The Printer Working Group

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8 **IPP Driverless Printing Extensions v2.0**
9 **(NODRIVER)**

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11 Status: Interim

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13 Abstract: The Internet Printing Protocol/2.0 provides IPP Printers and other IPP services
14 with the ability to describe their capabilities with high fidelity. This feature description
15 fidelity creates the opportunity to replace model-specific drivers with a single universal
16 "driverless" Client implementation. Some gaps still need to be addressed to provide a
17 complete Client user experience. This specification addresses those gaps by defining new
18 IPP attributes and operations, and also defining several resource types identified by IPP
19 attributes.

20 This is a PWG Working Draft. For a definition of a "PWG Working Draft", see:

21 https://ftp.pwg.org/pub/pwg/general/pwg-process30.pdf

22 This specification is available electronically at:

23 https://ftp.pwg.org/pub/pwg/ipp/wd/wd-ippjobprinterext3v20-20200204.docx
24 https://ftp.pwg.org/pub/pwg/ipp/wd/wd-ippjobprinterext3v20-20200204.pdf
25 https://ftp.pwg.org/pub/pwg/ipp/wd/wd-ippjobprinterext3v20-20200204-rev.docx
26 https://ftp.pwg.org/pub/pwg/ipp/wd/wd-ippjobprinterext3v20-20200204-rev.pdf
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66   About the IEEE-ISTO

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

72   For additional information regarding the IEEE-ISTO and its industry programs visit:

73   http://www.ieee-isto.org

74   About the IEEE-ISTO PWG

75   The Printer Working Group (or PWG) is a Program of the IEEE Industry Standards and
76   Technology Organization (ISTO) with member organizations including printer
77   manufacturers, print server developers, operating system providers, network operating
78   system providers, network connectivity vendors, and print management application
79   developers. The PWG is chartered to make printers and the applications and operating
80   systems supporting them work together better. All references to the PWG in this
81   document implicitly mean "The Printer Working Group, a Program of the IEEE ISTO."

82   To meet this objective, the PWG documents the results of their work as open standards
83   that define print related protocols, interfaces, procedures, and conventions. A PWG
84   standard is a stable, well understood, and technically competent specification that is widely
85   used with multiple independent and interoperable implementations. Printer manufacturers
86   and vendors of printer related software benefit from the interoperability provided by
87   voluntary conformance to these standards.

88   For additional information regarding the Printer Working Group visit:

89   http://www.pwg.org

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1. Introduction

IPP/1.1 [STD92] and IPP/2.0, IPP/2.1 and IPP/2.2 [PWG5100.12] provides Printers and other IPP service types with the ability to describe their capabilities such that a Client can discover and use all of that service's capabilities, creating the opportunity to replace model-specific drivers with one truly universal, generic "driverless" Client implementation. However, some gaps still remained. A generic, vendor-neutral "driverless" Client implementation will depend on the Printer for everything that traditionally was provided in a model-specific driver deployment, including localization catalogs for all attribute names and values, localized help content for all features supported by the service, icon images for representing the service, color management, and a feature constraints and resolution system. This IPP Driverless Printing Extensions v2.0 specification defines new attributes and resource types to close those gaps.

Additionally, this specification defines attributes and operations to identify and locate IPP services and their hosting devices to support printing from highly mobile devices, defines a general method for expressing limits in IPP, and defines a more extensibile method for filtering objects and attributes.

2. Terminology

2.1 Conformance Terminology

Capitalized terms, such as MUST, MUST NOT, RECOMMENDED, REQUIRED, SHOULD, SHOULD NOT, MAY, and OPTIONAL, have special meaning relating to conformance as defined in Key words for use in RFCs to Indicate Requirement Levels [BCP14]. The term

370 CONDITIONALLY REQUIRED is additionally defined for a conformance requirement that
371 applies when a specified condition is true.

372 The term DEPRECATED is used for previously defined and approved protocol elements
373 that SHOULD NOT be used or implemented. The term OBSOLETE is used for previously
374 defined and approved protocol elements that MUST NOT be used or implemented.

2.2 Printing Terminology

376 Normative definitions and semantics of printing terms are imported from the Internet
377 Printing Protocol/1.1 [STD92].

378 *Document*: An object created and managed by a Printer that contains the description,
379 processing, and status information. A Document object may have attached data and is
380 bound to a single Job.

381 *Job*: An object created and managed by a Printer that contains description, processing,
382 and status information. The Job also contains zero or more Document objects.

383 *Logical Device*: a print server, software service, or gateway that processes jobs and either
384 forwards or stores the processed job or uses one or more Physical Devices to render
385 output.

386 *Output Device*: a single Logical or Physical Device

387 *Physical Device*: a hardware implementation of a endpoint device, e.g., a marking engine,
388 a fax modem, etc.

2.3 Protocol Role Terminology

390 The following protocol roles are defined to specify unambiguous conformance
391 requirements:

392 *Client*: Initiator of outgoing connections and sender of outgoing operation requests
393 (Hypertext Transfer Protocol -- HTTP/1.1 [RFC7230] User Agent).

394 *Printer*: Listener for incoming connections and receiver of incoming operation requests
395 (Hypertext Transfer Protocol -- HTTP/1.1 [RFC7230] Server) that represents one or more
396 Physical Devices or a Logical Device.

2.4 Other Terminology

398 *Black Point Compensation*: The mapping of the darkest color in a source Color Space to
399 the darkest color in a destination Color Space, generally to improve the reproduction of
400 dark colors and shadows.

401   *Color Space*: The interpretation of color in a document, for example "RGB", "Grayscale",
402   "CMYK", and so forth.

403   *Document Content*: The entire sequence of octets transmitted as the Document Data in
404   the Print-Job and Send-Document operations or referenced by the "document-uri"
405   operation attribute in the Print-URI and Send-URI operations [STD92]. This sequence of
406   octets consists of one or more Input Pages.

407   *Gamut*: The range of colors that can be reproduced by a Printer or Color Space.

408   *Image Box*: The "content area" within a digital document.

409   *Impression*: The Document Content imposed upon one side of a Media Sheet by a
410   marking engine, independent of the number of times that the sheet side passes any
411   marker. An Impression contains one or more Input Pages that are imposed (scaled,
412   translated, and/or rotated) during processing of the Document data.

413   *Input Page*: A page according to the definition of "pages" in the language used to express
414   the Document data [STD92].

415   *i_{th}*: Referring to a specific 1setOf value - the first value, the second value, and so forth.

416   *Job Ticket*: A representation of the Job processing intent specified by the User to the
417   Client.

418   *Kerberized Printing*: Authenticated printing based on SPNEGO-based Kerberos and NTLM
419   HTTP Authentication in Microsoft Windows [RFC4559], Transport Layer Security/1.3
420   [RFC8446], and Upgrading to TLS Within HTTP/1.1 [RFC2817].

421   *Media Sheet*: The unit of media that a printer puts marks on. It is the most basic unit of
422   output from a printer [STD92]. A printer may mark on one side or on both sides of a sheet.

423   *Paid Imaging Services*: Printing, facsimile, and scanning performed for a fee. The means
424   of collecting payment is outside the scope of this specification.

425   *Printer Resident*: Hosted by the same host as the Printer. Usually used in discussing
426   Printer resources.

427   *Secure Transport*: Encryption of the IPP connection at the HTTP layer using Transport
428   Layer Security [RFC8446] as per [RFC7472].

429   *Set:* A logical boundary between the delivered Media Sheets of a printed Job [STD92]. For
430   example, in the case of a ten-page single Document with collated pages and a request for
431   50 copies, each of the 50 printed copies of the Document constitutes a Set. If the pages

432 were uncollated, then 50 copies of each of the individual pages within the Document would
433 represent each Set. Finishing processes operate on Sets.

434 **2.5 Acronyms and Organizations**

435 *IANA*: Internet Assigned Numbers Authority, https://www.iana.org/

436 *ICC: International Color Consortium,* https://www.color.org

437 *IETF*: Internet Engineering Task Force, https://www.ietf.org/

438 *ISO*: International Organization for Standardization, https://www.iso.org/

439 *PWG*: Printer Working Group, https://www.pwg.org/

3. Requirements

3.1 Rationale

The Internet Printing Protocol Version 2.0 Second Edition [PWG5100.12] defines:

1. A collection of existing IPP specifications that form the basis for IPP/2.0;
2. Standard Job Template attributes for document format, media size, print quality, and so forth;
3. Specific interoperability requirements, such as HTTP/1.1 support with chunking and IPP collection attribute support;
4. New version number and operation requirements for different classes of devices.

Printing from universal IPP Clients with a fidelity that matches model-specific custom drivers requires several new use cases that are not addressed by existing IPP standards.

Therefore, this IPP Driverless Printing Extensions v2.0 specification is intended to encourage adoption of modern IPP-based printing infrastructures by supporting:

1. Printer identification and geolocation;
2. Globally unique identifiers for all objects;
3. Job Template attribute and value constraint description and conflict resolution;
4. Extensible controls for the color rendition of a document and for Client-managed color workflows;
5. Supply monitoring and control;
6. Roll fed media support;
7. Localization of attributes and values via Printer Resident resources;
8. Printer Resident icon image resources;
9. Printer provided "Presets" to logically bundle some feature choices together.

3.2 Use Cases

The following use cases are supported by the IPP extensions defined in this specification.

3.2.1 Select Printer Using Geo-Location

Jan is a chemistry student, and is viewing a picture on her laptop in an unfamiliar studying location. She chooses to print the picture. The Client discovers Printers on her network, and for each Printer that responds, the Client requests geolocation information. The Client

469 uses its own location service facilities and the Printer discovery results to list the printers in
470 proximate order rather than alphabetic order. Jan selects the closest printer and prints to it.

471 **3.2.2 Select Printer with Confirmation**

472 After selecting the Printer, Jan uses the Client to send an identification request to the
473 Printer to provide a visual and/or auditory alert. Jan hears a tone, allowing her to confirm
474 that the selected Printer is nearby.

475 **3.2.3 List a Printer Once When Discovered Over Multiple Interfaces**

476 Gus is viewing a document on his tablet computer and touches the control to print the
477 document. His tablet computer is on his company's LAN, and it also supports peer-to-peer
478 wireless networking. The IPP client in the tablet uses discovery protocols on both the LAN
479 and peer-to-peer interfaces to discover available IPP print services. The Client recognizes
480 that the same printer was discovered over both interfaces, and presents only one item in
481 the discovery results list to provide a simpler user experience. Gus selects the printer, and
482 the Client in the tablet computer makes decisions about which interface to use.

483 **3.2.4 Filter Discovered Printers By Capability**

484 Gus is viewing a tax return on his tablet computer, and wants to print it on printers that
485 support Job Release [PWG5100.11]. When he goes to print, and his tablet computer
486 discovers available printers, he uses controls in the discovery UI to filter only those printers
487 that support that feature. The filtered results list a nearby printer. Gus chooses that printer,
488 uses the Job Release feature and submits the Job, then goes to the destination printer to
489 release the Job while he is present.

490 **3.2.5 Print Using Loaded Media**

491 Gerta is viewing a photo on her phone, and wants to print the photo on the largest
492 borderless photographic media loaded on her Printer.

493 After she initiates a print and selects a Printer, the Client discovers that the Printer can
494 report loaded media information such as size, type, coating, and weight, and automatically
495 selects the largest borderless photographic media loaded on the Selected Printer, and
496 selects the highest print quality based on the type of job and media selection. Gerta
497 selects additional processing intent for the Job and confirms the print action. The Client
498 sends a print job request to the Printer with the Job Ticket and local photo. The Printer
499 validates the Job Ticket and document data and then prints the photo.

500 **3.2.6 Print Using Specific Media**

501 Tim is the treasurer of a small training company that is holding a meeting and seminar at a
502 resort needs to print out 20 checks for training personnel. He uses an accounting program

503 to enter the hours worked, bonuses, reimbursable expenses, and so forth and prints the
504 checks on a printer provided by the resort using check blanks he brought to the meeting.

505 Tim loads check blanks into the Printer and configures the loaded media as necessary at
506 the Printer. When Tim initiates a print from his accounting program, selects the Printer for
507 printing, and selects check media to be used when printing this Job, the Client User
508 Interface displays a preview of the printed checks. Tim confirms that checks amounts,
509 payees and signature are correct. Tim selects additional processing intent for the Job and
510 confirms the print action. The Client sends a print job request to the Printer with the Job
511 Ticket and document data containing the checks, correctly oriented for the check blank
512 media. Tim waits for the checks to be printed and removes any excess media from the
513 Printer.

514 **3.2.7 Print a Secure Form**

515 Tim is the treasurer of a small training company, and he has received a PDF document of
516 a bank statement. The PDF document is password protected. He tries to print the PDF
517 document, and the Client asks for the PDF's password before it can send the PDF as the
518 Document Content for the Job. It creates the Job using Secure Transport, and includes the
519 document password in the Job Ticket. The Printer unlocks the PDF and prints the report.

520 **3.2.8 Print with Special Formatting**

521 At a seminar located at a country resort, Bernie has been asked to provide 80 sets of ten
522 keywords/phrases, clearly printed on 2-inch by 1-inch paper slips for use in a get
523 acquainted exercise. Costs are to be minimized because the club charges too much for
524 prints. Bernie has a laptop with a word processer program, the resort has a Wi-Fi network
525 available to users, and a networked MFD is connected to that LAN at the business center.
526 The attendant at the business center will charge for any printed sheets removed from
527 premises.

528 After Bernie initiates a print from his word processor and selects a Printer, he selects the
529 processing intent for the Job and confirms the print action. The Client produces document
530 data using the media information (size and margins) in the Job Ticket so that 2-inch by 1-
531 inch slips are spread evenly over each page and sends a print job request to the Printer

532 with the Job Ticket and document. The Printer validates the Job Ticket and document data
533 and then prints the document.

3.2.9 Print a Document with Page Subsets

535 Jim has 20 insurance policies to print, each consisting of 4 pages that must be stapled
536 together. Jim submits an 80-page report document for printing and specifies that he wants
537 every 4 pages stapled together.

3.2.10 Print From a Roll

539 Mike has a series of photos to print and a Printer that has a roll of photo media instead of
540 cut sheets of photo media. Mike submits a multi-document job for printing, and specifies
541 that the roll be cut between each document in the job.

3.2.11 Preventing Two-Sided Printing on Transparency Media

543 Sven is a graduate student for a very old professor who still uses a projector and
544 transparency media. He receives the set of slides from the professor via email, and is
545 instructed to print one set on transparency, and then print 30 copies on plain paper as
546 handouts. Sven starts by printing the 30 copies on plain paper, choosing to use two-sided
547 printing to save paper. He then starts to set up the print job for the transparency slides.
548 When he chooses "Transparency" media in the print dialog, he is presented with a dialog
549 informing him that this media type is not compatible with two-sided printing. He approves
550 disabling two-sided printing, and submits the Job to the Printer. Both the plain paper
551 handouts and the slides on transparency are printed as he was expecting them to be.

3.2.12 Supplies Status

553 Barbie is preparing to print a set of photos on her inkjet printer from her laptop. Software
554 on the laptop presents a notification indicating that her cyan ink cartridge is critically low.
555 She clicks on the notification to get to the printer driver's supplies status UI, and sees that
556 her magenta and black levels are also low. She clicks on a reorder link in the UI taken from
557 the Printer, which takes her to a web page in her browser. She orders supplies.

3.2.13 Job or Document Processing Failures

559 While processing a job, the Printer reports job or document processing issues to the Client,
560 which displays an error message as needed and asks the User or Operator to confirm the
561 disposition of the Job. Processing failures include out-of-memory, missing resource,
562 missing or incorrect password, and other conditions that prevent a particular Job or
563 document from printing.

3.2.14 Manual Duplex Printing

565 Larry has a long whitepaper he would like to print two-sided on an entry-level laser printer
566 without an automatic duplexer accessory. Larry submits the document for printing and
567 specifies two-sided printing. The Client software queries the Printer to determine the page

568 stacking order and delivery order for both the input and output trays and then sends the
569 even numbered pages in the correct order to the Printer. When those pages have been
570 printed, the Client software instructs Larry to insert the pages back in the input tray in the
571 correct orientation. Once the pages are loaded in the input tray, the Client software sends
572 the odd numbered pages to the Printer.

573 **3.2.15 Borderless Printing, Margin Eliminiation, and Presets**

574 Rick operates a print shop that has a number of expensive wide format printers. Paula is a
575 customer that wants a photo poster printed using the full width of the 36" paper loaded, but
576 with no white margins showing on the sides. Rick opens the photo in his system, chooses
577 the photo media Paula prefers, and chooses job settings to enable overprinting at the
578 edges and to eliminate unnecessary margins, which he knows he needs to do to ensure
579 there are no white areas. Paula is impressed with the speed and quality of output
580 produced by Rick and his printers, and plans to return with more jobs for him. Rick saves
581 these choices in a driver preset named for Paula so that he can use those settings again
582 with her work in the future.

583 **3.2.16 Banner Printing**

584 Rick operates a print shop, and Paula is a customer who brings him a set of images. She
585 wants the images printed as one long job with no spaces in between. Rick selects a
586 "Banner Print" feature in the dialog, which eliminates margins in between pages. Paula is
587 once again impressed with the speed and fidelity of Rick's systems and work.

588 **3.2.17 Continuous Printing**

589 Doug is a scientist who wants to continuously print graphs of seismometer readings on a
590 roll of paper loaded in a Printer with a roll cutter. The Client software collects data from the
591 seismometers and sends one-inch print documents to the Printer at regular intervals.
592 Every hour the Client Software instructs the Printer to trim the roll at the end of a
593 document.

594 **3.2.18 Correlation of Multiple Printers**

595 An operator monitors and maintains multiple printers managed by several print servers.
596 The Client software correlates Printers registered with a directory service or dynamic
597 discovery protocol in order to provide a hierarchical display of the available servers,
598 printers, jobs, and current state.

599 **3.2.19 Printer Resident Icons and Localization Resources**

600 Ava is at work and has a recipe on her phone, and wants to print a copy. Her phone's
601 Client searches for available printers using a discovery protocol, and for some of the
602 discovered printers, it shows an icon matching the printer. She chooses a printer that has
603 photo paper loaded, and after a few seconds, the selected printer's capabilities are shown.
604 She picks the photo media which has a vendor-specific brand name. She wants more

605 information, so she taps on a "?" button and the media selection control, and some
606 additional text describing the media is shown to her. She prints, marveling at how quickly it
607 was able to present a customized user experience without having to take a substantial
608 amount of time installing software like her old computer used to do, not realizing that the
609 icon images and localized resources were acquired from the printer itself.

610 **3.2.20 Manufacturer-Deployed Print Quality Mode**

611 X Printers, a printer manufacturer, has developed a new technology that provides
612 significant customer benefit above and beyond that of the existing print quality modes
613 available. It is exposed to the user as a new "X Magic" print quality mode. The "X Magic"
614 print quality mode depends on the printer having a print engine mechanism that
615 implements the requisite imaging technology.

616 The new print quality mode does not fit well in the context of the existing print quality
617 modes, and the vendor does not want to cause customer confusion by remapping the use
618 of existing print quality modes on devices that support the technology, and not on those
619 that do not. Doing so would also prevent product differentiation.

620 In this case, the existing basic print quality modes (Draft, Normal, High) are preserved and
621 the new print quality mode is added as a custom mode. A tooltip explains to the user the
622 value provided by the "X Magic" print quality mode. The client drivers are unaware of the
623 mode's meaning. Since the custom PQ mode is defined on the device, the mode will only
624 be shown when connected to a device supporting that mode.

625 **3.2.21 Administrator-Deployed Print Quality Mode**

626 A customer has agreed with its print service provider to pay for an additional print quality
627 mode called "Eco-Draft", that is enabled through the service contract. This additional print
628 quality mode will only be made available on select printers, facilitated by the print service
629 provider's IT administration and deployment system.

630 This "Eco-Draft" print mode differs from the standard "Draft", "Normal" and "High" modes in
631 that, when selected and indicated to the Printer, the Printer employs a unique combination
632 of rendering selections to produce output generally comparable to "Draft" but with a
633 significantly reduced ink or toner usage, and a corresponding reduction in per-page cost.
634 In order to preserve the conventional definition and user perception of "Draft", the "Eco-
635 Draft" is offered as a new print quality setting unique to this deployment. A unique name
636 and quality value are important for two reasons: making it clear to end users they are using
637 a different print quality, so they can make an informed choice; and for job accounting
638 reasons so that the billing system can bill pages using this quality level differently than the
639 other familiar quality levels.

640 The IT administrators have a print policy defined so that users from different departments
641 or role families are given different print capabilities. Those in the Finance department will
642 only be offered the "Eco-Draft" print quality option, while executives and those in the
643 Marketing department will be offered "Eco-Draft" in addition to the standard "Draft",

644 "Normal" and "High" options. The different quality levels factor into the billing cost the IT
645 administrators and their print service providers have negotiated.

3.2.22 Manufacturer-Deployed Color Transformation Preferences

647 X Printers, a printer manufacturer, has produced printers for many years. Its customers
648 have asked X Printers to provide a "color output mode" control with a "legacy color
649 compatibility mode" choice. X Printers implements this feature in its newer printers that
650 have more accurate color output, to cause them to produce output that appears as though
651 it was printed on an older printer whose output exhibited a different particular set of color
652 output characteristics. The customers want to be able to select this "color output
653 preference" on a per-job and/or per-Client basis, because some users have a need for this,
654 but only in certain applications, while others do not.

655 The customers have also asked for a "print preview" to show them what the color would
656 look like before printing. The printers that implement this new "legacy color compatibility
657 mode" also provide a special "soft proofing" ICC profile so that the client can present this
658 accurately to the user.

3.2.23 Administrator-Deployed Color Transformation Preference

660 Fred is a print administrator at an architecture firm. He has been tasked with finding a way
661 to provide a "blueprint output mode" to the architects in the office, that can be selected as
662 an option in the print dialog. When this option is selected, the submitted job will be output
663 as though it was printed from a blueprinting machine. To produce this, the document color
664 depth is flattened to a 1-bit monochrome, and then transformed so that the white
665 background is rendered in Prussian blue (Web color #003153 or sRGB 0,49,83), and the
666 "black" lines are rendered in white. Fred provisions the printer with settings and resources
667 to describe the desired color transformation to its users' systems using an administrative
668 interface to add this feature.

669 Lisa works in the office, and her laptop discovers this "Blueprint" color transformation
670 option when it interrogates the printer for its capabilities. Her client device presents the
671 "Blueprint" color transformation option in the print dialog. Lisa positions her mouse pointer
672 over the option and sees a "tool tip" (snippet of descriptive text) over the "Blueprint" option,
673 that describes what that will do. Lisa likes what the tool tip describes for the "Blueprint"
674 option and selects it. The print preview in the print dialog shows her what the output will
675 look like. She likes it more, so she clicks "Print", and the job is printed as per the preview.
676 Lisa is happy, and thanks Fred.

3.2.24 Print Quality Hints to Influence Printer Color Processing

678 Juan is a graphic artist, and his team has a high-performance color printer. It has produced
679 high quality output for all of the applications from which he and his team are printing. But
680 then Juan encounters a problem. He is viewing a document in a particular application,
681 prints the document, and realizes that the output is not meeting his needs. He is unable to
682 find settings in the application that will allow it to produce satisfactory printed output

683   without either changing the document in unacceptable ways or affecting other users of the
684   printer. He looks in the print dialog and finds a set of "print quality hints", and through a
685   process of trial-and-error, is able to produce output that meets his needs.

686   Knowing he will need these settings in the future, and also knowing that his computer
687   supports IPP Presets, he saves these settings as a Preset for future quick access.

688   **3.2.25 Explicit Preset Selection**

689   Bert has found a good recipe for gazpacho on the Web, and wants to print the recipe to put
690   it into his recipe binder. He clicks on the "Print" button in the web page. When the print
691   dialog is presented, he selects the Preset labeled "Recipe for binder". The "Recipe for
692   binder" Preset specifies "2 pages per sheet" page layout, one-sided printing, trimming and
693   punching. The Client applies the Preset to the settings in the print dialog. Bert clicks on
694   "Print"; the Client prints the Job. Bert puts it into his recipe binder.

695   **3.2.26 Implicit Preset Selection**

696   Kelli is in the process of printing a photo. In the print dialog, she switches the selected
697   media size from A4 to 4"x6". Her Client has a Trigger for 4"x6" media size that names a
698   Preset named "Photos"; the "Photos" Preset includes glossy photo media type, single-
699   sided printing, and 'high' print quality. The Client acts on the Trigger by applying the
700   settings in the "Photos" Preset. Kelli is pleased that these choices were made
701   automatically by her system, saving her time and effort.

702   **3.2.27 Client Storing a Preset to Printer**

703   Ernie has constructed his own Preset named "Better Binder Recipe", and he would like to
704   share it with Bert. Ernie selects that Preset and taps on the "Store Preset on Printer"
705   button. The Preset is uploaded to the Printer. When Bert next goes to print, he sees the
706   "Better Binder Recipe" Preset that Ernie added to the Printer, and uses that for his next
707   recipe printing tasks.

708   ## 3.3 Exceptions

709   The following subsections define exceptions in addition to those defined in the Internet
710   Printing Protocol/1.1 [STD92].

711   **3.3.1 Job or Document Processing Failures**

712   While processing a job, the Printer reports job or document processing issues to the Client,
713   which displays an error message as needed and asks the User or Operator to confirm the
714   disposition of the Job. Processing failures include out-of-memory, missing resource,

715 missing or incorrect password, and other conditions that prevent a particular Job or
716 document from printing.

3.4 Out of Scope

718 The following are considered out of scope for this specification:

719   1. Methods for geo-location and proximity detection for the Select Printer Using
720   Geo-Location use case (section 3.2.1);
721   2. Constraining choice of document formats suitable for the Print use cases;
722   3. Discovery protocols used to locate Printers.

3.5 Design Requirements

724 The design requirements for this specification are to support the use cases listed in section

725

726 The original design requirements are:

727   1. Follow the naming conventions defined in the IPP/1.1 Model and Semantics
728   [STD92], including keyword value (lowercase) and hyphenation requirements;
729   2. Optimize compatibility with existing IETF and PWG IPP operations when making
730   design decisions in defining new operations and attributes;
731   3. Define new device attributes that allow a Client to correlate multiple Printers to a
732   single device or server supporting the Printers;
733   4. Define new Printer identification attributes and an identification operation;
734   5. Define new geo-location attributes;
735   6. Define new Printer discovery and selection attributes;
736   7. Define new attributes to support Client-side Job Template constraints and
737   conflict resolution;
738   8. Define new secure printing, identification, and metadata attributes and values;
739   9. Define new media capability attributes;
740   10. Define new input and output tray attributes;
741   11. Define new limit and filtering attributes;
742   12. Define new subset printing attributes;
743   13. Define new color printing attributes;
744   14. Define new ICC color management attributes;
745   15. Define new roll-fed printing attributes and values;
746   16. Define new supply level and status monitoring attributes;
747   17. Define new localization attributes and a message catalog file format;
748   18. Define new globally unique identifier attributes for all objects; and
749   19. Define new preset attributes.

750   The design recommendations for this specification are:

751   1. Use Printer Resident resources as much as possible in order to support
752   driverless printer setup, color proofing, identification, localization, and
753   management even in cases where Internet access is unavailable (e.g. isolated
754   network, peer-to-peer network)

755 4. IPP Model

756   This specification extends the core features defined in the IPP/1.1 Model and Semantics
757   [STD92] and other IPP specifications in a number of significant ways. An overview of each
758   IPP extension is described below.

759   **Table 1 - Design Requirements, Use Cases and Definitions Cross Reference**

Design Requirement	Use Case(s)	Definitions
4. Define new Printer identification attributes and an identification operation	3.2.2, 3.2.3	5.1, 6.1.4, 6.7.8
5. Define new geo-location attributes	3.2.1	6.6.22
6. Define new Printer discovery and selection attributes	3.2.4	6.6.5, 6.6.23,
7. Define new attributes to support feature selection constraints and conflict resolution	3.2.11	6.6.6, 6.6.10
8. Define new secure printing, identification, and metadata attributes and values	3.2.7	6.5.2, 6.3.6, 7.7
9. Define new media capability attributes	3.2.10	8.2, 8.3
10. Define new input and output tray attributes	3.2.6, 3.2.8	6.6.26, 6.6.30
11. Define new limit and filtering attributes	3.2.9, 3.2.4	6.1.3,
12. Define new subset printing attributes	3.2.9	6.1.3
13. Define new color printing and print quality attributes	3.2.20, 3.2.21, 3.2.24	6.2.5, 6.2.6, 6.6.19, 8.5, 8.6
14. Define new color management and preview attributes	3.2.22, 3.2.23	6.6.18, 6.6.24
15. Define new roll-fed printing attributes and values	3.2.10, 3.2.15	6.2.1, 6.2.3, 6.2.4, 8.2, 8.3, 8.4
16. Define new supply level and status monitoring attributes	3.2.12	6.7.5, 6.7.6, 6.7.7
17. Define new localization attributes and a message catalog file format	3.2.19	6.6.31, 6.6.32, 10
18. Define new globally unique identifier attributes for all objects	3.2.3	6.3.6, 6.4.1, 6.5.2, 6.7.8
19. Define new preset attributes	3.2.15	6.6.9, 6.6.11

760 **4.1 Limits**

761　The IPP/1.1 Model and Semantics [STD92] defines support for limits in the Get-Jobs
762　operation to allow a Client to efficiently collect a large list of Job objects in groups of N
763　objects. Similarly, the IPP Event Notifications and Subscriptions [RFC3995] defines
764　support for limits in the Get-Subscriptions operation but without support for selecting the
765　first Subscription object to return.

766　This specification extends the notion of limits to include any operation that might return
767　large lists of objects or attributes with large amounts of data such as "media-col-database"
768　[PWG5100.7] and defines new attributes to allow a Client to discover which operations
769　support limits and specify which object or attribute value to return first using a "first-index"
770　operation attribute.

771　The new "first-index" operation attribute (section 6.1.3) is an integer value representing an
772　attribute value index in a 1setOf attribute value. The notion of an attribute value index
773　requires that a Printer use a consistent ordering of 1setOf values that can be limited, i.e.,
774　the order of "media-col-database" values must be defined by the printer and consistent
775　between Get-Printer-Attribute requests.

776　The existing "limit" operation attribute [STD92] is an integer value representing the
777　maximum number of values to return to the Client. Combined with "first-index", it allows a
778　Client to query a subset of the Printer's values.

779　Because existing conforming Printer implementations will return the 'successful-ok-
780　ignored-or-substituted-attributes' status code when they do not support the "first-index" or
781　"limit" operation attributes for a given request, a Client may be safely written to ask for a
782　subset of values but handle receiving the complete set of values.

783　Printers that support the "first-index" and "limit" operation attributes MUST provide the
784　values or objects in a consistent order such that a Client would be able to retrieve all of
785　those objects or values using a sequence of requests with increasing values for "first-
786　index".

787　**4.2 Filtering**

788　The IPP/1.1 Get-Printer-Attributes operation [STD92] supports operation response
789　attribute filtering using the "document-format" operation attribute. IPP/1.1 and IPP Event
790　Notifications and Subscriptions [RFC3995] both support operation response attribute
791　filtering based on the "requesting-user-name" or authenticated user for Job and
792　Subscription operations. The Get-User-Printer-Attributes operation [PWG5100.11]
793　provides an operation similar to Get-Printer-Attributes that supports operation response
794　attribute filtering based on the "requesting-user-name" or authenticated user.

795　This specification extends this filtering mechanism to allow the Printer to list additional Job
796　Creation attributes it supports for filtering, such as "sides" [STD92], so that a Client might
797　determine in more detail which attributes and attribute values are supported for a particular
798　type of Job. This specification also defines the new "ipp-features-supported" attribute to

799   allow the Printer to enumerate its support for macro-granularity features such as
800   "driverless", "document-object", and others.

4.3 Constraints and "preferred-attributes"

802   Printers can impose constraints between Job Creation attributes for practical (e.g.,
803   duplexing on transparency media), physical (e.g., label printing from a paper tray), and
804   policy (e.g., no color printing for students) reasons. This specification defines two
805   mechanisms on the Client and Printer that allow a Client to discover what those constraints
806   are prior to creating a print job.

807   Client constraint resolution uses two new Printer Description attributes that list the
808   constraints and a list of changes used by the printer for resolving them automatically.
809   These attributes allow the Client user interface to present a simple choice to the user when
810   a selection triggers a constraint: revert to the previous settings or make the following
811   additional changes.

812   Printer constraint resolution uses the Validate-Document and Validate-Job operations.
813   Clients submit a Validate-Document or Validate-Job request with Template attributes that
814   will be used in the actual document or job creation request. If conflicts are present in the
815   supplied Template attributes, the Printer returns a "preferred-attributes" collection attribute
816   indicating which substitute values will be used to resolve those conflicts.

817   There is no Validate-Subscription operation because subscriptions always enforce attribute
818   fidelity.

4.4 Printer Resources

820   This specification includes IPP attributes whose values are URIs that point to resources
821   such as printer icons, ICC profiles, and message catalog files. A supporting Client CAN
822   retrieve these resources using the protocol identified by the URI's scheme component.
823   Printer support for Printer resources of all types SHOULD be provided in alignment with
824   the Printer resources best practices in section 12.2.

4.5 ICC Color Management and Color Mode Previews

826   This specification supports a managed color workflow by defining new Printer Description
827   attributes to enumerate supported ICC color profile files [ISO15076-1]. Clients may specify
828   output rendering intent for a Job or Document and can query and download ICC color

829 profiles listed by the Printer for color proofing, Client-side color rendering, and other
830 workflows.

4.6 Localization

832 This specification defines and registers an existing plain text message catalog file format
833 (MIME media type "text/strings") used on NeXT's NeXTSTEP [NEXTSTEP] and Apple's
834 macOS [MACOS] operating systems, that allows a Printer to provide a Client with
835 localized textual values ("localized strings") for attribute names and/or attribute values. For
836 example, a Printer that supports vendor-unique media sizes and "printer-state-reasons"
837 keywords could provide the localized labels for these in its message catalogs. A Printer
838 Description attribute allows the Client to discover the location of message catalogs for the
839 language specified by the "attributes-natural-language" attribute in the Client request.
840 Clients can also use the HTTP If-Modified-Since header to detect whether the referenced
841 message catalog has been updated. The message catalog syntax also supports inline help
842 content to be associated with a given attribute or attribute keyword / enum value.

4.7 Device Information

844 IPP has long exposed device information that was necessary for printing. As IPP expands
845 to cover all of the Multi-Function Device (MFD) services defined by the PWG Semantic
846 Model working group, additional device information will be needed. In the context of
847 existing IPP-based printing, these new attributes are most applicable to print server
848 implementations such as CUPS [CUPS] and high duty cycle print systems that support
849 multiple independent IPP Printers.

850 This specification defines two new device attributes for IPP: the device unique identifier as
851 a UUID and a count of services provided by the device. The device unique identifier allows
852 a Client to correlate multiple IPP-based services to a single device or server. The count of
853 services tells the client whether a particular device or server provides more than one IPP-
854 based service, regardless of the type of service offered. This specification also defines
855 UUID-based attributes for the Printer, Job, Document and Subscription IPP object types.

4.8 Presets and Triggers

857 There are circumstances where a group of settings are chosen and applied as a set, to
858 achieve some common printing objective or workflow scenario. For example, the act of
859 selecting a 4"x6" media size might commonly imply the desire to print photos. Users
860 benefit from a facility that automatically selects an associated group of settings (change
861 media type to glossy photo, setting the print quality to 'best'). Many Clients driver system
862 support such associations, but this facility depends on including these grouping definitions
863 in the vendor / model-specific drivers themselves. This specification defines two new IPP

864 attributes to allow a Printer to provide Presets to its Clients, and describes a method for
865 the Client to define new ones and add them to a Printer.

5. New Operations

5.1 Identify-Printer

868 This CONDITIONALLY REQUIRED operation allows a Client to request the Printer to
869 physically identify itself by flashing lights, making sounds, or displaying something on the
870 control panel. A Printer MUST implement this operation if it is an Output Device.

871 The Printer SHOULD require an authenticated user [STD92] to perform this operation or
872 provide other safeguards to prevent abuse of this operation. When the operation is not
873 allowed for a security reason, the IPP object MUST reject the operation and return: 'client-

874 error-forbidden', 'client-error-not-authenticated', or 'client-error-not-authorized' as
875 appropriate.

5.1.1 Identify-Printer Request

877 The following groups of attributes are supplied as part of the Identify-Printer Request:

878 Group 1: Operation Attributes

879   Natural Language and Character Set:

880   The "attributes-charset" and "attributes-natural-language" attributes as
881   described in [STD92]

882   Target:

883   • The "printer-uri" (uri) operation attribute which is the target for this operation
884   as described in [STD92]

885   Requesting User:

886   • The "requesting-user-name" (name(MAX)) attribute SHOULD be supplied by
887   the Client as described in [STD92]. In addition, the "requesting-user-uri"
888   (section 6.1.6) attribute SHOULD be supplied by the Client as well.

889   "message" (text(127)):

890   • The Client OPTIONALLY supplies this attribute. The Printer object
891   OPTIONALLY supports this attribute. It is a message to the user for
892   purposes of identifying the Printer to the user.

893   "identify-actions" (1setOf type2 keyword) [section 6.1.4]:

894   • The Client OPTIONALLY supplies this attribute. The Printer object MUST
895   support this attribute. The value(s) specify how the Printer will identify itself to
896   the Client.

5.1.2 Identify-Printer Response

898 The following attributes are part of the Identify-Printer Response:

899 Group 1: Operation Attributes

900 Status Message:

901 In addition to the REQUIRED status code returned in every response, the response
902 OPTIONALLY includes a "status-message" (text(255)) and/or a "detailed-status-message"
903 (text(MAX)) operation attribute as described in [STD92] and Appendix B.

904   Natural Language and Character Set:

905   The "attributes-charset" and "attributes-natural-language" attributes as described in
906   [STD92].

907   Group 2: Unsupported Attributes

908   See [STD92] for details on returning Unsupported Attributes.

5.2 Validate-Document

910   This CONDITIONALLY REQUIRED operation allows a Client to verify operation and
911   Document Template attributes to be used in a subsequent Send-Document or Send-URI
912   request. Printers that implement the IPP Document Object [PWG5100.5] MUST implement
913   this operation.

914   This operation is similar to the Validate-Job operation [STD92] except that it validates
915   attributes used for the Send-Document or Send-URI operations. Like Validate-Job,
916   Validate-Document allocates no Printer resources (i.e., job objects) and does not allow a
917   "document-password" or "document-uri" operation attribute. Unlike the Send-Document or
918   Send-URI operations, this operation does not require a preceeding operation to create a
919   Job since it is only validating attributes.

920   Clients MUST NOT send the "document-password" operation attribute (section 6.1.2) in a
921   Validate-Document request. Printers MUST reject a Validate-Document request containing

922 a "document-password" operation attribute and return the client-error-bad-request status
923 code.

5.2.1 Validate-Document Request

925 The following groups of attributes are supplied as part of the Validate-Document Request:

926 Group 1: Operation Attributes

927 Natural Language and Character Set:

928 The "attributes-charset" and "attributes-natural-language" attributes as described in
929 [STD92].

930 Target:

931 The "printer-uri" (uri) operation attribute which is the target for this operation as described
932 in [STD92].

933 Requesting User:

934 The "requesting-user-name" (name(MAX)) attribute SHOULD be supplied by the Client as
935 described in [STD92]. In addition, the "requesting-user-uri" (section 6.1.6) attribute
936 SHOULD be supplied by the Client as well.

937 "document-name" (name(MAX))

938 The "document-name" attribute as described for the "Send-Document" operation [STD92].

939 "document-format" (mimeMediaType)

940 The "document-format" attribute as described for the "Send-Document" operation [STD92].

941 Group 2: Document Template Attributes

942 The client OPTIONALLY supplies a set of Document Template attributes and SHOULD
943 omit Group 2 rather than sending an empty group. However, a Printer MUST be able to
944 accept an empty group.

5.2.2 Validate-Document Response

946 The following attributes are part of the Validate-Document Response:

947 Group 1: Operation Attributes

948 Status Message:

949 In addition to the REQUIRED status code returned in every response, the response
950 OPTIONALLY includes a "status-message" (text(255)) and/or a "detailed-status-message"
951 (text(MAX)) operation attribute as described in [STD92] 4.1.6 and Appendix B.

952 Natural Language and Character Set:

953 The "attributes-charset" and "attributes-natural-language" attributes as described in
954 [STD92].

955 "preferred-attributes" (collection):

956 This attribute (defined in section 6.1.5) MAY be returned when conflicts are detected in the
957 supplied Operation and Document Template attributes.

958 Group 2: Unsupported Attributes

959 See [STD92] for details on returning Unsupported Attributes.

960 6. New Attributes

961 6.1 Operation Attributes

962 Table 2 lists the operation attributes defined in this specification, each with its
963 corresponding conformance requirements. The conformance requirements pertain to the
964 need for the attribute to be supported by the Printer, not that its support is required for all
965 operations.

966   **Table 2 - New Operation Attributes**

Attribute	Conformance
document-metadata	REQUIRED
document-password	CONDITIONALLY REQUIRED
first-index	REQUIRED
identify-actions	CONDITIONALLY REQUIRED
preferred-attributes	RECOMMENDED
requesting-user-uri	REQUIRED

967 6.1.1 document-metadata (1setOf octetString(MAX))

968 This REQUIRED operation attribute specifies one or more keyword/value pairs describing
969 the document being supplied. Each element in the set consists of a keyword followed by
970 "=" and a UTF-8 value string. Standard keywords are defined in The Dublin Core Metadata
971 Element Set [RFC5013] and DCMI Metadata Terms [DCMITERMS]. Vendor or customer-
972 defined keywords MUST use the prefix string "x-" to avoid future keyword name conflicts,

973 for example "x-vendor-foo" or "x-customer-bar". The complete ABNF definition is provided
974 in Figure 1. The ABNF is also available externally [ABNF].

975 Printers MUST copy this attribute to the corresponding Job Status (section 6.3.1) or
976 Document Status (section 6.5.1) attribute of the same name when processing Print-Job,
977 Print-URI, Send-Document, or Send-URI requests (section 7.6).

978 **Figure 1 - ABNF for "document-metadata" Values**

```
979      document-metadata = dc-elements "=" *utf8-char /
980                          dc-terms "=" *utf8-char /
981                          x-keyword "=" *utf8-char
982
983      dc-elements = "contributor" / "coverage" / "creator" /
984                   "date" / "description" / "format" /
985                   "identifier" / "language" / "publisher" /
986                   "relation" / "rights" / "source" /
987                   "subject" / "title" / "type"
988
989      dc-terms    = "abstract" / "accessRights" / "accrualMethod" /
990                   "accrualPeriodicity" / "accrualPolicy" / "alternative" /
991                   "audience" / "available" / "bibliographicCitation" /
992                   "conformsTo" / "created" / "dateAccepted" /
993                   "dateCopyrighted" / "dateSubmitted" / "educationLevel" /
994                   "extent" / "hasFormat" / "hasPart" / "hasVersion" /
995                   "instructionalMethod" / "isFormatOf" / "isPartOf" /
996                   "isReferencedBy" / "isReplacedBy" / "isRequiredBy" /
997                   "issued" / "isVersionOf" / "license" / "mediator" /
998                   "medium" / "modified" / "provenance" / "references" /
999                   "replaces" / "requires" / "rightsHolder" / "spatial" /
1000                  "tableOfContents" / "temporal" / "valid"
1001
1002     x-keyword   = "x-" 1*(ALPHA / DIGIT / "." / "-" / "_")
1003
1004     utf8-char   = %x20-7E /
1005                   %xC0-DF.80-BF /
1006                   %xE0-EF.80-BF.80-BF /
1007                   %xF0-F7.80-BF.80-BF.80-BF
```

1008 **6.1.2 document-password (octetString(1023))**

1009 This CONDITIONALLY REQUIRED operation attribute specifies an unencrypted
1010 passphrase, OAuth token, or other string to be used to access the document content
1011 provided with the Print-Job, Print-URI, Send-Document, or Send-URI operations (section
1012 7.6). A Printer MUST support this operation attribute if it supports the "application/pdf"
1013 document type.

1014 Typically, the "document-password" value is an alphanumeric passphrase used to "unlock"
1015 a protected PDF [ISO32000] document. The maximum length of the "document-password"
1016 value is specified by the "document-password-supported" Printer Description attribute
1017 (section 6.6.1). While the "document-password" value is necessarily associated with the
1018 document content, this attribute is not part of the Job or Document object and MUST NOT

1019 be reported by the Printer as part of a Job or Document object's description or template
1020 attributes. The value supplied MUST be retained by the Printer as long as the
1021 corresponding Document is retained.

1022 A Printer MUST support this attribute if it supports the "document-password-supported"
1023 attribute (section 6.6.1).

1024 Printers and Clients that support this attribute MUST support Secure Transport. Printers
1025 MUST negotiate a TLS session prior to accepting a request containing this attribute.
1026 Clients MUST negotiate a TLS session prior to sending a request containing this attribute.

1027 **6.1.3 first-index (integer(1:MAX))**

1028 This REQUIRED operation attribute specifies the first object or element, starting at 1, to be
1029 returned in a response.

1030 **6.1.4 identify-actions (1setOf type2 keyword)**

1031 This CONDITIONALLY REQUIRED operation attribute specifies the action(s) that are
1032 taken to identify the printer in an Identify-Printer request (section 5.1). A Printer MUST
1033 support this operation attribute if it implements the Identify-Printer operation. The standard
1034 keyword values are listed in Table 3.

1035 Note: This specification does not define a "print" action due to security and accounting
1036 concerns.

1037 **Table 3 - "identify-actions" Keyword Values**

Keyword	Description
display	Displays the default or Client-provided message on the printer control panel.
flash	Flashes lights or the display on the printer.
sound	Makes a sound.
speak	Speaks the default or Client-provided message.

1038 The default value of this operation attribute is defined by the "identify-actions-default"
1039 Printer Description attribute (section 6.6.2) and the supported values are defined by the
1040 "identify-actions-supported" Printer Description attribute (section 6.6.4).

1041 **6.1.5 preferred-attributes (collection)**

1042 This RECOMMENDED operation attribute specifies the attributes and values that will be
1043 substituted in a job or document creation request and is returned by the Printer in the
1044 Validate-Document response as defined in section 5.2 and the Validate-Job response as
1045 defined in section 7.9. Each member attribute in the collection represents an operation,

1046 Document Template, or Job Template attribute in the Validate-Document or Validate-Job
1047 request with the corresponding replacement value(s).

1048 **6.1.6 requesting-user-uri (uri)**

1049 This REQUIRED operation attribute contains the URI of the end user that is submitting the
1050 request. The value is typically a UUID encoded as defined in A Universally Unique
1051 IDentifier (UUID) URN Namespace [RFC4122] or an email address encoded as defined in
1052 the "mailto:" URI scheme [RFC6068], although any valid URI may be supplied.

1053 The intent of this attribute is to provide an unambiguous user identifier since the
1054 "requesting-user-name" operation attribute is often not unique, e.g., "John Doe". However,
1055 because both of the attributes can be supplied by the Client, the Printer object may modify
1056 the values supplied based on information obtained from an authentication service [STD92].

1057 The "requesting-user-uri-supported" Printer Description attribute (section 6.6.33) specifies
1058 whether the "requesting-user-uri" operation attribute is supported.

1059 ## 6.2 Job and Document Template Attributes

1060 Table 4 lists the Job and Document Template attributes defined in this specification, each
1061 with its corresponding conformance requirements.

1062 **Table 4 - New Job and Document Template Attributes**

Attribute	Conformance
eliminate-margins	RECOMMENDED
job-error-action	RECOMMENDED
media-overprint	CONDITIONALLY REQUIRED
media-overprint-type	CONDITIONALLY REQUIRED
print-color-mode	REQUIRED
print-rendering-intent	CONDITIONALLY REQUIRED

1063

1064 **6.2.1 eliminate-margins (type2 keyword)**

1065 This RECOMMENDED Job Template attribute specifies the set of margins the Printer
1066 should remove from the Input Pages. This is primarily to support certain types of roll-feed
1067 media printing scenarios but can be used with cut media as well.

1068 **Table 5 - "eliminate-margins" Keyword Values**

Keyword	Description
none	Do not eliminate any whitespace or margins.

all	Eliminate the "top margin" and adjacent whitespace at the top of each page and the "bottom margin" and adjacent whitespace at the bottom of each page.
banner	Eliminate whitespace and margins between pages, but not the "top margin" and adjacent whitespace at the top of the first page or the "bottom margin" and adjacent whitespace at the bottom of the last page.

1069   Figure 2 illustrates the basic problem that the 'all' keyword supports.
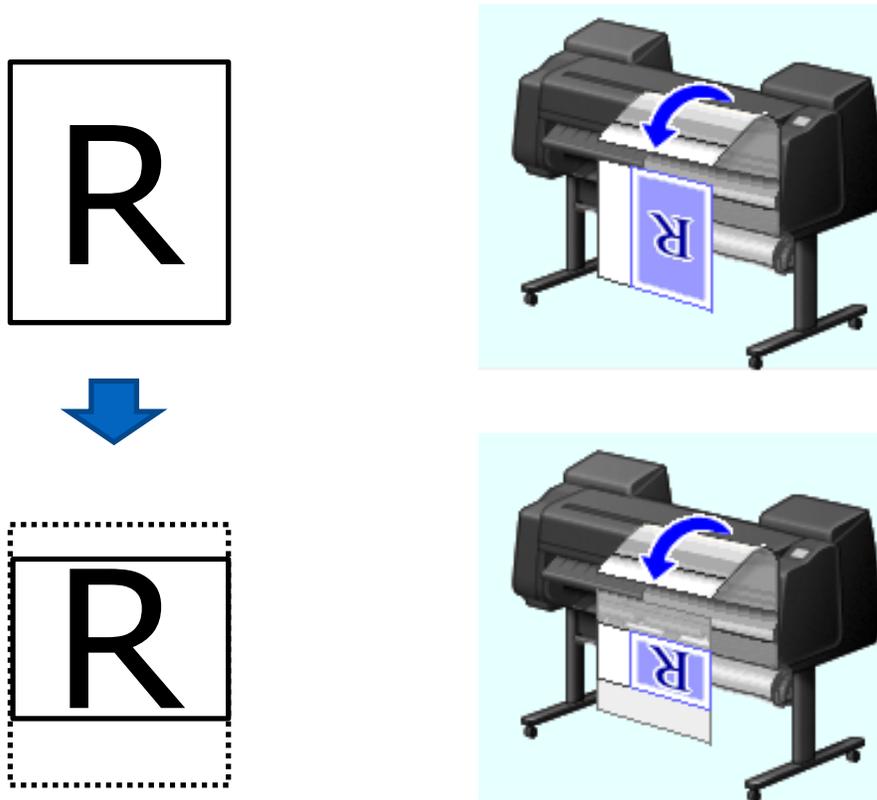
1070

1071   **Figure 2 - Illustration of "eliminate-margins"**

1072   Figure 3 illustrates the scenario that the 'banner' keyword supports.
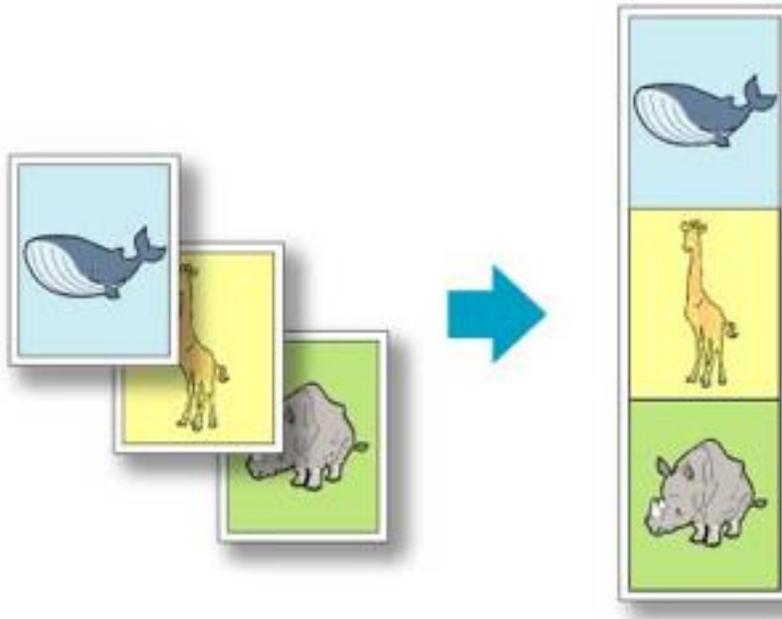
1073

1074   **Figure 3 - Banner Printing illustration**

1075   **6.2.2 job-error-action (type2 keyword)**

1076   This RECOMMENDED Job Template attribute specifies the action a Printer takes when an
1077   error is encountered in a document during processing of the job. Standard keyword values
1078   are shown in Table 6.

1079   Note: When a Printer stops processing a job, it MAY temporarily add the 'processing-to-
1080   stop-point' keyword to the "job-state-reasons" Job Description attribute. See [STD92] for
1081   more information.

1082   **Table 6 - "job-error-action" Keyword Values**

Keyword	Description
abort-job	Stop processing the job and move it to the 'aborted' state. The 'aborted-by-system' keyword MUST be present in the "job-state-reasons" Job Description attribute.
cancel-job	Stop processing the job as if the Printer had accepted a Cancel-Job request [STD92] from the user. The 'job-canceled-by-user' keyword MUST be present in the "job-state-reasons" Job Description attribute.
continue-job	Continue processing the next document in the job or, if this is the last document in the job, move the job to the 'completed' state.
suspend-job	Stop processing the job and move it to the 'processing-stopped' state as if the Printer had accepted a Suspend-

Current-Job request (section 4.3.1 [RFC3998]). The 'job-suspended-by-user' keyword MUST be present in the "job-state-reasons" Job Description attribute.

1083 **6.2.3 media-overprint (integer)**

1084 This RECOMMENDED Job Template attribute specifies how far the Printer should expand
1085 each Input Page content beyond the selected media edges to "overprint" it, to ensure there
1086 is no unmarked media in cases where the media being fed is misaligned. This attribute
1087 MUST be supported if the "media-overprint-type" attribute is supported.

1088 The value is measured in hundredths of millimeters (1/2540th of an inch). Although this is
1089 intended to support roll-fed media scenarios, it could support cut media scenarios as well.

1090 Figure 4 illustrates the extension
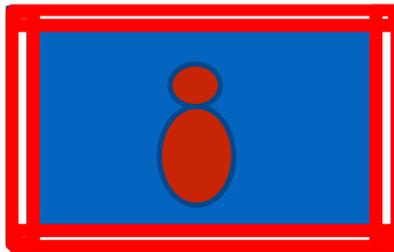
1091

1092 **Figure 4 - Extending the margins with "media-overprint"**

1093 **6.2.4 media-overprint-type (type2 keyword)**

1094 This RECOMMENDED Job Template attribute specifies the method the Printer should use
1095 to expand each Input Page content beyond the selected media edges to ensure no portion
1096 of the loaded media remains unmarked. Table 7 lists the defined keyword values. This
1097 attribute MUST be supported if the "media-overprint" attribute is supported.

1098 At least one of the values in Table 7 MUST be supported if this attribute is supported.

1099 **Table 7 - "media-overprint-type" Keyword Values**

Keyword	Description
scale	Input Page scaled up to overprint
extend	Input Page edge pixel color values "extended" to overprint

1100 **6.2.5 print-color-mode (type2 keyword | keyword)**

1101 This REQUIRED Job Template attribute specifies the color mode to use when printing a
1102 job. The Printer MUST print the job using the requested color mode. Standard keyword
1103 values are shown in Table 8.

1104 Vendor keywords SHOULD comply with the implementation guidance in [STD92] section
1105 7.3.

1106   **Table 8 - "print-color-mode" Standard Keyword Values**

Keyword	Description	Conformance
auto	Automatic based on document	REQUIRED
auto-monochrome	Printer chooses monochrome or process-monochrome based on document	RECOMMENDED
bi-level	1-colorant (typically black) threshold output	OPTIONAL (note 1)
color	Full-color output	CONDITIONALLY REQUIRED (note 2)
highlight	1-colorant + black output	OPTIONAL
monochrome	1-colorant (typically black) shaded/grayscale output	REQUIRED
process-bi-level	Process (2 or more colorants) threshold output	OPTIONAL
process-monochrome	Process (2 or more colorants) shaded/grayscale output	OPTIONAL (note 3)

1107 Notes:
1108   1 - Optional because the actual appearance is implementation-specific.
1109   2 - Required for color Printers.
1110   3 - Optional because process black on laser printers can be problematic.

1111 **6.2.6 print-rendering-intent (type2 keyword)**

1112 This CONDITIONALLY REQUIRED Job Template attribute specifies how out-of-gamut
1113 colors (or shades of gray) are mapped to device colors when printing. Printers MUST
1114 support this attribute if they support the "printer-icc-profiles" attribute (section 6.6.24). If
1115 supported, the Printer MUST print the job using the requested rendering intent. Standard
1116 keyword values are shown in Table 9.

1117   **Table 9 - "print-rendering-intent" Keyword Values**

Keyword	Description	Conformance
absolute	Clip out-of-gamut colors to preserve in-gamut accuracy without adjusting the white point.	OPTIONAL

auto	Automatically determine the rendering intent based on the document and job ticket.	REQUIRED
perceptual	Map out-of-gamut colors at the expense of in-gamut accuracy.	OPTIONAL
relative	Clip out-of-gamut colors to preserve in-gamut accuracy, adjusting the white point as necessary.	REQUIRED
relative-bpc	Clip out-of-gamut colors to preserve in-gamut accuracy, adjusting both the white and black points as necessary. (bpc = Black Point Compensation)	REQUIRED
saturation	Preserve saturated colors.	OPTIONAL

6.3 Job Status Attributes

Table 10 lists the Job Status attributes defined in this specification, each with its corresponding conformance requirements.

Table 10 - New Job Status Attributes

Attribute	Conformance
document-metadata	CONDITIONALLY REQUIRED
job-originating-user-uri	REQUIRED
job-pages	RECOMMENDED
job-pages-completed	RECOMMENDED
job-pages-completed-current-copy	RECOMMENDED
job-uuid	REQUIRED

6.3.1 document-metadata (1setOf octetString(MAX))

This CONDITIONALLY REQUIRED Job Status attribute specifies one or more keyword/value pairs describing the document being supplied. This attribute MUST be supported when the IPP Document Object [PWG5100.5] is not supported. The format of

1126   each element in the set is defined in section 6.1.1. The "document-metadata" Job Status
1127   attribute is copied from the operation attribute of the same name as defined in section 7.6.

1128   **6.3.2 job-originating-user-uri (uri)**

1129   This REQUIRED Job Status attribute contains the URI of the most authenticated end user
1130   that submitted the job creation request as defined in section 7.1.

1131   **6.3.3 job-pages (integer(0:MAX))**

1132   This RECOMMENDED Job Status attribute contains the total number of input pages for
1133   the documents in the Job. See section 11 for a description of the relationship of this
1134   attribute to the "job-impressions" and "job-media-sheets" attributes.

1135   This attribute MUST be supported if the "job-pages-completed" Job attribute (section 6.3.4)
1136   is supported.

1137   **6.3.4 job-pages-completed (integer(0:MAX))**

1138   This RECOMMENDED Job Status attribute specifies the total number of input pages of the
1139   documents in the Job that have been processed. See section 11 for a description of the

1140 relationship of this attribute to the "job-impressions-completed" and "job-media-sheets-
1141 completed" attributes.

1142 This attribute MUST be supported if the "job-pages" Job attribute (section 6.3.3) is
1143 supported.

6.3.5 job-pages-completed-current-copy (integer(0:MAX))

1145 This RECOMMENDED Job Status attribute specifies the total number of input pages of the
1146 documents in the Job that have been processed for the current copy. This attribute MUST
1147 be supported if the "job-pages" Job attribute (section 6.3.3) is supported.

6.3.6 job-uuid (uri(45))

1149 This REQUIRED Job Status attribute specifies a globally unique identifier that MUST be a
1150 45-octet "urn:uuid" URI [RFC4122]. The Printer generates the globally unique identifier
1151 when it creates the Job object in response to a Job Creation operation request.

1152 This attribute MUST NOT be used as a Job identifier in IPP Job operations, but MAY be
1153 used as a Job identifier for other protocol bindings and SHOULD be used for Job
1154 accounting and auditing.

6.4 Subscription Status Attributes

1156 Table 11 lists the Subscription Status attributes defined in this specification, each with its
1157 corresponding conformance requirements.

1158 **Table 11 - New Job Status Attributes**

Attribute	Conformance
notify-subscription-uuid	CONDITIONALLY REQUIRED
notify-subscriber-user-uri	CONDITIONALLY REQUIRED

1159 **6.4.1 notify-subscription-uuid (uri(45))**

1160 This CONDITIONALLY REQUIRED Subscription Status attribute specifies a globally
1161 unique identifier that MUST be a 45-octet "urn:uuid" URI [RFC4122]. This attribute is
1162 REQUIRED if "IPP: Event Notifications and Subscriptions" [RFC3995] is supported.

1163 The Printer generates the globally unique identifier when it creates a new Subscription
1164 object in response to a subscription creation request, which can be included as part of a
1165 job creation request.

1166 The "notify-subscription-uuid" attribute MUST NOT be used as a Subscription identifier in
1167 IPP subscription operations but MAY be used as a Subscription identifier for other protocol
1168 bindings and SHOULD be used for Subscription accounting and auditing.

1169 **6.4.2 notify-subscriber-user-uri (uri)**

1170 This CONDITIONALLY REQUIRED Subscription Status attribute contains the most
1171 authenticated URI of the end user that submitted the subscription creation request as
1172 defined in section 7.1. This attribute is REQUIRED if "IPP: Event Notifications and
1173 Subscriptions" [RFC3995] is supported.

1174 **6.5 Document Status Attributes**

1175 Table 12 lists the Document Description attributes defined in this specification, each with
1176 its corresponding conformance requirements.

1177 **Table 12 - New Document Status Attributes**

Attribute	Conformance
document-metadata	CONDITIONALLY REQUIRED
document-uuid	CONDITIONALLY REQUIRED
pages	OPTIONAL
pages-completed	OPTIONAL

1178

1179 **6.5.1 document-metadata (1setOf octetString(MAX))**

1180 This CONDITIONALLY REQUIRED Document Status attribute specifies one or more
1181 keyword/value pairs describing the document being supplied. This attribute MUST be
1182 supported when the IPP Document Object [PWG5100.5] is supported. The format of each

1183 element in the set is defined in section 6.1.1. The "document-metadata" Document Status
1184 attribute is copied from the operation attribute of the same name as defined in section 7.6.

6.5.2 document-uuid (uri(45))

1186 This CONDITIONALLY REQUIRED Document Status attribute specifies a globally unique
1187 identifier that MUST be a 45-octet "urn:uuid" URI [RFC4122]. This attribute is REQUIRED
1188 if the IPP Document Object [PWG5100.5] is supported.

1189 The Printer generates the globally unique identifier when it creates a new Document object
1190 in response to a document creation operation, which can be part of a job creation request.

1191 This attribute MUST NOT be used as a Document identifier in IPP document operations
1192 but MAY be used as a Document identifier for other protocol bindings and SHOULD be
1193 used for Document accounting and auditing.

6.5.3 pages (integer(0:MAX))

1195 This OPTIONAL Document Status attribute contains the total number of input pages for
1196 the document. See section 11 for a description of the relationship of this attribute to the
1197 "impressions" and "media-sheets" attributes.

1198 This attribute MUST be supported if both the "pages-completed" Document Status attribute
1199 (section 6.5.4) and the IPP Document Object [PWG5100.5] are supported.

6.5.4 pages-completed (integer(0:MAX))

1201 This OPTIONAL Document Status attribute specifies the total number of input pages of the
1202 document that have been processed. See section 11 for a description of the relationship of
1203 this attribute to the "impressions-completed" and "media-sheets-completed" attributes.

1204 This attribute MUST be supported if both the "pages" Document Status attribute (section
1205 6.5.3) and the IPP Document Object [PWG5100.5] are supported.

6.6 Printer Description Attributes

1207 Table 13 lists the Printer Description attributes defined in this specification, each with its
1208 corresponding conformance requirements.

1209   **Table 13 - New Printer Description Attributes**

Attribute	Conformance
document-password-supported	OPTIONAL
eliminate-margins-supported	OPTIONAL
identify-actions-default	CONDITIONALLY REQUIRED
identify-actions-supported	CONDITIONALLY REQUIRED
ipp-features-supported	REQUIRED

job-constraints-supported	RECOMMENDED
job-error-action-default	OPTIONAL
job-error-action-supported	OPTIONAL
job-presets-supported	RECOMMENDED
job-resolvers-supported	RECOMMENDED
job-triggers-supported	OPTIONAL
media-overprint-supported	OPTIONAL
media-overprint-type-supported	OPTIONAL
multiple-operation-time-out-action	OPTIONAL
preferred-attributes-supported	RECOMMENDED
print-color-mode-default	REQUIRED
print-color-mode-supported	REQUIRED
print-color-mode-icc-profiles	RECOMMENDED
print-quality-hints-supported	OPTIONAL
print-rendering-intent-default	OPTIONAL
print-rendering-intent-supported	OPTIONAL
printer-geo-location	RECOMMENDED
printer-get-attributes-supported	REQUIRED
printer-icc-profiles	RECOMMENDED
printer-icons	REQUIRED
printer-input-tray	CONDITIONALLY REQUIRED
printer-mandatory-job-attributes	OPTIONAL
printer-organization	RECOMMENDED
printer-organizational-unit	RECOMMENDED
printer-output-tray	CONDITIONALLY REQUIRED
printer-strings-languages-supported	REQUIRED
printer-strings-uri	REQUIRED
requesting-user-uri-supported	RECOMMENDED

6.6.1 document-password-supported (integer(0:1023))

This OPTIONAL Printer Description attribute provides the maximum number of octets the Printer will accept for a "document-password" operation attribute (section 6.1.2).

Printers that support the "document-password" attribute MUST also support this attribute with a value of at least 255. The value 0 indicates that the attribute is not supported. The values 1 through 254 are not allowed.

6.6.2 eliminate-margins-supported (1setOf type2 keyword)

This OPTIONAL Printer Description attribute lists the supported values the Printer supports for the "eliminate-margins" Job Template attribute (section 6.2.1). This attribute MUST be supported if the Printer supports the "eliminate-margins" Job Template attribute.

Note: There is no "eliminate-margins-default" Printer Description attribute. The intended semantic is that a Client omitting "eliminate-margins" means the Printer should behave as though "eliminate-margins" is 'none' for that Job.

6.6.3 identify-actions-default (1setOf type2 keyword)

This CONDITIONALLY REQUIRED Printer Description attribute provides the default value(s) the Printer will use if the Client omits the "identify-actions" operation attribute from an Identify-Printer operation request (section 5.1). This attribute MUST be supported if the Printer supports the Identify-Printer operation.

6.6.4 identify-actions-supported (1setOf type2 keyword)

This CONDITIONALLY REQUIRED Printer Description attribute lists the values the Printer supports for the "identify-actions" operation attribute. This attribute MUST be supported if the Printer supports the Identify-Printer operation (section 5.1).

6.6.5 ipp-features-supported (1setOf type2 keyword)

This REQUIRED Printer Description attribute lists the IPP extension features that are supported by the Printer. Standard keyword values are listed in Table 14. The value 'none' MUST be reported if no extension features are supported and MUST NOT be reported otherwise.

Table 14 - "ipp-features-supported" Keyword Values

Keyword	Description
none	No extension features are supported.
document-object	IPP Document Object [PWG5100.5]
driverless	IPP Driverless Printing Extensions (this specification)
page-overrides	Page overrides from IPP Page Overrides [PWG5100.6]
production	IPP Production Printing Extensions [PWG5100.3]
subscription-object	IPP Event Notifications and Subscriptions [RFC3995]

1238 **6.6.6 job-constraints-supported (1setOf collection)**

1239 This RECOMMENDED Printer Description attribute provides a set of collections that
1240 describe Job Template attributes that are not supported by the Printer, allowing a Client to
1241 pre-screen options selected by the user and resolve them prior to job submission or
1242 validation. This attribute is REQUIRED if the "job-resolvers-supported" attribute is
1243 supported.

1244 Each collection consists of a "resolver-name (name(MAX))" member attribute plus any Job
1245 Template attributes and their list of unsupported values. The "resolver-name" member
1246 attribute MUST refer to a collection in the "job-resolvers-supported" attribute described
1247 below that specifies a matching "resolver-name" value. Multiple constraint collections can
1248 refer to the same "job-resolvers-supported" collection. Constraints for the "media-col" Job
1249 Template attribute [PWG5100.7] can be incomplete; that is, the "media-col" collection
1250 values can contain only those member attributes that contribute to the constraint.

1251 Figure 5 illustrates how a constraint for duplex printing on transparency media could be
1252 specified by the Printer.

1253 **Figure 5 - Verbose "job-constraints-supported" and "job-resolvers-supported" Example**

```
1254        job-constraints-supported=
1255        {
1256          resolver-name="A"
1257          sides="two-sided-short-edge"
1258          media-col={
1259            media-type="transparency"
1260          }
1261        },
1262        {
1263          resolver-name="A"
1264          sides="two-sided-long-edge"
1265          media-col={
1266            media-type="transparency"
1267          }
1268        }
1269
1270        job-resolvers-supported=
1271        {
1272          resolver-name="A"
1273          sides="one-sided"
1274          media-col={
1275            media-type="stationery"
1276          }
1277        }
```

1278 To minimize the number of collections in "job-constraints-supported", multiple Job
1279 Template attribute value alternatives can be specified in a single collection using a "1setOf

1280 syntax" representation. Figure 6 illustrates a concise representation of the constraints
1281 described in Figure 5.

1282 **Figure 6 - Concise "job-constraints-supported" and "job-resolvers-supported" Example**

```
1283        job-constraints-supported=
1284        {
1285          resolver-name="A"
1286          sides="two-sided-long-edge","two-sided-short-edge"
1287          media-col={
1288            media-type="transparency"
1289          }
1290        }
1291
1292        job-resolvers-supported=
1293        {
1294          resolver-name="A"
1295          sides="one-sided"
1296          media-col={
1297            media-type="stationery"
1298          }
1299        }
```

1300 Both encodings are syntactically correct and semantically equivalent; the latter
1301 representation SHOULD be used, since it is more concise and less error-prone.

1302 **6.6.7 job-error-action-default (type2 keyword)**

1303 This OPTIONAL Printer Description attribute provides the default value supplied by the
1304 Printer if the Client omits the "job-error-action" Job Template attribute.

1305 **6.6.8 job-error-action-supported (1setOf type2 keyword)**

1306 This OPTIONAL Printer Description attribute lists the "job-error-action" Job Template
1307 attribute values supported by the Printer.

1308 **6.6.9 job-presets-supported (1setOf collection)**

1309 This RECOMMENDED Printer Description attribute lists named Presets that are stored on
1310 the Printer. Each collection value contains a REQUIRED "preset-name (keyword |
1311 name(MAX))" attribute and one or more Job Template attributes that are part of the Preset.
1312 The attribute names and values MUST be supported by the Printer and be listed in its
1313 Printer Description attributes. The set of attribute values MUST NOT be in conflict with one
1314 another as described by a constraint in "job-constraints-supported".

1315 A Client MUST copy all Preset member attributes (except "preset-name") from the selected
1316 Preset to the Job Creation Request, either with the values from the Preset or alternate

1317 values subsequently chosen by the User. This includes member attributes that the Client
1318 does not natively support.

1319 6.6.9.1 preset-name (keyword | name(MAX))

1320 This attribute provides a unique name for the Preset. Values can be localized using the
1321 message catalog provided at the URL specified by the "printer-strings-uri" Printer
1322 Description attribute (section 6.6.32).

1323 6.6.9.2 Examples

1324 Below is an example "job-presets-supported" attribute, which includes 2 collections,
1325 described using PAPI notation [PAPI]:

```
1326          job-presets-supported={
1327              preset-name="draft"
1328              print-quality=3
1329          },{
1330              preset-name="photo"
1331              print-content-optimize='graphics'
1332              print-quality=5
1333          }
```

1334 6.6.10 job-resolvers-supported (1setOf collection)

1335 This RECOMMENDED Printer Description attribute provides a set of collections that
1336 describe Job Template attribute changes to make for constrained values, allowing a Client
1337 to pre-screen options selected by the user and resolve them prior to job submission or
1338 validation. This attribute is REQUIRED if the "job-constraints-supported" attribute is
1339 supported.

1340 Each collection consists of a "resolver-name (name(MAX))" member attribute plus any Job
1341 Template attributes and their alternate values. Clients MUST only change as many Job
1342 Template attributes as are needed to resolve the constraint and MUST try each value in
1343 the order they are provided in the collection. The resolver potentially changes all of the
1344 constrained attributes in order to avoid constraint/resolver loops.

1345 Resolvers containing the "media-col" Job Template attribute [PWG5100.7] may provide an
1346 incomplete value; that is, the "media-col" collection value can contain only those member
1347 attributes that need to be changed to resolve the constraint.

1348 The "resolver-name" member attribute value MUST be used by at least one collection in
1349 the "job-constraints-supported" attribute described above. Constraint resolvers MUST NOT
1350 create loops, such that the resolver for constraint "A" causes constraint "B", but the
1351 resolver for constraint "B" causes constraint "A".

1352 For example, a resolver for duplex printing on transparency media would be encoded as a
1353 collection containing "resolver-name", "sides", and "media-col" member attributes. The

1354 "sides" member attribute would have the value "one-sided" while the "media-col" member
1355 attribute would contain a "media-type" member attribute with the value "stationery".

6.6.11 job-triggers-supported (1setOf collection)

1357 This OPTIONAL Printer Description attribute lists Triggers that are stored on the Printer.
1358 Each collection value contains a REQUIRED "preset-name (keyword | name(MAX))"
1359 member attribute (section 4.1.1.1) and one or more Job Template attributes that specify
1360 the Trigger. The Client applies the Preset named by "preset-name" once the User selects
1361 all the settings corresponding to the Job Template attributes specified in the Trigger.

6.6.11.1 Examples

1363 Here is an example "job-triggers-supported" attribute, which includes 2 collections,
1364 described using PAPI notation [PAPI]:

```
job-triggers-supported={
   preset-name="draft"
   media-col={media-type='stationery-recycled'}
},{
   preset-name="photo"
   media-col={
      media-type='photographic','photographic- glossy',
                  'photographic-matte'
   }
}
```

1375 In this example, if the user selects the 'stationery-recycled' media type, that will trigger the
1376 selection of the "draft" Preset from "job-presets-supported".

6.6.12 media-overprint-supported (rangeOfInteger(0:MAX))

1378 This OPTIONAL Printer Description attribute defines the range of supported values the
1379 Client can specify for the "media-overprint" attribute (section 6.2.3). If the Printer supports
1380 this attribute, then it must also support the "media-overprint-" attribute.

6.6.13 media-overprint-type-supported (1setOf type2 keyword)

1382 This OPTIONAL Printer Description attribute defines the values the Printer can accept for
1383 the "media-overprint-type" attribute (section 6.2.3). If the Printer supports this attribute,
1384 then it must also support the "media-overprint-type" attribute.

6.6.14 multiple-operation-time-out-action (type2 keyword)

1386 This CONDITIONALLY REQUIRED Printer Description attribute defines the action that is
1387 taken when open jobs time out. Printers that supports the Create-Job operation MUST
1388 support this attribute. Table 15 lists the available actions.

Table 15 - "multiple-document-time-out-action" Keyword Values

Keyword	Description
abort-job	The job is closed and moved to the 'aborted' state. The 'aborted-by-system' keyword MUST be present in the "job-state-reasons" Job Description attribute.
hold-job	The job is closed and moved to the 'pending-held' state. The 'job-hold-until-specified' keyword MUST be present in the "job-state-reasons" Job Description attribute and the "job-hold-until" Job Template attribute MUST be set to 'indefinite'.
process-job	The job is closed and moved to the 'pending' or 'processing' state.

6.6.15 preferred-attributes-supported (boolean)

This RECOMMENDED Printer Description attribute indicates whether the Printer will return the "preferred-attributes" operation attribute (section 6.1.5) in its Validate-Document (section 5.2) or Validate-Job (section 7.9) operation responses.

6.6.16 print-color-mode-default (type2 keyword)

This REQUIRED Printer Description attribute provides the default value supplied by the Printer if the Client omits the "print-color-mode" Job Template attribute (section 6.2.5).

6.6.17 print-color-mode-supported (1setOf type2 keyword)

This REQUIRED Printer Description attribute lists the supported "print-color-mode" attribute values supported by the Printer. The Printer MUST support this attribute if it supports the "print-color-mode" Job Template attribute (section).

If this attribute is supported and non-standard keywords are among the keywords listed by this attribute, the Printer SHOULD support the "print-color-mode-icc-profiles" attribute (section 6.6.18) and SHOULD provide an ICC profile for all supported keywords, to allow a Client to present a soft proof preview for each supported print color mode. The Printer's message catalogs SHOULD provide localized user-presentable label strings for all non-standard "print-color-mode" keywords. The Printer's message catalogs SHOULD provide localized "tooltip" contextual help strings for all non-standard "print-color-mode" keywords.

6.6.18 print-color-mode-icc-profiles (1setOf collection)

This RECOMMENDED Printer Description attribute lists the set of ICC profiles the Printer provides to allow a Client to preview the color transformation result from the supported "print-color-mode" values. This attribute is distinct from the "printer-icc-profiles" attribute (section 6.6.24) to make clear that the two sets of ICC profiles have different intended

1413 purposes. The profiles listed by this attribute are used only for soft proofing, while those
1414 provided by "printer-icc-profiles" are used only for color management.

1415 Each collection value includes the "print-color-mode" and "profile-uri" members. Each
1416 collection in the set MUST have a unique "print-color-mode" value.

1417 6.6.18.1 print-color-mode (type2 keyword)

1418 This REQUIRED member attribute identifies the print color mode corresponding to this
1419 profile. The value of this member MUST be one of the keywords specified by the Printer's
1420 "print-color-mode-supported" attribute (section 6.6.17).

1421 6.6.18.2 profile-uri (uri)

1422 This REQUIRED member attribute provides a reference to a Printer Resident or Site Local
1423 ICC color profile. The value MUST be an "https:" or "http:" scheme URI. The value
1424 SHOULD follow the Printer resources best practices in section 12.2.

1425 6.6.19 print-quality-hints-supported (1setOf keyword)

1426 This OPTIONAL Printer Description attribute lists the Printer's extended Job Template
1427 attributes that control parameters that affect output quality. This attribute provides the
1428 semantic grouping so that a Client doesn't have to "guess" as to the purpose from among
1429 all of the Printer's extended IPP attributes.

1430 The attribute syntax for all Job Template attributes named in this attribute MUST be one of
1431 the following:

1432 • boolean

1433 • enum

1434 • integer

1435 • keyword

1436 • name

1437 • rangeOfInteger

1438 • resolution

1439 A Client SHOULD ignore a named attribute whose syntax is not one of these types . For
1440 simplicity, the "collection" type is not supported. The Printer MUST support the "xxx-

1441 supported" Printer Description attribute for that named attribute. The Printer SHOULD
1442 support the "xxx-default" Printer Description attribute for that named attribute.

1443 **6.6.19.1 print-quality-hints-supported Attribute Syntax / UI Control Mapping**

1444 A Client that supports this attribute could present a grouping of "advanced print settings"
1445 controls to the user, without having to be aware of the semantics of their meaning or
1446 purpose. A supporting Client might present each of these member attributes using the
1447 attribute syntax / UI control type mapping listed in Table 16.

1448   **Table 16: "print-quality-hints-supported" Attribute Syntax Possible Control Mappings**

Syntax	Control	"-supported" Source Syntax
boolean	Checkbox	
enum	Pop-up Menu or List	
integer	Text Box	rangeOfInteger
keyword	Pop-up Menu or List	
name	Pop-up Menu or List	
rangeOfInteger	Pair of Text Boxes	
resolution	Pop-up Menu or List	

1449

1450 **6.6.19.2 print-quality-hints-supported Example**

1451 Figure 7 illustrates how this attribute might be used by a Client. The example Printer
1452 implements two vendor-unique print quality hint attributes "notpwg-clever-x" and "notpwg-
1453 magic-y", and names those two in its "print-quality-hints-supported" Printer Description
1454 attribute.

1455   **Figure 7 - "print-quality-hints-supported" example**

```
1456    ATTR boolean notpwg-clever-x-supported true
1457    ATTR boolean notpwg-clever-x-default false
1458    ATTR keyword notpwg-magic-y-supported 'none','aguamenti','duro','episkey'
1459    ATTR keyword notpwg-magic-y-default 'episkey'
1460    ATTR keyword print-quality-hints-supported 'notpwg-clever-x','notpwg-magic-y'
```

1461 A Client could present a checkbox for "notpwg-clever-x" and a pop-up menu or list for
1462 "notpwg-magic-y".

1463 **6.6.20 print-rendering-intent-default (type2 keyword)**

1464 This OPTIONAL Printer Description attribute provides the default value supplied by the
1465 Printer if the Client omits the "print-rendering-intent" Job Template attribute.

1466 **6.6.21 print-rendering-intent-supported (1setOf type2 keyword)**

1467 This OPTIONAL Printer Description attribute provides a list of supported "print-rendering-
1468 intent" Job Template attribute values. If the "print-rendering-intent" Job Template attribute
1469 is supported, then the values "relative" and "relative-bpc" MUST be supported as well.

1470 **6.6.22 printer-geo-location (uri | unknown)**

1471 This RECOMMENDED Printer Description attribute identifies the location of the associated
1472 device using the World Geodetic System 1984 [WGS84]. The means for expressing the
1473 location information is a "geo:" URI scheme [RFC5870]. When the information is unknown,
1474 Printers MUST return the "printer-geo-location" attribute using the 'unknown' out-of-band
1475 value [STD92]. Printers that support this attribute MUST allow the user to set the location
1476 manually.

1477 **6.6.23 printer-get-attributes-supported (1setOf keyword)**

1478 This REQUIRED Printer Description attribute lists the operation and Job Template
1479 attributes that contribute to the content returned by the Get-Printer-Attributes operation.
1480 The "document-format" value is REQUIRED for all Printers to conform to IPP/1.1 [STD92].
1481 All other values are OPTIONAL.

1482 **6.6.24 printer-icc-profiles (1setOf collection)**

1483 This RECOMMENDED Printer Description attribute lists one or more ICC profiles that
1484 characterize the Printer or its rendering. Each collection value consists of "profile-name
1485 (name(MAX))" and "profile-uri (uri)" member attributes plus any Job Template attributes
1486 (as member attributes) that contribute to the selection of the profile.

1487 ICC profiles are generally used for Client-side color proofing and/or color management and
1488 MAY be externally managed via IPP or other protocols.

1489 **6.6.24.1 profile-name (name(MAX))**

1490 This REQUIRED member attribute provides a unique name for a given ICC profile. A given
1491 "profile-name" value MAY appear in multiple collection values but MUST always be paired
1492 with the same "profile-uri" value. That is, a "profile-name" of "Glossy Paper, High Quality"

1493 might be listed multiple times but will always refer to the same "profile-uri", for example
1494 "https://example.com/glossy-high.icc".

1495 The "profile-name" value SHOULD be localized by the Printer based on the value of the
1496 "attributes-natural-language" operation attribute.

1497 **6.6.24.2 profile-uri (uri)**

1498 This REQUIRED member attribute references an ICC color profile as a "https:" or "http:"
1499 URI. Standard vendor-supplied profiles SHOULD be Printer Resident so that Client printing
1500 does not require access to hosts other than the one hosting the Printer. The value
1501 SHOULD follow the Printer resources best practices in section 12.2.

1502 **6.6.25 printer-icons (1setOf uri)**

1503 This REQUIRED Printer Description attribute lists URIs for one or more Printer Resident
1504 images using "http:" or "https:" URIs. The value SHOULD follow the Printer resources best
1505 practices in section 12.2.

1506 The referenced images MUST be RGBA PNG [RFC2083] format, have square dimensions
1507 of 48x48, 128x128, or 512x512 pixels, represent the physical appearance of the Printer,
1508 and show the same perspective/view of the Printer. If only one image is provided, it MUST
1509 have dimensions of 128x128 pixels. Images MUST be listed from smallest to largest
1510 dimensions. Images MUST provide an alpha channel to mask the background surrounding
1511 the printer.

1512 **6.6.26 printer-input-tray (1setOf octetString(MAX))**

1513 This CONDITIONALLY REQUIRED Printer Description attribute provides current input tray
1514 details mapped from the SNMP prtInputTable defined in IETF Printer MIB v2 [RFC3805].
1515 This attribute MUST be supported if the "media-source" member attribute [PWG5100.7] or
1516 "media-source-properties" member attribute [PWG5100.7] are supported.

1517 If supported, this attribute MUST have the same cardinality (contain the same number of
1518 values) as the "media-source-supported" attribute. The i_{th} value in the "printer-input-tray"
1519 attribute corresponds to the i_{th} value in the "media-source-supported" attribute.

1520 **6.6.26.1 Keywords for printer-input-tray**

1521 Table 17 defines the IPP datatypes and keywords for encoding "printer-input-tray" from the
1522 relevant machine-readable (non-localized) columnar objects of each prtInputEntry from
1523 prtInputTable [RFC3805]. Printer MIB objects without corresponding IPP keywords are not
1524 mapped, per DMTF CIM ranking activity in WIMS WG in 2006. A Printer MAY represent
1525 site-unique or vendor-unique information using extension keywords. The extension syntax
1526 is detailed in the ABNF.

1527   **Table 17 - Keywords for "printer-input-tray"**

Printer MIB Object	IPP Datatype	IPP Keyword	Conformance
prtInputCurrentLevel	Integer	level	REQUIRED
prtInputMaxCapacity	Integer	maxcapacity	REQUIRED
prtInputMediaDimFeedDirDeclared	Integer	mediafeed	REQUIRED
prtInputMediaDimXFeedDirDeclared	Integer	mediaxfeed	REQUIRED
prtInputName	String	name	REQUIRED
prtInputStatus	Integer	status	REQUIRED
prtInputType	String	type	REQUIRED
prtInputCapacityUnit	String	unit	RECOMMENDED
prtInputDimUnit	String	dimunit	RECOMMENDED
prtInputMediaColor (1)	String	mediacolor	RECOMMENDED
prtInputMediaName (1)	String	medianame	RECOMMENDED
prtInputMediaType (1)	String	mediatype	RECOMMENDED
prtInputMediaWeight (2)	Integer	mediaweight	OPTIONAL
prtInputIndex (3)	Integer	index	DEPRECATED

Notes:

1. prtInputMediaName, prtInputMediaType, and prtInputMediaColor are RECOMMENDED in "printer-input-tray", because they are important but often unknown to the printer (while loaded media dimensions are usually known).
2. prtInputMediaWeight is OPTIONAL in "printer-input-tray", because most Printers can't sense loaded media weight.
3. prtInputIndex is DEPRECATED in "printer-input-tray", because correlation with the original MIB order is considered unimportant.

6.6.26.2 Encoding of printer-input-tray

Values of "printer-input-tray" MUST be encoded using the Net-ASCII subset of the US-ASCII character set [RFC5198]. Control codes (0x00 to 0x1F and 0x7F) MUST NOT be used. The ABNF [STD68] in Figure 8 defines the standard encoding in "printer-input-tray" for all the machine-readable (non-localized) columnar objects in prtInputTable [RFC3805]. The ABNF is also available externally [ABNF].

Figure 8 - ABNF for "printer-input-tray" Values

```
printer-input-tray  = *input-required *[input-optional]
    ; set of input elements encoded into one value

input-required      = input-req ";"
input-req           = input-type /
                      input-media-feed /
                      input-media-xfeed /
                      input-max-capacity /
                      input-level /
                      input-status /
                      input-name

input-optional      = input-opt ";"
```

```
1556        input-opt           = input-index /
1557                              input-dim-unit /
1558                              input-unit /
1559                              input-media-name /
1560                              input-media-weight /
1561                              input-media-type /
1562                              input-media-color /
1563                              input-ext
1564
1565        input-type          = "type" "=" 1*ALPHA
1566            ; enumerated value as an alpha string (e.g.,
1567            ; 'sheetFeedAutoRemovableTray') of prtInputType in [RFC3805] mapped
1568            ; indirectly from the *label* in PrtInputTypeTC in [IANAPRT]
1569
1570        input-media-feed    = "mediafeed" "="  1*[DIGIT / "-"]
1571            ; integer value as a numeric string mapped directly from
1572            ; prtInputMediaDimFeedDirDeclared in [RFC3805]
1573
1574        input-media-xfeed   = "mediaxfeed" "="  1*[DIGIT / "-"]
1575            ; integer value as a numeric string mapped directly from
1576            ; prtInputMediaDimXFeedDirDeclared in [RFC3805]
1577
1578        input-max-capacity  = "maxcapacity" "=" 1*[DIGIT / "-"]
1579            ; integer value as a numeric string mapped directly from
1580            ; prtInputMaxCapacity in [RFC3805]
1581
1582        input-level         = "level" "=" 1*[DIGIT / "-"]
1583            ; integer value as a numeric string mapped directly from
1584            ; prtInputCurrentLevel in [RFC3805]
1585
1586        input-status        = "status" "=" 1*DIGIT
1587            ; integer value as a numeric string mapped directly from
1588            ; prtInputStatus in [RFC3805]
1589
1590        input-name          = "name" "=" 1*ALPHA
1591            ; string value as an alpha string mapped directly from
1592            ; prtInputName in [RFC3805]
1593
1594        input-index         = "index" "=" 1*DIGIT
1595            ; integer value as a numeric string mapped directly from
1596            ; prtInputIndex in [RFC3805]
1597
1598
1599        input-dim-unit      = "dimunit" "=" 1*ALPHA
1600            ; enumerated value as an alpha string (e.g., 'other') of
1601            ; prtInputDimUnit in [RFC3805] mapped indirectly from
1602            ; the *label* in PrtMediaUnitTC in [RFC3805]
1603
1604        input-unit          = "unit" "=" 1*ALPHA
1605            ; enumerated value as an alpha string (e.g., 'other') of
1606            ; prtInputCapacityUnit in [RFC3805] mapped indirectly from
1607            ; the *label* in PrtCapacityUnitTC in [RFC3805]
1608
1609        input-media-name    = "medianame" "=" 1*ALPHA
1610            ; string value as an alpha string mapped directly from
1611            ; prtInputMediaName in [RFC3805]
```

```
1612
1613        input-media-weight  = "mediaweight" "=" 1*[DIGIT / "-"]
1614            ; integer value as a numeric string mapped directly from
1615            ; prtInputMediaWeight in [RFC3805]
1616
1617        input-media-type    = "mediatype" "=" 1*ALPHA
1618            ; string value as an alpha string mapped directly from
1619            ; prtInputMediaType in [RFC3805]
1620
1621        input-media-color   = "mediacolor" "=" 1*ALPHA
1622            ; string value as an alpha string mapped directly from
1623            ; prtInputMediaColor in [RFC3805]
1624
1625        input-ext           = input-extname "=" input-extvalue
1626        input-extname       = 1*[ALPHA / DIGIT / "-"]
1627        input-extvalue      = 1*[ALPHA / DIGIT / "-" / "." / ","]
1628            ; extension point for other MIB values not mapped
1629
```

1630   **6.6.26.3 Examples of printer-input-tray**

1631   The following example shows two rows of the machine-readable (non-localized) columnar
1632   objects from prtInputTable encoded into corresponding values of "printer-input-tray".

1633   Note: Line breaks are shown below for readability of this example. Line breaks MUST NOT
1634   be encoded into actual values of "printer-input-tray".

```
1635        printer-input-tray[1] =
1636            type=sheetFeedAutoRemovableTray;
1637            mediafeed=110000;mediaxfeed=85000;
1638            maxcapacity=500;level=100;status=8;name=Tray1;
1639            index=1;dimunit=tenThousandthsOfInches;unit=sheets;
1640            medianame=na-letter;mediaweight=-2;
1641            mediatype=stationery;mediacolor=blue;
1642
1643        printer-input-tray[2] =
1644            type=sheetFeedAutoRemovableTray;
1645            mediafeed=110000;mediaxfeed=85000;
1646            maxcapacity=100;level=20;status=8;name=Tray2;
1647            index=2;dimunit=tenThousandthsOfInches;unit=sheets;
1648            medianame=na-letter;mediaweight=-2;
1649            mediatype=photographic;mediacolor=white;
```

1650   **6.6.27 printer-mandatory-job-attributes (1setOf keyword)**

1651   This OPTIONAL Printer Description attribute lists the minimum Job Template and
1652   operation attributes that are required for a successful job creation operation. A Printer MAY
1653   reject the job creation operation if the Client does not supply these attributes in its request.

1654   **6.6.28 printer-organization (1setOf text(MAX))**

1655   This RECOMMENDED Printer Description attribute specifies the name of the organization
1656   (e.g., company, university, social club, etc.) that is administratively associated with this

1657   Printer. This attribute is semantically equivalent to the 'o' attribute type in the LDAP User
1658   Schema [RFC4519].

1659   **6.6.29 printer-organizational-unit (1setOf text(MAX))**

1660   This RECOMMENDED Printer Description attribute specifies the name of the
1661   organizational unit (e.g., 'Human Resources', 'Finance', etc.) that is functionally associated
1662   with this Printer. This attribute is semantically equivalent to the 'ou' attribute type in the
1663   LDAP User Schema [RFC4519].

1664   **6.6.30 printer-output-tray (1setOf octetString(MAX))**

1665   This CONDITIONALLY REQUIRED Printer Description attribute provides current output
1666   tray details mapped from the SNMP prtOutputTable defined in IETF Printer MIB v2
1667   [RFC3805]. This attribute MUST be supported if the "output-bin" attribute [PWG5100.2] is
1668   supported.

1669   If supported, this attribute MUST have the same cardinality (contain the same number of
1670   values) as the "output-bin-supported" attribute. The i_{th} value in the "printer-output-tray"
1671   attribute corresponds to the i_{th} value in the "output-bin-supported" attribute.

1672   **6.6.30.1 Keywords for printer-output-tray**

1673   Table 18 defines the IPP datatypes and keywords for encoding "printer-output-tray" from
1674   all of the machine-readable (non-localized) columnar objects in each prtOutputEntry from
1675   prtOutputTable [RFC3805]. Printer MIB objects without corresponding IPP keywords are
1676   not mapped, per DMTF CIM ranking activity in WIMS WG in 2006. A Printer MAY
1677   represent site-unique or vendor-unique information using extension keywords. The
1678   extension syntax is detailed in the ABNF.

1679   **Table 18 - Keywords for "printer-output-tray"**

Printer MIB Object	IPP Datatype	IPP Keyword	Conformance
prtOutputMaxCapacity	Integer	maxcapacity	REQUIRED
prtOutputName	String	name	REQUIRED
prtOutputPageDeliveryOrientation	String	pagedelivery	REQUIRED (1)
prtOutputRemainingCapacity	Integer	remaining	REQUIRED
prtOutputStackingOrder	String	stackingorder	REQUIRED (1)
prtOutputStatus	Integer	status	REQUIRED
prtOutputType	String	type	REQUIRED
prtOutputCapacityUnit	String	unit	RECOMMENDED
prtOutputOffsetStacking	String	offsetstacking	OPTIONAL (2)
prtOutputIndex	Integer	index	DEPRECATED (3)

1680   Notes:

1681　　　　　1. prtOutputStackingOrder and prtOutputPageDeliveryOrientation are REQUIRED
1682　　　　　　 in "printer-output-tray" in order to enable a Client to provide media load
1683　　　　　　 instructions for manual duplexing, envelope, and form printing.
1684　　　　　2. prtOutputOffsetStacking is OPTIONAL because it was rated "B" (medium
1685　　　　　　 priority) in the DMTF CIM ranking activity in WIMS WG in 2006.
1686　　　　　3. prtOutputIndex is DEPRECATED in "printer-output-tray", because correlation
1687　　　　　　 with the original MIB order is considered unimportant.

1688　　**6.6.30.2 Encoding of printer-output-tray**

1689　　Values of "printer-output-tray" MUST be encoded using the Net-ASCII subset of the US-
1690　　ASCII character set [RFC5198]. Control codes (0x00 to 0x1F and 0x7F) MUST NOT be
1691　　used. The ABNF [STD68] in Figure 9 defines the standard encoding in "printer-output-tray"
1692　　for all the machine-readable (non-localized) columnar objects in prtOutputTable
1693　　[RFC3805]. The ABNF is also available externally [ABNF].

1694　　　　　　　　　**Figure 9 - ABNF for "printer-output-tray" Values**

```
1695        printer-output-tray = *output-required *[output-optional]
1696            ; set of output elements encoded into one value
1697
1698        output-required     = output-req ";"
1699        output-req          = output-type /
1700                                output-max-capacity /
1701                                output-page-delivery /
1702                                output-remaining /
1703                                output-stacking-order /
1704                                output-status /
1705                                output-name
1706
1707        output-optional     = output-opt ";"
1708
1709        output-opt          = output-index /
1710                                output-unit /
1711                                output-offset-stacking /
1712                                output-ext
1713
1714        output-type         = "type" "=" 1*ALPHA
1715            ; enumerated value as an alpha string
1716            ; (e.g., 'removableBin') of prtOutputType
1717            ; in [RFC3805] mapped indirectly from
1718            ; the *label* in PrtOutputTypeTC in [IANAPRT]
1719
1720        output-max-capacity = "maxcapacity" "=" 1*[DIGIT / "-"]
1721            ; integer value as a numeric string mapped directly from
1722            ; prtOutputMaxCapacity in [RFC3805]
1723
1724        output-remaining    = "remaining" "=" 1*[DIGIT / "-"]
1725            ; integer value as a numeric string mapped directly from
1726            ; prtOutputRemainingCapacity in [RFC3805]
1727
1728        output-status       = "status" "=" 1*DIGIT
1729            ; integer value as a numeric string mapped directly from
```

```
1730                 ; prtOutputStatus in [RFC3805]
1731
1732        output-name        = "name" "=" 1*ALPHA
1733            ; string value as an alpha string mapped directly from
1734            ; prtOutputName in [RFC3805]
1735
1736        output-index       = "index" "=" 1*DIGIT
1737            ; integer value as a numeric string mapped directly from
1738            ; prtOutputIndex in [RFC3805]
1739
1740        output-unit        = "unit" "=" 1*ALPHA
1741            ; enumerated value as an alpha string (e.g., 'other') of
1742            ; prtOutputCapacityUnit in [RFC3805] mapped indirectly from
1743            ; the *label* in PrtCapacityUnitTC in [RFC3805]
1744
1745        output-stacking-order = "stackingorder" "=" 1*ALPHA
1746            ; enumerated value as an alpha string (e.g., 'firstToLast') of
1747            ; prtOutputStackingOrder in [RFC3805] mapped indirectly from
1748            ; the *label* in PrtOutputStackingOrderTC in [RFC3805]
1749
1750        output-page-delivery = "pagedelivery" "=" 1*ALPHA
1751            ; enumerated value as an alpha string (e.g., 'faceUp') of
1752            ; prtOutputPageDeliveryOrientation in [RFC3805] mapped indirectly
1753            ; from the *label* in PrtOutputPageDeliveryOrientationTC in
1754            ; [RFC3805]
1755
1756        output-offset-stacking = "offsetstacking" "=" 1*ALPHA
1757            ; enumerated value as an alpha string (e.g., 'notPresent') of
1758            ; prtOutputOffsetStacking in [RFC3805] mapped indirectly from
1759            ; the *label* in PresentOnOff in [RFC3805]
1760
1761        output-ext         = output-extname "=" output-extvalue
1762        output-extname     = 1*[ALPHA / DIGIT / "-"]
1763        output-extvalue    = 1*[ALPHA / DIGIT / "-" / "." / ","]
1764            ; extension point for other MIB values not mapped
```

1765 6.6.30.3 Examples of printer-output-tray

1766 The following example shows two rows of the machine-readable (non-localized) columnar
1767 objects from prtOutputTable encoded into corresponding values of "printer-output-tray".

1768 Note: Line breaks are shown below for readability of this example. Line breaks MUST NOT
1769 be encoded into actual values of "printer-output-tray".

```
1770        printer-output-tray[1] =
1771            type=removableBin;
1772            maxcapacity=500;remaining=-3;status=12;name=LeftOutputBin;
1773            index=1;unit=sheets;stackingorder=firstToLast;
1774            pagedelivery=faceDown;offsetstacking=notPresent;
1775
1776        printer-output-tray[2] =
1777            type=removableBin;
1778            maxcapacity=300;remaining=-3;status=0;name=RightOutputBin;
1779            index=2;unit=sheets;stackingorder=firstToLast;
1780            pagedelivery=faceDown;offsetstacking=notPresent;
```

1781   **6.6.31 printer-strings-languages-supported (1setOf naturalLanguage)**

1782   This REQUIRED Printer Description attribute provides a list of languages that are
1783   supported for the "printer-strings-uri" Printer Description attribute (section 6.6.32).

1784   This attribute MUST be supported if the "printer-strings-uri" attribute is supported.

1785   **6.6.32 printer-strings-uri (uri | no-value)**

1786   This REQUIRED Printer Description attribute provides a URI to a "text/strings" message
1787   catalog file. The "text/strings" MIME media type is defined in section 10.1.

1788   If supported, the Printer MUST return a URI corresponding to the language specified by
1789   the "attributes-natural-language" operation attribute or the no-value out-of-band value if the
1790   Printer does not have a localization for the specified language but otherwise supports the
1791   attribute.

1792   The URI MUST use the "https:" or "http:" scheme. The value SHOULD point to a Printer
1793   Resident message catalog so that Client printing does not require access to hosts other
1794   than the one hosting the Printer. The value SHOULD follow the Printer resources best
1795   practices in section 12.2.

1796   Printers SHOULD provide localizations for all supported Job Template attributes,
1797   keywords, and enums as well as localizations for "document-state-reasons", "job-state-
1798   reasons", "notify-event", and "printer-state-reasons" keywords so that a Client may present
1799   a consistent user interface to the User.

1800   This attribute MUST be supported if the "printer-strings-languages-supported" (section
1801   6.6.31) attribute is supported.

1802   **6.6.33 requesting-user-uri-supported (boolean)**

1803   The RECOMMENDED "requesting-user-uri-supported" Printer Description attribute
1804   specifies whether the "requesting-user-uri" (section 6.1.6) operation, "job-originating-user-
1805   uri" (section 6.3.1) Job Description, and "notify-subscriber-user-uri" (section 6.4.2)
1806   Subscription Description attributes are supported. Printers SHOULD support this attribute
1807   with a value of 'true'.

1808   **6.7 Printer Status Attributes**

1809   Table 19 lists the Printer Status attributes defined in this specification, each with its
1810   corresponding conformance requirements.

1811   **Table 19 - New Printer Status Attributes**

Attribute	Conformance
device-service-count	DEPRECATED

device-uuid	REQUIRED
printer-config-change-date-time	RECOMMENDED
printer-config-change-time	RECOMMENDED
printer-supply	REQUIRED
printer-supply-description	REQUIRED
printer-supply-info-uri	REQUIRED
printer-uuid	REQUIRED

6.7.1 device-service-count (integer(1:MAX))

This DEPRECATED Printer Status attribute specifies the number of Printer instances supported by the Imaging Device.

6.7.2 device-uuid (uri(45))

This REQUIRED Printer Status attribute specifies a globally unique identifier for the Imaging Device that MUST be a 45-octet "urn:uuid:" URI [RFC4122].

6.7.3 printer-config-change-date-time (dateTime)

This RECOMMENDED Printer Status attribute records the most recent time at which the 'printer-config-changed' Printer Event occurred whether or not any Subscription objects were listening for this event. This attribute helps a Client or operator to determine how recently any of the Printer description attributes has been changed.

If this attribute is supported, the Printer populates this attribute with the value of its "printer-current-time" attribute on power-up so that it always has a value. Whenever the 'printer-config-changed' Printer Event occurs, the Printer updates this attribute with the value of the Printer's "printer-current-time" attribute.

6.7.4 printer-config-change-time (integer(1:MAX))

This RECOMMENDED Printer Status attribute records the most recent time at which the 'printer-config-changed' Printer Event occurred whether or not any Subscription objects were listening for this event. This attribute helps a Client or operator to determine how recently any of the Printer description attributes has been changed.

On power-up, the Printer populates this attribute with the value of its "printer-up-time" attribute so that it always has a value. Whenever the 'printer-config-changed' Printer Event

1834   occurs, the Printer updates this attribute with the value of the Printer's "printer-up-time"
1835   attribute.

6.7.5 printer-supply (1setOf octetString(MAX))

1836

1837   This REQUIRED Printer Status attribute provides current supply details mapped from the
1838   prtMarkerSuppliesTable and prtMarkerColorantTable objects defined in IETF Printer MIB
1839   v2 [RFC3805].

1840   This attribute MUST be supported if the "printer-supply-description" Printer Description
1841   attribute (section 5.5.22) is supported. If supported, this attribute MUST have the same
1842   cardinality (contain the same number of values) as the "printer-supply-description"
1843   attribute. The i_{th} value in the "printer-supply" attribute corresponds to the i_{th} value in the
1844   "printer-supply-description" attribute.

6.7.5.1 Keywords for printer-supply

1845

1846   Table 20 defines the IPP datatypes and keywords for encoding "printer-supply" from all of
1847   the machine-readable (non-localized) columnar objects in prtMarkerSuppliesTable and
1848   prtMarkerColorantTable [RFC3805]. A Printer MAY represent site-unique or vendor-unique
1849   information using extension keywords. The extension syntax is detailed in the ABNF.

1850   **Table 20 - Keywords for "printer-supply"**

Printer MIB Object	IPP Datatype	IPP Keyword	Conformance
prtMarkerSuppliesType	String	type	REQUIRED
prtMarkerSuppliesMaxCapacity	Integer	maxcapacity	REQUIRED
prtMarkerSuppliesLevel	Integer	level	REQUIRED
prtMarkerColorantValue	String	colorantname	REQUIRED
prtMarkerSuppliesClass	String	class	RECOMMENDED
prtMarkerSuppliesSupplyUnit	String	unit	RECOMMENDED
prtMarkerColorantIndex	Integer	colorantindex	OPTIONAL
prtMarkerColorantRole	String	colorantrole	OPTIONAL
prtMarkerColorantTonality	Integer	coloranttonality	OPTIONAL
prtMarkerSuppliesMarkerIndex	Integer	markerindex	OPTIONAL (1)
prtMarkerSuppliesIndex	Integer	index	DEPRECATED (2)

1851   Notes:

1852   1 - prtMarkerSuppliesMarkerIndex is OPTIONAL in "printer-supply" because most
1853   Printers don't have multiple markers.

1854   2 - prtMarkerSuppliesIndex is DEPRECATED in "printer-supply" because correlation
1855   with the original MIB order is considered unimportant.

1856 **6.7.5.2 Encoding of printer-supply**

1857 Values of "printer-supply" MUST be encoded using the Net-ASCII subset of the US-ASCII
1858 character set [RFC5198]. Control codes (0x00 to 0x1F and 0x7F) MUST NOT be
1859 used. The ABNF [STD68] in Figure 10 defines the standard encoding in "printer-supply" for
1860 all the machine-readable (non-localized) columnar objects in prtMarkerSuppliesTable and
1861 prtMarkerColorantTable [RFC3805]. The ABNF is also available externally [ABNF].

1862   **Figure 10 - ABNF for "printer-supply" Values**

```
1863         printer-supply      = *supply-required *[supply-optional]
1864            ; set of supply elements encoded into one value
1865
1866         supply-required     = supply-req ";"
1867         supply-req          = supply-type /
1868                               supply-max-capacity /
1869                               supply-level /
1870                               colorant-name
1871
1872         supply-optional     = supply-opt ";"
1873         supply-opt          = supply-index /
1874                               marker-index /
1875                               supply-class /
1876                               supply-unit /
1877                               colorant-index /
1878                               colorant-role /
1879                               colorant-tonality /
1880                               supply-ext
1881
1882         supply-type         = "type" "=" 1*ALPHA
1883            ; enumerated value as an alpha string (e.g., 'toner') of
1884            ; prtMarkerSuppliesType in [RFC3805] mapped indirectly from
1885            ; the *label* in PrtMarkerSuppliesTypeTC in [IANAPRT]
1886
1887         supply-max-capacity = "maxcapacity" "=" 1*[DIGIT / "-"]
1888            ; integer value as a numeric string mapped directly from
1889            ; prtMarkerSuppliesMaxCapacity in [RFC3805]
1890
1891         supply-level        = "level" "=" 1*[DIGIT / "-"]
1892            ; integer value as a numeric string mapped directly from
1893            ; prtMarkerSuppliesLevel in [RFC3805]
1894
1895         colorant-name       = "colorantname" "=" 1*ALPHA
1896            ; string value as an alpha string mapped directly from
1897            ; prtMarkerColorantValue in [RFC3805]
1898
1899         supply-index        = "index" "=" 1*DIGIT
1900            ; integer value as a numeric string mapped directly from
1901            ; prtMarkerSuppliesIndex in [RFC3805]
1902
1903         marker-index        = "markerindex" "=" 1*DIGIT
1904            ; integer value as a numeric string mapped directly from
1905            ; prtMarkerSuppliesMarkerIndex in [RFC3805]
1906
```

```
1907      supply-class      = "class" "=" 1*ALPHA
1908          ; enumerated value as an alpha string (e.g., 'other') of
1909          ; prtMarkerSuppliesClass in [RFC3805] mapped indirectly from
1910          ; the *label* in PrtMarkerSuppliesClassTC in [RFC3805]
1911
1912      supply-unit       = "unit" "=" 1*ALPHA
1913          ; enumerated value as an alpha string (e.g., 'other') of
1914          ; prtMarkerSuppliesSupplyUnit in [RFC3805] mapped indirectly from
1915          ; the *label* in PrtMarkerSuppliesSupplyUnitTC in [RFC3805]
1916
1917      colorant-index    = "colorantindex" "=" 1*DIGIT
1918          ; integer value as a numeric string mapped directly from
1919          ; prtMarkerColorantIndex in [RFC3805]
1920
1921      colorant-role     = "colorantrole" "=" 1*ALPHA
1922          ; enumerated value as an alpha string (e.g., 'other') of
1923          ; prtMarkerColorantRole in [RFC3805] mapped indirectly from
1924          ; the *label* in PrtMarkerColorantRoleTC in [RFC3805]
1925
1926      colorant-tonality = "coloranttonality" "=" 1*DIGIT
1927          ; integer value as a numeric string mapped directly from
1928          ; prtMarkerColorantTonality in [RFC3805]
1929
1930      supply-ext        = supply-extname "=" supply-extvalue
1931          ; extension point for other MIB values not mapped
1932          ; or site-unique / vendor-unique additional info
1933
1934      supply-extname    = 1*[ALPHA / DIGIT / "-"]
1935      supply-extvalue   = 1*[ALPHA / DIGIT / "-" / "." / ","]
```

6.7.5.3 Colorant Names in printer-supply

Colorant names in "printer-supply" values not listed or referenced in the IETF Printer MIB v2 MUST conform to the color names and extension formats defined in the PWG Media Standardized Names v2.0 [PWG5101.1], e.g., "light-cyan", "com.example-light-magenta_ff7fffff", etc. This allows Clients to present supply level monitoring user interface with the appropriate colors. Table 21 lists the standard colorant names with their corresponding reference sRGBA values.

Table 21 - Standard Colorant Names for "printer-supply"

Name	sRGBA Value	Sample
no-color	Undefined	
black	0x000000FF	
light-black	0x808080FF	
blue	0x0000FFFF	
cyan	0x00FFFFFF	
light-cyan	0xE0FFFFFF	
gold	0xFFD700FF	
gray	0x808080FF	
dark-gray	0x404040FF	
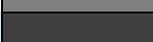
light-gray	0xD3D3D3FF	
green	0x008000FF	
magenta	0xFF00FFFF	
light-magenta	0xFF77FFFF	
multi-color	Undefined	
orange	0xFFA500FF	
red	0xFF0000FF	
silver	0xC0C0C0FF	
white	0xFFFFFFFF	
yellow	0xFFFF00FF	
dark-yellow	0xFFCC00FF	
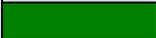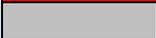
1944   **6.7.5.4 Example of printer-supply**

1945   Figure 11 shows the values of "printer-supply" in "PAPI" syntax encoding [PAPI],
1946   presenting seven rows of the machine-readable (non-localized) columnar objects from
1947   prtMarkerSuppliesTable and prtMarkerColorantTable.

1948   Note: Line breaks are shown below for readability of this example. Line breaks MUST
1949   NOT be encoded into actual values of "printer-supply", as per section 6.7.5.2.

1950   **Figure 11 - Example values for "printer-supply" Printer Status attribute**

```
1951   printer-supply[1] =
1952   "type=tonerCartridge;maxcapacity=100;level=56;unit:percent;
1953   colorantname=black;colorantindex=1;colorantrole=process;
1954   coloranttonality=128;class=supplyThatIsConsumed",
1955
1956   printer-supply[2] =
1957   "type=tonerCartridge;maxcapacity=100;level=77;unit:percent;
1958   colorantname=cyan;colorantindex=2;colorantrole=process;
1959   coloranttonality=128;class=supplyThatIsConsumed",
1960
1961   printer-supply[3] =
1962   "type=tonerCartridge;maxcapacity=100;level=19;unit:percent;
1963   colorantname=magenta;colorantindex=3;colorantrole=process;
1964   coloranttonality=128;class=supplyThatIsConsumed",
1965
1966   printer-supply[4] =
1967   "type=tonerCartridge;maxcapacity=100;level=31;unit:percent;
1968   colorantname=yellow;colorantindex=4;colorantrole=process;
1969   coloranttonality=128;class=supplyThatIsConsumed",
1970
1971   printer-supply[5] =
1972   "type=wasteToner;maxcapacity=100;level=67;unit=percent;
1973   colorantname=no-color;colorantindex=77;colorantrole=other;class=other",
1974
1975   printer-supply[6] =
1976   "type=fuser;maxcapacity=100;level=89;unit:percent;
1977   colorantname=no-color;colorantindex=88;colorantrole=other;class:other",
1978
```

```
1979      printer-supply[7] =
1980      "type=transferUnit;maxcapacity=100;level=84;unit:percent;
1981      colorantname=no-color;colorantindex=99;colorantrole=other;class:other"
```

6.7.6 printer-supply-description (1setOf text(MAX))

This RECOMMENDED attribute provides current supply descriptions mapped from the SNMP prtMarkerSuppliesDescription object in the prtMarkerSuppliesTable defined in IETF Printer MIB v2 [RFC3805].

This attribute MUST be supported if the "printer-supply" attribute (section 6.7.5) is supported. If supported, this attribute MUST have the same cardinality (contain the same number of values) as the "printer-supply" attribute. The i_{th} value in the "printer-supply-description" attribute corresponds to the i_{th} value in the "printer-supply" attribute.

6.7.6.1 Encoding of printer-supply-description

Values of the "printer-supply-description" attribute MUST be mapped from the corresponding human-readable (localized) values of prtMarkerSuppliesDescription, exactly as follows:

1. Each value of prtMarkerSuppliesDescription [RFC3805] MUST be converted from the character set specified by prtGeneralCurrentLocalization [RFC3805] and prtLocalizationCharacterSet [RFC3808] into the character set specified by "charset-configured" and then copied into the text value of "printer-supply-description";
2. Each value of "printer-supply-description" MUST be tagged [RFC5646] with the natural language specified by prtGeneralCurrentLocalization [RFC3805], prtLocalizationLanguage [RFC3808], and prtLocalizationCountry [RFC3808]; and
3. Each value of "printer-supply-description" MUST be in the same order as the corresponding value of "printer-supply" (i.e., strictly ascending order according to prtMarkerSuppliesIndex).

6.7.6.2 Example of printer-supply-description

Figure 12 describes in "PAPI" syntax encoding [PAPI] for the "printer-supply-description" values corresponding to the "printer-supply" values from Figure 11, encoding the Printer's prtMarkerSuppliesDescription values in its prtMarkerSuppliesTable.

Note: Line breaks are shown below for readability of this example. Line breaks MUST NOT be encoded into actual values of "printer-supply", as per section 6.7.6.1.

Figure 12 - Example of "printer-supply-description"

```
printer-supply-description[1] = "Black Toner Cartridge S/N:16859422"
printer-supply-description[2] = "Cyan Toner Cartridge S/N:16852765"
printer-supply-description[3] = "Magenta Toner Cartridge S/N:16859681"
printer-supply-description[4] = "Yellow Toner Cartridge S/N:16859372"
printer-supply-description[5] = "Waste Toner Bin S/N:16816815"
```

```
2017        printer-supply-description[6] = "Fuser Kit S/N:16820223"
2018        printer-supply-description[7] = "Transfer Kit S/N:16821304"
```

2019 **6.7.7 printer-supply-info-uri (uri)**

2020 This RECOMMENDED attribute provides a URI referring to a Printer Resident web page
2021 that provides controls for managing the Printer and its supplies, e.g., supply replacement,
2022 head alignment, self-test pages, and so forth. The web page MAY also provide supply part
2023 numbers, links for ordering supplies, and detailed instructions for replacing supplies.

2024 The URI MUST use the "http" or "https" scheme with the Printer. The value SHOULD
2025 follow the Printer resources best practices in section 12.2.

2026 **6.7.8 printer-uuid (uri(45))**

2027 This REQUIRED attribute specifies a globally unique identifier for the Printer. The value
2028 MUST be a 45-octet "urn:uuid" URI as per [RFC4122]. If a Printer object is made available
2029 over multiple network interfaces, it MUST present the same "printer-uuid" value on all
2030 interfaces.

2031 The "printer-uuid" attribute MUST NOT be used as a Printer identifier in IPP Printer
2032 operations but MAY be used as a Printer identifier for other protocol bindings and
2033 SHOULD be used for Printer accounting and auditing.

2034 # 7. Additional Semantics for Existing Operations

2035 ## 7.1 All Operations: "requesting-user-uri"

2036 If the Printer supports the "requesting-user-uri" (section 6.1.6) operation attribute, Clients
2037 MAY supply it in a Create-Job, Create-Job-Subscription, Create-Printer-Subscription, Print-
2038 Job, or Print-URI operation. The Printer object sets the "job-originating-user-uri" (section
2039 6.3.1) or "notify-subscriber-user-uri" (section 6.4.2) attribute as needed to the most
2040 authenticated URI that it can obtain from the authentication service over which the IPP
2041 operation was received. Only if such an authenticated URI is not available, does the
2042 Printer object use the value supplied by the Client in the "requesting-user-uri" operation of
2043 the operation (see IPP/1.1 Model and Semantics [STD92] sections 5.4.2, 5.4.3 and 9).

2044 ## 7.2 Get-Printer-Attributes Operation: "first-index" and "limit"

2045 Clients MAY provide and Printers MAY support job creation attributes beyond "document-
2046 format" to filter the response. The "printer-get-attributes-supported" Printer Description
2047 attribute (section 6.6.23) specifies which job creation attributes are supported by the Get-
2048 Printer-Attributes operation and MUST include "document-format".

2049 In addition, if a Printer supports the "media-col-database" Printer Description attribute
2050 [PWG5100.7], the Client MAY provide and the Printer SHOULD support the "first-index"

2051 (section 6.1.3) and "limit" ([STD92]) operation attributes to limit the number of "media-col-
2052 database" values that are returned in the response.

7.3 Get-Subscriptions Operation: "first-index" and "limit"

2054 If the Printer supports the Get-Subscriptions operation, Clients MAY provide and Printers
2055 MUST support the "first-index" operation attribute (section 6.1.3) in conjunction with the
2056 "limit" operation attribute ([STD92]) to select the first Subscription object that is returned in
2057 the response.

7.4 Get-Jobs Operation: "first-index" and "limit"

2059 Clients MAY provide and Printers MUST support the "first-index" operation attribute
2060 (section 6.1.3) in conjunction with the "limit" operation attribute ([STD92]) to select the first
2061 Job object that is returned in the response.

7.5 Get-Documents Operation: "first-index" and "limit"

2063 If the Printer supports the Get-Documents operation, Clients MAY provide and Printers
2064 MUST support the "first-index" operation attribute (section 6.1.3) in conjunction with the
2065 "limit" operation attribute ([STD92]) to select the first Document object that is returned in
2066 the response.

7.6 Print-Job, Print-URI, Send-Document, and Send-URI Operations: "document-metadata"

2069 Clients MAY supply and Printers MUST support the "document-metadata" (section 6.1.1)
2070 operation attribute in the Print-Job, Print-URI, Send-Document, or Send-URI operations.

2071 If the Printer conforms to the IPP Document Object [PWG5100.5], the Printer object MUST
2072 copy the attribute value to the Document object, otherwise the Printer object MUST copy
2073 the attribute value to the Job object.

7.7 Print-Job, Print-URI, Send-Document, and Send-URI Operations: "document-password"

2076 If the Printer supports the "document-password" (section 6.1.2) operation attribute, Clients
2077 MAY supply it in a Print-Job, Print-URI, Send-Document, or Send-URI operation. The
2078 Printer object MUST treat the attribute value as private and confidential, MUST retain the
2079 value as long as the corresponding Job and Document are retained, MUST NOT persist
2080 the value beyond the life of the Job or Document, MUST NOT return the value in the

2081   response to the request, and MUST NOT set any Job or Document object attribute with the
2082   value of the "document-password" attribute.

2083   If the Printer receives a request containing the "document-password" operation attribute
2084   prior to negotiation of a TLS session, it MUST return the 'client-error-bad-request' status
2085   code to the Client.

2086   If the Printer determines that the supplied "document-password" value is not correct, it
2087   MUST return the 'client-error-document-password-error' (section 9.1) status code to the
2088   Client if a response has not already been sent and add the 'document-password-error'
2089   keyword to the "job-state-reasons" and, if supported, "document-state-reasons" attributes.

2090   If the Printer determines that the supplied "document-password" value is correct but the
2091   Document does not allow printing, it MUST return the 'client-error-document-permission-
2092   error' status code to the Client if a response has not already been sent and add the
2093   'document-permission-error' keyword to the "job-state-reasons" and, if supported,
2094   "document-state-reasons" attributes.

2095   **7.8 Validate-Job Operation: "document-password"**

2096   Clients MUST NOT send the "document-password" operation attribute (section 6.1.2) in a
2097   Validate-Job request. Printers MUST reject a Validate-Job request containing a
2098   "document-password" operation attribute and return the client-error-bad-request status
2099   code.

2100   **7.9 Validate-Job Operation: "preferred-attributes"**

2101   Printers MAY support returning the values for specific Job Template attributes that would
2102   actually be used (or that the Printer would prefer to use) based on the job creation
2103   attributes included in the Validate-Job request. Each Job Template attribute is returned as
2104   a member attribute in the "preferred-attributes" attribute in the Operation Attributes Group.

2105   Printers indicate their support for this functionality by listing the Job Template attributes
2106   that may be returned in the "preferred-attributes-supported" Printer Description attribute
2107   (section 6.6.15).

2108   # 8. Additional Values and Semantics for Existing Attributes

2109   **8.1 document-state-reasons (1setOf type2 keyword) and job-state-**
2110   **reasons (1setOf type2 keyword)**

2111   Table 22 lists new "document-state-reasons" and "job-state-reasons" keyword values.

2112   **Table 22 - New "document-state-reasons" and "job-state-reasons" Keyword Values**

Keyword	Description
document-password-error	The Printer detected an incorrect document content password and was unable to unlock the document for printing. This value MUST be supported if the "document-password" (section 6.1.2) operation attribute is supported.
document-permission-error	The Printer was able to unlock the document but the document permissions do not allow for printing. This value MUST be supported if the "document-password" (section 6.1.2) operation attribute is supported.
document-security-error	The Printer detected security issues (virus, trojan horse, or other malicious software) embedded within the document. Whether the Printer aborts the job and moves the job to the 'aborted' job state or prints all documents that do not contain detected security issues and moves the job to the 'completed' job state and adds the 'completed-with-errors' value in the job's "job-state-reasons" attribute depends on implementation and/or site policy. This value SHOULD be supported.
document-unprintable-error	The Printer determined that the document was unprintable. This reason is intended to cover any issues of file size, format version, or complexity that would prevent the Printer from printing the document. Whether the Printer aborts the job and moves the job to the 'aborted' job state or prints all documents that do not contain detected security issues and moves the job to the 'completed' job state and adds the 'completed-with-errors' value in the job's "job-state-reasons" attribute depends on implementation and/or site policy. This value SHOULD be supported.

2113 ## 8.2 finishings (1setOf type2 enum)

2114 Table 23 lists new enum values for the "finishings" Job Template attribute that SHOULD
2115 be supported by Printers with roll-fed media.

2116 **Table 23 - New "finishings" Enum Values**

Value	Symbolic Name and Description
'60'	'trim-after-pages': Trim output after each page.
'61'	'trim-after-documents': Trim output after each document.

| **'62'** | 'trim-after-copies': Trim output after each copy. |
| '63' | 'trim-after-job': Trim output after job. |

8.3 media-source (type2 keyword | name(MAX))

This specification adds the new 'virtual' keyword value for the "media-source" member of "media-col" [PWG5100.7] to indicate a "virtual paper tray", to allow a Printer to indicate that it can produce a particular output size from some other media source (e.g. produce A4 output from A3 media, produce A3 output from A0 media using a cutter, etc.).

8.4 orientation-requested (type2 enum)

A new 'none' (7) value can be used with the "orientation-requested" Job Template attribute to specify that the Printer should not perform any rotations for orientation.

8.5 print-content-optimize (type2 keyword)

A new 'auto' value can be used with the "print-content-optimize" Job Template attribute [PWG5100.7] to specify that the Printer should automatically determine the best optimizations to perform when printing the document.

8.6 print-quality (type2 enum)

The following new enum values for the "print-quality" attribute allow a Printer to specify support for additional printer-specific print quality options that the Client can specify the Printer use for a Job. A Printer that supports any of the enum labels defined here MUST provide localized labels for each using the Localization Message Catalog available at the URL specified by "printer-strings-uri" (section 6.6.32). The Message Catalog localized strings provide the localization and the meaning of that enum for its own implementation. A Printer SHOULD also provide a localized "tool tip" using the "_tooltip" label extensions to

2137 the Message Catalog (section 10.1) to provide some contextual help for the vendor-unique
2138 or site-unique label string.

Enum Value	Enum Label	Description
3	draft	[STD92]
4	normal	[STD92]
5	high	[STD92]
10	custom-10	Lowest custom print quality level
11	custom-11	Custom print quality level lower that 'custom-12'
12	custom-12	Custom print quality level lower that 'draft'
16	custom-16	Custom print quality level higher than 'high'
17	custom-17	Custom print quality level higher than 'custom-16'
18	custom-18	Highest custom print quality level
20	custom-20	Non-linear custom print quality
21	custom-21	Non-linear custom print quality
22	custom-22	Non-linear custom print quality

2139 The string catalog entries for each of these might look like this:

```
2140    "print-quality.10" = "EcoWickedDrafty";
2141    "print-quality.12" = "EcoDrafty";
2142    "print-quality.3"  = "Draft";
2143    "print-quality.4"  = "Normal";
2144    "print-quality.5"  = "High";
2145    "print-quality.16" = "Max";
2146    "print-quality.18" = "MegaMax";
2147    "print-quality.20" = "Non-linear Ennui";
2148    "print-quality.21" = "Non-linear Trepidation";
2149    "print-quality.22" = "Non-linear Happiness";
2150
2151    "print-quality.10._tooltip" = "Usable only for rough layout";
2152    "print-quality.12._tooltip" = "Lower quality with greatly reduced toner use";
2153    "print-quality.3._tooltip"  = "Low quality with less toner use";
2154    "print-quality.4._tooltip"  = "Average quality - best for everyday use";
2155    "print-quality.5._tooltip"  = "Higher quality";
2156    "print-quality.16._tooltip" = "Maximum quality";
2157    "print-quality.18._tooltip" = "Super Maximum quality";
2158    "print-quality.20._tooltip" = "Produces output that makes you bored";
2159    "print-quality.21._tooltip" = "Produces output that makes you nervous ";
2160    "print-quality.22._tooltip" = "Produces output that makes you kinder";
```

8.7 printer-state-reasons (1setOf type2 keyword)

Table 24 lists new keyword values for the "printer-state-reasons" Printer Description attribute that MUST be supported by Printers that report the corresponding Printer MIB [RFC3805] supply types.

Table 24 - New "printer-state-reasons" Keyword Values

Keyword	Description
cleaner-life-almost-over	A cleaning component corresponding to the Printer MIB prtMarkerSuppliesType values cleanerUnit(18) and fuserCleaningPad(19) is nearing the end of its service life.
cleaner-life-over	A cleaning component corresponding to the Printer MIB prtMarkerSuppliesType values cleanerUnit(18) and fuserCleaningPad(19) has reached the end of its service life.

8.8 uri-authentication-supported (1setOf type2 keyword)

The 'negotiate' keyword value MUST be used to indicate support for HTTP Negotiate authentication based on SPNEGO-based Kerberos and NTLM HTTP Authentication in Microsoft Windows [RFC4559].

9. Status Codes

9.1 client-error-document-password-error (0x418)

The Client has attempted to submit a Document using the Print-Job, Print-URI, Send-Document, or Send-URI operations with the wrong passphrase. The Client MAY try the request again with a new passphrase.

9.2 client-error-document-permission-error (0x419)

The Client has attempted to submit a Document using the Print-Job, Print-URI, Send-Document, or Send-URI operations that does not allow printing. The Client MUST NOT retry the request using the same document.

2179 **9.3 client-error-document-security-error (0x41A)**

2180 The Printer has detected security issues (virus, trojan horse, or other malicious software)
2181 embedded within the document and will not accept it for printing.

2182 **9.4 client-error-document-unprintable-error (0x41B)**

2183 The Printer has determined that the document is unprintable due to size, format version, or
2184 complexity and will not accept it for printing.

2185 # 10. Localization of Attributes and Values

2186 The "printer-strings-uri" Printer Description attribute (section 6.6.32) provides the location
2187 of a language-specific, Printer Resident message catalog file that provides localizations for
2188 attribute names, keyword values, and enum values.

2189 ## 10.1 Message Catalog File Format

2190 This specification defines a new plain text message catalog format (MIME media type
2191 "text/strings") based on the Apple "strings" file format to allow Printers to supply and
2192 Clients to present localized strings for supported attributes values. A sample English
2193 localization for registered IPP attributes, enum values, and keyword values is available on
2194 the PWG FTP server [PWG-CATALOG]. Boolean, dateTime, and integer values are not
2195 localizable using this format, and name and text values are presumed to already be
2196 localized [STD92].

2197 Message catalog files consist of lines of UTF-8 encoded Unicode text following the general
2198 "KEY = VALUE" form. The KEY and VALUE elements can be wrapped in double quotes.:

```
2199        "attribute-name" = "Localized Attribute Name Label";
2200        "attribute-name.enum-value" = "Localized Enum Value Label";
2201        "attribute-name.keyword-value" = "Localized Keyword Value Label";
2202        /* Comment for/to localizers */
```

2203 Lines in a Message Catalog file can be terminated by a single line feed (%x0A) or a
2204 combination of carriage return and line feed (%x0D.0A). All lines in a Message Catalog file
2205 MUST use identical line terminators for consistency. Attribute names and values are
2206 limited to the characters defined for the IPP keyword value syntax [STD92].

2207 Control characters (%x00-1F, %x7F), the double quote (%x22), and the backslash (%x5C)
2208 MUST be escaped in localized strings using a subset of the C language syntax:

2209   \"   A double quote (%x22)

2210   \\   A backslash (%x5C)

2211   \n   A line feed (%x0A)

2212   \r   A carriage return (%x0D)

2213   \t   A horizontal tab (%x09)

2214   \###   An octet represented by 3 octal digits

2215   A more complete example is in section 10.3.

10.2 Message Catalog Help Resources

2217 A Message Catalog MAY also contain two types of "help" content. The "_tooltip" suffix can
2218 be used to specify brief help content suitable for contextual presentation such as when a
2219 mouse pointer is hovered over a label. The "_helpurl" suffix can be used to specify a URL
2220 to more detailed, rich and possibly lengthy help content that could be presented in a
2221 separate "help" window. The general form is like so:

```
"attribute-name._tooltip" = "Localized Attribute Name Tooltip Help String"
"attribute-name._helpurl" = "URL to localized attribute help content"

"attribute-name.enum-value._tooltip" = "Localized Enum Value Tooltip Help
String"
"attribute-name.enum-value._helpurl" = "URL to localized enum value help
content"

"attribute-name.keyword-value._tooltip" = "Localized Keyword Value Tooltip
Help String"
"attribute-name.keyword-value._helpurl" = "URL to localized keyword value
help content"
```

2234 A more complete example is in section 10.3.

10.3 Message Catalog Example

2236 A Printer that specifies two collections in its "media-col-ready" [PWG5100.7], one that
2237 specifies 'stationery' for its "media-type " value, and the other that specifies 'smi32473-eco-
2238 lite' for its "finishing-template" value, can implement among others the following attributes
2239 and values, represented using "PAPI" syntax:

```
printer-uri="https://myprinter.local.:631/ipp/print"
printer-strings-uri="https://myprinter.local.:631/ipp/en.strings"
media-col-ready={
    media-type="stationery"
    media-source="tray-1"
    media-size={
        x-dimension=21000
        y-dimension=29700
    }
    media-top-margin=500
```

```
2250            media-bottom-margin=500
2251            media-left-margin=500
2252            media-right-margin=500
2253        },{
2254            media-type="smi32473-eco-lite"
2255            media-source="tray-2"
2256            media-color=white
2257            media-size={
2258                x-dimension=21590
2259                y-dimension=27940
2260            }
2261            media-bottom-margin=500
2262            media-left-margin=500
2263            media-right-margin=500
2264            media-top-margin=500
2265        }
2266        print-color-mode-supported=
2267            auto,
2268            color,
2269            monochrome,
2270            smi32473-magic-color,
2271            smi32473-blueprint
2272        print-color-mode-icc-profiles={
2273            print-color-mode=smi32473-magic-color
2274            print-color-mode-profile-uri=https://myprinter.local.:631/sp/magic-
2275            color.icc
2276        },{
2277            print-color-mode=smi32473-blueprint
2278            print-color-mode-profile-
2279            uri=https://myprinter.local.:631/sp/blueprint.icc
2280        }
2281
```

2282   The Printer's Message Catalog corresponding to "attributes-natural-language" = 'en-us'
2283   might include the following:

```
2284        media-type = "Media Type";
2285        media-type.stationery = "Stationery";
2286        media-type.stationery._tooltip = "Conventional Stationery";
2287        media-type.stationery._helpurl = "//_help/media-types.html";
2288        media-type.smi32473-eco-lite = "PWG Eco Lite";
2289        media-type.smi32473-eco-lite._tooltip = "Lightweight paper that may tear";
2290        media-type.smi32473-eco-lite._helpurl = "//_help/media-types.html#ecolite";
2291        print-color-mode = "Print Color Mode";
2292        print-color-mode.auto = "Automatic";
2293        print-color-mode.auto-monochrome = "Auto Monochrome";
2294        print-color-mode.bi-level = "Text";
2295        print-color-mode.color = "Color";
2296        print-color-mode.highlight = "Highlight";
2297        print-color-mode.monochrome = "Monochrome";
2298        print-color-mode.process-bi-level = "Process Text";
2299        print-color-mode.process-monochrome = "Process Monochrome";
2300        print-color-mode.smi32473-magic-color = "Magic Color";
2301        print-color-mode.smi32473-magic-color._tooltip = "Makes the colors look
2302            magical";
2303        print-color-mode.smi32473-blueprint = "Blueprint";
```

```
2304    print-color-mode.smi32473-blueprint._tooltip = "Blue background with white
2305        foreground lines";
```

2306

10.4 Message Catalog ABNF

2308 Figure 13 provides the ABNF [STD68] for files conforming to the "text/strings" MIME media
2309 type. The ABNF is also available externally [ABNF].

2310   **Figure 13 - ABNF for the "text/strings" MIME Media Type**

```
2311        CATALOG       = *(MESSAGE / COMMENT / *WSP CFLF / *WSP LF)
2312        MESSAGE       = *WSP DQUOTE %x61-7A *KEYWORD-CHAR DQUOTE
2313                        *WSP "=" *WSP QUOTED-STRING *WSP ";" *WSP (CRLF / LF)
2314        COMMENT       = *WSP "/*" 1*CHAR "*/" *WSP (CRLF / LF)
2315        KEYWORD-CHAR  = %x61-7A / DIGIT / "-" / "." / "_"
2316        QUOTED-STRING = DQUOTE 1*QUOTED-CHAR DQUOTE
2317        QUOTED-CHAR   = %x20-21 /
2318                        %x23-5B /
2319                        %x5C.22 /                        ; \" = "   (%x22)
2320                        %x5C.5C /                        ; \\ = \   (%x5C)
2321                        %x5C.6E /                        ; \n = lf  (%x0A)
2322                        %x5C.71 /                        ; \r = cr  (%x0D)
2323                        %x5C.73 /                        ; \t = ht  (%x09)
2324                        %x5C.30-33.30-37.30-37 /         ; \ooo (octal)
2325                        %x5D-7E /
2326                        %xC0-DF.80-BF /
2327                        %xE0-EF.80-BF.80-BF /
2328                        %xF0-F7.80-BF.80-BF.80-BF
```

2329

2330 11. Relationship of Impressions, Pages, and Sheets

2331 The Internet Printing Protocol/1.1: Model and Semantics [STD92] defines attributes for the
2332 impressions and media sheets in a job, the PWG Standardized Imaging System Counters
2333 1.1 [PWG5106.1] clarifies the definitions of impressions and sheets, the Standard for the
2334 Internet Printing Protocol: Page Overrides [PWG5100.6] defines input pages for page
2335 overrides, and this specification defines new Job Description attributes to track the number
2336 and progress of input pages within the documents of a Job.

2337 Because the various IPP and PWG standards have used slightly different definitions of
2338 impressions, pages, and sheets, and because their interaction with various Job Template
2339 attributes has not been documented, the Job Description attributes for impressions ("job-
2340 impressions" and "job-impressions-completed") and sheets ("job-media-sheets" and "job-
2341 media-sheets-completed") have not been implemented consistently between different
2342 vendors' IPP Printers. Table 25 lists the Job Template attributes that affect reporting of
2343 impressions and sheets. Only the "page-ranges" Job Template attribute affects the page
2344 counts ("job-pages" and "job-pages-completed").

2345 11.1 Examples for Impressions, Pages, and Sheets

2346 11.1.1 Single Document Simplex Job Without Copies

2347 A single-document simplex job has the same number of impressions, pages, and sheets.
2348 Thus, a 10 page document will yield impression and sheet counts of 10 each.

2349 11.1.2 Single Document Duplex Job Without Copies

2350 A single-document duplex jobs ("sides" is "two-sided-long-edge" or "two-sided-short-edge")
2351 has the same number of impressions and pages but half as many sheets. Thus, an 11
2352 page document will yield 11 impressions and 6 sheets - the last sheet will only have one
2353 impression on it.

2354 11.1.3 Two Document Duplex Job With Copies, Number-Up, and Page-Ranges

2355 A two-document duplex job with copies and number-up will have different page,
2356 impression, and sheet counts. For example, a job containing documents of 11 and 28
2357 pages, a "copies" value of 10, a "multiple-document-handling" value of 'single-document', a
2358 "number-up" value of 6, a "page-ranges" value of 1-25, and a "sides" value of 'two-sided-
2359 long-edge' would yield a page count of 39 (11 + 28 pages from two documents), an
2360 impression count of 50 (25 6-up pages produces 5 impressions per copy), and a sheet
2361 count of 30 (5 impressions are printed on a total of 3 pages per copy). Figure 14 shows a
2362 graphical representation of this example.
2363

2364   **Figure 14 - Two Document Duplex Job With Copies, Number-Up, and Page-Ranges**

Job	single-document	page-ranges	number-up	sides

11 pages

28 pages

+

39 pages

25 pages

5 impressions
x
10 copies
=
50 total
impressions

3 sheets
x
10 copies
=
30 total sheets
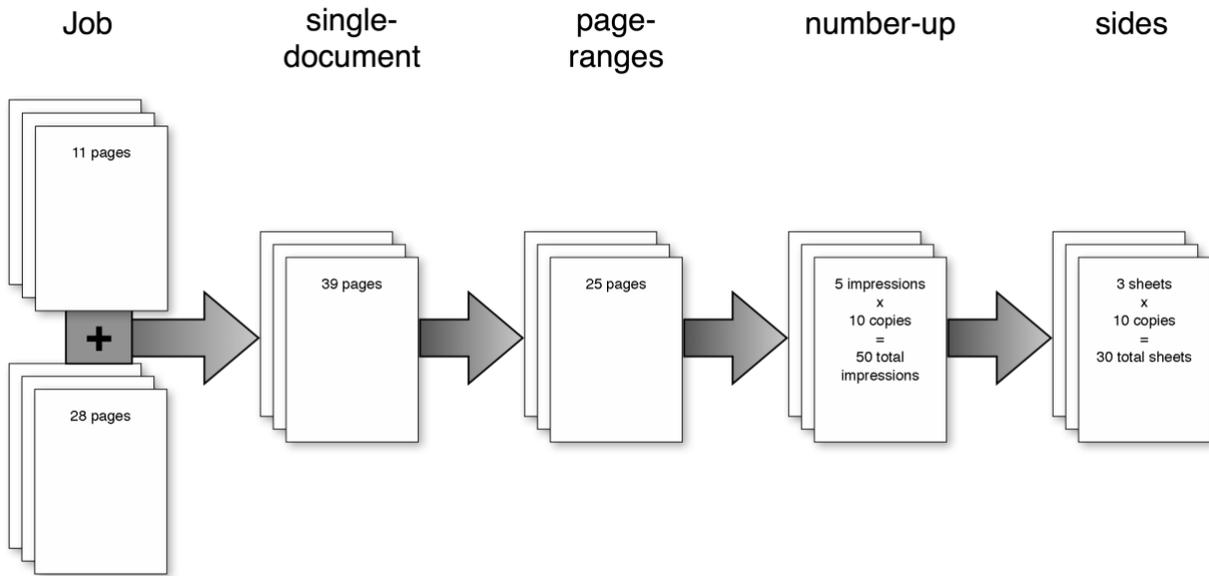
2365

2366 **Table 25 - Job Template Attributes That Affect Impressions and Sheets**

Attribute	Description
copies	Multiplier for impressions and sheets; also see job-copies, multiple-document-handling, and sheet-collate
cover-back	For 'print-none', adds one sheet per set
cover-front	For 'print-none', adds one sheet per set
insert-sheet	Adds N sheets for each copy and, potentially, each document in the Job
job-error-sheet	May add one or more impressions and sheets to the Job
job-sheets	May add one or more impressions and sheets to the Job
multiple-document-handling	For the value 'single-document', duplex Jobs may have a reduced number of sheets per copy when the input documents produce an odd number of impressions; also see copies, imposition-template, job-copies, and number-up
number-up	Generally a divisor for impressions and sheets
overrides	Can override any Job Template attribute (except overrides)
page-ranges	Changes the number of input pages that are processed, thus changing the impressions and sheets accordingly
proof-print	Overrides the copies and job-copies values
separator-sheets	'slip-sheets': adds one impression and sheet between each set in a Job 'start-sheet' and 'end-sheet': adds one impression and sheet for each set in a Job 'both-sheets': adds two impressions and sheets for each set in a Job
sides	For 'two-sided-long-edge' and 'two-sided-short-edge', generally makes sheets half of the number of impressions; also see copies, job-copies, multiple-document-handling, and sheet-collate

12. Implementation Best Practices

12.1 Presets and Triggers

12.1.1 Storing Presets and Triggers

A Client might enable Users to construct new Presets and/or Triggers. In some cases, such as the use case described in section 3.2.27, the User may want to store one or more of those Presets and/or Triggers on the Printer. The Printer will have to advertise it supports updates to its set of Presets, and the Client will have to support identifying that the Printer supports Preset updates and setting an updated set of Presets in the Printer.

A Printer advertises its support for accepting new Presets and Triggers by: supporting the Set-Printer-Attributes and Get-Printer-Supported-Values operations; including Set-Printer-Attributes and Get-Printer-Supported-Values in its "operations-supported" Printer Description attribute [STD92]; including "job-presets-supported" and "job-triggers-supported" in its "printer-settable-attributes-supported" Printer Description attribute [RFC3380]; specifying via a Get-Printer-Supported-Values operation [RFC3380] response the values that the Printer allows in the Set-Printer-Attributes operation for the "job-presets-supported" and "job-triggers-supported" attributes. A Client that implements Printer Preset updates uses the above to detect Printer support.

A Client adds a Preset to a Printer using the Set-Printer-Attributes operation [RFC3380]. The Set-Printer-Attributes operation [RFC3380] semantic is the assignment of a new value to the specified attribute; the attribute and its value sent in the operation request will become the Printer's new attribute value if the operation is successful. For example, to add an additional Preset to a Printer's current "job-presets-supported" attribute, the Client would acquire the current value of the "job-presets-supported" attribute using a Get-Printer-Attributes operation, append or insert the new Preset collection into the set, then perform a Set-Printer-Attributes operation to apply the new set value to the Printer. The result of the Set-Printer-Attributes operation will indicate whether the Printer accepts the update. If the new value is accepted, the Printer will atomically update its "job-presets-supported" attribute. If the he Printer rejects the new value for some reason, it ought to return a suitable status code indicating the underlying cause of the rejection.

12.1.2 Presets User Experience Recommendations

Although user experience is outside the scope of this specification, Client implementors ought to consider several important factors when implementing support for IPP Presets to ensure a good user experience.

After the User selects a Preset, the Client ought to allow the User to change individual settings. For example, if a Preset named "photo" includes "print-quality" of 'high' (5) and "print-color-mode" of 'color', and the User selects that Preset, the Client ought to allow the

2403   User to change the "print-quality" to some other value even after the User has selected
2404   that Preset.

2405   A Client SHOULD list available Presets by name wherever it presents printing choices to
2406   the User. The individual Presets might have originated in the Printer, or they might be local
2407   to the Client. When a User selects a Preset, the Client copies all Preset member attributes
2408   to the Job Creation Request.

2409   Client implementors might want to consider appropriate behavior in response to the User
2410   changing a setting and then the User chooses a Preset that overrides that earlier selection.
2411   The Client could notify the User that the setting will be changed. Alternately, the Client
2412   could apply the Preset but not change the setting changed by the User, or let the selected
2413   Preset overwrite the previous User selection.

2414   **12.1.3 Triggers User Experience Recommendations**

2415   The Client applies the Preset specified by the Trigger upon detecting that the pending
2416   Job's settings values match all the Trigger's members. Client implementors ought to
2417   consider cases where Triggers are disabled, such as following manual selection by a user,
2418   or perhaps only allowing one Trigger per "print dialog session" to be used. A Trigger ought
2419   to be applied only in response to user input, and not in response to a value being set by
2420   another Preset, a constraint, or some other automatic selection implemented by the Client.

12.2 Printer Resources Best Practices

2422   Printer resources SHOULD be Printer Resident to avoid communications with hosts other
2423   than the one hosting the Printer and to avoid problems with firewalls blocking other hosts
2424   or ports. Printers SHOULD provide these resources using "https:" or "http:" scheme URIs.
2425   If Secure Transport is used to convey IPP attributes specifying URIs to Printer resources,
2426   the URIs themselves SHOULD also specify the use of Secure Transport.

2427   The URI's port component SHOULD match the Printer's port number as specified by the
2428   Printer's "printer-uri" attribute, to ensure resource access even when other services are
2429   disabled on the Printer's network host. For example, if the value of "printer-uri" is
2430   "ipps://my-printer.local.:631/ipp/print", all the resource URIs SHOULD begin with
2431   "https://my-printer.local.:631/" rather than "https://my-printer.local.:443/". Requesting a
2432   valid resource URI SHOULD result in an HTTP 200 OK and the resource itself iin the
2433   response, and SHOULD NOT result in an HTTP 3XX redirection.

2434   In order to support efficient retrieval of these resources, Clients SHOULD provide and
2435   Printers SHOULD support the If-Modified-Since request header [RFC7232] to allow Clients
2436   to locally cache these resources to minimize network bandwidth usage and provide a

2437 responsive user interface. HTTP caching semantics [RFC7234], particularly with HTTP
2438 proxies [RFC7230] MUST be followed.

13. Obsolete Attributes

2440 Table 26 lists the attributes that are OBSOLETE.

2441 **Table 26 - Obsolete Attributes**

Attribute	Explanation
pages-completed-current-copy	RFC 3381 is obsolete
pages-per-subset	Redundant with "job-pages-per-set" [PWG5100.1]
pages-per-subset-supported	"pages-per-subset" has been obsoleted

14. Obsolete Values

2443 Table 27 lists the attribute values that are OBSOLETE.

2444 **Table 27 - Obsolete Values**

Attribute	Value	Explanation
ipp-features-supported	'job-save'	The "job-save" attribute [PWG5100.11] is obsolete.

15. Conformance Requirements

2446 This section summarizes the Conformance Requirements detailed in the definitions in this
2447 document for Clients and Printers.

15.1 Printer Conformance Requirements

2449 In order for a Printer to claim conformance to this specification, a Printer MUST support:

2450   1. The required attributes and values defined in section 6;
2451   2. The required operations defined in section 5;
2452   3. The additional semantics defined in section 7;
2453   4. The additional values defined in section 8;
2454   5. The status codes defined in section 9;
2455   6. The internationalization considerations defined in section 16; and
2456   7. The security considerations defined in section 17.

2457 **15.2 Client Conformance Requirements**

2458 In order for a Client to claim conformance to this specification, a Client MUST support:

2459   1. The required attributes and values defined in section 6;
2460   2. The required operations defined in section 5;
2461   3. The additional semantics defined in section 7;
2462   4. The additional values defined in section 8;
2463   5. The status codes defined in section 9;
2464   6. The internationalization considerations defined in section 16; and
2465   7. The security considerations defined in section 17.

2466 **15.3 HTTP Recommendations**

2467 In order to support efficient retrieval of printer icons, ICC profiles, and localization files,
2468 Clients SHOULD provide and Printers SHOULD support the If-Modified-Since request
2469 header [RFC7232] to allow Clients to locally cache these resources to minimize network
2470 bandwidth usage and provide a responsive user interface. HTTP caching semantics
2471 [RFC7234], particularly with HTTP proxies [RFC7230] MUST be followed.

2472 # 16. Internationalization Considerations

2473 For interoperability and basic support for multiple languages, conforming implementations
2474 MUST support:

2475   1. The Universal Character Set (UCS) Transformation Format -- 8 bit (UTF-8)
2476   [STD63] encoding of Unicode [UNICODE] [ISO10646]; and
2477   2. The Unicode Format for Network Interchange [RFC5198] which requires
2478   transmission of well-formed UTF-8 strings and recommends transmission of
2479   normalized UTF-8 strings in Normalization Form C (NFC) [UAX15].

2480 Unicode NFC is defined as the result of performing Canonical Decomposition (into base
2481 characters and combining marks) followed by Canonical Composition (into canonical
2482 composed characters wherever Unicode has assigned them).

2483 WARNING – Performing normalization on UTF-8 strings received from Clients and
2484 subsequently storing the results (e.g., in Job objects) could cause false negatives in Client
2485 searches and failed access (e.g., to Printers with percent-encoded UTF-8 URIs now
2486 'hidden').

2487 Implementations of this specification SHOULD conform to the following standards on
2488 processing of human-readable Unicode text strings, see:

2489   Unicode Bidirectional Algorithm [UAX9] – left-to-right, right-to-left, and vertical

2490   Unicode Line Breaking Algorithm [UAX14] – character classes and wrapping

2491   Unicode Normalization Forms [UAX15] – especially NFC for [RFC5198]

2492   Unicode Text Segmentation [UAX29] – grapheme clusters, words, sentences

2493   Unicode Identifier and Pattern Syntax [UAX31] – identifier use and normalization

2494   Unicode Collation Algorithm [UTS10] – sorting

2495   Unicode Locale Data Markup Language [UTS35] – locale databases

2496   Implementations of this specification are advised to also review the following informational
2497   documents on processing of human-readable Unicode text strings:

2498   Unicode Character Encoding Model [UTR17] – multi-layer character model

2499   Unicode Character Property Model [UTR23] – character properties

2500   Unicode Conformance Model [UTR33] – Unicode conformance basis

2501   17. Security Considerations

2502   The IPP extensions defined in this document require the same security considerations as
2503   defined in the Internet Printing Protocol/1.1 [STD92].

2504   Implementations of this specification SHOULD conform to the following standard on
2505   processing of human-readable Unicode text strings, see:

2506   Unicode Security Mechanisms [UTS39] – detecting and avoiding security attacks

2507   Implementations of this specification are advised to also review the following informational
2508   document on processing of human-readable Unicode text strings:

2509   Unicode Security FAQ [UNISECFAQ] – common Unicode security issues

2510   17.1 Security Considerations for the "document-password" Attribute

2511   The "document-password" operation attribute (section 6.1.2) MUST be treated as private
2512   and confidential, MUST be retained for as long as the corresponding Job and Document

2513 are retained, MUST NOT be persisted beyond the life of the Job or Document, and MUST
2514 NOT be returned to Clients in any IPP response.

2515 # 18. IANA Considerations

2516 ## 18.1 MIME Media Type Registration

2517 Name : Michael Sweet

2518 E-mail : msweet@apple.com

2519 MIME media type name : text

2520 MIME subtype name : Standards Tree – strings

2521 Required parameters : NONE

2522 Optional parameters : NONE

2523 Encoding considerations :

2524 UTF-8 encoded Unicode text.

2525 Security considerations :

2526 Localized strings may be arbitrarily large and could potentially cause a denial-of-service.

2527 Localized strings may contain printf-style format characters that could cause a program to
2528 display unintended information or crash.

2529 Interoperability considerations :

2530 NONE

2531 Published specification :

2532 https://ftp.pwg.org/pub/pwg/candidates/cs-ippjobprinterext3v10-20120727-5100.13.pdf

2533 Applications which use this media :

2534 All Cocoa, NeXTStep, and OpenStep applications
2535 CUPS
2536 IPP Everywhere

2537 Additional information :

2538 1. Magic number(s) :

2539   2. File extension(s) :

2540   strings

2541   3. Macintosh file type code :

2542   Person to contact for further information :

2543   1. Name : Michael Sweet

2544   2. E-mail : msweet@apple.com

2545   Intended usage : Common

2546   Used for providing localizations of English keywords and numeric values.

2547   Author/Change controller :

2548   The Printer Working Group
2549   c/o The IEEE Industry Standards and Technology Organization
2550   445 Hoes Lane
2551   Piscataway, NJ 08854
2552   USA

2553   **18.2 Attribute Registrations**

2554   The attributes defined in this specification will be published by IANA according to the
2555   procedures in the Internet Printing Protocol/1.1 [STD92] in the following file:

2556   http://www.iana.org/assignments/ipp-registrations

2557   The registry entries will contain the following information:

```
2558        Operation attributes:                                 Reference
2559        --------------------                                  ---------
2560        document-metadata (1setOf octetString(MAX))           [PWG5100.13]
2561        document-password (octetString(1023))                 [PWG5100.13]
2562        first-index (integer(1:MAX))                          [PWG5100.13]
2563        identify-actions (1setOf type2 keyword)               [PWG5100.13]
2564        preferred-attributes (collection)                     [PWG5100.13]
2565          <Any Template attribute>                            [PWG5100.13]
2566        requesting-user-uri (uri)                             [PWG5100.13]
2567
2568        Job Template attributes:                              Reference
2569        -----------------------                               ---------
2570        job-error-action (type2 keyword)                      [PWG5100.13]
2571        pages-per-subset (1setOf integer(1:MAX))              [PWG5100.13]
2572        print-color-mode (type2 keyword)                      [PWG5100.13]
2573        print-rendering-intent (type2 keyword)                [PWG5100.13]
2574
```

```
2575        Job Description attributes:                             Reference
2576        ---------------------------                             ---------
2577        document-metadata (1setOf octetString(MAX))             [PWG5100.13]
2578        job-originating-user-uri (uri)                          [PWG5100.13]
2579        job-pages (integer(0:MAX)                               [PWG5100.13]
2580        job-pages-completed (integer(0:MAX)                     [PWG5100.13]
2581        job-pages-completed-current-copy (integer(0:MAX)        [PWG5100.13]
2582        job-uuid (uri(45))                                      [PWG5100.13]
2583
2584        Document Template attributes:                           Reference
2585        -----------------------                                 ---------
2586        print-color-mode (type2 keyword)                        [PWG5100.13]
2587        print-rendering-intent (type2 keyword)                  [PWG5100.13]
2588
2589        Document Description attributes:                        Reference
2590        --------------------------                              ---------
2591        document-metadata (1setOf octetString(MAX))             [PWG5100.13]
2592        document-uuid (uri(45))                                 [PWG5100.13]
2593        pages (integer(0:MAX)                                   [PWG5100.13]
2594        pages-completed (integer(0:MAX)                         [PWG5100.13]
2595        pages-completed-current-copy (integer(0:MAX)            [PWG5100.13]
2596
2597        Printer Description attributes:                         Reference
2598        -----------------------------                           ---------
2599        device-service-count (integer(1:MAX))                   [PWG5100.13]
2600        device-uuid (uri(45))                                   [PWG5100.13]
2601        document-password-supported (integer(0:1023))           [PWG5100.13]
2602        identify-actions-default (1setOf type2 keyword)         [PWG5100.13]
2603        identify-actions-supported (1setOf type2 keyword)       [PWG5100.13]
2604        ipp-features-supported (1setOf type2 keyword)           [PWG5100.13]
2605        job-constraints-supported (1setOf collection)           [PWG5100.13]
2606        job-error-action-default (type2 keyword)                [PWG5100.13]
2607        job-error-action-supported (1setOf type2 keyword)       [PWG5100.13]
2608        job-resolvers-supported (1setOf collection)             [PWG5100.13]
2609        multiple-operation-time-out-action (type2 keyword)      [PWG5100.13]
2610        pages-per-subset-supported (boolean)                    [PWG5100.13]
2611        preferred-attributes-supported (boolean)                [PWG5100.13]
2612        print-color-mode-default (type2 keyword)                [PWG5100.13]
2613        print-color-mode-supported (1setOf type2 keyword)       [PWG5100.13]
2614        print-rendering-intent-default (type2 keyword)          [PWG5100.13]
2615        print-rendering-intent-supported (1setOf type2 keyword) [PWG5100.13]
2616        printer-charge-info (text(MAX))                         [PWG5100.13]
2617        printer-charge-info-uri (uri)                           [PWG5100.13]
2618        printer-geo-location (uri)                              [PWG5100.13]
2619        printer-get-attributes-supported (1setOf type2 keyword) [PWG5100.13]
2620        printer-icc-profiles (1setOf collection)                [PWG5100.13]
2621          <Any Template attribute>                              [PWG5100.13]
2622          profile-name (name(MAX))                              [PWG5100.13]
2623          profile-url (uri)                                     [PWG5100.13]
2624        printer-icons (1setOf uri)                              [PWG5100.13]
2625        printer-mandatory-job-attributes (1setOf type2 keyword) [PWG5100.13]
2626        printer-organization (1setOf text(MAX))                 [PWG5100.13]
2627        printer-organizational-unit (1setOf text(MAX))          [PWG5100.13]
2628        printer-supply (1setOf octetString(MAX))                [PWG5100.13]
2629        printer-supply-description (1setOf text(MAX))           [PWG5100.13]
2630        printer-supply-info-uri (uri)                           [PWG5100.13]
```

```
2631        printer-uuid (uri(45))                              [PWG5100.13]
2632        requesting-user-uri-supported (boolean)             [PWG5100.13]
2633
2634        Subscription Description attributes:                Reference
2635        ----------------------------------                  ---------
2636        notify-subscriber-user-uri (uri)                    [PWG5100.13]
2637        notify-subscription-uuid (uri)                      [PWG5100.13]
2638
```

2639   **18.3 Type2 keyword Registrations**

2640   The keyword values defined in this specification will be published by IANA according to the
2641   procedures in the Internet Printing Protocol/1.1 [STD92] in the following file:

2642   http://www.iana.org/assignments/ipp-registrations

2643   The registry entries will contain the following information:

```
2644        Attributes (attribute syntax)
2645          Keyword Attribute Value                           Reference
2646          ----------------------                            ---------
2647        document-state-reasons (1setOf type2 keyword)       [PWG5100.5]
2648          document-password-error                           [PWG5100.13]
2649          document-permission-error                         [PWG5100.13]
2650          document-security-error                           [PWG5100.13]
2651          document-unprintable-error                        [PWG5100.13]
2652
2653        identify-actions (1setOf type2 keyword)             [PWG5100.13]
2654          display                                           [PWG5100.13]
2655          flash                                             [PWG5100.13]
2656          sound                                             [PWG5100.13]
2657          speak                                             [PWG5100.13]
2658        identify-actions-default (1setOf type2 keyword)     [PWG5100.13]
2659          <Any "identify-actions" keyword value>            [PWG5100.13]
2660        identify-actions-supported (1setOf type2 keyword)   [PWG5100.13]
2661          <Any "identify-actions" keyword value>            [PWG5100.13]
2662        ipp-features-supported (1setOf type2 keyword)       [PWG5100.13]
2663          document-object                                   [PWG5100.13]
2664          job-save                                          [PWG5100.13]
2665          none                                              [PWG5100.13]
2666          page-overrides                                    [PWG5100.13]
2667          proof-print                                       [PWG5100.13]
2668          subscription-object                               [PWG5100.13]
2669
2670        job-error-action (type2 keyword)                    [PWG5100.13]
2671          abort-job                                         [PWG5100.13]
2672          cancel-job                                        [PWG5100.13]
2673          continue-job                                      [PWG5100.13]
2674          suspend-job                                       [PWG5100.13]
2675        job-error-action-default (type2 keyword)            [PWG5100.13]
2676          <Any "job-error-action" keyword value>            [PWG5100.13]
2677        job-error-action-supported (1setOf type2 keyword)   [PWG5100.13]
2678          <Any "job-error-action" keyword value>            [PWG5100.13]
2679
```

```
2680        job-state-reasons (1setOf type2 keyword)              [RFC8011]
2681          document-password-error                             [PWG5100.13]
2682          document-permission-error                           [PWG5100.13]
2683          document-security-error                             [PWG5100.13]
2684          document-unprintable-error                          [PWG5100.13]
2685
2686        multiple-operation-time-out-action (type2 keyword)    [PWG5100.13]
2687          abort-job                                           [PWG5100.13]
2688          hold-job                                            [PWG5100.13]
2689          process-job                                         [PWG5100.13]
2690
2691        print-color-mode (type2 keyword)                      [PWG5100.13]
2692          auto                                                [PWG5100.13]
2693          auto-monochrome                                     [PWG5100.13]
2694          bi-level                                            [PWG5100.13]
2695          color                                               [PWG5100.13]
2696          highlight                                           [PWG5100.13]
2697          monochrome                                          [PWG5100.13]
2698          process-bi-level                                    [PWG5100.13]
2699          process-monochrome                                  [PWG5100.13]
2700        print-color-mode-default (type2 keyword)              [PWG5100.13]
2701          <Any "print-color-mode" keyword value>              [PWG5100.13]
2702        print-color-mode-supported (1setOf type2 keyword)     [PWG5100.13]
2703          <Any "print-color-mode" keyword value>              [PWG5100.13]
2704
2705        print-content-optimize (type2 keyword)                [PWG5100.7]
2706          auto                                                [PWG5100.13]
2707
2708        print-rendering-intent (type2 keyword)                [PWG5100.13]
2709          absolute                                            [PWG5100.13]
2710          auto                                                [PWG5100.13]
2711          perceptual                                          [PWG5100.13]
2712          relative                                            [PWG5100.13]
2713          relative-bpc                                        [PWG5100.13]
2714          saturation                                          [PWG5100.13]
2715        print-rendering-intent-default (type2 keyword)        [PWG5100.13]
2716          <Any "print-rendering-intent" keyword value>        [PWG5100.13]
2717        print-rendering-intent-supported (1setOf type2 keyword) [PWG5100.13]
2718          <Any "print-rendering-intent" keyword value>        [PWG5100.13]
2719
2720        printer-get-attributes-supported (1setOf type2 keyword) [PWG5100.13]
2721          <Any Job Template attribute>
2722          <Any Operation attribute at the job level>
2723
2724        printer-mandatory-job-attributes (1setOf type2 keyword) [PWG5100.13]
2725          <Any Job Template attribute>
2726          <Any Operation attribute at the job level>
2727
2728        printer-state-reasons (1setOf type2 keyword)          [RFC8011]
2729          cleaner-life-almost-over                            [PWG5100.13]
2730          cleaner-life-over                                   [PWG5100.13]
2731
2732        uri-authentication-supported (1setOf type2 keyword)   [RFC8011]
2733          negotiate                                           [PWG5100.13]
```

18.4 Type2 enum Registrations

The enum values defined in this specification will be published by IANA according to the procedures in the Internet Printing Protocol/1.1 [STD92] in the following file:

http://www.iana.org/assignments/ipp-registrations

The registry entries will contain the following information:

```
Attributes (attribute syntax)
  Enum Value        Enum Symbolic Name              Reference
  ----------        ------------------              ---------
finishings (1setOf type2 enum)                      [RFC8011]
  60                trim-after-pages                [PWG5100.13]
  61                trim-after-documents            [PWG5100.13]
  62                trim-after-copies               [PWG5100.13]
  63                trim-after-job                  [PWG5100.13]

operations-supported (1setOf type2 enum)            [RFC8011]
  0x003C            Identify-Printer                [PWG5100.13]
  0x003D            Validate-Document               [PWG5100.13]

orientation-requested (type2 enum)                  [RFC8011]
  7                 none                            [PWG5100.13]
```

18.5 Operation Registrations

The operations defined in this specification will be published by IANA according to the procedures in the Internet Printing Protocol/1.1 [STD92] in the following file:

http://www.iana.org/assignments/ipp-registrations

The registry entries will contain the following information:

```
Operation Name                                      Reference
--------------                                      ---------
Create-Job (extension)                              [PWG5100.13]
Create-Job-Subscription (extension)                 [PWG5100.13]
Create-Printer-Subscription (extension)             [PWG5100.13]
Get-Documents (extension)                           [PWG5100.13]
Get-Jobs (extension)                                [PWG5100.13]
Get-Printer-Attributes (extension)                  [PWG5100.13]
Get-Subscriptions (extension)                       [PWG5100.13]
Identify-Printer                                    [PWG5100.13]
Print-Job (extension)                               [PWG5100.13]
Print-URI (extension)                               [PWG5100.13]
Send-Document (extension)                           [PWG5100.13]
Send-URI (extension)                                [PWG5100.13]
Validate-Document                                   [PWG5100.13]
Validate-Job (extension)                            [PWG5100.13]
```

2775 **18.6 Status Code Registrations**

2776 The status codes defined in this specification will be published by IANA according to the
2777 procedures in the Internet Printing Protocol/1.1 [STD92] in the following file:

2778   http://www.iana.org/assignments/ipp-registrations

2779 The registry entries will contain the following information:

```
2780   Value    Status Code Name                              Reference
2781   ------   ------------------------------------------    ---------
2782   0x0400:0x04FF - Client Error:
2783   0x0418   client-error-document-password-error          [PWG5100.13]
2784   0x0419   client-error-document-permission-error        [PWG5100.13]
2785   0x041A   client-error-document-security-error          [PWG5100.13]
2786   0x041B   client-error-document-unprintable-error       [PWG5100.13]
```

2787 # 19. Overview of Changes

2788 **19.1 IPP Driverless Printing Extensions v.2.0**

2789 The following changes were made to IPP Job and Printer Extensions - Set 3
2790 [PWG5100.13-2012]:

2791 • Renamed the specification to have a more specific and meaningful title

2792 • Resolved all errata from PWG errata tracking site
2793   (https://www.pwg.org/dynamo/issues.php?L+P-1+S-2+I0+E0+Z13+Q)

2794 • Reviewed and rewrote the Abstract and Introduction to better match the new title

2795 • Reviewed and rewrote a number of the use cases and added new use cases that
2796   should have already been there

2797 • Created table in section 4 mapping coordinating Use Cases and Design
2798   Requirements to the corresponding IPP additions defined in the body of the
2799   document

2800 • Imported the IPP Presets registration document definitions to add them to this
2801   specification

2802 • Moved "device-service-count", "device-uuid", "printer-organization", and "printer-
2803   organizational-unit" attributes and their associated use caess to IPP Enterprise

---

2804   Printing Extensions v2.0 [PWG5100.11-2020] becuase they more aligned with
2805   enterprise printing than driverless printing.

2806 • Added message catalog syntax extensions and semantics for "_tooltip" and
2807   "_helpurl" (content from the latest draft of HELPME)

2808 • Added extensions to "print-color-mode" and "print-quality" (content from the latest
2809   draft of PQI)

2810 • Added "print-color-mode-icc-profiles" and "print-quality-hints-supported" (content
2811   from the latest draft of PQI)

2812 • Added the "media-overprint" and "media-overprint-type" Job Template Attributes

2813 • The "subscription-uuid" attribute was corrected to be "notify-subscription-uuid" to
2814   match how it was registered in the IANA registry in 2012

2815 • The "multiple-operations-timeout-action" attribute's name was corrected to be
2816   "multiple-operations-time-out-action" to match how it was registered in the IANA
2817   registry in 2012

2818 • Deprecated the "device-service-count" attribute because IPP System Service v1.0
2819   **Error! Reference source not found.** provides a better solution and this attribute is a
2820   lmost entirely unused in the IPP ecosystem at large.

2821 # 20. References

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3028   To subscribe, see the PWG IPP workgroup web page:

3029   https://www.pwg.org/ipp/

3030   Implementers of this specification document are encouraged to join the IPP Mailing List in
3031   order to participate in any discussions of clarification issues and review of registration
3032   proposals for additional attributes and values.

3033   The authors would also like to thank the following individuals for their contributions to this
3034   specification:

3035   Robert Herriot - Xerox
3036   Andrew Mitchell - Hewlett Packard
3037   Kirk Ocke - Xerox

22. Change History

22.1 February 4, 2020

Accepted all changes and made all recommended edits from the November F2F review, which stopped at section 6.2. Made substantial changes from the beginning:

- Reviewed and rewrote the Abstract and Introduction to better match the new title

- Reviewed and rewrote a number of the use cases and added new use cases that should have already been there

- Created table in section 4 mapping coordinating Use Cases and Design Requirements to the corresponding IPP additions defined in the body of the document

- Imported the IPP Presets registration document definitions to add them to this specification

- Resolved the "vendor-keyword" question for "print-color-mode" by adding "keyword" to the syntax and referring the reader to STD92 section 7.3.

- Modified a number of conformance requirements.

22.2 November 21, 2019

Updated yet again to address a few more issues:

- Added the 'virtual' keyword for "media-source" as per IPP teleconference minutes from 20191107

- Added 'enterprise' and 'production' keywords to "ipp-features-supported" as per 20190828 IPP F2F minutes

- Removed comments that should have been removed following their approval in earlier reviews.

22.3 November 20, 2019

Updated to resolve a few minor issues:

- Added the "eliminate-margins-supported" Printer Description attribute and listed it in Table 13

3066   •   Resolved text formatting problems in Table 4

3067   •   Removed "pages-per-subset" since it has been obsoleted.

3068 22.4 October 3, 2019

3069 Updated to resolve all issues from August 1, 2019 conference call and August 2019 F2F
3070 reviews:

3071   •   Resolved all errata comments

3072   •   Renamed "soft-proof-icc-profiles" to "print-color-mode-icc-profiles" but chose
3073   alternate member attribute names

3074   •   Refactored tables for "printer-input-tray", "printer-output-tray" and "printer-supply" to
3075   make them easier to read and reference / cross-reference with RFC 3805, and spell
3076   checked all OID names to hopefully eliminate all typos that were in the old 5100.13

3077   •   Added conformance tables to all section 6 subsections.

3078   •   Created a new section 12 "Printer Resource Best Practices" from old section 14.4
3079   and referenced that for HTTP and URI best practices

3080   •   Refactored and updated the Conformance Requirements section

3081   •   Added "eliminate-margins" to support the "Eliminate Upper and Lower Margins" and
3082   "Banner printing" use cases requested by Canon and HP

3083   •   Added "media-overprint" to support the "Borderless adjustment setting" use case
3084   requested by Canon and HP

3085   •   Enhanced the description for "print-quality-hints-supported"

3086 22.5 July 24, 2019

3087 Copied in definitions for "soft-proof-icc-profiles" and "print-quality-hints-supported" and
3088 extensions for "print-color-mode" and "print-quality" (from the latest draft of PQI). Also
3089 resolved the following feedback from Mike Sweet's email to the IPP WG reflector:

3090   •   Drop "-5100.13" from the filename (that's just for published documents)

3091   •   Global: remove section references for all of the STD92 stuff (which would have
3092   been RFC2911 sections - they don't match up

3093   •   Global: fix "reference not found" issues (section 5.6.7 at least)

- I think much of the 1.x content should be moved to a new section 4 model, with the new operations starting in section 5 (in keeping with our current template)

- pages-per-subset should be deprecated, per our prior discussions on the subject (finishings 2.1 has the job-pages-per-set attribute)

- Might as well add the "auto-monochrome" value for print-color-mode as RECOMMENDED.

- Section 5.3 attributes that are READ-ONLY should be moved to a new Job Status Attributes section.

- Section 5.4 should be "Subscription Status Attributes"

- Section 5.5 attributes that are READ-ONLY should be moved to a new Document Status Attributes section.

- Section 5.5.3 (pages) attribute is READ-WRITE (Document Description), per prior registry correction

- Section 5.5.5 (pages-completed-current-copy) should be obsoleted since RFC 3381 has been obsoleted

- Section 5.6 attributes that are READ-ONLY should be moved to a new Printer Status Attributes section.

- Section 5.6.7, table 5: obsolete "job-save" since that spec is getting obsoleted, move "proof-print" to the new EPX spec? - Section 5.6.8: The examples seem to

3113   have a mix of quote styles, maybe "1setOf syntax" instead of "1setOf <type-def- for-
3114   job-template-attribute>"

3115   • Global: Remove all of the media-xxx attributes since those are part of Job
3116   Extensions v2.0

3117   • Section 5.6.17, table 6: fix title ("multiple-operation-time-out-action")

3118   • Section 5.6.18: Obsolete

3119   • Section 5.6.29 (printer-get-attributes-supported): Drop 'type2'

3120   • Section 5.6.33 (printer-mandatory-job-attributes): Drop 'type2'

3121   • Section 5.6.39.4 example should probably be expanded to include yellow and black
3122   (to be realistic), along with a wasteToner or wasteInk entry?

3123   • Section 5.6.40.2 sync up with printer-supply example changes

3124   • Section 6.10: Remove (all media-col stuff is in JOBEXT 2.0)

3125   • Section 7.2: Remove? I think these are now defined in Finishings 2.1?

3126   • Sections 7.6 and 7.7: Remove (all media-col stuff is in JOBEXT 2.0)

3127   • Section 9.1: Example on lines 1878 to 1881 uses left/right quotes instead of straight
3128   quotes

3129   • Section 10: Might want to wordsmith this now that STD92 has clarified things? Line
3130   1985 also has a typo ("page-range" instead of "page-ranges").

3131   • Table 15: Remove (obsolete) job-cover-back and job-cover-front attributes, change
3132   "pages-ranges" to "page-ranges", remove (obsolete) sheet-collate,

3133   • Section 11.2: "printer-config-change-time" (not printer-description-change-time),
3134   remove media-xxx references.

3135   • Global: Update RFC2616 references to the corresponding new RFC723x RFCs...

3136   • Section 16: Drop "using Address style", you should be listed as primary author,
3137   move/update others as appropriate

3138   References to PWG 5100.11 were left largely unchanged because it and related
3139   documents are in a state of flux.

22.6 July 10, 2019

3141   Initial revision for v1.1.

3142   • Copied all content from previous JPS3 MS Word document into latest template

3143   • Resolved all errata from PWG errata tracking site
3144   (https://www.pwg.org/dynamo/issues.php?L+P-1+S-2+I0+E0+Z13+Q)

3145   • Copied in message catalog syntax extensions and semantics for "_tooltip" and
3146   "_helpurl" from the latest draft of HELPME

3147   • Copied in extensions for "print-color-mode", "print-quality", from the latest draft of
3148   PQI