The Printer Working Group

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IPP Transaction-Based Printing Extensions

Status: Stable

Abstract: This document defines extensions to the Internet Printing Protocol that support the business transaction logic needed for paid, PIN, release, and quota-based printing through local and commercial services.

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

This document is available electronically at:

ftp://ftp.pwg.org/pub/pwg/candidates/cs-ipptrans10-20131108-5100.16.docx
ftp://ftp.pwg.org/pub/pwg/candidates/cs-ipptrans10-20131108-5100.16.pdf

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About the IEEE-ISTO PWG

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

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

For additional information regarding the Printer Working Group visit:

http://www.pwg.org

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About the Internet Printing Protocol Work Group

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

For additional information regarding IPP visit:

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

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

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1. Introduction

Whether provided by a third-party or an organization's infrastructure services, transaction-based printing services such as PIN, release, quota-based, managed, and account/payment-based printing are increasingly common. For example, a school may provide printing services to its students; each student submits print requests, authenticates with the print service either at time of submission or at the printer, and is then "billed" for their usage, where billing may just apply the print job against a monthly quota allowed by their student fees. Other organizations may require accounting of all print jobs; in those cases the transactions associate print jobs with customer accounts and/or track usage and content for regulatory compliance.

Whatever the usage, IPP currently exposes only a handful of attributes that describe a Printer's business transaction capabilities and does not allow a Client to directly participate in transaction-based printing through IPP. This specification defines additional attributes, values, and semantics to enable a variety of transaction-based printing services directly through IPP. The intent is not to define a full framework for a particular class of transaction-based printing such as that envisioned by the CIP4 PrintTalk [PrintTalk] specification, but rather to define a general-purpose framework that can be used by a variety of solutions using business transactions that is compatible with other public standards.

2. Terminology

2.1 Conformance Terminology

Capitalized terms, such as MUST, MUST NOT, RECOMMENDED, REQUIRED, SHOULD, SHOULD NOT, MAY, and OPTIONAL, have special meaning relating to conformance as defined in Key words for use in RFCs to Indicate Requirement Levels [RFC2119]. The term CONDITIONALLY REQUIRED is additionally defined for a conformance requirement that applies to a particular capability or feature.

2.2 Printing Terminology

Normative definitions and semantics of printing terms are imported from IETF IPP/1.1 [RFC2911]. This document also defines the following protocol roles in order to specify unambiguous conformance requirements:

Client: Initiator of outgoing IPP session requests and sender of outgoing IPP operation requests (Hypertext Transfer Protocol -- HTTP/1.1 [RFC2616] User Agent).

Printer: Listener for incoming IPP session requests and receiver of incoming IPP operation requests (Hypertext Transfer Protocol -- HTTP/1.1 [RFC2616] Server) that represents one or more Physical Devices or a Logical Device.

2.3 Other Terminology

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.

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

PIN Printing: Printing where the User/Client provides a passcode or number in the print request that is later used to release the Job at the Printer's console or control panel.

Quota-Based Printing: Printing where Jobs are measured and potentially limited by the Printer. The method of measurement and limiting are outside the scope of this document.

Release Printing: Printing where Jobs are submitted to the print service and held until the User subsequently provides identification information at the Printer, such as by entering a username and password at the console or swiping or presenting an idenfication card to a card reader on the Printer. Jobs may be directed at a Physical Printer or at a Logical Printer such as a central print service.

Paid Imaging Services: Printing, facsimile, and scanning performed for a monetary fee. Facsimile, scanning, and the means of collecting payment are outside the scope of this specification.

Transaction-Based Printing: Printing, including Paid Imaging Services, PIN Printing, Release Printing, and Quota-Based Printing, where authorized Jobs are a business transaction between the User/Client and Printer.

2.4 Acronyms and Organizations

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

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

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

PWG: Printer Working Group, http://www.pwg.org/

3. Requirements

3.1 Rationale for IPP Transaction-Based Printing Extensions

Given the following existing specifications and the need for a standard method of supporting Transaction-Based Printing without vendor-specific driver software, the IPP Transaction-Based Printing Extensions specification should:

1. Use existing the existing IPP specfications to support job submission to and monitoring of Paid Imaging Services,
2. Define HTTP authorization requirements as needed to support Transaction-Based Printing,
3. Define operation attributes and amend operation semantics as needed for a Client to obtain and supply authorization from an IPP Printer,
4. Define status code values needed for Transaction-Based Printing to inform a Client when exceptions occur during job submission,
5. Define Job Description attributes and values needed for Transaction-Based Printing to provide authorization status information to Clients, and
6. Define Job Template attributes needed to clearly express output intent for Transaction-Based Printing.

The IPP: "-actual" attributes [PWG5100.8] defines Job Description attributes that reflect the actual values used for various Job Template attributes.

The IPP Job and Printer Extensions - Set 2 (JPS2) [PWG5100.11] defines attributes for PIN Printing and accounting.

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

1. A collection of existing IPP specifications that form the basis for IPP/2.0
2. Standard job template attributes
3. Specific interoperability requirements, such as HTTP/1.1 support with chunking and IPP collection attribute support
4. New version number and operation requirements for different classes of Imaging Devices

The IPP Job and Printer Extensions - Set 3 (JPS3) [PWG5100.13] defines attributes to indicate whether a Printer supports Paid Imaging Services.

IPP Everywhere [PWG5100.14] defines:

1. Protocols and schema to support discovery, identification, and auto-configuration of Imaging Devices,
2. A standard profile of IPP attributes, operations, and values to promote interoperability, and
3. Standard document formats for job submission.

The PWG Raster Format [PWG5102.4] defines a minimal file format for transmission of multi-page color and grayscale bitmap images

The Document management -- Portable document format -- Part 1: PDF 1.7 [ISO32000] defines:

1. A rich file format for transmission of multi-page color and grayscale vector and bitmap images
2. Standard page attributes to support page size, orientation, and duplex functionality

The JPEG File Interchange Format Version 1.02 [JFIF] defines a compact file format for transmission of photographic images

The Open XML Paper Specification [ECMA388] defines a paginated document format based on Open Packaging Conventions (OPC) [ISO29500-2], Extensible Markup Language (XML) [XML11], and standard image and font formats with device-independent color.

3.2 Use Cases

3.2.1 Printing at a School

Jane wants to print her thesis on the laser printer in her school's computing lab. After initiating the print action in her application and selecting the laser printer, the application software validates access to the printer by providing the proposed job ticket information. The print service supporting the laser printer provides the application software an authorization code for the job submission. After Jane confirms the print action, the application software submits the print job with the authorization code to the print service. The print service then prints the job on the laser printer and includes the print job in her student activity fees.

3.2.2 Printing to a Reprographics Shop

John wants to print 100 marketing booklets for a real estate conference using a local reprographics shop. John prepares the electronic files needed for the booklets and then initiates a job submission through a generic job management utility. After selecting the reprographics shop and specifying the job processing intent and delivery location, the utility software validates access to the service for the shop. The service challenges the user (via the utility software) to provide user account information. Once accepted, the service provides an authorization code to the utility software, which then submits the complete job, including the authorization code, for printing. The shop charges John's account, prints the job, and delivers the booklets to the conference.

3.3 Exceptions

3.3.1 Account Exceeded Limit Exception

Jane wants to print flyers for a school event on the school's large format printer. After initiating the print action in her application and selecting the large format printer, the application software validates access to the printer, obtains an authorization code, and submits the job. After pre-processing the job, the print service associated with the printer determines that Jane's account lacks sufficient funds to complete the print job and stops the job from printing, adding status information to the job indicating the reason. The application software queries the print service for the job status and presents the issue to Jane. Jane then visits the web page provided by the print service to add additional printing credits to her school activity account. The print service then resumes processing of the job, printing the flyers on the large format printer.

3.4 Out of Scope

The following are considered out of scope for this specification:

1. The actual method of payment for Paid Imaging Services,
2. The actual methods of measurement and limit enforcement for Quota-Based Printing,
3. The actual methods of multi-factor authentication for PIN and Release Printing, e.g., smart cards, and
4. Definition of new HTTP authentication methods.

3.5 Design Requirements

The design requirements for the IPP Transaction-Based Printing Extensions specification are:

1. Define HTTP authorization extensions and requirements;
2. Follow the naming conventions defines in IPP/1.1: Model and Semantics [RFC2911], including keyword value case (lower) and hyphenation requirements;
3. Define attributes and values to support Transaction-Based Printing;
4. Amend operation semantics to support Transaction-Based Printing;
5. Support printing with vender-neutral Client software from any Client to any Printer using a variety of discovey protocols, IPP for the transport, and standard document formats.

4. Extensions for Transaction-Based Printing

This document defines new attributes, enum values for the "finishings" Job Template attribute, keyword values for the “job-state-reasons” Job Description attribute, and status codes for the Create-Job, Print-Job, Print-URI, and Validate-Job operations that allows IPP to support Transaction-Based Printing. Figure 1 shows the general model of Transaction-Based Printing while Figure 2 shows a typical paid printing interaction between a Client and Printer.

The “printer-charge-info-uri” Printer attribute [PWG5100.13] provides a URL that allows Users to manage paid printing accounts on the Printer. Typically this web page will allow new users to sign up for the paid printing service, purchase additional pages/credits for printing, manage queued jobs, and so forth.

The “job-authorization-uri” (section 6.1.2) operation attribute allows a Printer to provide an authorization or transaction code to the Client that is used in subsequent job creation requests to obtain a printout. The valid time period, number of print jobs, and/or number of pages for an authorization code is specific to the implementation. However, since there is no way for the Client to tell the Printer it will not be using the authorization code, the Printer MUST automatically expire the provided URI after a suitable period of time that SHOULD be longer than 60 seconds. Printers notify Clients that they require a “job-authorization-uri” value in a print job creation request by including the attribute name in the “printer-mandatory-job-attributes” Printer attribute [PWG5100.13]. Printers notify Clients that a “job-authorization-uri” value is no longer valid by returning the client-error-account-authorization-failed (section 8.2) status code and placing the “job-authorization-uri” attribute in the unsupported attributes group of the response.

The “job-impressions-estimated” (section 6.1.3) operation attribute allows the Client to supply an estimate of the number of impressions or sides that will be submitted for printing.

The “charge-info-message” (section 6.1.1) operation attribute allows the Printer to return a localized message to the Client tailored to the requesting user. The message is typically the current status of the account (number of pages/amount of credit remaining) but can also contain account-specific error messages when the account cannot be used for printing. Once a job is created, the “job-charge-info” (section 6.3.1) Job Description attribute provides any updated account information for that job.

Account issues that are discovered at validation or job creation time are reported using the new status codes defined in section 8.2. Once a job has been created, these same issues are reported in the “job-state-reasons” (section 8.1) Job Description attribute with the corresponding keyword values.

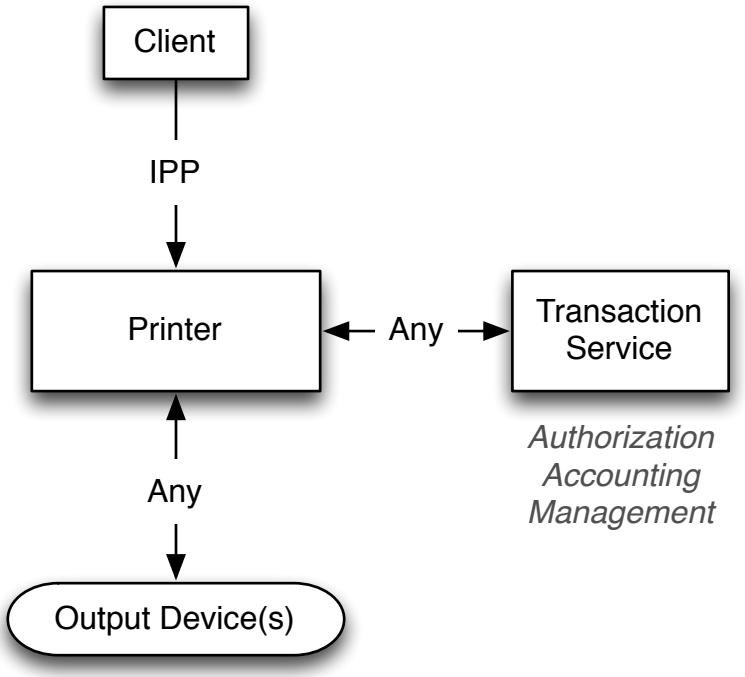

Figure 1 - Transaction-Based Printing Model

4.1 User Accounts vs. Payment/Billing Accounts

Printers that support multiple payment or billing options for each user account can support them via the “job-account-id” and “job-accounting-user-id” Job Template attributes [PWG5100.11]. Printers notify Clients that they require these values in a print job creation request by including the corresponding attribute names in the “printer-mandatory-job-attributes” Printer attribute [PWG5100.13].

4.2 PIN/Passcode Printing

Printers support PIN/passcode printing using the “job-password” and “job-password-encryption” operation attributes [PWG5100.11]. Jobs created with these attributes MUST be placed in the ‘pending-held’ state with the ‘job-password-wait’ keyword added to the “job-state-reasons” Job Description attribute.

When the User later enters the PIN/passcode on the Printer, the job is placed in the ‘pending’ or ‘processing’ state and the ‘job-password-wait’ keyword is removed from the “job-state-reasons” Job Description attribute.


```
Client                          Printer
POST Validate-Job Request →
                                ← 401 Unauthorized
                                WWW-Authenticate: Basic realm="Example"
POST Validate-Job Request →
Authentication: Basic dGVzdDp0ZXN0MTIzCg==
job-impressions-estimated=20
                                ← 200 OK
                                Validate-Job Response = successful-ok
                                charge-info-message="14 pages in account."
                                job-authorization-uri = "urn:uuid:..."
POST Print-Job Request →
Authentication: Basic dGVzdDp0ZXN0MTIzCg==
job-authorization-uri = "urn:uuid:..."
<20 page document>
                                ← 200 OK
                                Print-Job Response = successful-ok
                                charge-info-message="14 pages in account."
                                job-id=1234
                                job-state=pending
                                job-state-reasons="none"
POST Get-Job-Attributes Request →
Authentication: Basic dGVzdDp0ZXN0MTIzCg==
job-id=1234
                                ← 200 OK
                                Get-Job-Attributes Response = successful-ok
                                job-charge-info="6 pages in account."
                                job-impressions-completed=8
                                job-state=processing
                                job-state-reasons="job-printing"
POST Get-Job-Attributes Request →
Authentication: Basic dGVzdDp0ZXN0MTIzCg==
job-id=1234
                                ← 200 OK
                                Get-Job-Attributes Response = successful-ok
                                job-charge-info="Need to order more pages."
                                job-impressions-completed=14
                                job-state=processing-stopped
                                job-state-reasons="account-limit-reached"

... User Visits printer-charge-info-uri to order 10 more pages ...

POST Get-Job-Attributes Request →
Authentication: Basic dGVzdDp0ZXN0MTIzCg==
job-id=1234
                                ← 200 OK
                                Get-Job-Attributes Response = successful-ok
                                job-charge-info="20 pages charged."
                                job-impressions-completed=20
                                job-state=completed
                                job-state-reasons="none"
```

Figure 2 - Typical Paid Printing Sequence Diagram

4.3 Release Printing

Printers can act as “release printing” services for one or more associated output devices, where print jobs are spooled and later released by the User at an output device by entering a PIN/passcode (see section 4.2), swiping an identification card, or providing other identification to the associated Printer.

Jobs submitted to such a Printer MUST be placed in the ‘pending-held’ state with the ‘job-release-wait’ keyword added to the “job-state-reasons” Job Description attribute. The Job is placed in the 'pending-held' state because it cannot be processed until the Output Device has been selected, which determines the security policy and (if applicable) costs that must be accounted for and paid. When the User later releases the job at an output device, the job is placed in the ‘pending’ or ‘processing’ state and the ‘job-release-wait’ keyword is removed from the “job-state-reasons” Job Description attribute.

4.4 Priority of Service

The "job-priority" Job Template attribute MAY be used by the Printer to determine the cost of or type of service for the Job. For example, a Job with a priority of 100 would cause the Job to be processed before other Jobs of lesser priority and might then be billed at twice the normal rate. Similarly, a Job with a priority of 1 would cause the Job to be processed after all other Jobs and might be billed at half the normal rate.

The Printer MAY reflect the actual priority of service provided for the Job in the "job-priority-actual" Job Description attribute [PWG5100.8].

4.5 Job Review

Printers MAY institute a policy of holding new Jobs for review, such as when an unusual print request is received ("print one million copies of a brochure"), randomly as a means of auditing all print jobs, or as a blanket policy ("all color print jobs from students are held for review"). Such Jobs are placed in the 'pending-held' state with the 'job-held-for-review' keyword added to the "job-state-reasons" Job Description attribute. When released by an authorized user, the Printer then places the Job in the 'pending' or 'processing' states and removes the 'job-held-for-review' keyword.

5. HTTP Authentication - Default Username

Printers supporting Basic authentication [RFC2617] MUST support a default username specified in the WWW-Authenticate header. For example:

```
WWW-Authenticate: Basic realm="Example Printer" username="guest"
```

Printers supporting Digest authentication [RFC2617] MUST support a default username specified in the WWW-Authenticate header. For example:

```
WWW-Authenticate: Digest realm="Example Printer" \
    nonce="0123456789abcdefg" username="guest"
```

The default username MAY be changed or disabled through the Printer's web interface or other mechanisms.

6. IPP Attributes

6.1 Operation Attributes

6.1.1 charge-info-message (text)

The "charge-info-message" operation attribute provides a localized message concerning any paid printing charge information, typically the remaining balance on the requesting user's account. Printers that implement Paid Imaging Services SHOULD return this attribute in response to a Create-Job, Print-Job, Print-URI, or Validate-Job request.

6.1.2 job-authorization-uri (uri)

The "job-authorization-uri" operation attribute specifies an implementation-specific URI representing an authorization or reservation code for a print job creation request. It is returned by the Validate-Job operation (section 7.2) and supplied in the Create-Job, Print-Job, and Print-URI operations (section 7.1).

Printers that support this attribute MUST also support the "job-authorization-uri-supported" (section 6.4.3) Printer attribute.

6.1.3 job-impressions-estimated (integer(1:MAX))

The "job-impressions-estimated" operation attribute specifies the estimated "job-impressions" value for a subsequent print job creation request. It is supplied in a Validate-Job request (section 7.2) when supporting accounting or Paid Imaging Services.

6.1.4 profile-uri-actual (uri)

The "profile-uri-actual" operation attribute is returned by the Validate-Job operation (section 7.2) and specifies which ICC color profile will be used by the Printer for the given

Job Template attributes. This attribute MUST be supported if the "printer-icc-profiles" Printer attribute [PWG5100.13] is supported.

The ICC profile can be used for Client-based color matching and soft proofing.

6.2 Job Template Attributes

6.2.1 job-account-type (type2 keyword | name(MAX))

The RECOMMENDED "job-account-type" Job Template attribute specifies the type of value that was specified in the "job-account-id" Job Template attribute [PWG5100.11]. The following values are defined in this specification:

'general': A general-purpose identifier was supplied.

'group': A group identifier was supplied.

'none': No account identifier was supplied.

6.2.2 print-scaling (type2 keyword)

The REQUIRED "print-scaling" Job Template attribute specifies how the Printer scales the document data to fit the requested media. Standard keywords are:

'auto'; if the “ipp-attribute-fidelity” attribute is true or the document is larger than the requested media, scale the document using the 'fit' method if the margins are non-zero, otherwise scale using the 'fill' method. If the “ipp-attribute-fidelity” attribute is false or unspecified and the document is smaller than the requested media, scale using the 'none' method.

‘auto-fit’; if the “ipp-attribute-fidelity” attribute is true or the document is larger than the requested media, scale the document using the ‘fit’ method. Otherwise, scale using the ‘none’ method.

'fill'; scale the document to fill the requested media size, preserving the aspect ratio of the document data but potentially cropping portions of the document.

'fit'; scale the document to fit the printable area of the requested media size, preserving the aspect ratio of the document data without cropping the document.

'none'; do not scale the document to fit the requested media size. If the document is larger than the requested media, center and clip the resulting output. If the document is smaller than the requested media, center the resulting output.

The 'auto' value is typically the default. Figure 3 shows how a 3:2 aspect ratio photo image is scaled using the 'fit' and 'fill' values on US Letter and US Legal media.

The "print-scaling" attribute MUST control the scaling of the supported IPP Everywhere MIME media types - "application/oxps", "application/pdf", "image/jpeg", and "image/pwg-raster" - and SHOULD control the scaling of document data in other formats.

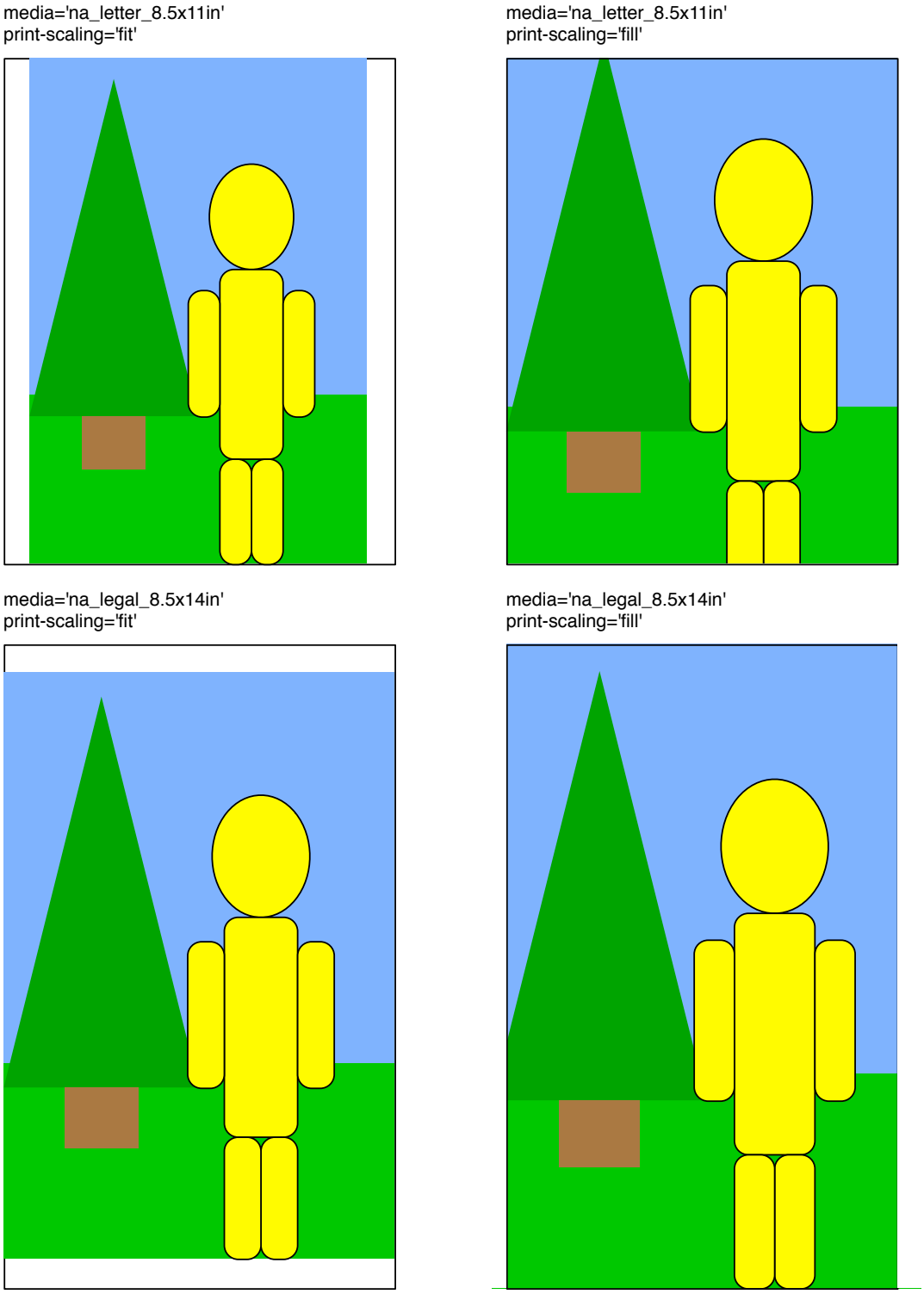

Figure 3 - "print-scaling" Values

6.3 Job Description Attributes

6.3.1 job-charge-info (text)

The RECOMMENDED "job-charge-info" Job Description attribute provides a localized message concerning any paid printing charge information, typically the cost charged to the requesting user's account.

6.4 Printer Description Attributes

6.4.1 job-account-type-default (type2 keyword | name(MAX))

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

6.4.2 job-account-type-supported (1setOf (type2 keyword | name(MAX)))

The list of supported "job-account-type" Job Template attribute values.

6.4.3 job-authorization-uri-supported (boolean)

The "job-authorization-uri-supported" Printer attribute specifies whether the "job-authorization-uri" (section 6.1.2) operation attribute is supported. This attribute is REQUIRED if the "job-authorization-uri" operation attribute is supported.

6.4.4 jpeg-k-octets-supported (rangeOfInteger(0:MAX))

The "jpeg-k-octets-supported" Printer attribute specifies the upper and lower bounds of total sizes of JFIF jobs in K octets, i.e., in units of 1024 octets. The lower bound is always 0. Printers that support the "image/jpeg" MIME media type MUST support this attribute.

6.4.5 jpeg-x-dimension-supported (rangeOfInteger(0:65535))

The "jpeg-x-dimension-supported" Printer attribute specifies the maximum horizontal dimension of JFIF jobs in samples per line. Persuant to the JPEG File Information Format Version 1.02 [JFIF], the lower bound is always 0. Printers that support the "image/jpeg" MIME media type MUST support this attribute.

6.4.6 jpeg-y-dimension-supported (rangeOfInteger(1:65535))

The "jpeg-y-dimension-supported" Printer attribute specifies the maximum vertical dimension of JFIF jobs in lines. Persuant to the JPEG File Information Format Version 1.02 [JFIF], the lower bound is always 1. Printers that support the "image/jpeg" MIME media type MUST support this attribute.

6.4.7 pdf-k-octets-supported (rangeOfInteger(0:MAX))

The "pdf-k-octets-supported" Printer attribute specifies the upper and lower bounds of total sizes of PDF jobs in K octets, i.e., in units of 1024 octets. The lower bound is always 0. Printers that support the "application/pdf" MIME media type MUST support this attribute.

6.4.8 pdf-versions-supported (1setOf type2 keyword)

The "pdf-versions-supported" Printer attribute specifies the supported versions of documents using the "application/pdf" MIME media type. Printers that support the "application/pdf" MIME media type MUST support this attribute.

The following keyword values are defined:

'adobe-1.3': PDF files conforming to Adobe PDF Language Reference, Version 1.3 [ADOBEPDF1.3] are supported

'adobe-1.4': PDF files conforming to Adobe PDF Language Reference, Version 1.4 [ADOBEPDF1.4] are supported

'adobe-1.5': PDF files conforming to Adobe PDF Language Reference, Version 1.5 [ADOBEPDF1.5] are supported

'adobe-1.6': PDF files conforming to Adobe PDF Language Reference, Version 1.6 [ADOBEPDF1.6] are supported

'iso-15930-1_2001': PDF files conforming to "Graphic technology -- Prepress digital data exchange -- Use of PDF -- Part 1: Complete exchange using CMYK data (PDF/X-1 and PDF/X-1a)" [ISO15930-1] are supported

'iso-15930-3_2002': PDF files conforming to "Graphic technology -- Prepress digital data exchange -- Use of PDF -- Part 3: Complete exchange suitable for colour-managed workflows (PDF/X-3)" [ISO15930-3] are supported

'iso-15930-4_2003': PDF files conforming to "Graphic technology -- Prepress digital data exchange using PDF -- Part 4: Complete exchange of CMYK and spot colour printing data using PDF 1.4 (PDF/X-1a)" [ISO15930-4] are supported

'iso-15930-6_2003': PDF files conforming to "Graphic technology -- Prepress digital data exchange using PDF -- Part 6: Complete exchange of printing data suitable for colour-managed workflows using PDF 1.4 (PDF/X-3)" [ISO15930-6] are supported

'iso-15930-7_2010': PDF files conforming to "Graphic technology -- Prepress digital data exchange using PDF -- Part 7: Complete exchange of printing data (PDF/X-4) and partial exchange of printing data with external profile reference (PDF/X-4p) using PDF 1.6" [ISO15930-7] are supported

'iso-15930-8_2010': PDF files conforming to "Graphic technology -- Prepress digital data exchange using PDF -- Part 8: Partial exchange of printing data using PDF 1.6 (PDF/X-5)" [ISO15930-8] are supported

'iso-16612-2:2010': PDF files conforming to "Graphic technology -- Variable data exchange -- Part 2: Using PDF/X-4 and PDF/X-5 (PDF/VT-1 and PDF/VT-2)" [ISO16612-2] are supported

'iso-19005-1_2005': PDF files conforming to *Document Management – Electronic document file format for long term preservation – Part 1: Use of PDF 1.4 (PDF/A-1)* [ISO19005-1] are supported

'iso-19005-2_2011': PDF files conforming to *Document management – Electronic document file format for long-term preservation – Part 2: Use of ISO 32000-1 (PDF/A-2)* [ISO19005-2] are supported

'iso-19005-3_2012': PDF files conforming to *Document management -- Electronic document file format for long-term preservation -- Part 3: Use of ISO 32000-1 with support for embedded files (PDF/A-3)* [ISO19005-3] are supported

'iso-32000-1_2008': PDF files conforming to Document management—Portable document format—Part 1: PDF 1.7 [ISO32000-1] are supported

'none': PDF files are not supported

'pwg-5102.3': PDF files conforming to Portable Document Format: Image Streamable (PDF/is) [PWG5102.3]

6.4.9 print-scaling-default (type2 keyword)

The REQUIRED "print-scaling-default" Printer attribute provides the default value supplied by the Printer if the Client omits the "print-scaling" (section 6.2.2) Job Template attribute from a print job creation request.

6.4.10 print-scaling-supported (1setOf type2 keyword)

The REQUIRED "print-scaling-supported" Printer attribute lists the supported values for the "print-scaling" (section 6.2.2) Job Template attribute. Printers MUST support all of the listed values for the supported IPP Everywhere MIME media types - "application/openxps", "application/pdf", "image/jpeg", and "image/pwg-raster".

6.4.11 printer-dns-sd-name (name(63))

The REQUIRED READ-WRITE "printer-dns-sd-name" Printer attribute provides the current DNS-SD service name for the Printer. For example, if the Printer registers “Example Make and Model._ipp._tcp,_print.local.”, this attribute would contain “Example Make and Model”.

Printers that support changing the value using the Set-Printer-Attributes operation MUST list "printer-dns-sd-name" in the "printer-settable-attributes-supported" Printer attribute [RFC3380]. When a new name is set, the Printer MUST re-register all DNS-SD services associated with it. However, if the new name causes a collision with other network devices, the Printer MUST replace the value set with a non-conflicting name as required by multicast DNS, typically by appending a unique number to the provided name.

Note: Changing the DNS-SD service name can prevent Clients from resolving the Printer's services if those Clients use a statically-configured name for the Printer.

6.4.12 printer-kind (1setOf type2 keyword | name(MAX))

The REQUIRED READ-WRITE "printer-kind" Printer attribute lists the categories of printing that are supported by the Printer. This information is typically used to conveniently determine whether a Printer supports the kind of printing required by the Client software. Name values define site- or vendor-specific categories while keywords define standard categories. The following keywords are defined:

‘disc’: the Printer supports printing on optical discs such as printable CD-Rs and DVD-Rs

‘document’: the Printer supports regular document printing on standard cut sheet media such as US Letter, US Legal, US Tabloid, ISO A4, and ISO A3 media

‘envelope’: the Printer supports printing on envelopes

‘label’: the Printer supports printing on cut labels

'large-format': the Printer supports printing on cut sheet sizes and roll media larger than ISO A3

‘photo’: the Printer supports printing with photographic print quality

'postcard': the Printer supports printing on postcards

‘receipt’: the Printer supports printing receipts on continuous rolls

‘roll’: the Printer supports printing documents or photos on continuous rolls, typically on large-format printers

Printers that support changing the value using the Set-Printer-Attributes operation MUST list "printer-kind" in the "printer-settable-attributes-supported" Printer attribute [RFC3380]. The Get-Printer-Supported-Values operation returns the factory default category values for the Printer.

7. Additional Semantics for Existing Operations

7.1 Create-Job, Print-Job, and Print-URI

Printers that support paid print services MAY accept the “job-authorization-uri” (section 6.1.2) operation attribute and SHOULD return the “charge-info-message” (section 6.1.1) operation attribute. Clients determine whether to include the "job-authorization-uri" operation attribute by querying for the value of the "job-authorization-uri-supported" (section 6.4.3) Printer attribute.

7.2 Validate-Job

The Validate-Job operation is used to validate access to the Printer, validate and resolve any conflicts in the Job Template attributes that will be used in a subsequent Create-Job or Print-Job request, and determine the optimal raster parameters for printing.

7.2.1 Validate-Job Request

Printers SHOULD accept the “job-impressions-estimated” (section 6.1.3) operation attribute.

7.2.2 Validate-Job Response

Printers SHOULD return the "charge-info-message" (section 6.1.1) and "job-authorization-uri" (section 6.1.2) operation attributes. Printers that support the "printer-icc-profiles" Printer attribute MUST return the "profile-uri-actual" (section 6.1.4) operation attribute in the Validate-Job response, which contains one of the "profile-uri" member attribute values contained in the "printer-icc-profiles" Printer attribute.

8. Additional Values for Existing Attributes

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

This specification defines the following new values for the “job-state-reasons” attribute:

‘account-authorization-failed’: The “job-authorization-uri” attribute was not supplied the value supplied is not valid, or the value supplied has expired.

‘account-closed’: The requesting user’s account has been closed.

‘account-info-needed’: Additional information is required, such as a “job-account-id” or “job-accounting-user-id” value.

‘account-limit-reached’: The requesting user’s account has reached its limit and/or exhausted any balance on the account.

'conflicting-attributes': The Job Template or Document Template attributes contain conflicting values.

'job-held-for-review': The Job has been held for review.

‘job-release-wait’: The Job is held until released for printing on a particular output device.

'unsupported-attributes-or-values': The Job Template or Document-Template attributes contain unsupported attributes or values.

8.2 Status Codes

This specification defines the following new status codes that may be returned by the Create-Job, Print-Job, Print-URI, or Validate-Job operations:

client-error-account-info-needed (0x41C); The request is missing required account information such as the “requesting-user-name”, “requesting-user-uri”, “job-account-id”, or “job-accounting-user-id”.

client-error-account-closed (0x41D); The requesting user’s account has been closed.

client-error-account-limit-reached (0x41E); The requesting user’s account has reached its limit or exhausted any remaining balance.

client-error-account-authorization-failed (0x41F); The print job creation request is missing the “job-authorization-uri” operation attribute, the supplied value is not valid, or the value supplied has expired.

9. Conformance Requirements

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

9.1 Conformance Requirements for Clients

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

1. The "print-scaling" (section 6.2.2) Job Template attribute
2. The "print-scaling-default" (section 6.4.9) and "print-scaling-supported" (section 6.4.10) Printer attributes

9.2 Conformance Requirements for Printers

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

1. The "print-scaling" (section 6.2.2) Job Template attribute
2. The "print-scaling-default" (section 6.4.9) and "print-scaling-supported" (section 6.4.10) Printer attributes
3. The "printer-dns-sd-name" (section 6.4.11) Printer attribute
4. The "printer-kind" (section 6.4.12) Printer attribute

Printers that conform to HTTP Authentication: Basic and Digest Access Authentication [RFC2617] MUST support the "username" attribute in the "WWW-Authenticate" header (section 0).

To claim conformance for the OPTIONAL "job-authorization-uri" (section 6.1.2) operation attribute, Printers MUST support the "job-authorization-uri-supported" (section 6.4.3) Printer attribute.

To claim conformance for the OPTIONAL "job-account-id" [PWG5100.11] Job Template attribute, Printers MUST support the "job-accounting-user-id" [PWG5100.11] Job Template attribute.

Printers that support the "printer-icc-profiles" Printer attribute MUST support the "profile-uri-actual" (section 6.1.4) operation attribute.

Printers that conform to the JPEG File Interchange Format Version 1.02 [JFIF] MUST support:

1. The "jpeg-k-octets-supported" (section 6.4.4) Printer attribute
2. The "jpeg-x-dimension-supported" (section 6.4.5) Printer attribute
3. The "jpeg-y-dimension-supported" (section 6.4.6) Printer attribute

Printers that conform to the Document management -- Portable document format -- Part 1: PDF 1.7 [ISO32000] MUST support:

1. The "pdf-k-octets-supported" (section 6.4.7) Printer attribute
2. The "pdf-versions-supported" (section 6.4.8) Printer attribute

10. 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].

11. Security Considerations

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

12. IANA Considerations

12.1 Attribute Registrations

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

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

The registry entries will contain the following information:

Operation attributes:	Reference
charge-info-message (text)	[PWG5100.16]
job-authorization-uri (uri)	[PWG5100.16]
job-impressions-estimated (integer(1:MAX))	[PWG5100.16]
profile-uri-actual (uri)	[PWG5100.16]

Job Template attributes:	Reference
job-account-type (type2 keyword | name(MAX))	[PWG5100.16]
print-scaling (type2 keyword)	[PWG5100.16]

Job Description attributes:	Reference
job-charge-info (text)	[PWG5100.16]

Printer Description attributes:	Reference
job-account-type-default (type2 keyword | name(MAX))	[PWG5100.16]


```
job-account-type-supported (1setOf (type2 keyword | name(MAX))
                                                              [PWG5100.16]
job-authorization-uri-supported (boolean)                     [PWG5100.16]
jpeg-k-octets-supported (rangeOfInteger(0:MAX))               [PWG5100.16]
jpeg-x-dimension-supported (rangeOfInteger(0:65535))          [PWG5100.16]
jpeg-y-dimension-supported (rangeOfInteger(1:65535))          [PWG5100.16]
pdf-k-octets-supported (rangeOfInteger(0:MAX))                [PWG5100.16]
pdf-versions-supported (1setOf type2 keyword)                 [PWG5100.16]
print-scaling-default (type2 keyword)                         [PWG5100.16]
print-scaling-supported (1setOf type2 keyword)                [PWG5100.16]
printer-dns-sd-name (name(63))                                [PWG5100.16]
printer-kind (1setOf type2 keyword)                           [PWG5100.16]
```

12.2 Attribute Value Registrations

The keyword attribute values defined in this document will be published by IANA according to the procedures in the IPP Model and Semantics [RFC2911] section 6.1 in the following file:

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

The registry entries will contain the following information:

```
Attributes (attribute syntax)
  Keyword Attribute Value                                     Reference
  -----------------------                                     ---------
job-account-type (type2 keyword | name(MAX))                  [PWG5100.16]
  general                                                     [PWG5100.16]
  group                                                       [PWG5100.16]
  none                                                        [PWG5100.16]
job-account-type (type2 keyword | name(MAX))                  [PWG5100.16]
  < any "job-account-type" value >                            [PWG5100.16]
job-account-type (1setOf (type2 keyword | name(MAX)))         [PWG5100.16]
  < any "job-account-type" value >                            [PWG5100.16]

job-state-reasons (1setOf type2 keyword)                      [RFC2911]
  account-authorization-failed                                [PWG5100.16]
  account-closed                                              [PWG5100.16]
  account-info-needed                                         [PWG5100.16]
  account-limit-reached                                       [PWG5100.16]
  conflicting-attributes                                      [PWG5100.16]
  job-held-for-review                                         [PWG5100.16]
  job-release-wait                                            [PWG5100.16]
  unsupported-attributes-or-values                            [PWG5100.16]

pdf-versions-supported (1setOf type2 keyword)                 [PWG5100.16]
  adobe-1.3                                                   [PWG5100.16]
  adobe-1.4                                                   [PWG5100.16]
  adobe-1.5                                                   [PWG5100.16]
  adobe-1.6                                                   [PWG5100.16]
  iso-15930-1_2001                                            [PWG5100.16]
  iso-15930-3_2002                                            [PWG5100.16]
  iso-15930-4_2003                                            [PWG5100.16]
```


iso-15930-6_2003	[PWG5100.16]
iso-15930-7_2010	[PWG5100.16]
iso-15930-8_2010	[PWG5100.16]
iso-16612-2_2010	[PWG5100.16]
iso-19005-1_2005	[PWG5100.16]
iso-19005-2_2011	[PWG5100.16]
iso-19005-3_2012	[PWG5100.16]
iso-32000-1_2008	[PWG5100.16]
none	[PWG5100.16]
pwg-5102.3	[PWG5100.16]

12.3 Operation Registrations

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

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

The registry entries will contain the following information:

Operation Name	Reference
Create-Job (extension)	[PWG5100.16]
Print-Job (extension)	[PWG5100.16]
Print-URI (extension)	[PWG5100.16]
Validate-Job (extension)	[PWG5100.16]

12.4 Status Code Registrations

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

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

The registry entries will contain the following information:

Value	Status Code Name	Reference
0x0400:0x04FF	- Client Error:	
0x041C	client-error-account-info-needed	[PWG5100.16]
0x041D	client-error-account-closed	[PWG5100.16]
0x041E	client-error-account-limit-reached	[PWG5100.16]
0x041F	client-error-account-authorization-failed	[PWG5100.16]

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