referenced by the job.

1445 If the Printer supports this attribute, it is OPTIONAL whether it supports the 'name' attribute syntax.

4.8.1 resource-cleanup-default (type3 keyword)

See [RFC2911] section 4.2 for the behavior of “xxx-default” Job Template Printer attributes.

4.8.2 resource-cleanup-supported (1setOf type3 keyword)

See [RFC2911] section 4.2 for the behavior of “xxx-supported” Job Template Printer attributes.

4.9 resource-pre-scan (type2 keyword)

This "resource-pre-scan" Job Template Job attribute indicates whether or not the Printer is to pre-scan the document data in order to validate that resources referenced within the document are accessible and, optionally, to pull them to the Printer, before processing the job, i.e., before RIPping or marking.

Standard keyword values are:

Keyword	Description
'no-pre-scan'	Perform no pre-scan of the document data before processing the job.
'pre-scan'	Before processing the job, pre-scan the document data and validate that each referenced resource exists and is accessible, but fetch the resource later when the document data is interpreted (RIPped).
'pre-scan-and-gather'	Pre-scan the document data and retrieve the referenced resources prior to processing the job. Note: It is an implementation decision whether the referenced resource files are inserted into the document data stream or are simply copied to the Printer's local disk.

If the Printer supports this attribute, it MUST support all three values. If the Printer does not support this attribute, the behavior is implementation dependent.

This attribute MUST NOT affect OPI images [OPI], only other referenced resources, such as fonts and other types of images. See the "opi-image-pre-scan" and "opi-image-insertion" attributes (in Section 4.6) which pre-scan and insert OPI images.

If the Printer encounters any errors, it MUST continue to process all resource references. If the Printer is unable to access some resources or is unable to fetch some resources during pre-scan, then the Printer MUST report each such problem as a separate value in the Job's "job-detailed-status-messages" (1setOf text(MAX)) and "job-document-access-errors" (1setOf text(MAX)) Job Description attributes (see descriptions in [RFC2911]).

If Printer detects that the input spool is full, it will stop gathering resources but continue to 'pre-scan'. The Printer will add a text value in the Job's "job-detailed-status-messages" (1setOf text(MAX)) attribute indicating that the spool space is full and the number of resources that were successfully copied to the spool space.

Note: Users should be aware of the number and size of referenced resources when using the 'pre-scan-and-gather' option, which will copy all resources to the input spool. In addition, users should not select the 'pre-scan-and-gather' option when client have copied resources to the Printer's local disk prior to submitting the job, since that would cause the Printer to perform an unnecessary copy operation.

4.9.1 resource-pre-scan-default (type2 keyword)

See [RFC2911] section 4.2 for the behavior of “xxx-default” Job Template Printer attributes.

4.9.2 resource-pre-scan-supported (1setOf type2 keyword)

See [RFC2911] section 4.2 for the behavior of “xxx-supported” Job Template Printer attributes.

5 Printer Description attributes

This section defines an additional Printer Description attribute.

5.1 colorants-supported (1setOf (type3 keyword | name(MAX)))

This "colorants-supported" Printer Description attribute lists the colorants which are currently in use by the Printer. This attribute is used in conjunction with the "color-depth-yyy" (integer(2:MAX)). The number of values in "colorants-supported" and number of "color-depth-yyy" attributes MUST match.

Standard keyword values are:

Keyword	Description
'black'	The specified colorant must be black.
'cyan'	The specified colorant must be cyan.
'magenta'	The specified colorant must be magenta.
'yellow'	The specified colorant must be yellow.
'red'	The specified colorant must be red.
'green'	The specified colorant must be green.
'blue'	The specified colorant must be blue.
'cardinal'	The specified colorant must be cardinal.
'royal'	The specified colorant must be royal.
'ruby'	The specified colorant must be ruby.
'violet'	The specified colorant must be violet.
'brown'	The specified colorant must be brown.

6 Conformance Requirements

This section summarizes the Conformance Requirements detailed in the definitions in this document for clients and Printer objects (servers or devices).

6.1 Conformance Requirements for Printer objects

In general each of the attributes defined in this document are OPTIONAL for a Printer to support, so that Printer implementers MAY implement any combination of attributes.

Each of the collection attribute definitions indicate which member attributes are REQUIRED and which are OPTIONAL for a Printer to support and is not repeated here.

If a Printer supports the 'collection' attribute syntax of a Job Template attribute, then it MUST support the distinguished ‘none’ value defined for that collection. See section 2.7 in [pwg-prod-print].

Support of the 'name' attribute syntax for Job Template attributes and collection member attributes is OPTIONAL, as in IPP/1.1 [RFC2911].

6.2 Conformance Requirements for clients

Clients that support a "xxx" collection Job Template Job attribute SHOULD use the Get-Printer-Attributes request to obtain the "xxx-default" collection and display that to the user, so that the user can make any changes before submitting the Job. Then the client submits values for all member attributes, rather than depending on the Printer's defaulting for omitted member attributes, since such defaulting is implementation dependent and will vary from Printer to Printer.

7 Normative References

This section lists references to documents whose implementation are required in order to conform to this specification.

[ICC]
International Color Consortium. See “ICC” in the Terminology section 2.2. See also http://www.color.org/

[IEC61966-2.1]
Colour measurement and management in multimedia systems and equipment. Part 2.1 of IEC 61966; Colour Management in Multimedia systems.

[ipp-coll]
deBry, R., , Hastings, T., Herriot, R., Ocke, K., and P. Zehler, "Internet Printing Protocol (IPP): collection attribute syntax", RFC 3382, September 2002.

[OPI]
"Open Prepress Interface (OPI)", Open Prepress Interchange Specification Version 2.0, Technical Note 5660, January 19, 2000, http://partners.adobe.com/asn/developer/PDFS/TN/5660.OPI_2.0.pdf and Open Prepress Interchange Specification 1.3, September 22, 1993, http://partners.adobe.com/asn/developer/PDFS/TN/OPI_13.pdf

[PCL]
Printer Control Language (PCL), PCL-PJL Technical Reference Manual Documentation Package HP Part No. 5012-0330, Hewlett-Packard Company.

[PDF]
Adobe Portable Document Format (PDF), version 1.4, Adobe Systems, “PDF Reference, third edition, Adobe Portable Document Format Version 1.4”, Addison-Wesley, December 2001, http://partners.adobe.com/asn/developer/acrosdk/docs/filefmtspecs/PDFReference.pdf. Also see errata: http://partners.adobe.com/asn/developer/acrosdk/docs/PDF14errata.txt.
Previous version: version 1.3, March 11, 1999. See http://www.pdfzone.com/resources/pdfspec13.html

[postscript]
PostScript ® Level 3 Reference Manual. http://www.adobe.com/products/postscript/main.html

[pwg-prod-print]
Ocke, K., Hastings, T., "Internet Printing Protocol (IPP): Production Printing Attributes - Set1", IEEE-ISTO 5100.3-2001, February 12, 2001.

[pwg-prod-print-2]
Hastings, T., and D. Fullman, "Internet Printing Protocol (IPP): Production Printing Attributes – Set 2", <pwg-ipp-prod-print-set2-draft-v0_1-020821.doc, rtf, .pdf>, Draft D0.1, August 21, 2002.

[RFC2119]
S. Bradner, "Key words for use in RFCs to Indicate Requirement Levels", RFC 2119 , March 1997

[RFC2910]
Herriot, R., Butler, S., Moore, P., Turner, R., and J. Wenn, "Internet Printing Protocol/1.1: Encoding and Transport", RFC 2910, September 2000.

[RFC2911]
Hastings, T., Herriot, R., deBry, R., Isaacson, S., and P. Powell, "Internet Printing Protocol/1.1: Model and Semantics", RFC 2911, September 2000.

[SMPTE-240M]
Standard 240m of the Society of Motion Picture and Television Engineers.

[SWOP]
Specifications for Web Offset Publications. See “SWOP” in the Terminology section 2.2. See also www.swop.org and www.color.org/overview.html.

8 Informative References

[ipp-admin-ops]
Kugler, C, Hastings, T., Lewis, H., "Internet Printing Protocol (IPP): Job and Printer Administrative Operations", <draft-ietf-ipp-ops-set2-03.txt>, July 27, 2001.

[ipp-override]
Ocke, K., Herriot, R., "Internet Printing Protocol (IPP): Override Attributes for Documents and Pages", IEEE-ISTO 5100.4-2000, February 7, 2001.

[RFC2565]
Herriot, R., Butler, S., Moore, P., and R. Turner, "Internet Printing Protocol/1.0: Encoding and Transport", RFC 2565, April 1999.

[RFC2566]
deBry, R., , Hastings, T., Herriot, R., Isaacson, S., Powell, P., "Internet Printing Protocol/1.0: Model and Semantics", RFC 2566, April 1999.

[ipp-set-ops]
Hastings, T., Herriot, R., Kugler, C., Lewis, H., "Internet Printing Protocol (IPP): Job and Printer Set Operations", RFC 3380, September 2002.

9 IANA Considerations

This section contains registration information for IANA to add to the IPP Registry according to the procedures defined in RFC 2911 [RFC2911] section 6. The resulting IPP registrations will be published in the http://www.iana.org/assignments/ipp-registrations registry.

9.1 Attribute Registration

The following table lists all of the attributes defined in this document. These are to be registered according to the procedures in RFC 2911 [RFC2911] section 6.2.

Job Template attributes:	Reference:	Section:
adjust-contrast (integer (-100:100))	5100.8	3.2.2
adjust-contrast-default (integer(-100:100))	5100.8	3.2.2.1
adjust-contrast-supported (rangeOfInteger(-100:100))	5100.8	3.2.2.2
adjust-cyan-red (integer(-100:100))	5100.8	3.2.1.1
adjust-cyan-red-default (integer(-100:100))	5100.8	3.2.1.1.1
adjust-cyan-red-supported (rangeOfInteger(-100:100))	5100.8	3.2.1.1.2
adjust-lightness (integer (-100:100))	5100.8	3.2.3
adjust-lightness-default (integer(-100:100))	5100.8	3.2.3.1
adjust-lightness-supported (rangeOfInteger(-100:100))	5100.8	3.2.3.2
adjust-magenta-green (integer (-100:100))	5100.8	3.2.1.2
adjust-magenta-green-default (integer(-100:100))	5100.8	3.2.1.2.1
adjust-magenta-green-supported (rangeOfInteger(-100:100))	5100.8	3.2.1.2.2
adjust-saturation (integer (-100:100))	5100.8	3.2.4
adjust-saturation-default (integer(-100:100))	5100.8	3.2.4.1
adjust-saturation-supported (rangeOfInteger(-100:100))	5100.8	3.2.4.2
adjust-yellow-blue (integer (-100:100))	5100.8	3.2.1.3
adjust-yellow-blue-default (integer(-100:100))	5100.8	3.2.1.3.1
adjust-yellow-blue-supported (rangeOfInteger(-100:100))	5100.8	3.2.1.3.2
anti-aliasing (type3 keyword)	5100.8	4.1
anti-aliasing-default (type3 keyword)	5100.8	4.1.1
anti-aliasing-supported (1setOf type3 keyword)	5100.8	4.1.2
black-overprint (type2 keyword)	5100.8	3.3
black-overprint-default (type2 keyword)	5100.8	3.3.1.1
black-overprint-supported (1setOf type2 keyword)	5100.8	3.3.1.2
bleed-edge-printing (type2 keyword)	5100.8	4.2
bleed-edge-printing-default (type2 keyword)	5100.8	4.2.1
bleed-edge-printing-supported (1setOf type2 keyword)	5100.8	4.2.2
color-depth-yyy (integer(2:MAX))	5100.8	3.4
color-depth-yyy-default (integer (2:MAX))	5100.8	3.4.1
color-depth-yyy-supported (1setOf integer (2:MAX))	5100.8	3.4.2
color-destination-profile-back (type3 keyword | name(MAX))	5100.8	3.5.1
color-destination-profile-back-default (type3 keyword | name(MAX))	5100.8	3.5.1.1


```
color-destination-profile-back-supported  (1setOf (type3 keyword | name(MAX)))
                                                        5100.8      3.5.1.2
color-destination-profile-front (type3 keyword | name(MAX))
                                                        5100.8      3.5.2
color-destination-profile-front-default  (type3 keyword | name(MAX))
                                                        5100.8      3.5.2.1
color-destination-profile-front-supported  (1setOf (type3 keyword | name(MAX)))
                                                        5100.8      3.5.2.2
color-effects-type (type2 keyword)                      5100.8      3.6
color-effects-type-default  (type2 keyword)             5100.8      3.6.1
color-effects-type-supported  (1setOf type2 keyword)   5100.8      3.6.2
color-emulation (type3 keyword | name (MAX))            5100.8      3.7
color-emulation-default  (type3 keyword | name(MAX))    5100.8      3.7.1.1
color-emulation-supported  (1setOf (type3 keyword | name(MAX)))
                                                        5100.8      3.7.1.2
halftone-graphics (type2 keyword | name(MAX))           5100.8      4.3
halftone-graphics-default  (type2 keyword | name(MAX))5100.8        4.5.1
halftone-graphics-supported  (1setOf (type2 keyword | name(MAX)))
                                                        5100.8      4.5.4
halftone-images (type2 keyword | name(MAX))             5100.8      4.4
halftone-images-default  (type2 keyword | name(MAX))    5100.8      4.5.2
halftone-images-supported  (1setOf (type2 keyword | name(MAX)))
                                                        5100.8      4.5.5
halftone-text (type2 keyword | name(MAX))               5100.8      4.5
halftone-text-default  (type2 keyword | name(MAX))      5100.8      4.5.3
halftone-text-supported  (1setOf (type2 keyword | name(MAX)))
                                                        5100.8      4.5.6
highlight-colorant (type3 keyword | name(MAX))          5100.8      3.8
highlight-colorant-default  (type3 keyword | name(MAX))
                                                        5100.8      3.8.1
highlight-colorant-supported  (1setOf (type3 keyword | name(MAX)))
                                                        5100.8      3.8.2
highlight-colorant-ready  (1setOf (type3 keyword | name(MAX)))
                                                        5100.8      3.8.3
highlight-colorant-mismatch (type3 keyword | name(MAX))
                                                        5100.8      3.9
highlight-colorant-mismatch-default  (type3 keyword | name(MAX))
                                                        5100.8      3.9.1
highlight-colorant-mismatch-supported  (1setOf (type3 keyword | name(MAX)))
                                                        5100.8      3.9.2
highlight-map (type3 keyword | name(MAX))               5100.8      3.10
highlight-map-default  (type3 keyword | name(MAX))      5100.8      3.10.1
highlight-map-supported  (1setOf (type3 keyword | name(MAX)))
                                                        5100.8      3.10.2
highlight-map-color  (type3 keyword | name(MAX))        5100.8      3.11
highlight-map-color-default  (type3 keyword | name(MAX))
                                                        5100.8      3.11.1
highlight-map-color-supported  (1setOf (type3 keyword | name(MAX)))
                                                        5100.8      3.11.2
opi-image-insertion (type2 keyword)                     5100.8      4.6.1
opi-image-insertion-default  (type2 keyword)            5100.8      4.6.1.1
opi-image-insertion-supported  (1setOf type2 keyword) 5100.8        4.6.1.2
opi-image-pre-scan (type2 keyword)                      5100.8      4.6.2
opi-image-pre-scan-default  (type2 keyword)             5100.8      4.6.2.1
opi-image-pre-scan-supported  (1setOf type2 keyword)   5100.8      4.6.2.2
page-rotation (type3 keyword | name(MAX))               5100.8      4.7
```


page-rotation-default (type3 keyword | name(MAX))	5100.8	4.7.1
page-rotation-supported (1setOf (type3 keyword | name(MAX)))	5100.8	4.7.2
rendering-intent-graphics (type2 keyword)	5100.8	3.12.1
rendering-intent-graphics-default (type2 keyword)	5100.8	3.12.3.1
rendering-intent-graphics-supported (1setOf type2 keyword)	5100.8	3.12.3.4
rendering-intent-images (type2 keyword)	5100.8	3.12.2
rendering-intent-images-default (type2 keyword)	5100.8	3.12.3.2
rendering-intent-images-supported (1setOf type2 keyword)	5100.8	3.12.3.5
rendering-intent-text (type2 keyword)	5100.8	3.12.3
rendering-intent-text-default (type2 keyword)	5100.8	3.12.3.3
rendering-intent-text-supported (1setOf type2 keyword)	5100.8	3.12.3.6
resource-cleanup (type3 keyword | 1setOf name(MAX))	5100.8	4.8
resource-cleanup-default (type3 keyword)	5100.8	4.8.1
resource-cleanup-supported (1setOf type3 keyword)	5100.8	4.8.2
resource-pre-scan (type2 keyword)	5100.8	4.9
resource-pre-scan-default (type2 keyword)	5100.8	4.9.1
resource-pre-scan-supported (1setOf type2 keyword)	5100.8	4.9.2
source-cmy-graphics (name(MAX))	5100.8	3.13.1
source-cmy-graphics-supported (1setOf name(MAX))	5100.8	3.13.6.5
source-cmy-images (name(MAX))	5100.8	3.13.3
source-cmy-images-supported (1setOf name(MAX))	5100.8	3.13.6.6
source-cmy-text (name(MAX))	5100.8	3.13.5
source-cmy-text-supported (1setOf name(MAX))	5100.8	3.13.6.7
source-cmyk-graphics (type3 keyword | name(MAX))	5100.8	3.13.7
source-cmyk-graphics-supported (1setOf (type3 keyword | name(MAX)))	5100.8	3.13.12.5
source-cmyk-images (type3 keyword | name(MAX))	5100.8	3.13.9
source-cmyk-images-supported (1setOf (type3 keyword | name(MAX)))	5100.8	3.13.12.6
source-cmyk-text (type3 keyword | name(MAX))	5100.8	3.13.11
source-cmyk-text-supported (1setOf (type3 keyword | name(MAX)))	5100.8	3.13.12.7
source-gray-graphics (name(MAX))	5100.8	3.13.13
source-gray-graphics-supported (1setOf name(MAX))	5100.8	3.13.18.5
source-gray-images (name(MAX))	5100.8	3.13.15
source-gray-images-supported (1setOf name(MAX))	5100.8	3.13.18.6
source-gray-text (name(MAX))	5100.8	3.13.17
source-gray-text-supported (1setOf name(MAX))	5100.8	3.13.18.7
source-rgb-graphics (type3 keyword | name(MAX))	5100.8	3.13.19
source-rgb-graphics-supported (1setOf (type3 keyword | name(MAX)))	5100.8	3.13.24.5
source-rgb-images (type3 keyword | name(MAX))	5100.8	3.13.21
source-rgb-images-supported (1setOf (type3 keyword | name(MAX)))	5100.8	3.13.24.6
source-rgb-text (type3 keyword | name(MAX))	5100.8	3.13.23
source-rgb-text-supported (1setOf (type3 keyword | name(MAX)))	5100.8	3.13.24.7
undefined-source-cmy-graphics (name(MAX))	5100.8	3.13.2
undefined-source-cmy-graphics-default (name(MAX))	5100.8	3.13.6.2
undefined-source-cmy-graphics-supported (1setOf name(MAX))	5100.8	3.13.6.8
undefined-source-cmy-images (name(MAX))	5100.8	3.13.4

```
undefined-source-cmy-images-default  (name(MAX))      5100.8      3.13.6.3
undefined-source-cmy-images-supported  (1setOf name(MAX))
                                                      5100.8      3.13.6.9
undefined-source-cmy-text (name(MAX))                 5100.8      3.13.6
undefined-source-cmy-text-default  (name(MAX))        5100.8      3.13.6.4
undefined-source-cmy-text-supported  (1setOf name(MAX))
                                                      5100.8      3.13.6.10
undefined-source-cmyk-graphics (type3 keyword | name(MAX))
                                                      5100.8      3.13.8
undefined-source-cmyk-graphics-default  (type3 keyword | name(MAX))
                                                      5100.8      3.13.12.2
undefined-source-cmyk-graphics-supported  (1setOf (type3 keyword | name(MAX)))
                                                      5100.8      3.13.12.8
undefined-source-cmyk-images (type3 keyword | name(MAX))
                                                      5100.8      3.13.10
undefined-source-cmyk-images-default  (type3 keyword | name(MAX))
                                                      5100.8      3.13.12.3
undefined-source-cmyk-images-supported  (1setOf (type3 keyword | name(MAX)))
                                                      5100.8      3.13.12.9
undefined-source-cmyk-text (type3 keyword | name(MAX))5100.8      3.13.12
undefined-source-cmyk-text-default  (type3 keyword | name(MAX))
                                                      5100.8      3.13.12.4
undefined-source-cmyk-text-supported  (1setOf (type3 keyword | name(MAX)))
                                                      5100.8      3.13.12.10
undefined-source-gray-graphics (name(MAX))            5100.8      3.13.14
undefined-source-gray-graphics-default  (name(MAX))   5100.8      3.13.18.2
undefined-source-gray-graphics-supported  (1setOf name(MAX))
                                                      5100.8      3.13.18.8
undefined-source-gray-images (name(MAX))              5100.8      3.13.16
undefined-source-gray-images-default  (name(MAX))     5100.8      3.13.18.3
undefined-source-gray-images-supported  (1setOf name(MAX))
                                                      5100.8      3.13.18.9
undefined-source-gray-text (name(MAX))                5100.8      3.13.18
undefined-source-gray-text-default  (name(MAX))       5100.8      3.13.18.4
undefined-source-gray-text-supported  (1setOf name(MAX))
                                                      5100.8      3.13.18.10
undefined-source-rgb-graphics (type3 keyword | name(MAX))
                                                      5100.8      3.13.20
undefined-source-rgb-graphics-default  (type3 keyword | name(MAX))
                                                      5100.8      3.13.24.2
undefined-source-rgb-graphics-supported  (1setOf (type3 keyword | name(MAX)))
                                                      5100.8      3.13.24.8
undefined-source-rgb-images (type3 keyword | name(MAX))
                                                      5100.8      3.13.22
undefined-source-rgb-images-default  (type3 keyword | name(MAX))
                                                      5100.8      3.13.24.3
undefined-source-rgb-images-supported  (1setOf (type3 keyword | name(MAX)))
                                                      5100.8      3.13.24.9
undefined-source-rgb-text (type3 keyword | name(MAX)) 5100.8      3.13.24
undefined-source-rgb-text-default  (type3 keyword | name(MAX))
                                                      5100.8      3.13.24.4
undefined-source-rgb-text-supported  (1setOf (type3 keyword | name(MAX)))
                                                      5100.8      3.13.24.10
trapping (type2 keyword)                              5100.8      3.14
trapping-default  (type2 keyword)                     5100.8      3.14.1.1
trapping-supported  (1setOf type2 keyword)            5100.8      3.14.1.2
```


trap-width-fast (integer(0:MAX))	5100.8	3.15
trap-width-fast-default (integer(0:MAX))	5100.8	3.16.1
trap-width-fast-supported (rangeOfInteger(0:MAX))	5100.8	3.16.3
trap-width-slow (integer(0:MAX))	5100.8	3.16
trap-width-slow-default (integer(0:MAX))	5100.8	3.16.2
trap-width-slow-supported (rangeOfInteger(0:MAX))	5100.8	3.16.4
trc (collection)	5100.8	3.17
“trc” Member Attributes:		
trc-type (type2 keyword)	5100.8	3.17.1
trc-name (name(MAX))	5100.8	3.17.2
trc-cyan-data (octetString(256))	5100.8	3.17.3.1
trc-magenta-data (octetString(256))	5100.8	3.17.3.2
trc-yellow-data (octetString(256))	5100.8	3.17.3.3
trc-black-data (octetString(256))	5100.8	3.17.3.4
trc-default (collection)	5100.8	3.17.5
trc-supported (1setOf type2 keyword)	5100.8	3.17.6

“xxx-supported” Printer Attributes for		
Member Attributes:	Reference:	Section:
trc-type-supported (1setOf type3 keyword)	5100.8	3.17.1.1
trc-name-supported (1setOf name(MAX))	5100.8	3.17.2.1

Printer Description attributes:	Reference:	Section:
colorants-supported (1setOf (type3 keyword | name(MAX)))	5100.8	5.1

9.2 Attribute Value Registration

The following table lists all of the attributes values defined in this document. These are to be registered according to the procedures in RFC 2911 [RFC2911] section 6.1.

Attribute Values:	Reference:	Section:
black-overprint (type2 keyword):		
black-overprint-off	5100.8	3.3
black-overprint-on	5100.8	3.3
color-destination-profile-back (type3 keyword | name(MAX)):		
system-specified	5100.8	3.5
color-destination-profile-front (type3 keyword | name(MAX)):		
system-specified	5100.8	3.5
color-effects-type (type2 keyword):		
color	5100.8	3.6
monochrome-grayscale	5100.8	3.6
color-emulation (type3 keyword | name (MAX)):		
none	5100.8	3.7
swop	5100.8	3.7
euroscale	5100.8	3.7
japan-color	5100.8	3.7
enhanced-swop	5100.8	3.7

	euroscale-matte	5100.8	3.7
	euroscale-uncoated	5100.8	3.7
	highlight-colorant (type3 keyword | name(MAX)):		
	red	5100.8	3.8
	green	5100.8	3.8
	blue	5100.8	3.8
	cyan	5100.8	3.8
	magenta	5100.8	3.8
	cardinal	5100.8	3.8
	royal	5100.8	3.8
	black	5100.8	3.8
	yellow	5100.8	3.8
	ruby	5100.8	3.8
	violet	5100.8	3.8
	brown	5100.8	3.8
	none	5100.8	3.8
	other	5100.8	3.8
	highlight-colorant-mismatch (type3 keyword | name(MAX)):		
	abort	5100.8	3.9
	use-ready	5100.8	3.9
	hold	5100.8	3.9
	stop	5100.8	3.9
	highlight-map (type3 keyword | name(MAX)):		
	pictorial	5100.8	3.10
	presentation	5100.8	3.10
	object-based	5100.8	3.10
	color-to-highlight	5100.8	3.10
	exact-color	5100.8	3.10
	color-tables	5100.8	3.10
	highlight-map-color (type3 keyword | name(MAX)):		
	red	5100.8	3.11
	green	5100.8	3.11
	blue	5100.8	3.11
	cyan	5100.8	3.11
	magenta	5100.8	3.11
	cardinal	5100.8	3.11
	royal	5100.8	3.11
	black	5100.8	3.11
	yellow	5100.8	3.11
	ruby	5100.8	3.11
	violet	5100.8	3.11
	brown	5100.8	3.11
	none	5100.8	3.11
	other	5100.8	3.11
	rendering-intent-graphics (type2 keyword),		
	rendering-intent-images (type2 keyword), and		
	rendering-intent-text (type2 keyword):		
	saturation	5100.8	3.12
	perceptual	5100.8	3.12
	relative-colorimetric	5100.8	3.12
	absolute-colorimetric	5100.8	3.12

	pure-text	5100.8	3.12
	blended-pictorial-and-graphics	5100.8	3.12
	automatic	5100.8	3.12
	source-cmyk-graphics (type3 keyword | name(MAX)),		
	source-cmyk-images (type3 keyword | name(MAX)),		
	source-cmyk-text (type3 keyword | name(MAX)),		
	undefined-source-cmyk-graphics (type3 keyword | name(MAX)),		
	undefined-source-cmyk-images (type3 keyword | name(MAX)), and		
	undefined-source-cmyk-text (type3 keyword | name(MAX)):		
	native-cmyk	5100.8	3.13
	swop	5100.8	3.13
	euroscale	5100.8	3.13
	japan-color	5100.8	3.13
	enhanced-swop	5100.8	3.13
	euroscale-matte	5100.8	3.13
	euroscale-uncoated	5100.8	3.13
	source-rgb-graphics (type3 keyword | name(MAX)),		
	source-rgb-images (type3 keyword | name(MAX)),		
	source-rgb-text (type3 keyword | name(MAX)),		
	undefined-source-rgb-graphics (type3 keyword | name(MAX)).		
	undefined-source-rgb-images (type3 keyword | name(MAX)), and		
	undefined-source-rgb-text (type3 keyword | name(MAX)):		
	sRGB	5100.8	3.13
	smpte-240m	5100.8	3.13
	trapping (type2 keyword):		
	off	5100.8	3.14
	all	5100.8	3.14
	trc-type (type2 keyword):		
	no-user-trc	5100.8	3.17.1
	public	5100.8	3.17.1
	private	5100.8	3.17.1
	anti-aliasing (type3 keyword):		
	none	5100.8	4.1
	standard	5100.8	4.1
	bleed-edge-printing (type2 keyword):		
	none	5100.8	4.2
	all	5100.8	4.2
	halftone-graphics (type2 keyword | name(MAX)),		
	halftone-images (type2 keyword | name(MAX), and		
	halftone-text (type2 keyword | name(MAX)):		
	none	5100.8	4.5
	low-frequency-dot	5100.8	4.5
	mid-frequency-dot	5100.8	4.5
	high-frequency-dot	5100.8	4.5
	highest-frequency-dot	5100.8	4.5
	low-frequency-line	5100.8	4.5
	mid-frequency-line	5100.8	4.5
	high-frequency-line	5100.8	4.5
	highest-frequency-line	5100.8	4.5

stochastic	5100.8	4.5
150-dpi	5100.8	4.5
175-dpi	5100.8	4.5
200-dpi	5100.8	4.5
53-lpi	5100.8	4.5
85-lpi	5100.8	4.5
106-lpi	5100.8	4.5
171-lpi	5100.8	4.5
200-lpi	5100.8	4.5
300-lpi	5100.8	4.5
600-lpi	5100.8	4.5
opi-image-insertion (type2 keyword):		
insert	5100.8	4.6.1
do-not-insert	5100.8	4.6.1
opi-image-pre-scan (type2 keyword):		
'no-pre-scan'	5100.8	4.6.2
'pre-scan'	5100.8	4.6.2
'pre-scan-and-gather'	5100.8	4.6.2
page-rotation (type3 keyword | name(MAX)):		
'rotate-0'	5100.8	4.7
'rotate-90'	5100.8	4.7
'rotate-180'	5100.8	4.7
'rotate-270'	5100.8	4.7
resource-cleanup (type3 keyword | 1setOf name(MAX)):		
delete	5100.8	4.8
keep	5100.8	4.8
resource-pre-scan (type2 keyword):		
no-pre-scan	5100.8	4.9
pre-scan	5100.8	4.9
pre-scan-and-gather	5100.8	4.9
colorants-supported (1setOf (type3 keyword | name(MAX))):		
black	5100.8	5.1
cyan	5100.8	5.1
magenta	5100.8	5.1
yellow	5100.8	5.1
red	5100.8	5.1
green	5100.8	5.1
blue	5100.8	5.1
cardinal	5100.8	5.1
royal	5100.8	5.1
ruby	5100.8	5.1
violet	5100.8	5.1
brown	5100.8	5.1

10 Internationalization Considerations

The IPP extensions defined in this document require the same internationalization considerations as any of the Job Template and Printer Description attributes defined in IPP/1.1 [RFC2911].

11 Security Considerations

The IPP extensions defined in this document require the same security considerations as any of the Job Template attributes defined in IPP/1.1 [RFC2911].

12 Contributors

Ann McCarthy, Color Scientist, Xerox Corp.

Mike Campanella, Controller Designer, Xerox Corp.

13 Author's Address

Tom Hastings
Xerox Corporation
701 South Aviation Blvd, ESAE-210
El Segundo, CA 90245

Phone: 310-333-6413
Fax: 310-333-5514
e-mail: hastings@cp10.es.xerox.com

Don Fullman
Xerox Corporation
701 South Aviation Blvd, ESAE-210
El Segundo, CA 90245

Phone: 310-333-8342
Fax: 310-333-5514
e-mail: fullman@cp10.es.xerox.com

IPP Web Page: http://www.pwg.org/ipp/
IPP Mailing List: ipp@pwg.org

To subscribe to the ipp mailing list, send the following email:

1) send it to majordomo@pwg.org
2) leave the subject line blank
3) put the following two lines in the message body:

subscribe ipp
end

Implementers of this specification document are encouraged to join IPP Mailing List in order to participate in any discussions of clarification issues and review of registration proposals for additional attributes and values.

14 Annex A: Description of Base IPP documents (Informative)

The base set of IPP documents includes:

Design Goals for an Internet Printing Protocol [RFC2567]
Rationale for the Structure and Model and Protocol for the Internet Printing Protocol [RFC2568]

2036 Internet Printing Protocol/1.1: Model and Semantics [RFC2911]
2037 Internet Printing Protocol/1.1: Encoding and Transport [RFC2910]
2038 Internet Printing Protocol/1.1: Implementer's Guide [RFC3196]
2039 Mapping between LPD and IPP Protocols [RFC2569]
2040
2041 The "Design Goals for an Internet Printing Protocol" document takes a broad look at distributed printing functionality,
2042 and it enumerates real-life scenarios that help to clarify the features that need to be included in a printing protocol for
2043 the Internet. It identifies requirements for three types of users: end users, operators, and administrators. It calls out
2044 a subset of end user requirements that are satisfied in IPP/1.0. A few OPTIONAL operator operations have been
2045 added to IPP/1.1.

2046 The "Rationale for the Structure and Model and Protocol for the Internet Printing Protocol" document describes IPP
2047 from a high level view, defines a roadmap for the various documents that form the suite of IPP specification
2048 documents, and gives background and rationale for the IETF working group's major decisions.

2049 The "Internet Printing Protocol/1.1: Model and Semantics" document describes a simplified model with abstract
2050 objects, their attributes, and their operations that are independent of encoding and transport. It introduces a Printer
2051 and a Job object. The Job object optionally supports multiple documents per Job. It also addresses security,
2052 internationalization, and directory issues.

2053 The "Internet Printing Protocol/1.1: Encoding and Transport" document is a formal mapping of the abstract operations
2054 and attributes defined in the model document onto HTTP/1.1 [RFC2616]. It defines the encoding rules for a new
2055 Internet MIME media type called "application/ipp". This document also defines the rules for transporting over HTTP a
2056 message body whose Content-Type is "application/ipp". This document defines the 'ipp' scheme for identifying IPP
2057 printers and jobs.

2058 The "Internet Printing Protocol/1.1: Implementer's Guide" document gives insight and advice to implementers of IPP
2059 clients and IPP objects. It is intended to help them understand IPP/1.1 and some of the considerations that may
2060 assist them in the design of their client and/or IPP object implementations. For example, a typical order of
2061 processing requests is given, including error checking. Motivation for some of the specification decisions is also
2062 included.

2063 The "Mapping between LPD and IPP Protocols" document gives some advice to implementers of gateways between
2064 IPP and LPD (Line Printer Daemon) implementations.

