



The Printer Working Group

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Working Draft

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## IPP Everywhere™ v1.1

Status: Stable

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

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:

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77 a stable, well understood, and technically competent specification that is widely used with  
78 multiple independent and interoperable implementations. Printer manufacturers and  
79 vendors of printer related software benefit from the interoperability provided by voluntary  
80 conformance to these standards.

81 For additional information regarding the Printer Working Group visit:

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

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## 207 **1. Introduction**

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

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

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

## 220 **2. Terminology**

### 221 **2.1 Printing Terminology**

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

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

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

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

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

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

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



## 237 **2.2 Protocol Role Terminology**

238 This document also defines the following protocol roles to specify unambiguous  
239 conformance requirements:

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

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

## 245 **2.3 Other Terminology**

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

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

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

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

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

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

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

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

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

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

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

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

## 271 **2.4 Acronyms and Organizations**

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

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

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

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

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

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

278

## 279 **3. Requirements**

### 280 **3.1 Rationale**

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

## 328 **3.2 Use Cases**

### 329 **3.2.1 Select Printer**

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

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

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

#### 339 **3.2.1.1 Select the Last Used Printer**

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

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

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

#### 346 **3.2.1.2 Select Printer Using Name or Address**

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

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

#### 353 **3.2.1.3 Select Printer Using URI**

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

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

#### 358 **3.2.1.4 Select Printer Using a Directory Service**

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

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

#### 365 **3.2.1.5 Select Printer Using a Cloud Service**

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

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

#### 372 **3.2.1.6 Select Printer Using a Discovery Protocol**

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

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

### 379 **3.2.1.7 Select Printer Using Geo-Location**

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

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

### 386 **3.2.1.8 Select Printer Using Out of Band Method**

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

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

### 393 **3.2.1.9 Select Printer Using Properties**

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

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

## 405 **3.2.2 Print**

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

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

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

#### 414 **3.2.2.1 Print a Document**

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

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

#### 421 **3.2.2.2 Print a Document by Reference**

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

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

#### 428 **3.2.2.3 Print Using Loaded Media**

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

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

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

#### 440 **3.2.2.4 Print a Secure Form**

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

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

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

### 458 **3.2.2.5 Print with Special Formatting**

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

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

### 471 **3.2.2.6 Print and Select at Printer**

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

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

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



**483 3.2.2.7 Print to a Service**

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

**491 3.2.2.8 Print to a Recipient**

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

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

**499 3.2.2.9 Print with a Proof Copy**

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

**506 3.2.3 Exceptions****507 3.2.3.1 Print Action Canceled**

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

**511 3.2.3.2 Select Printer Canceled**

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

**514 3.2.3.3 Printer No Longer Network Accessible after Selection**

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

**518 3.2.3.4 Not Authorized**

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

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

**525 3.2.3.5 Needs Authentication**

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

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

**530 3.2.3.6 Not Accepting Jobs**

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

**533 3.2.3.7 Job Ticket or Document Format Not Supported**

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

**537 3.2.3.8 Job or Document Processing Failures**

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

**542 3.2.3.9 Printer Fault**

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

**546 3.2.3.10 Printer Warning**

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

**550 3.3 Out of Scope**

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

- 552 1. The actual method of geo-location and geographic area detection for the Select  
553 Printer Using Geo-Location (section 3.2.1.7) use case
- 554 2. The actual method of payment for the Print to a Service (section 3.2.2.7) use  
555 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  
563 [STD92], 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  
566 Printer using a variety of discovery protocols, IPP for the transport, and  
567 standard document formats.

568

## 569 4. Discovery Protocols

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

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

### 575 4.1 Printer Description Attributes Used in Discovery

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

578 **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

579 Note 1: Extension attribute to RFC 7612.

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

## 581 4.2 DNS Service Discovery (DNS-SD)

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

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

### 590 4.2.1 IPP Everywhere™ Service Subtypes

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

- 593 • "\_print.\_sub.\_ipp.\_tcp" for IPP Everywhere™ Printers using the "ipp" URI scheme  
 594 [RFC3510]; and
- 595 • "\_print.\_sub.\_ipps.\_tcp" for IPP Everywhere™ Printers using the "ipps" URI  
 596 scheme [RFC7472].

### 597 4.2.2 Service (SRV) Instance Name

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

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

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

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

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

#### 615 **4.2.3 Geo-Location (LOC)**

616 Printers MUST publish LOC records [RFC1876] over mDNS to provide the physical location  
617 of the Printer. Printers MUST allow the End User to configure the geo-location manually. If  
618 the accuracy of the geo-location is unknown, a value of 9x10<sup>9</sup> meters (0x99) MUST be used.

#### 619 **4.2.4 Text (TXT)**

620 Printers MUST publish a text (TXT) record that provides service information over mDNS.

621 Printers that support dynamic DNS updates MUST publish separate TXT records for each  
622 domain that is updated. Table 1

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

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

628 For example, the IPP "printer-more-info" attribute has a maximum length of 1023 octets,  
 629 however the corresponding "adminurl" key cannot represent a value longer than 246 octets  
 630 (255 - 9 octets for "adminurl="). Printers MUST truncate long strings as described in section  
 631 13.

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

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

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

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

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

638

639

**Table 3 - DNS TXT Record Keys**

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

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

#### 641 4.2.4.1 air

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



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

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

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

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

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

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

#### 661 **4.2.4.2 pdl**

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

#### 668 **4.2.4.3 TLS**

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

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

673 '1.0'; TLS 1.0 [RFC2246] encryption is supported. This is equivalent to the value 'tls'  
674 for the "uri-security-supported" Printer Description attribute.

675 '1.1'; TLS 1.1 [RFC4346] encryption is supported. This is equivalent to the value 'tls'  
676 for the "uri-security-supported" Printer Description attribute.

677 '1.2'; TLS 1.2 [RFC5246] encryption is supported. This is equivalent to the value 'tls'  
678 for the "uri-security-supported" Printer Description attribute.

679 '1.3'; TLS 1.3 [RFC8446] encryption is supported. This is equivalent to the value 'tls'  
680 for the "uri-security-supported" Printer Description attribute.

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

#### 684 4.2.4.4 UUID

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

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

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

690 12345678-9ABC-DEF0-1234-56789ABCDEF0

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

#### 693 4.2.4.5 DUUID

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

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

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

699 12345678-9ABC-DEF0-1234-56789ABCDEF0

### 700 4.3 LDAP and SLP Discovery

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

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 End 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	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

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.

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

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

<b>Attribute</b>	<b>Reference</b>
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

<b>Attribute</b>	<b>Reference</b>
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

- 747 Note 1: CONDITIONALLY REQUIRED for Printers that implement Paid Imaging  
748 services.  
749 Note 2: REQUIRED for the "application/pdf" and "image/jpeg" MIME media types.  
750 Note 3: CONDITIONALLY REQUIRED for Printers with finishers.  
751 Note 4: CONDITIONALLY REQUIRED for Printers that support the Print to a  
752 Recipient (section 3.2.2.8) use case.  
753 Note 5: CONDITIONALLY REQUIRED for Printers that support long-edge feed  
754 media.

- 755 Note 6: URIs MUST be absolute, SHOULD use the Host value (including port  
 756 number) from the HTTP Host header (section 5.1.1), and MUST NOT use link-local  
 757 addresses (section 8.4).  
 758 Note 7: RECOMMENDED due to its omission from IPP Everywhere™ 1.0, however  
 759 it is needed for the underlying functionality.  
 760 Note 8: CONDITIONALLY REQUIRED for Printers that support ICC-based color  
 761 management.  
 762 Note 9: RECOMMENDED for Logical Devices, REQUIRED otherwise.

763 **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

764 **5.3.1 media-col-database (1setOf collection)**

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

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

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

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

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

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

### 791 5.3.2 media-col-ready (1setOf collection)

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

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

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



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

### 814 **5.3.3 media-ready (1setOf (type3 keyword | name(MAX)))**

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

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

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

830 Custom media sizes are described using the "custom" self-describing media size names  
831 defined in section 5 of the PWG Media Standardized Names [PWG5101.1] specification.  
832 For example, a custom media size of 4x8 inches might be listed with the name  
833 "custom\_current\_4x8in". The size name MUST include the source name if more than one  
834 custom size is loaded, for example "custom\_current.tray-1\_4x8in".

835 Similarly, roll media sized are described using "roll" self-describing media size names with  
836 the width of the loaded roll and a length of 0. For example, a 36 inch roll might be listed with  
837 the name "roll\_current\_36x0in". As for custom sizes, the size name MUST include the  
838 source name if more than one roll is loaded, for example "roll\_current.roll-1\_36x0in".

### 839 **5.3.4 media-size-supported (1setOf collection)**

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

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

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

```
848     media-size-supported=..., {  
849         x-dimension=5000-33020  
850         y-dimension=5000-48260 }, ...
```

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

```
857     media-size-supported=..., {  
858         x-dimension=20320-152400  
859         y-dimension=1524-9144000 }, ...
```

### 860 **5.3.5 media-supported (1setOf (type3 keyword | name(MAX)))**

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

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

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

875 Similarly, roll media sizes are described using the "roll\_min\_WIDTHxHEIGHTunits" and  
876 "roll\_max\_WIDTHxHEIGHTunits" names. The "WIDTH" values refer to the supported roll  
877 widths while the "HEIGHT" values refer to the supported roll lengths. The size name MUST  
878 include the source name if the Printer supports multiple source with different roll limits.

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

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

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

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

### 886 5.3.6 pdl-override-supported (type2 keyword)

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

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

## 893 5.4 IPP Printer Status Attributes

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

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

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

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

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

#### 904 5.4.1 printer-uri-supported (1setOf uri)

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

## 908 5.5 IPP Operation Attributes

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

910 **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

911 Note 1: CONDITIONALLY REQUIRED for Printers that support the "application/pdf"  
 912 MIME media type.  
 913 Note 2: CONDITIONALLY REQUIRED for Printers that support the Print to a  
 914 Recipient (section 3.2.2.8) use case.  
 915 Note 3: CONDITIONALLY REQUIRED for Printers that implement Paid Imaging  
 916 services.

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

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

## 918 5.6 IPP Job Description Attributes

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

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

Attribute	Reference
job-name	STD 92

## 921 5.7 IPP Job Status Attributes

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

923 **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

924  
 925 Note 1: URIs MUST be absolute, SHOULD use the Host value from HTTP header  
 926 (section 5.1.1), and MUST NOT use link-local addresses (section 8.4).

### 927 5.7.1 job-id (integer)

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

### 933 5.7.2 job-uri (uri)

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

## 940 5.8 IPP Job Template Attributes

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

943 **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

<b>Attribute</b>	<b>Reference</b>
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

- 944 Note 1: CONDITIONALLY REQUIRED for Printers that implement paid imaging  
 945 services.
- 946 Note 2: CONDITIONALLY REQUIRED for the "application/pdf" and "image/jpeg"  
 947 MIME media types.
- 948 Note 3: CONDITIONALLY REQUIRED for Printers that support the "application/pdf"  
 949 MIME media type.
- 950 Note 4: CONDITIONALLY REQUIRED for Printers with finishers.
- 951 Note 5: CONDITIONALLY REQUIRED for Printers that support long-edge feed  
 952 media.
- 953 Note 6: CONDITIONALLY REQUIRED for Printers that support multiple-Document  
 954 Jobs.
- 955 Note 7: CONDITIONALLY REQUIRED for Printers that support ICC-based color  
 956 management.

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

<b>Attribute</b>	<b>Reference</b>
job-account-type	PWG 5100.16
print-content-optimize	PWG 5100.7
print-scaling	PWG 5100.16

958

959 **6. Document Formats**

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

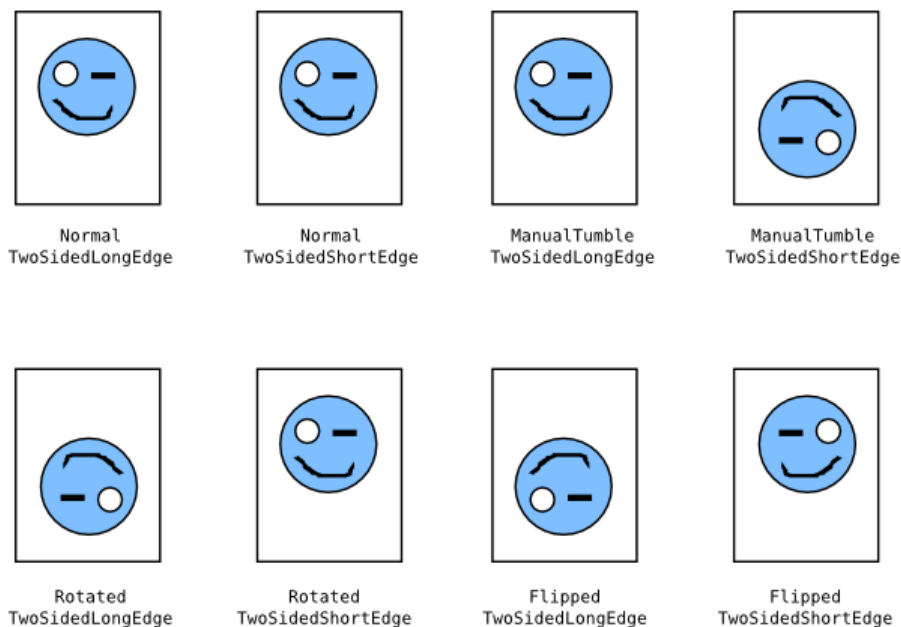
966 Printers SHOULD support documents conforming to Document management — Portable  
 967 document format — Part 1: PDF 1.7 [ISO32000] ("application/pdf").

968 **6.1 Supporting Long-Edge Feed Media with PWG Raster Format**  
 969 **Documents**

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

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

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



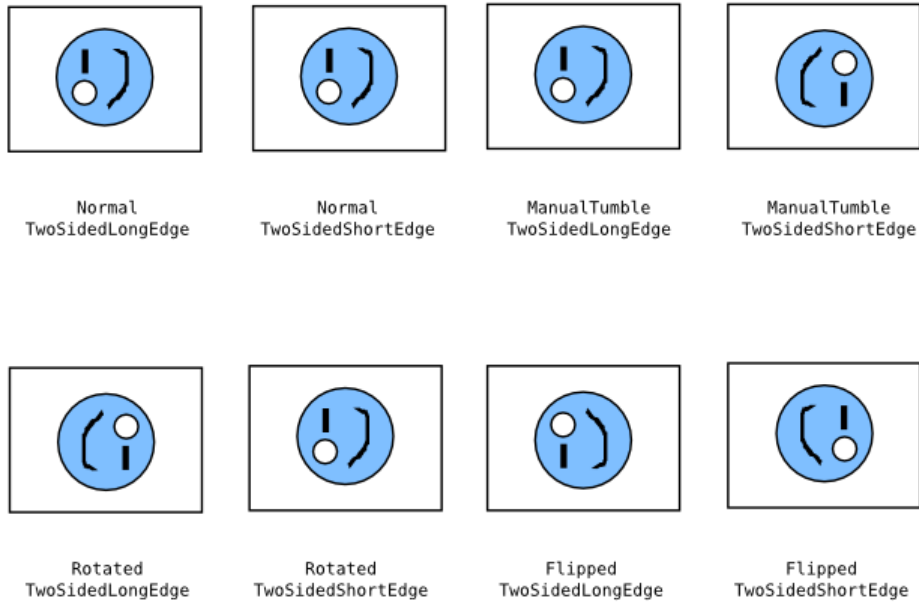
977

978

**Figure 1 - PWG Raster Bitmaps with Portrait Feed Orientation**



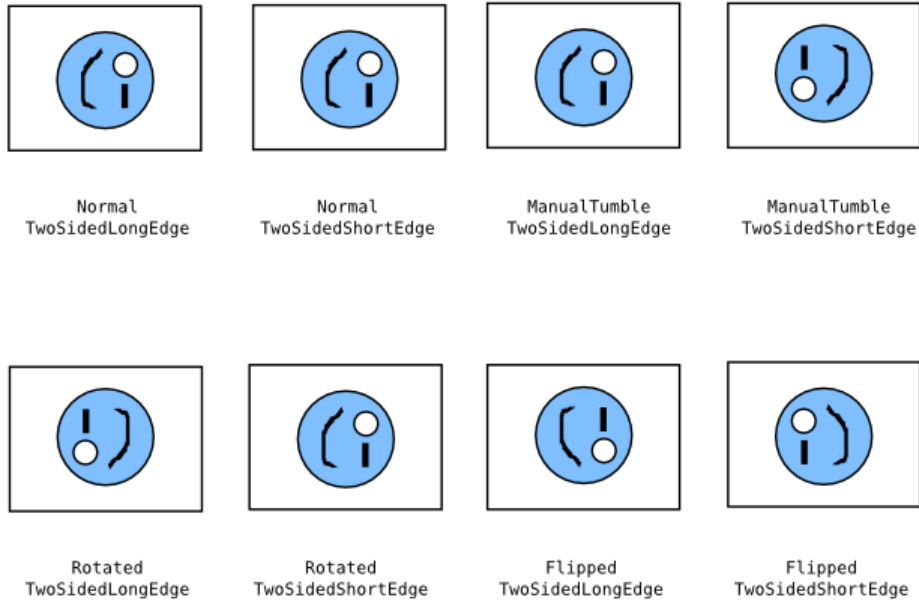
979



980

981

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

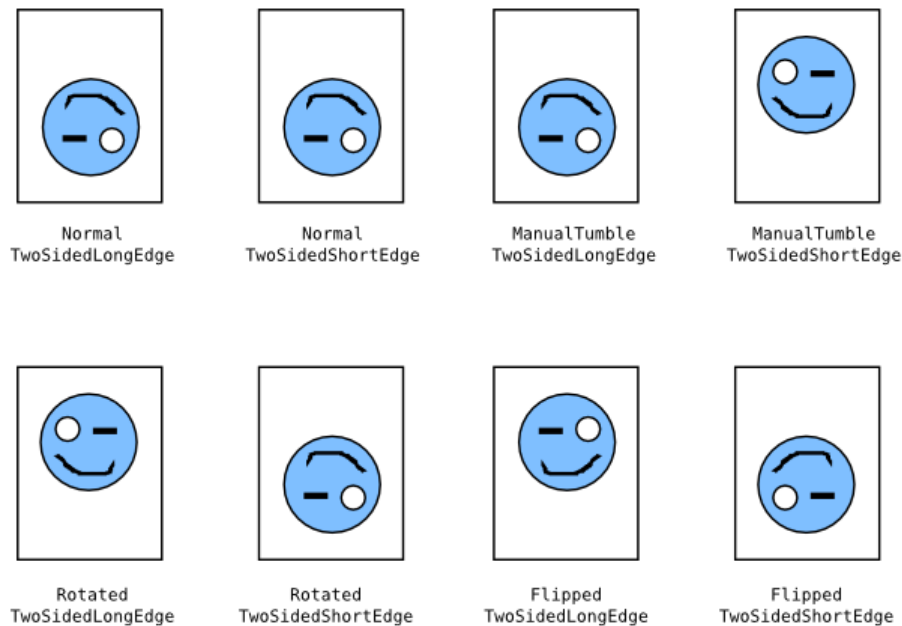


982

983

984

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



985

986

Figure 4 - PWG Raster Bitmaps with Reverse Portrait Feed Orientation

## 987 7. Additional Values for Existing Attributes

### 988 7.1 ipp-features-supported (1setOf type2 keyword)

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

991 This specification also defines the CONDITIONALLY REQUIRED keyword 'ipp-everywhere-  
992 server' for the "ipp-features-supported" Printer attribute. Printers representing Logical  
993 Devices MUST report this keyword. Printers representing Physical Devices MUST NOT  
994 report this keyword.

## 995 8. Additional Semantics for Existing Value Tags

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

## 1000 **8.1 nameWithLanguage and nameWithoutLanguage**

1001 Name values MUST NOT contain characters in the "C0 Control Character Set" or the DEL  
1002 character as defined in Unicode Format for Network Interchange [RFC5198]. Printers MUST  
1003 transcode and filter values from MIBs and other sources to conform to the added  
1004 restrictions.

## 1005 **8.2 naturalLanguage**

1006 NaturalLanguage values MUST conform to and be compared as defined in Tags for  
1007 Identifying Languages [BCP47]. The shortest language tag MUST be used, e.g., "en"  
1008 instead of "eng" for English. Printers SHOULD also support legacy language tags such as:

1009 'no'; replaced by 'nb' (Norwegian Bokmål),

1010 'zh-cn'; replaced by 'zh-hans' (Simplified Chinese), and

1011 'zh-tw'; replaced by 'zh-hant' (Traditional Chinese)

## 1012 **8.3 textWithLanguage and textWithoutLanguage**

1013 Text values MUST NOT contain the DEL character or characters in the "C0 Control  
1014 Character Set" other than CR, LF, and HT [RFC5198]. Printers MUST transcode and filter  
1015 values from MIBs and other sources to conform to the added restrictions.

## 1016 **8.4 uri**

1017 URI values MUST be in absolute form, i.e., "ipp://hostname.local/ipp/print" is acceptable but  
1018 "/ipp/print" is not. URI values MUST NOT contain link-local addresses in the host field.  
1019 Printers MUST NOT generate URI values with link-local addresses and SHOULD NOT  
1020 generate URI values with IP addresses obtained via Dynamic Host Control Protocol (DHCP)  
1021 [RFC2131] or other auto-configuration protocols. Printers SHOULD use the HTTP Host:  
1022 header value when generating URIs for use in Client responses.

## 1023 **9. Conformance Requirements**

1024 This section summarizes the Conformance Requirements detailed in the definitions in this  
1025 document for Clients and Printers.

### 1026 **9.1 Conformance Requirements for Clients**

1027 In order for a Client to claim conformance to this specification a Client MUST support the  
1028 following:

- 1029 1. DNS Service Discovery as defined in section 4.2  
1030 2. IPP/2.0 as defined in section 5  
1031 3. The REQUIRED operations listed in Table 4  
1032 4. The REQUIRED Printer Description attributes listed in Table 5  
1033 5. The REQUIRED operation attributes listed in Table 8  
1034 6. The REQUIRED Job Template attributes listed in Table 12  
1035 7. The REQUIRED Job Description attributes listed in Table 10  
1036 8. The REQUIRED document formats listed in section 5.8  
1037 9. The "media-source-properties" member attribute of the "media-col-database"  
1038 and "media-col-ready" Printer attributes as reported by the Printer and defined  
1039 in section 6.1  
1040 10. The internationalization considerations as defined in section 10  
1041 11. The security considerations as defined in section 0

## 1042 **9.2 Conformance Requirements for Printers**

1043 In order for a Printer to claim conformance to this specification a Printer MUST support the  
1044 following:

- 1045 1. DNS Service Discovery as defined in section 4.2  
1046 2. IPP/2.0 as defined in section 5  
1047 3. The REQUIRED operations listed in Table 4  
1048 4. The REQUIRED Printer Description attributes listed in Table 5  
1049 5. The REQUIRED operation attributes listed in Table 8  
1050 6. The REQUIRED Job Template attributes listed in Table 12  
1051 7. The REQUIRED Job Description attributes listed in Table 10  
1052 8. The REQUIRED document formats listed in section 5.8  
1053 9. The 'ipp-everywhere' value for the "ipp-features-supported" Printer Description  
1054 attribute as defined in section 7.1  
1055 10. The additional semantics for attribute values as defined in section 8  
1056 11. The internationalization considerations as defined in section 10  
1057 12. The security considerations as defined in section 0  
1058 13. The safe string truncation rules as defined in section 13

## 1059 **9.3 Conditional Conformance Requirements for Printers**

1060 Printers that support the "image/jpeg" [JFIF] MIME media type MUST support:

- 1061 1. The "copies-default", and "copies-supported" Printer Description attributes as  
1062 defined in section 5.3.  
1063 2. The "copies" Job Template attribute as defined in section 5.8.

1064 Printers that support the "application/pdf" [ISO32000] MIME media type MUST support:

- 1065 1. The "copies-default", "copies-supported", "document-password-supported", and  
1066 "page-ranges-supported" Printer Description attributes as defined in section 5.3,  
1067 2. The "document-password" Operation attribute as defined in section 5.4, and  
1068 3. The "copies", "multiple-document-handling", "overrides", and "page-ranges" Job  
1069 Template attributes as defined in section 5.8.

1070 Printers that support the Print to a Recipient use case (section 3.2.2.8) MUST support:

- 1071 1. The "job-password-supported" and "job-password-encryption-supported" Printer  
1072 Description attributes as defined in section 5.3, and  
1073 2. The "job-password" and "job-password-encryption" Operation attributes as  
1074 defined in section 5.4.

1075 Printers that provide Paid Print services MUST support:

- 1076 1. The "job-account-id-default", "job-account-id-supported", "job-accounting-user-  
1077 id-default", "job-accounting-user-id-supported", "job-mandatory-attributes-  
1078 default", "job-mandatory-attributes-supported", and "printer-mandatory-job-  
1079 attributes" Printer Description attributes as defined in section 5.3,  
1080 1. The "job-mandatory-attributes" operation attribute as defined in section 5.4, and  
1081 2. The "job-account-id" and "job-accounting-user-id" Job Template attributes as  
1082 defined in section 5.8.

1083 Printers that support long-edge feed media MUST support the "media-source-properties"  
1084 member attribute of the "media-col-database" and "media-col-ready" Printer Description  
1085 attributes as defined in section 5.3.

1086 Printers that support ICC-based color management MUST support:

- 1087 1. The "print-rendering-intent-default", "print-rendering-intent-supported", and  
1088 "printer-icc-profiles" Printer Description attributes as defined in section 5.3.  
1089 2. The "print-rendering-intent" Job Template attribute as defined in section 5.8.

1090 Printers representing Logical Devices MUST report the 'ipp-everywhere-server' value for  
1091 the "ipp-features-supported" Printer Description attribute as defined in section 7.1.

## 1092 **10. Internationalization Considerations**

1093 For interoperability and basic support for multiple languages, conforming implementations  
1094 MUST support:

- 1095 1. The Universal Character Set (UCS) Transformation Format -- 8 bit (UTF-8)  
1096 [STD63] encoding of Unicode [UNICODE] [ISO10646]; and  
1097 2. The Unicode Format for Network Interchange [RFC5198] which requires  
1098 transmission of well-formed UTF-8 strings and recommends transmission of  
1099 normalized UTF-8 strings in Normalization Form C (NFC) [UAX15].

1100 Unicode NFC is defined as the result of performing Canonical Decomposition (into base  
1101 characters and combining marks) followed by Canonical Composition (into canonical  
1102 composed characters wherever Unicode has assigned them).

1103 WARNING – Performing normalization on UTF-8 strings received from Clients and  
1104 subsequently storing the results (e.g., in Job objects) could cause false negatives in Client  
1105 searches and failed access (e.g., to Printers with percent-encoded UTF-8 URIs now  
1106 'hidden').

1107 Implementations of this specification SHOULD conform to the following standards on  
1108 processing of human-readable Unicode text strings, see:

1109 Unicode Bidirectional Algorithm [UAX9] – left-to-right, right-to-left, and vertical

1110 Unicode Line Breaking Algorithm [UAX14] – character classes and wrapping

1111 Unicode Normalization Forms [UAX15] – especially NFC for [RFC5198]

1112 Unicode Text Segmentation [UAX29] – grapheme clusters, words, sentences

1113 Unicode Identifier and Pattern Syntax [UAX31] – identifier use and normalization

1114 Unicode Collation Algorithm [UTS10] – sorting

1115 Unicode Locale Data Markup Language [UTS35] – locale databases

1116 Implementations of this specification are advised to also review the following informational  
1117 documents on processing of human-readable Unicode text strings:

1118 Unicode Character Encoding Model [UTR17] – multi-layer character model

1119 Unicode Character Property Model [UTR23] – character properties

1120 Unicode Conformance Model [UTR33] – Unicode conformance basis

## 1121 **11. Security Considerations**

1122 The IPP extensions defined in this document require the same security considerations as  
1123 defined in the Internet Printing Protocol/1.1 [STD92]. In addition, Printers MUST validate  
1124 the HTTP Host request header in order to protect against DNS rebinding attacks.

1125 Implementations of this specification SHOULD conform to the following standard on  
1126 processing of human-readable Unicode text strings, see:

1127 Unicode Security Mechanisms [UTS39] – detecting and avoiding security attacks

1128 Implementations of this specification are advised to also review the following  
1129 informational document on processing of human-readable Unicode text strings:

1130 Unicode Security FAQ [UNISECFAQ] – common Unicode security issues

## 1131 12. IANA Considerations

### 1132 12.1 Attribute Value Registrations

1133 The keyword attribute values defined in this document will be published by IANA according  
1134 to the procedures in the Internet Printing Protocol/1.1 [STD92] in the following file:

1135 <http://www.iana.org/assignments/ipp-registrations>

1136 The registry entries will contain the following information:

1137	Attributes (attribute syntax)	
1138	Keyword Attribute Value	Reference
1139	-----	-----
1140	ipp-features-supported (1setOf type2 keyword)	[PWG5100.13]
1141	ipp-everywhere	[PWG5100.14]
1142	ipp-everywhere-server	[PWG5100.14]

## 1143 13. Safe String Truncation

1144 Strings can be truncated or omitted when transferred over alternate protocols. Printers  
1145 MUST truncate long strings at logical boundaries. The following subsections describe how  
1146 this truncation is performed for different kinds of strings.

### 1147 13.1 Plain Text Strings

1148 Plain text strings MUST be truncated at the end of a valid character sequence. For example,  
1149 strings using the UTF-8 transformation format of ISO 10646 [STD0063] [ISO10646-1]  
1150 SHOULD be represented using the Unicode Format for Network Interchange [RFC5198]  
1151 and MUST be truncated at the end of a valid UTF-8 sequence.

1152 For example, the 9 octet UTF-8 sequence 0x48.65.CA.81.6C.6C.6F.C2.81 (Héllöj) would  
1153 be shortened to fit within 6 octets by composing the é (0x65.CA.81 becomes 0xC3.A9) and  
1154 removing the trailing UTF-8 sequence 0xC2.81 (j), resulting in the 6 octet UTF-8 sequence  
1155 0x48.C3.A9.6C.6C.6F (Héllö).

### 1156 13.2 URIs

1157 URIs MUST be truncated so that the URI remains valid and accepted by the Printer. For  
1158 example, the 46 octet URI "ipp://printer.example.com/ipp/really-long-name" might be

1159 shortened to fit within 32 octets by removing the last path name component, resulting in the  
1160 29 octet URI "ipp://printer.example.com/ipp". Similarly, the 52 octet URI  
1161 "ipp://printer.example.com/ipp?query-string" might be shortened to fit within 32 octets by  
1162 removing the query string.

1163 As recommended by the Uniform Resource Identifier (URI): Generic Syntax [STD66],  
1164 Printers SHOULD omit the port number from the URI when it has the default value, e.g., 80  
1165 for "http", 443 for "https", and 631 for "ipp" and "ipps" URIs.

### 1166 **13.3 MIME Media Types**

1167 MIME media type strings MUST be truncated at the end of the media subtype, removing  
1168 any parameters that are included with the media type. If the resulting string still exceeds the  
1169 maximum length it MUST be discarded. For example, the 24 octet MIME media type  
1170 "text/plain;charset=utf-8" would be shortened to fit within 16 octets by removing the trailing  
1171 parameter, resulting in the 10 octet MIME media type "text/plain".

### 1172 **13.4 Delimited Lists**

1173 Delimited Lists combine one or more string types listed in the previous sections, separated  
1174 by a delimiting character such as a comma or semicolon. Delimited lists MUST first be  
1175 shortened by removal of unnecessary path components (URIs) and parameters (MIME  
1176 media types) and second truncated at a delimiting character. For example, the 40 octet list  
1177 of MIME media types "text/plain;charset=utf-8,application/pdf" would be shortened to fit  
1178 within 32 octets by removing the MIME media type parameter, resulting in the 26 octet list  
1179 "text/plain,application/pdf". The same list would be shortened to fit within 16 octets by also  
1180 removing the last MIME media type, resulting in the 10 octet list "text/plain".

## 1181 **14. Overview of Changes**

### 1182 **14.1 IPP Everywhere™ v1.1**

1183 The following changes were made to PWG 5100.14-2013: IPP Everywhere [PWG5100.14-  
1184 2013]:

- 1185 • Print Servers (Logical Devices) are now explicitly addressed;
- 1186 • References now point to the current versions of dependent documents and  
1187 specifications at the time of publication;
- 1188 • Requirements for WS-Discovery have been removed due to a lack of  
1189 implementations, which effectively made WS-Discovery support OPTIONAL;
- 1190 • References to OpenXPS and SSDP have been removed;



- 1191 • The "printer-device-id" Printer Description attribute and associated DNS-SD TXT  
1192 record keys are no longer required;
- 1193 • DNS-SD is now RECOMMENDED for Printers representing Logical Devices (print  
1194 servers);
- 1195 • ICC attributes are now CONDITIONALLY REQUIRED for printers that support ICC-  
1196 based color management;
- 1197 • JPEG support is now CONDITIONALLY REQUIRED for color printers;
- 1198 • The "compression-supplied", "document-format-supplied", "document-format-  
1199 version", "document-format-version-supplied", "document-name-supplied" attributes  
1200 are no longer required;
- 1201 • The "feed-orientation", "feed-orientation-default", and "feed-orientation-supported"  
1202 attributes are no longer required;
- 1203 • The "print-content-optimize", "print-content-optimize-default", and "print-content-  
1204 optimize-supported" attributes have been reduced to RECOMMENDED;
- 1205 • IPP Finishings 2.1 and the "finishings-col" Job Template attribute are now  
1206 RECOMMENDED;
- 1207 • The "printer-input-tray" and "printer-output-tray" Printer Description attributes are  
1208 now RECOMMENDED to provide tray information and status;
- 1209 • The "printer-supply", "printer-supply-description", and "printer-supply-info-uri" Printer  
1210 Status attributes are now CONDITIONALLY REQUIRED for Printers that have  
1211 supplies;
- 1212 • The "printer-strings-languages-supported" and "printer-strings-uri" Printer Status  
1213 attributes are now RECOMMENDED to support localization; and
- 1214 • Printer Status and Job Status attributes are now listed in a separate section to match  
1215 STD 92 and the IANA IPP registry.

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1416 To subscribe, see the PWG web page:

1417 <https://www.pwg.org/ipp>

1418 Implementers of this specification document are encouraged to join the IPP Mailing List in  
1419 order to participate in any discussions of clarification issues and review of registration  
1420 proposals for additional attributes and values.

1421 The editors would like to especially thank the following individuals who also contributed  
1422 significantly to the development of this document:

1423 Andrew Mitchell  
1424 Jerry Thrasher - Lexmark  
1425 Peter Zehler - Xerox  
1426



## 1427 **17. Change History**

### 1428 **17.1 March 12, 2020**

- 1429 • Removed references to the Apple Bonjour Printing Specification
- 1430 • Updated DNS-SD text per IPP WG last call feedback, and removed deprecated TXT  
1431 keys.
- 1432 • Updated TLS 1.3 references
- 1433 • Updated LDAP text (no more printer-device-id, and didn't need to truncation warning  
1434 anymore)

### 1435 **17.2 February 19, 2020**

- 1436 • Global: Changed "Printers for Logical Devices" to "Printers representing Logical  
1437 Devices"
- 1438 • Section 5.3: Added max-page-ranges-supported and printer-firmware-xxx to  
1439 recommended list.
- 1440 • Section 7.1: Clarified that logical devices report as server, physical devices do not.
- 1441 • Section 9.3: "print-rendering-intent"
- 1442 • Section 16: Dropped my email address

### 1443 **17.3 February 11, 2020**

- 1444 • Fixed document links on cover page.
- 1445 • Brought back REPERTOIRE reference for job-password-repertoire-xxx attributes
- 1446 • Added CONDITIONALLY REQUIRED 'ipp-everywhere-server' keyword for Logical  
1447 Devices.
- 1448 • Sprinkled RECOMMENDED throughout for attributes and values that are not  
1449 required for Logical Devices.
- 1450 • Added notes for media-xxx-ready and Logical Devices, to make it clear that all  
1451 Printers must still support ready media even if the Printer doesn't represent a single  
1452 physical printer.

- 1453 • Simplified PDF requirements to SHOULD for all printers - previously it was SHOULD
- 1454 for IPP/2.0 and MUST for IPP/2.1 and IPP/2.2.
- 1455 • Dropped remaining references to feed-orientation.
- 1456 • Deleted unused OASIS acronym.
- 1457 •

#### 1458 **17.4 February 10, 2020**

- 1459 • Reverted PWG 5100.EPX reference to published specification (5100.11)
- 1460 • Global: RFC 8011 now STD 92
- 1461 • Updated document author information

#### 1462 **17.5 August 27, 2019**

- 1463 • Updated references - published PWG 5100.7 update and working draft of EPX

#### 1464 **17.6 June 27, 2019**

- 1465 • Removed feed-orientation-xxx attributes (obsolete)
- 1466 • Add pdl-override-supported to list of required Printer Description attributes (was
- 1467 already required in the text, just missing from the table)
- 1468 • Made print-content-optimize RECOMMENDED
- 1469 • Made printer-input-tray and printer-output-tray RECOMMENDED
- 1470 • Global: Change PWG 5100.3 and 5100.11, and all media-col attrs, to PWG 5100.7
- 1471 (JOBEXT v2.0)

#### 1472 **17.7 January 28, 2019**

- 1473 • Status: Stable
- 1474 • Updated reference to v1.0 to use -2013 suffix.
- 1475 • Sections 3.1 and 15.1: Added references to 5100.16 and registration documents
- 1476 • Section 5.3: Added recommended attributes table

- 1477 • Section 5.5: Added recommended attributes table
- 1478 • Sections 5.6 and 5.7: Tables used "Source" heading instead of "Reference"
- 1479 • Section 5.8: Table 10 had wrong note for finishings-col, added finishings-  
1480 col.finishing-template, made note 2 conditionally required, added recommended  
1481 attributes table

## 1482 **17.8 September 26, 2018**

- 1483 • Removed the "compression-supplied", "document-format-supplied", "document-  
1484 format-version", "document-format-version-supplied", and "document-name-  
1485 supplied" attributes from the required attribute lists since the corresponding attributes  
1486 are being obsoleted in PWG 5100.7.

## 1487 **17.9 August 24, 2018**

- 1488 • The current version of the Bonjour Printing Specification is 1.2.1.
- 1489 • Section 4: DNS-SD is now required for physical devices and recommended for  
1490 logical devices (print servers)
- 1491 • Section 5.1: Clarified that the use of the Host header value includes the port number.
- 1492 • Section 5.3: Moved printer-more-info to 5.4 Printer Status attributes
- 1493 • Section 5.4: Added RECOMMENDED printer-strings-languages-supported and  
1494 printer-strings-uri attributes from JPS3
- 1495 • Section 6: Still recommend JPEG for monochrome printers
- 1496 • Section 8.4: Clarified that we mean IP addresses from DHCP
- 1497 • Section 9.3: Fixed section 5.3 references
- 1498 • Section 10: Dropped UTR20 (now maintained by the W3C, but why do we care about  
1499 XML here?)
- 1500 • Section 12.1: Fixed STD 92 reference
- 1501 • Section 14.1: Updated the change list
- 1502 • Section 15.1: Fixed up STD 92 reference, added references to PWG 5100.18 (IPP  
1503 INFRA) and RFCs 6749 and 6750 (OAuth 2.0), updated all Unicode references,  
1504 dropped UTR20 (which is now maintained by the W3C)

**1505 17.10 July 4, 2018**

- 1506 • Status: Prototype
- 1507 • RFC 8011 is now STD 92
- 1508 • Updated Unicode to 11.0.0.

**1509 17.11 June 6, 2018**

- 1510 • Section 5.7: Fixed cross-reference to Table 10.
- 1511 • Section 14.1: Cleaned up WS-Discovery bullet.
- 1512 • Section 15.2: Updated Bonjour Printing specification reference.

**1513 17.12 April 17, 2018**

- 1514 • Removed all references to 1284 device IDs and associated information.

**1515 17.13 April 16, 2018**

- 1516 • Made sure IPP Everywhere™ consistently has trademark symbol.
- 1517 • Section 1: Drop examples of mobile devices.
- 1518 • Section 4.2.3.4: TLS key required for IPPS.
- 1519 • Section 5.1: Fix typos.
- 1520 • Section 5.2: Made Identify-Printer operation recommended for logical devices,  
1521 required otherwise.
- 1522 • Sections 5.3 and 5.8: Made print-rendering-intent and printer-icc-profiles  
1523 conditionally required for printers that support ICC-based color management.
- 1524 • Section 5.3.6: Clarify pdl-override-supported values and usage.
- 1525 • Section 5.7: Deleted stray "note 7"
- 1526 • Section 9.3: Added ICC attributes here.
- 1527 • Section 14: Reworded for present tense, clarified why WS-Discovery has been  
1528 removed, removed reason for removing OpenXPS and SSDP.

**1529 17.14 April 3, 2018**

- 1530 • Make JPEG support conditionally required for color printers.

**1531 17.15 February 9, 2018**

- 1532 • Initial v1.1 draft
- 1533 • Updated template
- 1534 • Updated abstract (can't call it a standard in the abstract)
- 1535 • Updated spec references to current versions
- 1536 • Dropped all mention of UPNP, SSDP, WS-Discovery, and OpenXPS (never  
1537 implemented)
- 1538 • Added a new "Overview of Changes" chapter that documents the high-level changes  
1539 since the original IPP Everywhere specification
- 1540 • Now recommend support for the Get-User-Printer-Attributes operation
- 1541 • Now recommend support for the "finishings-col" attributes (PWG 5100.1)
- 1542 • Now recommend support for TLS 1.3
- 1543 • Now recommend using a resource path of /ipp/print or /ipp/print/name in Printer URIs
- 1544 • Issue 11: printer-current-time is now listed as an IPP Everywhere attribute, although  
1545 only RECOMMENDED since it was missing in the 1.0 spec. (all of the date-time  
1546 attributes were previously required, so printer-current-time would have implicitly been  
1547 required)
- 1548 • Issue 12: The reference to PWG 5100.12 has been corrected
- 1549 • Issue 13: The reference to the EXIF specification has been updated.
- 1550 • Issue 13: The reference to PWG 5101.1 has been updated.
- 1551 • Issue 14: Clarified the pdl-override-supported requirements ('attempted' or  
1552 'guaranteed')
- 1553 • Issue 15: Clarified that relative URIs ("//ipp/print") are not allowed in IPP.
- 1554 • Issue 26: "job-preferred-attributes-supported" should have been "preferred-  
1555 attributes-supported"

- 1556 • Issue 31: Incorrect references to PWG 5101.2 have been changed to PWG 5101.1  
1557 (MSN)
- 1558 • Issue 33: The notes concerning IPP/2.x conformance changes were confusing and  
1559 have been removed
- 1560 • Issue 34: Table 6: overrides-supported now correctly references "note 2"  
1561 (conditionally required).
- 1562 • Issue 35: overrides-supported.document-numbers is now **CONDITIONALLY**  
1563 **REQUIRED**
- 1564 • Fixed attribute examples to use PAPI encoding
- 1565 • Fixed notes concerning "copies" to indicate that support is required for JPEG and  
1566 PDF documents
- 1567 • Separated Printer Status attributes from Printer Description
- 1568 • Separated Job Status attributes from Job Description