



The Printer Working Group

February 18, 2020
Working Draft

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

Status: Stable

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.

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

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

This document is available electronically at:

<https://ftp.pwg.org/pub/pwg/ipp/wd/wd-ipptrans11-20200218.docx>

<https://ftp.pwg.org/pub/pwg/ipp/wd/wd-ipptrans11-20200218.pdf>

1 Copyright © 2013-2020 The Printer Working Group. All rights reserved.

2 This document may be copied and furnished to others, and derivative works that comment
3 on, or otherwise explain it or assist in its implementation may be prepared, copied, published
4 and distributed, in whole or in part, without restriction of any kind, provided that the above
5 copyright notice, this paragraph and the title of the Document as referenced below are
6 included on all such copies and derivative works. However, this document itself may not be
7 modified in any way, such as by removing the copyright notice or references to the IEEE-
8 ISTO and the Printer Working Group, a program of the IEEE-ISTO.

9 Title: *IPP Transaction-Based Printing Extensions v1.1 (TRANS)*

10 The IEEE-ISTO and the Printer Working Group DISCLAIM ANY AND ALL WARRANTIES,
11 WHETHER EXPRESS OR IMPLIED INCLUDING (WITHOUT LIMITATION) ANY IMPLIED
12 WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

13 The Printer Working Group, a program of the IEEE-ISTO, reserves the right to make
14 changes to the document without further notice. The document may be updated, replaced
15 or made obsolete by other documents at any time.

16 The IEEE-ISTO takes no position regarding the validity or scope of any intellectual property
17 or other rights that might be claimed to pertain to the implementation or use of the technology
18 described in this document or the extent to which any license under such rights might or
19 might not be available; neither does it represent that it has made any effort to identify any
20 such rights.

21 The IEEE-ISTO invites any interested party to bring to its attention any copyrights, patents,
22 or patent applications, or other proprietary rights which may cover technology that may be
23 required to implement the contents of this document. The IEEE-ISTO and its programs shall
24 not be responsible for identifying patents for which a license may be required by a document
25 and/or IEEE-ISTO Industry Group Standard or for conducting inquiries into the legal validity
26 or scope of those patents that are brought to its attention. Inquiries may be submitted to the
27 IEEE-ISTO by e-mail at: ieee-isto@ieee.org.

28 The Printer Working Group acknowledges that the IEEE-ISTO (acting itself or through its
29 designees) is, and shall at all times be the sole entity that may authorize the use of
30 certification marks, trademarks, or other special designations to indicate compliance with
31 these materials.

32 Use of this document is wholly voluntary. The existence of this document does not imply that
33 there are no other ways to produce, test, measure, purchase, market, or provide other goods
34 and services related to its scope.

35

36 **About the IEEE-ISTO**

37 The IEEE-ISTO is a not-for-profit corporation offering industry groups an innovative and
38 flexible operational forum and support services. The IEEE-ISTO provides a forum not only
39 to develop standards, but also to facilitate activities that support the implementation and
40 acceptance of standards in the marketplace. The organization is affiliated with the IEEE
41 (<http://www.ieee.org/>) and the IEEE Standards Association (<http://standards.ieee.org/>).

42 For additional information regarding the IEEE-ISTO and its industry programs visit:

43 <http://www.ieee-isto.org>

44 **About the IEEE-ISTO PWG**

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

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

58 For additional information regarding the Printer Working Group visit:

59 <https://www.pwg.org>

60 Contact information:

61 The Printer Working Group
62 c/o The IEEE Industry Standards and Technology Organization
63 445 Hoes Lane
64 Piscataway, NJ 08854
65 USA

66

Table of Contents

67		
68	1. Introduction.....	6
69	2. Terminology.....	6
70	2.1 Conformance Terminology.....	6
71	2.2 Protocol Role Terminology.....	6
72	2.3 Printing Terminology	7
73	2.4 Acronyms and Organizations	7
74	3. Requirements	8
75	3.1 Rationale for IPP Transaction-Based Printing Extensions.....	8
76	3.2 Use Cases	9
77	3.2.1 Printing at a School.....	9
78	3.2.2 Printing to a Reprographics Shop	9
79	3.3 Exceptions	9
80	3.3.1 Account Exceeded Limit Exception.....	9
81	3.4 Out of Scope.....	10
82	3.5 Design Requirements.....	10
83	4. IPP Model	11
84	4.1 User Accounts vs. Payment/Billing Accounts	12
85	4.2 Priority of Service	12
86	4.3 Job Review	14
87	5. HTTP Authentication - Default Username	14
88	6. IPP Attributes	15
89	6.1 Operation Attributes	15
90	6.1.1 charge-info-message (text)	15
91	6.1.2 job-authorization-uri (uri)	15
92	6.1.3 job-impressions-estimated (integer(1:MAX))	15
93	6.2 Job Status Attributes	15
94	6.2.1 job-charge-info (text)	15
95	6.3 Job Template Attributes	16
96	6.3.1 job-account-type (type2 keyword name(MAX))	16
97	6.4 Printer Description Attributes	16
98	6.4.1 job-account-type-default (type2 keyword name(MAX)).....	16
99	6.4.2 job-account-type-supported (1setOf (type2 keyword name(MAX)))	16
100	6.4.3 job-authorization-uri-supported (boolean).....	16
101	6.4.4 printer-charge-info (text(MAX))	16
102	6.4.5 printer-charge-info-uri (uri)	16
103	6.4.6 printer-mandatory-job-attributes (1setOf keyword).....	17
104	6.4.7 printer-requested-job-attributes (1setOf keyword).....	17
105	7. Additional Semantics for Existing Operations	17
106	7.1 Create-Job, Print-Job, and Print-URI.....	17
107	7.2 Validate-Job.....	18
108	7.2.1 Validate-Job Request	18
109	7.2.2 Validate-Job Response	18
110	8. Additional Values for Existing Attributes.....	19
111	8.1 job-state-reasons (1setOf type2 keyword).....	19
112	8.2 Status Codes	19

113	9. Conformance Requirements.....	20
114	9.1 Conformance Requirements for Clients	20
115	9.2 Conformance Requirements for Printers	20
116	10. Internationalization Considerations	20
117	11. Security Considerations	21
118	12. IANA Considerations.....	22
119	12.1 Attribute Registrations.....	22
120	12.2 Type2 keyword Registrations.....	22
121	12.3 Operation Registrations	23
122	12.4 Status Code Registrations	23
123	13. Overview of Changes.....	24
124	13.1 IPP Transaction-Based Printing Extensions v1.1.....	24
125	14. References	25
126	14.1 Normative References.....	25
127	14.2 Informative References	26
128	15. Author's Address	27
129	16. Change History.....	28
130	16.1 February 20, 2020.....	28
131	16.2 January 30, 2020.....	28
132	16.3 January 28, 2020.....	29
133	16.4 December 16, 2019.....	29

134

135

136

List of Figures

137	Figure 1 - Transaction-Based Printing Model.....	12
138	Figure 2 - Typical Paid Imaging Sequence Diagram	13

139

140

141 **1. Introduction**

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

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

159 This specification updates the previous version [PWG5100.16-2013], adds related attributes
160 from other specifications, and moves unrelated attributes to other specifications. A list of
161 changes can be found in section 0.

162 **2. Terminology**

163 **2.1 Conformance Terminology**

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

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

172 **2.2 Protocol Role Terminology**

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

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

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

179 **2.3 Printing Terminology**

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

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

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

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

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

190 *Output Device*: A single Logical or Physical Device

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

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

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

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

201 **2.4 Acronyms and Organizations**

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

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

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

205 *PWG*: Printer Working Group, <https://www.pwg.org/>

206

207 **3. Requirements**

208 **3.1 Rationale for IPP Transaction-Based Printing Extensions**

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

- 212 1. Use the existing IPP specifications to support job submission to and monitoring
213 of Paid Imaging Services,
- 214 2. Define HTTP authorization requirements as needed to support Transaction-
215 Based Printing,
- 216 3. Define operation attributes and amend operation semantics as needed for a
217 Client to obtain and supply authorization from an IPP Printer,
- 218 4. Define status code values needed for Transaction-Based Printing to inform a
219 Client when exceptions occur during job submission,
- 220 5. Define Job Status attributes and values needed for Transaction-Based Printing
221 to provide authorization status information to Clients,
- 222 6. Define Job Template attributes needed to clearly express output intent for
223 Transaction-Based Printing, and
- 224 7. Define Printer Description attributes and values needed for Transaction-Based
225 Printing.

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

227 The IPP 2.0, 2.1, and 2.2 specification [PWG5100.12] defines:

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

234 IPP Everywhere [PWG5100.14] defines:

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

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

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

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

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

250 **3.2 Use Cases**

251 **3.2.1 Printing at a School**

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

259 **3.2.2 Printing to a Reprographics Shop**

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

269 **3.3 Exceptions**

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

272 **3.3.1 Account Exceeded Limit Exception**

273 Jane wants to print flyers for a school event on the school's large format printer. After
274 initiating the print action in her application and selecting the large format printer, the
275 application software validates access to the printer, obtains an authorization code, and
276 submits the job. After pre-processing the job, the print service associated with the printer

277 determines that Jane's account lacks sufficient funds to complete the print job and stops the
278 job from printing, adding status information to the job indicating the reason. The application
279 software queries the print service for the job status and presents the issue to Jane. Jane
280 then visits the web page provided by the print service to add additional printing credits to her
281 school activity account. The print service then resumes processing of the job, printing the
282 flyers on the large format printer.

283 **3.4 Out of Scope**

284 The following are considered out of scope for this specification:

- 285 1. The actual method of payment for Paid Imaging Services,
- 286 2. The actual methods of measurement and limit enforcement for Quota-Based
287 Printing, and
- 288 3. Definition of new HTTP authentication methods.

289 **3.5 Design Requirements**

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

- 292 1. Define HTTP authorization extensions and requirements;
- 293 2. Follow the naming conventions defines in the Internet Printing Protocol/1.1
294 [STD92], including keyword value case (lower) and hyphenation requirements;
- 295 3. Define attributes and values to support Transaction-Based Printing; and
- 296 4. Amend operation semantics to support Transaction-Based Printing.

297

298 **4. IPP Model**

299 This document defines new attributes, keyword values for the “job-state-reasons” Job Status
300 attribute, and status codes for the Create-Job, Print-Job, Print-URI, and Validate-Job
301 operations that allows IPP to support Transaction-Based Printing. Figure 1 shows the
302 general model of Transaction-Based Printing while Figure 2 shows a typical Paid Imaging
303 Service interaction between a Client and Printer.

304 The “printer-charge-info-uri” Printer Description attribute (section 6.4.5) provides a URL that
305 allows End Users to manage Paid Printing accounts on the Printer. Typically, this web page
306 will allow new End Users to sign up for the Paid Imaging Service, purchase additional pages
307 and/or credits for printing, manage queued Jobs, and so forth.

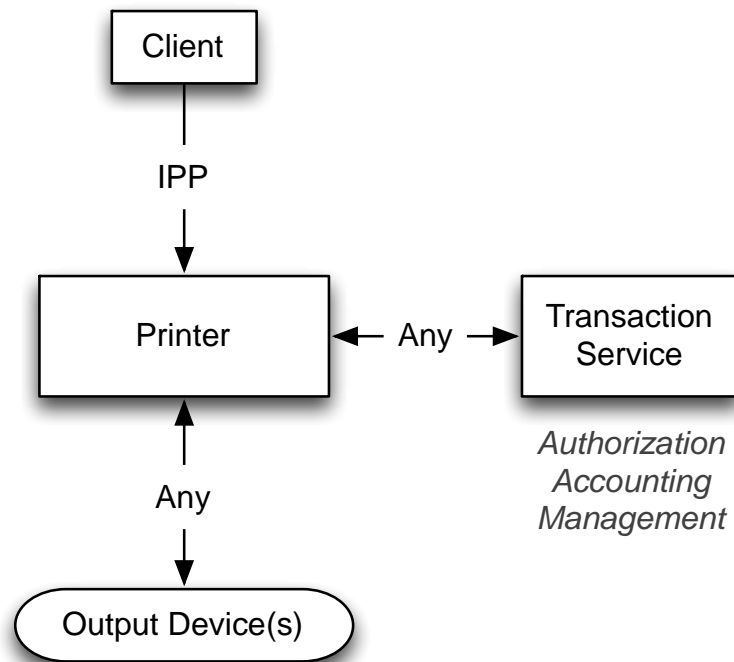
308 The “job-authorization-uri” (section 6.1.2) operation attribute allows a Printer to provide an
309 authorization or transaction code to the Client that is used in subsequent Job Creation
310 Requests to obtain a printout. The valid time period, number of print jobs, and/or number of
311 pages for an authorization code is specific to the implementation. However, since there is
312 no way for the Client to tell the Printer it will not be using the authorization code, the Printer
313 MUST automatically expire the provided URI after a suitable period of time that SHOULD be
314 longer than 60 seconds. Printers notify Clients that they require a “job-authorization-uri”
315 value in a print Job Creation Request by including the attribute name in the “printer-
316 mandatory-job-attributes” Printer Description attribute (section 6.4.6). Printers notify Clients
317 that a “job-authorization-uri” value is no longer valid by returning the client-error-account-
318 authorization-failed (section 8.2) status code and placing the “job-authorization-uri” attribute
319 in the unsupported attributes group of the response.

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

322 The “charge-info-message” (section 6.1.1) operation attribute allows the Printer to return a
323 localized message to the Client tailored to the requesting user. The message is typically the
324 current status of the account (number of pages and/or amount of credit remaining) but can
325 also contain account-specific error messages when the account cannot be used for printing.
326 Once a Job is created, the “job-charge-info” (section 6.2.1) Job Status attribute provides any
327 updated account information for that Job.

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

332



333

334

Figure 1 - Transaction-Based Printing Model

335

4.1 User Accounts vs. Payment/Billing Accounts

336 Printers that support multiple payment or billing options for each End User account can
 337 support them via the “job-account-id” and “job-accounting-user-id” Job Template attributes
 338 [PWG5100.7]. Printers notify Clients that they require these values in a print Job Creation
 339 Request by including the corresponding attribute names in the “printer-mandatory-job-
 340 attributes” Printer Description attribute (section 6.4.6).

341

4.2 Priority of Service

342 The “job-priority” [STD92] Job Template attribute can be used by the Printer to determine
 343 the cost of or type of service for the Job. For example, a Job with a priority of 100 would
 344 cause the Job to be processed before other Jobs of lesser priority and might then be billed
 345 at twice the normal rate. Similarly, a Job with a priority of 1 would cause the Job to be
 346 processed after all other Jobs and might be billed at half the normal rate.

347

```

348      Client
349      POST Validate-Job Request →
350
351      ← 401 Unauthorized
352      WWW-Authenticate: Basic realm="Example"
353
354      POST Validate-Job Request →
355      Authentication: Basic dGVzdDp0ZXN0MTIzCg==
356      job-impressions-estimated=20
357
358      ← 200 OK
359      Validate-Job Response = successful-ok
360      charge-info-message="14 pages in account."
361      job-authorization-uri = "urn:uuid:..."
362
363      POST Print-Job Request →
364      Authentication: Basic dGVzdDp0ZXN0MTIzCg==
365      job-authorization-uri = "urn:uuid:..."
366      <20 page document>
367
368      ← 200 OK
369      Print-Job Response = successful-ok
370      charge-info-message="14 pages in account."
371      job-id=1234
372      job-state=pending
373      job-state-reasons="none"
374
375      POST Get-Job-Attributes Request →
376      Authentication: Basic dGVzdDp0ZXN0MTIzCg==
377      job-id=1234
378
379      ← 200 OK
380      Get-Job-Attributes Response = successful-ok
381      job-charge-info="6 pages in account."
382      job-impressions-completed=8
383      job-state=processing
384      job-state-reasons="job-printing"
385
386      POST Get-Job-Attributes Request →
387      Authentication: Basic dGVzdDp0ZXN0MTIzCg==
388      job-id=1234
389
390      ← 200 OK
391      Get-Job-Attributes Response = successful-ok
392      job-charge-info="Need to order more pages."
393      job-impressions-completed=14
394      job-state=processing-stopped
395      job-state-reasons="account-limit-reached"
396
397      ... User Visits printer-charge-info-uri to order 10 more pages ...
398
399      POST Get-Job-Attributes Request →
400      Authentication: Basic dGVzdDp0ZXN0MTIzCg==
401      job-id=1234
402
403      ← 200 OK
404      Get-Job-Attributes Response = successful-ok
405      job-charge-info="20 pages charged."
406      job-impressions-completed=20
407      job-state=completed
408      job-state-reasons="none"

```

Figure 2 - Typical Paid Imaging Sequence Diagram

400 **4.3 Job Review**

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

408 **5. HTTP Authentication - Default Username**

409 Printers supporting Basic authentication [RFC7617] MUST support a default username
410 specified in the WWW-Authenticate header. For example:

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

412 Printers supporting Digest authentication [RFC7616] MUST support a default username
413 specified in the WWW-Authenticate header. For example:

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

416 The default username can be changed or disabled through the Printer's web interface or
417 other mechanisms.
418

419 **6. IPP Attributes**

420 **6.1 Operation Attributes**

421 **6.1.1 charge-info-message (text)**

422 This attribute provides a localized message concerning any Paid Imaging Service charge
423 information, typically the remaining balance on the requesting user's account. Printers that
424 implement Paid Imaging Services SHOULD return this attribute in response to a Create-Job,
425 Print-Job, Print-URI, or Validate-Job request.

426 **6.1.2 job-authorization-uri (uri)**

427 This RECOMMENDED attribute specifies an implementation-specific URI representing an
428 authorization or reservation code for a Job Creation Request. It is returned by the Validate-
429 Job operation (section 7.2) and supplied in the Create-Job, Print-Job, and Print-URI
430 operations (section 7.1).

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

433 **6.1.3 job-impressions-estimated (integer(1:MAX))**

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

437 **6.2 Job Status Attributes**

438 **6.2.1 job-charge-info (text)**

439 This RECOMMENDED attribute provides a localized message concerning any Paid Imaging
440 Service charge information, typically the cost charged to the requesting user's account.
441

442 **6.3 Job Template Attributes**

443 **6.3.1 job-account-type (type2 keyword | name(MAX))**

444 This RECOMMENDED attribute specifies the type of value that was specified in the "job-
445 account-id" Job Template attribute [PWG5100.7]. The following values are defined in this
446 specification:

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

448 'group': A group identifier was supplied.

449 'none': No account identifier was supplied.

450 **6.4 Printer Description Attributes**

451 **6.4.1 job-account-type-default (type2 keyword | name(MAX))**

452 The default value supplied by the Printer if the Client omits the "job-account-type" (section
453 6.3.1) Job Template attribute. This attribute is REQUIRED if the "job-account-type" Job
454 Template attribute is supported.

455 **6.4.2 job-account-type-supported (1setOf (type2 keyword | name(MAX)))**

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

458 **6.4.3 job-authorization-uri-supported (boolean)**

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

462 **6.4.4 printer-charge-info (text(MAX))**

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

465 **6.4.5 printer-charge-info-uri (uri)**

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

470 **6.4.6 printer-mandatory-job-attributes (1setOf keyword)**

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

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

478 Printers MUST NOT report this attribute in a Get-Printer-Attributes response if no attributes
479 are required for a successful Job Creation Request.

480 **6.4.7 printer-requested-job-attributes (1setOf keyword)**

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

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

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

498 **7. Additional Semantics for Existing Operations**

499 **7.1 Create-Job, Print-Job, and Print-URI**

500 Printers that support Paid Imaging Services SHOULD accept the "job-authorization-uri"
501 (section 6.1.2) operation attribute. Printers that support Paid Imaging Services SHOULD
502 also return the "charge-info-message" (section 6.1.1) operation attribute. Clients determine
503 whether to include the "job-authorization-uri" operation attribute by querying for the value of
504 the "job-authorization-uri-supported" (section 6.4.3) Printer attribute.

505 7.2 Validate-Job

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

509 7.2.1 Validate-Job Request

510 Printers SHOULD accept the "job-impressions-estimated" (section 6.1.3) operation attribute.

511 7.2.2 Validate-Job Response

512 Printers SHOULD return the "charge-info-message" (section 6.1.1) and "job-authorization-
513 uri" (section 6.1.2) operation attributes.

514

515 **8. Additional Values for Existing Attributes**

516 **8.1 job-state-reasons (1setOf type2 keyword)**

517 This specification defines the following new values for the “job-state-reasons” [STD92] Job
518 Status attribute:

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

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

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

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

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

527 **8.2 Status Codes**

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

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

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

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

537 client-error-account-authorization-failed (0x41F); The Job Creation Request is
538 missing the “job-authorization-uri” operation attribute, the supplied value is not valid,
539 or the value supplied has expired.

540

541 **9. Conformance Requirements**

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

544 **9.1 Conformance Requirements for Clients**

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

- 547 5. The internationalization considerations in section 10; and
- 548 1. The security consideration in section 11.

549 **9.2 Conformance Requirements for Printers**

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

- 551 2. The internationalization considerations in section 10; and
- 552 3. The security consideration in section 11.

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

556 To claim conformance for the RECOMMENDED "job-authorization-uri" (section 6.1.2)
557 operation attribute, Printers MUST support the "job-authorization-uri-supported" (section
558 6.4.3) Printer attribute.

559 **10. Internationalization Considerations**

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

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

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

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

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

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

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

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

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

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

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

581 Unicode Collation Algorithm [UTS10] – sorting

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

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

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

586 Unicode Character Property Model [UTR23] – character properties

587 Unicode Conformance Model [UTR33] – Unicode conformance basis

588 **11. Security Considerations**

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

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

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

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

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

597 12. IANA Considerations

598 12.1 Attribute Registrations

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

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

602 The registry entries will contain the following information:

603	Operation attributes:	Reference
604	-----	-----
605	charge-info-message (text)	[PWG5100.16]
606	job-authorization-uri (uri)	[PWG5100.16]
607	job-impressions-estimated (integer(1:MAX))	[PWG5100.16]
608		
609	Job Status attributes:	Reference
610	-----	-----
611	job-charge-info (text)	[PWG5100.16]
612		
613	Job Template attributes:	Reference
614	-----	-----
615	job-account-type (type2 keyword name(MAX))	[PWG5100.16]
616		
617	Printer Description attributes:	Reference
618	-----	-----
619	job-account-type-default (type2 keyword name(MAX))	[PWG5100.16]
620	job-account-type-supported (1setOf (type2 keyword name(MAX)))	[PWG5100.16]
621		[PWG5100.16]
622	job-authorization-uri-supported (boolean)	[PWG5100.16]
623	printer-charge-info (text(MAX))	[PWG5100.16]
624	printer-charge-info-uri (uri)	[PWG5100.16]
625	printer-mandatory-job-attributes (1setOf keyword)	[PWG5100.16]
626	printer-requested-job-attributes (1setOf keyword)	[PWG5100.16]

627 12.2 Type2 keyword Registrations

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

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

631 The registry entries will contain the following information:

632	Attributes (attribute syntax)	
633	Keyword Attribute Value	Reference
634	-----	-----
635	job-account-type (type2 keyword name(MAX))	[PWG5100.16]
636	general	[PWG5100.16]
637	group	[PWG5100.16]

```

638         none [PWG5100.16]
639     job-account-type (type2 keyword | name(MAX)) [PWG5100.16]
640     < any "job-account-type" value > [PWG5100.16]
641     job-account-type (1setOf (type2 keyword | name(MAX))) [PWG5100.16]
642     < any "job-account-type" value > [PWG5100.16]
643
644     job-state-reasons (1setOf type2 keyword) [STD92]
645         account-authorization-failed [PWG5100.16]
646         account-closed [PWG5100.16]
647         account-info-needed [PWG5100.16]
648         account-limit-reached [PWG5100.16]
649         job-held-for-review [PWG5100.16]

```

650 12.3 Operation Registrations

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

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

654 The registry entries will contain the following information:

655	Operation Name	Reference
656	-----	-----
657	Create-Job (extension)	[PWG5100.16]
658	Print-Job (extension)	[PWG5100.16]
659	Print-URI (extension)	[PWG5100.16]
660	Validate-Job (extension)	[PWG5100.16]

661 12.4 Status Code Registrations

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

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

665 The registry entries will contain the following information:

666	Value	Status Code Name	Reference
667	-----	-----	-----
668	0x0400:0x04FF	- Client Error:	
669	0x041C	client-error-account-info-needed	[PWG5100.16]
670	0x041D	client-error-account-closed	[PWG5100.16]
671	0x041E	client-error-account-limit-reached	[PWG5100.16]
672	0x041F	client-error-account-authorization-failed	[PWG5100.16]

673

674 **13. Overview of Changes**

675 **13.1 IPP Transaction-Based Printing Extensions v1.1**

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

- 678 • The RECOMMENDED "printer-charge-info" and "printer-charge-info-uri" Printer
679 Description attributes were added from [PWG5100.13-2012];
- 680 • The RECOMMENDED "printer-mandatory-job-attributes" Printer Description attribute
681 was added from [PWG5100.11-2010];
- 682 • The RECOMMENDED "printer-requested-job-attributes" Printer Description attribute
683 was added;
- 684 • The "profile-uri" operation attribute was moved to the IPP Driverless Printing
685 Extensions v2.0 (NODRIVER);
- 686 • The "print-scaling" Job Template attribute was moved to the IPP Driverless Printing
687 Extensions v2.0 (NODRIVER);
- 688 • The "jpeg-k-octets-supported", "jpeg-x-dimension-supported", "jpeg-y-dimension-
689 supported", "pdf-k-octets-supported", "pdf-versions-supported", "print-scaling-
690 default", "print-scaling-supported", "printer-dns-sd-name", and "printer-kind" Printer
691 Description attributes were moved to the IPP Driverless Printing Extensions v2.0
692 (NODRIVER);
- 693 • The 'conflicting-attributes', 'job-release-wait', and 'unsupported-attributes-or-values'
694 keywords for the "job-state-reasons" Job Status attribute were moved to the IPP
695 Enterprise Printing Extensions v2.0 (EPX); and
- 696 • The required state for Jobs submitted to release printing services was relaxed.
697

698 14. References

699 14.1 Normative References

- 700 [BCP14] S. Bradner, "Key words for use in RFCs to Indicate Requirement
701 Levels", RFC 2119/BCP 14, March 1997,
702 <https://tools.ietf.org/html/bcp14>
- 703 [ISO10646] "Information technology -- Universal Coded Character Set (UCS)",
704 ISO/IEC 10646:2011
- 705 [PWG5100.7] M. Sweet, "IPP Job Extensions v2.0 (JOBEXT)", PWG 5100.7-2019,
706 August 2019, [https://ftp.pwg.org/pub/pwg/candidates/cs-ippjobext20-
707 20190816-5100.7.pdf](https://ftp.pwg.org/pub/pwg/candidates/cs-ippjobext20-20190816-5100.7.pdf)
- 708 [PWG5100.12] R. Bergman, H. Lewis, I. McDonald, M. Sweet, "IPP 2.0, 2.1, and 2.2",
709 PWG 5100.12-2015, October 2015,
710 [https://www.pwg.org/pub/pwg/standards/std-ipp20-20151030-
711 5100.12.pdf](https://www.pwg.org/pub/pwg/standards/std-ipp20-20151030-5100.12.pdf)
- 712 [PWG5100.14] M. Sweet, I. McDonald, A. Mitchell, J. Hutchings, "IPP Everywhere",
713 PWG 5100.14-2013, January 2013,
714 [https://ftp.pwg.org/pub/pwg/candidates/cs-ippeve10-20130128-
715 5100.14.pdf](https://ftp.pwg.org/pub/pwg/candidates/cs-ippeve10-20130128-5100.14.pdf)
- 716 [RFC3380] T. Hastings, R. Herriot, C. Kugler, H. Lewis, "Internet Printing
717 Protocols (IPP): Job and Printer Set Operations", RFC 3380,
718 September 2002, <https://tools.ietf.org/html/rfc3380>
- 719 [RFC5198] J. Klensin, M. Padlipsky, "Unicode Format for Network Interchange",
720 RFC 5198, March 2008, <https://tools.ietf.org/html/rfc5198>
- 721 [RFC7230] R. Fielding, J. Reschke, "Hypertext Transfer Protocol (HTTP/1.1):
722 Message Syntax and Routing", RFC 7230, June 2014,
723 <https://tools.ietf.org/html/rfc7230>
- 724 [RFC7616] R. Shekh-Yusef, D. Ahrens, S. Bremer, "HTTP Digest Access
725 Authentication", RFC 7616, September 2015,
726 <https://tools.ietf.org/html/rfc7616>
- 727 [RFC7617] J. Reschke, "The 'Basic' HTTP Authentication Scheme", RFC 7617,
728 September 2015, <https://tools.ietf.org/html/rfc7617>
- 729 [STD63] F. Yergeau, "UTF-8, a transformation format of ISO 10646", RFC
730 3629/STD 63, November 2003, <https://tools.ietf.org/html/std63>

- 731 [STD92] M. Sweet, I. McDonald, "Internet Printing Protocol/1.1", STD 92, June
732 2018, <https://tools.ietf.org/html/std92>
- 733 [UAX9] Unicode Consortium, "Unicode Bidirectional Algorithm", UAX#9,
734 February 2019, <https://www.unicode.org/reports/tr9>
- 735 [UAX14] Unicode Consortium, "Unicode Line Breaking Algorithm", UAX#14,
736 February 2019, <https://www.unicode.org/reports/tr14>
- 737 [UAX15] M. Davis, M. Duerst, "Unicode Normalization Forms", Unicode
738 Standard Annex 15, February 2019,
739 <https://www.unicode.org/reports/tr15>
- 740 [UAX29] Unicode Consortium, "Unicode Text Segmentation", UAX#29,
741 February 2019, <https://www.unicode.org/reports/tr29>
- 742 [UAX31] Unicode Consortium, "Unicode Identifier and Pattern Syntax",
743 UAX#31, February 2019, <https://www.unicode.org/reports/tr31>
- 744 [UNICODE] Unicode Consortium, "Unicode Standard", Version 12.0.0, March
745 2019, <https://www.unicode.org/versions/Unicode12.0.0/>
- 746 [UTS10] Unicode Consortium, "Unicode Collation Algorithm", UTS#10, April
747 2019, <https://www.unicode.org/reports/tr10>
- 748 [UTS35] Unicode Consortium, "Unicode Locale Data Markup Language",
749 UTS#35, March 2019, <https://www.unicode.org/reports/tr35>
- 750 [UTS39] Unicode Consortium, "Unicode Security Mechanisms", UTS#39, May
751 2019, <https://www.unicode.org/reports/tr39>

752 14.2 Informative References

- 753 [PrintTalk] CIP4, "Print Talk Specification Version 2.0", October 2019,
754 <https://confluence.cip4.org/display/PUB/PrintTalk>
- 755 [PWG5100.11-2010]
756 T. Hastings, D. Fullman, "IPP Job and Printer Extensions - Set 2
757 (JPS2)", PWG 5100.11-2010, October 2010,
758 [https://ftp.pwg.org/pub/pwg/candidates/cs-ippjobprinterext10-
759 20101030-5100.11.pdf](https://ftp.pwg.org/pub/pwg/candidates/cs-ippjobprinterext10-20101030-5100.11.pdf)
- 760 [PWG5100.13-2012]
761 M. Sweet, I. McDonald, "IPP: Job and Printer Extensions - Set 3
762 (JPS3)", PWG 5100.13-2012, July 2012,
763 [https://ftp.pwg.org/pub/pwg/candidates/cs-ippjobprinterext3v10-
764 20120727-5100.13.pdf](https://ftp.pwg.org/pub/pwg/candidates/cs-ippjobprinterext3v10-20120727-5100.13.pdf)

- 765 [PWG5100.16-2013]
766 M. Sweet, "IPP Transaction-Based Printing Extensions", PWG
767 5100.16-2013, November 2013,
768 [https://ftp.pwg.org/pub/pwg/candidates/cs-ipptrans10-20131108-
769 5100.16.pdf](https://ftp.pwg.org/pub/pwg/candidates/cs-ipptrans10-20131108-5100.16.pdf)
- 770 [UTR17] Unicode Consortium "Unicode Character Encoding Model", UTR#17,
771 November 2008, <https://www.unicode.org/reports/tr17>
- 772 [UTR23] Unicode Consortium "Unicode Character Property Model", UTR#23,
773 May 2015, <https://www.unicode.org/reports/tr23>
- 774 [UTR33] Unicode Consortium "Unicode Conformance Model", UTR#33,
775 November 2008, <https://www.unicode.org/reports/tr33>
- 776 [UNISECFAQ] Unicode Consortium "Unicode Security FAQ", November 2016,
777 <https://www.unicode.org/faq/security.html>

778 **15. Author's Address**

779 Primary author:

780 Michael Sweet
781 Lakeside Robotics Corporation
782

783 16. Change History

784 This section will be removed when this document is published.

785 16.1 February 20, 2020

- 786 • Abstract: Removed PIN and Release Printing
- 787 • Removed "jpeg-xxx", "pdf-xxx", "print-scaling", "printer-dns-sd-name", and "printer-kind" attributes (these will now live in the updated PWG 5100.13)
- 788
- 789 • Updated references to point to published documents rather than the current working drafts
- 790
- 791 • Section 2.3: Fixed spelling mistake in definition of Release Printing
- 792 • Section 3.1: Fixed typo
- 793 • Sections 4.2 and 4.3: Job Status attributes
- 794 • Section 4.3: Capitalize defined terms
- 795 • Section 6.2.2: Remove mention of OpenXPS
- 796 • Moved "printer-mandatory-job-attributes" from PWG 5100.11 to this specification
- 797 • Moved "jpeg-k-octets-supported", "jpeg-x-dimension-supported", "jpeg-y-dimension-supported", "pdf-k-octets-supported", "pdf-versions-supported", "print-scaling", "print-scaling-default", "print-scaling-supported", "printer-dns-sd-name", "printer-kind", and "profile-uri" to NODRIVER
- 798
- 799
- 800
- 801 • Moved 'conflicting-attributes', 'job-release-wait', and 'unsupported-attributes-or-values' keywords to EPX
- 802

803 16.2 January 30, 2020

- 804 • Section 4: Changed title to "IPP Model"
- 805 • Section 6.4: Added printer-requested-job-attributes attribute from the Job Accounting draft.
- 806
- 807 • Section 7.1: Broke up SHOULDs into two separate sentences.

808 **16.3 January 28, 2020**

- 809 • Status: Stable
- 810 • Added line numbers
- 811 • Global: Reviewed all usage of MAY, replaced with "can" or "SHOULD" as appropriate
- 812 • Global: Paid Imaging Service is a defined term, use it
- 813 • Global: PIN Printing is a defined term, use it
- 814 • Section 4.3: Fixed some editorial issues suggested in the December 19, 2019 concall

815 **16.4 December 16, 2019**

816 Initial revision.