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Internet Printing Protocol (IPP): IPP URL Scheme

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Status of this Memo

Abstract

This document is a product of the Internet Printing Protocol Working Group of the Internet Engineering Task Force (IETF). Comments should be submitted to the ipp@pwg.org mailing list.

This document is intended for use in registering the "ipp" URL scheme with IANA and fully conforms to the requirements in [RFC-2717]. This document defines the "ipp" URL (Uniform Resource Locator) scheme for specifying the location of an IPP Printer, IPP Job, or other IPP object (defined in some future version of IPP) which implements the IPP/1.1 Model [RFC-2911] and the IPP/1.1 Protocol encoding over HTTP [RFC-2910] or any later version of IPP. The intended usage of the "ipp" URL scheme is COMMON.

The IPP URL scheme defined in this document is based on the ABNF for the HTTP URL scheme defined in HTTP/1.1 [RFC-2616], which is derived from the URI Generic Syntax [RFC-2396] and further updated by [RFC-2732] and [RFC-2373] (for IPv6 addresses in URLs). An IPP URL is transformed into an HTTP URL according to the rules specified in section 5 of the IPP/1.1 Protocol [RFC-2910].

Table of Contents

1. Introduction

See section 1 'Introduction' in [RFC-2911] for a full description of the IPP document set and overview information about IPP.

The open issues in this document each begin 'ISSUE_n:'.

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This document is intended for use in registering the "ipp" URL scheme with IANA and fully conforms to the requirements in [RFC-2717]. This document defines the "ipp" URL (Uniform Resource Locator) scheme for specifying the location of an IPP Printer, IPP Job, or other IPP object (defined in some future version of IPP) which implements the IPP/1.1 Model [RFC-2911] and the IPP/1.1 Protocol encoding over HTTP [RFC-2910] or any later version of IPP. The intended usage of the "ipp" URL scheme is COMMON.

This document defines:
- IPP URL scheme applicability and intended usage;
- IPP URL scheme associated port (i.e., well-known port 631);
- IPP URL scheme associated MIME type (i.e., "application/ipp");
- IPP URL scheme syntax in ABNF [RFC-2234];
- IPP URL scheme character encoding;
- IPP URL scheme IANA, internationalization, and security considerations.

This document is laid out as follows:
- Section 2 is the terminology used throughout the document.

- Section 3 provides references to the IPP Printer and IPP Job object model.

- Section 4 specifies IPP URL scheme.

- Section 5 specifies the conformance requirements for IPP Clients and IPP Printers that claim conformance to this document.

- Section 6, 7, and 8 specify IANA, internationalization, and security considerations.

- Sections 9, 10, 11, 12, and 13 list references, acknowledgements, authors' addresses, change history, and full IETF copyright statement.

2. Terminology

This specification document uses the terminology defined in this section.

2.1. Conformance Terminology

The uppercase terms "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT" "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in [RFC-2119]. These terms are used to specify conformance requirements for all implementations of this specification.

2.2. Model Terminology

See section 12.2 'Model Terminology' in [RFC-2911].

3. IPP Model for Printers and Jobs

See section 2 'IPP Objects', section 2.1 'Printer Object', and section 2.2 'Job Object' in [RFC-2911] for a full description of the IPP object model and terminology.

In this document, "IPP Client" means the software (on some hardware platform) that submits, monitors, and/or manages print jobs via IPP/1.1 [RFC-2910] [RFC-2911], or any later version of IPP to a spooler, gateway, or actual printing device.

In this document, "IPP Printer object" means the software (on some hardware platform) that receives print jobs and/or printer/job operations via IPP/1.1 [RFC-2910] [RFC-2911], or any later version of IPP from an "IPP Client".

In this document, "IPP Printer" is a synonym for "IPP Printer object".

In this document, "IPP Job object" means the set of attributes and documents for one print job on an "IPP Printer".

In this document, "IPP Job" is a synonym for "IPP Job object".

4. IPP URL Scheme

4.1. IPP URL Scheme Applicability and Intended Usage

This document is intended for use in registering the "ipp" URL scheme with IANA and fully conforms to the requirements in [RFC-2717]. This document defines the "ipp" URL (Uniform Resource Locator) scheme for specifying the location of an IPP Printer, IPP Job, or other IPP object (defined in some future version of IPP) which implements the IPP/1.1 Model [RFC-2911] and the IPP/1.1 Protocol encoding over HTTP [RFC-2910] or any later version of IPP. The intended usage of the "ipp" URL scheme is COMMON.

4.2. IPP URL Scheme Associated IPP Port

All IPP URLs which do NOT explicitly specify a port MUST be used over IANA-assigned well-known port 631 for the IPP protocol described in [RFC-2910].

See: IANA Port Numbers Registry [IANA-PORTREG]. registration with IANA.

4.3. IPP URL Scheme Associated MIME Type

All IPP protocol operations (requests and responses) MUST be conveyed in an "application/ipp" MIME media type as registered in [IANA-MIMEREG]. IPP URLs MUST refer to IPP Printers which support this "application/ipp" MIME media type.

See: IANA MIME Media Types Registry [IANA-MIMEREG].

4.4. IPP URL Scheme Character Encoding

The IPP URL scheme defined in this document is based on the ABNF for the HTTP URL scheme defined in HTTP/1.1 [RFC-2616], which is derived from the URI Generic Syntax [RFC-2396] and further updated by [RFC-2732] and [RFC-2373] (for IPv6 addresses in URLs). The IPP URL scheme is case-insensitive in the host name or host address part; however the path part is case-sensitive, as in [RFC-2396]. Codepoints outside [US-ASCII] MUST be hex escaped by the mechanism specified in [RFC-2396].

4.5. IPP URL Scheme Syntax in ABNF

This document is intended for use in registering the "ipp" URL scheme with IANA and fully conforms to the requirements in [RFC-2717]. This document defines the "ipp" URL (Uniform Resource Locator) scheme for specifying the location of an IPP Printer, IPP Job, or other IPP object (defined in some future version of IPP) which implements the IPP/1.1 Model [RFC-2911] and the IPP/1.1 Protocol encoding over HTTP [RFC-2910] or any later version of IPP. The intended usage of the "ipp" URL scheme is COMMON.

The IPP protocol places a limit 1023 octets (NOT characters) on the length of a URI in section 4.1.5 'uri' in [RFC-2911]. An IPP Printer implementation MUST be able to handle the URI of any resource that it supports. An IPP Printer MUST return 'client-error-request-value-too-long' (see section 13.1.4.10 in [RFC-2911]) when a URI received in a request (e.g., in the "printer-uri" attribute) is too long.

> Note: IPP Printers ought to be cautious about depending on URI lengths above 255 bytes, because some older client or proxy implementations might not properly support these lengths.

IPP URLs MUST be represented in absolute form. Absolute URLs always begin with a scheme name followed by a colon. For definitive information on URL syntax and semantics, see "Uniform Resource Identifiers (URI): Generic Syntax and Semantics" [RFC-2396]. This specification adopts the definitions of "URI-reference", "absoluteURI", "relativeURI", "port", "host","abs_path", "rel_path", and "authority" from [RFC-2396], as updated by [RFC-2732] and [RFC-2373] (for IPv6 addresses in URLs).

The IPP URL scheme syntax in ABNF is as follows:

```
ipp_URL = "http:" "//" host [ ":" port ] [ abs_path [ "?" query ]]
```

If the port is empty or not given, port 631 is assumed. The semantics are that the identified resource (see section 5.1.2 of [RFC-2616]) is located at the IPP Printer or IPP Job listening for HTTP connections on that port of that host, and the Request-URI for the identified resource is 'abs_path'. The use of IP addresses in URLs SHOULD be avoided whenever possible (see [RFC-1900]).

If the 'abs_path' is not present in the URL, it MUST be given as "/" when used as a Request-URI for a resource (see section 5.1.2 of [RFC-2616]). If a proxy receives a host name which is not a fully qualified domain name, it MAY add its domain to the host name it

received. If a proxy receives a fully qualified domain name, the

proxy MUST NOT change the host name.

4.5.1. IPP URL Examples

The following are examples of valid IPP URLs for IPP Printers:

```
ipp://abc.com
ipp://abc.com/printer
ipp://abc.com/tiger
ipp://abc.com/printers/tiger
ipp://abc.com/printers/fox
ipp://abc.com/printers/tiger/bob
ipp://abc.com/printers/tiger/ira
ipp://printer.abc.com
ipp://printers.abc.com/tiger
ipp://printers.abc.com/tiger/bob
ipp://printers.abc.com/tiger/ira
```

Each of the above URLs are legitimate URLs for IPP Printers and each references a logically different IPP Printer, even though some of the IPP Printers may share the same hardware. The last part of the path 'bob' or 'ira' may represent two different hardware devices where 'tiger' represents some grouping of IPP Printers (e.g., a load-balancing spooler) or the two names may represent separate human recipients ('bob' and 'ira') on the same hardware device (e.g., a printer supporting two job queues). In either case both 'bob' and 'ira' behave as different IPP Printers.

The following are examples of IPP URLs with (optional) ports and paths:

```
ipp://abc.com
ipp://abc.com/~smith/printer
ipp://abc.com:631/~smith/printer
```

The first and second IPP URLs above MUST be resolved to port 631 (IANA assigned well-known port for IPP). The second and third IPP URLs above are equivalent (see section 4.5.2 below).

The following literal IPv6 addresses (conformant to [RFC-2373]):

```
::192.9.5.5                         ; IPv4 address in IPv6 style
::FFFF:129.144.52.38                ; IPv4 address in IPv6 style
2010:836B:4179::836B:4179           ; IPv6 address per RFC 2373
```

are represented in the following example IPP URLs:

```
ipp://[::192.9.5.5]/prt1
```

ipp://[::FFFF:129.144.52.38]:631/printers/tiger

ipp://[2010:836B:4179::836B:4179]/printers/tiger/bob

4.5.2. IPP URL Comparisons

When comparing two IPP URLs to decide if they match or not, an IPP Client SHOULD use a case-sensitive octet-by-octet comparison of the entire URLs, with these exceptions:

- A port that is empty or not given is equivalent to the well-known port for that IPP URL (port 631);

- Comparisons of host names MUST be case-insensitive;

- Comparisons of scheme names MUST be case-insensitive;

- An empty 'abs_path' is equivalent to an 'abs_path' of "/".

Characters other than those in the "reserved" and "unsafe" sets (see [RFC-2396] and [RFC-2732]) are equivalent to their ""%" HEX HEX" encoding.

For example, the following three URIs are equivalent:

ipp://abc.com:631/~smith/printer
ipp://ABC.com/%7Esmith/printer
ipp://ABC.com:/%7esmith/printer

5. Conformance Requirements

5.1. Conformance Requirements for IPP Clients

IPP Clients that conform to this specification:

a) MUST send IPP URLs (e.g., in the "printer-uri" operation attribute in 'Print-Job') that conform to the ABNF specified in section 4.5 of this document;

b) MUST send IPP operations via the port specified in the IPP URL (if present) or otherwise via IANA assigned well-known port 631;

c) MUST convert IPP URLs to their corresponding HTTP URL forms according to the rules in section 5 'IPP URL Scheme' in [RFC-2910];

d) SHOULD interoperate with IPP/1.0 Printers according to the rules in section 9 'Interoperability with IPP/1.0 Implementations' and section 9.2 'Security and URL Schemes' in [RFC-2910].

5.2. Conformance Requirements for IPP Printers

IPP Printers that conform to this specification:

a) SHOULD reject received IPP URLs in "application/ipp" request bodies (e.g., in the "printer-uri" attribute in a 'Print-Job' request) that do not conform to the ABNF for IPP URLs specified in section 4.5 of this document;

b) SHOULD return IPP URLs in "application/ipp" response bodies (e.g., in the "job-uri" attribute in a 'Print-Job' response) that do conform to the ABNF for IPP URLs specified in section 4.5 of this document;

c) MUST listen for IPP operations on IANA-assigned well-known port 631, unless explicitly configured by system administrators or site policies;

d) SHOULD NOT listen for IPP operations on any other port, unless explicitly configured by system administrators or site policies;

e) SHOULD interoperate with IPP/1.0 Clients according to the rules in section 9 'Interoperability with IPP/1.0 Implementations' and

section 9.2 'Security and URL Schemes' in [RFC-2910].

6. IANA Considerations

This document is intended for use in registering the "ipp" URL scheme with IANA and fully conforms to the requirements in [RFC-2717]. This document defines the "ipp" URL (Uniform Resource Locator) scheme for specifying the location of an IPP Printer, IPP Job, or other IPP object (defined in some future version of IPP) which implements the IPP/1.1 Model [RFC-2911] and the IPP/1.1 Protocol encoding over HTTP [RFC-2910] or any later version of IPP. The intended usage of the "ipp" URL scheme is COMMON.

This IPP URL Scheme specification does not introduce any additional IANA considerations, beyond those described in [RFC-2910] and [RFC-2911].

See: Section 6 'IANA Considerations' in [RFC-2910]
See: Section 6 'IANA Considerations' in [RFC-2911].

7. Internationalization Considerations

This IPP URL Scheme specification does not introduce any additional internationalization considerations, beyond those described in [RFC-2910] and [RFC-2911].

See: Section 7 'Internationalization Considerations' in [RFC-2910].
See: Section 7 'Internationalization Considerations' in [RFC-2911].

8. Security Considerations

This IPP URL Scheme specification does not introduce any additional security considerations, beyond those described in [RFC-2910] and [RFC-2911].

See: Section 8 'Security Considerations' in [RFC-2910].
See: Section 8 'Security Considerations' in [RFC-2911].

9. References

See: Section 10 'References' in [RFC-2910].
See: Section 9 'References' in [RFC-2911].

[IANA-CHARREG] IANA Charset Registry.
ftp://ftp.isi.edu/in-notes/iana/assignments/character-sets

[IANA-MIMEREG] IANA MIME Media Types Registry.
ftp://ftp.isi.edu/in-notes/iana/assignments/media-types/...

[IANA-PORTREG] IANA Port Numbers Registry.
ftp://ftp.isi.edu/in-notes/iana/assignments/port-numbers

[NET-SSL3] Netscape. The SSL Protocol, Version 3 (text version 3.02), November 1996.

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[RFC-1900] B. Carpenter, Y. Rekhter. Renumbering Needs Work, RFC 1900, February 1996.

[RFC-2046] N. Freed, N. Borenstein. MIME Part Two: Media Types, RFC 2046, November 1996.

[RFC-2048] N. Freed, J. Klensin, J. Postel. MIME Part Four: Registration Procedures, RFC 2048, November 1996.

[RFC-2234] D. Crocker, P. Overell. Augmented BNF for Syntax Specifications: ABNF, RFC 2234, November 1997.

[RFC-2373] R. Hinden, S. Deering. IP Version 6 Addressing Architecture, RFC 2373, July 1998.

[RFC-2396] T. Berners-Lee, R. Fielding, L. Masinter. Uniform Resource Identifiers (URI): Generic Syntax, RFC 2396, August 1998.

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[RFC-2277] H. Alvestrand. IETF Policy on Character Sets and Languages, RFC 2277, January 1998.

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[RFC-2579] K. McCloghrie, D. Perkins, J. Schoenwaelder. Textual Conventions for SMIv2, RFC 2579, April 1999.

[RFC-2616] R. Fielding, J. Gettys, J. Mogul, H. Frystyk, L. Masinter, P. Leach, T. Berners-Lee. Hypertext Transfer Protocol -- HTTP/1.1, RFC 2616, June 1999.

[RFC-2617] J. Franks, P. Hallam-Baker, J. Hostetler, S. Lawrence, P. Leach, A. Luotonen, L. Stewart. HTTP Authentication: Basic and Digest Access Authentication, RFC 2617, June 1999.

[RFC-2717] R. Petke, I. King. Registration Procedures for URL Scheme Names, RFC 2717, November 1999.

[RFC-2718] L. Masinter, H. Alvestrand, D. Zigmond, R. Petke. Guidelines for new URL Scheme Names, RFC 2718, November 1999.

[RFC-2732] R. Hinden,B. Carpenter, L. Masinter. Format for Literal IPv6 Addresses in URL's, RFC 2732, December 1999.

[RFC-2910] R. Herriot, S. Butler, P. Moore, R. Turner, J. Wenn. IPP/1.1 Encoding and Transport, RFC 2910, September 2000.

[RFC-2911] T. Hastings, R. Herriot, R. deBry, S. Isaacson, P. Powell. IPP/1.1 Model and Semantics, RFC 2911, September 2000.

[RFC-2978] N. Freed, J. Postel. IANA Charset Registration Procedures, RFC 2978, October 2000.

[RFC-3066] H. Alvestrand. Tags for the Identification of Languages, RFC 3066, January 2001.

[US-ASCII] Coded Character Set -- 7-bit American Standard Code for Information Interchange, ANSI X3.4-1986.

10. Acknowledgments

This document is a product of the Internet Printing Protocol Working Group of the Internet Engineering Task Force (IETF). Comments should be submitted to the ipp@pwg.org mailing list.

Thanks to Pat Fleming (IBM), Tom Hastings (Xerox), Harry Lewis (IBM), and Hugo Parra (Novell).

[RFC-2910] was the primary input to this IPP URL Scheme specification.

11. Authors' Addresses

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12. Appendix X - Change History

[To be deleted before RFC publication]

5 February 2001 - draft-ietf-ipp-url-scheme-01.txt
- revised section 4.1 'IPP URL Applicability and Intended Usage' to clarify that a given IPP URL MAY identify an IPP Printer object or an IPP Job object, per request of Tom Hastings;
- revised section 4.5 'IPP URL Scheme Syntax in ABNF' to define IPP URLs consistently with section 3.2.2 'http URL' of HTTP/1.1 [RFC-2616], per request of Tom Hastings;
- revised section 4.5 'IPP URL Scheme Syntax in ABNF' to clarify that IPP URLs may reference IPP Printer objects, IPP Job objects, or (possibly other future) IPP objects, per request of Bob Herriot;
- added section 4.5.1 'IPP URL Examples' to supply meaningful examples of IPP URLs with host names, IPv4 addresses, and IPv6 addresses, per request of Tom Hastings;
- added section 4.5.2 'IPP URL Comparisons' to define IPP URL comparisons consistently with section 3.3 'URI Comparison' of HTTP/1.1 [RFC-2616], per request of Tom Hastings;
- revised section 5.1 'Conformance Requirements for IPP Clients' to clarify that an IPP Client MUST convert IPP URLs to their

corresponding HTTP URL forms according to section 5 'IPP URL

Scheme' in [RFC-2910], per request of Tom Hastings and Bob Herriot;
- revised section 5.1 'Conformance Requirements for IPP Clients' and section 5.2 'Conformance Requirements for IPP Printers' to clarify that IPP Clients and IPP Printers SHOULD interoperate with IPP/1.0 systems according to section 9 'Interoperability with IPP/1.0 Implementations' in [RFC-2910], per request of Carl Kugler;
- revised section 5.2 'Conformance Requirements for IPP Printers' to clarify that an IPP Printer MUST listen on (IANA assigned well-known) port 631, unless explicitly configured, per request of Michael Sweet;
- revised section 5.2 'Conformance Requirements for IPP Printers' to clarify that an IPP Printer SHOULD NOT listen on ports other than (IANA assigned well-known) port 631, unless explicitly configured, per request of Don Wright;
- revised section 6 'IANA Considerations' to clarify that the sole purpose of the entire document is IANA registration of the "ipp" URL scheme;
- deleted Appendix A 'Registration of IPP Port' as unnecessary (port is already registered);
- deleted Appendix B 'Registration of MIME "application/ipp" as unnecessary (MIME registry has recently caught up to RFC 2910);

11 January 2001 - draft-ietf-ipp-url-scheme-00.txt
- initial version - simple 'ipp:' URL scheme without parameters or query part (consistent with existing and IPP/1.1 implementations);
- added Appendix A 'Registration of IPP Port' (placeholder) for updated IANA registration of port 631 with references to IPP/1.1;
- added Appendix B 'Registration of MIME "application/ipp"' with updated IANA registration for IPP MIME type with references to both IPP/1.0 and IPP/1.1;

13. Full Copyright Statement

followed, or as required to translate it into languages other than English.