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Working Draft

The Printer Working Group

Note: MDNS is defined at line 293 and mDNS is defined at 541 for the same thing.

IPP Everywhere

Status: Stable

Abstract: This standard defines an extension of IPP to support 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: ftp://ftp.pwg.org/pub/pwg/general/pwg-process30.pdf

This document is available electronically at:

ftp://ftp.pwg.org/pub/pwg/ipp/wd/wd-ippeve10-20120724.docx
ftp://ftp.pwg.org/pub/pwg/ipp/wd/wd-ippeve10-20120724.pdf

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About the IEEE-ISTO PWG

The Printer Working Group (or PWG) is a Program of the IEEE Industry Standards and Technology Organization (ISTO) with member organizations including printer manufacturers, print server developers, operating system providers, network operating systems providers, network connectivity vendors, and print management application developers. The group is chartered to make printers and the applications and operating systems supporting them work together better. All references to the PWG in this document implicitly mean “The Printer Working Group, a Program of the IEEE ISTO.” In order to meet this objective, the PWG will document the results of their work as open standards that define print related protocols, interfaces, procedures and conventions. Printer manufacturers and vendors of printer related software will benefit from the interoperability provided by voluntary conformance to these standards.

In general, a PWG standard is a specification that is stable, well understood, and is technically competent, has multiple, independent and interoperable implementations with substantial operational experience, and enjoys significant public support.

For additional information regarding the Printer Working Group visit:

http://www.pwg.org

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About the Internet Printing Protocol Work Group

The Internet Printing Protocol (IPP) working group has developed a modern, full-featured network printing protocol, which is now the industry standard. IPP allows a print client to query a printer for its supported capabilities, features, and parameters to allow the selection of an appropriate printer for each print job. IPP also provides job information prior to, during, and at the end of job processing.

For additional information regarding IPP visit:

http://www.pwg.org/ipp/

Implementers of this specification are encouraged to join the IPP mailing list in order to participate in any discussions of the specification. Suggested additions, changes, or clarification to this specification, should be sent to the IPP mailing list for consideration.

Table of Contents

List of Figures

172
173

List of Tables

1. Introduction

This is not "really" true; mobile device do not incorporate a print-model. While IPP provides a common communication protocol it has nothing to do with vendor-specific drivers.

New mobile devices (e.g., cellphones, PDAs, netbooks, etc.) 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 now available for traditional desktop systems, this printer driver model is clearly not practical for mobile devices.

The goal of IPP Everywhere is to allow 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 Conformance Terminology

Capitalized terms, such as MUST, MUST NOT, RECOMMENDED, REQUIRED, SHOULD, SHOULD NOT, MAY, and OPTIONAL, have special meaning relating to conformance as defined in Key words for use in RFCs to Indicate Requirement Levels [RFC2119].

The term CONDITIONALLY REQUIRED is additionally defined for a conformance requirement that applies to a particular capability or feature.

2.2 Imaging 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 [RFC2911].

This document also defines the following protocol roles in order to specify unambiguous conformance requirements:

< can we put the definition here instead of looking it up in another spec>

Device; as defined in section 2.3 of Internet Printing Protocol/1.1: Model and Semantics; also see *Logical Device* and *Physical Device*

Client; Initiator of outgoing IPP session requests and sender of outgoing IPP operation requests (Hypertext Transfer Protocol -- HTTP/1.1 [RFC2616] User Agent).

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.

v physical

Physical Device; a device that renders output (typically on paper.)

vvvv IPP Printer (from later is spec, it should be IPP Everywhere Printer)

Printer; Listener for incoming IPP session requests and receiver of incoming IPP operation requests (Hypertext Transfer Protocol -- HTTP/1.1 [RFC2616] Server) that represents one or more Physical Devices or a Logical Device.

Imaging Device; A printer or other device that acts as an IPP Printer.

<????>

Job; A data object, created and managed by an IPP Printer, that contains the description, processing, and status information submitted by a User. The Job can contain zero or more Document objects.

2.3 Other Terminology

Coloring; Filtering of a response or results based on one or more attribute values.

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

Directory Service; A Service providing query and enumeration of information using names or other identifiers.

Discovery; The process of querying or browsing local network segments for Imaging Devices, such as Printers, or their services.

vvvv what is this vvvv connected

Discovery Protocol; A (typically) connectionless protocol for enumeration of local Devices.

Enumeration; The process of listing Imaging Devices that are registered with a Directory or other Service.

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

< to me this a strange term >

Operator; A person or automata responsible for maintaining and/or controlling a Device.

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

Secure Print; A print job using the "document-password", "job-password", and/or "job-password-encryption" operation attributes to provide document and/or physical security. See [PWG5100.11] and [PWG5100.JPS3].

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

User; A person or automata using a Device.

Visible Device; A Device that can be directly accessed by a Client.

Visible/Visibility; Refers to the ability of one device to communicate directly with another, for example a Client is able to connect to a Device, query for supported attributes, submit imaging job creation requests, and so forth.

Visible/Visibility also refers to whether the User is authorized to use a specific Printer.

3. Requirements

3.1 Rationale for IPP Everywhere

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

1. Use existing protocols and schema to support discovery, identification, and auto-configuration of Imaging Devices,
2. Use the 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

The Internet Printing Protocol Version 2.0 Second Edition [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: Job and Printer Extensions - Set 3 [PWG5100.JPS3] 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

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

vvvv eXtensible Markup Language (XML)

The Open XML Paper Specification [ECMA388] defines a paginated document format based on OPC, XML, and standard image and font formats with device-independent color.

vvvv No Reference

The Bonjour Printing Specification version 1.0.2 [BONJOUR] defines:

vvvv Domain Name System (DNS) Service (SRV)

1. Discovery of IPP printers using DNS SRV lookups [RFC2782]
2. Multicast DNS for use on link-local networks [MDNS]
3. Automatic address assignment for both IPv4 [RFC3927] and IPv6
4. DNS TXT record keys to support auto-configuration, capabilities, identification, and protocol selection

^^^^ Text (TXT)

The Lightweight Directory Access Protocol (LDAP): Schema for Printer Services [RFC3712] defines a schema for printer registrations and discovery via LDAP and SLP services.

Service Location Protocol (SLP) ^^^^

3.2 Use Cases

3.2.1 Select Printer

vvvv Print vvvv Printer

Printer selection is part of most Service use cases - the User selects a Printer, implicitly or explicitly, and the remainder of the use case applies to the selected Imaging Device. A Printer can be a Logical Printer (Service) or a Physical Printer. Selection use cases can often be combined, for example Selection Using a Directory Service (section 3.2.1.4) with Selection Using Properties (section 3.2.1.9).

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

Precondition: For all of the following use cases, the Printer must be Visible to the Client to be selected, either directly or through an intermediate Service.

3.2.1.1 Select the Last Used Printer

vvvv returns

The Client User Interface displays the last used Printer as a selection. The User then confirms the selection of the last used Printer.

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

3.2.1.2 Select Printer Using Name or Address

vvvv request

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

vvvv Service Discovery (SD)

The Printer name can be a DNS-SD Service name, a fully-qualified domain name, or other unique identifying name. The Printer address can be a numeric IP address or other unique identifying number.

3.2.1.3 Select Printer Using URI

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

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

3.2.1.4 Select Printer Using a Directory Service

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

Preconditions: One or more Printers are listed in a Directory Service and that Directory Service is Visible to the Client.

3.2.1.5 Select Printer Using a Cloud Service

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

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

3.2.1.6 Select Printer Using a Discovery Protocol

The Client initiates Discovery on behalf of the User and maintains a dynamic list of Visible Printers during selection. The Client User Interface asks the user to select one of the Visible Printers, updating those Printers as they come and go. Finally, the User selects a Printer and the Client terminates Discovery.

Preconditions: The Printer is Visible to the Client and supports a common Discovery Protocol.

3.2.1.7 Select Printer Using Geo-Location

The Client initiates a proximity detection of nearby Printers using Services and/or Discovery Protocols, hiding duplicate Printers that are reported by multiple Service and/or Discovery Protocols. The Client User Interface asks the User to select one of the nearby Printers. Finally, the User selects a nearby Printer.

Preconditions: Both the Client and Printer have access to geo-location information to allow for proximity detection, and both support common Discovery Protocol(s).

3.2.1.8 Select Printer Using Out of Band Method

vvvvvvvvvv what "identify" mean in this context?????????

The User asks the Client User Interface to identify the Printer. The Client initiates identification to obtain a Service URI and descriptive information. The Client User Interface then asks the User to confirm the selection of the identified Printer. Finally, the User confirms the selection.

Precondition: The Printer and Client support a common identifying technology such as near-field communications, QRCodes, or bar codes.

3.2.1.9 Select Printer Using Properties

< what protocol>

A User selects a Printer using properties such as Service, capability, or description properties of the Printer. Service properties include the application 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.

The User asks the Client User Interface to select using properties. The Client obtains a list of Printers for the User 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 the User to select one of the supported Printers. Finally, the User selects a Printer. ^^^^ request

3.2.2 Print

vvvv by the User initiating a print request and then User selects a Printer (section 3.2.1). Then, the Client queries

Printing is a common (perhaps the most common) use case for Printers. Each of the use cases in this section begin by initiating a print, 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 the User collecting the printout from the Printer.

^^^^ returns

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

3.2.2.1 Print a Document

vvvv Jane via

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

vvvv request vvvv Print

After the user User initiates a print and selects a Printer, the User specifies the processing intent for the Job and confirms the print action. The Client sends a print job request to the Printer with the Job Ticket and local document. The Printer validates the Job Ticket and document data and then prints the document.

^^^^ < Is the document attached or referenced?>

3.2.2.2 Print a Document by Reference

vvvv Jane via

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

vvvv User vvvv request vvvv Print

After the user initiates a print and selects a Printer, the User specifies the processing intent for the Job and confirms the print action. The Client sends a print job request to the Printer with the Job Ticket and remote document URI. The Printer validates the Job Ticket and document URI and then prints the document.

^^^^ the document's URI.

3.2.2.3 Print Using Loaded Media

vvvv The User

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

<What magic did the Client use to "know" the User was print a photo?>

vvvv print request

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

^^^^ request ^^^^ printing

vvvv type, orientation,

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

3.2.2.4 Print a Secure Form

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

vvvv the

The User loads check blanks into the Printer and configured the loaded media as necessary at the Printer. After the User initiates a print from his accounting program, selects a Printer for printing, and selects checks to be printed, the Client User Interface displays a preview of the printed checks and the User confirms that checks amounts, payees and signature are correct. The Client automatically selects the check blank media. The User selects additional processing intent for the Job and confirms the print action. The Client sends a print job request to the Printer with the Job Ticket and document data

^^^^ provides ^^^^ printing ^^^^ request.

vvvv < The User set the orientation based on preview.>

containing the checks, correctly oriented for the check blank media. The User waits for the checks to be printed and removes any excess media from the Printer.

vvvv The resort assistant

3.2.2.5 Print with Special Formatting

vvvv resort assistant

At a seminar located at a country resort, a factotum and general gofer has been asked to provide 80 sets of ten keywords/phrases, clearly printed on 2-inch by 1-inch paper slips for use in a get acquainted exercise. Costs are to be minimized. Gofer has a laptop with a word processer program. Resort has a Wi-Fi network available to users and a networked MFD at the business center. Attendant at business center will charge for any printed sheets removed from premises.

vvvv printing ^^^^ The resort vvvv the (word proc..) vvvv request.

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

word processor program ^^^^

Personal Identification Number (PIN) vvvv

3.2.2.6 Print and Select at Printer

vvvv associated

vvvv another

One or more Printers are integrated with a Service to provide "follow me" printing. The User may release a job at a given Printer by providing a PIN and/or other unique identification/authorization information such as a username and password or ID card.

vvvv request printing vvvv ^^^^ Identification (ID)

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

Precondition: The Client and Printer support a common authorization or identification system. The capability of associated printers are the same or the User selects best-effort.

3.2.2.7 Print to a Service

John is flying to New York for a presentation and doesn't want to carry the presentations. John arrives in New York and goes online from his mobile phone. He selects a local print provider after reviewing the provider web pages and submits his document for printing. He specifies that he needs 10 color copies, printed duplex and stapled on the left side. He also specifies the covers to be 80lb. stock, and the internal pages to be 24lb. stock. John arrives at the provider and picks up his presentations, paying with his corporate credit card.

< There is no general print paragraph unlike all the other use cases. Why? >

3.2.2.8 Print to a Recipient

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

vvvv request vvvv printing

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

3.2.2.9 Print with a Proof Copy

vvvv request vvvv printing

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

^^^^ part or all of the

3.2.3 Exceptions

3.2.3.1 Select Printer Canceled

< This statement should in its own section.>

The User cancels selection of a Printer. This may also cancel the print request.

3.2.3.2 Printer No Longer Visible after Selection

vvvv The selected

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

3.2.3.3 Not Authorized

<Authorization should not come from the Printer but either the "Visible" list of Printer or User-based capability constraints.

vvvv to the Printer.

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

3.2.3.4 Not Authenticated

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

3.2.3.5 Not Accepting Jobs

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

^^^^ accepting ^^^^ to

3.2.3.6 Job Ticket or Document Format Not Supported

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

^^^^ to

3.2.3.7 Job or Document Processing Failures

vvvv printing

vvvv printing

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

^^^^ resources,

^^^^ Printing

3.2.3.8 Printer Fault

vvvv printing

vvvv returns

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

^^^^ request

^^^^ printing

3.2.3.9 Printer Warning

vvvv printing

vvvv returns

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

^^^^ to the Client

^^^^ printing

3.3 Out of Scope

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

vvvv The actual method

vvvv User device or Select

1. Methods for geo-location and proximity detection for the Select Printer Using Geo-Location (section 3.2.1.7) use case
2. The actual method of payment for the Print to a Service (section 3.2.2.7) use case
3. Constraining choice of document formats suitable for the Print use cases
4. Definition of new discovery protocols used to locate Printers (however, extension of existing protocols is still in scope)

^^^^ find Visible

3.4 Design Requirements

The IPP Everywhere design should:

1. Define conformance profiles that reference the IPP/2.0 versions [PWG5100.12];
2. Follow the naming conventions defined in IETF IPP/1.1 [RFC2911], including keyword value case (lower) and hyphenation requirements;
3. Define conformance requirements for both Printers and Clients; and

4. Support printing with generic drivers from any Client to any Printer using a variety of discovery protocols, IPP for the transport, and standard document formats.

4. Discovery Protocols

IPP Everywhere Printers MUST support DNS-SD-based discovery and MAY support discovery via other protocols such as LDAP, SLP, SSDP, and WS-Discovery.

4.1 Printer Description Attributes Used in Discovery

Table 1 lists the IPP Printer Description attributes that would normally be used for discovery or coloring of discovered printers.

^^^^ filtering based on one or more printer attribute values (called "coloring" in IPP xxxx)

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-versions-supported	(subtype)	printer-ipp-versions-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

IPP Attribute	DNS-SD TXT Key	LDAP/SLP Attribute
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

Note 1: Extension attribute to RFC 3712.
Note 2: Available via subsequent IPP Get-Printer-Attributes request.

4.2 DNS Service Discovery (DNS-SD)

vvvv MDNS

DNS Service Discovery [DNS-SD] uses SRV records and traditional unicast and multicast DNS [mDNS] queries. This discovery protocol is collectively defined in the Bonjour Printing Specification version 1.0.2 [BONJOUR] and extended in this specification.

vvvv MDNS

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

vvvv Service (SRV) Instance Name

4.2.1 Service Instance Name (SRV)

IPP Everywhere 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.

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

^^^^ MDNS

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

^^^^ MDNS

vvvv MDNS

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

4.2.2 Geo-Location (LOC)

vvvv geo-LOCation (LOC)

vvvv MDNS

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.

4.2.3 Service Information (TXT)

vvvv MNDS

Printers MUST publish a TXT record over mDNS. Printers that support dynamic DNS updates MUST publish separate TXT records for each domain that is updated. The following subsections define new key/value pairs in addition to those required by the Bonjour Printing Specification [BONJOUR]. Table 2 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.

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 and MUST NOT exceed 1300 octets in order to fit in a standard 1500 octet packet. Printers MUST provide the "rp" TXT key/value pair within the first 400 octets of the TXT record. Clients MUST ignore incomplete key/value pairs at the end of a truncated TXT record.

Table 2 - 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 4.2.3.8.	" (empty string)

Key	Description	Default Value
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'
product	The PostScript product name, typically the value reported by the "printer-make-and-model" Printer Description attribute with parenthesis, e.g. '(Example Model)'.	" (empty string)
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'.	'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 4.2.3.3.	'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)
usb_CMD	The IEEE 1284 Device ID command set value. See section 4.2.3.4.	" (empty string)
usb_MDL	The IEEE 1284 Device ID model value. See section 4.2.3.6.	" (empty string)
usb_MFG	The IEEE 1284 Device ID manufacturer value. See section 4.2.3.5.	" (empty string)
UUID	The UUID of the Printer without the 'urn:uuid:' prefix as reported by the "printer-	" (empty string)

Key	Description	Default Value
	uuid" Printer Description attribute. See section 4.2.3.7.	

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

"auth-info-required" (air)

4.2.3.1 air

vvvv The ("auth-info-required")

The "air" key defines the type of authentication information that is required for imaging. The name "air" comes from the CUPS "auth-info-required" Printer Description attribute [CUPSIPP] that extends the "uri-authentication-supported" Printer Description attribute [RFC2911]. The following values are supported:

vvvv "Secure Sockets Layer/Transport Layer Security" (SSL/TLS)

'certificate'; Authentication using SSL/TLS certificates. This is equivalent to the value 'certificate' for the "uri-authentication-supported" Printer Description attribute [RFC2911].

'negotiate'; Kerberized authentication is required [RFC4559]. This is equivalent to the 'negotiate' value for the "uri-authentication-supported" Printer Description attribute [PWG5100.JPS3].

'none'; No authentication is required. This is equivalent to the value 'none' for the "uri-authentication-supported" Printer Description attribute [RFC2911].

'username,password'; Username + password authentication is required. This is equivalent to the values 'basic' or 'digest' for the "uri-authentication-supported" Printer Description attribute [RFC2911].

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

vvvv Multipurpose Internet Mail Extensions (MIME)

4.2.3.2 pdl

<<<< Page Description Language (PDL/pdl)

vvvv REQUIRED ("Page Description Language")

The REQUIRED "pdl" key lists the supported MIME media types. Because the total length of a key/value pair is 255 octets, the "pdl" value is typically a subset of the values reported by the "document-format-supported" Printer Description attribute. Printers SHOULD populate the "pdl" key with a comma-delimited list of the REQUIRED and preferred MIME media types and MUST NOT list the 'application/octet-stream' MIME media type.

vvvv Transport Layer Security (TLS/tls)

4.2.3.3 TLS

vvvv The ("Transport Layer Security")

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

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

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

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

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

The default value of the "TLS" key is 'none'.

vvvv Universal Serial Bus (USB/usb) Command (CMD)

4.2.3.4 usb_CMD

vvvvv REQUIRED ("Universal Serial Bus Command")

The REQUIRED "usb_CMD" key provides the command set [PWG5107.2] value from the "printer-device-id" Printer attribute.

vvvv Universal Serial Bus (USB/usb) Manufacture (MFG)

4.2.3.5 usb_MFG

vvvv REQUIRED ("Universal Serial Bus Manufacture")

The REQUIRED "usb_MFG" key provides the manufacturer value from the "printer-device-id" Printer attribute.

vvvv Universal Serial Bus (USB/usb) Model (MDL)

4.2.3.6 usb_MDL

vvvv REQUIRED ("Universal Serial Bus Model")

The REQUIRED "usb_MDL" key provides the model name value from the "printer-device-id" Printer attribute.

vvvv Universally Unique IDentifier (UUID)

4.2.3.7 UUID

vvvv REQUIRED ("Universally Unique IDentifier")

The REQUIRED "UUID" key provides the value of the "printer-uuid" Printer Description attribute [RFC4122] [PWG 5100.JPS3] without the leading "urn:uuid:". For example, if a printer reports a "printer-uuid" value of:

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

The "UUID" key will have a value of:

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

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

vvvv Device Universally Unique IDentifier (DUUID)

4.2.3.8 DUUID

vvvv RECOMMENDED ("Device Universally Unique IDentifier")

The RECOMMENDED "DUUID" key provides the value of the "device-uuid" Printer Description attribute [RFC4122] [PWG 5100.JPS3] without the leading "urn:uuid:". For example, if a printer reports a "device-uuid" value of:

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


The "DUUID" key will have a value of:

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

4.3 LDAP and SLP Discovery

LDAP and SLP discovery use the schema defined in Lightweight Directory Access Protocol (LDAP): Schema for Printer Services [RFC3712] [RFC4511] [RFC4515].

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

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

vvvv Simple Service Discovery Protocol (SSDP)

vvvv Play (UPnP)

User Datagram Protocol vvvv

4.4 SSDP Discovery

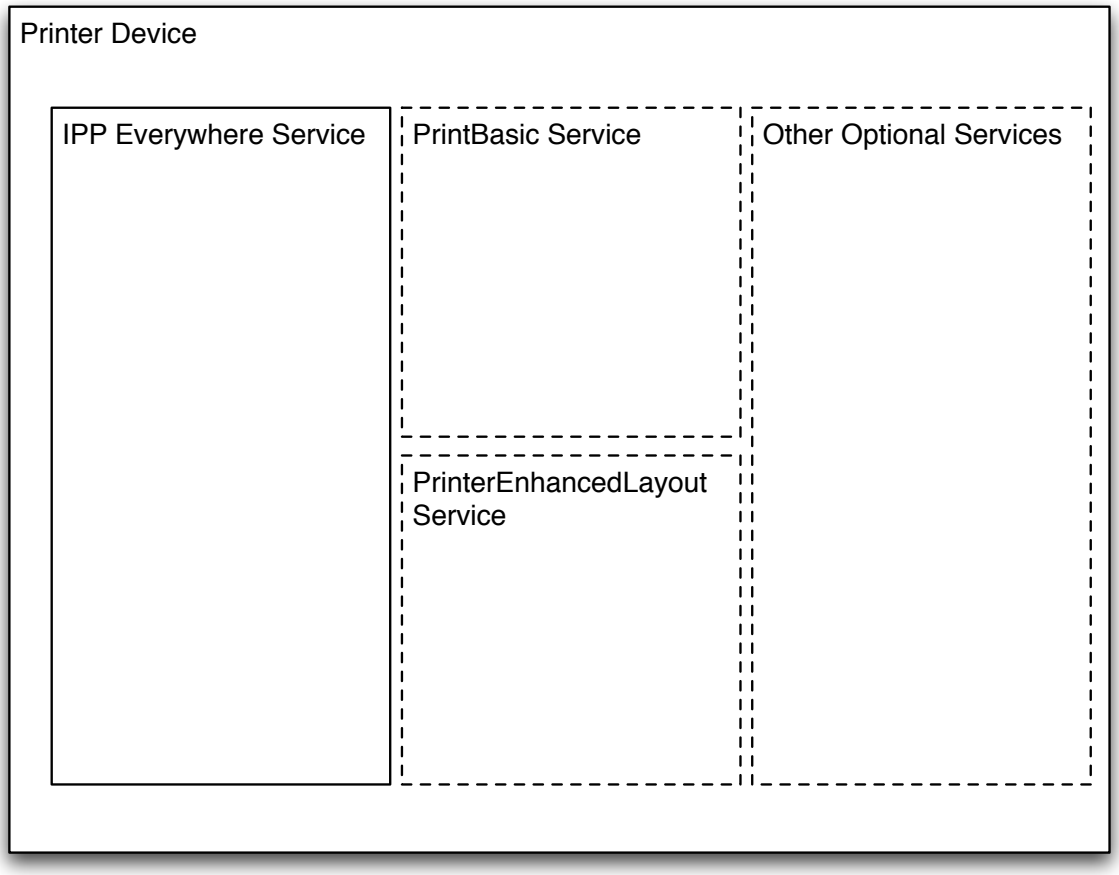
The Simple Service Discovery Protocol (SSDP) is a multicast UDP protocol used to support discovery of Universal Plug-and-Play [UPNP1.1] network devices and services. This document defines a new device template named "Printer:2" that is compliant with the UPnP Device Architecture, Version 1.1. The goal of Printer:2 is to modify the Printer Device as minimally as possible to support the discovery of IPP Everywhere Printers. In this case UPnP is being used as Discovery Service for an IPP Everywhere Printer and provides basic information about the capabilities of a Print class device without having to query the Printer's IPP attributes. After Discovery, all additional communication with the device is done via IPP.

^^^^^^^ < Does this text mean the physical printer or a print service?>

< what is the definition of a "Printer:1" or, in general, "Printer:N"?>

< What exactly is an "IPP Everywhere Service"? I understand the definition of a Printer (logical or physical) that has a Print Service that supports IPP Everywhere but, in general, the Print Service is likely to support more than one protocol not just IPP Everywhere. >

vvvvv < In the below diagram the PrintBasic and PrintEnhancedLayout are independent of IPP Everywhere (as stated below). I would drop the naming of these two service since they are really just Other Optional Services as far as IPP Everywhere Service is concerned.>



660

661 **Figure 1 - UPnP Printer:2 Functional Diagram**

662 Figure 1 illustrates a Printer Device with the required service being the IPP Everywhere
663 Service. The Printer Device includes the location of the IPP Everywhere endpoints for
664 communicating with the device. The Printer:2 advertisement includes the equivalent of the
665 DNS-SD TXT records for the Printer discovered with Printer:2.

666 The IPP Everywhere Service is REQUIRED in a Printer:2 Device. Additional services
667 MAY be present such as the optional PrintBasic service. The PrintBasic Service includes
668 print-related attributes along with all Job-related attributes (e.g., JobName,
669 DocumentFormat, Copies, etc). The optional PrintEnhancedLayout Service extends the
670 PrintBasic service with additional operations and semantics. Both PrintBasic and
671 PrintEnhancedLayout are OPTIONAL and provided only for legacy device support.

672 **4.4.1 Device Definitions**

673 **4.4.1.1 Device Type**

674 The following device type identifies a device that is compliant with this template:

675 `urn:schemas-upnp-org:device:printer:2`

4.4.1.2 Device Model

Products that expose devices of the type `printer:2` must implement minimum version numbers of all required embedded devices and services specified in Table 3.

Table 3 - Device Requirements for urn:schemas-upnp-org:printer:2

Device Type	Root	Req or Opt (note 1)	Service Type	Req or Opt (note 1)	Service ID (note 2)
Printer:2	Root	R	PrintBasic:1	O	1
			PrintEnhancedLayout:1	O	2
			IPPEverywhere:1	R	3
			^^^^ Other Optional Services	Opt	n

<<<< 1)

<<< 1

Note 1: R = Required, O = Optional, X = Non-standard.

Note 2: Prefixed by urn:upnp-org:serviceId:

^^ 1:

4.4.1.3 Description of Device Requirements

vvvv IPP Everywhere

The IPPEverywhere Service is a required service for a Printer:2 Device.

4.4.1.4 Relationships Between Services

vvvv Other Optional Services

vvvv IPP Everywhere

The Printer Device only REQUIRES one service, the IPPEverywhere Service. When PrintBasic or PrintEnhancedLayout are implemented, they are independent of IPPEverywhere, although PrintEnhancedLayout has a strong tie to PrintBasic. Again, these optional services are only present for backward compatibility

^^^^ IPP Everywhere Service

4.4.2 Theory of Operation

4.4.2.1 Discovery

When a device is added to the network, the UPnP discovery protocol allows that device to advertise its services to user control points on the network. The UPnP discovery protocol is based on SSDP. The Printer Device must announce itself as:

1. a root device
2. a device UUID for its device type
3. a device type

4.4.2.2 Job Submission and Control

Job Submission and Control are handled through standard IPP operations.

4.4.3 XML Device Description

The following XML describes a typical IPP Printer device:


```
<?xml version="1.0"?>
<root xmlns="urn:schemas-upnp-org:device-1-0">
<specVersion>
  <major>1</major>
  <minor>0</minor>
</specVersion>
<URLBase>base URL for all relative URLs</URLBase>
<device>
  <deviceType>urn:schemas-upnp-org:device:Printer:2</deviceType>
  <friendlyName>printer-info string</friendlyName>
  <manufacturer>manufacturer name</manufacturer>
  <manufacturerURL>URL to manufacturer site</manufacturerURL>
  <modelDescription>printer-make-and-model string</modelDescription>
  <modelName>model name</modelName>
  <modelNumber>model number</modelNumber>
  <modelURL>URL to model site</modelURL>
  <serialNumber>manufacturer's serial number</serialNumber>
  <UDN>urn:uuid:UUID</UDN>
  <UPC>Universal Product Code</UPC>
  <iconList>
    <icon>
      <mimetype>image/format</mimetype>
      <width>horizontal pixels</width>
      <height>vertical pixels</height>
      <depth>color depth</depth>
      <url>URL to icon</url>
    </icon>
    XML to declare other icons, if any, go here.
  </iconList>
  <serviceList>
    <service>
      <serviceType>urn:schemas-pwg.org:service:IPPEverywhere:1
        </serviceType>
      <serviceId>urn:upnp-org:serviceId:3</serviceId>
      <adminurl>printer-more-info string</adminurl>
      <note>printer-location string</note>
      <air>Type of authentication required for the services.</air>
      <tls>Version of TLS supported.</tls>
      <rp>This key is used to specify the print queue name.</rp>
      <pdlp>Comma-separated list of MIME types supported by
printing.</pdlp>
      <Bind>Set value to "T" if the printer is capable of binding its
output, "F" if its not.</Bind>
      <Collate>Set value to "T" if the printer is capable of generating
collated copies, "F" if its not.</Collate>
      <Color>Set value to "T" if the printer is capable of generating
color output, "F" if its not.</Color>
      <Copies>Set value to "T" if the printer is capable of generating
fast copies, "F" if its not.</Copies>
      <Duplex>Set value to "T" if the printer is capable of generating
two-sided output, "F" if its not.</Duplex>
      <PaperCustom>Set value to "T" if the printer can handle custom
paper sizes, "F" if its not.</PaperCustom>
      <PaperMax>"less-than-legal-A4", "legal-A4", "isoC-A2", or "greater-
than-isoC-A2"</PaperMax>
```



```
      <Punch> Set value to the number of holes of the hole puncher
supported by the printer.</Punch>
      <Sort> Set value to "T" if the printer is capable of sort- ing its
output, "F" if its not.</Sort>
      <Staple> Set value to "T" if the printer is capable of sta- pling
output, "F" if its not.</Sort>
    </service>
  </serviceList>
  <deviceList>
    Description of embedded devices added by UPnP vendor (if any) go here.
  </deviceList>
  <presentationURL>URL for presentation</presentationURL>
</device>
</root>
```

4.5 WS-Discovery

vvvv Organization fro the Advancement of Structured Information Standards (OASIS)

Printers using OASIS Web Services Dynamic Discovery (WS-Discovery) Version 1.1 [WSDD-DISCOVERY-1.1] may be discovered using the IPP Everywhere namespace (http://www.pwg.org/schemas/2012/4/ipp-everywhere) and LDAP Printer Schema. Here is an example probe message:

```
<s:Envelope
     xmlns:a="http://schemas.xmlsoap.org/ws/2004/08/addressing"
     xmlns:d="http://schemas.xmlsoap.org/ws/2005/04/discovery"
     xmlns:ippe="http://www.pwg.org/schemas/2012/4/ipp-everywhere"
     xmlns:s="http://www.w3.org/2003/05/soap-envelope" >
   <s:Header>
     <a:Action>
       http://schemas.xmlsoap.org/ws/2005/04/discovery/Probe
     </a:Action>
     <a:MessageID>
       uuid:0a6dc791-2be6-4991-9af1-454778a1917a
     </a:MessageID>
     <a:To>urn:schemas-xmlsoap-org:ws:2005:04:discovery</a:To>
   </s:Header>
   <s:Body>
     <d:Probe>
       <d:Types>ippe:Print</d:Types>
       <d:Scopes
    MatchBy="http://schemas.xmlsoap.org/ws/2005/04/discovery/ldap" >
         ldap:///ou=engineering,o=examplecom,c=us
       </d:Scopes>
     </d:Probe>
   </s:Body>
 </s:Envelope>
```


5. Protocol Binding

Printers and Clients MUST support IPP/2.0, IPP/2.1, and/or IPP/2.2 as defined in Internet Printing Protocol 2.0 Second Edition [PWG5100.12] and the IPP Job and Printer Extensions - Set 3 [PWG5100.JPS3].

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 additional to the IPP over HTTP conformance requirements defined in section 7.3 of the Internet Printing Protocol Version 2.0 Second Edition [PWG5100.12], Printers MUST support the following additional HTTP headers and status codes defined in Hypertext Transfer Protocol -- HTTP/1.1 [RFC2616].

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 14.25 [RFC2616]), the corresponding response status ("304 Not Modified", section 10.3.5 [RFC2616]), and the Last-Modified response header (section 14.29 [RFC2616]).

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 section 13 [RFC2616]. 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. 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 Required Operations

Code	Operation Name	Reference
0x0002	Print-Job	RFC 2911
0x0004	Validate-Job	RFC 2911
0x0005	Create-Job (note 1)	RFC 2911
0x0006	Send-Document (note 1)	RFC 2911
0x0008	Cancel-Job	RFC 2911
0x0009	Get-Job-Attributes	RFC 2911
0x000A	Get-Jobs	RFC 2911
0x000B	Get-Printer-Attributes	RFC 2911
0x0039	Cancel-My-Jobs (note 2)	PWG 5100.11
0x003B	Close-Job (note 2)	PWG 5100.11
0x003C	Identify-Printer (note 3)	PWG 5100.JPS3

Note 1: REQUIRED in addition to those operations defined for the IPP/2.0 conformance level.
Note 2: REQUIRED in addition to those operations defined for the IPP/2.0 and IPP/2.1 conformance levels.
Note 3: REQUIRED in addition to those operations defined for the IPP/2.0, IPP/2.1, and IPP/2.2 conformance levels.

5.3 IPP Printer Description Attributes

Table 5 lists the REQUIRED Printer Description attributes for an IPP Everywhere Printer.

Table 5 - IPP Everywhere Required Printer Description Attributes

Attribute	Reference
charset-configured	RFC 2911
charset-supported	RFC 2911
color-supported	RFC 2911
compression-supported	RFC 2911
copies-default (note 5)	RFC 2911
copies-supported (note 5)	RFC 2911
document-format-default	RFC 2911
document-format-supported	RFC 2911
document-password-supported	PWG 5100.JPS3
feed-orientation-default (note 9)	PWG 5100.11

Attribute	Reference
feed-orientation-supported (note 9)	PWG 5100.11
finishings-default (note 7)	RFC 2911
finishings-supported (note 7)	RFC 2911
generated-natural-language-supported	RFC 2911
identify-actions-default (note 3)	PWG 5100.JPS3
identify-actions-supported (note 3)	PWG 5100.JPS3
ipp-extensions-supported (note 3)	PWG 5100.JPS3
ipp-versions-supported	RFC 2911
job-constraints-supported (note 3)	PWG 5100.JPS3
job-creation-attributes-supported (note 2)	PWG 5100.11
job-ids-supported (note 2)	PWG 5100.11
job-password-supported (note 8)	PWG 5100.11
job-password-encryption-supported (note 8)	PWG 5100.11
job-preferred-attributes-supported (note 3)	PWG 5100.JPS3
job-resolvers-supported (note 3)	PWG 5100.JPS3
media-bottom-margin-supported (note 3)	PWG 5100.JPS3
media-col-database (note 2)	PWG 5100.11
media-col-database.media-source-properties (note 9)	PWG 5100.JPS3
media-col-default (note 1)	PWG 5100.3
media-col-ready (note 2)	PWG 5100.3
media-col-ready.media-source-properties (note 9)	PWG 5100.JPS3
media-col-supported (note 1)	PWG 5100.3
media-default	RFC 2911
media-left-margin-supported (note 3)	PWG 5100.JPS3
media-ready (note 2)	RFC 2911
media-right-margin-supported (note 3)	PWG 5100.JPS3
media-size-supported (note 1)	PWG 5100.3
media-source-supported (note 3)	PWG 5100.JPS3
media-supported	RFC 2911
media-top-margin-supported (note 3)	PWG 5100.JPS3
media-type-supported (note 1)	PWG 5100.3
multiple-document-jobs-supported (note 1)	RFC 2911
multiple-operation-timeout (note 1)	RFC 2911
multiple-operation-timeout-action (note 3)	PWG 5100.JPS3
natural-language-configured	RFC 2911
operations-supported	RFC 2911
orientation-requested-default	RFC 2911
orientation-requested-supported	RFC 2911
output-bin-default	PWG 5100.2
output-bin-supported	PWG 5100.2
overrides-supported (note 2)	PWG 5100.6
page-ranges-supported (note 6)	RFC 2911

Attribute	Reference
pages-per-minute	RFC 2911
pages-per-minute-color	RFC 2911
print-color-mode-default (note 3)	PWG 5100.JPS3
print-color-mode-supported (note 3)	PWG 5100.JPS3
print-content-optimize-default (note 3)	PWG 5100.7
print-content-optimize-supported (note 3)	PWG 5100.7
print-rendering-intent-default (note 3)	PWG 5100.JPS3
print-rendering-intent-supported (note 3)	PWG 5100.JPS3
print-quality-default	RFC 2911
print-quality-supported	RFC 2911
printer-alert (note 2)	PWG 5100.9
printer-alert-description (note 2)	PWG 5100.9
printer-charge-info (note 4)	PWG 5100.JPS3
printer-charge-info-uri (notes 4 and 10)	PWG 5100.JPS3
printer-config-change-date-time (note 3)	PWG 5100.JPS3
printer-config-change-time (note 3)	PWG 5100.JPS3
printer-device-id (note 2)	PWG 5107.2
printer-geo-location (note 3)	PWG 5100.JPS3
printer-get-attributes-supported (note 3)	PWG 5100.JPS3
printer-icc-profiles (notes 3 and 10)	PWG 5100.JPS3
printer-icons (notes 3 and 10)	PWG 5100.JPS3
printer-info	RFC 2911
printer-is-accepting-jobs	RFC 2911
printer-location	RFC 2911
printer-make-and-model	RFC 2911
printer-mandatory-job-attributes (note 4)	PWG 5100.JPS3
printer-more-info (note 10)	RFC 2911
printer-name	RFC 2911
printer-organization (note 3)	PWG 5100.JPS3
printer-organizational-unit (note 3)	PWG 5100.JPS3
printer-resolution-default	RFC 2911
printer-resolution-supported	RFC 2911
printer-state	RFC 2911
printer-state-change-data-time (note 2)	RFC 3995
printer-state-change-time (note 1)	RFC 3995
printer-state-message	RFC 2911
printer-state-reasons	RFC 2911
printer-supply (note 3)	PWG 5100.JPS3
printer-supply-description (note 3)	PWG 5100.JPS3
printer-supply-info-uri (notes 3 and 10)	PWG 5100.JPS3
printer-up-time	RFC 2911
printer-uri-supported (note 10)	RFC 2911
printer-uuid (note 3)	PWG 5100.JPS3
pwg-raster-document-resolution-supported	PWG 5102.4

Attribute	Reference
(note 3)	
pwg-raster-document-sheet-back (note 3)	PWG 5102.4
pwg-raster-document-type-supported (note 3)	PWG 5102.4
queued-job-count	RFC 2911
sides-default	RFC 2911
sides-supported	RFC 2911
uri-security-supported	RFC 2911
uri-authentication-supported	RFC 2911
which-jobs-supported (note 2)	PWG 5100.11

Note 1: REQUIRED in addition to those attributes defined for the IPP/2.0 conformance level.
Note 2: REQUIRED in addition to those attributes defined for the IPP/2.0 and IPP/2.1 conformance levels.
Note 3: REQUIRED in addition to those attributes defined for the IPP/2.0, IPP/2.1, and IPP/2.2 conformance levels.
Note 4: CONDITIONALLY REQUIRED for Printers that implement Paid Imaging services.
Note 5: CONDITIONALLY REQUIRED for Printers that support the "application/openxps" or "application/pdf" MIME media types.
Note 6: CONDITIONALLY REQUIRED for Printers that support the "application/openxps" or "application/pdf" MIME media types.
Note 7: CONDITIONALLY REQUIRED for Printers with finishers.
Note 8: CONDITIONALLY REQUIRED for Printers that support the Print to a Recipient (section 3.2.2.8) use case.
Note 9: CONDITIONALLY REQUIRED for Printers that support long-edge feed media.
Note 10: URIs SHOULD use Host value from HTTP header (section 5.1.1) and MUST NOT use link-local addresses (section 8.4).

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 might 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 8-60 inches in width and 6 inches to 300 feet in length might report:

^^^^ 8 to 60

```
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 [RFC2911], this specification defines how a Printer advertises custom, manually-fed, and roll-fed media in the "media-ready" attribute.

Manual feed media sizes MUST NOT be reported in the "media-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.

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

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

5.3.4 media-size-supported (1setOf collection)

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

Custom media sizes are described using rangeOfInteger values for the "x-dimension" and "y-dimension" member attributes. 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 might report:

```
media-size-supported = ...
                       { x-dimension = 5000-33020
                         y-dimension = 5000-48260 }
                       ...
```

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 8-60 inches in width and 6 inches to 300 feet in length might report:

^^^^ 8 to 60

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


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

The REQUIRED "media-supported" Printer attribute lists the supported media sizes for a Printer. In addition to the requirements set forth in [RFC2911], this specification defines how a Printer advertises custom and roll-fed media in the "media-supported" attribute.

Custom media sizes are described using two self-describing media names. The "custom_min_WIDTHxHEIGHTunits" value provides the minimum custom media dimensions and the "custom_max_WIDTHxHEIGHTunits" value provides the maximum custom media dimensions. The size name MUST include the source name if different dimensions are supported by each source. Dimensions are provided for sheets in portrait orientation, that is the "WIDTH" values refer to the short axis and the "HEIGHT" values 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 might report:

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

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

For example, a Printer supporting a single roll 8-60 inches in width and 6 inches to 300 feet in length might report:
^^^^ 8 to 60

```
media-size-supported = ...
                       roll_max_60x3600in
                       roll_min_8x6in
                       ...
```
vvvv 8 to 60

A Printer supporting two rolls, one 8-60 inches in width and 6 inches to 300 feet in length and the other 8-36 inches in width and 6 inches to 150 feet in length might report:
^^^^ 8 to 36

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

5.3.6 printer-device-id (text(1023))

Institute of Electrical and Electronics Engineers (IEEE) vvvv

The REQUIRED "printer-device-id" Printer attribute provides the IEEE 1284 Device ID 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:

< 'MANU' is not a valid value in IEEE 1284>

1. All required (MANUFACTURER/MANU/MFG, MODEL/MDL, and COMMAND SET/CMD) key/value pairs,
2. All optional key/value pairs, and
3. All vendor key/value pairs

The optional and vendor key/value pairs can be prioritized by Client software requirements. This allows the Printer to truncate the Device ID string as needed (section 13.4) without loss of critical information needed for selection of device-specific or generic driver software on the Client.

5.4 IPP Operation Attributes

Table 6 lists the REQUIRED operation attributes for an IPP Everywhere Printer.

Table 6 - IPP Everywhere Required Operation Attributes

Attribute	Reference
compression	RFC 2911
document-format	RFC 2911
document-format-version (note 1)	PWG 5100.7
document-name	RFC 2911, PWG 5100.5
document-password (note 4)	PWG 5100.JPS3
first-index (note 3)	PWG 5100.JPS3
first-job-id	RFC 2911
identify-actions (note 3)	PWG 5100.JPS3
ipp-attribute-fidelity	RFC 2911
job-ids (note 2)	PWG 5100.11
job-name	RFC 2911
job-password (note 5)	PWG 5100.11
job-password-encryption (note 5)	PWG 5100.11
last-document (note 1)	RFC 2911
limit	RFC 2911
requesting-user-name	RFC 2911
requesting-user-uri (note 3)	PWG 5100.JPS3
which-jobs (note 2)	RFC 2911, PWG 5100.11

Note 1: REQUIRED in addition to those attributes defined for the IPP/2.0 conformance level.
Note 2: REQUIRED in addition to those attributes defined for the IPP/2.0 and IPP/2.1 conformance levels.
Note 3: REQUIRED in addition to those attributes defined for the IPP/2.0, IPP/2.1, and IPP/2.2 conformance levels.
Note 4: CONDITIONALLY REQUIRED for Printers that support the "application/openxps" or "application/pdf" MIME media types.
Note 5: CONDITIONALLY REQUIRED for Printers that support the Print to a Recipient (section 3.2.2.8) use case.

5.5 IPP Job Template Attributes

Table 7 lists the REQUIRED Job Template attributes for an IPP Everywhere Printer.

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Table 7 - IPP Everywhere Required Job Template Attributes

Attribute	Reference
copies (note 5)	RFC 2911
feed-orientation (note 8)	PWG 5100.11

Attribute	Reference
finishings (note 7)	RFC 2911
job-accounting-user-id (note 4)	PWG 5100.3
job-billing-info (note 4)	PWG 5100.3
job-mandatory-attributes (note 2)	PWG 5100.11
media	RFC 2911
media-col (note 1)	PWG 5100.3
media-col.media-bottom-margin (note 3)	PWG 5100.JPS3
media-col.media-left-margin (note 3)	PWG 5100.JPS3
media-col.media-right-margin (note 3)	PWG 5100.JPS3
media-col.media-size (note 1)	PWG 5100.3
media-col.media-source (note 3)	PWG 5100.JPS3
media-col.media-top-margin (note 3)	PWG 5100.JPS3
media-col.media-type (note 1)	PWG 5100.3
multiple-document-handling (note 6)	RFC 2911
orientation-requested	RFC 2911
output-bin	PWG 5100.2
overrides (note 2)	PWG 5100.6
page-ranges (note 6)	RFC 2911
print-color-mode (note 3)	PWG 5100.JPS3
print-content-optimize (note 3)	PWG 5100.7
print-rendering-intent (note 3)	PWG 5100.JPS3
print-quality	RFC 2911
printer-resolution	RFC 2911
sides	RFC 2911

Note 1: REQUIRED in addition to those attributes defined for the IPP/2.0 conformance level.
Note 2: REQUIRED in addition to those attributes defined for the IPP/2.0 and IPP/2.1 conformance levels.
Note 3: REQUIRED in addition to those attributes defined for the IPP/2.0, IPP/2.1, and IPP/2.2 conformance levels.
Note 4: CONDITIONALLY REQUIRED for Printers that implement paid imaging services.
Note 5: CONDITIONALLY REQUIRED for printers that support the "application/openxps", "application/pdf", or "image/jpeg" MIME media types.
Note 6: CONDITIONALLY REQUIRED for printers that support the "application/openxps" or "application/pdf" MIME media types.
Note 7: CONDITIONALLY REQUIRED for printers with finishers.
Note 8: CONDITIONALLY REQUIRED for Printers that support long-edge feed media.

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
compression-supplied (note 1)	PWG 5100.7
date-time-at-completed (note 2)	RFC 2911
date-time-at-creation (note 2)	RFC 2911
date-time-at-processing (note 2)	RFC 2911
document-format-supplied (note 1)	PWG 5100.7
document-format-version-supplied (note 1)	PWG 5100.7
document-name-supplied (note 1)	PWG 5100.7
job-id	RFC 2911
job-impressions (note 2)	RFC 2911
job-impressions-completed (note 2)	RFC 2911
job-name	RFC 2911
job-originating-user-name	RFC 2911
job-printer-up-time	RFC 2911
job-printer-uri (note 4)	RFC 2911
job-state	RFC 2911
job-state-message (note 3)	RFC 2911
job-state-reasons	RFC 2911
job-uri (note 4)	RFC 2911
job-uuid (note 3)	PWG 5100.JPS3
time-at-completed	RFC 2911
time-at-creation	RFC 2911
time-at-processing	RFC 2911

Note 1: REQUIRED in addition to those attributes defined for the IPP/2.0 conformance level.
Note 2: REQUIRED in addition to those attributes defined for the IPP/2.0 and IPP/2.1 conformance levels.
Note 3: REQUIRED in addition to those attributes defined for the IPP/2.0, IPP/2.1, and IPP/2.2 conformance levels.
Note 4: URIs SHOULD use Host value from HTTP header (section 5.1.1) and MUST NOT use link-local addresses (section 8.4).

5.6.1 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].

5.6.2 job-uri (uri)

The REQUIRED "job-uri" Job Description attribute contains the 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].

6. Document Formats

IPP Everywhere Printers MUST support documents conforming to the PWG Raster Format [PWG5102.4] ("image/pwg-raster") and JPEG File Information Format Version 1.02 [JFIF] [EXIF] ("image/jpeg").

IPP/2.1 and IPP/2.2 Printers MUST and IPP/2.0 Printers SHOULD support documents conforming to Document management — Portable document format — Part 1: PDF 1.7 [ISO32000] ("application/pdf").

IPP Everywhere Printers SHOULD support documents conforming to the Open XML Paper Specification [ECMA388] ("application/openxps").

6.1 Notes for Long-Edge Feed Media and PWG Raster Format Documents

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

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

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

^^^^ Figure 5

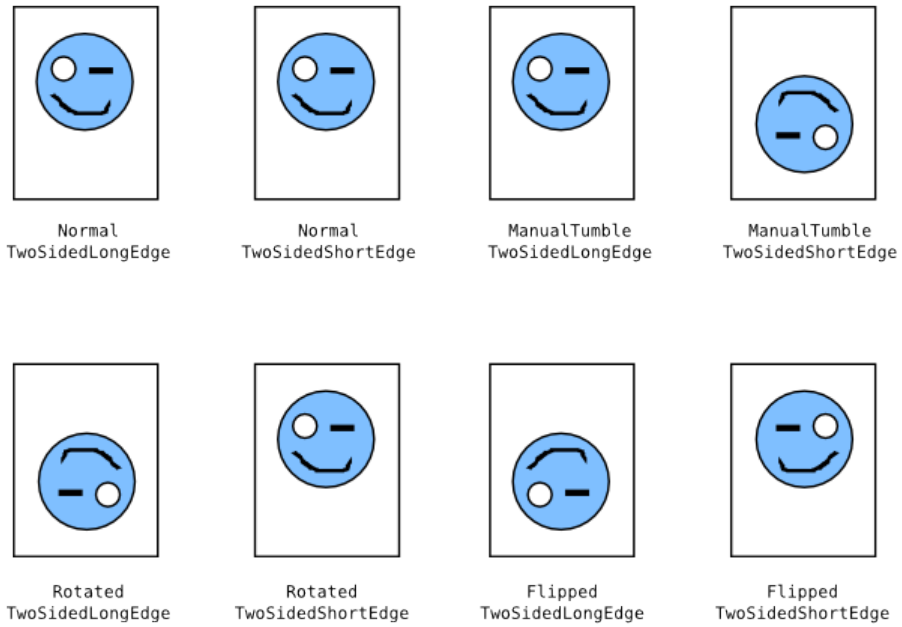

Figure 2 - PWG Raster Bitmaps with Portrait Feed Orientation

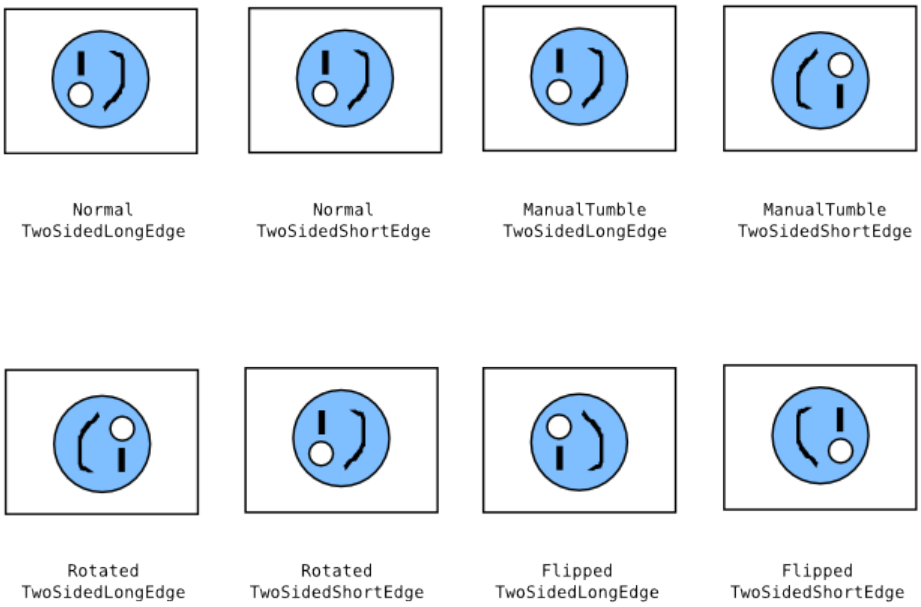

Figure 3 - PWG Raster Bitmaps with Landscape Feed Orientation

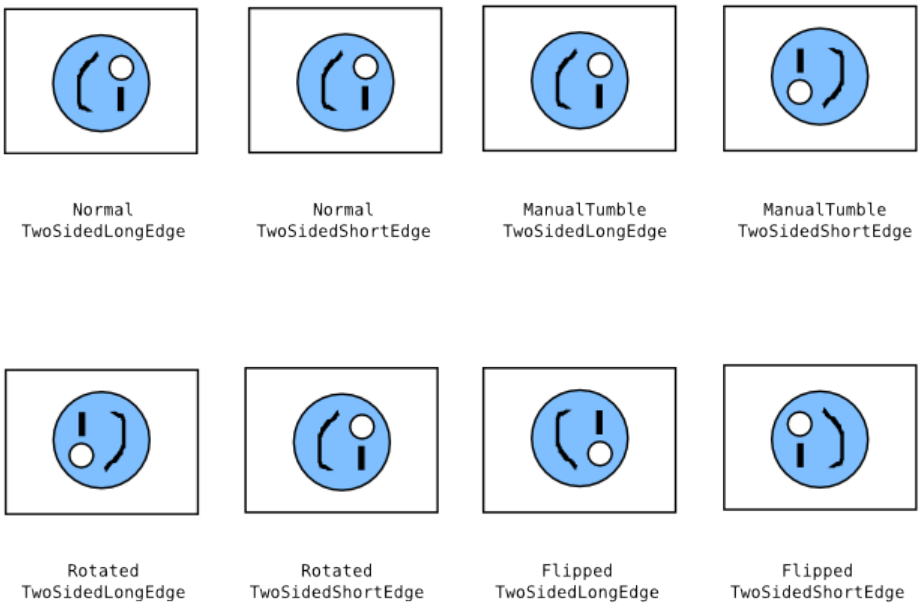

Figure 4 - PWG Raster Bitmaps with Reverse Landscape Feed Orientation

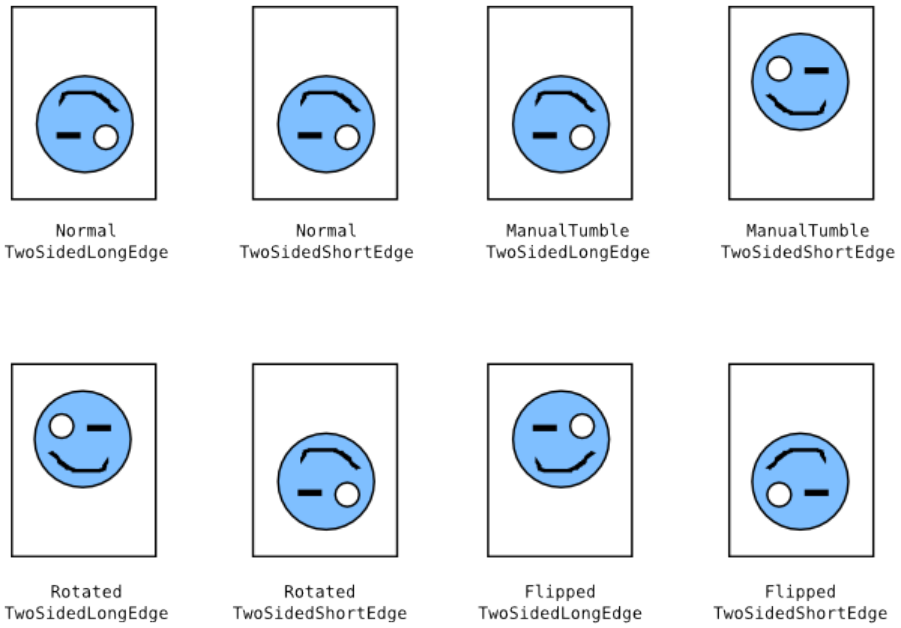

Figure 5 - PWG Raster Bitmaps with Reverse Portrait Feed Orientation

7. Additional Values for Existing Attributes

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

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

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 [RFC2911] with additional restrictions to improve interoperability.

8.1 nameWithLanguage and nameWithoutLanguage

vvvv'Name' vvvv control character set

Name values MUST NOT contain characters in the C0 block 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

vvvv 'NaturalLanguage'

NaturalLanguage values MUST conform to and be compared as defined in Content Language Headers [RFC3282], Matching of Language Tags [RFC4647], and Tags for Identifying Languages [RFC5646], which are the current set of RFCs replacing Tags for the Identification of Languages [RFC1766] that was used in IPP/1.1: Model and Semantics [RFC2911]. 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

vvvv 'Text" control character set vvvv

Text values MUST NOT contain the DEL character or characters in the C0 block 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

vvvv 'URI'

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

vvvv Dynamic Host Configuration Protocol (DHCP)

with addresses obtained via DHCP 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 6
6. The REQUIRED Job Template attributes listed in Table 7
7. The REQUIRED Job Description attributes listed in Table 8
8. The REQUIRED document formats listed in section 6
9. The "feed-orientation-supported" Printer attribute as reported by the Printer.
10. The "media-source-properties" member attribute of the "media-col-database" and "media-col-ready" Printer attributes as reported by the Printer

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 6
6. The REQUIRED Job Template attributes listed in Table 7
7. The REQUIRED Job Description attributes listed in Table 8
8. The REQUIRED document formats listed in section 6
9. The 'ipp-everywhere' value for the "ipp-features-supported" Printer Description attribute as defined in section 7.1

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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 5.3.

2. The "copies Job Template attribute as defined in section 5.5.

Printers that support the "application/openxps" [ECMA388] or "application/pdf" [ISO32000] MIME media types MUST support:

1. The "copies-default", "copies-supported", "document-password-supported", and "page-ranges-supported" Printer Description attributes as defined in section 5.3,
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 5.5.

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

4. The "job-password-supported" and "job-password-encryption-supported" Printer Description attributes as defined in section 5.3, and
5. 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 "printer-mandatory-job-attributes" Printer Description attribute as defined in section 5.3, and
2. The "job-accounting-user-id" and "job-billing-info" Job Template attributes as defined in section 5.5.

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 5.3.
2. The "media-source-properties" member attribute of the "media-col-database" and "media-col-ready" Printer Description attributes as defined in section 5.3.
3. The "feed-orientation" Job Template attribute as defined in section 5.5.

10. Internationalization Considerations

vvvv (Universal Character Set (UCS) Transformation Format -- 8 bit) UTF-8

For interoperability and basic support for multiple languages, conforming implementations MUST support the UTF-8 [RFC3629] encoding of Unicode [UNICODE] [ISO10646].

11. Security Considerations

The IPP extensions defined in this document require the same security considerations as defined in the IPP Model and Semantics [RFC2911]. In addition, Printers MUST validate the HTTP Host request header in order to protect against DNS rebinding attacks.

vvvv Internet Assigned Numbers Authority (IANA)

12. IANA Considerations

[Editor's note - replace PWG5100.EVE and PWG5100.JPS3 references below with final document numbers]

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 [RFC2911] section 6.1 in the following file:

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

The registry entries will contain the following information:

```
Attributes (attribute syntax)
  Keyword Attribute Value                                  Reference
  -----------------------                                  ---------
ipp-features-supported (1setOf type2 keyword)              [PWG5100.JPS3]
  ipp-everywhere                                           [PWG5100.EVE]
```


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

International Organization for Standardization (ISO) vvvv

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¡) 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 (¡), 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.

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

13.3 MIME Media Types

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

13.4 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 fix 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;".

13.5 Delimited Lists

vvvv Lists vvvv Lists

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

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

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Jerry Thrasher - Lexmark
Peter Zehler - Xerox

16. Change History

[PWG Secretary: This section must be removed when Document is approved]

16.1 July 24, 2012

1. MS1: Section 5.3.5 (media-supported) - clarify examples for roll feed
2. MS2: Section 5.3.7 (Notes for Long-Edge Feed ...) - Moved under section 6
3. MS3: Section 5.3.2 (media-col-ready) - Clarified difference in semantics and behavior for manual-feed vs. by-pass-tray (or any regular tray)
4. MS3: Section 5.3.3 (media-ready) - Talk briefly about manual feed vs. by-pass-tray
5. MS2: Section 6 (Document Formats) - Added figures 2 to 5 showing different feed orientations

16.2 June 27, 2012

1. Status: Stable
2. Added roll-fed media information in media-col-database, media-col-ready, media-ready, media-size, and media-supported subsections.

16.3 May 30, 2012

1. Added informative references for DNS-SD and IPPS Internet Drafts
2. Updated references for mDNS and LDAP Printer Schema Internet Drafts
3. Section 4.2: Updated to use references
4. Table 4: Removed duplicate "required"
5. Section 8.2: Conformance Requirements for Printers
6. Section 8.3: Dropped "objects" from title
7. Section 12.2: ", e.g., ..."
8. Section 6: Added reference to EXIF spec
9. Section 8 Additional Semantics for Existing Value Tags: Added with sections for name, naturalLanguage, text, and URI values
10. Section 5.1.1: Added Host section
11. Tables 5 and 8: Added references to Host and URI sections
12. Added references for RFC 3282, 4647, and 5646

16.4 April 20, 2012

1. Status: Prototype
2. Updated reference to PWG Raster (now a candidate standard)
3. Updated definitions for logical and physical device to match up with ISO DPA
4. Updated definition for Job to be zero-or-more documents
5. Clarified out-of-scope (section 3.3)

6. Section 4.1: fixed broken reference
7. Table 1: Added note for DNS-SD elements that are only available via IPP, added DUUID for device-uuid
8. Section 4.2: Clarified requirements for mDNS vs. dynamic DNS
9. Section 4.2.3: Added subsection for DUUID (device-uuid), fixed broken reference to Table 2 that inserted large gobs of old text
10. Section 4.5 WS-Discovery: OASIS, not OASYS
11. Section 5.1 HTTP Features: "the following additional HTTP headers"
12. Section 5.1.1: Added reference to RFC 2616 for section references.
13. Section 5.3: Added detailed conformance text for long-edge feed printers and client support
14. Section 5.6.1 job-id: Added reference to RFC 3196
15. Section 5.6.2 job-uri: Added references to RFC 3196 and 3510
16. Section 7.1: Change to ipp-features-supported
17. Section 8: Split client and printer conformance requirements, added client conformance requirement for media-source-properties and feed-orientation
18. Section 11.1: Changed to ipp-features-supported
19. Section 12: Changed to "Safe String Truncation", clarified intro text
20. Section 12.2 URIs: Added query string and reference to STD66
21. Section 12.3 MIME Media Types: discarded instead of omitted
22. Section 12.5 Lists: typos
23. Section 13.2: Added informative references to RFC 3196 and RFC 3510

16.5 April 8, 2012

1. Title: Dropped version number (just "IPP Everywhere")
2. Section 2.2: Added Logical and Physical Device, Paid Imaging Services, fixed references and referenced terminology
3. Section 2.3: Updated definition of Visible (submit imaging job creation requests) and added definition of Secure Print.
4. Section 3.3: Added out-of-scope list.
5. Section 4.2.2: Added default accuracy value.
6. Section 4.2.3: Added discussion of total length limits, priority, and behaviors
7. Table 2: Fixed section references
8. Section 4.2.3.7: Added note for why we use printer-uuid and not device-uuid for UUID key.
9. Section 4.5: New WS-Discovery section with Justin's proposed example.
10. Sections 5.3, 5.5, 8.2: Added new conditional requirement for feed-orientation and media-source-properties with printers that support long-edge feed media.
11. Section 5.6: Added new subsections for job-id and job-uri.
12. Section 8.2: Converted to numbered list of requirements as needed, added missing attributes.
13. Section 12: New smart string truncation reference.
14. Section 13.1: Added references for WS-Discovery and RFC 3806
15. Everywhere: Change "ipp-everywhere-1.0" to just "ipp-everywhere".

16. All tables: Updated requirements text and added "Required" to titles

16.6 February 1, 2012

1. Updated terminology.
2. Added section for WS-Discovery
3. Table 1: Updated LDAP attributes, added printer-charge-info
4. Updated note 3 for all tables
5. Updated LDAP and SLP section to talk about length limits
6. Fixed footer
7. Updated all attribute tables - xxx-default and xxx-supported are now in the Printer Description table, xxx-preferred has been removed, several Job Template attributes have been moved to the operation attributes table, and other general sync-up with JPS3
8. Added section on HTTP requirements/features
9. Added section on printer-device-id ordering of key/value pairs
10. Added missing references

16.7 September 27, 2011

1. Updated title to "IPP Everywhere 1.0"
2. Updated terminology
3. Updated references for OpenXPS and Bonjour
4. Filled in use cases from common use case document
5. Updated DNS SD (Bonjour) TXT record information.
6. Added SSDP/UPNP information from Andrew Mitchell's May 2011 whitepaper
7. Revamped transport binding section and added new content from JPS3 and PWG Raster
8. Added conformance requirements
9. Added security considerations
10. Added IANA considerations

16.8 August 3, 2011

1. Updated document status (interim)
2. Added OpenXPS and Port Monitor MIB references
3. Added usb_* key definitions
4. Added placeholder for UPNP
5. Cleaned up discovery attribute table
6. Added ipp-extensions-supported keyword definition.
7. Other changes per April 2011 F2F review (see posted minutes)

16.9 March 16, 2011

Initial revision.

