



The Printer Working Group

August 24, 2018
Working Draft

Deleted: July 4

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IPP Everywhere™ v1.1

Status: Prototype

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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82 multiple independent and interoperable implementations. Printer manufacturers and
83 vendors of printer related software benefit from the interoperability provided by voluntary
84 conformance to these standards.

85 For additional information regarding the Printer Working Group visit:

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	Table of Contents	
94		
95	1. Introduction.....	7
96	2. Terminology.....	7
97	2.1 Printing Terminology.....	7
98	2.2 Protocol Role Terminology.....	8
99	2.3 Other Terminology.....	8
100	2.4 Acronyms and Organizations.....	9
101	3. Requirements.....	10
102	3.1 Rationale.....	10
103	3.2 Use Cases.....	11
104	3.2.1 Select Printer.....	11
105	3.2.2 Print.....	13
106	3.2.3 Exceptions.....	16
107	3.3 Out of Scope.....	17
108	3.4 Design Requirements.....	18
109	4. Discovery Protocols.....	19
110	4.1 Printer Description Attributes Used in Discovery.....	19
111	4.2 DNS Service Discovery (DNS-SD).....	19
112	4.2.1 Service (SRV) Instance Name.....	19
113	4.2.2 Geo-Location (LOC).....	19
114	4.2.3 Text (TXT).....	20
115	4.3 LDAP and SLP Discovery.....	25
116	5. Protocol Binding.....	26
117	5.1 HTTP Features.....	26
118	5.1.1 Host.....	26
119	5.1.2 If-Modified-Since, Last-Modified, and 304 Not Modified.....	26
120	5.1.3 Cache-Control.....	26
121	5.2 IPP Operations.....	27
122	5.3 IPP Printer Description Attributes.....	27
123	5.3.1 media-col-database (1setOf collection).....	29
124	5.3.2 media-col-ready (1setOf collection).....	30
125	5.3.3 media-ready (1setOf (type3 keyword name(MAX))).....	31
126	5.3.4 media-size-supported (1setOf collection).....	31
127	5.3.5 media-supported (1setOf (type3 keyword name(MAX))).....	32
128	5.3.6 pdl-override-supported (type2 keyword).....	32
129	5.4 IPP Printer Status Attributes.....	33
130	5.4.1 printer-uri-supported (1setOf uri).....	33
131	5.5 IPP Operation Attributes.....	34
132	5.6 IPP Job Description Attributes.....	35
133	5.7 IPP Job Status Attributes.....	35
134	5.7.1 job-id (integer).....	35
135	5.7.2 job-uri (uri).....	36
136	5.8 IPP Job Template Attributes.....	36
137	6. Document Formats.....	37
138	6.1 Supporting Long-Edge Feed Media with PWG Raster Format Documents.....	37

139 7. Additional Values for Existing Attributes 40

140 7.1 ipp-features-supported (1setOf type2 keyword)..... 40

141 8. Additional Semantics for Existing Value Tags 41

142 8.1 nameWithLanguage and nameWithoutLanguage..... 41

143 8.2 naturalLanguage..... 41

144 8.3 textWithLanguage and textWithoutLanguage 41

145 8.4 uri..... 41

146 9. Conformance Requirements..... 42

147 9.1 Conformance Requirements for Clients..... 42

148 9.2 Conformance Requirements for Printers..... 42

149 9.3 Conditional Conformance Requirements for Printers..... 43

150 10. Internationalization Considerations 44

151 11. Security Considerations..... 45

152 12. IANA Considerations 46

153 12.1 Attribute Value Registrations 46

154 13. Safe String Truncation..... 46

155 13.1 Plain Text Strings..... 46

156 13.2 URIs..... 46

157 13.3 MIME Media Types..... 47

158 13.4 Delimited Lists 47

159 14. Overview of Changes 48

160 14.1 IPP Everywhere™ v1.1..... 48

161 15. References 49

162 15.1 Normative References 49

163 15.2 Informative References..... 54

164 16. Authors' Addresses 55

165 17. Change History..... 56

166 17.1 August 24, 2018..... 56

167 17.2 July 4, 2018 56

168 17.3 June 6, 2018 56

169 17.4 April 17, 2018..... 57

170 17.5 April 16, 2018..... 57

171 17.6 April 3, 2018..... 57

172 17.7 February 9, 2018 57

List of Figures

177 Figure 2 - PWG Raster Bitmaps with Portrait Feed Orientation..... 38

178 Figure 3 - PWG Raster Bitmaps with Landscape Feed Orientation..... 38

179 Figure 4 - PWG Raster Bitmaps with Reverse Landscape Feed Orientation 39

180 Figure 5 - PWG Raster Bitmaps with Reverse Portrait Feed Orientation 39

List of Tables

183
184
185 Table 1 - Attributes in Discovery Protocols..... 20
186 Table 2 - Priority of DNS TXT Key/Value Pairs 21
187 Table 3 - DNS TXT Record Keys 22
188 Table 5 - IPP Everywhere™ Operations 27
189 Table 6 - IPP Everywhere™ Printer Description Attributes 27
190 Table 6 - IPP Everywhere™ Printer Status Attributes 33
191 Table 7 - IPP Everywhere™ Required Operation Attributes..... 34
192 Table 9 - IPP Everywhere™ Required Job Description Attributes..... 35
193 Table 9 - IPP Everywhere™ Required Job Status Attributes 35
194 Table 8 - IPP Everywhere™ Job Template Attributes 36

195

196

197

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199 1. Introduction

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

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

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

212 2. Terminology

213 2.1 Printing Terminology

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

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

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

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

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

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

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

Deleted: Model and Semantics

Deleted: also see section 2.3 of

230 **2.2 Protocol Role Terminology**

231 This document also defines the following protocol roles to specify unambiguous
232 conformance requirements:

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

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

238 **2.3 Other Terminology**

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

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

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

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

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

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

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

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

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

258 *Secure Print*: A print job using the "document-password", "job-password", and/or "job-
259 password-encryption" operation attributes to provide document and/or physical security.
260 See [PWG5100.11] and [PWG5100.13].

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

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

264 **2.4 Acronyms and Organizations**

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

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

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

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

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

270 *OASIS*: Organization for the Advancement of Structured Information Standards,
271 <http://www.oasis-open.org/>

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

273

274 3. Requirements

275 3.1 Rationale

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

- 278 1. Use existing protocols and schema to support discovery, identification, and
279 auto-configuration of Imaging Devices,
- 280 2. Use existing IPP specifications to support job submission to and monitoring of
281 Imaging Devices,
- 282 3. Encourage support for printing through standard document formats, and
- 283 4. Discourage the further proliferation of vendor-specific page description
284 languages, formats, discovery protocols, interfaces, and transports

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

Deleted: : Encoding and Transport [RFC8010] and Internet
Printing Protocol/1.1: Model and Semantics

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

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

293 The IPP URL Scheme [RFC3510] defines the 'ipp' URI scheme and the IPP over HTTPS
294 Transport Binding and 'ipps' URI Scheme [RFC7472] defines the 'ipps' URI scheme used
295 for IPP.

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

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

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

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

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

310 The Bonjour Printing Specification version 1.2 [BONJOUR] defines:

- 311 1. Multicast DNS for use on link-local networks [RFC6762]
- 312 2. Discovery of Printers using Domain Name System (DNS) service (SRV) lookups
313 [RFC6763]
- 314 3. Automatic address assignment for both IPv4 [RFC3927] and IPv6
- 315 4. DNS text (TXT) record keys to support auto-configuration, capabilities,
316 identification, and protocol selection

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

320 **3.2 Use Cases**

321 **3.2.1 Select Printer**

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

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

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

331 **3.2.1.1 Select the Last Used Printer**

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

334 The last used Printer may be automatically selected by the Client User Interface and may
335 be affected by the current network topology or geo-location, for example the last used
336 Printer may be tracked on a per-network (e.g., default router or other criteria), per-location
337 (e.g., geo-location), or per-Service (e.g., current local server) basis.

338 **3.2.1.2 Select Printer Using Name or Address**

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

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

345 **3.2.1.3 Select Printer Using URI**

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

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

350 **3.2.1.4 Select Printer Using a Directory Service**

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

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

357 **3.2.1.5 Select Printer Using a Cloud Service**

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

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

364 **3.2.1.6 Select Printer Using a Discovery Protocol**

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

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

371 **3.2.1.7 Select Printer Using Geo-Location**

372 The Client initiates Enumeration of Printers within a geographic area using Services and/or
373 Discovery Protocols, hiding duplicate Printers that are reported by multiple Service and/or

374 Discovery Protocols. The Client User Interface asks Jane to select one of the Printers.
375 Finally, she selects a Printer.

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

378 **3.2.1.8 Select Printer Using Out of Band Method**

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

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

385 **3.2.1.9 Select Printer Using Properties**

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

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

397 **3.2.2 Print**

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

402 Preconditions: For all of the following use cases, the Printer must be Network Accessible to
403 the Client in order to be selected, either directly or through an intermediate Service. Also,
404 the document to be printed must be Network Accessible to the Printer and in a format
405 suitable for the Printer or converted by the Client or Service into a suitable format.

406 **3.2.2.1 Print a Document**

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

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

413 **3.2.2.2 Print a Document by Reference**

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

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

420 **3.2.2.3 Print Using Loaded Media**

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

423 After Jane initiates a print action from the phone and selects a Printer, the Client photo
424 application automatically selects the largest borderless photographic media loaded on the
425 Selected Printer and the highest print quality. Jane selects additional processing intent for
426 the Job and confirms the print action. The Client sends a print job request to the Printer with
427 the Job Ticket and local photo. The Printer validates the Job Ticket and document data and
428 then prints the photo.

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

432 **3.2.2.4 Print a Secure Form**

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

437 The treasurer loads check blanks into the Printer and configured the loaded media as
438 necessary at the Printer. After he initiates a print action from the accounting program,
439 selects a Printer for printing, and selects checks to be printed, the Client User Interface
440 displays a preview of the printed checks and he confirms that the checks are correctly
441 paginated and oriented and the amounts, payees and signature are correct. The Client
442 automatically selects the check blank media. The treasurer selects additional processing
443 intent for the Job and confirms the print action. The Client sends a print job request to the
444 Printer with the Job Ticket and document data containing the check information, correctly

445 oriented for the check blank media. He waits for the checks to be printed and removes any
446 excess media from the Printer.

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

450 **3.2.2.5 Print with Special Formatting**

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

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

463 **3.2.2.6 Print and Select at Printer**

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

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

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

475 **3.2.2.7 Print to a Service**

476 John is flying to New York for a presentation and doesn't want to carry the presentations.
477 John arrives in New York and goes online from his mobile phone. After initiating a print
478 action, he selects a local print provider, reviewing the provider web pages as needed. He
479 then specifies the processing intent as 10 color copies, printed duplex and stapled on the
480 left side, with the covers on 80lb. stock and the internal pages on 24lb. stock. After

481 confirming the print action, John goes to the provider and picks up his presentations, paying
482 with his corporate credit card.

483 **3.2.2.8 Print to a Recipient**

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

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

491 **3.2.2.9 Print with a Proof Copy**

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

498 **3.2.3 Exceptions**

499 **3.2.3.1 Print Action Canceled**

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

503 **3.2.3.2 Select Printer Canceled**

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

506 **3.2.3.3 Printer No Longer Network Accessible after Selection**

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

510 **3.2.3.4 Not Authorized**

511 After confirming the print request, the Printer responds that the User is not authorized to
512 print the Job document(s). The reason for the authorization failure may involve general

513 access to the Printer, Job document(s), or disallowed Job Ticket values, for example a User
514 may not be allowed to print in color.

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

517 **3.2.3.5 Needs Authentication**

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

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

522 **3.2.3.6 Not Accepting Jobs**

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

525 **3.2.3.7 Job Ticket or Document Format Not Supported**

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

529 **3.2.3.8 Job or Document Processing Failures**

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

534 **3.2.3.9 Printer Fault**

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

538 **3.2.3.10 Printer Warning**

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

542 **3.3 Out of Scope**

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

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

551 3.4 Design Requirements

552 The IPP Everywhere™ design should:

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

Deleted: IETF

562 4. Discovery Protocols

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

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

568 4.1 Printer Description Attributes Used in Discovery

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

571 4.2 DNS Service Discovery (DNS-SD)

572 DNS Service Discovery (DNS-SD) [RFC6762] uses service (SRV) records and traditional
573 unicast and multicast DNS (mDNS) [RFC6763] queries. This discovery protocol is
574 collectively defined in the Bonjour Printing Specification version 1.2.1 [BONJOUR] and
575 extended in this specification.

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

579 4.2.1 Service (SRV) Instance Name

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

582 Printers that support DNS-SD MUST advertise the "_ipp._tcp" (generic IPP) and
583 "_print._sub._ipp._tcp" (IPP Everywhere™) services over mDNS.

584 Printers that support DNS-SD and the "ipps" URI scheme [RFC7472] MUST advertise the
585 "_ipps._tcp" (generic IPPS) and "_print._sub._ipps._tcp" (IPP Everywhere™ Secure)
586 services over mDNS.

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

588 4.2.2 Geo-Location (LOC)

589 Printers MUST publish LOC records [RFC1876] over mDNS to provide the physical location
590 of the Printer. Printers MUST allow the User to configure the geo-location manually. If the
591 accuracy of the geo-location is unknown, a value of 9x10⁹ meters (0x99) MUST be used.
592

Deleted: supporting

594

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-service-count	(note 2)	printer-device-service-count (note 1)
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	chargeuri	printer-charge-info-uri (note 1)
printer-device-id	usb_CMD, usb_MDL, usb_MFG	printer-device-id (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)	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

595 Note 1: Extension attribute to RFC 7612.

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

597 **4.2.3 Text (TXT)**

598 Printers MUST publish a text (TXT) record that provides service information over mDNS.
599 Printers that support dynamic DNS updates MUST publish separate TXT records for each
600 domain that is updated. The following subsections define new key/value pairs in addition
601 to those required by the Bonjour Printing Specification [BONJOUR].

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

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

607 For example, the IPP "printer-more-info" attribute has a maximum length of 1023 octets,
 608 however the corresponding "adminurl" key cannot represent a value longer than 246 octets
 609 (255 - 9 octets for "adminurl="). Printers MUST truncate long strings as described in section
 610 13.

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

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

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

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

616 Clients MUST ignore incomplete key/value pairs at the end of a truncated TXT record.
 617

618

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 4.2.3.1.	'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 4.2.3.6.	" (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 4.2.3.2.	" (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)
qtotal	The number of queues for this Printer. MUST have the value '1'. See section 4.2.3.3	'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 4.2.3.4.	'none'
txtvers	The major version of the Bonjour Printing Specification. 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 4.2.3.5.	" (empty string)

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

620 4.2.3.1 air

621 The "air" key defines the type of authentication information that is required for imaging. The
 622 name "air" comes from the CUPS "auth-info-required" Printer Description attribute

623 [CUPSIPP] that extends the "uri-authentication-supported" Printer Description attribute
624 [STD92]. The following values are supported:

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

Deleted: value

Deleted: [STD92]

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

Deleted: [PWG5100.13]

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

Deleted: value

Deleted: [STD92]

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

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

Deleted: values

Deleted: [STD92]

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

640 4.2.3.2 pdl

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

647 4.2.3.3 qtotal

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

664 4.2.3.4 TLS

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

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

669 '1.0'; TLS 1.0 [RFC2246] encryption is supported. This is equivalent to the value 'tls'
670 for the "uri-security-supported" Printer Description attribute.

671 '1.1'; TLS 1.1 [RFC4346] encryption is supported. This is equivalent to the value 'tls'
672 for the "uri-security-supported" Printer Description attribute.

673 '1.2'; TLS 1.2 [RFC5246] encryption is supported. This is equivalent to the value 'tls'
674 for the "uri-security-supported" Printer Description attribute.

675 '1.3'; TLS 1.3 [RFC-TLS1.3] encryption is supported. This is equivalent to the value
676 'tls' for the "uri-security-supported" Printer Description attribute.

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

680 4.2.3.5 UUID

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

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

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

686 12345678-9ABC-DEF0-1234-56789ABCDEF0

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

689 4.2.3.6 DUUID

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

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

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

695 12345678-9ABC-DEF0-1234-56789ABCDEF0

696 **4.3 LDAP and SLP Discovery**

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

699 Both LDAP and SLP impose hard limits on the lengths of string values, typically 127 or 255
700 octets depending on the attribute. These limits are sometimes smaller than the limits
701 imposed by the corresponding IPP attributes.

702 For example, the IPP "printer-device-id" attribute has a maximum length of 1023 octets,
703 however the corresponding LDAP "printer-device-id" attribute has a maximum length of 255
704 octets. Printers MUST truncate long strings as defined in section 13.
705

706 5. Protocol Binding

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

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

711 5.1 HTTP Features

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

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

Deleted: -TLS1.3

719 5.1.1 Host

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

722 5.1.2 If-Modified-Since, Last-Modified, and 304 Not Modified

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

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

729 5.1.3 Cache-Control

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

735

737 **5.2 IPP Operations**

738 Table 4 lists the REQUIRED operations for an IPP Everywhere™ Printer. Additionally,
739 Clients and Printers SHOULD support the Get-User-Printer-Attributes [GUPA] operation for
740 per-User print policies.

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

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

Code	Operation Name	Reference
0x0002	Print-Job	RFC 8011
0x0004	Validate-Job	RFC 8011
0x0005	Create-Job	RFC 8011
0x0006	Send-Document	RFC 8011
0x0008	Cancel-Job	RFC 8011
0x0009	Get-Job-Attributes	RFC 8011
0x000A	Get-Jobs	RFC 8011
0x000B	Get-Printer-Attributes	RFC 8011
0x0039	Cancel-My-Jobs	PWG 5100.11
0x003B	Close-Job	PWG 5100.11
0x003C	Identify-Printer (note 1)	PWG 5100.13

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

746 **5.3 IPP Printer Description Attributes**

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

749 **Table 5 - IPP Everywhere™ Printer Description Attributes**

Attribute	Reference
charset-configured	RFC 8011
charset-supported	RFC 8011
color-supported	RFC 8011
compression-supported	RFC 8011
copies-default (note 2)	RFC 8011
copies-supported (note 2)	RFC 8011
document-format-default	RFC 8011
document-format-supported	RFC 8011
document-password-supported (note 2)	PWG 5100.13
feed-orientation-default (note 5)	PWG 5100.11
feed-orientation-supported (note 5)	PWG 5100.11
finishings-col-database (notes 3 and 7)	PWG 5100.1
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)	RFC 8011

Attribute	Reference
finishings-ready (notes 3 and 7)	RFC 8011
finishings-supported (note 3)	RFC 8011
generated-natural-language-supported	RFC 8011
identify-actions-default	PWG 5100.13
identify-actions-supported	PWG 5100.13
ipp-features-supported	PWG 5100.13
ipp-versions-supported	RFC 8011
job-account-id-default (note 1)	PWG 5100.3
job-account-id-supported (note 1)	PWG 5100.3
job-accounting-user-id-default (note 1)	PWG 5100.3
job-accounting-user-id-supported (note 1)	PWG 5100.3
job-constraints-supported	PWG 5100.13
job-creation-attributes-supported	PWG 5100.11
job-ids-supported	PWG 5100.11
job-password-supported (note 4)	PWG 5100.11
job-password-encryption-supported (note 4)	PWG 5100.11
job-resolvers-supported	PWG 5100.13
media-bottom-margin-supported	PWG 5100.13
media-col-database	PWG 5100.11
media-col-database.media-source-properties (note 5)	PWG 5100.13
media-col-default	PWG 5100.3
media-col-ready	PWG 5100.3
media-col-ready.media-source-properties (note 5)	PWG 5100.13
media-col-supported	PWG 5100.3
media-default	RFC 8011
media-left-margin-supported	PWG 5100.13
media-ready	RFC 8011
media-right-margin-supported	PWG 5100.13
media-size-supported	PWG 5100.3
media-source-supported	PWG 5100.13
media-supported	RFC 8011
media-top-margin-supported	PWG 5100.13
media-type-supported	PWG 5100.3
multiple-document-jobs-supported	RFC 8011
multiple-operation-timeout	RFC 8011
multiple-operation-timeout-action	PWG 5100.13
natural-language-configured	RFC 8011
operations-supported	RFC 8011
orientation-requested-default	RFC 8011
orientation-requested-supported	RFC 8011
output-bin-default	PWG 5100.2
output-bin-supported	PWG 5100.2
overrides-supported (note 2)	PWG 5100.6
page-ranges-supported (note 2)	RFC 8011
preferred-attributes-supported	PWG 5100.13
print-color-mode-default	PWG 5100.13
print-color-mode-supported	PWG 5100.13
print-content-optimize-default	PWG 5100.7
print-content-optimize-supported	PWG 5100.7
print-rendering-intent-default (note 8)	PWG 5100.13
print-rendering-intent-supported (note 8)	PWG 5100.13
print-quality-default	RFC 8011
print-quality-supported	RFC 8011

Attribute	Reference
printer-current-time (note 7)	RFC 8011
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	RFC 8011
printer-location	RFC 8011
printer-make-and-model	RFC 8011
printer-mandatory-job-attributes (note 1)	PWG 5100.13
printer-name	RFC 8011
printer-organization	PWG 5100.13
printer-organizational-unit	PWG 5100.13
printer-resolution-default	RFC 8011
printer-resolution-supported	RFC 8011
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	RFC 8011
sides-supported	RFC 8011
uri-security-supported	RFC 8011
uri-authentication-supported	RFC 8011
which-jobs-supported	PWG 5100.11

Deleted: printer-more-info (note 6)

... [1]

- 750 Note 1: CONDITIONALLY REQUIRED for Printers that implement Paid Imaging
751 services.
752 Note 2: REQUIRED for the "application/pdf" and "image/jpeg" MIME media types.
753 Note 3: CONDITIONALLY REQUIRED for Printers with finishers.
754 Note 4: CONDITIONALLY REQUIRED for Printers that support the Print to a
755 Recipient (section 3.2.2.8) use case.
756 Note 5: CONDITIONALLY REQUIRED for Printers that support long-edge feed
757 media.
758 Note 6: URIs MUST be absolute, SHOULD use the Host value (including port
759 number) from the HTTP Host header (section 5.1.1), and MUST NOT use link-local
760 addresses (section 8.4).
761 Note 7: RECOMMENDED due to its omission from IPP Everywhere™ 1.0, however
762 it is needed for the underlying functionality.
763 Note 8: CONDITIONALLY REQUIRED for Printers that support ICC-based color
764 management.
765

766 5.3.1 media-col-database (1setOf collection)

767 The REQUIRED "media-col-database" Printer attribute lists the supported combinations of
768 "media-col" member attributes for a Printer. In addition to the requirements set forth in IPP:
769 Job and Printer Extensions - Set 2 [PWG5100.11], this specification defines how a Printer
770 advertises custom and roll-fed media capabilities in the "media-col-database" attribute.

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

```
778     media-col-database=..., {  
779         media-size={  
780             x-dimension=5000-33020  
781             y-dimension=5000-48260 }  
782         media-source='by-pass-tray' },...
```

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

```
789     media-col-database=..., {  
790         media-size={  
791             x-dimension=20320-152400  
792             y-dimension=1524-9144000 } ,...
```

793 5.3.2 media-col-ready (1setOf collection)

794 The REQUIRED "media-col-ready" Printer attribute lists the loaded media combinations of
795 "media-col" member attributes for a Printer. In addition to the requirements set forth in IPP:
796 Production Printing Attributes - Set 1 [PWG5100.3], this specification defines how a Printer
797 advertises manually-fed and roll-fed media in the "media-col-ready" attribute.

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

804 Roll media sizes are described using an integer value for the "x-dimension" and a
805 rangeOfInteger value for the "y-dimension" member attributes of the "media-size" member
806 attribute. The "x-dimension" value refers to the width of the loaded roll, the lower bound of
807 the "y-dimension" value refers to the minimum length allowed, and the upper bound of the
808 "y-dimension" value refers to the remaining length of the loaded roll or, if the remainder is
809 not known, the maximum length allowed.

810 5.3.3 media-ready (1setOf (type3 keyword | name(MAX)))

811 The REQUIRED "media-ready" Printer attribute lists the loaded media for a Printer. In
 §12 addition to the requirements set forth in [the](#) Internet Printing Protocol/1.1, [STD92], this
 813 specification defines how a Printer advertises custom, manually-fed, and roll-fed media in
 814 the "media-ready" attribute.

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

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

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

830 5.3.4 media-size-supported (1setOf collection)

831 The REQUIRED "media-size-supported" Printer attribute lists the supported media sizes for
 832 a Printer. In addition to the requirements set forth in [PWG5100.3], this specification defines
 833 how a Printer advertises custom and roll-fed media in the "media-size" attribute.

834 Custom media sizes are described using rangeOfInteger values for the "x-dimension" and
 835 "y-dimension" member attributes. Dimensions are provided for sheets in portrait orientation,
 836 that is the "x-dimension" ranges refer to the short axis and the "y-dimension" ranges refer
 837 to the long axis of the sheet. For example, a Printer supporting sheet media from 50x50mm
 838 to 330.2x482.6mm from the by-pass tray would report:

```
839     media-size-supported=..., {
840         x-dimension=5000-33020
841         y-dimension=5000-48260 }, ...
```

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

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```
849     media-size-supported=...,{
850         x-dimension=20320-152400
851         y-dimension=1524-9144000 },...
```

852 5.3.5 media-supported (1setOf (type3 keyword | name(MAX)))

853 The REQUIRED "media-supported" Printer attribute lists the supported media sizes for a
854 Printer. In addition to the requirements set forth in [the Internet Printing Protocol/1.1](#) [STD92],
855 this specification defines how a Printer advertises custom and roll-fed media in the "media-
856 supported" attribute.

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

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

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

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

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

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

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

878 5.3.6 pdl-override-supported (type2 keyword)

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

882 When reporting capabilities for the 'application/pdf', 'image/jpeg', or 'image/pwg-raster'
883 MIME media types, Printers MUST report either 'attempted' [STD92] or 'guaranteed'
884 [PWG5100.11] for the "pdl-override-supported" Printer attribute.

885 **5.4 IPP Printer Status Attributes**

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

888 **Table 6 - IPP Everywhere™ Printer Status Attributes**

Attribute	Reference
pages-per-minute	RFC 8011
pages-per-minute-color	RFC 8011
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	RFC 8011
printer-more-info (note 1)	RFC 8011
printer-state	RFC 8011
printer-state-change-date-time	RFC 3995
printer-state-change-time	RFC 3995
printer-state-message	RFC 8011
printer-state-reasons	RFC 8011
printer-strings-languages-supported (note 2)	PWG 5100.13
printer-strings-uri (notes 1 and 2)	PWG 5100.13
printer-supply	PWG 5100.13
printer-supply-description	PWG 5100.13
printer-supply-info-uri (note 1)	PWG 5100.13
printer-up-time	RFC 8011
printer-uri-supported (note 1)	RFC 8011
printer-uuid	PWG 5100.13
pwg-raster-document-resolution-supported	PWG 5102.4
pwg-raster-document-sheet-back	PWG 5102.4
pwg-raster-document-type-supported	PWG 5102.4
queued-job-count	RFC 8011

889
890 Note 1: URIs MUST be absolute, SHOULD use the Host value [\(including port](#)
891 [number\)](#) from [the HTTP Host](#) header (section 5.1.1), and MUST NOT use link-local
892 addresses (section 8.4).

893 [Note 2: RECOMMENDED due to its omission from IPP Everywhere™ 1.0, however](#)
894 [it is needed for the underlying functionality.](#)

895 **5.4.1 printer-uri-supported (1setOf uri)**

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

899 5.5 IPP Operation Attributes

900 Table 7 lists the REQUIRED operation attributes for an IPP Everywhere™ Printer.

901 **Table 7 - IPP Everywhere™ Required Operation Attributes**

Attribute	Reference
compression	RFC 8011
document-format	RFC 8011
document-format-version	PWG 5100.7
document-name	RFC 8011, PWG 5100.5
document-password (note 1)	PWG 5100.13
first-index	PWG 5100.13
first-job-id	RFC 8011
identify-actions	PWG 5100.13
ipp-attribute-fidelity	RFC 8011
job-ids	PWG 5100.11
job-mandatory-attributes (note 3)	PWG 5100.7
job-name	RFC 8011
job-password (note 2)	PWG 5100.11
job-password-encryption (note 2)	PWG 5100.11
last-document	RFC 8011
limit	RFC 8011
requesting-user-name	RFC 8011
requesting-user-uri	PWG 5100.13
which-jobs	RFC 8011, PWG 5100.11

902
903 Note 1: CONDITIONALLY REQUIRED for Printers that support the "application/pdf"
904 MIME media type.

905 Note 2: CONDITIONALLY REQUIRED for Printers that support the Print to a
906 Recipient (section 3.2.2.8) use case.

907 Note 3: CONDITIONALLY REQUIRED for Printers that implement Paid Imaging
908 services.

909

910 5.6 IPP Job Description Attributes

911 Table 8 lists the REQUIRED Job Description attributes for an IPP Everywhere™ Printer.

912 **Table 8 - IPP Everywhere™ Required Job Description Attributes**

Attribute	Source
job-name	RFC 8011

913 5.7 IPP Job Status Attributes

914 Table 8 lists the REQUIRED Job Status attributes for an IPP Everywhere™ Printer.

915 **Table 9 - IPP Everywhere™ Required Job Status Attributes**

Attribute	Source
compression-supplied	PWG 5100.7
date-time-at-completed	RFC 8011
date-time-at-creation	RFC 8011
date-time-at-processing	RFC 8011
document-format-supplied	PWG 5100.7
document-format-version-supplied	PWG 5100.7
document-name-supplied	PWG 5100.7
job-id	RFC 8011
job-impressions	RFC 8011
job-impressions-completed	RFC 8011
job-originating-user-name	RFC 8011
job-printer-up-time	RFC 8011
job-printer-uri (note 1)	RFC 8011
job-state	RFC 8011
job-state-message	RFC 8011
job-state-reasons	RFC 8011
job-uri (note 1)	RFC 8011
job-uuid	PWG 5100.13
time-at-completed	RFC 8011
time-at-creation	RFC 8011
time-at-processing	RFC 8011

916
 917 Note 1: URIs MUST be absolute, SHOULD use the Host value from HTTP header
 918 (section 5.1.1), and MUST NOT use link-local addresses (section 8.4).

919 5.7.1 job-id (integer)

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

925 **5.7.2 job-uri (uri)**

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

932 **5.8 IPP Job Template Attributes**

933 Table 10 lists the Job Template attributes for an IPP Everywhere™ Printer. All attributes in
 934 the table are REQUIRED unless otherwise specified.

935 **Table 10 - IPP Everywhere™ Job Template Attributes**

Attribute	Reference
copies (note 2)	RFC 8011
feed-orientation (note 5)	PWG 5100.11
finishings (note 4)	RFC 8011
finishings-col (notes 5 and 7)	PWG 5100.1
job-account-id (note 1)	PWG 5100.3
job-accounting-user-id (note 1)	PWG 5100.3
media	RFC 8011
media-col	PWG 5100.3
media-col.media-bottom-margin	PWG 5100.13
media-col.media-left-margin	PWG 5100.13
media-col.media-right-margin	PWG 5100.13
media-col.media-size	PWG 5100.3
media-col.media-source	PWG 5100.13
media-col.media-top-margin	PWG 5100.13
media-col.media-type	PWG 5100.3
multiple-document-handling (note 3)	RFC 8011
orientation-requested	RFC 8011
output-bin	PWG 5100.2
overrides (note 3)	PWG 5100.6
overrides.document-numbers (note 6)	PWG 5100.6
page-ranges (note 3)	RFC 8011
print-color-mode	PWG 5100.13
print-content-optimize	PWG 5100.7
print-rendering-intent (note 7)	PWG 5100.13
print-quality	RFC 8011
printer-resolution	RFC 8011
sides	RFC 8011

936
 937 Note 1: CONDITIONALLY REQUIRED for Printers that implement paid imaging
 938 services.

939 Note 2: REQUIRED for the "application/pdf" and "image/jpeg" MIME media types.
940 Note 3: CONDITIONALLY REQUIRED for Printers that support the "application/pdf"
941 MIME media type.
942 Note 4: CONDITIONALLY REQUIRED for Printers with finishers.
943 Note 5: CONDITIONALLY REQUIRED for Printers that support long-edge feed
944 media.
945 Note 6: CONDITIONALLY REQUIRED for Printers that support multiple-Document
946 Jobs.
947 Note 7: CONDITIONALLY REQUIRED for Printers that support ICC-based color
948 management.

949 6. Document Formats

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

956 IPP/2.1 and IPP/2.2 Printers MUST and IPP/2.0 Printers SHOULD support documents
957 conforming to Document management — Portable document format — Part 1: PDF 1.7
958 [ISO32000] ("application/pdf"). IPP/2.0, IPP/2.1, and IPP/2.2 Printers are defined in
959 [PWG5100.12].

960 6.1 Supporting Long-Edge Feed Media with PWG Raster Format 961 Documents

962 Printers that support long-edge feed media MUST support the "feed-orientation" Job
963 Template attribute and corresponding "feed-orientation-default" and "feed-orientation-
964 supported" Printer attributes. In addition, Printers that support long-edge feed media MUST
965 report the "media-source-properties" member attribute in the "media-col-database" and
966 "media-col-ready" Printer attributes.

967 When submitting a PWG Raster document in a job or document creation request, Clients
968 MUST additionally query the Printer for the "feed-orientation-supported", "media-col-
969 database", and/or "media-col-ready" Printer attributes in order to provide a document in the
970 correct orientation and dimensions for the Printer.

971 Figures 2 through 5 show how raster data must be formatted for each feed orientation.
972

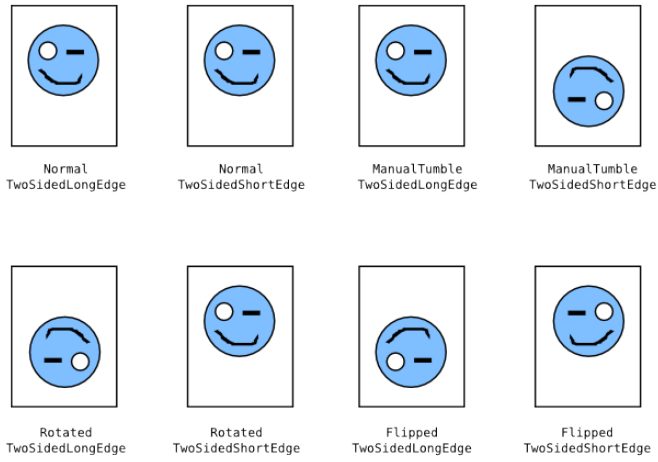


Figure 1 - PWG Raster Bitmaps with Portrait Feed Orientation

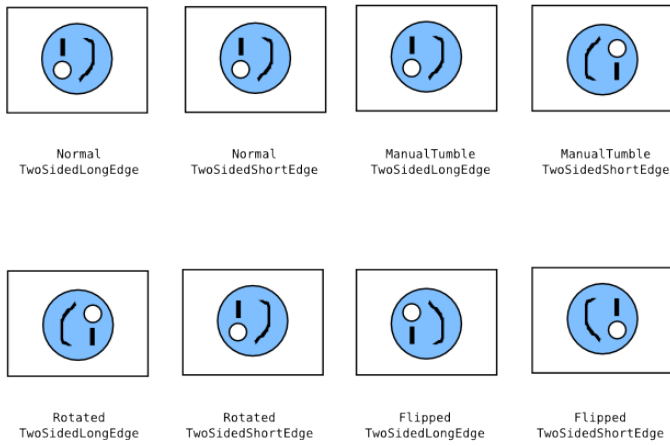
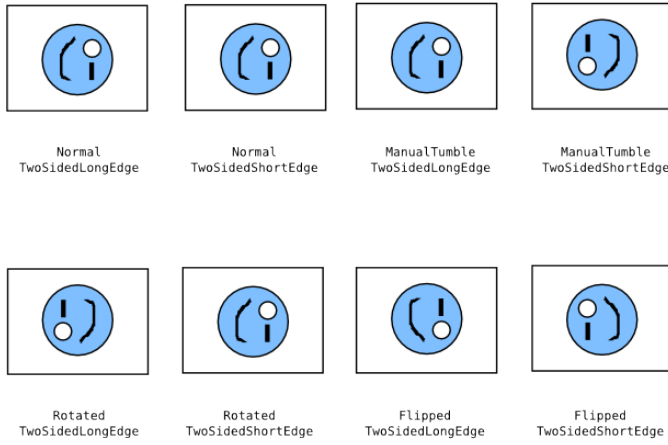


Figure 2 - PWG Raster Bitmaps with Landscape Feed Orientation

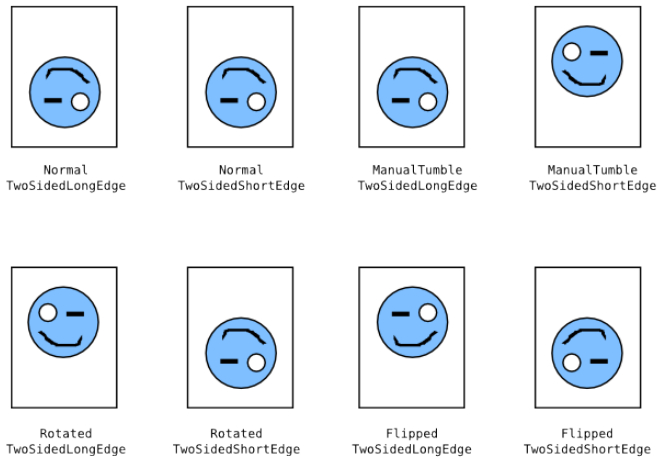


978

979

Figure 3 - PWG Raster Bitmaps with Reverse Landscape Feed Orientation

980



981

982

Figure 4 - PWG Raster Bitmaps with Reverse Portrait Feed Orientation

983 **7. Additional Values for Existing Attributes**

984 **7.1 ipp-features-supported (1setOf type2 keyword)**

985 This specification defines the REQUIRED keyword 'ipp-everywhere' for the "ipp-features-
986 supported" Printer attribute.
987

988 8. Additional Semantics for Existing Value Tags

989 This specification amends the definition of the nameWithLanguage,
990 nameWithoutLanguage, naturalLanguage, textWithLanguage, textWithoutLanguage, and
991 URI value tags defined in [the Internet Printing Protocol/1.1](#), [STD92] with additional
992 restrictions to improve interoperability.

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993 8.1 nameWithLanguage and nameWithoutLanguage

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

998 8.2 naturalLanguage

999 NaturalLanguage values MUST conform to and be compared as defined in Tags for
1000 Identifying Languages [BCP47]. The shortest language tag MUST be used, e.g., "en"
1001 instead of "eng" for English. Printers SHOULD also support legacy language tags such as:

- 1002 'no'; replaced by 'nb' (Norwegian Bokmål),
- 1003 'zh-cn'; replaced by 'zh-hans' (Simplified Chinese), and
- 1004 'zh-tw'; replaced by 'zh-hant' (Traditional Chinese)

1005 8.3 textWithLanguage and textWithoutLanguage

1006 Text values MUST NOT contain the DEL character or characters in the "C0 Control
1007 Character Set" other than CR, LF, and HT [RFC5198]. Printers MUST transcode and filter
1008 values from MIBs and other sources to conform to the added restrictions.

1009 8.4 uri

1010 URI values MUST be in absolute form, i.e., "ipp://hostname.local/ipp/print" is acceptable but
1011 "//ipp/print" is not. URI values MUST NOT contain link-local addresses in the host field.
1012 Printers MUST NOT generate URI values with link-local addresses and SHOULD NOT
1013 generate URI values with IP addresses obtained via Dynamic Host Control Protocol (DHCP)
1014 [RFC2131] or other auto-configuration protocols. Printers SHOULD use the HTTP Host:
1015 header value when generating URIs for use in Client responses.
1016

1018 9. Conformance Requirements

1019 This section summarizes the Conformance Requirements detailed in the definitions in this
1020 document for Clients and Printers.

1021 9.1 Conformance Requirements for Clients

1022 In order for a Client to claim conformance to this specification a Client MUST support the
1023 following:

- 1024 1. DNS Service Discovery as defined in section 4.2
- 1025 2. IPP/2.0 as defined in section 5
- 1026 3. The REQUIRED operations listed in Table 4
- 1027 4. The REQUIRED Printer Description attributes listed in Table 5
- 1028 5. The REQUIRED operation attributes listed in Table 7
- 1029 6. The REQUIRED Job Template attributes listed in Table 10
- 1030 7. The REQUIRED Job Description attributes listed in Table 8
- 1031 8. The REQUIRED document formats listed in section 5.8
- 1032 9. The "feed-orientation-supported" Printer attribute and "media-source-properties"
1033 member attribute of the "media-col-database" and "media-col-ready" Printer
1034 attributes as reported by the Printer and defined in section 6.1
- 1035 10. The internationalization considerations as defined in section 10
- 1036 11. The security considerations as defined in section 0

1037 9.2 Conformance Requirements for Printers

1038 In order for a Printer to claim conformance to this specification a Printer MUST support the
1039 following:

- 1040 1. DNS Service Discovery as defined in section 4.2
- 1041 2. IPP/2.0 as defined in section 5
- 1042 3. The REQUIRED operations listed in Table 4
- 1043 4. The REQUIRED Printer Description attributes listed in Table 5
- 1044 5. The REQUIRED operation attributes listed in Table 7
- 1045 6. The REQUIRED Job Template attributes listed in Table 10
- 1046 7. The REQUIRED Job Description attributes listed in Table 8
- 1047 8. The REQUIRED document formats listed in section 5.8
- 1048 9. The 'ipp-everywhere' value for the "ipp-features-supported" Printer Description
1049 attribute as defined in section 7.1
- 1050 10. The additional semantics for attribute values as defined in section 8
- 1051 11. The internationalization considerations as defined in section 10
- 1052 12. The security considerations as defined in section 0
- 1053 13. The safe string truncation rules as defined in section 13

1054 **9.3 Conditional Conformance Requirements for Printers**

1055 Printers that support the "image/jpeg" [JFIF] MIME media type MUST support:

- 1056 1. The "copies-default", and "copies-supported" Printer Description attributes as
1057 defined in section 5.3.
- 1058 2. The "copies" Job Template attribute as defined in section 5.8.

Deleted: 5.3

1059 Printers that support the "application/pdf" [ISO32000] MIME media type MUST support:

- 1060 1. The "copies-default", "copies-supported", "document-password-supported", and
1061 "page-ranges-supported" Printer Description attributes as defined in section 5.3.
- 1062 2. The "document-password" Operation attribute as defined in section 5.4, and
- 1063 3. The "copies", "multiple-document-handling", "overrides", and "page-ranges" Job
1064 Template attributes as defined in section 5.8.

Deleted: 5.3

1065 Printers that support the Print to a Recipient use case (section 3.2.2.8) MUST support:

- 1066 1. The "job-password-supported" and "job-password-encryption-supported" Printer
1067 Description attributes as defined in section 5.3, and
- 1068 2. The "job-password" and "job-password-encryption" Operation attributes as
1069 defined in section 5.4.

Deleted: 5.3

1070 Printers that provide Paid Print services MUST support:

- 1071 1. The "job-account-id-default", "job-account-id-supported", "job-accounting-user-
1072 id-default", "job-accounting-user-id-supported", "job-mandatory-attributes-
1073 default", "job-mandatory-attributes-supported", and "printer-mandatory-job-
1074 attributes" Printer Description attributes as defined in section 5.3.
- 1075 2. The "job-mandatory-attributes" operation attribute as defined in section 5.4, and
- 1076 3. The "job-account-id" and "job-accounting-user-id" Job Template attributes as
1077 defined in section 5.8.

Deleted: 5.3

1078 Printers that support long-edge feed media MUST support:

- 1079 1. The "feed-orientation-default" and "feed-orientation-supported" Printer
1080 Description attributes as defined in section 5.3.
- 1081 2. The "media-source-properties" member attribute of the "media-col-database"
1082 and "media-col-ready" Printer Description attributes as defined in section 5.3.
- 1083 3. The "feed-orientation" Job Template attribute as defined in section 5.8.

Deleted: 5.3

Deleted: 5.3

1084 Printers that support ICC-based color management MUST support:

- 1085 4. The "print-rendering-intent-default", "print-rendering-intent-supported", and
1086 "printer-icc-profiles" Printer Description attributes as defined in section 5.3.
- 1087 5. The "print-render-intent" Job Template attribute as defined in section 5.8.

Deleted: 5.3

1095 **10. Internationalization Considerations**

1096 For interoperability and basic support for multiple languages, conforming implementations
1097 MUST support:

- 1098 1. The Universal Character Set (UCS) Transformation Format – 8 bit (UTF-8)
1099 [STD63] encoding of Unicode [UNICODE] [ISO10646]; and
- 1100 2. The Unicode Format for Network Interchange [RFC5198] which requires
1101 transmission of well-formed UTF-8 strings and recommends transmission of
1102 normalized UTF-8 strings in Normalization Form C (NFC) [UAX15].

1103 Unicode NFC is defined as the result of performing Canonical Decomposition (into base
1104 characters and combining marks) followed by Canonical Composition (into canonical
1105 composed characters wherever Unicode has assigned them).

1106 WARNING – Performing normalization on UTF-8 strings received from Clients and
1107 subsequently storing the results (e.g., in Job objects) could cause false negatives in Client
1108 searches and failed access (e.g., to Printers with percent-encoded UTF-8 URIs now
1109 'hidden').

1110 Implementations of this specification SHOULD conform to the following standards on
1111 processing of human-readable Unicode text strings, see:

1112 Unicode Bidirectional Algorithm [UAX9] – left-to-right, right-to-left, and vertical

1113 Unicode Line Breaking Algorithm [UAX14] – character classes and wrapping

1114 Unicode Normalization Forms [UAX15] – especially NFC for [RFC5198]

1115 Unicode Text Segmentation [UAX29] – grapheme clusters, words, sentences

1116 Unicode Identifier and Pattern Syntax [UAX31] – identifier use and normalization

1117 Unicode Collation Algorithm [UTS10] – sorting

1118 Unicode Locale Data Markup Language [UTS35] – locale databases

1119 Implementations of this specification are advised to also review the following informational
1120 documents on processing of human-readable Unicode text strings:

1121 Unicode Character Encoding Model [UTR17] – multi-layer character model

1122 ~~Unicode Character Property Model [UTR23] – character properties~~

1123 Unicode Conformance Model [UTR33] – Unicode conformance basis

Deleted: Unicode in XML and other Markup Languages
[UTR20] – XML usage

1126 **11. Security Considerations**

1127 The IPP extensions defined in this document require the same security considerations as
1128 defined in the [Internet Printing Protocol/1.1](#) [STD92]. In addition, Printers MUST validate
1129 the HTTP Host request header in order to protect against DNS rebinding attacks.

Deleted: : Model and Semantics

1130 Implementations of this specification SHOULD conform to the following standard on
1131 processing of human-readable Unicode text strings, see:

1132 Unicode Security Mechanisms [UTS39] – detecting and avoiding security attacks

1133 Implementations of this specification are advised to also review the following
1134 informational document on processing of human-readable Unicode text strings:

1135 Unicode Security FAQ [UNISECFAQ] – common Unicode security issues

1136

1137

1139 12. IANA Considerations

1140 12.1 Attribute Value Registrations

1141 The keyword attribute values defined in this document will be published by IANA according
 1142 to the procedures in the [Internet Printing Protocol/1.1 \[STD92\]](#) in the following file:

1143 <http://www.iana.org/assignments/ipp-registrations>

1144 The registry entries will contain the following information:

1145	Attributes (attribute syntax)		Reference
1146	Keyword Attribute Value	-----	-----
1147	-----		
1148	ipp-features-supported (1setOf type2 keyword)		[PWG5100.13]
1149	ipp-everywhere		[PWG5100.14]

1150 13. Safe String Truncation

1151 Strings can be truncated or omitted when transferred over alternate protocols. Printers
 1152 MUST truncate long strings at logical boundaries. The following subsections describe how
 1153 this truncation is performed for different kinds of strings.

1154 13.1 Plain Text Strings

1155 Plain text strings MUST be truncated at the end of a valid character sequence. For example,
 1156 strings using the UTF-8 transformation format of ISO 10646 [STD0063] [ISO10646-1]
 1157 SHOULD be represented using the Unicode Format for Network Interchange [RFC5198]
 1158 and MUST be truncated at the end of a valid UTF-8 sequence.

1159 For example, the 9 octet UTF-8 sequence 0x48.65.CA.81.6C.6C.6F.C2.81 (Héllöj) would
 1160 be shortened to fit within 6 octets by composing the é (0x65.CA.81 becomes 0xC3.A9) and
 1161 removing the trailing UTF-8 sequence 0xC2.81 (j), resulting in the 6 octet UTF-8 sequence
 1162 0x48.C3.A9.6C.6C.6F (Héllö).

1163 13.2 URIs

1164 URIs MUST be truncated so that the URI remains valid and accepted by the Printer. For
 1165 example, the 46 octet URI "ipp://printer.example.com/ipp/really-long-name" might be
 1166 shortened to fit within 32 octets by removing the last path name component, resulting in the
 1167 29 octet URI "ipp://printer.example.com/ipp". Similarly, the 52 octet URI
 1168 "ipp://printer.example.com/ipp?query-string" might be shortened to fit within 32 octets by
 1169 removing the query string.

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1172 As recommended by the Uniform Resource Identifier (URI): Generic Syntax [STD66],
1173 Printers SHOULD omit the port number from the URI when it has the default value, e.g., 80
1174 for "http", 443 for "https", and 631 for "ipp" and "ipps" URIs.

1175 **13.3 MIME Media Types**

1176 MIME media type strings MUST be truncated at the end of the media subtype, removing
1177 any parameters that are included with the media type. If the resulting string still exceeds the
1178 maximum length it MUST be discarded. For example, the 24 octet MIME media type
1179 "text/plain;charset=utf-8" would be shortened to fit within 16 octets by removing the trailing
1180 parameter, resulting in the 10 octet MIME media type "text/plain".

1181 **13.4 Delimited Lists**

1182 Delimited Lists combine one or more string types listed in the previous sections, separated
1183 by a delimiting character such as a comma or semicolon. Delimited lists MUST first be
1184 shortened by removal of unnecessary path components (URIs) and parameters (MIME
1185 media types) and second truncated at a delimiting character. For example, the 40 octet list
1186 of MIME media types "text/plain;charset=utf-8,application/pdf" would be shortened to fit
1187 within 32 octets by removing the MIME media type parameter, resulting in the 26 octet list
1188 "text/plain,application/pdf". The same list would be shortened to fit within 16 octets by also
1189 removing the last MIME media type, resulting in the 10 octet list "text/plain".
1190

1191 14. Overview of Changes

1192 14.1 IPP Everywhere™ v1.1

1193 The following changes were made to PWG 5100.14-2013: IPP Everywhere [PWG5100.14]:

- 1194 • References now point to the current versions of dependent documents and
1195 specifications at the time of publication;
- 1196 • Requirements for WS-Discovery have been removed due to a lack of
1197 implementations, which effectively made WS-Discovery support OPTIONAL;
- 1198 • References to OpenXPS and SSDP have been removed;
- 1199 • The "printer-device-id" Printer Description attribute and associated DNS-SD TXT
1200 record keys are no longer required;
- 1201 • DNS-SD is now RECOMMENDED for Printers representing Logical Devices (print
1202 servers);
- 1203 • ICC attributes are now CONDITIONALLY REQUIRED for printers that support ICC-
1204 based color management;
- 1205 • JPEG support is now CONDITIONALLY REQUIRED for color printers;
- 1206 • IPP Finishings 2.1 and the "finishings-col" Job Template attribute are now
1207 RECOMMENDED;
- 1208 • The "printer-strings-languages-supported" and "printer-strings-uri" Printer Status
1209 attributes are now RECOMMENDED to support localization; and
- 1210 • Printer Status and Job Status attributes are now listed in a separate section to match
1211 STD 92 and the IANA IPP registry.
1212

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1496 ipp@pwg.org (subscribers only)

1497 To subscribe, see the PWG web page:

1498 <http://www.pwg.org/>

1499 Implementers of this specification document are encouraged to join the IPP Mailing List in
1500 order to participate in any discussions of clarification issues and review of registration
1501 proposals for additional attributes and values.

1502 The editors would like to especially thank the following individuals who also contributed
1503 significantly to the development of this document:

1504 Andrew Mitchell
1505 Jerry Thrasher - Lexmark
1506 Peter Zehler - Xerox
1507

17. Change History

17.1 August 24, 2018

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

17.2 July 4, 2018

- Status: Prototype
- RFC 8011 is now STD 92
- Updated Unicode to 11.0.0.

17.3 June 6, 2018

- Section 5.7: Fixed cross-reference to Table 10.

- 1533 • Section 14.1: Cleaned up WS-Discovery bullet.
- 1534 • Section 15.2: Updated Bonjour Printing specification reference.
- 1535 **17.4 April 17, 2018**
- 1536 • Removed all references to 1284 device IDs and associated information.
- 1537 **17.5 April 16, 2018**
- 1538 • Made sure IPP Everywhere™ consistently has trademark symbol.
- 1539 • Section 1: Drop examples of mobile devices.
- 1540 • Section 4.2.3.4: TLS key required for IPPS.
- 1541 • Section 5.1: Fix typos.
- 1542 • Section 5.2: Made Identify-Printer operation recommended for logical devices,
1543 required otherwise.
- 1544 • Sections 5.3 and 5.8: Made print-rendering-intent and printer-icc-profiles
1545 conditionally required for printers that support ICC-based color management.
- 1546 • Section 5.3.6: Clarify pdl-override-supported values and usage.
- 1547 • Section 5.7: Deleted stray "note 7"
- 1548 • Section 9.3: Added ICC attributes here.
- 1549 • Section 14: Reworded for present tense, clarified why WS-Discovery has been
1550 removed, removed reason for removing OpenXPS and SSDP.
- 1551 **17.6 April 3, 2018**
- 1552 • Make JPEG support conditionally required for color printers.
- 1553 **17.7 February 9, 2018**
- 1554 • Initial v1.1 draft
- 1555 • Updated template
- 1556 • Updated abstract (can't call it a standard in the abstract)

- 1557 • Updated spec references to current versions
- 1558 • Dropped all mention of UPNP, SSDP, WS-Discovery, and OpenXPS (never
1559 implemented)
- 1560 • Added a new "Overview of Changes" chapter that documents the high-level changes
1561 since the original IPP Everywhere specification
- 1562 • Now recommend support for the Get-User-Printer-Attributes operation
- 1563 • Now recommend support for the "finishings-col" attributes (PWG 5100.1)
- 1564 • Now recommend support for TLS 1.3
- 1565 • Now recommend using a resource path of /ipp/print or /ipp/print/name in Printer URIs
- 1566 • Issue 11: printer-current-time is now listed as an IPP Everywhere attribute, although
1567 only RECOMMENDED since it was missing in the 1.0 spec. (all of the date-time
1568 attributes were previously required, so printer-current-time would have implicitly been
1569 required)
- 1570 • Issue 12: The reference to PWG 5100.12 has been corrected
- 1571 • Issue 13: The reference to the EXIF specification has been updated.
- 1572 • Issue 13: The reference to PWG 5101.1 has been updated.
- 1573 • Issue 14: Clarified the pdl-override-supported requirements ('attempted' or
1574 'guaranteed')
- 1575 • Issue 15: Clarified that relative URIs ("//ipp/print") are not allowed in IPP.
- 1576 • Issue 26: "job-preferred-attributes-supported" should have been "preferred-
1577 attributes-supported"
- 1578 • Issue 31: Incorrect references to PWG 5101.2 have been changed to PWG 5101.1
1579 (MSN)
- 1580 • Issue 33: The notes concerning IPP/2.x conformance changes were confusing and
1581 have been removed
- 1582 • Issue 34: Table 6: overrides-supported now correctly references "note 2"
1583 (conditionally required).
- 1584 • Issue 35: overrides-supported.document-numbers is now **CONDITIONALLY**
1585 **REQUIRED**

- 1586 • Fixed attribute examples to use PAPI encoding
- 1587 • Fixed notes concerning "copies" to indicate that support is required for JPEG and
1588 PDF documents
- 1589 • Separated Printer Status attributes from Printer Description
- 1590 • Separated Job Status attributes from Job Description

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[printer-more-info \(note 6\)](#) [RFC 8011](#)

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: Model and Semantics

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