



The Printer Working Group

April 17, 2018
Working Draft

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IPP Everywhere™ v1.1

Status: Interim

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

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

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

This document is available electronically at:

<https://ftp.pwg.org/pub/pwg/ipp/wd/wd-ippeve11-20180417.docx>
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75 systems supporting them work together better. All references to the PWG in this document
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78 define print related protocols, interfaces, procedures, and conventions. A PWG standard is
79 a stable, well understood, and technically competent specification that is widely used with
80 multiple independent and interoperable implementations. Printer manufacturers and
81 vendors of printer related software benefit from the interoperability provided by voluntary
82 conformance to these standards.

83 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.

Deleted: (e.g., cellphones, PDAs, netbooks, etc.)

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.

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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.

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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 [RFC8011].

212 *Device*: A Logical or Physical Device associated with one or more Printers; also see section
213 2.3 of [RFC8011].

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 a endpoint device, e.g., a marking engine,
223 a fax modem, etc.

229 2.2 Protocol Role Terminology

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

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

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

237 2.3 Other Terminology

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

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

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

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

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

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

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

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

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

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

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

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

263 **2.4 Acronyms and Organizations**

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

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

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

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

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

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

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

272

273 **3. Requirements**

274 **3.1 Rationale**

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

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

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

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

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

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

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

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

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

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

Formatted: Numbered + Level: 1 +
Numbering Style: 1, 2, 3, ... + Start at: 1 +
Alignment: Left + Aligned at: 0.5" + Indent at:
0.75"

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

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

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

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

318 **3.2 Use Cases**

319 **3.2.1 Select Printer**

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

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

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

329 **3.2.1.1 Select the Last Used Printer**

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

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

336 3.2.1.2 Select Printer Using Name or Address

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

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

343 3.2.1.3 Select Printer Using URI

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

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

348 3.2.1.4 Select Printer Using a Directory Service

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

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

355 3.2.1.5 Select Printer Using a Cloud Service

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

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

362 3.2.1.6 Select Printer Using a Discovery Protocol

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

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

369 3.2.1.7 Select Printer Using Geo-Location

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

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

376 3.2.1.8 Select Printer Using Out of Band Method

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

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

383 3.2.1.9 Select Printer Using Properties

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

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

395 3.2.2 Print

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

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

404 3.2.2.1 Print a Document

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

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

411 3.2.2.2 Print a Document by Reference

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

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

418 3.2.2.3 Print Using Loaded Media

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

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

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

430 3.2.2.4 Print a Secure Form

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

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

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

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

448 **3.2.2.5 Print with Special Formatting**

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

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

461 **3.2.2.6 Print and Select at Printer**

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

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

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

473 3.2.2.7 Print to a Service

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

481 3.2.2.8 Print to a Recipient

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

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

489 3.2.2.9 Print with a Proof Copy

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

496 3.2.3 Exceptions**497 3.2.3.1 Print Action Canceled**

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

501 3.2.3.2 Select Printer Canceled

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

504 3.2.3.3 Printer No Longer Network Accessible after Selection

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

508 3.2.3.4 Not Authorized

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

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

515 3.2.3.5 Needs Authentication

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

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

520 3.2.3.6 Not Accepting Jobs

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

523 3.2.3.7 Job Ticket or Document Format Not Supported

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

527 3.2.3.8 Job or Document Processing Failures

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

532 3.2.3.9 Printer Fault

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

536 **3.2.3.10 Printer Warning**

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

540 **3.3 Out of Scope**

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

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

549 **3.4 Design Requirements**

550 The IPP Everywhere™ design should:

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

558

559 4. Discovery Protocols

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

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

564 4.1 Printer Description Attributes Used in Discovery

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

567 4.2 DNS Service Discovery (DNS-SD)

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

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

574 4.2.1 Service (SRV) Instance Name

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

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

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

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

583 4.2.2 Geo-Location (LOC)

584 Printers MUST publish LOC records [RFC1876] over mDNS to provide the physical location
585 of the Printer. Printers MUST allow the User to configure the geo-location manually. If the
586 accuracy of the geo-location is unknown, a value of 9×10^9 meters (0x99) MUST be used.
587

588

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

589 Note 1: Extension attribute to RFC 7612.

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

591 **4.2.3 Text (TXT)**

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

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

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

601 For example, the IPP "printer-more-info" attribute has a maximum length of 1023 octets,
 602 however the corresponding "adminurl" key cannot represent a value longer than 246 octets
 603 (255 - 9 octets for "adminurl="). Printers MUST truncate long strings as described in section
 604 13.

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

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

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

Most Important Access Keys	Identification Keys	Capability Keys	Least Important Keys
rp	UUID	Color	pdl
txtvers	DUUID	Duplex	
priority	ty	Copies	
qtotal		Collate	
note		PaperMax	
air		PaperCustom	
TLS		Bind	
adminurl		Punch	
		Sort	
		Staple	

Deleted: Product
 usb_MFG
 usb_MDLL
 usb_CMD

610 Clients MUST ignore incomplete key/value pairs at the end of a truncated TXT record.
 611

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'
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)

Deleted: product ... [1]

Deleted: usb_CMD ... [2]

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

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

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

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

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

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

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

637 4.2.3.2 pdl

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

644 4.2.3.3 qtotal

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

654 4.2.3.4 TLS

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

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

659 '1.0'; TLS 1.0 [RFC2246] encryption is supported. This is equivalent to the value 'tls'
660 for the "uri-security-supported" Printer Description attribute.

661 '1.1'; TLS 1.1 [RFC4346] encryption is supported. This is equivalent to the value 'tls'
662 for the "uri-security-supported" Printer Description attribute.

663 '1.2'; TLS 1.2 [RFC5246] encryption is supported. This is equivalent to the value 'tls'
664 for the "uri-security-supported" Printer Description attribute.

665 '1.3'; TLS 1.3 [RFC-TLS1.3] encryption is supported. This is equivalent to the value
666 'tls' for the "uri-security-supported" Printer Description attribute.

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

670 4.2.3.5 UUID

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

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

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

676 12345678-9ABC-DEF0-1234-56789ABCDEF0

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

679 4.2.3.6 DUUID

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

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

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

685 12345678-9ABC-DEF0-1234-56789ABCDEF0

Deleted: <#>usb_CMD
 <#>The REQUIRED "usb_CMD" key provides the COMMAND SET (CMD) [PWG5107.2] value from the "printer-device-id" Printer attribute.
 <#>usb_MFG
 <#>The REQUIRED "usb_MFG" key provides the MANUFACTURER (MFG) value from the "printer-device-id" Printer attribute.
 <#>usb_MDL
 <#>The REQUIRED "usb_MDL" key provides the MODEL (MDL) value from the "printer-device-id" Printer attribute.

698 **4.3 LDAP and SLP Discovery**

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

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

704 For example, the IPP "printer-device-id" attribute has a maximum length of 1023 octets,
705 however the corresponding LDAP "printer-device-id" attribute has a maximum length of 255
706 octets. Printers MUST truncate long strings as defined in section 13.
707

708 5. Protocol Binding

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

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

713 5.1 HTTP Features

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

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

721 5.1.1 Host

722 Printers MUST validate the Host request header and SHOULD use the Host value in
723 generated URIs.

724 5.1.2 If-Modified-Since, Last-Modified, and 304 Not Modified

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

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

731 5.1.3 Cache-Control

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

737

Deleted: al

Deleted: additional

740 **5.2 IPP Operations**

741 Table 4 lists the REQUIRED operations for an [IPP Everywhere™](#) Printer. Additionally,
 742 Clients and Printers SHOULD support the Get-User-Printer-Attributes [GUPA] operation for
 743 per-User print policies.

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

747 **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

Deleted: Required

Deleted: (note 2)

748 [Note 1: RECOMMENDED for Logical Devices, REQUIRED otherwise.](#)

749 **5.3 IPP Printer Description Attributes**

750 Table 5 lists the Printer Description attributes for an [IPP Everywhere™](#) Printer. All attributes
 751 in the table are REQUIRED unless otherwise specified.

752 **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

Deleted: printer-device-id ... [3]

755
 756 Note 1: CONDITIONALLY REQUIRED for Printers that implement Paid Imaging
 757 services.
 758 Note 2: REQUIRED for the "application/pdf" and "image/jpeg" MIME media types.
 759 Note 3: CONDITIONALLY REQUIRED for Printers with finishers.
 760 Note 4: CONDITIONALLY REQUIRED for Printers that support the Print to a
 761 Recipient (section 3.2.2.8) use case.
 762 Note 5: CONDITIONALLY REQUIRED for Printers that support long-edge feed
 763 media.
 764 Note 6: URIs MUST be absolute, SHOULD use the Host value from HTTP header
 765 (section 5.1.1), and MUST NOT use link-local addresses (section 8.4).
 766 Note 7: RECOMMENDED due to its omission from IPP Everywhere™ 1.0, however
 767 it is needed for the underlying functionality.
 768 [Note 8: CONDITIONALLY REQUIRED for Printers that support ICC-based color](#)
 769 [management.](#)

770 **5.3.1 media-col-database (1setOf collection)**

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

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

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

```
782     media-col-database=..., {  
783         media-size={  
784             x-dimension=5000-33020  
785             y-dimension=5000-48260 }  
786         media-source='by-pass-tray' }, ...
```

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

```
793     media-col-database=..., {  
794         media-size={  
795             x-dimension=20320-152400  
796             y-dimension=1524-9144000 }, ...
```

797 5.3.2 media-col-ready (1setOf collection)

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

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

808 Roll media sizes are described using an integer value for the "x-dimension" and a
809 `rangeOfInteger` value for the "y-dimension" member attributes of the "media-size" member
810 attribute. The "x-dimension" value refers to the width of the loaded roll, the lower bound of
811 the "y-dimension" value refers to the minimum length allowed, and the upper bound of the
812 "y-dimension" value refers to the remaining length of the loaded roll or, if the remainder is
813 not known, the maximum length allowed.

814 5.3.3 media-ready (1setOf (type3 keyword | name(MAX)))

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

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

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

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

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

834 5.3.4 media-size-supported (1setOf collection)

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

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

```
843     media-size-supported=..., {  
844         x-dimension=5000-33020  
845         y-dimension=5000-48260 }, ...
```

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

```
852     media-size-supported=..., {  
853         x-dimension=20320-152400  
854         y-dimension=1524-9144000 }, ...
```

855 5.3.5 media-supported (1setOf (type3 keyword | name(MAX)))

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

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

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

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

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

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

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

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

880 5.3.6 pdl-override-supported (type2 keyword)

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

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

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printer-device-id (text(1023))¶
The REQUIRED "printer-device-id" Printer attribute provides the IEEE 1284 Device ID [IEEE1284] string for the Imaging Device. Because discovery protocols often have lower limits on the length of string values, Printers MUST list the Device ID key/value pairs in the following order:¶
All required (MANUFACTURER/MFG, MODEL/MDL, and COMMAND SET/CMD) key/value pairs,¶
All optional key/value pairs, and¶
All vendor key/value pairs.¶
For interoperability, Printers MUST NOT report standard key/value pairs using non-standard abbreviations. For example, "MANU" is sometimes used as an abbreviation for "MANUFACTURER", however the only allowed abbreviation is "MFG".¶
The optional and vendor key/value pairs can be prioritized by Client software requirements. This allows the Printer to truncate the Device ID string on key/value boundaries as needed (section 13.4) without loss of critical information needed for selection of device-specific or generic driver software on the Client.¶

915 **5.4 IPP Printer Status Attributes**

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

918 **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

919
 920 Note 1: URIs MUST be absolute, SHOULD use the Host value from HTTP header
 921 (section 5.1.1), and MUST NOT use link-local addresses (section 8.4).

922 **5.4.1 printer-uri-supported (1setOf uri)**

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

926 **5.5 IPP Operation Attributes**

927 Table 7 lists the REQUIRED operation attributes for an [IPP Everywhere™](#) Printer.

928 **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

929 Note 1: CONDITIONALLY REQUIRED for Printers that support the "application/pdf"
 930 MIME media type.

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

933 Note 3: CONDITIONALLY REQUIRED for Printers that implement Paid Imaging
 934 services.

936

937 **5.6 IPP Job Description Attributes**938 Table 8 lists the REQUIRED Job Description attributes for an [IPP Everywhere™](#) Printer.939 **Table 8 - IPP Everywhere™ Required Job Description Attributes**

Attribute	Source
job-name	RFC 8011

940 **5.7 IPP Job Status Attributes**941 Table 8 lists the REQUIRED Job Status attributes for an [IPP Everywhere™](#) Printer.942 **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

943

944 Note 1: URIs MUST be absolute, SHOULD use the Host value from HTTP header
945 (section 5.1.1), and MUST NOT use link-local addresses (section 8.4).946 **5.7.1 job-id (integer)**

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

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

956 **5.7.2 job-uri (uri)**

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

963 **5.8 IPP Job Template Attributes**

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

966 **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

967
 968 **Note 1: CONDITIONALLY REQUIRED for Printers that implement paid imaging**
 969 **services.**

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971 Note 2: REQUIRED for the "application/pdf" and "image/jpeg" MIME media types.
972 Note 3: CONDITIONALLY REQUIRED for Printers that support the "application/pdf"
973 MIME media type.
974 Note 4: CONDITIONALLY REQUIRED for Printers with finishers.
975 Note 5: CONDITIONALLY REQUIRED for Printers that support long-edge feed
976 media.
977 Note 6: CONDITIONALLY REQUIRED for Printers that support multiple-Document
978 Jobs.
979 [Note 7: CONDITIONALLY REQUIRED for Printers that support ICC-based color](#)
980 [management.](#)

981 6. Document Formats

982 Printers MUST support documents conforming to the PWG Raster Format [PWG5102.4]
983 ("image/pwg-raster"). Color Printers MUST support documents conforming to the JPEG File
984 Information Format Version 1.02 [JFIF] ("image/jpeg"), specifically the metadata and JPEG
985 subset defined in the Standard of the Camera & Imaging Products Association, CIPA DC-
986 008-Translation-2016, Exchangeable image file format for digital still cameras: Exif Version
987 2.31 [EXIF].

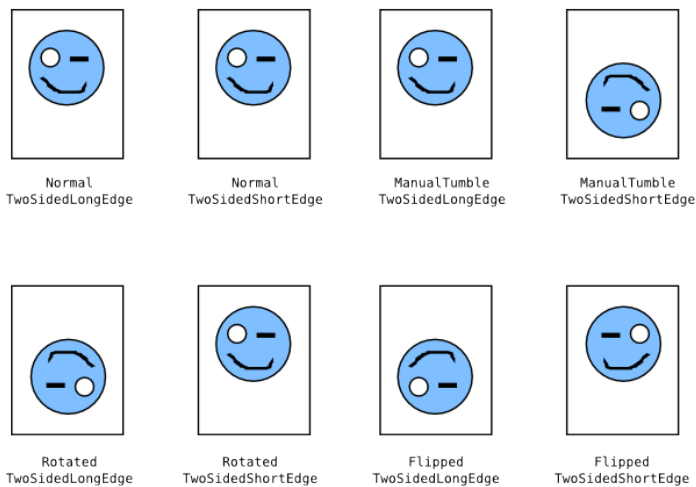
988 IPP/2.1 and IPP/2.2 Printers MUST and IPP/2.0 Printers SHOULD support documents
989 conforming to Document management — Portable document format — Part 1: PDF 1.7
990 [ISO32000] ("application/pdf"). IPP/2.0, IPP/2.1, and IPP/2.2 Printers are defined in
991 [PWG5100.12].

992 6.1 Supporting Long-Edge Feed Media with PWG Raster Format 993 Documents

994 Printers that support long-edge feed media MUST support the "feed-orientation" Job
995 Template attribute and corresponding "feed-orientation-default" and "feed-orientation-
996 supported" Printer attributes. In addition, Printers that support long-edge feed media MUST
997 report the "media-source-properties" member attribute in the "media-col-database" and
998 "media-col-ready" Printer attributes.

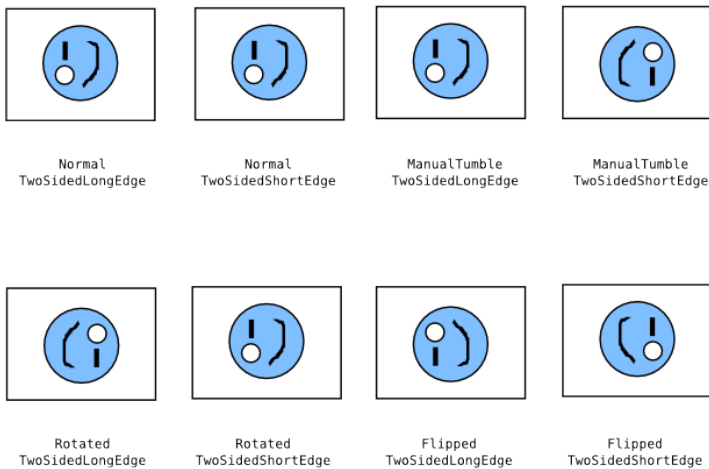
999 When submitting a PWG Raster document in a job or document creation request, Clients
1000 MUST additionally query the Printer for the "feed-orientation-supported", "media-col-
1001 database", and/or "media-col-ready" Printer attributes in order to provide a document in the
1002 correct orientation and dimensions for the Printer.

1003 Figures 2 through 5 show how raster data must be formatted for each feed orientation.
1004



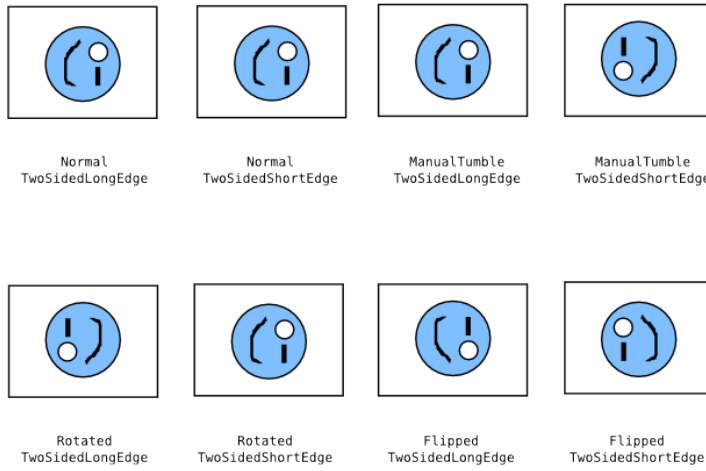
1005
1006
1007

Figure 1 - PWG Raster Bitmaps with Portrait Feed Orientation



1008
1009

Figure 2 - PWG Raster Bitmaps with Landscape Feed Orientation

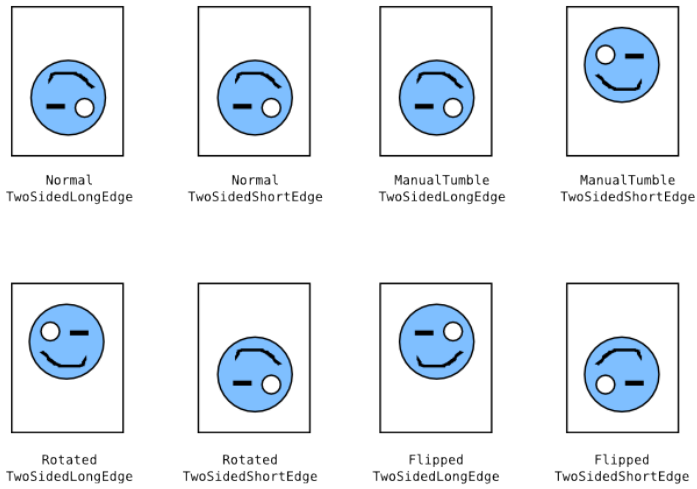


1010

1011

Figure 3 - PWG Raster Bitmaps with Reverse Landscape Feed Orientation

1012



1013

1014

Figure 4 - PWG Raster Bitmaps with Reverse Portrait Feed Orientation

1015 **7. Additional Values for Existing Attributes**

1016 **7.1 ipp-features-supported (1setOf type2 keyword)**

1017 This specification defines the REQUIRED keyword 'ipp-everywhere' for the "ipp-features-
1018 supported" Printer attribute.

1019

1020 **8. Additional Semantics for Existing Value Tags**

1021 This specification amends the definition of the nameWithLanguage,
1022 nameWithoutLanguage, naturalLanguage, textWithLanguage, textWithoutLanguage, and
1023 URI value tags defined in IPP/1.1: Model and Semantics [RFC8011] with additional
1024 restrictions to improve interoperability.

1025 **8.1 nameWithLanguage and nameWithoutLanguage**

1026 Name values MUST NOT contain characters in the "C0 Control Character Set" or the DEL
1027 character as defined in Unicode Format for Network Interchange [RFC5198]. Printers MUST
1028 transcode and filter values from MIBs and other sources to conform to the added
1029 restrictions.

1030 **8.2 naturalLanguage**

1031 NaturalLanguage values MUST conform to and be compared as defined in Tags for
1032 Identifying Languages [BCP47]. The shortest language tag MUST be used, e.g., "en"
1033 instead of "eng" for English. Printers SHOULD also support legacy language tags such as:

1034 'no'; replaced by 'nb' (Norwegian Bokmål),

1035 'zh-cn'; replaced by 'zh-hans' (Simplified Chinese), and

1036 'zh-tw'; replaced by 'zh-hant' (Traditional Chinese)

1037 **8.3 textWithLanguage and textWithoutLanguage**

1038 Text values MUST NOT contain the DEL character or characters in the "C0 Control
1039 Character Set" other than CR, LF, and HT [RFC5198]. Printers MUST transcode and filter
1040 values from MIBs and other sources to conform to the added restrictions.

1041 **8.4 uri**

1042 URI values MUST be in absolute form, i.e., "ipp://hostname.local/ipp/print" is acceptable but
1043 "///ipp/print" is not. URI values MUST NOT contain link-local addresses in the host field.
1044 Printers MUST NOT generate URI values with link-local addresses and SHOULD NOT
1045 generate URI values with addresses obtained via Dynamic Host Control Protocol (DHCP)
1046 [RFC2131] or other auto-configuration protocols. Printers SHOULD use the HTTP Host:
1047 header value when generating URIs for use in Client responses.
1048

1049 **9. Conformance Requirements**

1050 This section summarizes the Conformance Requirements detailed in the definitions in this
1051 document for Clients and Printers.

1052 **9.1 Conformance Requirements for Clients**

1053 In order for a Client to claim conformance to this specification a Client MUST support the
1054 following:

- 1055 1. DNS Service Discovery as defined in section 4.2
- 1056 2. IPP/2.0 as defined in section 5
- 1057 3. The REQUIRED operations listed in Table 4
- 1058 4. The REQUIRED Printer Description attributes listed in Table 5
- 1059 5. The REQUIRED operation attributes listed in Table 7
- 1060 6. The REQUIRED Job Template attributes listed in Table 10
- 1061 7. The REQUIRED Job Description attributes listed in Table 8
- 1062 8. The REQUIRED document formats listed in section 5.8
- 1063 9. The "feed-orientation-supported" Printer attribute and "media-source-properties"
1064 member attribute of the "media-col-database" and "media-col-ready" Printer
1065 attributes as reported by the Printer and defined in section 6.1
- 1066 10. The internationalization considerations as defined in section 10
- 1067 11. The security considerations as defined in section 0

1068 **9.2 Conformance Requirements for Printers**

1069 In order for a Printer to claim conformance to this specification a Printer MUST support the
1070 following:

- 1071 1. DNS Service Discovery as defined in section 4.2
- 1072 2. IPP/2.0 as defined in section 5
- 1073 3. The REQUIRED operations listed in Table 4
- 1074 4. The REQUIRED Printer Description attributes listed in Table 5
- 1075 5. The REQUIRED operation attributes listed in Table 7
- 1076 6. The REQUIRED Job Template attributes listed in Table 10
- 1077 7. The REQUIRED Job Description attributes listed in Table 8
- 1078 8. The REQUIRED document formats listed in section 5.8
- 1079 9. The 'ipp-everywhere' value for the "ipp-features-supported" Printer Description
1080 attribute as defined in section 7.1
- 1081 10. The additional semantics for attribute values as defined in section 8
- 1082 11. The internationalization considerations as defined in section 10
- 1083 12. The security considerations as defined in section 0
- 1084 13. The safe string truncation rules as defined in section 13

1085 9.3 Conditional Conformance Requirements for Printers

1086 Printers that support the "image/jpeg" [JFIF] MIME media type MUST support:

- 1087 1. The "copies-default", and "copies-supported" Printer Description attributes as
1088 defined in section 0.
1089 2. The "copies_" Job Template attribute as defined in section 5.8.

1090 Printers that support the "application/pdf" [ISO32000] MIME media type MUST support:

- 1091 1. The "copies-default", "copies-supported", "document-password-supported", and
1092 "page-ranges-supported" Printer Description attributes as defined in section 0,
1093 2. The "document-password" Operation attribute as defined in section 5.4, and
1094 3. The "copies", "multiple-document-handling", "overrides", and "page-ranges" Job
1095 Template attributes as defined in section 5.8.

1096 Printers that support the Print to a Recipient use case (section 3.2.2.8) MUST support:

- 1097 1. The "job-password-supported" and "job-password-encryption-supported" Printer
1098 Description attributes as defined in section 0, and
1099 2. The "job-password" and "job-password-encryption" Operation attributes as
1100 defined in section 5.4.

1101 Printers that provide Paid Print services MUST support:

- 1102 1. The "job-account-id-default", "job-account-id-supported", "job-accounting-user-
1103 id-default", "job-accounting-user-id-supported", "job-mandatory-attributes-
1104 default", "job-mandatory-attributes-supported", and "printer-mandatory-job-
1105 attributes" Printer Description attributes as defined in section 0,
1106 2. The "job-mandatory-attributes" operation attribute as defined in section 5.4, and
1107 3. The "job-account-id" and "job-accounting-user-id" Job Template attributes as
1108 defined in section 5.8.

1109 Printers that support long-edge feed media MUST support:

- 1110 1. The "feed-orientation-default" and "feed-orientation-supported" Printer
1111 Description attributes as defined in section 0.
1112 2. The "media-source-properties" member attribute of the "media-col-database"
1113 and "media-col-ready" Printer Description attributes as defined in section 0.
1114 3. The "feed-orientation" Job Template attribute as defined in section 5.8.

1115 [Printers that support ICC-based color management MUST support:](#)

- 1116 [4. The "print-rendering-intent-default", "print-rendering-intent-supported", and](#)
1117 ["printer-icc-profiles" Printer Description attributes as defined in section 5.3.](#)
1118 [5. The "print-render-intent" Job Template attribute as defined in section 5.8.](#)

1119 **10. Internationalization Considerations**

1120 For interoperability and basic support for multiple languages, conforming implementations
1121 MUST support:

- 1122 1. The Universal Character Set (UCS) Transformation Format -- 8 bit (UTF-8)
1123 [STD63] encoding of Unicode [UNICODE] [ISO10646]; and
- 1124 2. The Unicode Format for Network Interchange [RFC5198] which requires
1125 transmission of well-formed UTF-8 strings and recommends transmission of
1126 normalized UTF-8 strings in Normalization Form C (NFC) [UAX15].

1127 Unicode NFC is defined as the result of performing Canonical Decomposition (into base
1128 characters and combining marks) followed by Canonical Composition (into canonical
1129 composed characters wherever Unicode has assigned them).

1130 **WARNING** – Performing normalization on UTF-8 strings received from Clients and
1131 subsequently storing the results (e.g., in Job objects) could cause false negatives in Client
1132 searches and failed access (e.g., to Printers with percent-encoded UTF-8 URIs now
1133 'hidden').

1134 Implementations of this specification **SHOULD** conform to the following standards on
1135 processing of human-readable Unicode text strings, see:

- 1136 Unicode Bidirectional Algorithm [UAX9] – left-to-right, right-to-left, and vertical
- 1137 Unicode Line Breaking Algorithm [UAX14] – character classes and wrapping
- 1138 Unicode Normalization Forms [UAX15] – especially NFC for [RFC5198]
- 1139 Unicode Text Segmentation [UAX29] – grapheme clusters, words, sentences
- 1140 Unicode Identifier and Pattern Syntax [UAX31] – identifier use and normalization
- 1141 Unicode Collation Algorithm [UTS10] – sorting
- 1142 Unicode Locale Data Markup Language [UTS35] – locale databases

1143 Implementations of this specification are advised to also review the following informational
1144 documents on processing of human-readable Unicode text strings:

- 1145 Unicode Character Encoding Model [UTR17] – multi-layer character model
- 1146 Unicode in XML and other Markup Languages [UTR20] – XML usage
- 1147 Unicode Character Property Model [UTR23] – character properties
- 1148 Unicode Conformance Model [UTR33] – Unicode conformance basis

1149 **11. Security Considerations**

1150 The IPP extensions defined in this document require the same security considerations as
1151 defined in the IPP/1.1: Model and Semantics [RFC8011]. In addition, Printers MUST
1152 validate the HTTP Host request header in order to protect against DNS rebinding attacks.

1153 Implementations of this specification SHOULD conform to the following standard on
1154 processing of human-readable Unicode text strings, see:

1155 Unicode Security Mechanisms [UTS39] – detecting and avoiding security attacks

1156 Implementations of this specification are advised to also review the following
1157 informational document on processing of human-readable Unicode text strings:

1158 Unicode Security FAQ [UNISECFAQ] – common Unicode security issues

1159

1160

1161 12. IANA Considerations

1162 12.1 Attribute Value Registrations

1163 The keyword attribute values defined in this document will be published by IANA according
 1164 to the procedures in the IPP Model and Semantics [RFC8011] section 7.3 in the following
 1165 file:

1166 <http://www.iana.org/assignments/ipp-registrations>

1167 The registry entries will contain the following information:

1168	Attributes (attribute syntax)		Reference
1169	Keyword Attribute Value		-----
1170	-----		-----
1171	ipp-features-supported (1setOf type2 keyword)		[PWG5100.13]
1172	ipp-everywhere		[PWG5100.14]

1173 13. Safe String Truncation

1174 Strings can be truncated or omitted when transferred over alternate protocols. Printers
 1175 MUST truncate long strings at logical boundaries. The following subsections describe how
 1176 this truncation is performed for different kinds of strings.

1177 13.1 Plain Text Strings

1178 Plain text strings MUST be truncated at the end of a valid character sequence. For example,
 1179 strings using the UTF-8 transformation format of ISO 10646 [STD0063] [ISO10646-1]
 1180 SHOULD be represented using the Unicode Format for Network Interchange [RFC5198]
 1181 and MUST be truncated at the end of a valid UTF-8 sequence.

1182 For example, the 9 octet UTF-8 sequence 0x48.65.CA.81.6C.6C.6F.C2.81 (Héllö_i) would
 1183 be shortened to fit within 6 octets by composing the é (0x65.CA.81 becomes 0xC3.A9) and
 1184 removing the trailing UTF-8 sequence 0xC2.81 (_i), resulting in the 6 octet UTF-8 sequence
 1185 0x48.C3.A9.6C.6C.6F (Héllö).

1186 13.2 URIs

1187 URIs MUST be truncated so that the URI remains valid and accepted by the Printer. For
 1188 example, the 46 octet URI "ipp://printer.example.com/ipp/really-long-name" might be
 1189 shortened to fit within 32 octets by removing the last path name component, resulting in the
 1190 29 octet URI "ipp://printer.example.com/ipp". Similarly, the 52 octet URI
 1191 "ipp://printer.example.com/ipp?query-string" might be shortened to fit within 32 octets by
 1192 removing the query string.

1193 As recommended by the Uniform Resource Identifier (URI): Generic Syntax [STD66],
1194 Printers SHOULD omit the port number from the URI when it has the default value, e.g., 80
1195 for "http", 443 for "https", and 631 for "ipp" and "ipps" URIs.

1196 13.3 MIME Media Types

1197 MIME media type strings MUST be truncated at the end of the media subtype, removing
1198 any parameters that are included with the media type. If the resulting string still exceeds the
1199 maximum length it MUST be discarded. For example, the 24 octet MIME media type
1200 "text/plain;charset=utf-8" would be shortened to fit within 16 octets by removing the trailing
1201 parameter, resulting in the 10 octet MIME media type "text/plain".

1202 13.4 Delimited Lists

1203 Delimited Lists combine one or more string types listed in the previous sections, separated
1204 by a delimiting character such as a comma or semicolon. Delimited lists MUST first be
1205 shortened by removal of unnecessary path components (URIs) and parameters (MIME
1206 media types) and second truncated at a delimiting character. For example, the 40 octet list
1207 of MIME media types "text/plain;charset=utf-8,application/pdf" would be shortened to fit
1208 within 32 octets by removing the MIME media type parameter, resulting in the 26 octet list
1209 "text/plain,application/pdf". The same list would be shortened to fit within 16 octets by also
1210 removing the last MIME media type, resulting in the 10 octet list "text/plain".

Deleted: ~~IEEE 1284 Device ID Strings~~
~~IEEE 1284 device identifier strings contain a list of delimited key/value pairs. Device ID strings MUST be truncated at the end of a value key/value pair with the shortest form of a key used. For example, the 57 octet IEEE 1284 device ID string "MANUFACTURER:Example;MODEL:Laser Printer;COMMAND SET:PS;" would be shortened to fit within 32 octets by substituting the abbreviated key names and removing the trailing key/value pair, resulting in the 32 octet string "MFG:Example;MDL:Laser Printer;".~~

1211 14. Overview of Changes

1212 14.1 IPP Everywhere™ v1.1

1213 The following changes were made [to PWG 5100.14-2013: IPP Everywhere](#), [\[PWG5100.14\]](#):

1214 • References [now point to](#) the current versions of dependent documents and
1215 specifications at the time of publication;

1216 • Requirements to support [and definitions of](#) WS-Discovery [have been](#) removed due
1217 to [a lack of implementations, which effectively made WS-Discovery support](#)
1218 [OPTIONAL](#);

1219 • [References to OpenXPS and SSDP](#) [have been](#) removed;

1220 • [The "printer-device-id" Printer Description attribute and associated DNS-SD TXT](#)
1221 [record keys are no longer required](#);

1222 • [ICC attributes are now CONDITIONALLY REQUIRED for printers that support ICC-](#)
1223 [based color management](#);

Deleted: for

Deleted: v1.1

Deleted: were

Deleted: updated to reflect

Deleted: were

Deleted: , WS-Discovery, and OpenXPS

Deleted: were

Deleted: due to lack of implementation

- 1245 • JPEG support is now CONDITIONALLY REQUIRED for color printers.
- 1246 • IPP Finishings 2.1 and the "finishings-col" Job Template attribute are now
1247 RECOMMENDED; [and](#)
- 1248 • Printer Status and Job Status attributes are now listed in a separate section to match
1249 RFC 8011 and the IANA IPP registry.

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1470 ipp@pwg.org (subscribers only)

1471 To subscribe, see the PWG web page:

1472 <http://www.pwg.org/>

1473 Implementers of this specification document are encouraged to join the IPP Mailing List in
1474 order to participate in any discussions of clarification issues and review of registration
1475 proposals for additional attributes and values.

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1478 Andrew Mitchell
1479 Jerry Thrasher - Lexmark
1480 Peter Zehler - Xerox
1481

1482 17. Change History

1483 [17.1 April 17, 2018](#)

- 1484 [3. Removed all references to 1284 device IDs and associated information.](#)

1485 [17.2 April 16, 2018](#)

- 1486 [4. Made sure IPP Everywhere™ consistently has trademark symbol.](#)
1487 [5. Section 1: Drop examples of mobile devices.](#)
1488 [6. Section 4.2.3.4: TLS key required for IPPS.](#)
1489 [7. Section 5.1: Fix typos.](#)
1490 [8. Section 5.2: Made Identify-Printer operation recommended for logical devices,](#)
1491 [required otherwise.](#)
1492 [9. Sections 5.3 and 5.8: Made print-rendering-intent and printer-icc-profiles](#)
1493 [conditionally required for printers that support ICC-based color management.](#)
1494 [10. Section 5.3.6: Clarify pdl-override-supported values and usage.](#)
1495 [11. Section 5.7: Deleted stray "note 7"](#)
1496 [12. Section 9.3: Added ICC attributes here.](#)
1497 [13. Section 14: Reworded for present tense, clarified why WS-Discovery has been](#)
1498 [removed, removed reason for removing OpenXPS and SSDP.](#)

1499 17.3 April 3, 2018

- 1500 1. Make JPEG support conditionally required for color printers.

1501 17.4 February 9, 2018

- 1502 1. Initial v1.1 draft
1503 2. Updated template
1504 3. Updated abstract (can't call it a standard in the abstract)
1505 4. Updated spec references to current versions
1506 5. Dropped all mention of UPNP, SSDP, WS-Discovery, and OpenXPS (never
1507 implemented)
1508 6. Added a new "Overview of Changes" chapter that documents the high-level
1509 changes since the original IPP Everywhere specification
1510 7. Now recommend support for the Get-User-Printer-Attributes operation
1511 8. Now recommend support for the "finishings-col" attributes (PWG 5100.1)
1512 9. Now recommend support for TLS 1.3
1513 10. Now recommend using a resource path of /ipp/print or /ipp/print/name in Printer
1514 URIs
1515 11. Issue 11: printer-current-time is now listed as an IPP Everywhere attribute,
1516 although only RECOMMENDED since it was missing in the 1.0 spec. (all of the

- 1517 date-time attributes were previously required, so printer-current-time would
1518 have implicitly been required)
- 1519 12. Issue 12: The reference to PWG 5100.12 has been corrected
- 1520 13. Issue 13: The reference to the EXIF specification has been updated.
- 1521 14. Issue 13: The reference to PWG 5101.1 has been updated.
- 1522 15. Issue 14: Clarified the pdl-override-supported requirements ('attempted' or
1523 'guaranteed')
- 1524 16. Issue 15: Clarified that relative URIs ("//ipp/print") are not allowed in IPP.
- 1525 17. Issue 26: "job-preferred-attributes-supported" should have been "preferred-
1526 attributes-supported"
- 1527 18. Issue 31: Incorrect references to PWG 5101.2 have been changed to PWG
1528 5101.1 (MSN)
- 1529 19. Issue 33: The notes concerning IPP/2.x conformance changes were confusing
1530 and have been removed
- 1531 20. Issue 34: Table 6: overrides-supported now correctly references "note 2"
1532 (conditionally required).
- 1533 21. Issue 35: overrides-supported.document-numbers is now **CONDITIONALLY**
1534 **REQUIRED**
- 1535 22. Fixed attribute examples to use PAPI encoding
- 1536 23. Fixed notes concerning "copies" to indicate that support is required for JPEG
1537 and PDF documents
- 1538 24. Separated Printer Status attributes from Printer Description
- 1539 25. Separated Job Status attributes from Job Description

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product	The PostScript product name, typically the value reported by the "printer-make-and-model" Printer Description attribute with parenthesis, e.g., '(Example Model)'. <hr/>	" (empty string)
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usb_CMD	The IEEE 1284 Device ID command set value. See section 4.2.3.5.	" (empty string)
usb_MDL	The IEEE 1284 Device ID model value. See section 4.2.3.7.	" (empty string)
usb_MFG	The IEEE 1284 Device ID manufacturer value. See section 4.2.3.6. <hr/>	" (empty string)

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<u>printer-device-id</u>	<hr/>	PWG 5107.2
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