



The Printer Working Group

July 4, 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.

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<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:

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194 **1. Introduction**

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

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

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

207 **2. Terminology**

208 **2.1 Printing Terminology**

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

212 *Device*: A Logical or Physical Device associated with one or more Printers; also see section
213 2.3 of [STD92].

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

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

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

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

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

224 **2.2 Protocol Role Terminology**

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

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

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

232 **2.3 Other Terminology**

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

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

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

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

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

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

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

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

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

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

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

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

258 **2.4 Acronyms and Organizations**

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

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

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

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

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

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

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

267

268 **3. Requirements**

269 **3.1 Rationale**

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

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

279 Internet Printing Protocol/1.1: Encoding and Transport [RFC8010] and Internet Printing
280 Protocol/1.1: Model and Semantics [STD92] define 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 (QRcodes), 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 IETF IPP/1.1 [STD92], including
548 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 **MUST** support DNS-SD based Discovery. Printers **MAY** support other Discovery
556 protocols such as LDAP and SLP.

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

559 **4.1 Printer Description Attributes Used in Discovery**

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

562 **4.2 DNS Service Discovery (DNS-SD)**

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

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

569 **4.2.1 Service (SRV) Instance Name**

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

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

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

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

578 **4.2.2 Geo-Location (LOC)**

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

583

Table 1 - Attributes in Discovery Protocols

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

584 Note 1: Extension attribute to RFC 7612.

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

586 **4.2.3 Text (TXT)**

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

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

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

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

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

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

604 **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	pdl
air		PaperCustom	
TLS		Bind	
adminurl		Punch	
		Sort	
		Staple	

605 Clients MUST ignore incomplete key/value pairs at the end of a truncated TXT record.
 606

607

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)

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

609 **4.2.3.1 air**

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

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

614 'certificate'; Authentication using Secure Sockets Layer (SSL) and Transport Layer
615 Security (TLS) certificates. This is equivalent to the value 'certificate' for the "uri-
616 authentication-supported" Printer Description attribute [STD92].

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

620 'none'; No authentication is required. This is equivalent to the value 'none' for the
621 "uri-authentication-supported" Printer Description attribute [STD92].

622 'username,password'; Username + password authentication is required. This is
623 equivalent to the values 'basic' or 'digest' for the "uri-authentication-supported"
624 Printer Description attribute [STD92].

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

626 **4.2.3.2 pdl**

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

633 **4.2.3.3 qtotal**

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

643 **4.2.3.4 TLS**

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

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

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

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

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

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

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

659 **4.2.3.5 UUID**

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

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

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

665 `12345678-9ABC-DEF0-1234-56789ABCDEF0`

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

668 **4.2.3.6 DUUID**

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

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

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

674 `12345678-9ABC-DEF0-1234-56789ABCDEF0`

675 **4.3 LDAP and SLP Discovery**

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

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

681 For example, the IPP "printer-device-id" attribute has a maximum length of 1023 octets,
682 however the corresponding LDAP "printer-device-id" attribute has a maximum length of 255
683 octets. Printers MUST truncate long strings as defined in section 13.
684

685 **5. Protocol Binding**

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

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

690 **5.1 HTTP Features**

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

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

698 **5.1.1 Host**

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

701 **5.1.2 If-Modified-Since, Last-Modified, and 304 Not Modified**

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

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

708 **5.1.3 Cache-Control**

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

714

715 5.2 IPP Operations

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

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

722 **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

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

724 5.3 IPP Printer Description Attributes

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

727 **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

728

729

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

730

731

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

732

Note 3: CONDITIONALLY REQUIRED for Printers with finishers.

733

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

734

735

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

736

737

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).

738

739

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

740

741

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

742

743 5.3.1 media-col-database (1setOf collection)

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

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

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

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

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

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

769 5.3.2 media-col-ready (1setOf collection)

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

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

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

786 5.3.3 media-ready (1setOf (type3 keyword | name(MAX)))

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

789 [STD92], this specification defines how a Printer advertises custom, manually-fed, and roll-
790 fed media in the "media-ready" attribute.

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

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

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

806 **5.3.4 media-size-supported (1setOf collection)**

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

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

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

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

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

827 5.3.5 media-supported (1setOf (type3 keyword | name(MAX)))

828 The REQUIRED "media-supported" Printer attribute lists the supported media sizes for a
829 Printer. In addition to the requirements set forth in [STD92], this specification defines how a
830 Printer advertises custom and roll-fed media in the "media-supported" attribute.

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

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

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

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

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

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

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

852 5.3.6 pdl-override-supported (type2 keyword)

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

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

859 **5.4 IPP Printer Status Attributes**

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

862 **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

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

866 **5.4.1 printer-uri-supported (1setOf uri)**

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

870 **5.5 IPP Operation Attributes**

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

872 **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

873

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

880

881 5.6 IPP Job Description Attributes

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

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

Attribute	Source
job-name	RFC 8011

884 5.7 IPP Job Status Attributes

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

886 **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

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

890 5.7.1 job-id (integer)

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

896 **5.7.2 job-uri (uri)**

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

903 **5.8 IPP Job Template Attributes**

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

906 **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

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

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

920 **6. Document Formats**

921 Printers MUST support documents conforming to the PWG Raster Format [PWG5102.4]
922 ("image/pwg-raster"). Color Printers MUST support documents conforming to the JPEG File
923 Information Format Version 1.02 [JFIF] ("image/jpeg"), specifically the metadata and JPEG
924 subset defined in the Standard of the Camera & Imaging Products Association, CIPA DC-
925 008-Translation-2016, Exchangeable image file format for digital still cameras: Exif Version
926 2.31 [EXIF].

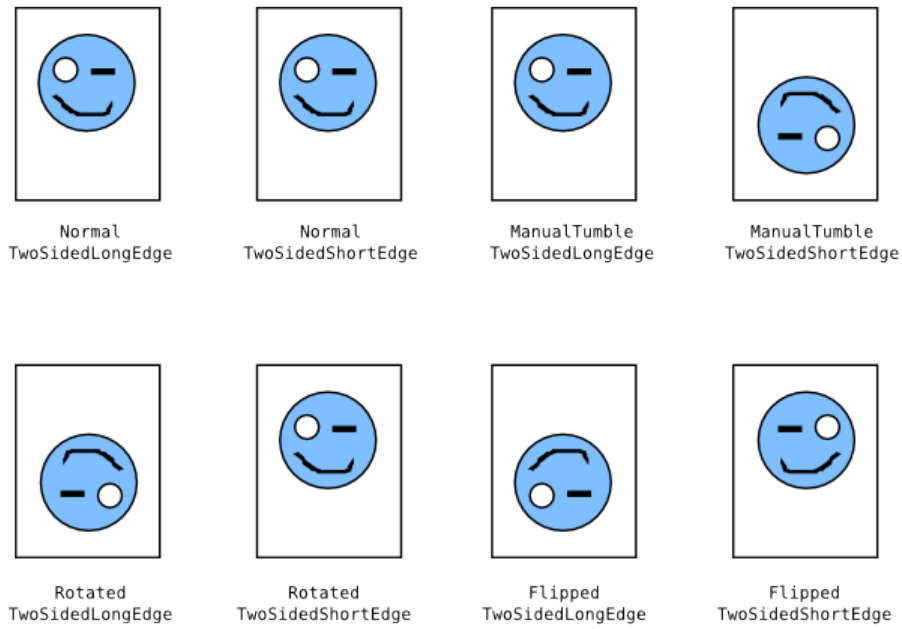
927 IPP/2.1 and IPP/2.2 Printers MUST and IPP/2.0 Printers SHOULD support documents
928 conforming to Document management — Portable document format — Part 1: PDF 1.7
929 [ISO32000] ("application/pdf"). IPP/2.0, IPP/2.1, and IPP/2.2 Printers are defined in
930 [PWG5100.12].

931 **6.1 Supporting Long-Edge Feed Media with PWG Raster Format** 932 **Documents**

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

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

942 Figures 2 through 5 show how raster data must be formatted for each feed orientation.
943

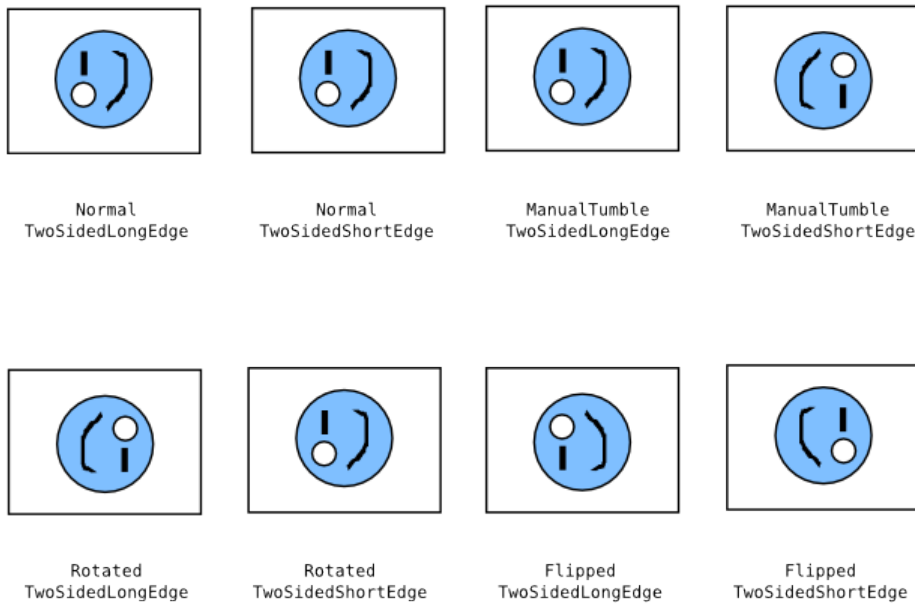


944

945

Figure 1 - PWG Raster Bitmaps with Portrait Feed Orientation

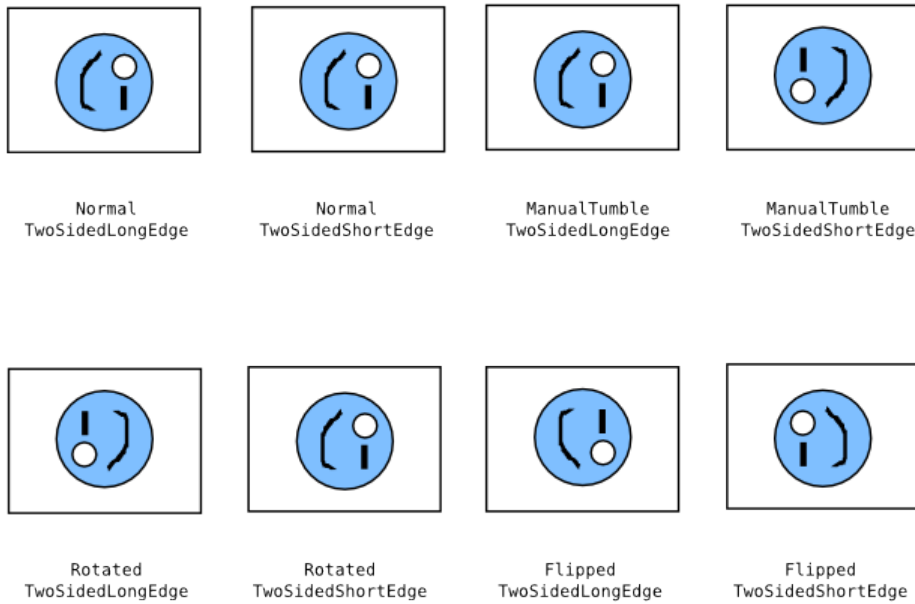
946



947

948

Figure 2 - PWG Raster Bitmaps with Landscape Feed Orientation

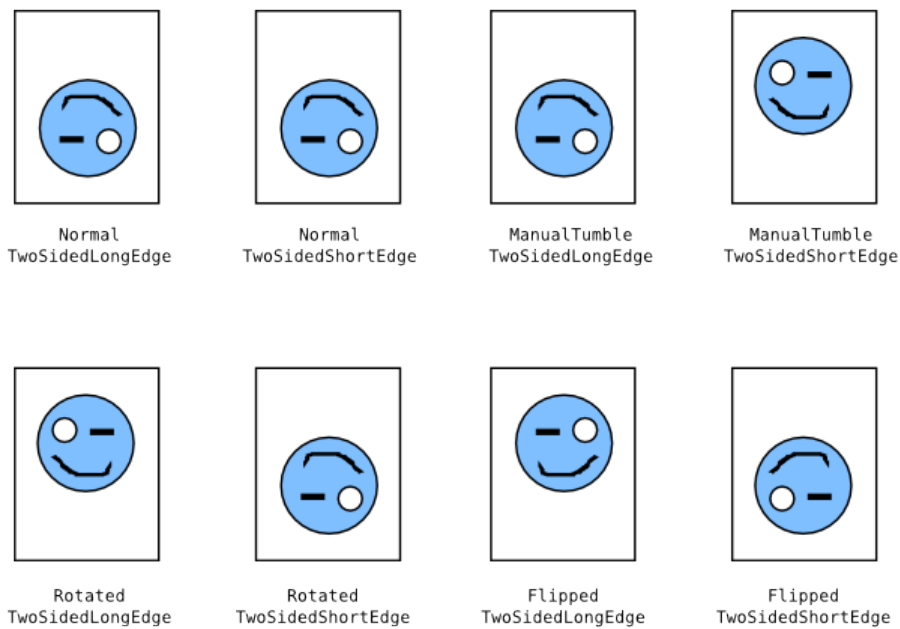


949

950

Figure 3 - PWG Raster Bitmaps with Reverse Landscape Feed Orientation

951



952

953

Figure 4 - PWG Raster Bitmaps with Reverse Portrait Feed Orientation

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

955 **7.1 ipp-features-supported (1setOf type2 keyword)**

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

958

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

960 This specification amends the definition of the nameWithLanguage,
961 nameWithoutLanguage, naturalLanguage, textWithLanguage, textWithoutLanguage, and
962 URI value tags defined in IPP/1.1: Model and Semantics [STD92] with additional restrictions
963 to improve interoperability.

964 **8.1 nameWithLanguage and nameWithoutLanguage**

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

969 **8.2 naturalLanguage**

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

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

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

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

976 **8.3 textWithLanguage and textWithoutLanguage**

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

980 **8.4 uri**

981 URI values MUST be in absolute form, i.e., "ipp://hostname.local/ipp/print" is acceptable but
982 "//ipp/print" is not. URI values MUST NOT contain link-local addresses in the host field.
983 Printers MUST NOT generate URI values with link-local addresses and SHOULD NOT
984 generate URI values with addresses obtained via Dynamic Host Control Protocol (DHCP)
985 [RFC2131] or other auto-configuration protocols. Printers SHOULD use the HTTP Host:
986 header value when generating URIs for use in Client responses.
987

988 **9. Conformance Requirements**

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

991 **9.1 Conformance Requirements for Clients**

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

- 994 1. DNS Service Discovery as defined in section 4.2
- 995 2. IPP/2.0 as defined in section 5
- 996 3. The REQUIRED operations listed in Table 4
- 997 4. The REQUIRED Printer Description attributes listed in Table 5
- 998 5. The REQUIRED operation attributes listed in Table 7
- 999 6. The REQUIRED Job Template attributes listed in Table 10
- 1000 7. The REQUIRED Job Description attributes listed in Table 8
- 1001 8. The REQUIRED document formats listed in section 5.8
- 1002 9. The "feed-orientation-supported" Printer attribute and "media-source-properties"
1003 member attribute of the "media-col-database" and "media-col-ready" Printer
1004 attributes as reported by the Printer and defined in section 6.1
- 1005 10. The internationalization considerations as defined in section 10
- 1006 11. The security considerations as defined in section 0

1007 **9.2 Conformance Requirements for Printers**

1008 In order for a Printer to claim conformance to this specification a Printer MUST support the
1009 following:

- 1010 1. DNS Service Discovery as defined in section 4.2
- 1011 2. IPP/2.0 as defined in section 5
- 1012 3. The REQUIRED operations listed in Table 4
- 1013 4. The REQUIRED Printer Description attributes listed in Table 5
- 1014 5. The REQUIRED operation attributes listed in Table 7
- 1015 6. The REQUIRED Job Template attributes listed in Table 10
- 1016 7. The REQUIRED Job Description attributes listed in Table 8
- 1017 8. The REQUIRED document formats listed in section 5.8
- 1018 9. The 'ipp-everywhere' value for the "ipp-features-supported" Printer Description
1019 attribute as defined in section 7.1
- 1020 10. The additional semantics for attribute values as defined in section 8
- 1021 11. The internationalization considerations as defined in section 10
- 1022 12. The security considerations as defined in section 0
- 1023 13. The safe string truncation rules as defined in section 13

1024 9.3 Conditional Conformance Requirements for Printers

1025 Printers that support the "image/jpeg" [JFIF] MIME media type MUST support:

- 1026 1. The "copies-default", and "copies-supported" Printer Description attributes as
1027 defined in section 0.
- 1028 2. The "copies" Job Template attribute as defined in section 5.8.

1029 Printers that support the "application/pdf" [ISO32000] MIME media type MUST support:

- 1030 1. The "copies-default", "copies-supported", "document-password-supported", and
1031 "page-ranges-supported" Printer Description attributes as defined in section 0,
- 1032 2. The "document-password" Operation attribute as defined in section 5.4, and
- 1033 3. The "copies", "multiple-document-handling", "overrides", and "page-ranges" Job
1034 Template attributes as defined in section 5.8.

1035 Printers that support the Print to a Recipient use case (section 3.2.2.8) MUST support:

- 1036 1. The "job-password-supported" and "job-password-encryption-supported" Printer
1037 Description attributes as defined in section 0, and
- 1038 2. The "job-password" and "job-password-encryption" Operation attributes as
1039 defined in section 5.4.

1040 Printers that provide Paid Print services MUST support:

- 1041 1. The "job-account-id-default", "job-account-id-supported", "job-accounting-user-
1042 id-default", "job-accounting-user-id-supported", "job-mandatory-attributes-
1043 default", "job-mandatory-attributes-supported", and "printer-mandatory-job-
1044 attributes" Printer Description attributes as defined in section 0,
- 1045 2. The "job-mandatory-attributes" operation attribute as defined in section 5.4, and
- 1046 3. The "job-account-id" and "job-accounting-user-id" Job Template attributes as
1047 defined in section 5.8.

1048 Printers that support long-edge feed media MUST support:

- 1049 1. The "feed-orientation-default" and "feed-orientation-supported" Printer
1050 Description attributes as defined in section 0.
- 1051 2. The "media-source-properties" member attribute of the "media-col-database"
1052 and "media-col-ready" Printer Description attributes as defined in section 0.
- 1053 3. The "feed-orientation" Job Template attribute as defined in section 5.8.

1054 Printers that support ICC-based color management MUST support:

- 1055 4. The "print-rendering-intent-default", "print-rendering-intent-supported", and
1056 "printer-icc-profiles" Printer Description attributes as defined in section 5.3.
- 1057 5. The "print-render-intent" Job Template attribute as defined in section 5.8.

1058 **10. Internationalization Considerations**

1059 For interoperability and basic support for multiple languages, conforming implementations
1060 MUST support:

- 1061 1. The Universal Character Set (UCS) Transformation Format -- 8 bit (UTF-8)
1062 [STD63] encoding of Unicode [UNICODE] [ISO10646]; and
- 1063 2. The Unicode Format for Network Interchange [RFC5198] which requires
1064 transmission of well-formed UTF-8 strings and recommends transmission of
1065 normalized UTF-8 strings in Normalization Form C (NFC) [UAX15].

1066 Unicode NFC is defined as the result of performing Canonical Decomposition (into base
1067 characters and combining marks) followed by Canonical Composition (into canonical
1068 composed characters wherever Unicode has assigned them).

1069 WARNING – Performing normalization on UTF-8 strings received from Clients and
1070 subsequently storing the results (e.g., in Job objects) could cause false negatives in Client
1071 searches and failed access (e.g., to Printers with percent-encoded UTF-8 URIs now
1072 'hidden').

1073 Implementations of this specification SHOULD conform to the following standards on
1074 processing of human-readable Unicode text strings, see:

1075 Unicode Bidirectional Algorithm [UAX9] – left-to-right, right-to-left, and vertical

1076 Unicode Line Breaking Algorithm [UAX14] – character classes and wrapping

1077 Unicode Normalization Forms [UAX15] – especially NFC for [RFC5198]

1078 Unicode Text Segmentation [UAX29] – grapheme clusters, words, sentences

1079 Unicode Identifier and Pattern Syntax [UAX31] – identifier use and normalization

1080 Unicode Collation Algorithm [UTS10] – sorting

1081 Unicode Locale Data Markup Language [UTS35] – locale databases

1082 Implementations of this specification are advised to also review the following informational
1083 documents on processing of human-readable Unicode text strings:

1084 Unicode Character Encoding Model [UTR17] – multi-layer character model

1085 Unicode in XML and other Markup Languages [UTR20] – XML usage

1086 Unicode Character Property Model [UTR23] – character properties

1087 Unicode Conformance Model [UTR33] – Unicode conformance basis

1088 **11. Security Considerations**

1089 The IPP extensions defined in this document require the same security considerations as
1090 defined in the IPP/1.1: Model and Semantics [STD92]. In addition, Printers **MUST** validate
1091 the HTTP Host request header in order to protect against DNS rebinding attacks.

1092 Implementations of this specification **SHOULD** conform to the following standard on
1093 processing of human-readable Unicode text strings, see:

1094 Unicode Security Mechanisms [UTS39] – detecting and avoiding security attacks

1095 Implementations of this specification are advised to also review the following
1096 informational document on processing of human-readable Unicode text strings:

1097 Unicode Security FAQ [UNISECFAQ] – common Unicode security issues

1098

1099

1100 12. IANA Considerations

1101 12.1 Attribute Value Registrations

1102 The keyword attribute values defined in this document will be published by IANA according
1103 to the procedures in the IPP Model and Semantics [STD92] section 7.3 in the following 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.

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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 July 4, 2018**

- 1382 • Status: Prototype
- 1383 • RFC 8011 is now STD 92
- 1384 • Updated Unicode to 11.0.0.

1385 **17.2 June 6, 2018**

- 1386 • Section 5.7: Fixed cross-reference to Table 10.
- 1387 • Section 14.1: Cleaned up WS-Discovery bullet.
- 1388 • Section 15.2: Updated Bonjour Printing specification reference.

1389 **17.3 April 17, 2018**

- 1390 • Removed all references to 1284 device IDs and associated information.

1391 **17.4 April 16, 2018**

- 1392 • Made sure IPP Everywhere™ consistently has trademark symbol.
- 1393 • Section 1: Drop examples of mobile devices.
- 1394 • Section 4.2.3.4: TLS key required for IPPS.
- 1395 • Section 5.1: Fix typos.
- 1396 • Section 5.2: Made Identify-Printer operation recommended for logical devices,
1397 required otherwise.
- 1398 • Sections 5.3 and 5.8: Made print-rendering-intent and printer-icc-profiles
1399 conditionally required for printers that support ICC-based color management.
- 1400 • Section 5.3.6: Clarify pdl-override-supported values and usage.
- 1401 • Section 5.7: Deleted stray "note 7"
- 1402 • Section 9.3: Added ICC attributes here.

- 1403 • Section 14: Reworded for present tense, clarified why WS-Discovery has been
1404 removed, removed reason for removing OpenXPS and SSDP.

1405 **17.5 April 3, 2018**

- 1406 • Make JPEG support conditionally required for color printers.

1407 **17.6 February 9, 2018**

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

- 1429 • Issue 15: Clarified that relative URIs ("//ipp/print") are not allowed in IPP.
- 1430 • Issue 26: "job-preferred-attributes-supported" should have been "preferred-attributes-supported"
- 1431
- 1432 • Issue 31: Incorrect references to PWG 5101.2 have been changed to PWG 5101.1
- 1433 (MSN)
- 1434 • Issue 33: The notes concerning IPP/2.x conformance changes were confusing and
- 1435 have been removed
- 1436 • Issue 34: Table 6: overrides-supported now correctly references "note 2"
- 1437 (conditionally required).
- 1438 • Issue 35: overrides-supported.document-numbers is now **CONDITIONALLY**
- 1439 **REQUIRED**
- 1440 • Fixed attribute examples to use PAPI encoding
- 1441 • Fixed notes concerning "copies" to indicate that support is required for JPEG and
- 1442 PDF documents
- 1443 • Separated Printer Status attributes from Printer Description
- 1444 • Separated Job Status attributes from Job Description