



The Printer Working Group

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Working Draft

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## IPP Everywhere™ v1.1

Status: Stable

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

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

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

This document is available electronically at:

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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>

83 Contact information:

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

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## 200 **1. Introduction**

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

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

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

## 213 **2. Terminology**

### 214 **2.1 Printing Terminology**

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

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

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

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

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

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

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



## 229 **2.2 Protocol Role Terminology**

230 This document also defines the following protocol roles to specify unambiguous  
231 conformance requirements:

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

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

## 237 **2.3 Other Terminology**

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

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

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

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

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

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

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

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

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

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

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

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

## 263 **2.4 Acronyms and Organizations**

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

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

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

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

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

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

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

272

## 273 **3. Requirements**

### 274 **3.1 Rationale**

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

## 324 **3.2 Use Cases**

### 325 **3.2.1 Select Printer**

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

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

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

#### 335 **3.2.1.1 Select the Last Used Printer**

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

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

#### 342 **3.2.1.2 Select Printer Using Name or Address**

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

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

#### 349 **3.2.1.3 Select Printer Using URI**

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

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

#### 354 **3.2.1.4 Select Printer Using a Directory Service**

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

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

#### 361 **3.2.1.5 Select Printer Using a Cloud Service**

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

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

#### 368 **3.2.1.6 Select Printer Using a Discovery Protocol**

369 The Client initiates Discovery on behalf of Jane and maintains a dynamic list of Network  
370 Accessible Printers during selection. The Client User Interface asks Jane to select one of

371 the Network Accessible Printers, updating those Printers as they come and go. Finally, she  
372 selects a Printer and the Client terminates Discovery.

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

### 375 **3.2.1.7 Select Printer Using Geo-Location**

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

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

### 382 **3.2.1.8 Select Printer Using Out of Band Method**

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

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

### 389 **3.2.1.9 Select Printer Using Properties**

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

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

### 401 **3.2.2 Print**

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

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

#### 410 **3.2.2.1 Print a Document**

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

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

#### 417 **3.2.2.2 Print a Document by Reference**

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

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

#### 424 **3.2.2.3 Print Using Loaded Media**

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

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

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

#### 436 **3.2.2.4 Print a Secure Form**

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

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

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

#### 454 **3.2.2.5 Print with Special Formatting**

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

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

#### 467 **3.2.2.6 Print and Select at Printer**

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

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

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



**479 3.2.2.7 Print to a Service**

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

**487 3.2.2.8 Print to a Recipient**

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

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

**495 3.2.2.9 Print with a Proof Copy**

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

**502 3.2.3 Exceptions****503 3.2.3.1 Print Action Canceled**

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

**507 3.2.3.2 Select Printer Canceled**

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

**510 3.2.3.3 Printer No Longer Network Accessible after Selection**

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

**514 3.2.3.4 Not Authorized**

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

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

**521 3.2.3.5 Needs Authentication**

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

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

**526 3.2.3.6 Not Accepting Jobs**

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

**529 3.2.3.7 Job Ticket or Document Format Not Supported**

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

**533 3.2.3.8 Job or Document Processing Failures**

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

**538 3.2.3.9 Printer Fault**

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

### 542 3.2.3.10 Printer Warning

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

## 546 3.3 Out of Scope

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

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

## 555 3.4 Design Requirements

556 The IPP Everywhere™ design should:

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

564

## 565 **4. Discovery Protocols**

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

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

### 571 **4.1 Printer Description Attributes Used in Discovery**

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

### 574 **4.2 DNS Service Discovery (DNS-SD)**

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

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

#### 582 **4.2.1 Service (SRV) Instance Name**

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

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

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

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

#### 591 **4.2.2 Geo-Location (LOC)**

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

596

**Table 1 - Attributes in Discovery Protocols**

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

597 Note 1: Extension attribute to RFC 7612.

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

599 **4.2.3 Text (TXT)**

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

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

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

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

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

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

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

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

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

620

**Table 3 - DNS TXT Record Keys**

Key	Description	Default Value
adminurl	The Printer-resident configuration page URL as reported by the "printer-more-info" Printer Description attribute.	" (empty string)
air	The type of authentication information that is required for the Printer. See section 4.2.3.1.	'none'
Bind	'T' if the Printer can bind output, 'F' otherwise.	'U' (note 1)
Collate	'T' if the Printer can collate copies, 'F' otherwise.	'U' (note 1)
Color	'T' if the Printer supports color printing, 'F' otherwise.	'U' (note 1)
Copies	'T' if the Printer can make copies on its own, 'F' otherwise.	'U' (note 1)
Duplex	'T' if the Printer supports duplex printing, 'F' otherwise	'U' (note 1)
DUUID	The UUID of the Device without the "urn:uuid:" prefix as reported by the "device-uuid" Printer Description attribute. See section 4.2.3.6.	" (empty string)
note	The location of the Printer as reported by the "printer-location" Printer Description attribute.	" (empty string)
PaperCustom	'T' if the Printer supports custom media sizes, 'F' otherwise.	'U' (note 1)
PaperMax	The maximum media size supported by the Printer: '<legal-A4', 'legal-A4', 'isoC-A2', '>isoC-A2'.	'legal-A4'
pdl	A comma-delimited list of supported MIME media types. See section 4.2.3.2.	" (empty string)
priority	The priority for the service from 0 to 99, where 0 is the highest priority and 99 is the lowest priority.	'50'
Punch	'T' if the Printer can punch output, 'F' otherwise.	'U' (note 1)
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)

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

622 **4.2.3.1 air**

623 The "air" key defines the type of authentication information that is required for imaging. The  
 624 name "air" comes from the CUPS "auth-info-required" Printer Description attribute

625 [CUPSIPP] that extends the "uri-authentication-supported" Printer Description attribute  
626 [STD92]. The following values are supported:

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

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

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

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

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

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

#### 642 4.2.3.2 pdl

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

#### 649 4.2.3.3 qtotal

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



#### 659 4.2.3.4 TLS

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

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

664 '1.0'; TLS 1.0 [RFC2246] encryption is supported. This is equivalent to the value 'tls'  
665 for the "uri-security-supported" Printer Description attribute.

666 '1.1'; TLS 1.1 [RFC4346] encryption is supported. This is equivalent to the value 'tls'  
667 for the "uri-security-supported" Printer Description attribute.

668 '1.2'; TLS 1.2 [RFC5246] encryption is supported. This is equivalent to the value 'tls'  
669 for the "uri-security-supported" Printer Description attribute.

670 '1.3'; TLS 1.3 [RFC-TLS1.3] encryption is supported. This is equivalent to the value  
671 'tls' for the "uri-security-supported" Printer Description attribute.

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

#### 675 4.2.3.5 UUID

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

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

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

681 12345678-9ABC-DEF0-1234-56789ABCDEF0

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

#### 684 4.2.3.6 DUUID

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

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

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

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

### 691 **4.3 LDAP and SLP Discovery**

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

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

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

## 701 **5. Protocol Binding**

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

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

### 706 **5.1 HTTP Features**

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

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

#### 714 **5.1.1 Host**

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

#### 717 **5.1.2 If-Modified-Since, Last-Modified, and 304 Not Modified**

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

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

#### 724 **5.1.3 Cache-Control**

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

730

## 731 5.2 IPP Operations

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

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

738 **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 5100.11
0x003B	Close-Job	PWG 5100.11
0x003C	Identify-Printer (note 1)	PWG 5100.13

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

## 740 5.3 IPP Printer Description Attributes

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

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

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

<b>Attribute</b>	<b>Reference</b>
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 5100.3
job-account-id-supported (note 1)	PWG 5100.3
job-accounting-user-id-default (note 1)	PWG 5100.3
job-accounting-user-id-supported (note 1)	PWG 5100.3
job-constraints-supported	PWG 5100.13
job-creation-attributes-supported	PWG 5100.11
job-ids-supported	PWG 5100.11
job-password-supported (note 4)	PWG 5100.11
job-password-encryption-supported (note 4)	PWG 5100.11
job-resolvers-supported	PWG 5100.13
media-bottom-margin-supported	PWG 5100.13
media-col-database	PWG 5100.11
media-col-database.media-source-properties (note 5)	PWG 5100.13
media-col-default	PWG 5100.3
media-col-ready	PWG 5100.3
media-col-ready.media-source-properties (note 5)	PWG 5100.13
media-col-supported	PWG 5100.3
media-default	RFC 8011
media-left-margin-supported	PWG 5100.13
media-ready	RFC 8011
media-right-margin-supported	PWG 5100.13
media-size-supported	PWG 5100.3
media-source-supported	PWG 5100.13
media-supported	RFC 8011
media-top-margin-supported	PWG 5100.13
media-type-supported	PWG 5100.3
multiple-document-jobs-supported	RFC 8011
multiple-operation-timeout	RFC 8011
multiple-operation-timeout-action	PWG 5100.13
natural-language-configured	RFC 8011
operations-supported	RFC 8011
orientation-requested-default	RFC 8011
orientation-requested-supported	RFC 8011
output-bin-default	PWG 5100.2
output-bin-supported	PWG 5100.2
overrides-supported (note 2)	PWG 5100.6
page-ranges-supported (note 2)	RFC 8011
preferred-attributes-supported	PWG 5100.13
print-color-mode-default	PWG 5100.13
print-color-mode-supported	PWG 5100.13
print-content-optimize-default	PWG 5100.7
print-content-optimize-supported	PWG 5100.7
print-rendering-intent-default (note 8)	PWG 5100.13
print-rendering-intent-supported (note 8)	PWG 5100.13
print-quality-default	RFC 8011
print-quality-supported	RFC 8011

Attribute	Reference
printer-current-time (note 7)	RFC 8011
printer-geo-location	PWG 5100.13
printer-get-attributes-supported	PWG 5100.13
printer-icc-profiles (notes 6 and 8)	PWG 5100.13
printer-icons (note 6)	PWG 5100.13
printer-info	RFC 8011
printer-location	RFC 8011
printer-make-and-model	RFC 8011
printer-mandatory-job-attributes (note 1)	PWG 5100.13
printer-name	RFC 8011
printer-organization	PWG 5100.13
printer-organizational-unit	PWG 5100.13
printer-resolution-default	RFC 8011
printer-resolution-supported	RFC 8011
pwg-raster-document-resolution-supported	PWG 5102.4
pwg-raster-document-sheet-back	PWG 5102.4
pwg-raster-document-type-supported	PWG 5102.4
sides-default	RFC 8011
sides-supported	RFC 8011
uri-security-supported	RFC 8011
uri-authentication-supported	RFC 8011
which-jobs-supported	PWG 5100.11

- 744
- 745 Note 1: CONDITIONALLY REQUIRED for Printers that implement Paid Imaging
- 746 services.
- 747 Note 2: REQUIRED for the "application/pdf" and "image/jpeg" MIME media types.
- 748 Note 3: CONDITIONALLY REQUIRED for Printers with finishers.
- 749 Note 4: CONDITIONALLY REQUIRED for Printers that support the Print to a
- 750 Recipient (section 3.2.2.8) use case.
- 751 Note 5: CONDITIONALLY REQUIRED for Printers that support long-edge feed
- 752 media.
- 753 Note 6: URIs MUST be absolute, SHOULD use the Host value (including port
- 754 number) from the HTTP Host header (section 5.1.1), and MUST NOT use link-local
- 755 addresses (section 8.4).
- 756 Note 7: RECOMMENDED due to its omission from IPP Everywhere™ 1.0, however
- 757 it is needed for the underlying functionality.
- 758 Note 8: CONDITIONALLY REQUIRED for Printers that support ICC-based color
- 759 management.
- 760

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

Attribute	Reference
job-account-type-default	PWG 5100.16
job-account-type-supported	PWG 5100.16
job-authorization-uri-supported	PWG 5100.16
job-password-repertoire-configured	REPertoire
job-password-repertoire-supported	REPertoire
job-presets-supported	PRESETS
job-privacy-attributes	PRIVACY
job-privacy-scope	PRIVACY
jpeg-features-supported	PWG 5100.16
jpeg-k-octets-supported	PWG 5100.16
jpeg-x-dimension-supported	PWG 5100.16
jpeg-y-dimension-supported	PWG 5100.16
pdf-k-octets-supported	PWG 5100.16
pdf-versions-supported	PWG 5100.16
print-scaling-default	PWG 5100.16
print-scaling-supported	PWG 5100.16
printer-dns-sd-name	PWG 5100.16
printer-privacy-policy-uri	PRIVACY

762 **5.3.1 media-col-database (1setOf collection)**

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

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

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

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

```
784 media-col-database=..., {
785     media-size={
```

```
x-dimension=20320-152400  
y-dimension=1524-9144000 },...
```

786  
787

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

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

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

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

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

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

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

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

821 Similarly, roll media sized are described using "roll" self-describing media size names with  
822 the width of the loaded roll and a length of 0. For example, a 36 inch roll might be listed with



823 the name "roll\_current\_36x0in". As for custom sizes, the size name MUST include the  
824 source name if more than one roll is loaded, for example "roll\_current.roll-1\_36x0in".

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

### 872 5.3.6 pdl-override-supported (type2 keyword)

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

876 When reporting capabilities for the 'application/pdf', 'image/jpeg', or 'image/pwg-raster'  
 877 MIME media types, Printers MUST report either 'attempted' [STD92] or 'guaranteed'  
 878 [PWG5100.11] for the "pdl-override-supported" Printer attribute.

## 879 5.4 IPP Printer Status Attributes

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

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

Attribute	Reference
pages-per-minute	RFC 8011
pages-per-minute-color	RFC 8011
printer-alert	PWG 5100.9
printer-alert-description	PWG 5100.9
printer-config-change-date-time	PWG 5100.13
printer-config-change-time	PWG 5100.13
printer-is-accepting-jobs	RFC 8011
printer-more-info (note 1)	RFC 8011
printer-state	RFC 8011
printer-state-change-date-time	RFC 3995
printer-state-change-time	RFC 3995
printer-state-message	RFC 8011
printer-state-reasons	RFC 8011
printer-strings-languages-supported (note 2)	PWG 5100.13
printer-strings-uri (notes 1 and 2)	PWG 5100.13

<b>Attribute</b>	<b>Reference</b>
printer-supply	PWG 5100.13
printer-supply-description	PWG 5100.13
printer-supply-info-uri (note 1)	PWG 5100.13
printer-up-time	RFC 8011
printer-uri-supported (note 1)	RFC 8011
printer-uuid	PWG 5100.13
pwg-raster-document-resolution-supported	PWG 5102.4
pwg-raster-document-sheet-back	PWG 5102.4
pwg-raster-document-type-supported	PWG 5102.4
queued-job-count	RFC 8011

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

#### 889 **5.4.1 printer-uri-supported (1setOf uri)**

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

893 **5.5 IPP Operation Attributes**

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

895 **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 5100.11
job-mandatory-attributes (note 3)	PWG 5100.7
job-name	RFC 8011
job-password (note 2)	PWG 5100.11
job-password-encryption (note 2)	PWG 5100.11
last-document	RFC 8011
limit	RFC 8011
requesting-user-name	RFC 8011
requesting-user-uri	PWG 5100.13
which-jobs	RFC 8011, PWG 5100.11

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

899 Note 2: CONDITIONALLY REQUIRED for Printers that support the Print to a  
900 Recipient (section 3.2.2.8) use case.

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

903 **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

904

## 905 5.6 IPP Job Description Attributes

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

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

Attribute	Reference
job-name	RFC 8011

## 908 5.7 IPP Job Status Attributes

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

910 **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
time-at-completed	RFC 8011
time-at-creation	RFC 8011
time-at-processing	RFC 8011

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

### 914 5.7.1 job-id (integer)

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

## 920 5.7.2 job-uri (uri)

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

## 927 5.8 IPP Job Template Attributes

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

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

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

931

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

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

Attribute	Reference
job-account-type	PWG 5100.16
print-scaling	PWG 5100.16

946

## 947 **6. Document Formats**

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

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

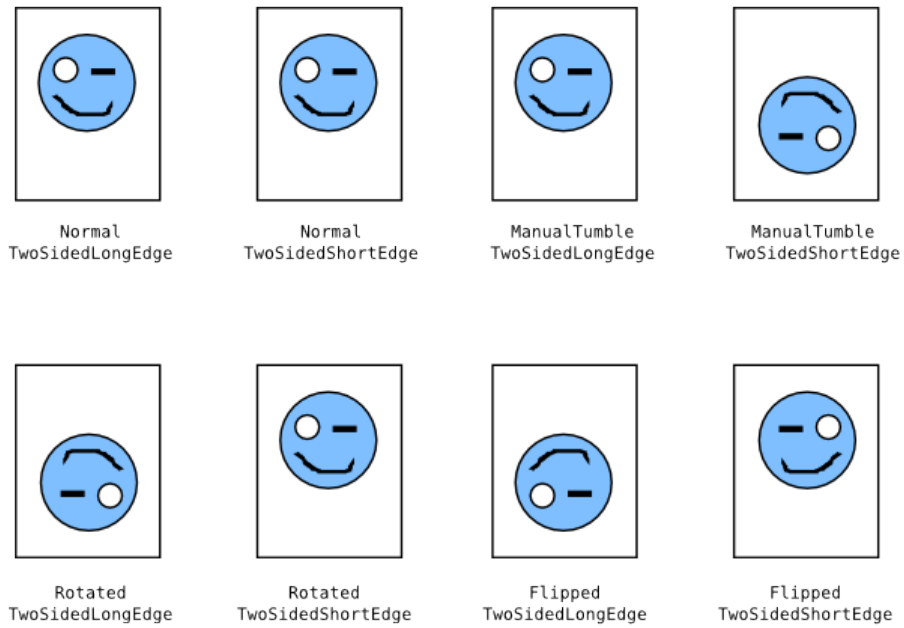
### 958 **6.1 Supporting Long-Edge Feed Media with PWG Raster Format** 959 **Documents**

960 Printers that support long-edge feed media MUST support the "feed-orientation" Job  
961 Template attribute and corresponding "feed-orientation-default" and "feed-orientation-  
962 supported" Printer attributes. In addition, Printers that support long-edge feed media MUST  
963 report the "media-source-properties" member attribute in the "media-col-database" and  
964 "media-col-ready" Printer attributes.

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

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



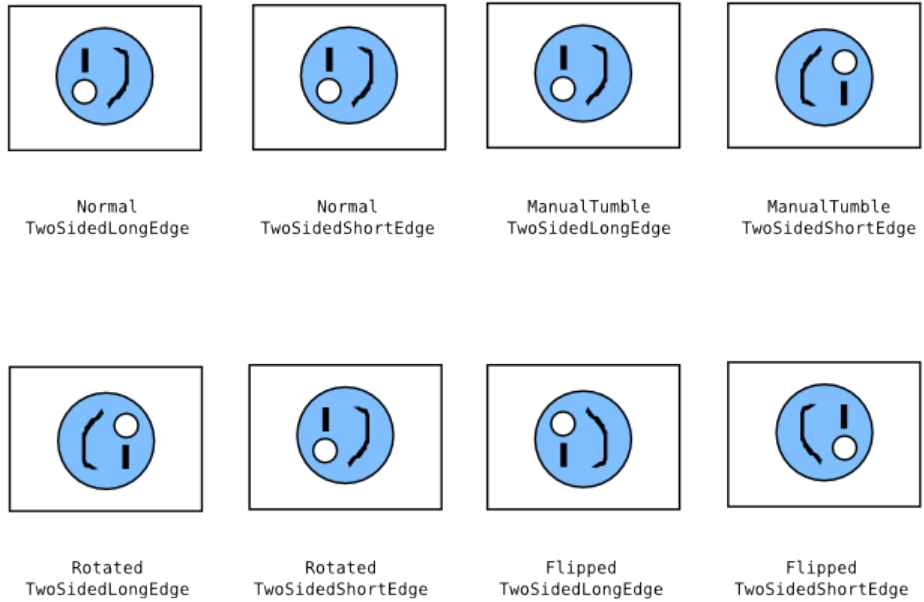


970

971

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

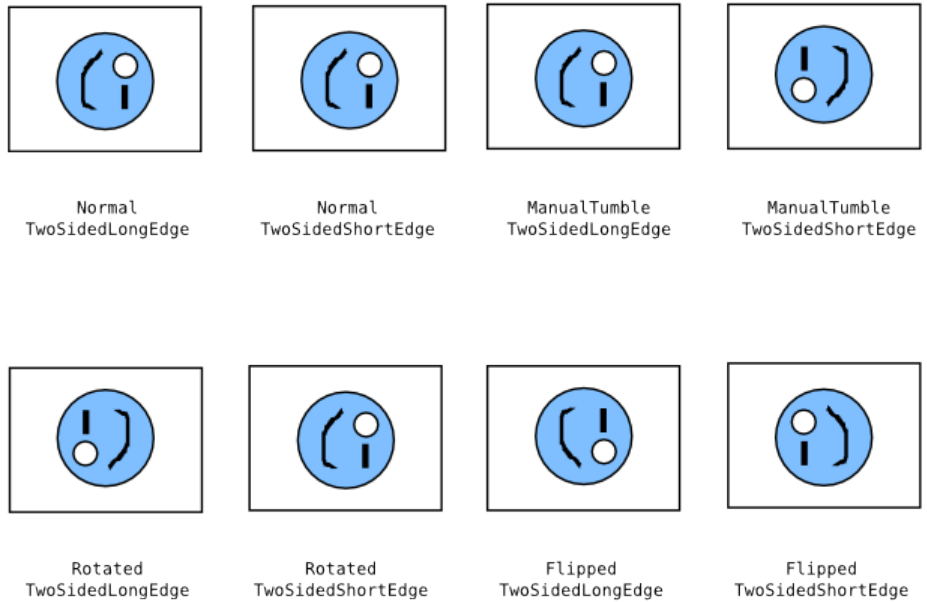
972



973

974

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

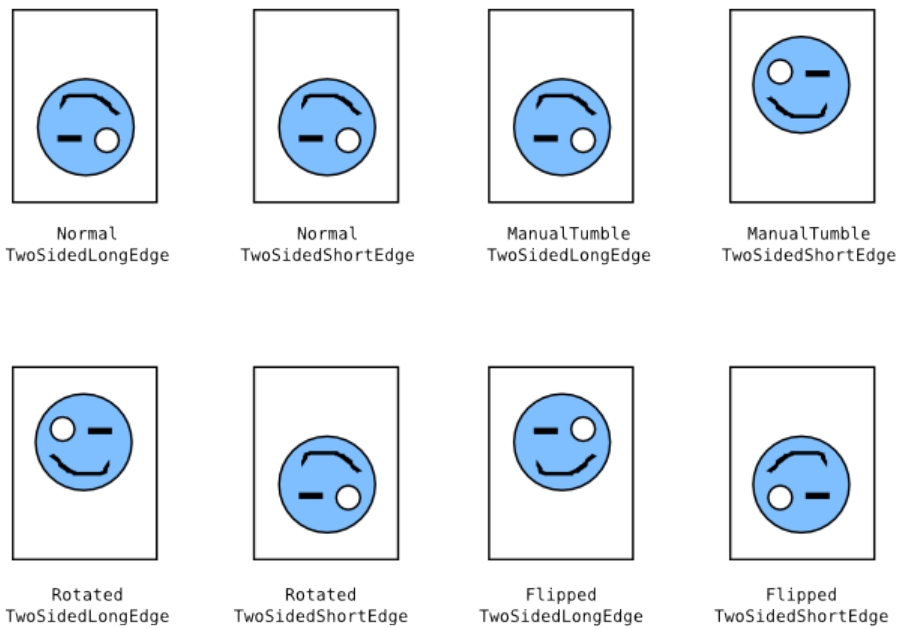


975

976

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

977



978

979

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

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

### 981 **7.1 ipp-features-supported (1setOf type2 keyword)**

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

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

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

### 989 **8.1 nameWithLanguage and nameWithoutLanguage**

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

### 994 **8.2 naturalLanguage**

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

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

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

1000 'zh-tw'; replaced by 'zh-hant' (Traditional Chinese)

### 1001 **8.3 textWithLanguage and textWithoutLanguage**

1002 Text values MUST NOT contain the DEL character or characters in the "C0 Control  
1003 Character Set" other than CR, LF, and HT [RFC5198]. Printers MUST transcode and filter  
1004 values from MIBs and other sources to conform to the added restrictions.

### 1005 **8.4 uri**

1006 URI values MUST be in absolute form, i.e., "ipp://hostname.local/ipp/print" is acceptable but  
1007 "///ipp/print" is not. URI values MUST NOT contain link-local addresses in the host field.

1008 Printers MUST NOT generate URI values with link-local addresses and SHOULD NOT  
1009 generate URI values with IP addresses obtained via Dynamic Host Control Protocol (DHCP)  
1010 [RFC2131] or other auto-configuration protocols. Printers SHOULD use the HTTP Host:  
1011 header value when generating URIs for use in Client responses.

## 1012 **9. Conformance Requirements**

1013 This section summarizes the Conformance Requirements detailed in the definitions in this  
1014 document for Clients and Printers.

### 1015 **9.1 Conformance Requirements for Clients**

1016 In order for a Client to claim conformance to this specification a Client MUST support the  
1017 following:

- 1018 1. DNS Service Discovery as defined in section 4.2
- 1019 2. IPP/2.0 as defined in section 5
- 1020 3. The REQUIRED operations listed in Table 4
- 1021 4. The REQUIRED Printer Description attributes listed in Table 5
- 1022 5. The REQUIRED operation attributes listed in Table 8
- 1023 6. The REQUIRED Job Template attributes listed in Table 12
- 1024 7. The REQUIRED Job Description attributes listed in Table 10
- 1025 8. The REQUIRED document formats listed in section 5.8
- 1026 9. The "feed-orientation-supported" Printer attribute and "media-source-properties"  
1027 member attribute of the "media-col-database" and "media-col-ready" Printer  
1028 attributes as reported by the Printer and defined in section 6.1
- 1029 10. The internationalization considerations as defined in section 10
- 1030 11. The security considerations as defined in section 0

### 1031 **9.2 Conformance Requirements for Printers**

1032 In order for a Printer to claim conformance to this specification a Printer MUST support the  
1033 following:

- 1034 1. DNS Service Discovery as defined in section 4.2
- 1035 2. IPP/2.0 as defined in section 5
- 1036 3. The REQUIRED operations listed in Table 4
- 1037 4. The REQUIRED Printer Description attributes listed in Table 5
- 1038 5. The REQUIRED operation attributes listed in Table 8
- 1039 6. The REQUIRED Job Template attributes listed in Table 12
- 1040 7. The REQUIRED Job Description attributes listed in Table 10
- 1041 8. The REQUIRED document formats listed in section 5.8
- 1042 9. The 'ipp-everywhere' value for the "ipp-features-supported" Printer Description  
1043 attribute as defined in section 7.1

- 1044 10. The additional semantics for attribute values as defined in section 8  
1045 11. The internationalization considerations as defined in section 10  
1046 12. The security considerations as defined in section 0  
1047 13. The safe string truncation rules as defined in section 13

### 1048 **9.3 Conditional Conformance Requirements for Printers**

1049 Printers that support the "image/jpeg" [JFIF] MIME media type MUST support:

- 1050 1. The "copies-default", and "copies-supported" Printer Description attributes as  
1051 defined in section 5.3.  
1052 2. The "copies" Job Template attribute as defined in section 5.8.

1053 Printers that support the "application/pdf" [ISO32000] MIME media type MUST support:

- 1054 1. The "copies-default", "copies-supported", "document-password-supported", and  
1055 "page-ranges-supported" Printer Description attributes as defined in section 5.3,  
1056 2. The "document-password" Operation attribute as defined in section 5.4, and  
1057 3. The "copies", "multiple-document-handling", "overrides", and "page-ranges" Job  
1058 Template attributes as defined in section 5.8.

1059 Printers that support the Print to a Recipient use case (section 3.2.2.8) MUST support:

- 1060 1. The "job-password-supported" and "job-password-encryption-supported" Printer  
1061 Description attributes as defined in section 5.3, and  
1062 2. The "job-password" and "job-password-encryption" Operation attributes as  
1063 defined in section 5.4.

1064 Printers that provide Paid Print services MUST support:

- 1065 1. The "job-account-id-default", "job-account-id-supported", "job-accounting-user-  
1066 id-default", "job-accounting-user-id-supported", "job-mandatory-attributes-  
1067 default", "job-mandatory-attributes-supported", and "printer-mandatory-job-  
1068 attributes" Printer Description attributes as defined in section 5.3,  
1069 2. The "job-mandatory-attributes" operation attribute as defined in section 5.4, and  
1070 3. The "job-account-id" and "job-accounting-user-id" Job Template attributes as  
1071 defined in section 5.8.

1072 Printers that support long-edge feed media MUST support:

- 1073 1. The "feed-orientation-default" and "feed-orientation-supported" Printer  
1074 Description attributes as defined in section 5.3.  
1075 2. The "media-source-properties" member attribute of the "media-col-database"  
1076 and "media-col-ready" Printer Description attributes as defined in section 5.3.  
1077 3. The "feed-orientation" Job Template attribute as defined in section 5.8.

1078 Printers that support ICC-based color management MUST support:

- 1079           4. The "print-rendering-intent-default", "print-rendering-intent-supported", and  
1080           "printer-icc-profiles" Printer Description attributes as defined in section 5.3.  
1081           5. The "print-render-intent" Job Template attribute as defined in section 5.8.

## 1082 **10. Internationalization Considerations**

1083 For interoperability and basic support for multiple languages, conforming implementations  
1084 MUST support:

- 1085           1. The Universal Character Set (UCS) Transformation Format -- 8 bit (UTF-8)  
1086           [STD63] encoding of Unicode [UNICODE] [ISO10646]; and  
1087           2. The Unicode Format for Network Interchange [RFC5198] which requires  
1088           transmission of well-formed UTF-8 strings and recommends transmission of  
1089           normalized UTF-8 strings in Normalization Form C (NFC) [UAX15].

1090 Unicode NFC is defined as the result of performing Canonical Decomposition (into base  
1091 characters and combining marks) followed by Canonical Composition (into canonical  
1092 composed characters wherever Unicode has assigned them).

1093 WARNING – Performing normalization on UTF-8 strings received from Clients and  
1094 subsequently storing the results (e.g., in Job objects) could cause false negatives in Client  
1095 searches and failed access (e.g., to Printers with percent-encoded UTF-8 URIs now  
1096 'hidden').

1097 Implementations of this specification SHOULD conform to the following standards on  
1098 processing of human-readable Unicode text strings, see:

- 1099           Unicode Bidirectional Algorithm [UAX9] – left-to-right, right-to-left, and vertical  
1100           Unicode Line Breaking Algorithm [UAX14] – character classes and wrapping  
1101           Unicode Normalization Forms [UAX15] – especially NFC for [RFC5198]  
1102           Unicode Text Segmentation [UAX29] – grapheme clusters, words, sentences  
1103           Unicode Identifier and Pattern Syntax [UAX31] – identifier use and normalization  
1104           Unicode Collation Algorithm [UTS10] – sorting  
1105           Unicode Locale Data Markup Language [UTS35] – locale databases

1106 Implementations of this specification are advised to also review the following informational  
1107 documents on processing of human-readable Unicode text strings:

1108 Unicode Character Encoding Model [UTR17] – multi-layer character model

1109 Unicode Character Property Model [UTR23] – character properties

1110 Unicode Conformance Model [UTR33] – Unicode conformance basis

## 1111 **11. Security Considerations**

1112 The IPP extensions defined in this document require the same security considerations as  
1113 defined in the Internet Printing Protocol/1.1 [STD92]. In addition, Printers **MUST** validate  
1114 the HTTP Host request header in order to protect against DNS rebinding attacks.

1115 Implementations of this specification **SHOULD** conform to the following standard on  
1116 processing of human-readable Unicode text strings, see:

1117 Unicode Security Mechanisms [UTS39] – detecting and avoiding security attacks

1118 Implementations of this specification are advised to also review the following  
1119 informational document on processing of human-readable Unicode text strings:

1120 Unicode Security FAQ [UNISECFAQ] – common Unicode security issues

## 1121 **12. IANA Considerations**

### 1122 **12.1 Attribute Value Registrations**

1123 The keyword attribute values defined in this document will be published by IANA according  
1124 to the procedures in the Internet Printing Protocol/1.1 [STD92] in the following file:

1125 <http://www.iana.org/assignments/ipp-registrations>

1126 The registry entries will contain the following information:

1127	Attributes (attribute syntax)	Reference
1128	Keyword Attribute Value	-----
1129	-----	-----
1130	ipp-features-supported (1setOf type2 keyword)	[PWG5100.13]
1131	ipp-everywhere	[PWG5100.14]

## 1132 **13. Safe String Truncation**

1133 Strings can be truncated or omitted when transferred over alternate protocols. Printers  
1134 **MUST** truncate long strings at logical boundaries. The following subsections describe how  
1135 this truncation is performed for different kinds of strings.

## 1136 **13.1 Plain Text Strings**

1137 Plain text strings MUST be truncated at the end of a valid character sequence. For example,  
1138 strings using the UTF-8 transformation format of ISO 10646 [STD0063] [ISO10646-1]  
1139 SHOULD be represented using the Unicode Format for Network Interchange [RFC5198]  
1140 and MUST be truncated at the end of a valid UTF-8 sequence.

1141 For example, the 9 octet UTF-8 sequence 0x48.65.CA.81.6C.6C.6F.C2.81 (Héllöï) would  
1142 be shortened to fit within 6 octets by composing the é (0x65.CA.81 becomes 0xC3.A9) and  
1143 removing the trailing UTF-8 sequence 0xC2.81 (ï), resulting in the 6 octet UTF-8 sequence  
1144 0x48.C3.A9.6C.6C.6F (Héllö).

## 1145 **13.2 URIs**

1146 URIs MUST be truncated so that the URI remains valid and accepted by the Printer. For  
1147 example, the 46 octet URI "ipp://printer.example.com/ipp/really-long-name" might be  
1148 shortened to fit within 32 octets by removing the last path name component, resulting in the  
1149 29 octet URI "ipp://printer.example.com/ipp". Similarly, the 52 octet URI  
1150 "ipp://printer.example.com/ipp?query-string" might be shortened to fit within 32 octets by  
1151 removing the query string.

1152 As recommended by the Uniform Resource Identifier (URI): Generic Syntax [STD66],  
1153 Printers SHOULD omit the port number from the URI when it has the default value, e.g., 80  
1154 for "http", 443 for "https", and 631 for "ipp" and "ipps" URIs.

## 1155 **13.3 MIME Media Types**

1156 MIME media type strings MUST be truncated at the end of the media subtype, removing  
1157 any parameters that are included with the media type. If the resulting string still exceeds the  
1158 maximum length it MUST be discarded. For example, the 24 octet MIME media type  
1159 "text/plain;charset=utf-8" would be shortened to fit within 16 octets by removing the trailing  
1160 parameter, resulting in the 10 octet MIME media type "text/plain".

## 1161 **13.4 Delimited Lists**

1162 Delimited Lists combine one or more string types listed in the previous sections, separated  
1163 by a delimiting character such as a comma or semicolon. Delimited lists MUST first be  
1164 shortened by removal of unnecessary path components (URIs) and parameters (MIME  
1165 media types) and second truncated at a delimiting character. For example, the 40 octet list  
1166 of MIME media types "text/plain;charset=utf-8,application/pdf" would be shortened to fit  
1167 within 32 octets by removing the MIME media type parameter, resulting in the 26 octet list  
1168 "text/plain,application/pdf". The same list would be shortened to fit within 16 octets by also  
1169 removing the last MIME media type, resulting in the 10 octet list "text/plain".



## 1170 **14. Overview of Changes**

### 1171 **14.1 IPP Everywhere™ v1.1**

1172 The following changes were made to PWG 5100.14-2013: IPP Everywhere [PWG5100.14-  
1173 2013]:

- 1174 • References now point to the current versions of dependent documents and  
1175 specifications at the time of publication;
- 1176 • Requirements for WS-Discovery have been removed due to a lack of  
1177 implementations, which effectively made WS-Discovery support OPTIONAL;
- 1178 • References to OpenXPS and SSDP have been removed;
- 1179 • The "printer-device-id" Printer Description attribute and associated DNS-SD TXT  
1180 record keys are no longer required;
- 1181 • DNS-SD is now RECOMMENDED for Printers representing Logical Devices (print  
1182 servers);
- 1183 • ICC attributes are now CONDITIONALLY REQUIRED for printers that support ICC-  
1184 based color management;
- 1185 • JPEG support is now CONDITIONALLY REQUIRED for color printers;
- 1186 • The "compression-supplied", "document-format-supplied", "document-format-  
1187 version", "document-format-version-supplied", "document-name-supplied" attributes  
1188 are no longer required;
- 1189 • IPP Finishings 2.1 and the "finishings-col" Job Template attribute are now  
1190 RECOMMENDED;
- 1191 • The "printer-strings-languages-supported" and "printer-strings-uri" Printer Status  
1192 attributes are now RECOMMENDED to support localization; and
- 1193 • Printer Status and Job Status attributes are now listed in a separate section to match  
1194 STD 92 and the IANA IPP registry.
- 1195

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1392 **16. Authors' Addresses**

1393 Primary authors:

1394 Michael Sweet  
1395 Apple Inc.  
1396 One Apple Park Way  
1397 MS 111-HOMC  
1398 Cupertino CA 95014  
1399 USA

1401 Ira McDonald  
1402 High North  
1403 PO Box 221  
1404 Grand Marais, MI 49839

1405 Send comments to the PWG IPP Mailing List:

1406 [ipp@pwg.org](mailto:ipp@pwg.org) (subscribers only)

1407 To subscribe, see the PWG web page:

1408 <http://www.pwg.org/>

1409 Implementers of this specification document are encouraged to join the IPP Mailing List in  
1410 order to participate in any discussions of clarification issues and review of registration  
1411 proposals for additional attributes and values.

1412 The editors would like to especially thank the following individuals who also contributed  
1413 significantly to the development of this document:

1414 Andrew Mitchell  
1415 Jerry Thrasher - Lexmark  
1416 Peter Zehler - Xerox  
1417



## 1418 **17. Change History**

### 1419 **17.1 January 28, 2019**

- 1420 • Status: Stable
- 1421 • Updated reference to v1.0 to use -2013 suffix.
- 1422 • Sections 3.1 and 15.1: Added references to 5100.16 and registration documents
- 1423 • Section 5.3: Added recommended attributes table
- 1424 • Section 5.5: Added recommended attributes table
- 1425 • Sections 5.6 and 5.7: Tables used "Source" heading instead of "Reference"
- 1426 • Section 5.8: Table 10 had wrong note for finishings-col, added finishings-  
1427 col.finishing-template, made note 2 conditionally required, added recommended  
1428 attributes table

### 1429 **17.2 September 26, 2018**

- 1430 • Removed the "compression-supplied", "document-format-supplied", "document-  
1431 format-version", "document-format-version-supplied", and "document-name-  
1432 supplied" attributes from the required attribute lists since the corresponding attributes  
1433 are being obsoleted in PWG 5100.7.

### 1434 **17.3 August 24, 2018**

- 1435 • The current version of the Bonjour Printing Specification is 1.2.1.
- 1436 • Section 4: DNS-SD is now required for physical devices and recommended for  
1437 logical devices (print servers)
- 1438 • Section 5.1: Clarified that the use of the Host header value includes the port number.
- 1439 • Section 5.3: Moved printer-more-info to 5.4 Printer Status attributes
- 1440 • Section 5.4: Added RECOMMENDED printer-strings-languages-supported and  
1441 printer-strings-uri attributes from JPS3
- 1442 • Section 6: Still recommend JPEG for monochrome printers
- 1443 • Section 8.4: Clarified that we mean IP addresses from DHCP

- 1444 • Section 9.3: Fixed section 5.3 references
- 1445 • Section 10: Dropped UTR20 (now maintained by the W3C, but why do we care about  
1446 XML here?)
- 1447 • Section 12.1: Fixed STD 92 reference
- 1448 • Section 14.1: Updated the change list
- 1449 • Section 15.1: Fixed up STD 92 reference, added references to PWG 5100.18 (IPP  
1450 INFRA) and RFCs 6749 and 6750 (OAuth 2.0), updated all Unicode references,  
1451 dropped UTR20 (which is now maintained by the W3C)

#### 1452 **17.4 July 4, 2018**

- 1453 • Status: Prototype
- 1454 • RFC 8011 is now STD 92
- 1455 • Updated Unicode to 11.0.0.

#### 1456 **17.5 June 6, 2018**

- 1457 • Section 5.7: Fixed cross-reference to Table 10.
- 1458 • Section 14.1: Cleaned up WS-Discovery bullet.
- 1459 • Section 15.2: Updated Bonjour Printing specification reference.

#### 1460 **17.6 April 17, 2018**

- 1461 • Removed all references to 1284 device IDs and associated information.

#### 1462 **17.7 April 16, 2018**

- 1463 • Made sure IPP Everywhere™ consistently has trademark symbol.
- 1464 • Section 1: Drop examples of mobile devices.
- 1465 • Section 4.2.3.4: TLS key required for IPPS.
- 1466 • Section 5.1: Fix typos.

- 1467 • Section 5.2: Made Identify-Printer operation recommended for logical devices,  
1468 required otherwise.
- 1469 • Sections 5.3 and 5.8: Made print-rendering-intent and printer-icc-profiles  
1470 conditionally required for printers that support ICC-based color management.
- 1471 • Section 5.3.6: Clarify pdl-override-supported values and usage.
- 1472 • Section 5.7: Deleted stray "note 7"
- 1473 • Section 9.3: Added ICC attributes here.
- 1474 • Section 14: Reworded for present tense, clarified why WS-Discovery has been  
1475 removed, removed reason for removing OpenXPS and SSDP.

## 1476 **17.8 April 3, 2018**

- 1477 • Make JPEG support conditionally required for color printers.

## 1478 **17.9 February 9, 2018**

- 1479 • Initial v1.1 draft
- 1480 • Updated template
- 1481 • Updated abstract (can't call it a standard in the abstract)
- 1482 • Updated spec references to current versions
- 1483 • Dropped all mention of UPNP, SSDP, WS-Discovery, and OpenXPS (never  
1484 implemented)
- 1485 • Added a new "Overview of Changes" chapter that documents the high-level changes  
1486 since the original IPP Everywhere specification
- 1487 • Now recommend support for the Get-User-Printer-Attributes operation
- 1488 • Now recommend support for the "finishings-col" attributes (PWG 5100.1)
- 1489 • Now recommend support for TLS 1.3
- 1490 • Now recommend using a resource path of /ipp/print or /ipp/print/name in Printer URIs
- 1491 • Issue 11: printer-current-time is now listed as an IPP Everywhere attribute, although  
1492 only RECOMMENDED since it was missing in the 1.0 spec. (all of the date-time

- 1493 attributes were previously required, so printer-current-time would have implicitly been  
1494 required)
- 1495 • Issue 12: The reference to PWG 5100.12 has been corrected
  - 1496 • Issue 13: The reference to the EXIF specification has been updated.
  - 1497 • Issue 13: The reference to PWG 5101.1 has been updated.
  - 1498 • Issue 14: Clarified the pdl-override-supported requirements ('attempted' or  
1499 'guaranteed')
  - 1500 • Issue 15: Clarified that relative URIs ("//ipp/print") are not allowed in IPP.
  - 1501 • Issue 26: "job-preferred-attributes-supported" should have been "preferred-  
1502 attributes-supported"
  - 1503 • Issue 31: Incorrect references to PWG 5101.2 have been changed to PWG 5101.1  
1504 (MSN)
  - 1505 • Issue 33: The notes concerning IPP/2.x conformance changes were confusing and  
1506 have been removed
  - 1507 • Issue 34: Table 6: overrides-supported now correctly references "note 2"  
1508 (conditionally required).
  - 1509 • Issue 35: overrides-supported.document-numbers is now **CONDITIONALLY**  
1510 **REQUIRED**
  - 1511 • Fixed attribute examples to use PAPI encoding
  - 1512 • Fixed notes concerning "copies" to indicate that support is required for JPEG and  
1513 PDF documents
  - 1514 • Separated Printer Status attributes from Printer Description
  - 1515 • Separated Job Status attributes from Job Description