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9 Internet Printing Protocol (IPP):
10 **Printer Installation Extension**

11
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24 **Abstract**

25
26 This document describes an OPTIONAL extension to the Internet Printing Protocol/1.0 (IPP)
27 [RFC2566, RFC2565] and IPP/1.1 [RFC2911, RFC2910]. Various client platforms require that some
28 setting up take place at the workstation before the client can properly submit jobs to a specific printer.
29 This setup process is sometimes referred to as printer installation. Most clients need some information
30 about the printer being installed as well as support files to complete the printer installation. The nature
31 of these "Client Print Support Files" varies depending on the specific client platform, from simple
32 configuration files to highly sophisticated printer drivers. The selection and installation process can be
33 simplified and even automated if the workstation can learn some key information about the printer and
34 which sets of Client Print Support Files are available. Such key information includes: operating system
35 type, CPU type, document-format (PDL), natural language, compression mechanism, file type, client file
36 name, policy for automatic loading, file size, file version, file date and time, file information description,
37 and digital signature.

38

38

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83 1 Introduction

84 This IPP notification specification is an OPTIONAL extension to Internet Printing Protocol/1.0 (IPP)
85 [RFC2566, RFC2565] and IPP/1.1 [RFC2911, RFC2910]. See section 13 for a brief description of the
86 IPP base documents.

87 A common configuration for printing from a workstation requires that some Client Print Support Files
88 (e.g., PPD, printer driver files) specific to the target printer be installed on that workstation. Selection
89 and configuration of the appropriate Client Print Support Files can be simplified and even automated if
90 the workstation can obtain some key information about the printer and which sets of Client Print
91 Support Files are available. Such key information includes: operating system type, CPU type,
92 document-format (PDL), natural language, compression mechanism, file type, client file name, policy
93 for automatic loading, file size, file version, file date and time, file information description, and digital
94 signature.

95 The **OPTIONAL** IPP extension defined in this document provides a simple and reliable vehicle for
96 printers to convey this information to interested workstations. This extension enables a flexible solution
97 for installing Client Print Support Files on workstations running different operating systems and for
98 printers of all makes and models. It allows Client Print Support Files to be downloaded from
99 repositories of different sorts. A possible repository for the files is the printer itself. The extensions
100 necessary for getting Client Print Support Files from the printer are included in this document, including
101 security for downloading executable code and data.

102 2 Terminology

103 This section defines the following terms that are used throughout this document:

104 This document uses the same terminology as [RFC2911], such as “attribute”, “attribute value”,
105 “keyword”, “operation”, “request”, “response”, and “support”. In addition, the following terms are
106 defined for use in this document and the Delivery Method Documents:

107 **Client Print Support Files** - a set of files, such as a printer driver, font metric file, printer configuration
108 file (PPD, GPD, etc.) that support a client printing to a particular Printer. A Printer MAY have multiple
109 sets of Client Print Support Files that work for different operating systems, document formats, natural
110 languages, CPUs, etc.

111 This document uses the same terminology as [RFC2911], such as “client”, “Printer”, “attribute”,
112 “attribute value”, “keyword”, “operation”, “request”, “response”, and “support”. This document uses
113 terms such as “attributes”, “keywords”, and “support”. These terms have special meaning and are
114 defined in the model terminology [RFC2911] section 12.2. This document also uses the terms “IPP
115 Printer”, “Printer” and “Printer object” interchangeably as in [RFC2911] to mean the software entity
116 that accepts IPP operation requests and returns IPP operation responses (see [RFC2911] section 2).

117 Capitalized terms, such as MUST, MUST NOT, REQUIRED, SHOULD, SHOULD NOT, MAY,
118 NEED NOT, and OPTIONAL, have special meaning relating to conformance. These terms are defined

119 ~~in [RFC2911] section 12.1 on conformance terminology, most of which is taken from as define in RFC~~
 120 ~~2119 [RFC2119] and [RFC2911] section 12.1. If an implementation supports the extension defined in~~
 121 ~~this document, then these terms apply; otherwise, they do not. These terms define conformance to this~~
 122 ~~document only; they do not affect conformance to other documents, unless explicitly stated otherwise.~~

123 ~~This section defines the following additional terms that are used throughout this document:~~

124 ~~REQUIRED: if an implementation supports the extensions described in this document, it MUST~~
 125 ~~support a REQUIRED feature.~~

126 ~~OPTIONAL: if an implementation supports the extensions described in this document, it MAY~~
 127 ~~support an OPTIONAL feature.~~

128 3 Model Extensions

129 To assist workstations in the printer installation process, an IPP printer needs to provide the
 130 workstation with information about the Client Print Support Files, such as the their name and location/s.
 131 This information needs to match the workstation's specific environment, such as its operating system,
 132 preferred natural language, and preferred document format.

133 The following extensions to the IPP model enable assisted or automated printer installation. This
 134 section describes each extension in detail.

- 135 - A new REQUIRED Printer Description attribute: "client-print-support-files-supported" (1setOf
 136 octetString(MAX)).
- 137 - A new REQUIRED Get-Printer-Attributes operation attribute: "client-print-support-files-filter"
 138 (octetString(MAX)).
- 139 - A new RECOMMENDED printer operation: Get-Client-Print-Support-Files.

140 3.1 client-print-support-files-supported (1setOf octetString(MAX))

141 An IPP Printer uses the REQUIRED Printer Description attribute "client-print-support-files-supported"
 142 to represent relevant information about all of the Client Print Support Files it supports. Each value is a
 143 composite UTF-8 string with well-defined fields (see Table 1). Each value string MUST be formatted
 144 as follows:

145 "uri=val₁< field-name₂=val₂₁,...,val_{2p}< ... < field-name_n=val_{n1},...,val_{nq}<"

146 The first field MUST be the "uri" field. The remaining fields MAY be in any order.

147 The string MUST NOT include any control characters (hex 00 to 1F), even the so-called white space
 148 control characters (TAB, CR, and LF) anywhere. Only zero or more UTF-8 SPACE characters (hex
 149 20) can be included and they can be included only IMMEDIATELY AFTER the delimiter character:
 150 "<", but NOT anywhere else, including after "=", and ",". However, if the UTF-8 SPACE character is
 151 needed in a client-file-name value, then each occurrence is included directly, without escaping (see

152 example). On the other hand, if the UTF-8 SPACE character is needed in a URL value, then each
153 occurrence is escaped as: “%20” (URI conventions - see [RFC2396]).

154 Table 1 lists the REQUIRED fields that a Printer MUST support and the OPTIONAL fields that a
155 Printer MAY support in the “client-print-support-files-supported” (1setOf octetString(MAX)) Printer
156 Description attribute. A Printer implementation MAY support additional fields using the same syntax.
157 Values are defined to be either CASE-SENSITIVE or ALL-LOWER-CASE according to the
158 definitions for the attribute syntaxes from [RFC2911] (set off by single quotes in the table). The CASE-
159 SENSITIVE values MAY have upper and lower case letters as for the corresponding attribute syntaxes
160 in [RFC2911]. The LOWER-CASE values MUST have all lower case alphabetic letters. Additional
161 characters, such as digits, hyphen-minus (-), period (.), and slash (/) are according to the corresponding
162 attribute syntaxes in [RFC2911]. Additional values for these fields can be registered with IANA
163 according to the procedures in [RFC2911] for registering additional values of attributes. Additional
164 fields can be registered with IANA according to the procedures defined in [RFC2911] for registering
165 attributes. See section 7.

166 Clients SHOULD ignore fields they don't recognize in a given value. This allows for future extensions
167 to the format of the string without breaking compatibility with earlier clients.

Table 1 - “client-print-support-files-supported” attribute fields

Field name	Field value
“uri”	<p>One REQUIRED CASE-SENSITIVE ‘uri’ string identifying the uri where to obtain the support files for each OS platform, document format, and natural language the printer supports. This MUST be the first field in each value. Examples of uri schemes that MAY be found here are ‘ftp’, ‘http’, and ‘ipp’. The ‘ftp’ and ‘http’ schemed URIs identify the archive file that contains all the necessary client support files.</p> <p>The ‘ipp’ schemed URIs identify the archive file that clients MAY obtain from the Printer using the Get-Client-Print-Support-Files operation (see section 3.3). The URI MUST be a valid URI to the same Printer object, i.e., one of the values of the Printer's "printer-uri-supported" attribute. The ‘ipp’ URI is used to distinguish between multiple Client Print Support Files in an implementation dependent manner using the URL query syntax (e.g., "?drv-id=xxx") [RFC2396]. The query part MUST NOT exceed 127 octets, not counting the “?” character that begins the query part. A Printer SHOULD support the ‘ipp’ scheme.</p>
“os-type”	<p>One or more REQUIRED comma-separated LOWER-CASE ‘keyword’ strings identifying the operating system types supported by this set of Client Print Support Files. Valid values are the operating system names defined in the IANA document [os-names] and the special keyword value: ‘unknown’. Although the IANA registry requires that the names be all upper-case, the values MUST be all lower case in this field (plus hyphen-minus (-), period (.), and slash (/)). Examples: ‘linux’, ‘linux-2.2’, ‘os/2’, ‘sun-os-4.0’, ‘unix’, ‘unix-bsd’, ‘win32’, ‘windows-95’, ‘windows-98’, ‘windows-ce’, ‘windows-nt’, ‘windows-nt-4’, ‘windows-nt-5’, ‘unknown’.</p>
“cpu-type”	<p>One or more REQUIRED comma-separated LOWER-CASE ‘keyword’ strings identifying the CPU types supported by this set of Client Print Support Files. The values indicate the CPU family independent of the CPU manufacturer. Standard keyword values are: ‘x86-16’, ‘x86-32’, ‘x86-64’, ‘dec-vax’, ‘alpha’, ‘power-pc’, ‘m-68000’, ‘sparc’, ‘itanium’, ‘mips’, ‘arm’ and will be used as the initial value for the “cpu-type” IANA registry. In addition, the special keyword value: ‘unknown’ is valid.</p>
“document-format”	<p>One or more REQUIRED comma-separated CASE-SENSITIVE ‘mimeType’ strings identifying the document formats supported by this set of Client Print Support Files. Valid values are the string representation of the IPP mimeType attribute syntax (see [RFC2911] section 4.1.9), for example ‘application/postscript’. In addition, the special keyword value: ‘unknown’ is valid.</p>
“natural-language”	<p>One or more REQUIRED comma-separated LOWER-CASE ‘naturalLanguage’ strings identifying the natural language used by this set of Client Print Support Files. Valid values are the string representation of the IPP ‘naturalLanguage’ attribute syntax (see [RFC2911] section 4.1.8), for example ‘en’ and ‘en-us’. In addition, the special keyword value: ‘unknown’ is valid.</p>

Field name	Field value
“compression”	One REQUIRED LOWER-CASE ‘keyword’ string identifying the mechanism used to compress this set of Client Print Support Files. All files needed for the installation of a printer driver MUST be compressed into a single file. Valid keyword values are the keywords defined by [RFC2911] or registered with IANA for use in the IPP “compression” and “compression-supported” attributes. See [RFC2911] section 4.4.32), for example ‘gzip’. The ‘none’ value limits the uncompressed Client Print Support File to a single file. The values for the “compression” field that a Printer supports NEED NOT be the same values that the Printer is configured to support in Job Creation operations as indicated in the Printer’s “compressions-supported” attribute.
“file-type”	One or more REQUIRED comma-separated LOWER-CASE ‘keyword’ strings identifying the type of the Client Print Support Files. Standard keyword values are: ‘printer-driver’, ‘ppd’, ‘updf’, ‘gpd’.
“client-file-name”	One REQUIRED CASE-SENSITIVE string identifying the name by which the Client Print Support Files will be installed on the workstation. For Client Print Support Files of type ‘printer-driver’, this is also the name that identifies this printer driver in an .inf file.
“policy”	One OPTIONAL LOWER-CASE ‘keyword’ string indicating the policy for automatic loading. Standard keyword values are: ‘manufacturer-recommended’, ‘administrator-recommended’, ‘manufacturer-experimental’, ‘administrator-experimental’. The experimental values are for beta test.
“file-size”	One OPTIONAL file size in octets represented as ASCII decimal digits.
“file-version”	One OPTIONAL LOWER-CASE version number. Recommended to be of the form “Major.minor[.revision]” where “Major” is the major version number, “minor” is the minor version number and “revision” is an optional revision number.
“file-date-time”	One OPTIONAL File CASE-SENSITIVE creation date and time according to ISO 8601 where all fields are fixed length with leading zeroes (see [RFC2518] Appendix 2). Examples: 2000-01-01T23:09:05Z and 2000-01-01T02:59:59-04.00
“file-info”	One OPTIONAL CASE-SENSITIVE human readable ‘text’ string describing this set of Client Print Support Files. The natural language for this value MUST be the natural language indicated by the Printer’s “natural-language-configured” attribute. To avoid exceeding the maximum limit imposed on IPP attributes and to increase interoperability with other systems, the length of this field value MUST not exceed 127 characters.
“digital-signature”	One REQUIRED LOWER-CASE ‘keyword’ string identifying the mechanism used to ensure the integrity and authenticity of this set of Client Print Support Files. Standard values are: ‘smime’, ‘pgp’, ‘dss’, and ‘xmldsig’ which are defined in [RFC2634], [RFC1991], [dss], and [xmldsig], respectively. In addition, the special keyword value: ‘none’ is valid.

169 Each value MUST refer to one and only one set of Client Print Support Files, even if the files are
170 downloadable from various repositories (i.e., even if they are associated with multiple URIs).

171 3.1.1 Use of Keyword Values in fields

172 A number of the fields in Table 1 use keyword strings as values. The syntax of these keywords is the
173 same as in [RFC2911], including the use of private keywords. See [RFC2911] sections 4.1.3 and 6.1.
174 Printer implementers are strongly RECOMMENDED to submit additional keyword values for
175 registration with IANA according to the procedures for registering attributes. See section 7 and
176 [RFC2911] section 6.1.

177 3.1.2 Use of the Special Keyword Value: 'unknown'

178 A number of REQUIRED 'keyword' value fields have a special keyword value: 'unknown' defined.
179 This value is intended for use when the actual value is not known, such as by an administrator automatic
180 software configuring the IPP Printer object. However, it is strongly RECOMMENDED that other
181 more meaningful values be used, instead of the 'unknown' value whenever possible.

182 3.1.3 Examples of "client-print-support-files-supported" attribute values

183 The following illustrates what two valid values of the "client-print-support-files-supported" (1setOf
184 octetString(MAX)) Printer Description attribute might look like:

```
185 uri=ipp://mycompany.com/myprinter?drv-id=ModelY.gz<  
186 os-type=windows-95< cpu-type=x86-32<  
187 document-format=application/postscript<  
188 natural-language=en< compression=gzip<  
189 file-type=printer-driver<  
190 client-file-name=CompanyX-ModelY-driver.gz<  
191 policy=manufacturer-recommended<
```

```
193 uri=ftp://mycompany.com/root/drivers/win95/CompanyX/ModelY.gz<  
194 os-type=windows-95< cpu-type=x86-32<  
195 document-format=application/postscript,application/vnd.hp-PCL<  
196 natural-language=en,fr< compression=gzip<  
197 file-type=printer-driver<  
198 client-file-name=Company T Model Z driver.gz<  
199 policy=manufacturer-recommended<
```

200 The above examples have been broken onto separate lines for readability in this document. However,
201 there MUST NOT be any line breaks in the actual values.

202 The "client-print-support-files-supported" Printer Description attribute MAY be preset at
203 manufacturing time or through administrative means outside the scope of this document.

204 3.2 Get-Printer-Attributes Operation Extension

205 The “client-print-support-files-supported” Printer Description attribute defined in section 3.1 contains
206 information, such as operating system, natural language, and document format, about *all* of the sets of
207 Client Print Support Files. This section defines an extension to the Get-Printer-Attributes operation that
208 allows a workstation to filter out all but the Client Print Support Files of interest.

209 3.2.1 Get-Printer-Attributes Request

210 A Printer MAY contain information about multiple sets of Client Print Support Files to match the
211 different operating systems, natural languages and document formats it supports. A workstation MAY
212 query this information by including the ‘client-print-support-files-supported’ keyword as a value of the
213 “requested-attributes” operation attribute of the Get-Printer-Attributes operation.

214 3.2.1.1 client-print-support-files-filter (octetString(MAX)) operation attribute

215 The client can request a subset of the values of the “client-print-support-files-supported” Printer
216 attribute by supplying the “client-print-support-files-filter” (octetString(MAX)) operation attribute in
217 the request as a filter. The filter value indicates in which Client Print Support Files the client is
218 interested. The client MAY supply this attribute. The Printer MUST support this attribute.

219 The filter value of the “client-print-support-files-filter” attribute is a composite string with the same
220 format as that of “client-print-support-files-supported” (see Table 1 - “client-print-support-files-
221 supported” attribute fields in section 3.1) with the following exceptions:

222

Table 2 - “client-print-support-files-filter” attribute fields

Field Name	Field Value in the “client-print-support-files-filter” attribute
uri-scheme	One or more comma-separated LOWER-CASE ‘uriScheme’ string values identifying the uri scheme to be filtered on. Valid values are the string representation of the IPP ‘uriScheme’ attribute syntax (see [RFC2911] section 4.1.6). Example URI schemes are: ‘ftp’, ‘http’, and ‘ipp’. The Printer SHOULD support the ‘ipp’ scheme. If supplied by the client, this field NEED NOT be first. If this field is omitted by the client, the Printer returns all schemes.
xxx	One or more comma-separated values for any of the fields defined in Table 1, with the single exception of the “uri” field which a client MUST NOT supply and a Printer MUST NOT support. The Printer MUST support any filter field having more than one value separated by a COMMA (,), including the fields that Table 1 indicates MUST BE single valued.

223

224

Printer implementations MUST support the “client-print-support-files-filter” operation attribute in a Get-Printer-Attributes request with the member fields listed Table 3. Printers MAY support any additional filter fields listed in Table 2.

225

226

227

Client implementations MAY supply any filter fields listed in Table 2 in the “client-print-support-files-filter” operation attribute of a Get-Printer-Attributes request.

228

229

Table 3 - REQUIRED “client-print-support-files-filter” fields

uri-scheme
os-type
cpu-type
document-format
natural-language

230

231 3.2.1.1.1 Filter matching rules

232

The Printer returns only the values of the “client-print-support-files-supported” Printer Description attribute that match the filter in the “client-print-support-files-filter” operation attribute. The following filter matching rules are defined:

233

234

235

1. A match occurs if at least one value of each field supplied by the client in the filter matches a Client Print Support File value. Printers MUST ignore a filter field supplied by a client that the Printer does not support and return a match if all supported fields do match, no matter what value the client supplied for that unsupported field. Similarly, Printers MUST ignore a filter

236

237

238

- 239 field supplied by a client that the Printer does support, but which the field has not been
240 populated for a Client Print Support Files and return a match if all supported and populated
241 fields do match, no matter what value the client supplied for that unpopulated field.
- 242 2. A match for a CASE-INSENSITIVE field occurs independent of the case of the letters supplied
243 by the client and those stored by the Printer, while a match for a LOWER-CASE field is a strict
244 character for character match.
- 245 3. A match for a 'keyword' Printer field that is populated with the 'unknown' special keyword
246 value occurs for *any* value supplied by the client for that field.
- 247 4. If the "client-print-support-files-filter" operation attribute filter is not supplied by the client, the
248 printer SHOULD behave as if the attribute had been provided with all fields left empty (i.e.,
249 return an unfiltered list).

250 The following are two examples of a "client-print-support-files-filter" filter value:

```
251 os-type=windows-95< cpu-type=x86-32<  
252 document-format=application-postscript< natural-language=en,de<  
253  
254 uri-scheme=ipp< os-type=windows-95< cpu-type=x86-32<  
255 document-format=application-postscript< natural-language=en,de<  
256
```

257 See section 3.2.2 for example matching responses.

258 It is RECOMMENDED that workstations first use the Get-Printer-Attributes operation in combination
259 with "client-print-support-files-filter" operation attribute filter to get a list of the potential Client Print
260 Support Files that meet the workstation's requirements. The workstation can then choose from the
261 returned list which Client Print Support Files to use and where to get them. If one of the URIs returned
262 is an IPP uri, the workstation can retrieve the Client Print Support Files from an IPP printer via the Get-
263 Client-Print-Support-Files operation (see section 3.3).

264 3.2.2 Get-Printer-Attributes Response

265 A Printer MUST return the "client-print-support-files-supported" (1setOf octetString(MAX)) attribute
266 in the Printer Object Attributes group ([gGroup 3](#)) when requested by a client, **unless there are no**
267 **matches, in which case the attribute is not returned in Group 3**. Each returned attribute value MUST
268 satisfy the criteria specified by the client in the request.

269 For example, if the request contains the following "client-print-support-files-filter" filter:

```
270 os-type=windows-95< cpu-type=x86-32<  
271 document-format=application-postscript<  
272 natural-language=en,de<
```

273 A conforming response is the following two octet String values:

```
274 uri=ipp://mycompany.com/myprinter?drv-id=ModelY.gz<
275 os-type=windows-95< cpu-type=x86-32<
276 document-format=application/postscript<
277 natural-language=en< compression=gzip<
278 file-type=printer-driver<
279 client-file-name=CompanyX-ModelY-driver.gz<
280 policy=manufacturer-recommended<
281 digital-signature=smime<
282
283 uri=ftp://mycompany.com/root/drivers/win95/CompanyX/ModelY.gz<
284 os-type=windows-95< cpu-type=x86-32<
285 document-format=application/postscript,application/vnd.hp-PCL<
286 natural-language=en,fr< compression=gzip<
287 file-type=printer-driver<
288 client-file-name=CompanyX-ModelY-driver.gz<
289 policy=manufacturer-recommended<
290 digital-signature=smime<
291
```

292 These examples have been broken onto separate lines for readability in this document. However, there
293 MUST NOT be any line breaks in the actual values.

294 As another example, if the above request had also contained the “uri-scheme” field in the following
295 “client-print-support-files-filter” filter:

```
296 uri-scheme=ipp< os-type=windows-95< cpu-type=x86-32<
297 document-format=application-postscript<
298 natural-language=en,de<
```

299 Then only the first value would have been returned as a single octetString value:

```
300 uri=ipp://mycompany.com/myprinter?drv-id=ModelY.gz<
301 os-type=windows-95< cpu-type=x86-32<
302 document-format=application/postscript<
303 natural-language=en< compression=gzip<
304 file-type=printer-driver<
305 client-file-name=CompanyX-ModelY-driver.gz<
306 policy=manufacturer-recommended<
307 digital-signature=smime<
```

308 3.3 Get-Client-Print-Support-Files

309 This RECOMMENDED operation allows a client to download Client Print Support Files from an IPP
310 Printer.

311 3.3.1 Get-Client-Print-Support-Files Request

312 The following sets of attributes are part of the Get-Client-Print-Support-Files request:

313 Group 1: Operation Attributes

314 Natural Language and Character Set:

315 The “attributes-charset” and “attributes-natural-language” attributes as described in [RFC2911],
316 section 3.1.4.1.

317 Target:

318 The “printer-uri” (uri) operation attribute which is the target for this operation as described in
319 [RFC2911], section 3.1.5. The client MUST use the URI value as the target of this operation
320 that the Printer returns in the “uri” field (see Table 1) in the Get-Printer-Attributes response.
321 Furthermore, the client MUST use the appropriate authorization and security mechanism for this
322 URI as indicated by the Printer’s “printer-uri-supported”, “uri-authentication-supported” and
323 “uri-security-supported” attributes (see [RFC2911] sections 4.4.1, 4.4.2, and 4.4.3). Only if the
324 URI returned in the “uri” field matches the URI that the client used for the Get-Printer-
325 Attributes request MAY the client use the same HTTP connection. The ‘ipp’ URL matching
326 rules are defined in [ipp-url] and do not include the query part.

327 Requesting User Name:

328 The “requesting-user-name” (name(MAX)) attribute SHOULD be supplied by the client as
329 described in [RFC2911], section 8.3.

330 “client-print-support-files-query” (text(127)):

331 The client MUST supply this attribute specifying the query part [RFC2396] of the ipp uri for the
332 desired Client Print Support Files not including the “?” character that starts the query part, i.e.,
333 the value of the “uri” field following the “?” character returned by the Get-Printer-Attributes in
334 one of the values of the “client-print-support-files-supported” (1setOf octetString(MAX))
335 Printer attribute (see Table 1) that had an ‘ipp’ scheme. If the Printer does not find any Client
336 Print Support Files which match the query, the Printer MUST reject this request with a ‘client-
337 error-client-print-support-file-not-found’ status code (see section 10.1).

338 3.3.2 Get-Client-Print-Support-Files Response

339 The Printer object returns the following sets of attributes as part of the Get-Client-Print-Support-Files
340 Response:

341 Group 1: Operation Attributes

342 Status Message:

343 In addition to the REQUIRED status code returned in every response, the response
 344 OPTIONALLY includes a “status-message” (text(255)) operation attribute as described in
 345 [RFC2911], sections 13 and 3.1.6.

346 Natural Language and Character Set:
 347 The “attributes-charset” and “attributes-natural-language” attributes as described in [RFC2911],
 348 section 3.1.4.2.

349
 350 Group 2: Unsupported Attributes

351 See [RFC2911], section 3.1.7 for details on returning Unsupported Attributes.
 352

353 Group 3: Printer Object Attributes

354 “client-print-support-files-supported” (octetString(MAX)).

355 This attribute identifies the properties of the returned Client Print Support Files. The Printer
 356 object MUST return this attribute if the response includes Group 4 (i.e., if a set of Client Print
 357 Support Files identified by the supplied “client-print-support-files-query” operation attribute was
 358 found). The Printer MUST return all configured fields for the selected Client Print Support Files
 359 in the format shown in section 3.1.
 360

361 Group 4: Client Print Support Files

362 The printer MUST supply the Client Print Support Files that match the client’s criteria following the
 363 “end-of-attributes” tag, same as for the Print-Job request. All necessary files MUST be compressed
 364 into a single transferred file.

365 **4 New Values for Existing Printer Description Attributes**

366 The following “operation-id” value is added in order to support the new operation defined in this
 367 document:

368 **Table 4 – Operation-id assignments**

<u>Value</u>	<u>Operation Name</u>
<u>0x0021</u>	<u>Get-Client-Print-Support-Files</u>

369

370 **5 Conformance**

371 **5.1 Printer Conformance Requirements**

372 A Printer conforming to this specification:

- 373 1. MUST support the “client-print-support-files-supported” Printer Description attribute as defined
374 in section 3.1, including all of the REQUIRED fields defined in Table 1 and MAY support the
375 OPTIONAL fields defined in Table 1.
- 376 2. MUST support the “client-print-support-files-filter” operation attribute in the Get-Printer-
377 Attributes request as defined in section 3.2, including all of the fields listed in Table 3 and
378 ignoring any fields not recognized.
- 379 3. MUST support at least one of the following URI schemes that identify the support files: ‘ftp’,
380 ‘http’, or ‘ipp’, of which the ‘ipp’ scheme is the RECOMMENDED one.
- 381 4. SHOULD support the Get-Client-Print-Support-Files operation as described in section 3.3. If
382 this operation is supported, then one of the supported schemes MUST be ‘ipp’.
- 383 5. SHOULD support TLS as described in section 9.
- 384 6. SHOULD support at least one method for the downloading of Client Print Support Files that
385 have been digitally signed as described in section 9.

386 5.2 Client Conformance Requirements

387 A client conforming to this specification:

- 388 1. MUST ignore any fields returned by the Printer in the “client-print-support-files-supported”
389 Printer Description attribute that the client does not recognize or support.
- 390 2. SHOULD be able to retrieve Client Print Support Files by either FTP Get or HTTP Get
391 operations.
- 392 3. MUST be able to retrieve Client Print Support Files using the Get-Client-Print-Support-Files
393 operation, i.e., support the ‘ipp’ scheme.
- 394 4. MUST supply the proper URI value for the “printer-uri” operation attribute as specified in
395 section 3.3.1 under Target:.
- 396 5. MUST validate that files that are supposed to be digitally signed are done with the indicated
397 mechanism as described in section 9.
- 398 6. SHOULD support TLS as described in section 9.

399 6 Encoding of the Operation Layer

400 This extension uses the operation layer encoding described in [RFC2910].

401 ~~6 Encoding of Transport Layer~~

402 ~~This specification uses the transport layer encoding described in [RFC2910] with the following~~
403 ~~extensions:~~

404 ~~New Error codes:~~

405 ~~—0x0417— client error client print support file not found~~

406 ~~New Operation code~~

407 ~~—0x0021— Get Client Print Support Files~~

408 7 IANA Considerations

409 The IANA-registered operating system names that IANA has registered [os-names] are required by this
410 spec for use in the “os-type” field (see Table 1).

411 Table 1 of this document defines possible ‘keyword’ values for the “cpu-type” field. However, the
412 existing IANA machine registration [cpu-names] is inadequate for two reasons: a) it is really a machine
413 model number, not a CPU type, and b) it doesn't express whether a CPU is 16-bit, 32-bit, or 64-bit
414 which needs to be indicated in the keyword value. Therefore, the “os-type” field will be a new
415 registration with initial values assigned.

416 Implementers may register additional values for the fields defined in Table 1 with IANA according to
417 the procedures in [RFC2911] for registering additional values of attributes. Implementers may register
418 additional fields with IANA according to the procedures defined in [RFC2911] for registering attribute
419 values, even though fields are more like attributes (see section 7.2.1).

420 The rest of this section contains the exact-registration information for IANA to add to the various IPP
421 Registries according to the procedures defined in RFC 2911 [RFC2911] section 6 to cover the
422 definitions in this document.

423 *Note to RFC Editors: Replace RFC NNNN below with the RFC number for this document, so that it*
424 *accurately reflects the content of the information for the IANA Registry.*

425 7.1 Attribute Registrations

426 The following table lists all attributes and fields defined in this document. These are to be registered
427 will be published by IANA according to the procedures in RFC 2911 [RFC2911] section 6.2. with the
428 following path:

429 <ftp.isi.edu/iana/assignments/ipp/attributes/>

430 The registry entry will contain the following information:

431 Printer Description Attributes: Ref: Section:
 432 client-print-support-files-supported (1setOf octetString(MAX))
 433 RFC NNNN 3.1
 434

435 Operation Attributes: Ref: Section:
 436 client-print-support-files-filter (octetString(MAX)) RFC NNNN 3.2
 437

438 The resulting attribute registrations will be published in the
 439 <ftp://ftp.iana.org/in-notes/iana/assignments/ipp/attributes/>
 440 area.
 441

442 7.2 Additional Attribute Value Registrations for existing attributes

443 This section lists additional attribute value registrations for use with existing attributes defined in other
 444 documents.

445 7.2.1 Additional values for the “client-print-support-files-xxx” attributes

446 The following table lists the fields defined in this document for use with the “client-print-support-files-
 447 supported” Printer Description (defined in section) attribute and the “client-print-support-files-filter”
 448 operation attribute (defined in section). For purposes of IANA registration, the following fields are
 449 registered according to the attribute value procedures in RFC 2911 [RFC2911] section 6.1, even though
 450 they are more like attributes and have an attribute syntax and string values.

451	field Attribute Values:	Ref:	Section:
452	os-type (type2 keyword)	RFC NNNN	3.1
453	cpu-type (type2 keyword)	RFC NNNN	3.1
454	document-format (mimeType)	RFC NNNN	3.1
455	natural-language (naturalLanguage)	RFC NNNN	3.1
456	compression (type2 keyword)	RFC NNNN	3.1
457	file-type (type2 keyword)	RFC NNNN	3.1
458	client-file-name (name(MAX))	RFC NNNN	3.1
459	policy (type2 keyword)	RFC NNNN	3.1
460	file-size (integer(0:MAX))	RFC NNNN	3.1
461	file-version (name(MAX))	RFC NNNN	3.1
462	file-date-time (text(25))	RFC NNNN	3.1
463	file-info (text(127))	RFC NNNN	3.1
464	digital-signature (type2 keyword)	RFC NNNN	3.1
465			

467 The resulting URI scheme attribute value registration will be published in the
 468 <ftp://ftp.iana.org/in-notes/iana/assignments/ipp/attribute-values/client-print-support-files-supported/>
 469 AND
 470 <ftp://ftp.iana.org/in-notes/iana/assignments/ipp/attribute-values/client-print-support-files-filter/>
 471 areas.

472
 473 uri (uri) RFC NNNN 3.1

474

475 [The resulting URI scheme attribute value registration will be published in the](ftp://ftp.iana.org/in-notes/iana/assignments/ipp/attribute-values/client-print-support-files-supported/)
 476 <ftp://ftp.iana.org/in-notes/iana/assignments/ipp/attribute-values/client-print-support-files-supported/>
 477 [area.](ftp://ftp.iana.org/in-notes/iana/assignments/ipp/attribute-values/client-print-support-files-supported/)

478

479 uri-scheme (uriScheme) RFC NNNN 3.2

480

481 [The resulting URI scheme attribute value registration will be published in the](ftp://ftp.iana.org/in-notes/iana/assignments/ipp/attribute-values/client-print-support-files-filter/)
 482 <ftp://ftp.iana.org/in-notes/iana/assignments/ipp/attribute-values/client-print-support-files-filter/>
 483 [area.](ftp://ftp.iana.org/in-notes/iana/assignments/ipp/attribute-values/client-print-support-files-filter/)

484

485 **7.2.2 Additional values for the “operations-supported” Printer attribute**

486 [The following table lists the enum attribute value defined in this document as an additional type2 enum](#)
 487 [value for use with the “operations-supported” Printer attribute defined in \[RFC2911\]. This is to be](#)
 488 [registered according to the procedures in RFC 2911 \[RFC2911\] section 6.1.](#)

type2 enum Attribute Values:	Value	Ref.	Section:
Get-Client-Print-Support-Files	0x0021	RFC NNNN	4

491

492 [The resulting enum attribute value registration will be published in the](ftp://ftp.iana.org/in-notes/iana/assignments/ipp/attribute-values/operations-supported/)
 493 <ftp://ftp.iana.org/in-notes/iana/assignments/ipp/attribute-values/operations-supported/>
 494 [area.](ftp://ftp.iana.org/in-notes/iana/assignments/ipp/attribute-values/operations-supported/)

495

496 **7.3 Operation Registrations**

497 The [following table lists the](#) operations defined in this document. [This is to be registered will be](#)
 498 [published by IANA](#) according to the procedures in RFC 2911 [RFC2911] section 6.4. [with the](#)
 499 [following path:](#)

500 [—ftp.isi.edu/iana/assignments/ipp/operations/](ftp://ftp.isi.edu/iana/assignments/ipp/operations/)

501 [The registry entry will contain the following information:](#)

Operations:	Ref.	Section:
Get-Client-Print-Support-Files	RFC NNNN	3.3

504

505 [The resulting operation registration will be published in the](ftp://ftp.iana.org/in-notes/iana/assignments/ipp/operations/)
 506 <ftp://ftp.iana.org/in-notes/iana/assignments/ipp/operations/>
 507 [area.](ftp://ftp.iana.org/in-notes/iana/assignments/ipp/operations/)

508 **7.4 Status Code Registrations**

509 [The following table lists the status code defined in this document. This is to be registered according to](#)
 510 [the procedures in RFC 2911 \[RFC2911\] section 6.6.](#)

511	Status codes:	Ref.	Section:
512	<u>client-error-client-print-support-file-not-found (0x0417)</u>	(0x0417)	
513		RFC NNNN	10.1

514
 515 The resulting status code registration will be published in the
 516 <ftp://ftp.iana.org/in-notes/iana/assignments/ipp/status-codes/>
 517 area.
 518

519 8 Internationalization Considerations

520 All text representations introduced by this specification adhere to the internationalization-friendly
 521 representation supported by IPP. This work is also accommodates the use of Client Print Support Files
 522 of different languages.

523 9 Security Considerations

524 The IPP Model and Semantics document [RFC2911] discusses high-level security requirements (Client
 525 Authentication, Server Authentication and Operation Privacy). Client Authentication is the mechanism
 526 by which the client proves its identity to the server in a secure manner. Server Authentication is the
 527 mechanism by which the server proves its identity to the client in a secure manner. Operation Privacy is
 528 defined as a mechanism for protecting operations from eavesdropping.

529 Only operators of a printer SHOULD be allowed to set the “client-print-support-files-supported”
 530 attribute and only users of the printer SHOULD be allowed to query that information.

531 The IPP extension described in this document introduces the potential for a security threat previously
 532 not encountered by IPP. As Client Print Support Files might exist in the form of executable objects (as
 533 is the case with printer drivers, for example), additional provisions are needed to prevent the distribution
 534 of malicious code through this mechanism. Digital signatures provide the message level security
 535 commonly used to help consumers of network resources verify the authenticity and integrity of those
 536 resources. Specifically, digital signatures help defend against security threats such as message insertion,
 537 message deletion, and message modification, and their combined use into man-in-the-middle attacks.

538 This document identifies some commonly used signing mechanisms (SMIME [RFC2634], PGP
 539 [RFC1991], DSS [dss], and XML Digital Signatures [xmldsig]), though any others MAY be used. Of
 540 course, it is assumed that once end-users know the identity of the provider of Client Print Support Files,
 541 they can make the correct determination as to whether it is safe to use those files.

542 Printers that support the Get-Client-Print-Support-Files operation SHOULD support the downloading
 543 of Client Print Support Files that have been digitally signed. Clients that invoke the Get-Client-Print-
 544 Support-Files operation MUST make sure that Client Print Support Files that are supposed to be signed
 545 (i.e., whose client-print-support-files-supported attribute value includes the "digital-signature" field) are
 546 indeed signed via the specified mechanism when downloaded from the printer.

547 Furthermore, printers that support the Get-Client-Print-Support-Files operation SHOULD implement
548 TLS to provide application level channel security and enable users to reliably authenticate the source of
549 the Client Print Support Files.

550 **10 Status Code Extensions**

551 The following status code is defined as an extension for Notification and is returned as the value of the
552 “status-code” parameter in the Operation Attributes Group of a response (see [RFC2911] section
553 3.1.6.1).

554 **10.1 client-error-client-print-support-file-not-found (0x0417)**

555 The Printer was unable to match the query in the Get-Client-Print-Support-Files request with any Client
556 Print Support Files. This status code is not used with the Get-Printer-Attributes operation.

557 **11 References**

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639 IPP Mailing List: ipp@pwg.org
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641 To subscribe to the ipp mailing list, send the following email:
642 1) send it to majordomo@pwg.org
643 2) leave the subject line blank
644 3) put the following two lines in the message body:
645 subscribe ipp
646 end
647

648 Implementers of this specification document are encouraged to join the IPP Mailing List in order to
649 participate in any discussions of clarification issues and review of registration proposals for additional
650 attributes and values. In order to reduce spam the mailing list rejects mail from non-subscribers, so you
651 must subscribe to the mailing list in order to send a question or comment to the mailing list.

652 **13 Description of the Base IPP Documents**

653 The base set of IPP documents includes:

- 654 Design Goals for an Internet Printing Protocol [RFC2567]
- 655 Rationale for the Structure and Model and Protocol for the Internet Printing Protocol [RFC2568]
- 656 Internet Printing Protocol/1.1: Model and Semantics [RFC2911]
- 657 Internet Printing Protocol/1.1: Encoding and Transport [RFC2910]
- 658 Internet Printing Protocol/1.1: Implementer's Guide [ipp-iig]
- 659 Mapping between LPD and IPP Protocols [RFC2569]

660
661 The "Design Goals for an Internet Printing Protocol" document takes a broad look at distributed
662 printing functionality, and it enumerates real-life scenarios that help to clarify the features that need to
663 be included in a printing protocol for the Internet. It identifies requirements for three types of users:
664 end users, operators, and administrators. It calls out a subset of end user requirements that are satisfied
665 in IPP/1.0 [RFC2566, RFC2565]. A few OPTIONAL operator operations have been added to IPP/1.1
666 [RFC2911, RFC2910].

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

671 The "Internet Printing Protocol/1.1: Encoding and Transport" document is a formal mapping of the
672 abstract operations and attributes defined in the model document onto HTTP/1.1 [RFC2616]. It defines
673 the encoding rules for a new Internet MIME media type called "application/ipp". This document also
674 defines the rules for transporting a message body over HTTP whose Content-Type is "application/ipp".
675 This document defines the 'ipp' scheme for identifying IPP printers and jobs.

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

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

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