The Printer Working Group

IPP Everywhere™ v1.1

Status: Approved

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 Candidate Standard. For a definition of a "PWG Candidate Standard", see:

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

This document is available electronically at:

https://ftp.pwg.org/pub/pwg/candidates/cs-ippeve11-20200515-5100.14.docx
https://ftp.pwg.org/pub/pwg/candidates/cs-ippeve11-20200515-5100.14.pdf

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About the IEEE-ISTO PWG

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

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

For additional information regarding the Printer Working Group visit:

https://www.pwg.org

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171 1. Introduction

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

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

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

184 2. Terminology

185 2.1 Conformance Terminology

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

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

194 2.2 Printing Terminology

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

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

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

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

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

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

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

210 **2.3 Protocol Role Terminology**

211 This document also defines the following protocol roles to specify unambiguous
212 conformance requirements:

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

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

218 **2.4 Other Terminology**

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

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

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

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

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

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

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

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

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

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

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

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

244   **2.5 Acronyms and Organizations**

245   *IANA*: Internet Assigned Numbers Authority, http://www.iana.org/

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

247   *IETF*: Internet Engineering Task Force, http://www.ietf.org/

248   *ISO*: International Organization for Standardization, http://www.iso.org/

249   *NFC*: Near Field Communications, http://www.nfc-forum.org/

250   *PWG*: Printer Working Group, http://www.pwg.org/
251

252 **3. Requirements**

253 **3.1 Rationale**

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

256   1. Use existing protocols and schema to support discovery, identification, and
257   auto-configuration of Imaging Devices,
258   2. Use existing IPP specifications to support job submission to and monitoring of
259   Imaging Devices,
260   3. Encourage support for printing through standard document formats, and
261   4. Discourage the further proliferation of vendor-specific page description
262   languages, formats, discovery protocols, interfaces, and transports

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

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

265   1. A collection of existing IPP specifications that form the basis for IPP/2.0
266   2. Standard job template attributes
267   3. Specific interoperability requirements, such as HTTP/1.1 support with chunking
268   and IPP collection attribute support
269   4. New version number and operation requirements for different classes of
270   Imaging Devices

271 The IPP URL Scheme [RFC3510] defines the 'ipp' URI scheme and the IPP over HTTPS
272 Transport Binding and 'ipps' URI Scheme [RFC7472] defines the 'ipps' URI scheme used
273 for IPP.

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

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

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

280 The IPP Job Password Repertoire [REPERTOIRE] defines attributes that articulate the
281 repertoire of allowable password strings.

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

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

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

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

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

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

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

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

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

3.2 Use Cases

3.2.1 Select Printer

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

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

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

3.2.1.1 Select the Last Used Printer

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

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

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

319 **3.2.1.2 Select Printer Using Name or Address**

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

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

326 **3.2.1.3 Select Printer Using URI**

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

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

331 **3.2.1.4 Select Printer Using a Directory Service**

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

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

338 **3.2.1.5 Select Printer Using a Cloud Service**

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

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

345 **3.2.1.6 Select Printer Using a Discovery Protocol**

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

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

3.2.1.7 Select Printer Using Geo-Location

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

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

3.2.1.8 Select Printer Using Out of Band Method

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

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

3.2.1.9 Select Printer Using Properties

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

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

3.2.2 Print

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

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

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

387   **3.2.2.1 Print a Document**

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

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

394   **3.2.2.2 Print a Document by Reference**

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

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

401   **3.2.2.3 Print Using Loaded Media**

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

404   After Jane initiates a print action from the phone and selects a Printer, the Client photo
405   application automatically selects the largest borderless photographic media loaded on the
406   Selected Printer and the highest print quality. Jane selects additional processing intent for
407   the Job and confirms the print action. The Client sends a print job request to the Printer with
408   the Job Ticket and local photo. The Printer validates the Job Ticket and document data and
409   then prints the photo.

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

413   **3.2.2.4 Print a Secure Form**

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

418 The treasurer loads check blanks into the Printer and configured the loaded media as
419 necessary at the Printer. After he initiates a print action from the accounting program,
420 selects a Printer for printing, and selects checks to be printed, the Client User Interface
421 displays a preview of the printed checks and he confirms that the checks are correctly
422 paginated and oriented and the amounts, payees and signature are correct. The Client
423 automatically selects the check blank media. The treasurer selects additional processing
424 intent for the Job and confirms the print action. The Client sends a print job request to the
425 Printer with the Job Ticket and document data containing the check information, correctly
426 oriented for the check blank media. He waits for the checks to be printed and removes any
427 excess media from the Printer.

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

431 **3.2.2.5 Print with Special Formatting**

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

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

444 **3.2.2.6 Print and Select at Printer**

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

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

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

456 **3.2.2.7 Print to a Service**

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

464 **3.2.2.8 Print to a Recipient**

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

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

472 **3.2.2.9 Print with a Proof Copy**

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

479 **3.2.3 Exceptions**

480 **3.2.3.1 Print Action Canceled**

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

484 **3.2.3.2 Select Printer Canceled**

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

3.2.3.3 Printer No Longer Network Accessible after Selection

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

3.2.3.4 Not Authorized

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

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

3.2.3.5 Needs Authentication

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

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

3.2.3.6 Not Accepting Jobs

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

3.2.3.7 Job Ticket or Document Format Not Supported

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

3.2.3.8 Job or Document Processing Failures

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

3.2.3.9 Printer Fault

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

519   **3.2.3.10 Printer Warning**

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

523   **3.3 Out of Scope**

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

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

532   **3.4 Design Requirements**

533   The IPP Everywhere™ design should:

534   1. Define conformance profiles that reference the IPP/2.0 versions [PWG5100.12];
535   2. Follow the naming conventions defined in the Internet Printing Protocol/1.1
536   [STD92], including keyword value case (lower) and hyphenation requirements;
537   3. Define conformance requirements for both Printers and Clients; and
538   4. Support printing with vendor-neutral Client software from any Client to any
539   Printer using a variety of discovery protocols, IPP for the transport, and
540   standard document formats.
541

542 **4. Discovery Protocols**

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

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

4.1 Printer Description Attributes Used in Discovery
548

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

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

IPP Attribute	DNS-SD TXT Key	LDAP/SLP Attribute
color-supported	Color	printer-color-supported
copies-supported	Copies	printer-copies-supported
device-uuid	DUUID	printer-device-uuid (note 1)
document-formats-supported	pdl	printer-document-format-supported
finishings-supported	Bind, Punch, Sort, Staple	printer-finishings-supported
ipp-features-supported	(subtype)	printer-ipp-features-supported
media-supported	PaperCustom, PaperMax	printer-media-supported
multiple-document-handling	Collate	-
pages-per-minute	(note 2)	printer-pages-per-minute
pages-per-minute-color	(note 2)	printer-pages-per-minute-color
printer-charge-info	(note 2)	printer-charge-info (note 1)
printer-charge-info-uri	(note 2)	printer-charge-info-uri (note 1)
printer-geo-location	(LOC record)	printer-geo-location (note 1)
printer-info	(instance)	printer-info
printer-location	note	printer-location
printer-make-and-model	ty	printer-make-and-model
printer-more-info	adminurl	printer-more-info

IPP Attribute	DNS-SD TXT Key	LDAP/SLP Attribute
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

552   Note 1: Extension attribute to RFC 7612.
553   Note 2: Available via subsequent IPP Get-Printer-Attributes request.

554 4.2 DNS Service Discovery (DNS-SD)

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

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

563 4.2.1 IPP Everywhere™ Service Subtypes

564 In order for a Client to discover IPP Printers that conform to this specification (and not just
565 [STD92]), this specification defines the following DNS-SD service subtypes:

566   • "_print._sub._ipp._tcp" for IPP Everywhere™ Printers using the "ipp" URI scheme
567   [RFC3510]; and

568   • "_print._sub._ipps._tcp" for IPP Everywhere™ Printers using the "ipps" URI
569   scheme [RFC7472].

570 4.2.2 Service (SRV) Instance Name

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

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

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

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

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

588   **4.2.3 Geo-Location (LOC)**

589   Printers MUST publish LOC records [RFC1876] over mDNS to provide the physical location
590   of the Printer. Printers MUST allow the End User to configure the geo-location manually. If
591   the accuracy of the geo-location is unknown, a value of $9x10_9$ meters (0x99) MUST be used.

592   **4.2.4 Text (TXT)**

593   **4.2.4.1 Printers MUST publish a text (TXT) record that provides service information over mDNS.**
594   **Printers that support dynamic DNS updates MUST publish separate TXT records for each**
595   **domain that is updated. Table 1air**

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

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

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

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

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

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

614   The default value for the "air" key is 'none'.
615

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

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

621 For example, the IPP "printer-more-info" attribute has a maximum length of 1023 octets,
622 however the corresponding "adminurl" key cannot represent a value longer than 246 octets
623 (255 - 9 octets for "adminurl="). Printers MUST truncate long strings as described in section
624 0.

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

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

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

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

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

631 **4.2.4.2 air**

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

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

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

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

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

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

650   The default value for the "air" key is 'none'.
651

652   **Table 3 - DNS TXT Record Keys**

Key	Description	Default Value
adminurl	The Printer-resident configuration page URL as reported by the "printer-more-info" Printer Description attribute.	'' (empty string)
air	The type of authentication information that is required for the Printer. See section 4.2.4.2.	'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 Status attribute. See section 4.2.4.6.	'' (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 0.	'' (empty string)
priority	The priority for the service from 0 to 99, where 0 is the highest priority and 99 is the lowest priority.	'50'
Punch	'T' if the Printer can punch output, 'F' otherwise.	'U' (note 1)
rp	The remote print queue name, which is the resource path portion of the Printer URI without the leading slash.	'' (empty string)
Sort	'T' if the Printer can sort output, 'F' otherwise.	'U' (note 1)
Staple	'T' if the Printer can staple output, 'F' otherwise.	'U' (note 1)
TLS	The maximum TLS version supported or 'none' if no version of TLS is supported. See section 4.2.4.4.	'none'
txtvers	The major version of the TXT record. MUST have the value '1'.	'1'
ty	The make and model of the Printer as reported by the "printer-make-and-model" Printer Description attribute.	'' (empty string)
UUID	The UUID of the Printer without the 'urn:uuid:' prefix as reported by the "printer-uuid" Printer Status attribute. See section 4.2.4.5.	'' (empty string)

653   Note 1: The value 'U' means "undefined".
654

655 **4.2.4.3 pdl**

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

662 **4.2.4.4 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 [RFC8446] encryption is supported. This is equivalent to the value 'tls'
674 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 **4.2.4.5 UUID**

679 The REQUIRED "UUID" key provides the value of the "printer-uuid" Printer Status attribute
680 [RFC4122] [PWG 5100.13] without the leading "urn:uuid:". For example, if a Printer reports
681 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 **4.2.4.6 DUUID**

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

698 # 5. Protocol Binding

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

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

703 ## 5.1 HTTP Features

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

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

711 ### 5.1.1 Host

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

714 ### 5.1.2 If-Modified-Since, Last-Modified, and 304 Not Modified

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

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

721 ### 5.1.3 Cache-Control

722 Printers and Clients MUST conform to the caching semantics defined in [RFC7234].
723 Typically, most resource files provided by a Printer in a GET response will be cacheable but
724 IPP responses in a POST response are not. Therefore, Printers MAY provide a Cache-
725 Control header in GET responses with an appropriate "max-age" value and MUST provide
726 a Cache-Control header in IPP POST responses with the value "no-cache".
727

728 **5.2 IPP Operations**

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

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

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

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

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

737 **5.3 IPP Printer Description Attributes**

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

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

Attribute	Reference
charset-configured	STD 92
charset-supported	STD 92
color-supported	STD 92
compression-supported	STD 92
copies-default (note 2)	STD 92
copies-supported (note 2)	STD 92
document-format-default	STD 92
document-format-supported	STD 92
document-password-supported (note 10)	PWG 5100.13
finishing-template-supported (notes 3 and 7)	PWG 5100.1
finishings-col-database (notes 3 and 7)	PWG 5100.1

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

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

741   Note 1: CONDITIONALLY REQUIRED for Printers that implement Paid Imaging
742   services.
743   Note 2: REQUIRED for the "application/pdf" and "image/jpeg" MIME media types.
744   Note 3: CONDITIONALLY REQUIRED for Printers with finishers.
745   Note 4: CONDITIONALLY REQUIRED for Printers that support the Print to a
746   Recipient (section 3.2.2.8) use case.
747   Note 5: CONDITIONALLY REQUIRED for Printers that support long-edge feed
748   media.

749   Note 6: URIs MUST be absolute, SHOULD use the Host value (including port
750   number) from the HTTP Host header (section 5.1.1), and MUST NOT use link-local
751   addresses (section 8.4).
752   Note 7: RECOMMENDED due to its omission from IPP Everywhere™ 1.0, however
753   it is needed for the underlying functionality.
754   Note 8: CONDITIONALLY REQUIRED for Printers that support ICC-based color
755   management.
756   Note 9: RECOMMENDED for Logical Devices, REQUIRED otherwise.
757   Note 10: CONDITIONALLY REQUIRED for the "application/pdf" MIME media type.

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

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

759   5.3.1 media-col-database (1setOf collection)

760   The REQUIRED "media-col-database" Printer attribute lists the supported combinations of
761   "media-col" member attributes for a Printer. In addition to the requirements set forth in the

762 IPP Job Extensions v2.0 [PWG5100.7], this specification defines how a Printer advertises
763 custom and roll-fed media capabilities in the "media-col-database" attribute to be consistent
764 with the definition of the "media-size-supported" attribute.

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

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

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

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

786 **5.3.2 media-col-ready (1setOf collection)**

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

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

797 Manual feed media sizes MUST NOT be reported in the "media-col-ready" attribute. By
798 definition the 'manual-feed' media source requires the Printer to ask the End User/Operator
799 to load the requested media, thus the media can never be "ready" for use. However, many
800 Printers offer a multi-purpose tray that serves as both a manual feed source and an ad-hoc

801   paper tray. Printers that provide such a multi-purpose tray MUST advertise media loaded in
802   the tray using a different media source such as 'by-pass-tray'.

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

809   5.3.3 media-ready (1setOf (type3 keyword | name(MAX))

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

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

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

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

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

834   5.3.4 media-size-supported (1setOf collection)

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

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

```
843           media-size-supported=...,{
844                                  x-dimension=5000-33020
845                                  y-dimension=5000-48260 },...
```

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

```
852           media-size-supported=...,{
853                                  x-dimension=20320-152400
854                                  y-dimension=1524-9144000 },...
```

855   **5.3.5 media-supported (1setOf (type3 keyword | name(MAX))**

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

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

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

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

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

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

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

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

881 **5.3.6 pdl-override-supported (type2 keyword)**

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

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

888 ## 5.4 IPP Printer Status Attributes

889 Table 7 lists the Printer Status attributes for an IPP Everywhere™ Printer. All attributes in
890 the table are REQUIRED unless otherwise specified in a note below.

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

Attribute	Reference
pages-per-minute	STD 92
pages-per-minute-color	STD 92
printer-alert (note 5)	PWG 5100.9
printer-alert-description (note 5)	PWG 5100.9
printer-config-change-date-time	PWG 5100.13
printer-config-change-time	PWG 5100.13
printer-is-accepting-jobs	STD 92
printer-more-info (note 1)	STD 92
printer-state	STD 92
printer-state-change-date-time	RFC 3995
printer-state-change-time	RFC 3995
printer-state-message	STD 92
printer-state-reasons	STD 92
printer-strings-languages-supported (note 2)	PWG 5100.13
printer-strings-uri (notes 1 and 2)	PWG 5100.13
printer-supply (notes 3 and 4)	PWG 5100.13
printer-supply-description (notes 3 and 4)	PWG 5100.13
printer-supply-info-uri (notes 1, 3, and 4)	PWG 5100.13
printer-up-time	STD 92
printer-uri-supported (note 1)	STD 92

Attribute	Reference
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	STD 92

892 Note 1: URIs MUST be absolute, SHOULD use the Host value (including port
893 number) from the HTTP Host header (section 5.1.1), and MUST NOT use link-local
894 addresses (section 8.4).
895 Note 2: RECOMMENDED due to its omission from IPP Everywhere™ 1.0, however
896 it is needed for the underlying functionality.
897 Note 3: CONDITIONALLY REQUIRED for Printers that use marker supplies.
898 Note 4: RECOMMENDED for Logical Devices, REQUIRED otherwise.
899 Note 5: RECOMMENDED for Physical Devices, OPTIONAL for Logical Devices.

900 **5.4.1 printer-alert (1setOf octetString(MAX))**

901 This attribute lists members of the prtAlertTable from the Printer MIB v2 [RFC3805].
902 Physical Devices SHOULD and Logical Devices MAY support this attribute. When
903 supported, Printers SHOULD NOT report the attribute if the prtAlertTable is empty.

904 Note: The IPP Printer State Extensions v1.0 [PWG5100.9] does not specify the behavior of
905 the "printer-alert" attribute when the prtAlertTable is empty. Some implementations have
906 chosen to report a placeholder value such as 'code=other' or the empty string.

907 **5.4.2 printer-alert-description (1setOf text(MAX))**

908 This attribute lists the prtAlertDescription values of the prtAlertTable from the Printer MIB
909 v2 [RFC3805]. Physical Devices SHOULD and Logical Devices MAY support this attribute.
910 When supported, Printers SHOULD NOT report the attribute if the prtAlertTable is empty.

911 **5.4.3 printer-uri-supported (1setOf uri)**

912 This REQUIRED attribute provides 'ipp' and 'ipps' URIs that can be used to access the
913 Printer. Printers SHOULD advertise URIs with a resource path of the form "/ipp/print" or
914 "/ipp/print/queuename".
915

916   **5.5 IPP Operation Attributes**

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

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

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

919   Note 1: CONDITIONALLY REQUIRED for Printers that support the "application/pdf"
920   MIME media type.
921   Note 2: CONDITIONALLY REQUIRED for Printers that support the Print to a
922   Recipient (section 3.2.2.8) use case.
923   Note 3: CONDITIONALLY REQUIRED for Printers that implement Paid Imaging
924   services.

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

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

926

927   **5.6 IPP Job Description Attributes**

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

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

Attribute	Reference
job-name	STD 92

930   **5.7 IPP Job Status Attributes**

931   Table 11 lists the REQUIRED Job Status attributes for an IPP Everywhere™ Printer.

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

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

933
934   Note 1: URIs MUST be absolute, SHOULD use the Host value from HTTP header
935   (section 5.1.1), and MUST NOT use link-local addresses (section 8.4).

936   **5.7.1 job-id (integer)**

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

942 **5.7.2 job-uri (uri)**

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

949 ## 5.8 IPP Job Template Attributes

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

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

Attribute	Reference
copies (note 2)	STD 92
finishings (note 4)	STD 92
finishings-col (note 4)	PWG 5100.1
finishings-col.finishing-template (note 4)	PWG 5100.1
job-account-id (note 1)	PWG 5100.7
job-accounting-user-id (note 1)	PWG 5100.7
media	STD 92
media-col	PWG 5100.7
media-col.media-bottom-margin	PWG 5100.7
media-col.media-left-margin	PWG 5100.7
media-col.media-right-margin	PWG 5100.7
media-col.media-size	PWG 5100.7
media-col.media-source	PWG 5100.7
media-col.media-top-margin	PWG 5100.7
media-col.media-type	PWG 5100.7
multiple-document-handling (note 3)	STD 92
orientation-requested	STD 92
output-bin	PWG 5100.2
overrides (note 3)	PWG 5100.6
overrides.document-numbers (note 6)	PWG 5100.6
page-ranges (note 3)	STD 92
print-color-mode	PWG 5100.13
print-rendering-intent (note 7)	PWG 5100.13
print-quality	STD 92
printer-resolution	STD 92
sides	STD 92

953   Note 1: CONDITIONALLY REQUIRED for Printers that implement paid imaging
954   services.
955   Note 2: CONDITIONALLY REQUIRED for the "application/pdf" and "image/jpeg"
956   MIME media types.
957   Note 3: CONDITIONALLY REQUIRED for Printers that support the "application/pdf"
958   MIME media type.
959   Note 4: CONDITIONALLY REQUIRED for Printers with finishers.
960   Note 5: CONDITIONALLY REQUIRED for Printers that support long-edge feed
961   media.
962   Note 6: CONDITIONALLY REQUIRED for Printers that support multiple-Document
963   Jobs.
964   Note 7: CONDITIONALLY REQUIRED for Printers that support ICC-based color
965   management.

966   **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

967

6. Document Formats

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

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

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

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

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

Figures 1 through 4 show how raster data must be formatted for each feed orientation.
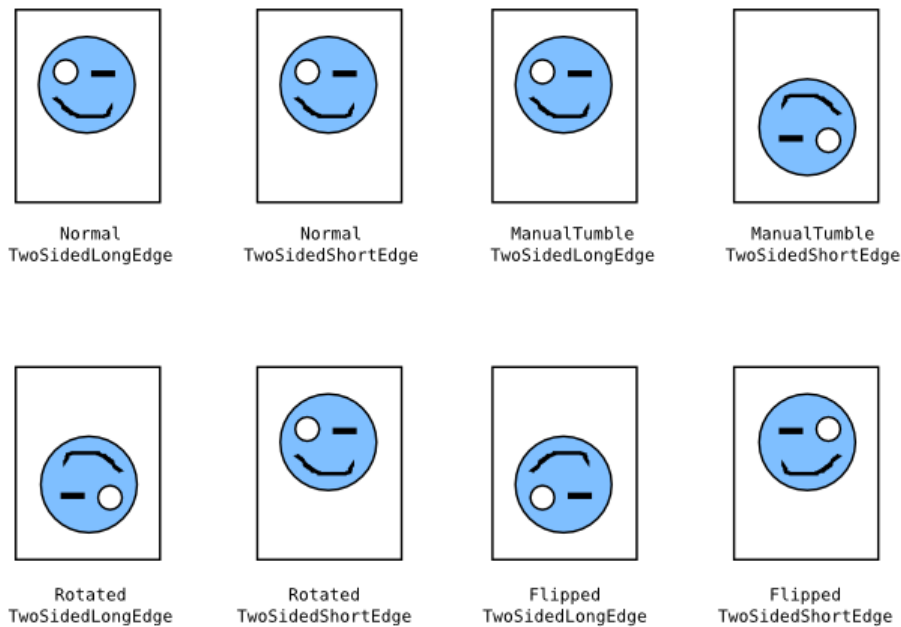
Figure 1 - PWG Raster Bitmaps with Portrait Feed Orientation
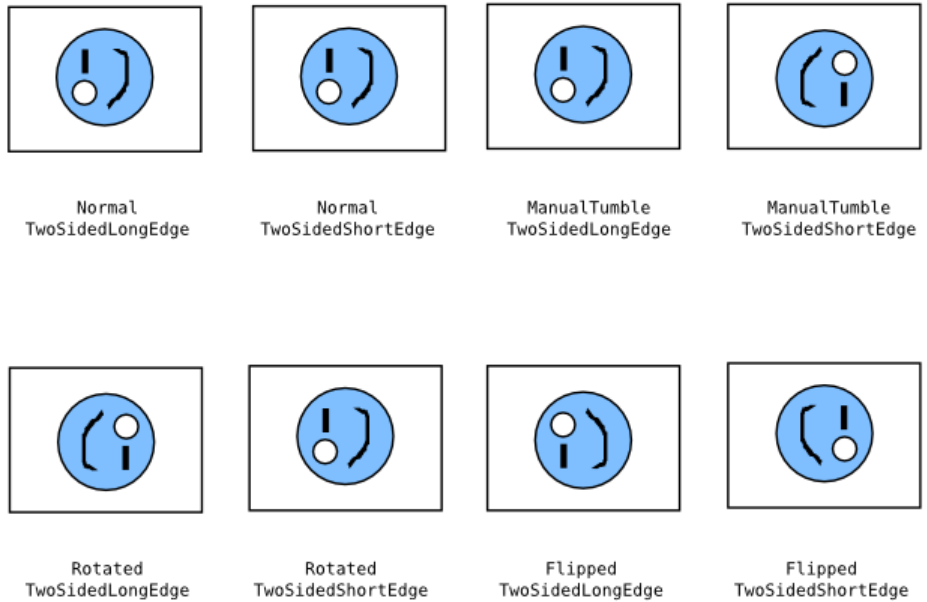
988

989   **Figure 2 - PWG Raster Bitmaps with Landscape Feed Orientation**
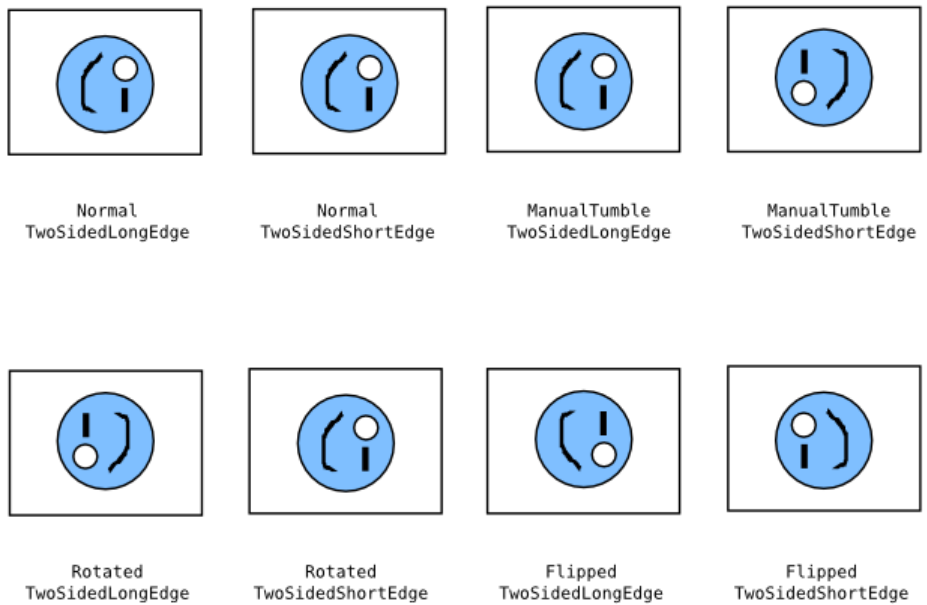
990

991   **Figure 3 - PWG Raster Bitmaps with Reverse Landscape Feed Orientation**
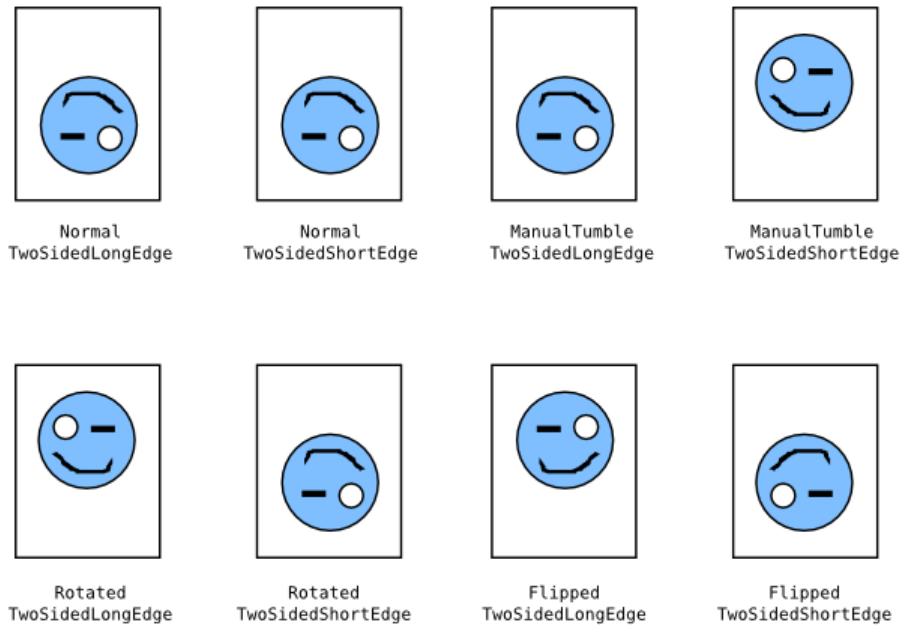
992

993   **Figure 4 - PWG Raster Bitmaps with Reverse Portrait Feed Orientation**

994 # 7. Additional Values for Existing Attributes

995 ## 7.1 ipp-features-supported (1setOf type2 keyword)

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

998 This specification also defines the CONDITIONALLY REQUIRED keyword 'ipp-everywhere-
999 server' for the "ipp-features-supported" Printer attribute. Printers representing Logical
1000 Devices MUST report this keyword. Printers representing Physical Devices MUST NOT
1001 report this keyword.

1002

1003 **8. Additional Semantics for Existing Value Tags**

1004 This specification amends the definition of the nameWithLanguage,
1005 nameWithoutLanguage, naturalLanguage, textWithLanguage, textWithoutLanguage, and
1006 URI value tags defined in the Internet Printing Protocol/1.1 [STD92] with additional
1007 restrictions to improve interoperability.

1008 **8.1 nameWithLanguage and nameWithoutLanguage**

1009 Printers MUST NOT return name values containing characters in the "C0 Control Character
1010 Set" or the DEL character as defined in Unicode Format for Network Interchange
1011 [RFC5198]. Printers MUST transcode and filter values from MIBs and other sources to
1012 conform to the added restrictions.

1013 **8.2 naturalLanguage**

1014 Printers MUST return and compare naturalLanguage values that conform to Tags for
1015 Identifying Languages [BCP47]. Printer MUST use the shortest language tag, e.g., "en"
1016 instead of "eng" for English. Printers SHOULD also support legacy language tags such as:

1017   'no'; replaced by 'nb' (Norwegian Bokmål),

1018   'zh-cn'; replaced by 'zh-hans' (Simplified Chinese), and

1019   'zh-tw'; replaced by 'zh-hant' (Traditional Chinese)

1020 **8.3 textWithLanguage and textWithoutLanguage**

1021 Printers MUST NOT return text values containing the DEL character or characters in the
1022 "C0 Control Character Set" other than CR, LF, and HT [RFC5198]. Printers MUST
1023 transcode and filter values from MIBs and other sources to conform to the added
1024 restrictions.

1025 **8.4 uri**

1026 Printer MUST generate absolute URI values, i.e., "ipp://hostname.local/ipp/print" is
1027 acceptable but "//ipp/print" is not. Printers MUST NOT generate URI values with link-local
1028 addresses unless they are taken from the HTTP Host: field (section 5.1.1). Printers
1029 SHOULD NOT generate URI values with IP addresses obtained via Dynamic Host
1030 Configuration Protocol (DHCP) [RFC2131] or other auto-configuration protocols unless they
1031 are taken from the HTTP Host: field (section 5.1.1).

1032 Printers SHOULD use the HTTP Host: header value when generating URIs for use in Client
1033 responses. Printers SHOULD use the "http" URI scheme when responding to requests

1034   using the "ipp" URI scheme and the "https" URI scheme when responding to requests using
1035   the "ipps" URI scheme. Printers SHOULD use the same port number for IPP and HTTP
1036   URIs.

1037   9. Conformance Requirements

1038   This section summarizes the Conformance Requirements detailed in the definitions in this
1039   document for Clients and Printers.

1040   9.1 Conformance Requirements for Clients

1041   In order for a Client to claim conformance to this specification a Client MUST support the
1042   following:

1043   1. DNS Service Discovery as defined in section 4.2
1044   2. IPP/2.0 as defined in section 5
1045   3. The REQUIRED operations listed in Table 4
1046   4. The REQUIRED Printer Description attributes listed in Table 5
1047   5. The REQUIRED operation attributes listed in Table 8
1048   6. The REQUIRED Job Template attributes listed in Table 12
1049   7. The REQUIRED Job Description attributes listed in Table 10
1050   8. The REQUIRED document formats listed in section 5.8
1051   9. The "media-source-properties" member attribute of the "media-col-database"
1052   and "media-col-ready" Printer attributes as reported by the Printer and defined
1053   in section 6.1
1054   10. The internationalization considerations as defined in section 10
1055   11. The security considerations as defined in section 11

1056   9.2 Conformance Requirements for Printers

1057   In order for a Printer to claim conformance to this specification a Printer MUST support the
1058   following:

1059   1. DNS Service Discovery as defined in section 4.2
1060   2. IPP/2.0 as defined in section 5
1061   3. The REQUIRED operations listed in Table 4
1062   4. The REQUIRED Printer Description attributes listed in Table 5
1063   5. The REQUIRED operation attributes listed in Table 8
1064   6. The REQUIRED Job Template attributes listed in Table 12
1065   7. The REQUIRED Job Description attributes listed in Table 10
1066   8. The REQUIRED document formats listed in section 5.8
1067   9. The 'ipp-everywhere' value for the "ipp-features-supported" Printer Description
1068   attribute as defined in section 7.1
1069   10. The additional semantics for attribute values as defined in section 8

1070   11. The internationalization considerations as defined in section 10
1071   12. The security considerations as defined in section 11
1072   13. The safe string truncation rules as defined in section 13

1073 9.3 Conditional Conformance Requirements for Printers

1074 Printers that support the "image/jpeg" [JFIF] MIME media type MUST support:

1075   1. The "copies-default", and "copies-supported" Printer Description attributes as
1076   defined in section 5.3.
1077   2. The "copies" Job Template attribute as defined in section 5.8.

1078 Printers that support the "application/pdf" [ISO32000] MIME media type MUST support:

1079   1. The "copies-default", "copies-supported", "document-password-supported", and
1080   "page-ranges-supported" Printer Description attributes as defined in section 5.3,
1081   2. The "document-password" Operation attribute as defined in section 5.4, and
1082   3. The "copies", "multiple-document-handling", "overrides", and "page-ranges" Job
1083   Template attributes as defined in section 5.8.

1084 Printers that support the Print to a Recipient use case (section 3.2.2.8) MUST support:

1085   1. The "job-password-supported" and "job-password-encryption-supported" Printer
1086   Description attributes as defined in section 5.3, and
1087   2. The "job-password" and "job-password-encryption" Operation attributes as
1088   defined in section 5.4.

1089 Printers that provide Paid Print services MUST support:

1090   1. The "job-account-id-default", "job-account-id-supported", "job-accounting-user-
1091   id-default", "job-accounting-user-id-supported", "job-mandatory-attributes-
1092   default", "job-mandatory-attributes-supported", and "printer-mandatory-job-
1093   attributes" Printer Description attributes as defined in section 5.3,
1094   1. The "job-mandatory-attributes" operation attribute as defined in section 5.4, and
1095   2. The "job-account-id" and "job-accounting-user-id" Job Template attributes as
1096   defined in section 5.8.

1097 Printers that support long-edge feed media MUST support the "media-source-properties"
1098 member attribute of the "media-col-database" and "media-col-ready" Printer Description
1099 attributes as defined in section 5.3.

1100 Printers that support ICC-based color management MUST support:

1101   1. The "print-rendering-intent-default", "print-rendering-intent-supported", and
1102   "printer-icc-profiles" Printer Description attributes as defined in section 5.3.
1103   2. The "print-rendering-intent" Job Template attribute as defined in section 5.8.

1104 Printers representing Logical Devices MUST report the 'ipp-everywhere-server' value for
1105 the "ipp-features-supported" Printer Description attribute as defined in section 7.1.

10. Internationalization Considerations

1107 For interoperability and basic support for multiple languages, conforming implementations
1108 MUST support:

1109   1. The Universal Character Set (UCS) Transformation Format -- 8 bit (UTF-8)
1110   [STD63] encoding of Unicode [UNICODE] [ISO10646]; and
1111   2. The Unicode Format for Network Interchange [RFC5198] which requires
1112   transmission of well-formed UTF-8 strings and recommends transmission of
1113   normalized UTF-8 strings in Normalization Form C (NFC) [UAX15].

1114 Unicode NFC is defined as the result of performing Canonical Decomposition (into base
1115 characters and combining marks) followed by Canonical Composition (into canonical
1116 composed characters wherever Unicode has assigned them).

1117 WARNING – Performing normalization on UTF-8 strings received from Clients and
1118 subsequently storing the results (e.g., in Job objects) could cause false negatives in Client
1119 searches and failed access (e.g., to Printers with percent-encoded UTF-8 URIs now
1120 'hidden').

1121 Implementations of this specification SHOULD conform to the following standards on
1122 processing of human-readable Unicode text strings, see:

1123   Unicode Bidirectional Algorithm [UAX9] – left-to-right, right-to-left, and vertical

1124   Unicode Line Breaking Algorithm [UAX14] – character classes and wrapping

1125   Unicode Normalization Forms [UAX15] – especially NFC for [RFC5198]

1126   Unicode Text Segmentation [UAX29] – grapheme clusters, words, sentences

1127   Unicode Identifier and Pattern Syntax [UAX31] – identifier use and normalization

1128   Unicode Collation Algorithm [UTS10] – sorting

1129   Unicode Locale Data Markup Language [UTS35] – locale databases

1130 Implementations of this specification are advised to also review the following informational
1131 documents on processing of human-readable Unicode text strings:

1132   Unicode Character Encoding Model [UTR17] – multi-layer character model

1133   Unicode Character Property Model [UTR23] – character properties

1134   Unicode Conformance Model [UTR33] – Unicode conformance basis
1135

1136 11. Security Considerations

1137 The IPP extensions defined in this document require the same security considerations as
1138 defined in the Internet Printing Protocol/1.1 [STD92]. In addition, Printers MUST validate
1139 the HTTP Host request header in order to protect against DNS rebinding attacks.

1140 Implementations of this specification SHOULD conform to the following standard on
1141 processing of human-readable Unicode text strings, see:

1142   Unicode Security Mechanisms [UTS39] – detecting and avoiding security attacks

1143   Implementations of this specification are advised to also review the following
1144   informational document on processing of human-readable Unicode text strings:

1145   Unicode Security FAQ [UNISECFAQ] – common Unicode security issues

1146 12. IANA Considerations

1147 12.1 Attribute Value Registrations

1148 The keyword attribute values defined in this document will be published by IANA according
1149 to the procedures in the Internet Printing Protocol/1.1 [STD92] in the following file:

1150   http://www.iana.org/assignments/ipp-registrations

1151 The registry entries will contain the following information:

```
1152     Attributes (attribute syntax)
1153       Keyword Attribute Value                             Reference
1154       ----------------------                              ---------
1155     ipp-features-supported (1setOf type2 keyword)         [PWG5100.13]
1156       ipp-everywhere                                      [PWG5100.14]
1157       ipp-everywhere-server                               [PWG5100.14]
1158
```

1159   **13. Safe String Truncation**

1160   Strings can be truncated or omitted when transferred over alternate protocols. Printers
1161   MUST truncate long strings at logical boundaries. The following subsections describe how
1162   this truncation is performed for different kinds of strings.

1163   **13.1 Plain Text Strings**

1164   Printers MUST truncate plain text strings at the end of a valid character sequence. Printers
1165   SHOULD represent strings using the UTF-8 transformation format of ISO 10646 [STD0063]
1166   [ISO10646-1] and the Unicode Format for Network Interchange [RFC5198].

1167   For example, the 9 octet UTF-8 sequence 0x48.65.CA.81.6C.6C.6F.C2.81 (Héllo¡) would
1168   be shortened to fit within 6 octets by composing the é (0x65.CA.81 becomes 0xC3.A9) and
1169   removing the trailing UTF-8 sequence 0xC2.81 (¡), resulting in the 6 octet UTF-8 sequence
1170   0x48.C3.A9.6C.6C.6F (Héllo).

1171   **13.2 URIs**

1172   Printers MUST truncate URIs so that each URI remains valid and accepted by the Printer.

1173   For example, the 46 octet URI "ipp://printer.example.com/ipp/really-long-name" might be
1174   shortened to fit within 32 octets by removing the last path name component, resulting in the
1175   29   octet   URI   "ipp://printer.example.com/ipp".   Similarly,   the   52   octet   URI
1176   "ipp://printer.example.com/ipp?query-string" might be shortened to fit within 32 octets by
1177   removing the query string.

1178   As recommended by the Uniform Resource Identifier (URI): Generic Syntax [STD66],
1179   Printers SHOULD omit the port number from the URI when it has the default value, e.g., 80
1180   for "http", 443 for "https", and 631 for "ipp" and "ipps" URIs.

1181   **13.3 MIME Media Types**

1182   Printers MUST truncate MIME media type strings at the end of each media subtype,
1183   removing any parameters that are included with the media type. If the resulting string still
1184   exceeds the maximum length it MUST be discarded.

1185   For example, the 24 octet MIME media type "text/plain;charset=utf-8" would be shortened
1186   to fit within 16 octets by removing the trailing parameter, resulting in the 10 octet MIME
1187   media type "text/plain".

1188 ## 13.4 Delimited Lists

1189 Delimited Lists combine one or more string types listed in the previous sections, separated
1190 by a delimiting character such as a comma or semicolon. Printers MUST shorten delimited
1191 lists by removing:

1192   1. Unnecessary path components (URIs) and parameters (MIME media types),
1193   and then
1194   2. Excess values after delimiting characters.

1195 For example, the 40 octet list of MIME media types "text/plain;charset=utf-8,application/pdf"
1196 would be shortened to fit within 32 octets by removing the MIME media type parameter,
1197 resulting in the 26 octet list "text/plain,application/pdf". The same list would be shortened to
1198 fit within 16 octets by also removing the last MIME media type, resulting in the 10 octet list
1199 "text/plain".

1200 # 14. Overview of Changes

1201 ## 14.1 IPP Everywhere™ v1.1

1202 The following changes were made to PWG 5100.14-2013: IPP Everywhere [PWG5100.14-
1203 2013]:

1204 • Print Servers (Logical Devices) are now explicitly addressed;

1205 • References now point to the current versions of dependent documents and
1206   specifications at the time of publication;

1207 • Requirements for WS-Discovery have been removed due to a lack of
1208   implementations, which effectively made WS-Discovery support OPTIONAL;

1209 • References to OpenXPS and SSDP have been removed;

1210 • The "printer-alert" and "printer-alert-description" Printer Status attributes are now
1211   RECOMMENDED for Printers representing Physical Devices and OPTIONAL for
1212   Printers representing Logical Devices;

1213 • The "printer-device-id" Printer Description attribute and associated DNS-SD TXT
1214   record keys are no longer required;

1215 • DNS-SD is now RECOMMENDED for Printers representing Logical Devices (print
1216   servers);

1217 • ICC attributes are now CONDITIONALLY REQUIRED for printers that support ICC-
1218   based color management;

1219   • JPEG support is now CONDITIONALLY REQUIRED for color printers;

1220   • The "compression-supplied", "document-format-supplied", "document-format-
1221   version", "document-format-version-supplied", "document-name-supplied" attributes
1222   are no longer required;

1223   • The "feed-orientation", "feed-orientation-default", and "feed-orientation-supported"
1224   attributes are no longer required;

1225   • The "print-content-optimize", "print-content-optimize-default", and "print-content-
1226   optimize-supported" attributes have been reduced to RECOMMENDED;

1227   • IPP Finishings 2.1 and the "finishings-col" Job Template attribute are now
1228   RECOMMENDED;

1229   • The "printer-input-tray" and "printer-output-tray" Printer Description attributes are
1230   now RECOMMENDED to provide tray information and status;

1231   • The "printer-supply", "printer-supply-description", and "printer-supply-info-uri" Printer
1232   Status attributes are now CONDITIONALLY REQUIRED for Printers that have
1233   supplies;

1234   • The "printer-strings-languages-supported" and "printer-strings-uri" Printer Status
1235   attributes are now RECOMMENDED to support localization; and

1236   • Printer Status and Job Status attributes are now listed in a separate section to match
1237   STD 92 and the IANA IPP registry.

1238   15. References

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1443 Implementers of this specification document are encouraged to join the IPP Mailing List in
1444 order to participate in any discussions of clarification issues and review of registration
1445 proposals for additional attributes and values.

1446 The editors would like to especially thank the following individuals who also contributed
1447 significantly to the development of this document:

1448   Andrew Mitchell
1449   Jerry Thrasher - Lexmark
1450   Peter Zehler - Xerox
1451