



The Printer Working Group

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IPP Everywhere™ v1.1

Status: Stable

Abstract: This specification defines an IPP profile that supports network printing without vendor-specific driver software, including the transport, various discovery protocols, and standard document formats.

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86 conformance to these standards.

87 For additional information regarding the Printer Working Group visit:

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89 Contact information:

90 The Printer Working Group
91 c/o The IEEE Industry Standards and Technology Organization
92 445 Hoes Lane
93 Piscataway, NJ 08854
94 USA
95

Table of Contents

96		
97	1. Introduction	8
98	2. Terminology	8
99	2.1 Printing Terminology	8
100	2.2 Protocol Role Terminology	9
101	2.3 Other Terminology.....	9
102	2.4 Acronyms and Organizations	10
103	3. Requirements.....	11
104	3.1 Rationale	11
105	3.2 Use Cases.....	12
106	3.2.1 Select Printer	12
107	3.2.2 Print	14
108	3.2.3 Exceptions	17
109	3.3 Out of Scope	19
110	3.4 Design Requirements.....	19
111	4. Discovery Protocols	20
112	4.1 Printer Description Attributes Used in Discovery.....	20
113	4.2 DNS Service Discovery (DNS-SD).....	21
114	4.2.1 IPP Everywhere™ Service Subtypes	21
115	4.2.2 Service (SRV) Instance Name.....	21
116	4.2.3 Geo-Location (LOC)	22
117	4.2.4 Text (TXT).....	22
118	4.3 LDAP and SLP Discovery	25
119	5. Protocol Binding.....	26
120	5.1 HTTP Features.....	26
121	5.1.1 Host	26
122	5.1.2 If-Modified-Since, Last-Modified, and 304 Not Modified	26
123	5.1.3 Cache-Control.....	26
124	5.2 IPP Operations	27
125	5.3 IPP Printer Description Attributes.....	27
126	5.3.1 media-col-database (1setOf collection)	30
127	5.3.2 media-col-ready (1setOf collection).....	31
128	5.3.3 media-ready (1setOf (type3 keyword name(MAX)))	32
129	5.3.4 media-size-supported (1setOf collection)	32
130	5.3.5 media-supported (1setOf (type3 keyword name(MAX)))	33
131	5.3.6 pdl-override-supported (type2 keyword).....	34
132	5.4 IPP Printer Status Attributes.....	34
133	5.4.1 printer-uri-supported (1setOf uri)	35
134	5.5 IPP Operation Attributes.....	35
135	5.6 IPP Job Description Attributes.....	36
136	5.7 IPP Job Status Attributes	36
137	5.7.1 job-id (integer).....	37
138	5.7.2 job-uri (uri)	37
139	5.8 IPP Job Template Attributes.....	37
140	6. Document Formats	39

141	6.1 Supporting Long-Edge Feed Media with PWG Raster Format Documents	39
142	7. Additional Values for Existing Attributes	41
143	7.1 ipp-features-supported (1setOf type2 keyword)	41
144	8. Additional Semantics for Existing Value Tags	41
145	8.1 nameWithLanguage and nameWithoutLanguage	42
146	8.2 naturalLanguage	42
147	8.3 textWithLanguage and textWithoutLanguage	42
148	8.4 uri	42
149	9. Conformance Requirements	42
150	9.1 Conformance Requirements for Clients	42
151	9.2 Conformance Requirements for Printers	43
152	9.3 Conditional Conformance Requirements for Printers	43
153	10. Internationalization Considerations	44
154	11. Security Considerations	45
155	12. IANA Considerations	46
156	12.1 Attribute Value Registrations	46
157	13. Safe String Truncation	46
158	13.1 Plain Text Strings	46
159	13.2 URIs	46
160	13.3 MIME Media Types	47
161	13.4 Delimited Lists	47
162	14. Overview of Changes	47
163	14.1 IPP Everywhere™ v1.1	47
164	15. References	48
165	15.1 Normative References	48
166	15.2 Informative References	53
167	16. Authors' Addresses	55
168	17. Change History	56
169	17.1 March 12, 2020	56
170	17.2 February 19, 2020	56
171	17.3 February 11, 2020	56
172	17.4 February 10, 2020	57
173	17.5 August 27, 2019	57
174	17.6 June 27, 2019	57
175	17.7 January 28, 2019	57
176	17.8 September 26, 2018	58
177	17.9 August 24, 2018	58
178	17.10 July 4, 2018	59
179	17.11 June 6, 2018	59
180	17.12 April 17, 2018	59
181	17.13 April 16, 2018	59
182	17.14 April 3, 2018	60
183	17.15 February 9, 2018	60
184		
185		

List of Figures

186
187
188 Figure 2 - PWG Raster Bitmaps with Portrait Feed Orientation.....39
189 Figure 3 - PWG Raster Bitmaps with Landscape Feed Orientation.....40
190 Figure 4 - PWG Raster Bitmaps with Reverse Landscape Feed Orientation40
191 Figure 5 - PWG Raster Bitmaps with Reverse Portrait Feed Orientation41
192
193

List of Tables

194
195
196 Table 1 - Attributes in Discovery Protocols20
197 Table 2 - Priority of DNS TXT Key/Value Pairs.....22
198 Table 3 - DNS TXT Record Keys.....23
199 Table 4 - IPP Everywhere™ Operations.....27
200 Table 5 - Required IPP Everywhere™ Printer Description Attributes27
201 Table 6 - RECOMMENDED IPP Everywhere™ Printer Description Attributes.....30
202 Table 7 - IPP Everywhere™ Printer Status Attributes34
203 Table 8 - REQUIRED IPP Everywhere™ Operation Attributes35
204 Table 9 - RECOMMENDED IPP Everywhere™ Operation Attributes36
205 Table 10 - IPP Everywhere™ Required Job Description Attributes.....36
206 Table 11 - IPP Everywhere™ Required Job Status Attributes.....36
207 Table 12 - REQUIRED IPP Everywhere™ Job Template Attributes37
208 Table 13 - RECOMMENDED IPP Everywhere™ Job Template Attributes38

209

210

211
212

213 1. Introduction

214 Mobile devices do not follow the traditional use models for printing services. For mobile
215 devices, discovery of available printers and their capabilities is both more difficult than for
216 traditional desktop systems and more important because of dynamically changing network
217 attachment points.

218 Printer vendors and software vendors have defined and deployed many different document
219 formats (page description languages) and also dialects of those document formats,
220 increasing the traditional desktop system need for model-specific printer drivers. While there
221 are millions of model-specific printer drivers available for traditional desktop systems, this
222 printer driver model is clearly not practical for mobile devices.

223 IPP Everywhere™ allows Clients, particularly mobile Internet devices, to easily support
224 printing using IPP but without the use of vendor-specific drivers through the adoption of
225 standard document formats, discovery protocols, and schemas.

226 2. Terminology

227 2.1 Printing Terminology

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

231 *Device*: A Logical or Physical Device associated with one or more Printers [STD92].

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

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

237 *Logical Device*: a print server, software service, or gateway that processes Jobs and either
238 forwards or stores the processed Job or uses one or more Physical Devices to render
239 output.

240 *Output Device*: a single Logical or Physical Device

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

243 **2.2 Protocol Role Terminology**

244 This document also defines the following protocol roles to specify unambiguous
245 conformance requirements:

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

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

251 **2.3 Other Terminology**

252 *Direct Imaging*: Printing, facsimile, and scanning performed by direct communication from
253 the Client to an Imaging Device or local print server.

254 *Directory Service*: A Service providing query and enumeration of information using names
255 or other identifiers.

256 *Discovery*: Finding Printers by querying or browsing local network segments or Enumeration
257 of Directory or Name Services.

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

259 *Enumeration*: Listing Printers that are registered with a Directory or other Service.

260 *Indirect Imaging*: Printing, facsimile, and scanning performed by communication from the
261 Client and/or Imaging Device to an intermediary service in a different administrative domain,
262 for example when the Client communicates with a third-party print service or when an
263 Imaging Device communicates with a Cloud service.

264 *Network Accessible Device*: A Device that can be directly accessed by a Client.

265 *Network Accessible/Accessibility*: Refers to the ability of one device to communicate directly
266 with another, for example a Client is able to connect to a Device, query for supported
267 attributes, submit Job creation requests, and so forth.

268 *Operator*: A person or automata that typically oversees the Printer. The Operator is allowed
269 to query and manage the Printer, Jobs and Documents based on site policy.

270 *Paid Imaging Services*: Printing, facsimile, and scanning performed for a fee. The means of
271 collecting payment is outside the scope of this specification.

272 *Secure Print*: A print job using the "document-password", "job-password", and/or "job-
273 password-encryption" operation attributes to provide document and/or physical security.
274 See [PWG5100.7] and [PWG5100.13].

275 *Service*: Software providing access to physical, logical, or virtual resources and (typically)
276 processing of queued Jobs.

277 **2.4 Acronyms and Organizations**

278 *IANA*: Internet Assigned Numbers Authority, <http://www.iana.org/>

279 *IEEE*: Institute of Electrical and Electronics Engineers, <http://www.ieee.org/>

280 *IETF*: Internet Engineering Task Force, <http://www.ietf.org/>

281 *ISO*: International Organization for Standardization, <http://www.iso.org/>

282 *NFC*: Near Field Communications, <http://www.nfc-forum.org/>

283 *PWG*: Printer Working Group, <http://www.pwg.org/>

284

285 **3. Requirements**

286 **3.1 Rationale**

287 Given the following existing specifications and the need for a standard method of Direct
288 Imaging without traditional vendor-specific driver software, this specification should:

- 289 1. Use existing protocols and schema to support discovery, identification, and
290 auto-configuration of Imaging Devices,
- 291 2. Use existing IPP specifications to support job submission to and monitoring of
292 Imaging Devices,
- 293 3. Encourage support for printing through standard document formats, and
- 294 4. Discourage the further proliferation of vendor-specific page description
295 languages, formats, discovery protocols, interfaces, and transports

296 The Internet Printing Protocol/1.1 [STD92] defines the core Internet Printing Protocol.

297 IPP Version 2.0, 2.1, and 2.2 [PWG5100.12] defines:

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

304 The IPP URL Scheme [RFC3510] defines the 'ipp' URI scheme and the IPP over HTTPS
305 Transport Binding and 'ipps' URI Scheme [RFC7472] defines the 'ipps' URI scheme used
306 for IPP.

307 The IPP Job Extensions v2.0 [PWG5100.7] defines new Job management, monitoring, and
308 processing capabilities.

309 The IPP: Job and Printer Extensions - Set 3 [PWG5100.13] define new attributes and
310 operations required for mobile printing and printing with generic drivers.

311 The IPP Transaction-Based Printing Extensions [PWG5100.16] define attributes required
312 for Paid Imaging Services.

313 The IPP Job Password Repertoire [REPertoire] defines attributes that articulate the
314 repertoire of allowable password strings.

315 The IPP Presets [PRESETS] define attributes for predefined sets of Job Template values.

316 The IPP Privacy Attributes v1.0 [PRIVACY] define attributes for specifying the privacy
317 policies of Jobs and Printers.

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

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

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

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

328 ~~Multicast DNS, [RFC6762] defines a protocol for hostname lookups on link-local networks.~~

329 ~~DNS Service Discovery [RFC6763] defines how to discover~~ Printers using Domain Name
330 System (DNS) service (SRV) ~~and text (TXT) lookups.~~

331 ~~The Lightweight Directory Access Protocol (LDAP): Schema for Printer Services [RFC7612]~~
332 ~~defines a schema for Printer registrations and discovery via LDAP [RFC4510] and Service~~
333 ~~Location Protocol (SLP) [RFC2608] services.~~

334 3.2 Use Cases

335 3.2.1 Select Printer

336 Printer selection is part of most Print use cases - Jane selects a Printer, implicitly or
337 explicitly, and the remainder of the use case applies to the selected Printer. A Printer can
338 be a Logical Printer (Service) or a Physical Printer (section 2.1). Selection use cases can
339 often be combined, for example Selection Using a Directory Service (section 3.2.1.4) with
340 Selection Using Properties (section 3.2.1.9).

341 In order to simplify the selection use cases, common exceptions are listed as separate use
342 cases in section 3.2.3.

343 Precondition: For all of the following use cases, the Printer is Network Accessible to be
344 selected, either directly or through an intermediate Service.

345 3.2.1.1 Select the Last Used Printer

346 The Client User Interface provides the last used Printer as a selection. Jane then confirms
347 the selection of the last used Printer.

348 The last used Printer may be automatically selected by the Client User Interface and may
349 be affected by the current network topology or geo-location, for example the last used

Deleted: The Bonjour Printing Specification version 1.2 [BONJOUR] defines:¶

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Deleted: [RFC6763]

Deleted: Automatic address assignment for both IPv4 [RFC3927] and IPv6¶
DNS text (TXT) record keys to support auto-configuration, capabilities, identification, and protocol selection¶

366 Printer may be tracked on a per-network (e.g., default router or other criteria), per-location
367 (e.g., geo-location), or per-Service (e.g., current local server) basis.

368 **3.2.1.2 Select Printer Using Name or Address**

369 The Client User Interface asks Jane for a name or address for the Printer. She then provides
370 a Printer name or address through the Client User Interface. Finally, the Client User
371 Interface queries the Printer for valid Service Uniform Resource Identifiers (URIs).

372 The Printer name can be a DNS Service Discovery (DNS-SD) Service name, a fully-
373 qualified domain name, or other unique identifying name. The Printer address can be a
374 numeric IP address or other unique identifying number.

375 **3.2.1.3 Select Printer Using URI**

376 The Client User Interface asks Jane for a Service URI for the Printer. She then provides a
377 URI through the Client User Interface or cancels selection.

378 For example, Jane could supply an IPP URI: "ipp://example.com/port1" as reported by the
379 Printer's network configuration page.

380 **3.2.1.4 Select Printer Using a Directory Service**

381 The Client obtains a list of Printers on behalf of Jane from the Directory Service and
382 validates that each Printer supports one or more Client-supported Service protocols. The
383 Client User Interface then asks Jane to select one of the supported Printers. Finally, she
384 selects a Printer.

385 Preconditions: One or more Printers are listed in a Directory Service and that Directory
386 Service is Network Accessible to the Client.

387 **3.2.1.5 Select Printer Using a Cloud Service**

388 The Client obtains a list of Printers on behalf of Jane from the Cloud Service(s). The Client
389 User Interface then asks Jane to select one of the Printers. Finally, she selects a Printer.

390 Preconditions: The Client and one or more Printers are registered with a Cloud Service, and
391 that Cloud Service is Network Accessible to both the Client and Printers. The Client and
392 Printers may be registered with multiple Cloud Services, and both may maintain multiple
393 identities for a particular Cloud Service.

394 **3.2.1.6 Select Printer Using a Discovery Protocol**

395 The Client initiates Discovery on behalf of Jane and maintains a dynamic list of Network
396 Accessible Printers during selection. The Client User Interface asks Jane to select one of
397 the Network Accessible Printers, updating those Printers as they come and go. Finally, she
398 selects a Printer and the Client terminates Discovery.

399 Preconditions: The Printer is Network Accessible to the Client and supports a common
400 Discovery Protocol.

401 **3.2.1.7 Select Printer Using Geo-Location**

402 The Client initiates Enumeration of Printers within a geographic area using Services and/or
403 Discovery Protocols, hiding duplicate Printers that are reported by multiple Service and/or
404 Discovery Protocols. The Client User Interface asks Jane to select one of the Printers.
405 Finally, she selects a Printer.

406 Preconditions: Both the Client and Printer have access to geo-location information to allow
407 for Enumeration within a geographic area, and both support common Discovery Protocol(s).

408 **3.2.1.8 Select Printer Using Out of Band Method**

409 Jane asks the Client User Interface to identify the Printer using a built-in camera, Near-Field
410 Communications (NFC) chip, or other sensing technology. The Client initiates identification
411 to obtain a Service URI and descriptive information. The Client User Interface then asks
412 Jane to confirm the selection of the identified Printer. Finally, she confirms the selection.

413 Precondition: The Printer and Client support a common identifying technology such as NFC,
414 Quick Response Codes (QR Codes), or bar codes.

415 **3.2.1.9 Select Printer Using Properties**

416 Jane selects a Printer using properties such as Service, capability, or description properties
417 of the Printer. Service properties include the application (printing) protocol, security, or
418 restrictions such as the maximum number of pages allowed in a job. Capability properties
419 include values such as media, duplex, finishing, color support, and so forth, Description
420 properties include values such as location, speed, color support, and job size. The
421 properties may be provided by a combination of user input, policy, and/or software heuristic.

422 Jane asks the Client User Interface to select using properties. The Client obtains a list of
423 Printers for Jane that meet the given properties provided by the Client software, policy,
424 and/or user and validates that each Printer supports one or more Client-supported Service
425 protocols. The Client User Interface then asks Jane to select one of the supported Printers.
426 Finally, she selects a Printer.

427 **3.2.2 Print**

428 Each of the use cases in this section begin by initiating a print action, selecting a Printer
429 (section 3.2.1), querying the Printer status, capabilities, and status information, and
430 displaying of any status information important to the User. Each use case generally ends
431 with Jane collecting the printout from the Printer.

432 Preconditions: For all of the following use cases, the Printer must be Network Accessible to
433 the Client in order to be selected, either directly or through an intermediate Service. Also,

434 the document to be printed must be Network Accessible to the Printer and in a format
435 suitable for the Printer or converted by the Client or Service into a suitable format.

436 **3.2.2.1 Print a Document**

437 Jane has a Client connected to the Wi-Fi network in her business and has a document to
438 print prior to a meeting that is stored on her phone.

439 After Jane initiates a print action and selects a Printer, she specifies the processing intent
440 for the Job and confirms the print action. The Client sends a print job request to the Printer
441 with the Job Ticket and attached document data. The Printer validates the Job Ticket and
442 document data and then prints the document.

443 **3.2.2.2 Print a Document by Reference**

444 Jane has a Client connected to the Wi-Fi network in her business and is viewing a document
445 on a server that she would like to print.

446 After Jane initiates a print action and selects a Printer, she specifies the processing intent
447 for the Job and confirms the print action. The Client sends a print job request to the Printer
448 with the Job Ticket and document URI. The Printer validates the Job Ticket and document
449 URI and then prints the document.

450 **3.2.2.3 Print Using Loaded Media**

451 Jane is viewing a photo and would like to print the photo on the largest borderless
452 photographic media loaded on her Printer.

453 After Jane initiates a print action from the phone and selects a Printer, the Client photo
454 application automatically selects the largest borderless photographic media loaded on the
455 Selected Printer and the highest print quality. Jane selects additional processing intent for
456 the Job and confirms the print action. The Client sends a print job request to the Printer with
457 the Job Ticket and local photo. The Printer validates the Job Ticket and document data and
458 then prints the photo.

459 Preconditions: Printer can report loaded media information such as size, orientation, type,
460 coating, and weight. This may be detected automatically or manually entered by the User
461 or Operator when loading the media.

462 **3.2.2.4 Print a Secure Form**

463 The treasurer of a small training company that is holding a meeting and seminar at a resort
464 needs to print out 20 checks for training personnel. He uses an accounting program to
465 enter the hours worked, bonuses, reimbursable expenses, and so forth and prints the
466 checks on a printer provided by the resort using check blanks he brought to the meeting.

467 The treasurer loads check blanks into the Printer and configured the loaded media as
468 necessary at the Printer. After he initiates a print action from the accounting program,
469 selects a Printer for printing, and selects checks to be printed, the Client User Interface
470 displays a preview of the printed checks and he confirms that the checks are correctly
471 paginated and oriented and the amounts, payees and signature are correct. The Client
472 automatically selects the check blank media. The treasurer selects additional processing
473 intent for the Job and confirms the print action. The Client sends a print job request to the
474 Printer with the Job Ticket and document data containing the check information, correctly
475 oriented for the check blank media. He waits for the checks to be printed and removes any
476 excess media from the Printer.

477 Preconditions: Printer can report loaded media information such as size, orientation, type,
478 coating, and weight. This may be detected automatically or manually entered by the User
479 or Operator when loading the media.

480 **3.2.2.5 Print with Special Formatting**

481 At a seminar located at a country resort, an assistant has been asked to provide 80 sets of
482 ten keywords/phrases, clearly printed on 2-inch by 1-inch paper slips for use in a get
483 acquainted exercise. Costs are to be minimized. The assistant has a laptop with a word
484 processor program. The resort has a Wi-Fi network available to Users and a networked
485 MFD at the business center. The attendant at the business center will charge for any printed
486 sheets removed from the premises.

487 After the assistant initiates a print action from the word processor and selects a Printer, he
488 selects the processing intent for the Job and confirms the print action. The word processor
489 produces document data using the media information (size and margins) in the Job Ticket
490 so that 2-inch by 1-inch slips are spread evenly over each page and sends a print job
491 request to the Printer with the Job Ticket and document. The Printer validates the Job Ticket
492 and document data and then prints the document.

493 **3.2.2.6 Print and Select at Printer**

494 One or more Printers are associated with a Service that allows Users to release and print
495 Jobs at any associated Printer. Each User may release a job at a given Printer by providing
496 a Personal Identification Number (PIN) and/or other unique identification/authorization
497 information such as a username and password or IDentification (ID) card.

498 After initiating a print action and selecting a Service, Jane specifies the processing intent
499 and PIN for the Job and confirms the print action. The Client sends a print job request to
500 the Service with the Job Ticket and local document. The Service validates the Job Ticket
501 and document data and then holds the document until released by Jane at the Printer.

502 Precondition: The Client and Printer support a common authorization or identification
503 system. The capability of associated Printers are the same or the User selects a best-effort
504 job processing intent.

505 3.2.2.7 Print to a Service

506 John is flying to New York for a presentation and doesn't want to carry the presentations.
507 John arrives in New York and goes online from his mobile phone. After initiating a print
508 action, he selects a local print provider, reviewing the provider web pages as needed. He
509 then specifies the processing intent as 10 color copies, printed duplex and stapled on the
510 left side, with the covers on 80lb. stock and the internal pages on 24lb. stock. After
511 confirming the print action, John goes to the provider and picks up his presentations, paying
512 with his corporate credit card.

513 3.2.2.8 Print to a Recipient

514 The recipient may release a job at a given Printer by providing a PIN and/or other unique
515 identification/authorization information such as a username and password or ID card.

516 After initiating a print action and selecting a Printer, Jane specifies the processing intent,
517 specifies John as the recipient, and confirms the print action. The Client sends a print job
518 request to the Printer with the Job Ticket and local document. The Printer validates the Job
519 Ticket and document data and then holds the document until released by John. Finally,
520 John collects the printout from the Printer.

521 3.2.2.9 Print with a Proof Copy

522 After initiating a print action and selecting a Printer, John specifies the processing intent,
523 requests a proof print, and confirms the print action. The Client sends a print job request to
524 the Printer with the Job Ticket and local document. The Printer validates the Job Ticket and
525 document data and then prints a proof copy of the document. John collects the proof printout
526 from the Printer and verifies correct output. John then initiates a full print of the document
527 from the Client or Printer to produce part or all of the final output.

528 3.2.3 Exceptions**529 3.2.3.1 Print Action Canceled**

530 Jane cancels the print action UI. The Client then discontinues any active printer selection,
531 print job submission, or other operations and cancels any incomplete print job submission
532 as needed.

533 3.2.3.2 Select Printer Canceled

534 John cancels selection of a Printer. The Client then discontinues any active discovery,
535 Enumeration, or query operations as needed.

536 3.2.3.3 Printer No Longer Network Accessible after Selection

537 After selecting a Network Accessible Printer, the Client, selected Printer, or network suffers
538 a failure preventing the Client from communicating with the Printer. Typically this will display
539 an error message on the Client and cancel the print request.

540 3.2.3.4 Not Authorized

541 After confirming the print request, the Printer responds that the User is not authorized to
542 print the Job document(s). The reason for the authorization failure may involve general
543 access to the Printer, Job document(s), or disallowed Job Ticket values, for example a User
544 may not be allowed to print in color.

545 Precondition: The Printer has access to a file, database, or Service that provides
546 authorization information.

547 3.2.3.5 Needs Authentication

548 After confirming the print request or selecting the Printer, the User is asked to authenticate
549 with the Printer in order to gain access.

550 Precondition: The Printer has access to a file, database, or Service that provide
551 authentication and authorization information.

552 3.2.3.6 Not Accepting Jobs

553 After confirming the print request, the Client discovers that the Printer is no longer accepting
554 jobs, displays an error message, and cancels the print request.

555 3.2.3.7 Job Ticket or Document Format Not Supported

556 After confirming the print request, the Printer rejects the request because the job ticket or
557 document format is not supported. The Client displays an error message and cancels the
558 print request.

559 3.2.3.8 Job or Document Processing Failures

560 While processing a job, the Printer reports job or document processing issues to the Client,
561 which displays an error message as needed and asks the User or Operator to confirm the
562 disposition of the Job. Processing failures include out-of-memory, missing resources, and
563 other conditions that prevent a particular Job or document from printing.

564 3.2.3.9 Printer Fault

565 While processing a Job, the Printer reports faults to the Client, which displays an error
566 message as needed and asks the User or Operator to confirm the disposition of the Job.
567 Printer faults include "out of paper" and other conditions that stop the processing of Jobs.

568 **3.2.3.10 Printer Warning**

569 While processing a Job, the Printer reports warnings to the Client, which provides a warning
570 message as needed. Printer warnings include "low toner" and other advisory conditions that
571 do not stop the processing of Jobs and do not require immediate attention.

572 **3.3 Out of Scope**

573 The following elements of the use cases are considered out of scope for this specification:

- 574 1. The actual method of geo-location and geographic area detection for the Select
575 Printer Using Geo-Location (section 3.2.1.7) use case
576 2. The actual method of payment for the Print to a Service (section 3.2.2.7) use
577 case
578 3. Constraining choice of document formats suitable for the Print use cases
579 4. Definition of new discovery protocols used to find Network Accessible Printers
580 (however, extension of existing protocols is still in scope)

581 **3.4 Design Requirements**

582 The IPP Everywhere™ design should:

- 583 1. Define conformance profiles that reference the IPP/2.0 versions [PWG5100.12];
584 2. Follow the naming conventions defined in the Internet Printing Protocol/1.1
585 [STD92], including keyword value case (lower) and hyphenation requirements;
586 3. Define conformance requirements for both Printers and Clients; and
587 4. Support printing with vendor-neutral Client software from any Client to any
588 Printer using a variety of discovery protocols, IPP for the transport, and
589 standard document formats.

590

591 **4. Discovery Protocols**

592 Printers representing Physical Devices MUST and Printers representing Logical Devices
 593 (i.e. print servers) SHOULD support DNS-SD based Discovery. Printers MAY support other
 594 Discovery protocols such as LDAP and SLP.

595 Clients MUST support DNS-SD. Clients MAY support other Discovery protocols such as
 596 LDAP and SLP.

597 **4.1 Printer Description Attributes Used in Discovery**

598 Table 1 lists the Printer Description attributes that would normally be used for Discovery or
 599 filtering of discovered Printers based on one or more specified Printer attribute values.

600 **Table 1 - Attributes in Discovery Protocols**

IPP Attribute	DNS-SD TXT Key	LDAP/SLP Attribute
color-supported	Color	printer-color-supported
copies-supported	Copies	printer-copies-supported
device-uuid	DUUID	printer-device-uuid (note 1)
document-formats-supported	pdl	printer-document-format-supported
finishings-supported	Bind, Punch, Sort, Staple	printer-finishings-supported
ipp-features-supported	(subtype)	printer-ipp-features-supported
media-supported	PaperCustom, PaperMax	printer-media-supported
multiple-document-handling	Collate	-
pages-per-minute	(note 2)	printer-pages-per-minute
pages-per-minute-color	(note 2)	printer-pages-per-minute-color
printer-charge-info	(note 2)	printer-charge-info (note 1)
printer-charge-info-uri	(note 2)	printer-charge-info-uri (note 1)
printer-geo-location	(LOC record)	printer-geo-location (note 1)
printer-info	(instance)	printer-info
printer-location	note	printer-location
printer-make-and-model	ty	printer-make-and-model
printer-more-info	adminurl	printer-more-info
printer-name	(instance)	printer-name
printer-organization	(note 2)	O
printer-organizational-unit	(note 2)	OU
printer-uri-supported	(service + host + port) rp	printer-uri, printer-xri-supported
printer-uuid	UUID	printer-uuid (note 1)
sides-supported	Duplex	printer-sides-supported
uri-authentication-supported	air	printer-xri-supported
uri-security-supported	TLS	printer-xri-supported

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Deleted: device-service-count ... [1]

Deleted: chargeuri

Deleted: printer-device-id ... [2]

601 Note 1: Extension attribute to RFC 7612.

602 Note 2: Available via subsequent IPP Get-Printer-Attributes request.

606 4.2 DNS Service Discovery (DNS-SD)

607 DNS Service Discovery (DNS-SD) [RFC6763] uses service (SRV) records and traditional
 608 unicast and multicast DNS (mDNS) [RFC6762] queries. Services are identified by a service
 609 instance name consisting of an instance name, a service type or subtype name, and a
 610 domain name. Discovery of Printers involves multiple service types and subtypes
 611 as described in the following sections.

Deleted: RFC6762

Deleted: RFC6763

Deleted: This discovery protocol is collectively defined in the Bonjour Printing Specification version 1.2.1 [BONJOUR] and extended in this specification.

612 Printers that support DNS-SD MUST support mDNS and MAY support dynamic DNS
 613 updates via Dynamic Updates in the Domain Name System (DNS UPDATE) [RFC2136]
 614 and other mechanisms.

615 4.2.1 IPP Everywhere™ Service Subtypes

616 In order for a Client to discover IPP Printers that conform to this specification (and not just
 617 STD921), this specification defines the following DNS-SD service subtypes:

- 618 • "_print._sub._ipp._tcp" for IPP Everywhere™ Printers using the "ipp" URI scheme
 619 [RFC3510]; and
- 620 • "_print._sub._ipps._tcp" for IPP Everywhere™ Printers using the "ipps" URI
 621 scheme [RFC7472].

622 4.2.2 Service (SRV) Instance Name

623 Printers MUST NOT use a service instance name containing a unique identifier by default.
 624 A unique identifier MAY be added to the instance if there is a name collision.

625 The domain portion of the service instance name MUST BE "local." for mDNS.

626 Printers that support DNS-SD MUST advertise the "_printer._tcp" (LPD) service over mDNS
 627 in order to conform to the Flagship Naming requirements as defined in [RFC6763]. For
 628 example, a Printer named "Example Printer" would advertise the service instance name
 629 "Example Printer._printer._tcp.local." with a port number of 0 to indicate that the LPD
 630 protocol is not actually supported.

631 Printers that support DNS-SD MUST also advertise the "_ipp._tcp" (generic IPP) and
 632 "_print._sub._ipp._tcp" (IPP Everywhere™) services over mDNS. For example, a Printer
 633 named "Example Printer" would advertise the service instance names "Example
 634 Printer._ipp._tcp.local." and "Example Printer._print._sub._ipp._tcp.local."

635 Printers that support DNS-SD and the "ipps" URI scheme [RFC7472] MUST advertise the
 636 "_ipps._tcp" (generic IPPS) and "_print._sub._ipps._tcp" (IPP Everywhere™ Secure)
 637 services over mDNS. For example, a Printer named "Example Printer" would advertise the
 638 service instance names "Example Printer._ipps._tcp.local." and
 639 "Example Printer._print._sub._ipps._tcp.local."

647 **4.2.3 Geo-Location (LOC)**

648 Printers MUST publish LOC records [RFC1876] over mDNS to provide the physical location
649 of the Printer. Printers MUST allow the End User to configure the geo-location manually. If
650 the accuracy of the geo-location is unknown, a value of 9×10^9 meters (0x99) MUST be used.

651 **4.2.4 Text (TXT)**

652 Printers MUST publish a text (TXT) record that provides service information over mDNS.
653 Printers that support dynamic DNS updates MUST publish separate TXT records for each
654 domain that is updated. Table 1.

Deleted: The domain portion of the service instance name MUST BE "local." for mDNS.¶

Deleted: The following subsections define new key/value pairs in addition to those required by the Bonjour Printing Specification [BONJOUR].¶

662 Table 3 lists all the key/value pairs that are defined with the corresponding default values.
 663 Printers SHOULD omit key/value pairs when the value matches the default value for the
 664 corresponding key to limit the size of the TXT record.

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665 The combined length of a TXT key/value pair ("key=value") cannot exceed 255 octets. This
 666 limit is sometimes smaller than the limit imposed by the corresponding IPP attribute.

667 For example, the IPP "printer-more-info" attribute has a maximum length of 1023 octets,
 668 however the corresponding "adminurl" key cannot represent a value longer than 246 octets
 669 (255 - 9 octets for "adminurl="). Printers MUST truncate long strings as described in section
 670 13.

671 The combined length of all TXT key/value pairs provided by the Printer SHOULD BE 400
 672 octets or less for unicast DNS and MUST NOT exceed 1300 octets for multicast DNS.

673 Printers MUST provide the "rp" TXT key/value pair within the first 400 octets of the TXT
 674 record. Table 2 shows the priority of TXT key/value pairs.

675 Clients MUST ignore incomplete key/value pairs at the end of a truncated TXT record.

676 **Table 2 - Priority of DNS TXT Key/Value Pairs**

Most Important Access Keys	Identification Keys	Capability Keys	Least Important Keys
rp	UUID	Color	pdl
txtvers	DUUID	Duplex	
priority	ty	Copies	
note		Collate	
air		PaperMax	
TLS		PaperCustom	
adminurl		Bind	
		Punch	
		Sort	
		Staple	

Deleted: Product
 usb_MFG
 usb_MDL
 usb_CMD
 Deleted: qtotal

677

684

Table 3 - DNS TXT Record Keys

Key	Description	Default Value
adminurl	The Printer-resident configuration page URL as reported by the "printer-more-info" Printer Description attribute.	" (empty string)
air	The type of authentication information that is required for the Printer. See section 4.2.4.1.	'none'
Bind	'T' if the Printer can bind output, 'F' otherwise.	'U' (note 1)
Collate	'T' if the Printer can collate copies, 'F' otherwise.	'U' (note 1)
Color	'T' if the Printer supports color printing, 'F' otherwise.	'U' (note 1)
Copies	'T' if the Printer can make copies on its own, 'F' otherwise.	'U' (note 1)
Duplex	'T' if the Printer supports duplex printing, 'F' otherwise.	'U' (note 1)
DUUID	The UUID of the Device without the "urn:uuid:" prefix as reported by the "device-uuid" Printer Description attribute. See section 4.2.4.5.	" (empty string)
note	The location of the Printer as reported by the "printer-location" Printer Description attribute.	" (empty string)
PaperCustom	'T' if the Printer supports custom media sizes, 'F' otherwise.	'U' (note 1)
PaperMax	The maximum media size supported by the Printer: '<legal-A4', 'legal-A4', 'isoC-A2', '>isoC-A2'.	'legal-A4'
pdl	A comma-delimited list of supported MIME media types. See section 4.2.4.2.	" (empty string)
priority	The priority for the service from 0 to 99, where 0 is the highest priority and 99 is the lowest priority.	'50'
Punch	'T' if the Printer can punch output, 'F' otherwise.	'U' (note 1)
rp	The remote print queue name, which is the resource path portion of the Printer URI without the leading slash.	" (empty string)
Sort	'T' if the Printer can sort output, 'F' otherwise.	'U' (note 1)
Staple	'T' if the Printer can staple output, 'F' otherwise.	'U' (note 1)
TLS	The maximum TLS version supported or 'none' if no version of TLS is supported. See section 4.2.4.3.	'none'
txtvers	The major version of the TXT record . MUST have the value '1'.	'1'
ty	The make and model of the Printer as reported by the "printer-make-and-model" Printer Description attribute.	" (empty string)
UUID	The UUID of the Printer without the 'urn:uuid:' prefix as reported by the "printer-uuid" Printer Description attribute. See section 4.2.4.4.	" (empty string)

Deleted: qtotal ... [3]

Deleted: Bonjour Printing Specification

685 Note 1: The value 'U' means "undefined".

686 **4.2.4.1 air**

687 The "air" key defines the type of authentication information that is required for imaging. The
 688 name "air" comes from the CUPS "auth-info-required" Printer Description attribute
 689 [CUPSIPP] that extends the "uri-authentication-supported" Printer Description attribute
 690 [STD92]. The following values are supported:

694 'certificate'; Authentication using Secure Sockets Layer (SSL) and Transport Layer
695 Security (TLS) certificates. This is equivalent to the 'certificate' value for the "uri-
696 authentication-supported" Printer Description attribute.

697 'negotiate'; Kerberized authentication is required [RFC4559]. This is equivalent to the
698 'negotiate' value [PWG5100.13] for the "uri-authentication-supported" Printer
699 Description attribute.

700 'none'; No authentication is required. This is equivalent to the 'none' value for the
701 "uri-authentication-supported" Printer Description attribute.

702 'oauth'; OAuth 2.0 authentication [RFC6749] is required using the Bearer method
703 [RFC6750]. This is equivalent to the 'oauth' value [PWG5100.18] for the "uri-
704 authentication-supported" Printer Description attribute.

705 'username,password'; Username + password authentication is required. This is
706 equivalent to the 'basic' or 'digest' values for the "uri-authentication-supported"
707 Printer Description attribute.

708 The default value for the "air" key is 'none'.

709 4.2.4.2 pdl

710 The REQUIRED "pdl" (Page Description Language) key lists the supported MIME media
711 types. Because the total length of a key/value pair is 255 octets, the "pdl" value is typically
712 a subset of the values reported by the "document-format-supported" Printer Description
713 attribute. Printers SHOULD populate the "pdl" key with a comma-delimited list of the
714 REQUIRED and preferred Multipurpose Internet Mail Extensions (MIME) media types and
715 MUST NOT list the 'application/octet-stream' MIME media type.

716 4.2.4.3 TLS

717 The "TLS" key defines the highest version of TLS that is supported for encrypted
718 communications with the Printer. The following values are currently defined:

719 'none'; No encryption is supported. This is equivalent to the value 'none' for the "uri-
720 security-supported" Printer Description attribute.

721 '1.0'; TLS 1.0 [RFC2246] encryption is supported. This is equivalent to the value 'tls'
722 for the "uri-security-supported" Printer Description attribute.

723 '1.1'; TLS 1.1 [RFC4346] encryption is supported. This is equivalent to the value 'tls'
724 for the "uri-security-supported" Printer Description attribute.

725 '1.2'; TLS 1.2 [RFC5246] encryption is supported. This is equivalent to the value 'tls'
726 for the "uri-security-supported" Printer Description attribute.

Deleted: <#>qtotal
<#>The "qtotal" key defines the number of services supported by the Printer with this service instance name. While the Bonjour Printing Specification [BONJOUR] does allow Printers to advertise multiple services with the same name using multiple TXT records, historically this functionality has caused interoperability and stability issues for Printers and Clients that support multiple network interfaces, e.g., Wi-Fi and Ethernet. Therefore, Printers MUST NOT advertise multiple services using the same name and MUST always use the default value (1) for the "qtotal" key and advertise the default (print) service in the TXT record. Printers with multiple print service endpoints MAY advertise multiple uniquely named services, each providing a single TXT record for their corresponding information.

751 '1.3'; TLS 1.3 [RFC8446] encryption is supported. This is equivalent to the value 'tls'
752 for the "uri-security-supported" Printer Description attribute.

Deleted: -TLS1.3

753 The default value of the "TLS" key is 'none'. Version numbers correspond to the currently
754 defined TLS protocol versions as defined by the IETF and are not limited to the version
755 numbers shown above. Printers that support IPPS MUST report the TLS key.

756 4.2.4.4 UUID

757 The REQUIRED "UUID" key provides the value of the "printer-uuid" Printer Description
758 attribute [RFC4122] [PWG 5100.13] without the leading "urn:uuid:". For example, if a Printer
759 reports a "printer-uuid" value of:

760 urn:uuid:12345678-9ABC-DEF0-1234-56789ABCDEF0

761 The "UUID" key will have a value of:

762 12345678-9ABC-DEF0-1234-56789ABCDEF0

763 Note: The "printer-uuid" value is used instead of "device-uuid" because DNS-SD identifies
764 services and not devices.

765 4.2.4.5 DUUID

766 The "DUUID" key provides the value of the "device-uuid" Printer Description attribute
767 [RFC4122] [PWG 5100.13] without the leading "urn:uuid:". For example, if a Printer reports
768 a "device-uuid" value of:

769 urn:uuid:12345678-9ABC-DEF0-1234-56789ABCDEF0

770 The "DUUID" key will have a value of:

771 12345678-9ABC-DEF0-1234-56789ABCDEF0

772 4.3 LDAP and SLP Discovery

773 LDAP and SLP discovery use the schema defined in Lightweight Directory Access Protocol
774 (LDAP): Schema for Printer Services [RFC4511] [RFC4515] [RFC7612].

775

Deleted: Both LDAP and SLP impose hard limits on the lengths of string values, typically 127 or 255 octets depending on the attribute. These limits are sometimes smaller than the limits imposed by the corresponding IPP attributes. For example, the IPP "printer-device-id" attribute has a maximum length of 1023 octets, however the corresponding LDAP "printer-device-id" attribute has a maximum length of 255 octets. Printers MUST truncate long strings as defined in section 13.

791 **5. Protocol Binding**

792 Printers and Clients MUST support IPP/2.0, IPP/2.1, and/or IPP/2.2 [PWG5100.12] and the
793 IPP Job and Printer Extensions - Set 3 [PWG5100.13].

794 While this specification defines an IPP binding, the same set of Semantic Elements can be
795 applied to any protocol that conforms to the PWG Semantic Model.

796 **5.1 HTTP Features**

797 In addition to the IPP over HTTP conformance requirements defined in section 7.3 of IPP
798 Version 2.0, 2.1, and 2.2 [PWG5100.12], Printers MUST support the following HTTP
799 headers and status codes defined in HTTP/1.1 - Message Syntax and Routing [RFC7230],
800 HTTP/1.1 - Semantics and Content [RFC7231], HTTP/1.1 - Conditional Requests
801 [RFC7232], and HTTP/1.1 - Caching [RFC7234].

802 Clients and Printers MUST support IPP over HTTP [RFC3510] and SHOULD support IPP
803 over HTTPS [RFC7472] with the most recent version of TLS [RFC8446].

804 **5.1.1 Host**

805 Printers MUST validate the Host request header and SHOULD use the Host value in
806 generated URIs, including any port number.

807 **5.1.2 If-Modified-Since, Last-Modified, and 304 Not Modified**

808 Printers MUST support the If-Modified-Since request header (section 3.3 [RFC7232]), the
809 corresponding response status ("304 Not Modified", section 4.1 [RFC7232]), and the Last-
810 Modified response header (section 2.2 [RFC7232]).

811 The If-Modified-Since request header allows a Client to efficiently determine whether a
812 particular resource file (icon, ICC profile, localization file, etc.) has been updated since the
813 last time the Client requested it.

814 **5.1.3 Cache-Control**

815 Printers and Clients MUST conform to the caching semantics defined in [RFC7234].
816 Typically, most resource files provided by a Printer in a GET response will be cacheable but
817 IPP responses in a POST response are not. Therefore, Printers MAY provide a Cache-
818 Control header in GET responses with an appropriate "max-age" value and MUST provide
819 a Cache-Control header in IPP POST responses with the value "no-cache".
820

821 **5.2 IPP Operations**

822 Table 4 lists the REQUIRED operations for an IPP Everywhere™ Printer. Additionally,
823 Clients and Printers SHOULD support the Get-User-Printer-Attributes [GUPA] operation for
824 End User print policies.

825 Note: The Create-Job and Send-Document operations are required in order to support
826 reliable Job management (e.g., cancellation) during Print Job submission, but Printers are
827 not required to support multiple Document Jobs.

828 **Table 4 - IPP Everywhere™ Operations**

Code	Operation Name	Reference
0x0002	Print-Job	STD 92
0x0004	Validate-Job	STD 92
0x0005	Create-Job	STD 92
0x0006	Send-Document	STD 92
0x0008	Cancel-Job	STD 92
0x0009	Get-Job-Attributes	STD 92
0x000A	Get-Jobs	STD 92
0x000B	Get-Printer-Attributes	STD 92
0x0039	Cancel-My-Jobs	PWG 5100.7
0x003B	Close-Job	PWG 5100.7
0x003C	Identify-Printer (note 1)	PWG 5100.13

829 Note 1: RECOMMENDED for Logical Devices, REQUIRED otherwise.

830 **5.3 IPP Printer Description Attributes**

831 Table 5 lists the Printer Description attributes for an IPP Everywhere™ Printer. All attributes
832 in the table are REQUIRED unless otherwise specified.

833 **Table 5 - Required IPP Everywhere™ Printer Description Attributes**

Attribute	Reference
charset-configured	STD 92
charset-supported	STD 92
color-supported	STD 92
compression-supported	STD 92
copies-default (note 2)	STD 92
copies-supported (note 2)	STD 92
document-format-default	STD 92
document-format-supported	STD 92
document-password-supported (note 2)	PWG 5100.13
finishing-template-supported (notes 3 and 7)	PWG 5100.1
finishings-col-database (notes 3 and 7)	PWG 5100.1

Attribute	Reference
finishings-col-default (notes 3 and 7)	PWG 5100.1
finishings-col-ready (notes 3 and 7)	PWG 5100.1
finishings-col-supported (notes 3 and 7)	PWG 5100.1
finishings-default (note 3)	STD 92
finishings-ready (notes 3 and 7)	STD 92
finishings-supported (note 3)	STD 92
generated-natural-language-supported	STD 92
identify-actions-default (note 9)	PWG 5100.13
identify-actions-supported (note 9)	PWG 5100.13
ipp-features-supported	PWG 5100.13
ipp-versions-supported	STD 92
job-account-id-default (note 1)	PWG 5100.7
job-account-id-supported (note 1)	PWG 5100.7
job-accounting-user-id-default (note 1)	PWG 5100.7
job-accounting-user-id-supported (note 1)	PWG 5100.7
job-constraints-supported	PWG 5100.13
job-creation-attributes-supported	PWG 5100.7
job-ids-supported	PWG 5100.7
job-password-encryption-supported (note 4)	PWG 5100.11
job-password-supported (note 4)	PWG 5100.11
job-resolvers-supported	PWG 5100.13
media-bottom-margin-supported	PWG 5100.7
media-col-database	PWG 5100.7
media-col-database.media-source-properties (note 5)	PWG 5100.7
media-col-default	PWG 5100.7
media-col-ready	PWG 5100.7
media-col-ready.media-source-properties (note 5)	PWG 5100.7
media-col-supported	PWG 5100.7
media-default	STD 92
media-left-margin-supported	PWG 5100.7
media-ready	STD 92
media-right-margin-supported	PWG 5100.7
media-size-supported	PWG 5100.7
media-source-supported	PWG 5100.7
media-supported	STD 92
media-top-margin-supported	PWG 5100.7
media-type-supported	PWG 5100.7
multiple-document-jobs-supported	STD 92
multiple-operation-timeout	STD 92
multiple-operation-timeout-action	PWG 5100.13
natural-language-configured	STD 92
operations-supported	STD 92
orientation-requested-default	STD 92
orientation-requested-supported	STD 92

Attribute	Reference
output-bin-default	PWG 5100.2
output-bin-supported	PWG 5100.2
overrides-supported (note 2)	PWG 5100.6
page-ranges-supported (note 2)	STD 92
pdl-override-supported	STD 92
preferred-attributes-supported	PWG 5100.13
print-color-mode-default	PWG 5100.13
print-color-mode-supported	PWG 5100.13
print-quality-default	STD 92
print-quality-supported	STD 92
print-rendering-intent-default (note 8)	PWG 5100.13
print-rendering-intent-supported (note 8)	PWG 5100.13
printer-current-time (note 7)	STD 92
printer-geo-location	PWG 5100.13
printer-get-attributes-supported	PWG 5100.13
printer-icc-profiles (notes 6 and 8)	PWG 5100.13
printer-icons (note 6)	PWG 5100.13
printer-info	STD 92
printer-location	STD 92
printer-make-and-model	STD 92
printer-mandatory-job-attributes (note 1)	PWG 5100.13
printer-name	STD 92
printer-organization	PWG 5100.13
printer-organizational-unit	PWG 5100.13
printer-resolution-default	STD 92
printer-resolution-supported	STD 92
pwg-raster-document-resolution-supported	PWG 5102.4
pwg-raster-document-sheet-back	PWG 5102.4
pwg-raster-document-type-supported	PWG 5102.4
sides-default	STD 92
sides-supported	STD 92
uri-authentication-supported	STD 92
uri-security-supported	STD 92
which-jobs-supported	PWG 5100.7

834 Note 1: CONDITIONALLY REQUIRED for Printers that implement Paid Imaging
835 services.
836 Note 2: REQUIRED for the "application/pdf" and "image/jpeg" MIME media types.
837 Note 3: CONDITIONALLY REQUIRED for Printers with finishers.
838 Note 4: CONDITIONALLY REQUIRED for Printers that support the Print to a
839 Recipient (section 3.2.2.8) use case.
840 Note 5: CONDITIONALLY REQUIRED for Printers that support long-edge feed
841 media.

842 Note 6: URIs MUST be absolute, SHOULD use the Host value (including port
 843 number) from the HTTP Host header (section 5.1.1), and MUST NOT use link-local
 844 addresses (section 8.4).
 845 Note 7: RECOMMENDED due to its omission from IPP Everywhere™ 1.0, however
 846 it is needed for the underlying functionality.
 847 Note 8: CONDITIONALLY REQUIRED for Printers that support ICC-based color
 848 management.
 849 Note 9: RECOMMENDED for Logical Devices, REQUIRED otherwise.

850 **Table 6 - RECOMMENDED IPP Everywhere™ Printer Description Attributes**

Attribute	Reference
job-account-type-default	PWG 5100.16
job-account-type-supported	PWG 5100.16
job-authorization-uri-supported	PWG 5100.16
job-mandatory-attributes-supported	PWG 5100.7
job-password-repertoire-configured	REPertoire
job-password-repertoire-supported	REPertoire
job-presets-supported	PRESETS
job-privacy-attributes	PRIVACY
job-privacy-scope	PRIVACY
jpeg-features-supported	PWG 5100.16
jpeg-k-octets-supported	PWG 5100.16
jpeg-x-dimension-supported	PWG 5100.16
jpeg-y-dimension-supported	PWG 5100.16
max-page-ranges-supported	IANA IPP Registry
pdf-k-octets-supported	PWG 5100.16
pdf-versions-supported	PWG 5100.16
print-content-optimize-default	PWG 5100.7
print-content-optimize-supported	PWG 5100.7
print-scaling-default	PWG 5100.16
print-scaling-supported	PWG 5100.16
printer-dns-sd-name	PWG 5100.16
printer-firmware-name	IANA IPP Registry
printer-firmware-patches	IANA IPP Registry
printer-firmware-string-version	IANA IPP Registry
printer-firmware-version	IANA IPP Registry
printer-input-tray	PWG 5100.13
printer-output-tray	PWG 5100.13
printer-privacy-policy-uri	PRIVACY

851 **5.3.1 media-col-database (1setOf collection)**

852 The REQUIRED "media-col-database" Printer attribute lists the supported combinations of
 853 "media-col" member attributes for a Printer. In addition to the requirements set forth in the
 854 IPP Job Extensions v2.0 [PWG5100.7], this specification defines how a Printer advertises

855 custom and roll-fed media capabilities in the "media-col-database" attribute to be consistent
856 with the definition of the "media-size-supported" attribute.

857 Custom media sizes are described using rangeOfInteger values for the "x-dimension" and
858 "y-dimension" member attributes of the "media-size" member attribute. Dimensions are
859 provided for sheets in portrait orientation, that is the "x-dimension" ranges refer to the short
860 axis and the "y-dimension" ranges refer to the long axis of the sheet. For example, a Printer
861 supporting sheet media from 50x50mm to 330.2x482.6mm from the by-pass tray could
862 report:

```
863     media-col-database=...,{  
864         media-size={  
865             x-dimension=5000-33020  
866             y-dimension=5000-48260 }  
867         media-source='by-pass-tray' },...
```

868 Similarly, roll media sizes are also described using rangeOfInteger values, however the "x-
869 dimension" value refers to the cross-feed (width) dimension and the "y-dimension" value
870 refers to the feed (length) dimension. The supported ranges provide the capabilities of the
871 Printer and not of any loaded media which is reported separately in the "media-col-ready"
872 and "media-ready" attributes. For example, a Printer supporting rolls 8 to 60 inches wide
873 and 6 inches to 300 feet long would report:

```
874     media-col-database=...,{  
875         media-size={  
876             x-dimension=20320-152400  
877             y-dimension=1524-9144000 },...
```

878 5.3.2 media-col-ready (1setOf collection)

879 The REQUIRED "media-col-ready" Printer attribute lists the loaded media combinations of
880 "media-col" member attributes for a Printer. In addition to the requirements set forth in the
881 IPP Job Extensions v2.0 [PWG5100.7], this specification defines how a Printer advertises
882 manually-fed and roll-fed media in the "media-col-ready" attribute to be consistent with the
883 definition of the "media-size-supported" attribute.

884 Note: Printers representing Logical Devices report a list of ready media that has either been
885 configured by the Administrator or generated from the set of media loaded in all of the
886 Physical Devices associated with the Logical Devices. This allows Clients that present UI
887 based on the loaded media to function equally with both Physical Devices and Logical
888 Devices.

889 Manual feed media sizes MUST NOT be reported in the "media-col-ready" attribute. By
890 definition the 'manual-feed' media source requires the Printer to ask the End User/Operator
891 to load the requested media, thus the media can never be "ready" for use. However, many
892 Printers offer a multi-purpose tray that serves as both a manual feed source and an ad-hoc
893 paper tray. Printers that provide such a multi-purpose tray MUST advertise media loaded in
894 the tray using a different media source such as 'by-pass-tray'.

895 Roll media sizes are described using an integer value for the "x-dimension" and a
896 rangeOfInteger value for the "y-dimension" member attributes of the "media-size" member
897 attribute. The "x-dimension" value refers to the width of the loaded roll, the lower bound of
898 the "y-dimension" value refers to the minimum length allowed, and the upper bound of the
899 "y-dimension" value refers to the remaining length of the loaded roll or, if the remainder is
900 not known, the maximum length allowed.

901 **5.3.3 media-ready (1setOf (type3 keyword | name(MAX)))**

902 The REQUIRED "media-ready" Printer attribute lists the loaded media for a Printer. In
903 addition to the requirements set forth in the Internet Printing Protocol/1.1 [STD92], this
904 specification defines how a Printer advertises custom, manually-fed, and roll-fed media in
905 the "media-ready" attribute.

906 Note: Printers representing Logical Devices report a list of ready media that has either been
907 configured by the Administrator or generated from the set of media loaded in all of the
908 Physical Devices associated with the Logical Devices. This allows Clients that present UI
909 based on the loaded media to function equally with both Physical Devices and Logical
910 Devices.

911 Manual feed media sizes MUST NOT be reported in the "media-ready" attribute. By
912 definition the 'manual-feed' media source requires the Printer to ask the End User/Operator
913 to load the requested media, thus the media can never be "ready" for use. However, many
914 Printers offer a multi-purpose tray that serves as both a manual feed source and an ad-hoc
915 paper tray. Printers that provide such a multi-purpose tray MUST advertise media loaded in
916 the tray.

917 Custom media sizes are described using the "custom" self-describing media size names
918 defined in section 5 of the PWG Media Standardized Names [PWG5101.1] specification.
919 For example, a custom media size of 4x8 inches might be listed with the name
920 "custom_current_4x8in". The size name MUST include the source name if more than one
921 custom size is loaded, for example "custom_current.tray-1_4x8in".

922 Similarly, roll media sized are described using "roll" self-describing media size names with
923 the width of the loaded roll and a length of 0. For example, a 36 inch roll might be listed with
924 the name "roll_current_36x0in". As for custom sizes, the size name MUST include the
925 source name if more than one roll is loaded, for example "roll_current.roll-1_36x0in".

926 **5.3.4 media-size-supported (1setOf collection)**

927 The REQUIRED "media-size-supported" Printer attribute lists the supported media sizes for
928 a Printer. In addition to the requirements set forth in [PWG5100.7], this specification defines
929 how a Printer advertises custom and roll-fed media in the "media-size" attribute.

930 Custom media sizes are described using rangeOfInteger values for the "x-dimension" and
931 "y-dimension" member attributes. Dimensions are provided for sheets in portrait orientation,

932 that is the "x-dimension" ranges refer to the short axis and the "y-dimension" ranges refer
933 to the long axis of the sheet. For example, a Printer supporting sheet media from 50x50mm
934 to 330.2x482.6mm from the by-pass tray would report:

```
935     media-size-supported=..., {  
936         x-dimension=5000-33020  
937         y-dimension=5000-48260 },...
```

938 Similarly, roll media sizes are also described using rangeOfInteger values, however the "x-
939 dimension" value refers to the cross-feed (width) dimension and the "y-dimension" value
940 refers to the feed (length) dimension. The supported ranges provide the capabilities of the
941 Printer and not of any loaded media which is reported separately in the "media-col-ready"
942 and "media-ready" attributes. For example, a Printer supporting rolls 8 to 60 inches wide
943 and 6 inches to 300 feet long would report:

```
944     media-size-supported=..., {  
945         x-dimension=20320-152400  
946         y-dimension=1524-9144000 },...
```

947 5.3.5 media-supported (1setOf (type3 keyword | name(MAX)))

948 The REQUIRED "media-supported" Printer attribute lists the supported media sizes for a
949 Printer. In addition to the requirements set forth in the Internet Printing Protocol/1.1 [STD92],
950 this specification defines how a Printer advertises custom and roll-fed media in the "media-
951 supported" attribute.

952 Custom media sizes are described using two self-describing media names. The
953 "custom_min_WIDTHxHEIGHTunits" value provides the minimum custom media
954 dimensions and the "custom_max_WIDTHxHEIGHTunits" value provides the maximum
955 custom media dimensions. The size name MUST include the source name if different
956 dimensions are supported by each source. Dimensions are provided for sheets in portrait
957 orientation, that is the "WIDTH" values refer to the short axis and the "HEIGHT" values refer
958 to the long axis of the sheet. For example, a Printer supporting sheet media from 50x50mm
959 to 330.2x482.6mm from the by-pass tray could report:

```
960     media-supported=..., custom_max.by-pass-tray_330.2x482.6mm,  
961     custom_min.by-pass-tray_50x50mm,...
```

962 Similarly, roll media sizes are described using the "roll_min_WIDTHxHEIGHTunits" and
963 "roll_max_WIDTHxHEIGHTunits" names. The "WIDTH" values refer to the supported roll
964 widths while the "HEIGHT" values refer to the supported roll lengths. The size name MUST
965 include the source name if the Printer supports multiple source with different roll limits.

966 For example, a Printer supporting a single roll 8 to 60 inches wide and 6 inches to 300 feet
967 long would report:

```
968     media-supported=..., roll_max_60x3600in, roll_min_8x6in,...
```

969 A Printer supporting two rolls, one 8 to 60 inches wide and 6 inches to 300 feet long and
970 the other 8 to 36 inches wide and 6 inches to 150 feet long would report:

971 `media-size-supported=...,roll_max.roll-1_60x3600in,roll_min.roll-1_8x6in,`
972 `roll_max.roll-2_36x1800in,roll_min.roll-2_8x6in,...`

973 5.3.6 pdl-override-supported (type2 keyword)

974 The REQUIRED "pdl-override-supported" Printer attribute informs the Client whether Job
975 Ticket information embedded in the Document data for a Job is overridden by Job Template
976 attributes.

977 When reporting capabilities for the 'application/pdf', 'image/jpeg', or 'image/pwg-raster'
978 MIME media types, Printers MUST report either 'attempted' [STD92] or 'guaranteed'
979 [PWG5100.7] for the "pdl-override-supported" Printer attribute.

980 5.4 IPP Printer Status Attributes

981 Table 5 lists the Printer Status attributes for an IPP Everywhere™ Printer. All attributes in
982 the table are REQUIRED unless otherwise specified.

983 **Table 7 - IPP Everywhere™ Printer Status Attributes**

Attribute	Reference
pages-per-minute	STD 92
pages-per-minute-color	STD 92
printer-alert	PWG 5100.9
printer-alert-description	PWG 5100.9
printer-config-change-date-time	PWG 5100.13
printer-config-change-time	PWG 5100.13
printer-is-accepting-jobs	STD 92
printer-more-info (note 1)	STD 92
printer-state	STD 92
printer-state-change-date-time	RFC 3995
printer-state-change-time	RFC 3995
printer-state-message	STD 92
printer-state-reasons	STD 92
printer-strings-languages-supported (note 2)	PWG 5100.13
printer-strings-uri (notes 1 and 2)	PWG 5100.13
printer-supply (notes 3 and 4)	PWG 5100.13
printer-supply-description (notes 3 and 4)	PWG 5100.13
printer-supply-info-uri (notes 1, 3, and 4)	PWG 5100.13
printer-up-time	STD 92
printer-uri-supported (note 1)	STD 92
printer-uuid	PWG 5100.13
pwg-raster-document-resolution-supported	PWG 5102.4

Attribute	Reference
pwg-raster-document-sheet-back	PWG 5102.4
pwg-raster-document-type-supported	PWG 5102.4
queued-job-count	STD 92

- 984 Note 1: URIs MUST be absolute, SHOULD use the Host value (including port
 985 number) from the HTTP Host header (section 5.1.1), and MUST NOT use link-local
 986 addresses (section 8.4).
 987 Note 2: RECOMMENDED due to its omission from IPP Everywhere™ 1.0, however
 988 it is needed for the underlying functionality.
 989 Note 3: CONDITIONALLY REQUIRED for Printers that use marker supplies.
 990 Note 4: RECOMMENDED for Logical Devices, REQUIRED otherwise.

991 5.4.1 printer-uri-supported (1setOf uri)

- 992 The REQUIRED "printer-uri-supported" Printer attribute provides 'ipp' and 'ipps' URIs that
 993 can be used to access the Printer. Printers SHOULD advertise URIs with a resource path
 994 of the form "/ipp/print" or "/ipp/print/queuename".

995 5.5 IPP Operation Attributes

- 996 Table 8 lists the REQUIRED operation attributes for an IPP Everywhere™ Printer.

997 **Table 8 - REQUIRED IPP Everywhere™ Operation Attributes**

Attribute	Reference
compression	STD 92
document-format	STD 92
document-name	STD 92, PWG 5100.5
document-password (note 1)	PWG 5100.13
first-index	PWG 5100.13
first-job-id	STD 92
identify-actions	PWG 5100.13
ipp-attribute-fidelity	STD 92
job-ids	PWG 5100.7
job-mandatory-attributes (note 3)	PWG 5100.7
job-name	STD 92
job-password (note 2)	PWG 5100.11
job-password-encryption (note 2)	PWG 5100.11
last-document	STD 92
limit	STD 92
requesting-user-name	STD 92
requesting-user-uri	PWG 5100.13
which-jobs	STD 92, PWG 5100.7

998 Note 1: CONDITIONALLY REQUIRED for Printers that support the "application/pdf"
 999 MIME media type.
 1000 Note 2: CONDITIONALLY REQUIRED for Printers that support the Print to a
 1001 Recipient (section 3.2.2.8) use case.
 1002 Note 3: CONDITIONALLY REQUIRED for Printers that implement Paid Imaging
 1003 services.

1004 **Table 9 - RECOMMENDED IPP Everywhere™ Operation Attributes**

Attribute	Reference
job-authorization-uri	PWG 5100.16
job-impressions-estimated	PWG 5100.16

1005 5.6 IPP Job Description Attributes

1006 Table 10 lists the REQUIRED Job Description attributes for an IPP Everywhere™ Printer.

1007 **Table 10 - IPP Everywhere™ Required Job Description Attributes**

Attribute	Reference
job-name	STD 92

1008 5.7 IPP Job Status Attributes

1009 Table 10 lists the REQUIRED Job Status attributes for an IPP Everywhere™ Printer.

1010 **Table 11 - IPP Everywhere™ Required Job Status Attributes**

Attribute	Reference
date-time-at-completed	STD 92
date-time-at-creation	STD 92
date-time-at-processing	STD 92
job-id	STD 92
job-impressions	STD 92
job-impressions-completed	STD 92
job-originating-user-name	STD 92
job-printer-up-time	STD 92
job-printer-uri (note 1)	STD 92
job-state	STD 92
job-state-message	STD 92
job-state-reasons	STD 92
job-uri (note 1)	STD 92
job-uuid	PWG 5100.13
time-at-completed	STD 92
time-at-creation	STD 92
time-at-processing	STD 92

1011
 1012 Note 1: URIs MUST be absolute, SHOULD use the Host value from HTTP header
 1013 (section 5.1.1), and MUST NOT use link-local addresses (section 8.4).

1014 5.7.1 job-id (integer)

1015 The REQUIRED "job-id" Job Description attribute contains the ID of the Job. In order to
 1016 support reliable job submission and management, Printers MUST NOT reuse "job-id"
 1017 values since the last power cycle of the Printer and SHOULD NOT reuse "job-id" values
 1018 for the life of the Printer as described in section 3.1.2.3.9 of the Internet Printing
 1019 Protocol/1.1: Implementer's Guide [RFC3196].

1020 5.7.2 job-uri (uri)

1021 The REQUIRED "job-uri" Job Description attribute contains the absolute URI of the Job. In
 1022 order to support reliable job submission and management, Printers MUST NOT reuse
 1023 "job-uri" values since the Printer was last powered up and SHOULD NOT reuse "job-uri"
 1024 values for the life of the Printer as described in section 3.1.2.3.9 of the Internet Printing
 1025 Protocol/1.1: Implementer's Guide [RFC3196]. In addition, the "job-uri" value SHOULD be
 1026 derived from the "job-id" value as described in the IPP URL Scheme [RFC3510].

1027 5.8 IPP Job Template Attributes

1028 Table 12 lists the Job Template attributes for an IPP Everywhere™ Printer. All attributes in
 1029 the table are REQUIRED unless otherwise specified.

1030 **Table 12 - REQUIRED IPP Everywhere™ Job Template Attributes**

Attribute	Reference
copies (note 2)	STD 92
finishings (note 4)	STD 92
finishings-col (note 4)	PWG 5100.1
finishings-col.finishing-template (note 4)	PWG 5100.1
job-account-id (note 1)	PWG 5100.7
job-accounting-user-id (note 1)	PWG 5100.7
media	STD 92
media-col	PWG 5100.7
media-col.media-bottom-margin	PWG 5100.7
media-col.media-left-margin	PWG 5100.7
media-col.media-right-margin	PWG 5100.7
media-col.media-size	PWG 5100.7
media-col.media-source	PWG 5100.7
media-col.media-top-margin	PWG 5100.7
media-col.media-type	PWG 5100.7
multiple-document-handling (note 3)	STD 92
orientation-requested	STD 92

Attribute	Reference
output-bin	PWG 5100.2
overrides (note 3)	PWG 5100.6
overrides.document-numbers (note 6)	PWG 5100.6
page-ranges (note 3)	STD 92
print-color-mode	PWG 5100.13
print-rendering-intent (note 7)	PWG 5100.13
print-quality	STD 92
printer-resolution	STD 92
sides	STD 92

- 1031 Note 1: CONDITIONALLY REQUIRED for Printers that implement paid imaging
 1032 services.
 1033 Note 2: CONDITIONALLY REQUIRED for the "application/pdf" and "image/jpeg"
 1034 MIME media types.
 1035 Note 3: CONDITIONALLY REQUIRED for Printers that support the "application/pdf"
 1036 MIME media type.
 1037 Note 4: CONDITIONALLY REQUIRED for Printers with finishers.
 1038 Note 5: CONDITIONALLY REQUIRED for Printers that support long-edge feed
 1039 media.
 1040 Note 6: CONDITIONALLY REQUIRED for Printers that support multiple-Document
 1041 Jobs.
 1042 Note 7: CONDITIONALLY REQUIRED for Printers that support ICC-based color
 1043 management.

1044 **Table 13 - RECOMMENDED IPP Everywhere™ Job Template Attributes**

Attribute	Reference
job-account-type	PWG 5100.16
print-content-optimize	PWG 5100.7
print-scaling	PWG 5100.16

1045

1046 **6. Document Formats**

1047 Printers MUST support documents conforming to the PWG Raster Format [PWG5102.4]
1048 ("image/pwg-raster"). Color Printers MUST and monochrome Printers SHOULD support
1049 documents conforming to the JPEG File Information Format Version 1.02 [JFIF]
1050 ("image/jpeg"), specifically the metadata and JPEG subset defined in the Standard of the
1051 Camera & Imaging Products Association, CIPA DC-008-Translation-2016, Exchangeable
1052 image file format for digital still cameras: Exif Version 2.31 [EXIF].

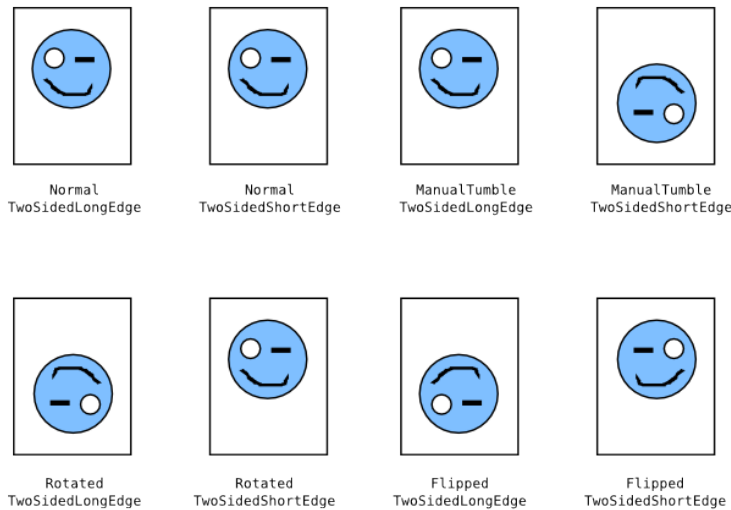
1053 Printers SHOULD support documents conforming to Document management — Portable
1054 document format — Part 1: PDF 1.7 [ISO32000] ("application/pdf").

1055 **6.1 Supporting Long-Edge Feed Media with PWG Raster Format**
1056 **Documents**

1057 Printers that support long-edge feed media MUST report the "media-source-properties"
1058 member attribute in the "media-col-database" and "media-col-ready" Printer attributes.

1059 When submitting a PWG Raster document in a Job or Document Creation request, Clients
1060 MUST additionally query the Printer for the "media-col-database" and/or "media-col-ready"
1061 Printer attributes in order to provide a document in the correct orientation and dimensions
1062 for the Printer.

1063 Figures 2 through 5 show how raster data must be formatted for each feed orientation.

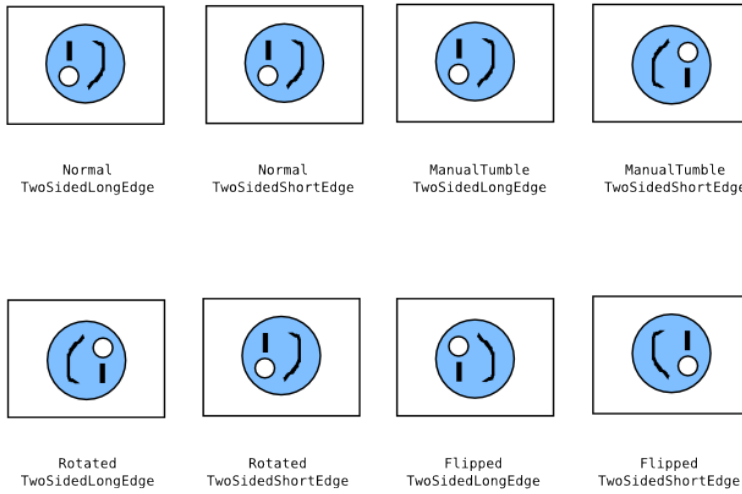


1064

1065

Figure 1 - PWG Raster Bitmaps with Portrait Feed Orientation

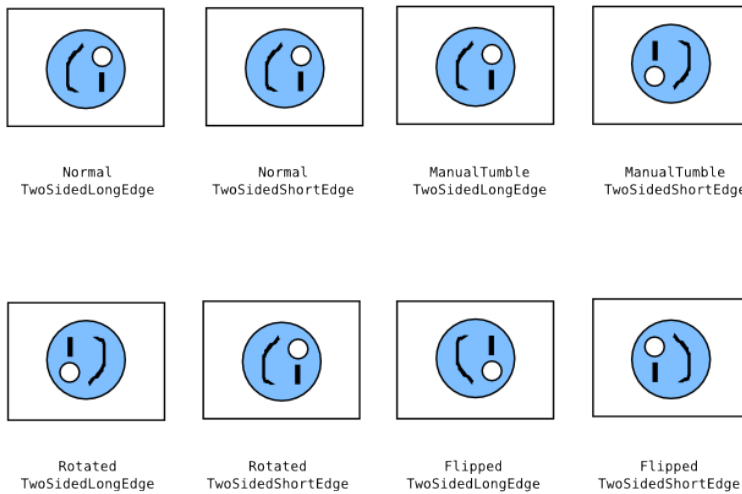
1066



1067

1068

Figure 2 - PWG Raster Bitmaps with Landscape Feed Orientation



1069

1070

1071

Figure 3 - PWG Raster Bitmaps with Reverse Landscape Feed Orientation

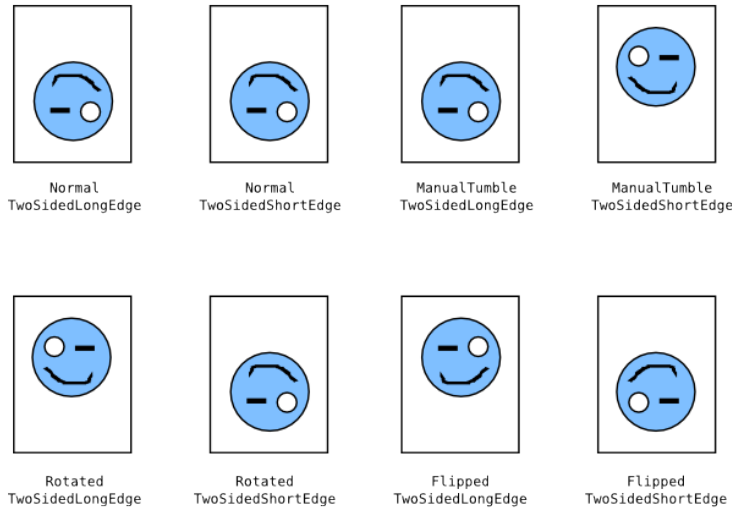


Figure 4 - PWG Raster Bitmaps with Reverse Portrait Feed Orientation

1072

1073

1074 7. Additional Values for Existing Attributes

1075 7.1 ipp-features-supported (1setOf type2 keyword)

1076 This specification defines the REQUIRED keyword 'ipp-everywhere' for the "ipp-features-
1077 supported" Printer attribute.

1078 This specification also defines the CONDITIONALLY REQUIRED keyword 'ipp-everywhere-
1079 server' for the "ipp-features-supported" Printer attribute. Printers representing Logical
1080 Devices MUST report this keyword. Printers representing Physical Devices MUST NOT
1081 report this keyword.

1082 8. Additional Semantics for Existing Value Tags

1083 This specification amends the definition of the nameWithLanguage,
1084 nameWithoutLanguage, naturalLanguage, textWithLanguage, textWithoutLanguage, and
1085 URI value tags defined in the Internet Printing Protocol/1.1 [STD92] with additional
1086 restrictions to improve interoperability.

1087 **8.1 nameWithLanguage and nameWithoutLanguage**

1088 Name values MUST NOT contain characters in the "C0 Control Character Set" or the DEL
1089 character as defined in Unicode Format for Network Interchange [RFC5198]. Printers MUST
1090 transcode and filter values from MIBs and other sources to conform to the added
1091 restrictions.

1092 **8.2 naturalLanguage**

1093 NaturalLanguage values MUST conform to and be compared as defined in Tags for
1094 Identifying Languages [BCP47]. The shortest language tag MUST be used, e.g., "en"
1095 instead of "eng" for English. Printers SHOULD also support legacy language tags such as:

1096 'no'; replaced by 'nb' (Norwegian Bokmål),

1097 'zh-cn'; replaced by 'zh-hans' (Simplified Chinese), and

1098 'zh-tw'; replaced by 'zh-hant' (Traditional Chinese)

1099 **8.3 textWithLanguage and textWithoutLanguage**

1100 Text values MUST NOT contain the DEL character or characters in the "C0 Control
1101 Character Set" other than CR, LF, and HT [RFC5198]. Printers MUST transcode and filter
1102 values from MIBs and other sources to conform to the added restrictions.

1103 **8.4 uri**

1104 URI values MUST be in absolute form, i.e., "ipp://hostname.local/ipp/print" is acceptable but
1105 "///ipp/print" is not. URI values MUST NOT contain link-local addresses in the host field.
1106 Printers MUST NOT generate URI values with link-local addresses and SHOULD NOT
1107 generate URI values with IP addresses obtained via Dynamic Host Control Protocol (DHCP)
1108 [RFC2131] or other auto-configuration protocols. Printers SHOULD use the HTTP Host:
1109 header value when generating URIs for use in Client responses.

1110 **9. Conformance Requirements**

1111 This section summarizes the Conformance Requirements detailed in the definitions in this
1112 document for Clients and Printers.

1113 **9.1 Conformance Requirements for Clients**

1114 In order for a Client to claim conformance to this specification a Client MUST support the
1115 following:

- 1116 1. DNS Service Discovery as defined in section 4.2
- 1117 2. IPP/2.0 as defined in section 5
- 1118 3. The REQUIRED operations listed in Table 4
- 1119 4. The REQUIRED Printer Description attributes listed in Table 5
- 1120 5. The REQUIRED operation attributes listed in Table 8
- 1121 6. The REQUIRED Job Template attributes listed in Table 12
- 1122 7. The REQUIRED Job Description attributes listed in Table 10
- 1123 8. The REQUIRED document formats listed in section 5.8
- 1124 9. The "media-source-properties" member attribute of the "media-col-database"
- 1125 and "media-col-ready" Printer attributes as reported by the Printer and defined
- 1126 in section 6.1
- 1127 10. The internationalization considerations as defined in section 10
- 1128 11. The security considerations as defined in section 0

1129 9.2 Conformance Requirements for Printers

1130 In order for a Printer to claim conformance to this specification a Printer MUST support the
1131 following:

- 1132 1. DNS Service Discovery as defined in section 4.2
- 1133 2. IPP/2.0 as defined in section 5
- 1134 3. The REQUIRED operations listed in Table 4
- 1135 4. The REQUIRED Printer Description attributes listed in Table 5
- 1136 5. The REQUIRED operation attributes listed in Table 8
- 1137 6. The REQUIRED Job Template attributes listed in Table 12
- 1138 7. The REQUIRED Job Description attributes listed in Table 10
- 1139 8. The REQUIRED document formats listed in section 5.8
- 1140 9. The 'ipp-everywhere' value for the "ipp-features-supported" Printer Description
- 1141 attribute as defined in section 7.1
- 1142 10. The additional semantics for attribute values as defined in section 8
- 1143 11. The internationalization considerations as defined in section 10
- 1144 12. The security considerations as defined in section 0
- 1145 13. The safe string truncation rules as defined in section 13

1146 9.3 Conditional Conformance Requirements for Printers

1147 Printers that support the "image/jpeg" [JFIF] MIME media type MUST support:

- 1148 1. The "copies-default", and "copies-supported" Printer Description attributes as
- 1149 defined in section 5.3.
- 1150 2. The "copies" Job Template attribute as defined in section 5.8.

1151 Printers that support the "application/pdf" [ISO32000] MIME media type MUST support:

- 1152 1. The "copies-default", "copies-supported", "document-password-supported", and
1153 "page-ranges-supported" Printer Description attributes as defined in section 5.3,
1154 2. The "document-password" Operation attribute as defined in section 5.4, and
1155 3. The "copies", "multiple-document-handling", "overrides", and "page-ranges" Job
1156 Template attributes as defined in section 5.8.

1157 Printers that support the Print to a Recipient use case (section 3.2.2.8) MUST support:

- 1158 1. The "job-password-supported" and "job-password-encryption-supported" Printer
1159 Description attributes as defined in section 5.3, and
1160 2. The "job-password" and "job-password-encryption" Operation attributes as
1161 defined in section 5.4.

1162 Printers that provide Paid Print services MUST support:

- 1163 1. The "job-account-id-default", "job-account-id-supported", "job-accounting-user-
1164 id-default", "job-accounting-user-id-supported", "job-mandatory-attributes-
1165 default", "job-mandatory-attributes-supported", and "printer-mandatory-job-
1166 attributes" Printer Description attributes as defined in section 5.3,
1167 1. The "job-mandatory-attributes" operation attribute as defined in section 5.4, and
1168 2. The "job-account-id" and "job-accounting-user-id" Job Template attributes as
1169 defined in section 5.8.

1170 Printers that support long-edge feed media MUST support the "media-source-properties"
1171 member attribute of the "media-col-database" and "media-col-ready" Printer Description
1172 attributes as defined in section 5.3.

1173 Printers that support ICC-based color management MUST support:

- 1174 1. The "print-rendering-intent-default", "print-rendering-intent-supported", and
1175 "printer-icc-profiles" Printer Description attributes as defined in section 5.3.
1176 2. The "print-rendering-intent" Job Template attribute as defined in section 5.8.

1177 Printers representing Logical Devices MUST report the 'ipp-everywhere-server' value for
1178 the "ipp-features-supported" Printer Description attribute as defined in section 7.1.

1179 **10. Internationalization Considerations**

1180 For interoperability and basic support for multiple languages, conforming implementations
1181 MUST support:

- 1182 1. The Universal Character Set (UCS) Transformation Format -- 8 bit (UTF-8)
1183 [STD63] encoding of Unicode [UNICODE] [ISO10646]; and
1184 2. The Unicode Format for Network Interchange [RFC5198] which requires
1185 transmission of well-formed UTF-8 strings and recommends transmission of
1186 normalized UTF-8 strings in Normalization Form C (NFC) [UAX15].

1187 Unicode NFC is defined as the result of performing Canonical Decomposition (into base
1188 characters and combining marks) followed by Canonical Composition (into canonical
1189 composed characters wherever Unicode has assigned them).

1190 WARNING – Performing normalization on UTF-8 strings received from Clients and
1191 subsequently storing the results (e.g., in Job objects) could cause false negatives in Client
1192 searches and failed access (e.g., to Printers with percent-encoded UTF-8 URIs now
1193 'hidden').

1194 Implementations of this specification SHOULD conform to the following standards on
1195 processing of human-readable Unicode text strings, see:

1196 Unicode Bidirectional Algorithm [UAX9] – left-to-right, right-to-left, and vertical

1197 Unicode Line Breaking Algorithm [UAX14] – character classes and wrapping

1198 Unicode Normalization Forms [UAX15] – especially NFC for [RFC5198]

1199 Unicode Text Segmentation [UAX29] – grapheme clusters, words, sentences

1200 Unicode Identifier and Pattern Syntax [UAX31] – identifier use and normalization

1201 Unicode Collation Algorithm [UTS10] – sorting

1202 Unicode Locale Data Markup Language [UTS35] – locale databases

1203 Implementations of this specification are advised to also review the following informational
1204 documents on processing of human-readable Unicode text strings:

1205 Unicode Character Encoding Model [UTR17] – multi-layer character model

1206 Unicode Character Property Model [UTR23] – character properties

1207 Unicode Conformance Model [UTR33] – Unicode conformance basis

1208 **11. Security Considerations**

1209 The IPP extensions defined in this document require the same security considerations as
1210 defined in the Internet Printing Protocol/1.1 [STD92]. In addition, Printers MUST validate
1211 the HTTP Host request header in order to protect against DNS rebinding attacks.

1212 Implementations of this specification SHOULD conform to the following standard on
1213 processing of human-readable Unicode text strings, see:

1214 Unicode Security Mechanisms [UTS39] – detecting and avoiding security attacks

- 1215 Implementations of this specification are advised to also review the following
 1216 informational document on processing of human-readable Unicode text strings:
 1217 Unicode Security FAQ [UNISECFAQ] – common Unicode security issues

1218 12. IANA Considerations

1219 12.1 Attribute Value Registrations

- 1220 The keyword attribute values defined in this document will be published by IANA according
 1221 to the procedures in the Internet Printing Protocol/1.1 [STD92] in the following file:

1222 <http://www.iana.org/assignments/ipp-registrations>

- 1223 The registry entries will contain the following information:

1224	Attributes (attribute syntax)	
1225	Keyword Attribute Value	Reference
1226	-----	-----
1227	ipp-features-supported (1setOf type2 keyword)	[PWG5100.13]
1228	ipp-everywhere	[PWG5100.14]
1229	ipp-everywhere-server	[PWG5100.14]

1230 13. Safe String Truncation

- 1231 Strings can be truncated or omitted when transferred over alternate protocols. Printers
 1232 MUST truncate long strings at logical boundaries. The following subsections describe how
 1233 this truncation is performed for different kinds of strings.

1234 13.1 Plain Text Strings

- 1235 Plain text strings MUST be truncated at the end of a valid character sequence. For example,
 1236 strings using the UTF-8 transformation format of ISO 10646 [STD0063] [ISO10646-1]
 1237 SHOULD be represented using the Unicode Format for Network Interchange [RFC5198]
 1238 and MUST be truncated at the end of a valid UTF-8 sequence.

- 1239 For example, the 9 octet UTF-8 sequence 0x48.65.CA.81.6C.6C.6F.C2.81 (Héllöj) would
 1240 be shortened to fit within 6 octets by composing the é (0x65.CA.81 becomes 0xC3.A9) and
 1241 removing the trailing UTF-8 sequence 0xC2.81 (j), resulting in the 6 octet UTF-8 sequence
 1242 0x48.C3.A9.6C.6C.6F (Héllö).

1243 13.2 URIs

- 1244 URIs MUST be truncated so that the URI remains valid and accepted by the Printer. For
 1245 example, the 46 octet URI "ipp://printer.example.com/ipp/really-long-name" might be

1246 shortened to fit within 32 octets by removing the last path name component, resulting in the
1247 29 octet URI "ipp://printer.example.com/ipp". Similarly, the 52 octet URI
1248 "ipp://printer.example.com/ipp?query-string" might be shortened to fit within 32 octets by
1249 removing the query string.

1250 As recommended by the Uniform Resource Identifier (URI): Generic Syntax [STD66],
1251 Printers SHOULD omit the port number from the URI when it has the default value, e.g., 80
1252 for "http", 443 for "https", and 631 for "ipp" and "ipps" URIs.

1253 **13.3 MIME Media Types**

1254 MIME media type strings MUST be truncated at the end of the media subtype, removing
1255 any parameters that are included with the media type. If the resulting string still exceeds the
1256 maximum length it MUST be discarded. For example, the 24 octet MIME media type
1257 "text/plain;charset=utf-8" would be shortened to fit within 16 octets by removing the trailing
1258 parameter, resulting in the 10 octet MIME media type "text/plain".

1259 **13.4 Delimited Lists**

1260 Delimited Lists combine one or more string types listed in the previous sections, separated
1261 by a delimiting character such as a comma or semicolon. Delimited lists MUST first be
1262 shortened by removal of unnecessary path components (URIs) and parameters (MIME
1263 media types) and second truncated at a delimiting character. For example, the 40 octet list
1264 of MIME media types "text/plain;charset=utf-8,application/pdf" would be shortened to fit
1265 within 32 octets by removing the MIME media type parameter, resulting in the 26 octet list
1266 "text/plain,application/pdf". The same list would be shortened to fit within 16 octets by also
1267 removing the last MIME media type, resulting in the 10 octet list "text/plain".

1268 **14. Overview of Changes**

1269 **14.1 IPP Everywhere™ v1.1**

1270 The following changes were made to PWG 5100.14-2013: IPP Everywhere [PWG5100.14-
1271 2013]:

- 1272 • Print Servers (Logical Devices) are now explicitly addressed;
- 1273 • References now point to the current versions of dependent documents and
1274 specifications at the time of publication;
- 1275 • Requirements for WS-Discovery have been removed due to a lack of
1276 implementations, which effectively made WS-Discovery support OPTIONAL;
- 1277 • References to OpenXPS and SSDP have been removed;

- 1278 • The "printer-device-id" Printer Description attribute and associated DNS-SD TXT
1279 record keys are no longer required;
- 1280 • DNS-SD is now RECOMMENDED for Printers representing Logical Devices (print
1281 servers);
- 1282 • ICC attributes are now CONDITIONALLY REQUIRED for printers that support ICC-
1283 based color management;
- 1284 • JPEG support is now CONDITIONALLY REQUIRED for color printers;
- 1285 • The "compression-supplied", "document-format-supplied", "document-format-
1286 version", "document-format-version-supplied", "document-name-supplied" attributes
1287 are no longer required;
- 1288 • The "feed-orientation", "feed-orientation-default", and "feed-orientation-supported"
1289 attributes are no longer required;
- 1290 • The "print-content-optimize", "print-content-optimize-default", and "print-content-
1291 optimize-supported" attributes have been reduced to RECOMMENDED;
- 1292 • IPP Finishings 2.1 and the "finishings-col" Job Template attribute are now
1293 RECOMMENDED;
- 1294 • The "printer-input-tray" and "printer-output-tray" Printer Description attributes are
1295 now RECOMMENDED to provide tray information and status;
- 1296 • The "printer-supply", "printer-supply-description", and "printer-supply-info-uri" Printer
1297 Status attributes are now CONDITIONALLY REQUIRED for Printers that have
1298 supplies;
- 1299 • The "printer-strings-languages-supported" and "printer-strings-uri" Printer Status
1300 attributes are now RECOMMENDED to support localization; and
- 1301 • Printer Status and Job Status attributes are now listed in a separate section to match
1302 STD 92 and the IANA IPP registry.

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1497

1498 **16. Authors' Addresses**

1499 Primary authors:

1500 Michael Sweet
1501 Lakeside Robotics Corporation

1502
1503 Ira McDonald
1504 High North
1505 PO Box 221
1506 Grand Marais, MI 49839

1507 Send comments to the PWG IPP Mailing List:

1508 ipp@pwg.org (subscribers only)

1509 To subscribe, see the PWG web page:

1510 <https://www.pwg.org/ipp>

1511 Implementers of this specification document are encouraged to join the IPP Mailing List in
1512 order to participate in any discussions of clarification issues and review of registration
1513 proposals for additional attributes and values.

1514 The editors would like to especially thank the following individuals who also contributed
1515 significantly to the development of this document:

1516 Andrew Mitchell
1517 Jerry Thrasher - Lexmark
1518 Peter Zehler - Xerox
1519

1520 **17. Change History**

1521 **17.1 March 12, 2020**

- 1522 • Removed references to the Apple Bonjour Printing Specification
- 1523 • Updated DNS-SD text per IPP WG last call feedback, and removed deprecated TXT
1524 keys.
- 1525 • Updated TLS 1.3 references
- 1526 • Updated LDAP text (no more printer-device-id, and didn't need to truncation warning
1527 anymore)

1528 **17.2 February 19, 2020**

- 1529 • Global: Changed "Printers for Logical Devices" to "Printers representing Logical
1530 Devices"
- 1531 • Section 5.3: Added max-page-ranges-supported and printer-firmware-xxx to
1532 recommended list.
- 1533 • Section 7.1: Clarified that logical devices report as server, physical devices do not.
- 1534 • Section 9.3: "print-rendering-intent"
- 1535 • Section 16: Dropped my email address

1536 **17.3 February 11, 2020**

- 1537 • Fixed document links on cover page.
- 1538 • Brought back REPERTOIRE reference for job-password-repertoire-xxx attributes
- 1539 • Added CONDITIONALLY REQUIRED 'ipp-everywhere-server' keyword for Logical
1540 Devices.
- 1541 • Sprinkled RECOMMENDED throughout for attributes and values that are not
1542 required for Logical Devices.
- 1543 • Added notes for media-xxx-ready and Logical Devices, to make it clear that all
1544 Printers must still support ready media even if the Printer doesn't represent a single
1545 physical printer.

- 1546 • Simplified PDF requirements to SHOULD for all printers - previously it was SHOULD
1547 for IPP/2.0 and MUST for IPP/2.1 and IPP/2.2.

- 1548 • Dropped remaining references to feed-orientation.

- 1549 • Deleted unused OASIS acronym.

- 1550 •

1551 **17.4 February 10, 2020**

- 1552 • Reverted PWG 5100.EPX reference to published specification (5100.11)

- 1553 • Global: RFC 8011 now STD 92

- 1554 • Updated document author information

1555 **17.5 August 27, 2019**

- 1556 • Updated references - published PWG 5100.7 update and working draft of EPX

1557 **17.6 June 27, 2019**

- 1558 • Removed feed-orientation-xxx attributes (obsolete)

- 1559 • Add pdl-override-supported to list of required Printer Description attributes (was
1560 already required in the text, just missing from the table)

- 1561 • Made print-content-optimize RECOMMENDED

- 1562 • Made printer-input-tray and printer-output-tray RECOMMENDED

- 1563 • Global: Change PWG 5100.3 and 5100.11, and all media-col attrs, to PWG 5100.7
1564 (JOBEXT v2.0)

1565 **17.7 January 28, 2019**

- 1566 • Status: Stable

- 1567 • Updated reference to v1.0 to use -2013 suffix.

- 1568 • Sections 3.1 and 15.1: Added references to 5100.16 and registration documents

- 1569 • Section 5.3: Added recommended attributes table

- 1570 • Section 5.5: Added recommended attributes table
- 1571 • Sections 5.6 and 5.7: Tables used "Source" heading instead of "Reference"
- 1572 • Section 5.8: Table 10 had wrong note for finishings-col, added finishings-
1573 col.finishing-template, made note 2 conditionally required, added recommended
1574 attributes table

1575 **17.8 September 26, 2018**

- 1576 • Removed the "compression-supplied", "document-format-supplied", "document-
1577 format-version", "document-format-version-supplied", and "document-name-
1578 supplied" attributes from the required attribute lists since the corresponding attributes
1579 are being obsoleted in PWG 5100.7.

1580 **17.9 August 24, 2018**

- 1581 • The current version of the Bonjour Printing Specification is 1.2.1.
- 1582 • Section 4: DNS-SD is now required for physical devices and recommended for
1583 logical devices (print servers)
- 1584 • Section 5.1: Clarified that the use of the Host header value includes the port number.
- 1585 • Section 5.3: Moved printer-more-info to 5.4 Printer Status attributes
- 1586 • Section 5.4: Added RECOMMENDED printer-strings-languages-supported and
1587 printer-strings-uri attributes from JPS3
- 1588 • Section 6: Still recommend JPEG for monochrome printers
- 1589 • Section 8.4: Clarified that we mean IP addresses from DHCP
- 1590 • Section 9.3: Fixed section 5.3 references
- 1591 • Section 10: Dropped UTR20 (now maintained by the W3C, but why do we care about
1592 XML here?)
- 1593 • Section 12.1: Fixed STD 92 reference
- 1594 • Section 14.1: Updated the change list
- 1595 • Section 15.1: Fixed up STD 92 reference, added references to PWG 5100.18 (IPP
1596 INFRA) and RFCs 6749 and 6750 (OAuth 2.0), updated all Unicode references,
1597 dropped UTR20 (which is now maintained by the W3C)

1598 **17.10 July 4, 2018**

- 1599 • Status: Prototype
- 1600 • RFC 8011 is now STD 92
- 1601 • Updated Unicode to 11.0.0.

1602 **17.11 June 6, 2018**

- 1603 • Section 5.7: Fixed cross-reference to Table 10.
- 1604 • Section 14.1: Cleaned up WS-Discovery bullet.
- 1605 • Section 15.2: Updated Bonjour Printing specification reference.

1606 **17.12 April 17, 2018**

- 1607 • Removed all references to 1284 device IDs and associated information.

1608 **17.13 April 16, 2018**

- 1609 • Made sure IPP Everywhere™ consistently has trademark symbol.
- 1610 • Section 1: Drop examples of mobile devices.
- 1611 • Section 4.2.3.4: TLS key required for IPPS.
- 1612 • Section 5.1: Fix typos.
- 1613 • Section 5.2: Made Identify-Printer operation recommended for logical devices,
1614 required otherwise.
- 1615 • Sections 5.3 and 5.8: Made print-rendering-intent and printer-icc-profiles
1616 conditionally required for printers that support ICC-based color management.
- 1617 • Section 5.3.6: Clarify pdl-override-supported values and usage.
- 1618 • Section 5.7: Deleted stray "note 7"
- 1619 • Section 9.3: Added ICC attributes here.
- 1620 • Section 14: Reworded for present tense, clarified why WS-Discovery has been
1621 removed, removed reason for removing OpenXPS and SSDP.

1622 **17.14 April 3, 2018**

- 1623 • Make JPEG support conditionally required for color printers.

1624 **17.15 February 9, 2018**

- 1625 • Initial v1.1 draft
- 1626 • Updated template
- 1627 • Updated abstract (can't call it a standard in the abstract)
- 1628 • Updated spec references to current versions
- 1629 • Dropped all mention of UPNP, SSDP, WS-Discovery, and OpenXPS (never
1630 implemented)
- 1631 • Added a new "Overview of Changes" chapter that documents the high-level changes
1632 since the original IPP Everywhere specification
- 1633 • Now recommend support for the Get-User-Printer-Attributes operation
- 1634 • Now recommend support for the "finishings-col" attributes (PWG 5100.1)
- 1635 • Now recommend support for TLS 1.3
- 1636 • Now recommend using a resource path of /ipp/print or /ipp/print/name in Printer URIs
- 1637 • Issue 11: printer-current-time is now listed as an IPP Everywhere attribute, although
1638 only RECOMMENDED since it was missing in the 1.0 spec. (all of the date-time
1639 attributes were previously required, so printer-current-time would have implicitly been
1640 required)
- 1641 • Issue 12: The reference to PWG 5100.12 has been corrected
- 1642 • Issue 13: The reference to the EXIF specification has been updated.
- 1643 • Issue 13: The reference to PWG 5101.1 has been updated.
- 1644 • Issue 14: Clarified the pdl-override-supported requirements ('attempted' or
1645 'guaranteed')
- 1646 • Issue 15: Clarified that relative URIs ("//ipp/print") are not allowed in IPP.
- 1647 • Issue 26: "job-preferred-attributes-supported" should have been "preferred-
1648 attributes-supported"

- 1649 • Issue 31: Incorrect references to PWG 5101.2 have been changed to PWG 5101.1
1650 (MSN)
- 1651 • Issue 33: The notes concerning IPP/2.x conformance changes were confusing and
1652 have been removed
- 1653 • Issue 34: Table 6: overrides-supported now correctly references "note 2"
1654 (conditionally required).
- 1655 • Issue 35: overrides-supported.document-numbers is now CONDITIONALLY
1656 REQUIRED
- 1657 • Fixed attribute examples to use PAPI encoding
- 1658 • Fixed notes concerning "copies" to indicate that support is required for JPEG and
1659 PDF documents
- 1660 • Separated Printer Status attributes from Printer Description
- 1661 • Separated Job Status attributes from Job Description

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