

Internet Printing Protocol/1.0: Directory Schema

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Abstract

This Internet-Draft specifies an Internet Printing Protocol (IPP) that is intended to be version 1.0. This protocol is heavily influenced by the semantic operations and attributes defined in ISO/IEC 10175 Document Printing Application (DPA) parts 1 and 3. It also incorporates some of the implementation and interoperability lessons learned from other printing related standards such as POSIX System Administration - Part 4 (POSIX 1378.4) and X/Open A Printing System Interoperability Specification (PSIS).

IPP is defined as a set of abstract data types and operations. The operations are implemented using a simple request and response mechanism built on top of HTTP. The abstract data types are encoded as simple ASCII text strings.

The IPP protocol covers only end user operations on basic print service objects. Authentication is realized by mechanisms outside the scope of the protocol, but the protocol does introduce some access control functionality so that only authorized end users are allowed to submit print jobs to printers whose implementation and site policy support access control. Also, the Cancel Job operation requires some authentication so that jobs can only be canceled by the end user who submitted the job. Extended monitoring and management is possible through other protocols such as the SNMP Printer MIB. In the areas

46 where there are no existing standards, some proposed and emerging
47 standards are being worked (management, security, etc.). As these
48 services become more stable, this document (and hence the protocol)
49 can be updated to reflect the integration and relationships with
50 these other standards.

51 Table of Contents

52	1. Introduction	2
53	2. Naming	3
54	2.1 Directory Services	4
55	2.2 Directory Entry Schema	4
56	2.2.1 Name	5
57	2.2.2 Description	5
58	2.2.3 Location	5
59	2.2.4 Maximum Print Quality	5
60	2.2.5 Cost	5
61	2.2.6 Resolution	5
62	2.2.7 Color Supported	5
63	2.2.8 Fonts Supported	6
64	2.2.9 Maximum Speed	6
65	2.2.10 Device Id	6
66	2.2.11 Make and Model	6
67	2.2.12 Marker Type	6
68	2.2.13 Document Formats Supported	7
69	2.2.14 Sides Supported	7
70	2.2.15 Finishings Supported	7
71	2.3 Directory Entries Using LDAP	7
72	3. Security Considerations	8
73	4. References	9
74	5. Author's Address	9

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76 1. Introduction

77 The Internet Printing Protocol (IPP) is an application level protocol
78 that can be used for distributed printing on the Internet. The
79 protocol is heavily influenced by the printing model introduced in
80 the Document Printing Application (ISO/IEC 10175 DPA) standard, which
81 describes a distributed printing service. DPA identifies the end user
82 and administrative roles associated with a distributed printing
83 service, and defines the set of operations supported by the service.
84 This IPP specification (version 1.0) deals only with the end user
85 role. These ideas and concepts, when unified with other Internet
86 protocols and services, realize a distributed print service for the
87 Internet.

88 This specification uses the verbs: "shall", "should", "may", and
89 "need not" to specify conformance requirements as follows:

90 - "shall": indicates an action that the subject of the sentence
91 must implement in order to claim conformance to this specification

- 92 - "may": indicates an action that the subject of the sentence does
93 not have to implement in order to claim conformance to this
94 specification, in other words that action is an implementation
95 option
- 96 - "need not": indicates an action that the subject of the sentence
97 does not have to implement in order to claim conformance to this
98 specification. The verb "need not" is used instead of "may not",
99 since "may not" sounds like a prohibition.
- 100 - "should": indicates an action that is recommended for the subject
101 of the sentence to implement, but is not required, in order to
102 claim conformance to this specification.

103 2. Naming

104 Clients identify Printer objects by using an HTTP type URL. For
105 example, a URL for a Printer object named "printer-1" whose network
106 node's domain name is "some.domain.com", might look like:

107 `http://some.domain.com/printer-1`

108 In this case, the URL identifies the use of the HTTP protocol. The
109 Printer is located at the node identified by the DNS name
110 "some.domain.com" and "printer-1" is the name of the Printer.

111 Another example is the following URL:

112 `http://1.2.3.4:nnn/printer-2`

113 In this case, the URL identifies the use of the HTTP protocol. The
114 Printer is located at the node identified by the IP address of
115 "1.2.3.4" using port nnn for the HTTP server, and "printer-2" is the
116 name of the Printer. (The actual value of nnn is to be assigned by
117 IANA as part of this standards project).

118 It is not necessary to expose the Job Template objects that might be
119 associated with a given printer as separate objects. They can be
120 exposed in two ways through URL naming.

- 121 - The Job Template can be hidden from the end user by a URL that
122 represents just the Job Template name (but does not expose the
123 Printer object name) as the two URLs

- 124 1) `http://some.domain.com/two-sided-printer`, and
125 2) `http://some.domain.com/draft-printer`.

126
127 These look like two different Printers , but underneath they
128 represent the same Printer object, but that Printer object has two
129 associated Job Templates and each is exposed through a different
130 URL for the same Printer object. Each one of the Job Templates

131 specified by a URL would contain a different Job Template default
132 attribute set. One Job Template would contain the defaults for
133 two-sides printing and the other would contain the defaults for
134 draft printing.

135 - The Job Template can be exposed along with the name of the Printer
136 object directly in the URL as in:

- 137 1) <http://some.domain.com/hr-printer/resumes>
138 2) <http://some.domain.com/hr-printer/1040forms>

139 In this case there are "resumes" and "1040forms" Job Templates
140 associated with the "hr-printer" Printer.

141 This specification establishes, through IANA, a new well known port,
142 port nnn, for the use of IPP over HTTP. The purpose of this new well
143 known port would be to distinguish printing from non-printing
144 content. While any acceptable HTTP content could be inter-mixed over
145 HTTP well known port 80, only IPP printing would be acceptable on
146 port nnn.

147 2.1 Directory Services

148 IPP does not require any specific directory service. However, this
149 specification does define a generic schema that can be used for any
150 specific instance of a directory service. That is, some of the
151 attributes from the Printer object are called out as attributes that
152 may be added to a directory entry which represents that Printer.
153 This allows directory users to find and locate IPP Printers by either
154 a simple name look up or by some filtered attribute search.

157 2.2 Directory Entry Schema

158 The following attributes define the generic directory entry schema.
159 All directories entries for IPP Printers in all types of directories
160 should support at least these attributes.

161 Issue: The use of "objective" attributes vs. "subjective" attributes
162 still needs to be resolved. For example, for Maximum Print Quality
163 is it better to have values like "high", "medium", "low" or to have
164 explicit, quantified, measurable values? Some of the issues are: end
165 users don't often know what explicit objective values are or what
166 they really mean and they want to depend on an administrator to
167 define what is "high" quality printing and what is "low" quality,
168 especially since today's objective values that equate to "high" are
169 tomorrow's objective values that equate to "medium". On the other
170 hand, some end users demand the control and power explicit values can
171 give them when they do filtered searching. For example, they know
172 and appreciate the difference between 20 ppm printers and 23 ppm
173 printers.

174 Issue: We must specify which attributes are "mandatory" and which are
175 "optional". LDAP uses the terms "must" and "may" to identify
176 attributes that "must" appear and attributes that "may" appear in a
177 given entry in the directory.

178 2.2.1 Name

179 This directory attribute is the printers name. It is a URL so it
180 contains sufficient information to not only name, but to address the
181 printer using IPP as well.

182 2.2.2 Description

183 This directory attribute is a free form string that can contain any
184 site-specific descriptive information about this printer.

185 2.2.3 Location

186 This directory attribute is a free form string that can contain any
187 site specific location information.

188 In order for filtered searches to be more effective, a given site may
189 use some regular structuring within the string values such as
190 "SITE:USA-San Jose,BUILDING:A1,FLOOR:2,ROOM:555" or "department5-
191 2ndFloor-A5-IndianHills-Chicago-IL-USA".

192 2.2.4 Maximum Print Quality

193 This directory attribute indicates a somewhat subjective evaluation
194 of the overall printing quality. The syntax and values shall be the
195 same as for the print-quality Job attribute.

196 2.2.5 Cost

197 This directory attribute indicates a somewhat subjective evaluation
198 of the overall cost of printing at this printer: "high", "medium", or
199 "low".

200 2.2.6 Resolution

201 This directory attribute is the maximum resolution of the Printer in
202 dpi.

203 The syntax and semantics shall be the same as for the printer-
204 resolution-select job attribute.

205 2.2.7 Color Supported

206 This directory attribute specifies whether the Printer supports color
207 and, if so, what type. The values are a type2Enum (see section 6).

208 Standard values are: "none", "highlight", "three color (CMY)", "four
209 color (CMYK)", "monochromatic".

210 2.2.8 Fonts Supported

211 This directory attribute takes on a list of fonts that are supported
212 by the printer. The syntax and values shall be the same as for the
213 fonts-used job attribute..

214 2.2.9 Maximum Speed

215 This directory attribute is the maximum speed of the printer ppm,
216 ipm, spm, lpm, or cps. The syntax and values shall be the same as
217 for the maximum-printer-speed Printer attribute.

218 2.2.10 Device Id

219 This directory attribute can be used for automatic driver download,
220 database access, or other automatic configuration tasks. It might be
221 used to generate a platform specific id such as the Windows Plug-and-
222 Play id.

223 Issue: Is this the IEEE 1284-1994 device id, the Object Identifier as
224 used in the Host Resource MIB hrDeviceId object, or some other
225 identifier?

226 2.2.11 Make and Model

227 This directory attribute is a simple text string defined by the
228 manufacturer that contains some reference to the make and model of
229 the entity being represented to the end-user by this Printer object.
230 The syntax shall be:

231 vendor-name "/" model-name

232 where the vendor-name is the same as that registered with IANA for
233 use in domain names.

234 For example: "vendor-x/super-duper-printer".

235 2.2.12 Marker Type

236 This directory attribute is the printing mechanism of the print
237 device: electrophotographic-laser, inkjet-aqueous, thermal-transfer,
238 etc. The syntax and values shall be the same as for the printer-
239 types Printer attribute, except the value of the Marker Type
240 directory attribute shall be single-valued

241 2.2.13 Document Formats Supported

242 This directory attribute is a list of all of the document formats
243 that the printer and/or its interpreter(s) support. The syntax and
244 values shall be the same as for the document-format Job attribute.

245 2.2.14 Sides Supported

246 This directory attribute specifies the capabilities of the Printer
247 for marking on sides of the medium. The syntax and values shall be
248 the same as the sides Job attribute.

249 2.2.15 Finishings Supported

250 This directory attribute identifies the finishing operations
251 supported by the Printer. The syntax and values shall be the same as
252 the finishing job attribute.

253 2.3 Directory Entries Using LDAP

254 To allow directory users to locate an IPP Printer, a corresponding
255 entry must be defined within a directory. This section describes how
256 this is done using the Lightweight Directory Access Protocol (LDAP).

257 The LDAP directory entry includes the name of the entry and the
258 attributes as defined in "4.2 Directory Entry Schema". The following
259 is an example of how to define a directory entry for a Printer object
260 using LDAP. It is given to assist the reader's understanding of this
261 specification.

262 To create a Printer object directory entry using LDAP:

263 1. An administrator uses a program to create an entry for the Printer
264 object on a directory server that supports LDAP. The administrator
265 defines the Distinguished Name (dn) and the default subjective
266 attributes for the Printer object directory entry.

267 Issue: Should the administrator also define default objective
268 attributes or wait for the Printer object itself to initialize these
269 attributes?

270 2. The Printer object invokes the ldap_open API to open a connection
271 to the directory server:

272 Example: ld=ldap_open ("dir.host.name", LDAP_PORT)

273 where ld is the connection handle for subsequent LDAP APIs.

274 3. The Printer object invokes an ldap "bind" API to authenticate with
275 the directory server.

276 Example: ldap_simple_bind_s (ld, dn, NULL) (which does a simple
277 authentication without a password).

278 4. The Printer object invokes the ldap_modify or ldap_modify_s API to
279 define the objective attributes for the Printer object entry as
280 identified by its Distinguished Name (dn).

281 Example: ldap_modify_s (ld, dn, mods) (where mods is a NULL-
282 terminated array of objective attributes and values to add or modify
283 in the directory entry)

284 5. The Printer object invokes the ldap_unbind API to close the
285 connection to the directory server.

286 Example: ldap_unbind (ld)

287 When one or more objective attributes are modified for a Printer
288 object, the Printer object repeats steps 2-5 to update the modified
289 objective attributes in its directory entry.

290 To locate a Printer object entry using LDAP, a program can use the
291 ldap_search or ldap_search APIs or a user can specify an LDAP URL.

292 For example, to locate all Printer objects that support duplex, a
293 user can specify URL:

```
294 ldap:///dir.host.name???(objectClass=printer)  
295 (sides-supported=2-sided-long-edge)  
296
```

297 Issue: Is it allowed to filter the search based on the object class
298 itself, in this case the object class of Printer? We need to define
299 this new object class. How do we do this? One proposal is to
300 subclass the device class defined in X.500:

```
301 printer OBJECT-CLASS ::= {  
302     SUBCLASS OF {device}  
303     MUST CONTAIN {<list of mandatory attributes>}  
304     MAY CONTAIN {<list of optional attributes>}  
305
```

306 3. Security Considerations

307 This protocol does not identify any new authentication mechanisms.
308 The authentication mechanisms built into HTTP (such as SSL and SHTTP)
309 are recommended.

310 This protocol does define a simple authorization mechanism by
311 introducing the "end-user-acl" attribute as part of the Printer
312 object. This ACL attribute is a multi-valued list of all of the
313 authenticated names of end-users. This protocol does not specify
314 what the domain is for names in this ACL attribute.

315 Issue: Will it always be possible for a Printer to obtain a
316 meaningful authenticated name that the Printer can match against the
317 end-user-acl, or will some other mechanism be necessary, such as a
318 password?

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355 5. Author's Address

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