



The Printer Working Group

January 28 August 27, 2019
Working Draft

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22

IPP Everywhere™ v1.1

Status: Stable

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

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

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

This document is available electronically at:

~~<https://ftp.pwg.org/pub/pwg/ipp/wd/wd-ippeve11-20190128.docx>~~
<https://ftp.pwg.org/pub/pwg/ipp/wd/wd-ippeve11-20190827.docx>

Field Code Changed

23
24
25

~~<https://ftp.pwg.org/pub/pwg/ipp/wd/wd-ippeve11-20190128.pdf>~~
<https://ftp.pwg.org/pub/pwg/ipp/wd/wd-ippeve11-20190827.pdf>

Field Code Changed

26 Copyright © 2011-2019 The Printer Working Group. All rights reserved.

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

34 Title: *IPP Everywhere™ v1.1*

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

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

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

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

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

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

60

61 **About the IEEE-ISTO**

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

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

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

69 **About the IEEE-ISTO PWG**

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

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

83 For additional information regarding the Printer Working Group visit:

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

85 Contact information:

86 The Printer Working Group
87 c/o The IEEE Industry Standards and Technology Organization
88 445 Hoes Lane
89 Piscataway, NJ 08854
90 USA

91

Table of Contents

| | | |
|-----|---|----|
| 92 | | |
| 93 | 1. Introduction | 10 |
| 94 | 2. Terminology | 10 |
| 95 | 2.1 Printing Terminology..... | 10 |
| 96 | 2.2 Protocol Role Terminology | 11 |
| 97 | 2.3 Other Terminology | 11 |
| 98 | 2.4 Acronyms and Organizations | 12 |
| 99 | 3. Requirements..... | 13 |
| 100 | 3.1 Rationale..... | 13 |
| 101 | 3.2 Use Cases | 14 |
| 102 | 3.2.1 Select Printer | 14 |
| 103 | 3.2.2 Print..... | 17 |
| 104 | 3.2.3 Exceptions | 20 |
| 105 | 3.3 Out of Scope..... | 21 |
| 106 | 3.4 Design Requirements | 22 |
| 107 | 4. Discovery Protocols | 23 |
| 108 | 4.1 Printer Description Attributes Used in Discovery | 23 |
| 109 | 4.2 DNS Service Discovery (DNS-SD)..... | 23 |
| 110 | 4.2.1 Service (SRV) Instance Name | 23 |
| 111 | 4.2.2 Geo-Location (LOC) | 24 |
| 112 | 4.2.3 Text (TXT)..... | 26 |
| 113 | 4.3 LDAP and SLP Discovery..... | 31 |
| 114 | 5. Protocol Binding..... | 33 |
| 115 | 5.1 HTTP Features | 33 |
| 116 | 5.1.1 Host..... | 33 |
| 117 | 5.1.2 If-Modified-Since, Last-Modified, and 304 Not Modified..... | 33 |
| 118 | 5.1.3 Cache-Control..... | 33 |

| | | |
|-----|--|----|
| 119 | 5.2 IPP Operations | 34 |
| 120 | 5.3 IPP Printer Description Attributes | 34 |
| 121 | 5.3.1 media-col-database (1setOf collection) | 40 |
| 122 | 5.3.2 media-col-ready (1setOf collection) | 41 |
| 123 | 5.3.3 media-ready (1setOf (type3 keyword name(MAX))) | 42 |
| 124 | 5.3.4 media-size-supported (1setOf collection) | 42 |
| 125 | 5.3.5 media-supported (1setOf (type3 keyword name(MAX))) | 43 |
| 126 | 5.3.6 pdl-override-supported (type2 keyword) | 44 |
| 127 | 5.4 IPP Printer Status Attributes | 44 |
| 128 | 5.4.1 printer-uri-supported (1setOf uri) | 45 |
| 129 | 5.5 IPP Operation Attributes | 46 |
| 130 | 5.6 IPP Job Description Attributes | 48 |
| 131 | 5.7 IPP Job Status Attributes | 48 |
| 132 | 5.7.1 job-id (integer) | 49 |
| 133 | 5.7.2 job-uri (uri) | 49 |
| 134 | 5.8 IPP Job Template Attributes | 49 |
| 135 | 6. Document Formats | 52 |
| 136 | 6.1 Supporting Long-Edge Feed Media with PWG Raster Format Documents | 52 |
| 137 | 7. Additional Values for Existing Attributes | 55 |
| 138 | 7.1 ipp-features-supported (1setOf type2 keyword) | 55 |
| 139 | 8. Additional Semantics for Existing Value Tags | 55 |
| 140 | 8.1 nameWithLanguage and nameWithoutLanguage | 55 |
| 141 | 8.2 naturalLanguage | 55 |
| 142 | 8.3 textWithLanguage and textWithoutLanguage | 55 |
| 143 | 8.4 uri | 56 |
| 144 | 9. Conformance Requirements | 56 |
| 145 | 9.1 Conformance Requirements for Clients | 56 |

146 9.2 Conformance Requirements for Printers..... 56

147 9.3 Conditional Conformance Requirements for Printers 57

148 10. Internationalization Considerations 58

149 11. Security Considerations..... 59

150 12. IANA Considerations 59

151 12.1 Attribute Value Registrations..... 59

152 13. Safe String Truncation 60

153 13.1 Plain Text Strings..... 60

154 13.2 URIs 60

155 13.3 MIME Media Types..... 61

156 13.4 Delimited Lists 61

157 14. Overview of Changes 61

158 14.1 IPP Everywhere™ v1.1 61

159 15. References..... 62

160 15.1 Normative References..... 62

161 15.2 Informative References 68

162 16. Authors' Addresses..... 70

163 17. Change History 71

164 17.1 August 27, 2019..... 71

165 17.2 June 27, 2019 71

166 17.3 January 28, 2019..... 71

167 17.4 September 26, 2018 72

168 17.5 August 24, 2018..... 72

169 17.6 July 4, 2018..... 72

170 17.7 June 6, 2018 73

171 17.8 April 17, 2018..... 73

172 17.9 April 16, 2018..... 73

173 17.10 April 3, 2018..... 74
174 17.11 February 9, 2018 74

175

176

177

List of Figures

178

179 Figure 2 - PWG Raster Bitmaps with Portrait Feed Orientation 53
180 Figure 3 - PWG Raster Bitmaps with Landscape Feed Orientation 53
181 Figure 4 - PWG Raster Bitmaps with Reverse Landscape Feed Orientation 54
182 Figure 5 - PWG Raster Bitmaps with Reverse Portrait Feed Orientation 54

183

184

List of Tables

185

186

187 Table 1 - Attributes in Discovery Protocols 25

188 Table 2 - Priority of DNS TXT Key/Value Pairs..... 27

189 Table 3 - DNS TXT Record Keys 28

190 Table 4 - IPP Everywhere™ Operations 34

191 Table 5 - Required IPP Everywhere™ Printer Description Attributes 35

192 Table 6 - RECOMMENDED IPP Everywhere™ Printer Description Attributes 39

193 Table 7 - IPP Everywhere™ Printer Status Attributes 44

194 Table 8 - REQUIRED IPP Everywhere™ Operation Attributes 46

195 Table 9 - RECOMMENDED IPP Everywhere™ Operation Attributes 47

196 Table 10 - IPP Everywhere™ Required Job Description Attributes 48

197 Table 11 - IPP Everywhere™ Required Job Status Attributes 48

198 Table 12 - REQUIRED IPP Everywhere™ Job Template Attributes 49

199 Table 13 - RECOMMENDED IPP Everywhere™ Job Template Attributes 51

200

201

202

203

204 1. Introduction

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

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

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

217 2. Terminology

218 2.1 Printing Terminology

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

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

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

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

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

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

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

233 **2.2 Protocol Role Terminology**

234 This document also defines the following protocol roles to specify unambiguous
235 conformance requirements:

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

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

241 **2.3 Other Terminology**

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

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

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

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

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

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

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

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

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

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

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

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

267 **2.4 Acronyms and Organizations**

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

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

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

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

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

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

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

276

277 3. Requirements

278 3.1 Rationale

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

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

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

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

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

296 The IPP URL Scheme [RFC3510] defines the 'ipp' URI scheme and the IPP over HTTPS
297 Transport Binding and 'ipps' URI Scheme [RFC7472] defines the 'ipps' URI scheme used
298 for IPP.

299 [The IPP Job Extensions v2.0 \[PWG5100.7\] defines new Job management, monitoring, and](#)
300 [processing capabilities.](#)

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

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

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

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

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

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

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

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

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

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

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

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

329 **3.2 Use Cases**

330 **3.2.1 Select Printer**

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

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

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

340 **3.2.1.1 Select the Last Used Printer**

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

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

347 **3.2.1.2 Select Printer Using Name or Address**

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

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

354 **3.2.1.3 Select Printer Using URI**

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

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

359 **3.2.1.4 Select Printer Using a Directory Service**

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

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

366 3.2.1.5 Select Printer Using a Cloud Service

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

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

373 3.2.1.6 Select Printer Using a Discovery Protocol

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

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

380 3.2.1.7 Select Printer Using Geo-Location

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

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

387 3.2.1.8 Select Printer Using Out of Band Method

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

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

394 3.2.1.9 Select Printer Using Properties

395 Jane selects a Printer using properties such as Service, capability, or description properties
396 of the Printer. Service properties include the application (printing) protocol, security, or

397 restrictions such as the maximum number of pages allowed in a job. Capability properties
398 include values such as media, duplex, finishing, color support, and so forth, Description
399 properties include values such as location, speed, color support, and job size. The
400 properties may be provided by a combination of user input, policy, and/or software heuristic.

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

406 **3.2.2 Print**

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

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

415 **3.2.2.1 Print a Document**

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

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

422 **3.2.2.2 Print a Document by Reference**

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

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

429 3.2.2.3 Print Using Loaded Media

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

432 After Jane initiates a print action from the phone and selects a Printer, the Client photo
433 application automatically selects the largest borderless photographic media loaded on the
434 Selected Printer and the highest print quality. Jane selects additional processing intent for
435 the Job and confirms the print action. The Client sends a print job request to the Printer with
436 the Job Ticket and local photo. The Printer validates the Job Ticket and document data and
437 then prints the photo.

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

441 3.2.2.4 Print a Secure Form

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

446 The treasurer loads check blanks into the Printer and configured the loaded media as
447 necessary at the Printer. After he initiates a print action from the accounting program,
448 selects a Printer for printing, and selects checks to be printed, the Client User Interface
449 displays a preview of the printed checks and he confirms that the checks are correctly
450 paginated and oriented and the amounts, payees and signature are correct. The Client
451 automatically selects the check blank media. The treasurer selects additional processing
452 intent for the Job and confirms the print action. The Client sends a print job request to the
453 Printer with the Job Ticket and document data containing the check information, correctly
454 oriented for the check blank media. He waits for the checks to be printed and removes any
455 excess media from the Printer.

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

459 3.2.2.5 Print with Special Formatting

460 At a seminar located at a country resort, an assistant has been asked to provide 80 sets of
461 ten keywords/phrases, clearly printed on 2-inch by 1-inch paper slips for use in a get
462 acquainted exercise. Costs are to be minimized. The assistant has a laptop with a word

463 processor program. The resort has a Wi-Fi network available to Users and a networked
464 MFD at the business center. The attendant at the business center will charge for any printed
465 sheets removed from the premises.

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

472 **3.2.2.6 Print and Select at Printer**

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

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

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

484 **3.2.2.7 Print to a Service**

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

492 **3.2.2.8 Print to a Recipient**

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

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

500 **3.2.2.9 Print with a Proof Copy**

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

507 **3.2.3 Exceptions**

508 **3.2.3.1 Print Action Canceled**

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

512 **3.2.3.2 Select Printer Canceled**

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

515 **3.2.3.3 Printer No Longer Network Accessible after Selection**

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

519 **3.2.3.4 Not Authorized**

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

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

526 3.2.3.5 Needs Authentication

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

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

531 3.2.3.6 Not Accepting Jobs

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

534 3.2.3.7 Job Ticket or Document Format Not Supported

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

538 3.2.3.8 Job or Document Processing Failures

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

543 3.2.3.9 Printer Fault

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

547 3.2.3.10 Printer Warning

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

551 3.3 Out of Scope

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

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

559 3.4 Design Requirements

560 The IPP Everywhere™ design should:

- 561 1. Define conformance profiles that reference the IPP/2.0 versions [PWG5100.12];
- 562 2. Follow the naming conventions defined in the Internet Printing Protocol/1.1 [STD92],
- 563 including keyword value case (lower) and hyphenation requirements;
- 564 3. Define conformance requirements for both Printers and Clients; and
- 565 4. Support printing with vendor-neutral Client software from any Client to any Printer using
- 566 a variety of discovery protocols, IPP for the transport, and standard document formats.
- 567

568 **4. Discovery Protocols**

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

572 Clients **MUST** support DNS-SD. Clients **MAY** support other Discovery protocols such as
573 LDAP and SLP.

574 **4.1 Printer Description Attributes Used in Discovery**

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

577 **4.2 DNS Service Discovery (DNS-SD)**

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

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

585 **4.2.1 Service (SRV) Instance Name**

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

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

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

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

594 **4.2.2 Geo-Location (LOC)**

595 Printers MUST publish LOC records [RFC1876] over mDNS to provide the physical location
596 of the Printer. Printers MUST allow the User to configure the geo-location manually. If the
597 accuracy of the geo-location is unknown, a value of 9×10^9 meters (0x99) MUST be used.
598

599

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 | pdf | 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 |

| IPP Attribute | DNS-SD TXT Key | LDAP/SLP Attribute |
|------------------------------|----------------------------|------------------------------------|
| printer-more-info | adminurl | printer-more-info |
| printer-name | (instance) | printer-name |
| printer-organization | (note 2) | O |
| printer-organizational-unit | (note 2) | OU |
| printer-uri-supported | (service + host + port) rp | printer-uri, printer-xri-supported |
| printer-uuid | UUID | printer-uuid (note 1) |
| sides-supported | Duplex | printer-sides-supported |
| uri-authentication-supported | air | printer-xri-supported |
| uri-security-supported | TLS | printer-xri-supported |

600 Note 1: Extension attribute to RFC 7612.

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

602 4.2.3 Text (TXT)

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

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

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

612 For example, the IPP "printer-more-info" attribute has a maximum length of 1023 octets,
 613 however the corresponding "adminurl" key cannot represent a value longer than 246 octets
 614 (255 - 9 octets for "adminurl="). Printers MUST truncate long strings as described in section
 615 13.

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

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

620

Table 2 - Priority of DNS TXT Key/Value Pairs

| Most Important | | Least Important | |
|----------------|---------------------|-----------------|---------|
| Access Keys | Identification Keys | Capability Keys | 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 | |

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

622

623

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) |

| Key | Description | Default Value |
|---------|--|------------------|
| 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) |

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

625 4.2.3.1 air

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

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

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

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

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

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

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

645 **4.2.3.2 pdl**

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

652 **4.2.3.3 qtotal**

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

662 **4.2.3.4 TLS**

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

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

667 '1.0'; TLS 1.0 [RFC2246] encryption is supported. This is equivalent to the value 'tls'
668 for the "uri-security-supported" Printer Description attribute.

669 '1.1'; TLS 1.1 [RFC4346] encryption is supported. This is equivalent to the value 'tls'
670 for the "uri-security-supported" Printer Description attribute.

671 '1.2'; TLS 1.2 [RFC5246] encryption is supported. This is equivalent to the value 'tls'
672 for the "uri-security-supported" Printer Description attribute.

673 '1.3'; TLS 1.3 [RFC-TLS1.3] encryption is supported. This is equivalent to the value
674 'tls' for the "uri-security-supported" Printer Description attribute.

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

678 4.2.3.5 UUID

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

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

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

684 12345678-9ABC-DEF0-1234-56789ABCDEF0

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

687 4.2.3.6 DUUID

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

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

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

693 12345678-9ABC-DEF0-1234-56789ABCDEF0

694 4.3 LDAP and SLP Discovery

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

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

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

704 5. Protocol Binding

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

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

709 5.1 HTTP Features

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

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

717 5.1.1 Host

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

720 5.1.2 If-Modified-Since, Last-Modified, and 304 Not Modified

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

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

727 5.1.3 Cache-Control

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

734 **5.2 IPP Operations**

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

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

741 **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 5100.44Z |
| 0x003B | Close-Job | PWG 5100.44Z |
| 0x003C | Identify-Printer (note 1) | PWG 5100.13 |

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

743 **5.3 IPP Printer Description Attributes**

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

Formatted Table

746

Table 5 - Required IPP Everywhere™ Printer Description Attributes

| Attribute | Reference |
|--|-----------------------------|
| feed-orientation-default (note 5) | PWG 5100.11 |
| feed-orientation-supported (note 5) | PWG 5100.11 |
| print-content-optimize-default | PWG 5100.7 |
| print-content-optimize-supported | PWG 5100.7 |
| 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 |
| finishing-template-supported (notes 3 and 7) | PWG 5100.1 |
| 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 |
| 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 |

Formatted Table

| Attribute | Reference |
|---|---------------------------------|
| identify-actions-supported | PWG 5100.13 |
| ipp-features-supported | PWG 5100.13 |
| ipp-versions-supported | RFC 8011 |
| job-account-id-default (note 1) | PWG 5100.35 100.7 |
| job-account-id-supported (note 1) | PWG 5100.35 100.7 |
| job-accounting-user-id-default (note 1) | PWG 5100.35 100.7 |
| job-accounting-user-id-supported (note 1) | PWG 5100.35 100.7 |
| job-constraints-supported | PWG 5100.13 |
| job-creation-attributes-supported | PWG 5100. 44 7 |
| job-ids-supported | PWG 5100. 44 7 |
| job-password-encryption-supported (note 4) | PWG 5100. 44 EPXZ |
| job-password-supported (note 4) | PWG 5100. 44 EPXZ |
| job-resolvers-supported | PWG 5100.13 |
| media-bottom-margin-supported | PWG 5100. 43 7 |
| media-col-database | PWG 5100. 44 7 |
| media-col-database.media-source-properties (note 5) | PWG 5100. 43 7 |
| media-col-default | PWG 5100.35 100.7 |
| media-col-ready | PWG 5100.35 100.7 |
| media-col-ready.media-source-properties (note 5) | PWG 5100. 43 7 |

Formatted Table

| Attribute | Reference |
|-----------------------------------|---------------------------------|
| media-col-supported | PWG 5100.35 100.7 |
| media-default | RFC 8011 |
| media-left-margin-supported | PWG 5100. 43 7 |
| media-ready | RFC 8011 |
| media-right-margin-supported | PWG 5100. 43 7 |
| media-size-supported | PWG 5100.35 100.7 |
| media-source-supported | PWG 5100. 43 7 |
| media-supported | RFC 8011 |
| media-top-margin-supported | PWG 5100. 43 7 |
| media-type-supported | PWG 5100.35 100.7 |
| 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 |
| <u>pdl-override-supported</u> | <u>RFC 8011</u> |

Formatted Table

| Attribute | Reference |
|---|-------------|
| preferred-attributes-supported | PWG 5100.13 |
| print-color-mode-default | PWG 5100.13 |
| print-color-mode-supported | PWG 5100.13 |
| print-quality-default | RFC 8011 |
| print-quality-supported | RFC 8011 |
| print-rendering-intent-default (note 8) | PWG 5100.13 |
| print-rendering-intent-supported (note 8) | PWG 5100.13 |
| 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 |

Formatted Table

| Attribute | Reference |
|------------------------------|--------------|
| sides-default | RFC 8011 |
| sides-supported | RFC 8011 |
| uri-authentication-supported | RFC 8011 |
| uri-security-supported | RFC 8011 |
| which-jobs-supported | PWG 5100.44Z |

Formatted Table

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

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

| Attribute | Reference |
|--|--|
| job-account-type-default | PWG 5100.16 |
| job-account-type-supported | PWG 5100.16 |
| job-authorization-uri-supported | PWG 5100.16 |
| job-mandatory-attributes-supported | PWG 5100.7 |
| job-password-repertoire-configured | REPertoirePWG 5100.EPX |
| job-password-repertoire-supported | REPertoirePWG 5100.EPX |
| job-presets-supported | PRESETS |

| Attribute | Reference |
|--|-----------------------------|
| job-privacy-attributes | PRIVACY |
| job-privacy-scope | PRIVACY |
| jpeg-features-supported | PWG 5100.16 |
| jpeg-k-octets-supported | PWG 5100.16 |
| jpeg-x-dimension-supported | PWG 5100.16 |
| jpeg-y-dimension-supported | PWG 5100.16 |
| pdf-k-octets-supported | PWG 5100.16 |
| pdf-versions-supported | PWG 5100.16 |
| print-content-optimize-default | PWG 5100.7 |
| print-content-optimize-supported | PWG 5100.7 |
| print-scaling-default | PWG 5100.16 |
| print-scaling-supported | PWG 5100.16 |
| printer-dns-sd-name | PWG 5100.16 |
| printer-input-tray | PWG 5100.13 |
| printer-output-tray | PWG 5100.13 |
| printer-privacy-policy-uri | PRIVACY |

761 5.3.1 media-col-database (1setOf collection)

762 The REQUIRED "media-col-database" Printer attribute lists the supported combinations of
 763 "media-col" member attributes for a Printer. In addition to the requirements set forth in IPP:
 764 Job ~~Extensions v2.0 and Printer Extensions—Set 2~~ [PWG5100.447], this specification
 765 defines how a Printer advertises custom and roll-fed media capabilities in the "media-col-
 766 database" attribute.

767 Custom media sizes are described using rangeOfInteger values for the "x-dimension" and
 768 "y-dimension" member attributes of the "media-size" member attribute. Dimensions are
 769 provided for sheets in portrait orientation, that is the "x-dimension" ranges refer to the short
 770 axis and the "y-dimension" ranges refer to the long axis of the sheet. For example, a Printer

771 supporting sheet media from 50x50mm to 330.2x482.6mm from the by-pass tray could
772 report:

```
773     media-col-database=..., {  
774         media-size={  
775             x-dimension=5000-33020  
776             y-dimension=5000-48260 }  
777         media-source='by-pass-tray' }, ...
```

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

```
784     media-col-database=..., {  
785         media-size={  
786             x-dimension=20320-152400  
787             y-dimension=1524-9144000 }, ...
```

788 5.3.2 media-col-ready (1 setOf collection)

789 The REQUIRED "media-col-ready" Printer attribute lists the loaded media combinations of
790 "media-col" member attributes for a Printer. In addition to the requirements set forth in IPP:
791 Production Printing Attributes - Set 1 [PWG5100.7], this specification defines how a
792 Printer advertises manually-fed and roll-fed media in the "media-col-ready" attribute.

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

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

805 5.3.3 media-ready (1setOf (type3 keyword | name(MAX)))

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

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

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

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

825 5.3.4 media-size-supported (1setOf collection)

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

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

```
834     media-size-supported=..., {  
835         x-dimension=5000-33020  
836         y-dimension=5000-48260 },...
```

837 Similarly, roll media sizes are also described using rangeOfInteger values, however the "x-
838 dimension" value refers to the cross-feed (width) dimension and the "y-dimension" value
839 refers to the feed (length) dimension. The supported ranges provide the capabilities of the

840 Printer and not of any loaded media which is reported separately in the "media-col-ready"
841 and "media-ready" attributes. For example, a Printer supporting rolls 8 to 60 inches wide
842 and 6 inches to 300 feet long would report:

```
843     media-size-supported=..., {  
844         x-dimension=20320-152400  
845         y-dimension=1524-9144000 },...
```

846 5.3.5 media-supported (1setOf (type3 keyword | name(MAX)))

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

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

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

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

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

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

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

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

872 5.3.6 pdl-override-supported (type2 keyword)

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

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

879 5.4 IPP Printer Status Attributes

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

882 **Table 7 - 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 |

| Attribute | Reference |
|--|-------------|
| 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 |

883 Note 1: URIs MUST be absolute, SHOULD use the Host value (including port number)
884 from the HTTP Host header (section 5.1.1), and MUST NOT use link-local addresses
885 (section 8.4).
886 Note 2: RECOMMENDED due to its omission from IPP Everywhere™ 1.0, however it is
887 needed for the underlying functionality.

888 5.4.1 printer-uri-supported (1setOf uri)

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

892 **5.5 IPP Operation Attributes**

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

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

| Attribute | Reference |
|-----------------------------------|------------------------|
| compression | RFC 8011 |
| document-format | RFC 8011 |
| 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 5100.447 |
| job-mandatory-attributes (note 3) | PWG 5100.7 |
| job-name | RFC 8011 |
| job-password (note 2) | PWG 5100.447EPX |
| job-password-encryption (note 2) | PWG 5100.447EPX |
| last-document | RFC 8011 |
| limit | RFC 8011 |
| requesting-user-name | RFC 8011 |
| requesting-user-uri | PWG 5100.13 |
| which-jobs | RFC 8011, PWG 5100.447 |

895 Note 1: CONDITIONALLY REQUIRED for Printers that support the "application/pdf" MIME
 896 media type.

897 Note 2: CONDITIONALLY REQUIRED for Printers that support the Print to a Recipient
898 (section 3.2.2.8) use case.
899 Note 3: CONDITIONALLY REQUIRED for Printers that implement Paid Imaging services.

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

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

901

902 5.6 IPP Job Description Attributes

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

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

| Attribute | Reference |
|-----------|-----------|
| job-name | RFC 8011 |

905 5.7 IPP Job Status Attributes

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

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

| Attribute | Reference |
|---------------------------|-------------|
| date-time-at-completed | RFC 8011 |
| date-time-at-creation | RFC 8011 |
| date-time-at-processing | RFC 8011 |
| 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 |

| Attribute | Reference |
|--------------------|-----------|
| time-at-completed | RFC 8011 |
| time-at-creation | RFC 8011 |
| time-at-processing | RFC 8011 |

908
 909 Note 1: URIs MUST be absolute, SHOULD use the Host value from HTTP header (section
 910 5.1.1), and MUST NOT use link-local addresses (section 8.4).

911 5.7.1 job-id (integer)

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

917 5.7.2 job-uri (uri)

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

924 5.8 IPP Job Template Attributes

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

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

| Attribute | Reference |
|--------------------------------------|------------------------|
| copies (note 2) | RFC 8011 |
| feed-orientation (note 5) | PWG 5100.11 |
| finishings (note 4) | RFC 8011 |

| Attribute | Reference |
|--|--------------------------------|
| finishings-col (note 4) | PWG 5100.1 |
| finishings-col.finishing-template (note 4) | PWG 5100.1 |
| job-account-id (note 1) | PWG 5100.35100.7 |
| job-accounting-user-id (note 1) | PWG 5100.35100.7 |
| media | RFC 8011 |
| media-col | PWG 5100.35100.7 |
| media-col.media-bottom-margin | PWG 5100. 437 |
| media-col.media-left-margin | PWG 5100. 437 |
| media-col.media-right-margin | PWG 5100. 437 |
| media-col.media-size | PWG 5100.35100.7 |
| media-col.media-source | PWG 5100. 437 |
| media-col.media-top-margin | PWG 5100. 437 |
| media-col.media-type | PWG 5100.35100.7 |
| 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 |

| Attribute | Reference |
|--|----------------------------|
| 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 |

- 928 Note 1: CONDITIONALLY REQUIRED for Printers that implement paid imaging services.
 929 Note 2: CONDITIONALLY REQUIRED for the "application/pdf" and "image/jpeg" MIME
 930 media types.
 931 Note 3: CONDITIONALLY REQUIRED for Printers that support the "application/pdf" MIME
 932 media type.
 933 Note 4: CONDITIONALLY REQUIRED for Printers with finishers.
 934 Note 5: CONDITIONALLY REQUIRED for Printers that support long-edge feed media.
 935 Note 6: CONDITIONALLY REQUIRED for Printers that support multiple-Document Jobs.
 936 Note 7: CONDITIONALLY REQUIRED for Printers that support ICC-based color
 937 management.

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

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

939

940 6. Document Formats

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

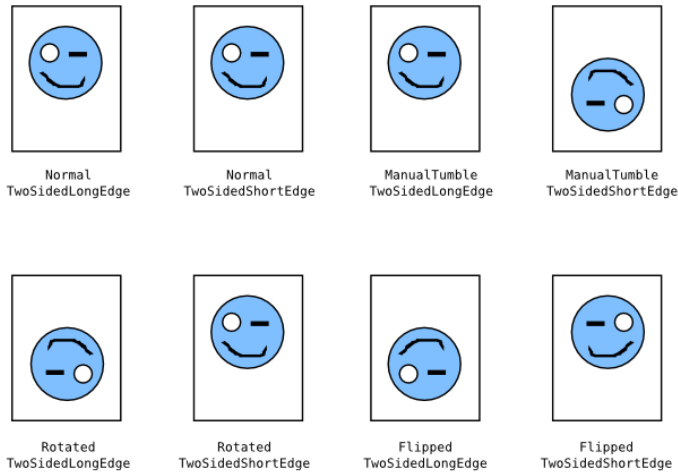
947 IPP/2.1 and IPP/2.2 Printers MUST and IPP/2.0 Printers SHOULD support documents
948 conforming to Document management — Portable document format — Part 1: PDF 1.7
949 [ISO32000] ("application/pdf"). IPP/2.0, IPP/2.1, and IPP/2.2 Printers are defined in
950 [PWG5100.12].

951 6.1 Supporting Long-Edge Feed Media with PWG Raster Format 952 Documents

953 Printers that support long-edge feed media MUST support the "feed-orientation" Job
954 Template attribute and corresponding "feed-orientation-default" and "feed-orientation-
955 supported" Printer attributes. In addition, Printers that support long-edge feed media MUST
956 report the "media-source-properties" member attribute in the "media-col-database" and
957 "media-col-ready" Printer attributes.

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

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

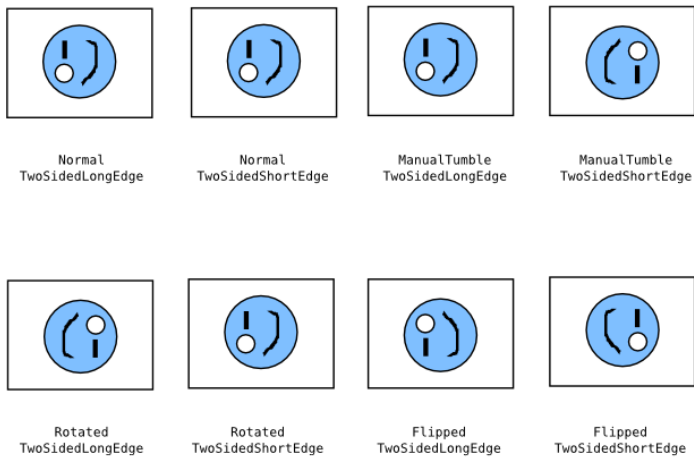


963

964

965

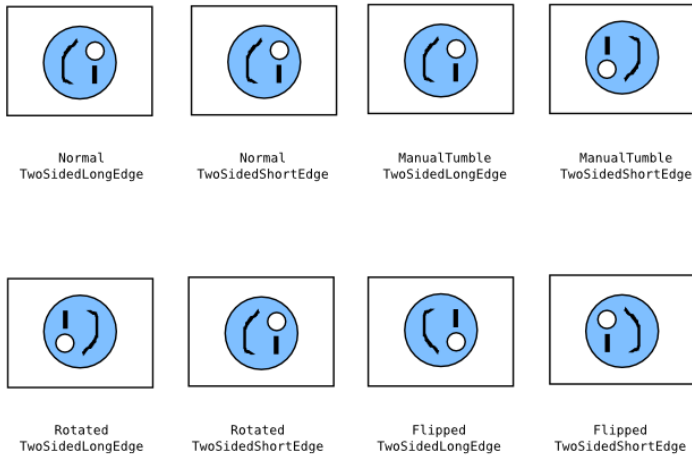
Figure 1 - PWG Raster Bitmaps with Portrait Feed Orientation



966

967

Figure 2 - PWG Raster Bitmaps with Landscape Feed Orientation

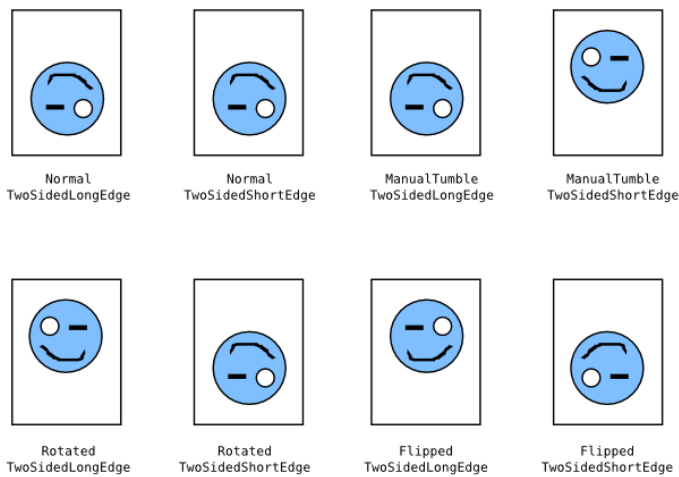


968

969

Figure 3 - PWG Raster Bitmaps with Reverse Landscape Feed Orientation

970



971

972

Figure 4 - PWG Raster Bitmaps with Reverse Portrait Feed Orientation

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

974 **7.1 ipp-features-supported (1setOf type2 keyword)**

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

977 **8. Additional Semantics for Existing Value Tags**

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

982 **8.1 nameWithLanguage and nameWithoutLanguage**

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

987 **8.2 naturalLanguage**

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

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

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

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

994 **8.3 textWithLanguage and textWithoutLanguage**

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

998 8.4 uri

999 URI values MUST be in absolute form, i.e., "ipp://hostname.local/ipp/print" is acceptable but
1000 "/ipp/print" is not. URI values MUST NOT contain link-local addresses in the host field.
1001 Printers MUST NOT generate URI values with link-local addresses and SHOULD NOT
1002 generate URI values with IP addresses obtained via Dynamic Host Control Protocol (DHCP)
1003 [RFC2131] or other auto-configuration protocols. Printers SHOULD use the HTTP Host:
1004 header value when generating URIs for use in Client responses.

1005 9. Conformance Requirements

1006 This section summarizes the Conformance Requirements detailed in the definitions in this
1007 document for Clients and Printers.

1008 9.1 Conformance Requirements for Clients

1009 In order for a Client to claim conformance to this specification a Client MUST support the
1010 following:

- 1011 1. DNS Service Discovery as defined in section 4.2
- 1012 2. IPP/2.0 as defined in section 5
- 1013 3. The REQUIRED operations listed in Table 4
- 1014 4. The REQUIRED Printer Description attributes listed in Table 5
- 1015 5. The REQUIRED operation attributes listed in Table 8
- 1016 6. The REQUIRED Job Template attributes listed in Table 12
- 1017 7. The REQUIRED Job Description attributes listed in Table 10
- 1018 8. The REQUIRED document formats listed in section 5.8
- 1019 9. The "media-source-properties"
1020 member attribute of the "media-col-database" and "media-col-ready" Printer attributes
1021 as reported by the Printer and defined in section 6.1
- 1022 10. The internationalization considerations as defined in section 10
- 1023 11. The security considerations as defined in section 0

1024 9.2 Conformance Requirements for Printers

1025 In order for a Printer to claim conformance to this specification a Printer MUST support the
1026 following:

- 1027 1. DNS Service Discovery as defined in section 4.2
- 1028 2. IPP/2.0 as defined in section 5
- 1029 3. The REQUIRED operations listed in Table 4

- 1030 4. The REQUIRED Printer Description attributes listed in Table 5
- 1031 5. The REQUIRED operation attributes listed in Table 8
- 1032 6. The REQUIRED Job Template attributes listed in Table 12
- 1033 7. The REQUIRED Job Description attributes listed in Table 10
- 1034 8. The REQUIRED document formats listed in section 5.8
- 1035 9. The 'ipp-everywhere' value for the "ipp-features-supported" Printer Description attribute
- 1036 as defined in section 7.1
- 1037 10. The additional semantics for attribute values as defined in section 8
- 1038 11. The internationalization considerations as defined in section 10
- 1039 12. The security considerations as defined in section 0
- 1040 13. The safe string truncation rules as defined in section 13

1041 9.3 Conditional Conformance Requirements for Printers

1042 Printers that support the "image/jpeg" [JFIF] MIME media type MUST support:

- 1043 1. The "copies-default", and "copies-supported" Printer Description attributes as defined in
- 1044 section 5.3.
- 1045 2. The "copies" Job Template attribute as defined in section 5.8.

1046 Printers that support the "application/pdf" [ISO32000] MIME media type MUST support:

- 1047 1. The "copies-default", "copies-supported", "document-password-supported", and "page-
- 1048 ranges-supported" Printer Description attributes as defined in section 5.3,
- 1049 2. The "document-password" Operation attribute as defined in section 5.4, and
- 1050 3. The "copies", "multiple-document-handling", "overrides", and "page-ranges" Job
- 1051 Template attributes as defined in section 5.8.

1052 Printers that support the Print to a Recipient use case (section 3.2.2.8) MUST support:

- 1053 1. The "job-password-supported" and "job-password-encryption-supported" Printer
- 1054 Description attributes as defined in section 5.3, and
- 1055 2. The "job-password" and "job-password-encryption" Operation attributes as defined in
- 1056 section 5.4.

1057 Printers that provide Paid Print services MUST support:

- 1058 1. The "job-account-id-default", "job-account-id-supported", "job-accounting-user-id-
- 1059 default", "job-accounting-user-id-supported", "job-mandatory-attributes-default", "job-
- 1060 mandatory-attributes-supported", and "printer-mandatory-job-attributes" Printer
- 1061 Description attributes as defined in section 5.3,
- 1062 2. The "job-mandatory-attributes" operation attribute as defined in section 5.4, and

1063 3. The "job-account-id" and "job-accounting-user-id" Job Template attributes as defined in
1064 section 5.8.

1065 Printers that support long-edge feed media MUST support:

- 1066 1. The "feed-orientation-default" and "feed-orientation-supported" Printer Description
1067 attributes as defined in section 5.3.
- 1068 2. The "media-source-properties" member attribute of the "media-col-database" and
1069 "media-col-ready" Printer Description attributes as defined in section 5.3.
- 1070 3. The "feed-orientation" Job Template attribute as defined in section 5.8.

1071 Printers that support ICC-based color management MUST support:

- 1072 4. The "print-rendering-intent-default", "print-rendering-intent-supported", and "printer-icc-
1073 profiles" Printer Description attributes as defined in section 5.3.
- 1074 5. The "print-render-intent" Job Template attribute as defined in section 5.8.

1075 10. Internationalization Considerations

1076 For interoperability and basic support for multiple languages, conforming implementations
1077 MUST support:

- 1078 1. The Universal Character Set (UCS) Transformation Format -- 8 bit (UTF-8) [STD63]
1079 encoding of Unicode [UNICODE] [ISO10646]; and
- 1080 2. The Unicode Format for Network Interchange [RFC5198] which requires transmission
1081 of well-formed UTF-8 strings and recommends transmission of normalized UTF-8
1082 strings in Normalization Form C (NFC) [UAX15].

1083 Unicode NFC is defined as the result of performing Canonical Decomposition (into base
1084 characters and combining marks) followed by Canonical Composition (into canonical
1085 composed characters wherever Unicode has assigned them).

1086 WARNING – Performing normalization on UTF-8 strings received from Clients and
1087 subsequently storing the results (e.g., in Job objects) could cause false negatives in Client
1088 searches and failed access (e.g., to Printers with percent-encoded UTF-8 URIs now
1089 'hidden').

1090 Implementations of this specification SHOULD conform to the following standards on
1091 processing of human-readable Unicode text strings, see:

1092 Unicode Bidirectional Algorithm [UAX9] – left-to-right, right-to-left, and vertical

1093 Unicode Line Breaking Algorithm [UAX14] – character classes and wrapping

- 1094 Unicode Normalization Forms [UAX15] – especially NFC for [RFC5198]
- 1095 Unicode Text Segmentation [UAX29] – grapheme clusters, words, sentences
- 1096 Unicode Identifier and Pattern Syntax [UAX31] – identifier use and normalization
- 1097 Unicode Collation Algorithm [UTS10] – sorting
- 1098 Unicode Locale Data Markup Language [UTS35] – locale databases
- 1099 Implementations of this specification are advised to also review the following informational
- 1100 documents on processing of human-readable Unicode text strings:
- 1101 Unicode Character Encoding Model [UTR17] – multi-layer character model
- 1102 Unicode Character Property Model [UTR23] – character properties
- 1103 Unicode Conformance Model [UTR33] – Unicode conformance basis

1104 **11. Security Considerations**

- 1105 The IPP extensions defined in this document require the same security considerations as
- 1106 defined in the Internet Printing Protocol/1.1 [STD92]. In addition, Printers MUST validate
- 1107 the HTTP Host request header in order to protect against DNS rebinding attacks.
- 1108 Implementations of this specification SHOULD conform to the following standard on
- 1109 processing of human-readable Unicode text strings, see:
- 1110 Unicode Security Mechanisms [UTS39] – detecting and avoiding security attacks
- 1111 Implementations of this specification are advised to also review the following informational
- 1112 document on processing of human-readable Unicode text strings:
- 1113 Unicode Security FAQ [UNISECFAQ] – common Unicode security issues

1114 **12. IANA Considerations**

1115 **12.1 Attribute Value Registrations**

- 1116 The keyword attribute values defined in this document will be published by IANA according
- 1117 to the procedures in the Internet Printing Protocol/1.1 [STD92] in the following file:

1118 <http://www.iana.org/assignments/ipp-registrations>

1119 The registry entries will contain the following information:

| 1120 | Attributes (attribute syntax) | | Reference |
|------|---|--|--------------|
| 1121 | Keyword Attribute Value | | |
| 1122 | ----- | | ----- |
| 1123 | ipp-features-supported (1setOf type2 keyword) | | [PWG5100.13] |
| 1124 | ipp-everywhere | | [PWG5100.14] |

1125 13. Safe String Truncation

1126 Strings can be truncated or omitted when transferred over alternate protocols. Printers
1127 MUST truncate long strings at logical boundaries. The following subsections describe how
1128 this truncation is performed for different kinds of strings.

1129 13.1 Plain Text Strings

1130 Plain text strings MUST be truncated at the end of a valid character sequence. For example,
1131 strings using the UTF-8 transformation format of ISO 10646 [STD0063] [ISO10646-1]
1132 SHOULD be represented using the Unicode Format for Network Interchange [RFC5198]
1133 and MUST be truncated at the end of a valid UTF-8 sequence.

1134 For example, the 9 octet UTF-8 sequence 0x48.65.CA.81.6C.6C.6F.C2.81 (Héllöj) would
1135 be shortened to fit within 6 octets by composing the é (0x65.CA.81 becomes 0xC3.A9) and
1136 removing the trailing UTF-8 sequence 0xC2.81 (j), resulting in the 6 octet UTF-8 sequence
1137 0x48.C3.A9.6C.6C.6F (Héllö).

1138 13.2 URIs

1139 URIs MUST be truncated so that the URI remains valid and accepted by the Printer. For
1140 example, the 46 octet URI "ipp://printer.example.com/ipp/really-long-name" might be
1141 shortened to fit within 32 octets by removing the last path name component, resulting in the
1142 29 octet URI "ipp://printer.example.com/ipp". Similarly, the 52 octet URI
1143 "ipp://printer.example.com/ipp?query-string" might be shortened to fit within 32 octets by
1144 removing the query string.

1145 As recommended by the Uniform Resource Identifier (URI): Generic Syntax [STD66],
1146 Printers SHOULD omit the port number from the URI when it has the default value, e.g., 80
1147 for "http", 443 for "https", and 631 for "ipp" and "ipps" URIs.

1148 **13.3 MIME Media Types**

1149 MIME media type strings **MUST** be truncated at the end of the media subtype, removing
1150 any parameters that are included with the media type. If the resulting string still exceeds the
1151 maximum length it **MUST** be discarded. For example, the 24 octet MIME media type
1152 "text/plain;charset=utf-8" would be shortened to fit within 16 octets by removing the trailing
1153 parameter, resulting in the 10 octet MIME media type "text/plain".

1154 **13.4 Delimited Lists**

1155 Delimited Lists combine one or more string types listed in the previous sections, separated
1156 by a delimiting character such as a comma or semicolon. Delimited lists **MUST** first be
1157 shortened by removal of unnecessary path components (URIs) and parameters (MIME
1158 media types) and second truncated at a delimiting character. For example, the 40 octet list
1159 of MIME media types "text/plain;charset=utf-8,application/pdf" would be shortened to fit
1160 within 32 octets by removing the MIME media type parameter, resulting in the 26 octet list
1161 "text/plain,application/pdf". The same list would be shortened to fit within 16 octets by also
1162 removing the last MIME media type, resulting in the 10 octet list "text/plain".

1163 **14. Overview of Changes**

1164 **14.1 IPP Everywhere™ v1.1**

1165 The following changes were made to PWG 5100.14-2013: IPP Everywhere [PWG5100.14-
1166 2013]:

- 1167 • References now point to the current versions of dependent documents and
1168 specifications at the time of publication;
- 1169 • Requirements for WS-Discovery have been removed due to a lack of
1170 implementations, which effectively made WS-Discovery support **OPTIONAL**;
- 1171 • References to OpenXPS and SSDP have been removed;
- 1172 • The "printer-device-id" Printer Description attribute and associated DNS-SD TXT
1173 record keys are no longer required;
- 1174 • DNS-SD is now **RECOMMENDED** for Printers representing Logical Devices (print
1175 servers);

- 1176 • ICC attributes are now **CONDITIONALLY REQUIRED** for printers that support ICC-
1177 based color management;
- 1178 • JPEG support is now **CONDITIONALLY REQUIRED** for color printers;
- 1179 • The "compression-supplied", "document-format-supplied", "document-format-
1180 version", "document-format-version-supplied", "document-name-supplied" attributes
1181 are no longer required;
- 1182 • The "feed-orientation", "feed-orientation-default", and "feed-orientation-supported"
1183 attributes are no longer required;
- 1184 • The "print-content-optimize", "print-content-optimize-default", and "print-content-
1185 optimize-supported" attributes have been reduced to RECOMMENDED;
- 1186 • IPP Finishings 2.1 and the "finishings-col" Job Template attribute are now
1187 RECOMMENDED;
- 1188 • The "printer-input-tray" and "printer-output-tray" Printer Description attributes are
1189 now RECOMMENDED to provide tray information and status;
- 1190 • The "printer-strings-languages-supported" and "printer-strings-uri" Printer Status
1191 attributes are now RECOMMENDED to support localization; and
- 1192 • Printer Status and Job Status attributes are now listed in a separate section to match
1193 STD 92 and the IANA IPP registry.

1194 15. References

1195 15.1 Normative References

- 1196 [BCP14] S. Bradner, "Key words for use in RFCs to Indicate Requirement
1197 Levels", RFC 2119/BCP 14, March 1997,
1198 <https://tools.ietf.org/html/rfc2119>
- 1199 [BCP47] A. Phillips, Ed., M. Davis, Ed., "Tags for Identifying Languages", BCP
1200 47/RFC 5646, September 2009, <https://tools.ietf.org/html/rfc5646>
- 1201 [EXIF] "Standard of the Camera & Imaging Products Association, CIPA DC-
1202 008-Translation-2016, Exchangeable image file format for digital still
1203 cameras: Exif Version 2.31", July 2016,
1204 <http://www.cipa.jp/std/documents/e/DC-008-Translation-2016-E.pdf>

| | | |
|------|------------------|--|
| 1205 | [GUPA] | S. Kennedy, "IPP Get-User-Printer-Attributes Operation (GUPA)", December 2017, https://ftp.pwg.org/pub/pwg/ipp/registrations/reg-ippgupa-20171214.pdf |
| 1206 | | |
| 1207 | | |
| 1208 | [ISO10646] | "Information technology -- Universal Coded Character Set (UCS)", ISO/IEC 10646:2011 |
| 1209 | | |
| 1210 | [ISO32000] | "Document management — Portable document format — Part 1: PDF 1.7", ISO 32000-2008 |
| 1211 | | |
| 1212 | [JFIF] | E. Hamilton, "JPEG File Interchange Format Version 1.02", September 1992, http://www.w3.org/Graphics/JPEG/jfif3.pdf |
| 1213 | | |
| 1214 | <u>[PRESETS]</u> | <u>S. Kennedy, "IPP Presets (PRESET)", December 2017,</u> |
| 1215 | | <u>https://ftp.pwg.org/pub/pwg/ipp/registrations/reg-ippreset-20171214.pdf</u> |
| 1216 | | |
| 1217 | <u>[PRIVACY]</u> | <u>M. Sweet, "IPP Privacy Attributes v1.0 (PRIVACY)", April 2018,</u> |
| 1218 | | <u>https://ftp.pwg.org/pub/pwg/ipp/registrations/reg-ippprivacy10-20180412.pdf</u> |
| 1219 | | |
| 1220 | [PWG5100.1] | S. Kennedy, M. Sweet, "IPP Finishings 2.1 (FIN)", PWG 5100.1-2017, February 2017, https://ftp.pwg.org/pub/pwg/candidates/cs-ippfinishings21-20170217-5100.1.pdf |
| 1221 | | |
| 1222 | | |
| 1223 | [PWG5100.7] | <u>M. Sweet, "IPP Job Extensions v2.0 (JOBEXT)", PWG 5100.7-2019,</u> |
| 1224 | | <u>[PWG5100.7] M. Sweet, "IPP Job Extensions v2.0 (JOBEXT)",</u> |
| 1225 | | <u>[PWG5100.7] M. Sweet, "IPP Job Extensions v2.0 (JOBEXT)",</u> |
| 1226 | | <u>[PWG5100.7] M. Sweet, "IPP Job Extensions v2.0 (JOBEXT)",</u> |
| 1227 | [PWG5100.7] | <u>T. Hastings, P. ZehlerM. Sweet, "Standard for The Internet Printing Protocol (IPP): IPP Job Extensions v2.0 (JOBEXT)", PWG 5100.7-</u> |
| 1228 | | <u>200320YY19, October MONTHAugust 200320??219,</u> |
| 1229 | | <u>https://ftp.pwg.org/pub/pwg/candidates/cs-ippjobext10-20031031-5100.7.pdf</u> <u>https://ftp.pwg.org/pub/pwg/ipp/wd/wd-ippjobext20-20190418.pdf</u> <u>https://ftp.pwg.org/pub/pwg/candidates/cs-ippjobext20-20190816-5100.7.pdf</u> |
| 1230 | | |
| 1231 | | |
| 1232 | | |
| 1233 | | |
| 1234 | [PWG5100.9] | I. McDonald, C. Whittle, "Internet Printing Protocol (IPP)/ Printer State Extensions v1.0", PWG 5100.9-2009, July 2009, https://ftp.pwg.org/pub/pwg/candidates/cs-ippstate10-20090731-5100.9.pdf |
| 1235 | | |
| 1236 | | |
| 1237 | | |

Field Code Changed

- 1238 [PWG5100.12] R. Bergman, H. Lewis, I. McDonald, M. Sweet, "IPP Version 2.0, 2.1,
1239 [PWG5100.12] R. Bergman, H. Lewis, I. McDonald, M. Sweet,
1240 [PWG5100.12] R. Bergman, H. Lewis, I. McDonald, M. Sweet,
1241 [PWG5100.12] R. Bergman, H. Lewis, I. McDonald, M. Sweet,
- 1242 [PWG5100.12] R. Bergman, H. Lewis, I. McDonald, M. Sweet, "IPP Version 2.0, 2.1,
1243 and 2.2", PWG Standard 5100.12-2015, October 2015,
1244 [https://ftp.pwg.org/pub/pwg/standards/std-ipp20-20151030-
1245 5100.12.pdf](https://ftp.pwg.org/pub/pwg/standards/std-ipp20-20151030-5100.12.pdf)
- 1246 [PWG5100.13] M. Sweet, I. McDonald, "IPP: Job and Printer Extensions - Set 3
1247 (JPS3)", PWG 5100.13-2012, July 2012,
1248 [https://ftp.pwg.org/pub/pwg/candidates/cs-ippjobprinterext3v10-
1249 20120727-5100.13.pdf](https://ftp.pwg.org/pub/pwg/candidates/cs-ippjobprinterext3v10-20120727-5100.13.pdf)
- 1250 [PWG5100.16] M. Sweet, "IPP Transaction-Based Printing Extensions", PWG
1251 5100.16-2013, November 2013,
1252 [https://ftp.pwg.org/pub/pwg/candidates/cs-ipptrans10-20131108-
1253 5100.16.pdf](https://ftp.pwg.org/pub/pwg/candidates/cs-ipptrans10-20131108-5100.16.pdf)
- 1254 [PWG5100.18] M. Sweet, I. McDonald, "IPP Shared Infrastructure Extensions
1255 (INFRA)", PWG 5100.18-2015, June 2015,
1256 [https://ftp.pwg.org/pub/pwg/candidates/cs-ippinfra10-20150619-
1257 5100.18.pdf](https://ftp.pwg.org/pub/pwg/candidates/cs-ippinfra10-20150619-5100.18.pdf)
- 1258 [~~PWG5100.EPX~~] ~~S. Kennedy, "IPP Enterprise Printing Extensions v2.0 (EPX)", PWG
1259 5100.EPX-YYYY, Month YYYY,
1260 <https://ftp.pwg.org/pub/pwg/ipp/wd/wd-ippepx-20190614.pdf>~~
- 1261 [PWG5101.1] M. Sweet, R. Bergman, T. Hastings, "PWG Media Standardized
1262 Names 2.0 (MSN2)", PWG 5101.1-2013, March 2013,
1263 [https://ftp.pwg.org/pub/pwg/candidates/cs-pwgmsn20-20130328-
1264 5101.1.pdf](https://ftp.pwg.org/pub/pwg/candidates/cs-pwgmsn20-20130328-5101.1.pdf)
- 1265 [PWG5102.4] M. Sweet, "PWG Raster Format", PWG 5102.4-2012, April 2012,
1266 [https://ftp.pwg.org/pub/pwg/candidates/cs-ipp raster10-20120420-
1267 5102.4.pdf](https://ftp.pwg.org/pub/pwg/candidates/cs-ipp raster10-20120420-5102.4.pdf)
- 1268 [RFC2083] T. Boutell, "PNG (Portable Network Graphics) Specification Version
1269 [RFC2083] T. Boutell, "PNG (Portable Network Graphics)
1270 [RFC2083] T. Boutell, "PNG (Portable Network Graphics)

- 1271 [RFC2083] T. Boutell, "PNG (Portable Network Graphics) Specification Version
1272 1.0", RFC 2083, March 1997, <https://tools.ietf.org/html/rfc2083>
- 1273 [RFC2131] R. Droms, "Dynamic Host Configuration Protocol", RFC 2131, March
1274 1997, <https://tools.ietf.org/html/rfc2131>
- 1275 [RFC2136] P. Vixie, S. Thomson, Y. Rekhter, J. Bound, "Dynamic Updates in the
1276 Domain Name System (DNS UPDATE)", RFC 2136, April 1997,
1277 <https://tools.ietf.org/html/rfc2136>
- 1278 [RFC2246] T.Dierks, C. Allen, "The TLS Protocol Version 1.0", RFC 2246,
1279 January 1999, <https://tools.ietf.org/html/rfc2246>
- 1280 [RFC2608] E. Guttman, C. Perkins, J. Veizades, M. Day, "Service Location
1281 Protocol, Version 2", RFC 2608, June 1999,
1282 <https://tools.ietf.org/html/rfc2608>
- 1283 [RFC2782] A. Gulbrandsen, P. Vixie, L. Esibov, "A DNS RR for specifying the
1284 location of services (DNS SRV)", RFC 2782, February 2000,
1285 <https://tools.ietf.org/html/rfc2782>
- 1286 [RFC3510] R. Herriot, I. McDonald, "Internet Printing Protocol/1.1: IPP URL
1287 Scheme", RFC 3510, April 2003, <https://tools.ietf.org/html/rfc3510>
- 1288 [RFC3805] R. Bergman, H. Lewis, I. McDonald, "Printer MIB v2", RFC 3805,
1289 June 2004, <https://tools.ietf.org/html/rfc3805>
- 1290 [RFC3806] R. Bergman, H. Lewis, I. McDonald, "Printer Finishing MIB", RFC
1291 3806, June 2004, <https://tools.ietf.org/html/rfc3806>
- 1292 [RFC3927] S. Cheshire, B. Aboba, E. Guttman, "Dynamic Configuration of IPv4
1293 Link-Local Addresses", RFC 3927, May 2005,
1294 <https://tools.ietf.org/html/rfc3927>
- 1295 [RFC3995] R. Herriot, T. Hastings, "IPP Event Notifications and Subscriptions",
1296 RFC 3995, March 2005, <https://tools.ietf.org/html/rfc3995>
- 1297 [RFC4122] P. Leach, M. Mealling, R. Salz, "A Universally Unique Identifier
1298 (UUID) URN Namespace", RFC 4122, July 2005,
1299 <https://tools.ietf.org/html/rfc4122>
- 1300 [RFC4346] T.Dierks, E. Rescorla, "Transport Layer Security 1.1", RFC 4346,
1301 April 2006, <https://tools.ietf.org/html/rfc4346>

- 1302 [RFC4510] K. Zeilenga, "Lightweight Directory Access Protocol (LDAP):
1303 Technical Specification Road Map", RFC 4510, June 2006,
1304 <https://tools.ietf.org/html/rfc4510>
- 1305 [RFC4519] A. Sciberras, "Lightweight Directory Access Protocol (LDAP): Schema
1306 for User Applications", RFC 4519, June 2006,
1307 <https://tools.ietf.org/html/rfc4519>
- 1308 [RFC5198] J. Klensin, M. Padlipsky, "Unicode Format for Network Interchange",
1309 RFC 5198, March 2008, <https://tools.ietf.org/html/rfc5198>
- 1310 [RFC5246] T.Dierks, E. Rescorla, "Transport Layer Security 1.2", RFC 5246,
1311 August 2008, <https://tools.ietf.org/html/rfc5246>
- 1312 [RFC5870] A. Mayrhofer, C. Spanring, "A Uniform Resource Identifier for
1313 Geographic Locations ('geo' URI)", RFC 5870, June 2010,
1314 <https://tools.ietf.org/html/rfc5870>
- 1315 [RFC5198] J. Klensin, M. Padlipsky, "Unicode Format for Network Interchange",
1316 RFC 5198, March 2008, <https://tools.ietf.org/html/rfc5198>
- 1317 [RFC6749] D. Hardt, "The OAuth 2.0 Authorization Framework", RFC 6749,
1318 October 2012, <https://tools.ietf.org/html/rfc6749>
- 1319 [RFC6750] M. Jones, D. Hardt, "The OAuth 2.0 Authorization Framework: Bearer
1320 Token Usage", RFC 6750, October 2012,
1321 <https://tools.ietf.org/html/rfc6750>
- 1322 [RFC7230] R. Fielding, J. Reschke, "Hypertext Transfer Protocol (HTTP/1.1):
1323 Message Syntax and Routing", RFC 7230, June 2014,
1324 <https://tools.ietf.org/html/rfc7230>
- 1325 [RFC7231] R. Fielding, J. Reschke, "Hypertext Transfer Protocol (HTTP/1.1):
1326 Semantics and Content", RFC 7231, June 2014,
1327 <https://tools.ietf.org/html/rfc7231>
- 1328 [RFC7232] R. Fielding, J. Reschke, "Hypertext Transfer Protocol (HTTP/1.1):
1329 Conditional Requests", RFC 7232, June 2014,
1330 <https://tools.ietf.org/html/rfc7232>
- 1331 [RFC7234] R. Fielding, J. Reschke, "Hypertext Transfer Protocol (HTTP/1.1):
1332 Caching", RFC 7234, June 2014, <https://tools.ietf.org/html/rfc7234>

- 1333 [RFC7472] I. McDonald, M. Sweet, "Internet Printing Protocol (IPP) over HTTPS
1334 Transport Binding and the 'ipps' URI Scheme", RFC 7472, March
1335 2015, <https://tools.ietf.org/html/rfc7472>
- 1336 [RFC7612] P. Fleming, I. McDonald, "Lightweight Directory Access Protocol
1337 (LDAP): Schema for Printer Services", RFC 7612, June 2015,
1338 <https://tools.ietf.org/html/rfc7612>
- 1339 [RFC8446] E. Rescorla, "The Transport Layer Security (TLS) Protocol Version
1340 1.3", RFC 8446, August 2018, <https://tools.ietf.org/html/rfc8446>
- 1341 [STD63] F. Yergeau, "UTF-8, a transformation format of ISO 10646", RFC
1342 3629/STD 63, November 2003,
1343 <https://tools.ietf.org/html/rfc3629><https://tools.ietf.org/html/std63>
- 1344 [STD66] T. Berners-Lee, R. Fielding, L. Masinter, "Uniform Resource Identifier
1345 (URI): Generic Syntax", RFC 3986/STD 66, January 2005,
1346 <https://tools.ietf.org/html/rfc3986><https://tools.ietf.org/html/std66>
- 1347 [STD92] M. Sweet, I. McDonald, "Internet Printing Protocol/1.1", STD 92, June
1348 2018, <https://tools.ietf.org/html/std92>
- 1349 [UAX9] Unicode Consortium, "Unicode Bidirectional Algorithm", UAX#9, May
1350 2018, <https://www.unicode.org/reports/tr9>
- 1351 [UAX14] Unicode Consortium, "Unicode Line Breaking Algorithm", UAX#14,
1352 May 2018, <https://www.unicode.org/reports/tr14>
- 1353 [UAX15] M. Davis, M. Duerst, "Unicode Normalization Forms", Unicode
1354 Standard Annex 15, May 2018, <https://www.unicode.org/reports/tr15>
- 1355 [UAX29] Unicode Consortium, "Unicode Text Segmentation", UAX#29, May
1356 2018, <https://www.unicode.org/reports/tr29>
- 1357 [UAX31] Unicode Consortium, "Unicode Identifier and Pattern Syntax",
1358 UAX#31, June 2018, <https://www.unicode.org/reports/tr31>
- 1359 [UNICODE] Unicode Consortium, "Unicode Standard", Version ~~4.1~~12.0.0, June
1360 ~~2018~~2019,
1361 <https://www.unicode.org/versions/Unicode11.0.0/><https://www.unicode.org/versions/Unicode12.0.0/>
- 1363 [UTS10] Unicode Consortium, "Unicode Collation Algorithm", UTS#10, May
1364 2018, <https://www.unicode.org/reports/tr10>

Field Code Changed

Field Code Changed

Field Code Changed

- 1365 [UTS35] Unicode Consortium, "Unicode Locale Data Markup Language",
1366 UTS#35, March 2018, <https://www.unicode.org/reports/tr35>
- 1367 [UTS39] Unicode Consortium, "Unicode Security Mechanisms", UTS#39, May
1368 2018, <https://www.unicode.org/reports/tr39>
- 1369 [WGS84] National Geospatial-Intelligence Agency, "Department of Defense
1370 World Geodetic System 1984, Its Definition and Relationships With
1371 Local Geodetic Systems, Third Edition", NIMA Technical Report
1372 TR8350.2, January 2000,
1373 <http://earth-info.nga.mil/GandG/publications/tr8350.2/wgs84fin.pdf>
- 1374 [X.520] International Telecommunication Union, "Information technology -
1375 Open Systems Interconnection - The Directory: Selected attribute
1376 types", ITU-T X.520, November 2008.

1377 15.2 Informative References

- 1378 [BONJOUR] Apple Inc., "Bonjour Printing Specification Version 1.2.1", February
1379 2015, <https://developer.apple.com/bonjour/>
- 1380 [CUPSIPP] Apple Inc., "CUPS Implementation of IPP",
1381 <https://www.cups.org/doc/spec-ipp.html>
- 1382 [PWG5100.14-2013]
1383 M. Sweet, I. McDonald, A. Mitchell, J. Hutchings, "IPP Everywhere",
1384 PWG 5100.14-2013, January 2013,
1385 [https://ftp.pwg.org/pub/pwg/candidates/cs-ippeve10-20130128-
1386 5100.14.pdf](https://ftp.pwg.org/pub/pwg/candidates/cs-ippeve10-20130128-5100.14.pdf)
- 1387 [RFC3196] T. Hastings, C. Manros, P. Zehler, C. Kugler, H. Holst, "Internet
1388 Printing Protocol/1.1: Implementer's Guide", RFC 3196, November
1389 2001, <https://tools.ietf.org/html/rfc3196>
- 1390 [UTR17] Unicode Consortium "Unicode Character Encoding Model", UTR#17,
1391 November 2008, <https://www.unicode.org/reports/tr17>
- 1392 [UTR23] Unicode Consortium "Unicode Character Property Model", UTR#23,
1393 May 2015, <https://www.unicode.org/reports/tr23>
- 1394 [UTR33] Unicode Consortium "Unicode Conformance Model", UTR#33,
1395 November 2008, <https://www.unicode.org/reports/tr33>

1396 [UNISECFAQ] Unicode Consortium “Unicode Security FAQ”, November 2013,
1397 <https://www.unicode.org/faq/security.html>
1398

1399 **16. Authors' Addresses**

1400 Primary authors:

1401 Michael Sweet
1402 Apple Inc.
1403 One Apple Park Way
1404 MS 111-HOMC
1405 Cupertino CA 95014
1406 USA

1408 Ira McDonald
1409 High North
1410 PO Box 221
1411 Grand Marais, MI 49839

1412 Send comments to the PWG IPP Mailing List:

1413 ipp@pwg.org (subscribers only)

1414 To subscribe, see the PWG web page:

1415 <http://www.pwg.org/>

1416 Implementers of this specification document are encouraged to join the IPP Mailing List in
1417 order to participate in any discussions of clarification issues and review of registration
1418 proposals for additional attributes and values.

1419 The editors would like to especially thank the following individuals who also contributed
1420 significantly to the development of this document:

1421 Andrew Mitchell
1422 Jerry Thrasher - Lexmark
1423 Peter Zehler - Xerox

1424

1425 **17. Change History**

1426 **17.1 August 27, 2019**

- 1427
 - Updated references - published PWG 5100.7 update and working draft of EPX

1428 **17.2 June 27, 2019**

- 1429
 - Removed feed-orientation-xxx attributes (obsolete)
- 1430
 - Add pdl-override-supported to list of required Printer Description attributes (was
- 1431
 - already required in the text, just missing from the table)
- 1432
 - Made print-content-optimize RECOMMENDED
- 1433
 - Made printer-input-tray and printer-output-tray RECOMMENDED
- 1434
 - Global: Change PWG 5100.3 and 5100.11, and all media-col attrs, to PWG 5100.7
- 1435
 - (JOBEXT v2.0)

1436 **17.117.3 January 28, 2019**

- 1437
 - Status: Stable
- 1438
 - Updated reference to v1.0 to use -2013 suffix.
- 1439
 - Sections 3.1 and 15.1: Added references to 5100.16 and registration documents
- 1440
 - Section 5.3: Added recommended attributes table
- 1441
 - Section 5.5: Added recommended attributes table
- 1442
 - Sections 5.6 and 5.7: Tables used "Source" heading instead of "Reference"
- 1443
 - Section 5.8: Table 10 had wrong note for finishings-col, added finishings-
- 1444
 - col.finishing-template, made note 2 conditionally required, added recommended
- 1445
 - attributes table

1446 17.217.4 September 26, 2018

- 1447
- 1448
- 1449
- 1450
- Removed the "compression-supplied", "document-format-supplied", "document-format-version", "document-format-version-supplied", and "document-name-supplied" attributes from the required attribute lists since the corresponding attributes are being obsoleted in PWG 5100.7.

1451 17.317.5 August 24, 2018

- 1452
- 1453
- 1454
- 1455
- 1456
- 1457
- 1458
- 1459
- 1460
- 1461
- 1462
- 1463
- 1464
- 1465
- 1466
- 1467
- 1468
- 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)

1469 17.417.6 July 4, 2018

- 1470
- Status: Prototype

1471 • RFC 8011 is now STD 92

1472 • Updated Unicode to 11.0.0.

1473 **17.517.7 June 6, 2018**

1474 • Section 5.7: Fixed cross-reference to Table 10.

1475 • Section 14.1: Cleaned up WS-Discovery bullet.

1476 • Section 15.2: Updated Bonjour Printing specification reference.

1477 **17.617.8 April 17, 2018**

1478 • Removed all references to 1284 device IDs and associated information.

1479 **17.717.9 April 16, 2018**

1480 • Made sure IPP Everywhere™ consistently has trademark symbol.

1481 • Section 1: Drop examples of mobile devices.

1482 • Section 4.2.3.4: TLS key required for IPPS.

1483 • Section 5.1: Fix typos.

1484 • Section 5.2: Made Identify-Printer operation recommended for logical devices,
1485 required otherwise.

1486 • Sections 5.3 and 5.8: Made print-rendering-intent and printer-icc-profiles
1487 conditionally required for printers that support ICC-based color management.

1488 • Section 5.3.6: Clarify pdl-override-supported values and usage.

1489 • Section 5.7: Deleted stray "note 7"

1490 • Section 9.3: Added ICC attributes here.

1491 • Section 14: Reworded for present tense, clarified why WS-Discovery has been
1492 removed, removed reason for removing OpenXPS and SSDP.

1493 **17.817.10 April 3, 2018**

- 1494 • Make JPEG support conditionally required for color printers.

1495 **17.917.11 February 9, 2018**

- 1496 • Initial v1.1 draft
- 1497 • Updated template
- 1498 • Updated abstract (can't call it a standard in the abstract)
- 1499 • Updated spec references to current versions
- 1500 • Dropped all mention of UPNP, SSDP, WS-Discovery, and OpenXPS (never
1501 implemented)
- 1502 • Added a new "Overview of Changes" chapter that documents the high-level changes
1503 since the original IPP Everywhere specification
- 1504 • Now recommend support for the Get-User-Printer-Attributes operation
- 1505 • Now recommend support for the "finishings-col" attributes (PWG 5100.1)
- 1506 • Now recommend support for TLS 1.3
- 1507 • Now recommend using a resource path of /ipp/print or /ipp/print/name in Printer URIs
- 1508 • Issue 11: printer-current-time is now listed as an IPP Everywhere attribute, although
1509 only RECOMMENDED since it was missing in the 1.0 spec. (all of the date-time
1510 attributes were previously required, so printer-current-time would have implicitly been
1511 required)
- 1512 • Issue 12: The reference to PWG 5100.12 has been corrected
- 1513 • Issue 13: The reference to the EXIF specification has been updated.
- 1514 • Issue 13: The reference to PWG 5101.1 has been updated.
- 1515 • Issue 14: Clarified the pdl-override-supported requirements ('attempted' or
1516 'guaranteed')
- 1517 • Issue 15: Clarified that relative URIs ("//ipp/print") are not allowed in IPP.

- 1518 • Issue 26: "job-preferred-attributes-supported" should have been "preferred-
1519 attributes-supported"
- 1520 • Issue 31: Incorrect references to PWG 5101.2 have been changed to PWG 5101.1
1521 (MSN)
- 1522 • Issue 33: The notes concerning IPP/2.x conformance changes were confusing and
1523 have been removed
- 1524 • Issue 34: Table 6: overrides-supported now correctly references "note 2"
1525 (conditionally required).
- 1526 • Issue 35: overrides-supported.document-numbers is now **CONDITIONALLY**
1527 **REQUIRED**
- 1528 • Fixed attribute examples to use PAPI encoding
- 1529 • Fixed notes concerning "copies" to indicate that support is required for JPEG and
1530 PDF documents
- 1531 • Separated Printer Status attributes from Printer Description
- 1532 • Separated Job Status attributes from Job Description