



A Project of the PWG IPP Working Group

DRAFT Proposal Internet Printing Protocol (IPP): Advertisement via the Simple Service Discovery Protocol

IEEE-ISTO Printer Working Group
DRAFT 5100.X-2001

April 17, 2001

Abstract

This document specifies how a printer that supports the Internet Printing Protocol /1.1 [1, 2] can use the Simple Service Discovery Protocol (SSDP) [3] to advertise its print service. A number of service advertising methods exist. This document does not recommend one method over another. The intent is to detail how the advertisement would be accomplished with SSDP.

This document is an IEEE-ISTO PWG Draft Standard. For a definition of a "PWG Draft Standard", see: <ftp://ftp.pwg.org/pub/pwg/general/pwg-process.pdf>.

This document is available from: ftp://ftp.pwg.org/pub/pwg/ipp/new_SSDP/pwg5100_X_SSDP_1.pdf,
.doc

Copyright (C) 2001, IEEE Industry Standards and Technology Organization. All rights reserved.

This document may be copied and furnished to others, and derivative works that comment on, or otherwise explain it or assist in its implementation may be prepared, copied, published and distributed, in whole or in part, without restriction of any kind, provided that the above copyright notice, this paragraph and the title of the Document as referenced below are included on all such copies and derivative works. However, this document itself may not be modified in any way, such as by removing the copyright notice or references to the IEEE-ISTO and the Printer Working Group, a program of the IEEE-ISTO.

Title: Internet Printing Protocol (IPP): Advertisement via the Simple Service Discovery Protocol

The IEEE-ISTO and the Printer Working Group DISCLAIM ANY AND ALL WARRANTIES, WHETHER EXPRESS OR IMPLIED INCLUDING (WITHOUT LIMITATION) ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

The Printer Working Group, a program of the IEEE-ISTO, reserves the right to make changes to the document without further notice. The document may be updated, replaced or made obsolete by other documents at any time.

The IEEE-ISTO takes no position regarding the validity or scope of any intellectual property or other rights that might be claimed to pertain to the implementation or use of the technology described in this document or the extent to which any license under such rights might or might not be available; neither does it represent that it has made any effort to identify any such rights.

The IEEE-ISTO invites any interested party to bring to its attention any copyrights, patents, or patent applications, or other proprietary rights which may cover technology that may be required to implement the contents of this document. The IEEE-ISTO and its programs shall not be responsible for identifying patents for which a license may be required by a document and/or IEEE-ISTO Industry Group Standard or for conducting inquiries into the legal validity or scope of those patents that are brought to its attention. Inquiries may be submitted to the IEEE-ISTO by e-mail at:

ieee-isto@ieee.org.

The Printer Working Group acknowledges that the IEEE-ISTO (acting itself or through its designees) is, and shall at all times, be the sole entity that may authorize the use of certification marks, trademarks, or other special designations to indicate compliance with these materials.

Use of this document is wholly voluntary. The existence of this document does not imply that there are no other ways to produce, test, measure, purchase, market, or provide other goods and services related to its scope.

TABLE OF CONTENTS

1	Introduction	5
1.1	Problem.....	5
1.2	Solution.....	5
2	Advertisement: IPP Printer available.....	5
2.1	Notify:alive Request.....	5
2.1.1	Template.....	6
2.1.2	Request Line.....	6
2.1.3	HOST	6
2.1.4	CACHE_CONTROL	6
2.1.5	LOCATION.....	6
2.1.6	NT	7
2.1.7	NTS	7
2.1.8	SERVER	7
2.1.9	USN.....	7
2.2	Notify Response.....	7
3	Advertisement: IPP Printer unavailable.....	7
3.1	Notify:byebye Request	7
3.1.1	Template.....	8
3.1.2	Request Line.....	8
3.1.3	HOST	8
3.1.4	NT	8
3.1.5	NTS	8
3.1.6	USN.....	8
3.2	Notify Response.....	8
4	Search: IPP Printer.....	9
4.1	M-SEARCH Request	9
4.1.1	Template.....	9
4.1.2	Request Line.....	9
4.1.3	HOST	9
4.1.4	MAN	9

4.1.5	MX	10
4.1.6	ST	10
4.2	Notify Response	10
4.2.1	Template	10
4.2.2	Response Line	11
4.2.3	CACHE_CONTROL	11
4.2.4	DATE	11
4.2.5	EXT	11
4.2.6	LOCATION	11
4.2.7	SERVER	11
4.2.8	ST	11
4.2.9	USN	12
5	Conformance Requirements	12
6	IANA Considerations	12
7	Internationalization Considerations	12
8	Security Considerations	12
9	References	12
10	Change History	13
11	Author's Addresses	14
12	Appendix A: Summary of other IPP documents	15
13	Appendix B: Description of the IEEE Industry Standards and Technology (ISTO)	15
14	Appendix C: Description of the IEEE-ISTO PWG	16

1 Introduction

1.1 Problem

Not all customer environments support the proposed IETF standard for printer discovery via the Service Location Protocol (SLPv2) [9,10]. An industry wide initiative led by Microsoft to enable network services in an unmanaged network has addressed printing. This initiative is UPnP. The Service Discovery Protocol (SSDP) [3] is widely deployed as part of Microsoft Corporation's UPnP (UPnP) [5] effort.

Although SSDP is not a standards-track Internet protocol, it will be widely deployed. It is important that IPP printers are able to advertise themselves over SSDP in a uniform manner.

1.2 Solution

The UPnP device architecture [4] provides a framework for devices and services including print devices and services. The print services offered in UPnP are simple and targeted at home networks. The semantics for UPnP print services are derived from IPP [2].

UPnP uses SSDP for discovering HTTP based services. SSDP uses multicast advertisements and queries with unicast responses to allow a client to locate an appropriate service provider. UPnP Printers advertise a root device, a print device and a print service. All UPnP devices advertise the root device. An UPnP Printer advertises the print device that is contained in the root device. The advertised print service is contained in the print device. UPnP used devices as containers. The UPnP client interacts with UPnP services.

IPP is not UPnP. It does not fit within the UPnP framework. However IPP and UPnP do share a lot in common such as using HTTP as a transport and they are both based on the same print semantics. It would not be unusual to have both IPP and UPnP print services hosted on the same printer.

An IPP Printer can use SSDP as one method to advertise. The use of SSDP to advertise IPP would be restricted to environments where SSDP is deemed appropriate. Certainly if SSDP is being used to advertise a UPnP printer and the printer also supports IPP, then SSDP should be used to advertise the IPP Printer.

2 Advertisement: IPP Printer available

2.1 Notify:alive Request

An IPP Printer will send out this request when the IPP Printer becomes available on the network or prior to its advertisement expiration (i.e. refresh cache). All SSDP requests/responses are carried in a UDP packet. This request is sent to the SSDP multicast address and port.

2.1.1 Template

Note: Those values in *italics* are variable and explained after the template

```
NOTIFY * HTTP/1.1
HOST: 239.255.255.250:1900
CACHE-CONTROL: max-age = mas
LOCATION: ippurl
NT: urn:pwg-org:IPP:1.1
NTS: ssdp:alive
SERVER: os / osver, IPP / 1.1, prod / prodver
USN: uuid:devuuid::urn:pwg-org:IPP:1.1
Blank line
```

Where

mas = time in seconds until the advertisement expires

ippurl = URL of the IPP printer using the *ipp://* scheme

os = Operating system name

osver = Operating system version

prod = name of the product

prodver = version of the product

devuuid = universally unique id for the IPP Printer

Blank line = a blank line must follow the notify message (i.e. 0x0A 0x0D)

2.1.2 Request Line

Required. This line MUST be 'Notify * HTTP/1.1'.

2.1.3 HOST

Required. Must use the Internet Assigned Numbers Authority (IANA) assigned relative address used with the scoped multicast channel [6] and the IANA assigned port for SSDP [7].

This header MUST be 'HOST: 239.255.255.250:1900'

2.1.4 CACHE_CONTROL

Required. The 'max-age' is the number of seconds until the IPP Printer advertisement expires. The value for 'max-age' is implementation specific. The IPP Printer should re-advertise itself before its current advertisement times out.

This header must be 'CACHE_CONTROL: max-age=*mas*' where *mas* is an implementation or site-specific value.

2.1.5 LOCATION

Required. The location identifies the IPP Printer. This URL is where an IPP Client would direct its IPP Requests. Note that the URL is specified using the *ipp://* scheme. This scheme is mapped to *http://* scheme with an explicit port of 631 [1]. IPP requests will be sent to the IPP Printer in an HTTP 'POST' sent to this IANA assigned port.

Since SSDP is intended for the discovery of HTTP based services the IPP Printer implementation should be prepared to handle an HTTP 'GET' operation on the IPP URL. It is recommended that the 'GET' request be redirected to the embedded web server if possible.

This header must be 'LOCATION: *ippurl*' where *ippurl* is the URI of the printer using the *ipp://* scheme.

2.1.6 NT

Required. The Notification Type (NT) identifies the advertiser as an IPP v1.1 Printer.

This header MUST be 'NT: urn:pwg-org:IPP:1.1'.

2.1.7 NTS

Required. The Notification Sub-Type (NTS) identifies this Notify is announcing the availability of the target.

This header MUST be 'NTS: sssdp:alive'.

2.1.8 SERVER

Recommended. The Server header is required in UPnP. This header contains a concatenation of the OS, OS version, IPP, IPP version, product and product version.

This header SHOULD be present and SHOULD be of the form 'SERVER: *os / osver*, IPP / 1.1, *prod / prodver*'. The values for *os* and *osver* are the name and version of the operating system on the printer. The values for *prod* and *prodver* are the name and version of the printer.

2.1.9 USN

Required. The Unique Service Name (USN) identifies the IPP Printer.

This header MUST be 'USN: *uuid:devuuid::urn:pwg-org:IPP:1.1*' where *devuuid* is a globally unique identifier for the IPP Printer.

2.2 Notify Response

No response is required for a Notify request.

3 Advertisement: IPP Printer unavailable

3.1 Notify:byebye Request

An IPP Printer will send out this request when the IPP Printer is about to become unavailable on the network. All SSDP requests/responses are carried in a UDP packet. This request is sent to the SSDP multicast address and port.

3.1.1 Template

Note: Those values in *italics* are variable and explained after the template

```
NOTIFY * HTTP/1.1
HOST: 239.255.255.250:1900
NT: urn:pwg-org:IPP:1.1
NTS: ssdp:byebye
USN: uuid:devuuid::urn:pwg-org:IPP:1.1
Blank line
```

Where

devuuid = universally unique id for the IPP Printer

Blank line = a blank line must follow the notify message (i.e. 0x0A 0x0D)

3.1.2 Request Line

Required. This line MUST be 'Notify * HTTP/1.1'.

3.1.3 HOST

Required. Must use the Internet Assigned Numbers Authority (IANA) assigned relative address used with the scoped multicast channel [6] and the IANA assigned port for SSDP [7].

This header MUST be 'HOST: 239.255.255.250:1900'

3.1.4 NT

Required. The Notification Type (NT) identifies the advertiser as an IPP v1.1 Printer.

This header MUST be 'NT: urn:pwg-org:IPP:1.1'.

3.1.5 NTS

Required. The Notification Sub-Type (NTS) identifies this Notify is announcing the associated target is no longer available.

This header MUST be 'NTS: ssdp:byebye'.

3.1.6 USN

Required. The Unique Service Name (USN) identifies the IPP Printer.

This header MUST be 'USN: uuid:*devuuid*::urn:pwg-org:IPP:1.1' where *devuuid* is a globally unique identifier for the IPP Printer.

3.2 Notify Response

None

4 Search: IPP Printer

A Client will send out this request to locate an IPP Printer. All SSDP requests/responses are carried in a UDP packet. This request is sent to the SSDP multicast address and port.

4.1 M-SEARCH Request

4.1.1 Template

Note: Those values in *italics* are variable and explained after the template

```
M_SEARCH * HTTP/1.1
HOST: 239.255.255.250:1900
MAN: "ssdp:discover"
MX: mxs
ST: target
Blank line
```

Where

mxs = number of seconds to delay response

target = *all*, *anyIPP*, *specificIPP*

all = ssdp:all

anyIPP = urn:pwg-org:IPP:1.1

specificIPP = uuid:*devuuid*::urn:pwg-org:IPP:1.1

devuuid = universally unique id for the IPP Printer

Blank line = a blank line must follow the notify message (i.e. 0x0A 0x0D)

4.1.2 Request Line

Required. This line MUST be "M_SEARCH * HTTP/1.1".

4.1.3 HOST

Required. Must use the Internet Assigned Numbers Authority (IANA) assigned relative address used with the scoped multicast channel [6] and the IANA assigned port for SSDP [7].

This header MUST be 'HOST: 239.255.255.250:1900'

4.1.4 MAN

Required. The MAN header identifies this 'M-SEARCH' as a discovery request.

This header MUST be 'MAN: "ssdp:discover"'. Note that the value for the MAN header includes the double quotes (").

4.1.5 MX

Required. When sending a response the IPP Printer should choose an arbitrary delay before sending its response. The Maximum Wait (MX) specifies the maximum amount of time in seconds that the target can delay its response.

This header MUST be 'MX: *mxs*' where *mxs* is a implementation specific value.

4.1.6 ST

Required. The Search Target (ST) identifies the group or of a targets, or individual printer, that should respond to the search. IPP Printers should respond to request for all SSDP objects, all IPP Printers and for itself.

To search for all SSDP objects, the header MUST be 'ST: ssdp:all'

To search for all IPP Printers, the header MUST be 'ST: urn:pwg-org:IPP:1.1'

To search for a specific IPP Printer, the header MUST be 'ST: uuid:*devuuid*::urn:pwg-org:IPP:1.1' where *devuuid* is a globally unique identifier for the IPP Printer.

4.2 Notify Response

An IPP Printer will return this response to the client. All SSDP requests/responses are carried in a UDP packet. This response is sent to the unicast address and port of the client.

4.2.1 Template

Note: Those values in *italics* are variable and explained after the template

```
HTTP/1.1 200 OK
CACHE-CONTROL: max-age = mas
DATE: date
EXT:
LOCATION: ippurl
SERVER: os / osver, IPP / 1.1, prod / prodver
ST: target
USN: uuid:devuuid::urn:pwg-org:IPP:1.1
Blank line
```

Where

mas = time in seconds until the advertisement expires

date = current date

ippurl = URL of the IPP printer using the *ipp://* scheme

os = Operating system name

osver = Operating system version

prod = name of the product

prodver = version of the product

target = from the request i.e. *all*, *anyIPP*, *specificIPP*

all = ssdp:all

anyIPP = urn:pwg-org:IPP:1.1

specificIPP = uuid:*devuuid*::urn:pwg-org:IPP:1.1
devuuid = universally unique id for the IPP Printer
Blank line = a blank line must follow the notify message (i.e. 0x0A 0x0D)

4.2.2 Response Line

Required. This line MUST be “HTTP/1.1 200 OK”.

4.2.3 CACHE_CONTROL

Required. The ‘max-age’ is the number of seconds until the IPP Printer advertisement expires. The value for ‘max-age’ is implementation specific. The IPP Printer should re-advertise itself before its current advertisement times out.

This header must be ‘CACHE_CONTROL: max-age=*mas*’ where *mas* is an implementation or site-specific value.

4.2.4 DATE

Required. The DATE header identifies date the response was generated. The format is 1*2DIGIT month 2*4DIGIT (e.g. 31 January 1964). [8].

This header MUST be ‘DATE: *date*’. Where *date* is formatted as indicated above.

4.2.5 EXT

Required. The EXT header indicates the ‘MAN’ header was understood.

This header MUST be ‘EXT:’. Note that the value MUST be empty.

4.2.6 LOCATION

Required. The location identifies the IPP Printer. This URL is where an IPP Client would direct its IPP Requests. Note that the URL is specified using the *ipp://* scheme. (See also section 2.1.5)

This header must be ‘LOCATION: *ippurl*’ where *ippurl* is the URI of the printer using the *ipp://* scheme.

4.2.7 SERVER

Recommended. The Server header is required in UPnP. This header contains a concatenation of the OS, OS version, IPP, IPP version, product and product version.

This header SHOULD be present and SHOULD be of the form ‘SERVER: *os / osver*, IPP / 1.1, *prod / prodver*’. The values for *os* and *osver* are the name and version of the operating system on the printer. The values for *prod* and *prodver* are the name and version of the printer.

4.2.8 ST

Required. The Search Target (ST) identifies the group or of a targets, or individual printer, from the associated request.

The header MUST be copied from the request’s ST header. (See section 4.1.6)

4.2.9 USN

Required. The Unique Service Name (USN) identifies the IPP Printer.

This header MUST be 'USN: uuid:*devuuid*::urn:pwg-org:IPP:1.1' where *devuuid* is a globally unique identifier for the IPP Printer.

5 Conformance Requirements

Advertisement of IPP Printers via SSDP is optional. Any IPP Printer that does advertise using SSDP must respond to queries for all SSDP objects, all IPP Printers as well as request for itself.

6 IANA Considerations

None

7 Internationalization Considerations

None.

8 Security Considerations

TBD

9 References

[1]

Herriot, R., Butler, S., Moore, P., Turner, R., and J. Wenn, "Internet Printing Protocol/1.1: Encoding and Transport", RFC 2910, September 2000.

<http://www.ietf.cnri.reston.va.us/rfc/rfc2910.txt>

[2]

Hastings, T., Herriot, R., deBry, R., Isaacson, S., and P. Powell, "Internet Printing Protocol/1.1: Model and Semantics", RFC 2911, September 2000.

<http://www.ietf.cnri.reston.va.us/rfc/rfc2911.txt>

[3]

Goland, Y., Cai, T. Leach, P., Gu, Y., Albright, S., "Simple Service Discovery Protocol/1.0 Operating without an Arbiter", draft-cai-ssdp-v1-03, October 28, 1999.

http://www.upnp.org/draft_cai_ssdp_v1_03.txt

- [4]
Microsoft Corp “Universal Plug and Play Device Architecture”, Version 1.0, June 8, 2000.
http://www.upnp.org/download/UPnPDA10_20000613.htm
- [5]
Universal Plug and Play Forum, Microsoft Corp.,
<http://www.upnp.org/default.htm>
- [6]
IANA assigned Internet Multicast Addresses
<http://www.isi.edu/in-notes/iana/assignments/multicast-addresses>
- [7]
IANA assigned port numbers
<http://www.isi.edu/in-notes/iana/assignments/port-numbers>
- [8]
Branden, R., IETF, “Requirements for Internet Hosts -- Application and Support”, rfc1123, October 1989.
<http://info.internet.isi.edu/in-notes/rfc/files/rfc1123.txt>
- [9]
St. Pierre, Isaacson, McDonald. “Definition Printer Abstract Service Type v2.0”, , March 2000.
<ftp://ftp.isi.edu/in-notes/iana/assignments/svrlc-templates/printer.2.0.en>
- [10]
E. Guttman, C. Perkins, J. Veizades, M. Day., “Service Location Protocol, Version 2”, rfc2608, June 1999.
<http://info.internet.isi.edu/in-notes/rfc/files/rfc2608.txt>

10 Change History

- 4/17/01 Incorporated input from Carl-Uno Manros and Don Wright. Initial draft release.
- 4/16/01 Incorporated input from Jim Mayer

11 Author's Addresses

Tom Hastings
Xerox Corporation
737 Hawaii St. ESAE 231
El Segundo, CA 90245

Phone: 310-333-6413
Fax: 310-333-5514
e-mail: hastings@cp10.es.xerox.com

Harry Lewis
IBM

Phone: (303) 924-5337
e-mail: harryl@us.ibm.com

Peter Zehler
Xerox Corporation
800 Phillips Road M/S 128-69E
Webster, NY 14580

Phone: 716-265-8755
Fax: 716-265-8792
e-mail: pzehler@crt.xerox.com

IPP Web Page: <http://www.pwg.org/ipp/>
IPP Mailing List: ipp@pwg.org

To subscribe to the ipp mailing list, send the following email:

- 1) send it to majordomo@pwg.org
- 2) leave the subject line blank
- 3) put the following two lines in the message body:
 subscribe ipp
 end

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

Other Participants:
Shivaun Albright Hewlett Packard
Carl-Uno Manros Xerox
Don Wright Lexmark

Bob Van Andel Allegro Systems
Jim Mayer Xerox

12 Appendix A: Summary of other IPP documents

The full set of IPP documents includes:

- Design Goals for an Internet Printing Protocol (RFC2567)
- Rationale for the Structure and Model and Protocol for the Internet Printing Protocol (RFC2568)
- Internet Printing Protocol/1.1: Model and Semantics (RFC2911)
- Internet Printing Protocol/1.1: Encoding and Transport (RFC2910)
- Internet Printing Protocol/1.1: Implementer's Guide (IPP-IIG)
- Mapping between LPD and IPP Protocols (RFC2569)

The “Design Goals for an Internet Printing Protocol” document takes a broad look at distributed printing functionality, and it enumerates real-life scenarios that help to clarify the features that need to be included in a printing protocol for the Internet. It identifies requirements for three types of users: end users, operators, and administrators. It calls out a subset of end user requirements that are satisfied in IPP/1.0. A few OPTIONAL operator operations have been added to IPP/1.1.

The “Rationale for the Structure and Model and Protocol for the Internet Printing Protocol” document describes IPP from a high level view, defines a roadmap for the various documents that form the suite of IPP specification documents, and gives background and rationale for the IETF working group's major decisions.

The “Internet Printing Protocol/1.1: Encoding and Transport” document is a formal mapping of the abstract operations and attributes defined in the model document onto HTTP/1.1 (RFC2616). It defines the encoding rules for a new Internet MIME media type called “application/ipp”. This document also defines the rules for transporting over HTTP a message body whose Content-Type is “application/ipp”. This document defines a new scheme named ‘ipp’ for identifying IPP printers and jobs.

The “Internet Printing Protocol/1.1: Implementer's Guide” document gives insight and advice to implementers of IPP clients and IPP objects. It is intended to help them understand IPP/1.1 and some of the considerations that may assist them in the design of their client and/or IPP object implementations. For example, a typical order of processing requests is given, including error checking. Motivation for some of the specification decisions is also included.

The “Mapping between LPD and IPP Protocols” document gives some advice to implementers of gateways between IPP and LPD (Line Printer Daemon) implementations.

13 Appendix B: Description of the IEEE Industry Standards and Technology (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>.

14 Appendix C: Description of 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 would 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>