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IPP: Job and Printer Extensions – Set 3 (JPS3)

Status: Approved

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 document is a PWG Candidate Standard. For a definition of a "PWG Candidate Standard", see: ftp://ftp.pwg.org/pub/pwg/general/pwg-process30.pdf

This document is available electronically at:

ftp://ftp.pwg.org/pub/pwg/candidates/cs-ippjobprinterext3v10-20120727-5100.13.docx
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Title: *IPP: Job and Printer Extensions – Set 3 (JPS3)*

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

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

For additional information regarding the Printer Working Group visit:

http://www.pwg.org

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About the Internet Printing Protocol Work Group

The Internet Printing Protocol (IPP) working group has developed a modern, full-featured network printing protocol, which is now the industry standard. IPP allows a print client to query a printer for its supported capabilities, features, and parameters to allow the selection of an appropriate printer for each print job. IPP also provides job information prior to, during, and at the end of job processing.

For additional information regarding IPP visit:

http://www.pwg.org/ipp/

Implementers of this specification are encouraged to join the IPP mailing list in order to participate in any discussions of the specification. Suggested additions, changes, or clarification to this specification, should be sent to the IPP mailing list for consideration.

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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 [RFC2911] [PWG5100.12] to better support generic, vendor-neutral implementations of printing in these environments.

This specification extends the IPP Model and Semantics [RFC2911] by defining:

1. a general method for limits and coloring 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.

1.1 Limits

The IPP/1.1 Model and Semantics [RFC2911] 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".

1.2 Coloring

The Get-Printer-Attributes operation in the IPP/1.1 Model and Semantics [RFC2911] supports attribute "coloring" using the "document-format" operation attribute. This specification extends this 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 "coloring" based on the "requesting-user-name" or authenticated user for Job and Subscription operations.

1.3 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.

1.4 ICC Color Management

This specification adds new Job Template and Printer 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.

1.5 Localization

This specification defines and registers an existing plain text message catalog file format (MIME media type "text/strings") used on Mac OS X 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.

1.6 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.

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 [RFC2119].

The term CONDITIONALLY REQUIRED is additionally defined for a conformance requirement that applies to a particular capability or feature.

2.2 Printing Terminology

Normative definitions and semantics of printing terms are imported from IETF Printer MIB v2 [RFC3805], IETF Finisher MIB [RFC3806], and IETF IPP/1.1 [RFC2911].

This document also defines the following terms in order to specify unambiguous conformance requirements:

IPP Client; Initiator of outgoing IPP session requests and sender of outgoing IPP operation requests (HTTP/1.1 Client [RFC2616]).

IPP Printer; Listener for incoming IPP session requests and receiver of incoming IPP operation requests (HTTP/1.1 Server [RFC2616]).

Job Description; Attributes supplied by the Client or end user including job processing instructions which are intended to override any Printer object defaults and/or instructions embedded within the document data (IPP Model and Semantics [RFC2911]).

Job Template; Attributes describing the Job object's identification, state, size, etc. (IPP Model and Semantics [RFC2911])

Job Ticket; The combination of Job Description and Job Template attributes.

2.3 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 [RFC2911] 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.

3. Requirements

3.1 Rationale for Job and Printer Extensions – Set 3

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 JPS3 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

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.

3.3 Out of Scope

The following elements of the use cases 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

3.4 Design Requirements

The IPP Job and Printer Extensions - Set 3 design requirements are:

1. Follow the naming conventions defined in the IPP/1.1 Model and Semantics [RFC2911], 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 coloring 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 IPP Job and Printer Extensions - Set 3 design recommendations are:

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

4. New Operations

4.1 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 (see section 8.3 of [RFC2911]) 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.

4.1.1 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 [RFC2911] section 3.1.4.1.

Target:

The "printer-uri" (uri) operation attribute which is the target for this operation as described in [RFC2911] section 3.1.5.

Requesting User:

The "requesting-user-name" (name(MAX)) attribute SHOULD be supplied by the Client as described in [RFC2911] section 8.3. In addition, the "requesting-user-uri" (section 5.1.6) 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 5.1.4]:

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.

4.1.2 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 [RFC2911] sections 13 and 3.1.6.

Natural Language and Character Set:

The "attributes-charset" and "attributes-natural-language" attributes as described in [RFC2911] section 3.1.4.2.

Group 2: Unsupported Attributes

See [RFC2911] section 3.1.7 for details on returning Unsupported Attributes.

4.2 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 5.1.2) 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.

4.2.1 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 [RFC2911] section 3.1.4.1.

Target:

The "printer-uri" (uri) operation attribute which is the target for this operation as described in [RFC2911] section 3.1.5.

Requesting User:

The "requesting-user-name" (name(MAX)) attribute SHOULD be supplied by the Client as described in [RFC2911] section 8.3. In addition, the "requesting-user-uri" (section 5.1.6) 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.

4.2.2 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 [RFC2911] sections 13 and 3.1.6.

Natural Language and Character Set:

The "attributes-charset" and "attributes-natural-language" attributes as described in [RFC2911] section 3.1.4.2.

"preferred-attributes" (collection):

This attribute (defined in section 5.1.5) MAY be returned when conflicts are detected in the supplied Operation and Document Template attributes.

Group 2: Unsupported Attributes

See [RFC2911] section 3.1.7 for details on returning Unsupported Attributes.

5. Attributes

5.1 Operation Attributes

5.1.1 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 5.3.2) or Document Description (section 5.5.2) attribute of the same name when processing Print-Job, Print-URI, Send-Document, or Send-URI requests (section 6.6).

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
```


5.1.2 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 6.6). 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 5.6.2) 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 5.6.2) 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.

5.1.3 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.

5.1.4 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 4.1, "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 5.6.5) Printer attribute and the supported values are defined by the "identify-actions-supported (section 5.6.6) Printer attribute.

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

5.1.5 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 4.2 and the Validate-Job response as defined in section 6.12. 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).

5.1.6 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 (see Sections 4.4.2, 4.4.3, and 8 of the IPP/1.1 Model and Semantics [RFC2911]).

The "requesting-user-uri-supported" (section 5.6.42) Printer attribute specifies whether the "requesting-user-uri" operation attribute is supported.

5.2 Job and Document Template Attributes

5.2.1 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.

Note: When a Printer stops processing a job, it MAY temporarily add the 'processing-to-stop-point' keyword to the "job-state-reasons" Job Description attribute. See rule 1 in section 3.3.3 [RFC2911] for more information.

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 (section 3.3.3 [RFC2911]) 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.

5.2.2 pages-per-subset (1setOf integer(1:MAX))

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

The value of the attribute is a set of one or more integers, where each integer specifies the number of Input-Pages in a subset, and the set is treated as a repeating sequence of integers. Thus, when the attribute contains a single integer, the integer specifies the number of Input-Pages in each subset, as a repeating sequence of the single integer. When the number of integers in this attribute exceeds 1, the first integer specifies the number of Input-Pages in the first subset, the second integer specifies the number of Input-Pages in the second subset and so on. If numbers in this attribute are exhausted

before partitioning all of the Input-Pages, the Printer starts at the beginning of the sequence again and continues until all Input-Pages are partitioned.

If the job contains more than one Input-Document, the Input-Pages are treated as a single stream of Input-Pages which are partitioned into contiguous subsets with some subsets possibly belonging to more than one Input-Document. If the number of Input-Pages available for the last subset is less than the number specified by this attribute, the Printer MUST treat 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 5.6.18).

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.

5.2.3 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.

Table 3 - "print-color-mode" Keyword Values

Keyword	Description	Conformance
auto	Automatic based on document	REQUIRED
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)

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

5.2.4 print-rendering-intent (type2 keyword)

The RECOMMENDED "print-rendering-intent" Job and Document Template attribute specifies how out-of-gamut colors (or shades of gray) are mapped to device colors when printing. Printers MUST support this attribute if they support the "printer-icc-profiles" attribute (section 5.6.30). If supported, the Printer MUST print the job using the requested rendering intent. Standard keyword values are shown in Table 4.

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

5.3 Job Description Attributes

5.3.1 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.

5.3.2 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 5.1.1. The "document-metadata" Document attribute is copied from the operation attribute of the same name as defined in section 6.6.

5.3.3 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 6.1.

5.3.4 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 10 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 5.3.5) is supported.

5.3.5 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 10 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 5.3.4) is supported.

5.3.6 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 5.3.4) is supported.

5.4 Subscription Description Attributes

5.4.1 subscription-uuid (uri(45))

The CONDITIONALLY REQUIRED "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 "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.

5.4.2 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 6.1. This attribute is REQUIRED if IPP: Event Notifications and Subscriptions [RFC3995] are supported.

5.5 Document Description Attributes

5.5.1 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.

5.5.2 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 5.1.1. The "document-metadata" Document attribute is copied from the operation attribute of the same name as defined in section 6.6.

5.5.3 pages (integer(0:MAX))

The "pages" READ-ONLY Document attribute contains the total number of input pages for the document. See section 10 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 5.5.4) and the IPP Document Object [PWG5100.5] are supported.

5.5.4 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 10 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 5.5.3) and the IPP Document Object [PWG5100.5] are supported.

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

The "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 5.5.3) and the IPP Document Object [PWG5100.5] are supported.

5.6 Printer Description Attributes

5.6.1 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.

5.6.2 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.

5.6.3 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].

5.6.4 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 5.1.2).

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.

5.6.5 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 4.1.

5.6.6 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 4.1.

5.6.7 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	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]

5.6.8 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. 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.

For example, a constraint 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 two values - “two-sided-long-edge” and “two-sided-short-edge” - while the “media-col” member attribute would have a single "media-type" member attribute with the value “transparency”.

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

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

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

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

5.6.11 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”.

5.6.12 media-bottom-margin-supported (1setOf integer(0:MAX))

The REQUIRED "media-bottom-margin-supported" Printer attribute lists the supported values for the "media-bottom-margin" member attribute (section 7.6.1) for the "media-col" Job Template attribute [PWG5100.3]. Each value is a non-negative integer in hundredths of millimeters or 1/2540th of an inch and specifies a hardware margin supported by the Printer.

5.6.13 media-left-margin-supported (1setOf integer(0:MAX))

The REQUIRED "media-left-margin-supported" Printer attribute lists the supported values for the "media-left-margin" member attribute (section 7.6.2) for the "media-col" Job Template attribute [PWG5100.3]. Each value is a non-negative integer in hundredths of millimeters or 1/2540th of an inch and specifies a hardware margin supported by the Printer.

5.6.14 media-right-margin-supported (1setOf integer(0:MAX))

The REQUIRED "media-right-margin-supported" Printer attribute lists the supported values for the "media-right-margin" member attribute (section 7.6.3) for the "media-col" Job Template attribute [PWG5100.3]. Each value is a non-negative integer in hundredths of millimeters or 1/2540th of an inch and specifies a hardware margin supported by the Printer.

5.6.15 media-source-supported (1setOf (type3 keyword | name(MAX))

The RECOMMENDED "media-source-supported" Printer attribute lists the supported values for the "media-source" member attribute (section 7.6.5) for the "media-col" Job Template attribute [PWG5100.3]. Each value is standard or locally-defined tray, slot, roll, or other media source name.

This attribute MUST be supported if the "media-source" member attribute (section 7.6.5) is supported.

5.6.16 media-top-margin-supported (1setOf integer(0:MAX))

The REQUIRED "media-top-margin-supported" Printer attribute lists the supported values for the "media-top-margin" member attribute (section 7.6.7) for the "media-col" Job Template attribute [PWG5100.3]. Each value is a non-negative integer in hundredths of millimeters or 1/2540th of an inch and specifies a hardware margin supported by the Printer.

5.6.17 multiple-operation-timeout-action (type2 keyword)

The "multiple-operation-timeout-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-timeout-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.

5.6.18 pages-per-subset-supported (boolean)

The "pages-per-subset-supported" Printer attribute specifies whether the "pages-per-subset" attribute (section 5.2) is supported. This attribute is REQUIRED when the Printer also supports the "pages-per-subset" attribute.

5.6.19 preferred-attributes-supported (boolean)

The RECOMMENDED "preferred-attributes-supported" Printer attribute specifies whether the "preferred-attributes" attribute (section 5.1.5) will be returned by the Validate-Document (section 4.2) or Validate-Job (section 6.12) operations.

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

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

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

The list of supported "print-color-mode" Job Template attribute values.

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

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

5.6.23 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.

5.6.24 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.

5.6.25 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.

5.6.26 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.

5.6.27 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.

5.6.28 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.

5.6.29 printer-get-attributes-supported (1setOf type2 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 [RFC2911]. All other values are OPTIONAL.

5.6.30 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.

5.6.30.1 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.

5.6.30.2 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.

5.6.31 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.

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

The RECOMMENDED "printer-input-tray" Printer attribute provides current input tray details mapped from the SNMP prtInputTrayTable defined in IETF Printer MIB v2 [RFC3805]. This attribute MUST be supported if the "media-source" member attribute (section 7.6.5) or "media-source-properties" member attribute (section 7.6.6) are supported.

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

5.6.32.1 Keywords for printer-input-tray

Table 7 defines the IPP datatypes and keywords for encoding "printer-input-tray" from all of the machine-readable (non-localized) columnar objects in prtInputTrayTable [RFC3805].

Table 7 - Keywords for "printer-input-tray"

Printer MIB Object	IPP Data-type	IPP Keyword	PWG SM Keyword	Conformance
prtInputTray...				
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.

5.6.32.2 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 2 defines the standard encoding in "printer-input-tray" for all the machine-readable (non-localized) columnar objects in prtInputTrayTable [RFC3805].

Figure 2 - 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-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]
```


Figure 2 - ABNF for "printer-input-tray" Values (con't)

```
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]
```


5.6.32.3 Examples of printer-input-tray

The following example shows two rows of the machine-readable (non-localized) columnar objects from prtInputTrayTable 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;
```

5.6.33 printer-mandatory-job-attributes (1setOf type2 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.

5.6.34 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].

5.6.35 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].

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

The CONDITIONALLY REQUIRED "printer-output-tray" Printer attribute provides current output tray details mapped from the SNMP prtOutputTrayTable 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.

5.6.36.1 Keywords for printer-output-tray

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

Table 8 - 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.

5.6.36.2 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 3 defines the standard encoding in "printer-output-tray" for all the machine-readable (non-localized) columnar objects in prtOutputTrayTable [RFC3805].

Figure 3 - 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-remaining /
                      output-status /
                      output-name

output-optional     = output-opt ";"
```


Figure 3 - ABNF for "printer-output-tray" Values (con't)

```
output-opt          = output-index /
                      output-unit /
                      output-stacking-order /
                      output-page-delivery /
                      output-offset-stacking

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]
```


5.6.36.3 Examples of printer-output-tray

The following example shows two rows of the machine-readable (non-localized) columnar objects from prtOutputTrayTable 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;
```

5.6.37 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 5.6.38) Printer attribute.

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

5.6.38 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 5.6.37) attribute is supported.

The "text/strings" MIME media type is defined in section 9.1.

5.6.39 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.

5.6.39.1 Keywords for printer-supply

Table 9 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].

5.6.39.2 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 4 defines the standard encoding in "printer-supply" for all the machine-readable (non-localized) columnar objects in prtMarkerSuppliesTable and prtMarkerColorantTable [RFC3805].

Table 9 - Keywords for "printer-supply"

SNMP Supply Object	IPP Data-type	IPP Keyword	SM Keyword	Conformance
prtMarkerSupplies...				
Index (note 1)	Integer	index	Id	REQUIRED
MarkerIndex (note 2)	Integer	markerindex		OPTIONAL
ColorantIndex (note 3)	Integer	---	MarkerSupply ColorantId	---
Class	String	class	MarkerSupply Class	RECOMMENDED
Type	String	type	MarkerSupply Type	REQUIRED
SupplyUnit	String	unit	MarkerSupply CapacityUnit	RECOMMENDED
MaxCapacity	Integer	maxcapacity	MarkerSupply MaxCapacity	REQUIRED
Level	Integer	level	MarkerSupply CurrentLevel	REQUIRED
prtMarkerColorant...				
Index	Integer	colorantindex	Id	OPTIONAL
Role	String	colorantrole	MarkerColorant Role	OPTIONAL
Value	String	colorantname	MarkerColorant Name	REQUIRED
Tonality	Integer	coloranttonality	MarkerColorant Tonality	OPTIONAL

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.

Figure 4 - 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 /

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

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]

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
    ; prtMarkerSuppliesSupplUnit 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]
```


Figure 4 - ABNF for "printer-supply" Values (con't)

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

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

5.6.39.3 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 [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 10 lists the standard colorant names with their corresponding reference sRGBA values.

Table 10 - Standard Colorant Names for "printer-supply"

Name	sRGBA Value	Sample
no-color	Undefined	
black	000000ff	
light-black	808080ff	
blue	0000ffff	
cyan	00ffffff	
light-cyan	e0ffffff	
gold	ffd700ff	
gray	808080ff	
dark-gray	404040ff	
light-gray	d3d3d3ff	
green	008000ff	
magenta	ff00ffff	
light-magenta	ff77ffff	
multi-color	Undefined	
orange	ffa500ff	
red	ff0000ff	
silver	c0c0c0ff	
white	ffffffff	
yellow	ffff00ff	
dark-yellow	ffcc00ff	

5.6.39.4 Example of printer-supply

The following example shows two rows of the machine-readable (non-localized) columnar objects from prtMarkerSuppliesTable and prtMarkerColorantTable encoded into corresponding values of "printer-supply".

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

```
printer-supply[1] =
    type=toner;maxcapacity=100;level=75;index=1;markerindex=1;
    class=supplyThatIsConsumed;unit=percent;
    colorantindex=4;colorantrole=process;colorantname=cyan;
    coloranttonality=128;

printer-supply[2] =
    type=toner;maxcapacity=100;level=72;index=2;markerindex=1;
    class=supplyThatIsConsumed;unit=percent;
    colorantindex=4;colorantrole=process;colorantname=magenta;
    coloranttonality=128;
```

5.6.40 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 5.5.21) 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.

5.6.40.1 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).

5.6.40.2 Example of printer-supply-description

The following example shows two instances of the human-readable (localized) columnar object prtMarkerSuppliesDescription in the prtMarkerSuppliesTable encoded into corresponding values of "printer-supply-description".

```
printer-supply-description[1] =
    Cyan Toner Cartridge S/N:CRUM-09111141087

printer-supply-description[2] =
    Magenta Toner Cartridge S/N:CRUM-08561031091
```

5.6.41 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.

5.6.42 requesting-user-uri-supported (boolean)

The REQUIRED "requesting-user-uri-supported" Printer attribute specifies whether the "requesting-user-uri" (section 5.1.6) operation, "job-originating-user-uri" (section 5.3.3) Job Description, and "notify-subscriber-user-uri" (section 5.4.2) Subscription Description attributes are supported. Printers MUST support this attribute with a value of 'true'.

6. Additional Semantics for Existing Operations

6.1 All Operations: "requesting-user-uri"

If the Printer supports the "requesting-user-uri" (section 5.1.6) 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 5.3.3) or "notify-subscriber-user-uri" (section 5.4.2) 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 Sections 4.4.2, 4.4.3, and 8 of the IPP/1.1 Model and Semantics [RFC2911]).

6.2 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 5.1.3) and "limit" ([RFC2911]) operation attributes to limit the number of "media-col-database" values that are returned in the response.

6.3 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 5.1.3) in conjunction with the "limit" operation attribute ([RFC2911]) to select the first Subscription object that is returned in the response.

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

Clients MAY provide and Printers MUST support the "first-index" operation attribute (section 5.1.3) in conjunction with the "limit" operation attribute ([RFC2911]) to select the first Job object that is returned in the response.

6.5 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 5.1.3) in conjunction with the

"limit" operation attribute ([RFC2911]) to select the first Document object that is returned in the response.

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

Clients MAY supply and Printers MUST support the "document-metadata" (section 5.1.1) 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.

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

If the Printer supports the "document-password" (section 5.1.2) 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 8.1) 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.

6.8 Validate-Job Operation: "document-password"

Clients MUST NOT send the "document-password" operation attribute (section 5.1.2) 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.

6.9 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.

6.10 Create-Job, Print-Job, and Print-URI Operations: "ipp-attribute-fidelity", "job-mandatory-elements", and "media-col"

When a Client specifies conflicting or unsupported member attribute values in a "media-col" attribute in a job creation request, the Printer MUST either:

1. Substitute non-conflicting or supported member attribute values and return the successful-ok-ignored-or-substituted-attributes status code - this is allowed only when the "ipp-attribute-fidelity" operation attribute is false/unspecified and the "job-mandatory-attributes" operation attribute does not contain the "media-col" keyword; or
2. Return the media-col attribute in the Unsupported attributes group with the client-error-conflicting-attributes or client-error-attributes-or-values-not-supported status code.

The typical case where a Printer will perform a substitution is for the "media-bottom-margin" (section 7.6.1), "media-left-margin" (section 7.6.2), "media-right-margin" (section 7.6.3), and "media-top-margin" (section 7.6.7) values - a Client might request borderless printing by specifying values of 0 for each member attribute but the Printer is unable to satisfy that request based on the values of other Job Template attributes.

Similarly, a Client might request printing using a specific combination of "media-size", "media-source" (section 7.6.5), and "media-type" values. In general, Printers SHOULD give precedence to "media-size" and "media-type" over "media-source" unless the media source is defined to have an interrupting behavior, e.g., "by-pass-tray" or "manual-feed".

6.11 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.

6.12 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 "job-preferred-attributes-supported" Printer attribute (section 5.5.4).

7. Additional Values and Semantics for Existing Attributes

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

Table 11 lists new "document-state-reasons" and "job-state-reasons" keyword values.

Table 11 - 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 5.1.2) 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 5.1.2) 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.

7.2 finishings (1setOf type2 enum)

Table 12 lists new enum values for the "finishings" Job Template attribute that SHOULD be supported by Printers with roll-fed media.

Table 12 - 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.

7.3 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.

7.4 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.

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

Table 13 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 13 - 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.

7.6 media-col Member Attributes

This specification makes the "media-col" attribute REQUIRED and defines several new "media-col" member attributes to support media selection on common consumer and small-business Printers.

7.6.1 media-bottom-margin (integer(0:MAX))

The RECOMMENDED "media-bottom-margin" member attribute defines the Printer's physical bottom margin in hundredths of millimeters from the bottom edge, without respect to the value of the “orientation-requested” Job Template attribute.

7.6.2 media-left-margin (integer(0:MAX))

The RECOMMENDED "media-left-margin" member attribute defines the Printer's physical left margin in hundredths of millimeters from the left edge, without respect to the value of the “orientation-requested” Job Template attribute.

7.6.3 media-right-margin (integer(0:MAX))

The RECOMMENDED "media-right-margin" member attribute defines the Printer's physical right margin in hundredths of millimeters from the right edge, without respect to the value of the “orientation-requested” Job Template attribute.

7.6.4 media-size-name (type3 keyword | name(MAX))

The RECOMMENDED "media-size-name" member attribute defines the media size using a PWG media size name [PWG5101.1] instead of the dimensions in the "media-size" member attribute. Clients and Printers MUST NOT specify both the "media-size" and "media-size-name" member attributes in a collection.

7.6.5 media-source (type3 keyword | name(MAX))

The RECOMMENDED "media-source" member attribute specifies the input tray, slot, roll, or other source for the media. Printers MUST support this member attribute when the "media-source-properties" member attribute (section 7.6.6) or "printer-input-tray" Printer attribute (section 5.6.32) are supported.

The standard keyword values are shown in Table 14.

Note: The name "media-source" was chosen over "media-input-tray" since the values represent more than trays. However, the "printer-input-tray" Printer attribute (section 5.6.32) retains the input tray name because it provides access to Printer MIB [RFC3805] properties of the same name.

Table 14 - "media-source" Keyword Values

Keyword	Description
alternate	The alternate or secondary input tray
alternate-roll	The alternate or secondary roll
auto	The Printer's automatic choice
bottom	The bottom input tray
by-pass-tray	The by-pass tray
center	The center feed slot/tray
disc	The CD/DVD/Bluray disc feed slot/tray
envelope	The envelope feed slot/tray
hagaki	The Hagaki feed slot/tray
large-capacity	The large capacity input tray
left	The left feed slot/tray
main	The main or primary input tray
main-roll	The main or primary roll
manual	The manual feed slot
middle	The middle input tray
photo	The photo feed slot/tray
rear	The rear feed slot/tray
right	The right feed slot/tray
roll-1	The first roll
roll-2	The second roll
roll-3	The third roll
roll-4	The fourth roll
roll-5	The fifth roll
roll-6	The sixth roll
roll-7	The seventh roll
roll-8	The eighth roll
roll-9	The ninth roll
roll-10	The tenth roll
side	The side feed slot/tray
top	The topmost input tray
tray-1	The first tray
tray-2	The second tray
tray-3	The third tray
tray-4	The fourth tray
tray-5	The fifth tray
tray-6	The sixth tray
tray-**7**	The seventh tray
tray-8	The eighth tray
tray-9	The ninth tray
tray-10	The tenth tray
tray-11	The eleventh tray
tray-12	The twelfth tray
tray-13	The thirteenth tray

Keyword	Description
tray-14	The fourteenth tray
tray-15	The fifteenth tray
tray-16	The sixteenth tray
tray-17	The seventeenth tray
tray-18	The eighteenth tray
tray-19	The nineteenth tray
tray-20	The twentieth tray

7.6.6 media-source-properties (collection)

The RECOMMENDED "media-source-properties" member attribute is provided in the "media-col-database" and "media-col-ready" collections to describe the media path and natural orientation for the specified collection. For example, when printing an envelope or form it is important to know which orientation to use for the document data.

Printers MUST support this member attribute when the "media-source" member attribute (section 7.6.5) or "printer-input-tray" Printer attribute (section 5.6.32) are supported.

When supported, Clients SHOULD use "media-col-ready" instead of "media-col-database" since the latter includes all possible media combinations, including potentially multiple instances of the same media with different "media-source-properties" values.

This member attribute MUST NOT be included in the "media-col" Job Template attribute since it is informational rather than specifying intent.

7.6.6.1 media-source-feed-direction (type2 keyword)

The "media-source-feed-direction" member attribute of "media-source-properties" defines whether the long edge ('long-edge-first') or short edge ('short-edge-first') of the media is pulled from the source.

7.6.6.2 media-source-feed-orientation (type2 enum)

The "media-source-feed-orientation" member attribute of "media-source-properties" defines the orientation of the media as pulled from the source. The value is an "orientation-requested" enumeration.

7.6.7 media-top-margin (integer(0:MAX))

The RECOMMENDED "media-top-margin" member attribute defines the Printer's physical top margin in hundredths of millimeters from the top edge, without respect to the value of the “orientation-requested” Job Template attribute.

7.6.8 Media Selection and Full-Bleed Printing

The "media-bottom-margin", "media-left-margin", "media-right-margin", and "media-top-margin" member attributes specify the Printer's physical margins, allowing a Printer to

determine how the content needs to be printed. A Client specifies that is has borderless or "full-bleed" content by setting all of the margins to 0.

Printers that support full-bleed printing MUST accept margins of 0 and MAY scale and center the print document to fill as needed to achieve full-bleed output. Printers SHOULD use the document Image Box when scaling for full-bleed output.

7.7 media-col-database Values

Because a Printer may support multiple values for the "media-bottom-margin", "media-left-margin", "media-right-margin", and "media-top-margin" member attributes, a Printer MAY only enumerate the best (smallest) values of these attributes to reduce the number of collection values returned in the "media-col-database" Printer attribute. However, if full-bleed and non-full-bleed margins have a significant performance, scaling, or quality differences, a Printer MUST enumerate both the full-bleed (all zeroes) and smallest non-zero hardware margins in the "media-col-database" Printer attribute.

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

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

8. Status Codes

8.1 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.

8.2 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.

8.3 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.

8.4 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.

9. Localization of Attributes and Values

The "printer-strings-uri" Printer attribute (section 5.6.38) provides the location of a language-specific, printer-resident message catalog file that provides localizations for attribute names, keyword values, and enum values.

9.1 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.

Message catalog files consist of lines of UTF-8 encoded Unicode text of the form:

```
“attribute-name” = “Localized String”;
“attribute-name.enum-value” = “Localized String”;
“attribute-name.keyword-value” = “Localized String”;
/* Comment for/to localizers */
```

Lines can be terminated by a single line feed (%x0A) or a combination of carriage return and line feed (%x0D.0A).

Attribute names and values are limited to the characters defined for the IPP keyword value syntax [RFC2911].

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

The following example file shows how various “media” and "orientation-requested" attribute values would be localized:

```
“media” = “Page Size”;
“media.na_letter_8.5x11in” = “US Letter - 8.5 x 11\””;
“media.na_legal_8.5x14in” = “US Legal - 8.5 x 14\””;
“media.na_number-10_4.125x9.5in” = “#10 Envelope - 4.125 x 9.5\””;
“media.iso_a4_210x297mm” = “A4 - 210x297mm”;
“media.iso_dl_110x220mm” = “DL Envelope - 110x220mm”;
```



```
"orientation-requested" = "Orientation";
"orientation-requested.3" = "Portrait";
"orientation-requested.4" = "Landscape";
"orientation-requested.5" = "Reverse Landscape";
"orientation-requested.6" = "Reverse Portrait";
```

Figure 5 provides the ABNF [STD68] for files conforming to the “text/strings” MIME media type.

Figure 5 - 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
```


10. Relationship of Impressions, Pages, and Sheets

The Internet Printing Protocol/1.1: Model and Semantics [RFC2911] 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").

10.1 Examples for Impressions, Pages, and Sheets

10.1.1 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.

10.1.2 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.

10.1.3 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 6 shows a graphical representation of this example.

Figure 6 - Two Document Duplex Job With Copies, Number-Up, and Page-Ranges

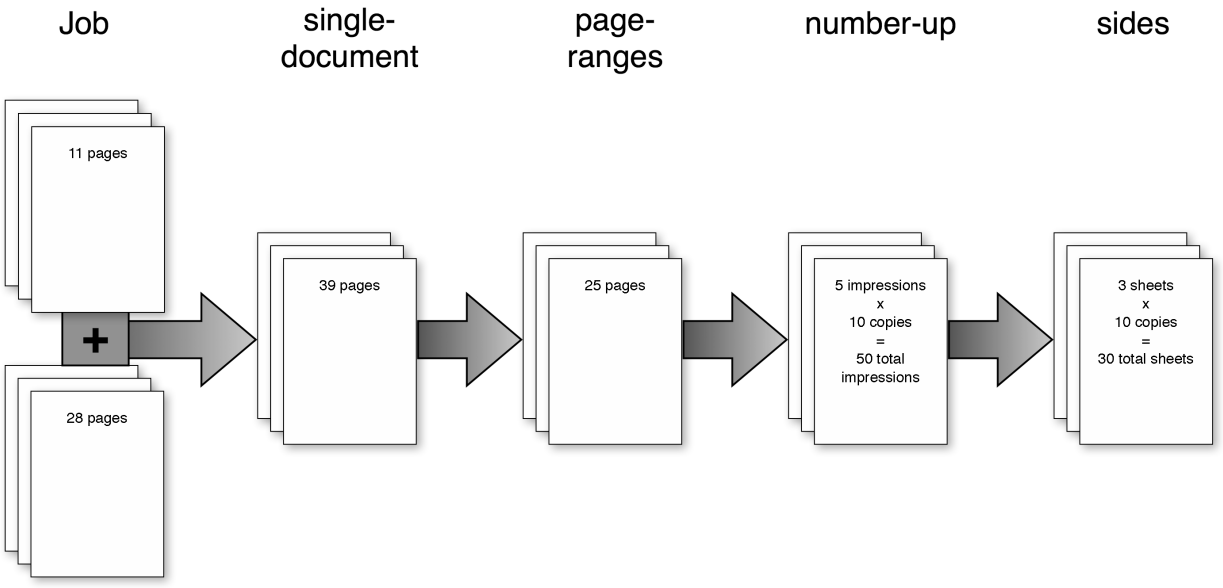

Table 15 - Job Template Attributes That Affect Impressions and Sheets

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-cover-back	For 'print-none', adds one sheet per set
job-cover-front	For 'print-none', adds one sheet per set
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)
pages-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
sheet-collate	Controls how documents and copies form a set
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

11. Conformance Requirements

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

11.1 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. The "document-metadata" operation (section 5.1.1) and Job Description (section 5.3.2) attributes
2. The "requesting-user-uri" operation (section 5.1.6) and "job-originating-user-uri" Job Description (section 5.3.3) attributes
3. The "print-color-mode" (section 5.2.3) and "print-rendering-intent" (section 5.2.4) Job Template attributes
4. The "job-uuid" (section 5.3.1) Job Description attribute
5. The "ipp-features-supported" (section 5.6.7) Printer Description attribute.
6. The "printer-get-attributes-supported" (section 5.6.29) Printer Description attribute
7. The "printer-icons" (section 5.6.31) Printer Description attribute
8. The "printer-organization" (section 5.6.34) and "printer-organizational-unit" (section 5.6.35) Printer Description attributes
9. The "printer-uuid" (section 5.6.1) Printer Description attribute

11.2 Conditional Conformance Requirements for Printer Objects

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

1. The "first-index" (section 5.1.3) operation attribute
2. The "subscription-uuid" (section 5.4.1) Subscription Description attribute
3. The "printer-description-change-time" (section 5.6.27) 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 4.2) operation
2. The "document-metadata" (section 5.5.2) Document Description attribute
3. The "document-uuid" (section 5.5.1) Document Description attribute
4. The "print-color-mode" (section 5.2.3) Document Template attribute
5. The "print-rendering-intent" (section 5.2.4) Document Template attribute

To claim conformance for the OPTIONAL Identify-Printer operation (section 4.1), Printers MUST support the following:

1. The "identify-actions" (section 5.1.4) operation attribute
2. The "identify-actions-default" (section 5.6.1) Printer Description attribute
3. The "identify-actions-supported" (section 5.6.6) Printer Description attribute.

To claim conformance for the OPTIONAL "printer-icc-profiles" (section 5.6.30) Printer attribute, Printers MUST support:

1. The "print-rendering-intent" (section 5.2.4) Job Template attribute, and
2. The "print-rendering-intent-default" (section 5.6.22) and "print-rendering-intent-supported" (section 5.6.23) Printer Description attributes.

To claim conformance for the REQUIRED "requesting-user-uri" (section 5.1.6) operation attribute, Printers conforming to IPP Event Notifications and Subscriptions [RFC3995] MUST support the "notify-subscriber-user-uri" (section 5.4.2) Subscription attribute, and vice-versa.

To claim conformance for the OPTIONAL "pages-per-subset" (section 5.2) attribute, Printers MUST support the "pages-per-subset-supported" Printer Description attribute, and vice-versa.

To claim conformance for the OPTIONAL "document-password" (section 5.1.2) operation attribute, Printers MUST support the following:

1. The "document-password-supported" (section 5.6.2) Printer Description attribute
2. The 'document-password-error' and 'document-permission-error' (section 7.1) keywords for the "document-state-reasons" and "job-state-reasons" attributes
3. The 'client-error-document-password-error' (section 8.1) and 'client-error-document-permission-error' (section 8.2) 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 5.1.5) operation attribute, and
2. The "preferred-attributes-supported" (section 5.6.19) Printer Description attribute.

To claim conformance for the OPTIONAL "job-constraints-supported" (section 5.6.8) Printer Description attribute, Printers MUST support the "job-resolvers-supported" (section 5.6.11) Printer Description attribute, and vice-versa.

To claim conformance for the OPTIONAL "printer-strings-uri" (section 5.6.38) Printer Description attribute, Printers MUST supply the "printer-strings-languages-supported" (section 5.6.37) Printer Description attribute, and vice-versa.

To claim conformance for the OPTIONAL "printer-supply" (section 5.6.37) Printer Description attribute, Printers MUST supply the "printer-supply-description" (section 5.6.40) Printer Description attribute, and vice-versa.

To claim conformance for the OPTIONAL "media-source" (section 7.6.4) member attribute MUST support:

1. The "media-source-supported" (section 5.6.15) Printer Description attribute, and
2. The "media-source-properties" (section 7.6.6) member attribute.

To claim conformance for the OPTIONAL Create-Job operation, Printers MUST support the "multiple-operation-timeout-action" (section 5.6.17) Printer Description attribute.

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

1. The "printer-charge-info" (section 5.6.19) Printer Description attribute
2. The "printer-charge-info-uri" (section 5.6.18) Printer Description attribute
3. The "printer-mandatory-job-attributes" (section 5.6.32) 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 7.8) in the "uri-authentication-supported" Printer Description attribute

11.3 Conditional Conformance Requirements for Clients

To claim conformance for the OPTIONAL "document-password" (section 5.1.2) 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

11.4 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 as defined in section 14.28 of the Hypertext Transfer Protocol -- HTTP/1.1 [RFC2616] to allow Clients to locally cache these resources to minimize network bandwidth usage and provide a responsive user interface. HTTP caching semantics (section 13 of [RFC2616]), particularly with HTTP proxies (section 15.7 of [RFC2616]) MUST be followed.

12. Internationalization Considerations

For interoperability and basic support for multiple languages, conforming implementations MUST support the UTF-8 [RFC3629] encoding of Unicode [UNICODE] [ISO10646].

13. Security Considerations

The IPP attributes and operations defined in this document require the same security considerations as defined in the IPP/1.1 Model and Semantics [RFC2911].

The "document-password" (section 5.1.2) 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.

14. IANA Considerations

14.1 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 :

ftp://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

14.2 Attribute Registrations

The attributes defined in this document will be published by IANA according to the procedures in IPP Model and Semantics [RFC2911] section 6.2 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]
media-col (collection)	[PWG5100.3]
media-bottom-margin (integer(0:MAX))	[PWG5100.13]
media-left-margin (integer(0:MAX))	[PWG5100.13]
media-right-margin (integer(0:MAX))	[PWG5100.13]
media-size-name (type3 keyword | name(MAX))	[PWG5100.13]
media-source (type3 keyword | name(MAX))	[PWG5100.13]
media-top-margin (integer(0:MAX))	[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]
media-bottom-margin-supported (1setOf integer(0:MAX))       [PWG5100.13]
media-col-database (1setOf collection)                      [PWG5100.11]
  media-source-properties (collection)                      [PWG5100.13]
    media-source-feed-direction (type2 keyword)             [PWG5100.13]
    media-source-feed-orientation (type2 enum)              [PWG5100.13]
media-col-ready (1setOf collection)                         [PWG5100.3]
  media-source-properties (collection)                      [PWG5100.13]
    media-source-feed-direction (type2 keyword)             [PWG5100.13]
    media-source-feed-orientation (type2 enum)              [PWG5100.13]
media-left-margin-supported (1setOf integer(0:MAX))         [PWG5100.13]
media-right-margin-supported (1setOf integer(0:MAX))        [PWG5100.13]
media-source-supported (1setOf (type3 keyword | name(MAX))
                                                            [PWG5100.13]
media-top-margin-supported (1setOf integer(0:MAX))          [PWG5100.13]
multiple-operation-timeout-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]
subscription-uuid (uri)                                    [PWG5100.13]
```

14.3 Attribute Value Registrations

The keyword attribute values defined in this document will be published by IANA according to the procedures in the IPP Model and Semantics [RFC2911] section 6.1 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)                 [RFC2911]
  document-password-error                                [PWG5100.13]
  document-permission-error                              [PWG5100.13]
  document-security-error                                [PWG5100.13]
  document-unprintable-error                             [PWG5100.13]

media-col-supported (1setOf type2 keyword)               [PWG5100.3]
  media-bottom-margin                                    [PWG5100.13]
  media-left-margin                                      [PWG5100.13]
  media-right-margin                                     [PWG5100.13]
  media-size-name                                        [PWG5100.13]
  media-source                                           [PWG5100.13]
  media-top-margin                                       [PWG5100.13]

media-source-feed-direction (type2 keyword)              [PWG5100.13]
  <Any "feed-orientation" keyword value>

media-source (type3 keyword | name(MAX))                 [PWG5100.13]
  alternate                                              [PWG5100.13]
  alternate-roll                                         [PWG5100.13]
  auto                                                   [PWG5100.13]
  bottom                                                 [PWG5100.13]
  by-pass-tray                                           [PWG5100.13]
  center                                                 [PWG5100.13]
  disc                                                   [PWG5100.13]
  envelope                                               [PWG5100.13]
  hagaki                                                 [PWG5100.13]
  large-capacity                                         [PWG5100.13]
  left                                                   [PWG5100.13]
  main                                                   [PWG5100.13]
  main-roll                                              [PWG5100.13]
  manual                                                 [PWG5100.13]
  middle                                                 [PWG5100.13]
  photo                                                  [PWG5100.13]
  rear                                                   [PWG5100.13]
  right                                                  [PWG5100.13]
  roll-1                                                 [PWG5100.13]
  roll-10                                                [PWG5100.13]
```



```
    roll-2                                                    [PWG5100.13]
    roll-3                                                    [PWG5100.13]
    roll-4                                                    [PWG5100.13]
    roll-5                                                    [PWG5100.13]
    roll-6                                                    [PWG5100.13]
    roll-7                                                    [PWG5100.13]
    roll-8                                                    [PWG5100.13]
    roll-9                                                    [PWG5100.13]
    side                                                      [PWG5100.13]
    top                                                       [PWG5100.13]
    tray-1                                                    [PWG5100.13]
    tray-10                                                   [PWG5100.13]
    tray-11                                                   [PWG5100.13]
    tray-12                                                   [PWG5100.13]
    tray-13                                                   [PWG5100.13]
    tray-14                                                   [PWG5100.13]
    tray-15                                                   [PWG5100.13]
    tray-16                                                   [PWG5100.13]
    tray-17                                                   [PWG5100.13]
    tray-18                                                   [PWG5100.13]
    tray-19                                                   [PWG5100.13]
    tray-2                                                    [PWG5100.13]
    tray-20                                                   [PWG5100.13]
    tray-3                                                    [PWG5100.13]
    tray-4                                                    [PWG5100.13]
    tray-5                                                    [PWG5100.13]
    tray-6                                                    [PWG5100.13]
    tray-7                                                    [PWG5100.13]
    tray-8                                                    [PWG5100.13]
    tray-9                                                    [PWG5100.13]
  media-source-supported (1setOf (type3 keyword | name(MAX))
                                                              [PWG5100.13]
    <Any "media-source" keyword value>                        [PWG5100.13]

  multiple-operation-timeout-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]
    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)                [RFC2911]
  cleaner-life-almost-over                                  [PWG5100.13]
  cleaner-life-over                                         [PWG5100.13]

uri-authentication-supported (1setOf type2 keyword)         [RFC2911]
  negotiate                                                 [PWG5100.13]
```

14.4 Type2 enum Attribute Value Registrations

The enumerations defined in this document will be published by IANA according to the procedures in the IPP Model and Semantics [RFC2911] section 6.2 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)                              [RFC2911]
  60              trim-after-pages                          [PWG5100.13]
  61              trim-after-documents                      [PWG5100.13]
  62              trim-after-copies                         [PWG5100.13]
  63              trim-after-job                            [PWG5100.13]

media-source-feed-orientation (type2 enum)                  [PWG5100.13]
  <Any "orientation-requested" enum value>

operations-supported (1setOf type2 enum)                    [RFC2911]
  0x003C          Identify-Printer                          [PWG5100.13]
  0x003D          Validate-Document                         [PWG5100.13]

orientation-requested (type2 enum)                          [RFC2911]
  7               none                                      [PWG5100.13]
```


14.5 Operation Registrations

The operations defined in this document will be published by IANA according to the procedures in the IPP Model and Semantics [RFC2911] section 6.2 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]

14.6 Status Code Registrations

The status codes defined in this document will be published by IANA according to the procedures in the IPP Model and Semantics [RFC2911] section 6.6 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]

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

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