The Printer Working Group

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IPP Registration

Deprecating IPP Print by Reference v1.0 (DEPURI)

Status: Approved

Abstract: This registration formally deprecates the IPP print-by-reference operations, attributes, values, and status codes.

This registration is available electronically at:

https://ftp.pwg.org/pub/pwg/ipp/registrations/reg-ippdepuri10-20211215.docx
https://ftp.pwg.org/pub/pwg/ipp/registrations/reg-ippdepuri10-20211215.pdf

Title: *Deprecating IPP Print by Reference*

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1. Introduction

This registration document deprecates the Print-URI and Send-URI operations [STD92] and associated attributes, values, and status codes. The reasons for these deprecations are security risks and 20 years of limited usage.

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 [BCP14]. The term CONDITIONALLY REQUIRED is additionally defined for a conformance requirement that applies when a specified condition is true.

The term DEPRECATED is used for previously defined and approved protocol elements that SHOULD NOT be used or implemented. The term OBSOLETE is used for previously defined and approved protocol elements that MUST NOT be used or implemented.

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 Internet Printing Protocol/1.1 [STD92].

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

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

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

Output Device: a single Logical or Physical Device

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

2.3 Protocol Role Terminology

The following protocol roles are defined to specify unambiguous conformance requirements:

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

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

2.4 Other Terminology

Edge Computing Service: A network service that provides access to computing or storage resources closer to a Client and/or Printer.

2.5 Acronyms and Organizations

IANA: Internet Assigned Numbers Authority, https://www.iana.org/

IETF: Internet Engineering Task Force, https://www.ietf.org/

ISO: International Organization for Standardization, https://www.iso.org/

PWG: Printer Working Group, https://www.pwg.org/

3. Requirements

3.1 Rationale

Given the following existing specifications:

1. Internet Printing Protocol/1.1 [STD92]
2. IPP Shared Infrastructure Extensions v1.0 (INFRA) [PWG5100.18]

And given the need for providing a secure, reliable, and interoperable network printing protocol, this registration should:

1. Deprecate the Print-URI and Send-URI operations,
2. Deprecate the associated attributes, values, and status codes, and
3. Define alternatives to print by reference.

3.2 Use Cases

3.2.1 Print an Online Document Directly

Jane wants to print an IPP standard from the PWG FTP server. She uses her Client software to send a print request to her corporate printer. Since the printer does not support print by reference, her software sends a PDF file downloaded from the standard's URL.

3.2.2 Print an Online Document via Edge Computing Service

Alex wants to print an online document that is being hosted by a Content Delivery Network (CDN) or a regional cloud storage service. Alex uses Client software to send a print request to their corporate printer, which has been configured to allow printing documents from the CDN and regional cloud storage service.

3.2.3 Transform a Document Using a Cloud Service

Jamal uses a managed printing solution to support printing from Client devices to the printers in his enterprise. Each Client submits print requests through a cloud service which converts the Client's Documents into a format the printer will accept. The cloud service provides a URL to the Client when the transform is completed, which the Client software can then either supply to the printer or download and submit the URL content directly to the printer.

3.3 Exceptions

There are no exceptions beyond those defined in the Internet Printing Protocol/1.1 [STD92].

3.4 Out of Scope

The following are considered out of scope for this registration:

1. Definition of new file formats; and
2. Definition of new protocol bindings.

3.5 Design Requirements

The design requirements for this registration are:

1. Identify use cases for print by reference;
2. Deprecate the Print-URI and Send-URI operations;
3. Deprecate all attributes, values, and status codes related to the Print-URI and Send-URI operations;
4. Identify existing alternate methods of printing referenced documents;
5. Identify security requirements necessary to securely support print by reference; and
6. Define sections to deprecate the attributes, values, operations, and status codes with IANA.

4. Model

The Internet Printing Protocol/1.1 [STD92] defines two OPTIONAL operations, Print-URI and Send-URI, to support printing documents using a referenced URI. Printers that support these operations typically support the 'ftp' URI scheme in addition to 'http' and 'https' URI schemes without authentication.

Implementation experience since the original definition of these operations in 1998 has revealed several issues which are summarized in the following subsections.

4.1 Print by Reference Issues

4.1.1 Network Accessibility

Clients and Printers can have different network access levels, which can lead to Print-URI and Send-URI Jobs failing:

- A Printer might not be able to access a network resource because it resides on a different network or is missing the credentials needed for the resource; or
- A Printer might have access to otherwise protected/restricted network resources, e.g., by bypassing personal firewalls.

4.1.2 Network Abuse

Remote URIs can incur additional costs for network data and bandwidth usage by the Printer that might otherwise not be accounted for or allowed.

4.1.3 Time of Access

A network resource that is available when a Client submits a Print-URI or Send-URI request might not be available to the Printer when the Job later enters the 'processing' state.

4.1.4 Identification/Authentication/Access Control

Clients cannot always provide a Printer with the necessary credentials to access a remote resource, and sending some types of credentials to the Printer poses a security and/or privacy threat, e.g., passwords, user names, etc.

4.1.5 Denial of Service Attacks

A Client could potentially cause a Denial-of-Service by sending a URI to a network service designed to provide malicious content to the Printer and/or to delay network transactions in a way that keeps the Printer busy fetching the remote Document and preventing other Jobs from being processed.

4.1.6 Limited URI Schemes

IPP/1.1 [STD92] only requires support for the 'ftp' URI scheme/protocol, which is no longer supported by the major web browsers and operating systems, is not a secure or modern protocol, and is often blocked by firewalls and ISPs.

Printers that support the Print-URI and Send-URI operations also typically support the 'http' and 'https' URI schemes.

Of these URI schemes, none provide durable document references that would solve the time of access issues identified in section 4.1.3.

4.1.7 Secure Access

Some spooler (Client) implementations have made use of the Print-URI and Send-URI operations to provide access to local resources without extra copying. For example, when printing photos on iOS devices, the printd spooler accepts durable, authenticated URIs with a custom scheme referencing the camera roll. This type of URI is not remotely accessible, so the local spooler copies the local reference to the Printer in a Print-Job or Send-Document request instead.

Some printing solutions use the Print-URI and Send-URI operations to "release" Jobs to a local Printer, where the referenced Document is hosted by a caching and/or storage service. Because the Documents are available to any network device with access to the service, these solutions pose serious security issues, particularly if the solution relies only on obfuscated URIs to limit access.

4.2 Print by Reference Replacement Recommendations

Most Client usage of the Print-URI and Send-URI operations can simply be replaced by sending the corresponding URI contents using the Print-Job or Send-Document operations.

In situations where Print-URI or Send-URI are used to cross network boundaries or make use of Edge Computing Services, the IPP Shared Infrastructure Extensions [PWG5100.18] offer a secure and reliable alternative to print by reference.

5. Deprecated Attributes

5.1 Operation Attributes

5.1.1 document-access (collection)

This DEPRECATED operation attribute [PWG5100.18] specifies access credentials for the referenced Document in a Print-URI or Send-URI request. Printers that support this attribute SHOULD only support the "access-oauth-token" and "access-oauth-uri" member attributes and SHOULD NOT support the "access-password", "access-pin", or "access-user-name" member attributes because they expose private access credentials.

5.1.2 document-access-error (text(MAX))

This DEPRECATED operation attribute [STD92] is returned in a Print-URI or Send-URI response when the Printer is unable to access the referenced Document.

5.1.3 document-uri (uri)

This DEPRECATED operation attribute [STD92] specifies the referenced Document URI. Printers that support this attribute SHOULD support the 'https' URI scheme and SHOULD NOT support the 'ftp' URI scheme.

5.2 Document Status Attributes

5.2.1 document-access-errors (1setOf text(MAX))

This DEPRECATED attribute [PWG5100.5] lists any errors that have occurred while accessing the reference Document.

5.2.2 document-uri (uri)

This DEPRECATED attribute [PWG5100.5] contains the referenced Document URI.

5.3 Job Status Attributes

5.3.1 job-document-access-errors (1setOf text(MAX))

This DEPRECATED attribute [STD92] lists any errors that have occurred while accessing any referenced Documents in the Job.

5.4 Printer Description Attributes

5.4.1 document-access-supported (1setOf keyword)

This DEPRECATED attribute [PWG5100.18] lists the supported "document-access" member attributes. Printers that support the "document-access" operation attribute (section 5.1.1) SHOULD support the "access-oauth-token" and "access-oauth-uri" member attributes and SHOULD NOT support the "access-password", "access-pin", or "access-user-name" member attributes because they expose private access credentials.

5.4.2 reference-uri-schemes-supported (1setOf uriScheme)

This DEPRECATED attribute (STD92) lists the supported "document-uri" URI schemes. Printers that support print by reference SHOULD support the 'https' URI scheme and SHOULD NOT support the 'ftp' URI scheme.

6. Deprecated Operations

6.1 Print-URI

This DEPRECATED operation [STD92] creates a Job with a single referenced Document.

6.2 Send-URI

This DEPRECATED operation [STD92] adds a single referenced Document to a Job.

7. Deprecated Values for Existing Attributes

7.1 document-state-reasons (1setOf type2 keyword)

The DEPRECATED 'document-access-error' keyword [PWG5100.5] indicates that an error occurred when accessing a referenced Document.

7.2 job-state-reasons (1setOf type2 keyword)

The DEPRECATED 'document-access-error' keyword [STD92] indicates that an error occurred when accessing a referenced Document.

7.3 operations-supported (1setOf type2 enum)

The DEPRECATED Print-URI (0x0003) and Send-URI (0x0007) operation codes [STD92] are used to submit a referenced Document for printing.

7.4 Status Code (type2 enum)

The DEPRECATED 'client-error-document-access-error' (0x0412) status code [STD92] is returned by the Print-URI or Send-URI operations when the Printer determines that a referenced Document cannot be accessed at submission time.

8. Internationalization Considerations

This registration has the same internationalization considerations as the Internet Printing Protocol/1.1 [STD92].

9. Security Considerations

The following subsections define additional security considerations to the Internet Printing Protocol/1.1 [STD92].

9.1 Remote Document Access Risks

Printers can have different network access than Clients. Printers SHOULD support configuration of access limits, timeouts, and usage in order to minimize the opportunities for unauthorized access of remote Documents and denial of service attacks through remote services.

9.2 Document Access Credentials

Printers SHOULD NOT accept or support plain text credentials using the "access-password", "access-pin", or "access-user-name" member attributes [PWG5100.18] because they expose End User information that could lead to unauthorized access.

9.3 Secure Access Protocols

Printers SHOULD only support secure access protocols that provide protection of data in transit and/or integrity verification.

9.4 Time of Access and Redirection

Printers SHOULD access a referenced Document and/or validate the Document URI as soon as feasible after receiving a Print-URI or Send-URI request to minimize time of access issues.

Printers that support URI redirection SHOULD support configuration of redirection rules to prevent redirection to arbitrary URIs that could expose the Printer to man-in-the-middle or malicious content attacks.

10. IANA Considerations

10.1 Attribute Registrations

The attributes defined in this registration will be published by IANA according to the procedures in the Internet Printing Protocol/1.1 [STD92] in the following location:

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

The registry entries will contain the following information:

Document Status attributes:	Reference
document-access-errors (1setOf text(MAX))	[PWG5100.5]
document-access-errors(deprecated)	[DEPURI]
document-uri (uri)	[PWG5100.5]
document-uri(deprecated)	[DEPURI]

Job Status attributes:	Reference
job-document-access-errors (1setOf text(MAX))	[STD92]
job-document-access-errors(deprecated)	[DEPURI]

Operation attributes:	Reference
document-access (collection | no-value)	[PWG5100.18]
document-access(deprecated)	[DEPURI]
document-access-error (text(MAX))	[STD92]
document-access-error(deprecated)	[DEPURI]
document-uri (uri)	[STD92]
document-uri(deprecated)	[DEPURI]

Printer Description attributes:	Reference
document-access-supported (1setOf keyword)	[PWG5100.18]
document-access-supported(deprecated)	[DEPURI]
reference-uri-schemes-supported (1setOf uriScheme)	[STD92]
reference-uri-schemes-supported(deprecated)	[DEPURI]

10.2 Type2 keyword Registrations

The attributes defined in this registration will be published by IANA according to the procedures in the Internet Printing Protocol/1.1 [STD92] in the following location:

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

The registry entries will contain the following information:

Attributes (attribute syntax) Keyword Attribute Value	Reference


```
document-state-reasons (1setOf type2 keyword)                    [PWG5100.5]
  document-access-error                                          [PWG5100.5]
  document-access-error(deprecated)                              [DEPURI]

job-state-reasons (1setOf type2 keyword)                         [STD92]
  document-access-error                                          [STD92]
  document-access-error(deprecated)                              [DEPURI]
```

10.3 Type2 enum Registrations

The attributes defined in this registration will be published by IANA according to the procedures in the Internet Printing Protocol/1.1 [STD92] in the following file:

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

The registry entries will contain the following information:

```
Attributes (attribute syntax)
  Enum Value  Enum Symbolic Name                                 Reference
  ----------  ------------------                                 ---------
operations-supported (1setOf type2 enum)                         [STD92]
  0x0003              Print-URI                                  [STD92]
  0x0003(deprecated)  Print-URI                                  [DEPURI]
  0x0007              Send-URI                                   [STD92]
  0x0007(deprecated)  Send-URI                                   [DEPURI]
```

10.4 Operation Registrations

The attributes defined in this registration will be published by IANA according to the procedures in the Internet Printing Protocol/1.1 [STD92] in the following location:

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

The registry entries will contain the following information:

```
Operation Name                                                   Reference
--------------                                                   ---------
Print-URI                                                        [STD92]
Print-URI(deprecated)                                            [DEPURI]
Send-URI                                                         [STD92]
Send-URI(deprecated)                                             [DEPURI]
```

10.5 Status Code Registrations

The attributes defined in this registration will be published by IANA according to the procedures in the Internet Printing Protocol/1.1 [STD92] in the following location:

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

The registry entries will contain the following information:


```
Value    Status Code Name                                          Reference
------   ----------------------------------------------------      ---------
0x0400:0x04FF - Client Error:
  0x0412 client-error-document-access-error                        [STD92]
  0x0412(deprecated)                                               [DEPURI]
```

11. References

11.1 Normative References

[BCP14] S. Bradner, "Key words for use in RFCs to Indicate Requirement Levels", RFC 2119/BCP 14, March 1997, https://datatracker.ietf.org/doc/html/bcp14

[PWG5100.5] M. Sweet, "IPP Document Object v1.1", PWG 5100.5-2019, May 2019, https://ftp.pwg.org/pub/pwg/candidates/cs-ippdocument11-20190521-5100.5.pdff

[PWG5100.18] M. Sweet, I. McDonald, "IPP Shared Infrastructure Extensions (INFRA)", PWG 5100.18-2015, June 2015, https://ftp.pwg.org/pub/pwg/candidates/cs-ippinfra10-2015069-5100.18.pdf

[RFC5198] J. Klensin, M. Padlipsky, "Unicode Format for Network Interchange", RFC 5198, March 2008, https://datatracker.ietf.org/doc/html/rfc5198

[RFC7230] R. Fielding, J. Reschke, "Hypertext Transfer Protocol (HTTP/1.1): Message Syntax and Routing", RFC 7230, June 2014, https://datatracker.ietf.org/doc/html/rfc7230

[STD92] M. Sweet, I. McDonald, "Internet Printing Protocol/1.1", STD 92, June 2018, https://datatracker.ietf.org/doc/html/std92

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