



The Printer Working Group

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Working Draft

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IPP Everywhere™ v1.1

Status: Interim

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

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

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

This document is available electronically at:

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

81 For additional information regarding the Printer Working Group visit:

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

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193 **1. Introduction**

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

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

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

206 **2. Terminology**

207 **2.1 Printing Terminology**

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

211 *Device*: A Logical or Physical Device associated with one or more Printers; also see section
212 2.3 of [RFC8011].

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

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

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

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

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

223 **2.2 Protocol Role Terminology**

224 This document also defines the following protocol roles to specify unambiguous
225 conformance requirements:

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

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

231 **2.3 Other Terminology**

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

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

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

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

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

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

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

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

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

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

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

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

257 **2.4 Acronyms and Organizations**

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

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

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

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

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

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

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

266

267 **3. Requirements**

268 **3.1 Rationale**

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

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

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

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

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

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

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

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

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

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

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

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

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

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

312 **3.2 Use Cases**

313 **3.2.1 Select Printer**

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

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

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

323 **3.2.1.1 Select the Last Used Printer**

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

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

330 **3.2.1.2 Select Printer Using Name or Address**

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

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

337 **3.2.1.3 Select Printer Using URI**

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

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

342 **3.2.1.4 Select Printer Using a Directory Service**

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

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

349 **3.2.1.5 Select Printer Using a Cloud Service**

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

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

356 **3.2.1.6 Select Printer Using a Discovery Protocol**

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

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

363 3.2.1.7 Select Printer Using Geo-Location

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

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

370 3.2.1.8 Select Printer Using Out of Band Method

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

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

377 3.2.1.9 Select Printer Using Properties

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

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

389 3.2.2 Print

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

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

398 **3.2.2.1 Print a Document**

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

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

405 **3.2.2.2 Print a Document by Reference**

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

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

412 **3.2.2.3 Print Using Loaded Media**

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

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

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

424 **3.2.2.4 Print a Secure Form**

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

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

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

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

442 **3.2.2.5 Print with Special Formatting**

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

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

455 **3.2.2.6 Print and Select at Printer**

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

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

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

467 3.2.2.7 Print to a Service

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

475 3.2.2.8 Print to a Recipient

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

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

483 3.2.2.9 Print with a Proof Copy

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

490 3.2.3 Exceptions**491 3.2.3.1 Print Action Canceled**

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

495 3.2.3.2 Select Printer Canceled

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

498 3.2.3.3 Printer No Longer Network Accessible after Selection

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

502 3.2.3.4 Not Authorized

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

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

509 3.2.3.5 Needs Authentication

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

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

514 3.2.3.6 Not Accepting Jobs

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

517 3.2.3.7 Job Ticket or Document Format Not Supported

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

521 3.2.3.8 Job or Document Processing Failures

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

526 3.2.3.9 Printer Fault

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

530 **3.2.3.10 Printer Warning**

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

534 **3.3 Out of Scope**

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

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

543 **3.4 Design Requirements**

544 The IPP Everywhere™ design should:

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

552

553 **4. Discovery Protocols**

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

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

558 **4.1 Printer Description Attributes Used in Discovery**

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

561 **4.2 DNS Service Discovery (DNS-SD)**

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

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

568 **4.2.1 Service (SRV) Instance Name**

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

571 Printers **MUST** advertise the "_ipp._tcp" (generic IPP) and "_print._sub._ipp._tcp" (IPP
572 Everywhere™) services over mDNS.

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

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

577 **4.2.2 Geo-Location (LOC)**

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

582

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

583 Note 1: Extension attribute to RFC 7612.

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

585 **4.2.3 Text (TXT)**

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

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

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

595 For example, the IPP "printer-more-info" attribute has a maximum length of 1023 octets,
 596 however the corresponding "adminurl" key cannot represent a value longer than 246 octets
 597 (255 - 9 octets for "adminurl="). Printers MUST truncate long strings as described in section
 598 13.

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

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

603 **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	

604 Clients MUST ignore incomplete key/value pairs at the end of a truncated TXT record.
 605

606

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)

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

608 **4.2.3.1 air**

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

611 [CUPSIPP] that extends the "uri-authentication-supported" Printer Description attribute
612 [RFC8011]. The following values are supported:

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

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

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

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

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

625 **4.2.3.2 pdl**

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

632 **4.2.3.3 qtotal**

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

642 **4.2.3.4 TLS**

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

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

647 '1.0'; TLS 1.0 [RFC2246] encryption is supported. This is equivalent to the value 'tls'
648 for the "uri-security-supported" Printer Description attribute.

649 '1.1'; TLS 1.1 [RFC4346] encryption is supported. This is equivalent to the value 'tls'
650 for the "uri-security-supported" Printer Description attribute.

651 '1.2'; TLS 1.2 [RFC5246] encryption is supported. This is equivalent to the value 'tls'
652 for the "uri-security-supported" Printer Description attribute.

653 '1.3'; TLS 1.3 [RFC-TLS1.3] encryption is supported. This is equivalent to the value
654 'tls' for the "uri-security-supported" Printer Description attribute.

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

658 **4.2.3.5 UUID**

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

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

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

664 12345678-9ABC-DEF0-1234-56789ABCDEF0

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

667 **4.2.3.6 DUUID**

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

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

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

673 12345678-9ABC-DEF0-1234-56789ABCDEF0

674 **4.3 LDAP and SLP Discovery**

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

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

680 For example, the IPP "printer-device-id" attribute has a maximum length of 1023 octets,
681 however the corresponding LDAP "printer-device-id" attribute has a maximum length of 255
682 octets. Printers **MUST** truncate long strings as defined in section 13.
683

684 **5. Protocol Binding**

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

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

689 **5.1 HTTP Features**

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

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

697 **5.1.1 Host**

698 Printers **MUST** validate the Host request header and **SHOULD** use the Host value in
699 generated URIs.

700 **5.1.2 If-Modified-Since, Last-Modified, and 304 Not Modified**

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

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

707 **5.1.3 Cache-Control**

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

713

714 **5.2 IPP Operations**

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

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

721 **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

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

723 **5.3 IPP Printer Description Attributes**

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

726 **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-more-info (note 6)	RFC 8011
printer-name	RFC 8011
printer-organization	PWG 5100.13
printer-organizational-unit	PWG 5100.13
printer-resolution-default	RFC 8011
printer-resolution-supported	RFC 8011
pwg-raster-document-resolution-supported	PWG 5102.4
pwg-raster-document-sheet-back	PWG 5102.4
pwg-raster-document-type-supported	PWG 5102.4
sides-default	RFC 8011
sides-supported	RFC 8011
uri-security-supported	RFC 8011
uri-authentication-supported	RFC 8011
which-jobs-supported	PWG 5100.11

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728

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

729

730

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

731

Note 3: CONDITIONALLY REQUIRED for Printers with finishers.

732

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

733

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

735

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

737

738

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

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

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742

5.3.1 media-col-database (1setOf collection)

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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.

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Custom media sizes are described using rangeOfInteger values for the "x-dimension" and "y-dimension" member attributes of the "media-size" member attribute. Dimensions are

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749 provided for sheets in portrait orientation, that is the "x-dimension" ranges refer to the short
750 axis and the "y-dimension" ranges refer to the long axis of the sheet. For example, a Printer
751 supporting sheet media from 50x50mm to 330.2x482.6mm from the by-pass tray could
752 report:

```
753     media-col-database=..., {  
754         media-size={  
755             x-dimension=5000-33020  
756             y-dimension=5000-48260 }  
757         media-source='by-pass-tray' }, ...
```

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

```
764     media-col-database=..., {  
765         media-size={  
766             x-dimension=20320-152400  
767             y-dimension=1524-9144000 }, ...
```

768 5.3.2 media-col-ready (1setOf collection)

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

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

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

785 5.3.3 media-ready (1setOf (type3 keyword | name(MAX)))

786 The REQUIRED "media-ready" Printer attribute lists the loaded media for a Printer. In
787 addition to the requirements set forth in Internet Printing Protocol/1.1: Model and Semantics

788 [RFC8011], this specification defines how a Printer advertises custom, manually-fed, and
789 roll-fed media in the "media-ready" attribute.

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

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

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

805 **5.3.4 media-size-supported (1setOf collection)**

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

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

```
814     media-size-supported=..., {  
815         x-dimension=5000-33020  
816         y-dimension=5000-48260 },...
```

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

```
823     media-size-supported=..., {  
824         x-dimension=20320-152400  
825         y-dimension=1524-9144000 },...
```

826 5.3.5 media-supported (1setOf (type3 keyword | name(MAX)))

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

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

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

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

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

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

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

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

851 5.3.6 pdl-override-supported (type2 keyword)

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

855 When reporting capabilities for the 'application/pdf', 'image/jpeg', or 'image/pwg-raster'
856 MIME media types, Printers MUST report either 'attempted' [RFC8011] or 'guaranteed'
857 [PWG5100.11] for the "pdl-override-supported" Printer attribute.

858 **5.4 IPP Printer Status Attributes**

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

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

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

862
863 Note 1: URIs MUST be absolute, SHOULD use the Host value from HTTP header
864 (section 5.1.1), and MUST NOT use link-local addresses (section 8.4).

865 **5.4.1 printer-uri-supported (1setOf uri)**

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

869 **5.5 IPP Operation Attributes**

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

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

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

872
873 Note 1: CONDITIONALLY REQUIRED for Printers that support the "application/pdf"
874 MIME media type.
875 Note 2: CONDITIONALLY REQUIRED for Printers that support the Print to a
876 Recipient (section 3.2.2.8) use case.
877 Note 3: CONDITIONALLY REQUIRED for Printers that implement Paid Imaging
878 services.
879

880 5.6 IPP Job Description Attributes

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

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

Attribute	Source
job-name	RFC 8011

883 5.7 IPP Job Status Attributes

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

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

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

886
 887 Note 1: URIs MUST be absolute, SHOULD use the Host value from HTTP header
 888 (section 5.1.1), and MUST NOT use link-local addresses (section 8.4).

889 5.7.1 job-id (integer)

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

895 **5.7.2 job-uri (uri)**

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

902 **5.8 IPP Job Template Attributes**

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

905 **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

906
 907 Note 1: CONDITIONALLY REQUIRED for Printers that implement paid imaging
 908 services.

909 Note 2: REQUIRED for the "application/pdf" and "image/jpeg" MIME media types.
910 Note 3: CONDITIONALLY REQUIRED for Printers that support the "application/pdf"
911 MIME media type.
912 Note 4: CONDITIONALLY REQUIRED for Printers with finishers.
913 Note 5: CONDITIONALLY REQUIRED for Printers that support long-edge feed
914 media.
915 Note 6: CONDITIONALLY REQUIRED for Printers that support multiple-Document
916 Jobs.
917 Note 7: CONDITIONALLY REQUIRED for Printers that support ICC-based color
918 management.

919 **6. Document Formats**

920 Printers MUST support documents conforming to the PWG Raster Format [PWG5102.4]
921 ("image/pwg-raster"). Color Printers MUST support documents conforming to the JPEG File
922 Information Format Version 1.02 [JFIF] ("image/jpeg"), specifically the metadata and JPEG
923 subset defined in the Standard of the Camera & Imaging Products Association, CIPA DC-
924 008-Translation-2016, Exchangeable image file format for digital still cameras: Exif Version
925 2.31 [EXIF].

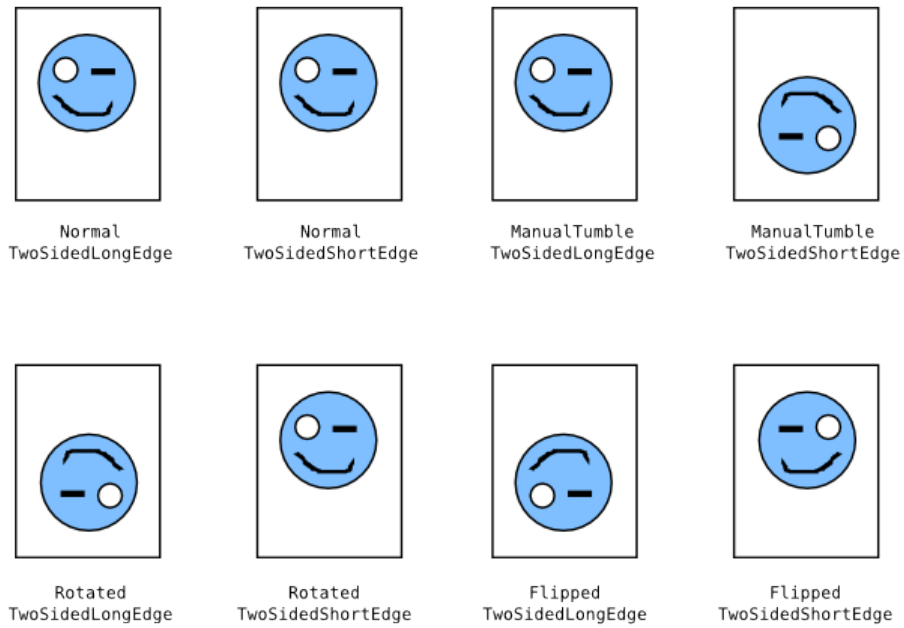
926 IPP/2.1 and IPP/2.2 Printers MUST and IPP/2.0 Printers SHOULD support documents
927 conforming to Document management — Portable document format — Part 1: PDF 1.7
928 [ISO32000] ("application/pdf"). IPP/2.0, IPP/2.1, and IPP/2.2 Printers are defined in
929 [PWG5100.12].

930 **6.1 Supporting Long-Edge Feed Media with PWG Raster Format** 931 **Documents**

932 Printers that support long-edge feed media MUST support the "feed-orientation" Job
933 Template attribute and corresponding "feed-orientation-default" and "feed-orientation-
934 supported" Printer attributes. In addition, Printers that support long-edge feed media MUST
935 report the "media-source-properties" member attribute in the "media-col-database" and
936 "media-col-ready" Printer attributes.

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

941 Figures 2 through 5 show how raster data must be formatted for each feed orientation.
942

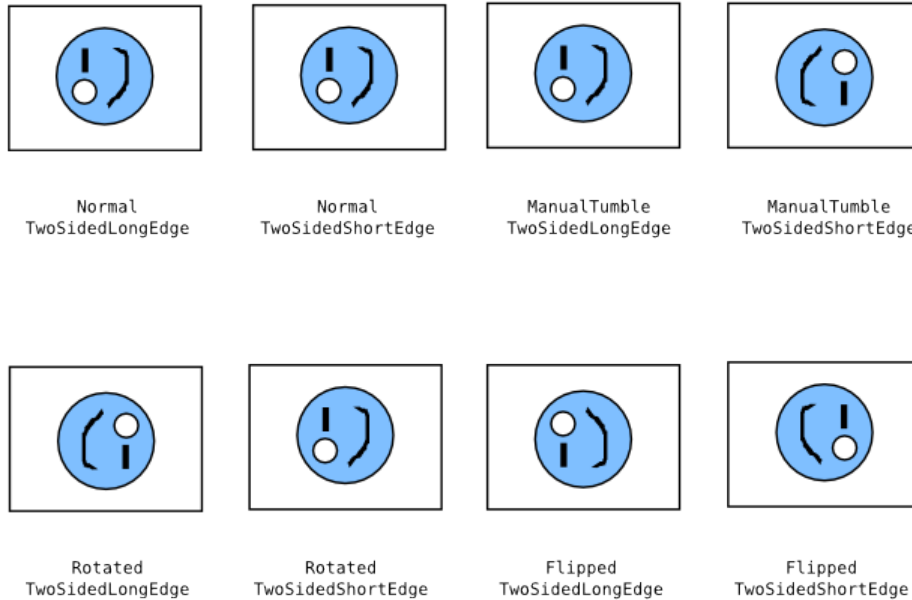


943

944

Figure 1 - PWG Raster Bitmaps with Portrait Feed Orientation

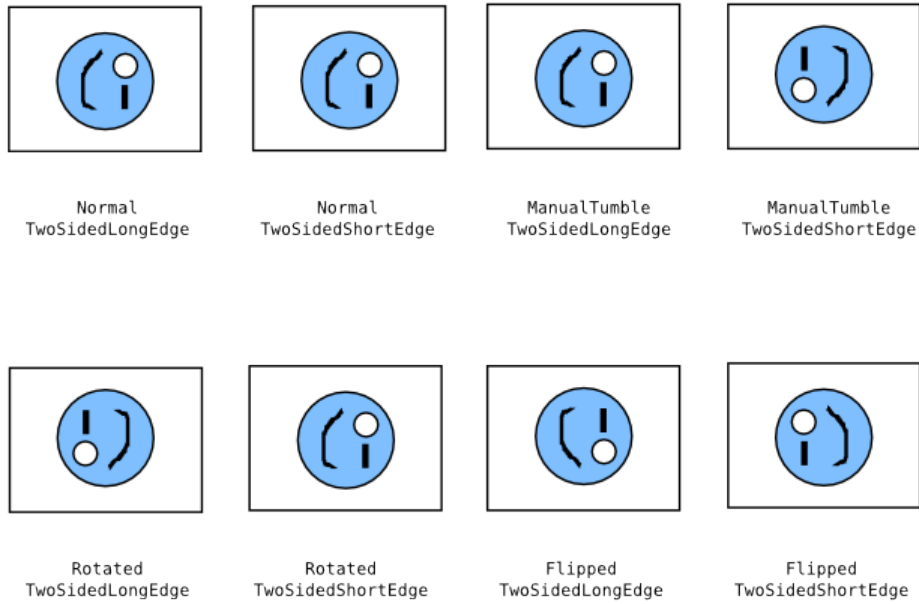
945



946

947

Figure 2 - PWG Raster Bitmaps with Landscape Feed Orientation

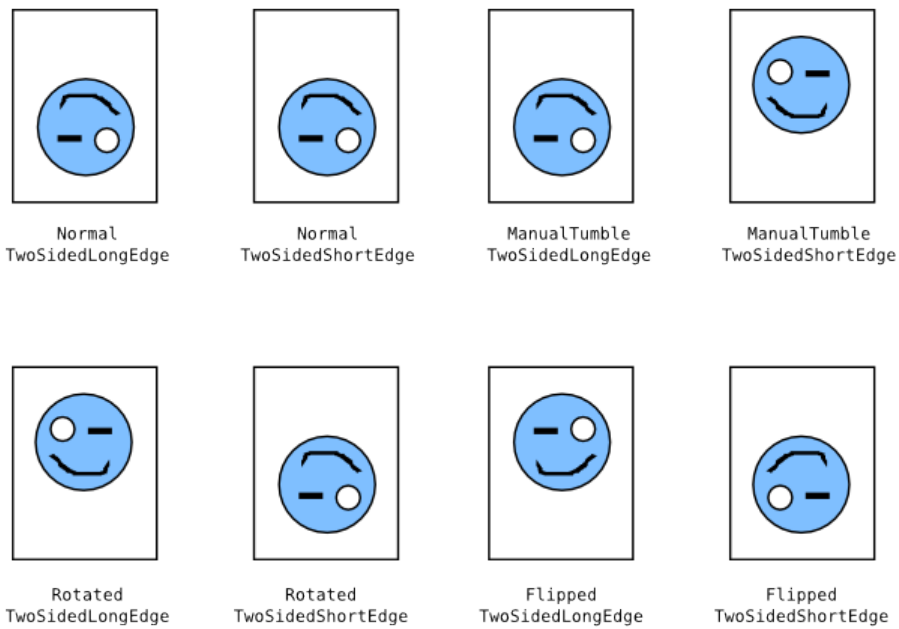


948

949

Figure 3 - PWG Raster Bitmaps with Reverse Landscape Feed Orientation

950



951

952

Figure 4 - PWG Raster Bitmaps with Reverse Portrait Feed Orientation

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

954 **7.1 ipp-features-supported (1setOf type2 keyword)**

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

957

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

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

963 **8.1 nameWithLanguage and nameWithoutLanguage**

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

968 **8.2 naturalLanguage**

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

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

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

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

975 **8.3 textWithLanguage and textWithoutLanguage**

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

979 **8.4 uri**

980 URI values MUST be in absolute form, i.e., "ipp://hostname.local/ipp/print" is acceptable but
981 "//ipp/print" is not. URI values MUST NOT contain link-local addresses in the host field.
982 Printers MUST NOT generate URI values with link-local addresses and SHOULD NOT
983 generate URI values with addresses obtained via Dynamic Host Control Protocol (DHCP)
984 [RFC2131] or other auto-configuration protocols. Printers SHOULD use the HTTP Host:
985 header value when generating URIs for use in Client responses.
986

987 **9. Conformance Requirements**

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

990 **9.1 Conformance Requirements for Clients**

991 In order for a Client to claim conformance to this specification a Client MUST support the
992 following:

- 993 1. DNS Service Discovery as defined in section 4.2
- 994 2. IPP/2.0 as defined in section 5
- 995 3. The REQUIRED operations listed in Table 4
- 996 4. The REQUIRED Printer Description attributes listed in Table 5
- 997 5. The REQUIRED operation attributes listed in Table 7
- 998 6. The REQUIRED Job Template attributes listed in Table 10
- 999 7. The REQUIRED Job Description attributes listed in Table 8
- 1000 8. The REQUIRED document formats listed in section 5.8
- 1001 9. The "feed-orientation-supported" Printer attribute and "media-source-properties"
1002 member attribute of the "media-col-database" and "media-col-ready" Printer
1003 attributes as reported by the Printer and defined in section 6.1
- 1004 10. The internationalization considerations as defined in section 10
- 1005 11. The security considerations as defined in section 0

1006 **9.2 Conformance Requirements for Printers**

1007 In order for a Printer to claim conformance to this specification a Printer MUST support the
1008 following:

- 1009 1. DNS Service Discovery as defined in section 4.2
- 1010 2. IPP/2.0 as defined in section 5
- 1011 3. The REQUIRED operations listed in Table 4
- 1012 4. The REQUIRED Printer Description attributes listed in Table 5
- 1013 5. The REQUIRED operation attributes listed in Table 7
- 1014 6. The REQUIRED Job Template attributes listed in Table 10
- 1015 7. The REQUIRED Job Description attributes listed in Table 8
- 1016 8. The REQUIRED document formats listed in section 5.8
- 1017 9. The 'ipp-everywhere' value for the "ipp-features-supported" Printer Description
1018 attribute as defined in section 7.1
- 1019 10. The additional semantics for attribute values as defined in section 8
- 1020 11. The internationalization considerations as defined in section 10
- 1021 12. The security considerations as defined in section 0
- 1022 13. The safe string truncation rules as defined in section 13

1023 9.3 Conditional Conformance Requirements for Printers

1024 Printers that support the "image/jpeg" [JFIF] MIME media type MUST support:

- 1025 1. The "copies-default", and "copies-supported" Printer Description attributes as
1026 defined in section 0.
- 1027 2. The "copies" Job Template attribute as defined in section 5.8.

1028 Printers that support the "application/pdf" [ISO32000] MIME media type MUST support:

- 1029 1. The "copies-default", "copies-supported", "document-password-supported", and
1030 "page-ranges-supported" Printer Description attributes as defined in section 0,
- 1031 2. The "document-password" Operation attribute as defined in section 5.4, and
- 1032 3. The "copies", "multiple-document-handling", "overrides", and "page-ranges" Job
1033 Template attributes as defined in section 5.8.

1034 Printers that support the Print to a Recipient use case (section 3.2.2.8) MUST support:

- 1035 1. The "job-password-supported" and "job-password-encryption-supported" Printer
1036 Description attributes as defined in section 0, and
- 1037 2. The "job-password" and "job-password-encryption" Operation attributes as
1038 defined in section 5.4.

1039 Printers that provide Paid Print services MUST support:

- 1040 1. The "job-account-id-default", "job-account-id-supported", "job-accounting-user-
1041 id-default", "job-accounting-user-id-supported", "job-mandatory-attributes-
1042 default", "job-mandatory-attributes-supported", and "printer-mandatory-job-
1043 attributes" Printer Description attributes as defined in section 0,
- 1044 2. The "job-mandatory-attributes" operation attribute as defined in section 5.4, and
- 1045 3. The "job-account-id" and "job-accounting-user-id" Job Template attributes as
1046 defined in section 5.8.

1047 Printers that support long-edge feed media MUST support:

- 1048 1. The "feed-orientation-default" and "feed-orientation-supported" Printer
1049 Description attributes as defined in section 0.
- 1050 2. The "media-source-properties" member attribute of the "media-col-database"
1051 and "media-col-ready" Printer Description attributes as defined in section 0.
- 1052 3. The "feed-orientation" Job Template attribute as defined in section 5.8.

1053 Printers that support ICC-based color management MUST support:

- 1054 4. The "print-rendering-intent-default", "print-rendering-intent-supported", and
1055 "printer-icc-profiles" Printer Description attributes as defined in section 5.3.
- 1056 5. The "print-render-intent" Job Template attribute as defined in section 5.8.

1057 **10. Internationalization Considerations**

1058 For interoperability and basic support for multiple languages, conforming implementations
1059 MUST support:

- 1060 1. The Universal Character Set (UCS) Transformation Format -- 8 bit (UTF-8)
1061 [STD63] encoding of Unicode [UNICODE] [ISO10646]; and
- 1062 2. The Unicode Format for Network Interchange [RFC5198] which requires
1063 transmission of well-formed UTF-8 strings and recommends transmission of
1064 normalized UTF-8 strings in Normalization Form C (NFC) [UAX15].

1065 Unicode NFC is defined as the result of performing Canonical Decomposition (into base
1066 characters and combining marks) followed by Canonical Composition (into canonical
1067 composed characters wherever Unicode has assigned them).

1068 WARNING – Performing normalization on UTF-8 strings received from Clients and
1069 subsequently storing the results (e.g., in Job objects) could cause false negatives in Client
1070 searches and failed access (e.g., to Printers with percent-encoded UTF-8 URIs now
1071 'hidden').

1072 Implementations of this specification SHOULD conform to the following standards on
1073 processing of human-readable Unicode text strings, see:

1074 Unicode Bidirectional Algorithm [UAX9] – left-to-right, right-to-left, and vertical

1075 Unicode Line Breaking Algorithm [UAX14] – character classes and wrapping

1076 Unicode Normalization Forms [UAX15] – especially NFC for [RFC5198]

1077 Unicode Text Segmentation [UAX29] – grapheme clusters, words, sentences

1078 Unicode Identifier and Pattern Syntax [UAX31] – identifier use and normalization

1079 Unicode Collation Algorithm [UTS10] – sorting

1080 Unicode Locale Data Markup Language [UTS35] – locale databases

1081 Implementations of this specification are advised to also review the following informational
1082 documents on processing of human-readable Unicode text strings:

1083 Unicode Character Encoding Model [UTR17] – multi-layer character model

1084 Unicode in XML and other Markup Languages [UTR20] – XML usage

1085 Unicode Character Property Model [UTR23] – character properties

1086 Unicode Conformance Model [UTR33] – Unicode conformance basis

1087 **11. Security Considerations**

1088 The IPP extensions defined in this document require the same security considerations as
1089 defined in the IPP/1.1: Model and Semantics [RFC8011]. In addition, Printers MUST
1090 validate the HTTP Host request header in order to protect against DNS rebinding attacks.

1091 Implementations of this specification SHOULD conform to the following standard on
1092 processing of human-readable Unicode text strings, see:

1093 Unicode Security Mechanisms [UTS39] – detecting and avoiding security attacks

1094 Implementations of this specification are advised to also review the following
1095 informational document on processing of human-readable Unicode text strings:

1096 Unicode Security FAQ [UNISECFAQ] – common Unicode security issues

1097

1098

1099 12. IANA Considerations

1100 12.1 Attribute Value Registrations

1101 The keyword attribute values defined in this document will be published by IANA according
 1102 to the procedures in the IPP Model and Semantics [RFC8011] section 7.3 in the following
 1103 file:

1104 <http://www.iana.org/assignments/ipp-registrations>

1105 The registry entries will contain the following information:

1106	Attributes (attribute syntax)	Reference
1107	Keyword Attribute Value	-----
1108	-----	-----
1109	ipp-features-supported (1setOf type2 keyword)	[PWG5100.13]
1110	ipp-everywhere	[PWG5100.14]

1111 13. Safe String Truncation

1112 Strings can be truncated or omitted when transferred over alternate protocols. Printers
 1113 MUST truncate long strings at logical boundaries. The following subsections describe how
 1114 this truncation is performed for different kinds of strings.

1115 13.1 Plain Text Strings

1116 Plain text strings MUST be truncated at the end of a valid character sequence. For example,
 1117 strings using the UTF-8 transformation format of ISO 10646 [STD0063] [ISO10646-1]
 1118 SHOULD be represented using the Unicode Format for Network Interchange [RFC5198]
 1119 and MUST be truncated at the end of a valid UTF-8 sequence.

1120 For example, the 9 octet UTF-8 sequence 0x48.65.CA.81.6C.6C.6F.C2.81 (Héllöj) would
 1121 be shortened to fit within 6 octets by composing the é (0x65.CA.81 becomes 0xC3.A9) and
 1122 removing the trailing UTF-8 sequence 0xC2.81 (j), resulting in the 6 octet UTF-8 sequence
 1123 0x48.C3.A9.6C.6C.6F (Héllö).

1124 13.2 URIs

1125 URIs MUST be truncated so that the URI remains valid and accepted by the Printer. For
 1126 example, the 46 octet URI "ipp://printer.example.com/ipp/really-long-name" might be
 1127 shortened to fit within 32 octets by removing the last path name component, resulting in the
 1128 29 octet URI "ipp://printer.example.com/ipp". Similarly, the 52 octet URI
 1129 "ipp://printer.example.com/ipp?query-string" might be shortened to fit within 32 octets by
 1130 removing the query string.

1131 As recommended by the Uniform Resource Identifier (URI): Generic Syntax [STD66],
1132 Printers SHOULD omit the port number from the URI when it has the default value, e.g., 80
1133 for "http", 443 for "https", and 631 for "ipp" and "ipps" URIs.

1134 **13.3 MIME Media Types**

1135 MIME media type strings MUST be truncated at the end of the media subtype, removing
1136 any parameters that are included with the media type. If the resulting string still exceeds the
1137 maximum length it MUST be discarded. For example, the 24 octet MIME media type
1138 "text/plain;charset=utf-8" would be shortened to fit within 16 octets by removing the trailing
1139 parameter, resulting in the 10 octet MIME media type "text/plain".

1140 **13.4 Delimited Lists**

1141 Delimited Lists combine one or more string types listed in the previous sections, separated
1142 by a delimiting character such as a comma or semicolon. Delimited lists MUST first be
1143 shortened by removal of unnecessary path components (URIs) and parameters (MIME
1144 media types) and second truncated at a delimiting character. For example, the 40 octet list
1145 of MIME media types "text/plain;charset=utf-8,application/pdf" would be shortened to fit
1146 within 32 octets by removing the MIME media type parameter, resulting in the 26 octet list
1147 "text/plain,application/pdf". The same list would be shortened to fit within 16 octets by also
1148 removing the last MIME media type, resulting in the 10 octet list "text/plain".

1149 **14. Overview of Changes**

1150 **14.1 IPP Everywhere™ v1.1**

1151 The following changes were made to PWG 5100.14-2013: IPP Everywhere [PWG5100.14]:

- 1152 • References now point to the current versions of dependent documents and
1153 specifications at the time of publication;
- 1154 • Requirements for WS-Discovery have been removed due to a lack of
1155 implementations, which effectively made WS-Discovery support OPTIONAL;
- 1156 • References to OpenXPS and SSDP have been removed;
- 1157 • The "printer-device-id" Printer Description attribute and associated DNS-SD TXT
1158 record keys are no longer required;
- 1159 • ICC attributes are now CONDITIONALLY REQUIRED for printers that support ICC-
1160 based color management;
- 1161 • JPEG support is now CONDITIONALLY REQUIRED for color printers;

- 1162 • IPP Finishings 2.1 and the "finishings-col" Job Template attribute are now
1163 RECOMMENDED; and
- 1164 • Printer Status and Job Status attributes are now listed in a separate section to match
1165 RFC 8011 and the IANA IPP registry.

1166 15. References

1167 15.1 Normative References

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1368 ipp@pwg.org (subscribers only)

1369 To subscribe, see the PWG web page:

1370 <http://www.pwg.org/>

1371 Implementers of this specification document are encouraged to join the IPP Mailing List in
1372 order to participate in any discussions of clarification issues and review of registration
1373 proposals for additional attributes and values.

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1375 significantly to the development of this document:

1376 Andrew Mitchell
1377 Jerry Thrasher - Lexmark
1378 Peter Zehler - Xerox
1379

1380 **17. Change History**

1381 **17.1 June 6, 2018**

- 1382 • Section 5.7: Fixed cross-reference to Table 10.
- 1383 • Section 14.1: Cleaned up WS-Discovery bullet.
- 1384 • Section 15.2: Updated Bonjour Printing specification reference.

1385 **17.2 April 17, 2018**

- 1386 • Removed all references to 1284 device IDs and associated information.

1387 **17.3 April 16, 2018**

- 1388 • Made sure IPP Everywhere™ consistently has trademark symbol.
- 1389 • Section 1: Drop examples of mobile devices.
- 1390 • Section 4.2.3.4: TLS key required for IPPS.
- 1391 • Section 5.1: Fix typos.
- 1392 • Section 5.2: Made Identify-Printer operation recommended for logical devices,
1393 required otherwise.
- 1394 • Sections 5.3 and 5.8: Made print-rendering-intent and printer-icc-profiles
1395 conditionally required for printers that support ICC-based color management.
- 1396 • Section 5.3.6: Clarify pdl-override-supported values and usage.
- 1397 • Section 5.7: Deleted stray "note 7"
- 1398 • Section 9.3: Added ICC attributes here.
- 1399 • Section 14: Reworded for present tense, clarified why WS-Discovery has been
1400 removed, removed reason for removing OpenXPS and SSDP.

1401 **17.4 April 3, 2018**

- 1402 • Make JPEG support conditionally required for color printers.

1403 17.5 February 9, 2018

- 1404 • Initial v1.1 draft
- 1405 • Updated template
- 1406 • Updated abstract (can't call it a standard in the abstract)
- 1407 • Updated spec references to current versions
- 1408 • Dropped all mention of UPNP, SSDP, WS-Discovery, and OpenXPS (never
1409 implemented)
- 1410 • Added a new "Overview of Changes" chapter that documents the high-level changes
1411 since the original IPP Everywhere specification
- 1412 • Now recommend support for the Get-User-Printer-Attributes operation
- 1413 • Now recommend support for the "finishings-col" attributes (PWG 5100.1)
- 1414 • Now recommend support for TLS 1.3
- 1415 • Now recommend using a resource path of /ipp/print or /ipp/print/name in Printer URIs
- 1416 • Issue 11: printer-current-time is now listed as an IPP Everywhere attribute, although
1417 only RECOMMENDED since it was missing in the 1.0 spec. (all of the date-time
1418 attributes were previously required, so printer-current-time would have implicitly been
1419 required)
- 1420 • Issue 12: The reference to PWG 5100.12 has been corrected
- 1421 • Issue 13: The reference to the EXIF specification has been updated.
- 1422 • Issue 13: The reference to PWG 5101.1 has been updated.
- 1423 • Issue 14: Clarified the pdl-override-supported requirements ('attempted' or
1424 'guaranteed')
- 1425 • Issue 15: Clarified that relative URIs ("//ipp/print") are not allowed in IPP.
- 1426 • Issue 26: "job-preferred-attributes-supported" should have been "preferred-
1427 attributes-supported"
- 1428 • Issue 31: Incorrect references to PWG 5101.2 have been changed to PWG 5101.1
1429 (MSN)

- 1430 • Issue 33: The notes concerning IPP/2.x conformance changes were confusing and
1431 have been removed
- 1432 • Issue 34: Table 6: overrides-supported now correctly references "note 2"
1433 (conditionally required).
- 1434 • Issue 35: overrides-supported.document-numbers is now CONDITIONALLY
1435 REQUIRED
- 1436 • Fixed attribute examples to use PAPI encoding
- 1437 • Fixed notes concerning "copies" to indicate that support is required for JPEG and
1438 PDF documents
- 1439 • Separated Printer Status attributes from Printer Description
- 1440 • Separated Job Status attributes from Job Description