**14 February 2011**
**Candidate Standard 5100.12-2011**


**The Printer Working Group**

# Internet Printing Protocol Version 2.0 Second Edition (IPP/2.0 SE)

## Status: Approved

**Abstract:** Since the release of IPP/1.1 (RFC 2910 and RFC 2911), numerous extensions to the IPP protocol have been published as IETF RFCs or PWG Candidate Standards. Many IPP developers are not aware of the existence of many of these extensions, and there is no published document that references all of these extension specifications. As a consequence, only some of the extensions have been implemented.

This specification combines all of the previous IPP IETF or PWG IPP extensions into a new base IPP/2.0 conformance level and two new extended IPP/2.1 and IPP/2.2 conformance levels. No new IPP functionality is specified in this document, beyond that defined in the previous IPP extensions.

Implementation of this specification will allow printing applications to easily determine the capabilities of an IPP Printer without the need for extensive queries to the IPP Printer.

This document is a PWG Candidate Standard. For a definition of a "PWG Candidate Standard", see:

ftp://ftp.pwg.org/pub/pwg/general/pwg-process30.pdf

This document is available at:

ftp://ftp.pwg.org/pub/pwg/candidates/cs-ipp20-20110214-5100.12.pdf

## About the IEEE-ISTO

The IEEE-ISTO is a not-for-profit corporation offering industry groups an innovative and flexible operational forum and support services. The IEEE-ISTO provides a forum not only to develop standards, but also to facilitate activities that support the implementation and acceptance of standards in the marketplace. The organization is affiliated with the IEEE (http://www.ieee.org/) and the IEEE Standards Association (http://standards.ieee.org/).

For additional information regarding the IEEE-ISTO and its industry programs visit http://www.ieee-isto.org.

## 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

## Contact information:

The Printer Working Group
c/o The IEEE Industry Standards and Technology Organization
445 Hoes Lane
Piscataway, NJ 08854
USA

IPP Web Page:

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

IPP Mailing List:

ipp@pwg.org

Instructions for subscribing to the IPP mailing list can be found at the following link:
http://www.pwg.org/mailhelp.html

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

1 Introduction (Informative) ..... 6
1.1 New IPP Versions ..... 6
2 Terminology ..... 7
2.1 Conformance Terminology ..... 7
2.2 Printing Terminology ..... 7
3 Requirements ..... 8
3.1 Rationale ..... 8
3.2 Use Models ..... 9
3.2.1 IPP/2.0 Printer ..... 9
3.2.2 IPP/2.1 Printer ..... 9
3.2.3 IPP/2.2 Printer ..... 9
3.3 Design Requirements ..... 9
4 IPP Standards ..... 10
4.1 IPP/2.0 Standards ..... 11
4.2 IPP/2.1 Standards ..... 11
4.3 IPP/2.2 Standards ..... 12
5 IPP Operations ..... 13
5.1 Original IPP/1.1 Operations (Informative) ..... 13
5.2 IPP/2.0 Operations ..... 14
5.3 IPP/2.1 Operations ..... 15
5.4 IPP/2.2 Operations ..... 17
6 IPP Attributes ..... 19
6.1 Original IPP/1.1 Attributes ..... 19
6.2 IPP/2.0 Attributes ..... 21
6.3 IPP/2.1 Attributes ..... 23
6.4 IPP/2.2 Attributes ..... 26
7 Conformance Requirements ..... 28
7.1 IPP Printer Conformance Requirements ..... 28
7.2 IPP Client Conformance Requirements ..... 28
7.3 IPP over HTTP Conformance Requirements ..... 28
7.4 IPP over TLS Conformance Requirements ..... 28
7.5 IPP Unsupported Attributes Conformance Requirements ..... 28
8 IANA and PWG Considerations ..... 29
9 Internationalization Considerations ..... 29
10 Security Considerations ..... 30
11 References ..... 31
11.1 Normative References ..... 31
11.2 Informative References ..... 33
12 Editors' Addresses (Informative) ..... 34

 

# List of Tables

Table 1 - Summary of IETF/PWG Specifications and IPP Conformance Levels ..... 10
Table 2 - Original IPP/1.1 Operations ..... 13
Table 3 - IPP/2.0 Operations ..... 14
Table 4 - IPP/2.1 Operations ..... 15
Table 5 - IPP/2.2 Operations ..... 17
Table 6 - Original IPP/1.1 Attributes ..... 19
Table 7 - Attributes in IPP/2.0 ..... 22
Table 8 - IPP/2.1 Attributes ..... 24
Table 9 - IPP/2.2 Attributes ..... 27
Table 10 - TLS Cipher Suite Requirements in IPP Versions ..... 30

 

# 1 Introduction (Informative)

The original IPP/1.0 protocol specifications, [RFC2565] and [RFC 2566], were published by the IETF in April 1999.The subsequent IPP/1.1 protocol specifications, [RFC2910] and [RFC2911], were published by the IETF in September 2000. Since the publication of IPP/1.1, numerous IETF and PWG IPP extension specifications have been approved and published.

## 1.1 New IPP Versions

The purpose of this document is to provide a single reference to all of the existing IETF or PWG IPP extension specifications and to define new IPP versions (i.e., conformance levels) that provide simple statements of the capabilities of an IPP Printer.

In sections 5 and 6, this document defines the new IPP/2.0, IPP/2.1, and IPP/2.2 conformance levels. Below is a brief informal description of the targeted printing environments:

**IPP/2.0** – This IPP conformance level is targeted to an environment where a small number of users are typically physically located close to the device and the device is typically managed by the local users. The device is typically a low speed IPP/2.0 Printer with a limited feature set tailored to the requirements of a small group of users. Routine maintenance, such as loading paper and clearing paper jams, is usually performed by the current user. The configuration of the IPP/2.0 Printer for special jobs, such as the need for a unique paper size or color, is also handled by the user requiring the changed configuration.

**IPP/2.1** – This IPP conformance level is targeted to an environment with more users and devices with higher speed and duty cycle ratings than IPP/2.0 Printers, but the primary difference is in the supported features, physical location, and maintenance of the device. A IPP/2.1 Printer is typically located in a central location with most users not very close physically. An End User's access to the IPP/2.1 Printer may be limited and maintenance is typically performed by assigned, trained personnel. Features such as paper size and type are typically fixed by site policies and are not easily modified for special use.IPP/2.1 Printers often have more post-processing features (such as punching, folding, stapling, etc.) than IPP/2.0 Printers.

**IPP/2.2** – This IPP conformance level is targeted to an environment with high speed and very high duty cycle devices as compared to IPP/2.0 and IPP/2.1 Printers. One example of this environment is a data center where jobs are centrally scheduled rather than sent ad-hoc from a group of End Users. This class of Printer is expected to consume significantly more supplies (such as paper, toner, etc.) and have a larger memory capacity than the other classes.

 

# 2 Terminology

## 2.1 Conformance Terminology

The capitalized key words "MUST", "MUST NOT", "REQUIRED", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document shall be interpreted as defined in [RFC2119].

## 2.2 Printing Terminology

Normative definitions and semantics of printing terms are imported from IETF Printer MIB v2 [RFC3805], IETF Finisher MIB [RFC3806], and IETF IPP/1.1 [RFC2911].

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

IPP Client - Initiator of outgoing IPP session requests and sender of outgoing IPP operation requests (HTTP/1.0 Client [RFC1957] / HTTP/1.1 Client [RFC2616]).

IPP Printer - Listener for incoming IPP session requests and receiver of incoming IPP operation requests (HTTP/1.0 Server [RFC1957] / HTTP/1.1 Server [RFC2616]).

 

# 3 Requirements

Per the PWG Process, this section specifies the formal rationale for developing an IPP Version 2.0 specification, based on existing printing industry standards. This section also describes simple use models for IPP/2.0, IPP/2.1, and IPP/2.2 environments and defines design requirements for IPP Version 2.0.

## 3.1 Rationale

The Printer MIB v2 [RFC3805] and Port Monitor MIB [PWG5107.1] define:

(a) Model of Print Devices
(b) Operations for Print Devices
- prtGeneralReset
- prtConsoleDisable

(c) Groups of simple attributes for Print Devices
- prtInputTable --> prtInputName
- ppmPortTable --> ppmPortServiceNameOrURI

(d) Conformance requirements for implementations of Printer MIB v2 and Port Monitor MIB

The IPP/1.1 Model and Semantics [RFC2911] defines:

(a) Model of Print Services, Print Devices, and Print Jobs
(b) Operations for Print Services and Print Jobs
- Pause-Printer
- Print-Job

(c) Attributes for Print Services and Print Jobs
- printer-location
- job-id

(d) Conformance requirements for implementations of IPP/1.1

The IPP/1.1 Encoding and Transport [RFC2910] defines:

(a) Protocol Bindings for IPP/1.1
- HTTP with optional upgrade to TLS

(b) Mappings of operations for Print Services and Print Jobs.
(c) Conformance requirements for implementations of IPP/1.1

Later IETF and PWG standards-track specifications defined numerous IPP/1.1 extensions including:

(a) New operations
- Set-Printer-Attributes [RFC3380]
- Resume-Job [RFC3998]

(b) New attribute syntaxes
- collection [RFC3382]

(c) New objects
- Subscription [RFC3995]

Therefore an IPP Version 2.0 specification should:

(a) Standardize profiles of the IPP/1.1 extensions for advanced printing functionality and reliable interoperability
(b) Encourage adoption of modern IPP-based printing infrastructures
(c) Discourage the further proliferation of vendor proprietary IPP operations and attributes that damage IPP interoperability by duplicating IETF or PWG IPP standard operations and attributes

 

## 3.2 Use Models

See the informal descriptions of the IPP/2.0, IPP/2.1, and IPP/2.2 printing environments in section 1.1.

### 3.2.1 IPP/2.0 Printer

Alice, Bob, and Charlie are graphic artists who share a printer down the hall. They all load paper when needed. Alice and Bob have convinced Charlie that he should load the toner cartridges. But they do use many paper sizes - they need PWG Media Standardized Names [PWG5101.1] used in the IPP 'media' attribute.

### 3.2.2 IPP/2.1 Printer

Joe and his colleagues send large documents to a printer in a building across the street in a 'glasshouse' with some web servers.

Both Joe and the operator Sue in the glasshouse manage lots of jobs - they need to hold and release jobs. Joe wants to keep track of his jobs - he needs to subscribe for job events.

Sue is expected to manage several printers - she needs to enable and disable printers (i.e., enable/disable accepting new jobs over input channels).

### 3.2.3 IPP/2.2 Printer

Louise works in Accounting for a big wholesaler in Kansas City. She sends variable data jobs (e.g., different user names, user addresses, and balance owed amounts formatted onto a pre-printed form) to a printer in Chicago.

Her friend Sam is a night-shift operator in Chicago. Sam has to make sure that job resources (e.g., the pre-printed forms for Louise's jobs) are loaded when needed - he often needs to pause the printer after the current job.

## 3.3 Design Requirements

The IPP Version 2.0 design should:

(1) Define conformance profiles that reference all previous IETF IPP and PWG IPP specifications;
(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 IPP Printers and IPP Clients; and
(4) Define IANA registration information for new values of “ipp-versions-supported”.

 

# 4 IPP Standards

This section specifies the IPP standards that are REQUIRED, RECOMMENDED, or OPTIONAL at each IPP conformance level defined in this specification. Each IPP conformance level requires support for most of the required functionality of all lower versions (by intentional design).

Note: The original Experimental IETF IPP/1.0 conformance level (now Obsolete) was defined in [RFC2565] and [RFC2566]. The subsequent standards-track IETF IPP/1.1 conformance level was defined in [RFC2910] and [RFC2911].

All of the IETF and PWG specification requirements for each IPP conformance level are summarized below in Table 1, in order to simplify IPP design, implementation, and testing.

Notes:

(1) Empty cells below represent OPTIONAL conformance requirements.

(2) The last 3 rows in this table represent the transport layer security requirements for each IPP version, i.e., support for TLS/1.0 [RFC2246], TLS/1.1 [RFC4346], and TLS/1.2 [RFC5246].

**Table 1 - Summary of IETF/PWG Specifications and IPP Conformance Levels**

| IETF or PWG Specification | IPP/1.1 Support | IPP/2.0 Support | IPP/2.1 Support | IPP/2.2 Support |
|---|---|---|---|---|
| [PWG5100.1] | | REQUIRED | REQUIRED | REQUIRED |
| [PWG5100.2] | | REQUIRED | REQUIRED | REQUIRED |
| [PWG5100.3] | | | REQUIRED | REQUIRED |
| [PWG5100.5] | | | | REQUIRED |
| [PWG5100.6] | | | RECOMMENDED | REQUIRED |
| [PWG5100.7] | | | REQUIRED | REQUIRED |
| [PWG5100.8] | | | | REQUIRED |
| [PWG5100.9] | | RECOMMENDED | REQUIRED | REQUIRED |
| [PWG5100.11] | | OPTIONAL | RECOMMENDED | REQUIRED |
| [PWG5101.1] | | REQUIRED | REQUIRED | REQUIRED |
| [PWG5107.2] | | RECOMMENDED | RECOMMENDED | REQUIRED |
| [RFC2910] | REQUIRED | REQUIRED | REQUIRED | REQUIRED |
| [RFC2911] | REQUIRED | REQUIRED | REQUIRED | REQUIRED |
| [RFC3380] | | | REQUIRED | REQUIRED |
| [RFC3381] | | | REQUIRED | REQUIRED |
| [RFC3382] | | | REQUIRED | REQUIRED |
| [RFC3510] | REQUIRED | REQUIRED | REQUIRED | REQUIRED |
| [RFC3995] | | | REQUIRED | REQUIRED |
| [RFC3996] | | | REQUIRED | REQUIRED |
| [RFC3998] | | OPTIONAL | REQUIRED | REQUIRED |
| [RFC2246] | RECOMMENDED | RECOMMENDED | RECOMMENDED | RECOMMENDED |
| [RFC4346] | | RECOMMENDED | RECOMMENDED | RECOMMENDED |
| [RFC5246] | | | RECOMMENDED | REQUIRED |

 

### 4.1 IPP/2.0 Standards

An IPP/2.0 Printer MUST support the following IETF or PWG specifications:

[RFC2910] Internet Printing Protocol/1.1: Encoding and Transport

[RFC2911] Internet Printing Protocol/1.1: Model and Semantics

[RFC3510] Internet Printing Protocol: IPP URL Scheme

[PWG5100.1] Internet Printing Protocol: “finishings” attribute values extension

[PWG5100.2] Internet Printing Protocol: “output-bin” attribute extension

[PWG5101.1] PWG Standard for Media Size Names (for “media” attribute)

An IPP/2.0 Printer SHOULD support the following specifications:

[PWG5100.9] Internet Printing Protocol: Printer State Extensions

[PWG5107.2] Command Set Format for IEEE 1284 Device ID

[RFC2246] Transport Layer Security 1.0

[RFC4346] Transport Layer Security 1.1

An IPP/2.0 Printer MAY support the following specifications:

[RFC3998] Internet Printing Protocol: Job and Printer Administrative Operations

[PWG5100.11] Internet Printing Protocol: Job and Printer Operations – Set 2 (JPS2)

### 4.2 IPP/2.1 Standards

An IPP/2.1 Printer MUST support the IETF or PWG specifications required for IPP/2.0 plus the following:

[RFC3380] Internet Printing Protocol: Job and Printer Set Operations

[RFC3381] Internet Printing Protocol: Job Progress Attributes

[RFC3382] The 'collection' Attribute Syntax (for “media-col” and other attributes)

[RFC3995] Internet Printing Protocol: Event Notifications and Subscriptions

[RFC3996] Internet Printing Protocol: The ‘ippget’ Delivery Method for Event Notifications

[RFC3998] Internet Printing Protocol: Job and Printer Administrative Operations

[PWG5100.3] Internet Printing Protocol: Production Printing Attributes – Set 1 (for “media-col” attributes)

[PWG5100.7] Internet Printing Protocol: Job Extensions

[PWG5100.9] Internet Printing Protocol: Printer State Extensions

An IPP/2.1 Printer SHOULD support the following specifications:

[PWG5100.6] Internet Printing Protocol: Page Overrides

[PWG5100.11] Internet Printing Protocol: Job and Printer Operations – Set 2 (JPS2)

[PWG5107.2] Command Set Format for IEEE 1284 Device ID

[RFC2246] Transport Layer Security 1.0

[RFC4346] Transport Layer Security 1.1

[RFC5246] Transport Layer Security 1.2

 

### 4.3 IPP/2.2 Standards

An IPP/2.2 printer MUST support the IETF or PWG specifications defined for IPP/2.1 plus the following:

[PWG5100.5] Internet Printing Protocol: Document Object

[PWG5100.6] Internet Printing Protocol: Page Overrides

[PWG5100.8] Internet Printing Protocol: “-actual” Attributes

[PWG5100.11] Internet Printing Protocol: Job and Printer Operations – Set 2 (JPS2)

[PWG5107.2] Command Set Format for IEEE 1284 Device ID

[RFC5246] Transport Layer Security 1.2

An IPP/2.2 Printer SHOULD support the following specifications:

[RFC2246] Transport Layer Security 1.0

[RFC4346] Transport Layer Security 1.1

 

# 5 IPP Operations

IPP/2.0, IPP/2.1, and IPP/2.2 specify higher conformance requirements for some IPP Operations in comparison to previous IPP specifications. Many IPP Operations were defined in their source specifications as optional. If they remained optional in this specification, the desired interoperability objective would not be achieved.

## 5.1 Original IPP/1.1 Operations (Informative)

The following IPP Operations in Table 2 were originally specified as required in IPP/1.1. See note 1 before Table 3 in section 5.2 for a discussion of Validate-Job.

**Table 2 - Original IPP/1.1 Operations**

| Code | Operation Name | Source |
|---|---|---|
| 0x0002 | Print-Job | [RFC2911] |
| 0x0004 | Validate-Job | [RFC2911] |
| 0x0008 | Cancel-Job | [RFC2911] |
| 0x0009 | Get-Job-Attributes | [RFC2911] |
| 0x000A | Get-Jobs | [RFC2911] |
| 0x000B | Get-Printer-Attributes | [RFC2911] |

 

## 5.2 IPP/2.0 Operations

The following IPP Operations in Table 3 are defined in their respective source documents. The conformance requirements for each IPP Operation in an IPP/2.0 implementation are defined below. Note that an IPP/2.0 implementation MAY also include support for additional IPP operations other than those specified in this list.

Notes:

(1) Validate-Job is not widely supported in existing IPP/1.1 implementations and can only validate the Job attributes included in a Print-Job or Create-Job operation, but not the Job document data (for interpreter errors). However, Validate-Job can be used to validate end user access and authorization rights to an IPP Printer before attempting a (possibly rejected) Job creation operation on the IPP Printer. Therefore, Validate-Job is reduced to RECOMMENDED in IPP/2.0. To improve Job accounting, Validate-Job SHOULD be used to verify end user access and authorization rights instead of Create-Job (also defined in [RFC2911]).

(2) Restart-Job is OPTIONAL and DEPRECATED in IPP/2.0 because it destroys accounting information. Instead use Reprocess-Job defined in [RFC3998] or Resubmit-Job defined in [PWG5100.11] as appropriate.

(3) Purge-Jobs is OPTIONAL and DEPRECATED in IPP/2.0 because it destroys accounting information. Instead use Cancel-Jobs (Operator) or Cancel-My-Jobs (End User), both defined in [PWG5100.11], as appropriate

**Table 3 - IPP/2.0 Operations**

| Code | Operation Name | Source | Support |
|---|---|---|---|
| 0x0002 | Print-Job | [RFC2911] | REQUIRED |
| 0x0003 | Print-URI | [RFC2911] | OPTIONAL |
| 0x0004 | Validate-Job (note 1) | [RFC2911] | RECOMMENDED |
| 0x0005 | Create-Job | [RFC2911] | OPTIONAL |
| 0x0006 | Send-Document | [RFC2911] | OPTIONAL |
| 0x0007 | Send-URI | [RFC2911] | OPTIONAL |
| 0x0008 | Cancel-Job | [RFC2911] | REQUIRED |
| 0x0009 | Get-Job-Attributes | [RFC2911] | REQUIRED |
| 0x000A | Get-Jobs | [RFC2911] | REQUIRED |
| 0x000B | Get-Printer-Attributes | [RFC2911] | REQUIRED |
| 0x000C | Hold-Job | [RFC2911] | OPTIONAL |
| 0x000D | Release-Job | [RFC2911] | OPTIONAL |
| 0x000E | Restart-Job (note 2) | [RFC2911] | OPTIONAL – DEPRECATED |
| 0x0010 | Pause-Printer | [RFC2911] | OPTIONAL |
| 0x0011 | Resume-Printer | [RFC2911] | OPTIONAL |
| 0x0012 | Purge-Jobs (note 3) | [RFC2911] | OPTIONAL – DEPRECATED |
| 0x002C | Reprocess-Job (note 2) | [RFC3998] | OPTIONAL |
| 0x0038 | Cancel-Jobs (note 3) | [PWG5100.11] | OPTIONAL |
| 0x0039 | Cancel-My-Jobs (note 3) | [PWG5100.11] | OPTIONAL |
| 0x003A | Resubmit-Job (note 2) | [PWG5100.11] | OPTIONAL |

 

## 5.3 IPP/2.1 Operations

The following IPP Operations in Table 4 are included in their respective source documents. The conformance requirements (some higher than in IPP/2.0) for each IPP Operation in an IPP/2.1 implementation are defined below. Note that an IPP/2.1 implementation MAY also include support for additional IPP operations other than those specified in this list.

Notes:

(1) Validate-Job is REQUIRED in IPP/2.1 (as in IPP/1.1), for strict IPP/1.1 compatibility. See note 1 before Table 2 in section 5.2 for further discussion of Validate-Job.
(2) Restart-Job is OPTIONAL and DEPRECATED in IPP/2.1 because it destroys accounting information. Instead use Reprocess-Job defined in [RFC3998] or Resubmit-Job defined in [PWG5100.11] as appropriate.
(3) Purge-Jobs is OPTIONAL and DEPRECATED in IPP/2.1 because it destroys accounting information. Instead use Cancel-Jobs (Operator) or Cancel-My-Jobs (End User) as appropriate, both defined in [PWG5100.11].
(4) Activate-Printer and Deactivate-Printer are OPTIONAL and DEPRECATED in IPP/2.1, because they are not widely implemented and are redundant compound operations (Enable/Resume and Disable/Pause) designed to close theoretical race conditions.
(5) Delete-Document is OPTIONAL and DEPRECATED in IPP/2.1 because it destroys accounting information. Instead use Cancel-Document defined in [PWG5100.5].
(6) Cancel-Jobs, Cancel-My-Jobs, Resubmit-Job, and Close-Job are RECOMMENDED in IPP/2.1 for extended Job management and reprint features (see note 2 and note 3 above).

**Table 4 - IPP/2.1 Operations**

| Code | Operation Name | Source | Support |
|---|---|---|---|
| 0x0002 | Print-Job | [RFC2911] | REQUIRED |
| 0x0003 | Print-URI | [RFC2911] | OPTIONAL |
| 0x0004 | Validate-Job (note 1) | [RFC2911] | REQUIRED |
| 0x0005 | Create-Job | [RFC2911] | REQUIRED |
| 0x0006 | Send-Document | [RFC2911] | REQUIRED |
| 0x0007 | Send-URI | [RFC2911] | OPTIONAL |
| 0x0008 | Cancel-Job | [RFC2911] | REQUIRED |
| 0x0009 | Get-Job-Attributes | [RFC2911] | REQUIRED |
| 0x000A | Get-Jobs | [RFC2911] | REQUIRED |
| 0x000B | Get-Printer-Attributes | [RFC2911] | REQUIRED |
| 0x000C | Hold-Job | [RFC2911] | REQUIRED |
| 0x000D | Release-Job | [RFC2911] | REQUIRED |
| 0x000E | Restart-Job (note 2) | [RFC2911] | OPTIONAL – DEPRECATED |
| 0x0010 | Pause-Printer | [RFC2911] | REQUIRED |
| 0x0011 | Resume-Printer | [RFC2911] | REQUIRED |
| 0x0012 | Purge-Jobs (note 3) | [RFC2911] | OPTIONAL – DEPRECATED |
| 0x0013 | Set-Printer-Attributes | [RFC3380] | REQUIRED |
| 0x0014 | Set-Job-Attributes | [RFC3380] | REQUIRED |
| 0x0015 | Get-Printer-Supported-Values | [RFC3380] | REQUIRED |
| 0x0016 | Create-Printer-Subscriptions | [RFC3995] | REQUIRED |
| 0x0017 | Create-Job-Subscriptions | [RFC3995] | OPTIONAL |
| 0x0018 | Get-Subscription-Attributes | [RFC3995] | REQUIRED |
| 0x0019 | Get-Subscriptions | [RFC3995] | REQUIRED |
| 0x001A | Renew-Subscription | [RFC3995] | REQUIRED |
| 0x001B | Cancel-Subscription | [RFC3995] | REQUIRED |
| 0x001C | Get-Notifications | [RFC3995] | REQUIRED |
| 0x0022 | Enable-Printer | [RFC3998] | REQUIRED |
| 0x0023 | Disable-Printer | [RFC3998] | REQUIRED |

 

| Code | Operation Name | Source | Support |
|---|---|---|---|
| 0x0024 | Pause-Printer-After-Current-Job | [RFC3998] | OPTIONAL |
| 0x0025 | Hold-New-Jobs | [RFC3998] | OPTIONAL |
| 0x0026 | Release-Held-New-Jobs | [RFC3998] | OPTIONAL |
| 0x0027 | Deactivate-Printer (note 4) | [RFC3998] | OPTIONAL – DEPRECATED |
| 0x0028 | Activate-Printer (note 4) | [RFC3998] | OPTIONAL – DEPRECATED |
| 0x0029 | Restart-Printer | [RFC3998] | OPTIONAL |
| 0x002A | Shutdown-Printer | [RFC3998] | OPTIONAL |
| 0x002B | Startup-Printer | [RFC3998] | OPTIONAL |
| 0x002C | Reprocess-Job (note 2) | [RFC3998] | RECOMMENDED |
| 0x002D | Cancel-Current-Job | [RFC3998] | OPTIONAL |
| 0x002E | Suspend-Current-Job | [RFC3998] | OPTIONAL |
| 0x002F | Resume-Job | [RFC3998] | OPTIONAL |
| 0x0030 | Promote-Job | [RFC3998] | OPTIONAL |
| 0x0031 | Schedule-Job-After | [RFC3998] | OPTIONAL |
| 0x0033 | Cancel-Document | [PWG5100.5] | OPTIONAL |
| 0x0034 | Get-Document-Attributes | [PWG5100.5] | OPTIONAL |
| 0x0035 | Get-Documents | [PWG5100.5] | OPTIONAL |
| 0x0036 | Delete-Document (note 5) | [PWG5100.5] | OPTIONAL – DEPRECATED |
| 0x0037 | Set-Document-Attributes | [PWG5100.5] | OPTIONAL |
| 0x0038 | Cancel-Jobs (note 3, 6) | [PWG5100.11] | RECOMMENDED |
| 0x0039 | Cancel-My-Jobs (note 3, 6) | [PWG5100.11] | RECOMMENDED |
| 0x003A | Resubmit-Job (note 2, 6) | [PWG5100.11] | RECOMMENDED |
| 0x003B | Close-Job (note 6) | [PWG5100.11] | RECOMMENDED |

 

## 5.4 IPP/2.2 Operations

The following IPP Operations in Table 5 are included in their respective source documents. The conformance requirements (some higher than in IPP/2.1) for each IPP Operation in an IPP/2.2 implementation are defined below. Note that an IPP/2.2 implementation MAY also include support for additional IPP operations other than those specified in this list.

Notes:

(1) Validate-Job is REQUIRED in IPP/2.2 (as in IPP/1.1), for strict IPP/1.1 compatibility. See note 1 before Table 3 in section 5.2 for further discussion of Validate-Job.
(2) Restart-Job is OPTIONAL and DEPRECATED in IPP/2.2 because it destroys accounting information. Instead use Reprocess-Job defined in [RFC3998] or Resubmit-Job defined in [PWG5100.11] as appropriate.
(3) Purge-Jobs is OPTIONAL and DEPRECATED in IPP/2.2 because it destroys accounting information. Instead use Cancel-Jobs (Operator) or Cancel-My-Jobs (End User) as appropriate, both defined in [PWG5100.11].
(4) Activate-Printer and Deactivate-Printer are OPTIONAL and DEPRECATED in IPP/2.2, because they are not widely implemented and are redundant compound operations (Enable/Resume and Disable/Pause) designed to close theoretical race conditions.
(5) Delete-Document is OPTIONAL and DEPRECATED in IPP/2.2 because it destroys accounting information. Instead use Cancel-Document defined in [PWG5100.5].

**Table 5 - IPP/2.2 Operations**

| Code | Operation Name | Source | Support |
|---|---|---|---|
| 0x0002 | Print-Job | [RFC2911] | REQUIRED |
| 0x0003 | Print-URI | [RFC2911] | OPTIONAL |
| 0x0004 | Validate-Job (note 1) | [RFC2911] | REQUIRED |
| 0x0005 | Create-Job | [RFC2911] | REQUIRED |
| 0x0006 | Send-Document | [RFC2911] | REQUIRED |
| 0x0007 | Send-URI | [RFC2911] | OPTIONAL |
| 0x0008 | Cancel-Job | [RFC2911] | REQUIRED |
| 0x0009 | Get-Job-Attributes | [RFC2911] | REQUIRED |
| 0x000A | Get-Jobs | [RFC2911] | REQUIRED |
| 0x000B | Get-Printer-Attributes | [RFC2911] | REQUIRED |
| 0x000C | Hold-Job | [RFC2911] | REQUIRED |
| 0x000D | Release-Job | [RFC2911] | REQUIRED |
| 0x000E | Restart-Job (note 2) | [RFC2911] | OPTIONAL – DEPRECATED |
| 0x0010 | Pause-Printer | [RFC2911] | REQUIRED |
| 0x0011 | Resume-Printer | [RFC2911] | REQUIRED |
| 0x0012 | Purge-Jobs (note 3) | [RFC2911] | OPTIONAL – DEPRECATED |
| 0x0013 | Set-Printer-Attributes | [RFC3380] | REQUIRED |
| 0x0014 | Set-Job-Attributes | [RFC3380] | REQUIRED |
| 0x0015 | Get-Printer-Supported-Values | [RFC3380] | REQUIRED |
| 0x0016 | Create-Printer-Subscriptions | [RFC3995] | REQUIRED |
| 0x0017 | Create-Job-Subscriptions | [RFC3995] | OPTIONAL |
| 0x0018 | Get-Subscription-Attributes | [RFC3995] | REQUIRED |
| 0x0019 | Get-Subscriptions | [RFC3995] | REQUIRED |
| 0x001A | Renew-Subscription | [RFC3995] | REQUIRED |
| 0x001B | Cancel-Subscription | [RFC3995] | REQUIRED |
| 0x001C | Get-Notifications | [RFC3995] | REQUIRED |
| 0x0022 | Enable-Printer | [RFC3998] | REQUIRED |
| 0x0023 | Disable-Printer | [RFC3998] | REQUIRED |

| Code | Operation Name | Source | Support |
|---|---|---|---|
| 0x0024 | Pause-Printer-After-Current-Job | [RFC3998] | REQUIRED |
| 0x0025 | Hold-New-Jobs | [RFC3998] | REQUIRED |
| 0x0026 | Release-Held-New-Jobs | [RFC3998] | REQUIRED |
| 0x0027 | Deactivate-Printer (note 4) | [RFC3998] | OPTIONAL – DEPRECATED |
| 0x0028 | Activate-Printer (note 4) | [RFC3998] | OPTIONAL – DEPRECATED |
| 0x0029 | Restart-Printer | [RFC3998] | REQUIRED |
| 0x002A | Shutdown-Printer | [RFC3998] | REQUIRED |
| 0x002B | Startup-Printer | [RFC3998] | REQUIRED |
| 0x002C | Reprocess-Job (note 2) | [RFC3998] | REQUIRED |
| 0x002D | Cancel-Current-Job | [RFC3998] | REQUIRED |
| 0x002E | Suspend-Current-Job | [RFC3998] | REQUIRED |
| 0x002F | Resume-Job | [RFC3998] | REQUIRED |
| 0x0030 | Promote-Job | [RFC3998] | REQUIRED |
| 0x0031 | Schedule-Job-After | [RFC3998] | REQUIRED |
| 0x0033 | Cancel-Document | [PWG5100.5] | REQUIRED |
| 0x0034 | Get-Document-Attributes | [PWG5100.5] | REQUIRED |
| 0x0035 | Get-Documents | [PWG5100.5] | REQUIRED |
| 0x0036 | Delete-Document (note 5) | [PWG5100.5] | OPTIONAL – DEPRECATED |
| 0x0037 | Set-Document-Attributes | [PWG5100.5] | REQUIRED |
| 0x0038 | Cancel-Jobs (note 3) | [PWG5100.11] | REQUIRED |
| 0x0039 | Cancel-My-Jobs (note 3) | [PWG5100.11] | REQUIRED |
| 0x003A | Resubmit-Job (note 2) | [PWG5100.11] | REQUIRED |
| 0x003B | Close-Job | [PWG5100.11] | REQUIRED |

 

# 6 IPP Attributes

This section specifies the IPP attributes that MUST be implemented for conformance to IPP/2.0, IPP/2.1, and IPP/2.2 and also provides a summary of the original required IPP/1.1 Attributes.

## 6.1 Original IPP/1.1 Attributes

The following IPP attributes in Table 6 were originally specified as required in IPP/1.1 [RFC2911]. All of these IPP attributes are REQUIRED in IPP/2.0, IPP/2.1, and IPP/2.2 (see following sections).

Notes:

1. The required parameters for all operations and/or responses are defined in section 3.1.1 of IETF IPP/1.1 [RFC2911] and are listed below.

**Table 6 - Original IPP/1.1 Attributes**

| Attribute Name | Object | Source |
|---|---|---|
| attributes-charset | All (operation/all) | [RFC2911] |
| attributes-natural-language | All (operation/all) | [RFC2911] |
| charset-configured | Printer | [RFC2911] |
| charset-supported | Printer | [RFC2911] |
| compression | Job | [RFC2911] |
| compression-supported | Printer | [RFC2911] |
| document-format | Job | [RFC2911] |
| document-format-default | Printer | [RFC2911] |
| document-format-supported | Printer | [RFC2911] |
| document-name | Job | [RFC2911] |
| generated-natural-language-supported | Printer | [RFC2911] |
| ipp-attribute-fidelity | Job | [RFC2911] |
| ipp-versions-supported | Printer | [RFC2911] |
| job-id | Job | [RFC2911] |
| job-name | Job | [RFC2911] |
| job-originating-user-name | Job | [RFC2911] |
| job-printer-up-time | Job | [RFC2911] |
| job-printer-uri | Job | [RFC2911] |
| job-state | Job | [RFC2911] |
| job-state-reasons | Job | [RFC2911] |
| job-uri | Job | [RFC2911] |
| limit | Printer (operation) | [RFC2911] |
| my-jobs | Printer (operation) | [RFC2911] |
| natural-language-configured | Printer | [RFC2911] |
| operation-id (note 1) | All (parameter) | [RFC2911] |
| operations-supported | Printer | [RFC2911] |
| pdl-override-supported | Printer | [RFC2911] |
| printer-is-accepting-jobs | Printer | [RFC2911] |
| printer-name | Printer | [RFC2911] |
| printer-state | Printer | [RFC2911] |
| printer-state-reasons | Printer | [RFC2911] |
| printer-up-time | Printer | [RFC2911] |

 

| Attribute Name | Object | Source |
|---|---|---|
| printer-uri | All (operation) | [RFC2911] |
| printer-uri-supported | Printer | [RFC2911] |
| queued-job-count | Printer | [RFC2911] |
| request-id (note 1) | All (parameter) | [RFC2911] |
| requested-attributes | All (operation) | [RFC2911] |
| requesting-user-name | All (operation) | [RFC2911] |
| status-code (note 1) | All (parameter) | [RFC2911] |
| time-at-completed | Job | [RFC2911] |
| time-at-creation | Job | [RFC2911] |
| time-at-processing | Job | [RFC2911] |
| uri-authentication-supported | Printer | [RFC2911] |
| uri-security-supported | Printer | [RFC2911] |
| version-number (note 1) | All (parameter) | [RFC2911] |
| which-jobs | Printer (operation) | [RFC2911] |

 

## 6.2 IPP/2.0 Attributes

The following IPP attributes in Table 7 are REQUIRED, unless otherwise specified in notes below, in an IPP/2.0 implementation, in addition to all the IPP attributes listed in Table 6 in section 6.1 above. Note that an IPP/2.0 implementation MAY also include support for additional IPP attributes other than those specified in this list.

Notes:

1. Values of the “media” attribute that contain media size names and media type names MUST conform to [PWG5101.1] for IPP/2.0 implementations.

2. The “pages-per-minute-color” attribute is only required for IPP/2.0 implementations if the printer supports more than 1 color (i.e., the value of “color-supported” is ‘true’).

3. The “media-ready” attribute is OPTIONAL for IPP/2.0 implementations, because it often cannot be supported by remote IPP spoolers.

4. The “printer-alert” and “printer-alert-description” attributes [PWG5100.9] are RECOMMENDED in IPP/2.0 for reliable device management.

5. The “printer-device-id” attribute [PWG5107.2] is RECOMMENDED in IPP/2.0 for reliable driver installation.

6. The “status-message” response attribute [RFC2911] is RECOMMENDED in IPP/2.0 for internationalization.

7. The “job-creation-attributes-supported” attribute [PWG5100.11] is RECOMMENDED in IPP/2.0 for reliable job creation operations.

8. The “print-quality” attribute has higher precedence than “printer-resolution”, if the IPP Printer can’t support a requested combination, and returns the usual successful-ok-ignored-or-substituted-attributes status-code.

 

467

468 **Table 7 - Attributes in IPP/2.0**

| Attribute Name | Object | Source |
|---|---|---|
| color-supported | Printer | [RFC2911] |
| copies | Job | [RFC2911] |
| copies-default | Printer | [RFC2911] |
| copies-supported | Printer | [RFC2911] |
| finishings | Job | [RFC2911] |
| finishings-default | Printer | [RFC2911] |
| finishings-supported | Printer | [RFC2911] |
| job-creation-attributes-supported (RECOMMENDED – note 7) | Printer | [PWG5100.11] |
| media (note 1) | Job | [RFC2911] |
| media-default (note 1) | Printer | [RFC2911] |
| media-ready (OPTIONAL – note 3) | Printer | [RFC2911] |
| media-supported (note 1) | Printer | [RFC2911] |
| orientation-requested | Job | [RFC2911] |
| orientation-requested-default | Printer | [RFC2911] |
| orientation-requested-supported | Printer | [RFC2911] |
| output-bin | Job | [PWG5100.2] |
| output-bin-default | Printer | [PWG5100.2] |
| output-bin-supported | Printer | [PWG5100.2] |
| pages-per-minute | Printer | [RFC2911] |
| pages-per-minute-color (REQUIRED for color – note 2) | Printer | [RFC2911] |
| print-quality (note 8) | Job | [RFC2911] |
| print-quality-default | Printer | [RFC2911] |
| print-quality-supported | Printer | [RFC2911] |
| printer-alert (RECOMMENDED - note 4) | Printer | [PWG5100.9] |
| printer-alert-description (RECOMMENDED - note 4) | Printer | [PWG5100.9] |
| printer-device-id (RECOMMENDED - note 5) | Printer | [PWG5107.2] |
| printer-info | Printer | [RFC2911] |
| printer-location | Printer | [RFC2911] |
| printer-make-and-model | Printer | [RFC2911] |
| printer-more-info | Printer | [RFC2911] |
| printer-resolution (note 8) | Job | [RFC2911] |
| printer-resolution-default | Printer | [RFC2911] |
| printer-resolution-supported | Printer | [RFC2911] |
| sides | Job | [RFC2911] |
| sides-default | Printer | [RFC2911] |
| sides-supported | Printer | [RFC2911] |
| status-message (RECOMMENDED – note 6) | All (response) | [RFC2911] |

 

## 6.3 IPP/2.1 Attributes

The following IPP attributes in Table 8 are REQUIRED, unless otherwise specified in notes below, in an IPP/2.1 implementation, in addition to all the IPP attributes listed in sections 6.1 and 6.2 above. Note that an IPP/2.1 implementation MAY also include support for additional IPP attributes other than those specified in this list.

Notes:

1. The “media-col”, “media-col-default”, and “media-col-supported” attributes are REQUIRED in IPP/2.1 implementations (see note 2 below) and are normatively defined in [PWG5100.3] and only briefly described in an *example* in [RFC3382].

2. The specified “media-col” member attributes are REQUIRED in IPP/2.1 implementations – all other “media-col” member attributes not listed in Table 8 are OPTIONAL in IPP/2.1 per original specification of this collection in [PWG5100.3]. Values of “media-col.media-color”, “media-col.media-size”, and “media-col.media-type” attributes MUST conform to [PWG5101.1] for IPP/2.1 implementations.

3. The “media-col-ready” attribute is OPTIONAL for IPP/2.1 implementations, because it often cannot be supported by remote IPP spoolers.

4. The “job-ids”, “job-ids-supported”, “proof-print”, and “which-jobs-supported” attributes [PWG5100.11] are RECOMMENDED in IPP/2.1 (see note 6 in section 5.3).

5. The “printer-device-id” attribute [PWG5107.2] is RECOMMENDED in IPP/2.1 for reliable driver installation.

6. The “printer-state-reasons” attribute is REQUIRED in IPP/2.1 to support the complete mapping of prtAlertCode [RFC3805] that is defined in [PWG5100.9] for all alert code values supported in the implementation.

7. The “overrides”, “overrides-actual”, and “overrides-supported” attributes [PWG5100.6] are RECOMMENDED in IPP/2.1.

8. The “status-message” response attribute [RFC2911] is RECOMMENDED in IPP/2.1 for internationalization.

9. The “job-creation-attributes-supported” attribute [PWG5100.11] is RECOMMENDED in IPP/2.1 for reliable job creation operations.

10. The “printer-alert” and “printer-alert-description” attributes [PWG5100.9] are REQUIRED in IPP/2.1 for reliable device management.

 

500
501

**Table 8 - IPP/2.1 Attributes**

| Attribute Name | Object | Source |
|---|---|---|
| compression-supplied | Job | [PWG5100.7] |
| document-format-supplied | Job | [PWG5100.7] |
| document-format-version | Job (operation) | [PWG5100.7] |
| document-format-version-supplied | Job | [PWG5100.7] |
| document-name-supplied | Job | [PWG5100.7] |
| ippget-event-life | Printer | [RFC3996] |
| job-creation-attributes-supported (RECOMMENDED – note 9) | Printer | [PWG5100.11] |
| job-hold-until | Job | [RFC2911] |
| job-hold-until-default | Printer | [RFC2911] |
| job-hold-until-supported | Printer | [RFC2911] |
| job-ids (RECOMMENDED - note 4) | Printer (operation) | [PWG5100.11] |
| job-ids-supported (RECOMMENDED - note 4) | Printer | [PWG5100.11] |
| job-priority | Job | [RFC2911] |
| job-priority-default | Printer | [RFC2911] |
| job-priority-supported | Printer | [RFC2911] |
| job-settable-attributes-supported | Printer | [RFC3380] |
| job-sheets | Job | [RFC2911] |
| job-sheets-default | Printer | [RFC2911] |
| job-sheets-supported | Printer | [RFC2911] |
| last-document | Job (operation) | [RFC2911] |
| media-col (note 1) | Job | [RFC3382] & [PWG5100.3] |
| media-col-default (note 1) | Printer | [RFC3382] & [PWG5100.3] |
| media-col-ready (OPTIONAL – note 3) | Printer | [RFC3382] & [PWG5100.3] |
| media-col-supported (note 1) | Printer | [RFC3382] & [PWG5100.3] |
| media-col.media-color (note 2) | Job | [PWG5100.3] |
| media-col.media-key (note 2) | Job | [PWG5100.3] |
| media-col.media-size (note 2) | Job | [PWG5100.3] |
| media-col.media-type (note 2) | Job | [PWG5100.3] |
| multiple-operation-time-out | Printer | [RFC2911] |
| notify-charset | Subscription | [RFC3995] |
| notify-events | Subscription | [RFC3995] |
| notify-events-default | Printer | [RFC3995] |
| notify-events-supported | Printer | [RFC3995] |
| notify-get-interval | Printer (response) | [RFC3996] |
| notify-job-id | Subscription | [RFC3995] |
| notify-lease-duration | Subscription | [RFC3995] |
| notify-lease-duration-default | Printer | [RFC3995] |
| notify-lease-duration-supported | Printer | [RFC3995] |
| notify-lease-expiration-time | Subscription | [RFC3995] |
| notify-max-events-supported | Printer | [RFC3995] |
| notify-natural-language | Subscription | [RFC3995] |

 

| Attribute Name | Object | Source |
|---|---|---|
| notify-printer-up-time | Subscription | [RFC3995] |
| notify-printer-uri | Subscription | [RFC3995] |
| notify-pull-method | Subscription | [RFC3995] |
| notify-pull-method-supported | Printer | [RFC3995] |
| notify-sequence-number | Subscription | [RFC3995] |
| notify-sequence-numbers | Printer (operation) | [RFC3996] |
| notify-subscribed-event | Subscription | [RFC3995] |
| notify-subscriber-user-name | Subscription | [RFC3995] |
| notify-subscription-id | Subscription | [RFC3995] |
| notify-subscription-ids | Printer (operation) | [RFC3996] |
| notify-text | Subscription | [RFC3995] |
| notify-time-interval | Subscription | [RFC3995] |
| notify-user-data | Subscription | [RFC3995] |
| notify-wait | Printer (operation) | [RFC3996] |
| output-device-assigned | Job | [RFC3998] |
| overrides (RECOMMENDED - note 7) | Job | [PWG5100.6] |
| overrides-actual (RECOMMENDED - note 7) | Job | [PWG5100.6] |
| overrides-supported (RECOMMENDED - note 7) | Printer | [PWG5100.6] |
| printer-alert (note 10) | Printer | [PWG5100.9] |
| printer-alert-description (note 10) | Printer | [PWG5100.9] |
| printer-device-id (RECOMMENDED - note 5) | Printer | [PWG5107.2] |
| printer-settable-attributes-supported | Printer | [RFC3380] |
| printer-state-change-time | Printer | [RFC3995] |
| printer-state-reasons (note 6) | Printer | [RFC2911] & [PWG5100.9] |
| proof-print (RECOMMENDED - note 4) | Job | [PWG5100.11] |
| status-message (RECOMMENDED – note 8) | All (response) | [RFC2911] |
| which-jobs-supported (RECOMMENDED - note 4) | Printer | [PWG5100.11] |

 

## 6.4 IPP/2.2 Attributes

The following IPP attributes are REQUIRED, unless otherwise specified in notes below, in an IPP/2.2 implementation, in addition to all the IPP attributes listed in sections 6.1, 6.2, and 6.3 above. Note that an IPP/2.2 implementation MAY also include support for additional IPP attributes other than those specified in this list.

Notes:

1. The “job-ids” operation attribute [PWG5100.11] is REQUIRED in IPP/2.2, for use in the Get-Jobs [RFC2911], Cancel-Jobs [PWG5100.11], and Cancel-My-Jobs [PWG5100.11] operations.
2. The “job-ids-supported”, “proof-print”, and “which-jobs-supported” attributes [PWG5100.11] are REQUIRED in IPP/2.2.
3. The “printer-device-id” attribute [PWG5107.2] is REQUIRED in IPP/2.2 for reliable driver installation.
4. The “overrides”, “overrides-actual”, and “overrides-supported” attributes [PWG5100.6] are REQUIRED in IPP/2.2.
5. The “media-col-ready” attribute is OPTIONAL for IPP/2.2 implementations, because it often cannot be supported by remote IPP spoolers.
6. The “status-message” response attribute [RFC2911] is REQUIRED in IPP/2.2 for internationalization.
7. The “job-creation-attributes-supported” attribute [PWG5100.11] is REQUIRED in IPP/2.2 for reliable job creation operations.
8. The “document-format-detected”, “document-format-supplied”, “document-name”, and “document-name-supplied” attributes are REQUIRED in IPP/2.2 for the Document object [PWG5100.5], in addition to the Job object [PWG5100.7] requirements in IPP/2.1.

 

525 **Table 9 - IPP/2.2 Attributes**

526

| Attribute Name | Object | Source |
|---|---|---|
| copies-actual | Job | [PWG5100.8] |
| document-job-id | Document | [PWG5100.5] |
| document-job-uri | Document | [PWG5100.5] |
| document-format-detected (note 8) | Document | [PWG5100.5] |
| document-format-supplied (note 8) | Document | [PWG5100.5] |
| document-message | Job/Document | [PWG5100.7] & [PWG5100.5] |
| document-message-supplied | Job/Document | [PWG5100.7] & [PWG5100.5] |
| document-name (note 8) | Document | [PWG5100.5] |
| document-name-supplied (note 8) | Document | [PWG5100.5] |
| document-number | Document | [PWG5100.5] |
| document-printer-uri | Document | [PWG5100.5] |
| document-state | Document | [PWG5100.5] |
| document-state-reasons | Document | [PWG5100.5] |
| finishings-actual | Job | [PWG5100.8] |
| job-creation-attributes-supported (note 7) | Printer | [PWG5100.11] |
| job-mandatory-attributes | Job (operation) | [PWG5100.7] |
| job-hold-until-actual | Job | [PWG5100.8] |
| job-ids (note 1) | Printer (operation) | [PWG5100.11] |
| job-ids-supported (note 2) | Printer | [PWG5100.11] |
| job-priority-actual | Job | [PWG5100.8] |
| job-sheets-actual | Job | [PWG5100.8] |
| media-actual | Job | [PWG5100.8] |
| media-col-actual | Job | [PWG5100.8] |
| media-col-ready (OPTIONAL – note 5) | Printer | [PWG5100.3] |
| multiple-document-handling | Job | [PWG5100.5] |
| multiple-document-handling-actual | Job | [PWG5100.8] |
| multiple-document-jobs-supported | Printer | [RFC2911] |
| number-of-documents | Job | [PWG5100.5] |
| number-up | Job | [RFC2911] |
| number-up-actual | Job | [PWG5100.8] |
| number-up-default | Printer | [RFC2911] |
| number-up-supported | Printer | [RFC2911] |
| output-bin-actual | Job | [PWG5100.8] |
| orientation-requested-actual | Job | [PWG5100.8] |
| overrides (note 4) | Job | [PWG5100.6] |
| overrides-actual (note 4) | Job | [PWG5100.6] |
| overrides-supported (note 4) | Printer | [PWG5100.6] |
| page-ranges | Job | [RFC2911] |
| page-ranges-actual | Job | [PWG5100.8] |
| page-ranges-supported | Printer | [RFC2911] |
| print-quality-actual | Job | [PWG5100.8] |
| printer-device-id (note 3) | Printer | [PWG5107.2] |
| printer-message-from-operator | Printer | [RFC2911] |
| printer-resolution-actual | Job | [PWG5100.8] |
| proof-print (note 2) | Job | [PWG5100.11] |
| sides-actual | Job | [PWG5100.8] |
| status-message (note 6) | All (response) | [RFC2911] |
| which-jobs-supported (note 2) | Printer | [PWG5100.11] |

 

# 7 Conformance Requirements

## 7.1 IPP Printer Conformance Requirements

To claim conformance to this specification, an IPP Printer implementation MUST:

(a) support all REQUIRED IPP Operations defined in section 5 of this specification;
(b) support all REQUIRED IPP Attributes defined in section 6 of this specification;.
(c) conform to the requirements for an IPP Object specified in section 5.2 of [RFC2911];
(d) conform to the IPP Job and Printer Administrative operation requirements specified in section 11 of [RFC3998];
(e) conform to the Internationalization Considerations defined in section 9 of this specification; and
(f) conform to the Security Considerations defined in section 10 of this specification, including the RECOMMENDED or REQUIRED TLS versions for IPP/2.0, IPP/2.1, and IPP/2.2 implementations.

## 7.2 IPP Client Conformance Requirements

To claim conformance to this specification, an IPP Client MUST:

(a) explicitly identify the implemented set of IPP Operations defined in section 5 of this specification;
(b) explicitly identify the implemented set of IPP Attributes defined in section 6 of this specification;
(c) conform to the requirements for an IPP Client specified in section 5.1 of [RFC2911];
(d) conform to the Internationalization Considerations defined in section 9 of this specification; and
(e) conform to the Security Considerations defined in section 10 of this specification, including the RECOMMENDED or REQUIRED TLS versions for IPP/2.0, IPP/2.1, and IPP/2.2 implementations.

## 7.3 IPP over HTTP Conformance Requirements

The IPP/1.1 specification [RFC2911] requires implementation of IPP/1.1 transport over HTTP/1.1 as defined in [RFC2616]. Historically, some IPP implementations have not implemented an HTTP/1.1 transport (i.e., have only supported HTTP/1.0) or else have not implemented complete HTTP/1.1 support.

To claim conformance to this specification, an IPP Printer or IPP Client implementation MUST:

(a) support the complete HTTP/1.1 protocol as defined in [RFC2616];
(b) support chunking as defined in section 3.6.1 of [RFC2616];
(c) support the Expect header as defined in section 5.3 of [RFC2616].

## 7.4 IPP over TLS Conformance Requirements

To claim conformance to this specification, an IPP Printer or IPP Client that supports TLS/1.0 [RFC2246] or later TLS specification MUST:

(a) support the HTTP Upgrade protocol as defined in [RFC2817]; and
(b) support the required minimum cipher suite for interoperability defined in the claimed TLS specification.

## 7.5 IPP Unsupported Attributes Conformance Requirements

The IPP/1.1 specification [RFC2911] requires that IPP Attributes received, that are not supported or not understood, must be processed according to the defined procedures, and that an appropriate status code must be returned. Historically, some IPP implementations have not conformed to this requirement, causing communication problems and failed IPP printing operations.

To claim conformance to this specification, an IPP Printer or IPP Client implementation MUST:

(a) correctly process unsupported attributes, values, or groups as defined in sections 3.1.7, 3.1.8, 3.2.1.2, 3.3.5.1, 3.3.7.1, 4.1.2.3, and 13.1.2.2 in [RFC2911];
(b) correctly process unsupported collection attributes as defined in section 7 in [RFC3382];
(c) correctly support reading the IPP noValue tag as a valid value for an attribute that normally would be encoded as an enum, integer, name, or keyword value tag;
(d) correctly process (or ignore) collection values as defined by [RFC3382], even if the IPP implementation does not support the collection attribute itself.

 

# 8 IANA and PWG Considerations

This section contains the exact registration information for IANA to update the procedures defined in [RFC2911].

The registry entry will contain the following information:

```
Section 9 (References)

[PWG5100.12] PWG IPP Version 2.0 Second Edition, PWG 5100.12, February 2011.
             ftp://ftp.pwg.org/pub/pwg/candidates/
                 cs-ipp20-20110214-5100.12.pdf

Section 2 (Keyword Attribute Values)

The following new keyword values are defined for the ipp-versions-supported
attribute [RFC2911]:
   '2.0':   Meets all the conformance requirements of IPP version 2.0, as
     specified in [PWG5100.12], in addition to the requirements for IPP/1.1 as
     specified in [RFC2911] and [RFC2910].
   '2.1':   Meets all the conformance requirements of IPP version 2.1, as
     specified in [PWG5100.12], in addition to the requirements for IPP 2.0 as
     specified above.
   '2.2':   Meets all the conformance requirements of IPP version 2.2, as
     specified in [PWG5100.12], in addition to the requirements for IPP 2.1 as
     specified above.

Attribute (attribute syntax)
  Keyword Attribute Value                        Reference
  -----------------------                        ---------
ipp-versions-supported                           [RFC2911]
  2.0                                            [PWG5100.12]
  2.1                                            [PWG5100.12]
  2.2                                            [PWG5100.12]
```

# 9 Internationalization Considerations

IPP/1.1 [RFC2911] requires conforming IPP Printer implementations to support the UTF-8 [RFC3629] encoding of Unicode [UNICODE] [ISO10646].

To claim conformance to this specification, IPP Printer or IPP Client implementation:

(a) MUST support UTF-8 as defined in [RFC3629]; and

 

(b) SHOULD support Network Unicode as defined in [RFC5198], which requires transmission of well-formed UTF-8 strings and recommends transmission of normalized UTF-8 strings in Normalization Form C (NFC) [UAX15].

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

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

# 10 Security Considerations

To claim conformance to this specification, an IPP Printer or IPP Client implementation that supports Transport Layer Security (TLS) MUST support the mandatory cipher suite required in the claimed TLS specification (summarized in the table below).

Conformance: An IPP/2.2 implementation MUST support TLS/1.2 [RFC5246].

**Table 10 - TLS Cipher Suite Requirements in IPP Versions**

| IPP Version | TLS Version | TLS Requirement in IPP | Mandatory TLS Cipher Suite |
|---|---|---|---|
| IPP/1.1 | 1.0 [RFC2246] | should per [RFC2911] | TLS_DHE_DSS_WITH_3DES_EDE_CBC_SHA |
| IPP/2.0 | 1.1 [RFC4346] | SHOULD | TLS_RSA_WITH_3DES_EDE_CBC_SHA |
| IPP/2.1 | 1.2 [RFC5246] | SHOULD | TLS_RSA_WITH_AES_128_CBC_SHA |
| IPP/2.2 | 1.2 [RFC5246] | MUST | TLS_RSA_WITH_AES_128_CBC_SHA |

 

# 11 References

## 11.1 Normative References

[ISO10646] "Information Technology - Universal Multiple-octet Coded Character Set (UCS)", ISO/IEC Standard 10646, 2006.

[PWG5100.1]
PWG Candidate Standard 5100.1-2001, IPP “finishings” attribute values extension, PWG 5100.1, February 2001.
ftp://ftp.pwg.org/pub/pwg/candidates/cs-ippfinishings10-20010205-5100.1.pdf, .doc

[PWG5100.2]
PWG Candidate Standard 5100.2-2001, IPP “output-bin” attribute extension, PWG 5100.2, February 2001.
ftp://ftp.pwg.org/pub/pwg/candidates/cs-ippoutputbin10-20010207-5100.2.pdf, .doc

[PWG5100.3]
PWG Candidate Standard 5100.3-2001, IPP Production Printing Attributes – Set 1, PWG 5100.3, February 2001.
ftp://ftp.pwg.org/pub/pwg/candidates/cs-ippprodprint10-20010212-5100.3.pdf, .doc

[PWG5100.5]
PWG Candidate Standard 5100.5-2003, Internet Printing Protocol: Document Object, PWG 5100.5, October 2003.
ftp://ftp.pwg.org/pub/pwg/candidates/cs-ippdocobject10-20031031-5100.5.pdf, .doc

[PWG5100.6]
PWG Candidate Standard 5100.6-2003, Internet Printing Protocol: Page Overrides, PWG 5100.6, October 2003.
ftp://ftp.pwg.org/pub/pwg/candidates/cs-ipppageoverride10-20031031-5100.6.pdf, .doc

[PWG5100.7]
PWG Candidate Standard 5100.7, IPP Job Extensions, PWG 5100.7, October 2003.
ftp://ftp.pwg.org/pub/pwg/candidates/cs-ippjobext10-20031031-5100.7.pdf, .doc

[PWG5100.8]
PWG Candidate Standard 5100.8-2003, Internet Printing Protocol: “-actual” Attributes, PWG 5100.8, March 2003.
ftp://ftp.pwg.org/pub/pwg/candidates/cs-ippactuals10-20030313-5100.8.pdf, .doc

[PWG5100.9]
PWG Candidate Standard 5100.9-2009, IPP Printer State Extensions, PWG 5100.9 July 2009.
ftp://ftp.pwg.org/pub/pwg/candidates/ cs-ippstate10-20090731-5100.9.pdf, .doc

[PWG5100.11]
PWG Candidate Standard 5100.11-2010, IPP Job and Printer Extensions – Set 2 (JPS2), PWG 5100.11, October 2010.
ftp://ftp.pwg.org/pub/pwg/candidates/ cs-ippjobprinterext10-20101030-5100.11.pdf, .doc

[PWG5101.1]
PWG Candidate Standard 5101.1-2002, Media Standardized Names, PWG 5101.1, February 2002.
ftp://ftp.pwg.org/pub/pwg/candidates/cs-pwgmsn10-20020226-5101.1.pdf, .doc

[PWG5107.2]

 

PWG Candidate Standard 5107.2-2010, Command Set Format for IEEE 1284 Device ID, PWG 5107.2, May 2010.
ftp://ftp.pwg.org/pub/pwg/candidates/cs-pmp1284cmdset10-20100531-5107.2.pdf, .doc

[RFC2119]
Key words for use in RFCs to Indicate Requirement Levels, RFC 2119, Bradner. March 1997.
http://www.ietf.org/rfc/rfc2219.txt

[RFC2246] T.Dierks, C. Allen, "Transport Layer Security 1.0", RFC 2246, January 1999,
http://www.ietf.org/rfc/rfc2246.txt

[RFC2616]
Hypertext Transfer Protocol -- HTTP/1.1. R. Fielding, J. Gettys, J. Mogul, H. Frystyk, L. Masinter, P. Leach, T. Berners-Lee, RFC 2616, June 1999.
http://www.ietf.org/rfc/rfc2616.txt

[RFC2817]
Upgrading to TLS Within HTTP/1.1. R. Khare, S. Lawrence, RFC 2817, May 2000.
http://www.ietf.org/rfc/rfc2817.txt

[RFC2910]
R. Herriot, S. Butler, P. Moore, R. Tuner, J. Wenn "Internet Printing Protocol/1.1: Encoding and Transport", RFC 2910, September, 2000.
http://www.ietf.org/rfc/rfc2910.txt

[RFC2911]
R. deBry, T. Hastings, R. Herriot, S. Isaacson, P. Powell, "Internet Printing Protocol/1.1: Model and Semantics", RFC 2911, September, 2000.
http://www.ietf.org/rfc/rfc2911.txt

[RFC3380]
T. Hastings, R. Herriot, C. Kugler, H. Lewis, "Internet Printing Protocol (IPP): Job and Printer Set Operations", RFC 3380, September 2002.
http://www.ietf.org/rfc/rfc3380.txt

[RFC3381]
T. Hastings, H. Lewis, R. Bergman, "Internet Printing Protocol (IPP): Job Progress Attributes, RFC 3381, September 2002.
http://www.ietf.org/rfc/rfc3381.txt

[RFC3382]
R. deBry, R. Herriot, T. Hastings, K. Ocke, P. Zehler, "Internet Printing Protocol (IPP): The ‘collection’ Attribute Syntax", RFC 3382, September 2002.
http://www.ietf.org/rfc/rfc3382.txt

[RFC3510]
R. Herriot, I. McDonald, "Internet Printing Protocol/1.1: IPP URL Scheme", RFC 3510, April 2003.
http://www.ietf.org/rfc/rfc3510.txt

[RFC3629] F. Yergeau, "UTF-8 Transformation of ISO 10646", RFC 3629, November 2003.
http://www.ietf.org/rfc/rfc3629.txt

[RFC3995]
R. Herriot, T. Hastings, "Internet Printing Protocol/1.1: IPP Event Notifications and Subscriptions", RFC 3995, March 2005.

 

http://www.ietf.org/rfc/rfc3995.txt

[RFC3996]
R. Herriot, T. Hastings, H. Lewis, "Internet Printing Protocol (IPP): The 'ippget' Delivery Method for Event Notifications", RFC 3996, March, 2005.
http://www.ietf.org/rfc/rfc3996.txt

[RFC3998]
Kugler, Lewis, Hastings. "Internet Printing Protocol (IPP):Job and Printer Administrative Operations", RFC 3998, March, 2005.
http://www.ietf.org/rfc/rfc3998.txt

[RFC4346] T.Dierks, E. Rescorla, "Transport Layer Security 1.1", RFC 4346, April 2006,
http://www.ietf.org/rfc/rfc4346.txt

[RFC5198]
J. Klensin, M. Padlipsky. "Unicode Format for Network Interchange", RFC 5198, March, 2008.
http://www.ietf.org/rfc/rfc5198.txt

[RFC5246] T.Dierks, E. Rescorla, "Transport Layer Security 1.2", RFC 5246, August 2008,
http://www.ietf.org/rfc/rfc5246.txt

[UAX15] M. Davis, M. Duerst, "Unicode Normalization Forms", Unicode Standard Annex 15, March 2008,
http://www.unicode.org/reports/tr15/

[UNICODE] M. Davis, et al, "Unicode Standard v5.1.0", Unicode Standard, April 2008,
http://www.unicode.org/versions/Unicode5.1.0/

## 11.2 Informative References

[RFC2565]
R. Herriot, S. Butler, P. Moore, R. Turner, "Internet Printing Protocol/1.0: Encoding and Transport", RFC 2565, April, 1999.
http://www.ietf.org/rfc/rfc2565.txt

[RFC2566]
R. deBry, T. Hastings, R. Herriot, S. Isaacson, P. Powell, "Internet Printing Protocol/1.0: Model and Semantics", RFC 2566, April, 1999.
http://www.ietf.org/rfc/rfc2566.txt

[RFC2567]
D. Wright, IETF IPP Design Goals, RFC 2567, April 1999.
http://www.ietf.org/rfc/rfc2567.txt

[RFC3196]
T. Hastings, C. Manros, K. Kugler, H. Holst, P. Zehler, "Internet Printing Protocol/1.1: Implementor's Guide", RFC 3196, November, 2001.
http://www.ietf.org/rfc/rfc3196.txt

 

# 12 Editors' Addresses (Informative)

**Ron Bergman** Email: RGBergman@hotmail.com

**Harry Lewis**
InfoPrint Solutions Company Phone: 303-924-5337
6300 Diagonal Highway
Boulder, CO 80301 Email: harry.lewis@infoprint.com

**Ira McDonald**
High North Phone: 906-494-2434
PO Box 221
Grand Marais, MI 49839 Email: blueroofmusic@gmail.com

**Michael R. Sweet**
Apple Inc Phone: 408-974-8798
10431 N De Anza Blvd, M/S 38-4LPT
Cupertino, CA 95014 Email: msweet@apple.com

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

| | |
|---|---|
| Shah Bhatti | |
| Nancy Chen | Okidata |
| Lee Farrell | |
| Gail Giansiracusa | Kyocera Mita |
| Tom Hastings | retired from Xerox |
| Makoto "Mac" Matsuda | Brother |
| Joe Murdock | Sharp |
| Glen Petrie | Epson |
| Jerry Thrasher | Lexmark |
| Ted Tronson | Novell |
| Paul Tykodi | TCS |
| Bill Wagner | TIC |
| Dave Whitehead | independent contractor |
| Craig Whittle | Sharp |
| Peter Zehler | Xerox |

 