Abstract: This specification defines the IPP Job Release, Job Storage, Print Policy and Proof Print features, to support printing workflows important to institutional IT environments such as corporate businesses, governments and universities.

This specification was previously titled "IPP Job and Printer Extensions - Set 2".

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Title: IPP Enterprise Printing Extensions v2.0 (EPX)

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1. Introduction

This specification defines the IPP Job Release, Job Storage, Print Policy and Proof Print features, to support printing workflows important to institutional IT environments such as corporate businesses, governments and universities.

This specification updates "IPP Job and Printer Extensions - Set 2" [PWG5100.11-2010]. Section 13.3 lists the changes since that earlier revision of this specification.

2. Terminology

This section defines the following additional terms that are used throughout this document.

2.1 Conformance Terminology

Capitalized terms, such as MUST, MUST NOT, RECOMMENDED, REQUIRED, SHOULD, SHOULD NOT, MAY, and OPTIONAL, have special meaning relating to conformance as defined in Key words for use in RFCs to Indicate Requirement Levels [BCP14]. The term CONDITIONALLY REQUIRED is additionally defined for a conformance requirement that applies when a specified condition is true.

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

2.2 Printing Terminology

Normative definitions and semantics of printing terms are imported from IETF Printer MIB v2 [RFC3805], IETF Finisher MIB [RFC3806], and IETF Internet Printing Protocol/1.1: Model and Semantics [STD92].

Administrator: An End User who is also authorized to manage all aspects of an Output Device or Printer, including creating the printer instances and controlling the authorization of other End Users and Operators [RFC2567].

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

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

Logical Device: a print server, software service, or gateway that processes Jobs and either forwards or stores the processed Job or uses one or more Physical Devices to render output.
Operator: An End User that also has special rights on the Output Device or Printer. The Operator typically monitors the status of the Printer and manages and controls the Jobs at the Output Device [RFC2567]. The Operator can query and control the Printer, Jobs, and Documents based on site policy.

Output Device: a single Logical or Physical Device

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

PIN Printing: Printing where the User/Client provides a numerical password in the print request that is later used to release the Job at the Printer's console or control panel. Some Printers only supported a numerical password repertoire.

Release Job: A Job submitted to a print service with annotations indicating that the receiving Printer is to withhold the Job from processing until the Printer receives some input action, such as a button press on its control panel, a Job password, or user authentication credentials, to authorize the Printer to "release" the Job into the processing queue.

Release Printing: A workflow where Release Jobs are submitted to a print service and held until the User provides necessary information to release it to processing. The necessary information may depend on the solution but might include information such as a username and password, swiping an identification card or credit card in a card reader on the Printer, or simply pushing a button. The print service may be a Physical Printer or a Logical Printer such as a centralized print service or print service provider.

2.3 Protocol Role Terminology

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

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

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

2.4 Other Terminology

Document Creation Operations: The operations that create Document objects: Print-Job, Print-URI, Send-Document and Sent-URI [STD92].

Input Page: A page according to the definition of "pages" in the language used to express the Document data [STD92].
Job Creation operation: An IPP operation that creates a Job object: Print-Job, Print-URI and Create-Job. The Restart-Job operation [STD92] is not considered a Job Creation operation, since the Printer re-uses the existing Job object. The Validate-Job operation is not considered a Job Creation operation because no Job object is created.

Job Submission Operations: The Job Submission Operations are the IPP operations that create Jobs and Documents: Print-Job, Print-URI, Create-Job, Send-Document and Send-URI [STD92].

Password Release Job: The Job that has a password permanently attached to it that must be provided to the Printer to authorize its printing. If the Job is duplicated via whatever method, the duplication process includes the password from the old Job in the new Job to preserve the authorization protection.

Precedence: The specification of the order or ranking of a series of instructions or attributes from multiple sources referring to the same functionality. See section 4.2 of this specification for a description of the Attribute Precedence model.

Production Printer: A Printer that produces large quantities of high-quality output, that often requires operator participation to make decisions as to the choice of Job and its parameters.

Proof Job: A Retained Job that the Printer retains the initial "proof" set of copies has been produced, to enable the remaining copies to be printed at some later time, rather than aging the Job out after an implementation-defined period.

Raster image: A binary bitmap representation of an image.

Retained Job: A Job that the Printer retains in the Job Retention Phase [STD92] once the Job has reached its terminal state ('completed', 'aborted', or 'canceled'), for an implementation-defined period.

RIP: Raster Image Processor - a page description language interpreter.

Stored Job: A Retained Job that has reached the 'completed' state and that has identifying characteristics marking it as a Stored Job instead of simply as a previously processed Job. The Documents in a Stored Job are maintained in their originally submitted state and format. The Printer retains a Stored Job for an implementation-defined period, unless otherwise configured, so that it can be listed and selected for reprinting at some time in the future.

2.5 Acronyms and Organizations

IANA: Internet Assigned Numbers Authority, https://www.iana.org/
3. Requirements

3.1 Rationale for IPP Enterprise Printing Extensions v2.0

IETF and PWG IPP printing standards define an abstract model of a Print Service (i.e., ISO DPA Logical Printer) and a Print Device (i.e., ISO DPA Physical Printer) in section 3.1 of IETF IPP/1.1 [STD92]. Some IPP Printers already support proofing, saving, and reprinting of large Print Jobs via vendor proprietary operations and attributes.

Therefore, this IPP Enterprise Printing Extensions v2.0 specification SHOULD extend IPP so that it supports:

1. Creating a Proof Job using IPP Job Creation operations;
2. Creating a Stored Job using IPP Job Creation operations;
3. Creating a new Job using IPP from a Stored Job or Proof Job, with the new Job having possibly different processing instructions;
4. Creating a Protected Job using IPP Job Creation operations;
5. Releasing a Protected Job using IPP Job operations;

These extensions to IPP SHOULD be designed in such a way that Proof Jobs, Stored Jobs and Protected Jobs can interoperate, so that a single Job could be a Protected Job, a Stored Job and a Proof Job.

3.2 Use Cases

3.2.1 Protecting a Job with Button Press Release

Lisa is a high school student. She has finished writing a paper for her Ancient History class and wants to print a copy to turn into her teacher. She wants to have the Printer hold the Job until she releases it so that it isn't sitting in the output tray. She selects the "Button Press" option in the print options dialog window and clicks "Print" to submit the Job. The printer holds the Job. When Lisa goes to the Printer, it is listed on the control panel. She pushes the "OK" button and the Job prints.
3.2.2 Protecting a Job with Job Password Release

Frank works in a sales office that is large enough for him to have privacy concerns, but not so large that the printers are integrated into the IT infrastructure in a sophisticated manner. He is editing a sensitive business report that contains financial data. He wants to make sure that, if he prints it to the office's workgroup printer, he can be confident only people with the original password can pick it up or re-print it. Frank sees that the workgroup printer supports Password Release Jobs, so he selects the "Job Password" option in the print options dialog window, overrides the automatically generated unique password with one of his choosing, and clicks "Print" to submit the Job. The workgroup printer delays printing the Job until someone first provides the matching password. Frank goes to the workgroup printer, observes that his Password Release Job is listed on the control panel, selects it, and enters the job's password at the prompt. The printer prints the Password Release Job, and Frank can relax knowing the printed Job was safe from others' view.

3.2.3 Protecting a Job with User Authorized Release

James works in a large law office where the printers are integrated into the IT AAA (Authentication, Authorization, Accounting) infrastructure. He is editing a set of documents for a client. He wants to make sure that he will be the only one able to collect the printed copy or reprint it if he submits it to the office's workgroup printer. James selects the "Authorized Release" option in the print options dialog window and clicks "Print" to submit the Job. The workgroup printer challenges James' laptop for authentication credentials, and James provides them to the Client. The Job is submitted to the workgroup printer, which holds the Job until James logs into it and releases it. James goes to the workgroup printer, logs into it with his identity badge and selects the held Job to release it. The workgroup printer prints the Job and James takes it back to his desk.

3.2.4 Storing a Job for Later Reprinting

Vincent is an administrative assistant for a school. The school provides its teachers with paper forms for documenting their class assignments and attendance. Vincent makes these forms available on the school's web site and also on the school's workgroup printer as a Stored Job accessible by any accounts in the Faculty user group. He sends an email to the school faculty letting them know that the Stored Job is available for reprinting.

3.2.5 Reprinting a Stored Job

Lily is a teacher. She has run out of her supply of assignment tracking forms. She goes to the school's office, logs in using her faculty account, and selects Stored Jobs on its control panel. Among the Stored Jobs listed, she finds the assignment tracking form that had been stored by Vincent. She selects that Stored Job for reprinting, choosing to have 30 copies made, and taps Print. The copies are printed, and she returns to her classroom with the newly printed copies.
3.2.6 Proof Printing

Abby, Brian, and Cyrus work in the system engineering department of a large software vendor. They collaborate to find, describe, and evaluate software feature requirements for financial management tools in their requirements database.

Abby is an artist and chooses their standard fonts and writes style sheets and layout guides for their software requirements specifications. Brian is a quiet, steady worker and an excellent proofreader. Cyrus is a good talker who does the interviewing of the marketers and engineers.

Once a month, Cyrus extracts from their database all of the detailed software requirements for each project into a spreadsheet. He also extracts all the high-level software requirements into a word processing document. Cyrus then submits a single Print Job with two Documents [PWG5100.5] (the spreadsheet and the word processing document) for a proof print of 3 copies (single-sided and portrait).

Abby searches for layout and visual content errors, while Brian looks for typos and missing words. Cyrus commits their fixes to the database, regenerates the source documents, and does another cycle of proof print.

Finally, Cyrus wants to produce 60 copies (2-up, two-sided, and landscape) of the retained proof job. So, he reprints the saved Print Job (without sending the document data again) but specifying overrides of some processing instructions.

3.2.7 Print Policy for Some Users Limits Print Capabilities

Sue wants to print her report on her department's workgroup printer. She wants to print it in color to make the color graphs look best. However, she has abused her printing privileges, so her department head has instructed the network administrator to restrict her user account's ability to print in color.

Sue opens the document on her laptop, chooses to print, and selects the department's workgroup printer. The Printer authenticates the laptop using Sue's credentials, and then provides the laptop with the print choices available for Sue's account, which does not include color printing. Sue decides whether to print it in black-and-white anyway or to print from one of the campus printing centers, where she can pay to print in color.

Bob is an associate professor in the same department as Sue. His account has no limitations for color printing. He opens a document on his tablet, taps to print, and selects the department's workgroup printer. His tablet presents print options including the option of printing in color. Bob chooses to print in color, and prints his document, which prints in color as he expects.

Figure 1 illustrates this use case with a sequence diagram.
3.2.8 User Not Listed in Print Policy Denied Ability to Print in Color

Duncan is at the office and needs to print a 5-page report that contains color diagrams before his next meeting. His office user account has been granted permission by his office network administrator to print in color. Duncan opens the document on his tablet, taps to print, and selects the desired Printer. The tablet fetches the Printer's default capabilities, and then authenticates using Duncan's user account to retrieve the print options available to him as per his account's print policy, including the option to print in color or monochrome. He prints the document using the color option, retrieves the hardcopy from the printer, and then goes on to his meeting.

Ed is visiting Duncan's office and needs to print a 3-page document. Ed is not listed as a user in the print policy. Ed opens the document on his laptop, clicks to print, and selects the Printer Duncan pointed out to him. The laptop does not support print policies or does but has no valid credentials. The Printer provides Ed's laptop with the default print capabilities. When the Job is submitted to the Printer, the Printer rejects the Job or identifies the setting that were adjusted, since unknown users don't have the right to print in color on this printer.

Figure 2 illustrates this use case with a sequence diagram.
3.3 Exceptions

3.3.1 Incorrect Job Password Prevents Release

Velma is one of Frank's co-workers. She is very competitive and has questionable business ethics. She goes to the department's workgroup printer to see if she can re-print any of Frank's jobs. Many of Frank's jobs are submitted as requiring user account authorization to release or reprint and are not visible to her, but she finds one Job Frank submitted using password release. She suspects this Job is the latest draft of a key report and tries to re-print it. The Job she selected is a Password Release Job, so the workgroup printer presents a password challenge UI to authorize re-printing. Velma doesn't know it, so she guesses a few times, gives up, and goes to the break room to brood.

3.3.2 Incorrect User Credentials Prevents Release

Wilbur is a corporate spy who has infiltrated the offices of James' law firm. He is hoping that he can acquire documents pertaining to a case, but he cannot access the documents on the law firm's computers. He hopes he will be able to reprint documents on the printers since they are not as carefully protected. He goes to the control panel and looks for the printer's Job History. The printer does allow listing the Job history to unauthenticated users, so he looks through the past jobs, selects one and taps "Print". He is challenged to log into the printer using matching account credentials, but he doesn't have credentials that are authorized access to any of the jobs in the history. Wilbur gives up and goes looking for a recycle bin to plunder.

3.4 Out of Scope

The following are considered out of scope for this specification:

1. Specifying the methods used by the Printer to manage its storage for Stored Jobs or pending Jobs;
2. Defining specific methods for multi-factor authentication for PIN and Release Printing, e.g., smart cards;
3. Specifying the methods used by the Printer to implement authentication and authorization;
4. Specifying the methods used by the Printer to present features on its control panel.

3.5 Design Requirements

This IPP Enterprise Printing Extensions v2.0 design should:

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

3. Define an IPP operation to allow a Client to obtain supported Printer capabilities for a particular User;

4. Define new attributes to support the Job Release feature;

5. Define new attributes to support the Job Storage feature;

6. Define new attributes to support the Proof Print feature;

7. Define additional attributes to support other minor enhancements to IPP that relate to the significant features defined in this specification.
4. IPP Model

This specification extends the Internet Printing Protocol/1.1 [STD92] model to add support for the Proof Print, Job Release, and Job Storage features. All of these features involve the definition of conditions under which a Job may move between different Job States. Figure 3 illustrates the IPP Job States defined in IPP/1.1 [STD92].

This specification defines the Get-User-Printer-Attributes operation to support per-user print feature filtering based on the most authenticated user. A number of new IPP attributes to support enterprise printers are also defined to better satisfy the use cases in section 3.2.

Figure 3 - IPP Job States and Transitions

4.1 Job Release

Job Release enables a Client to request that the Printer create a Release Job, which will cause the Printer to withhold processing the Job until the Printer has received the specified supported User input used as the "release method". The Client specifies this release method at Job Creation time to indicate the Job is a Release Job.
This specification defines 3 release methods: Button Press release; Job Password release; and User Authorized release. Table 1 lists the IPP operation or Job Template attribute(s) a Client includes in a Job Creation operation request to specify the release method. A Client MUST only specify one release method for a given Job. A Printer MUST reject a Job Creation operation request that includes more than one of the release methods in Table 1. The table also lists the corresponding "job-state-reasons" keyword (section 8.3) indicating the Job's release method.

<table>
<thead>
<tr>
<th>Feature</th>
<th>Attribute(s) in Job Creation operation</th>
<th>&quot;job-state-reasons&quot; indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td>Button Press Release</td>
<td>&quot;job-hold-until&quot; = 'button-press' (8.2)</td>
<td>'job-held-for-button-press' 'job-release-wait'</td>
</tr>
<tr>
<td></td>
<td>&quot;job-password&quot; (6.1.1)</td>
<td>'job-password-wait'</td>
</tr>
<tr>
<td></td>
<td>&quot;job-password-encryption&quot; (6.1.2)</td>
<td></td>
</tr>
<tr>
<td>User Authorized Release</td>
<td>&quot;job-hold-until&quot; = 'owner-authorized' (8.2)</td>
<td>'job-held-for-authorization' 'job-release-wait'</td>
</tr>
</tbody>
</table>

The release method is durable and persistent, which means the Job Status attributes specifying the release method MUST persist in the Job at least until the Job's Document Content is removed (e.g. when the Job enters the Job History phase [STD92]). If the Job is copied, as in the case of reprinting a Stored Job or completing a Proof Job, the Job Status attributes specifying the release method MUST be preserved in the new copy to maintain the release protection.

The Printer initially places the Release Job into the 'pending-held' state when processing will result in the immediate production of physical output (Media Sheets). A Physical Device supporting Job Release MUST hold the newly created Release Job by initially placing it in the 'pending-held' state, unless the Release Job is also a Stored Job with "job-storage-disposition" set to 'store-only'. If the Release Job is also a Stored Job with "job-storage-disposition" set to 'store-only', the Printer MUST place the Job into the 'pending' or 'processing' state and process it immediately, since this processing will not produce physical output.

A Logical Device supporting Job Release MAY place the new Release Job in the 'pending-held' state, depending on how many Physical Devices it represents, whether the Physical Device has been selected, whether the Printer is an Infrastructure Printer taking part in an Infrastructure System [PWG5100.18], and other factors.
All Printers supporting Job Release MUST also support the "job-spooling-supported" Printer Description attribute [PWG5100.7]. A Client supporting Job Release SHOULD support multiple Job spooling when the target Printer's "job-spooling-supported" Printer Description attribute is set to 'spool' or 'automatic'. If the Printer's "job-spooling-supported" Printer Description attribute is set to 'stream', the Printer might be unable to receive additional Jobs until the Release Job has been released, or the Client might have to keep open the TCP connection until the Job has been released, which could cause an adverse use of resources on the Client.

When the User later releases the Job at a Physical Device, the keyword indicating the retention method is removed from the “job-state-reasons” Job Status attribute, and the Job is placed in the ‘pending’ or ‘processing’ state unless there are other dependencies that prevent its immediate processing.

### 4.2 Job Storage

Job Storage enables a Client to request that the Printer "store" a Job and its Documents in their originally submitted form to make them available for later reprinting. A Client requests a Job be a Stored Job by supplying the “job-storage” operation attribute (section 6.1.3) in the Job Creation operation request. Job Storage access settings determine whether the Job is accessible by all users, only the originating user, or users that are part of a group. The Printer lists the supported groups in its "job-storage-group-supported" Printer Description attribute (section 6.4.14).

As with the DEPRECATED Job Save and Reprint feature [PWG5100.11-2010], the Printer retains the Stored Job for an implementation-defined period in the Job Retention Phase (see [STD92] section 5.3.7.2 "Partitioning of Job States") in the Job’s terminal state ('completed', 'aborted', or 'canceled') after processing it, rather than aging the Job out after an implementation-defined period (which can be overridden using the "job,retain-until" / "job,retain-until-interval" / "job,retain-until-time" attributes [PWG5100.7]).

### 4.2.1 Creating Stored Jobs

A Printer states support for Job Storage by supporting the "job-storage-supported" Printer Description attribute (section 6.4.15) and related Printer Description attributes. A Client creates a Stored Job using the "job-storage" Job Template attribute (section 6.1.3) in the Job Creation operation. That Job becomes a Stored Job when it has reached the "completed" state [STD92]. The Job's storage status is indicated by the "job-state-reasons" Job Status attribute [STD92] if the "job-state-reasons" Job Status attribute includes the "job-stored-successfully", "job-stored-with-errors", "job-stored-with-warnings", or "job-storing" keywords defined in section 8.3 for the Job Storage feature.
4.2.2 Identifying and Listing Stored Jobs

A Client can acquire a list of Stored Jobs using a Get-Jobs operation request [STD92] that includes either the 'stored-public', 'stored-group' or 'stored-owner' keyword for the "which-jobs" operation attribute (section 8.4) in a Get-Jobs request. A Client can also detect that a Job is a Stored Job if the "job-state-reasons" Job Status attribute includes the 'job-stored-successfully', 'job-stored-with-errors', 'job-stored-with-warnings', or 'job-storing' keywords defined in section 8.3 for the Job Storage feature.

Many of the "job-state-reasons" keywords can apply to a 'store-only' Stored Job as well as a Job submitted for printing. If the value of the "job-storage-disposition" attribute is 'store-only', the "job-state-reasons" attribute MAY include 'job-incoming', 'resources-are-not-ready' (perhaps if a font is missing), 'job-interpreting', and 'job-queued'. Likewise, errors that occur on a Stored Job MAY be indicated by the 'job-data-insufficient', 'document-access-error', 'submission-interrupted', 'job-canceled-by-user', 'aborted-by-system', or other "job-state-reasons" keywords. Table 2 lists the possible combinations of print and save success, warning, and error conditions. Note that two values occur only when there are print warnings/errors and a save error.

<table>
<thead>
<tr>
<th>Not storing</th>
<th>Store was successful</th>
<th>Store was unsuccessful</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not printing</td>
<td>&lt;not possible&gt;</td>
<td>'job-completed-successfully'</td>
</tr>
<tr>
<td>Print successful</td>
<td>'job-completed-successfully'</td>
<td>'job-completed-successfully'</td>
</tr>
<tr>
<td>Print warnings and errors</td>
<td>'job-completed-with-errors'</td>
<td>'job-completed-with-errors'</td>
</tr>
</tbody>
</table>
4.2.3 Reprinting Stored Jobs

There are two methods defined to reprint a copy of the Saved Job: using the Resubmit-Job operation [PWG5100.7]; and by direct interaction with the Printer's control panel. The Reprocess-Job operation [RFC3998] has been deprecated. If the Printer supports the Stored Job feature in this specification and the Reprocess-Job operation, the Reprocess-Job operation MUST support reprocessing a Stored Job.

4.2.3.1 Reprinting Stored Jobs using the Resubmit-Job operation

The Resubmit-Job operation [PWG5100.7] re-processes a copy of any Retained Job with the ability to supply additional operation and Job Template attributes that will affect the processing of that copy of the Job by either overriding the values of existing attributes or providing additional attributes. The Client MUST be prepared for an authentication challenge.

4.2.3.2 Reprinting Stored Jobs using the Printer Control Panel

Stored Jobs can be reprinted using the Printer's control panel (control console). The details of the user experience and presentation are beyond the scope of this document, but ought to reflect the semantics of the Job Storage feature defined in this IPP Enterprise Printing Extensions v2.0 specification.

4.3 Print Policy

Print Policy enables a Client to retrieve the Printer's attributes and capabilities that are available specifically to the Client's most authenticated User. The Client does this using the Get-User-Printer-Attributes operation (section 5.1) The Get-User-Printer-Attributes operation is semantically analogous to the existing Get-Printer-Attributes IPP operation [STD92], with the key difference that the Printer will likely respond with an authentication challenge. If authentication succeeds, the Printer will return the authorized set of Printer Description attributes available to the authenticated user.

A Printer declares its support for the Print Policy feature by including the 'Get-User-Printer-Attributes' keyword in its "operations-supported" Printer Description attribute [STD92].
4.4 Proof Print

Proof Print enables a User to submit a Job as a Proof Job, indicating to the Printer that it is to produce a certain small number of copies and then save it in such a way that a User can request the completion of the Proof Job at a later time, with possibly different Job Ticket selections. A Client requests a Printer to print and save a Proof Job by supplying the “proof-print” Job Template attribute (section 6.2.4) when submitting the job. In this case, the Printer retains the Proof Job in the so-called Job Retention Phase [STD92] in the Job’s terminal state (‘completed’, ‘aborted’, or ‘canceled’) after processing it, rather than aging the Job out after an implementation-defined period. A Client can request the Printer to reprint a copy of the Proof Job using the Resubmit-Job operation [PWG5100.7] to complete the Proof Job. If a reprint is not desired by the User, it SHOULD be cleaned up by the Printer after an implementation-defined length of time.

5. New Operations

5.1 Get-User-Printer-Attributes

This RECOMMENDED operation is semantically analogous to the Get-Printer-Attributes operation [STD92] but the set of attributes in the response is filtered based on the most authenticated user. The authenticated user (see [STD92] RFC 8011 section 9.3) performing this operation MUST be either a User permitted to create Print Jobs or an Operator or Administrator of the Printer. Otherwise, the Printer MUST reject the operation and return 'client-error-forbidden', 'client-error-not-authenticated', or 'client-error-not-authorized' as appropriate.

The Client MUST be prepared to handle an HTTP authentication challenge in response to a Get-User-Printer-Attributes operation request. If the Client initiates the Get-User-Printer-Attributes operation over an HTTP connection without TLS, the Client MUST be prepared to receive an HTTP 426 response to upgrade the connection to TLS [RFC2817][RFC8446]. A Printer MUST send a Get-User-Printer-Attributes response over Secure Transport for authentication methods that require a secure channel, as defined in [STD92].

A Printer MUST support all the same operation attributes for a Get-User-Printer-Attributes operation that it supports with a Get-Printer-Attributes operation, including those a Client can use to request a filtered response: “document-format” [STD92]; “first-index” [PWG5100.13]; “limit” [PWG5100.13]; and any of the attributes named by “printer-get-attributes-supported” [PWG5100.13].

5.1.1 Get-User-Printer-Attributes Request

The following groups of attributes are supplied as part of the Get-User-Printer-Attributes request:

Group 1: Operation Attributes
"attributes-charset" (charset) and "attributes-natural-language" (naturalLanguage):

The Client MUST supply and the Printer MUST support both of these attributes, as described in [RFC8011] Section 4.1.4.1.

"printer-uri" (uri):

The Client MUST supply and the Printer MUST support this attribute, which specifies the target for this operation, as described in [RFC8011] Section 4.1.5.

"requesting-user-name" (name(MAX)):

The Client MUST supply and the Printer MUST support this attribute, as described in [RFC8011] Section 9.3.

"requesting-user-uri" (uri):

The Client SHOULD supply and the Printer MUST support this attribute, as described in [PWG5100.13] section 5.1.6.

"requesting-user-vcard" (1setOf text(MAX)):

The Client SHOULD supply and the Printer MUST support this attribute, as described in [PWG5100.SYSTEM] section 7.1.6.

"requested-attributes" (1setOf keyword):

This attribute MAY be supplied by the Client and MUST be supported by the Printer as described in [RFC8011] Section 4.2.5.1.

"document-format" (mimeMediaType):

This attribute SHOULD be supplied by the Client as described in [RFC8011] Section 4.2.5.1.

5.1.2 Get-User-Printer-Attributes Response

The Printer returns the following sets of attributes as part of the Get-User-Printer-Attributes response:

Group 1: Operation Attributes

"attributes-charset" (charset) and "attributes-natural-language" (naturalLanguage):

The Client MUST support and the Printer MUST supply both of these attributes, as described in [RFC8011] Section 4.1.4.1.
Status Message:

In addition to the REQUIRED status-code returned in every IPP operation response, the response MAY include a "status-message" (text(255)) and/or a "detailed-status-message" (text(MAX)) operation attribute as described in [RFC8011] Appendix B and Section 4.1.6.

Group 2: Unsupported Attributes

See [RFC8011] Section 4.1.7 for details on returning unsupported attributes.

Group 3: Printer Attributes

This is the set of requested attributes and their current values. See [RFC8011] Section 4.2.5.2 for details.

6. New Attributes

6.1 Operation Attributes

Table 3 lists the operation attributes defined in this specification, each with its corresponding conformance requirements. The conformance requirements pertain to the need for the attribute to be supported by the Printer, not that its support is required for all operations.

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Conformance</th>
</tr>
</thead>
<tbody>
<tr>
<td>job-password</td>
<td>CONDITIONALLY REQUIRED</td>
</tr>
<tr>
<td>job-password-encryption</td>
<td>CONDITIONALLY REQUIRED</td>
</tr>
<tr>
<td>job-storage</td>
<td>CONDITIONALLY REQUIRED</td>
</tr>
</tbody>
</table>

6.1.1 job-password (octetString(255)) for Job Creation operations

This CONDITIONALLY REQUIRED operation attribute allows a User to specify a password for that Job, causing the Job to become a Password Release Job. Printers that support the Password Release method for the Job Release feature MUST support this attribute. The Printer will only print a Password Release Job once the matching password value has been provided on the Printer’s control panel.

Printers and Clients that support this attribute SHOULD support Secure Transport. Printers SHOULD negotiate a TLS session prior to accepting a Validate-Job or Job Creation request containing this attribute. Clients SHOULD negotiate a TLS session prior to sending a Validate-Job or Job Creation request containing this attribute.
The Client "encrypts" the password string using one of the methods listed in the Printer's "job-password-encryption-supported" Printer Description attribute (section 6.4.3). The encrypted password value is sent to the Printer as the value of the "job-password" operation attribute, and the method used is sent as the value of the "job-password-encryption" operation attribute.

When the Printer receives a password on its control panel to release the Job, it encrypts the password using the same encryption method specified by the Job's "job-password-encryption" attribute. If that value matches the value of the Job's "job-password" Job Status attribute, the Printer releases the Job to processing. The method in which the password is entered and validated at the Printer is implementation dependent.

If the Password Release Job is released by the User while another Job is printing, the Password Release Job SHOULD be the next Job printed after the current Job, unless the Printer has another Job which has a higher priority than the Password Release Job as determined by the "job-priority" attribute.

If the Printer's "job-password-repertoire-configured" Printer Description attribute (section 6.4.5) specifies one of the UTF-8 repertoires, the Client and the Printer MUST normalize the encoding of the provided password value to use Network Unicode UTF-8 encoding [RFC5198] [UAX15] to prevent binary differences in the cleartext password values, which will cause differences in the outputs of the chosen hashing function specified by the associated "job-password-encryption" attribute (section 6.1.2).

The Printer MUST set the Job's initial state according to the methodology specified in section 4.1. The Job MUST add the 'job-password-wait' keyword to its "job-state-reasons" attribute at the time the Job is created. When the Printer has received the matching password and the Job is released to processing, the Job removes the 'job-password-wait' keyword its "job-state-reasons" attribute to indicate that that condition is no longer preventing processing.

A Client MAY include this operation attribute in a Job Creation operation (Print-Job, Print-URI, and Create-Job) request, as per section 7.1. A Client MUST NOT include this operation attribute in a Validate-Job operation request, as per section 7.3.

The Job MUST preserve its "job-password" attribute, if it has one, for its entire lifespan. If a copy of a Job is created by a Resubmit-Job operation or via some mechanism out-of-band of IPP, the new copy MUST have a copy of the "job-password" attribute so that the new copy is also a Password Release Job. The "job-password" Job Status attribute value MUST NOT be returned in any IPP operation response. The "job-password" Job Status attribute value MUST NOT be accessible via any non-IPP protocol.
6.1.2 job-password-encryption (type2 keyword) for Job Creation operations

This CONDITIONALLY REQUIRED operation attribute specifies the cryptographic hash method the Client used to obfuscate the value of the "job-password" operation attribute sent in a Job Creation (Print-Job, Print-URI, or Create-Job) operation request. A Printer that supports the Job Password Release feature MUST support this attribute. The Client MUST supply this operation attribute whenever the Client supplies a "job-password" operation attribute in a Job Creation operation request. The value MUST be one of the values listed by the Printer's "job-password-encryption-supported" attribute (section 6.4.3).

Note: The original definition of this attribute also included the "name(MAX)" syntax in its syntax definition, but site-local or vendor-unique hashing algorithms were never used and are of little value, so that syntax is now DEPRECATED.

6.1.3 job-storage (collection)

This CONDITIONALLY REQUIRED operation attribute is a collection whose members specify how a Printer processes a Job to become a Stored Job. A Printer that supports the Job Storage feature MUST support this attribute. See section 0 for a full description of the Job Storage feature. The Printer copies the "job-storage" attribute received in a Job Creation request into the corresponding Job as a Job Status attribute (section 6.3.1).

This attribute MAY be used with the "job-password" attribute (section 6.1.1) or the "job-hold-until" attribute (section 8.2) to create a Release Job that is also a Stored Job. A Client determines whether a Printer supports Stored Jobs that are also Release Jobs by first finding the 'job-storage' keyword in the Printer's "printer-get-attributes-supported" Printer Description attribute, then sending an empty "job-storage" collection as an operation attribute in a new Get-Printer-Attributes request, and finally detecting that the response contains both "job-storage-supported" (section 6.4.15) and one of the release methods discussed in section 4.1 ("job-password-supported" and/or "job-hold-until").

6.1.3.1 job-storage-access (type2 keyword)

This member attribute specifies the access restrictions on the Stored Job. The value MUST be one of the keywords specified by the Printer's "job-storage-access-supported" Printer Description attribute (section 6.4.12). The "job-storage-access" member attribute MUST be preserved by the Job as a member of the "job-storage" Job Status attribute (section 6.3.1).

6.1.3.2 job-storage-disposition (type2 keyword)

This member attribute specifies how the Job is to be handled by the Printer during the 'processing' state. The value MUST be one of the values specified by the Printer's "job-storage-disposition-supported" Printer Description attribute (section 6.4.13).
If the Client specifies 'save-only' for this member attribute and specifies operation attribute or Job Template attributes requesting that this Job be a Release Job, a newly created Job MUST be processed immediately to allow it to become a Stored Job, since processing will not produce any physical output.

The "job-storage-disposition" member attribute MUST NOT be preserved by the Job as a member of the "job-storage" Job Status attribute (section 6.3.1).

6.1.3.3 job-storage-group (name(MAX))

This member attribute specifies the group, if any, in which the Stored Job is listed. The value specified by the "job-storage-access" attribute (section 6.1.3.1) coordinates with the value of this attribute. If the "job-storage-access" attribute is 'group', then the value of this attribute MUST be one of the values specified by the Printer's "job-storage-group-supported" Printer Description attribute (section 6.4.17).

6.2 Job Template Attributes

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

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Conformance</th>
</tr>
</thead>
<tbody>
<tr>
<td>job-cancel-after</td>
<td>OPTIONAL</td>
</tr>
<tr>
<td>job-phone-number</td>
<td>OPTIONAL</td>
</tr>
<tr>
<td>job-recipient-name</td>
<td>OPTIONAL</td>
</tr>
<tr>
<td>proof-print</td>
<td>CONDITIONALLY REQUIRED</td>
</tr>
</tbody>
</table>

6.2.1 job-cancel-after (integer(1:MAX))

This OPTIONAL Job Template attribute specifies the maximum number of seconds that are allowed for processing a Job. The cancel timer does not begin until the Job enters the 'processing' state. If the Job is canceled because of this timer, the Printer MUST add the 'job-canceled-after-timeout' keyword to the "job-state-reasons" Job Status attribute (section 8.3).

6.2.2 job-phone-number (uri)

This OPTIONAL Job Template attribute contains the contact telephone number for the Job. If supported, the Printer MUST accept the ‘tel:’ URI scheme [RFC2806] and MAY accept other schemes, such as the ‘fax:’ scheme [RFC2806]. Any processing by the Printer of the “job-phone-number” attribute is implementation-dependent.
6.2.3 job-recipient-name (name(MAX))

This OPTIONAL Job Template attribute contains the name of the person that is to receive the output of the Job. A zero-length value indicates that there is no job recipient name. If the Client omits this attribute in a Job Creation request, the Printer MAY use the value held by the Printer's "job-recipient-name-default" Printer Description attribute, unless it has not been configured by the administrator, or MAY use the "authenticated user" name [STD92], depending on implementation.

6.2.4 proof-print (collection)

This CONDITIONALLY REQUIRED Job Template attribute indicates this Job is a Proof Job. The members of this collection indicate the number of "proof" copies to produce and any of the attributes the Printer names in its "proof-print-supported" Printer Description attribute (section 6.4.19). Printers that support the Proof Print feature MUST support this attribute.

When printing the proof copies, the Printer prioritizes the Job member attributes in the "proof-print" collection over the other Job Template attributes, to allow for special processing to be performed with the proof copies. After the proof prints have been produced, the Printer MUST retain the completed Job as a Proof Job to allow the proof prints to be reviewed. This time period SHOULD be longer than the period for ordinary completed Jobs [STD92]. The implementation-defined period can be overridden using the "job-retain-until", "job-retain-until-interval", or "job-retain-until-time" attribute [PWG5100.7].

When a Proof Job is concluded, using any of the operations that reprint a Retained Job (e.g., Reprocess-Job or Resubmit-Job), the Printer MUST remove the "proof-print" attribute from the copy of the Proof Job so that the Job is not proofed again. Only if the Resubmit-Job operation supplies its own "proof-print" attribute, will the copied Job be re-proofed.

This attribute MAY be used with the "job-password" attribute (section 6.1.1) or the "job-hold-until" attribute (section 8.2) to create a Release Job that is also a Proof Job. A Client determines whether a Printer supports Proof Jobs that are also Release Jobs by first finding the 'proof-print' keyword in the Printer's "printer-get-attributes-supported" Printer Description attribute, then sending an empty "proof-print" collection as an operation attribute in a new Get-Printer-Attributes request, and finally detecting that the response contains both "proof-print-supported" (section 6.4.19) and one of the release methods discussed in section 4.1 ("job-password-supported" and/or "job-hold-until").

Table 5 lists the member attributes of the "proof-print" collection attribute.
Table 5 - "proof-print" Member Attributes

<table>
<thead>
<tr>
<th>Member Attribute Name</th>
<th>Request</th>
<th>Printer Support</th>
</tr>
</thead>
<tbody>
<tr>
<td>proof-print-copies</td>
<td>MUST</td>
<td>MUST</td>
</tr>
<tr>
<td>media</td>
<td>MUST include one or the other, but MUST NOT include both</td>
<td>MUST</td>
</tr>
<tr>
<td>media-col</td>
<td>MAY</td>
<td>MAY</td>
</tr>
<tr>
<td>{Any attributes listed in &quot;proof-print-supported&quot; (6.4.19)}</td>
<td>MAY</td>
<td>MAY</td>
</tr>
</tbody>
</table>

6.2.4.1 proof-print-copies (integer (0:MAX))

This REQUIRED member attribute specifies the number of proof copies the Printer produces when the Job is processed. The range of allowed values is reported by the Printer's "proof-print-copies-supported" Printer Description attributes (section 6.4.17). This number is separate from the "copies" Job Template attribute. A Proof Job where "proof-print-copies" is 4 and "copies" is 10 will ultimately produce 14 copies.

If the "proof-print-copies" value is 0 (zero), then no proof prints are produced. There are legacy environments that provide a simple short-lived "job storage" feature using ProofPrint using this [PWG5100.11-2010], but the preferred method for doing "job-storage" is using the Job Storage feature described in section 4.2.

6.2.4.2 media (type2 keyword | name(MAX)) or media-col (collection)

These CONDITIONALLY REQUIRED member attributes are used to indicate the media that the Printer MUST use for the specified "proof-print-copies" of the Proof Job. The Client MUST supply either the "media" or the "media-col" member attribute but MUST NOT supply both. If a Printer receives a Job Creation request that includes neither or both in a "proof-print" Job Template attribute, the Printer MUST either reject the request and return the 'client-error-bad-request' status code [STD92], or accept the request and use the "media" or "media-col" member attribute, independent of the value of the "ipp-attribute-fidelity" attribute [STD92] supplied by the Client, depending on implementation.

6.3 Job Status Attributes

6.3.1 job-storage (collection)

This CONDITIONALLY REQUIRED Job Status attribute contains a complete copy of the "job-storage" operation attribute (section 6.1.3), including all its members. If the Printer supports the "job-storage" operation attribute, then it MUST support this Job Status attribute.
6.3.2 proof-print (collection)

This CONDITIONALLY REQUIRED Job Status attribute contains a complete copy of the "proof-print" Job Template attribute (section 6.2.4), including all its members. If the Printer supports the "proof-print" Job Template attribute, then it MUST support this Job Status attribute.

6.4 Printer Description Attributes

Table 6 lists the Printer Description attributes defined in this specification, each with its corresponding conformance requirement. The extensions to the "job-hold-until" attribute [STD92] used for Button Press Release and Authenticated Release are discussed in section 8.2.

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Conformance</th>
</tr>
</thead>
<tbody>
<tr>
<td>job-cancel-after-default</td>
<td>CONDITIONALLY REQUIRED</td>
</tr>
<tr>
<td>job-cancel-after-supported</td>
<td>CONDITIONALLY REQUIRED</td>
</tr>
<tr>
<td>job-password-encryption-supported</td>
<td>CONDITIONALLY REQUIRED</td>
</tr>
<tr>
<td>job-password-length-supported</td>
<td>CONDITIONALLY REQUIRED</td>
</tr>
<tr>
<td>job-password-repertoire-supported</td>
<td>CONDITIONALLY REQUIRED</td>
</tr>
<tr>
<td>job-password-repertoire-configured</td>
<td>CONDITIONALLY REQUIRED</td>
</tr>
<tr>
<td>job-password-supported</td>
<td>CONDITIONALLY REQUIRED</td>
</tr>
<tr>
<td>job-phone-number-default</td>
<td>CONDITIONALLY REQUIRED</td>
</tr>
<tr>
<td>job-phone-number-supported</td>
<td>CONDITIONALLY REQUIRED</td>
</tr>
<tr>
<td>job-recipient-name-default</td>
<td>CONDITIONALLY REQUIRED</td>
</tr>
<tr>
<td>job-recipient-name-supported</td>
<td>CONDITIONALLY REQUIRED</td>
</tr>
<tr>
<td>job-storage-access-supported</td>
<td>CONDITIONALLY REQUIRED</td>
</tr>
<tr>
<td>job-storage-disposition-supported</td>
<td>CONDITIONALLY REQUIRED</td>
</tr>
<tr>
<td>job-storage-group-supported</td>
<td>CONDITIONALLY REQUIRED</td>
</tr>
<tr>
<td>job-storage-supported</td>
<td>CONDITIONALLY REQUIRED</td>
</tr>
<tr>
<td>printer-detailed-status-messages</td>
<td>OPTIONAL</td>
</tr>
<tr>
<td>proof-print-copies-supported</td>
<td>CONDITIONALLY REQUIRED</td>
</tr>
<tr>
<td>proof-print-default</td>
<td>DEPRECATED</td>
</tr>
<tr>
<td>proof-print-supported</td>
<td>CONDITIONALLY REQUIRED</td>
</tr>
<tr>
<td>which-jobs-supported</td>
<td>CONDITIONALLY REQUIRED</td>
</tr>
</tbody>
</table>

6.4.1 job-cancel-after-default (integer(1:MAX) | no-value)

This CONDITIONALLY REQUIRED Printer Description attribute provides the default value of the "job-cancel-after" Job Template attribute (section 6.2.1). Printers that support the "job-cancel-after" Job Template attribute MUST support this attribute.
6.4.2 job-cancel-after-supported (rangeOfInteger(1:MAX))

This CONDITIONALLY REQUIRED Printer Description attribute provides the allowed range of values the Printer will accept for the "job-cancel-after" Job Template attribute (section 6.2.1). Printers that support the "job-cancel-after" Job Template attribute MUST support this attribute.

6.4.3 job-password-encryption-supported (1setOf (type2 keyword))

This CONDITIONALLY REQUIRED Printer Description attribute specifies which cryptographic hashes the Printer supports for obfuscating the cleartext password value accepted from the User by the Client. Printers that support the "job-password-encryption" operation attribute (section 6.1.2) MUST support this attribute.

Note: The original definition of this attribute also included the "name(MAX)" syntax in its syntax definition, but site-local or vendor-unique hashing algorithms were never used and are of little value, so that syntax is now DEPRECATED.

Table 7 lists the standard keyword values. The 'md2', 'md4', 'md5', and 'sha' keywords are DEPRECATED. Others may be deprecated in the future as the state of the art of cryptographic hashing evolves.

<table>
<thead>
<tr>
<th>Keyword</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>'none'</td>
<td>The &quot;job-password&quot; attribute value is passed in the clear. No cryptographic hashing has been applied. This method SHOULD NOT be used unless the entire operation is sent over Secure Transport.</td>
</tr>
<tr>
<td>'md2'</td>
<td>The MD2 hash algorithm [RFC 1319] - DEPRECATED</td>
</tr>
<tr>
<td>'md4'</td>
<td>The MD4 hash algorithm [RFC 1320] - DEPRECATED</td>
</tr>
<tr>
<td>'md5'</td>
<td>The MD5 hash algorithm [RFC 1321] - DEPRECATED</td>
</tr>
<tr>
<td>'sha'</td>
<td>The Secure Hash Algorithm 1 defined by the National Institute of Standards and Technology [1], - DEPRECATED</td>
</tr>
<tr>
<td>'sha2-224'</td>
<td>The Secure Hash Algorithm 2 [FIPS180-4], with an output size of 224 bits.</td>
</tr>
<tr>
<td>'sha2-256'</td>
<td>The Secure Hash Algorithm 2 [FIPS180-4], with an output size of 256 bits.</td>
</tr>
<tr>
<td>Function</td>
<td>Description</td>
</tr>
<tr>
<td>--------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>'sha2-384'</td>
<td>The Secure Hash Algorithm 2 [FIPS180-4], with an output size of 384 bits.</td>
</tr>
<tr>
<td>'sha2-512'</td>
<td>The Secure Hash Algorithm 2 [FIPS180-4], with an output size of 512 bits.</td>
</tr>
<tr>
<td>'sha2-512_224'</td>
<td>The Secure Hash Algorithm 2 [FIPS180-4], with an output size of 512 bits, truncated to 224 bits.</td>
</tr>
<tr>
<td>'sha2-512_256'</td>
<td>The Secure Hash Algorithm 2 [FIPS180-4], with an output size of 512 bits, truncated to 256 bits.</td>
</tr>
<tr>
<td>'sha3-224'</td>
<td>The Secure Hash Algorithm 3 [FIPS202], with an output size of 224 bits.</td>
</tr>
<tr>
<td>'sha3-256'</td>
<td>The Secure Hash Algorithm 3 [FIPS202], with an output size of 256 bits.</td>
</tr>
<tr>
<td>'sha3-384'</td>
<td>The Secure Hash Algorithm 3 [FIPS202], with an output size of 384 bits.</td>
</tr>
<tr>
<td>'sha3-512'</td>
<td>The Secure Hash Algorithm 3 [FIPS202], with an output size of 512 bits.</td>
</tr>
<tr>
<td>'sha3-512_224'</td>
<td>The Secure Hash Algorithm 3 [FIPS202], with an output size of 512 bits, truncated to 224 bits.</td>
</tr>
<tr>
<td>'sha3-512_256'</td>
<td>The Secure Hash Algorithm 3 [FIPS202], with an output size of 512 bits, truncated to 256 bits.</td>
</tr>
<tr>
<td>'shake-128'</td>
<td>The SHAKE128 method [FIPS202], with an output size of 128 bits.</td>
</tr>
<tr>
<td>'shake-256'</td>
<td>The SHAKE256 method [FIPS202], with an output size of 256 bits.</td>
</tr>
</tbody>
</table>

NOTES:
1. Not clearly defined in [PWG5100.11-2010]

6.4.4 **job-password-length-supported (rangeOfInteger (0:255))**

This CONDITIONALLY REQUIRED Printer Description attribute specifies the minimum and maximum supported length of the unencrypted password, measured in characters. Printers that support the "job-password" operation attribute (section 6.1.1) MUST support this attribute.
The character set encoding is specified by the "job-password-repertoire-configured" attribute (section 6.4.5). The Printer is configured to accept an empty password if the range's minimum value is 0 (zero). This attribute complements the "job-password-supported" attribute (section 6.4.7), which specifies the maximum password length supported before encryption, measured in octets.

6.4.5 job-password-repertoire-configured (type2 keyword)

This CONDITIONALLY REQUIRED Printer Description attribute indicates the Printer's currently configured password repertoire. Printers that support the "job-password" operation attribute (section 6.1.1) MUST support this attribute.

The value of this attribute MUST be one of the values specified in the Printer's "job-password-repertoire-supported" attribute (section 6.4.5). A supporting Client can use this attribute's value to limit User input so that the value in "job-password" will comply with the configured password repertoire.

6.4.6 job-password-repertoire-supported (1setOf (type2 keyword))

This CONDITIONALLY REQUIRED Printer Description attribute enumerates the Job password repertoires (allowable characters, character sets and encodings) supported by the Printer. Printers that support the "job-password" operation attribute (section 6.1.1) MUST support this attribute. A Client intending to engage in printing should ignore this attribute and instead use the "job-password-repertoire-configured" attribute (section 6.4.5) to identify the Printer's currently configured Job password repertoire.

The keywords follow a 'REGISTRY_ENCODING_RANGE' naming structure. Table 8 lists the standard keywords. The "utf-8" encoding element indicates the use of Network Unicode [RFC5198].

Vendor repertoire keywords, prefixed with "vendor_" to indicate a vendor-specific registry, MAY also be used. Vendor repertoire keywords SHOULD be registered with the PWG to achieve interoperability. As an example, a vendor may choose to register the 'vendor_us-ascii_lowercase' keyword to specify a repertoire limited to using only lowercase characters from the US ASCII encoding.

Table 8 - "job-password-repertoire-supported" Standard Keywords

<table>
<thead>
<tr>
<th>Keyword</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>'iana_us-ascii_digits'</td>
<td>Value must consist of only ASCII digits (0x30-0x39)</td>
</tr>
<tr>
<td>'iana_us-ascii_letters'</td>
<td>Value must consist of only US ASCII letters (0x41-0x5A, 0x61-0x7A)</td>
</tr>
</tbody>
</table>
6.4.7 job-password-supported (integer(0:255))

This CONDITIONALLY REQUIRED Printer Description attribute indicates the maximum length that the Printer will accept for the unencrypted password which the Client will encrypt as the value of the "job-password" Operation Attribute. Printers that support the "job-password" operation attribute (section 6.1.1) MUST support this attribute.

A conforming Printer MUST be able to accept 255 octets without truncation. However, a Printer MAY be implemented as a gateway to another print system that cannot accept the full 255-octet range, in which case the Client MUST NOT allow an unencrypted password greater than the length specified by this attribute.

6.4.8 job-phone-number-default (uri)

This CONDITIONALLY REQUIRED Printer Description attribute indicates the default value supplied by the Printer if the Client omits the 'job-phone-number” Job Template attribute (section 6.2.2). This attribute SHOULD use the ‘tel:’ scheme [RFC2806]. Printers that support the "job-phone-number" Job Template attribute (section 6.2.2) MUST support this attribute.

6.4.9 job-phone-number-supported (boolean)

This CONDITIONALLY REQUIRED Printer Description attribute indicates whether the "job-phone-number" attribute (section 6.2.2) is supported. A true value indicates that the Printer accepts the "job-phone-number" attribute. Printers that support the "job-phone-number" Job Template attribute (section 6.2.2) MUST support this attribute.

6.4.10 job-recipient-name-default (name(MAX))

This CONDITIONALLY REQUIRED Printer Description attribute indicates the default recipient name supplied by the Printer if the Client omits the ‘job-recipient-name” Job Template attribute. Printers that support the "job-recipient-name" Job Template attribute (section 6.2.3) MUST support this attribute.
6.4.11 job-recipient-name-supported (boolean)

This CONDITIONALLY REQUIRED Printer Description attribute indicates whether the Printer accepts the "job-recipient-name" attribute. Printers that support the "job-recipient-name" Job Template attribute (section 6.2.3) MUST support this attribute.

6.4.12 job-storage-access-supported (1setOf type2 keyword)

This CONDITIONALLY REQUIRED Printer Description attribute specifies the Job Storage access modes supported by the Printer. Printers that support Job Storage MUST support this attribute.

Standard keywords for the "job-storage-access" attribute are listed in Table 9.

Table 9 - "job-storage-access-supported" Standard Keywords

<table>
<thead>
<tr>
<th>Keyword</th>
<th>Meaning</th>
<th>Conformance Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;group&quot;</td>
<td>Visible to only the group to which the submitting most authenticated user is a member</td>
<td>MAY</td>
</tr>
<tr>
<td>&quot;owner&quot;</td>
<td>Visible to only the submitting most authenticated user</td>
<td>MUST</td>
</tr>
<tr>
<td>&quot;public&quot;</td>
<td>Visible to all users (may still be password protected)</td>
<td>MUST</td>
</tr>
</tbody>
</table>

6.4.13 job-storage-disposition-supported (1setOf type2 keyword)

This CONDITIONALLY REQUIRED Printer Description attribute specifies the Job Storage dispositions supported by the Printer. Printers that support Job Storage MUST support this attribute.

Standard keywords for the "job-storage-access" attribute are listed in Table 10.

Table 10 - "job-storage-disposition-supported" Standard Keywords

<table>
<thead>
<tr>
<th>Keyword</th>
<th>Meaning</th>
<th>Conformance Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>'none'</td>
<td>The Printer MUST print the Job. The Printer MUST NOT retain the Job in the Job Retention phase; it MUST move it immediately to the Job History phase.</td>
<td>MAY</td>
</tr>
<tr>
<td>'print-and-store'</td>
<td>The Printer MUST print the Job. If the Job reaches the 'completed' state, it MUST retain the Job in the Job Retention phase.</td>
<td>MUST</td>
</tr>
</tbody>
</table>
6.4.14 job-storage-group-supported (1setOf name(MAX))

This CONDITIONALLY REQUIRED Printer Description attribute specifies the groups the Printer supports with which a Stored Job could be associated, using the "job-storage-group" member (section 6.1.3.3) of the "job-storage" attribute (section 6.1.3). The value of this attribute could list different values if returned in an authenticated Get-Printer-Attributes or Get-User-Printer-Attributes response.

Printers that support Job Storage and that list the 'group' keyword in their "job-storage-access-supported" Printer Description attribute (section 6.4.12) MUST support this attribute.

6.4.15 job-storage-supported (1setOf keyword)

This CONDITIONALLY REQUIRED Printer Description attribute indicates support for Job Storage and lists the supported member attributes of the "job-storage" operation attribute. Printers that support Job Storage MUST support this attribute. Table 11 lists the supported keywords.

Table 11 - "job-storage-supported" Standard Keywords

<table>
<thead>
<tr>
<th>Keyword</th>
<th>Printer Conformance Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>'job-storage-access'</td>
<td>MUST</td>
</tr>
<tr>
<td>'job-storage-disposition'</td>
<td>MUST</td>
</tr>
<tr>
<td>'job-storage-group'</td>
<td>MAY</td>
</tr>
</tbody>
</table>

6.4.16 printer-detailed-status-messages (1setOf text(MAX))

This OPTIONAL Printer Description attribute specifies additional detailed and technical information about the printer, in the same way "job-detailed-status-messages" provides additional information about a job. Printer-specific information such as fault and warning messages can be captured, and the 1setOf syntax supports multiple messages. The Printer MAY localize the message(s), but is not required to do so, since the message(s) are intended for consumption by the Administrator or other experienced technical persons. Clients MUST NOT attempt to parse the value(s) of this attribute.
6.4.17 proof-print-copies-supported (rangeOfInteger(0:MAX))

This CONDITIONALLY REQUIRED Printer Description attribute specifies the range of values the Printer supports for the "proof-print-copies" member attribute of the "proof-print" Job Template attribute (section 6.2.4.1). Printers that support Proof Print MUST support this attribute.

6.4.18 proof-print-default (collection)

This DEPRECATED Printer Description attribute specifies the default value of "proof-print" the Printer will use when the Client doesn't specify the "proof-print" Job Template attribute in a Job Creation request. The semantics of this attribute was poorly defined in earlier versions of this specification [PWG5100.11-2010] and so this attribute is DEPRECATED and not recommended.

6.4.19 proof-print-supported (1setOf keyword)

This CONDITIONALLY REQUIRED Printer Description attribute lists the Job Template attributes the Printer supports as members of a "proof-print" Job Template attribute (section 6.2.4.1) that the Printer supports. Printers that support Proof Print MUST support this attribute.

6.4.20 which-jobs-supported (1setOf type2 keyword)

This CONDITIONALLY REQUIRED Printer Description attribute lists the keywords the Printer will accept for the "which-jobs" operation attribute for the Get-Jobs operation [STD92]. Printers that support Job Storage or Proof Print MUST support this attribute. If this attribute is supported, then the Printer MUST list both 'completed' and 'not-completed' [STD92].

7. Additional Semantics for Existing Operations

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

A Printer that supports the "job-password" operation attribute (section 6.1.1) and the "job-password-encryption" operation attribute (section 6.1.2) MUST validate the values supplied and return the 'client-error-bad-request' status code if the values are invalid or not supported. A Printer MUST NOT return the "job-password" or "job-password-encryption" attributes in the Unsupported Attributes Group to prevent the leaking of security information.
7.2 Create-Job, Print-Job, and Print-URI Operations: "job-storage"

A Printer that supports the "job-storage" operation attribute (section 6.1.3) MUST validate the values supplied and return the 'client-error-bad-request' status code if the values are invalid or not supported. A Printer MAY return the "job-storage" attributes in the Unsupported Attributes Group.

7.3 Get-Jobs: "job-storage-group"

When a Client includes the "which-jobs" attribute in a Get-Jobs request, and the value provided for "which-jobs" is 'stored-group', the Client MUST also include a "job-storage-group" attribute in the request with the value specifying one of the groups listed by the Printer's job-storage-group-supported" Printer Description attribute (section 6.4.14).

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

A Client MAY send the "job-password" operation attribute (section 6.1.1) and/or the "job-password-encryption" operation attribute (section 6.1.2) in a Validate-Job request [STD92]. Printers conforming to [PWG5100.11-2010] will likely reject a Validate-Job request containing "job-password" and/or "job-password-encryption" operation attributes and return the 'client-error-bad-request' status code as this was disallowed in the previous version of this specification. A Printer MAY validate the received "job-password-encryption" and report unsupported attributes or values. A Printer MUST discard these attributes and values along with the rest of the values as per the semantics of the Validate-Job operation. A Printer MUST NOT return the "job-password" attribute in a Validate-Job response.

8. Additional Values and Semantics for Existing IPP Attributes

This section defines additional values for existing attributes. The existing text for those attributes is not reproduced here in order to prevent deviations.

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

This IPP Enterprise Printing Extensions v2.0 specification defines new keyword values for the "ipp-features-supported" Printer Description attribute [PWG5100.13] to enable the Printer to indicate its support for one or more of the major features defined in this specification. The new values are in

Table 12 - "ipp-features-supported" Additional Keywords

<table>
<thead>
<tr>
<th>Keyword</th>
<th>Conformance Requirement</th>
</tr>
</thead>
</table>

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8.2 job-hold-until (type2 keyword | name(MAX))

This IPP Enterprise Printing Extensions v2.0 specification defines additional keyword values for the "job-hold-until" Job Template attribute [STD92] to support Button Press Release and Authenticated Release. Table 13 lists the new values and their uses.

The "job-password" (section 6.1.1) and "job-password-encryption" (section 6.1.2) operation attributes MUST NOT be provided in a Job Creation operation request if this attribute is specified with either the 'button-press' or 'owner-authorized' keyword values. The 'button-press' and 'owner-authorized' values for "job-hold-until" and the "job-password" / "job-password-encryption" attribute set each individually indicate a distinct and mutually exclusive user-initiated release method.

Table 13 - "job-hold-until" Additional Keywords

<table>
<thead>
<tr>
<th>Keyword</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>'button-press'</td>
<td>Hold the Job until a button press on the Output Device's control panel authorizes it to be released to processing.</td>
</tr>
<tr>
<td>'owner-authorized'</td>
<td>Hold the Job until the Owner has authorized it to be released. Job Creation MUST be authenticated, Release-Job MUST be authenticated, and release at Printer console MUST be authenticated (e.g. ID card, etc.). A supporting Printer MUST authenticate any Job Creation request or Release-Job request including this value for &quot;job-hold-until&quot;. A supporting Client MUST be prepared to for an authentication challenge if it supplies this keyword in one of its Job Creation requests or a Release-Job request.</td>
</tr>
</tbody>
</table>
8.3 job-state-reasons (1setOf type2 keyword) Job Description attribute

This IPP Enterprise Printing Extensions v2.0 specification defines additional keyword values for the "job-state-reasons" attribute [STD92] to support the Job Release feature (section 4.1), the Job Storage feature (section 4.2), and the Proof Print feature (section 4.4), as well as other keywords to report additional conditions. Table 14 defines the meanings of the new "job-state-reasons" keywords.

Table 14 - "job-state-reasons" Additional Keywords

<table>
<thead>
<tr>
<th>Keyword</th>
<th>Conformance Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>'conflicting-attributes'</td>
<td>The Job Template or Document Template attributes contain conflicting values. REQUIRED</td>
</tr>
<tr>
<td>'job-canceled-after-timeout'</td>
<td>The Job was canceled because the time span specified by the &quot;job-cancel-after&quot; Job Description attribute elapsed before the Job could be processed. CONDITIONALLY REQUIRED [1]</td>
</tr>
<tr>
<td>'job-held-for-authorization'</td>
<td>The Job is being held in the 'pending-held' state until the Printer receives authenticated authorization to release it to processing. CONDITIONALLY REQUIRED [4]</td>
</tr>
<tr>
<td>'job-held-for-button-press'</td>
<td>The Job is being held in the 'pending-held' state until the Printer receives a button press or similar physical input to release it to processing. CONDITIONALLY REQUIRED [3]</td>
</tr>
<tr>
<td>'job-held-for-proof-release'</td>
<td>The initial copies of the Proof Job have been processed and the Proof Job has reached its terminal state and is ready to be released for final processing or cancellation. CONDITIONALLY REQUIRED [6]</td>
</tr>
<tr>
<td>'job-password-wait'</td>
<td>The Job is being held in the 'pending-held' state until the Printer receives a password value that matches the Job's &quot;job-password&quot; value to release it to processing.</td>
</tr>
</tbody>
</table>
### CONDITIONALLY REQUIRED [2]

<table>
<thead>
<tr>
<th>Keyword</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>'job-printed-successfully'</td>
<td>The Job was successfully printed but was not successfully stored as indicated by 'job-stored-successfully' or 'job-stored-with-warnings' or 'job-stored-with-errors'. If the Job was not requested to be stored, the Printer MUST use the 'job-completed-successfully' keyword instead.</td>
</tr>
</tbody>
</table>

### CONDITIONALLY REQUIRED [5]

<table>
<thead>
<tr>
<th>Keyword</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>'job-printed-with-errors'</td>
<td>The Job was printed with errors but was successfully stored as indicated by 'job-stored-successfully' or was not successfully saved as indicated by 'job-stored-with-warnings' or 'job-stored-with-errors'. If the Job was not requested to be stored, the Printer MUST use the 'job-completed-with-errors' keyword instead.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Keyword</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>'job-printed-with-warnings'</td>
<td>The Job was printed with warnings but was successfully stored as indicated by 'job-stored-successfully' or was not successfully stored as indicated by 'job-stored-with-warnings' or 'job-stored-with-errors'. If the Job was not requested to be stored, the Printer MUST use the 'job-completed-with-warnings' value instead.</td>
</tr>
</tbody>
</table>

### CONDITIONALLY REQUIRED [5]

<table>
<thead>
<tr>
<th>Keyword</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>'job-release-wait'</td>
<td>The Job is held until released for printing on a particular output device.</td>
</tr>
</tbody>
</table>


<table>
<thead>
<tr>
<th>Keyword</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>'job-resuming'</td>
<td>The Printer is in the process of moving the Job from the 'processing-stopped' state to the 'processing' state.</td>
</tr>
</tbody>
</table>

### CONDITIONALLY REQUIRED [9]

<table>
<thead>
<tr>
<th>Keyword</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>'job-stored-successfully'</td>
<td>The Job was successfully stored. The Printer MUST also supply 'job-completed-successfully', except when &quot;job-storage-disposition&quot; = 'save-only'.</td>
</tr>
<tr>
<td>Keyword</td>
<td>Description</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>'job-stored-with-errors'</td>
<td>The Job was not stored successfully. Whether it was printed successfully, printed with warnings, printed with errors, or not printed is indicated by other keywords. The Printer MUST ensure that none of the Stored Job is accessible, if it was unable to successfully store all of the Job.</td>
</tr>
<tr>
<td>'job-stored-with-warnings'</td>
<td>The Job was stored with warnings.</td>
</tr>
<tr>
<td>'job-storing'</td>
<td>The Printer is in the process of storing the Job to its storage location, similar to how the 'job-printing' keyword indicates that printing is in progress.</td>
</tr>
<tr>
<td>'job-suspended-by-operator'</td>
<td>The Job has been indefinitely suspended by the Printer operator.</td>
</tr>
<tr>
<td>'job-suspended-by-system'</td>
<td>The Job has been indefinitely suspended by the Printer's system software during normal processing of the Job.</td>
</tr>
<tr>
<td>'job-suspended-by-user'</td>
<td>The Job has been indefinitely suspended by the user.</td>
</tr>
<tr>
<td>'job-suspending'</td>
<td>The Printer is in the process of moving the Job from the 'processing' state to the 'processing-stopped' state.</td>
</tr>
<tr>
<td>'unsupported-attributes-or-values'</td>
<td>The Job Template or Document Template attributes contain unsupported attributes or values.</td>
</tr>
</tbody>
</table>
Notes:

1. REQUIRED if the Printer supports the "job-cancel-after" Job Template attribute
2. REQUIRED if the Printer supports the Password release method for Job Release
3. REQUIRED if the Printer supports the Button release method for Job Release
4. REQUIRED if the Printer supports the User Authorized release method for Job Release
5. REQUIRED if the Printer supports Job Storage
6. REQUIRED if the Printer supports Proof Print
7. REQUIRED if the Printer supports "job-spooling-supported"
8. REQUIRED if the Printer supports the Suspend-Current-Job operation [RFC3998]
9. REQUIRED if the Printer supports the Resume-Job operation [RFC3998]

The semantics of the 'job-completed-successfully', 'job-completed-with-warnings', and 'job-completed-with-errors' keywords [STD92] are also clarified in the list above for implementations that support the "job-storage-disposition" member attribute of "job-storage" (section 6.1.3.2), in such a way that these values remain compatible with Printers and Clients that do not support Job Storage.

Table 15 enumerates the possible combinations of print and store success, warning, and error conditions. Note that two values occur only when there are print warnings/errors and a store error.

**Table 15 - Values of "job-state-reasons" attribute for various Job conditions**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Not storing</th>
<th>Store successful</th>
<th>Store unsuccessful</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not printing</td>
<td>&lt;not possible&gt;</td>
<td>'job-completed-successfully'</td>
<td>'job-stored-with-errors'</td>
</tr>
<tr>
<td>Print successful</td>
<td>'job-completed-successfully'</td>
<td>'job-completed-successfully'</td>
<td>'job-stored-with-errors'</td>
</tr>
<tr>
<td>Print warnings and errors</td>
<td>'job-completed-with-errors'</td>
<td>'job-completed-with-errors'</td>
<td>'job-completed-with-errors', 'job-stored-with-errors'</td>
</tr>
</tbody>
</table>
8.3.1 Additional Semantics for "job-state-reasons" and "job-storage-disposition"

Many of the existing "job-state-reasons" attribute values can apply to a ‘save-only’ job as well as a Job submitted for printing. If the value of the “job-storage-disposition” member attribute is 'save-only', the "job-state-reasons" attribute MAY include commonly used standard keywords such as 'job-incoming', 'resources-are-not-ready' (such as a font), 'job-interpreting', and 'job-queued'. Likewise, errors that occur on a Stored Job MAY have existing "job-state-reasons" attribute values such as 'job-data-insufficient', 'document-access-error', 'submission-interrupted', 'job-canceled-by-user', 'aborted-by-system', etc.

This IPP Enterprise Printing Extensions v2.0 specification defines four new CONDITIONALLY REQUIRED "job-state-reasons" keyword values that a Printer MUST support if it supports Job Storage: 'job-storing', 'job-stored-successfully', 'job-stored-with-warnings', and 'job-stored-with-errors'. The existing 'job-completed-successfully', 'job-completed-with-warnings', and 'job-completed-with-errors' values are also clarified in the list above for Printers that support Job Storage, in such a way that these values remain compatible with Printers and clients that do not support Job Storage.

8.4 which-jobs (type2 keyword)

This IPP Enterprise Printing Extensions v2.0 specification defines additional keyword values for the IPP "which-jobs" operation attribute for the Get-Jobs operation [STD92], and the "which-jobs-supported" Printer Description attribute [PWG5100.7], to support filtering for Proof Jobs as well as different accessibility levels of Stored Jobs. Table 16 lists the new values and their uses.

Table 16 - "which-jobs" Additional Keywords

<table>
<thead>
<tr>
<th>Keyword</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>'proof-print'</td>
<td>Proof Jobs, i.e., Jobs that have been submitted using the &quot;proof-print&quot; Job Template attribute and which are in the 'completed', 'canceled', or 'aborted' state. If the Printer supports the &quot;proof-print&quot; Job Template attribute, the Printer MUST support this keyword.</td>
</tr>
</tbody>
</table>
'stored-group' Group Stored Jobs, i.e., Jobs that have been stored using the "job-storage" operation attribute where the "job-storage-access" member attribute specifies 'group', and which have reached the 'completed' state. If the Printer's "job-storage-access-supported" Printer Description attribute lists the "group" keyword, the Printer MUST support this keyword. A Client specifying this keyword for "which-jobs" MUST be prepared to handle an authentication challenge from the Printer. A Client specifying this keyword for "which-jobs" MUST also provide the "job-storage-group" operation attribute in the Get-Jobs request (section 7.3).

'stored-owner' Private Stored Jobs, i.e., Jobs that have been stored using the "job-storage" operation attribute where the "job-storage-access" member attribute specifies 'owner', and which have reached the 'completed' state. If the Printer supports the "job-storage" Job Template attribute and the "job-storage-access-supported" Printer Description attribute, and the latter attribute includes the "owner" keyword, the Printer MUST support this keyword. A Client that specifies the 'stored-owner' keyword for "which-jobs" MUST be prepared to handle an authentication challenge from the Printer.

'stored-public' Public Stored Jobs, i.e., Jobs that have been stored using the "job-storage" operation attribute where the "job-storage-access" member attribute specifies 'public', and which are in the 'completed' state. If the Printer supports the "job-storage" Job Template attribute, it MUST support this keyword.

9. Obsolete Attributes and Values

9.1 Obsolete Attributes

Table 17 lists the attributes defined in [PWG5100.11-2010] that are OBSOLETE.

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Explanation</th>
</tr>
</thead>
</table>

Table 17 - Obsolete Attributes
<table>
<thead>
<tr>
<th>Attribute</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>job-save-disposition</td>
<td>The Job Save and Reprint feature [PWG5100.11-2010] has been made obsolete.</td>
</tr>
<tr>
<td>pdl-init-file</td>
<td>The &quot;pdl-init-file&quot; attribute [PWG5100.11-2010] has been made obsolete.</td>
</tr>
<tr>
<td>pdl-init-file-default</td>
<td>The &quot;pdl-init-file&quot; attribute [PWG5100.11-2010] has been made obsolete.</td>
</tr>
<tr>
<td>pdl-init-file-entry</td>
<td>The &quot;pdl-init-file&quot; attribute [PWG5100.11-2010] has been made obsolete.</td>
</tr>
<tr>
<td>pdl-init-file-entry-supported</td>
<td>The &quot;pdl-init-file&quot; attribute [PWG5100.11-2010] has been made obsolete.</td>
</tr>
<tr>
<td>pdl-init-file-location</td>
<td>The &quot;pdl-init-file&quot; attribute [PWG5100.11-2010] has been made obsolete.</td>
</tr>
<tr>
<td>pdl-init-file-location-supported</td>
<td>The &quot;pdl-init-file&quot; attribute [PWG5100.11-2010] has been made obsolete.</td>
</tr>
<tr>
<td>pdl-init-file-name</td>
<td>The &quot;pdl-init-file&quot; attribute [PWG5100.11-2010] has been made obsolete.</td>
</tr>
<tr>
<td>pdl-init-file-name-supported</td>
<td>The &quot;pdl-init-file&quot; attribute [PWG5100.11-2010] has been made obsolete.</td>
</tr>
<tr>
<td>pdl-init-file-name-subdirectory-supported</td>
<td>The &quot;pdl-init-file&quot; attribute [PWG5100.11-2010] has been made obsolete.</td>
</tr>
<tr>
<td>save-disposition</td>
<td>The Job Save and Reprint feature [PWG5100.11-2010] has been made obsolete.</td>
</tr>
<tr>
<td>save-disposition-supported</td>
<td>The Job Save and Reprint feature [PWG5100.11-2010] has been made obsolete.</td>
</tr>
<tr>
<td>save-document-format</td>
<td>The Job Save and Reprint feature [PWG5100.11-2010] has been made obsolete.</td>
</tr>
<tr>
<td>save-document-format-default</td>
<td>The Job Save and Reprint feature [PWG5100.11-2010] has been made obsolete.</td>
</tr>
<tr>
<td>save-document-format-supported</td>
<td>The Job Save and Reprint feature [PWG5100.11-2010] has been made obsolete.</td>
</tr>
<tr>
<td>save-info</td>
<td>The Job Save and Reprint feature [PWG5100.11-2010] has been made obsolete.</td>
</tr>
<tr>
<td>Attribute</td>
<td>Value</td>
</tr>
<tr>
<td>---------------------------------</td>
<td>--------------------------------------------</td>
</tr>
<tr>
<td>job-state-reasons</td>
<td>'job-saved-successfully'</td>
</tr>
<tr>
<td>job-state-reasons</td>
<td>'job-saved-with-errors'</td>
</tr>
<tr>
<td>job-state-reasons</td>
<td>'job-saved-with-warnings'</td>
</tr>
<tr>
<td>job-state-reasons</td>
<td>'job-saving'</td>
</tr>
<tr>
<td>which-jobs</td>
<td>'saved'</td>
</tr>
</tbody>
</table>

## 9.2 Obsolete Values

Table 18 lists the values defined in [PWG5100.11-2010] that are OBSOLETE.

### Table 18 - Obsolete Values

1140 **10. Conformance Requirements**

1141 This section summarizes the Conformance Requirements detailed in the definitions in this document for Client and Printer objects (servers or devices).
10.1 Printer Conformance Requirements

A Printer claiming conformance with this IPP Enterprise Printing Extensions v2.0 specification MUST support:

1. The internationalization considerations defined in section 11; and
2. The security considerations defined in section 12.

The Printer MUST also support at least one of the features defined in this specification:

10.1.1 Job Release

A Printer supporting the Button Press method for the Job Release feature defined in section 4.1 MUST support:

1. The "job-hold-until" attribute defined in [STD92] and the 'button-press' keyword defined in section 8.2;
2. The 'job-release' keyword for the "ipp-features-supported" Printer Description attribute defined in section 8.1;
3. The status codes defined in section 8.3.

A Printer supporting the Owner Authorized method for the Job Release feature defined in section 4.1 MUST support:

1. The "job-hold-until" attribute defined in [STD92] and the 'owner-authorized' keyword defined in section 8.2;
2. The 'job-release' keyword for the "ipp-features-supported" Printer Description attribute defined in section 8.1;
3. The status codes defined in section 8.3.

A Printer supporting the Job Password method for the Job Release feature defined in section 4.1 MUST support:

4. The "job-password" operation attribute defined in section 6.1.1 and the "job-password-encryption" operation attribute defined in section 6.1.2;
5. The "job-password-supported", "job-password-encryption-supported", "job-password-length-supported", "job-password-repertoire-configured", and "job-password-repertoire-supported" Printer Description attributes defined in section 6.4;
6. The 'job-release' keyword for the "ipp-features-supported" Printer Description attribute defined in section 8.1;
7. The status codes defined in section 8.3.

10.1.2 Job Storage

A Printer claiming support for the Job Storage feature defined in section 4.2 MUST support:
1. The "job-storage" operation attribute defined in section 6.1.3;
2. The 'job-storage' keyword for the "ipp-features-supported" Printer Description attribute defined in section 8.1;
3. The 'stored-public' and 'stored-owner' keywords defined in section 8.4 for the "which-jobs" operation attribute defined in [STD92];
4. The status codes defined in section 8.3.

10.1.3 Print Policy

A Printer claiming support for the Print Policy feature defined in section 4.3 MUST support:
1. The Get-User-Printer-Attributes operation defined in section 5.1.

10.1.4 Proof Print

A Printer claiming support for the Proof Print feature defined in section 4.4 MUST support:
1. The "proof-print" Job Template attribute defined in section 6.2.4;
2. The 'proof-print' keyword for the "ipp-features-supported" Printer Description attribute defined in section 8.1;
3. The status codes defined in section 8.3.

10.2 Client Conformance Requirements

A Client claiming conformance with this IPP Enterprise Printing Extensions v2.0 specification MUST support:
1. The internationalization considerations defined in section 11; and
2. The security considerations defined in section 12.

The Client MUST also support at least one of the features defined in this specification:

10.2.1 Job Release

A Client supporting the Button Press method for the Job Release feature defined in section 4.1 MUST support:
1. The "job-hold-until" attribute defined in [STD92] and the 'button-press' keyword defined in section 8.2;
2. The 'job-release' keyword for the "ipp-features-supported" Printer Description attribute defined in section 8.1;
3. The status codes defined in section 8.3.

A Client supporting the Owner Authorized method for the Job Release feature defined in section 4.1 MUST support:
1. The "job-hold-until" attribute defined in [STD92] and the 'owner-authorized' keyword defined in section 8.2;
2. The 'job-release' keyword for the "ipp-features-supported" Printer Description attribute defined in section 8.1;
3. The status codes defined in section 8.3.

A Client supporting the Job Password method for the Job Release feature defined in section 4.1 MUST support:

1. The "job-password" operation attribute defined in section 6.1.1 and the "job-password-encryption" operation attribute defined in section 6.1.2;
2. The "job-password-supported", "job-password-encryption-supported", "job-password-length-supported", "job-password-remotive-configured", and "job-password-remotive-supported" Printer Description attributes defined in section 6.4;
3. The 'job-release' keyword for the "ipp-features-supported" Printer Description attribute defined in section 8.1;
4. The status codes defined in section 8.3.

10.2.2 Job Storage

A Client claiming support for the Job Storage feature defined in section 4.2 MUST support:

1. The "job-storage" operation attribute defined in section 6.1.3;
2. The 'job-storage' keyword for the "ipp-features-supported" Printer Description attribute defined in section 8.1;
3. The 'stored-public' and 'stored-owner' keywords defined in section 8.4 for the "which-jobs" operation attribute defined in [STD92];
4. The status codes defined in section 8.3.

10.2.3 Print Policy

A Client claiming support for the Print Policy feature defined in section 4.3 MUST support:

1. The Get-User-Printer-Attributes operation defined in section 5.1.

10.2.4 Proof Print

A Client claiming support for the Proof Print feature defined in section 4.4 MUST support:

1. The "proof-print" Job Template attribute defined in section 6.2.4;
2. The 'proof-print' keyword for the "ipp-features-supported" Printer Description attribute defined in section 8.1;
3. The status codes defined in section 8.3.
11. Internationalization Considerations

For interoperability and basic support for multiple languages, conforming implementations MUST support the Universal Character Set (UCS) Transformation Format -- 8 bit (UTF-8) [STD63] encoding of Unicode [UNICODE] [ISO10646] and the Unicode Format for Network Interchange [RFC5198].

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

- Unicode Bidirectional Algorithm [UAX9] – left-to-right, right-to-left, and vertical
- Unicode Line Breaking Algorithm [UAX14] – character classes and wrapping
- Unicode Normalization Forms [UAX15] – especially NFC for [RFC5198]
- Unicode Text Segmentation [UAX29] – grapheme clusters, words, sentences
- Unicode Identifier and Pattern Syntax [UAX31] – identifier use and normalization
- Unicode Collation Algorithm [UTS10] – sorting
- Unicode Locale Data Markup Language [UTS35] – locale databases

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

- Unicode Character Encoding Model [UTR17] – multi-layer character model
- Unicode Character Property Model [UTR23] – character properties
- Unicode Conformance Model [UTR33] – Unicode conformance basis

12. Security Considerations

In addition to the security considerations described in the IPP/1.1: Model and Semantics [STD92], implementations of this specification SHOULD conform to the following standards on processing of human-readable Unicode text strings:

- Unicode Security FAQ [UNISECFAQ] – common Unicode security issues
13. IANA Considerations

13.1 Attribute Registrations

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

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

The registry entries will contain the following information:

<table>
<thead>
<tr>
<th>Operation attributes:</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>job-password (octetString(255))</td>
<td>[IPPEPX]</td>
</tr>
<tr>
<td>job-password-encryption (deprecated) (type2 keyword</td>
<td>[IPPEPX]</td>
</tr>
<tr>
<td>job-password-encryption (type2 keyword)</td>
<td>[IPPEPX]</td>
</tr>
<tr>
<td>job-storage (collection)</td>
<td>[IPPEPX]</td>
</tr>
<tr>
<td>job-storage-access (type2 keyword)</td>
<td>[IPPEPX]</td>
</tr>
<tr>
<td>job-storage-disposition (type2 keyword)</td>
<td>[IPPEPX]</td>
</tr>
<tr>
<td>job-storage-group (name(MAX))</td>
<td>[IPPEPX]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Job Template attributes:</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>job-cancel-after (integer(1:MAX))</td>
<td>[IPPEPX]</td>
</tr>
<tr>
<td>job-phone-number (uri)</td>
<td>[IPPEPX]</td>
</tr>
<tr>
<td>job-recipient-name (name(MAX))</td>
<td>[IPPEPX]</td>
</tr>
<tr>
<td>proof-print (collection)</td>
<td>[IPPEPX]</td>
</tr>
<tr>
<td>proof-print-copies (integer (0:MAX))</td>
<td>[IPPEPX]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Job Status attributes:</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>job-storage (collection)</td>
<td>[IPPEPX]</td>
</tr>
<tr>
<td>&lt;Any &quot;job-storage&quot; member attribute&gt;</td>
<td>[IPPEPX]</td>
</tr>
<tr>
<td>proof-print (collection)</td>
<td>[IPPEPX]</td>
</tr>
<tr>
<td>&lt;Any &quot;proof-print&quot; member attribute&gt;</td>
<td>[IPPEPX]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Printer Description attributes:</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>job-cancel-after-default (integer(1:MAX))</td>
<td>[IPPEPX]</td>
</tr>
<tr>
<td>job-password-encryption-supported (deprecated) (isetOf (type2 keyword</td>
<td>name(MAX)))</td>
</tr>
<tr>
<td>job-password-encryption-supported (isetOf (type2 keyword)</td>
<td>[IPPEPX]</td>
</tr>
<tr>
<td>job-password-length-supported (rangeOfInteger(0:255))</td>
<td>[IPPEPX]</td>
</tr>
<tr>
<td>job-password-repertoire-configured (isetOf (type2 keyword</td>
<td>name(MAX)))</td>
</tr>
<tr>
<td>job-password-repertoire-supported (isetOf (type2 keyword</td>
<td>name(MAX)))</td>
</tr>
<tr>
<td>job-password-supported (integer(0:255))</td>
<td>[IPPEPX]</td>
</tr>
<tr>
<td>job-phone-number-default (uri)</td>
<td>[IPPEPX]</td>
</tr>
<tr>
<td>job-phone-number-supported (boolean)</td>
<td>[IPPEPX]</td>
</tr>
<tr>
<td>job-recipient-name-default (name(MAX))</td>
<td>[IPPEPX]</td>
</tr>
<tr>
<td>job-recipient-name-supported (boolean)</td>
<td>[IPPEPX]</td>
</tr>
<tr>
<td>job-storage-access-supported (isetOf type2 keyword)</td>
<td>[IPPEPX]</td>
</tr>
<tr>
<td>job-storage-disposition-supported (isetOf type2 keyword)</td>
<td>[IPPEPX]</td>
</tr>
<tr>
<td>job-storage-group-supported (isetOf name(MAX))</td>
<td>[IPPEPX]</td>
</tr>
<tr>
<td>job-storage-supported (isetOf keyword)</td>
<td>[IPPEPX]</td>
</tr>
<tr>
<td>printer-detailed-status-messages (isetOf text(MAX))</td>
<td>[IPPEPX]</td>
</tr>
</tbody>
</table>
### 13.2 Type2 keyword Registrations

The keyword values defined in this specification will be published by IANA according to the procedures in IPP/1.1 Model and Semantics [STD92] in the following file:

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

The registry entries will contain the following information:

<table>
<thead>
<tr>
<th>Attribute (attribute syntax)</th>
<th>Keyword Attribute Value</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>ipp-features-supported (1setOf (type2 keyword))</td>
<td></td>
<td>[PWG5100.13]</td>
</tr>
<tr>
<td>job-release</td>
<td></td>
<td>[IPPEPX]</td>
</tr>
<tr>
<td>job-storage</td>
<td></td>
<td>[IPPEPX]</td>
</tr>
<tr>
<td>proof-print</td>
<td></td>
<td>[IPPEPX]</td>
</tr>
<tr>
<td>job-hold-until (type2 keyword)</td>
<td></td>
<td>[RFC8011]</td>
</tr>
<tr>
<td>job-hold-until-supported (1setOf (type2 keyword))</td>
<td></td>
<td>[RFC8011]</td>
</tr>
<tr>
<td>owner-authorized</td>
<td></td>
<td>[IPPEPX]</td>
</tr>
<tr>
<td>button-press</td>
<td></td>
<td>[IPPEPX]</td>
</tr>
<tr>
<td>job-password-encryption (type2 keyword</td>
<td></td>
<td>[IPPEPX]</td>
</tr>
<tr>
<td>job-password-encryption-supported (1setOf (type2 keyword</td>
<td></td>
<td>[IPPEPX]</td>
</tr>
<tr>
<td>md2 (deprecated)</td>
<td></td>
<td>[IPPEPX]</td>
</tr>
<tr>
<td>md4 (deprecated)</td>
<td></td>
<td>[IPPEPX]</td>
</tr>
<tr>
<td>md5 (deprecated)</td>
<td></td>
<td>[IPPEPX]</td>
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<tr>
<td>none</td>
<td></td>
<td>[IPPEPX]</td>
</tr>
<tr>
<td>sha (deprecated)</td>
<td></td>
<td>[IPPEPX]</td>
</tr>
<tr>
<td>sha2-224</td>
<td></td>
<td>[IPPEPX]</td>
</tr>
<tr>
<td>sha2-256</td>
<td></td>
<td>[IPPEPX]</td>
</tr>
<tr>
<td>sha2-384</td>
<td></td>
<td>[IPPEPX]</td>
</tr>
<tr>
<td>sha2-512</td>
<td></td>
<td>[IPPEPX]</td>
</tr>
<tr>
<td>sha2-512_224</td>
<td></td>
<td>[IPPEPX]</td>
</tr>
<tr>
<td>sha2-512_256</td>
<td></td>
<td>[IPPEPX]</td>
</tr>
<tr>
<td>sha3-224</td>
<td></td>
<td>[IPPEPX]</td>
</tr>
<tr>
<td>sha3-256</td>
<td></td>
<td>[IPPEPX]</td>
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<tr>
<td>sha3-384</td>
<td></td>
<td>[IPPEPX]</td>
</tr>
<tr>
<td>sha3-512</td>
<td></td>
<td>[IPPEPX]</td>
</tr>
<tr>
<td>sha3-512_224</td>
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<td>[IPPEPX]</td>
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<tr>
<td>sha3-512_256</td>
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<td>[IPPEPX]</td>
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<td>shake-256</td>
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<td>[IPPEPX]</td>
</tr>
<tr>
<td>shake-512</td>
<td></td>
<td>[IPPEPX]</td>
</tr>
<tr>
<td>job-storage-access-supported (1setOf type2 keyword)</td>
<td></td>
<td>[IPPEPX]</td>
</tr>
<tr>
<td>group</td>
<td></td>
<td>[IPPEPX]</td>
</tr>
<tr>
<td>owner</td>
<td></td>
<td>[IPPEPX]</td>
</tr>
<tr>
<td>public</td>
<td></td>
<td>[IPPEPX]</td>
</tr>
<tr>
<td>job-storage-disposition-supported (1setOf type2 keyword)</td>
<td></td>
<td>[IPPEPX]</td>
</tr>
<tr>
<td>none</td>
<td></td>
<td>[IPPEPX]</td>
</tr>
<tr>
<td>print-and-store</td>
<td></td>
<td>[IPPEPX]</td>
</tr>
<tr>
<td>store-only</td>
<td></td>
<td>[IPPEPX]</td>
</tr>
<tr>
<td>job-storage-supported (1setOf type2 keyword)</td>
<td></td>
<td>[IPPEPX]</td>
</tr>
</tbody>
</table>
1374  job-storage-access [IPPEPX]
1375  job-storage-disposition [IPPEPX]
1376  job-storage-group [IPPEPX]
1377  job-state-reasons (type2 keyword) [RFC8011]
1378  conflicting-attributes [IPPEPX]
1379  job-canceled-after-timeout [IPPEPX]
1380  job-held-for-authorization [IPPEPX]
1381  job-held-for-button-press [IPPEPX]
1382  job-held-for-proof-release [IPPEPX]
1383  job-password-wait [IPPEPX]
1384  job-printed-successfully [IPPEPX]
1385  job-printed-with-errors [IPPEPX]
1386  job-printed-with-warnings [IPPEPX]
1387  job-resuming [IPPEPX]
1388  job-release-wait [IPPEPX]
1389  job-saved-successfully (deprecated) [IPPEPX]
1390  job-saved-with-errors (deprecated) [IPPEPX]
1391  job-saved-with-warnings (deprecated) [IPPEPX]
1392  job-saving (deprecated) [IPPEPX]
1393  job-stored-successfully [IPPEPX]
1394  job-stored-with-errors [IPPEPX]
1395  job-stored-with-warnings [IPPEPX]
1396  job-storing [IPPEPX]
1397  job-suspended-by-operator [IPPEPX]
1398  job-suspended-by-system [IPPEPX]
1399  job-suspended-by-user [IPPEPX]
1400  job-suspending [IPPEPX]
1401  unsupported-attributes-or-values [IPPEPX]
1402  proof-print-supported (1setOf type2 keyword) [IPPEPX]
1403  proof-print-copies [IPPEPX]
1404  media [IPPEPX]
1405  media-col [IPPEPX]
1406  which-jobs (type2 keyword) [RFC8011]
1407  proof-print [IPPEPX]
1408  stored-group [IPPEPX]
1409  stored-owner [IPPEPX]
1410  stored-public [IPPEPX]
1411
1412
1413
1414
1415
1416
1417
1418

13.3 Type2 enum Registrations

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

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

The registry entries will contain the following information:

<table>
<thead>
<tr>
<th>Attributes (attribute syntax)</th>
<th>Enum Value</th>
<th>Enum Symbolic Name</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>operations-supported (1setOf type2 enum)</td>
<td>---</td>
<td>---</td>
<td>[STD92]</td>
</tr>
</tbody>
</table>
13.4 Operation Registrations

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

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

The registry entries will contain the following information:

<table>
<thead>
<tr>
<th>Operation Name</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Create-Job (Extension)</td>
<td>[EPX]</td>
</tr>
<tr>
<td>Get-Jobs (Extension)</td>
<td>[EPX]</td>
</tr>
<tr>
<td>Get-User-Printer-Attributes</td>
<td>[EPX]</td>
</tr>
<tr>
<td>Print-Job (Extension)</td>
<td>[EPX]</td>
</tr>
<tr>
<td>Print-URI (Extension)</td>
<td>[EPX]</td>
</tr>
<tr>
<td>Validate-Job (Extension)</td>
<td>[EPX]</td>
</tr>
</tbody>
</table>

14. Overview of Changes

14.1 IPP Enterprise Printing Extensions v2.0

The Proof Print, Job Save and Secure Print features defined in "Internet Printing Protocol (IPP): Job and Printer Extensions – Set 2 (JPS2)" [PWG5100.11-2010] were not defined in such a way that they could interoperate in practice. The Job Save and Reprint feature is OBSOLETE, replaced by the Job Storage feature (section 4.2). The Secure Print feature has been refactored and extended to become the Job Release feature (section 4.1), which interoperates with the Job Storage feature and the Proof Print feature (section 4.4) to enable more complex print workflow solutions to be created.

The Print Policy feature (section 4.3) was added by adopting the Get-User-Printer-Attributes operation registered in 2017.

The following additional changes were made to the previous version of this specification:

- Defined keywords for "ipp-features-supported" for Job Release, Job Storage, and Proof Print features

- Deprecated the "name(MAX)" syntax from the original definition of the "job-password-encryption" attribute since the "type2 keyword" syntax allows for site-local or -vendor-unique hashing algorithms, which were never observed to have been used in practice.

- A Client can now include the "job-password" and "job-password-encryption" attributes in a Validate-Job request. This was disallowed in the previous version of this specification [PWG5100.11-2010].
• "proof-print-default" is DEPRECATED because its semantics were not clearly defined and its value is unclear.

• Many attributes and keywords were moved to "IPP Job Extensions v2.0" [PWG5100.7] because they don't specifically apply to "enterprise printing".

15. References

15.1 Normative References


[RFC2806] A. Vaha-Sipila, "URLs for Telephone Calls", RFC 2806, April 2000, 


1540 15.2 Informative References

16. Authors' Addresses

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HP Inc.  
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Implementers of this specification document are encouraged 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.

The editors would like to especially thank the following individuals who also contributed significantly to the development of this document:

Ira McDonald  
High North, Inc.

Chris Rizzo  
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17. Change History

17.1 May 4, 2020

Updated to add in the 'conflicting-attributes', 'job-release-wait', and 'unsupported-attributes-or-values' keywords for the "job-state-reasons" Job Status attribute moved from "IPP Transaction-Based Printing Extensions (2016)" that was overlooked in the April 28, 2020 draft.

17.2 April 28, 2020

Updated as per review from 2019-09-26 and 2019-10-24 IPP WG teleconferences, the November 2019 F2F, and from other sources:
• Moved "Additional Semantics for Existing Operations" subsections relating to "job-password" from JPS3v2 to new section 9 / 9.1 / 9.2

• Updated IANA Considerations section with many editorial fixes

• Expanded the model feature descriptions in section 4 to tie together the disparate elements defined in other parts of the specification.

• Expanded the "Job Release" feature description substantially, and as a result added section 7.3 'Get-Jobs: "job-storage-group" to provide a Client with a way to filter on a particular group

• Removed "job-password-action" and instead defined more clear semantics about when a new Job is to be placed in the 'pending-held' state and when it should proceed to the 'pending' or 'processing' state, depending on context.

• Added query semantics enabling a Client to discover whether the Printer supports Job Release with Job Storage and/or Proof Print, resolving a shortcoming of 5100.11-2010.

• Updated Obsolete Attributes and Obsolete Values with complete list

• Updated "job-state-reasons", conformance requirements, and IANA Considerations to hopefully correctly list all the definitions from sections 5-9.

17.3 October 10, 2019

Updated as per brief review from 2019-09-26 and from other sources:

• Moved "Additional Semantics for Existing Operations" subsections relating to "job-password" from JPS3v2 to new section 9 / 9.1 / 9.2

• Updated IANA Considerations section with many editorial fixes

• Expanded the "Authorized Release Feature" feature description

17.4 September 11, 2019

Added definition of the 'enterprise’ keyword for "ipp-features-supported" as per agenda for 2019-09-12 IPP WG meeting and added reference to PWG 5100.13. Also made all URLs in references use the "https" scheme.

17.5 September 3, 2019

Updated as per feedback from the July 18 IPP Workgroup teleconference review and other feedback:
• Added version number ("v2.0") to title and name

• Updated abstract and other references to use new feature names

• Restored IPP Proof Print from 5100.11 and "rebranded" it as the Proof Print feature in this document. Abandoned the proposed new Proof Print feature from HP.

• Removed the " | name(MAX)" from the syntax definition for job-password-encryption, since site-defined localized strings in that context would seem to be unlikely and of limited value

• Added "job-pause-after" and then questioned whether we ought to be adding it

• Added a MAY statement allowing "job-password" to be used with "proof-print", with corresponding conditional requirements, so that the Proof Print feature and Job Protection feature can be used with a single Job to make a Protected Proof Job.

• Added "proof-print-password-supported" and "proof-print-copies-supported"

• Various questions still to be resolved are in comments

17.6 June 14, 2019

Updated to resolve issues identified in the April 2019 PWG F2F and to align with IPP Job Extensions v2.0.

17.7 March 27, 2019

Initial revision based on an abandoned update to JPS2v2 and discussions on the IPP WG reflector.