



The Printer Working Group

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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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1. Introduction

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

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

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

2. Terminology

2.1 Printing Terminology

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

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

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

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

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

Output Device: a single Logical or Physical Device

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

227 2.2 Protocol Role Terminology

228 This document also defines the following protocol roles to specify unambiguous
229 conformance requirements:

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

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

235 2.3 Other Terminology

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

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

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

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

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

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

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

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

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

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

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

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

261 **2.4 Acronyms and Organizations**

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

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

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

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

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

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

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

270

3. Requirements

3.1 Rationale

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

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

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

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

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

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

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

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

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

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

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

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

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

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

316 **3.2 Use Cases**

317 **3.2.1 Select Printer**

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

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

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

327 **3.2.1.1 Select the Last Used Printer**

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

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

334 3.2.1.2 Select Printer Using Name or Address

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

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

341 3.2.1.3 Select Printer Using URI

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

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

346 3.2.1.4 Select Printer Using a Directory Service

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

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

353 3.2.1.5 Select Printer Using a Cloud Service

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

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

360 3.2.1.6 Select Printer Using a Discovery Protocol

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

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

3.2.1.7 Select Printer Using Geo-Location

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

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

3.2.1.8 Select Printer Using Out of Band Method

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

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

3.2.1.9 Select Printer Using Properties

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

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

3.2.2 Print

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

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

402 3.2.2.1 Print a Document

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

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

409 3.2.2.2 Print a Document by Reference

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

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

416 3.2.2.3 Print Using Loaded Media

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

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

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

428 3.2.2.4 Print a Secure Form

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

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

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

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

446 **3.2.2.5 Print with Special Formatting**

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

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

459 **3.2.2.6 Print and Select at Printer**

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

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

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

471 3.2.2.7 Print to a Service

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

479 3.2.2.8 Print to a Recipient

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

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

487 3.2.2.9 Print with a Proof Copy

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

494 3.2.3 Exceptions**495 3.2.3.1 Print Action Canceled**

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

499 3.2.3.2 Select Printer Canceled

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

502 3.2.3.3 Printer No Longer Network Accessible after Selection

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

506 3.2.3.4 Not Authorized

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

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

513 3.2.3.5 Needs Authentication

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

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

518 3.2.3.6 Not Accepting Jobs

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

521 3.2.3.7 Job Ticket or Document Format Not Supported

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

525 3.2.3.8 Job or Document Processing Failures

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

530 3.2.3.9 Printer Fault

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

534 3.2.3.10 Printer Warning

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

538 3.3 Out of Scope

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

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

547 3.4 Design Requirements

548 The IPP Everywhere™ design should:

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

4. Discovery Protocols

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

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

4.1 Printer Description Attributes Used in Discovery

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

4.2 DNS Service Discovery (DNS-SD)

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

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

4.2.1 Service (SRV) Instance Name

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

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

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

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

4.2.2 Geo-Location (LOC)

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

586

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

587 Note 1: Extension attribute to RFC 7612.

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

589 **4.2.3 Text (TXT)**

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

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

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

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

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

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

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	

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

610

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: printing

Deleted: specification

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

612 **4.2.3.1 air**

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

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

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

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

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

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

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

631 4.2.3.2 pdl

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

638 4.2.3.3 qtotal

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

648 4.2.3.4 TLS

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

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

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

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

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

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

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

664 4.2.3.5 UUID

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

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

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

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

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

673 4.2.3.6 DUUID

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

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

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

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

680 **4.3 LDAP and SLP Discovery**

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

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

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

5. Protocol Binding

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

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

5.1 HTTP Features

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

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

5.1.1 Host

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

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

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

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

5.1.3 Cache-Control

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

5.2 IPP Operations

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

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

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

Note 1: RECOMMENDED for Logical Devices, REQUIRED otherwise.

5.3 IPP Printer Description Attributes

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

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

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

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

Note 3: CONDITIONALLY REQUIRED for Printers with finishers.

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

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

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

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

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

5.3.1 media-col-database (1setOf collection)

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

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

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

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

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

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

5.3.2 media-col-ready (1setOf collection)

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

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

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

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

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

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

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

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

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

811 5.3.4 media-size-supported (1setOf collection)

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

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

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

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

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

832 5.3.5 media-supported (1setOf (type3 keyword | name(MAX)))

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

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

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

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

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

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

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

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

857 5.3.6 pdl-override-supported (type2 keyword)

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

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

5.4 IPP Printer Status Attributes

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

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

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

5.4.1 printer-uri-supported (1setOf uri)

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

5.5 IPP Operation Attributes

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

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

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

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

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

5.6 IPP Job Description Attributes

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

Table 8 - IPP Everywhere™ Required Job Description Attributes

Attribute	Source
job-name	RFC 8011

5.7 IPP Job Status Attributes

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

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

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

5.7.1 job-id (integer)

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

5.7.2 job-uri (uri)

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

5.8 IPP Job Template Attributes

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

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

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

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

925 6. Document Formats

926 Printers MUST support documents conforming to the PWG Raster Format [PWG5102.4]
927 ("image/pwg-raster"). Color Printers MUST support documents conforming to the JPEG File
928 Information Format Version 1.02 [JFIF] ("image/jpeg"), specifically the metadata and JPEG
929 subset defined in the Standard of the Camera & Imaging Products Association, CIPA DC-
930 008-Translation-2016, Exchangeable image file format for digital still cameras: Exif Version
931 2.31 [EXIF].

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

936 6.1 Supporting Long-Edge Feed Media with PWG Raster Format 937 Documents

938 Printers that support long-edge feed media MUST support the "feed-orientation" Job
939 Template attribute and corresponding "feed-orientation-default" and "feed-orientation-
940 supported" Printer attributes. In addition, Printers that support long-edge feed media MUST
941 report the "media-source-properties" member attribute in the "media-col-database" and
942 "media-col-ready" Printer attributes.

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

947 Figures 2 through 5 show how raster data must be formatted for each feed orientation.
948

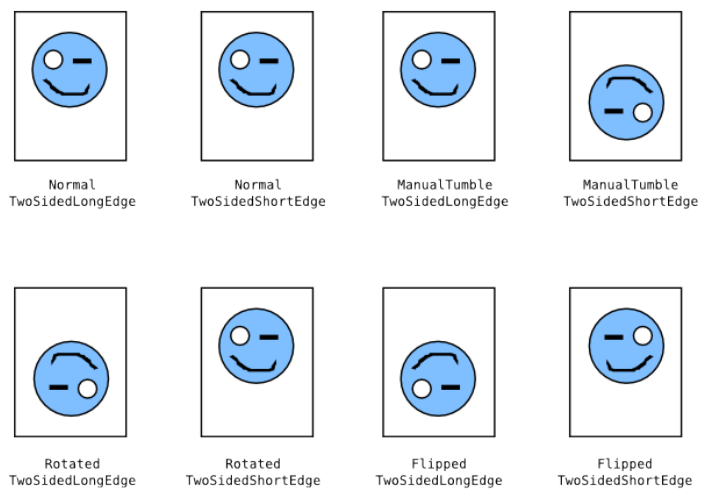


Figure 1 - PWG Raster Bitmaps with Portrait Feed Orientation

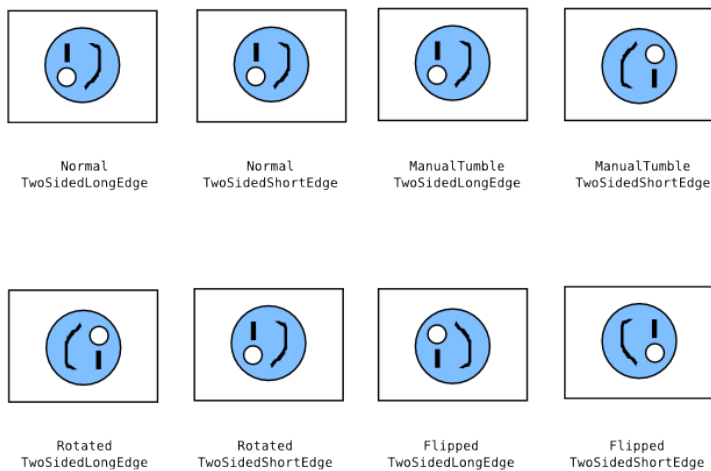


Figure 2 - PWG Raster Bitmaps with Landscape Feed Orientation

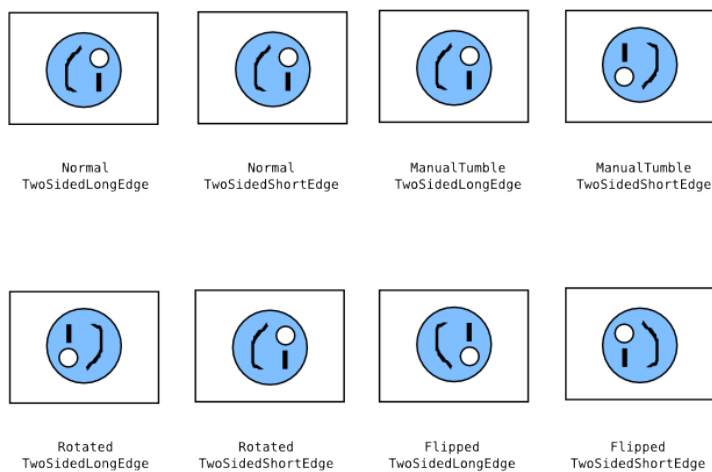


Figure 3 - PWG Raster Bitmaps with Reverse Landscape Feed Orientation

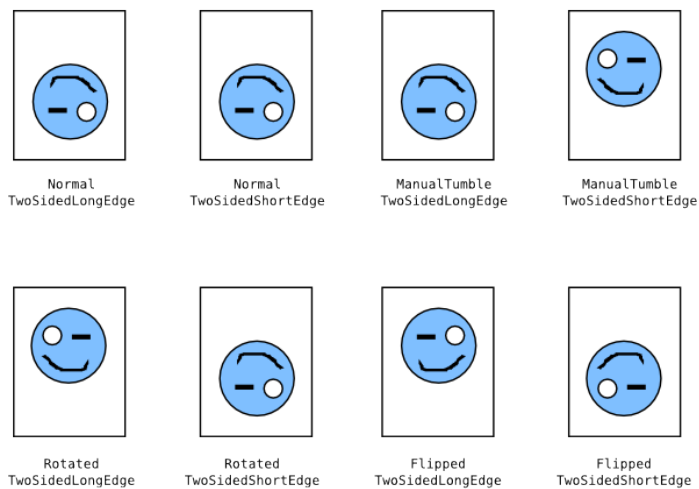


Figure 4 - PWG Raster Bitmaps with Reverse Portrait Feed Orientation

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

960 **7.1 ipp-features-supported (1setOf type2 keyword)**

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

963

8. Additional Semantics for Existing Value Tags

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

8.1 `nameWithLanguage` and `nameWithoutLanguage`

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

8.2 `naturalLanguage`

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

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

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

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

8.3 `textWithLanguage` and `textWithoutLanguage`

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

8.4 `uri`

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

9. Conformance Requirements

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

9.1 Conformance Requirements for Clients

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

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

9.2 Conformance Requirements for Printers

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

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

9.3 Conditional Conformance Requirements for Printers

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

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

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

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

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

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

Printers that provide Paid Print services MUST support:

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

Printers that support long-edge feed media MUST support:

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

Printers that support ICC-based color management MUST support:

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

10. Internationalization Considerations

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

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

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

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

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

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

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

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

11. Security Considerations

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

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

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

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

Unicode Security FAQ [UNISECFAQ] – common Unicode security issues

12. IANA Considerations

12.1 Attribute Value Registrations

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

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

The registry entries will contain the following information:

Attributes (attribute syntax)	Reference
Keyword Attribute Value	-----
-----	-----
ipp-features-supported (lsetOf type2 keyword)	[PWG5100.13]
ipp-everywhere	[PWG5100.14]

13. Safe String Truncation

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

13.1 Plain Text Strings

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

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

13.2 URIs

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

1137 As recommended by the Uniform Resource Identifier (URI): Generic Syntax [STD66],
1138 Printers SHOULD omit the port number from the URI when it has the default value, e.g., 80
1139 for "http", 443 for "https", and 631 for "ipp" and "ipps" URIs.

1140 13.3 MIME Media Types

1141 MIME media type strings MUST be truncated at the end of the media subtype, removing
1142 any parameters that are included with the media type. If the resulting string still exceeds the
1143 maximum length it MUST be discarded. For example, the 24 octet MIME media type
1144 "text/plain;charset=utf-8" would be shortened to fit within 16 octets by removing the trailing
1145 parameter, resulting in the 10 octet MIME media type "text/plain".

1146 13.4 Delimited Lists

1147 Delimited Lists combine one or more string types listed in the previous sections, separated
1148 by a delimiting character such as a comma or semicolon. Delimited lists MUST first be
1149 shortened by removal of unnecessary path components (URIs) and parameters (MIME
1150 media types) and second truncated at a delimiting character. For example, the 40 octet list
1151 of MIME media types "text/plain;charset=utf-8,application/pdf" would be shortened to fit
1152 within 32 octets by removing the MIME media type parameter, resulting in the 26 octet list
1153 "text/plain,application/pdf". The same list would be shortened to fit within 16 octets by also
1154 removing the last MIME media type, resulting in the 10 octet list "text/plain".

1155 14. Overview of Changes

1156 14.1 IPP Everywhere™ v1.1

1157 The following changes were made to PWG 5100.14-2013: IPP Everywhere [PWG5100.14]:

- 1158 • References now point to the current versions of dependent documents and
1159 specifications at the time of publication;
- 1160 • Requirements ~~for~~ WS-Discovery have been removed due to a lack of
1161 implementations, which effectively made WS-Discovery support OPTIONAL;
- 1162 • References to OpenXPS and SSDP have been removed;
- 1163 • The "printer-device-id" Printer Description attribute and associated DNS-SD TXT
1164 record keys are no longer required;
- 1165 • ICC attributes are now CONDITIONALLY REQUIRED for printers that support ICC-
1166 based color management;
- 1167 • JPEG support is now CONDITIONALLY REQUIRED for color printers;

Deleted: to support and definitions of

- 1169 • IPP Finishings 2.1 and the "finishings-col" Job Template attribute are now
1170 RECOMMENDED; and
- 1171 • Printer Status and Job Status attributes are now listed in a separate section to match
1172 RFC 8011 and the IANA IPP registry.

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1380 To subscribe, see the PWG web page:
1381 <http://www.pwg.org/>

1382 Implementers of this specification document are encouraged to join the IPP Mailing List in
1383 order to participate in any discussions of clarification issues and review of registration
1384 proposals for additional attributes and values.

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1387 Andrew Mitchell
1388 Jerry Thrasher - Lexmark
1389 Peter Zehler - Xerox
1390

17. Change History

[17.1 June 6, 2018](#)

- [Section 5.7: Fixed cross-reference to Table 10.](#)
- [Section 14.1: Cleaned up WS-Discovery bullet.](#)
- [Section 15.2: Updated Bonjour Printing specification reference.](#)

17.2 April 17, 2018

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

17.3 April 16, 2018

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

17.4 April 3, 2018

- Make JPEG support conditionally required for color printers.

1414 17.5 February 9, 2018

- 1415 • Initial v1.1 draft
- 1416 • Updated template
- 1417 • Updated abstract (can't call it a standard in the abstract)
- 1418 • Updated spec references to current versions
- 1419 • Dropped all mention of UPNP, SSDP, WS-Discovery, and OpenXPS (never
1420 implemented)
- 1421 • Added a new "Overview of Changes" chapter that documents the high-level changes
1422 since the original IPP Everywhere specification
- 1423 • Now recommend support for the Get-User-Printer-Attributes operation
- 1424 • Now recommend support for the "finishings-col" attributes (PWG 5100.1)
- 1425 • Now recommend support for TLS 1.3
- 1426 • Now recommend using a resource path of /ipp/print or /ipp/print/name in Printer URIs
- 1427 • Issue 11: printer-current-time is now listed as an IPP Everywhere attribute, although
1428 only RECOMMENDED since it was missing in the 1.0 spec. (all of the date-time
1429 attributes were previously required, so printer-current-time would have implicitly been
1430 required)
- 1431 • Issue 12: The reference to PWG 5100.12 has been corrected
- 1432 • Issue 13: The reference to the EXIF specification has been updated.
- 1433 • Issue 13: The reference to PWG 5101.1 has been updated.
- 1434 • Issue 14: Clarified the pdl-override-supported requirements ('attempted' or
1435 'guaranteed')
- 1436 • Issue 15: Clarified that relative URIs ("//ipp/print") are not allowed in IPP.
- 1437 • Issue 26: "job-preferred-attributes-supported" should have been "preferred-
1438 attributes-supported"
- 1439 • Issue 31: Incorrect references to PWG 5101.2 have been changed to PWG 5101.1
1440 (MSN)

- 1441 • Issue 33: The notes concerning IPP/2.x conformance changes were confusing and
1442 have been removed
- 1443 • Issue 34: Table 6: overrides-supported now correctly references "note 2"
1444 (conditionally required).
- 1445 • Issue 35: overrides-supported.document-numbers is now CONDITIONALLY
1446 REQUIRED
- 1447 • Fixed attribute examples to use PAPI encoding
- 1448 • Fixed notes concerning "copies" to indicate that support is required for JPEG and
1449 PDF documents
- 1450 • Separated Printer Status attributes from Printer Description
- 1451 • Separated Job Status attributes from Job Description