The Printer Working Group

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IPP Job and Printer Extensions Set 3 v1.1 (JPS3)

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Abstract: Printing on new operating systems, distributed computing systems, and mobile devices emphasizes the challenges of generating document data, discovering available Printers, and communicating that document data to a Printer. This specification adds additional attributes and operations to IPP to better support generic, vendor-neutral implementations of printing in these environments.

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

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

This specification is available electronically at:

https://ftp.pwg.org/pub/pwg/ipp/wd/wd-ippjobprinterext3v11-20190724.docx
https://ftp.pwg.org/pub/pwg/ipp/wd/wd-ippjobprinterext3v11-20190724.pdf

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About the IEEE-ISTO PWG

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

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

For additional information regarding the Printer Working Group visit:

http://www.pwg.org

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1. Introduction

Printing on new operating systems, distributed computing systems, and mobile devices emphasizes the challenges of generating document data, discovering available Printers, and communicating that document data to a Printer. This specification adds additional attributes and operations to IPP/1.1 [STD92] and IPP/2.0, IPP/2.1 and IPP/2.2 [PWG5100.12] to better support generic, vendor-neutral implementations of printing in these environments.

This specification extends the IPP Model and Semantics [STD92] by defining:

1. A general method for limits and filtering for objects and attributes;
2. Constraint handling mechanisms for clients and printers;
3. ICC-based color management, and
4. Localization of attribute names and values.

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

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

2.2 Printing Terminology

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

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

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

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

Output Device: a single Logical or Physical Device

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

2.3 Protocol Role Terminology

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

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

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

2.4 Other Terminology

Black Point Compensation; the mapping of the darkest color in a source Color Space to the darkest color in a destination Color Space, generally to improve the reproduction of dark colors and shadows.

Color Space; the interpretation of color in a document, for example “RGB”, “Grayscale”, “CMYK”, and so forth.

Coloring; filtering or otherwise limiting the return of information such as limiting reported values to those supported for a given file format or hiding private information from unauthorized users.

Content; document data such as photos, web pages, email messages, reports and presentations, and books or other longer documents.

Gamut; the range of colors that can be reproduced by a Printer or Color Space.

Image Box; the "content area" within a digital document.

Input-Document; the entire sequence of bytes transmitted as the Document Content in the Print-Job and Send-Document operations or referenced by the "document-uri" operation attribute in the Print-URI and Send-URI operations. This sequence of bytes consists of one or more Input-Pages.

Input-Page; a sequence of bytes that describe how to mark a single Output-Page. IPP 1.1 [STD92] uses the term “print-stream-pages” to refer to both Input-Pages and Output-Pages. There is a one to one relationship between Input-Pages and Output-Pages and they are in the same order. Both Input-Pages and Output-Pages are numbered sequentially starting from 1 at the beginning of each Input-Document or Output-Document, respectively. When the first Input-Page of an Input-Document coincides with the first Output-Page of an Output-Document, the numbering of Input-Pages and Output-Pages coincides; otherwise it doesn’t.

i^{th}; referring to a specific 1setOf value - the first value, the second value, and so forth.

Kerberized Printing; authenticated printing based on SPNEGO-based Kerberos and NTLM HTTP Authentication in Microsoft Windows [RFC4559], Transport Layer Security/1.2 [RFC5246], and Upgrading to TLS Within HTTP/1.1 [RFC2817].

Output-Document; a set of one or more Sheets which either are permanently bound into a single unit, e.g., with a staple, or are intended to be treated by an end-user as a single unit, e.g., for a loose-leaf binder. If an Output-Document is bound, it is uniformly bound; if it is not bound, no subset of sheets within it are bound. The Output-Pages that comprise an Output-Document may come from, all the Input-Pages of an Input-Document, a proper subset of the Input-Pages of the Input-Document, or all the Input-Pages of several Input-Documents. An Output-Document is *not* a set of sheets that are bound temporarily for shipping, e.g., with banding.

Output-Page; the set of all markings that the author intended to be placed on one side of a Sheet, including, but not limited to, text, drawings, images, footers and headers.

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

Secure Transport; encryption of the HTTP connection using Transport Layer Security [RFC5246]. The security session may be negotiated at the initiation of the connection ("HTTPS") or by Upgrading to TLS Within HTTP/1.1 [RFC2817].

Sheet; the unit of media that a printer puts marks on. It is the most basic unit of output from a printer. A printer may mark on one side or on both sides of a sheet.

2.5 Acronyms and Organizations

IANA: Internet Assigned Numbers Authority, http://www.iana.org/

IETF: Internet Engineering Task Force, http://www.ietf.org/

ISO: International Organization for Standardization, http://www.iso.org/

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 mobile devices and to distributed print services involves several new use cases that are not addressed by existing IPP standards.

Therefore, this IPP Job and Printer Extensions Set 3 v1.1 specification should

1. Support identification of the Printer;
2. Support determination of the proximity of the Client to the Printer;
3. Support job ticket constraint resolution;
4. Support job ticket-based Printer capability queries;
5. Support controls for the color rendition of a document and for Client-managed color workflows;
6. Support Paid Imaging Services (specifically printing);
7. Support supply monitoring and control;
8. Support globally-unique identifiers for all objects;
9. Support Client localization of Printer attributes and values;
10. Encourage adoption of modern IPP-based printing infrastructures; and
11. Discourage the proliferation of vendor proprietary IPP operations and attributes that damage IPP interoperability by duplicating IETF or PWG IPP standard operations and attributes.

3.2 Use Cases

Provide use cases for the document in subsections using the casual use case format.

3.2.1 Select Printer Using Geo-Location

The Client initiates a proximity detection of nearby Printers using Services and/or Discovery Protocols, hiding duplicate Printers that are reported by multiple Service and/or Discovery Protocols. The Client User Interface asks the User to select one of the nearby Printers. Finally, the User selects a nearby Printer.

Preconditions: Both the Client and Printer have access to out-of-band geo-location information to allow for proximity detection, and both support common Discovery Protocol(s).

Geo-location information can be obtained via manual configuration by the User, Operator, or Administrator, or through location sensing technologies such as the Global Positioning System or radio signal triangulation.

3.2.2 Select Printer with Confirmation

After selecting a Printer using any of several methods, the Client sends an identification request to the Printer to provide a visual and/or auditory alert on the Printer to allow the User to confirm that the correct Printer has been selected.

3.2.3 Print Using Loaded Media

User is viewing a photo and would like to print the photo on the largest borderless photographic media loaded on her Printer.

After the User initiates a print from the phone and selects a Printer, the Client automatically selects the largest borderless photographic media loaded on the Selected Printer and the highest print quality. The User selects additional processing intent for the Job and confirms the print action. The Client sends a print job request to the Printer with the Job Ticket and local photo. The Printer validates the Job Ticket and document data and then prints the photo.

Preconditions: Printer can report loaded media information such as size, type, coating, and weight. This may be detected automatically or manually entered by the User or Operation when loading the media.

3.2.4 Print a Secure Form

The treasurer of a small training company that is holding a meeting and seminar at a resort needs to print out 20 checks for training personnel. He uses an accounting program to enter the hours worked, bonuses, reimbursable expenses, and so forth and prints the checks on a printer provided by the resort using check blanks he brought to the meeting.

The User loads check blanks into the Printer and configured the loaded media as necessary at the Printer. After the User initiates a print from his accounting program, selects a Printer for printing, and selects checks to be printed, the Client User Interface displays a preview of the printed checks and the User confirms that checks amounts, payees and signature are correct. The Client automatically selects the check blank media. The User selects additional processing intent for the Job and confirms the print action. The Client sends a print job request to the Printer with the Job Ticket and document data containing the checks, correctly oriented for the check blank media. The User waits for the checks to be printed and removes any excess media from the Printer.

3.2.5 Print with Special Formatting

At a seminar located at a country resort, a factotum and general gofer has been asked to provide 80 sets of ten keywords/phrases, clearly printed on 2-inch by 1-inch paper slips for

use in a get acquainted exercise. Costs are to be minimized. Gofer has a laptop with a word processer program. Resort has a Wi-Fi network available to users and a networked MFD at the business center. Attendant at business center will charge for any printed sheets removed from premises.

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

3.2.6 Print to a Service

John is flying to New York for a presentation and doesn't want to carry the presentations. John arrives in New York and goes online from his mobile phone. He selects a local print provider after reviewing the provider web pages and submits his document for printing. He specifies that he needs 10 color copies, printed duplex and stapled on the left side. He also specifies the covers to be 80lb. stock, and the internal pages to be 24lb. stock. John arrives at the provider and picks up his presentations, paying with his corporate credit card using an out-of-band method such as making a telephone call and providing the job identification and credit card numbers.

3.2.7 Print a Document with Page Subsets

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

3.2.8 Print on a Roll

Mike has a series of photos to print on a roll of photo media. Mike submits a multi-document job for printing and specifies that the roll be cut between each document in the job.

3.2.9 Job or Document Processing Failures

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

3.2.10 Manual Duplex Printing

Larry has a long whitepaper he would like to print 2-sided on an entry-level laser printer without an automatic duplexer accessory. Larry submits the document for printing and specifies 2-sided printing. The Client software queries the Printer to determine the page

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

3.2.11 Continuous Printing

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

3.2.12 Correlation of Multiple Printers

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

3.2.13 Manufacturer-Deployed Print Quality Mode

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

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

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

3.2.14 Administrator-Deployed Print Quality Mode

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

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

The IT administrators have a print policy defined so that users from different departments or role families are given different print capabilities. Those in the Finance department will only be offered the “Eco-Draft” print quality option, while executives and those in the Marketing department will be offered "Eco-Draft" in addition to the standard “Draft”, “Normal” and “High” options. The different quality levels factor into the billing cost the IT administrators and their print service providers have negotiated.

3.2.15 Manufacturer-Deployed Color Transformation Preferences

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

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

3.2.16 Administrator-Deployed Color Transformation Preference

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

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

3.2.17 Print Quality Hints to Influence Printer Color Processing

Juan is a graphic artist, and his team has a high-performance color printer. It has produced high quality output for all of the applications from which he and his team are printing. But then Juan encounters a problem. He is viewing a document in a particular application, prints the document, and realizes that the output is not meeting his needs. He is unable to find settings in the application that will allow it to produce satisfactory printed output without either changing the document in unacceptable ways or affecting other users of the printer. He looks in the print dialog and finds a set of "print quality hints", and through a process of trial-and-error, is able to produce output that meets his needs.

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

3.3 Exceptions

Provide exceptions for the use cases using the casual use case format.

3.4 Out of Scope

The following are considered out of scope for this specification:

1. Methods for geo-location and proximity detection for the Select Printer Using Geo-Location (section 3.2.1) use case
2. The actual method of payment for the Print to a Service (section 3.2.6) use case
3. Constraining choice of document formats suitable for the Print use cases
4. Discovery protocols used to locate Printers

3.5 Design Requirements

The design requirements for this specification are:

1. Follow the naming conventions defined in the IPP/1.1 Model and Semantics [STD92], including keyword value (lowercase) and hyphenation requirements;
2. Optimize compatibility with existing IETF and PWG IPP operations when making design decisions in defining new operations and attributes;

3. Define new device attributes that allow a Client to correlate multiple Printers to a single device or server supporting the Printers;
4. Define new Printer identification attributes and an identification operation;
5. Define new geo-location attributes;
6. Define new attributes for Paid Imaging Services (specifically printing);
7. Define new Printer discovery and selection attributes;
8. Define new job ticket constraint resolution attributes;
9. Define new secure printing, identification, and metadata attributes and values;
10. Define new media capability attributes;
11. Define new input and output tray attributes;
12. Define new limit and filtering attributes;
13. Define new subset printing attributes;
14. Define new color printing attributes
15. Define new ICC color management attributes;
16. Define new roll-fed printing attributes and values;
17. Define new supply level and status monitoring attributes;
18. Define new localization attributes and a message catalog file format; and
19. Define new globally-unique identifier attributes for all objects.

The design recommendations for this specification are:

1. Recommend the use of Printer-resident resources in order to support color proofing, identification, localization, and management.

4. Model

4.1 Limits

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

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

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

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

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

Printers that support the "first-index" and "limit" operation attributes must provide the values or objects in a consistent order such that a Client may retrieve all of those objects or values using a sequence of requests with increasing values for "first-index".

4.2 Filtering

The Get-Printer-Attributes operation in the IPP/1.1 Model and Semantics [STD92] supports attribute "filtering" using the "document-format" operation attribute. This specification extends this filtering mechanism to include arbitrary Job Creation attributes such as "sides" so that Clients may determine which attribute values are supported for a particular type of Job.

Similarly, the IPP/1.1 Model and Semantics and IPP Event Notifications and Subscriptions [RFC3995] allow for attribute "filtering" based on the "requesting-user-name" or authenticated user for Job and Subscription operations.

4.3 Constraints and "preferred-attributes"

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

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

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

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

4.4 ICC Color Management and Color Mode Previews

This specification adds new Printer Description attributes to support a managed color workflow using ICC color profiles. Clients may specify output rendering intent for a Job or Document and can query and download ICC color profiles listed by the Printer for color proofing or Client-side color rendering, especially when the Printer does not support a desired output rendering intent. This specification also adds new Printer Description attributes that specify URIs to ICC profiles to allow a Client to present a preview of a color mode transformation.

4.5 Localization

This specification defines and registers an existing plain text message catalog file format (MIME media type "text/strings") used on macOS and NeXTSTEP that allows a Client to present localized strings for attribute names and their associated values. For example, a Printer might provide localizations for vendor media sizes and "printer-state-reasons" keywords. A Printer attribute allows the Client to discover the location of message catalogs for the language specified by the "attributes-natural-language" attribute in the Client request. Clients can also use the HTTP If-Modified-Since header to detect whether the referenced message catalog has been updated. The message catalogs can also include inline help content that is associated with a particular attribute or attribute keyword / enum value.

4.6 Device Information

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

This specification defines two new device attributes for IPP: the device unique identifier as a UUID and a count of services provided by the device. The device unique identifier allows a Client to correlate multiple IPP-based services to a single device or server. The count of services tells the client whether a particular device or server provides more than one IPP-based service, regardless of the type of service offered.

5. New Operations

Provide detailed data model and semantic information starting in section 4. Definition of data elements/attributes and operations happen in later sections.

5.1 Identify-Printer

The RECOMMENDED Identify-Printer operation allows a Client to request the Printer to physically identify itself by flashing lights, making sounds, or displaying something on the control panel.

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

5.1.1 Identify-Printer Request

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

Group 1: Operation Attributes

Natural Language and Character Set:

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

Target:

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

Requesting User:

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

"message" (text(127)):

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

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

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

5.1.2 Identify-Printer Response

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

Group 1: Operation Attributes

Status Message:

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

Natural Language and Character Set:

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

Group 2: Unsupported Attributes

See [STD92] for details on returning Unsupported Attributes.

5.2 Validate-Document

The CONDITIONALLY REQUIRED Validate-Document operation allows a Client to verify operation and Document Template attributes to be used in a subsequent Send-Document or Send-URI request. This operation MUST be supported by Printers that conform to the IPP Document Object [PWG5100.5].

This operation is similar to the Validate-Job operation except that it validates attributes used for the Send-Document or Send-URI operations. Like Validate-Job, Validate-Document allocates no Printer resources (i.e., job objects) and does not allow a "document-password" or "document-uri" operation attribute.

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

5.2.1 Validate-Document Request

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

Group 1: Operation Attributes

Natural Language and Character Set:

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

Target:

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

Requesting User:

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

"document-format" (mimeMediaType)

"document-name" (name(MAX))

Group 2: Document Template Attributes

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

5.2.2 Validate-Document Response

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

Group 1: Operation Attributes

Status Message:

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

Natural Language and Character Set:

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

"preferred-attributes" (collection):

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

Group 2: Unsupported Attributes

See [STD92] for details on returning Unsupported Attributes.

6. New Attributes

Or new elements (Semantic Model) or properties (SNMP), etc.

6.1 Operation Attributes

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

The REQUIRED "document-metadata" operation attribute specifies one or more keyword/value pairs describing the document being supplied. Each element in the set consists of a keyword followed by "=" and a UTF-8 value string. Standard keywords are defined in The Dublin Core Metadata Element Set [RFC5013] and DCMI Metadata Terms [DCMITERMS]. Vendor or customer-defined keywords MUST use the prefix string "x-" to avoid future keyword name conflicts, for example "x-vendor-foo" or "x-customer-bar". The complete ABNF definition is provided in Figure 1.

Printers MUST copy this attribute to the corresponding Job Description (section 6.3.1) or Document Description (section 6.6.1) attribute of the same name when processing Print-Job, Print-URI, Send-Document, or Send-URI requests (section 7.6).

Figure 1 - ABNF for "document-metadata" Values

```
document-metadata = dc-elements "=" *utf8-char /
                    dc-terms "=" *utf8-char /
                    x-keyword "=" *utf8-char

dc-elements = "contributor" / "coverage" / "creator" /
              "date" / "description" / "format" /
              "identifier" / "language" / "publisher" /
              "relation" / "rights" / "source" /
              "subject" / "title" / "type"

dc-terms    = "abstract" / "accessRights" / "accrualMethod" /
              "accrualPeriodicity" / "accrualPolicy" / "alternative" /
              "audience" / "available" / "bibliographicCitation" /
              "conformsTo" / "created" / "dateAccepted" /
              "dateCopyrighted" / "dateSubmitted" / "educationLevel" /
              "extent" / "hasFormat" / "hasPart" / "hasVersion" /
              "instructionalMethod" / "isFormatOf" / "isPartOf" /
              "isReferencedBy" / "isReplacedBy" / "isRequiredBy" /
              "issued" / "isVersionOf" / "license" / "mediator" /
              "medium" / "modified" / "provenance" / "references" /
              "replaces" / "requires" / "rightsHolder" / "spatial" /
```



```
                    "tableOfContents" / "temporal" / "valid"

x-keyword   = "x-" 1*(ALPHA / DIGIT / "." / "-" / "_")

utf8-char   = %x20-7E /
              %xC0-DF.80-BF /
              %xE0-EF.80-BF.80-BF /
              %xF0-F7.80-BF.80-BF.80-BF
```

6.1.2 document-password (octetString(1023))

The "document-password" operation attribute specifies an unencrypted passphrase, OAuth token, or other string to be used to access the document content provided with the Print-Job, Print-URI, Send-Document, or Send-URI operations (section 7.6). Typically, the "document-password" value is an alphanumeric passphrase used to "unlock" a protected PDF [ISO32000] or OpenXPS [ECMA388] document. The maximum length of the "document-password" value is specified by the "document-password-supported" (section 6.8.1) Printer attribute.

While the "document-password" value is necessarily associated with the document content, this attribute is not part of the Job or Document object and MUST NOT be reported by the Printer as part of a Job or Document object's description or template attributes. The value supplied MUST be retained by the Printer as long as the corresponding Document is retained.

This attribute MUST be supported if the Printer also supports the "document-password-supported" (section 6.8.1) attribute.

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

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

The REQUIRED "first-index" operation attribute specifies the first object or element, starting at 1, to be returned in a response.

6.1.4 identify-actions (1setOf type2 keyword)

The "identify-actions" operation attribute specifies the action(s) that are taken to identify the printer in an Identify-Printer request as defined in section 5.1, "Identify-Printer Operation". The standard keyword values are listed in Table 1 - "identify-actions" Keyword Values.

This attribute MUST be supported if the Printer supports the Identify-Printer operation.

Table 1 - "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.

The default value of this operation attribute is defined by the "identify-actions-default" (section 6.8.2) Printer attribute and the supported values are defined by the "identify-actions-supported (section 6.8.3) Printer attribute.

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

6.1.5 preferred-attributes (collection)

The RECOMMENDED "preferred-attributes" attribute specifies the attributes and values that will be substituted in a job or document creation request and is returned by the Printer in the Validate-Document response as defined in section 5.2 and the Validate-Job response as defined in section 7.11. Each member attribute in the collection represents an operation, Document Template, or Job Template attribute in the Validate-Document or Validate-Job request with the corresponding replacement value(s).

6.1.6 requesting-user-uri (uri)

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

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

The "requesting-user-uri-supported" (section 6.8.30) Printer attribute specifies whether the "requesting-user-uri" operation attribute is supported.

6.2 Job and Document Template Attributes

6.2.1 job-error-action (type2 keyword)

The "job-error-action" Job Template attribute specifies the action a Printer takes when an error is encountered in a document during processing of the job. Standard keyword values are shown in Table 2.

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

895 **Table 2 - "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.

896 **6.2.2 pages-per-subset (1setOf integer(1:MAX))**

897 The OBSOLETE "pages-per-subset" Job Template attribute partitions one or more Input-
898 Documents into contiguous subsets of Input-Pages. Each subset is defined to be an Output-
899 Document and finishing options such as stapling are applied as if the Client had submitted
900 the document as multiple jobs.

901 The value of the attribute is a set of one or more integers, where each integer specifies the
902 number of Input-Pages in a subset, and the set is treated as a repeating sequence of
903 integers. Thus, when the attribute contains a single integer, the integer specifies the number
904 of Input-Pages in each subset, as a repeating sequence of the single integer. When the
905 number of integers in this attribute exceeds 1, the first integer specifies the number of Input-
906 Pages in the first subset, the second integer specifies the number of Input-Pages in the
907 second subset and so on. If numbers in this attribute are exhausted before partitioning all of
908 the Input-Pages, the Printer starts at the beginning of the sequence again and continues
909 until all Input-Pages are partitioned.

910 If the job contains more than one Input-Document, the Input-Pages are treated as a single
911 stream of Input-Pages which are partitioned into contiguous subsets with some subsets
912 possibly belonging to more than one Input-Document. If the number of Input-Pages available
913 for the last subset is less than the number specified by this attribute, the Printer MUST treat
914 the last subset as an Output-Document.

If the “multiple-document-handling” attribute is present, the Printer MUST ignore the "pages-per-subset" attribute if the "multiple-document-handling" attribute has any value other than 'separate-documents-collated-copies' or 'separate-documents-uncollated-copies' and MUST return the "pages-per-subset" attribute in the unsupported attributes group of a Create-Job, Print-Job, Print-URI, or Validate-Job response with the successful-ok-ignored-or-substituted-attributes status code.

Printers that support this attribute MUST also support the "pages-per-subset-supported" Printer attribute (section 6.8.10).

There is no “pages-per-subset-default” attribute because there is no mechanism for a Client to specify that there are no Input-Page subsets except to omit this attribute, which would cause the Printer to use the “pages-per-subset-default” attribute and create the default subsets.

6.2.3 print-color-mode (type2 keyword)

The REQUIRED "print-color-mode" Job and Document Template attribute specifies the color mode to use when printing a job. If supported, the Printer MUST print the job using the requested color mode. Standard keyword values are shown in Table 3.

Vendor-defined keywords SHOULD have the distinguishing prefix 'smiNNN-' [STD92] where NNN is an SMI Private Enterprise Number (PEN) [IANA-PEN]. Vendor-defined keywords SHOULD have either the '-monochrome' or '-color' suffixes to assist clients. For example, if the company Example Corp. had obtained the SMI PEN 32473, has a vendor-unique color mode "magic" that pertains to color, the Printer could specify the 'smi32473-magic-color'.

937 **Table 3 - "print-color-mode" 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)

938 Notes:

939 1 - Optional because the actual appearance is implementation-specific.

940 2 - Required for color Printers.

941 3 - Optional because process black on laser printers can be problematic.

942 ### 6.2.4 print-rendering-intent (type2 keyword)

943 The RECOMMENDED "print-rendering-intent" Job and Document Template attribute
944 specifies how out-of-gamut colors (or shades of gray) are mapped to device colors when
945 printing. Printers MUST support this attribute if they support the "printer-icc-profiles" attribute
946 (section 6.8.21). If supported, the Printer MUST print the job using the requested rendering
947 intent. Standard keyword values are shown in Table 4.

948 **Table 4 - "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 Description Attributes

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

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

6.4 Job Status Attributes

6.4.1 job-originating-user-uri (uri)

The REQUIRED "job-originating-user-uri" READ-ONLY Job attribute contains the most authenticated URI of the end user that submitted the job creation request as defined in section 7.1.

6.4.2 job-pages (integer(0:MAX))

The "job-pages" READ-ONLY Job attribute contains the total number of input pages for the documents in the Job. See section 11 for a description of the relationship of this attribute to the "job-impressions" and "job-media-sheets" attributes.

This attribute MUST be supported if the "job-pages-completed" Job attribute (section 6.4.3) is supported.

6.4.3 job-pages-completed (integer(0:MAX))

The "job-pages-completed" READ-ONLY Job attribute specifies the total number of input pages of the documents in the Job that have been processed. See section 11 for a description of the relationship of this attribute to the "job-impressions-completed" and "job-media-sheets-completed" attributes.

This attribute MUST be supported if the "job-pages" Job attribute (section 6.4.2) is supported.

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

The "job-pages-completed-current-copy" READ-ONLY Job attribute specifies the total number of input pages of the documents in the Job that have been processed for the current copy.

This attribute MUST be supported if the "job-pages" Job attribute (section 6.4.2) is supported.

6.4.5 job-uuid (uri(45))

The REQUIRED "job-uuid" READ-ONLY Job attribute specifies a globally-unique identifier that MUST be a 45-octet "urn:uuid" URI [RFC4122]. The Printer generates the globally-unique identifier when it creates a new Job object in response to a job creation request.

The "job-uuid" attribute MUST NOT be used as a Job identifier in IPP job operations but MAY be used as a Job identifier for other protocol bindings and SHOULD be used for accounting and auditing of Jobs.

6.5 Subscription Status Attributes

6.5.1 notify-subscription-uuid (uri(45))

The CONDITIONALLY REQUIRED "notify-subscription-uuid" READ-ONLY Subscription attribute specifies a globally-unique identifier that MUST be a 45-octet "urn:uuid" URI [RFC4122]. This attribute is REQUIRED if IPP: Event Notifications and Subscriptions [RFC3995] are supported.

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

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

6.5.2 notify-subscriber-user-uri (uri)

The CONDITIONALLY REQUIRED "notify-subscriber-user-uri" READ-ONLY Subscription attribute contains the most authenticated URI of the end user that submitted the subscription creation request as defined in section 7.1. This attribute is REQUIRED if IPP: Event Notifications and Subscriptions [RFC3995] are supported.

6.6 Document Description Attributes

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

The CONDITIONALLY REQUIRED "document-metadata" Document 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 supported. The format of each element in the set is defined in section 6.1.1. The "document-metadata" Document attribute is copied from the operation attribute of the same name as defined in section 7.6.

6.6.2 pages (integer(0:MAX))

The "pages" Document attribute contains the total number of input pages for the document. See section 11 for a description of the relationship of this attribute to the "impressions" and "media-sheets" attributes.

This attribute MUST be supported if the "pages-completed" Document attribute (section 6.7.2) and the IPP Document Object [PWG5100.5] are supported.

6.7 Document Status Attributes

6.7.1 document-uuid (uri(45))

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

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

The "document-uuid" attribute MUST NOT be used as a Document identifier in IPP document operations but MAY be used as a Document identifier for other protocol bindings and SHOULD be used for accounting and auditing of Documents.

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

The "pages-completed" READ-ONLY Document attribute specifies the total number of input pages of the document that have been processed. See section 11 for a description of the relationship of this attribute to the "impressions-completed" and "media-sheets-completed" attributes.

This attribute MUST be supported if the "pages" Document attribute (section 6.6.2) and the IPP Document Object [PWG5100.5] are supported.

6.7.3 pages-completed-current-copy (integer(0:MAX))

The OBSOLETE "pages-completed-current-copy" READ-ONLY Document attribute specifies the total number of input pages of the document that have been processed for the current copy.

This attribute MUST be supported if the "pages" Document attribute (section 6.6.2) and the IPP Document Object [PWG5100.5] are supported.

6.8 Printer Description Attributes

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

The "document-password-supported" Printer attribute specifies the maximum number of octets for the "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.

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

The default value(s) supplied by the Printer if the Client omits the "identify-actions" operation attribute from the Identify-Printer request. This attribute MUST be supported if the Printer supports the Identify-Printer operation defined in section 5.1.

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

The list of supported values for the "identify-actions" operation attribute. This attribute MUST be supported if the Printer supports the Identify-Printer operation defined in section 5.1.

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

The REQUIRED "ipp-features-supported" Printer attribute lists the IPP extension features that are supported by the Printer. Standard keyword values are listed in Table 5. The value 'none' MUST be reported if no extension features are supported and MUST NOT be reported otherwise.

Table 5 - "ipp-features-supported" Keyword Values

Keyword	Description
document-object	IPP Document Object [PWG5100.5]
job-save (OBSOLETE)	Job save from IPP Job and Printer Extensions - Set 2 [PWG5100.11]
none	No extension features are supported.
page-overrides	Page overrides from IPP Page Overrides [PWG5100.6]

proof-print	Proof print from IPP Job and Printer Extensions - Set 2 [PWG5100.11]
subscription-object	IPP Event Notifications and Subscriptions [RFC3995]

6.8.5 job-constraints-supported (1setOf collection)

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

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

Figure 2 illustrates how a constraint for duplex printing on transparency media could be specified by the Printer.

Figure 2 - Verbose "job-constraints-supported" and "job-resolvers-supported" Example

```
job-constraints-supported=
{
  resolver-name="A"
  sides="two-sided-short-edge"
  media-col={
    media-type="transparency"
  }
},
{
  resolver-name="A"
  sides="two-sided-long-edge"
  media-col={
    media-type="transparency"
  }
}

job-resolvers-supported=
{
  resolver-name="A"
  sides="one-sided"
  media-col={
    media-type="stationery"
  }
}
```


To minimize the number of collections in "job-constraints-supported", multiple Job Template attribute value alternatives can be specified in a single collection using a "1setOf syntax" representation. Figure 3 illustrates a concise representation of the constraints described in Figure 2.

Figure 3 - Concise "job-constraints-supported" and "job-resolvers-supported" Example

```
job-constraints-supported=
{
  resolver-name="A"
  sides="two-sided-long-edge","two-sided-short-edge"
  media-col={
    media-type="transparency"
  }
}

job-resolvers-supported=
{
  resolver-name="A"
  sides="one-sided"
  media-col={
    media-type="stationery"
  }
}
```

Both are syntactically correct, but the latter representation SHOULD be used, since it is more concise and minimizes encoding size.

6.8.6 job-error-action-default (type2 keyword)

The default value supplied by the Printer if the Client omits the "job-error-action" Job Template attribute.

6.8.7 job-error-action-supported (1setOf type2 keyword)

The list of supported "job-error-action" Job Template attribute values.

6.8.8 job-resolvers-supported (1setOf collection)

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

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

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

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

For example, a resolver for duplex printing on transparency media would be encoded as a collection containing “resolver-name”, “sides”, and “media-col” member attributes. The “sides” member attribute would have the value “one-sided” while the “media-col” member attribute would contain a "media-type" member attribute with the value “stationery”.

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

The "multiple-operation-time-out-action" Printer attribute defines the action that is taken when open jobs time out and is REQUIRED if the Printer supports the Create-Job operation. Table 6 lists the available actions.

Table 6 - "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.

6.8.10 pages-per-subset-supported (boolean)

The OBSOLETE "pages-per-subset-supported" Printer attribute specifies whether the "pages-per-subset" attribute (section 6.2) is supported. This attribute is REQUIRED when the Printer also supports the "pages-per-subset" attribute.

6.8.11 preferred-attributes-supported (boolean)

The RECOMMENDED "preferred-attributes-supported" Printer attribute specifies whether the "preferred-attributes" attribute (section 6.1.5) will be returned by the Validate-Document (section 5.2) or Validate-Job (section 7.11) operations.

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

The default value supplied by the Printer if the Client omits the "print-color-mode" Job Template attribute.

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

This attribute specifies the Printer's set of supported "print-color-mode" Job Template attribute values.

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.

If this attribute is supported and non-standard keywords are among the keywords listed by this attribute, the Printer SHOULD support the "soft-proof-icc-profiles" attribute (section 6.8.31) 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. Figure 4 illustrates, in "ipptoolfile" syntax, a Printer's implementation of "print-color-mode-supported" that specifies two vendor-unique color modes, and Figure 5 describes the corresponding Message Catalog entries supporting the attributes and values specified in Figure 4.

Figure 4 - "print-color-mode-supported" Vendor Extension Example

```
ATTR keyword print-color-mode-supported auto,color,monochrome,smi32473-magic-
   color,smi32473-blueprint
ATTR uri printer-strings-uri https://myprinter.local.:631/strings/ipp-
   en.strings
ATTR uri soft-proof-icc-profiles {
    MEMBER name smi32473-magic-color
    MEMBER uri https://myprinter.local.:631/proofing/magic-color.icc
},{
    MEMBER name smi32473-blueprint
    MEMBER uri https://myprinter.local.:631/proofing/blueprint.icc
}
```

Its message catalog at /strings/ipp-en.strings would include the following (for en-us):

Figure 5 - "print-color-mode" Vendor Extension Message Catalog Example

```
"print-color-mode" = "Print Color Mode";
"print-color-mode.auto" = "Automatic";
"print-color-mode.auto-monochrome" = "Auto Monochrome";
"print-color-mode.bi-level" = "Text";
"print-color-mode.color" = "Color";
"print-color-mode.highlight" = "Highlight";
"print-color-mode.monochrome" = "Monochrome";
"print-color-mode.process-bi-level" = "Process Text";
"print-color-mode.process-monochrome" = "Process Monochrome";
"print-color-mode.smi32473-magic-color" = "Magic Color";
```



```
"print-color-mode.smi32473-magic-color._tooltip" = "Makes the colors look
   magical";
"print-color-mode.smi32473-blueprint" = "Blueprint";
"print-color-mode.smi32473-blueprint._tooltip" = "Blue background with white
   foreground lines";
```

6.8.14 print-quality-hints-supported (1setOf keyword)

This OPTIONAL “print-quality-hints-supported” attribute specifies the supported set of print quality related Job Template attributes that specify "rendering hints" to influence implementation details relating to print quality. A Client that supports this attribute can present a collection of "advanced print settings" controls to the user, without having to be aware of the semantics of their meaning or purpose. The specified attribute names could be vendor- or site-unique.

The supporting Client might present these member attributes using the following UI control types:

Table 7: Attribute syntax and controls for "print-quality-hints-supported"

Syntax	Control
boolean	Checkbox
integer	Text box
type2 keyword	Pop-up menu or list
name	Pop-up menu or list

The attribute syntax for all Job Template attributes named in "print-quality-hints-supported" MUST use one of the following attribute syntaxes:

- boolean
- integer
- type2 keyword
- name

A Client encountering an attribute with some other syntax type SHOULD ignore that attribute. The Printer MUST support "xxx-supported" and "xxx-default" Printer Description attributes for every attribute whose name is specified in "print-quality-hints-supported".

Figure 6 illustrates how this attribute would be used, a printer could implement two vendor-unique print quality hint attributes "notpwg-clever-x" and "notpwg-magic-y", and specify those two as print quality hint attributes to supporting Clients.

Figure 6 - "print-quality-hints-supported" example

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

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

6.8.15 print-rendering-intent-default (type2 keyword)

The default value supplied by the Printer if the Client omits the "print-rendering-intent" Job Template attribute.

6.8.16 print-rendering-intent-supported (1setOf type2 keyword)

The list of supported "print-rendering-intent" Job Template attribute values. If the "print-rendering-intent" Job Template attribute is supported, then the values "relative" and "relative-bpc" MUST be supported as well.

6.8.17 printer-charge-info (text(MAX))

The OPTIONAL "printer-charge-info" Printer attribute provides a human-readable description of paid printing services for the Printer. Typically, this description will provide a summary of cost information.

6.8.18 printer-charge-info-uri (uri)

The OPTIONAL "printer-charge-info-uri" Printer attribute provides a "http:" or "https:" URI referring to a human-readable web page for paid printing services for the Printer. Typically, this web page will provide cost information and allow the Client to obtain a "job-accounting-id" value for subsequent print jobs.

6.8.19 printer-geo-location (uri | unknown)

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

6.8.20 printer-get-attributes-supported (1setOf keyword)

The REQUIRED "printer-get-attributes-supported" Printer attribute lists the operation and Job Template attributes that contribute to the content returned by the Get-Printer-Attributes

operation. The "document-format" value is REQUIRED for all Printers to conform to IPP/1.1 [STD92]. All other values are OPTIONAL.

6.8.21 printer-icc-profiles (1setOf collection)

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

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

6.8.21.1 profile-name (name(MAX))

The REQUIRED "profile-name" member attribute provides a unique name for a given ICC profile. A given "profile-name" value MAY appear in multiple collection values but MUST always be paired with the same "profile-uri" value. That is, a "profile-name" of "Glossy Paper, High Quality" might be listed multiple times but will always refer to the same "profile-uri", for example "http://example.com/glossy-high.icc".

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

6.8.21.2 profile-uri (uri)

The REQUIRED "profile-uri" member attribute references an ICC color profile as a "http:" or "https:" URI. Standard vendor-supplied profiles SHOULD be Printer-resident so that Client printing does not require access to external networks.

6.8.22 printer-icons (1setOf uri)

The REQUIRED "printer-icons" Printer attribute lists one or more Printer-resident images using "http:" or "https:" URIs. The referenced images MUST be RGBA PNG [RFC2083] format, have square dimensions of 48x48, 128x128, or 512x512 pixels, represent the physical appearance of the Printer, and show the same perspective/view of the Printer. If only one image is provided, it MUST have dimensions of 128x128 pixels. Images MUST be listed from smallest to largest dimensions. Images MUST provide an alpha channel to mask the background surrounding the printer.

6.8.23 printer-input-tray (1setOf octetString(MAX))

The RECOMMENDED "printer-input-tray" Printer attribute provides current input tray details mapped from the SNMP prtInputTable defined in IETF Printer MIB v2 [RFC3805]. This attribute MUST be supported if the "media-source" member attribute (section **Error! Reference source not found.**) or "media-source-properties" member attribute (section **Error! Reference source not found.**) are supported.

1301 If supported, this attribute MUST have the same cardinality (contain the same number of
1302 values) as the "media-source-supported" attribute. The i^{th} value in the "printer-input-tray"
1303 attribute corresponds to the i^{th} value in the "media-source-supported" attribute.
1304

1305 **6.8.23.1 Keywords for printer-input-tray**

1306 Table 8 defines the IPP datatypes and keywords for encoding "printer-input-tray" from all of
1307 the machine-readable (non-localized) columnar objects in prtInputTable [RFC3805].

1308 **Table 8 - Keywords for "printer-input-tray"**

Printer MIB Object	IPP Data-type	IPP Keyword	PWG SM Keyword	Conformance
prtInput...				
Index (note 1)	Integer	index	Id	OPTIONAL
Type	String	type	InputTrayType	REQUIRED
DimUnit	String	dimunit	[.01 mm]	RECOMMENDED
MediaDimFeed-DirDeclared	Integer	mediafeed	InputTrayMedia-Size.XDimension	REQUIRED
MediaDimXFeed-DirDeclared	Integer	mediaxfeed	InputTrayMedia-Size.YDimension	REQUIRED
MediaDimFeed-DirChosen	---	---		---
MediaDimXFeed-DirChosen	---	---		---
CapacityUnit	String	unit	InputTray-CapacityUnit	RECOMMENDED
MaxCapacity	Integer	maxcapacity	InputTrayMax-Capacity	REQUIRED
CurrentLevel	Integer	level	InputTrayCurrent Level	REQUIRED
Status	Integer	status	SubunitStates	REQUIRED
MediaName (note 2)	String	medianame	InputTrayMedia-SizeName	RECOMMENDED
Name	String	name	InputTrayName	REQUIRED
VendorName	---	---	InputTrayVendor Name	---
Model	---	---	InputTrayModel	---
Version	---	---	InputTrayVersion	---
SerialNumber	---	---	InputTraySerial-Number	---
Security	---	---	InputTraySecurity	---
MediaWeight (note 3)	Integer	mediaweight	InputTrayMedia-WeightMetric	OPTIONAL
MediaType (note 2)	String	mediatype	InputTrayMedia-Type	RECOMMENDED
MediaColor (note 2)	String	mediacolor	InputTrayMedia-Color	RECOMMENDED
MediaFormParts	---	---	InputTrayMedia-FormParts	---
MediaLoadTimeout	---	---	InputTrayMedia-LoadTimeout	---

Printer MIB Object	IPP Data-type	IPP Keyword	PWG SM Keyword	Conformance
NextIndex	---	---	InputTrayNext-InputTrayId	---

Notes:

1. prtInputIndex is OPTIONAL in "printer-input-tray", because correlation with the original MIB order is considered unimportant.
2. 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).
3. prtInputMediaWeight is OPTIONAL in "printer-input-tray", because because most Printers can't sense loaded media weight.
4. Printer MIB objects without corresponding IPP keywords are *not* mapped, per DMTF CIM ranking activity in WIMS WG in 2006.

6.8.23.2 Encoding of printer-input-tray

Values of "printer-input-tray" MUST be encoded using a visible subset of the [US-ASCII] charset. Control codes (0x00 to 0x1F and 0x7F) MUST NOT be used. The ABNF [STD68] in Figure 7 defines the standard encoding in "printer-input-tray" for all the machine-readable (non-localized) columnar objects in prtInputTable [RFC3805].

Figure 7 - 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 ";"
input-opt           = input-index /
                      input-dim-unit /
                      input-unit /
                      input-media-name /
                      input-media-weight /
                      input-media-type /
                      input-media-color /
                      input-ext
```



```
input-type          = "type" "=" 1*ALPHA
    ; enumerated value as an alpha string (e.g.,
    ; 'sheetFeedAutoRemovableTray') of prtInputType in [RFC3805] mapped
    ; indirectly from the *label* in PrtInputTypeTC in [IANAPRT]

input-media-feed    = "mediafeed" "="  1*[DIGIT / "-"]
    ; integer value as a numeric string mapped directly from
    ; prtInputMediaDimFeedDirDeclared in [RFC3805]

input-media-xfeed   = "mediaxfeed" "="  1*[DIGIT / "-"]
    ; integer value as a numeric string mapped directly from
    ; prtInputMediaDimXFeedDirDeclared in [RFC3805]

input-max-capacity  = "maxcapacity" "=" 1*[DIGIT / "-"]
    ; integer value as a numeric string mapped directly from
    ; prtInputMaxCapacity in [RFC3805]

input-level         = "level" "=" 1*[DIGIT / "-"]
    ; integer value as a numeric string mapped directly from
    ; prtInputCurrentLevel in [RFC3805]

input-status        = "status" "=" 1*DIGIT
    ; integer value as a numeric string mapped directly from
    ; prtInputStatus in [RFC3805]

input-name          = "name" "=" 1*ALPHA
    ; string value as an alpha string mapped directly from
    ; prtInputName in [RFC3805]

input-index         = "index" "=" 1*DIGIT
    ; integer value as a numeric string mapped directly from
    ; prtInputIndex in [RFC3805]

input-dim-unit      = "dimunit" "=" 1*ALPHA
    ; enumerated value as an alpha string (e.g., 'other') of
    ; prtInputDimUnit in [RFC3805] mapped indirectly from
    ; the *label* in PrtMediaUnitTC in [RFC3805]

input-unit          = "unit" "=" 1*ALPHA
    ; enumerated value as an alpha string (e.g., 'other') of
    ; prtInputCapacityUnit in [RFC3805] mapped indirectly from
    ; the *label* in PrtCapacityUnitTC in [RFC3805]

input-media-name    = "medianame" "=" 1*ALPHA
    ; string value as an alpha string mapped directly from
    ; prtInputMediaName in [RFC3805]

input-media-weight  = "mediaweight" "=" 1*[DIGIT / "-"]
    ; integer value as a numeric string mapped directly from
    ; prtInputMediaWeight in [RFC3805]

input-media-type    = "mediatype" "=" 1*ALPHA
    ; string value as an alpha string mapped directly from
    ; prtInputMediaType in [RFC3805]

input-media-color   = "mediacolor" "=" 1*ALPHA
```



```
        ; string value as an alpha string mapped directly from
        ; prtInputMediaColor in [RFC3805]

input-ext           = input-extname "=" input-extvalue
input-extname       = 1*[ALPHA / DIGIT / "-"]
input-extvalue      = 1*[ALPHA / DIGIT / "-" / "." / ","]
        ; extension point for other MIB values not mapped
```


6.8.23.3 Examples of printer-input-tray

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

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

```
printer-input-tray[1] =
    type=sheetFeedAutoRemovableTray;
    mediafeed=110000;mediaxfeed=85000;
    maxcapacity=500;level=100;status=8;name=Tray1;
    index=1;dimunit=tenThousandthsOfInches;unit=sheets;
    medianame=na-letter;mediaweight=-2;
    mediatype=stationery;mediacolor=blue;

printer-input-tray[2] =
    type=sheetFeedAutoRemovableTray;
    mediafeed=110000;mediaxfeed=85000;
    maxcapacity=100;level=20;status=8;name=Tray2;
    index=2;dimunit=tenThousandthsOfInches;unit=sheets;
    medianame=na-letter;mediaweight=-2;
    mediatype=photographic;mediacolor=white;
```

6.8.24 printer-mandatory-job-attributes (1setOf keyword)

The OPTIONAL "printer-mandatory-job-attributes" Printer attribute lists the minimum Job Template and operation attributes that are required for a successful job creation operation.

6.8.25 printer-organization (1setOf text(MAX))

The REQUIRED "printer-organization" Printer attribute specifies the name of the organization (e.g., company, university, social club, etc.) that is administratively associated with this Printer.

See section 5.4.1 'OrganizationName' in ITU-T [X.520] and the derived section 2.19 'o' in IETF LDAP User Schema [RFC4519] for more information.

6.8.26 printer-organizational-unit (1setOf text(MAX))

The REQUIRED "printer-organizational-unit" Printer attribute specifies the name of the organizational unit (e.g., 'Human Resources', 'Finance', etc.) that is functionally associated with this Printer.

See section 5.4.2 'OrganizationalUnitName' in ITU-T [X.520] and the derived section 2.20 'ou' in LDAP User Schema [RFC4519] for more information.

6.8.27 printer-output-tray (1setOf octetString(MAX))

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

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

6.8.27.1 Keywords for printer-output-tray

Table 9 defines the IPP datatypes and keywords for encoding "printer-output-tray" from all of the machine-readable (non-localized) columnar objects in prtOutputTable [RFC3805].

Table 9 - Keywords for "printer-output-tray"

Printer MIB Object	IPP Data-type	IPP Keyword	PWG SM Keyword	Conformance
prtOutput...				
Index (note 1)	Integer	index	Id	OPTIONAL
Type	String	type	OutputTrayType	REQUIRED
CapacityUnit	String	unit	OutputTrayCapacity-Unit	RECOMMENDED
MaxCapacity	Integer	maxcapacity	OutputTrayMax-Capacity	REQUIRED
RemainingCapacity	Integer	remaining	OutputTrayRemaining Capacity	REQUIRED
Status	Integer	status	SubunitStates	REQUIRED
Name	String	name	OutputTrayName	REQUIRED
VendorName	---	---	OutputTrayVendor-Name	---
Model	---	---	OutputTrayModel	---
Version	---	---	OutputTrayVersion	---
SerialNumber	---	---	OutputTraySerial-Number	---
Security	---	---	OutputTraySecurity	---
DimUnit (note 2)	---	---		---
MaxDimFeedDir (note 2)	---	---	OutputTrayMax-MediaSizeName	---
MaxDimXFeedDir (note 2)	---	---	OutputTrayMax-MediaSizeName	---
MinDimFeedDir (note 2)	---	---	OutputTrayMin-MediaSizeName	---
MinDimXFeedDir (note 2)	---	---	OutputTrayMin-MediaSizeName	---

Printer MIB Object	IPP Data-type	IPP Keyword	PWG SM Keyword	Conformance
StackingOrder (note 3)	String	stackingorder	OutputTrayStacking-Order	REQUIRED
PageDelivery-Orientation (note 3)	String	pagedelivery	OutputTrayPage-DeliveryOrientation	REQUIRED
Bursting	---	---	OutputTrayBursting	---
Decollating	---	---	OutputTrayDecollating	---
PageCollated	---	---	OutputTrayPageCollated	---
OffsetStacking (note 4)	String	offsetstacking	OutputTrayOffsetStacking	OPTIONAL

Notes:

1. prtOutputIndex is OPTIONAL in "printer-output-tray", because correlation with the original MIB order is considered unimportant.
2. prtOutputDimUnit, prtOutputMaxDimFeedDir, prtOutputMaxDimXFeedDir, prtOutputMinDimFeedDir, and prtOutputMinDimXFeedDir are *not* mapped, because they were rated "C" (low priority) in the DMTF CIM ranking activity in WIMS WG in 2006.
3. prtOutputStackingOrder and prtOututPageDeliveryOrientation are REQUIRED in "printer-output-tray" in order to enable a Client to provide media load instructions for manual duplexing, envelope, and form printing.
4. prtOutputOffsetStacking is OPTIONAL because it was rated "B" (medium priority) in the DMTF CIM ranking activity in WIMS WG in 2006.
5. Printer MIB objects without corresponding IPP keywords are *not* mapped, per DMTF CIM ranking activity in WIMS WG in 2006.

6.8.27.2 Encoding of printer-output-tray

Values of "printer-output-tray" MUST be encoded using a visible subset of the [US-ASCII] charset. Control codes (0x00 to 0x1F and 0x7F) MUST NOT be used. The ABNF [STD68] in Figure 8 defines the standard encoding in "printer-output-tray" for all the machine-readable (non-localized) columnar objects in prtOutputTable [RFC3805].

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

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

output-required     = output-req ";"
output-req          = output-type /
                      output-max-capacity /
                      output-page-delivery /
                      output-remaining /
                      output-stacking-order /
```



```
                          output-status /
                          output-name

output-optional     = output-opt ";"

output-opt          = output-index /
                      output-unit /
                      output-offset-stacking /
                      output-ext

output-type         = "type" "=" 1*ALPHA
    ; enumerated value as an alpha string
    ; (e.g., 'removableBin') of prtOutputType
    ; in [RFC3805] mapped indirectly from
    ; the *label* in PrtOutputTypeTC in [IANAPRT]

output-max-capacity = "maxcapacity" "=" 1*[DIGIT / "-"]
    ; integer value as a numeric string mapped directly from
    ; prtOutputMaxCapacity in [RFC3805]

output-remaining    = "remaining" "=" 1*[DIGIT / "-"]
    ; integer value as a numeric string mapped directly from
    ; prtOutputRemainingCapacity in [RFC3805]

output-status       = "status" "=" 1*DIGIT
    ; integer value as a numeric string mapped directly from
    ; prtOutputStatus in [RFC3805]

output-name         = "name" "=" 1*ALPHA
    ; string value as an alpha string mapped directly from
    ; prtOutputName in [RFC3805]

output-index        = "index" "=" 1*DIGIT
    ; integer value as a numeric string mapped directly from
    ; prtOutputIndex in [RFC3805]

output-unit         = "unit" "=" 1*ALPHA
    ; enumerated value as an alpha string (e.g., 'other') of
    ; prtOutputCapacityUnit in [RFC3805] mapped indirectly from
    ; the *label* in PrtCapacityUnitTC in [RFC3805]

output-stacking-order = "stackingorder" "=" 1*ALPHA
    ; enumerated value as an alpha string (e.g., 'firstToLast') of
    ; prtOutputStackingOrder in [RFC3805] mapped indirectly from
    ; the *label* in PrtOutputStackingOrderTC in [RFC3805]

output-page-delivery = "pagedelivery" "=" 1*ALPHA
    ; enumerated value as an alpha string (e.g., 'faceUp') of
    ; prtOutputPageDeliveryOrientation in [RFC3805] mapped indirectly
    ; from the *label* in PrtOutputPageDeliveryOrientationTC in
    ; [RFC3805]

output-offset-stacking = "offsetstacking" "=" 1*ALPHA
    ; enumerated value as an alpha string (e.g., 'notPresent') of
    ; prtOutputOffsetStacking in [RFC3805] mapped indirectly from
    ; the *label* in PresentOnOff in [RFC3805]
```



```
output-ext           = output-extname "=" output-extvalue
output-extname       = 1*[ALPHA / DIGIT / "-"]
output-extvalue      = 1*[ALPHA / DIGIT / "-" / "." / ","]
    ; extension point for other MIB values not mapped
```

6.8.27.3 Examples of printer-output-tray

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

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

```
printer-output-tray[1] =
    type=removableBin;
    maxcapacity=500;remaining=-3;status=12;name=LeftOutputBin;
    index=1;unit=sheets;stackingorder=firstToLast;
    pagedelivery=faceDown;offsetstacking=notPresent;

printer-output-tray[2] =
    type=removableBin;
    maxcapacity=300;remaining=-3;status=0;name=RightOutputBin;
    index=2;unit=sheets;stackingorder=firstToLast;
    pagedelivery=faceDown;offsetstacking=notPresent;
```

6.8.28 printer-strings-languages-supported (1setOf naturalLanguage)

The RECOMMENDED "printer-strings-languages-supported" Printer attribute provides a list of languages that are supported for the "printer-strings-uri" (section 6.8.29) Printer attribute.

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

6.8.29 printer-strings-uri (uri | no-value)

The RECOMMENDED "printer-strings-uri" Printer attribute provides a "text/strings" message catalog file using "http:" or "https:" URIs that SHOULD be Printer-resident so that Client printing does not require access to external networks. Printers SHOULD provide localizations for all supported Job Template attributes, keywords, and enums as well as localizations for "document-state-reasons", "job-state-reasons", "notify-event", and "printer-state-reasons" keywords so that a Client may present a consistent user interface to the User.

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

This attribute MUST be supported if the "printer-strings-languages-supported" (section 6.8.28) attribute is supported.

The "text/strings" MIME media type is defined in section 10.1.

6.8.30 requesting-user-uri-supported (boolean)

The REQUIRED "requesting-user-uri-supported" Printer attribute specifies whether the "requesting-user-uri" (section 6.1.6) operation, "job-originating-user-uri" (section 6.4.1) Job Description, and "notify-subscriber-user-uri" (section 6.5.2) Subscription Description attributes are supported. Printers MUST support this attribute with a value of 'true'.

6.8.31 soft-proof-icc-profiles (1setOf collection)

The "soft-proof-icc-profiles" Printer Description attribute specifies the set of ICC profiles the Printer provides for soft proofing the color transformation the Printer will perform for the corresponding "print-color-mode" keyword. This set is distinct from the "printer-icc-profiles" attribute (section 6.8.21) because the ICC profiles are used for different purposes. These profiles MUST be used ONLY for soft proofing and MUST NOT be used for color management.

Each collection value consists of "profile-name (name(MAX))" and "profile-uri (uri)" member attributes plus any Job Template attributes (as member attributes) that contribute to the selection of the profile.

6.8.31.1 profile-name (name(MAX))

The REQUIRED "profile-name" member attribute provides a unique name for a given ICC profile. A given "profile-name" value MAY appear in multiple collection values but MUST always be paired with the same "profile-uri" value. That is, a "profile-name" of "Glossy Paper, High Quality" might be listed multiple times but will always refer to the same "profile-uri", for example "http://example.com/glossy-high.icc".

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

6.8.31.2 profile-uri (uri)

The REQUIRED "profile-uri" member attribute references an ICC color profile as a "http:" or "https:" URI. Standard vendor-supplied profiles SHOULD be Printer-resident so that Client printing does not require access to external networks. Printer-resident profiles SHOULD be made available on the same TCP port number used for IPP (default 631) to ensure resource availability.

6.9 Printer Status Attributes

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

The REQUIRED "device-service-count" READ-ONLY Printer attribute specifies the number of Printer instances supported by the Imaging Device.

6.9.2 device-uuid (uri(45))

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

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

The RECOMMENDED "printer-config-change-date-time" READ-ONLY Printer 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.

This attribute MUST be READ-ONLY - the only way to change its value is to change a Printer description attribute.

If this attribute is supported, the Printer MUST populate 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 MUST update this attribute with the value of the Printer's "printer-current-time" attribute.

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

The RECOMMENDED "printer-config-change-time" READ-ONLY Printer 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.

This attribute MUST be READ-ONLY - the only way to change its value is to change a Printer description attribute.

On power-up, the Printer MUST populate 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 occurs, the Printer MUST update this attribute with the value of the Printer's "printer-up-time" attribute.

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

The RECOMMENDED "printer-supply" READ-ONLY Printer attribute provides current supply details mapped from the SNMP prtMarkerSuppliesTable and prtMarkerColorantTable defined in IETF Printer MIB v2 [RFC3805].

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

6.9.5.1 Keywords for printer-supply

Table 10 defines the IPP datatypes and keywords for encoding "printer-supply" from all of the machine-readable (non-localized) columnar objects in prtMarkerSuppliesTable and prtMarkerColorantTable [RFC3805]. A Printer MAY represent site-unique or vendor-unique information using extension keywords. The extension keyword syntax

Table 10 - Keywords for "printer-supply"

SNMP Supply Object	IPP Data-type	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
prtMarkerSuppliesIndex	Integer	index	OPTIONAL (note 1)
prtMarkerSuppliesMarkerIndex	Integer	markerindex	OPTIONAL (note 2)
prtMarkerSuppliesColorantIndex	Integer	n/a	n/a (note 3)

Notes:

1 - prtMarkerSuppliesIndex is OPTIONAL in "printer-supply" because correlation with the original MIB order is considered unimportant.

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

3 - prtMarkerSuppliesColorantIndex is omitted in "printer-supply" because it is redundant with prtMarkerColorantIndex for the rows that include colorant information.

6.9.5.2 Encoding of printer-supply

Values of "printer-supply" MUST be encoded using a visible subset of the [US-ASCII] charset. Control codes (0x00 to 0x1F and 0x7F) MUST NOT be used. The ABNF [STD68] in Figure 9 defines the standard encoding in "printer-supply" for all the machine-

readable (non-localized) columnar objects in prtMarkerSuppliesTable and prtMarkerColorantTable [RFC3805].

Figure 9 - ABNF for "printer-supply" Values

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

supply-required     = supply-req ";"
supply-req          = supply-type /
                      supply-max-capacity /
                      supply-level /
                      colorant-name

supply-optional     = supply-opt ";"
supply-opt          = supply-index /
                      marker-index /
                      supply-class /
                      supply-unit /
                      colorant-index /
                      colorant-role /
                      colorant-tonality /
                      supply-ext

supply-type         = "type" "=" 1*ALPHA
    ; enumerated value as an alpha string (e.g., 'toner') of
    ; prtMarkerSuppliesType in [RFC3805] mapped indirectly from
    ; the *label* in PrtMarkerSuppliesTypeTC in [IANAPRT]

supply-max-capacity = "maxcapacity" "=" 1*[DIGIT / "-"]
    ; integer value as a numeric string mapped directly from
    ; prtMarkerSuppliesMaxCapacity in [RFC3805]

supply-level        = "level" "=" 1*[DIGIT / "-"]
    ; integer value as a numeric string mapped directly from
    ; prtMarkerSuppliesLevel in [RFC3805]

colorant-name       = "colorantname" "=" 1*ALPHA
    ; string value as an alpha string mapped directly from
    ; prtMarkerColorantValue in [RFC3805]

supply-index        = "index" "=" 1*DIGIT
    ; integer value as a numeric string mapped directly from
    ; prtMarkerSuppliesIndex in [RFC3805]

marker-index        = "markerindex" "=" 1*DIGIT
    ; integer value as a numeric string mapped directly from
    ; prtMarkerSuppliesMarkerIndex in [RFC3805]

supply-class        = "class" "=" 1*ALPHA
    ; enumerated value as an alpha string (e.g., 'other') of
    ; prtMarkerSuppliesClass in [RFC3805] mapped indirectly from
    ; the *label* in PrtMarkerSuppliesClassTC in [RFC3805]

supply-unit         = "unit" "=" 1*ALPHA
```



```
        ; enumerated value as an alpha string (e.g., 'other') of
        ; prtMarkerSuppliesSupplyUnit in [RFC3805] mapped indirectly from
        ; the *label* in PrtMarkerSuppliesSupplyUnitTC in [RFC3805]

    colorant-index      = "colorantindex" "=" 1*DIGIT
        ; integer value as a numeric string mapped directly from
        ; prtMarkerColorantIndex in [RFC3805]

    colorant-role       = "colorantrole" "=" 1*ALPHA
        ; enumerated value as an alpha string (e.g., 'other') of
        ; prtMarkerColorantRole in [RFC3805] mapped indirectly from
        ; the *label* in PrtMarkerColorantRoleTC in [RFC3805]

    colorant-tonality   = "coloranttonality" "=" 1*DIGIT
        ; integer value as a numeric string mapped directly from
        ; prtMarkerColorantTonality in [RFC3805]

    supply-ext          = supply-extname "=" supply-extvalue
        ; extension point for other MIB values not mapped
        ; or site-unique / vendor-unique additional info

    supply-extname      = 1*[ALPHA / DIGIT / "-"]
    supply-extvalue     = 1*[ALPHA / DIGIT / "-" / "." / ","]
```

6.9.5.3 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 11 lists the standard colorant names with their corresponding reference sRGBA values.

Table 11 - 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	

6.9.5.4 Example of printer-supply

Figure 10 shows the values of "printer-supply" in "ipptoolfile" syntax [IPPSAMPLE], encoding seven rows of the machine-readable (non-localized) columnar objects from prtMarkerSuppliesTable and prtMarkerColorantTable.

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 6.9.5.2.

Figure 10 - Example values for "printer-supply" Printer Status attribute

```
ATTR octetString printer-supply

"type=tonerCartridge;maxcapacity=100;level=56;unit:percent;
colorantname=black;colorantindex=1;colorantrole=process;
coloranttonality=128;class=supplyThatIsConsumed",

"type=tonerCartridge;maxcapacity=100;level=77;unit:percent;
colorantname=cyan;colorantindex=2;colorantrole=process;
coloranttonality=128;class=supplyThatIsConsumed",

"type=tonerCartridge;maxcapacity=100;level=19;unit:percent;
colorantname=magenta;colorantindex=3;colorantrole=process;
coloranttonality=128;class=supplyThatIsConsumed",

"type=tonerCartridge;maxcapacity=100;level=31;unit:percent;
colorantname=yellow;colorantindex=4;colorantrole=process;
coloranttonality=128;class=supplyThatIsConsumed",

"type=wasteToner;maxcapacity=100;level=67;unit=percent;
colorantname=no-color;colorantindex=77;colorantrole=other;class=other",

"type=fuser;maxcapacity=100;level=89;unit:percent;
colorantname=no-color;colorantindex=88;colorantrole=other;class:other",

"type=transferUnit;maxcapacity=100;level=84;unit:percent;
colorantname=no-color;colorantindex=99;colorantrole=other;class:other"
```

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

The RECOMMENDED "printer-supply-description" READ-ONLY Printer 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" (section 6.9.5) Printer attribute 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.

6.9.6.1 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 MUST be converted from the charset [RFC3808] specified by prtGeneralCurrentLocalization and prtLocalizationCharacterSet into the charset specified by "charset-configured" and then copied into a text value of "printer-supply-description";
2. Each value of "printer-supply-description" MUST be tagged with the natural language [RFC5646] specified by prtGeneralCurrentLocalization, prtLocalizationLanguage, and prtLocalizationCountry; 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).

6.9.6.2 Example of printer-supply-description

Figure 11 describes in "ipptoolfile" syntax [IPPSAMPLE] the "printer-supply-description" values corresponding to the "printer-supply" values from Figure 10, 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 6.9.6.1.

Figure 11 - Example of "printer-supply-description"

```
ATTR textWithoutLanguage printer-supply-description
        "Black Toner Cartridge S/N:16859422",
        "Cyan Toner Cartridge S/N:16852765",
        "Magenta Toner Cartridge S/N:16859681",
        "Yellow Toner Cartridge S/N:16859372",
        "Waste Toner Bin S/N:16816815",
        "Fuser Kit S/N:16820223",
        "Transfer Kit S/N:16821304"
```

6.9.7 printer-supply-info-uri (uri)

The RECOMMENDED "printer-supply-info-uri" Printer attribute provides a URI referring to a Printer-resident web page that provides controls for managing the Printer and its supplies, e.g., supply replacement, head alignment, self-test pages, and so forth. The web page MAY also provide supply part numbers, links for ordering supplies, and detailed instructions for replacing supplies.

The URI MUST use the “http” or “https” scheme with the Printer as the destination host - external URIs are not allowed.

6.9.8 printer-uuid (uri(45))

The REQUIRED "printer-uuid" READ-ONLY Printer attribute specifies a globally-unique identifier for the Printer that MUST be a 45-octet "urn:uuid" URI [RFC4122].

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

7. Additional Semantics for Existing Operations

7.1 All Operations: "requesting-user-uri"

If the Printer supports the "requesting-user-uri" (section 6.1.6) operation attribute, Clients MAY supply it in a Create-Job, Create-Job-Subscription, Create-Printer-Subscription, Print-Job, or Print-URI operation. The Printer object sets the "job-originating-user-uri" (section 6.4.1) or "notify-subscriber-user-uri" (section 6.5.2) attribute as needed to the most authenticated URI that it can obtain from the authentication service over which the IPP operation was received. Only if such an authenticated URI is not available, does the Printer object use the value supplied by the Client in the "requesting-user-uri" operation of the operation (see IPP/1.1 Model and Semantics [STD92] sections 5.4.2, 5.4.3 and 9).

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

Clients MAY provide and Printers MAY support job creation attributes beyond "document-format" to color (filter) the response. The "printer-get-attributes-supported" Printer attribute (section 5.5.15) specifies which job creation attributes are supported by the Get-Printer-Attributes operation and MUST include "document-format".

In addition, if a Printer supports the "media-col-database" Printer attribute ([PWG5100.11]), the Client MAY provide and the Printer SHOULD support the "first-index" (section 6.1.3) and "limit" ([STD92]) operation attributes to limit the number of "media-col-database" values that are returned in the response.

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

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

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

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

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

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

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

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

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

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

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

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

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

If the Printer determines that the supplied "document-password" value is correct but the Document does not allow printing, it MUST return the 'client-error-document-permission-

error' status code to the Client if a response has not already been sent and add the 'document-permission-error' keyword to the "job-state-reasons" and, if supported, "document-state-reasons" attributes.

7.8 Validate-Job Operation: "document-password"

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

7.9 Create-Job, Print-Job, and Print-URI Operations: "job-password" and "job-password-encryption"

Printers that support the "job-password" and "job-password-encryption" operation attributes [PWG5100.11] MUST validate the values supplied and return the client-error-bad-request status code if the values are invalid or not supported. Printers MUST NOT return the "job-password" or "job-password-encryption" attributes in the Unsupported Attributes Group to prevent the leaking of security information.

7.10 Validate-Job Operation: "job-password" and "job-password-encryption"

Clients MUST NOT send the "job-password" or "job-password-encryption" operation attributes [PWG5100.11] in a Validate-Job request. Printers MUST reject a Validate-Job request containing a "job-password" or "job-password-encryption" operation attribute and return the client-error-bad-request status code.

7.11 Validate-Job Operation: "preferred-attributes"

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

Printers indicate their support for this functionality by listing the Job Template attributes that may be returned in the "preferred-attributes-supported" Printer attribute (section 5.5.4).

8. Additional Values and Semantics for Existing Attributes

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

Table 12 lists new "document-state-reasons" and "job-state-reasons" keyword values.

1927 **Table 12 - 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.

1928 ## 8.2 finishings (1setOf type2 enum)

1929 Table 13 lists new enum values for the "finishings" Job Template attribute that SHOULD be
1930 supported by Printers with roll-fed media.

1931 **Table 13 - 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 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.

8.4 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.

8.5 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 6.8.29). 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 the Message Catalog (section 10.1) to provide some contextual help for the vendor-unique 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-2'
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

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

```
"print-quality.10" = "EcoWickedDrafty";
"print-quality.12" = "EcoDrafty";
"print-quality.3"  = "Draft";
"print-quality.4"  = "Normal";
"print-quality.5"  = "High";
"print-quality.16" = "Max";
"print-quality.18" = "MegaMax";
"print-quality.20" = "Non-linear Ennui";
"print-quality.21" = "Non-linear Trepidation";
"print-quality.22" = "Non-linear Happiness";

"print-quality.10._tooltip" = "Usable only for rough layout";
"print-quality.12._tooltip" = "Lower quality with greatly reduced toner use";
"print-quality.3._tooltip"  = "Low quality with less toner use";
"print-quality.4._tooltip"  = "Average quality - best for everyday use";
"print-quality.5._tooltip"  = "Higher quality";
"print-quality.16._tooltip" = "Maximum quality";
"print-quality.18._tooltip" = "Super Maximum quality";
"print-quality.20._tooltip" = "Produces output that makes you bored";
"print-quality.21._tooltip" = "Produces output that makes you nervous ";
"print-quality.22._tooltip" = "Produces output that makes you kinder";
```

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

Table 14 lists new keyword values for the "printer-state-reasons" Printer attribute that MUST be supported by Printers that report the corresponding Printer MIB [RFC3805] supply types.

Table 14 - 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.

8.7 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.

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

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

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

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

10. Localization of Attributes and Values

The "printer-strings-uri" Printer attribute (section 6.8.29) provides the location of a language-specific, printer-resident message catalog file that provides localizations for attribute names, keyword values, and enum values.

10.1 Message Catalog File Format

This specification defines a new plain text message catalog format (MIME media type “text/strings”) based on the Apple “strings” file format to allow Printers to supply and Clients to present localized strings for supported attributes values. A sample English localization for registered IPP attributes, enum values, and keyword values is available on the PWG FTP

server [PWG-CATALOG]. Boolean, dateTime, and integer values are not localizable using this format, and name and text values are presumed to already be localized [STD92].

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

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

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

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

\" A double quote (%x22)

\\ A backslash (%x5C)

\n A line feed (%x0A)

\r A carriage return (%x0D)

\t A horizontal tab (%x09)

\### An octet represented by 3 octal digits

A more complete example is in section 10.3.

10.2 Message Catalog Help Resources

A Message Catalog MAY also contain two types of "help" content. The "_tooltip" suffix can be used to specify brief help content suitable for contextual presentation such as when a mouse pointer is hovered over a label. The "_helpurl" suffix can be used to specify a URL to more detailed, rich and possibly lengthy help content that could be presented in a 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"
```

A more complete example is in section 10.3.

10.3 Message Catalog Example

A Printer that specifies two collections in its "media-col-ready", one that specifies 'stationery' for its "media-type " value, and the other that specifies 'smi32473-eco-lite' for its "finishing-template" value, can implement among others the following attributes and values, using "ipptoolfile" syntax [IPPSAMPLE]:

```
ATTR collection media-col-ready
{
    MEMBER keyword media-type "stationery"
    MEMBER keyword media-source "tray-1"
    MEMBER collection media-size
    {
        # iso_a4_210x297mm
        MEMBER integer x-dimension 21000
        MEMBER integer y-dimension 29700
    }
    MEMBER integer media-top-margin 500
    MEMBER integer media-bottom-margin 500
    MEMBER integer media-left-margin 500
    MEMBER integer media-right-margin 500
},{
    MEMBER keyword media-type "smi32473-eco-lite"
    MEMBER keyword media-source "tray-2"
    MEMBER keyword media-color white
    MEMBER collection media-size
    {
        # na_letter_8.5x11in
        MEMBER integer x-dimension 21590
        MEMBER integer y-dimension 27940
    }
    MEMBER integer media-bottom-margin 500
    MEMBER integer media-left-margin 500
    MEMBER integer media-right-margin 500
    MEMBER integer media-top-margin 500
}
```

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

```
media-type = "Media Type";
media-type.stationery = "Stationery";
media-type.stationery._tooltip = "Conventional Stationery";
media-type.stationery._helpurl = "//_help/media-types.html";
media-type.smi32473-eco-lite = "PWG Eco Lite";
media-type.smi32473-eco-lite._tooltip = "Lightweight paper that may tear";
```


media-type.smi32473-eco-lite._helpurl = "//_help/media-types.html#ecolite";

10.4 Message Catalog ABNF

Figure 12 provides the ABNF [STD68] for files conforming to the “text/strings” MIME media type.

Figure 12 - ABNF for the "text/strings" MIME Media Type

```
CATALOG       = *(MESSAGE / COMMENT / *WSP CFLF / *WSP LF)
MESSAGE       = *WSP DQUOTE %x61-7A *KEYWORD-CHAR DQUOTE
                *WSP "=" *WSP QUOTED-STRING *WSP ";" *WSP (CRLF / LF)
COMMENT       = *WSP "/*" 1*CHAR "*/" *WSP (CRLF / LF)
KEYWORD-CHAR  = %x61-7A / DIGIT / "-" / "." / "_"
QUOTED-STRING = DQUOTE 1*QUOTED-CHAR DQUOTE
QUOTED-CHAR   = %x20-21 /
                %x23-5B /
                %x5C.22 /                          ; \" = "   (%x22)
                %x5C.5C /                          ; \\ = \   (%x5C)
                %x5C.6E /                          ; \n = lf  (%x0A)
                %x5C.71 /                          ; \r = cr  (%x0D)
                %x5C.73 /                          ; \t = ht  (%x09)
                %x5C.30-33.30-37.30-37 /           ; \ooo (octal)
                %x5D-7E /
                %xC0-DF.80-BF /
                %xE0-EF.80-BF.80-BF /
                %xF0-F7.80-BF.80-BF.80-BF
```


11. Relationship of Impressions, Pages, and Sheets

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

Because the various IPP and PWG standards have used slightly different definitions of impressions, pages, and sheets, and because their interaction with various Job Template attributes has not been documented, the Job Description attributes for impressions ("job-impressions" and "job-impressions-completed") and sheets ("job-media-sheets" and "job-media-sheets-completed") have not been implemented consistently between different vendors' IPP Printers. Table 15 lists the Job Template attributes that affect reporting of impressions and sheets. Only the "page-range" Job Template attribute affects the page counts ("job-pages" and "job-pages-completed").

11.1 Examples for Impressions, Pages, and Sheets

11.1.1 Single Document Simplex Job Without Copies

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

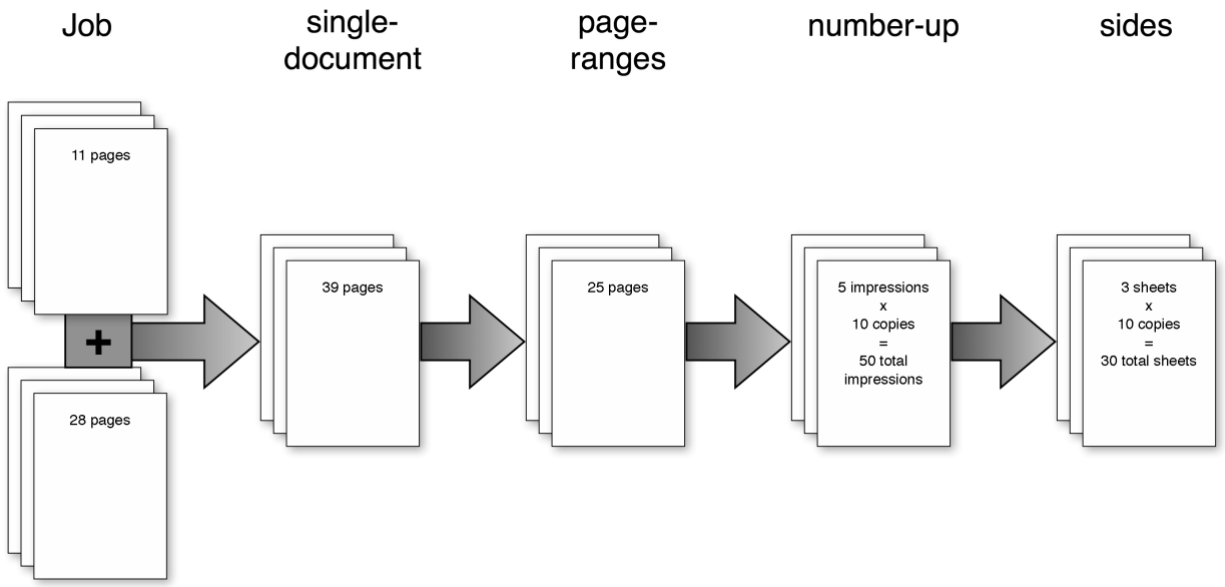
11.1.2 Single Document Duplex Job Without Copies

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

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

A two-document duplex job with copies and number-up will have different page, impression, and sheet counts. For example, a job containing documents of 11 and 28 pages, a "copies" value of 10, a "multiple-document-handling" value of 'single-document', a "number-up" value of 6, a "page-ranges" value of 1-25, and a "sides" value of 'two-sided-long-edge' would yield a page count of 39 (11 + 28 pages from two documents), an impression count of 50 (25 6-up pages produces 5 impressions per copy), and a sheet count of 30 (5 impressions are printed on a total of 3 pages per copy). Figure 13 shows a graphical representation of this example.

2143 **Figure 13 - Two Document Duplex Job With Copies, Number-Up, and Page-Ranges**



2144

2145 **Table 15 - 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-copies	Multiplier for impressions and sheets; also see copies, multiple-document-handling, and sheet-collate
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

2146 # 12. Obsolete Attributes

2147 Table 16 lists the attributes that are OBSOLETE.

Table 16 - Obsolete Attributes

Attribute	Explanation
job-cover-back	
job-cover-front	
pages-completed-current-copy	RFC 3381 is obsolete
pages-per-subset	Redundant with "job-pages-per-set" [PWG5100.1]
sheet-collate	

13. Obsolete Values

Table 17 lists the attribute values that are OBSOLETE.

Table 17 - Obsolete Values

Attribute	Value	Explanation
ipp-features-supported	'job-save'	The "Job Save and Reprint" will be obsoleted in the process of obsoleting PWG 5100.11

14. Conformance Requirements

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

14.1 Conformance Requirements for this Specification

In order for a Client and a Printer to claim conformance to this specification a Client MUST be able to supply and a Printer MUST support the following:

1. "document-metadata" (sections 6.1.1 and 6.3.1)
2. "requesting-user-uri" (section 6.1.6)
3. "job-originating-user-uri" (section 6.4.1)
4. "print-color-mode" (section 6.2.3)
5. "print-rendering-intent" (section 6.2.4)

6. "job-uuid" (section 6.4.5)
7. "ipp-features-supported" (section 6.8.4)
8. The "printer-get-attributes-supported" (section 6.8.20) Printer Description attribute
9. The "printer-icons" (section 6.8.22) Printer Description attribute
10. "printer-organization" (section 6.8.25)
11. "printer-organizational-unit" (section 6.8.26)
12. The "printer-uuid" (section 6.9.8) Printer Status attribute

14.2 Conditional Conformance Requirements for Printer Objects

To claim conformance to this specification, Printers conforming to IPP Event Notifications and Subscriptions [RFC3995] MUST support the following:

1. The "first-index" (section 6.1.3) operation attribute
2. The "notify-subscription-uuid" (section 6.5.1) Subscription Description attribute
3. The "printer-config-change-time" (section 6.9.4) Printer Description attribute.

To claim conformance to this specification, Printers conforming to the Standard for IPP Document Object [PWG5100.5] MUST support the following:

1. The Validate-Document (section 5.2) operation
2. The "document-metadata" (section 6.6.1) Document Description attribute
3. The "document-uuid" (section 6.7.1) Document Description attribute
4. The "print-color-mode" (section 6.2.3) Document Template attribute
5. The "print-rendering-intent" (section 6.2.4) Document Template attribute

To claim conformance for the OPTIONAL Identify-Printer operation (section 5.1), Printers MUST support the following:

1. The "identify-actions" (section 6.1.4) operation attribute
2. The "identify-actions-default" (section 6.8.1) Printer Description attribute
3. The "identify-actions-supported" (section 6.8.3) Printer Description attribute.

To claim conformance for the OPTIONAL "printer-icc-profiles" (section 6.8.21) Printer attribute, Printers MUST support:

1. The "print-rendering-intent" (section 6.2.4) Job Template attribute, and
2. The "print-rendering-intent-default" (section 6.8.14) and "print-rendering-intent-supported" (section 6.8.16) Printer Description attributes.

To claim conformance for the REQUIRED "requesting-user-uri" (section 6.1.6) operation attribute, Printers conforming to IPP Event Notifications and Subscriptions [RFC3995] MUST support the "notify-subscriber-user-uri" (section 6.5.2) Subscription attribute, and vice-versa.

To claim conformance for the OPTIONAL "pages-per-subset" (section 6.2) attribute, Printers MUST support the "pages-per-subset-supported" Printer Description attribute, and vice-versa.

To claim conformance for the OPTIONAL "document-password" (section 6.1.2) operation attribute, Printers MUST support the following:

1. The "document-password-supported" (section 6.8.1) Printer Description attribute
2. The 'document-password-error' and 'document-permission-error' (section 8.1) keywords for the "document-state-reasons" and "job-state-reasons" attributes
3. The 'client-error-document-password-error' (section 9.1) and 'client-error-document-permission-error' (section 9.2) status codes.
4. Transport Layer Security 1.2 [RFC5246] or higher
5. Upgrading to TLS Within HTTP/1.1 [RFC2817].
6. Negotiation of a TLS session prior to accepting a request containing the "document-password" operation attribute

To claim conformance for the OPTIONAL job ticket preflighting using the Validate-Job operation, Printers MUST support:

1. The "preferred-attributes" (section 6.1.5) operation attribute, and
2. The "preferred-attributes-supported" (section 6.8.11) Printer Description attribute.

To claim conformance for the OPTIONAL "job-constraints-supported" (section 6.8.5) Printer Description attribute, Printers MUST support the "job-resolvers-supported" (section 6.8.8) Printer Description attribute, and vice-versa.

To claim conformance for the OPTIONAL "printer-strings-uri" (section 6.8.29) Printer Description attribute, Printers MUST supply the "printer-strings-languages-supported" (section 6.8.28) Printer Description attribute, and vice-versa.

To claim conformance for the OPTIONAL "printer-supply" (section 6.8.28) Printer Description attribute, Printers MUST supply the "printer-supply-description" (section 6.9.6) Printer Description attribute, and vice-versa.

To claim conformance for the OPTIONAL Create-Job operation, Printers MUST support the "multiple-operation-time-out-action" (section 6.8.9) Printer Description attribute.

To claim conformance for the OPTIONAL Paid Imaging Services, Printers MUST support the following:

1. The "printer-charge-info" (section 6.8.11) Printer Description attribute
2. The "printer-charge-info-uri" (section 6.8.10) Printer Description attribute
3. The "printer-mandatory-job-attributes" (section 6.8.23) Printer Description attribute

To claim conformance for the OPTIONAL Kerberized Printing, Printers MUST support the following:

1. HTTP Negotiate authentication based on SPNEGO-based Kerberos and NTLM HTTP Authentication in Microsoft Windows [RFC4559]
2. The 'negotiate' value (section 8.7) in the "uri-authentication-supported" Printer Description attribute

14.3 Conditional Conformance Requirements for Clients

To claim conformance for the OPTIONAL "document-password" (section 6.1.2) operation attribute, Clients MUST support the following:

1. Transport Layer Security 1.2 [RFC5246] or higher and Upgrading to TLS Within HTTP/1.1 [RFC2817]
2. Negotiation of a TLS session prior to sending a request containing the "document-password" operation attribute

14.4 HTTP Recommendations

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

15. Internationalization Considerations

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

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

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

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

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

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

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

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

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

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

Unicode Collation Algorithm [UTS10] – sorting

Unicode Locale Data Markup Language [UTS35] – locale databases

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

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

Unicode Character Property Model [UTR23] – character properties

Unicode Conformance Model [UTR33] – Unicode conformance basis

16. Security Considerations

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

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

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

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

Unicode Security FAQ [UNISECFAQ] – common Unicode security issues

The "document-password" (section 6.1.2) operation attribute MUST be treated as private and confidential, MUST be retained for as long as the corresponding Job and Document are retained, MUST NOT be persisted beyond the life of the Job or Document, and MUST NOT be returned to Clients in any IPP response.

17. IANA Considerations

17.1 MIME Media Type Registration

Name : Michael Sweet

E-mail : msweet@apple.com

MIME media type name : text

MIME subtype name : Standards Tree – strings

Required parameters : NONE

Optional parameters : NONE

Encoding considerations :

UTF-8 encoded Unicode text.

Security considerations :

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

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

Interoperability considerations :

NONE

Published specification :

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

Applications which use this media :

All Cocoa, NeXTStep, and OpenStep applications
CUPS
IPP Everywhere

Additional information :

1. Magic number(s) :

2. File extension(s) :

strings

3. Macintosh file type code :

Person to contact for further information :

1. Name : Michael Sweet

2. E-mail : msweet@apple.com

Intended usage : Common

Used for providing localizations of English keywords and numeric values.

Author/Change controller :

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

17.2 Attribute Registrations

The attributes 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 attributes:	Reference
document-metadata (1setOf octetString(MAX))	[PWG5100.13]
document-password (octetString(1023))	[PWG5100.13]
first-index (integer(1:MAX))	[PWG5100.13]
identify-actions (1setOf type2 keyword)	[PWG5100.13]
preferred-attributes (collection)	[PWG5100.13]
<Any Template attribute>	[PWG5100.13]
requesting-user-uri (uri)	[PWG5100.13]

Job Template attributes:	Reference
job-error-action (type2 keyword)	[PWG5100.13]
pages-per-subset (1setOf integer(1:MAX))	[PWG5100.13]
print-color-mode (type2 keyword)	[PWG5100.13]
print-rendering-intent (type2 keyword)	[PWG5100.13]

Job Description attributes:	Reference
document-metadata (1setOf octetString(MAX))	[PWG5100.13]
job-originating-user-uri (uri)	[PWG5100.13]
job-pages (integer(0:MAX)	[PWG5100.13]
job-pages-completed (integer(0:MAX)	[PWG5100.13]
job-pages-completed-current-copy (integer(0:MAX)	[PWG5100.13]
job-uuid (uri(45))	[PWG5100.13]

Document Template attributes:	Reference
print-color-mode (type2 keyword)	[PWG5100.13]
print-rendering-intent (type2 keyword)	[PWG5100.13]

Document Description attributes:	Reference
document-metadata (1setOf octetString(MAX))	[PWG5100.13]
document-uuid (uri(45))	[PWG5100.13]
pages (integer(0:MAX)	[PWG5100.13]
pages-completed (integer(0:MAX)	[PWG5100.13]
pages-completed-current-copy (integer(0:MAX)	[PWG5100.13]

Printer Description attributes:	Reference
device-service-count (integer(1:MAX))	[PWG5100.13]
device-uuid (uri(45))	[PWG5100.13]
document-password-supported (integer(0:1023))	[PWG5100.13]
identify-actions-default (1setOf type2 keyword)	[PWG5100.13]
identify-actions-supported (1setOf type2 keyword)	[PWG5100.13]
ipp-features-supported (1setOf type2 keyword)	[PWG5100.13]
job-constraints-supported (1setOf collection)	[PWG5100.13]
job-error-action-default (type2 keyword)	[PWG5100.13]
job-error-action-supported (1setOf type2 keyword)	[PWG5100.13]
job-resolvers-supported (1setOf collection)	[PWG5100.13]
multiple-operation-time-out-action (type2 keyword)	[PWG5100.13]


```
pages-per-subset-supported (boolean)                        [PWG5100.13]
preferred-attributes-supported (boolean)                    [PWG5100.13]
print-color-mode-default (type2 keyword)                    [PWG5100.13]
print-color-mode-supported (1setOf type2 keyword)           [PWG5100.13]
print-rendering-intent-default (type2 keyword)              [PWG5100.13]
print-rendering-intent-supported (1setOf type2 keyword)     [PWG5100.13]
printer-charge-info (text(MAX))                             [PWG5100.13]
printer-charge-info-uri (uri)                               [PWG5100.13]
printer-geo-location (uri)                                  [PWG5100.13]
printer-get-attributes-supported (1setOf type2 keyword)     [PWG5100.13]
printer-icc-profiles (1setOf collection)                    [PWG5100.13]
  <Any Template attribute>                                  [PWG5100.13]
  profile-name (name(MAX))                                  [PWG5100.13]
  profile-url (uri)                                         [PWG5100.13]
printer-icons (1setOf uri)                                  [PWG5100.13]
printer-mandatory-job-attributes (1setOf type2 keyword)     [PWG5100.13]
printer-organization (1setOf text(MAX))                    [PWG5100.13]
printer-organizational-unit (1setOf text(MAX))             [PWG5100.13]
printer-supply (1setOf octetString(MAX))                    [PWG5100.13]
printer-supply-description (1setOf text(MAX))               [PWG5100.13]
printer-supply-info-uri (uri)                               [PWG5100.13]
printer-uuid (uri(45))                                      [PWG5100.13]
requesting-user-uri-supported (boolean)                     [PWG5100.13]

Subscription Description attributes:                        Reference
-----------------------------------                         ---------
notify-subscriber-user-uri (uri)                            [PWG5100.13]
notify-subscription-uuid (uri)                              [PWG5100.13]
```

17.3 Type2 keyword Registrations

The keyword 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)
  Keyword Attribute Value                                   Reference
  -----------------------                                   ---------
document-state-reasons (1setOf type2 keyword)               [PWG5100.5]
  document-password-error                                   [PWG5100.13]
  document-permission-error                                 [PWG5100.13]
  document-security-error                                   [PWG5100.13]
  document-unprintable-error                                [PWG5100.13]

identify-actions (1setOf type2 keyword)                     [PWG5100.13]
  display                                                   [PWG5100.13]
  flash                                                     [PWG5100.13]
  sound                                                     [PWG5100.13]
  speak                                                     [PWG5100.13]
identify-actions-default (1setOf type2 keyword)             [PWG5100.13]
```



```
    <Any "identify-actions" keyword value>                [PWG5100.13]
  identify-actions-supported (1setOf type2 keyword)       [PWG5100.13]
    <Any "identify-actions" keyword value>                [PWG5100.13]
  ipp-features-supported (1setOf type2 keyword)           [PWG5100.13]
    document-object                                       [PWG5100.13]
    job-save                                              [PWG5100.13]
    none                                                  [PWG5100.13]
    page-overrides                                        [PWG5100.13]
    proof-print                                           [PWG5100.13]
    subscription-object                                   [PWG5100.13]

  job-error-action (type2 keyword)                        [PWG5100.13]
    abort-job                                             [PWG5100.13]
    cancel-job                                            [PWG5100.13]
    continue-job                                          [PWG5100.13]
    suspend-job                                           [PWG5100.13]
  job-error-action-default (type2 keyword)                [PWG5100.13]
    <Any "job-error-action" keyword value>                [PWG5100.13]
  job-error-action-supported (1setOf type2 keyword)       [PWG5100.13]
    <Any "job-error-action" keyword value>                [PWG5100.13]

  job-state-reasons (1setOf type2 keyword)                [RFC8011]
    document-password-error                               [PWG5100.13]
    document-permission-error                             [PWG5100.13]
    document-security-error                               [PWG5100.13]
    document-unprintable-error                            [PWG5100.13]

  multiple-operation-time-out-action (type2 keyword)      [PWG5100.13]
    abort-job                                             [PWG5100.13]
    hold-job                                              [PWG5100.13]
    process-job                                           [PWG5100.13]

  print-color-mode (type2 keyword)                        [PWG5100.13]
    auto                                                  [PWG5100.13]
    auto-monochrome                                       [PWG5100.13]
    bi-level                                              [PWG5100.13]
    color                                                 [PWG5100.13]
    highlight                                             [PWG5100.13]
    monochrome                                            [PWG5100.13]
    process-bi-level                                      [PWG5100.13]
    process-monochrome                                    [PWG5100.13]
  print-color-mode-default (type2 keyword)                [PWG5100.13]
    <Any "print-color-mode" keyword value>                [PWG5100.13]
  print-color-mode-supported (1setOf type2 keyword)       [PWG5100.13]
    <Any "print-color-mode" keyword value>                [PWG5100.13]

  print-content-optimize (type2 keyword)                  [PWG5100.7]
    auto                                                  [PWG5100.13]

  print-rendering-intent (type2 keyword)                  [PWG5100.13]
    absolute                                              [PWG5100.13]
    auto                                                  [PWG5100.13]
    perceptual                                            [PWG5100.13]
    relative                                              [PWG5100.13]
    relative-bpc                                          [PWG5100.13]
    saturation                                            [PWG5100.13]
```



```
print-rendering-intent-default (type2 keyword)            [PWG5100.13]
  <Any "print-rendering-intent" keyword value>            [PWG5100.13]
print-rendering-intent-supported (1setOf type2 keyword)   [PWG5100.13]
  <Any "print-rendering-intent" keyword value>            [PWG5100.13]

printer-get-attributes-supported (1setOf type2 keyword)   [PWG5100.13]
  <Any Job Template attribute>
  <Any Operation attribute at the job level>

printer-mandatory-job-attributes (1setOf type2 keyword)   [PWG5100.13]
  <Any Job Template attribute>
  <Any Operation attribute at the job level>

printer-state-reasons (1setOf type2 keyword)              [RFC8011]
  cleaner-life-almost-over                                [PWG5100.13]
  cleaner-life-over                                       [PWG5100.13]

uri-authentication-supported (1setOf type2 keyword)       [RFC8011]
  negotiate                                               [PWG5100.13]
```

17.4 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]
```

17.5 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]

17.6 Status Code Registrations

The status codes 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:

Value	Status Code Name	Reference
0x0400:0x04FF	- Client Error:	
0x0418	client-error-document-password-error	[PWG5100.13]
0x0419	client-error-document-permission-error	[PWG5100.13]
0x041A	client-error-document-security-error	[PWG5100.13]
0x041B	client-error-document-unprintable-error	[PWG5100.13]

18. Overview of Changes

18.1 IPP Job and Printer Extensions Set 3 v.1.1

The following changes were made to the previous version of this specification [PWG5100.13-2012]:

- Resolved all errata from PWG errata tracking site (https://www.pwg.org/dynamo/issues.php?L+P-1+S-2+I0+E0+Z13+Q)
- Added message catalog syntax extensions and semantics for "_tooltip" and "_helpurl" (content from the latest draft of HELPME)

- Added "soft-proof-icc-profiles" and "print-quality-hints-supported" (content from the latest draft of PQI)

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

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21. Change History

21.1 July 24, 2019

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

- Drop "-5100.13" from the filename (that's just for published documents)
- Global: remove section references for all of the STD92 stuff (which would have been RFC2911 sections - they don't match up
- 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 have a mix of quote styles, maybe "1setOf syntax" instead of "1setOf <type-def- for-job-template-attribute>"
- Global: Remove all of the media-xxx attributes since those are part of Job Extensions v2.0
- Section 5.6.17, table 6: fix title ("multiple-operation-time-out-action")
- Section 5.6.18: Obsolete
- Section 5.6.29 (printer-get-attributes-supported): Drop 'type2'
- Section 5.6.33 (printer-mandatory-job-attributes): Drop 'type2'
- Section 5.6.39.4 example should probably be expanded to include yellow and black (to be realistic), along with a wasteToner or wasteInk entry?
- Section 5.6.40.2 sync up with printer-supply example changes
- Section 6.10: Remove (all media-col stuff is in JOBEXT 2.0)
- Section 7.2: Remove? I think these are now defined in Finishings 2.1?
- Sections 7.6 and 7.7: Remove (all media-col stuff is in JOBEXT 2.0)

- Section 9.1: Example on lines 1878 to 1881 uses left/right quotes instead of straight quotes
- Section 10: Might want to wordsmith this now that STD92 has clarified things? Line 1985 also has a typo ("page-range" instead of "page-ranges").
- Table 15: Remove (obsolete) job-cover-back and job-cover-front attributes, change "pages-ranges" to "page-ranges", remove (obsolete) sheet-collate,
- Section 11.2: "printer-config-change-time" (not printer-description-change-time), remove media-xxx references.
- Global: Update RFC2616 references to the corresponding new RFC723x RFCs...
- Section 16: Drop "using Address style", you should be listed as primary author, move/update others as appropriate

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

21.2 July 10, 2019

Initial revision for v1.1.

- Copied all content from previous JPS3 MS Word document into latest template
- Resolved all errata from PWG errata tracking site (https://www.pwg.org/dynamo/issues.php?L+P-1+S-2+I0+E0+Z13+Q)
- Copied in message catalog syntax extensions and semantics for "_tooltip" and "_helpurl" from the latest draft of HELPME
- Copied in extensions for "print-color-mode", "print-quality", from the latest draft of PQI

