

Network Working Group
INTERNET-DRAFT
Updates: [2910](#), [2911](#) (if approved)
Intended Status: Standards Track
Expires: 19 March 2014

Ira McDonald
High North Inc
Michael Sweet
Apple Inc
19 September 2013

IPP over HTTPS Transport Binding and 'ipps' URI Scheme
draft-mcdonald-ipps-uri-scheme-08.txt

Abstract

This memo defines the Internet Printing Protocol (IPP) over HTTPS transport binding and the corresponding 'ipps' URI scheme, that is used to designate the access to the network location of a secure IPP print service or a network resource (for example, a print job) managed by such a service.

This memo is published by the IETF on behalf of the Internet Printing Protocol Working Group of the IEEE-ISTO Printer Working Group.

This memo updates [RFC 2910](#) and [RFC 2911](#).

Status of this Memo

This Internet-Draft is submitted in full conformance with the provisions of [BCP 78](#) and [BCP 79](#). Internet-Drafts are working documents of the Internet Engineering Task Force (IETF), its areas, and its working groups. Note that other groups may also distribute working documents as Internet-Drafts.

Internet-Drafts are draft documents valid for a maximum of six months and may be updated, replaced, or obsoleted by other documents at any time. It is inappropriate to use Internet-Drafts as reference material or to cite them other than as "work in progress."

The list of current Internet-Drafts can be accessed at
<http://www.ietf.org/1id-abstracts.html>

The list of Internet-Draft Shadow Directories can be accessed at
<http://www.ietf.org/shadow.html>

This Internet-Draft will expire on 19 March 2014.

Copyright Notice

Copyright (c) 2012 IETF Trust and the persons identified as the document authors. All rights reserved.

McDonald, Sweet

Expires 19 March 2014

[Page 1]

This document is subject to [BCP 78](#) and the IETF Trust's Legal Provisions Relating to IETF Documents (<http://trustee.ietf.org/license-info>) in effect on the date of publication of this document. Please review these documents carefully, as they describe your rights and restrictions with respect to this document. Code Components extracted from this document must include Simplified BSD License text as described in Section 4.e of the Trust Legal Provisions and are provided without warranty as described in the Simplified BSD License.

Table of Contents

1.	Introduction	3
1.1.	Structure of this document	3
1.2.	Rationale for this document	4
2.	Conventions Used in this Document	4
3.	IPP Transport Bindings	5
3.1.	IPP over HTTP Transport Binding (Informative)	5
3.2.	IPP over HTTPS Transport Binding (Normative)	6
4.	Definition of 'ipps' URI Scheme	7
4.1.	Applicability of 'ipps' URI Scheme	7
4.2.	Syntax of 'ipps' URI Scheme	7
4.3.	Associated Port for 'ipps' URI Scheme	9
4.4.	Associated MIME Type for 'ipps' URI Scheme	9
4.5.	Character Encoding of 'ipps' URI Scheme	9
4.6.	Examples of 'ipps' URI	9
4.6.1.	Examples of 'ipps' URI for Printers	9
4.6.2.	Examples of 'ipps' URI for Jobs	10
4.7.	Comparisons of 'ipps' URI	11
5.	Applicability of this Specification	11
5.1.	Applicability to IPP Clients	11
5.2.	Applicability to IPP Printers	12
6.	IANA Considerations	13
7.	Security Considerations	14
8.	References	15
8.1.	Normative References	15
8.2.	Informative References	16
9.	Appendix A - Acknowledgments	17
10.	Appendix B - Abbreviations Used in this Document	17
11.	Appendix X - Change History	18
12.	Authors' Addresses	21

McDonald, Sweet

Expires 19 March 2014

[Page 2]

1. Introduction

This memo defines the Internet Printing Protocol (IPP) over HTTPS transport binding and the corresponding 'ipps' URI scheme, that is used to designate the access to the network location of a secure IPP print service or a network resource (for example, a print job) managed by such a service. Therefore, this memo defines 'ipps' URI scheme applicability, associated port, associated MIME type, character encoding, and syntax.

This memo updates:

- a) IPP/1.1 Encoding and Transport [[RFC2910](#)], by extending [section 4](#) 'Encoding of the Transport Layer', [section 5](#) 'IPP URL Scheme', and [section 8.2](#) 'Using IPP with TLS';
- b) IPP/1.1 Model and Semantics [[RFC2911](#)], by extending [section 4.1.6](#) 'uriScheme' and [section 4.4.1](#) 'printer-uri-supported'; and
- c) IEEE-ISTO PWG IPP Version 2.0 Second Edition [[PWG5100.12](#)], by extending [section 4](#) 'IPP Standards' and [section 10](#) 'Security Considerations'.

This memo is published by IETF on behalf of the Internet Printing Protocol Working Group of the IEEE-ISTO Printer Working Group, as part of their PWG IPP Everywhere [[PWG5100.14](#)] project for secure mobile printing with vendor-neutral Client software.

The following versions of IPP are currently defined:

- 1.0 in [[RFC2566](#)] (obsolete)
- 1.1 in [[RFC2911](#)]
- 2.0 in [[PWG5100.12](#)]
- 2.1 in [[PWG5100.12](#)]
- 2.2 in [[PWG5100.12](#)]

Overview information about IPP is available in [section 1 of RFC 2911](#) [[RFC2911](#)], [section 1 of RFC 3196](#) [[RFC3196](#)], and [section 1](#) of PWG IPP Version 2.0 Second Edition [[PWG5100.12](#)].

1.1. Structure of this document

This document contains the following sections: [Section 2](#) defines the conventions used throughout the document.

[Section 3](#) defines the IPP over HTTPS transport binding, after first summarizing the original IPP over HTTP transport binding.

[Section 4](#) defines the 'ipps' URI scheme.

[Section 5](#) defines the applicability of this specification to IPP

McDonald, Sweet

Expires 19 March 2014

[Page 3]

Clients and IPP Printers.

Sections [6](#) and [7](#) contain IANA and security considerations, respectively.

[Section 8](#) contains references.

[Appendix A](#) contains acknowledgments and [Appendix B](#) explains abbreviations used in this document.

[1.2.](#) Rationale for this document

The 'ipps' URI scheme was defined for the following reasons:

- 1) Many existing IPP Client and IPP Printer implementations of Upgrading to TLS Within HTTP/1.1 [[RFC 2817](#)] are flawed and unreliable.
- 2) Some existing IPP Client and IPP Printer implementations of HTTP Upgrade [[RFC 2717](#)] do not perform upgrade at the beginning of every HTTP connection, but instead only shift to secure IPP for selected IPP operations (inherently dangerous behavior on the same underlying TCP connection).
- 3) IPP Printer server-mandated HTTP Upgrade [[RFC 2817](#)] can still lead to exposure of IPP Client data if the Expect request header is not used - basically the IPP Client can send its whole Print-Job request before the IPP Printer has a chance to respond and say, "Wait! You need to encrypt first!"

[2.](#) Conventions Used in this Document

The key words "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](#) [[RFC2119](#)].

The reader of this document should be familiar with the terminology in IPP/1.1 Model and Semantics [[RFC2911](#)] (particularly, with the definition of 'IPP Objects', 'Printer Object' and 'Job Object'), abbreviations described in [Appendix B](#) and the following terms.

In this document, "IPP Client" means the software (on some hardware platform) that submits, monitors, and/or manages secure print jobs via the IPP/1.1 Encoding and Transport [[RFC2910](#)] or IEEE-ISTO PWG IPP Version 2.0 Second Edition [[PWG5100.12](#)] to a secure print spooler, secure print gateway, or secure physical printing device.

McDonald, Sweet

Expires 19 March 2014

[Page 4]

In this document, "IPP Printer object" means the software (on some hardware platform) that receives secure print jobs and/or secure printer/job operations via the IPP/1.1 Encoding and Transport [[RFC2910](#)] or IEEE-ISTO PWG IPP Version 2.0 Second Edition [[PWG5100.12](#)] 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 secure print job instantiated on an "IPP Printer".

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

In this document, "'ipps' URI" means a URI using the 'ipps' URI scheme defined in [section 4](#) of this specification.

[3.](#) IPP Transport Bindings

3.1. IPP over HTTP Transport Binding (Informative)

This section is informative.

When using an 'ipp' URI [[RFC3510](#)], an IPP Client establishes an IPP application layer connection according to the following sequence:

- 1) The IPP Client selects an 'ipp' URI value from "printer-uri-supported" Printer attribute [[RFC2911](#)], a directory entry, discovery info, a web page, etc.;
- 2) The IPP Client converts the 'ipp' URI to an 'http' URI (replacing 'ipp' with 'http' and inserting port 631);
- 3) The IPP Client establishes a TCP [[STD7](#)] reliable transport layer connection to the target endpoint - see [section 3.4](#) 'Establishing a connection' in TCP [[STD7](#)];
- 4) The IPP Client establishes an HTTP [[RFC2616](#)] session layer connection to the target endpoint - see [section 8](#) 'Connections' in HTTP/1.1 [[RFC2616](#)];
- 5) Optionally, either the IPP Client upgrades to TLS within HTTP/1.1 per [section 3](#) 'Client Requested Upgrade to HTTP over TLS' of [[RFC2817](#)] or the IPP Printer upgrades to TLS within HTTP/1.1 per

[section 4](#) 'Server Requested Upgrade to HTTP over TLS' of

McDonald, Sweet

Expires 19 March 2014

[Page 5]

[[RFC2817](#)], in order to establish a TLS Protocol [[RFC5246](#)] secure transport sublayer within the original TCP/HTTP connection - per the "uri-security-supported" ([section 4.4.3 in \[RFC2911\]](#)) Printer attribute value parallel to the "printer-uri-supported" (see [section 4.4.1 in \[RFC2911\]](#)) value that matches this connection; and

- 6) The IPP Client sends IPP application layer requests to and receives responses from the IPP Printer over the HTTP [[RFC2616](#)] session layer connection using the POST method defined in [section 9.5](#) of HTTP/1.1 [[RFC2616](#)], as specified in [section 4](#) 'Encoding of Transport Layer' in IPP/1.1 Encoding and Transport [[RFC2910](#)].

See: [Section 8](#) 'Security Considerations' in [[RFC2817](#)].

3.2. IPP over HTTPS Transport Binding (Normative)

This section is normative.

This document defines the following IPP over HTTPS alternate transport binding for the abstract protocol defined in IPP/1.1 Model and Semantics [[RFC2911](#)] and IEEE-ISTO PWG IPP Version 2.0 Second Edition [[PWG5100.12](#)].

When using an 'ipps' URI, an IPP Client MUST establish an IPP application layer connection according to the following sequence:

- 1) The IPP Client selects an 'ipps' URI value from "printer-uri-supported" Printer attribute [[RFC2911](#)], a directory entry, discovery info, a web page, etc.;
- 2) The IPP Client converts the 'ipps' URI to an 'https' URI (replacing 'ipps' with 'https' and inserting port 631);
- 3) The IPP Client establishes a TCP [[STD7](#)] reliable transport layer connection to the target endpoint - see [section 3.4](#) 'Establishing a connection' in TCP [[STD7](#)];
- 4) The IPP Client establishes a TLS [[RFC5246](#)] secure transport layer connection to the target endpoint - see [section 7](#) 'The TLS Handshaking Protocols' in TLS [[RFC5246](#)];
- 5) The IPP Client establishes an HTTPS [[RFC2818](#)] secure session layer connection over the TLS [[RFC5246](#)] secure transport layer to the target endpoint; and
- 6) The IPP Client sends IPP application layer requests to and receives responses from the IPP Printer over the HTTPS [[RFC2818](#)]

secure session layer connection using the POST method defined in

McDonald, Sweet

Expires 19 March 2014

[Page 6]

[section 9.5](#) of HTTP/1.1 [[RFC2616](#)], as specified in [section 4](#) 'Encoding of Transport Layer' in IPP/1.1 Encoding and Transport [[RFC2910](#)].

See: Section 'Security Considerations' in [[RFC2818](#)].

4. Definition of 'ipps' URI Scheme

4.1. Applicability of 'ipps' URI Scheme

The 'ipps' URI scheme MUST only be used to specify absolute URI (relative 'ipps' URI are not allowed) for IPP secure print services and their associated network resources. The 'ipps' URI scheme MUST only be used to specify the use of the abstract protocol defined in IPP/1.1 Model and Semantics [[RFC2911](#)] and IEEE-ISTO PWG IPP Version 2.0 Second Edition [[PWG5100.12](#)] over an HTTPS [[RFC2818](#)] transport, as defined in this specification. Any other transport binding for IPP would require a different URI scheme.

The 'ipps' URI scheme allows an IPP Client to choose an appropriate IPP secure print service (for example, from a directory). The IPP Client can establish an HTTPS connection to the specified IPP secure print service. The IPP Client can send IPP protocol requests (for example, 'Print-Job' requests) and receive IPP protocol responses over that HTTPS connection.

See: [Section 3.2](#) of this document.

See: [Section 4.4.1](#) 'printer-uri-supported' in IPP/1.1 Model and Semantics [[RFC2911](#)].

See: [Section 5](#) 'IPP URL Scheme' in IPP/1.1 Encoding and Transport [[RFC2910](#)].

See: [Section 4](#) 'IPP Standards' and [section 10](#) 'Security Considerations' of IEEE-ISTO PWG IPP Version 2.0 Second Edition [[PWG5100.12](#)].

4.2. Syntax of 'ipps' URI Scheme

The abstract protocol defined in IPP/1.1 Model and Semantics [[RFC2911](#)] places a limit of 1023 octets (NOT characters) on the length of a URI.

See: [Section 4.1.5](#) 'uri' in [[RFC2911](#)].

McDonald, Sweet

Expires 19 March 2014

[Page 7]

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

'ipps' URI MUST be represented in absolute form. Absolute URI MUST always begin with a scheme name followed by a colon. For definitive information on URI syntax and semantics, see "Uniform Resource Identifiers (URI) Generic Syntax and Semantics" [[STD66](#)]. This specification adopts the definitions of "host", "port", "path-absolute", and "query" from [[STD66](#)].

The 'ipps' URI scheme syntax in ABNF [[STD68](#)] is defined as follows:

```
ipps-uri =  
  "ipps:" "/" host [ ":" port ] [ path-absolute [ "?" query ] ]
```

Note: The higher-level production "authority" is not imported from [[STD66](#)], because it includes an optional "userinfo" component which cannot be used in 'ipps' URI.

If the port is empty or not given, then port 631 MUST be used. The semantics are that the identified resource (see [section 5.1.2 of \[RFC2616\]](#)) is located at the IPP secure print service listening for HTTPS connections on that port of that host, and the Request-URI for the identified resource is 'path-absolute'.

Note: Literal IPv4 or IPv6 addresses SHOULD NOT be used in 'ipps' URI, because:

- a) IP addresses are often changed after network device installation (e.g., based on DHCP reassignment after a power cycle);
- b) IP addresses often don't map simply to security domains;
- c) IP addresses are difficult to validate with X.509 server certificates (because they do not map to common name or alternate name attributes); and
- d) IPv6 link local addresses are not "portable" due to link identity

If the 'path-absolute' is not present in the URI, it MUST be given as "/" when used as a Request-URI for a resource (see [section 5.1.2 of \[RFC2616\]](#)).

An 'ipps' URI is transformed into an 'https' URI by replacing "ipps:" with "https:" and inserting port 631 (if the 'port' is not present in the original 'ipps' URI).

See: [Section 3.2](#) of this document.

McDonald, Sweet

Expires 19 March 2014

[Page 8]

4.3. Associated Port for 'ipps' URI Scheme

All 'ipps' URI which do NOT explicitly specify a port MUST be resolved to IANA-assigned well-known port 631, as registered in [[PORTREG](#)].

See: IANA Port Numbers Registry [[PORTREG](#)].

See: IPP/1.1 Encoding and Transport [[RFC2910](#)].

4.4. Associated MIME Type for 'ipps' URI Scheme

All 'ipps' URI MUST be used to specify secure print services which support the "application/ipp" MIME media type as registered in [[MIMEREG](#)] for IPP protocol requests and responses.

See: IANA MIME Media Types Registry [[MIMEREG](#)].

See: IPP/1.1 Encoding and Transport [[RFC2910](#)].

4.5. Character Encoding of 'ipps' URI Scheme

'ipps' URI MUST use the UTF-8 [[STD63](#)] charset for all components. 'ipps' URI MUST use [[STD66](#)] rules for percent encoding data octets outside the US-ASCII coded character set [[ASCII](#)].

4.6. Examples of 'ipps' URI

4.6.1. Examples of 'ipps' URI for Printers

The following are examples of well-formed 'ipps' URI for IPP Printers (for example, to be used as protocol elements in 'printer-uri' operation attributes of 'Print-Job' request messages):

```
ipps://example.com
ipps://example.com/ipp
ipps://example.com/ipp/tiger
ipps://example.com/ipp/fox
ipps://example.com/ipp/tiger/bob
ipps://example.com/ipp/tiger/ira
```


Each of the above URI are well-formed URI for IPP Printers and each would reference a logically different IPP Printer, even though some of those IPP Printers might share the same host system. The 'bob' or 'ira' last path components might represent two different physical printer devices, while 'tiger' might represent some grouping of IPP Printers (for example, a load-balancing spooler). Or the 'bob' and 'ira' last path components might represent separate human recipients on the same physical printer device (for example, a physical printer supporting two job queues). In either case, both 'bob' and 'ira' would behave as different and independent IPP Printers.

The following are examples of well-formed 'ipps' URI for IPP Printers with (optional) ports and paths:

```
ipps://example.com
ipps://example.com/ipp
ipps://example.com:631/ipp
```

The first and second 'ipps' URI above MUST be resolved to port 631 (IANA assigned well-known port for IPP). The second and third 'ipps' URI above are equivalent (see [section 4.7](#) below).

4.6.2. Examples of 'ipps' URI for Jobs

The following are examples of well-formed 'ipps' URI for IPP Jobs (for example, to be used as protocol elements in 'job-uri' attributes of 'Print-Job' response messages):

```
ipps://example.com/ipp/123
ipps://example.com/ipp/tiger/job123
```

'ipps' URI for Jobs are valid and meaningful only until Job completion and possibly an implementation defined optional period of persistence after Job completion (see IPP Model [[RFC2911](#)]).

Ambiguously, [section 4.3.1](#) 'job-uri' of IPP Model [[RFC2911](#)] states that:

"the precise format of a Job URI is implementation dependent."

Thus, the relationship between the value of the "printer-uri" operation attribute used in a 'Print-Job' request and the value of the "job-uri" attribute returned in the corresponding 'Print-Job' response is entirely implementation dependent. Also, [section 4.3.3](#) 'job-printer-uri' of IPP Model [[RFC2911](#)] states that the 'job-printer-uri' attribute of a Job object:

McDonald, Sweet

Expires 19 March 2014

[Page 10]

"permits a client to identify the Printer object that created this Job object when only the Job object's URI is available to the client."

However, the above statement is erroneous, because the transform from a URI for an IPP Job to the corresponding URI for the associated IPP Printer is unspecified in either IPP/1.1 Model and Semantics [[RFC2911](#)] or IPP/1.1 Encoding and Transport [[RFC2910](#)].

IPP Printers that implement this specification SHOULD only generate 'ipps' URI for Jobs (for example, in the "job-uri" attribute in a 'Print-Job' response) by appending exactly one path component to the corresponding 'ipps' URI for the associated Printer (for interoperability).

4.7. Comparisons of 'ipps' URI

When comparing two 'ipps' URI to decide if they match or not, an IPP Client MUST use the same rules as those defined for 'http' URI comparisons in [[RFC2616](#)] as updated by the 'https' URI scheme [[RFC2818](#)], with the sole following exception:

- A port that is empty or not given MUST be treated as equivalent to the well-known port for that 'ipps' URI (port 631).

See: [Section 3.2.3](#) 'URI Comparison' in [[RFC2616](#)].

See: [Section 2.4](#) 'URI Format' in [[RFC2818](#)].

5. Applicability of this Specification

5.1. Applicability to IPP Clients

IPP Clients that implement this specification:

- MUST support the IPP over HTTPS transport binding defined in [section 3.2](#) and the 'ipps' URI scheme defined in [section 4](#);
- MUST support the IPP over HTTP transport binding with TLS defined in [section 8.2](#) 'Using IPP with TLS' of IPP/1.1 Encoding and Transport [[RFC2910](#)] (for interoperability with existing IPP implementations);
- MUST only send IPP protocol connections to IANA assigned

well-known port 631 or to the explicit port specified in a given

McDonald, Sweet

Expires 19 March 2014

[Page 11]

'ipps' URI;

- d) MUST only send 'ipps' URI used as protocol elements in outgoing IPP protocol request messages that conform to the ABNF specified in [section 4.2](#) of this document (for example, in the "printer-uri" operation attribute in a 'Print-Job' request);
- e) MUST only convert 'ipps' URI to their corresponding 'https' URI forms [[RFC2818](#)] according to the rules in [section 4.2](#) of this document.

5.2. Applicability to IPP Printers

IPP Printers that implement this specification:

- a) MUST support the IPP over HTTPS transport binding defined in [section 3.2](#) and the 'ipps' URI scheme defined in [section 4](#);
- b) MUST support the IPP over HTTP transport binding with TLS defined in [section 8.2](#) 'Using IPP with TLS' of IPP/1.1 Encoding and Transport [[RFC2910](#)] (for interoperability with existing IPP implementations);
- c) MUST only listen for incoming IPP protocol connections on IANA-assigned well-known port 631 and MUST NOT listen for incoming IPP protocol connections on any other port, unless explicitly configured by system administrators or site policies;
- d) MUST only generate 'ipps' URI used as protocol elements in outgoing IPP protocol response messages that conform to the ABNF specified in [section 4.2](#) of this document (for example, in the "job-uri" attribute in a 'Print-Job' response);
- e) SHOULD only accept 'ipps' URI used as protocol elements in incoming IPP protocol request messages that conform to the ABNF specified in [section 4.2](#) of this document (for example, in the "printer-uri" operation attribute in a 'Print-Job' request);
- f) SHOULD only generate 'ipps' URI for Jobs by appending exactly one path component to the corresponding 'ipps' URI for the associated Printer (for example, in the "job-uri" attribute in a 'Print-Job' response);
- g) SHOULD NOT generate 'ipps' URI that use literal IPv6 or IPv4 addresses (see [section 4.2](#) for rationale).

McDonald, Sweet

Expires 19 March 2014

[Page 12]

6. IANA Considerations

IANA is asked to register the 'ipps' URI scheme using the following template, which conforms to [\[BCP35\]](#).

URI scheme name: ipps

Status: Permanent

URI scheme syntax: See [section 4.2](#) of RFC xxxx.

URI scheme semantics: The 'ipps' URI scheme is used to designate secure IPP Printer objects (spoolers, application gateways, print devices, etc.) on Internet hosts accessible using the IPP protocol enhanced to support guaranteed data integrity and negotiable data privacy using TLS [\[RFC5246\]](#) as specified in HTTP over TLS [\[RFC2818\]](#).

Encoding Considerations: See [section 4.3](#) of RFC xxxx.

Applications/protocols that use this URI scheme name:

The 'ipps' URI scheme is intended to be used by applications that need to access secure IPP Printers using the IPP protocol enhanced to support guaranteed data integrity and negotiable data privacy using TLS [\[RFC5246\]](#) as specified in HTTP over TLS [\[RFC2818\]](#). Such applications may include (but are not limited to) IPP-capable web browsers, IPP Clients that wish to print a file, and servers (e.g., print spoolers) that wish to forward a print Job for processing.

Interoperability Considerations: A widely deployed IPP print service CUPS (on most UNIX, Linux, and Mac OS X client systems) has supported 'ipps' URI for several years. PWG IPP Everywhere [\[PWG5100.14\]](#) (IPP secure, mobile printing extensions) requires the use of 'ipps' URI for mandatory data integrity and optional data confidentiality.

Security Considerations: See: [Section 8](#) of RFC xxxx.

Contact:

Ira McDonald <blueroofmusic@gmail.com>

Michael Sweet <msweet@apple.com>

Author/Change controller:

IESG

McDonald, Sweet

Expires 19 March 2014

[Page 13]

References: [RFC 2910](#), [RFC 2911](#), and RFC xxxx.

[RFC Editor: Replace 'xxxx' with assigned RFC number before publication]

7. Security Considerations

This 'ipps' URI Scheme specification adds the following additional security considerations to those described in [\[RFC2910\]](#), [\[RFC2911\]](#), [\[RFC2818\]](#), and [\[PWG5100.12\]](#):

- a) An 'ipps' URI might be faked to point to a rogue IPP secure print service, thus collecting confidential document contents from IPP Clients.

Server authentication mechanisms and security mechanisms specified in IPP/1.1 Encoding and Transport [\[RFC2910\]](#), TLS/1.2 Protocol [\[RFC5246\]](#), and HTTP over TLS [\[RFC2818\]](#) can be used to address this threat.

- b) An 'ipps' URI might be used to access an IPP secure print service by an unauthorized IPP Client.

Client authentication mechanisms and security mechanisms specified in IPP/1.1 Encoding and Transport [\[RFC2910\]](#), TLS/1.2 Protocol [\[RFC5246\]](#), and HTTP over TLS [\[RFC2818\]](#) can be used to address this threat.

- c) An 'ipps' URI might be used to access an IPP secure print service at a print protocol application layer gateway (for example, an IPP to LPD [\[RFC1179\]](#) gateway [\[RFC2569\]](#)), potentially causing silent compromise of IPP security mechanisms.

There is no general defense against this threat by an IPP Client. System administrators should avoid such configurations.

- d) An 'ipps' URI does not define parameters to specify the required IPP Client authentication mechanism (for example, 'certificate' as defined in [section 4.4.2](#) 'uri-authentication-supported' of IPP Model [\[RFC2911\]](#)).

Service discovery or directory protocols should be used to discover the required IPP Client authentication mechanisms associated with given 'ipps' URI.

See: [Section 8](#) 'Security Considerations' in [\[RFC2910\]](#).

See: [Section 8](#) 'Security Considerations' in [[RFC2911](#)].

McDonald, Sweet

Expires 19 March 2014

[Page 14]

See: [Section 10](#) 'Security Considerations' in [[PWG5100.12](#)].

See: Section 'Security Considerations' in [[RFC2818](#)].

See: [Section 15](#) 'Security Considerations' in [[RFC2616](#)].

See: [Section 7](#) 'Security Considerations' in [[STD66](#)].

[8.](#) References

[8.1.](#) Normative References

- [ASCII] "American National Standards Institute, Coded Character Set -- 7-bit American Standard Code for Information Interchange", ANSI X3.4, 1986.
- [PWG5100.12] Bergman, R., Lewis, H., McDonald, I., and M. Sweet, "Internet Printing Protocol Version 2.0 Second Edition (IPP/2.0 SE)", PWG 5100.12, February 2011.
<<http://www.pwg.org/standards.html>>
- [PWG5100.14] McDonald, I. and M. Sweet, "PWG IPP Everywhere", PWG 5100.14, January 2013.
<<http://www.pwg.org/standards.html>>
- [RFC2119] Bradner, S., Key words for use in RFCs to Indicate Requirement Levels, [BCP 14](#), [RFC 2119](#), March 1997.
- [RFC2616] Fielding, R., Gettys, J., Mogul, J., Frystyk, H., Masinter, L., Leach, P., and T. Berners-Lee, "Hypertext Transfer Protocol -- HTTP/1.1", [RFC 2616](#), June 1999.
- [RFC2818] Rescorla, E., "HTTP Over TLS", [RFC 2818](#), May 2000.
- [RFC2910] Herriot, R., Ed., Butler, S., Moore, P., Turner, R., and J. Wenn, "Internet Printing Protocol/1.1: Encoding and Transport", [RFC 2910](#), September 2000.
- [RFC2911] Hastings, T., Ed., Herriot, R., deBry, R., Isaacson, S., and P. Powell, "Internet Printing Protocol/1.1: Model and Semantics", [RFC 2911](#), September 2000.
- [RFC5246] Dierks, T., and E. Rescorla, "The Transport Layer Security (TLS) Protocol Version 1.2", [RFC 5246](#), August 2008.

- [STD7] Postel, J., "Transmission Control Protocol", STD 7, [RFC 793](#), September 1981.
- [STD63] Yergeau, F., "UTF-8, a transformation format of ISO 10646", STD 63, [RFC 3629](#), November 2003.
- [STD66] Berners-Lee, T., Fielding, R., and L. Masinter, Uniform Resource Identifiers (URI) Generic Syntax, STD 66, [RFC 3986](#), January 2005.
- [STD68] Crocker, D., Ed., and P. Overell, "Augmented BNF for Syntax Specifications: ABNF", STD 68, [RFC 5234](#), January 2008.

8.2. Informative References

- [BCP35] Hansen, T., Hardie, T., and L. Masinter, "Guidelines and Registration Procedures for New URI Schemes", [BCP 35](#), [RFC 4395](#), February 2006.
- [MIMEREG] Internet Assigned Numbers Authority (IANA) Registry "MIME Media Types"
<<http://www.iana.org/assignments/media-types/>>
- [PORTREG] Internet Assigned Numbers Authority (IANA) Registry "Port Numbers"
<<http://www.iana.org/assignments/port-numbers>>
- [RFC1179] McLaughlin, L., "Line Printer Daemon Protocol", [RFC 1179](#), August 1990.
- [RFC2569] Herriot, R., Ed., Hastings, T., Jacobs, N., and J. Martin, "Mapping between LPD and IPP Protocols", [RFC 2569](#), April 1999.
- [RFC2817] Khare, R. and S. Lawrence, "Upgrading to TLS Within HTTP/1.1", [RFC 2817](#), May 2000.
- [RFC3196] Hastings, T., Manros, C., Zehler, P., Kugler, C., and H. Holst, "Internet Printing Protocol/1.1: Implementor's Guide", [RFC 3196](#), November 2001.
- [RFC3510] Herriot, R. and I. McDonald, "Internet Printing Protocol/1.1: IPP URL Scheme", [RFC 3510](#), April 2003.

McDonald, Sweet

Expires 19 March 2014

[Page 16]

9. [Appendix A](#) - Acknowledgments

This memo is published by IETF on behalf of the Internet Printing Protocol Working Group of the IEEE-ISTO Printer Working Group, as part of their PWG IPP Everywhere [[PWG5100.14](#)] project for secure mobile printing with vendor-neutral Client software.

Thanks to Tom Hastings (retired from Xerox), Bjoern Hoerhmann, Jerry Thrasher (Lexmark), Mykyta Yevstifeyev, Pete Zehler (Xerox), and the members of the PWG IPP WG.

The IPP URL Scheme [[RFC3510](#)] was the primary source for this document.

10. [Appendix B](#) - Abbreviations Used in this Document

This document makes use of the following abbreviations (given with their expanded forms and references for further reading):

- ABNF - Augmented Backus-Naur Form [[STD68](#)]
- ASCII - American Standard Code for Information Interchange [[ASCII](#)]
- HTTP - HyperText Transfer Protocol [[RFC2616](#)]
- HTTPS - HTTP over TLS [[RFC2818](#)]
- IANA - Internet Assigned Numbers Authority
<<http://www.iana.org>>
- IEEE - Institute of Electrical and Electronics Engineers
<<http://www.ieee.org>>
- IESG - Internet Engineering Steering Group
<<http://www.ietf.org/iesg/>>
- IPP - Internet Printing Protocol [[RFC2911](#)] and [[PWG5100.12](#)]
<<http://www.pwg.org/ipp/>>
- ISTO - IEEE Industry Standards and Technology Organization
<<http://www.ieee-isto.org/>>
- LPD - Line Printer Daemon Protocol [[RFC1179](#)]
- PWG - IEEE-ISTO Printer Working Group
<<http://www.pwg.org>>

RFC - Request for Comments
<<http://www.rfc-editor.org/rfc.html>>

TCP - Transmission Control Protocol [[STD7](#)]

TLS - Transport Layer Security [[RFC5246](#)]

URI - Uniform Resource Identifier [[STD66](#)]

URL - Uniform Resource Locator [[STD66](#)]

UTF-8 - Unicode Transformation Format - 8-bit [[STD63](#)]

11. Appendix X - Change History

[RFC Editor: Delete this section before publication as an RFC]

19 September 2013 - [draft-mcdonald-ipps-uri-scheme-08.txt](#)

Global - Updated references, per IPP WG review.

12 May 2013 - [draft-mcdonald-ipps-uri-scheme-07.txt](#)

Editorial - Revised [section 1](#) (introduction) to add 'Rationale for this document', per Smith Kennedy.

Editorial - Global - Changed 'Conformance Requirements' to 'Applicability', per Barry Leiba.

Editorial - Global - Changed '[[PWG5100.EW](#)]' to '[[PWG5100.14](#)]', corrected date and URI, and moved [section 8.1](#) (normative references), per IPP WG review.

10 November 2012 - [draft-mcdonald-ipps-uri-scheme-06.txt](#)

Editorial - Global - Fixed typos and indentation, per IPP WG review.

Editorial - Global - changed 'generic drivers' to 'vendor-neutral Client software', per IPP WG review.

Editorial - Revised [section 8.2](#) (informative references, to correct title of "PWG IPP Everywhere" (i.e., delete version number), per IPP WG review.

14 May 2012 - [draft-mcdonald-ipps-uri-scheme-05.txt](#)

Editorial - Global - Fixed typos and indentation, per IPP WG review.

Editorial - Revised sections [3.1](#) and [3.2](#) (transport bindings) to insert missing "to" in "connection to the target endpoint", per IPP WG review.

Editorial - Revised [section 4.2](#) (syntax), to correct indentation of first "Note:", per IPP WG review.

Editorial - Revised sections [5.1](#) and [5.2](#) (client/printer conformance) and [section 7](#) (security considerations) to delete the out-of-scope normative references to [[RFC2817](#)], per IPP WG review.

McDonald, Sweet

Expires 19 March 2014

[Page 18]

22 November 2011 - [draft-mcdonald-ipps-uri-scheme-04.txt](#)

Editorial - Global - Fixed typos and indentation, per IPP WG review.

Editorial - Revised Introduction and Acknowledgments to say 'project for mobile, ubiquitous printing with generic drivers', per IPP WG review.

Editorial - Revised sections [3.1](#) and [3.2](#) (transport bindings) to add references to HTTP POST and [section 4 of RFC 2910](#), per IPP WG review.

Editorial - Revised sections [3.1](#) and [3.2](#) (transport bindings) to add section references to all well-known standards (connection setup, etc.), per IPP WG review.

Editorial - Revised [section 4.2](#) (syntax) to move note from [section 4.6](#) (examples) and explain why literal IP addresses should NOT be used in 'ipps' URI, per IPP WG review.

Editorial - Revised sections [4.6.1](#) and [4.6.2](#) (examples) to replace 'abc.com' w/ 'example.com' (per IETF) and replace '/printer' path element w/ '/ipp' (better practice), per IPP WG review.

Editorial - Revised [section 5.2](#) (Printer conformance) to fold former (c) and (d) into a single requirement for standard port 631 and reordered other requirements to group MUSTs before SHOULDs, per IPP WG review.

Editorial - Revised [section 5.2](#) (Printer conformance) to add backward reference to [section 4.2](#) for rationale for not using IP literal addresses, per IPP WG review.

Editorial - Revised [section 6](#) (IANA) to explicitly state that 'ipps' uses secure communications using HTTP over TLS, per IPP WG review.

Editorial - Revised [section 7](#) (Security) to cleanup numerous loose ends, per IPP WG review.

Editorial - Revised [section 8](#) (References) to cleanup typos and links, per IPP WG review.

Editorial - Revised [section 1](#) (introduction), [section 8.2](#) (informative references, and [section 9](#) (appendix A) to change "[IPPEVE]" to "[PWG5100.EW]", per IPP WG review.

26 August 2011 - [draft-mcdonald-ipps-uri-scheme-03.txt](#)

Editorial - Revised Abstract and Introduction to state published by the IETF on behalf of IEEE-ISTO PWG (to avoid status ambiguity), per Mykyta Yevstifeyev.

Editorial - Revised [section 1](#) to list all currently defined versions of IPP in [RFC 2566](#), [RFC 2911](#), and PWG 5100.12, per Mykyta Yevstifeyev.

Technical - Revised [section 1](#), [section 2](#), [section 3.2](#), [section 4.1](#), and [section 7](#), to reference IPP Version 2.0 Second Edition (PWG 5100.12), per Mykyta Yevstifeyev.

Editorial - Revised [section 3.1](#), to fix broken STD7 reference, per Mykyta Yevstifeyev.

Editorial - Revised [section 6](#), to add [BCP35](#) reference for template (regression loss when the template was moved up from former appendix), per Mykyta Yevstifeyev.

Editorial - Revised [section 8.1](#) to add PWG 5100.12 (normative),

McDonald, Sweet

Expires 19 March 2014

[Page 19]

Editorial - Revised [section 8.2](#) to add PWG IPP Everywhere (informative) and [RFC 1179](#) (informative), per Mykyta Yevstifeyev.
Editorial - Revised [appendix B](#) to add references for more reading, per Mykyta Yevstifeyev.

28 February 2011 - [draft-mcdonald-ipps-uri-scheme-02.txt](#)

Editorial - Revised document title to emphasize IPP over HTTPS Transport Binding (reason for IETF standards-track status).

Editorial - Replaced "IPP URI" with "'ipp' URI", "IPPS URI" with "'ipps' URI", "HTTP URI" with "'http' URI", and "HTTPS URI" with "'https' URI" throughout this document for conformance to [section 3.1 of \[STD66\]](#), per Mykyta Yevstifeyev.

Editorial - Revised and simplified Abstract, per Mykyta Yevstifeyev.

Editorial - Revised and simplified [section 1](#) 'Introduction', per Mykyta Yevstifeyev.

Editorial - Renamed [section 2](#) from 'Conformance Terminology' to 'Conventions Used in this Document', per Mykyta Yevstifeyev.

Editorial - Moved former [section 3.1](#) 'IPP Model Terminology (Normative)' content into [section 2](#) 'Conventions Used in this Document' for readability, per Mykyta Yevstifeyev.

Editorial - Reordered subsections and reversed word order in all subsection titles in [section 4](#) 'The 'ipps' URI Scheme' for readability, per Mykyta Yevstifeyev.

Editorial - Added note to [section 4.2](#) 'Syntax of 'ipps' URI Scheme' to explain why 'authority' production is NOT imported from [\[STD66\]](#), because it includes an optional 'userinfo' component which cannot be used in 'ipps' URI values.

Editorial - Deleted note describing empty 'host' component from [section 4.2](#) 'Syntax of 'ipps' URI Scheme', because 'host' component is mandatory in [\[STD66\]](#).

Editorial - Deleted 'Internationalization Considerations' section which was redundant with [section 4.3](#) 'Character Encoding of 'ipps' URI Scheme', per Mykyta Yevstifeyev.

Editorial - Revised all references to follow current RFC Editor style, per Mykyta Yevstifeyev.

Editorial - Moved former 'Appendix A - Registration of IPPS URI Scheme' content inline into [section 6](#) 'IANA Considerations', per Mykyta Yevstifeyev.

Editorial - Moved former body section 'Acknowledgements' to 'Appendix A - Acknowledgements', per Mykyta Yevstifeyev.

Editorial - Added new 'Appendix B - Abbreviations Used in this Document' for readability, per Mykyta Yevstifeyev.

Editorial - Moved section 'Authors' Addresses' to end of document, per Mykyta Yevstifeyev.

1 December 2010 - [draft-mcdonald-ipps-uri-scheme-01.txt](#)

- Technical - added UTF-8 [\[STD63\]](#) as required charset for all IPPS URI in [section 4.4](#) and [section 7](#), per Bjoern Hoehrmann.

- Technical - corrected percent encoding for data octets outside the

US-ASCII range in [section 4.4](#) and [section 7](#), per Bjoern Hoehrmann.

McDonald, Sweet

Expires 19 March 2014

[Page 20]

- Editorial - global - changed "[[RFC4395](#)]" to "[[BCP35](#)]", changed "[[RFC3629](#)]" to "[[STD63](#)]", changed "[[RFC3986](#)]" to "[[STD66](#)]", and changed "[[RFC5234](#)]" to "[[STD68](#)]", per Bjoern Hoehrmann.
- Editorial - restored trailing "]" in ABNF syntax in [section 4.5](#), per Bjoern Hoehrmann.
- Editorial - changed "Author/Change controller" to "IESG" in [section 12 Appendix A](#) registration template, as required by [section 5.3 of \[BCP35\]](#), per Bjoern Hoehrmann.

10 October 2010 - [draft-mcdonald-ipps-uri-scheme-00.txt](#)

- Editorial - complete rewrite of [RFC 3510](#) for new transport binding
- Editorial - moved Abstract to beginning of first page, per ID-Nits
- Editorial - fixed copyright, boilerplate, and typos, per ID-Nits
- Editorial - added references to RFCs 2119 and 3510, per ID-Nits
- Editorial - deleted obsolete references to RFCs 2246 and 4346, per ID-Nits
- Technical - changed Intended Status to Standards Track to reflect the new normative IPPS URI scheme and transport binding
- Technical - added [section 3.2](#) IPP over HTTP Transport Binding (informative)
- Technical - added [section 3.3](#) IPP over HTTPS Transport Binding (normative)
- Technical - updated [section 5](#) Conformance Requirements to require HTTP Upgrade ([RFC 2817](#)) support (for interoperability with existing IPP implementations), per discussion on IPP WG mailing list
- Editorial - updated [Appendix A](#) w/ registration template from [RFC 4395](#)

[12.](#) Authors' Addresses

Ira McDonald
High North Inc
221 Ridge Ave
Grand Marais, MI 49839

Phone: +1 906-494-2434
Email: blueroofmusic@gmail.com

Michael Sweet
Apple Inc
10431 N De Anza Blvd, M/S 38-4LPT
Cupertino, CA 95014

Phone: +1 408-974-8798
Email: msweet@apple.com

McDonald, Sweet

Expires 19 March 2014

[Page 21]

Usage questions and comments on this 'ipps' URI Scheme should be sent directly to the editors at their above addresses and also to the PWG IPP WG mailing list. Instructions for subscribing to the PWG IPP WG mailing list can be found at:

PWG IPP WG Web Page: <http://www.pwg.org/ipp/>

[PWG](#) IPP WG Mailing List: ipp@pwg.org

PWG IPP WG Subscription: <http://www.pwg.org/mailhelp.html>

Implementers of this specification are encouraged to join the PWG IPP WG Mailing List in order to participate in any discussions of clarification issues and comments. Note that this IEEE-ISTO PWG mailing list rejects mail from non-subscribers (in order to reduce spam).

