



The Printer Working Group

April 3, 2018  
Working Draft

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## IPP Everywhere v1.1

Status: Interim

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

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

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

This document is available electronically at:

<https://ftp.pwg.org/pub/pwg/ipp/wd/wd-ippeve11-20180209.docx>

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75 define print related protocols, interfaces, procedures, and conventions. A PWG standard is  
76 a stable, well understood, and technically competent specification that is widely used with  
77 multiple independent and interoperable implementations. Printer manufacturers and  
78 vendors of printer related software benefit from the interoperability provided by voluntary  
79 conformance to these standards.

80 For additional information regarding the Printer Working Group visit:

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

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## 191 **1. Introduction**

192 Mobile devices (e.g., cellphones, PDAs, netbooks, etc.) do not follow the traditional use  
193 models for printing services. For mobile devices, discovery of available printers and their  
194 capabilities is both more difficult than for traditional desktop systems and more important  
195 because of dynamically changing network attachment points.

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

201 The goal of IPP Everywhere is to allow Clients, particularly mobile Internet devices, to easily  
202 support printing using IPP but without the use of vendor-specific drivers through the  
203 adoption of standard document formats, discovery protocols, and schemas.

## 204 **2. Terminology**

### 205 **2.1 Printing Terminology**

206 Normative definitions and semantics of printing terms are imported from IETF Printer MIB  
207 v2 [RFC3805], IETF Finisher MIB [RFC3806], and IETF Internet Printing Protocol/1.1:  
208 Model and Semantics [RFC8011].

209 *Device*: A Logical or Physical Device associated with one or more Printers; also see section  
210 2.3 of [RFC8011].

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

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

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

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

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

## 221 **2.2 Protocol Role Terminology**

222 This document also defines the following protocol roles to specify unambiguous  
223 conformance requirements:

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

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

## 229 **2.3 Other Terminology**

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

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

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

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

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

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

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

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

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

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



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

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

## 255 **2.4 Acronyms and Organizations**

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

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

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

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

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

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

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

264

## 265 **3. Requirements**

### 266 **3.1 Rationale**

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

- 269 1. Use existing protocols and schema to support discovery, identification, and  
270 auto-configuration of Imaging Devices,
- 271 2. Use existing IPP specifications to support job submission to and monitoring of  
272 Imaging Devices,
- 273 3. Encourage support for printing through standard document formats, and
- 274 4. Discourage the further proliferation of vendor-specific page description  
275 languages, formats, discovery protocols, interfaces, and transports

276 Internet Printing Protocol/1.1: Encoding and Transport [RFC8010] and Internet Printing  
277 Protocol/1.1: Model and Semantics [RFC8011] define the core Internet Printing Protocol.

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

- 279 1. A collection of existing IPP specifications that form the basis for IPP/2.0
- 280 2. Standard job template attributes
- 281 3. Specific interoperability requirements, such as HTTP/1.1 support with chunking  
282 and IPP collection attribute support
- 283 4. New version number and operation requirements for different classes of  
284 Imaging Devices

285 The IPP URL Scheme [RFC3510] defines the 'ipp' URI scheme and the IPP over HTTPS  
286 Transport Binding and 'ipps' URI Scheme [RFC7472] defines the 'ipps' URI scheme used  
287 for IPP.

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

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

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

- 294 5. A rich file format for transmission of multi-page color and grayscale vector and  
295 bitmap images
- 296 6. Standard page attributes to support page size, orientation, and duplex  
297 functionality

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

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

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

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

## 310 **3.2 Use Cases**

### 311 **3.2.1 Select Printer**

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

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

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

#### 321 **3.2.1.1 Select the Last Used Printer**

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

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

**328 3.2.1.2 Select Printer Using Name or Address**

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

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

**335 3.2.1.3 Select Printer Using URI**

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

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

**340 3.2.1.4 Select Printer Using a Directory Service**

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

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

**347 3.2.1.5 Select Printer Using a Cloud Service**

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

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

**354 3.2.1.6 Select Printer Using a Discovery Protocol**

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

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

### 361 **3.2.1.7 Select Printer Using Geo-Location**

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

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

### 368 **3.2.1.8 Select Printer Using Out of Band Method**

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

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

### 375 **3.2.1.9 Select Printer Using Properties**

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

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

### 387 **3.2.2 Print**

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

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

### 396 **3.2.2.1 Print a Document**

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

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

### 403 **3.2.2.2 Print a Document by Reference**

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

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

### 410 **3.2.2.3 Print Using Loaded Media**

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

413 After Jane initiates a print action from the phone and selects a Printer, the Client photo  
414 application automatically selects the largest borderless photographic media loaded on the  
415 Selected Printer and the highest print quality. Jane selects additional processing intent for  
416 the Job and confirms the print action. The Client sends a print job request to the Printer with  
417 the Job Ticket and local photo. The Printer validates the Job Ticket and document data and  
418 then prints the photo.

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

### 422 **3.2.2.4 Print a Secure Form**

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

427 The treasurer loads check blanks into the Printer and configured the loaded media as  
428 necessary at the Printer. After he initiates a print action from the accounting program,  
429 selects a Printer for printing, and selects checks to be printed, the Client User Interface  
430 displays a preview of the printed checks and he confirms that the checks are correctly

431 paginated and oriented and the amounts, payees and signature are correct. The Client  
432 automatically selects the check blank media. The treasurer selects additional processing  
433 intent for the Job and confirms the print action. The Client sends a print job request to the  
434 Printer with the Job Ticket and document data containing the check information, correctly  
435 oriented for the check blank media. He waits for the checks to be printed and removes any  
436 excess media from the Printer.

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 **3.2.2.5 Print with Special Formatting**

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

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

#### 453 **3.2.2.6 Print and Select at Printer**

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

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

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

**465 3.2.2.7 Print to a Service**

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

**473 3.2.2.8 Print to a Recipient**

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

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

**481 3.2.2.9 Print with a Proof Copy**

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

**488 3.2.3 Exceptions****489 3.2.3.1 Print Action Canceled**

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

**493 3.2.3.2 Select Printer Canceled**

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



**496 3.2.3.3 Printer No Longer Network Accessible after Selection**

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

**500 3.2.3.4 Not Authorized**

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

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

**507 3.2.3.5 Needs Authentication**

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

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

**512 3.2.3.6 Not Accepting Jobs**

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

**515 3.2.3.7 Job Ticket or Document Format Not Supported**

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

**519 3.2.3.8 Job or Document Processing Failures**

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

**524 3.2.3.9 Printer Fault**

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

**528 3.2.3.10 Printer Warning**

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

**532 3.3 Out of Scope**

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

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

**541 3.4 Design Requirements**

542 The IPP Everywhere design should:

- 543 1. Define conformance profiles that reference the IPP/2.0 versions [PWG5100.12];
- 544 2. Follow the naming conventions defined in IETF IPP/1.1 [RFC8011], including keyword  
545 value case (lower) and hyphenation requirements;
- 546 3. Define conformance requirements for both Printers and Clients; and
- 547 4. Support printing with vendor-neutral Client software from any Client to any Printer  
548 using a variety of discovery protocols, IPP for the transport, and standard document  
549 formats.

550

## 551 **4. Discovery Protocols**

552 Printers **MUST** support DNS-SD based Discovery. Printers **MAY** support other Discovery  
553 protocols such as LDAP and SLP.

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

### 556 **4.1 Printer Description Attributes Used in Discovery**

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

### 559 **4.2 DNS Service Discovery (DNS-SD)**

560 DNS Service Discovery [RFC6762] uses service (SRV) records and traditional unicast and  
561 multicast DNS (mDNS) [RFC6763] queries. This discovery protocol is collectively defined  
562 in the Bonjour Printing Specification version 1.2 [BONJOUR] and extended in this  
563 specification.

564 Printers **MUST** support mDNS and **MAY** support dynamic DNS updates via Dynamic  
565 Updates in the Domain Name System (DNS UPDATE) [RFC2136] and other mechanisms.

#### 566 **4.2.1 Service (SRV) Instance Name**

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

569 Printers **MUST** advertise the "\_ipp.\_tcp" (generic IPP) and "\_print.\_sub.\_ipp.\_tcp" (IPP  
570 Everywhere) services over mDNS.

571 Printers supporting the "ipps" URI scheme [RFC7472] **MUST** advertise the "\_ipps.\_tcp"  
572 (generic IPPS) and "\_print.\_sub.\_ipps.\_tcp" (IPP Everywhere Secure) services over mDNS.

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

#### 574 **4.2.2 Geo-Location (LOC)**

575 Printers **MUST** publish LOC records [RFC1876] over mDNS to provide the physical location  
576 of the Printer. Printers **MUST** allow the User to configure the geo-location manually. If the  
577 accuracy of the geo-location is unknown, a value of  $9 \times 10^9$  meters (0x99) **MUST** be used.  
578

579

**Table 1 - Attributes in Discovery Protocols**

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

580 Note 1: Extension attribute to RFC 7612.

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

### 582 4.2.3 Text (TXT)

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

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

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

592 For example, the IPP "printer-more-info" attribute has a maximum length of 1023 octets,  
 593 however the corresponding "adminurl" key cannot represent a value longer than 246 octets  
 594 (255 - 9 octets for "adminurl="). Printers MUST truncate long strings as described in section  
 595 13.

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

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

600

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

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

601 Clients MUST ignore incomplete key/value pairs at the end of a truncated TXT record.  
 602

603

**Table 3 - DNS TXT Record Keys**

<b>Key</b>	<b>Description</b>	<b>Default Value</b>
adminurl	The Printer-resident configuration page URL as reported by the "printer-more-info" Printer Description attribute.	" (empty string)
air	The type of authentication information that is required for the Printer. See section 4.2.3.1.	'none'
Bind	'T' if the Printer can bind output, 'F' otherwise.	'U' (note 1)
Collate	'T' if the Printer can collate copies, 'F' otherwise.	'U' (note 1)
Color	'T' if the Printer supports color printing, 'F' otherwise.	'U' (note 1)
Copies	'T' if the Printer can make copies on its own, 'F' otherwise.	'U' (note 1)
Duplex	'T' if the Printer supports duplex printing, 'F' otherwise	'U' (note 1)
DUUID	The UUID of the Device without the "urn:uuid:" prefix as reported by the "device-uuid" Printer Description attribute. See section 4.2.3.9.	" (empty string)
note	The location of the Printer as reported by the "printer-location" Printer Description attribute.	" (empty string)
PaperCustom	'T' if the Printer supports custom media sizes, 'F' otherwise.	'U' (note 1)
PaperMax	The maximum media size supported by the Printer: '<legal-A4', 'legal-A4', 'isoC-A2', '>isoC-A2'.	'legal-A4'
pdl	A comma-delimited list of supported MIME media types. See section 4.2.3.2.	" (empty string)
priority	The priority for the service from 0 to 99, where 0 is the highest priority and 99 is the lowest priority.	'50'
product	The PostScript product name, typically the value reported by the "printer-make-and-model" Printer Description attribute with parenthesis, e.g., '(Example Model)'.	" (empty string)
Punch	'T' if the Printer can punch output, 'F' otherwise.	'U' (note 1)
qtotal	The number of queues for this Printer. MUST have the value '1'. See section 4.2.3.3	'1'
rp	The remote print queue name, which is the resource path portion of the Printer URI without the leading slash.	" (empty string)
Sort	'T' if the Printer can sort output, 'F' otherwise.	'U' (note 1)
Staple	'T' if the Printer can staple output, 'F' otherwise.	'U' (note 1)
TLS	The maximum TLS version supported or 'none' if no version of TLS is supported. See section 4.2.3.4.	'none'
txtvers	The major version of the Bonjour printing specification. MUST have the value '1'.	'1'
ty	The make and model of the Printer as reported by the "printer-make-and-model" Printer Description attribute.	" (empty string)
usb_CMD	The IEEE 1284 Device ID command set value. See section 4.2.3.5.	" (empty string)
usb_MDL	The IEEE 1284 Device ID model value. See section 4.2.3.7.	" (empty string)
usb_MFG	The IEEE 1284 Device ID manufacturer value. See section 4.2.3.6.	" (empty string)

Key	Description	Default Value
UUID	The UUID of the Printer without the 'urn:uuid:' prefix as reported by the "printer-uuid" Printer Description attribute. See section 4.2.3.8.	" (empty string)

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

#### 605 4.2.3.1 air

606 The "air" key defines the type of authentication information that is required for imaging. The  
 607 name "air" comes from the CUPS "auth-info-required" Printer Description attribute  
 608 [CUPSIPP] that extends the "uri-authentication-supported" Printer Description attribute  
 609 [RFC8011]. The following values are supported:

610 'certificate'; Authentication using Secure Sockets Layer (SSL) and Transport Layer  
 611 Security (TLS) certificates. This is equivalent to the value 'certificate' for the "uri-  
 612 authentication-supported" Printer Description attribute [RFC8011].

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

616 'none'; No authentication is required. This is equivalent to the value 'none' for the  
 617 "uri-authentication-supported" Printer Description attribute [RFC8011].

618 'username,password'; Username + password authentication is required. This is  
 619 equivalent to the values 'basic' or 'digest' for the "uri-authentication-supported"  
 620 Printer Description attribute [RFC8011].

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

#### 622 4.2.3.2 pdl

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

#### 629 4.2.3.3 qtotal

630 The "qtotal" key defines the number of services supported by the Printer with this service  
 631 instance name. While the Bonjour Printing Specification [BONJOUR] does allow Printers to  
 632 advertise multiple services with the same name using multiple TXT records, historically this  
 633 functionality has caused interoperability and stability issues for Printers and Clients that  
 634 support multiple network interfaces, e.g., Wi-Fi and Ethernet. Therefore, Printers MUST

635 NOT advertise multiple services using the same name and MUST always use the default  
636 value (1) for the "qtotal" key and advertise the default (print) service in the TXT record.  
637 Printers with multiple print service endpoints MAY advertise multiple uniquely named  
638 services, each providing a single TXT record for their corresponding information.

#### 639 **4.2.3.4 TLS**

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

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

644 '1.0'; TLS 1.0 [RFC2246] encryption is supported. This is equivalent to the value 'tls'  
645 for the "uri-security-supported" Printer Description attribute.

646 '1.1'; TLS 1.1 [RFC4346] encryption is supported. This is equivalent to the value 'tls'  
647 for the "uri-security-supported" Printer Description attribute.

648 '1.2'; TLS 1.2 [RFC5246] encryption is supported. This is equivalent to the value 'tls'  
649 for the "uri-security-supported" Printer Description attribute.

650 '1.3'; TLS 1.3 [RFC-TLS1.3] encryption is supported. This is equivalent to the value  
651 'tls' for the "uri-security-supported" Printer Description attribute.

652 The default value of the "TLS" key is 'none'. Version numbers correspond to the currently  
653 defined TLS protocol versions as defined by the IETF and are not limited to the version  
654 numbers shown above.

#### 655 **4.2.3.5 usb\_CMD**

656 The REQUIRED "usb\_CMD" key provides the COMMAND SET (CMD) [PWG5107.2] value  
657 from the "printer-device-id" Printer attribute.

#### 658 **4.2.3.6 usb\_MFG**

659 The REQUIRED "usb\_MFG" key provides the MANUFACTURER (MFG) value from the  
660 "printer-device-id" Printer attribute.

#### 661 **4.2.3.7 usb\_MDL**

662 The REQUIRED "usb\_MDL" key provides the MODEL (MDL) value from the "printer-device-  
663 id" Printer attribute.



#### 664 **4.2.3.8 UUID**

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

668 `urn:uuid:12345678-9ABC-DEF0-1234-56789ABCDEF0`

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

670 `12345678-9ABC-DEF0-1234-56789ABCDEF0`

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

#### 673 **4.2.3.9 DUUID**

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

677 `urn:uuid:12345678-9ABC-DEF0-1234-56789ABCDEF0`

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

679 `12345678-9ABC-DEF0-1234-56789ABCDEF0`

### 680 **4.3 LDAP and SLP Discovery**

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

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

686 For example, the IPP "printer-device-id" attribute has a maximum length of 1023 octets,  
687 however the corresponding LDAP "printer-device-id" attribute has a maximum length of 255  
688 octets. Printers MUST truncate long strings as defined in section 13.  
690

## 691 **5. Protocol Binding**

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

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

### 696 **5.1 HTTP Features**

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

702 Clients and Printers MUST support IPP over HTTP [RFC3510] and SHOULD support IPP  
703 over HTTPS [RFC7472] with the most recent version of TLS [RFC-TLS1.3].

#### 704 **5.1.1 Host**

705 Printers MUST validate the Host request header and SHOULD use the Host value in  
706 generated URIs.

#### 707 **5.1.2 If-Modified-Since, Last-Modified, and 304 Not Modified**

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

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

#### 714 **5.1.3 Cache-Control**

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

720

## 721 5.2 IPP Operations

722 Table 4 lists the REQUIRED operations for a Printer. Additionally, Clients and Printers  
723 SHOULD support the Get-User-Printer-Attributes [GUPA] operation for per-User print  
724 policies.

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

728 **Table 4 - IPP Everywhere Required Operations**

Code	Operation Name	Reference
0x0002	Print-Job	RFC 8011
0x0004	Validate-Job	RFC 8011
0x0005	Create-Job	RFC 8011
0x0006	Send-Document	RFC 8011
0x0008	Cancel-Job	RFC 8011
0x0009	Get-Job-Attributes	RFC 8011
0x000A	Get-Jobs	RFC 8011
0x000B	Get-Printer-Attributes	RFC 8011
0x0039	Cancel-My-Jobs	PWG 5100.11
0x003B	Close-Job (note 2)	PWG 5100.11
0x003C	Identify-Printer	PWG 5100.13

## 729 5.3 IPP Printer Description Attributes

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

732 **Table 5 - IPP Everywhere Printer Description Attributes**

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

Attribute	Reference
generated-natural-language-supported	RFC 8011
identify-actions-default	PWG 5100.13
identify-actions-supported	PWG 5100.13
ipp-features-supported	PWG 5100.13
ipp-versions-supported	RFC 8011
job-account-id-default (note 1)	PWG 5100.3
job-account-id-supported (note 1)	PWG 5100.3
job-accounting-user-id-default (note 1)	PWG 5100.3
job-accounting-user-id-supported (note 1)	PWG 5100.3
job-constraints-supported	PWG 5100.13
job-creation-attributes-supported	PWG 5100.11
job-ids-supported	PWG 5100.11
job-password-supported (note 4)	PWG 5100.11
job-password-encryption-supported (note 4)	PWG 5100.11
job-resolvers-supported	PWG 5100.13
media-bottom-margin-supported	PWG 5100.13
media-col-database	PWG 5100.11
media-col-database.media-source-properties (note 5)	PWG 5100.13
media-col-default	PWG 5100.3
media-col-ready	PWG 5100.3
media-col-ready.media-source-properties (note 5)	PWG 5100.13
media-col-supported	PWG 5100.3
media-default	RFC 8011
media-left-margin-supported	PWG 5100.13
media-ready	RFC 8011
media-right-margin-supported	PWG 5100.13
media-size-supported	PWG 5100.3
media-source-supported	PWG 5100.13
media-supported	RFC 8011
media-top-margin-supported	PWG 5100.13
media-type-supported	PWG 5100.3
multiple-document-jobs-supported	RFC 8011
multiple-operation-timeout	RFC 8011
multiple-operation-timeout-action	PWG 5100.13
natural-language-configured	RFC 8011
operations-supported	RFC 8011
orientation-requested-default	RFC 8011
orientation-requested-supported	RFC 8011
output-bin-default	PWG 5100.2
output-bin-supported	PWG 5100.2
overrides-supported (note 2)	PWG 5100.6
page-ranges-supported (note 2)	RFC 8011
preferred-attributes-supported	PWG 5100.13
print-color-mode-default	PWG 5100.13
print-color-mode-supported	PWG 5100.13
print-content-optimize-default	PWG 5100.7
print-content-optimize-supported	PWG 5100.7
print-rendering-intent-default	PWG 5100.13
print-rendering-intent-supported	PWG 5100.13
print-quality-default	RFC 8011
print-quality-supported	RFC 8011
printer-current-time (note 7)	RFC 8011
printer-device-id	PWG 5107.2

Attribute	Reference
printer-geo-location	PWG 5100.13
printer-get-attributes-supported	PWG 5100.13
printer-icc-profiles (note 6)	PWG 5100.13
printer-icons (note 6)	PWG 5100.13
printer-info	RFC 8011
printer-location	RFC 8011
printer-make-and-model	RFC 8011
printer-mandatory-job-attributes (note 1)	PWG 5100.13
printer-more-info (note 6)	RFC 8011
printer-name	RFC 8011
printer-organization	PWG 5100.13
printer-organizational-unit	PWG 5100.13
printer-resolution-default	RFC 8011
printer-resolution-supported	RFC 8011
pwg-raster-document-resolution-supported	PWG 5102.4
pwg-raster-document-sheet-back	PWG 5102.4
pwg-raster-document-type-supported	PWG 5102.4
sides-default	RFC 8011
sides-supported	RFC 8011
uri-security-supported	RFC 8011
uri-authentication-supported	RFC 8011
which-jobs-supported	PWG 5100.11

733

734

Note 1: CONDITIONALLY REQUIRED for Printers that implement Paid Imaging services.

735

Note 2: REQUIRED for the "application/pdf" and "image/jpeg" MIME media types.

736

737

Note 3: CONDITIONALLY REQUIRED for Printers with finishers.

738

739

Note 4: CONDITIONALLY REQUIRED for Printers that support the Print to a Recipient (section 3.2.2.8) use case.

740

741

Note 5: CONDITIONALLY REQUIRED for Printers that support long-edge feed media.

742

743

Note 6: URIs MUST be absolute, SHOULD use the Host value from HTTP header (section 5.1.1), and MUST NOT use link-local addresses (section 8.4).

744

745

Note 7: RECOMMENDED due to its omission from IPP Everywhere 1.0, however it is needed for the underlying functionality.

746

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

747

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

748

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751

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

752

753

754

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

```
757     media-col-database=..., {  
758         media-size={  
759             x-dimension=5000-33020  
760             y-dimension=5000-48260 }  
761         media-source='by-pass-tray' }, ...
```

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

```
768     media-col-database=..., {  
769         media-size={  
770             x-dimension=20320-152400  
771             y-dimension=1524-9144000 }, ...
```

### 772 5.3.2 media-col-ready (1setOf collection)

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

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

783 Roll media sizes are described using an integer value for the "x-dimension" and a  
784 rangeOfInteger value for the "y-dimension" member attributes of the "media-size" member  
785 attribute. The "x-dimension" value refers to the width of the loaded roll, the lower bound of  
786 the "y-dimension" value refers to the minimum length allowed, and the upper bound of the  
787 "y-dimension" value refers to the remaining length of the loaded roll or, if the remainder is  
788 not known, the maximum length allowed.

### 789 5.3.3 media-ready (1setOf (type3 keyword | name(MAX)))

790 The REQUIRED "media-ready" Printer attribute lists the loaded media for a Printer. In  
791 addition to the requirements set forth in Internet Printing Protocol/1.1: Model and Semantics  
792 [RFC8011], this specification defines how a Printer advertises custom, manually-fed, and  
793 roll-fed media in the "media-ready" attribute.

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

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

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

#### 809 **5.3.4 media-size-supported (1setOf collection)**

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

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

```
818     media-size-supported=..., {  
819         x-dimension=5000-33020  
820         y-dimension=5000-48260 }, ...
```

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

```
827     media-size-supported=..., {  
828         x-dimension=20320-152400  
829         y-dimension=1524-9144000 }, ...
```

### 830 **5.3.5 media-supported (1setOf (type3 keyword | name(MAX)))**

831 The REQUIRED "media-supported" Printer attribute lists the supported media sizes for a  
832 Printer. In addition to the requirements set forth in [RFC8011], this specification defines how  
833 a Printer advertises custom and roll-fed media in the "media-supported" attribute.

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

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

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

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

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

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

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

### 855 **5.3.6 pdl-override-supported (type2 keyword)**

856 The REQUIRED "pdl-override-supported" Printer attribute informs the Client whether Job  
857 Ticket information embedded in the Document data for a Job can be ignored or overridden  
858 by Job Template attributes.

859 When reporting capabilities for the 'application/pdf', 'image/jpeg', or 'image/pwg-raster'  
860 MIME media types, Printers MUST report either 'attempted' or 'guaranteed' for the "pdl-  
861 override-supported" Printer attribute.

### 862 **5.3.7 printer-device-id (text(1023))**

863 The REQUIRED "printer-device-id" Printer attribute provides the IEEE 1284 Device ID  
864 [IEEE1284] string for the Imaging Device. Because discovery protocols often have lower



865 limits on the length of string values, Printers MUST list the Device ID key/value pairs in the  
866 following order:

- 867 5. All required (MANUFACTURER/MFG, MODEL/MDL, and COMMAND  
868 SET/CMD) key/value pairs,
- 869 6. All optional key/value pairs, and
- 870 7. All vendor key/value pairs

871 For interoperability, Printers MUST NOT report standard key/value pairs using non-standard  
872 abbreviations. For example, "MANU" is sometimes used as an abbreviation for  
873 "MANUFACTURER", however the only allowed abbreviation is "MFG".

874 The optional and vendor key/value pairs can be prioritized by Client software requirements.  
875 This allows the Printer to truncate the Device ID string on key/value boundaries as needed  
876 (section 13.4) without loss of critical information needed for selection of device-specific or  
877 generic driver software on the Client.  
878

879 **5.4 IPP Printer Status Attributes**

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

882 **Table 6 - IPP Everywhere Printer Status Attributes**

Attribute	Reference
pages-per-minute	RFC 8011
pages-per-minute-color	RFC 8011
printer-alert	PWG 5100.9
printer-alert-description	PWG 5100.9
printer-config-change-date-time	PWG 5100.13
printer-config-change-time	PWG 5100.13
printer-is-accepting-jobs	RFC 8011
printer-state	RFC 8011
printer-state-change-date-time	RFC 3995
printer-state-change-time	RFC 3995
printer-state-message	RFC 8011
printer-state-reasons	RFC 8011
printer-supply	PWG 5100.13
printer-supply-description	PWG 5100.13
printer-supply-info-uri (note 1)	PWG 5100.13
printer-up-time	RFC 8011
printer-uri-supported (note 1)	RFC 8011
printer-uuid	PWG 5100.13
pwg-raster-document-resolution-supported	PWG 5102.4
pwg-raster-document-sheet-back	PWG 5102.4
pwg-raster-document-type-supported	PWG 5102.4
queued-job-count	RFC 8011

883  
884 Note 1: URIs MUST be absolute, SHOULD use the Host value from HTTP header  
885 (section 5.1.1), and MUST NOT use link-local addresses (section 8.4).

886 **5.4.1 printer-uri-supported (1setOf uri)**

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

890 **5.5 IPP Operation Attributes**

891 Table 7 lists the REQUIRED operation attributes for a Printer.

892 **Table 7 - IPP Everywhere Required Operation Attributes**

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

893

894 Note 1: CONDITIONALLY REQUIRED for Printers that support the "application/pdf"  
895 MIME media type.896 Note 2: CONDITIONALLY REQUIRED for Printers that support the Print to a  
897 Recipient (section 3.2.2.8) use case.898 Note 3: CONDITIONALLY REQUIRED for Printers that implement Paid Imaging  
899 services.

900

901 Note 7: RECOMMENDED due to its omission from IPP Everywhere 1.0, however it  
902 is needed for the underlying functionality.

## 903 5.6 IPP Job Description Attributes

904 Table 8 lists the REQUIRED Job Description attributes for a Printer.

905 **Table 8 - IPP Everywhere Required Job Description Attributes**

Attribute	Source
job-name	RFC 8011

## 906 5.7 IPP Job Status Attributes

907 Table 8 lists the REQUIRED Job Status attributes for a Printer.

908 **Table 9 - IPP Everywhere Required Job Status Attributes**

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

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

### 912 5.7.1 job-id (integer)

913 The REQUIRED "job-id" Job Description attribute contains the ID of the Job. In order to  
914 support reliable job submission and management, Printers MUST NOT reuse "job-id"  
915 values since the last power cycle of the Printer and SHOULD NOT reuse "job-id" values

916 for the life of the Printer as described in section 3.1.2.3.9 of the Internet Printing  
917 Protocol/1.1: Implementer's Guide [RFC3196].

## 918 5.7.2 job-uri (uri)

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

## 925 5.8 IPP Job Template Attributes

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

928 **Table 10 - IPP Everywhere Job Template Attributes**

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

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

## 940 **6. Document Formats**

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

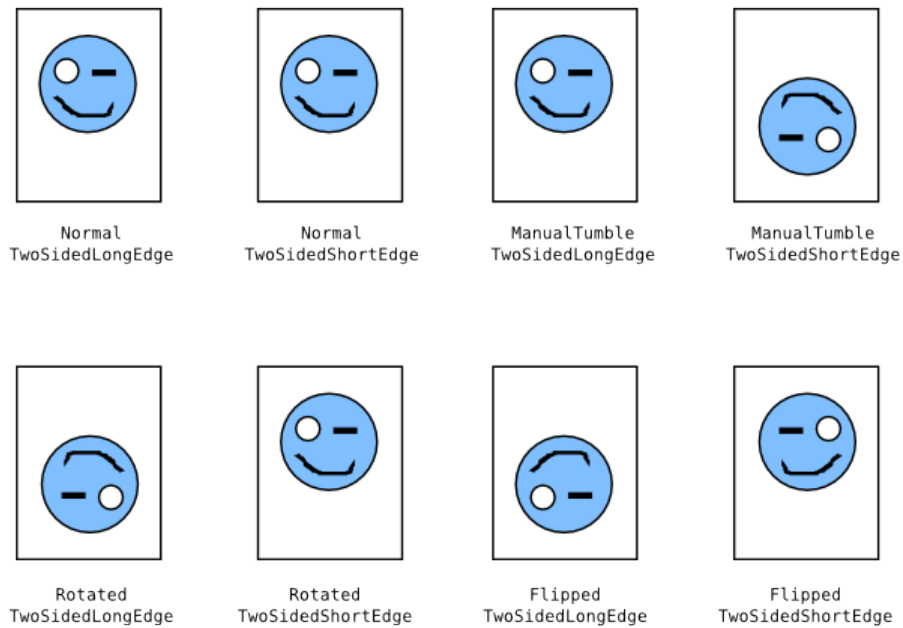
947 IPP/2.1 and IPP/2.2 Printers MUST and IPP/2.0 Printers SHOULD support documents  
948 conforming to Document management — Portable document format — Part 1: PDF 1.7  
949 [ISO32000] ("application/pdf"). IPP/2.0, IPP/2.1, and IPP/2.2 Printers are defined in  
950 [PWG5100.12].

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

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

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

962 Figures 2 through 5 show how raster data must be formatted for each feed orientation.  
963

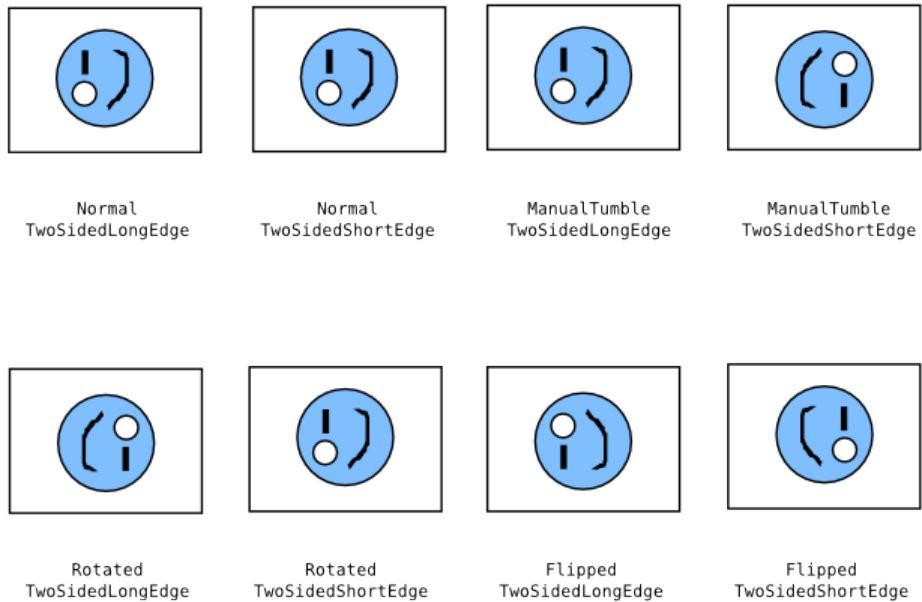


964

965

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

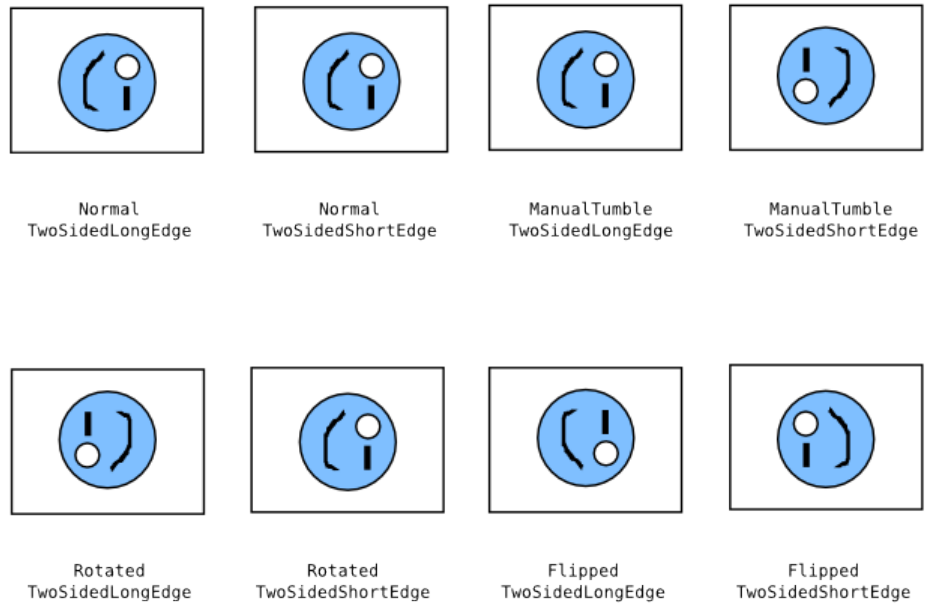
966



967

968

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

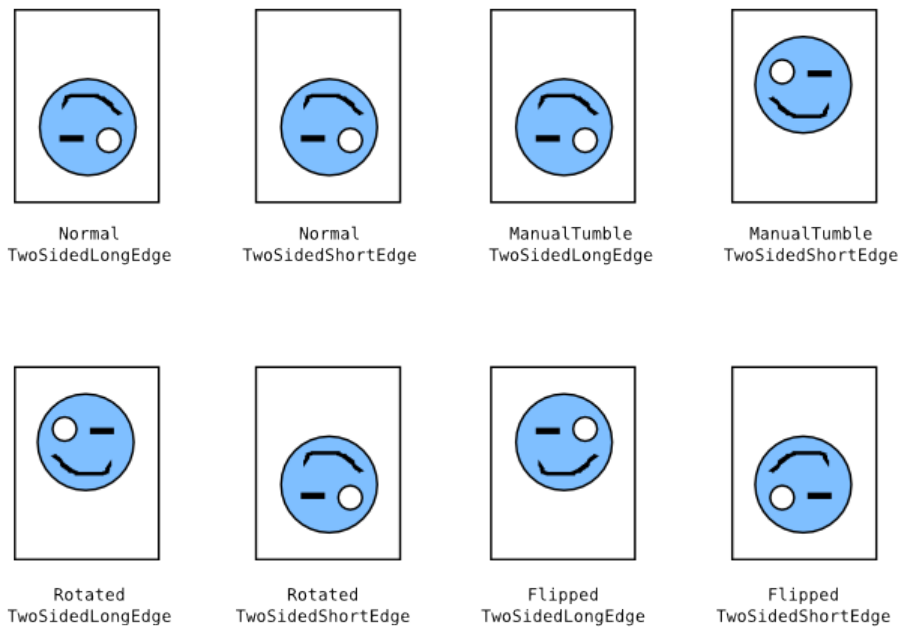


969

970

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

971



972

973

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



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

975 **7.1 ipp-features-supported (1setOf type2 keyword)**

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

978

## 979 **8. Additional Semantics for Existing Value Tags**

980 This specification amends the definition of the nameWithLanguage,  
981 nameWithoutLanguage, naturalLanguage, textWithLanguage, textWithoutLanguage, and  
982 URI value tags defined in IPP/1.1: Model and Semantics [RFC8011] with additional  
983 restrictions to improve interoperability.

### 984 **8.1 nameWithLanguage and nameWithoutLanguage**

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

### 989 **8.2 naturalLanguage**

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

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

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

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

### 996 **8.3 textWithLanguage and textWithoutLanguage**

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

### 1000 **8.4 uri**

1001 URI values MUST be in absolute form, i.e., "ipp://hostname.local/ipp/print" is acceptable but  
1002 "//ipp/print" is not. URI values MUST NOT contain link-local addresses in the host field.  
1003 Printers MUST NOT generate URI values with link-local addresses and SHOULD NOT  
1004 generate URI values with addresses obtained via Dynamic Host Control Protocol (DHCP)  
1005 [RFC2131] or other auto-configuration protocols. Printers SHOULD use the HTTP Host:  
1006 header value when generating URIs for use in Client responses.  
1007

## 1008 **9. Conformance Requirements**

1009 This section summarizes the Conformance Requirements detailed in the definitions in this  
1010 document for Clients and Printers.

### 1011 **9.1 Conformance Requirements for Clients**

1012 In order for a Client to claim conformance to this specification a Client MUST support the  
1013 following:

- 1014 1. DNS Service Discovery as defined in section 4.2
- 1015 2. IPP/2.0 as defined in section 5
- 1016 3. The REQUIRED operations listed in Table 4
- 1017 4. The REQUIRED Printer Description attributes listed in Table 5
- 1018 5. The REQUIRED operation attributes listed in Table 7
- 1019 6. The REQUIRED Job Template attributes listed in Table 10
- 1020 7. The REQUIRED Job Description attributes listed in Table 8
- 1021 8. The REQUIRED document formats listed in section 5.8
- 1022 9. The "feed-orientation-supported" Printer attribute and "media-source-properties"  
1023 member attribute of the "media-col-database" and "media-col-ready" Printer  
1024 attributes as reported by the Printer and defined in section 6.1
- 1025 10. The internationalization considerations as defined in section 10
- 1026 11. The security considerations as defined in section 0

### 1027 **9.2 Conformance Requirements for Printers**

1028 In order for a Printer to claim conformance to this specification a Printer MUST support the  
1029 following:

- 1030 1. DNS Service Discovery as defined in section 4.2
- 1031 2. IPP/2.0 as defined in section 5
- 1032 3. The REQUIRED operations listed in Table 4
- 1033 4. The REQUIRED Printer Description attributes listed in Table 5
- 1034 5. The REQUIRED operation attributes listed in Table 7
- 1035 6. The REQUIRED Job Template attributes listed in Table 10
- 1036 7. The REQUIRED Job Description attributes listed in Table 8
- 1037 8. The REQUIRED document formats listed in section 5.8
- 1038 9. The 'ipp-everywhere' value for the "ipp-features-supported" Printer Description  
1039 attribute as defined in section 7.1
- 1040 10. The additional semantics for attribute values as defined in section 8
- 1041 11. The internationalization considerations as defined in section 10
- 1042 12. The security considerations as defined in section 0
- 1043 13. The safe string truncation rules as defined in section 13

### 1044 9.3 Conditional Conformance Requirements for Printers

1045 Printers that support the "image/jpeg" [JFIF] MIME media type MUST support:

- 1046 1. The "copies-default", and "copies-supported" Printer Description attributes as  
1047 defined in section 5.3.
- 1048 2. The "copies Job Template attribute as defined in section 5.8.

1049 Printers that support the "application/pdf" [ISO32000] MIME media type MUST support:

- 1050 1. The "copies-default", "copies-supported", "document-password-supported", and  
1051 "page-ranges-supported" Printer Description attributes as defined in section 5.3,
- 1052 2. The "document-password" Operation attribute as defined in section 5.4, and
- 1053 3. The "copies", "multiple-document-handling", "overrides", and "page-ranges" Job  
1054 Template attributes as defined in section 5.8.

1055 Printers that support the Print to a Recipient use case (section 3.2.2.8) MUST support:

- 1056 1. The "job-password-supported" and "job-password-encryption-supported" Printer  
1057 Description attributes as defined in section 5.3, and
- 1058 2. The "job-password" and "job-password-encryption" Operation attributes as  
1059 defined in section 5.4.

1060 Printers that provide Paid Print services MUST support:

- 1061 1. The "job-account-id-default", "job-account-id-supported", "job-accounting-user-  
1062 id-default", "job-accounting-user-id-supported", "job-mandatory-attributes-  
1063 default", "job-mandatory-attributes-supported", and "printer-mandatory-job-  
1064 attributes" Printer Description attributes as defined in section 5.3,
- 1065 2. The "job-mandatory-attributes" operation attribute as defined in section 5.4, and
- 1066 3. The "job-account-id" and "job-accounting-user-id" Job Template attributes as  
1067 defined in section 5.8.

1068 Printers that support long-edge feed media MUST support:

- 1069 1. The "feed-orientation-default" and "feed-orientation-supported" Printer  
1070 Description attributes as defined in section 5.3.
- 1071 2. The "media-source-properties" member attribute of the "media-col-database"  
1072 and "media-col-ready" Printer Description attributes as defined in section 5.3.
- 1073 3. The "feed-orientation" Job Template attribute as defined in section 5.8.

1074

## 1075 **10. Internationalization Considerations**

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

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

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

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

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

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

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

1094 Unicode Normalization Forms [UAX15] – especially NFC for [RFC5198]

1095 Unicode Text Segmentation [UAX29] – grapheme clusters, words, sentences

1096 Unicode Identifier and Pattern Syntax [UAX31] – identifier use and normalization

1097 Unicode Collation Algorithm [UTS10] – sorting

1098 Unicode Locale Data Markup Language [UTS35] – locale databases

1099 Implementations of this specification are advised to also review the following informational  
1100 documents on processing of human-readable Unicode text strings:

1101 Unicode Character Encoding Model [UTR17] – multi-layer character model

1102 Unicode in XML and other Markup Languages [UTR20] – XML usage

1103 Unicode Character Property Model [UTR23] – character properties

1104 Unicode Conformance Model [UTR33] – Unicode conformance basis

## 1105 **11. Security Considerations**

1106 The IPP extensions defined in this document require the same security considerations as  
1107 defined in the IPP/1.1: Model and Semantics [RFC8011]. In addition, Printers MUST  
1108 validate the HTTP Host request header in order to protect against DNS rebinding attacks.

1109 Implementations of this specification SHOULD conform to the following standard on  
1110 processing of human-readable Unicode text strings, see:

1111       Unicode Security Mechanisms [UTS39] – detecting and avoiding security attacks

1112       Implementations of this specification are advised to also review the following  
1113       informational document on processing of human-readable Unicode text strings:

1114       Unicode Security FAQ [UNISECFAQ] – common Unicode security issues

1115

1116

## 1117 12. IANA Considerations

### 1118 12.1 Attribute Value Registrations

1119 The keyword attribute values defined in this document will be published by IANA according  
 1120 to the procedures in the IPP Model and Semantics [RFC8011] section 7.3 in the following  
 1121 file:

1122 <http://www.iana.org/assignments/ipp-registrations>

1123 The registry entries will contain the following information:

1124	Attributes (attribute syntax)		Reference
1125	Keyword Attribute Value	-----	-----
1126	-----		
1127	ipp-features-supported (1setOf type2 keyword)		[PWG5100.13]
1128	ipp-everywhere		[PWG5100.14]

## 1129 13. Safe String Truncation

1130 Strings can be truncated or omitted when transferred over alternate protocols. Printers  
 1131 MUST truncate long strings at logical boundaries. The following subsections describe how  
 1132 this truncation is performed for different kinds of strings.

### 1133 13.1 Plain Text Strings

1134 Plain text strings MUST be truncated at the end of a valid character sequence. For example,  
 1135 strings using the UTF-8 transformation format of ISO 10646 [STD0063] [ISO10646-1]  
 1136 SHOULD be represented using the Unicode Format for Network Interchange [RFC5198]  
 1137 and MUST be truncated at the end of a valid UTF-8 sequence.

1138 For example, the 9 octet UTF-8 sequence 0x48.65.CA.81.6C.6C.6F.C2.81 (Héllöj) would  
 1139 be shortened to fit within 6 octets by composing the é (0x65.CA.81 becomes 0xC3.A9) and  
 1140 removing the trailing UTF-8 sequence 0xC2.81 (j), resulting in the 6 octet UTF-8 sequence  
 1141 0x48.C3.A9.6C.6C.6F (Héllö).

### 1142 13.2 URIs

1143 URIs MUST be truncated so that the URI remains valid and accepted by the Printer. For  
 1144 example, the 46 octet URI "ipp://printer.example.com/ipp/really-long-name" might be  
 1145 shortened to fit within 32 octets by removing the last path name component, resulting in the  
 1146 29 octet URI "ipp://printer.example.com/ipp". Similarly, the 52 octet URI  
 1147 "ipp://printer.example.com/ipp?query-string" might be shortened to fit within 32 octets by  
 1148 removing the query string.

1149 As recommended by the Uniform Resource Identifier (URI): Generic Syntax [STD66],  
1150 Printers SHOULD omit the port number from the URI when it has the default value, e.g., 80  
1151 for "http", 443 for "https", and 631 for "ipp" and "ipps" URIs.

### 1152 **13.3 MIME Media Types**

1153 MIME media type strings MUST be truncated at the end of the media subtype, removing  
1154 any parameters that are included with the media type. If the resulting string still exceeds the  
1155 maximum length it MUST be discarded. For example, the 24 octet MIME media type  
1156 "text/plain;charset=utf-8" would be shortened to fit within 16 octets by removing the trailing  
1157 parameter, resulting in the 10 octet MIME media type "text/plain".

### 1158 **13.4 IEEE 1284 Device ID Strings**

1159 IEEE 1284 device identifier strings contain a list of delimited key/value pairs. Device ID  
1160 strings MUST be truncated at the end of a value key/value pair with the shortest form of a  
1161 key used. For example, the 57 octet IEEE 1284 device ID string  
1162 "MANUFACTURER:Example;MODEL:Laser Printer;COMMAND SET:PS;" would be  
1163 shortened to fit within 32 octets by substituting the abbreviated key names and removing  
1164 the trailing key/value pair, resulting in the 32 octet string "MFG:Example;MDL:Laser  
1165 Printer;".

### 1166 **13.5 Delimited Lists**

1167 Delimited Lists combine one or more string types listed in the previous sections, separated  
1168 by a delimiting character such as a comma or semicolon. Delimited lists MUST first be  
1169 shortened by removal of unnecessary path components (URIs) and parameters (MIME  
1170 media types) and second truncated at a delimiting character. For example, the 40 octet list  
1171 of MIME media types "text/plain;charset=utf-8,application/pdf" would be shortened to fit  
1172 within 32 octets by removing the MIME media type parameter, resulting in the 26 octet list  
1173 "text/plain,application/pdf". The same list would be shortened to fit within 16 octets by also  
1174 removing the last MIME media type, resulting in the 10 octet list "text/plain".

## 1175 **14. Overview of Changes**

### 1176 **14.1 IPP Everywhere v1.1**

1177 The following changes were made for IPP Everywhere v1.1:

- 1178 • References were updated to reflect the current versions of dependent documents  
1179 and specifications at the time of publication
- 1180 • Requirements to support WS-Discovery were removed due to lack of implementation



- 1181 • References to SSDP, WS-Discovery, and OpenXPS were removed due to lack of  
1182 implementation
- 1183 • JPEG support is now CONDITIONALLY REQUIRED for color printers
- 1184 • IPP Finishings 2.1 and the "finishings-col" Job Template attribute are now  
1185 RECOMMENDED
- 1186 • Printer Status and Job Status attributes are now listed in a separate section to match  
1187 RFC 8011 and the IANA IPP registry

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1380 [UNISECFAQ] Unicode Consortium “Unicode Security FAQ”, November 2013,  
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## 1382 **16. Authors' Addresses**

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1397 To subscribe, see the PWG web page:

1398 <http://www.pwg.org/>

1399 Implementers of this specification document are encouraged to join the IPP Mailing List in  
1400 order to participate in any discussions of clarification issues and review of registration  
1401 proposals for additional attributes and values.

1402 The editors would like to especially thank the following individuals who also contributed  
1403 significantly to the development of this document:

1404 Andrew Mitchell  
1405 Jerry Thrasher - Lexmark  
1406 Peter Zehler - Xerox  
1407

## 1408 **17. Change History**

### 1409 **17.1 April 3, 2018**

- 1410 3. Make JPEG support conditionally required for color printers.

### 1411 **17.2 February 9, 2018**

- 1412 1. Initial v1.1 draft  
1413 2. Updated template  
1414 3. Updated abstract (can't call it a standard in the abstract)  
1415 4. Updated spec references to current versions  
1416 5. Dropped all mention of UPNP, SSDP, WS-Discovery, and OpenXPS (never  
1417 implemented)  
1418 6. Added a new "Overview of Changes" chapter that documents the high-level  
1419 changes since the original IPP Everywhere specification  
1420 7. Now recommend support for the Get-User-Printer-Attributes operation  
1421 8. Now recommend support for the "finishings-col" attributes (PWG 5100.1)  
1422 9. Now recommend support for TLS 1.3  
1423 10. Now recommend using a resource path of /ipp/print or /ipp/print/name in Printer  
1424 URIs  
1425 11. Issue 11: printer-current-time is now listed as an IPP Everywhere attribute,  
1426 although only RECOMMENDED since it was missing in the 1.0 spec. (all of the  
1427 date-time attributes were previously required, so printer-current-time would  
1428 have implicitly been required)  
1429 12. Issue 12: The reference to PWG 5100.12 has been corrected  
1430 13. Issue 13: The reference to the EXIF specification has been updated.  
1431 14. Issue 13: The reference to PWG 5101.1 has been updated.  
1432 15. Issue 14: Clarified the pdl-override-supported requirements ('attempted' or  
1433 'guaranteed')  
1434 16. Issue 15: Clarified that relative URIs ("//ipp/print") are not allowed in IPP.  
1435 17. Issue 26: "job-preferred-attributes-supported" should have been "preferred-  
1436 attributes-supported"  
1437 18. Issue 31: Incorrect references to PWG 5101.2 have been changed to PWG  
1438 5101.1 (MSN)  
1439 19. Issue 33: The notes concerning IPP/2.x conformance changes were confusing  
1440 and have been removed  
1441 20. Issue 34: Table 6: overrides-supported now correctly references "note 2"  
1442 (conditionally required).  
1443 21. Issue 35: overrides-supported.document-numbers is now **CONDITIONALLY**  
1444 **REQUIRED**  
1445 22. Fixed attribute examples to use PAPI encoding  
1446 23. Fixed notes concerning "copies" to indicate that support is required for JPEG  
1447 and PDF documents



- 1448            24. Separated Printer Status attributes from Printer Description
- 1449            25. Separated Job Status attributes from Job Description