



The Printer Working Group

September 26, 2018
Working Draft

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IPP Everywhere™ v1.1

Status: Prototype

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>

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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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196 **1. Introduction**

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

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

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

209 **2. Terminology**

210 **2.1 Printing Terminology**

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

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

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

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

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

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

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

225 **2.2 Protocol Role Terminology**

226 This document also defines the following protocol roles to specify unambiguous
227 conformance requirements:

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

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

233 **2.3 Other Terminology**

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

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

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

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

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

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

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

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

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

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

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

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

259 **2.4 Acronyms and Organizations**

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

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

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

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

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

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

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

268

269 **3. Requirements**

270 **3.1 Rationale**

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

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

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

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

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

288 The IPP URL Scheme [RFC3510] defines the 'ipp' URI scheme and the IPP over HTTPS
289 Transport Binding and 'ipps' URI Scheme [RFC7472] defines the 'ipps' URI scheme used
290 for IPP.

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

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

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

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

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

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

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

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

313 **3.2 Use Cases**

314 **3.2.1 Select Printer**

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

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

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

324 **3.2.1.1 Select the Last Used Printer**

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

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

331 **3.2.1.2 Select Printer Using Name or Address**

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

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

338 **3.2.1.3 Select Printer Using URI**

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

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

343 **3.2.1.4 Select Printer Using a Directory Service**

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

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

350 **3.2.1.5 Select Printer Using a Cloud Service**

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

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

357 **3.2.1.6 Select Printer Using a Discovery Protocol**

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

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

364 **3.2.1.7 Select Printer Using Geo-Location**

365 The Client initiates Enumeration of Printers within a geographic area using Services and/or
366 Discovery Protocols, hiding duplicate Printers that are reported by multiple Service and/or

367 Discovery Protocols. The Client User Interface asks Jane to select one of the Printers.
368 Finally, she selects a Printer.

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

371 **3.2.1.8 Select Printer Using Out of Band Method**

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

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

378 **3.2.1.9 Select Printer Using Properties**

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

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

390 **3.2.2 Print**

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

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

399 **3.2.2.1 Print a Document**

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

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

406 **3.2.2.2 Print a Document by Reference**

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

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

413 **3.2.2.3 Print Using Loaded Media**

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

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

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

425 **3.2.2.4 Print a Secure Form**

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

430 The treasurer loads check blanks into the Printer and configured the loaded media as
431 necessary at the Printer. After he initiates a print action from the accounting program,
432 selects a Printer for printing, and selects checks to be printed, the Client User Interface
433 displays a preview of the printed checks and he confirms that the checks are correctly
434 paginated and oriented and the amounts, payees and signature are correct. The Client
435 automatically selects the check blank media. The treasurer selects additional processing
436 intent for the Job and confirms the print action. The Client sends a print job request to the
437 Printer with the Job Ticket and document data containing the check information, correctly

438 oriented for the check blank media. He waits for the checks to be printed and removes any
439 excess media from the Printer.

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

443 **3.2.2.5 Print with Special Formatting**

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

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

456 **3.2.2.6 Print and Select at Printer**

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

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

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

468 **3.2.2.7 Print to a Service**

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

474 confirming the print action, John goes to the provider and picks up his presentations, paying
475 with his corporate credit card.

476 **3.2.2.8 Print to a Recipient**

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

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

484 **3.2.2.9 Print with a Proof Copy**

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

491 **3.2.3 Exceptions**

492 **3.2.3.1 Print Action Canceled**

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

496 **3.2.3.2 Select Printer Canceled**

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

499 **3.2.3.3 Printer No Longer Network Accessible after Selection**

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

503 **3.2.3.4 Not Authorized**

504 After confirming the print request, the Printer responds that the User is not authorized to
505 print the Job document(s). The reason for the authorization failure may involve general

506 access to the Printer, Job document(s), or disallowed Job Ticket values, for example a User
507 may not be allowed to print in color.

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

510 **3.2.3.5 Needs Authentication**

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

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

515 **3.2.3.6 Not Accepting Jobs**

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

518 **3.2.3.7 Job Ticket or Document Format Not Supported**

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

522 **3.2.3.8 Job or Document Processing Failures**

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

527 **3.2.3.9 Printer Fault**

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

531 **3.2.3.10 Printer Warning**

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

535 **3.3 Out of Scope**

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

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

544 **3.4 Design Requirements**

545 The IPP Everywhere™ design should:

- 546 1. Define conformance profiles that reference the IPP/2.0 versions [PWG5100.12];
547 2. Follow the naming conventions defined in the Internet Printing Protocol/1.1
548 [STD92], including keyword value case (lower) and hyphenation requirements;
549 3. Define conformance requirements for both Printers and Clients; and
550 4. Support printing with vendor-neutral Client software from any Client to any
551 Printer using a variety of discovery protocols, IPP for the transport, and
552 standard document formats.
553

554 **4. Discovery Protocols**

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

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

560 **4.1 Printer Description Attributes Used in Discovery**

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

563 **4.2 DNS Service Discovery (DNS-SD)**

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

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

571 **4.2.1 Service (SRV) Instance Name**

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

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

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

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

580 **4.2.2 Geo-Location (LOC)**

581 Printers **MUST** publish LOC records [RFC1876] over mDNS to provide the physical location
582 of the Printer. Printers **MUST** allow the User to configure the geo-location manually. If the
583 accuracy of the geo-location is unknown, a value of 9×10^9 meters (0x99) **MUST** be used.
584

585

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

586 Note 1: Extension attribute to RFC 7612.

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

588 **4.2.3 Text (TXT)**

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

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

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

598 For example, the IPP "printer-more-info" attribute has a maximum length of 1023 octets,
 599 however the corresponding "adminurl" key cannot represent a value longer than 246 octets
 600 (255 - 9 octets for "adminurl="). Printers MUST truncate long strings as described in section
 601 13.

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

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

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

Most Important Access Keys	Identification Keys	Capability Keys	Least Important Keys
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	

607 Clients MUST ignore incomplete key/value pairs at the end of a truncated TXT record.
 608

609

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)

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

611 4.2.3.1 air

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

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

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

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

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

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

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

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

631 **4.2.3.2 pdl**

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

638 **4.2.3.3 qtotal**

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

648 4.2.3.4 TLS

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

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

653 '1.0'; TLS 1.0 [RFC2246] encryption is supported. This is equivalent to the value 'tls'
654 for the "uri-security-supported" Printer Description attribute.

655 '1.1'; TLS 1.1 [RFC4346] encryption is supported. This is equivalent to the value 'tls'
656 for the "uri-security-supported" Printer Description attribute.

657 '1.2'; TLS 1.2 [RFC5246] encryption is supported. This is equivalent to the value 'tls'
658 for the "uri-security-supported" Printer Description attribute.

659 '1.3'; TLS 1.3 [RFC-TLS1.3] encryption is supported. This is equivalent to the value
660 'tls' for the "uri-security-supported" Printer Description attribute.

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

664 4.2.3.5 UUID

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

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

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

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

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

673 4.2.3.6 DUUID

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

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

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

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

680 **4.3 LDAP and SLP Discovery**

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

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

686 For example, the IPP "printer-device-id" attribute has a maximum length of 1023 octets,
687 however the corresponding LDAP "printer-device-id" attribute has a maximum length of 255
688 octets. Printers **MUST** truncate long strings as defined in section 13.
689

690 **5. Protocol Binding**

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

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

695 **5.1 HTTP Features**

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

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

703 **5.1.1 Host**

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

706 **5.1.2 If-Modified-Since, Last-Modified, and 304 Not Modified**

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

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

713 **5.1.3 Cache-Control**

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

719

720 5.2 IPP Operations

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

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

727 **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

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

729 5.3 IPP Printer Description Attributes

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

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

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

Attribute	Reference
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

733

734

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

735

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

736

737

Note 3: CONDITIONALLY REQUIRED for Printers with finishers.

738

739

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

740

741

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

742

743

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

744

745

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

746

747

Note 8: CONDITIONALLY REQUIRED for Printers that support ICC-based color management.

748

749

5.3.1 media-col-database (1setOf collection)

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751

752

753

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

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

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

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

```
771     media-col-database=..., {  
772         media-size={  
773             x-dimension=20320-152400  
774             y-dimension=1524-9144000 } , ...
```

775 5.3.2 media-col-ready (1setOf collection)

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

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

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

792 **5.3.3 media-ready (1setOf (type3 keyword | name(MAX)))**

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

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

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

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

812 **5.3.4 media-size-supported (1setOf collection)**

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

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

```
821     media-size-supported=..., {  
822         x-dimension=5000-33020  
823         y-dimension=5000-48260 },...
```

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

```
830     media-size-supported=..., {  
831         x-dimension=20320-152400  
832         y-dimension=1524-9144000 },...
```

833 **5.3.5 media-supported (1setOf (type3 keyword | name(MAX)))**

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

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

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

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

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

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

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

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

859 **5.3.6 pdl-override-supported (type2 keyword)**

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

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

866 **5.4 IPP Printer Status Attributes**

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

869 **Table 6 - IPP Everywhere™ Printer Status Attributes**

Attribute	Reference
pages-per-minute	RFC 8011
pages-per-minute-color	RFC 8011
printer-alert	PWG 5100.9
printer-alert-description	PWG 5100.9
printer-config-change-date-time	PWG 5100.13
printer-config-change-time	PWG 5100.13
printer-is-accepting-jobs	RFC 8011
printer-more-info (note 1)	RFC 8011
printer-state	RFC 8011
printer-state-change-date-time	RFC 3995
printer-state-change-time	RFC 3995
printer-state-message	RFC 8011
printer-state-reasons	RFC 8011
printer-strings-languages-supported (note 2)	PWG 5100.13
printer-strings-uri (notes 1 and 2)	PWG 5100.13
printer-supply	PWG 5100.13
printer-supply-description	PWG 5100.13
printer-supply-info-uri (note 1)	PWG 5100.13
printer-up-time	RFC 8011
printer-uri-supported (note 1)	RFC 8011
printer-uuid	PWG 5100.13
pwg-raster-document-resolution-supported	PWG 5102.4
pwg-raster-document-sheet-back	PWG 5102.4
pwg-raster-document-type-supported	PWG 5102.4
queued-job-count	RFC 8011

870
871 Note 1: URIs MUST be absolute, SHOULD use the Host value (including port
872 number) from the HTTP Host header (section 5.1.1), and MUST NOT use link-local
873 addresses (section 8.4).
874 Note 2: RECOMMENDED due to its omission from IPP Everywhere™ 1.0, however
875 it is needed for the underlying functionality.

876 **5.4.1 printer-uri-supported (1setOf uri)**

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

880 **5.5 IPP Operation Attributes**

881 Table 7 lists the REQUIRED operation attributes for an IPP Everywhere™ Printer.

882 **Table 7 - IPP Everywhere™ Required Operation Attributes**

Attribute	Reference
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

883
884 Note 1: CONDITIONALLY REQUIRED for Printers that support the "application/pdf"
885 MIME media type.

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

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

890

891 5.6 IPP Job Description Attributes

892 Table 8 lists the REQUIRED Job Description attributes for an IPP Everywhere™ Printer.

893 **Table 8 - IPP Everywhere™ Required Job Description Attributes**

Attribute	Source
job-name	RFC 8011

894 5.7 IPP Job Status Attributes

895 Table 8 lists the REQUIRED Job Status attributes for an IPP Everywhere™ Printer.

896 **Table 9 - IPP Everywhere™ Required Job Status Attributes**

Attribute	Source
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

897
 898 Note 1: URIs MUST be absolute, SHOULD use the Host value from HTTP header
 899 (section 5.1.1), and MUST NOT use link-local addresses (section 8.4).

900 5.7.1 job-id (integer)

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

906 5.7.2 job-uri (uri)

907 The REQUIRED "job-uri" Job Description attribute contains the absolute URI of the Job. In
 908 order to support reliable job submission and management, Printers MUST NOT reuse

909 "job-uri" values since the Printer was last powered up and SHOULD NOT reuse "job-uri"
 910 values for the life of the Printer as described in section 3.1.2.3.9 of the Internet Printing
 911 Protocol/1.1: Implementer's Guide [RFC3196]. In addition, the "job-uri" value SHOULD be
 912 derived from the "job-id" value as described in the IPP URL Scheme [RFC3510].

913 5.8 IPP Job Template Attributes

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

916 **Table 10 - IPP Everywhere™ Job Template Attributes**

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

917
 918 Note 1: CONDITIONALLY REQUIRED for Printers that implement paid imaging
 919 services.

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

921 Note 3: CONDITIONALLY REQUIRED for Printers that support the "application/pdf"
 922 MIME media type.

923 Note 4: CONDITIONALLY REQUIRED for Printers with finishers.

924 Note 5: CONDITIONALLY REQUIRED for Printers that support long-edge feed
925 media.
926 Note 6: CONDITIONALLY REQUIRED for Printers that support multiple-Document
927 Jobs.
928 Note 7: CONDITIONALLY REQUIRED for Printers that support ICC-based color
929 management.

930 **6. Document Formats**

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

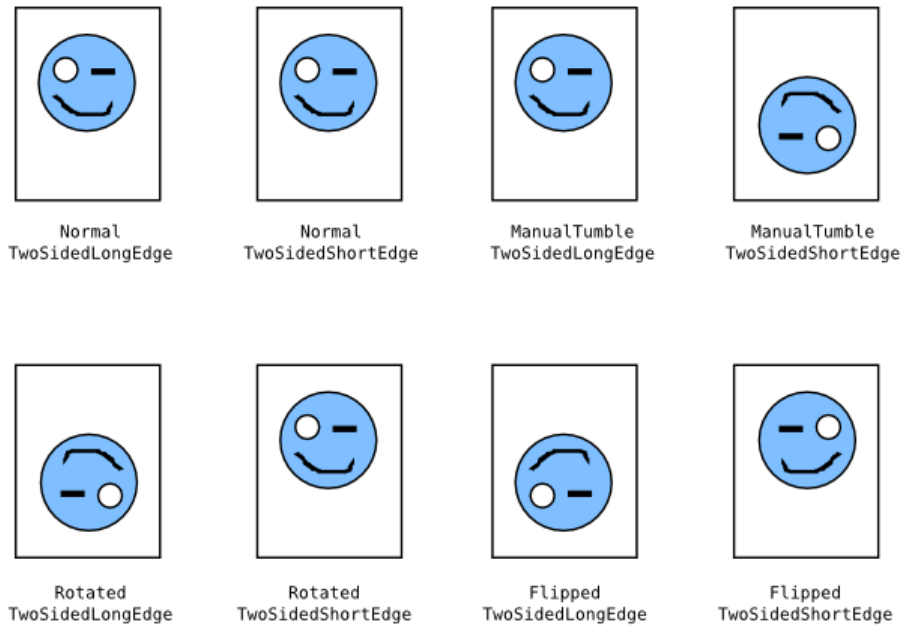
937 IPP/2.1 and IPP/2.2 Printers MUST and IPP/2.0 Printers SHOULD support documents
938 conforming to Document management — Portable document format — Part 1: PDF 1.7
939 [ISO32000] ("application/pdf"). IPP/2.0, IPP/2.1, and IPP/2.2 Printers are defined in
940 [PWG5100.12].

941 **6.1 Supporting Long-Edge Feed Media with PWG Raster Format** 942 **Documents**

943 Printers that support long-edge feed media MUST support the "feed-orientation" Job
944 Template attribute and corresponding "feed-orientation-default" and "feed-orientation-
945 supported" Printer attributes. In addition, Printers that support long-edge feed media MUST
946 report the "media-source-properties" member attribute in the "media-col-database" and
947 "media-col-ready" Printer attributes.

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

952 Figures 2 through 5 show how raster data must be formatted for each feed orientation.
953

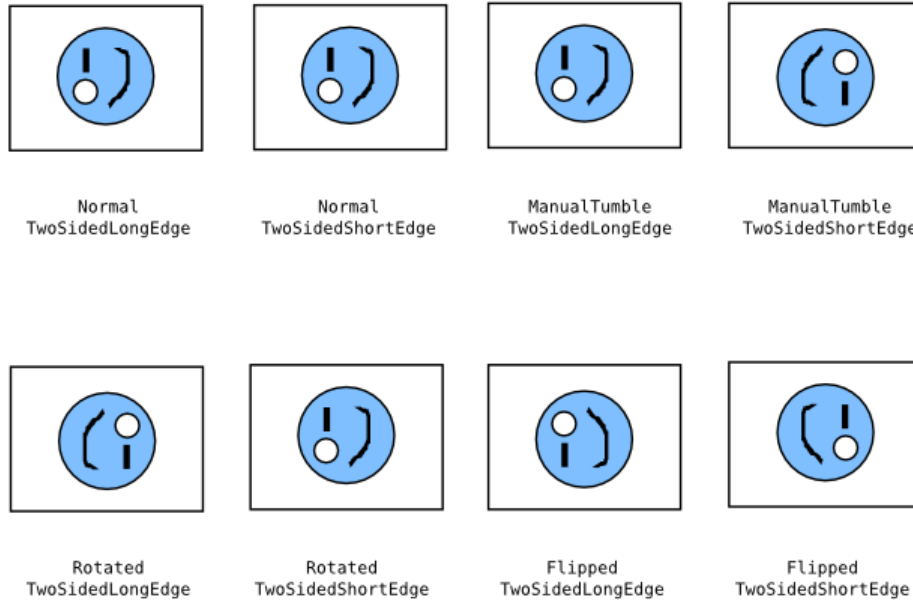


954

955

Figure 1 - PWG Raster Bitmaps with Portrait Feed Orientation

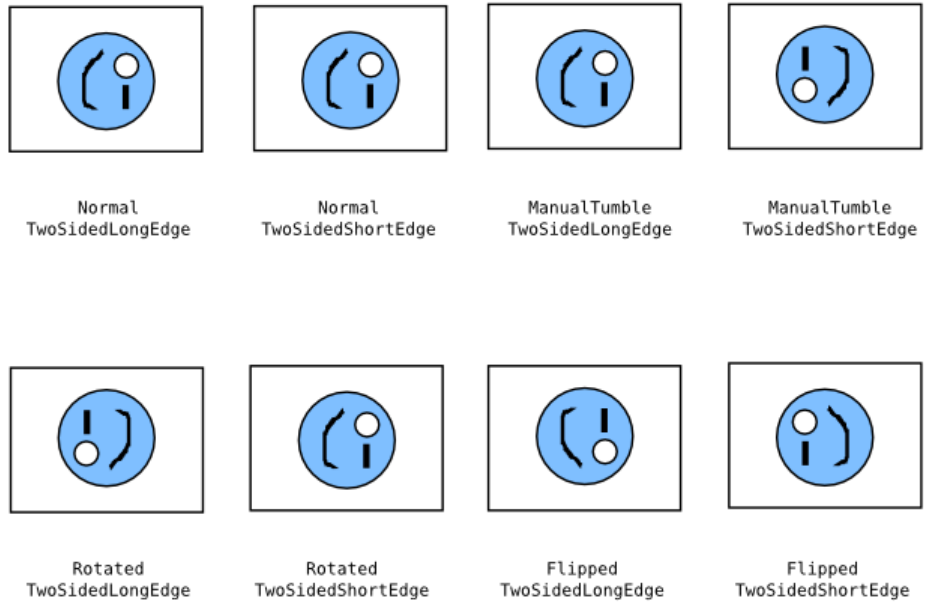
956



957

958

Figure 2 - PWG Raster Bitmaps with Landscape Feed Orientation

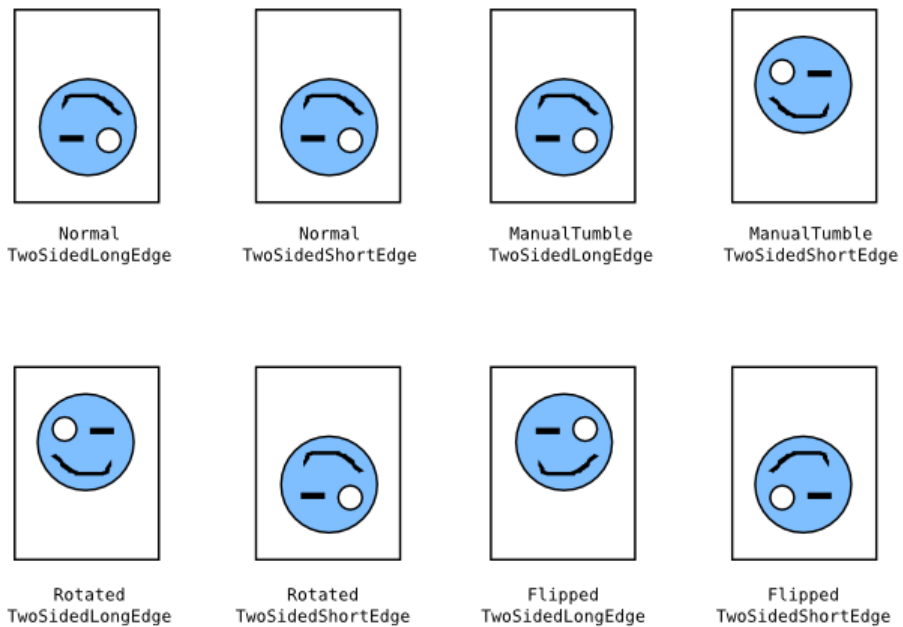


959

960

Figure 3 - PWG Raster Bitmaps with Reverse Landscape Feed Orientation

961



962

963

Figure 4 - PWG Raster Bitmaps with Reverse Portrait Feed Orientation

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

965 **7.1 ipp-features-supported (1setOf type2 keyword)**

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

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

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

973 **8.1 nameWithLanguage and nameWithoutLanguage**

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

978 **8.2 naturalLanguage**

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

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

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

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

985 **8.3 textWithLanguage and textWithoutLanguage**

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

989 **8.4 uri**

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

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

996 **9. Conformance Requirements**

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

999 **9.1 Conformance Requirements for Clients**

1000 In order for a Client to claim conformance to this specification a Client MUST support the
1001 following:

- 1002 1. DNS Service Discovery as defined in section 4.2
- 1003 2. IPP/2.0 as defined in section 5
- 1004 3. The REQUIRED operations listed in Table 4
- 1005 4. The REQUIRED Printer Description attributes listed in Table 5
- 1006 5. The REQUIRED operation attributes listed in Table 7
- 1007 6. The REQUIRED Job Template attributes listed in Table 10
- 1008 7. The REQUIRED Job Description attributes listed in Table 8
- 1009 8. The REQUIRED document formats listed in section 5.8
- 1010 9. The "feed-orientation-supported" Printer attribute and "media-source-properties"
1011 member attribute of the "media-col-database" and "media-col-ready" Printer
1012 attributes as reported by the Printer and defined in section 6.1
- 1013 10. The internationalization considerations as defined in section 10
- 1014 11. The security considerations as defined in section 0

1015 **9.2 Conformance Requirements for Printers**

1016 In order for a Printer to claim conformance to this specification a Printer 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 7
- 1023 6. The REQUIRED Job Template attributes listed in Table 10
- 1024 7. The REQUIRED Job Description attributes listed in Table 8
- 1025 8. The REQUIRED document formats listed in section 5.8
- 1026 9. The 'ipp-everywhere' value for the "ipp-features-supported" Printer Description
1027 attribute as defined in section 7.1

- 1028 10. The additional semantics for attribute values as defined in section 8
1029 11. The internationalization considerations as defined in section 10
1030 12. The security considerations as defined in section 0
1031 13. The safe string truncation rules as defined in section 13

1032 **9.3 Conditional Conformance Requirements for Printers**

1033 Printers that support the "image/jpeg" [JFIF] MIME media type MUST support:

- 1034 1. The "copies-default", and "copies-supported" Printer Description attributes as
1035 defined in section 5.3.
1036 2. The "copies" Job Template attribute as defined in section 5.8.

1037 Printers that support the "application/pdf" [ISO32000] MIME media type MUST support:

- 1038 1. The "copies-default", "copies-supported", "document-password-supported", and
1039 "page-ranges-supported" Printer Description attributes as defined in section 5.3,
1040 2. The "document-password" Operation attribute as defined in section 5.4, and
1041 3. The "copies", "multiple-document-handling", "overrides", and "page-ranges" Job
1042 Template attributes as defined in section 5.8.

1043 Printers that support the Print to a Recipient use case (section 3.2.2.8) MUST support:

- 1044 1. The "job-password-supported" and "job-password-encryption-supported" Printer
1045 Description attributes as defined in section 5.3, and
1046 2. The "job-password" and "job-password-encryption" Operation attributes as
1047 defined in section 5.4.

1048 Printers that provide Paid Print services MUST support:

- 1049 1. The "job-account-id-default", "job-account-id-supported", "job-accounting-user-
1050 id-default", "job-accounting-user-id-supported", "job-mandatory-attributes-
1051 default", "job-mandatory-attributes-supported", and "printer-mandatory-job-
1052 attributes" Printer Description attributes as defined in section 5.3,
1053 2. The "job-mandatory-attributes" operation attribute as defined in section 5.4, and
1054 3. The "job-account-id" and "job-accounting-user-id" Job Template attributes as
1055 defined in section 5.8.

1056 Printers that support long-edge feed media MUST support:

- 1057 1. The "feed-orientation-default" and "feed-orientation-supported" Printer
1058 Description attributes as defined in section 5.3.
1059 2. The "media-source-properties" member attribute of the "media-col-database"
1060 and "media-col-ready" Printer Description attributes as defined in section 5.3.
1061 3. The "feed-orientation" Job Template attribute as defined in section 5.8.

1062 Printers that support ICC-based color management MUST support:

- 1063 4. The "print-rendering-intent-default", "print-rendering-intent-supported", and
1064 "printer-icc-profiles" Printer Description attributes as defined in section 5.3.
1065 5. The "print-render-intent" Job Template attribute as defined in section 5.8.

1066 **10. Internationalization Considerations**

1067 For interoperability and basic support for multiple languages, conforming implementations
1068 MUST support:

- 1069 1. The Universal Character Set (UCS) Transformation Format -- 8 bit (UTF-8)
1070 [STD63] encoding of Unicode [UNICODE] [ISO10646]; and
1071 2. The Unicode Format for Network Interchange [RFC5198] which requires
1072 transmission of well-formed UTF-8 strings and recommends transmission of
1073 normalized UTF-8 strings in Normalization Form C (NFC) [UAX15].

1074 Unicode NFC is defined as the result of performing Canonical Decomposition (into base
1075 characters and combining marks) followed by Canonical Composition (into canonical
1076 composed characters wherever Unicode has assigned them).

1077 WARNING – Performing normalization on UTF-8 strings received from Clients and
1078 subsequently storing the results (e.g., in Job objects) could cause false negatives in Client
1079 searches and failed access (e.g., to Printers with percent-encoded UTF-8 URIs now
1080 'hidden').

1081 Implementations of this specification SHOULD conform to the following standards on
1082 processing of human-readable Unicode text strings, see:

1083 Unicode Bidirectional Algorithm [UAX9] – left-to-right, right-to-left, and vertical

1084 Unicode Line Breaking Algorithm [UAX14] – character classes and wrapping

1085 Unicode Normalization Forms [UAX15] – especially NFC for [RFC5198]

1086 Unicode Text Segmentation [UAX29] – grapheme clusters, words, sentences

1087 Unicode Identifier and Pattern Syntax [UAX31] – identifier use and normalization

1088 Unicode Collation Algorithm [UTS10] – sorting

1089 Unicode Locale Data Markup Language [UTS35] – locale databases

1090 Implementations of this specification are advised to also review the following informational
1091 documents on processing of human-readable Unicode text strings:

1092 Unicode Character Encoding Model [UTR17] – multi-layer character model

1093 Unicode Character Property Model [UTR23] – character properties

1094 Unicode Conformance Model [UTR33] – Unicode conformance basis

1095 **11. Security Considerations**

1096 The IPP extensions defined in this document require the same security considerations as
1097 defined in the Internet Printing Protocol/1.1 [STD92]. In addition, Printers MUST validate
1098 the HTTP Host request header in order to protect against DNS rebinding attacks.

1099 Implementations of this specification SHOULD conform to the following standard on
1100 processing of human-readable Unicode text strings, see:

1101 Unicode Security Mechanisms [UTS39] – detecting and avoiding security attacks

1102 Implementations of this specification are advised to also review the following
1103 informational document on processing of human-readable Unicode text strings:

1104 Unicode Security FAQ [UNISECFAQ] – common Unicode security issues

1105 **12. IANA Considerations**

1106 **12.1 Attribute Value Registrations**

1107 The keyword attribute values defined in this document will be published by IANA according
1108 to the procedures in the Internet Printing Protocol/1.1 [STD92] in the following file:

1109 <http://www.iana.org/assignments/ipp-registrations>

1110 The registry entries will contain the following information:

1111	Attributes (attribute syntax)	
1112	Keyword Attribute Value	Reference
1113	-----	-----
1114	ipp-features-supported (1setOf type2 keyword)	[PWG5100.13]
1115	ipp-everywhere	[PWG5100.14]

1116 **13. Safe String Truncation**

1117 Strings can be truncated or omitted when transferred over alternate protocols. Printers
1118 MUST truncate long strings at logical boundaries. The following subsections describe how
1119 this truncation is performed for different kinds of strings.

1120 **13.1 Plain Text Strings**

1121 Plain text strings MUST be truncated at the end of a valid character sequence. For example,
1122 strings using the UTF-8 transformation format of ISO 10646 [STD0063] [ISO10646-1]
1123 SHOULD be represented using the Unicode Format for Network Interchange [RFC5198]
1124 and MUST be truncated at the end of a valid UTF-8 sequence.

1125 For example, the 9 octet UTF-8 sequence 0x48.65.CA.81.6C.6C.6F.C2.81 (Héllö;) would
1126 be shortened to fit within 6 octets by composing the é (0x65.CA.81 becomes 0xC3.A9) and
1127 removing the trailing UTF-8 sequence 0xC2.81 (;), resulting in the 6 octet UTF-8 sequence
1128 0x48.C3.A9.6C.6C.6F (Héllö).

1129 **13.2 URIs**

1130 URIs MUST be truncated so that the URI remains valid and accepted by the Printer. For
1131 example, the 46 octet URI "ipp://printer.example.com/ipp/really-long-name" might be
1132 shortened to fit within 32 octets by removing the last path name component, resulting in the
1133 29 octet URI "ipp://printer.example.com/ipp". Similarly, the 52 octet URI
1134 "ipp://printer.example.com/ipp?query-string" might be shortened to fit within 32 octets by
1135 removing the query string.

1136 As recommended by the Uniform Resource Identifier (URI): Generic Syntax [STD66],
1137 Printers SHOULD omit the port number from the URI when it has the default value, e.g., 80
1138 for "http", 443 for "https", and 631 for "ipp" and "ipps" URIs.

1139 **13.3 MIME Media Types**

1140 MIME media type strings MUST be truncated at the end of the media subtype, removing
1141 any parameters that are included with the media type. If the resulting string still exceeds the
1142 maximum length it MUST be discarded. For example, the 24 octet MIME media type
1143 "text/plain;charset=utf-8" would be shortened to fit within 16 octets by removing the trailing
1144 parameter, resulting in the 10 octet MIME media type "text/plain".

1145 **13.4 Delimited Lists**

1146 Delimited Lists combine one or more string types listed in the previous sections, separated
1147 by a delimiting character such as a comma or semicolon. Delimited lists MUST first be
1148 shortened by removal of unnecessary path components (URIs) and parameters (MIME
1149 media types) and second truncated at a delimiting character. For example, the 40 octet list
1150 of MIME media types "text/plain;charset=utf-8,application/pdf" would be shortened to fit
1151 within 32 octets by removing the MIME media type parameter, resulting in the 26 octet list
1152 "text/plain,application/pdf". The same list would be shortened to fit within 16 octets by also
1153 removing the last MIME media type, resulting in the 10 octet list "text/plain".

1154 **14. Overview of Changes**

1155 **14.1 IPP Everywhere™ v1.1**

1156 The following changes were made to PWG 5100.14-2013: IPP Everywhere [PWG5100.14]:

- 1157 • References now point to the current versions of dependent documents and
1158 specifications at the time of publication;
- 1159 • Requirements for WS-Discovery have been removed due to a lack of
1160 implementations, which effectively made WS-Discovery support OPTIONAL;
- 1161 • References to OpenXPS and SSDP have been removed;
- 1162 • The "printer-device-id" Printer Description attribute and associated DNS-SD TXT
1163 record keys are no longer required;
- 1164 • DNS-SD is now RECOMMENDED for Printers representing Logical Devices (print
1165 servers);
- 1166 • ICC attributes are now CONDITIONALLY REQUIRED for printers that support ICC-
1167 based color management;
- 1168 • JPEG support is now CONDITIONALLY REQUIRED for color printers;
- 1169 • The "compression-supplied", "document-format-supplied", "document-format-
1170 version", "document-format-version-supplied", "document-name-supplied" attributes
1171 are no longer required;
- 1172 • IPP Finishings 2.1 and the "finishings-col" Job Template attribute are now
1173 RECOMMENDED;
- 1174 • The "printer-strings-languages-supported" and "printer-strings-uri" Printer Status
1175 attributes are now RECOMMENDED to support localization; and
- 1176 • Printer Status and Job Status attributes are now listed in a separate section to match
1177 STD 92 and the IANA IPP registry.
1178

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1361

1362 **16. Authors' Addresses**

1363 Primary authors:

1364 Michael Sweet
1365 Apple Inc.
1366 One Apple Park Way
1367 MS 111-HOMC
1368 Cupertino CA 95014
1369 USA

1370
1371 Ira McDonald
1372 High North
1373 PO Box 221
1374 Grand Marais, MI 49839

1375 Send comments to the PWG IPP Mailing List:

1376 ipp@pwg.org (subscribers only)

1377 To subscribe, see the PWG web page:

1378 <http://www.pwg.org/>

1379 Implementers of this specification document are encouraged to join the IPP Mailing List in
1380 order to participate in any discussions of clarification issues and review of registration
1381 proposals for additional attributes and values.

1382 The editors would like to especially thank the following individuals who also contributed
1383 significantly to the development of this document:

1384 Andrew Mitchell
1385 Jerry Thrasher - Lexmark
1386 Peter Zehler - Xerox
1387

1388 **17. Change History**

1389 **17.1 September 26, 2018**

- 1390 • Removed the "compression-supplied", "document-format-supplied", "document-
1391 format-version", "document-format-version-supplied", and "document-name-
1392 supplied" attributes from the required attribute lists since the corresponding attributes
1393 are being obsoleted in PWG 5100.7.

1394 **17.2 August 24, 2018**

- 1395 • The current version of the Bonjour Printing Specification is 1.2.1.
- 1396 • Section 4: DNS-SD is now required for physical devices and recommended for
1397 logical devices (print servers)
- 1398 • Section 5.1: Clarified that the use of the Host header value includes the port number.
- 1399 • Section 5.3: Moved printer-more-info to 5.4 Printer Status attributes
- 1400 • Section 5.4: Added RECOMMENDED printer-strings-languages-supported and
1401 printer-strings-uri attributes from JPS3
- 1402 • Section 6: Still recommend JPEG for monochrome printers
- 1403 • Section 8.4: Clarified that we mean IP addresses from DHCP
- 1404 • Section 9.3: Fixed section 5.3 references
- 1405 • Section 10: Dropped UTR20 (now maintained by the W3C, but why do we care about
1406 XML here?)
- 1407 • Section 12.1: Fixed STD 92 reference
- 1408 • Section 14.1: Updated the change list
- 1409 • Section 15.1: Fixed up STD 92 reference, added references to PWG 5100.18 (IPP
1410 INFRA) and RFCs 6749 and 6750 (OAuth 2.0), updated all Unicode references,
1411 dropped UTR20 (which is now maintained by the W3C)

1412 **17.3 July 4, 2018**

- 1413 • Status: Prototype

- 1414 • RFC 8011 is now STD 92
- 1415 • Updated Unicode to 11.0.0.

1416 **17.4 June 6, 2018**

- 1417 • Section 5.7: Fixed cross-reference to Table 10.
- 1418 • Section 14.1: Cleaned up WS-Discovery bullet.
- 1419 • Section 15.2: Updated Bonjour Printing specification reference.

1420 **17.5 April 17, 2018**

- 1421 • Removed all references to 1284 device IDs and associated information.

1422 **17.6 April 16, 2018**

- 1423 • Made sure IPP Everywhere™ consistently has trademark symbol.
- 1424 • Section 1: Drop examples of mobile devices.
- 1425 • Section 4.2.3.4: TLS key required for IPPS.
- 1426 • Section 5.1: Fix typos.
- 1427 • Section 5.2: Made Identify-Printer operation recommended for logical devices,
1428 required otherwise.
- 1429 • Sections 5.3 and 5.8: Made print-rendering-intent and printer-icc-profiles
1430 conditionally required for printers that support ICC-based color management.
- 1431 • Section 5.3.6: Clarify pdl-override-supported values and usage.
- 1432 • Section 5.7: Deleted stray "note 7"
- 1433 • Section 9.3: Added ICC attributes here.
- 1434 • Section 14: Reworded for present tense, clarified why WS-Discovery has been
1435 removed, removed reason for removing OpenXPS and SSDP.

1436 **17.7 April 3, 2018**

- 1437 • Make JPEG support conditionally required for color printers.

1438 17.8 February 9, 2018

- 1439 • Initial v1.1 draft
- 1440 • Updated template
- 1441 • Updated abstract (can't call it a standard in the abstract)
- 1442 • Updated spec references to current versions
- 1443 • Dropped all mention of UPNP, SSDP, WS-Discovery, and OpenXPS (never
1444 implemented)
- 1445 • Added a new "Overview of Changes" chapter that documents the high-level changes
1446 since the original IPP Everywhere specification
- 1447 • Now recommend support for the Get-User-Printer-Attributes operation
- 1448 • Now recommend support for the "finishings-col" attributes (PWG 5100.1)
- 1449 • Now recommend support for TLS 1.3
- 1450 • Now recommend using a resource path of /ipp/print or /ipp/print/name in Printer URIs
- 1451 • Issue 11: printer-current-time is now listed as an IPP Everywhere attribute, although
1452 only RECOMMENDED since it was missing in the 1.0 spec. (all of the date-time
1453 attributes were previously required, so printer-current-time would have implicitly been
1454 required)
- 1455 • Issue 12: The reference to PWG 5100.12 has been corrected
- 1456 • Issue 13: The reference to the EXIF specification has been updated.
- 1457 • Issue 13: The reference to PWG 5101.1 has been updated.
- 1458 • Issue 14: Clarified the pdl-override-supported requirements ('attempted' or
1459 'guaranteed')
- 1460 • Issue 15: Clarified that relative URIs ("//ipp/print") are not allowed in IPP.
- 1461 • Issue 26: "job-preferred-attributes-supported" should have been "preferred-
1462 attributes-supported"
- 1463 • Issue 31: Incorrect references to PWG 5101.2 have been changed to PWG 5101.1
1464 (MSN)

- 1465 • Issue 33: The notes concerning IPP/2.x conformance changes were confusing and
1466 have been removed
- 1467 • Issue 34: Table 6: overrides-supported now correctly references "note 2"
1468 (conditionally required).
- 1469 • Issue 35: overrides-supported.document-numbers is now **CONDITIONALLY**
1470 **REQUIRED**
- 1471 • Fixed attribute examples to use PAPI encoding
- 1472 • Fixed notes concerning "copies" to indicate that support is required for JPEG and
1473 PDF documents
- 1474 • Separated Printer Status attributes from Printer Description
- 1475 • Separated Job Status attributes from Job Description