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Status of this Memo			6
This document is an Int all provisions of Sect documents of the Intern and its working groups working documents as In	ternet-Draft and is in ful ion 10 of RFC2026. Intern net Engineering Task Force . Note that other groups nternet-Drafts.	ll conformance with het-Drafts are working e (IETF), its areas, may also distribute	7 8 9 10 11
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Abstract			18
This document is a prod Group of the Internet I be submitted to the ipp	duct of the Internet Print Engineering Task Force (I p@pwg.org mailing list.	ting Protocol Working ETF). Comments should	19 20 21
This document is intend with IANA and fully con document defines the " specifying the location object (defined in some IPP/1.1 Model [RFC-2912 [RFC-2910] or any late: "ipp" URL scheme is CO	ded for use in registering nforms to the requirements ipp" URL (Uniform Resource n of an IPP Printer, IPP (e future version of IPP) v 1] and the IPP/1.1 Protoco r version of IPP. The int MMON.	g the "ipp" URL scheme s in [RFC-2717]. This e Locator) scheme for Job, or other IPP which implements the ol encoding over HTTP tended usage of the	22 23 24 25 26 27 28 29
The IPP URL scheme def the HTTP URL scheme de from the URI Generic S [RFC-2732] and [RFC-23 is transformed into an section 5 of the IPP/1	ined in this document is b fined in HTTP/1.1 [RFC-263 yntax [RFC-2396] and furth 73] (for IPv6 addresses in HTTP URL according to the .1 Protocol [RFC-2910].	based on the ABNF for [6], which is derived her updated by h URLs). An IPP URL e rules specified in	30 31 32 33 34 35
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1.	Introduction			
	See section 1 'Introduct the IPP document set and	ion' in [RFC-2911] f overview informatio	or a full description of n about IPP.	60 61
	The open issues in this	document each begin	'ISSUE_n:'.	62
	This document is a produ Group of the Internet En be submitted to the ipp@	ct of the Internet P gineering Task Force pwg.org mailing list	rinting Protocol Working (IETF). Comments should	63 64 65
	This document is intende with IANA and fully conf document defines the "ip specifying the location object (defined in some IPP/1.1 Model [RFC-2911] [RFC-2910] or any later "ipp" URL scheme is COMM	d for use in registe orms to the requirem p" URL (Uniform Reso of an IPP Printer, I future version of IP and the IPP/1.1 Pro version of IPP. The ON.	ring the "ipp" URL scheme ents in [RFC-2717]. This urce Locator) scheme for PP Job, or other IPP P) which implements the tocol encoding over HTTP intended usage of the	66 67 68 69 70 71 72 73
	 This document defines: IPP URL scheme applica IPP URL scheme associa IPP URL scheme associa IPP URL scheme syntax IPP URL scheme charact IPP URL scheme IANA, i considerations. 	bility and intended ted port (i.e., well ted MIME type (i.e., in ABNF [RFC-2234]; er encoding; nternationalization,	usage; -known port 631); "application/ipp"); and security	74 75 76 77 78 79 80 81
	This document is laid ou - Section 2 is the termi	t as follows: nology used througho	ut the document.	82 83
	- Section 3 provides ref model.	erences to the IPP P	rinter and IPP Job object	84 85
	- Section 4 specifies IP	P URL scheme.		86
	- Section 5 specifies th and IPP Printers that	e conformance requir claim conformance to	ements for IPP Clients this document.	87 88
	- Section 6, 7, and 8 sp security consideration	ecify IANA, internat s.	ionalization, and	89 90
	- Sections 9, 10, 11, 12 authors' addresses, ch statement.	, and 13 list refere ange history, and fu	nces, acknowledgements, ll IETF copyright	91 92 93

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2. Terminology

This	specification	document	uses	the	terminology	defined	in	this	94
sect	ion.								95

2.1. Conformance Terminology

The uppercase terms "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL96NOT" "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in97this document are to be interpreted as described in [RFC-2119].98These terms are used to specify conformance requirements for all99implementations of this specification.100

2.2. Model Terminology

See	section	12.2	'Model	Terminology'	in	[RFC-2911].	1	.0:	L
-----	---------	------	--------	--------------	----	-------------	---	-----	---

3. IPP Model for Printers and Jobs

See section 2 'IPP Objec section 2.2 'Job Object' IPP object model and ter	ts', section 2.1 'Printer Ob in [RFC-2911] for a full de minology.	oject', and escription of the	102 103 104
In this document, "IPP C platform) that submits, IPP/1.1 [RFC-2910] [RFC- spooler, gateway, or act	lient" means the software (c monitors, and/or manages pri 2911], or any later version ual printing device.	on some hardware nt jobs via of IPP to a	105 106 107 108
In this document, "IPP P hardware platform) that operations via IPP/1.1 [IPP from an "IPP Client"	rinter object" means the sof receives print jobs and/or p RFC-2910] [RFC-2911], or any	tware (on some printer/job later version of	109 110 111 112
In this document, "IPP P object".	rinter" is a synonym for "IP	PP Printer	113 114
In this document, "IPP J documents for one print	ob object" means the set of job on an "IPP Printer".	attributes and	115 116
In this document, "IPP J	ob" is a synonym for "IPP Jo	b object".	117
In this document, "IPP U	RL" means a URL with the "ip	pp" scheme.	118
Note: In this document, section 4 'IPP URL Schem	"IPP URL" is a synonym for e' of this document) and "ip	"ipp_URL" (in pp-URL" (in	119 120
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section 5 'IPP URL	Scheme' of [RFC-2910]).	121

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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 122 with IANA and fully conforms to the requirements in [RFC-2717]. 123 This document defines the "ipp" URL (Uniform Resource Locator) scheme for 124 specifying the location of an IPP Printer, IPP Job, or other IPP 125 object (defined in some future version of IPP) which implements the 126 IPP/1.1 Model [RFC-2911] and the IPP/1.1 Protocol encoding over HTTP 127 [RFC-2910] or any later version of IPP. The intended usage of the 128 "ipp" URL scheme is COMMON. 129

4.2. IPP URL Scheme Associated IPP Port

All IPP URLs which do NOT explicitly specify a port MUST be used over 130 IANA-assigned well-known port 631 for the IPP protocol described in 131 [RFC-2910]. 132

See: IANA Port Numbers Registry [IANA-PORTREG]. registration with 133 IANA. 134

4.3. IPP URL Scheme Associated MIME Type

All IPP protocol operations (requests and responses) MUST be conveyed135in an "application/ipp" MIME media type as registered in136[IANA-MIMEREG]. IPP URLS MUST refer to IPP Printers which support137this "application/ipp" MIME media type.138

See: IANA MIME Media Types Registry [IANA-MIMEREG]. 139

4.4. IPP URL Scheme Character Encoding

The IPP URL scheme defined in this document is based on the ABNF for 140 the HTTP URL scheme defined in HTTP/1.1 [RFC-2616], which is derived 141 from the URI Generic Syntax [RFC-2396] and further updated by 142 [RFC-2732] and [RFC-2373] (for IPv6 addresses in URLs). The IPP URL 143 scheme is case-insensitive in the host name or host address part; 144 however the path part is case-sensitive, as in [RFC-2396]. 145 Codepoints outside [US-ASCII] MUST be hex escaped by the mechanism 146 specified in [RFC-2396]. 147

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4.5. IPP URL Scheme Syntax in ABNF

Note:	In	this	document,	"IPP	URL"	is a synonym for "ipp_URL" (in	148
section	1 4	'IPP	URL Schem	e' of	this	document) and "ipp-URL" (in	149
section	ı 5	'IPP	URL Schem	e' of	[RFC-	-2910]).	150

This document is intended for use in registering the "ipp" URL scheme 151 with IANA and fully conforms to the requirements in [RFC-2717]. This 152 document defines the "ipp" URL (Uniform Resource Locator) scheme for 153 specifying the location of an IPP Printer, IPP Job, or other IPP 154 object (defined in some future version of IPP) which implements the 155 IPP/1.1 Model [RFC-2911] and the IPP/1.1 Protocol encoding over HTTP 156 [RFC-2910] or any later version of IPP. The intended usage of the 157 "ipp" URL scheme is COMMON. 158

The IPP protocol places a limit of 1023 octets (NOT characters) on159the length of a URI (see section 4.1.5 'uri' in [RFC-2911]). An IPP160Printer MUST return 'client-error-request-value-too-long' (see161section 13.1.4.10 in [RFC-2911]) when a URI received in a request162(e.g., in the "printer-uri" attribute) is too long.163

Note:IPP Printers ought to be cautious about depending on URI164lengths above 255 bytes, because some older client or proxy165implementations might not properly support these lengths.166

IPP URLs MUST be represented in absolute form. Absolute URLs always 167 begin with a scheme name followed by a colon. For definitive 168 information on URL syntax and semantics, see "Uniform Resource 169 Identifiers (URI): Generic Syntax and Semantics" [RFC-2396]. 170 This specification adopts the definitions of "URI-reference", 171 "absoluteURI", "relativeURI", "port", "host","abs_path", "rel_path", 172 and "authority" from [RFC-2396], as updated by [RFC-2732] and 173 [RFC-2373] (for IPv6 addresses in URLs). 174

The IPP URL scheme syntax in ABNF is as follows: 175

ipp_URL = "ipp:" "//" host [":" port] [abs_path ["?" query]] 176

If the port is empty or not given, port 631 is assumed. The177semantics are that the identified resource (see section 5.1.2 of178[RFC-2616]) is located at the IPP Printer or IPP Job listening for179HTTP connections on that port of that host, and the Request-URI for180the identified resource is 'abs_path'.181

Note: The use of IP addresses in URLs SHOULD be avoided whenever 182 possible (see [RFC-1900]). 183

If the 'abs_path' is not present in the URL, it MUST be given as "/" 184

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Internet Draft IPP URL Scheme 13 February 2001 when used as a Request-URI for a resource (see section 5.1.2 of 185 [RFC-2616]). If a proxy receives a host name which is not a fully 186 qualified domain name, it MAY add its domain to the host name it 187 received. If a proxy receives a fully qualified domain name, the 188 proxy MUST NOT change the host name. 189 4.5.1. IPP URL Examples The following are examples of valid IPP URLs for IPP Printers: 190 191 ipp://abc.com ipp://abc.com/printer 192 193 ipp://abc.com/tiger ipp://abc.com/printers/tiger 194 ipp://abc.com/printers/fox 195 ipp://abc.com/printers/tiger/bob 196 ipp://abc.com/printers/tiger/ira 197 198 ipp://printer.abc.com ipp://printers.abc.com/tiger 199 ipp://printers.abc.com/tiger/bob 200 ipp://printers.abc.com/tiger/ira 201 Each of the above URLs are legitimate URLs for IPP Printers and each 202 references a logically different IPP Printer, even though some of the 203 IPP Printers may share the same hardware. The last part of the path 204 'bob' or 'ira' may represent two different hardware devices where 205 'tiger' represents some grouping of IPP Printers (e.g., a 206 load-balancing spooler) or the two names may represent separate human 207 recipients ('bob' and 'ira') on the same hardware device (e.g., a 208 printer supporting two job queues). In either case both 'bob' and 209 'ira' behave as different IPP Printers. 210 The following are examples of IPP URLs with (optional) ports and 211 paths: 212 ipp://abc.com 213 ipp://abc.com/~smith/printer 214 ipp://abc.com:631/~smith/printer 215 The first and second IPP URLs above MUST be resolved to port 631 216 (IANA assigned well-known port for IPP). The second and third IPP 217 URLs above are equivalent (see section 4.5.2 below). 218 Note: The use of IP addresses in URLs SHOULD be avoided whenever 219 possible (see [RFC-1900]). 220 The following literal IPv4 addresses: 221

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Internet	: Draft	IPP URL Scheme		13 February 20	001
1	.92.9.5.5 .86.7.8.9		; IPv4 addre; ; IPv4 addre;	ss in IPv4 sty ss in IPv4 sty:	le 222 le 223
are r	represented in the fo	llowing exampl	e IPP URLs:		224
i i	.pp://192.9.5.5/prt1 .pp://186.7.8.9/print	ers/tiger/bob			225 226
The f	following literal IPv	6 addresses (c	onformant to	[RFC-2373]):	227
: 2	:192.9.5.5 :FFFF:129.144.52.38 2010:836B:4179::836B:	4179	; IPv4 addres ; IPv4 addres ; IPv6 addres	ss in IPv6 sty ss in IPv6 sty ss per RFC 237:	le 228 le 229 3 230
are r	represented in the fo	llowing exampl	e IPP URLs:		231
i i i	.pp://[::192.9.5.5]/p .pp://[::FFFF:129.144 .pp://[2010:836B:4179	rt1 .52.38]:631/pr ::836B:4179]/p	inters/tiger rinters/tiger	/bob	232 233 234

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	235 236
entire URLs, with these exceptions:	237
- A port that is empty or not given is equivalent to the well-known port for that IPP URL (port 631);	238 239
- Comparisons of host names MUST be case-insensitive;	240
- Comparisons of scheme names MUST be case-insensitive;	241
- An empty 'abs_path' is equivalent to an 'abs_path' of "/".	242
Characters other than those in the "reserved" and "unsafe" sets (see [RFC-2396] and [RFC-2732]) are equivalent to their ""%" HEX HEX" encoding.	243 244 245
For example, the following three URIs are equivalent:	246
<pre>ipp://abc.com:631/~smith/printer ipp://ABC.com/%7Esmith/printer ipp://ABC.com:/%7esmith/printer</pre>	247 248 249

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5. C	onformance Requirement	s		
5.	1. Conformance Require	ements for IPP Clients		
IP	P Clients that conform	to this specification:		250
a)	MUST send IPP URLs (e in 'Print-Job') that of this document;	.g., in the "printer-uri" or conform to the ABNF specifie	peration attribute ed in section 4.5	251 252 253
b)	MUST send IPP operation present) or otherwise	ons via the port specified i via IANA assigned well-know	in the IPP URL (if wn port 631;	254 255
с)	MUST convert IPP URLs according to the rules [RFC-2910];	to their corresponding HTTI s in section 5 'IPP URL Sche	? URL forms eme' in	256 257 258
d)	SHOULD interoperate w in section 9 'Interop section 9.2 'Security	ith IPP/1.0 Printers accord erability with IPP/1.0 Imple and URL Schemes' in [RFC-29	ing to the rules ementations' and 910].	259 260 261
5.	2. Conformance Require	ements for IPP Printers		
IP	P Printers that conform	m to this specification:		262
a)	SHOULD reject received bodies (e.g., in the request) that do not section 4.5 of this de	d IPP URLs in "application/: "printer-uri" attribute in a conform to the ABNF for IPP ocument;	ipp" request a 'Print-Job' URLs specified in	263 264 265 266
b)	SHOULD return IPP URL in the "job-uri" attr conform to the ABNF fo document;	s in "application/ipp" respo ibute in a 'Print-Job' respo or IPP URLs specified in sec	onse bodies (e.g., onse) that do ction 4.5 of this	267 268 269 270
с)	MUST listen for IPP of 631, unless explicitly policies;	perations on IANA-assigned v y configured by system admir	well-known port histrators or site	271 272 273
d)	SHOULD NOT listen for explicitly configured	IPP operations on any other by system administrators or	r port, unless r site policies;	274 275
e)	SHOULD interoperate w section 9 'Interoperal section 9.2 'Security	ith IPP/1.0 Clients accordin bility with IPP/1.0 Implemen and URL Schemes' in [RFC-29	ng to the rules in ntations' and 910].	276 277 278

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6. IANA Considerations

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This document is intended for use in registering the "ipp" URL scheme	279
with IANA and fully conforms to the requirements in [RFC-2717]. This	280
document defines the "ipp" URL (Uniform Resource Locator) scheme for	281
specifying the location of an IPP Printer, IPP Job, or other IPP	282
object (defined in some future version of IPP) which implements the	283
IPP/1.1 Model [RFC-2911] and the IPP/1.1 Protocol encoding over HTTP	284
[RFC-2910] or any later version of IPP. The intended usage of the	285
"ipp" URL scheme is COMMON.	286

This IPP URL Scheme specification does not introduce any additional 287 IANA considerations, beyond those described in [RFC-2910] and 288 289 [RFC-2911].

See:	Section	б	'IANA	Considerations'	in	[RFC-2910]	290
See:	Section	6	'IANA	Considerations'	in	[RFC-2911].	291

7. Internationalization Considerations

This	IPP URL Scheme specification does not introduce any additional	292
inter	nationalization considerations, beyond those described in	293
[RFC-	2910] and [RFC-2911].	294
See:	Section 7 'Internationalization Considerations' in [RFC-2910].	295
See:	Section 7 'Internationalization Considerations' in [RFC-2911].	296

8. Security Considerations

This	IPP URL Scheme specification does not introduce any additional	297
secur	ity considerations, beyond those described in [RFC-2910] and	298
[RFC-	2911].	299
See:	Section 8 'Security Considerations' in [RFC-2910].	300
See:	Section 8 'Security Considerations' in [RFC-2911].	301

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

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9.	Refe	rences			
	See: See:	Section 1 Section 9	0 'References' in [RFC-2910 'References' in [RFC-2911]].	302 303
	[IANA ftp:/	-CHARREG] : /ftp.isi.ed	IANA Charset Registry. du/in-notes/iana/assignment	s/character-sets	304 305
	[IANA ftp:/	-MIMEREG] : /ftp.isi.ed	IANA MIME Media Types Regis du/in-notes/iana/assignment	try. s/media-types/	306 307
	[IANA ftp:/	-PORTREG] : /ftp.isi.ed	IANA Port Numbers Registry. du/in-notes/iana/assignment	s/port-numbers	308 309
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Section 5 'IPP URL Scheme' in IPP/1.1 Encoding and Transport	365
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file:///C|/MYDOCU~1/IPP_URL2.TXT (13 of 16) [2/13/2001 1:12:12 PM]

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[RFC-2910] was specification.	the primary inpu	t to this IPP.	URL Scheme	366 367

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12. Appendix X - Change History

[To be deleted before RF	C publication]	382
<pre>13 February 2001 - draft - revised section 3 'IPP 'IPP URL Scheme Syntax (in this document) is request of Bob Herriot - revised section 4.5 'I that showed "http:" ra request of Tom Hasting - revised section 4.5.1 the use of literal IP [RFC-1900];</pre>	-ietf-ipp-url-scheme-02.txt Model for Printers and Jobs in ABNF' to add notes stati a synonym for "ipp-URL" in [; PP URL Scheme Syntax in ABNF ther than "ipp:" in the one- s; 'IPP URL Examples' to add a addresses in URLs, per [RFC-	383 and section 4.5 ng that "IPP URL" RFC-2910], per 386 387 ' to correct typo 1ine ABNF, per 390 note discouraging 2616] and 393
5 February 2001 - draft- - revised section 4.1 'I clarify that a given I an IPP Job object, per - revised section 4.5 'I URLs consistently with [RFC-2616], per reques	ietf-ipp-url-scheme-01.txt PP URL Applicability and Int PP URL MAY identify an IPP P request of Tom Hastings; PP URL Scheme Syntax in ABNF section 3.2.2 'http URL' of st of Tom Hastings;	394 ended Usage' to 395 printer object or 396 397 '' to define IPP 398 HTTP/1.1 399 400
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Internet Draft	IPP URL Scheme	13 February	2001
 revised section 4.5 'IP IPP URLs may reference (possibly other future) added section 4.5.1 'IP examples of IPP URLs wi addresses, per request added section 4.5.2 'IP comparisons consistent HTTP/1.1 [RFC-2616], pe revised section 5.1 'Co clarify that an IPP Cli corresponding HTTP URL Scheme' in [RFC-2910], revised section 5.1 'Co section 5.2 'Conformance that IPP Clients and IP systems according to se Implementations' in [RF revised section 5.2 'Co clarify that an IPP Pri well-known) port 631, u Michael Sweet; revised section 5.2 'Co clarify that an IPP Pri (IANA assigned well-kno per request of Don Wrig revised section 6 'IANA purpose of the entire d URL scheme; deleted Appendix A 'Reg is already registered); deleted Appendix B 'Reg unnecessary (MIME regis 	P URL Scheme Syntax i IPP Printer objects, IPP objects, per req P URL Examples' to su th host names, IPv4 a of Tom Hastings; P URL Comparisons' to y with section 3.3 'U er request of Tom Hast onformance Requirement ent MUST convert IPP forms according to se per request of Tom Ha onformance Requirement e Requirements for IP P Printers SHOULD int ection 9 'Interoperabi C-2910], per request onformance Requirement inter MUST listen on (anless explicitly conf onformance Requirement inter SHOULD NOT liste own) port 631, unless ht; A Considerations' to c locument is IANA regis distration of IPP Port per y has recently caug etf-ipp-url-scheme-00	n ABNF' to clarify IPP Job objects, or uest of Bob Herriot pply meaningful ddresses, and IPv6 define IPP URL RI Comparison' of ings; s for IPP Clients' URLs to their ction 5 'IPP URL stings and Bob Herr s for IPP Clients' P Printers' to clar eroperate with IPP/1 lity with IPP/1.0 of Carl Kugler; s for IPP Printers' IANA assigned igured, per request s for IPP Printers' explicitly configured clarify that the solution of the "ipp ' as unnecessary (per plication/ipp" as th up to RFC 2910); .txt	that 401 402 403 404 405 406 407 408 409 to 410 411 412 iot; 413 and 414 ify 415 1.0 416 417 418 to 419 0f 421 420 of 421 422 to 423 an 424 ed, 425 e 427 " 428 ort 430 431 432
 initial version - simpl query part (consistent added Appendix A 'Regis updated IANA registrati added Appendix B 'Regis updated IANA registrati IPP/1.0 and IPP/1.1; 	with existing and IPP etration of IPP Port' on of port 631 with r tration of MIME "appl on for IPP MIME type	thout parameters or /1.1 implementations (placeholder) for references to IPP/1. ication/ipp"' with with references to I	435 435 436 437 1; 438 439 both 440 441

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