



The Printer Working Group

August 27, 2019  
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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76 define print related protocols, interfaces, procedures, and conventions. A PWG standard is  
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 <http://www.pwg.org>

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## 202 **1. Introduction**

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

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

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

## 215 **2. Terminology**

### 216 **2.1 Printing Terminology**

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

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

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

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

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

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

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

## 231 **2.2 Protocol Role Terminology**

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

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

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

## 239 **2.3 Other Terminology**

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

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

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

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

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

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

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

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

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

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

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

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

## 265 **2.4 Acronyms and Organizations**

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

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

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

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

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

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

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

274

## 275 **3. Requirements**

### 276 **3.1 Rationale**

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

## 327 **3.2 Use Cases**

### 328 **3.2.1 Select Printer**

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

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

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

#### 338 **3.2.1.1 Select the Last Used Printer**

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

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

#### 345 **3.2.1.2 Select Printer Using Name or Address**

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

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

#### 352 **3.2.1.3 Select Printer Using URI**

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

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

#### 357 **3.2.1.4 Select Printer Using a Directory Service**

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

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

### 364 **3.2.1.5 Select Printer Using a Cloud Service**

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

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

### 371 **3.2.1.6 Select Printer Using a Discovery Protocol**

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

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

### 378 **3.2.1.7 Select Printer Using Geo-Location**

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

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

### 385 **3.2.1.8 Select Printer Using Out of Band Method**

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

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

### 392 **3.2.1.9 Select Printer Using Properties**

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



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

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

### 404 **3.2.2 Print**

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

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

#### 413 **3.2.2.1 Print a Document**

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

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

#### 420 **3.2.2.2 Print a Document by Reference**

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

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

### 427 **3.2.2.3 Print Using Loaded Media**

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

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

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

### 439 **3.2.2.4 Print a Secure Form**

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

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

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

### 457 **3.2.2.5 Print with Special Formatting**

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

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

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

#### 470 **3.2.2.6 Print and Select at Printer**

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

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

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

#### 482 **3.2.2.7 Print to a Service**

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

#### 490 **3.2.2.8 Print to a Recipient**

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

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

#### 498 **3.2.2.9 Print with a Proof Copy**

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

### 505 **3.2.3 Exceptions**

#### 506 **3.2.3.1 Print Action Canceled**

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

#### 510 **3.2.3.2 Select Printer Canceled**

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

#### 513 **3.2.3.3 Printer No Longer Network Accessible after Selection**

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

#### 517 **3.2.3.4 Not Authorized**

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

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

**524 3.2.3.5 Needs Authentication**

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

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

**529 3.2.3.6 Not Accepting Jobs**

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

**532 3.2.3.7 Job Ticket or Document Format Not Supported**

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

**536 3.2.3.8 Job or Document Processing Failures**

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

**541 3.2.3.9 Printer Fault**

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

**545 3.2.3.10 Printer Warning**

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

**549 3.3 Out of Scope**

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

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

### 557 **3.4 Design Requirements**

558 The IPP Everywhere™ design should:

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

## 566 **4. Discovery Protocols**

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

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

### 572 **4.1 Printer Description Attributes Used in Discovery**

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

### 575 **4.2 DNS Service Discovery (DNS-SD)**

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

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

#### 583 **4.2.1 Service (SRV) Instance Name**

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

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

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

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

**592 4.2.2 Geo-Location (LOC)**

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



597

**Table 1 - Attributes in Discovery Protocols**

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

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

598 Note 1: Extension attribute to RFC 7612.

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

### 600 4.2.3 Text (TXT)

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

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

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

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

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

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

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

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

619 Clients MUST ignore incomplete key/value pairs at the end of a truncated TXT record.  
 620

621

**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 4.2.3.6.	" (empty string)
note	The location of the Printer as reported by the "printer-location" Printer Description attribute.	" (empty string)
PaperCustom	'T' if the Printer supports custom media sizes, 'F' otherwise.	'U' (note 1)
PaperMax	The maximum media size supported by the Printer: '<legal-A4', 'legal-A4', 'isoC-A2', '>isoC-A2'.	'legal-A4'
pdl	A comma-delimited list of supported MIME media types. See section 4.2.3.2.	" (empty string)
priority	The priority for the service from 0 to 99, where 0 is the highest priority and 99 is the lowest priority.	'50'
Punch	'T' if the Printer can punch output, 'F' otherwise.	'U' (note 1)

Key	Description	Default Value
qtotal	The number of queues for this Printer. MUST have the value '1'. See section 4.2.3.3	'1'
rp	The remote print queue name, which is the resource path portion of the Printer URI without the leading slash.	" (empty string)
Sort	'T' if the Printer can sort output, 'F' otherwise.	'U' (note 1)
Staple	'T' if the Printer can staple output, 'F' otherwise.	'U' (note 1)
TLS	The maximum TLS version supported or 'none' if no version of TLS is supported. See section 4.2.3.4.	'none'
txtvers	The major version of the Bonjour Printing Specification. MUST have the value '1'.	'1'
ty	The make and model of the Printer as reported by the "printer-make-and-model" Printer Description attribute.	" (empty string)
UUID	The UUID of the Printer without the 'urn:uuid:' prefix as reported by the "printer-uuid" Printer Description attribute. See section 4.2.3.5.	" (empty string)

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

### 623 4.2.3.1 air

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

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

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

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

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

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

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

#### 643 **4.2.3.2 pdl**

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

#### 650 **4.2.3.3 qtotal**

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

#### 660 **4.2.3.4 TLS**

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

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

665 '1.0'; TLS 1.0 [RFC2246] encryption is supported. This is equivalent to the value 'tls'  
666 for the "uri-security-supported" Printer Description attribute.

667 '1.1'; TLS 1.1 [RFC4346] encryption is supported. This is equivalent to the value 'tls'  
668 for the "uri-security-supported" Printer Description attribute.

669 '1.2'; TLS 1.2 [RFC5246] encryption is supported. This is equivalent to the value 'tls'  
670 for the "uri-security-supported" Printer Description attribute.

671 '1.3'; TLS 1.3 [RFC-TLS1.3] encryption is supported. This is equivalent to the value  
672 'tls' for the "uri-security-supported" Printer Description attribute.

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

#### 676 **4.2.3.5 UUID**

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

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

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

682 12345678-9ABC-DEF0-1234-56789ABCDEF0

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

#### 685 **4.2.3.6 DUUID**

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

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

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

691 12345678-9ABC-DEF0-1234-56789ABCDEF0

### 692 **4.3 LDAP and SLP Discovery**

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

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

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



## 702 **5. Protocol Binding**

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

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

### 707 **5.1 HTTP Features**

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

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

#### 715 **5.1.1 Host**

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

#### 718 **5.1.2 If-Modified-Since, Last-Modified, and 304 Not Modified**

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

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

#### 725 **5.1.3 Cache-Control**

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

## 732 5.2 IPP Operations

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

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

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

Code	Operation Name	Reference
0x0002	Print-Job	RFC 8011
0x0004	Validate-Job	RFC 8011
0x0005	Create-Job	RFC 8011
0x0006	Send-Document	RFC 8011
0x0008	Cancel-Job	RFC 8011
0x0009	Get-Job-Attributes	RFC 8011
0x000A	Get-Jobs	RFC 8011
0x000B	Get-Printer-Attributes	RFC 8011
0x0039	Cancel-My-Jobs	PWG 5100.7
0x003B	Close-Job	PWG 5100.7
0x003C	Identify-Printer (note 1)	PWG 5100.13

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

## 741 5.3 IPP Printer Description Attributes

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

744

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

<b>Attribute</b>	<b>Reference</b>
charset-configured	RFC 8011
charset-supported	RFC 8011
color-supported	RFC 8011
compression-supported	RFC 8011
copies-default (note 2)	RFC 8011
copies-supported (note 2)	RFC 8011
document-format-default	RFC 8011
document-format-supported	RFC 8011
document-password-supported (note 2)	PWG 5100.13
finishing-template-supported (notes 3 and 7)	PWG 5100.1
finishings-col-database (notes 3 and 7)	PWG 5100.1
finishings-col-default (notes 3 and 7)	PWG 5100.1
finishings-col-ready (notes 3 and 7)	PWG 5100.1
finishings-col-supported (notes 3 and 7)	PWG 5100.1
finishings-default (note 3)	RFC 8011
finishings-ready (notes 3 and 7)	RFC 8011
finishings-supported (note 3)	RFC 8011
generated-natural-language-supported	RFC 8011
identify-actions-default	PWG 5100.13
identify-actions-supported	PWG 5100.13
ipp-features-supported	PWG 5100.13
ipp-versions-supported	RFC 8011
job-account-id-default (note 1)	PWG 5100.7

<b>Attribute</b>	<b>Reference</b>
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.EPX
job-password-supported (note 4)	PWG 5100.EPX
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	RFC 8011
media-left-margin-supported	PWG 5100.7
media-ready	RFC 8011
media-right-margin-supported	PWG 5100.7
media-size-supported	PWG 5100.7
media-source-supported	PWG 5100.7
media-supported	RFC 8011
media-top-margin-supported	PWG 5100.7

<b>Attribute</b>	<b>Reference</b>
media-type-supported	PWG 5100.7
multiple-document-jobs-supported	RFC 8011
multiple-operation-timeout	RFC 8011
multiple-operation-timeout-action	PWG 5100.13
natural-language-configured	RFC 8011
operations-supported	RFC 8011
orientation-requested-default	RFC 8011
orientation-requested-supported	RFC 8011
output-bin-default	PWG 5100.2
output-bin-supported	PWG 5100.2
overrides-supported (note 2)	PWG 5100.6
page-ranges-supported (note 2)	RFC 8011
pdl-override-supported	RFC 8011
preferred-attributes-supported	PWG 5100.13
print-color-mode-default	PWG 5100.13
print-color-mode-supported	PWG 5100.13
print-quality-default	RFC 8011
print-quality-supported	RFC 8011
print-rendering-intent-default (note 8)	PWG 5100.13
print-rendering-intent-supported (note 8)	PWG 5100.13
printer-current-time (note 7)	RFC 8011
printer-geo-location	PWG 5100.13
printer-get-attributes-supported	PWG 5100.13
printer-icc-profiles (notes 6 and 8)	PWG 5100.13

<b>Attribute</b>	<b>Reference</b>
printer-icons (note 6)	PWG 5100.13
printer-info	RFC 8011
printer-location	RFC 8011
printer-make-and-model	RFC 8011
printer-mandatory-job-attributes (note 1)	PWG 5100.13
printer-name	RFC 8011
printer-organization	PWG 5100.13
printer-organizational-unit	PWG 5100.13
printer-resolution-default	RFC 8011
printer-resolution-supported	RFC 8011
pwg-raster-document-resolution-supported	PWG 5102.4
pwg-raster-document-sheet-back	PWG 5102.4
pwg-raster-document-type-supported	PWG 5102.4
sides-default	RFC 8011
sides-supported	RFC 8011
uri-authentication-supported	RFC 8011
uri-security-supported	RFC 8011
which-jobs-supported	PWG 5100.7

745 Note 1: CONDITIONALLY REQUIRED for Printers that implement Paid Imaging services.  
746 Note 2: REQUIRED for the "application/pdf" and "image/jpeg" MIME media types.  
747 Note 3: CONDITIONALLY REQUIRED for Printers with finishers.  
748 Note 4: CONDITIONALLY REQUIRED for Printers that support the Print to a Recipient  
749 (section 3.2.2.8) use case.  
750 Note 5: CONDITIONALLY REQUIRED for Printers that support long-edge feed media.  
751 Note 6: URIs MUST be absolute, SHOULD use the Host value (including port number)  
752 from the HTTP Host header (section 5.1.1), and MUST NOT use link-local addresses  
753 (section 8.4).

754 Note 7: RECOMMENDED due to its omission from IPP Everywhere™ 1.0, however it is  
 755 needed for the underlying functionality.  
 756 Note 8: CONDITIONALLY REQUIRED for Printers that support ICC-based color  
 757 management.

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

<b>Attribute</b>	<b>Reference</b>
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	PWG 5100.EPX
job-password-repertoire-supported	PWG 5100.EPX
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
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

Attribute	Reference
printer-input-tray	PWG 5100.13
printer-output-tray	PWG 5100.13
printer-privacy-policy-uri	PRIVACY

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

760 The REQUIRED "media-col-database" Printer attribute lists the supported combinations of  
 761 "media-col" member attributes for a Printer. In addition to the requirements set forth in IPP:  
 762 Job Extensions v2.0 [PWG5100.7], this specification defines how a Printer advertises  
 763 custom and roll-fed media capabilities in the "media-col-database" attribute.

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

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

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

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

### 785 5.3.2 media-col-ready (1setOf collection)

786 The REQUIRED "media-col-ready" Printer attribute lists the loaded media combinations of  
 787 "media-col" member attributes for a Printer. In addition to the requirements set forth in IPP:



788 Production Printing Attributes - Set 1 [PWG5100.7], this specification defines how a Printer  
789 advertises manually-fed and roll-fed media in the "media-col-ready" attribute.

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

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

### 802 **5.3.3 media-ready (1setOf (type3 keyword | name(MAX)))**

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

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

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

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

### 822 5.3.4 media-size-supported (1setOf collection)

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

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

```
831     media-size-supported=..., {  
832         x-dimension=5000-33020  
833         y-dimension=5000-48260 },...
```

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

```
840     media-size-supported=..., {  
841         x-dimension=20320-152400  
842         y-dimension=1524-9144000 },...
```

### 843 5.3.5 media-supported (1setOf (type3 keyword | name(MAX)))

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

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

```
856     media-supported=..., custom_max.by-pass-tray_330.2x482.6mm,
```

857 `custom_min.by-pass-tray_50x50mm,...`

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

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

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

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

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

### 869 5.3.6 pdl-override-supported (type2 keyword)

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

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

## 876 5.4 IPP Printer Status Attributes

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

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

Attribute	Reference
pages-per-minute	RFC 8011
pages-per-minute-color	RFC 8011
printer-alert	PWG 5100.9
printer-alert-description	PWG 5100.9

<b>Attribute</b>	<b>Reference</b>
printer-config-change-date-time	PWG 5100.13
printer-config-change-time	PWG 5100.13
printer-is-accepting-jobs	RFC 8011
printer-more-info (note 1)	RFC 8011
printer-state	RFC 8011
printer-state-change-date-time	RFC 3995
printer-state-change-time	RFC 3995
printer-state-message	RFC 8011
printer-state-reasons	RFC 8011
printer-strings-languages-supported (note 2)	PWG 5100.13
printer-strings-uri (notes 1 and 2)	PWG 5100.13
printer-supply	PWG 5100.13
printer-supply-description	PWG 5100.13
printer-supply-info-uri (note 1)	PWG 5100.13
printer-up-time	RFC 8011
printer-uri-supported (note 1)	RFC 8011
printer-uuid	PWG 5100.13
pwg-raster-document-resolution-supported	PWG 5102.4
pwg-raster-document-sheet-back	PWG 5102.4
pwg-raster-document-type-supported	PWG 5102.4
queued-job-count	RFC 8011

880 Note 1: URIs MUST be absolute, SHOULD use the Host value (including port number)  
881 from the HTTP Host header (section 5.1.1), and MUST NOT use link-local addresses  
882 (section 8.4).

883 Note 2: RECOMMENDED due to its omission from IPP Everywhere™ 1.0, however it is  
884 needed for the underlying functionality.

**885 5.4.1 printer-uri-supported (1setOf uri)**

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

889 **5.5 IPP Operation Attributes**

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

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

<b>Attribute</b>	<b>Reference</b>
compression	RFC 8011
document-format	RFC 8011
document-name	RFC 8011, PWG 5100.5
document-password (note 1)	PWG 5100.13
first-index	PWG 5100.13
first-job-id	RFC 8011
identify-actions	PWG 5100.13
ipp-attribute-fidelity	RFC 8011
job-ids	PWG 5100.7
job-mandatory-attributes (note 3)	PWG 5100.7
job-name	RFC 8011
job-password (note 2)	PWG 5100.EPX
job-password-encryption (note 2)	PWG 5100.EPX
last-document	RFC 8011
limit	RFC 8011
requesting-user-name	RFC 8011
requesting-user-uri	PWG 5100.13
which-jobs	RFC 8011, PWG 5100.7

892 Note 1: CONDITIONALLY REQUIRED for Printers that support the "application/pdf" MIME  
893 media type.894 Note 2: CONDITIONALLY REQUIRED for Printers that support the Print to a Recipient  
895 (section 3.2.2.8) use case.

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

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

<b>Attribute</b>	<b>Reference</b>
job-authorization-uri	PWG 5100.16
job-impressions-estimated	PWG 5100.16

898

## 899 5.6 IPP Job Description Attributes

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

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

Attribute	Reference
job-name	RFC 8011

## 902 5.7 IPP Job Status Attributes

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

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

Attribute	Reference
date-time-at-completed	RFC 8011
date-time-at-creation	RFC 8011
date-time-at-processing	RFC 8011
job-id	RFC 8011
job-impressions	RFC 8011
job-impressions-completed	RFC 8011
job-originating-user-name	RFC 8011
job-printer-up-time	RFC 8011
job-printer-uri (note 1)	RFC 8011
job-state	RFC 8011
job-state-message	RFC 8011
job-state-reasons	RFC 8011
job-uri (note 1)	RFC 8011
job-uuid	PWG 5100.13



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

905  
 906 Note 1: URIs MUST be absolute, SHOULD use the Host value from HTTP header (section  
 907 5.1.1), and MUST NOT use link-local addresses (section 8.4).

### 908 5.7.1 job-id (integer)

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

### 914 5.7.2 job-uri (uri)

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

## 921 5.8 IPP Job Template Attributes

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

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

Attribute	Reference
copies (note 2)	RFC 8011
finishings (note 4)	RFC 8011
finishings-col (note 4)	PWG 5100.1

<b>Attribute</b>	<b>Reference</b>
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	RFC 8011
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)	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-rendering-intent (note 7)	PWG 5100.13
print-quality	RFC 8011
printer-resolution	RFC 8011
sides	RFC 8011

925 Note 1: CONDITIONALLY REQUIRED for Printers that implement paid imaging services.

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

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

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

936

## 937 **6. Document Formats**

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

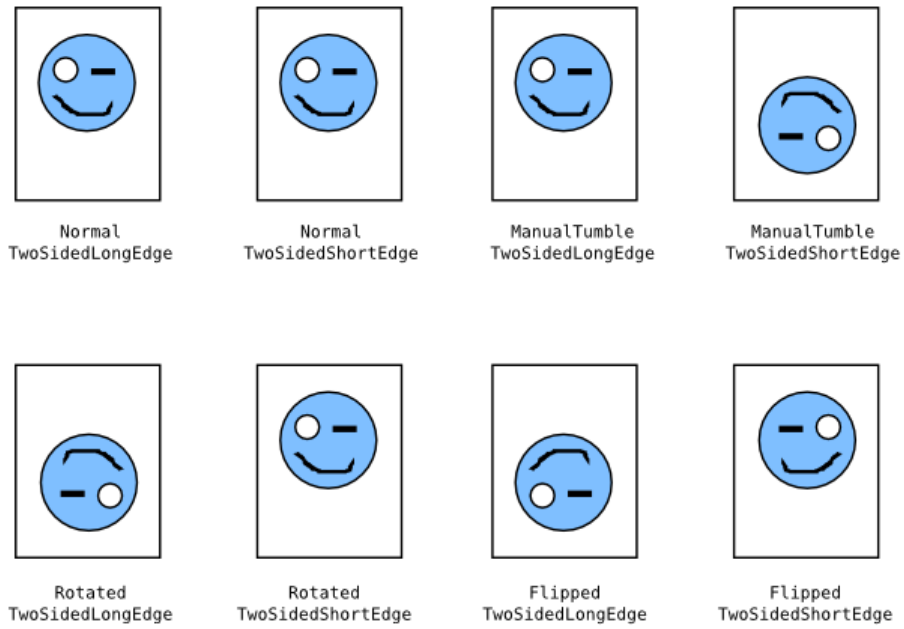
944 IPP/2.1 and IPP/2.2 Printers MUST and IPP/2.0 Printers SHOULD support documents  
945 conforming to Document management — Portable document format — Part 1: PDF 1.7  
946 [ISO32000] ("application/pdf"). IPP/2.0, IPP/2.1, and IPP/2.2 Printers are defined in  
947 [PWG5100.12].

### 948 **6.1 Supporting Long-Edge Feed Media with PWG Raster Format** 949 **Documents**

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

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

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

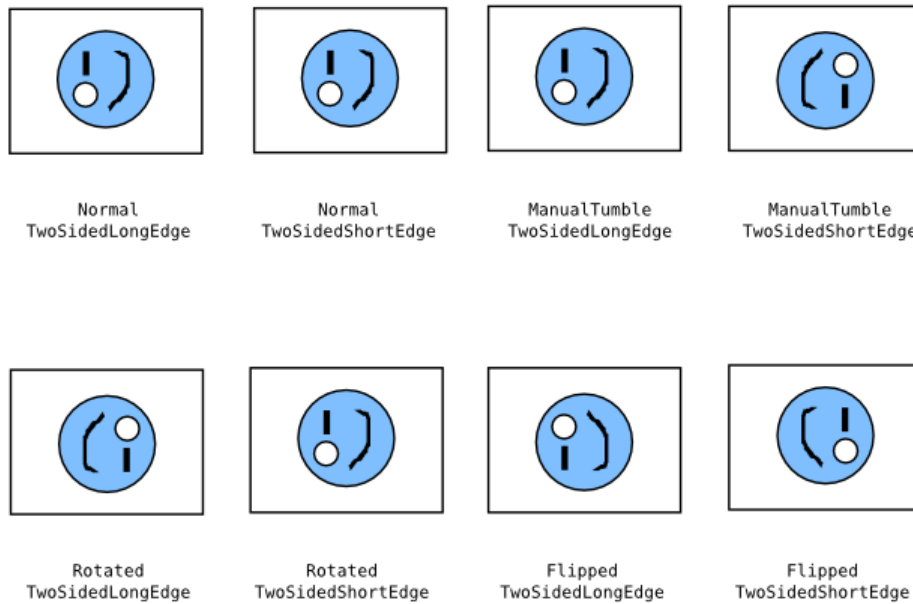


960

961

962

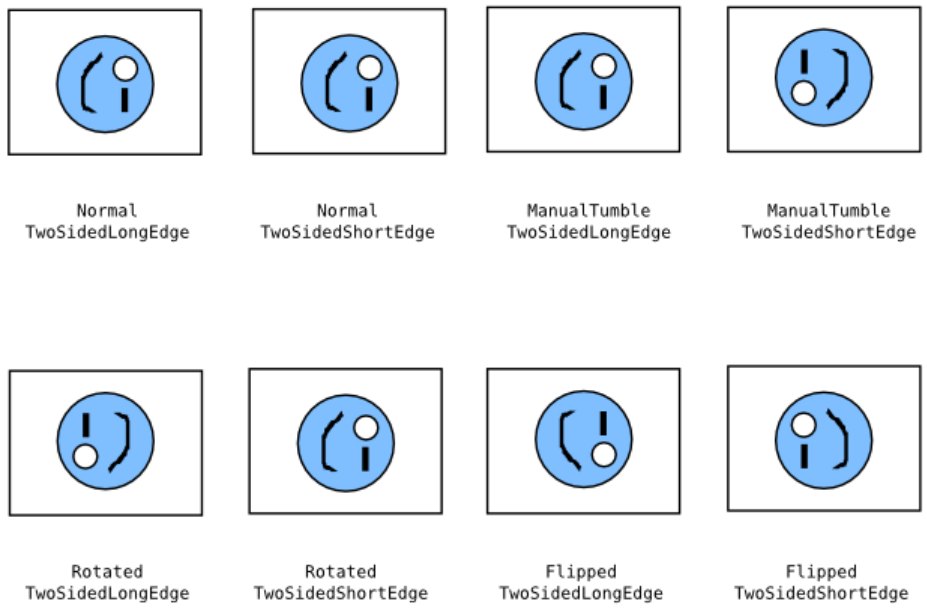
**Figure 1 - PWG Raster Bitmaps with Portrait Feed Orientation**



963

964

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

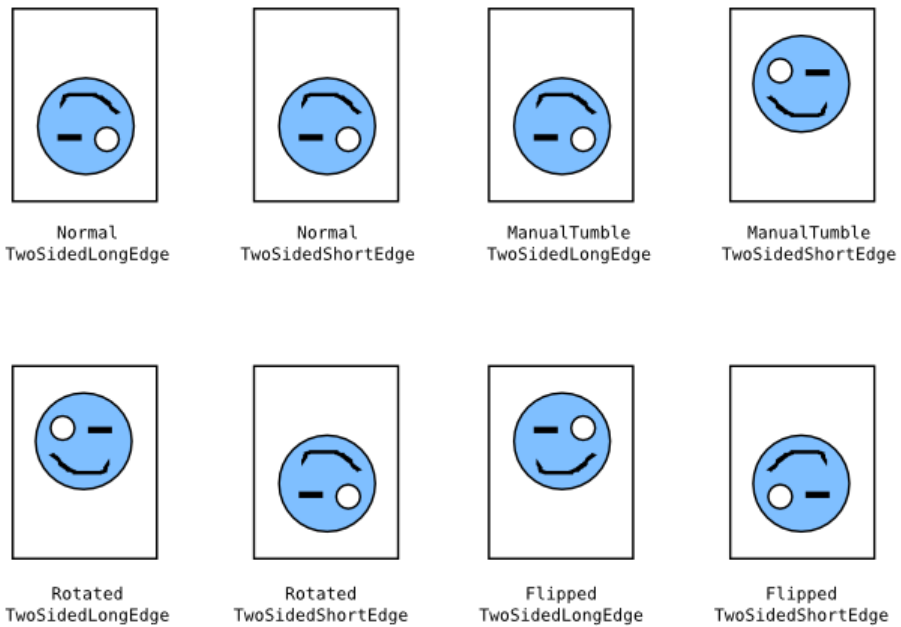


965

966

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

967



968

969

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

## 970 **7. Additional Values for Existing Attributes**

### 971 **7.1 ipp-features-supported (1setOf type2 keyword)**

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

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

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

### 979 **8.1 nameWithLanguage and nameWithoutLanguage**

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

### 984 **8.2 naturalLanguage**

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

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

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

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

### 991 **8.3 textWithLanguage and textWithoutLanguage**

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

## 995 **8.4 uri**

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

## 1002 **9. Conformance Requirements**

1003 This section summarizes the Conformance Requirements detailed in the definitions in this  
1004 document for Clients and Printers.

### 1005 **9.1 Conformance Requirements for Clients**

1006 In order for a Client to claim conformance to this specification a Client MUST support the  
1007 following:

- 1008 1. DNS Service Discovery as defined in section 4.2
- 1009 2. IPP/2.0 as defined in section 5
- 1010 3. The REQUIRED operations listed in Table 4
- 1011 4. The REQUIRED Printer Description attributes listed in Table 5
- 1012 5. The REQUIRED operation attributes listed in Table 8
- 1013 6. The REQUIRED Job Template attributes listed in Table 12
- 1014 7. The REQUIRED Job Description attributes listed in Table 10
- 1015 8. The REQUIRED document formats listed in section 5.8
- 1016 9. The "media-source-properties" member attribute of the "media-col-database" and  
1017 "media-col-ready" Printer attributes as reported by the Printer and defined in section  
1018 6.1
- 1019 10. The internationalization considerations as defined in section 10
- 1020 11. The security considerations as defined in section 0

### 1021 **9.2 Conformance Requirements for Printers**

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

- 1024 1. DNS Service Discovery as defined in section 4.2
- 1025 2. IPP/2.0 as defined in section 5
- 1026 3. The REQUIRED operations listed in Table 4



- 1027 4. The REQUIRED Printer Description attributes listed in Table 5
- 1028 5. The REQUIRED operation attributes listed in Table 8
- 1029 6. The REQUIRED Job Template attributes listed in Table 12
- 1030 7. The REQUIRED Job Description attributes listed in Table 10
- 1031 8. The REQUIRED document formats listed in section 5.8
- 1032 9. The 'ipp-everywhere' value for the "ipp-features-supported" Printer Description attribute
- 1033 as defined in section 7.1
- 1034 10. The additional semantics for attribute values as defined in section 8
- 1035 11. The internationalization considerations as defined in section 10
- 1036 12. The security considerations as defined in section 0
- 1037 13. The safe string truncation rules as defined in section 13

### 1038 **9.3 Conditional Conformance Requirements for Printers**

1039 Printers that support the "image/jpeg" [JFIF] MIME media type MUST support:

- 1040 1. The "copies-default", and "copies-supported" Printer Description attributes as defined in
- 1041 section 5.3.
- 1042 2. The "copies" Job Template attribute as defined in section 5.8.

1043 Printers that support the "application/pdf" [ISO32000] MIME media type MUST support:

- 1044 1. The "copies-default", "copies-supported", "document-password-supported", and "page-
- 1045 ranges-supported" Printer Description attributes as defined in section 5.3,
- 1046 2. The "document-password" Operation attribute as defined in section 5.4, and
- 1047 3. The "copies", "multiple-document-handling", "overrides", and "page-ranges" Job
- 1048 Template attributes as defined in section 5.8.

1049 Printers that support the Print to a Recipient use case (section 3.2.2.8) MUST support:

- 1050 1. The "job-password-supported" and "job-password-encryption-supported" Printer
- 1051 Description attributes as defined in section 5.3, and
- 1052 2. The "job-password" and "job-password-encryption" Operation attributes as defined in
- 1053 section 5.4.

1054 Printers that provide Paid Print services MUST support:

- 1055 1. The "job-account-id-default", "job-account-id-supported", "job-accounting-user-id-
- 1056 default", "job-accounting-user-id-supported", "job-mandatory-attributes-default", "job-
- 1057 mandatory-attributes-supported", and "printer-mandatory-job-attributes" Printer
- 1058 Description attributes as defined in section 5.3,
- 1059 2. The "job-mandatory-attributes" operation attribute as defined in section 5.4, and

1060 3. The "job-account-id" and "job-accounting-user-id" Job Template attributes as defined in  
1061 section 5.8.

1062 Printers that support long-edge feed media MUST support:

- 1063 1. The "feed-orientation-default" and "feed-orientation-supported" Printer Description  
1064 attributes as defined in section 5.3.
- 1065 2. The "media-source-properties" member attribute of the "media-col-database" and  
1066 "media-col-ready" Printer Description attributes as defined in section 5.3.
- 1067 3. The "feed-orientation" Job Template attribute as defined in section 5.8.

1068 Printers that support ICC-based color management MUST support:

- 1069 4. The "print-rendering-intent-default", "print-rendering-intent-supported", and "printer-icc-  
1070 profiles" Printer Description attributes as defined in section 5.3.
- 1071 5. The "print-render-intent" Job Template attribute as defined in section 5.8.

## 1072 **10. Internationalization Considerations**

1073 For interoperability and basic support for multiple languages, conforming implementations  
1074 MUST support:

- 1075 1. The Universal Character Set (UCS) Transformation Format -- 8 bit (UTF-8) [STD63]  
1076 encoding of Unicode [UNICODE] [ISO10646]; and
- 1077 2. The Unicode Format for Network Interchange [RFC5198] which requires transmission  
1078 of well-formed UTF-8 strings and recommends transmission of normalized UTF-8  
1079 strings in Normalization Form C (NFC) [UAX15].

1080 Unicode NFC is defined as the result of performing Canonical Decomposition (into base  
1081 characters and combining marks) followed by Canonical Composition (into canonical  
1082 composed characters wherever Unicode has assigned them).

1083 WARNING – Performing normalization on UTF-8 strings received from Clients and  
1084 subsequently storing the results (e.g., in Job objects) could cause false negatives in Client  
1085 searches and failed access (e.g., to Printers with percent-encoded UTF-8 URIs now  
1086 'hidden').

1087 Implementations of this specification SHOULD conform to the following standards on  
1088 processing of human-readable Unicode text strings, see:

1089 Unicode Bidirectional Algorithm [UAX9] – left-to-right, right-to-left, and vertical

1090 Unicode Line Breaking Algorithm [UAX14] – character classes and wrapping

- 1091 Unicode Normalization Forms [UAX15] – especially NFC for [RFC5198]
- 1092 Unicode Text Segmentation [UAX29] – grapheme clusters, words, sentences
- 1093 Unicode Identifier and Pattern Syntax [UAX31] – identifier use and normalization
- 1094 Unicode Collation Algorithm [UTS10] – sorting
- 1095 Unicode Locale Data Markup Language [UTS35] – locale databases
- 1096 Implementations of this specification are advised to also review the following informational  
1097 documents on processing of human-readable Unicode text strings:
- 1098 Unicode Character Encoding Model [UTR17] – multi-layer character model
- 1099 Unicode Character Property Model [UTR23] – character properties
- 1100 Unicode Conformance Model [UTR33] – Unicode conformance basis

## 1101 **11. Security Considerations**

1102 The IPP extensions defined in this document require the same security considerations as  
1103 defined in the Internet Printing Protocol/1.1 [STD92]. In addition, Printers MUST validate  
1104 the HTTP Host request header in order to protect against DNS rebinding attacks.

1105 Implementations of this specification SHOULD conform to the following standard on  
1106 processing of human-readable Unicode text strings, see:

1107 Unicode Security Mechanisms [UTS39] – detecting and avoiding security attacks

1108 Implementations of this specification are advised to also review the following informational  
1109 document on processing of human-readable Unicode text strings:

1110 Unicode Security FAQ [UNISECFAQ] – common Unicode security issues

## 1111 **12. IANA Considerations**

### 1112 **12.1 Attribute Value Registrations**

1113 The keyword attribute values defined in this document will be published by IANA according  
1114 to the procedures in the Internet Printing Protocol/1.1 [STD92] in the following file:

1115 <http://www.iana.org/assignments/ipp-registrations>

1116 The registry entries will contain the following information:

1117	Attributes (attribute syntax)		Reference
1118	Keyword Attribute Value		
1119	-----		-----
1120	ipp-features-supported (1setOf type2 keyword)		[PWG5100.13]
1121	ipp-everywhere		[PWG5100.14]

## 1122 13. Safe String Truncation

1123 Strings can be truncated or omitted when transferred over alternate protocols. Printers  
 1124 MUST truncate long strings at logical boundaries. The following subsections describe how  
 1125 this truncation is performed for different kinds of strings.

### 1126 13.1 Plain Text Strings

1127 Plain text strings MUST be truncated at the end of a valid character sequence. For example,  
 1128 strings using the UTF-8 transformation format of ISO 10646 [STD0063] [ISO10646-1]  
 1129 SHOULD be represented using the Unicode Format for Network Interchange [RFC5198]  
 1130 and MUST be truncated at the end of a valid UTF-8 sequence.

1131 For example, the 9 octet UTF-8 sequence 0x48.65.CA.81.6C.6C.6F.C2.81 (Hélløj) would  
 1132 be shortened to fit within 6 octets by composing the é (0x65.CA.81 becomes 0xC3.A9) and  
 1133 removing the trailing UTF-8 sequence 0xC2.81 (j), resulting in the 6 octet UTF-8 sequence  
 1134 0x48.C3.A9.6C.6C.6F (Héllø).

### 1135 13.2 URIs

1136 URIs MUST be truncated so that the URI remains valid and accepted by the Printer. For  
 1137 example, the 46 octet URI "ipp://printer.example.com/ipp/really-long-name" might be  
 1138 shortened to fit within 32 octets by removing the last path name component, resulting in the  
 1139 29 octet URI "ipp://printer.example.com/ipp". Similarly, the 52 octet URI  
 1140 "ipp://printer.example.com/ipp?query-string" might be shortened to fit within 32 octets by  
 1141 removing the query string.

1142 As recommended by the Uniform Resource Identifier (URI): Generic Syntax [STD66],  
 1143 Printers SHOULD omit the port number from the URI when it has the default value, e.g., 80  
 1144 for "http", 443 for "https", and 631 for "ipp" and "ipps" URIs.

### 1145 **13.3 MIME Media Types**

1146 MIME media type strings MUST be truncated at the end of the media subtype, removing  
1147 any parameters that are included with the media type. If the resulting string still exceeds the  
1148 maximum length it MUST be discarded. For example, the 24 octet MIME media type  
1149 "text/plain;charset=utf-8" would be shortened to fit within 16 octets by removing the trailing  
1150 parameter, resulting in the 10 octet MIME media type "text/plain".

### 1151 **13.4 Delimited Lists**

1152 Delimited Lists combine one or more string types listed in the previous sections, separated  
1153 by a delimiting character such as a comma or semicolon. Delimited lists MUST first be  
1154 shortened by removal of unnecessary path components (URIs) and parameters (MIME  
1155 media types) and second truncated at a delimiting character. For example, the 40 octet list  
1156 of MIME media types "text/plain;charset=utf-8,application/pdf" would be shortened to fit  
1157 within 32 octets by removing the MIME media type parameter, resulting in the 26 octet list  
1158 "text/plain,application/pdf". The same list would be shortened to fit within 16 octets by also  
1159 removing the last MIME media type, resulting in the 10 octet list "text/plain".

## 1160 **14. Overview of Changes**

### 1161 **14.1 IPP Everywhere™ v1.1**

1162 The following changes were made to PWG 5100.14-2013: IPP Everywhere [PWG5100.14-  
1163 2013]:

- 1164 • References now point to the current versions of dependent documents and  
1165 specifications at the time of publication;
- 1166 • Requirements for WS-Discovery have been removed due to a lack of  
1167 implementations, which effectively made WS-Discovery support OPTIONAL;
- 1168 • References to OpenXPS and SSDP have been removed;
- 1169 • The "printer-device-id" Printer Description attribute and associated DNS-SD TXT  
1170 record keys are no longer required;
- 1171 • DNS-SD is now RECOMMENDED for Printers representing Logical Devices (print  
1172 servers);

- 1173 • ICC attributes are now **CONDITIONALLY REQUIRED** for printers that support ICC-  
1174 based color management;
- 1175 • JPEG support is now **CONDITIONALLY REQUIRED** for color printers;
- 1176 • The "compression-supplied", "document-format-supplied", "document-format-  
1177 version", "document-format-version-supplied", "document-name-supplied" attributes  
1178 are no longer required;
- 1179 • The "feed-orientation", "feed-orientation-default", and "feed-orientation-supported"  
1180 attributes are no longer required;
- 1181 • The "print-content-optimize", "print-content-optimize-default", and "print-content-  
1182 optimize-supported" attributes have been reduced to **RECOMMENDED**;
- 1183 • IPP Finishings 2.1 and the "finishings-col" Job Template attribute are now  
1184 **RECOMMENDED**;
- 1185 • The "printer-input-tray" and "printer-output-tray" Printer Description attributes are  
1186 now **RECOMMENDED** to provide tray information and status;
- 1187 • The "printer-strings-languages-supported" and "printer-strings-uri" Printer Status  
1188 attributes are now **RECOMMENDED** to support localization; and
- 1189 • Printer Status and Job Status attributes are now listed in a separate section to match  
1190 STD 92 and the IANA IPP registry.

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1377

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1393 To subscribe, see the PWG web page:

1394 <http://www.pwg.org/>

1395 Implementers of this specification document are encouraged to join the IPP Mailing List in  
1396 order to participate in any discussions of clarification issues and review of registration  
1397 proposals for additional attributes and values.

1398 The editors would like to especially thank the following individuals who also contributed  
1399 significantly to the development of this document:

1400 Andrew Mitchell  
1401 Jerry Thrasher - Lexmark  
1402 Peter Zehler - Xerox

1403

## 1404 **17. Change History**

### 1405 **17.1 August 27, 2019**

- 1406 • Updated references - published PWG 5100.7 update and working draft of EPX

### 1407 **17.2 June 27, 2019**

- 1408 • Removed feed-orientation-xxx attributes (obsolete)
- 1409 • Add pdl-override-supported to list of required Printer Description attributes (was  
1410 already required in the text, just missing from the table)
- 1411 • Made print-content-optimize RECOMMENDED
- 1412 • Made printer-input-tray and printer-output-tray RECOMMENDED
- 1413 • Global: Change PWG 5100.3 and 5100.11, and all media-col attrs, to PWG 5100.7  
1414 (JOBEXT v2.0)

### 1415 **17.3 January 28, 2019**

- 1416 • Status: Stable
- 1417 • Updated reference to v1.0 to use -2013 suffix.
- 1418 • Sections 3.1 and 15.1: Added references to 5100.16 and registration documents
- 1419 • Section 5.3: Added recommended attributes table
- 1420 • Section 5.5: Added recommended attributes table
- 1421 • Sections 5.6 and 5.7: Tables used "Source" heading instead of "Reference"
- 1422 • Section 5.8: Table 10 had wrong note for finishings-col, added finishings-  
1423 col.finishing-template, made note 2 conditionally required, added recommended  
1424 attributes table

**1425 17.4 September 26, 2018**

- 1426 • Removed the "compression-supplied", "document-format-supplied", "document-  
1427 format-version", "document-format-version-supplied", and "document-name-  
1428 supplied" attributes from the required attribute lists since the corresponding attributes  
1429 are being obsoleted in PWG 5100.7.

**1430 17.5 August 24, 2018**

- 1431 • The current version of the Bonjour Printing Specification is 1.2.1.
- 1432 • Section 4: DNS-SD is now required for physical devices and recommended for  
1433 logical devices (print servers)
- 1434 • Section 5.1: Clarified that the use of the Host header value includes the port number.
- 1435 • Section 5.3: Moved printer-more-info to 5.4 Printer Status attributes
- 1436 • Section 5.4: Added RECOMMENDED printer-strings-languages-supported and  
1437 printer-strings-uri attributes from JPS3
- 1438 • Section 6: Still recommend JPEG for monochrome printers
- 1439 • Section 8.4: Clarified that we mean IP addresses from DHCP
- 1440 • Section 9.3: Fixed section 5.3 references
- 1441 • Section 10: Dropped UTR20 (now maintained by the W3C, but why do we care about  
1442 XML here?)
- 1443 • Section 12.1: Fixed STD 92 reference
- 1444 • Section 14.1: Updated the change list
- 1445 • Section 15.1: Fixed up STD 92 reference, added references to PWG 5100.18 (IPP  
1446 INFRA) and RFCs 6749 and 6750 (OAuth 2.0), updated all Unicode references,  
1447 dropped UTR20 (which is now maintained by the W3C)

**1448 17.6 July 4, 2018**

- 1449 • Status: Prototype

- 1450 • RFC 8011 is now STD 92
- 1451 • Updated Unicode to 11.0.0.

## 1452 **17.7 June 6, 2018**

- 1453 • Section 5.7: Fixed cross-reference to Table 10.
- 1454 • Section 14.1: Cleaned up WS-Discovery bullet.
- 1455 • Section 15.2: Updated Bonjour Printing specification reference.

## 1456 **17.8 April 17, 2018**

- 1457 • Removed all references to 1284 device IDs and associated information.

## 1458 **17.9 April 16, 2018**

- 1459 • Made sure IPP Everywhere™ consistently has trademark symbol.
- 1460 • Section 1: Drop examples of mobile devices.
- 1461 • Section 4.2.3.4: TLS key required for IPPS.
- 1462 • Section 5.1: Fix typos.
- 1463 • Section 5.2: Made Identify-Printer operation recommended for logical devices,  
1464 required otherwise.
- 1465 • Sections 5.3 and 5.8: Made print-rendering-intent and printer-icc-profiles  
1466 conditionally required for printers that support ICC-based color management.
- 1467 • Section 5.3.6: Clarify pdl-override-supported values and usage.
- 1468 • Section 5.7: Deleted stray "note 7"
- 1469 • Section 9.3: Added ICC attributes here.
- 1470 • Section 14: Reworded for present tense, clarified why WS-Discovery has been  
1471 removed, removed reason for removing OpenXPS and SSDP.



**1472 17.10 April 3, 2018**

- 1473 • Make JPEG support conditionally required for color printers.

**1474 17.11 February 9, 2018**

- 1475 • Initial v1.1 draft
- 1476 • Updated template
- 1477 • Updated abstract (can't call it a standard in the abstract)
- 1478 • Updated spec references to current versions
- 1479 • Dropped all mention of UPNP, SSDP, WS-Discovery, and OpenXPS (never  
1480 implemented)
- 1481 • Added a new "Overview of Changes" chapter that documents the high-level changes  
1482 since the original IPP Everywhere specification
- 1483 • Now recommend support for the Get-User-Printer-Attributes operation
- 1484 • Now recommend support for the "finishings-col" attributes (PWG 5100.1)
- 1485 • Now recommend support for TLS 1.3
- 1486 • Now recommend using a resource path of /ipp/print or /ipp/print/name in Printer URIs
- 1487 • Issue 11: printer-current-time is now listed as an IPP Everywhere attribute, although  
1488 only RECOMMENDED since it was missing in the 1.0 spec. (all of the date-time  
1489 attributes were previously required, so printer-current-time would have implicitly been  
1490 required)
- 1491 • Issue 12: The reference to PWG 5100.12 has been corrected
- 1492 • Issue 13: The reference to the EXIF specification has been updated.
- 1493 • Issue 13: The reference to PWG 5101.1 has been updated.
- 1494 • Issue 14: Clarified the pdl-override-supported requirements ('attempted' or  
1495 'guaranteed')
- 1496 • Issue 15: Clarified that relative URIs ("//ipp/print") are not allowed in IPP.

- 1497 • Issue 26: "job-preferred-attributes-supported" should have been "preferred-attributes-supported"
- 1498
- 1499 • Issue 31: Incorrect references to PWG 5101.2 have been changed to PWG 5101.1 (MSN)
- 1500
- 1501 • Issue 33: The notes concerning IPP/2.x conformance changes were confusing and have been removed
- 1502
- 1503 • Issue 34: Table 6: overrides-supported now correctly references "note 2" (conditionally required).
- 1504
- 1505 • Issue 35: overrides-supported.document-numbers is now **CONDITIONALLY REQUIRED**
- 1506
- 1507 • Fixed attribute examples to use PAPI encoding
- 1508 • Fixed notes concerning "copies" to indicate that support is required for JPEG and PDF documents
- 1509
- 1510 • Separated Printer Status attributes from Printer Description
- 1511 • Separated Job Status attributes from Job Description