



The Printer Working Group

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IPP Everywhere™ v1.1

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

86 For additional information regarding the Printer Working Group visit:

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

88 Contact information:

89 The Printer Working Group
90 c/o The IEEE Industry Standards and Technology Organization
91 445 Hoes Lane
92 Piscataway, NJ 08854
93 USA
94

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199 1. Introduction

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

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

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

212 2. Terminology

213 2.1 Printing Terminology

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

Deleted: RFC8011

217 *Device*: A Logical or Physical Device associated with one or more Printers; also see section
218 2.3 of [STD92].

Deleted: RFC8011

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

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

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

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

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

231 2.2 Protocol Role Terminology

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

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

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

239 2.3 Other Terminology

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

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

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

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

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

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

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

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

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

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

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

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

265 **2.4 Acronyms and Organizations**

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

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

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

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

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

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

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

274

275 3. Requirements

276 3.1 Rationale

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

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

286 Internet Printing Protocol/1.1: Encoding and Transport [RFC8010] and Internet Printing
287 Protocol/1.1: Model and Semantics [STD92] define the core Internet Printing Protocol.

Deleted: RFC8011

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

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

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

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

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

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

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

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

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

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

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

321 **3.2 Use Cases**

322 **3.2.1 Select Printer**

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

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

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

332 **3.2.1.1 Select the Last Used Printer**

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

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

339 3.2.1.2 Select Printer Using Name or Address

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

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

346 3.2.1.3 Select Printer Using URI

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

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

351 3.2.1.4 Select Printer Using a Directory Service

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

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

358 3.2.1.5 Select Printer Using a Cloud Service

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

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

365 3.2.1.6 Select Printer Using a Discovery Protocol

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

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

372 3.2.1.7 Select Printer Using Geo-Location

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

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

379 3.2.1.8 Select Printer Using Out of Band Method

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

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

386 3.2.1.9 Select Printer Using Properties

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

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

398 3.2.2 Print

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

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

407 3.2.2.1 Print a Document

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

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

414 3.2.2.2 Print a Document by Reference

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

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

421 3.2.2.3 Print Using Loaded Media

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

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

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

433 3.2.2.4 Print a Secure Form

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

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

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

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

451 **3.2.2.5 Print with Special Formatting**

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

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

464 **3.2.2.6 Print and Select at Printer**

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

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

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

476 3.2.2.7 Print to a Service

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

484 3.2.2.8 Print to a Recipient

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

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

492 3.2.2.9 Print with a Proof Copy

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

499 3.2.3 Exceptions**500 3.2.3.1 Print Action Canceled**

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

504 3.2.3.2 Select Printer Canceled

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

507 3.2.3.3 Printer No Longer Network Accessible after Selection

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

511 3.2.3.4 Not Authorized

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

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

518 3.2.3.5 Needs Authentication

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

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

523 3.2.3.6 Not Accepting Jobs

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

526 3.2.3.7 Job Ticket or Document Format Not Supported

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

530 3.2.3.8 Job or Document Processing Failures

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

535 3.2.3.9 Printer Fault

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

539 **3.2.3.10 Printer Warning**

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

543 **3.3 Out of Scope**

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

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

552 **3.4 Design Requirements**

553 The IPP Everywhere™ design should:

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

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563 4. Discovery Protocols

564 Printers MUST support DNS-SD based Discovery. Printers MAY support other Discovery
565 protocols such as LDAP and SLP.

566 Clients MUST support DNS-SD. Clients MAY support other Discovery protocols such as
567 LDAP and SLP.

568 4.1 Printer Description Attributes Used in Discovery

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

571 4.2 DNS Service Discovery (DNS-SD)

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

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

578 4.2.1 Service (SRV) Instance Name

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

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

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

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

587 4.2.2 Geo-Location (LOC)

588 Printers MUST publish LOC records [RFC1876] over mDNS to provide the physical location
589 of the Printer. Printers MUST allow the User to configure the geo-location manually. If the
590 accuracy of the geo-location is unknown, a value of 9×10^9 meters (0x99) MUST be used.
591

592

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 | 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 |

593 Note 1: Extension attribute to RFC 7612.

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

595 **4.2.3 Text (TXT)**

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

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

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

605 For example, the IPP "printer-more-info" attribute has a maximum length of 1023 octets,
 606 however the corresponding "adminurl" key cannot represent a value longer than 246 octets
 607 (255 - 9 octets for "adminurl="). Printers MUST truncate long strings as described in section
 608 13.

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

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

613 **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 | |

614 Clients MUST ignore incomplete key/value pairs at the end of a truncated TXT record.
 615

616

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' |
| pdfl | 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) |

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

618 4.2.3.1 air

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

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

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

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

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

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

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

635 4.2.3.2 pdl

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

642 4.2.3.3 qtotal

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

652 4.2.3.4 TLS

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

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

661 '1.0'; TLS 1.0 [RFC2246] encryption is supported. This is equivalent to the value 'tls'
662 for the "uri-security-supported" Printer Description attribute.

663 '1.1'; TLS 1.1 [RFC4346] encryption is supported. This is equivalent to the value 'tls'
664 for the "uri-security-supported" Printer Description attribute.

665 '1.2'; TLS 1.2 [RFC5246] encryption is supported. This is equivalent to the value 'tls'
666 for the "uri-security-supported" Printer Description attribute.

667 '1.3'; TLS 1.3 [RFC-TLS1.3] encryption is supported. This is equivalent to the value
668 'tls' for the "uri-security-supported" Printer Description attribute.

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

672 4.2.3.5 UUID

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

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

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

678 12345678-9ABC-DEF0-1234-56789ABCDEF0

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

681 4.2.3.6 DUUID

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

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

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

687 12345678-9ABC-DEF0-1234-56789ABCDEF0

688 **4.3 LDAP and SLP Discovery**

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

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

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

698 5. Protocol Binding

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

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

703 5.1 HTTP Features

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

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

711 5.1.1 Host

712 Printers MUST validate the Host request header and SHOULD use the Host value in
713 generated URIs.

714 5.1.2 If-Modified-Since, Last-Modified, and 304 Not Modified

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

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

721 5.1.3 Cache-Control

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

728 5.2 IPP Operations

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

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

735 **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 |

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

737 5.3 IPP Printer Description Attributes

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

740 **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 |

- 741
742 Note 1: CONDITIONALLY REQUIRED for Printers that implement Paid Imaging
743 services.
744 Note 2: REQUIRED for the "application/pdf" and "image/jpeg" MIME media types.
745 Note 3: CONDITIONALLY REQUIRED for Printers with finishers.
746 Note 4: CONDITIONALLY REQUIRED for Printers that support the Print to a
747 Recipient (section 3.2.2.8) use case.
748 Note 5: CONDITIONALLY REQUIRED for Printers that support long-edge feed
749 media.
750 Note 6: URIs MUST be absolute, SHOULD use the Host value from HTTP header
751 (section 5.1.1), and MUST NOT use link-local addresses (section 8.4).
752 Note 7: RECOMMENDED due to its omission from IPP Everywhere™ 1.0, however
753 it is needed for the underlying functionality.
754 Note 8: CONDITIONALLY REQUIRED for Printers that support ICC-based color
755 management.

756 5.3.1 media-col-database (1setOf collection)

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

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

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

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

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

```
778     media-col-database=..., {  
779         media-size={  
780             x-dimension=20320-152400  
781             y-dimension=1524-9144000 },...
```

782 5.3.2 media-col-ready (1setOf collection)

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

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

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

799 5.3.3 media-ready (1setOf (type3 keyword | name(MAX)))

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

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

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

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

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

819 5.3.4 media-size-supported (1setOf collection)

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

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

```
828     media-size-supported=..., {  
829         x-dimension=5000-33020  
830         y-dimension=5000-48260 },...
```

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

```
837     media-size-supported=..., {  
838         x-dimension=20320-152400  
839         y-dimension=1524-9144000 },...
```

841 5.3.5 media-supported (1setOf (type3 keyword | name(MAX)))

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

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

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

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

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

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

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

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

866 5.3.6 pdl-override-supported (type2 keyword)

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

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

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875 **5.4 IPP Printer Status Attributes**

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

878 **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 |

879
880 Note 1: URIs MUST be absolute, SHOULD use the Host value from HTTP header
881 (section 5.1.1), and MUST NOT use link-local addresses (section 8.4).

882 **5.4.1 printer-uri-supported (1setOf uri)**

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

886 **5.5 IPP Operation Attributes**

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

888 **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 |

889 Note 1: CONDITIONALLY REQUIRED for Printers that support the "application/pdf"
890 MIME media type.892 Note 2: CONDITIONALLY REQUIRED for Printers that support the Print to a
893 Recipient (section 3.2.2.8) use case.894 Note 3: CONDITIONALLY REQUIRED for Printers that implement Paid Imaging
895 services.

896

897 5.6 IPP Job Description Attributes

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

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

| Attribute | Source |
|-----------|----------|
| job-name | RFC 8011 |

900 5.7 IPP Job Status Attributes

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

902 **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 |

903
 904 Note 1: URIs MUST be absolute, SHOULD use the Host value from HTTP header
 905 (section 5.1.1), and MUST NOT use link-local addresses (section 8.4).

906 5.7.1 job-id (integer)

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

912 **5.7.2 job-uri (uri)**

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

919 **5.8 IPP Job Template Attributes**

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

922 **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 |

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

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

936 6. Document Formats

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

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

947 6.1 Supporting Long-Edge Feed Media with PWG Raster Format 948 Documents

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

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

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

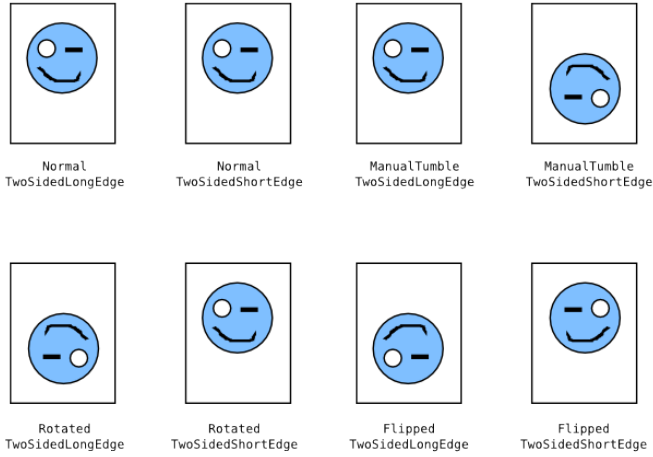


Figure 1 - PWG Raster Bitmaps with Portrait Feed Orientation

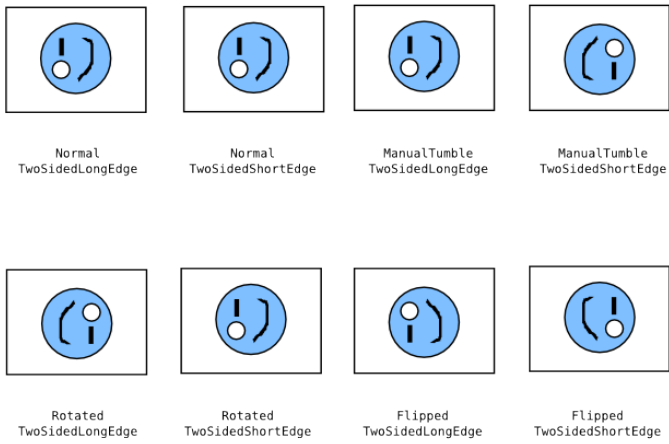
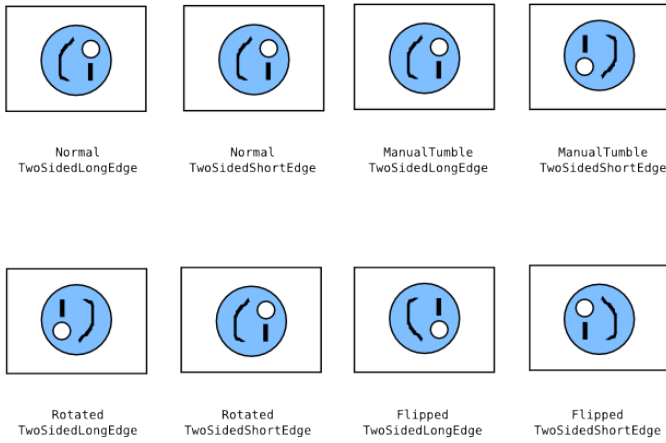


Figure 2 - PWG Raster Bitmaps with Landscape Feed Orientation

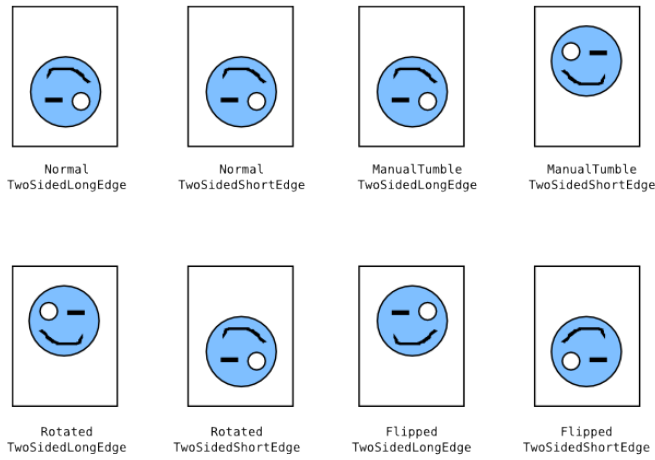
960
961
962

963
964



965
966
967

Figure 3 - PWG Raster Bitmaps with Reverse Landscape Feed Orientation



968
969

Figure 4 - PWG Raster Bitmaps with Reverse Portrait Feed Orientation

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

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

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

974

975 8. Additional Semantics for Existing Value Tags

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

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980 8.1 nameWithLanguage and nameWithoutLanguage

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

985 8.2 naturalLanguage

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

- 989 'no'; replaced by 'nb' (Norwegian Bokmål),
- 990 'zh-cn'; replaced by 'zh-hans' (Simplified Chinese), and
- 991 'zh-tw'; replaced by 'zh-hant' (Traditional Chinese)

992 8.3 textWithLanguage and textWithoutLanguage

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

996 8.4 uri

997 URI values MUST be in absolute form, i.e., "ipp://hostname.local/ipp/print" is acceptable but
998 "//ipp/print" is not. URI values MUST NOT contain link-local addresses in the host field.
999 Printers MUST NOT generate URI values with link-local addresses and SHOULD NOT
1000 generate URI values with addresses obtained via Dynamic Host Control Protocol (DHCP)
1001 [RFC2131] or other auto-configuration protocols. Printers SHOULD use the HTTP Host:
1002 header value when generating URIs for use in Client responses.
1003

1005 9. Conformance Requirements

1006 This section summarizes the Conformance Requirements detailed in the definitions in this
1007 document for Clients and Printers.

1008 9.1 Conformance Requirements for Clients

1009 In order for a Client to claim conformance to this specification a Client MUST support the
1010 following:

- 1011 1. DNS Service Discovery as defined in section 4.2
- 1012 2. IPP/2.0 as defined in section 5
- 1013 3. The REQUIRED operations listed in Table 4
- 1014 4. The REQUIRED Printer Description attributes listed in Table 5
- 1015 5. The REQUIRED operation attributes listed in Table 7
- 1016 6. The REQUIRED Job Template attributes listed in Table 10
- 1017 7. The REQUIRED Job Description attributes listed in Table 8
- 1018 8. The REQUIRED document formats listed in section 5.8
- 1019 9. The "feed-orientation-supported" Printer attribute and "media-source-properties"
1020 member attribute of the "media-col-database" and "media-col-ready" Printer
1021 attributes as reported by the Printer and defined in section 6.1
- 1022 10. The internationalization considerations as defined in section 10
- 1023 11. The security considerations as defined in section 0

1024 9.2 Conformance Requirements for Printers

1025 In order for a Printer to claim conformance to this specification a Printer MUST support the
1026 following:

- 1027 1. DNS Service Discovery as defined in section 4.2
- 1028 2. IPP/2.0 as defined in section 5
- 1029 3. The REQUIRED operations listed in Table 4
- 1030 4. The REQUIRED Printer Description attributes listed in Table 5
- 1031 5. The REQUIRED operation attributes listed in Table 7
- 1032 6. The REQUIRED Job Template attributes listed in Table 10
- 1033 7. The REQUIRED Job Description attributes listed in Table 8
- 1034 8. The REQUIRED document formats listed in section 5.8
- 1035 9. The 'ipp-everywhere' value for the "ipp-features-supported" Printer Description
1036 attribute as defined in section 7.1
- 1037 10. The additional semantics for attribute values as defined in section 8
- 1038 11. The internationalization considerations as defined in section 10
- 1039 12. The security considerations as defined in section 0
- 1040 13. The safe string truncation rules as defined in section 13

1041 9.3 Conditional Conformance Requirements for Printers

1042 Printers that support the "image/jpeg" [JFIF] MIME media type MUST support:

- 1043 1. The "copies-default", and "copies-supported" Printer Description attributes as
1044 defined in section 0.
1045 2. The "copies" Job Template attribute as defined in section 5.8.

1046 Printers that support the "application/pdf" [ISO32000] MIME media type MUST support:

- 1047 1. The "copies-default", "copies-supported", "document-password-supported", and
1048 "page-ranges-supported" Printer Description attributes as defined in section 0,
1049 2. The "document-password" Operation attribute as defined in section 5.4, and
1050 3. The "copies", "multiple-document-handling", "overrides", and "page-ranges" Job
1051 Template attributes as defined in section 5.8.

1052 Printers that support the Print to a Recipient use case (section 3.2.2.8) MUST support:

- 1053 1. The "job-password-supported" and "job-password-encryption-supported" Printer
1054 Description attributes as defined in section 0, and
1055 2. The "job-password" and "job-password-encryption" Operation attributes as
1056 defined in section 5.4.

1057 Printers that provide Paid Print services MUST support:

- 1058 1. The "job-account-id-default", "job-account-id-supported", "job-accounting-user-
1059 id-default", "job-accounting-user-id-supported", "job-mandatory-attributes-
1060 default", "job-mandatory-attributes-supported", and "printer-mandatory-job-
1061 attributes" Printer Description attributes as defined in section 0,
1062 2. The "job-mandatory-attributes" operation attribute as defined in section 5.4, and
1063 3. The "job-account-id" and "job-accounting-user-id" Job Template attributes as
1064 defined in section 5.8.

1065 Printers that support long-edge feed media MUST support:

- 1066 1. The "feed-orientation-default" and "feed-orientation-supported" Printer
1067 Description attributes as defined in section 0.
1068 2. The "media-source-properties" member attribute of the "media-col-database"
1069 and "media-col-ready" Printer Description attributes as defined in section 0.
1070 3. The "feed-orientation" Job Template attribute as defined in section 5.8.

1071 Printers that support ICC-based color management MUST support:

- 1072 4. The "print-rendering-intent-default", "print-rendering-intent-supported", and
1073 "printer-icc-profiles" Printer Description attributes as defined in section 5.3.
1074 5. The "print-render-intent" Job Template attribute as defined in section 5.8.

1075 **10. Internationalization Considerations**

1076 For interoperability and basic support for multiple languages, conforming implementations
1077 MUST support:

- 1078 1. The Universal Character Set (UCS) Transformation Format -- 8 bit (UTF-8)
1079 [STD63] encoding of Unicode [UNICODE] [ISO10646]; and
- 1080 2. The Unicode Format for Network Interchange [RFC5198] which requires
1081 transmission of well-formed UTF-8 strings and recommends transmission of
1082 normalized UTF-8 strings in Normalization Form C (NFC) [UAX15].

1083 Unicode NFC is defined as the result of performing Canonical Decomposition (into base
1084 characters and combining marks) followed by Canonical Composition (into canonical
1085 composed characters wherever Unicode has assigned them).

1086 WARNING – Performing normalization on UTF-8 strings received from Clients and
1087 subsequently storing the results (e.g., in Job objects) could cause false negatives in Client
1088 searches and failed access (e.g., to Printers with percent-encoded UTF-8 URIs now
1089 'hidden').

1090 Implementations of this specification SHOULD conform to the following standards on
1091 processing of human-readable Unicode text strings, see:

1092 Unicode Bidirectional Algorithm [UAX9] – left-to-right, right-to-left, and vertical

1093 Unicode Line Breaking Algorithm [UAX14] – character classes and wrapping

1094 Unicode Normalization Forms [UAX15] – especially NFC for [RFC5198]

1095 Unicode Text Segmentation [UAX29] – grapheme clusters, words, sentences

1096 Unicode Identifier and Pattern Syntax [UAX31] – identifier use and normalization

1097 Unicode Collation Algorithm [UTS10] – sorting

1098 Unicode Locale Data Markup Language [UTS35] – locale databases

1099 Implementations of this specification are advised to also review the following informational
1100 documents on processing of human-readable Unicode text strings:

1101 Unicode Character Encoding Model [UTR17] – multi-layer character model

1102 Unicode in XML and other Markup Languages [UTR20] – XML usage

1103 Unicode Character Property Model [UTR23] – character properties

1104 Unicode Conformance Model [UTR33] – Unicode conformance basis

1105 **11. Security Considerations**

1106 The IPP extensions defined in this document require the same security considerations as
1107 defined in the IPP/1.1: Model and Semantics [STD92]. In addition, Printers MUST validate
1108 the HTTP Host request header in order to protect against DNS rebinding attacks.

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1109 Implementations of this specification SHOULD conform to the following standard on
1110 processing of human-readable Unicode text strings, see:

1111 Unicode Security Mechanisms [UTS39] – detecting and avoiding security attacks

1112 Implementations of this specification are advised to also review the following
1113 informational document on processing of human-readable Unicode text strings:

1114 Unicode Security FAQ [UNISECFAQ] – common Unicode security issues

1115

1116

1118 12. IANA Considerations**1119 12.1 Attribute Value Registrations**

1120 The keyword attribute values defined in this document will be published by IANA according
 1121 to the procedures in the IPP Model and Semantics [STD92] section 7.3 in the following file:

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1122 <http://www.iana.org/assignments/ipp-registrations>

1123 The registry entries will contain the following information:

| 1124 | Attributes (attribute syntax) | | Reference |
|------|---|--|--------------|
| 1125 | Keyword Attribute Value | | ----- |
| 1126 | ----- | | ----- |
| 1127 | ipp-features-supported (1setOf type2 keyword) | | [PWG5100.13] |
| 1128 | ipp-everywhere | | [PWG5100.14] |

1129 13. Safe String Truncation

1130 Strings can be truncated or omitted when transferred over alternate protocols. Printers
 1131 MUST truncate long strings at logical boundaries. The following subsections describe how
 1132 this truncation is performed for different kinds of strings.

1133 13.1 Plain Text Strings

1134 Plain text strings MUST be truncated at the end of a valid character sequence. For example,
 1135 strings using the UTF-8 transformation format of ISO 10646 [STD0063] [ISO10646-1]
 1136 SHOULD be represented using the Unicode Format for Network Interchange [RFC5198]
 1137 and MUST be truncated at the end of a valid UTF-8 sequence.

1138 For example, the 9 octet UTF-8 sequence 0x48.65.CA.81.6C.6C.6F.C2.81 (Héllöj) would
 1139 be shortened to fit within 6 octets by composing the é (0x65.CA.81 becomes 0xC3.A9) and
 1140 removing the trailing UTF-8 sequence 0xC2.81 (j), resulting in the 6 octet UTF-8 sequence
 1141 0x48.C3.A9.6C.6C.6F (Héllö).

1142 13.2 URIs

1143 URIs MUST be truncated so that the URI remains valid and accepted by the Printer. For
 1144 example, the 46 octet URI "ipp://printer.example.com/ipp/really-long-name" might be
 1145 shortened to fit within 32 octets by removing the last path name component, resulting in the
 1146 29 octet URI "ipp://printer.example.com/ipp". Similarly, the 52 octet URI
 1147 "ipp://printer.example.com/ipp?query-string" might be shortened to fit within 32 octets by
 1148 removing the query string.

1150 As recommended by the Uniform Resource Identifier (URI): Generic Syntax [STD66],
1151 Printers SHOULD omit the port number from the URI when it has the default value, e.g., 80
1152 for "http", 443 for "https", and 631 for "ipp" and "ipps" URIs.

1153 13.3 MIME Media Types

1154 MIME media type strings MUST be truncated at the end of the media subtype, removing
1155 any parameters that are included with the media type. If the resulting string still exceeds the
1156 maximum length it MUST be discarded. For example, the 24 octet MIME media type
1157 "text/plain;charset=utf-8" would be shortened to fit within 16 octets by removing the trailing
1158 parameter, resulting in the 10 octet MIME media type "text/plain".

1159 13.4 Delimited Lists

1160 Delimited Lists combine one or more string types listed in the previous sections, separated
1161 by a delimiting character such as a comma or semicolon. Delimited lists MUST first be
1162 shortened by removal of unnecessary path components (URIs) and parameters (MIME
1163 media types) and second truncated at a delimiting character. For example, the 40 octet list
1164 of MIME media types "text/plain;charset=utf-8,application/pdf" would be shortened to fit
1165 within 32 octets by removing the MIME media type parameter, resulting in the 26 octet list
1166 "text/plain,application/pdf". The same list would be shortened to fit within 16 octets by also
1167 removing the last MIME media type, resulting in the 10 octet list "text/plain".

1168 14. Overview of Changes

1169 14.1 IPP Everywhere™ v1.1

1170 The following changes were made to PWG 5100.14-2013: IPP Everywhere [PWG5100.14]:

- 1171 • References now point to the current versions of dependent documents and
1172 specifications at the time of publication;
- 1173 • Requirements for WS-Discovery have been removed due to a lack of
1174 implementations, which effectively made WS-Discovery support OPTIONAL;
- 1175 • References to OpenXPS and SSDP have been removed;
- 1176 • The "printer-device-id" Printer Description attribute and associated DNS-SD TXT
1177 record keys are no longer required;
- 1178 • ICC attributes are now CONDITIONALLY REQUIRED for printers that support ICC-
1179 based color management;
- 1180 • JPEG support is now CONDITIONALLY REQUIRED for color printers;

- 1181 • IPP Finishings 2.1 and the "finishings-col" Job Template attribute are now
1182 RECOMMENDED; and
- 1183 • Printer Status and Job Status attributes are now listed in a separate section to match
1184 RFC 8011 and the IANA IPP registry.

1185 15. References

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1382 **16. Authors' Addresses**

1383 Primary authors:

1384 Michael Sweet
1385 Apple Inc.
1386 One Apple Park Way
1387 MS 111-HOMC
1388 Cupertino CA 95014
1389 USA

1390
1391 Ira McDonald
1392 High North
1393 PO Box 221
1394 Grand Marais, MI 49839

1395 Send comments to the PWG IPP Mailing List:

1396 ipp@pwg.org (subscribers only)

1397 To subscribe, see the PWG web page:

1398 <http://www.pwg.org/>

1399 Implementers of this specification document are encouraged to join the IPP Mailing List in
1400 order to participate in any discussions of clarification issues and review of registration
1401 proposals for additional attributes and values.

1402 The editors would like to especially thank the following individuals who also contributed
1403 significantly to the development of this document:

1404 Andrew Mitchell
1405 Jerry Thrasher - Lexmark
1406 Peter Zehler - Xerox
1407

1408 **17. Change History**

1409 **17.1 July 4, 2018**

- 1410 • Status: Prototype
- 1411 • RFC 8011 is now STD 92
- 1412 • Updated Unicode to 11.0.0.

1413 **17.2 June 6, 2018**

- 1414 • Section 5.7: Fixed cross-reference to Table 10.
- 1415 • Section 14.1: Cleaned up WS-Discovery bullet.
- 1416 • Section 15.2: Updated Bonjour Printing specification reference.

1417 **17.3 April 17, 2018**

- 1418 • Removed all references to 1284 device IDs and associated information.

1419 **17.4 April 16, 2018**

- 1420 • Made sure IPP Everywhere™ consistently has trademark symbol.
- 1421 • Section 1: Drop examples of mobile devices.
- 1422 • Section 4.2.3.4: TLS key required for IPPS.
- 1423 • Section 5.1: Fix typos.
- 1424 • Section 5.2: Made Identify-Printer operation recommended for logical devices,
1425 required otherwise.
- 1426 • Sections 5.3 and 5.8: Made print-rendering-intent and printer-icc-profiles
1427 conditionally required for printers that support ICC-based color management.
- 1428 • Section 5.3.6: Clarify pdl-override-supported values and usage.
- 1429 • Section 5.7: Deleted stray "note 7"
- 1430 • Section 9.3: Added ICC attributes here.

- 1431 • Section 14: Reworded for present tense, clarified why WS-Discovery has been
1432 removed, removed reason for removing OpenXPS and SSDP.

1433 **17.5 April 3, 2018**

- 1434 • Make JPEG support conditionally required for color printers.

1435 **17.6 February 9, 2018**

- 1436 • Initial v1.1 draft
- 1437 • Updated template
- 1438 • Updated abstract (can't call it a standard in the abstract)
- 1439 • Updated spec references to current versions
- 1440 • Dropped all mention of UPNP, SSDP, WS-Discovery, and OpenXPS (never
1441 implemented)
- 1442 • Added a new "Overview of Changes" chapter that documents the high-level changes
1443 since the original IPP Everywhere specification
- 1444 • Now recommend support for the Get-User-Printer-Attributes operation
- 1445 • Now recommend support for the "finishings-col" attributes (PWG 5100.1)
- 1446 • Now recommend support for TLS 1.3
- 1447 • Now recommend using a resource path of /ipp/print or /ipp/print/name in Printer URIs
- 1448 • Issue 11: printer-current-time is now listed as an IPP Everywhere attribute, although
1449 only RECOMMENDED since it was missing in the 1.0 spec. (all of the date-time
1450 attributes were previously required, so printer-current-time would have implicitly been
1451 required)
- 1452 • Issue 12: The reference to PWG 5100.12 has been corrected
- 1453 • Issue 13: The reference to the EXIF specification has been updated.
- 1454 • Issue 13: The reference to PWG 5101.1 has been updated.
- 1455 • Issue 14: Clarified the pdl-override-supported requirements ('attempted' or
1456 'guaranteed')

- 1457 • Issue 15: Clarified that relative URIs ("//ipp/print") are not allowed in IPP.
- 1458 • Issue 26: "job-preferred-attributes-supported" should have been "preferred-attributes-supported"
- 1459
- 1460 • Issue 31: Incorrect references to PWG 5101.2 have been changed to PWG 5101.1
- 1461 (MSN)
- 1462 • Issue 33: The notes concerning IPP/2.x conformance changes were confusing and
- 1463 have been removed
- 1464 • Issue 34: Table 6: overrides-supported now correctly references "note 2"
- 1465 (conditionally required).
- 1466 • Issue 35: overrides-supported.document-numbers is now **CONDITIONALLY**
- 1467 **REQUIRED**
- 1468 • Fixed attribute examples to use PAPI encoding
- 1469 • Fixed notes concerning "copies" to indicate that support is required for JPEG and
- 1470 PDF documents
- 1471 • Separated Printer Status attributes from Printer Description
- 1472 • Separated Job Status attributes from Job Description