



The Printer Working Group

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IPP Transaction-Based Printing Extensions v1.1 (TRANS)

Status: Approved

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

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

This document is available electronically at:

<https://ftp.pwg.org/pub/pwg/candidates/cs-ipptrans11-20200327-5100.16.docx>
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1. Introduction

Whether provided by a third-party or an organization's infrastructure services, transaction-based printing services such as 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.

This specification updates the previous version [PWG5100.16-2013], adds related attributes from other specifications, and moves unrelated attributes to other specifications. A list of changes can be found in section 13.

2. Terminology

2.1 Conformance Terminology

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

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

2.2 Protocol Role Terminology

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

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

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

2.3 Printing 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.

End User: A person or automata using a Client to communicate with a Printer.

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.

Job Accounting: Collection of Metadata to audit, bill, or otherwise report on the origin, processing, and disposition of Jobs and Documents.

Job Creation Request: Any operation that causes the creation of a Job object, e.g., the Create-Job, Print-Job, and Print-URI operations [STD92].

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

Output Device: A single Logical or Physical Device

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.

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

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.

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

2.4 Acronyms and Organizations

IANA: Internet Assigned Numbers Authority, <https://www.iana.org/>

IETF: Internet Engineering Task Force, <https://www.ietf.org/>

ISO: International Organization for Standardization, <https://www.iso.org/>

PWG: Printer Working Group, <https://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 the existing IPP specifications 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 Status attributes and values needed for Transaction-Based Printing to provide authorization status information to Clients,
6. Define Job Template attributes needed to clearly express output intent for Transaction-Based Printing, and
7. Define Printer Description attributes and values needed for Transaction-Based Printing.

The IPP Job Extensions v2.0 (JOBEXT) [PWG5100.7] defines attributes for Job accounting.

The IPP 2.0, 2.1, and 2.2 specification [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

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

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

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

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, and
3. 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 the Internet Printing Protocol/1.1 [STD92], including keyword value case (lower) and hyphenation requirements;
3. Define attributes and values to support Transaction-Based Printing; and
4. Amend operation semantics to support Transaction-Based Printing.

4. IPP Model

This document defines new attributes, keyword values for the “job-state-reasons” Job Status 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 Imaging Service interaction between a Client and Printer.

The “printer-charge-info-uri” Printer Description attribute (section 6.4.5) provides a URL that allows End Users to manage Paid Printing accounts on the Printer. Typically, this web page will allow new End Users to sign up for the Paid Imaging Service, purchase additional pages and/or 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 Description attribute (section 6.4.6). 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 and/or 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 6.2.1) Job Status 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 Status attribute with the corresponding keyword values.

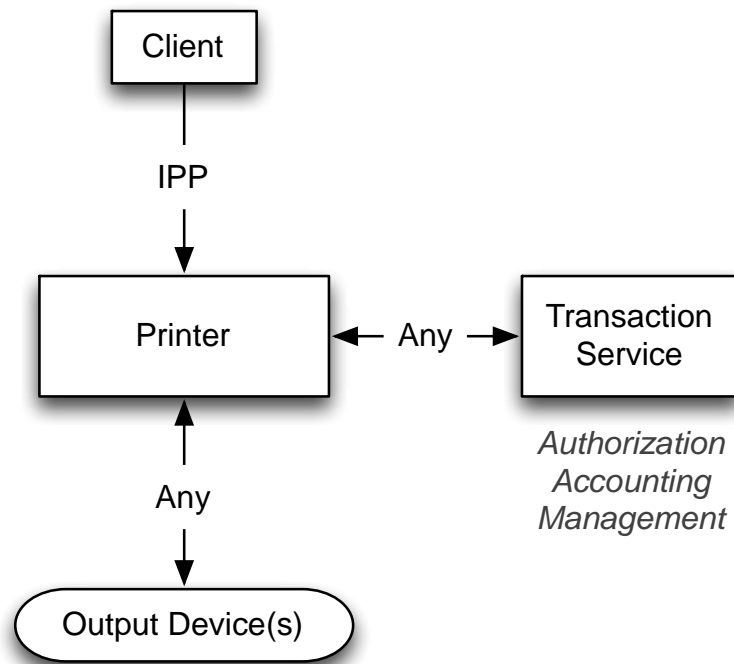


Figure 1 - Transaction-Based Printing Model

4.1 User Accounts vs. Payment/Billing Accounts

Printers that support multiple payment or billing options for each End User account can support them via the “job-account-id” and “job-accounting-user-id” Job Template attributes [PWG5100.7]. 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 Description attribute (section 6.4.6).

4.2 Priority of Service

The “job-priority” [STD92] Job Template attribute can 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.

| 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 Imaging Sequence Diagram

4.3 Job Review

Printers can 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 Status 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 [RFC7617] 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 [RFC7616] 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 can 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)

This attribute provides a localized message concerning any Paid Imaging Service 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)

This RECOMMENDED attribute specifies an implementation-specific URI representing an authorization or reservation code for a 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 Description attribute.

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

This attribute specifies the estimated "job-impressions" [STD92] value for a subsequent Job Creation Request. It is supplied in a Validate-Job request (section 7.2) when supporting accounting or Paid Imaging Services.

6.2 Job Status Attributes

6.2.1 job-charge-info (text)

This RECOMMENDED attribute provides a localized message concerning any Paid Imaging Service charge information, typically the cost charged to the requesting user's account.

6.3 Job Template Attributes

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

This RECOMMENDED attribute specifies the type of value that was specified in the "job-account-id" Job Template attribute [PWG5100.7]. 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.

6.4 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" (section 6.3.1) Job Template attribute. This attribute is REQUIRED if the "job-account-type" Job Template attribute is supported.

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

The list of supported "job-account-type" (section 6.3.1) Job Template attribute values. This attribute is REQUIRED if the "job-account-type" Job Template attribute is supported.

6.4.3 job-authorization-uri-supported (boolean)

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

This RECOMMENDED attribute provides a human-readable description of Paid Imaging Services for the Printer. Typically, this description will provide a summary of cost information.

6.4.5 printer-charge-info-uri (uri)

This RECOMMENDED attribute provides a "http:" or "https:" URI referring to a human-readable web page for Paid Imaging Services for the Printer. Typically, this web page will provide cost information and allow the Client to obtain a "job-accounting-id" value for subsequent print jobs.

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

This RECOMMENDED Printer Description attribute lists the minimum Job Template and operation attributes that are required for a successful Job Creation Request. A Printer MAY reject the Job Creation Request if the Client does not supply these attributes in its request.

Member attributes of collections are specified by concatenating attribute names delimited by the period (".") character, e.g., the "media-source" member attribute of the "media-col" Job Template attribute [PWG5100.7] would be requested using the keyword value 'media-col.media-source'.

Printers MUST NOT report this attribute in a Get-Printer-Attributes response if no attributes are required for a successful Job Creation Request. Values listed in this attribute MUST not be listed in the "printer-requested-job-attributes" (section 6.4.7) Printer Description attribute.

6.4.7 printer-requested-job-attributes (1setOf keyword)

This RECOMMENDED attribute lists the attributes the Printer wants but does not need in order to support Job Accounting. Member attributes of collections are specified by concatenating attribute names delimited by the period (".") character, e.g., the "document-source-application-name" member attribute of the "document-format-details" operation attribute [PWG5100.7] would be requested using the keyword value 'document-format-details.document-source-application-name'. If supported, Clients MUST allow the End User to explicitly consent to the sending of any attributes or values that are not explicitly chosen by the End User.

For example, a Printer can list the 'media' and 'media-col' keywords in "printer-requested-job-attributes". If the Client application provides a UI control for selecting a media size, no additional consent is needed since the UI allows the User to select which value is sent.

However, if a Printer lists the "document-format-details.document-source-application-name" keyword in "printer-requested-job-attributes", it is unlikely that the Client application will provide a UI control for selecting the application name that is sent to the Printer. In this case, the Client MUST provide a UI that allows the End User to opt out of sending the requested information. If the End User opts out of sending the requested information, the Client MUST NOT send it.

Printers MUST NOT report this attribute in a Get-Printer-Attributes response if no attributes are being requested for Job Accounting. Values listed in this attribute MUST not be listed in the "printer-mandatory-job-attributes" (section 6.4.6) Printer Description attribute.

7. Additional Semantics for Existing Operations

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

Printers that support Paid Imaging Services SHOULD accept the “job-authorization-uri” (section 6.1.2) operation attribute. Printers that support Paid Imaging Services SHOULD also 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.

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” [STD92] Job Status 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.

‘job-held-for-review’: The Job has been held for review.

8.2 Status Codes

This specification defines the following new status codes that can 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 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 internationalization considerations in section 10; and
2. The security consideration in section 11.

9.2 Conformance Requirements for Printers

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

1. The internationalization considerations in section 10; and
2. The security consideration in section 11.

Printers that conform to HTTP Digest Access Authentication [RFC7616] and/or the HTTP 'Basic' Authentication Scheme [RFC7617] **MUST** support the "username" attribute in the "WWW-Authenticate" header (section 5).

To claim conformance for the RECOMMENDED "job-authorization-uri" (section 6.1.2) operation attribute, Printers **MUST** support the "job-authorization-uri-supported" (section 6.4.3) Printer attribute and the additional semantics for existing operations in section 7.

10. Internationalization Considerations

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

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

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

WARNING – Performing normalization on UTF-8 strings received from Clients and subsequently storing the results (e.g., in Job objects) could cause false negatives in Client

searches and failed access (e.g., to Printers with percent-encoded UTF-8 URIs now 'hidden').

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

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

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

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

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

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

- Unicode Collation Algorithm [UTS10] – sorting

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

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

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

- Unicode Character Property Model [UTR23] – character properties

- Unicode Conformance Model [UTR33] – Unicode conformance basis

11. Security Considerations

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

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

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

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

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

12. IANA Considerations

12.1 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:

| Operation attributes: ----- | Reference ----- |
|---|--------------------|
| charge-info-message (text) | [PWG5100.16] |
| job-authorization-uri (uri) | [PWG5100.16] |
| job-impressions-estimated (integer(1:MAX)) | [PWG5100.16] |
| Job Status attributes: ----- | Reference ----- |
| job-charge-info (text) | [PWG5100.16] |
| Job Template attributes: ----- | Reference ----- |
| job-account-type (type2 keyword name(MAX)) | [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] |
| printer-charge-info (text(MAX)) | [PWG5100.16] |
| printer-charge-info-uri (uri) | [PWG5100.16] |
| printer-mandatory-job-attributes (1setOf keyword) | [PWG5100.16] |
| printer-requested-job-attributes (1setOf keyword) | [PWG5100.16] |

12.2 Type2 keyword Registrations

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

<https://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) | [STD92] |
| account-authorization-failed | [PWG5100.16] |
| account-closed | [PWG5100.16] |
| account-info-needed | [PWG5100.16] |
| account-limit-reached | [PWG5100.16] |
| job-held-for-review | [PWG5100.16] |

12.3 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:

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

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

The registry entries will contain the following information:

| Value | Status Code Name | Reference |
|-------------------------------|---|--------------|
| ----- | ----- | ----- |
| 0x0400:0x04FF - Client Error: | | |
| 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] |

13. Overview of Changes

13.1 IPP Transaction-Based Printing Extensions v1.1

The following changes were made to the previous version of this specification [PWG5100.16-2013]:

- The RECOMMENDED "printer-charge-info" and "printer-charge-info-uri" Printer Description attributes were added from [PWG5100.13-2012];
- The RECOMMENDED "printer-mandatory-job-attributes" Printer Description attribute was added from [PWG5100.11-2010];
- The RECOMMENDED "printer-requested-job-attributes" Printer Description attribute was added;
- The "profile-uri-actual" operation attribute was moved to the IPP Driverless Printing Extensions v2.0 (NODRIVER);
- The "print-scaling" Job Template attribute was moved to the IPP Driverless Printing Extensions v2.0 (NODRIVER);
- The "jpeg-k-octets-supported", "jpeg-x-dimension-supported", "jpeg-y-dimension-supported", "pdf-k-octets-supported", "pdf-versions-supported", "print-scaling-default", "print-scaling-supported", "printer-dns-sd-name", and "printer-kind" Printer Description attributes were moved to the IPP Driverless Printing Extensions v2.0 (NODRIVER);
- The 'conflicting-attributes', 'job-release-wait', and 'unsupported-attributes-or-values' keywords for the "job-state-reasons" Job Status attribute were moved to the IPP Enterprise Printing Extensions v2.0 (EPX); and
- The required state for Jobs submitted to release printing services was relaxed.

14. References

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