

1 INTERNET-DRAFT 6 ISSUES are highlighted like this.
2 <draft-ietf-ipp-not-spec-02.txt>

S. Isaacson
Novell, Inc.
J. Martin
Underscore
R. deBry
Utah Valley State College
T. Hastings
Xerox Corporation
M. Shepherd
Xerox Corporation
R. Bergman
Dataproducts Corp.
March 6, 2000

15 Internet Printing Protocol (IPP):
16 **IPP Event Notification Specification**

17 Copyright (C) The Internet Society (2000). All Rights Reserved.

18 Status of this Memo

19
20 This document is an Internet-Draft and is in full conformance with all provisions of Section 10 of
21 [RFC2026]. Internet-Drafts are working documents of the Internet Engineering Task Force (IETF), its
22 areas, and its working groups. Note that other groups may also distribute working documents as Internet-
23 Drafts.

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

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

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

29 **Abstract**

30 This document describes an extension to the IPP/1.0, IPP/1.1, and future versions that allows a client to
31 subscribe to printing related events. Subscriptions include "Per-Job subscriptions" and "Per-Printer
32 subscriptions". One or more Per-Job Submission subscriptions are specified by the client when submitting
33 a job. Additional Per-Job and Per-Printer subscriptions are created by performing separate explicit Create-
34 Job-Subscription Create-Printer-Subscription operations, respectively. Subscriptions are modeled as
35 Subscription objects. Four other operations are defined for Subscription objects: Get-Attributes, Get-
36 Subscriptions, Renew-Subscription, and Cancel-Subscription.

37 A subscription request and the Subscription object includes: the names of Job and/or Printer events, the
38 Notification Recipient URL, the Notification Content format, if several are supported, possibly some
39 opaque data, and the charset and natural language. In addition, the subscription request includes: the
40 requested lease time and persistency for the subscription. When the event occurs, a notification is
41 generated and delivered using the information specified in the subscription.

42 The full set of IPP documents includes:

43 Design Goals for an Internet Printing Protocol [RFC2567]

44 Rationale for the Structure and Model and Protocol for the Internet Printing Protocol [RFC2568]

45 Internet Printing Protocol/1.1: Model and Semantics [IPP-MOD]

46 Internet Printing Protocol/1.1: Encoding and Transport [IPP-PRO]

47 Internet Printing Protocol/1.1: Implementer's Guide [IPP-IIG]

48 Mapping between LPD and IPP Protocols [RFC2569]

49

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

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

59 The "Internet Printing Protocol/1.1: Model and Semantics", describes a simplified model with abstract
60 objects, their attributes, and their operations that are independent of encoding and transport. It introduces a
61 Printer and a Job object. The Job object optionally supports multiple documents per Job. It also addresses
62 security, internationalization, and directory issues.

63 The "Internet Printing Protocol/1.1: Encoding and Transport" document is a formal mapping of the abstract
64 operations and attributes defined in the model document onto HTTP/1.1. It defines the encoding rules for a
65 new Internet MIME media type called "application/ipp". This document also defines the rules for
66 transporting over HTTP a message body whose Content-Type is "application/ipp". This document defines
67 a new scheme named 'ipp' for identifying IPP printers and jobs. Finally, this document defines
68 interoperability rules for supporting IPP/1.0 clients.

69 The "Internet Printing Protocol/1.1: Implementer's Guide" document gives insight and advice to
70 implementers of IPP clients and IPP objects. It is intended to help them understand IPP/1.0 and some of
71 the considerations that may assist them in the design of their client and/or IPP object implementations. For
72 example, a typical order of processing requests is given, including error checking. Motivation for some of
73 the specification decisions is also included.

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

76
77**Table of Contents**

78	1	Introduction	6
79	1.1	Notification Overview	6
80	2	Model for Per-Job and Per-Printer Subscription and Event Notification.....	9
81	2.1	Model for Per-Job Subscription and Notification	9
82	2.2	Model for Per-Printer Subscription and Notification	10
83	2.3	Relationship between the Printer object and the Notification Delivery Service	11
84	2.3.1	Use of a Notification Service transparently to clients	11
85	2.3.2	Use of Notification Service transparently to the IPP Printer.....	11
86	3	Terminology	12
87	3.1	Conformance Terminology	12
88	3.2	Other terminology	13
89	4	Object Model for Notification.....	15
90	4.1	Object relationships	16
91	4.1.1	Printer object and Per-Printer Subscription objects.....	16
92	4.1.2	Job object and Per-Job Subscription objects	17
93	5	Subscription Object attributes	17
94	5.1	notify-recipient (uri)	19
95	5.2	notify-events (1setOf type2 keyword).....	20
96	5.3	notify-format (mimeMediaType)	23
97	5.4	subscriber-user-data (octetString(63)).....	23
98	5.5	notify-charset (charset).....	24
99	5.6	notify-natural-language (naturalLanguage).....	24
100	5.7	subscription-request-id	24
101	5.8	subscription-id (integer (1:MAX))	24
102	5.9	notify-lease-expiration-time (integer(0:MAX))	24
103	5.10	printer-uri (uri).....	25
104	5.11	subscriber-user-name (name(MAX))	25
105	5.12	notify-server-up-time (integer(1:MAX)).....	25
106	5.13	notify-persistence-granted (boolean).....	26
107	6	Printer Description Attributes related to Notification	26
108	6.1	notify-schemes-supported (1setOf uriScheme).....	27
109	6.2	notify-events-default (1setOf type2 keyword)	27
110	6.3	notify-events-supported (1setOf type2 keyword).....	27
111	6.4	max-events-supported (integer(5:MAX)).....	27
112	6.5	notify-format-supported (1setOf mimeMediaType).....	27
113	6.6	max-job-subscriptions-supported (integer(0:MAX))	28
114	6.7	max-printer-subscriptions-supported (integer(0:MAX)).....	28
115	6.8	notify-lease-time-supported (rangeOfInteger(0:MAX))	28
116	6.9	notify-lease-time-default (integer(0:MAX))	28
117	6.10	persistent-jobs-supported (boolean)	29
118	6.11	persistent-subscriptions-supported (boolean).....	29

119	6.12 printer-state-change-time (integer(1:MAX)).....	29
120	6.13 printer-state-change-date-time (dateTime).....	29
121	7 Notification Content	29
122	7.1 Notification content MIME media type formats	30
123	7.1.1 Human Consumable form.....	30
124	7.1.2 Machine Consumable form	30
125	7.2 Notification content attributes common to Job and Printer events.....	31
126	7.2.1 "trigger-event" (type2 keyword).....	33
127	7.2.2 "trigger-time" (integer(MIN:MAX)).....	33
128	7.2.3 "trigger-date-time" (dateTime).....	33
129	7.2.4 "human-readable-report" (text(MAX)).....	33
130	7.3 Additional Notification content attributes for Job events <i>only</i>	33
131	7.4 Additional Notification content attributes for Printer events <i>only</i>	34
132	8 Operations for notification	34
133	8.1 Operations for Per-Job Subscriptions <i>only</i>	34
134	8.1.1 Job Creation Operations (Create-Job, Print-Job, Print-URI) and Validate-Job	35
135	8.1.2 Create-Job-Subscription operation	37
136	8.2 Operations for Per-Printer Subscriptions <i>only</i>	39
137	8.2.1 Create-Printer-Subscription operation.....	39
138	8.3 Common Operations for Per-Job and Per-Printer Subscriptions.....	41
139	8.3.1 Get-Subscription-Attributes operation	42
140	8.3.2 Get-Subscriptions operation	43
141	8.3.3 Renew-Subscription operation	44
142	8.3.4 Cancel-Subscription operation	46
143	9 Comparison of Per-Job versus Per-Printer Subscriptions	47
144	10 Out of Band Values	47
145	10.1 'none'.....	47
146	11 The specified attribute in the request MUST NOT be applied to the job. Specifically, this value	
147	overrides the Printer's "xxx-default" attribute value for the attribute, if one exists. This out-of-band value is	
148	needed since attributes that are of the 'collection', 'uri', and 'mimeType' need a way for a client to	
149	specify that the Printer MUST NOT apply the value of an "xxx-default" attribute to the job. See [ipp-coll]	
150	for a complete specification, including encoding. Conformance Requirements.....	47
151	12 IANA Considerations	48
152	13 Internationalization Considerations.....	48
153	14 Security Considerations.....	48
154	15 Status Codes	49
155	15.1 'successful-ok-ignored-subscriptions' (0x0003)	49
156	15.2 client-error-uri-notification-scheme-not-supported (0x0414).....	49
157	15.3 client-error-too-many-subscriptions (0x0415)	50
158	15.4 client-error-too-many-events (0x0416)	50
159	16 Addition attribute tag encodings	50
160	17 References	50

161	18	Author's Addresses	52
162	A.	Appendix - Summary of Notification Attribute Usage	53
163	B.	Appendix: Change History	58
164	18.1	Changes to the February 2, 2000 version to create the March 6, 2000 version	58
165	18.2	Changes to the October 14, 1999 version to create the February 2, 2000 version.....	59
166	C.	Appendix: Full Copyright Statement.....	61

167
168

Tables

169	Table 1 - Summary of Per-Job and Per-Printer Subscription operations	8
170	Table 2 - Subscription object attributes.....	18
171	Table 3 - Printer Description attributes associated with Notification	26
172	Table 4 - Common Job and Printer Notification content attributes.....	31
173	Table 5 - Additional Notification content attributes for Job events <i>only</i>	33
174	Table 6 - Additional Notification content attributes for Printer events <i>only</i>	34
175	Table 7 - Member attributes of the "job-notify" collection operation attribute.....	35
176	Table 8 - Conformance Requirements for Operations	48

177

Figures

178	Figure 1 - Client-Printer Per-Job Subscription and Notification Model	9
179	Figure 2 - Client-Server-Printer Per-Job Subscription and Notification Model.....	10
180	Figure 3 - Client-Printer Per-Printer Subscription and Notification Model.....	10
181	Figure 4 - Opaque Use of a Notification Service Transparent to the Client	11
182	Figure 5 - Use of a Notification Service transparent to the IPP Printer	12
183	Figure 6 - Object Model for Notification	16

184

185

186 **1 Introduction**

187 This IPP notification specification is an extension to IPP/1.0 [RFC2568, RFC2569] and IPP/1.1 [ipp-mod,
188 ipp-pro]. This document in combination with the following documents is intended to meet the notification
189 requirements described in [ipp-not-req]:

190 Internet Printing Protocol/1.0 & 1.1: "Collection Attribute Syntax" [ipp-coll]

191 Internet Printing Protocol/1.0 & 1.1: "Job Progress Attributes" [ipp-prog]

192 Internet Printing Protocol/1.0 & 1.1: "Notification Change History" [ipp-not-hist]

193 In addition, each notification delivery method, whether REQUIRED or OPTIONAL, is described in
194 separate documents:

195 Internet Printing Protocol/1.0 & 1.1: "Notification Delivery Method xxx [TBD]

196 Internet Printing Protocol/1.0 & 1.1: "Notification Delivery Method yyy [TBD]

197

198 The rest of this document is laid out as follows:

- 199 - The rest of Section 1.1 is an overview of IPP Notification.
- 200 - Section 2 is the model for network entities that use IPP notification, including clients (desktop and
201 servers), IPP Printers (servers and devices), and Notification Recipients.
- 202 - Section 3 is the terminology used throughout the document.
- 203 - Section 4 is the object model for notification, including Job, Printer, and Subscription objects.
- 204 - Section 5 defines the Subscription object and its attributes.
- 205 - Section 6 defines the Printer Description attributes
- 206 - Section 7 defines the Notification content of Human Consumable and Machine Consumable Event
207 formats.
- 208 - Sections 8 and 9 define the Per-Job and Per-Printer Subscription operations.
- 209 - Section 10 defines the out-of-band values.
- 210 - Section 11 and 12 define the conformance requirements and IANA requirements, respectively.
- 211 - Section 13 - 15 cover Internationalization, Security, and Status codes.
- 212 - Appendix A is a summary of the Notification Attribute usage
- 213 - Appendix B is a Change History

214 **1.1 Notification Overview**

215 A client can establish an event notification subscription so that when one of the specified events occurs, an
216 asynchronous Notification is sent to a specified Notification Recipient.

217 One or more Per-Job Submission subscriptions are specified by the client when submitting a job. One or
218 more Per-Job or Per-Printer subscriptions are created by performing separate explicit Create-Job-
219 Subscription or Create-Printer-Subscriptions operations, respectively.

220 A Per-Job or Per-Printer subscription request includes:

- 221 1. the names of Job and/or Printer events that are of interest to the Notification Recipient
- 222 2. the delivery method and address to use to deliver the notification to one Notification Recipient
- 223 3. if Human Consumable notification content is to be sent, which text format
- 224 4. some opaque data that the subscriber wants to be sent to the Notification Recipient in the
225 Notification, perhaps to identify either the subscriber or the ultimate recipient
- 226 5. the charset to use in the Notification, if it is to be different than the one used in the request that
227 created the subscription
- 228 6. the natural language to use in the Human Consumable Notification, if it is to be different than the
229 one used in the request that created the subscription
- 230 7. the requested lease time in seconds for the subscription
- 231 8. whether or not the subscription is requested to be persistent across power cycles.

232 For Per-Job subscriptions, a client requests job and printer event notification using the "job-notify"
233 operation attribute when creating a job with any of the Job Creation operation: Print-Job, Print-URI, and
234 Create-Job. The "job-notify" operation attributes may be submitted to the Validate-Job in order to be
235 validated. The "job-notify" operation attribute contains one or more collection values, each consisting of a
236 number of member attributes that specify a subscription, so that a Job can have more than one Per-Job
237 subscription. The 'collection' is a new attribute syntax (see [ipp-coll]). The member attributes of each
238 collection value are copied to separate Subscription objects to populate the corresponding Subscription
239 Description attributes.

240 For Per-Printer subscriptions and Per-Job subscriptions created after the Job has been created, a client
241 requests job and printer event notification using new operations independent of any job. The Printer keeps
242 each subscription in a separate Subscription object. The Create-Job-Subscription and Create-Printer-
243 Subscription operations create an instance of the Subscription object supplying these new operation
244 attributes and returns a subscription-id (analogous to a job-id for a Job object). These operation attributes
245 are copied to the Subscription object as Subscription Description attributes and so may be queried using the
246 Get-Subscription-Attributes and Get-Subscriptions operations. The subscriber requests a lease time for
247 each Per-Printer subscription which MAY be infinite. The Printer grants a lease time according to its
248 configured policy. A client MUST renew the Subscription before the granted lease time expires using the
249 Renew-Subscription operation.

250 Table 1 summarizes the Per-Job and Per-Printer Subscription operations, assigns their operation-id (see
251 [ipp-mod] section 4.4.15) and their salient input operation attributes.

252

Table 1 - Summary of Per-Job and Per-Printer Subscription operations

Operation:	Oper. ID	Per-Job	Per-Printer	Brief Description salient inputs beside printer-uri:
Print-Job, Print-URI, Create-Job	see [ipp-mod]	yes	no	Create one or more Per-Job Subscriptions as part of the Job Creation operations 1setOf {recipient, [events,] [format,] [user-data,] [charset,] [natural-language]}
Validate-Job	see [ipp-mod]	yes	no	Check that the Job Creation operation would be accepted including the Subscription 1setOf {recipient, [events,] [format,] [user-data,] [charset,] [natural-language]}
Create-Printer-Subscription	0x0016	no	yes	Create a Per-Printer Subscription recipient, [events,] [format,] [user-data,] [charset,] [natural-language,] [lease-time-requested,] [persistence-requested]
Create-Job-Subscription	0x0017	yes	no	Create a Per-Job Subscription recipient, job-id, [events,] [format,] [user-data,] [charset,] [natural-language,]
Get-Subscription-Attributes	0x0018	yes	yes	Get specified Subscription attributes of the specified Subscription object subscription-id, [requested-attributes]
Get-Subscriptions	0x0019	yes	yes	Get the specified Subscription attributes from all my or all of the Subscription objects [job-id], [my-subscriptions,] [requested-attributes]
Renew-Subscription	0x001A	yes	yes	Renew the Subscription lease subscription-id, [lease time-requested]
Cancel-Subscription	0x001B	yes	yes	Cancel the Subscription subscription-id

253

254 There are two steps that IPP notification must take regarding each event - an internal event recording, and
255 an external notification:

256 1) As an events occurs, the printer internally records in the job objects and the printer objects those
257 events which are required to be supported by the system and those that are subscribed to by a
258 notification recipient.

259 2) As an events occurs, the Printer searches the set of subscriptions for any interest in that event. As
260 the Printer finds that some notification recipient is interested in that event (the notification recipient
261 is subscribed to the event), the Printer increments the Subscription object's "subscription-request-id"
262 (integer (0:MAX)) attribute and a notification is generated and delivered using the methods and
263 target addresses identified in the subscription, passing the incremented "request-id". The

264 "subscription-request-id" sequence number permits a Notification Recipient to detect duplicate
265 notifications due either to duplicate subscriptions or retries and to detect dropped notifications.

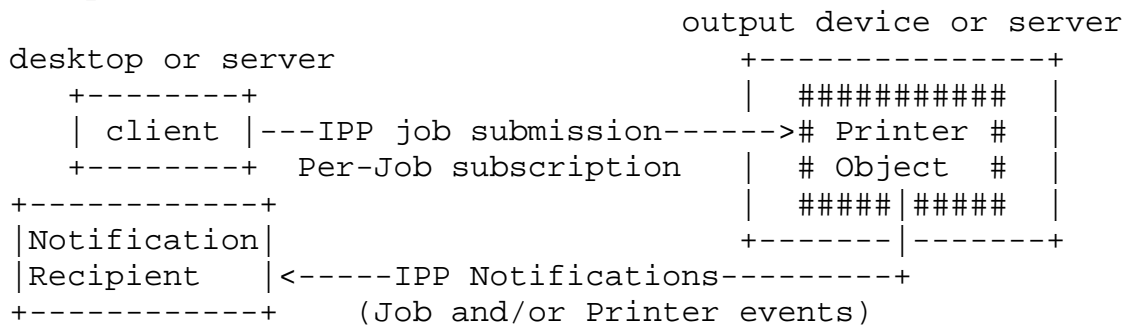
266 **2 Model for Per-Job and Per-Printer Subscription and Event Notification**

267 **2.1 Model for Per-Job Subscription and Notification**

268 Per-Job subscriptions are created by a client (desktop or server acting as a client) as part of creation of the
269 job in an IPP Printer (printing device or server). More than one subscription may be submitted with a job.
270 Additional subscriptions may be associated with the job using the Create-Job-Subscription operation. The
271 IPP Printer object delivers a Notifications to the Notification Recipient supplied by the Client in each
272 subscription. A Notification Recipient can be the Job submitter or a third party.

273 Figure 1 shows the Per-Job subscription notification model for a simple Client - Printer relationship.

274
275 embedded printer:



285 **Figure 1 - Client-Printer Per-Job Subscription and Notification Model**

286 Figure 2 shows a (spooling or non-spooling) Server that implements two Printer objects (1 and 2) that
287 represent two devices. The devices A and B in turn each implement an IPP Printer object (3 and 4,
288 respectively). The Server implementation has three choices for how to support Per-Job subscriptions to the
289 client (and itself):

- 290 1. forward the Per-Job subscriptions to the down stream IPP Printer and let it perform the
 291 notification directly to the Notification Recipients supplied by the Client (Notifications(C)) and
 292 use Per-Printer Subscriptions for the Server's own purposes.
- 293 2. save the client-supplied Per-Job subscription on the Job object in the server and substitute its
 294 own Per-Job subscription with the Server as the Notification Recipient (Notifications(B)). Then
 295 the Server relays Notifications to the client-supplied Notification Recipients (Notifications(A)).
- 296 3. A combination of 1 and 2 in which the Server adds its own Per-Job subscriptions to those
 297 supplied by the client. Thus the IPP Job that goes to Printer object 4 has a combination of
 298 subscription information from both the Client and the Server. This latter approach is sometimes
 299 called "piggy-backing" because the Server is adding its Per-Job subscription information to that
 300 supplied by the client. Piggy-backing is especially useful, if device B also accepts (IPP or non-
 301 IPP) requests from other servers. Then when all the jobs from Server S have been completed by
 302 device B, there will be no more Job events sent to Server S. (Server S could still maintain a

long term Per-Printer subscription with Printer D to that Server S can have Printer B's state track (shadow) that of Printer D or Server S could poll Printer D when queried about Printer B).

303
304
305
306
307
308
309
310
311
312
313
314
315
316
317
318
319
320
321
322
323

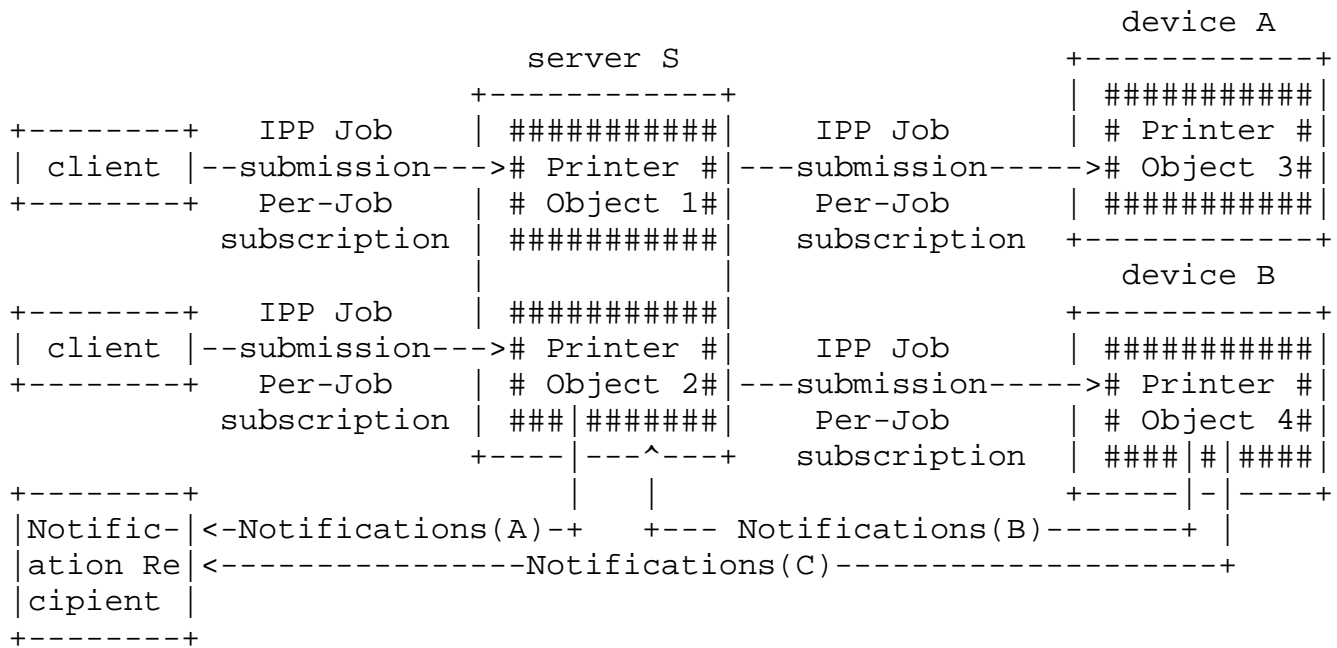


Figure 2 - Client-Server-Printer Per-Job Subscription and Notification Model

2.2 Model for Per-Printer Subscription and Notification

Per-Printer subscriptions are created by a client (an end user, an operator, or a server acting as a client) using a Create-Printer-Subscription operation that is independent of Job Submission. The Printer object (printing device or server) creates a Subscription object to hold the attributes supplied by the subscriber. The client creates separate Per-Printer subscriptions if more than one Notification Recipient is desired. The Printer delivers Notifications to the Notification Recipient specified by each Per-Printer subscription. A Notification Recipient may be the subscriber or a third party. Figure 3 shows the Per-Printer subscription notification model for the Client - Printer relationship where the client may be an end user, an operator, or a server acting as a client.

334
335
336
337
338
339
340
341
342
343
344

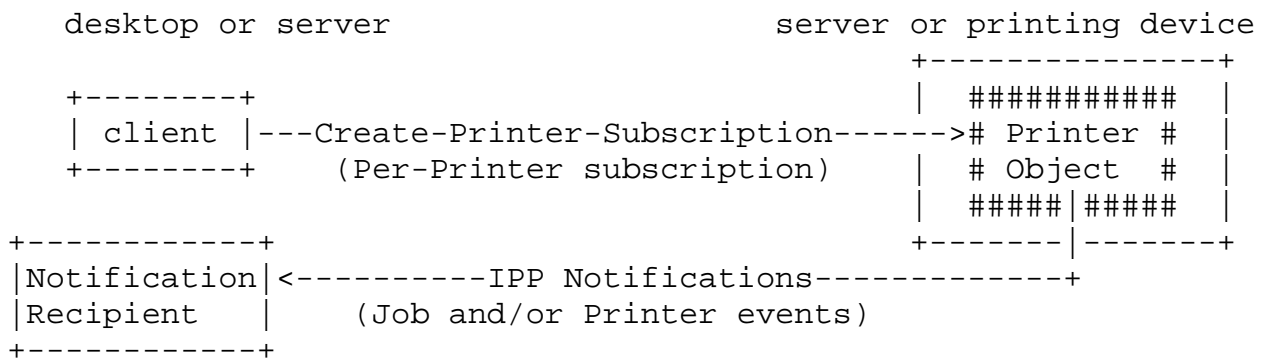


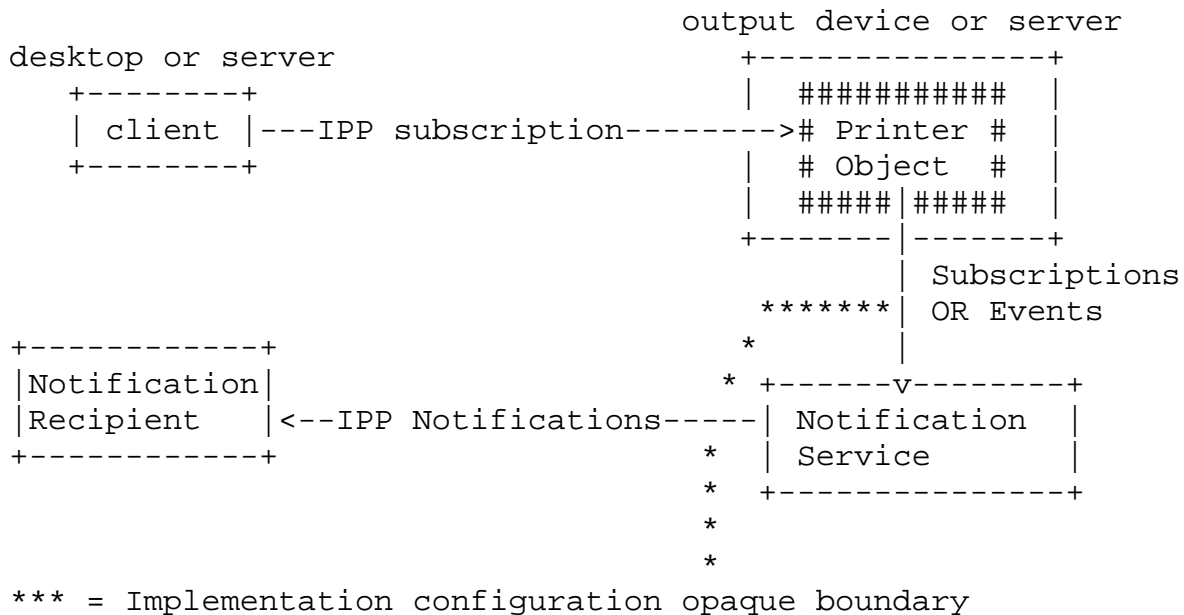
Figure 3 - Client-Printer Per-Printer Subscription and Notification Model

346 **2.3 Relationship between the Printer object and the Notification Delivery Service**

347 The IPP Notification model does not mandate that the IPP Printer object implement the full semantics of
 348 subscription, report generation, and multiple delivery methods itself. This section describes two methods
 349 of using third party notification services. The first is transparent to the client and the second is transparent
 350 to the IPP Printer.

351 **2.3.1 Use of a Notification Service transparently to clients**

352 An implementation may be configured to use some other notification service to either (1) delivery the
 353 Notifications to the Notification Recipient(s) specified in the IPP Subscription or (2) keep the
 354 Subscriptions, accept events, possibly format the notification in the natural language of the Notification
 355 Recipient when a Human Consumable text format is used, and deliver the Notifications to the Notification
 356 Recipient(s) indicated in the IPP Subscription. Figure 4 shows this partitioning.



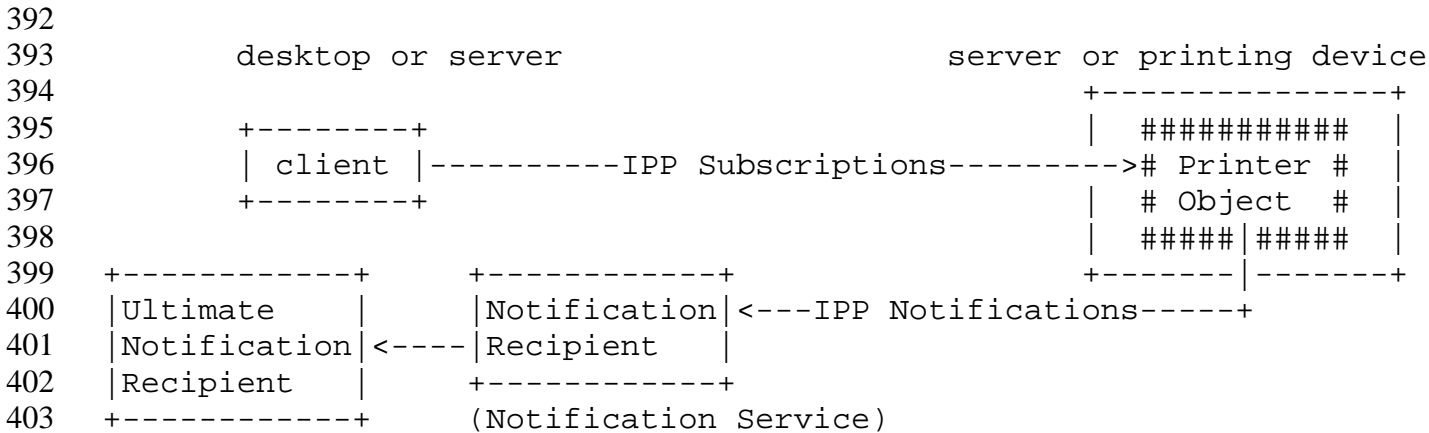
376 **Figure 4 - Opaque Use of a Notification Service Transparent to the Client**

377 In any case, the interface between the IPP Printer and the other notification service is outside the scope of
 378 this document and is intended to be transparent to the client and this specification.

379 **2.3.2 Use of Notification Service transparently to the IPP Printer**

380 Another way that a Notification Service can be used is if the Notification Recipient indicated in the IPP
 381 Subscription is a notification service (transparent to the IPP Printer), which in turn forwards the
 382 Notification to the Ultimate Notification Recipient using additional parameters in the IPP Subscription
 383 (URI parameters or subscriber user data). In such cases, the Ultimate Notification Recipient has also
 384 subscribed directly with the other notification service (by means outside this document). As far as the IPP
 385 Printer is concerned, the IPP Subscription indicated that the IPP Printer is to delivery Notifications to the
 386 Notification Recipient (Notification Service) using the specified notification delivery method. The method
 387 that the Notification Recipient uses for delivering the notification to the Ultimate Notification Recipient is

388 beyond the scope of this document and is transparent to the IPP Printer. However, the client does have to
389 know how to pass additional information to the Notification Recipient in the IPP Subscription using either
390 extra parameters in the URI or subscriber user data. Examples of this latter approach are paging,
391 immediate messaging services, and NOS vendors infrastructure. Figure 5 shows this approach.



404 **Figure 5 - Use of a Notification Service transparent to the IPP Printer**

405 **3 Terminology**

406 This section defines terminology used throughout this document.

407 **3.1 Conformance Terminology**

408 Capitalized terms, such as **MUST**, **MUST NOT**, **REQUIRED**, **SHOULD**, **SHOULD NOT**, **MAY**,
409 **NEED NOT**, and **OPTIONAL**, have special meaning relating to conformance to this specification.

410 These terms are defined in [ipp-mod section 13.1 on conformance terminology, most of which is
411 taken from RFC 2119 [RFC2119].

412 **REQUIRED** - an adjective used to indicate that a conforming IPP Printer implementation **MUST**
413 support the indicated operation, object, attribute, attribute value, status code, or out-of-band value in
414 requests and responses. See [ipp-mod] "Appendix A - Terminology for a definition of "support".
415 *Since support of this entire notification specification is OPTIONAL for conformance to IPP/1.0
416 or IPP/1.1, the use of the term REQUIRED in this document means "REQUIRED if this
417 OPTIONAL notification specification is implemented".*

418 **RECOMMENDED** - an adjective used to indicate that a conforming IPP Printer implementation is
419 recommended to support the indicated operation, object, attribute, attribute value, status code, or
420 out-of-band value in requests and responses. *Since support of this entire notification specification
421 is OPTIONAL for conformance to IPP/1.0 or IPP/1.1, the use of the term REQUIRED in this
422 document means "RECOMMENDED if this OPTIONAL notification specification is
423 implemented".*

424 **OPTIONAL** - an adjective used to indicate that a conforming IPP Printer implementation **MAY**, but is
425 **NOT REQUIRED** to, support the indicated operation, object, attribute, attribute value, status code,
426 or out-of-band value in requests and responses.

427 **settable** - an adjective used to indicate that a Printer implementation supports setting the value(s) of an
428 attribute using the Set-Job-Attributes or Set-Printer-Attributes operations (see [ipp-set]).

429 **READ-ONLY** - an adjective used in an attribute definition to indicate that an IPP Printer MUST NOT
430 support the attribute as being settable using the Set-Job-Attributes or Set-Printer-Attributes
431 operations (see [ipp-set]).

432 **3.2 Other terminology**

433 **Job Submitting End User** - A human end user who submits a print job to an IPP Printer. This person
434 may or may not be within the same security domain as the Printer. This person may or may not be
435 geographically near the printer.

436 **Administrator** - A human user who established policy for and configures the print system.

437 **Operator** - A human user who carries out the policy established by the Administrator and controls the
438 day to day running of the print system.

439 **Job Submitting Application** - An application (for example, a batch application), acting on behalf of a
440 Job Submitting End User, which submits a print job to an IPP Printer. The application may or may
441 not be within the same security domain as the Printer. This application may or may not be
442 geographically near the printer.

443 **Security Domain** - The set of network components which can communicate without going through a
444 proxy or firewall. A security domain may be geographically very large, for example - anyplace
445 within IBM.COM.

446 **IPP Client (or client)** - The software component (desktop or server) that sends an IPP operation
447 request to an IPP Printer object (server or printing device) and accepts the resulting operation
448 response from the IPP Printer object.

449 **Job Recipient** - A human who is the ultimate consumer of the print job. In many cases this will be the
450 same person as the Job Submitting End User, but need not be.

451 Example: If I use IPP to print a document on a printer in a business partner's office, I am the Job
452 Submitting End User, while the person I intend the document for in my business partner's office is
453 the Job Recipient. Since one of the goals of IPP is to be able to print near the Job Recipient of the
454 printed output, we would normally expect that person to be in the same security domain as, and
455 geographically near, the Printer. However, this may not always be the case. For example, I submit a
456 print job across the Internet to a Kinko's print shop. I am both the Submitting End User and the Job
457 Recipient, but I am neither near nor in the same security domain as the Printer.

458 **Job Recipient Proxy** - A human acting on behalf of the Job Recipient. In particular, the Job Recipient
459 Proxy physically picks up the printed document from the Printer, if the Job Recipient cannot
460 perform that function. The Proxy is **by definition** geographically near and in the same security
461 domain as the printer.

462 Example: I submit a print job from home to be printed on a printer at work. I'd like my secretary to
463 pick up the print job and put it on my desk. In this case, I am acting as both Job Submitting End
464 User and Job Recipient. My secretary is acting as a Job Recipient Proxy

465 **Notification Subscriber (or Subscriber)** - A client that requests the IPP Printer to send Event
466 Notifications to one or more Notification Recipients. A Notification Subscriber may be:

- 467 1. a Job Submitting End User or Job Submitting Application (desktop or server) that is submitting
468 a job or
- 469 2. an End User, an Operator, or an Administrator that is not submitting a job.

470 **Subscription** - A request by a Notification Subscriber to the IPP Printer to send Event Notifications to
471 a specified Notification Recipient when the event occur. A Subscription is represented as a set of
472 attributes that indicate the "what, where, who, and how" for notification. Notifications are

473 generated for certain events (what) and delivered using various delivery methods (how) to certain
474 addresses (where and who).

475 **Per-Job Subscription** - A Subscription that a client specifies as part of a create job operation (Print-
476 Job, Print-URI, Create-Job), a Validate-Job operation, or an explicit Create-Job-Subscription
477 operation with a Job object as the target.

478 **Per-Printer Subscription** - A Subscription that a client specifies using an explicit Create-Printer-
479 Subscription operation with a Printer object as the target.

480 **Notification Source** - The entity that sends Event Notifications. It MAY be the IPP Printer itself or the
481 IPP Printer MAY be configured to use a Notification Service to delivery Notifications transparently
482 to the subscribing clients (see Figure 4).

483 **Notification Recipient** - The entity identified as a recipient within a subscription that receives IPP
484 Notifications about Job and/or Printer events (see Figure 4 and Figure 5). A Notification Recipient
485 may be a: Job Submitting End User, Job Submitting Application (desktop or server), Job Recipient,
486 Job Recipient Proxy, a Notification Service, an Operator, or Administrator, etc., and their
487 representative or log file or usage statistics gathering application or other active or passive entities.
488 A Java Listener is an example of a Notification Recipient.

489 **Ultimate Notification Recipient** - The entity to which the Notification Recipient (stores and) forwards
490 an IPP Notification when the Notification Recipient is a Notification Service (see Figure 5).

491 **Event** - An event is some occurrence (either expected or unexpected) within the printing system of a
492 change of state, condition, or configuration of a Job or Printer object. A property of an event is that
493 it only occurs at one instant in time and does not span the time the physical event takes place. For
494 instance, jam-occurred and jam-cleared are two distinct events. The jam-occurred event is reported
495 only when the jam initially occurs and only if there is one or more event subscriptions outstanding
496 for that event.

497 Events can be classified along two dimensions:

- 499 - Either as Job Events or Printer Events, and
- 500 - Either as Errors, Warnings, or Reports

501
502 A Job event is some interesting state change in the Job object, and a Printer event is some
503 interesting change in the Printer object.

504
505 A report event is purely informational, such as 'job-completed' or 'accepting-jobs'. A warning is not
506 serious and processing continues. An error is serious and either the job is aborted or the printer
507 stops. These are typical uses of the terms report, warning, and error, although the actual usage is
508 implementation dependent.

509
510 An event occurs for a job or printer whether any entity has subscribed to be notified for that event or
511 not. A notification is only generated depending on the set of subscriptions outstanding.

512
513 **Notification** - When an event occurs, a Notification is generated that fully describes the event (what
514 the event was, where it occurred, when it occurred, etc.). Notifications are delivered to each
515 Notification Recipient that has a subscription that includes the event, if any. The Notification is
516 delivered to the address of the Notification Recipient using the notification delivery method defined
517 in the subscription. However, a Notification is sent ONLY if there is a corresponding subscription.

518 **Notification Delivery Method** (or **Delivery Method** for short) - Notifications are delivered using a
519 method, such as email, TCP/IP, etc.

520 **Immediate Notification** - Notifications that are delivered using a delivery method which is not store-
521 and-forward (e.g. TCP connection, UDP datagram). This can be on the order of several minutes
522 subject to network latency.

523 **Store and Forward Notification** - A Notification which are not necessarily delivered to Notification
524 Recipients immediately, but is queued for delivery by some intermediate network application, for
525 later retrieval. Email and Instant Messaging services are examples of a store and forward
526 notification delivery method.

527 **Human Consumable Notification** - Notifications that are intended to be consumed by human End
528 Users only. They are simple text that has been localized for the Notification Recipient as specified
529 in the subscription. Programs are not intended to parse Human Consumable Notification, since it is
530 localized and the content depends on implementation. There is no standardized format.

531 **Machine Consumable Notification** - Notifications that are intended for consumption by a program
532 only. They use the encoding of an IPP response. The Notification Recipient must localize the
533 contents, if displaying it to a human.

534 **Subscription Creation operation** - One of the operations that creates a Subscription object: Job
535 Creation operations (Create-Job, Print-Job, and Print-URI), Create-Job-Subscription, and Create-
536 Printer-Subscription.

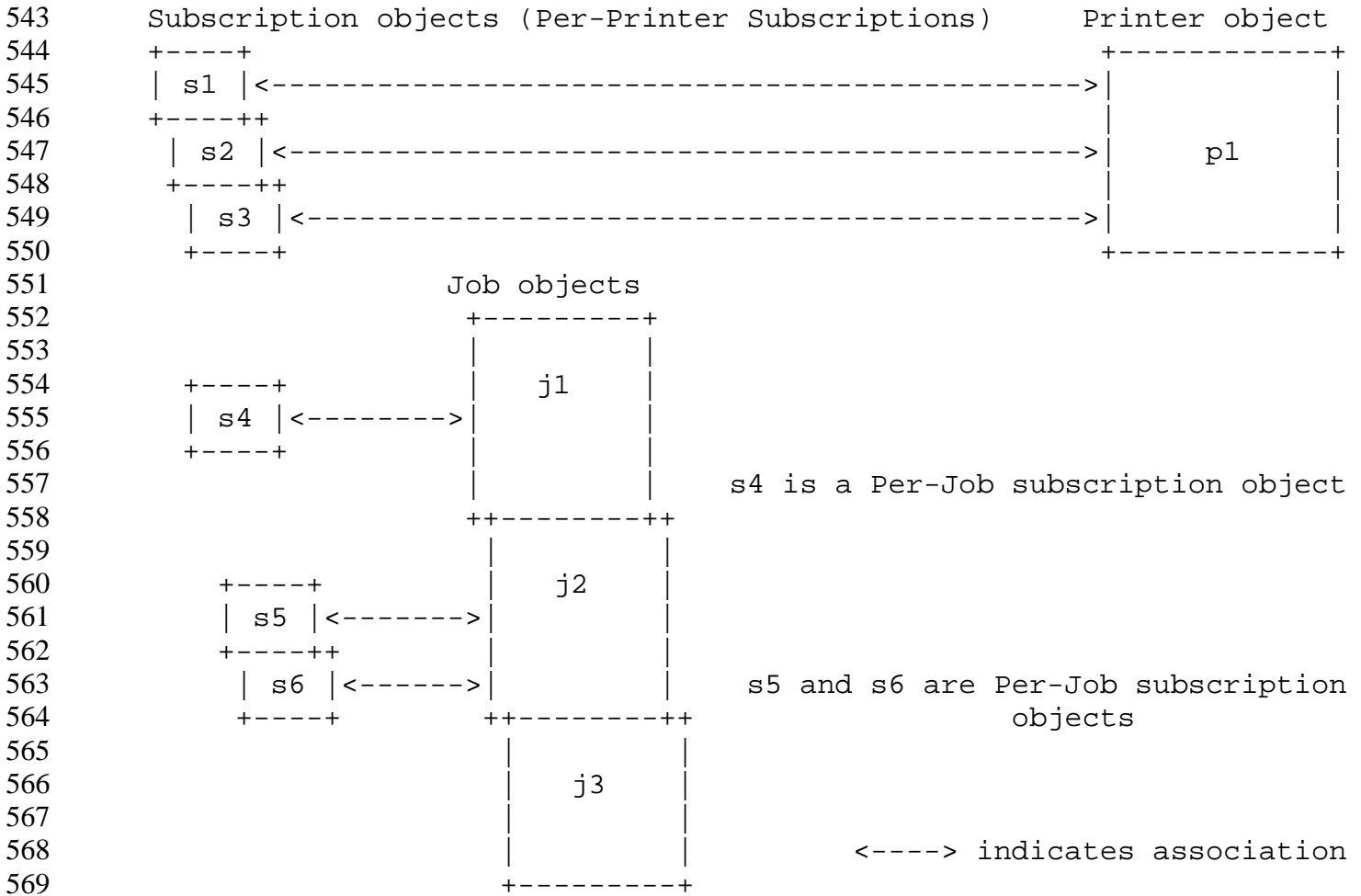
537 4 Object Model for Notification

538 This section describes the notification object model that adds a REQUIRED Subscription object which
539 together with the Job and Printer object provide the complete notification semantics.

540

541 The object relationships can be seen pictorially as:

542



570 **Figure 6 - Object Model for Notification**

571 s1, s2, and s3 are Per-Printer Subscription objects and can identify Printer and/or Job events.

572 s4, s5, and s6 are Per-Job subscription objects and can identify Printer and/or Job events.

573 **4.1 Object relationships**

574 This sub-section defines the object relationships between the Printer, Job, and Subscription objects.
575 Whether Per-Printer Subscription objects are actually contained in a Printer object or are just bi-
576 directionally associated with them in some way is IMPLEMENTATION DEPENDENT and is transparent
577 to the client. Similarly, whether Per-Job Subscription objects are actually contained in a Job object or are
578 just bi-directionally associated with them in some way is IMPLEMENTATION DEPENDENT and is
579 transparent to the client. The object relationships are defined as follows:

580 **4.1.1 Printer object and Per-Printer Subscription objects**

- 581 1. The Printer object contains (is associated with) zero or more Per-Printer Subscription objects (p1
582 contains s1-s3 Per-Printer Subscription objects).

- 583 2. A Per-Printer Subscription object (s1-s3) cannot be contained in (or associated with) more than one
584 Printer object (p1).
- 585 3. Each Per-Printer Subscription object (s1, s2, and s3) is contained in (or is associated with) one
586 Printer object (p1) and each represents one Per-Printer subscription.
- 587 4. Each Per-Printer Subscription object identifies one or more Job and/or Printer events. Such Job
588 events are for *all* jobs on the Printer. Such Printer events are for *any* Printer event, no matter which
589 job is processing and when no jobs are processing.

590 **4.1.2 Job object and Per-Job Subscription objects**

- 591 5. A Job object (j1, j2, j3) contains (is associated with) zero or more Per-Job subscription objects (s4-
592 s6). Job j1 is associated with Per-Job subscription object s4, Job j2 is associated with Per-Job
593 subscription objects s5 and s6, and Job j3 is not associated with any Per-Job subscription object.
- 594 6. A Per-Job Subscription object cannot be contained in (or associated with) more than one Job object.
- 595 7. Each Per-Job Subscription object is contained in (or associated with) one Job object and each
596 represents one Per-Job Subscription.
- 597 8. Each Per-Job Subscription object identifies one or more Job and/or Printer events. Such Job events
598 are only for *this* job (different than "per-Printer" Subscriptions). Such Printer events are for *any*
599 Printer event, no matter which job and when no jobs are processing (same as for "per-Printer"
600 Subscriptions).

601 **5 Subscription Object attributes**

602 Table 2 lists the Subscription object attributes defined in this section and the related Printer Description
603 attributes defined in section 6, if any. The definitions of the object attributes are specified in this section so
604 that they can be referred to from the subsequent definitions of the operations that set them. All of the
605 Subscription object attributes are READ-ONLY. They can be set only by specific operations that create or
606 perform operations on Subscription objects (see section 8).

607

Table 2 - Subscription object attributes

Subscription object attributes: Set by client input to a Subscription Creation operation	Printer support	Related Printer Description attribute(s)
notify-recipient (uri)	REQUIRED	notify-schemes-supported (1setOf uriScheme)
notify-events (1setOf type2 keyword)	REQUIRED	notify-events-default (1setOf type2 keyword) notify-events-supported (1setOf type2 keyword) max-events-supported (integer(5:MAX))
notify-format (mimeMediaType)	REQUIRED	notify-format-supported (1setOf mimeMediaType)
subscriber-user-data (octetString(63))	REQUIRED	
notify-charset (charset)	OPTIONAL	charset-supported (1setOf charset)
notify-natural-languages (1setOf naturalLanguage)	OPTIONAL	generated-natural-language-supported (1setOf naturalLanguage)

608

Subscription object attributes: Printer initializes to 0, increments at beginning of each event	Printer support	Related Printer Description attribute(s)
subscription-request-id (integer(0:MAX))	REQUIRED	

609

Subscription object attributes: Printer sets as part of Subscription Creation operation	Printer support	Related Printer Description attribute(s)
subscription-id (integer(1:MAX))	REQUIRED	max-job-subscriptions-supported (integer(0:MAX)) max-printer-subscriptions-supported (integer(0:MAX))
notify-lease-expiration-time (integer(0:MAX))	REQUIRED	notify-lease-time-default (integer(0:MAX)) notify-lease-time-supported (rangeOfInteger(0:MAX))
printer-uri (uri)	REQUIRED	
subscriber-user-name (name(MAX))	REQUIRED	

610

Subscription object attributes: Returned by Printer on Subscription Creation operation	Printer support	Related Printer Description attribute(s)
notify-server-up-time (integer(1:MAX))	REQUIRED	printer-up-time (integer(1:MAX))
notify-persistence-granted (boolean)	REQUIRED	persistent-subscriptions-supported (boolean)

611 Note: The Subscription object does not contain the "job-id" Subscription Description attribute. The Get-
612 Subscriptions operation has the "job-id" as an input operation attribute, so the "job-id" isn't returned in the
613 response. If an implementation needs such a link between Subscription objects and Job objects, then it
614 keeps such a link as in internal attribute. The intent is that whether Per-Job Subscription objects are
615 actually contained in a Job object or are just associated with them in some way is IMPLEMENTATION
616 DEPENDENT and is transparent to the client.

617 5.1 notify-recipient (uri)

618 This REQUIRED READ-ONLY Subscription object attribute describes both where (the address of the
619 Notification Recipient) and how (the delivery method) notifications are to be delivered to the Notification
620 Recipient when any of the events specified in the "notify-events" attribute occur.

621 There are potentially many different notification delivery methods for IPP notifications, standardized as
622 well as proprietary. This document does not define any of these delivery mechanisms; they will each be
623 described in separate complementary documents.

624 Each of the notification delivery method documents must provide at least the following information:

- 625 1) The URI scheme used.
- 626 2) The supported and default delivery format, and if not one of the specified types in Section 5.3,
627 description of the notification content.
- 628 3) Any content length restrictions imposed by the delivery protocol.
- 629 4) The latency of the delivery protocol used.
- 630 5) The reliability of the transport and delivery protocol used.
- 631 6) The security aspects of the transport and delivery protocol used, e.g. how it is handled in firewalls.
- 632 7) How the delivery protocol is initiated, e.g. does it have to be initiated by the receiving user (pull), or
633 is it initiated by the notification service (push).

634 The following notification delivery schemes are defined in other documents for use as part of the URI value
635 of this attribute:

- 636 'ipp:' - The Notification Recipient uses server directed polling to pull Notifications [ipp-method-poll]
- 637 'indp:' - The Notification Source sends Send-Notifications operations to the Notification Recipient [ipp-
638 method-indp]
- 639 'mailto:' - The Notification Source sends a email message using SMTP with possible attachments
640 containing Machine Consumable Notification Content [ipp-method-mailto]
- 641 'snmp:' - The Notification Source sends SNMP traps and/or informs to the Notification Recipient [ipp-
642 method-snmp]

643 **ISSUE 01** - Ok to include the notification delivery scheme names 'ipp:', 'indp:', 'mailto:', and 'snmp:' that
644 are in progress as example values of the "notify-recipient" (uri) attribute?

645 **ISSUE 02** - Once a number of delivery solutions have been developed and evaluated, we may want to
646 make one or several of them REQUIRED for implementation to ensure a minimum set of interoperability.
647 Which one or ones should be REQUIRED?

648 **5.2 notify-events (1setOf type2 keyword)**

649 This REQUIRED READ-ONLY Subscription object attribute identifies the job and/or printer events that
650 are to be delivered to the Notification Recipient as Notifications as defined in section 7. If the client did
651 not supply this attribute when supplying the subscription, the Printer object populates this attribute with its
652 "notify-events-default" attribute value (see section 6.2).

653 There are both job events and printer events. Each job and printer event is assigned a keyword to use in
654 this attribute and in the Notification. Job and printer events have the following semantics depending on
655 whether the subscription is a Per-Job or a Per-Printer subscription:

656 Job events: The semantics for job events depends on whether the subscription is a Per-Job
657 Subscription or a Per-Printer Subscription. For Per-Job Subscriptions, the Printer MUST
658 generate Notifications only for the job events of the job with which the Subscription is
659 associated. For Per-Printer Subscriptions, the Printer MUST generate Notifications for the
660 job events for any job submitted to the Printer.

661 For example, consider the event when there are 10 'pending' jobs, one 'processing' job, and
662 30 'completed' jobs and the 'processing' job completes. The Printer MUST generate a 'job-
663 completed' job event Notification if the job has a Per-Job Subscription that contained the
664 'job-completed' event in this attribute. The Printer MUST NOT generate Notifications for
665 any other jobs whose Per-Job Subscriptions contain the 'job-completed' event in this
666 attribute.

667 Printer events: The semantics for printer events does not depend on whether the subscription is a
668 Per-Job or a Per-Printer Subscription. For both Per-Job Subscriptions and Per-Printer
669 Subscriptions, the Printer MUST generate Notifications for printer events, no matter what
670 job is processing, including when no jobs are processing.

671 For example, consider the event when there are 10 'pending' jobs, one 'processing' job, and
672 30 'completed' jobs and the Printer enters the 'stopped' state. The Printer MUST generate a
673 'printer-state-changed' printer event Notification for each of the 11 'pending' and 'processing'
674 jobs whose Per-Job Subscriptions contain the 'printer-state-changed' event in this attribute.
675 The Printer MUST NOT generate Notifications for any of the 'completed' jobs' whose Per-
676 Job Subscriptions contain the 'printer-state-changed' event in this attribute.

677 The events are defined to be disjoint. For example, the 'job-state-changed' event does not include the 'job-
678 created' and 'job-completed' events. In order to get all three events, the client supplies all three keywords in
679 this attribute.

680 A Printer MUST support the events indicated as "REQUIRED" and MAY support of the events indicated
681 as "OPTIONAL".

682 The standard job event keyword values are:

683 **'none'**: REQUIRED - no notifications of any events (an IPP object can use this value to indicate that it
684 is configured not to support event notification; a client would not subscribe to this event).

685 **'job-created'**: REQUIRED - the Printer object has accepted a Job Creation operation (Print-Job, Print-
686 URI, or Create-Job) and the job's "time-at-creation" attribute value is set (see [ipp-mod] section
687 4.3.14.1). The Printer puts the job in the 'pending', 'pending-held' or 'processing' states.

688 Note: This event is separate from the 'job-state-changed' event so that it can be subscribed to
689 without having to get every job state change event for a Notification Recipient that is only
690 interested in when the job is first created.

691 **'job-completed'**: REQUIRED - the job has reached one of the completed states, i.e., the value of the
692 job's "job-state" attribute has changed to: 'completed', 'aborted', or 'canceled'. The Job's "time-at-
693 completed" and "date-time-at-completed" (if supported) attributes are set (see [ipp-mod] section
694 4.3.14).

695 Note: This event is separate from 'job-state-changed' so that it can be subscribed to without having
696 to get every job state change event for a Notification Recipient that is only interested in when the
697 job is completed.

698 **'job-state-changed'**: REQUIRED - the job has changed from any state to any other state and/or a
699 value has been added or removed from the job's "job-state-reasons" attribute, except when the job is
700 created or when the job moves to any of the "completed" job states ('completed', 'aborted', or
701 'canceled').

702
703 This event also indicates that one or more values have been added to or removed from the Job's
704 "job-state-reasons" attribute, such as 'job-queued' or 'job-printing', whether or not the job's state has
705 changed. If job state reasons are added when the job is created, only the 'job-created' event is
706 generated, in order to keep the events disjoint. If job state reasons are added or removed when the
707 job is completed, only the 'job-completed' event is generated, in order to keep the events disjoint.

708
709 A client that wants to subscribe to all job state changes, including creation and completion, includes
710 the 'job-created', 'job-state-changed', and 'job-completed' in the notification subscription. When a
711 job is finally removed from the Job History (see [ipp-mod] 4.3.7.1) no event is generated, i.e.,
712 neither a 'job-state-changed' event nor a 'job-purged' event is generated.

713 **'job-config-changed'**: OPTIONAL - when the configuration of a job has changed, i.e., the value of the
714 "job-message-from-operator" or any of the non-READ-ONLY Job attributes have changed, such as
715 any of the job template attributes or the "job-name" attribute. Often, such a change is the result of
716 the user or the operator performing a Set-Job-Attributes operation (see [ipp-set]) on the Job object.
717 The client performs a Get-Job-Attributes to find out the new values of the changed attributes. This
718 event is useful for GUI clients and drivers to update the job information to the user.

719 **'job-purged'**: OPTIONAL - when a 'not-completed' job (i.e., not 'completed', 'canceled', or 'aborted')
720 was purged from the printer using the Purge-Jobs operation. No event, including this event, is
721 generated when a job is aged out of the Job History or moved out explicitly with the Purge-Jobs
722 operation.

723 **'job-progress'** - a sheet or copy has completed. See separate [ipp-prog] spec.
724

725 The standard Printer event keywords values are:

726 **'none'**: REQUIRED - no notification of any events (an IPP object can use this value to indicate that it
727 is configured not to support event notification; a client would not subscribe to this event).

- 728 **'printer-restarted'**: OPTIONAL - when the printer is powered up or the Restart-Printer operation is
729 performed (see [ipp-mod]).
730 Note: This event is separate from the 'printer-state-changed' event so that it can be subscribed to
731 without having to get every printer state change event, for a Notification Recipient that is only
732 interested in when the Printer first comes up.
- 733 **'printer-shutdown'**: OPTIONAL - when the device is being powered down or the Shutdown-Printer
734 operation has been performed (see [ipp-set2]).
735 Note: This event is separate from 'printer-state-changed' so that it can be subscribed to without
736 having to get every Printer state change event, for a Notification Recipient that is only interested in
737 when the Printer is powered down or shutdown.
- 738 **'printer-state-changed'**: REQUIRED - the Printer changed state, i.e., the value of the Printer's
739 "printer-state", "printer-state-reasons" (whether "printer-state" changed or not), and/or "printer-is-
740 accepting-jobs" attributes changed, except when the Printer starts up or is shutdown. If printer state
741 reasons are added when the Printer is started up, only the 'printer-restarted' event is generated, in
742 order to keep the events disjoint. If printer state reasons are added or removed when the printer is
743 powered-down or shutdown, only the 'printer-shutdown' event is generated, in order to keep the
744 events disjoint.
745
- 746 A client that wants to subscribe to all printer state changes, including restart and power-
747 down/shutdown, includes the 'printer-restarted', 'printer-state-changed', and 'printer-shutdown' in the
748 notification subscription.
- 749 **'printer-media-changed'**: OPTIONAL - when the media loaded on a printer has been changed, i.e.,
750 the "media-ready" attribute has changed. This event includes both an actual media change and
751 filling an empty input tray with the same or different media. The client must check the "media-
752 ready" Printer attribute (see [ipp-mod] section 4.2.11) separately to find out what new media was
753 loaded or filled.
- 754 **'printer-config-changed'**: OPTIONAL - when the configuration of a Printer has changed, i.e., the
755 value of the "printer-message-from-operator" or any non-READ-ONLY Printer attribute has
756 changed, except for "media-ready" (which has its own event), whether through the Set-Printer-
757 Attributes operation or by other means and whether initiated by a human or not. For example, any
758 "xxx-supported", "xxx-default", "printer-message-from-operator", etc. values have changed. The
759 client has to perform a Get-Printer-Attributes to find out the new values of these changed attributes.
760 This event is useful for GUI clients and drivers to update the available printer capabilities to the
761 user.
- 762 **'printer-queue-changed'**: OPTIONAL - the order of jobs in the Printer's queue has changed, so that an
763 application that is monitoring the queue can perform a Get-Jobs operation to determine the new
764 order. This event does not include when a job enters the queue (the 'job-created' event covers that)
765 and does not include when a job leaves the queue (the 'job-completed' event covers that).
- 766 **'printer-no-longer-full'**: OPTIONAL - when the Printer can now accept a Print-Job, Print-URI,
767 Create-Job, Send-Document, or Send-URI request. This event is used when there is more than one
768 client feeding a printer/server (fan-in), and the Printer may still be printing but has acquired more
769 buffer space to accept jobs. This event only occurs when the Printer did not have room to accept
770 jobs previously and rejected a Print-Job, Print-URI, Create-Job, Send-Document, or Send-URI
771 operation.
- 772 **'printer-almost-idle'**: OPTIONAL - when the Printer needs another Job in order to stay busy. This
773 event is used when a spooler is feeding more than one printer/server (fan-out), and the spooler holds

774 jobs until a Printer requests them, rather than committing jobs to IPP Printers before it is necessary.
775 This event MAY be used by a Printer implementation to request a new job from any subscribers
776 sufficiently ahead of time so that the device does not run out of work between jobs.
777

778 **5.3 notify-format (mimeMediaType)**

779 This REQUIRED READ-ONLY Subscription object attribute indicates the MIME Media type of Human
780 Consumable and/or Machine Consumable format content that is to be sent in the Notifications for the
781 Notification Content that is under control of the Subscriber. Depending on the delivery method definition
782 document, this attribute MAY specify the MIME Media type for the entire Notification Content, or just a
783 portion that is controllable by the subscriber, if there is a fixed part as well. For example, if the entire
784 Notification Content is always a fixed Machine Consumable MIME Media type, such as the 'ipp:' delivery
785 method which uses the 'application/ipp' MIME Media type (see [indp-method]), then this attribute controls
786 the format of the "human-readable-report" (text(MAX)) Notification Content attribute (see section 7.2) in
787 the Machine Consumable form. As another example, if the Notification Content is always a Human
788 Consumable format content with a MIME Media attachment, such as with the 'mailto:' delivery method
789 [ipp-method-mailto], this attribute controls the format of the attachment.

790 If the 'text' MIME media type registration permits a charset parameter, than such a specification MUST be
791 used (instead of the "notify-charset" attribute - see section 5.5) in order to indicate the charset to be used in
792 the notification content.

793 If the Subscriber did not supply this attribute when requesting the subscription, the Printer object populates
794 this Subscription object attribute with either the 'none' out-of-band value (see section 10.1) or one of the
795 values of the Printer's "notify-format-supported" attribute (see section 6.5), depending on the delivery
796 method and implementation, since there is no "notify-format-default" defined in this document.

797 Standard mimeMediaType values are:

- 798 'none': This out-of-band value (see section 10.1) indicates that the Subscriber-controllable part of the
799 Notification content is not to be sent.
- 800 'text/plain; charset=utf-8': Human Consumable plain text containing characters from ISO 10646
801 represented as UTF-8 [RFC2279] as defined in section 7.1.1.
- 802 'text/html': Human Consumable HTML data [RFC1866] as defined in section 7.1.1.
- 803 'text/xml': Machine Consumable XML data [RFC2376] as defined in section 7.1.2.
- 804 'application/ipp': Machine Consumable IPP request as defined in section 7.1.2 data encoded as in [ipp-
805 pro].
- 806 'application/postscript': Human Consumable PostScript [RFC2046]
- 807 'image/tiff': Human Consumable image data [RFC2302]

809 **5.4 subscriber-user-data (octetString(63))**

810 This REQUIRED READ-ONLY Subscription object attribute holds opaque information being sent from
811 the Subscriber to the Notification Recipient, such as the identify of the Subscriber or a path or index to
812 some Subscriber information. Or it MAY contain a key that the Notification Recipient needs in order to
813 process the Notification, such as the ultimate recipient, if the Notification Recipient is a general application

814 that in turn forwards notifications and the ultimate recipient isn't included in the value of the "notify-
815 recipient" attribute. An Instant Messaging Service is an example of such a general application where the
816 "subscriber-user-data" might be the user's id for that messaging service and the "notification-recipient" is
817 the URL of the messaging service.

818 **5.5 notify-charset (charset)**

819 This OPTIONAL READ-ONLY Subscription object attribute specifies the charset to be used in the
820 Notification content sent to the Notification Recipient, whether the notification content is Machine
821 Consumable or Human Consumable. This attribute MUST NOT be used when the "notify-format" attribute
822 value specifies the charset parameter in its MIME media type value, e.g., 'text/plain; charset=utf-8'.

823 **5.6 notify-natural-language (naturalLanguage)**

824 This OPTIONAL READ-ONLY Subscription object attribute specifies the natural language for the IPP
825 object to use in the Notification content that is sent to the Notification Recipient, whether the notification
826 content is Machine Consumable or Human Consumable.

827 **5.7 subscription-request-id**

828 This REQUIRED READ-ONLY Subscription object attribute holds the most recent request-id sequence
829 number delivered in a Notification content to the Notification Recipient. A value of 0 indicates that no
830 Notifications have been sent for this subscription. The first request-id sent for a subscription MUST be 1.
831 Each Notification Recipient receives its own monotonically increasing series of request-ids operation
832 parameters (see [ipp-mod] section 3.1.2), i.e., no gaps, in order to be able to detect a missing notification.

833 **5.8 subscription-id (integer (1:MAX))**

834 This REQUIRED READ-ONLY Subscription object attribute uniquely identifies this Subscription object
835 instance on this Printer object or this Job object. The Printer object, on acceptance of a Create-Job-
836 Subscription or Create-Printer-Subscription request, generates an ID which identifies the new Subscription
837 object on that Printer or Job. The Printer returns the value of the "subscription-id" attribute as part of the
838 response to a Create-Job-Subscription or Create-Printer-Subscription request. The 0 value is not included
839 to allow for compatibility with "job-id" and with SNMP index values which also cannot be 0.

840 It is RECOMMENDED that Per-Printer Subscription objects be persistent. Then the Subscription objects
841 including the subscription-id remains unique across power-cycles. Even if an implementation does not
842 make Per-Printer subscription objects persist, the implementation SHOULD make every attempt not to re-
843 use subscription ids that subscribers might still think are valid. In other words, the Printer SHOULD at
844 least keep the next subscription-id to be assigned in non-volatile memory. Note: it is assumed that Per-Job
845 subscriptions are persistent if Jobs are persistent, in order to be consistent with the persistency of Job
846 objects. The [ipp-mod] RECOMMENDS that Job objects be persistent.

847 **5.9 notify-lease-expiration-time (integer(0:MAX))**

848 This REQUIRED READ-ONLY Subscription object attribute specifies the time in the future when the
849 subscription lease will expire, i.e., the "printer-up-time" value at which the lease will expire. When the

850 Printer object creates a Per-Printer Subscription object, it populates this attribute with the appropriate value.
851 When the indicated time arrives, the Printer MUST delete the Per-Printer Subscription object. Per-Job
852 Subscription objects always return a value of 0 since Per-Job Subscriptions don't have a lease, but exist for
853 the life-time of the Job instead.

854 A client is able to extend a lease of a Per-Printer subscription using the Renew-Subscription operation (see
855 section 8.3.3). A value of 0 indicates an infinite time, if such a policy is supported as indicated in the
856 "notify-lease-time-supported" (integer(0:MAX)) Printer Description attribute (see section 6.8) and the
857 subscriber is authorized to request an infinite lease. A Per-Job subscription cannot be renewed.

858 Note: In order to compute the number of seconds remaining in a Per-Printer Subscription lease, a client can
859 subtract the "notify-server-up-time" Subscription object attribute (see section 5.12) from the "notify-lease-
860 expiration-time" Subscription object attribute.

861 **5.10 printer-uri (uri)**

862 This REQUIRED READ-ONLY Subscription object attribute identifies the Printer object that created this
863 Subscription object. When a Printer object creates a Subscription object, it populates this attribute with the
864 Printer object URI that was used in the create request. This attribute permits a client to identify the Printer
865 object URI that was used to create this Subscription object, i.e., what security scheme was used.

866 **5.11 subscriber-user-name (name(MAX))**

867 This REQUIRED READ-ONLY Subscription object attribute contains the name of the user that created the
868 Subscription object. The Printer object sets this attribute to the most authenticated printable name that it
869 can obtain from the authentication service over which the IPP operation was received. This attribute is
870 intended to help a human user determine for which Per-Printer Subscriptions they are the Subscriber. Only
871 if such is not available, does the Printer object use the value supplied by the client in the "requesting-user-
872 name" operation attribute of the create operation (see [IPP-MOD] Sections 4.4.2, 4.4.3, and 8). For Per-Job
873 subscriptions created as part of the Job creation operation, the value of the "subscriber-user-name" is the
874 same as the "job-originating-user-name" Job attribute (see [ipp-mod] section 4.3.6).

875 The value of the "subscriber-user-name" is implementation dependent when a server accepts a request and
876 forwards it to a downstream IPP Printer (see Figure 2 and the [ipp-iig]).

877 Note: The Printer object needs to keep an internal originating user id of some form, typically as a
878 credential of a principal, with the Subscription object. Since such an internal attribute is implementation-
879 dependent and not of interest to clients, it is not specified as a Subscription Description attribute. This
880 originating user id is used for authorization checks (if any) on all subsequent operations.

881 **5.12 notify-server-up-time (integer(1:MAX))**

882 This REQUIRED READ-ONLY Subscription object attribute indicates the amount of time (in seconds)
883 that the Printer or Notification Delivery Service implementation has been up and running. This attribute is
884 an alias for the Printer's "printer-up-time" attribute" (see [ipp-mod] section 4.4.29) if the Printer is keeping
885 the Subscription objects or is the up time for the Notification Delivery Service if the Printer has delegated
886 the responsibility for keeping Subscription objects to a notification delivery service, in an analogous way

887 that the Job's "job-printer-up-time" is an alias for "printer-up-time" Printer attribute (see [ipp-mod] section
888 4.3.13.4).

889 Note: The purpose of this attribute is so that a client can request this attribute in a Get-Subscription-
890 Attributes or Get-Subscriptions request and use the value returned in combination with the "notify-lease-
891 expiration-time" (see section 5.9) in order to display the wall clock time equivalent to the user. The
892 difference between this attribute and the 'integer' value of the "notify-lease-expiration-time" attribute is the
893 number of seconds in the future that the subscription will expire. A client can compute the wall-clock time
894 at which the subscription will expire by adding this difference to the client's wall-clock time.

895 **5.13 notify-persistence-granted (boolean)**

896 This REQUIRED READ-ONLY Subscription object attribute indicates whether or not the Per-Job or Per-
897 Printer Subscription is persistent, i.e., saved across power cycles in an implementation-define manner.

898 **6 Printer Description Attributes related to Notification**

899 This section defines the Printer Description attributes that are related to Notification. Table 3 lists the
900 Printer Description attributes and indicates the Printer support required for conformance and whether or not
901 the attribute is READ-ONLY: .

902

Table 3 - Printer Description attributes associated with Notification

Printer object attributes:	Printer support	READ-ONLY?
notify-schemes-supported (1setOf uriScheme)	REQUIRED	no
notify-events-default (1setOf type2 keyword)	REQUIRED	no
notify-events-supported (1setOf type2 keyword)	REQUIRED	no
max-events-supported (integer(5:MAX))	REQUIRED	no
notify-format-supported (1setOf mimeType)	REQUIRED	no
max-job-subscriptions-supported (integer(0:MAX))	REQUIRED	no
max-printer-subscriptions-supported (integer(0:MAX))	REQUIRED	no
notify-lease-time-supported (rangeOfInteger(0:MAX))	REQUIRED	no
notify-lease-time-default (integer(0:MAX))	REQUIRED	no
persistent-jobs-supported (boolean)	OPTIONAL	no ISSUE 03: ok to allow to be settable?
persistent-subscriptions-supported (boolean)	OPTIONAL	no ISSUE 04: ok to allow to be settable?
printer-state-change-time (integer(1:MAX))	OPTIONAL	yes
printer-state-change-date-time (dateTime)	OPTIONAL	yes

903

904 6.1 notify-schemes-supported (1setOf uriScheme)

905 This REQUIRED Printer attribute describes the notification delivery methods supported by this Printer
906 object. Standard values are defined in Section 5.1.

907 6.2 notify-events-default (1setOf type2 keyword)

908 This REQUIRED Printer attribute identifies the event values if the client does not supply the "notify-
909 events" operation attribute in a Subscription Creation operation. Any value in this attribute MUST also
910 appear in the "notify-events-supported" attribute, i.e., be a supported event.

911 6.3 notify-events-supported (1setOf type2 keyword)

912 This REQUIRED Printer attribute identifies the events supported by this Printer object for both Per-Job and
913 Per-Printer subscriptions which MUST be the same. Standard values are defined in Section 5.2.

914 6.4 max-events-supported (integer(5:MAX))

915 This REQUIRED Printer attribute specifies the maximum number of events that are supported in a single
916 Per-Job or Per-Printer subscription which must be the same. A Printer MUST support at least 5 events per
917 subscription, so that clients can depend on at least 5 events in a single subscription. If the number of events
918 supplied by a client in a subscription exceed this number, the Printer rejects the request and returns the
919 'client-error-too-many-events (see section 15.4). If notification is not supported, this attribute MUST NOT
920 be supported.

921 6.5 notify-format-supported (1setOf mimeType)

922 This REQUIRED Printer attributes identifies the MIME media types supported for Human Consumable
923 and/or Machine Consumable notification content that the subscriber can control, if any. If the Notification
924 content is fixed by the implementation, then the value of this attribute is that MIME media type, if it has
925 been registered, or the 'none' out-of-band value (see section 10.1) otherwise. See the definition of the
926 "notify-format" attribute in section 5.3 for details and some example values.

927 Not all formats listed in the "notify-format-supported" attribute need be available with all delivery methods
928 specified in the "notify-schemes-supported". However, all Human Consumable formats, if any, SHOULD
929 be available with all delivery methods. It is much harder to support a Human Consumable format because
930 of localization issues. Once the code is written to support a particular Human Consumable format, it is
931 easy to transmit it on any of the supported notify-schemes. Thus, if a vendor decides to support a notify-
932 scheme, it has already committed to implement the Machine Consumable format. This may be simple if
933 existing code can be reused, e.g. application/ipp and or more difficult if new code must be written, e.g., it is
934 SNMP.

935 **6.6 max-job-subscriptions-supported (integer(0:MAX))**

936 This REQUIRED Printer attribute specifies the maximum number of Per-Job subscriptions that are
937 supported for a job, i.e., the maximum number of collection values for the "job-notify" operation attribute,
938 and/or the maximum number of subsequent Create-Job-Subscription operation requests in combination for
939 a job. A value of 0 indicates no effective maximum. A Printer MUST support at least 1 Per-Job
940 subscription. If the number of Per-Job subscriptions supplied by a client in a Job Creation request exceeds
941 the value of this attribute or would exceed some implementation-defined total number of Per-Job
942 Subscriptions for the Printer, the Printer MUST accept the Job Creation and ignore the excess
943 subscriptions. If a subsequent Create-Job-Subscription request would exceed this number, the Printer
944 rejects the request and returns the 'client-error-too-many-subscriptions' (see section 15.3).

945 If a Printer does not support Per-Job Subscriptions, it MUST NOT support this attribute. The usual way for
946 a client to determine whether an IPP Printer supports a feature is to query the Printer's "operations-
947 supported" attribute. However, there is no new REQUIRED operation for Per-Job Subscriptions.
948 Therefore, the RECOMMENDED way for a client to determine whether or not a Printer supports Per-Job
949 Subscriptions is to query this attribute to see if it is supported (since the Create-Job-Subscriptions is an
950 OPTIONAL operation).

951 **6.7 max-printer-subscriptions-supported (integer(0:MAX))**

952 This REQUIRED Printer attribute specifies the maximum number of Per-Printer subscriptions that are
953 supported by multiple Create-Printer-Subscription requests, i.e., the maximum number of un-expired Per-
954 Printer Subscription objects that the Printer supports at a time. A value of 0 indicates no effective
955 maximum. A Printer MUST support at least 1 Per-Printer subscription. If the number of Per-Printer
956 subscriptions exceeds the value of this attribute or would exceed some implementation-defined total
957 number of Per-Printer Subscriptions for the Printer (if any), the Printer rejects the Create-Printer-
958 Subscription request and returns the 'client-error-too-many-subscriptions' (see section 15.3).

959 If a Printer does not support Per-Printer Subscriptions, then it MUST NOT support this attribute. None the
960 less, the RECOMMENDED way for a client to determine whether or not a Printer supports Per-Printer
961 Subscriptions is to query the "operations-supported" to see if the Create-Printer-Subscriptions operation is
962 supported, rather than querying this attribute.

963 **6.8 notify-lease-time-supported (rangeOfInteger(0:MAX))**

964 This REQUIRED Printer attribute specifies the range of values in seconds that are supported for the
965 "notify-lease-time-requested" operation attribute in a Create-Printer-Subscription or Renew-Subscription
966 request for a Per-Printer subscription. When the lease time expires for a Per-Printer Subscription without
967 renewing, the Printer MUST delete the Subscription object. If the client requests a value outside this range,
968 the Printer MUST grant a value that is in this range (see section 5.9). A value of 0 indicates an infinite
969 lease, i.e., one that does not expire.

970 **6.9 notify-lease-time-default (integer(0:MAX))**

971 This REQUIRED Printer attribute specifies the value of the lease time that the Printer object has been
972 configured to assume if the client does not supply a "notify-lease-time-requested" operation attribute in the
973 Create-Printer-Subscription or Renew-Subscription requests.

974 **6.10 persistent-jobs-supported (boolean)**

975 This OPTIONAL Printer attribute indicates whether or not the Printer supports persistent Jobs, i.e., Jobs
976 object that are preserved across power cycles. If Jobs are persistent, then Per-Job Subscriptions MUST also
977 be persistent, since they are part of the Job object. It is RECOMMENDED that Jobs (and Per-Job
978 Subscriptions) be persistent.

979 If the Printer supports this attribute as settable, then its value MUST control whether or not the Printer
980 keeps Jobs persistently as per the rules in [ipp-set]).

981 **ISSUE 03 again: OK to allow the "persistent-jobs-supported" (boolean) Printer Description attribute to be**
982 **settable?**

983 **6.11 persistent-subscriptions-supported (boolean)**

984 This OPTIONAL Printer attribute indicates whether or not the Printer supports persistent Per-Printer
985 Subscriptions, i.e., Subscription objects that are preserved across power cycles. When this value is 'true'
986 the implementation MAY support some that are persistent and some that are not. If the value is 'false' or
987 the attribute is not supported, Per-Printer Subscriptions MUST NOT be persistent. It is RECOMMENDED
988 that Per-Printer subscriptions be persistent.

989 If the Printer supports this attribute as settable, then its value MUST control whether or not the Printer
990 keeps Subscription objects persistently as per the rules in [ipp-set]).

991 **ISSUE 04 again: OK to allow the "persistent-subscriptions-supported" (boolean) Printer Description**
992 **attribute to be settable?**

993 **6.12 printer-state-change-time (integer(1:MAX))**

994 This OPTIONAL READ-ONLY Printer attribute records the time, i.e., copy of the Printer's "printer-up-
995 time" attribute, that the Printer's "printer-state" attribute was last changed. On power-up, the Printer
996 populates the "printer-state-change-time" from its "printer-up-time" attribute, so that it always has a value.

997 **6.13 printer-state-change-date-time (dateTime)**

998 This OPTIONAL READ-ONLY Printer attribute records the date and time, i.e., copy of the Printer's
999 "printer-current-time" (dateTime) attribute (see [ipp-mod] section 4.4.30), that the Printer's "printer-state"
1000 attribute was last changed. On power-up, the Printer populates the "printer-state-change-date-time" from
1001 its "printer-current-time" attribute, so that it always has a value.

1002 **7 Notification Content**

1003 This section defines the Notification content that is sent to a Notification Recipient when an event occurs.
1004 The Notification MAY be sent by the IPP Printer or a third party Notification Service (see section 2.3).

1005 There are two notification content types: Machine Consumable and Human Consumable, i.e., 'text' MIME
1006 media type. For most notification delivery methods both content types are defined. Each Notification
1007 Content type will either define one specific Machine Consumable form (usual) or indicate that no Machine
1008 Consumable form is defined. In addition, each Notification Content type will indicates whether (usual) or

1009 not Human Consumable forms are permitted. But the definition will not define the Human Consumable
1010 forms. For those Human Consumable forms that a Printer implementation supports as indicated in the
1011 Printer's "notify-format-supported" attribute, it MUST support for all Notification Content formats
1012 supported that permit Human Consumable form.

1013 **7.1 Notification content MIME media type formats**

1014 This section defines the Notification content that the Notification Source sends asynchronously to each
1015 Notification Recipient based on the subscription information stored with the subscription. The Notification
1016 is either in a Human Consumable or Machine Consumable form.

1017 **7.1.1 Human Consumable form**

1018 If the notification delivery method is defined to permit Human Consumable forms such as the entire
1019 Notification Content or a portion of the Notification Content, such as either an attachment or the "human-
1020 readable-report" attribute (see section 7.2) then the following RECOMMENDATIONS apply:

1021 The text message SHOULD include information about the attributes in sections 7.2 and 7.3 for job events
1022 or in sections 7.2 and 7.4 for printer events. This information is localized according to the information
1023 about natural language and charset in the subscription.

1024 An implementation MAY extend the contents of a Human Consumable notification by adding additional
1025 information.

1026 **7.1.2 Machine Consumable form**

1027 If the notification delivery method is defined to have a Machine Consumable form and that form is defined
1028 to be the 'application/ipp' MIME media type [ipp-mod], then the following rules apply:

- 1029 1. The notification content MUST use the 'application/ipp' MIME media type [ipp-mod] using one
1030 of: (1) the Get-Job-Attributes response encoding for job events, (2) Get-Printer-Attributes
1031 response for printer events, or (3) a new Sent-Notifications operation for both job and printer
1032 events.
- 1033 2. The attributes listed in sections 7.2 and 7.3 are sent in a Notification for Job events.
- 1034 3. The attributes listed in sections 7.2 and 7.4 are sent in a Notification for Printer events.
- 1035 4. For any 'text' or 'name' attribute value in any notification, the charset and natural language rules
1036 that apply to all IPP operations apply to these attributes as well, since they are represented as
1037 operation responses.
- 1038 5. The "human-readable-report" attribute can be defined to be REQUIRED, OPTIONAL, or
1039 MUST NOT be sent.
- 1040 6. If the values of any of the attributes sent in an notification content are not known, the value sent
1041 in the report content is the out-of-band 'unknown' value, rather than omitting the attribute (see
1042 the beginning of [ipp-mod] section 4.1).

1043 An implementation MAY extend the contents of the Machine Consumable notification by adding additional
1044 attributes. Notification Recipients MUST be able to accept Notifications containing attributes they do not
1045 recognize. What a Notification Recipient does with an unrecognized attribute is implementation-

1046 dependent. Notification Recipients MAY attempt to display unrecognized attributes anyway or MAY
1047 ignore them.

1048 **ISSUE 05 - Can an implementation extend the Notification Content to include an attribute that uses the**
1049 **'collection' attribute syntax? If so, should we REQUIRE that Notification Recipients that can accept**
1050 **Machine Consumable Notifications, be able to accept the 'collection' attribute syntax?**

1051 7.2 Notification content attributes common to Job and Printer events

1052 This section lists the parameters and attributes that are included in both Job and Printer event Notifications.

1053 The notification delivery method either models the Notification as a (1) request if the IPP Printer sends the
1054 Notification to the Notification Recipient when the event occurs or as a (2) response if the IPP Printer is
1055 queried for the Notification by a Notification Recipient:

1056 Request: If the delivery method defines that the IPP Printer sends the Notification, then the delivery
1057 method also defines whether or not the Notification Recipient returns a response. If the IPP Printer
1058 sends a Notification request, it uses the "operation-id alternative for item #2 in Table 4:

1059 Response: If the delivery method defines that the IPP Printer supports an operation that returns a
1060 Notification as a response to the Notification Recipient, it uses the "status-code" alternative for item
1061 #2 in Table 4.

1062 Some events do not include all of these attributes as shown in Table 4. Each notification content contains a
1063 single Job or Printer event, whether that event was subscribed using the Job Submission Subscription
1064 mechanism or the Per-Printer subscription mechanism. If either kind of Subscription subscribed to both
1065 Job and Printer events, then the Printer will send or return them as separate Job Notification content and
1066 Printer Notification contents to the same Notification Recipient.

1067 Table 4 lists the attributes that are defined for use in Notifications and indicates the Printer support required
1068 for conformance: References of the form "mod m.n.o" refer to [ipp-mod] sections.

1069 **Table 4 - Common Job and Printer Notification content attributes**

Attributes	Reference	Events	
		'job-progress'	all others
The following attributes MUST occur in this order:			
1. version-number (integer (0:32767))	mod 3.1.1	REQUIRED	REQUIRED
2. operation-id (integer (0:32767)) or status-code (integer (0:32767))	mod 3.1.1	REQUIRED	REQUIRED
3. request-id (integer (0:MAX))	5.7 & mod 3.1.1	REQUIRED	REQUIRED
4. attributes-charset (charset)	5.5 & mod 3.1.4	REQUIRED	REQUIRED
5. attributes-natural-language (naturalLanguage)	5.6 & mod 3.1.4	REQUIRED	REQUIRED
6. printer-uri (uri)	5.10	REQUIRED	REQUIRED
The following attribute MAY occur in any order:			
7. printer-name (name(127))	mod 4.4.4	n/a	REQUIRED

Attributes	Reference	Events	
		'job-progress'	all others
8. job-id (integer(1:MAX))	mod 4.3.2	REQUIRED	REQUIRED**
9. job-name (name(MAX))	mod 4.3.5	n/a	REQUIRED**
10. trigger-event (type2 keyword)	7.2.1	REQUIRED	REQUIRED
11. trigger-time (integer(MIN:MAX))	7.2.2	REQUIRED	REQUIRED
12. trigger-date-time (dateTime)	7.2.3	n/a	OPTIONAL
13. subscription-id (integer(1:MAX))	5.8	REQUIRED	REQUIRED
14. subscriber-user-name (name(MAX))	5.11	REQUIRED	REQUIRED
15. subscriber-user-data (octetString(63))	5.4	REQUIRED	REQUIRED
16. notify-format (mimeType)	5.3	OPTIONAL	OPTIONAL
17. human-readable-report (text(MAX))	7.2.4	OPTIONAL	OPTIONAL

1070 Attribute Notes:

1071 "version-number" - the major and minor version number.

1072 "operation-id" - the operation id if the delivery method document models the Notification as the Printer
 1073 sending the Notification to the Notification Recipient (whether the Notification Recipient returns a
 1074 response or not).

1075 "status-code" - a value of 0x600 (hexadecimal 600) for a Job event and 0x601 (hexadecimal 601) for a
 1076 Printer event if the delivery method document models the Notification as the Printer returning the
 1077 Notification to the Notification Recipient as a response to a request.

1078 "request-id" - the sequence number for this subscription, starting at 1, for each subscription, i.e., the Printer
 1079 copies the current value of the "subscription-request-id" Subscription object attribute to the
 1080 Notification request content.

1081 "attributes-charset" - the value comes from the "notify-charset" attribute in the Subscription object.

1082 "attributes-natural-language" - the value comes from the "notify-natural-language" attribute in the
 1083 Subscription object.

1084 "printer-uri" - the value comes from the "job-printer-uri" Job attribute for Per-Job subscriptions.

1085 **"job-id" and "job-name" - included in Printer event Notifications only for Per-Job subscriptions.

1086 "job-name" - SNMP delivery method can truncate to less than 255 octets, since the Notification needs to fit
 1087 into 484 octets or so on some transports that SNMP is defined for.

1088 "subscription-id" - the unique identifier for the Subscription object on this Printer.

1089 "subscriber-user-name" - the subscriber user name that created the Subscription object. SNMP delivery
 1090 method can truncate to less than 255 octets, since the Notification needs to fit into 484 octets or so
 1091 on some transports that SNMP is defined for.

1092 "subscriber-user-data" - opaque user data that may identify either the Subscriber and/or the ultimate
 1093 Notification Recipient. The client **MUST** supply this attribute, if the definition of the delivery
 1094 method specified in the "notify-recipient" attribute **REQUIRES** the client to supply it.

1095 "notify-format (mimeMediaType)" - indicates the text MIME media type (see section 5.3) for the "human-
 1096 readable-report" attribute. This attribute **MUST** be present if the "human-readable-report"
 1097 (text(MAX)) attribute is present in order to unambiguously identify the format of its text value to
 1098 the Notification Recipient.

1099 **7.2.1 "trigger-event" (type2 keyword)**

1100 This **REQUIRED** Notification Content attribute indicates the event that caused this Notification to be
 1101 delivered.

1102 **7.2.2 "trigger-time" (integer(MIN:MAX))**

1103 This **REQUIRED** Notification Content attribute indicates the time at which the event occurred, i.e., the
 1104 "printer-up-time" value (see [ipp-mod] section 4.4.29) when the event occurred.

1105 **7.2.3 "trigger-date-time" (dateTime)**

1106 This **OPTIONAL** Notification Content attribute indicates the date and time at which the event occurred,
 1107 i.e., the "printer-current-time" value (see [ipp-mod] section 4.4.30) when the event occurred.

1108 **7.2.4 "human-readable-report" (text(MAX))**

1109 This **OPTIONAL** Notification Content attribute contains the human consumable text message (see section
 1110 7.1.1) that describes the event and is represented in the text format specified by the "notify-format"
 1111 attribute. Whether or not this attribute is defined depends on the delivery method definition document and
 1112 **MUST** be defined only for use in the Machine Consumable format. If this attribute is defined for use in the
 1113 Machine Consumable Notification, then whether this attribute is **REQUIRED** or **OPTIONAL** also depends
 1114 on the delivery method definition document.

1115 **7.3 Additional Notification content attributes for Job events *only***

1116 Table 5 lists the additional attributes that are included only in Job event Notifications and indicates the
 1117 Printer support required for conformance: "R" indicates **REQUIRED**, "O" indicates **OPTIONAL**, and
 1118 "CR" indicates **CONDITIONALLY REQUIRED**, i.e., **REQUIRED** in a Notification if the corresponding
 1119 Job attributes are supported. Some events do not include all of these attributes as shown in Table 5.

1120 **Table 5 - Additional Notification content attributes for Job events *only***

Attributes	Reference	Events		
		'job-progress'	'job-completed'	all others
18. job-state (type1 enum)	mod 4.3.7	R	R	R

Attributes	Reference	Events		
		'job-progress'	'job-completed'	all others
19. job-state-reasons (1setOf type2 keyword)	mod 4.3.8	R	R	R
20. job-k-octets (integer(0:MAX))	mod 4.3.17.1	O	O	
21. job-k-octets-processed (integer(0:MAX))	mod 4.3.18.1	O	O	
22. job-impressions (integer(0:MAX))	mod 4.2.17.2	O	O	
23. job-impressions-completed (integer(0:MAX))	mod 4.3.18.2	CR	CR	
24. impressions-completed-current-copy (integer(0:MAX))	[ipp-prog]	R		
25. job-media-sheets (integer(0:MAX))	mod 4.3.17.3	O	O	
26. job-media-sheets-completed (integer(0:MAX))	mod 4.3.18.3	CR	CR	
27. job-collation-type (type2 enum)	[ipp-prog]	R		
28. sheet-completed-copy-number (integer(0:MAX))	[ipp-prog]	R		
29. sheet-completed-document-number(integer(0:MAX))	[ipp-prog]	R		

7.4 Additional Notification content attributes for Printer events *only*

Table 6 lists the additional attributes that are included only in Printer event Notifications and indicates the Printer support required for conformance:

Table 6 - Additional Notification content attributes for Printer events *only*

Attributes	Reference	Events
		all printer events
30. printer-state (type1 enum)	mod 4.4.11	REQUIRED
31. printer-state-reasons (1setOf type2 keyword)	mod 4.4.12	REQUIRED
32. printer-is-accepting-jobs (boolean)	mod 4.4.23	REQUIRED

8 Operations for notification

This section defines all of the operations for notification which are summarized in Table 1 in section 1.1, including the assignment of the operation-id.

8.1 Operations for Per-Job Subscriptions *only*

This section defines the operation requests and responses that are related to Per-Job subscriptions and its Subscription object. Section 8.3 defines the REQUIRED operation requests and responses associated with the REQUIRED Per-Printer subscription and its Subscription object.

8.1.1 Job Creation Operations (Create-Job, Print-Job, Print-URI) and Validate-Job

The usual method for a client to associate one subscription with a Job is to specify the subscription when the job is created. For a Per-Job Subscription, the client supplies the "job-notify (1setOf collection)" operation attribute with the member attributes listed in Table 7 with any of the Job Creation operations (Create-Job, Print-Job, Print-URI), plus Validate-Job (which doesn't create a job or subscription). If the client does not supply the "job-notify" attribute in the create operation, there is no subscription made (either implicitly or explicitly).

If a Printer does not support this notification specification, then it MUST ignore the "job-notify" operation attribute and return it in the response indicated as an attribute that is not supported. See [ipp-mod] section 3.1.7 for details on returning Unsupported Attributes.

Table 7 - Member attributes of the "job-notify" collection operation attribute

Member attribute of "job-notify" collection	Reference	client MUST supply	Printer support
notify-recipient (uri)	5.1	yes	REQUIRED
notify-events (1setOf type2 keyword)	5.2	no	REQUIRED
notify-format (mimeMediaType)	5.3	no	REQUIRED
subscriber-user-data (octetString(63))	5.4	depends on delivery method **	REQUIRED
notify-charset (charset)	5.5	no	OPTIONAL
notify-natural-language (naturalLanguage)	5.6	no	OPTIONAL

ISSUE 06: Ok that "notify-charset" and "notify-natural-language" member attributes don't follow the "xxx-supported" rule for collection member attributes, since the "xxx-supported" attributes are "charset-supported" and "generated-natural-language-supported", respectively, instead of "notify-charset-supported" and "notify-natural-language-supported"?

See the referenced sections for a definition of these operation attributes, since they are copied to the Subscription object as the Subscription Description attributes described in section 5.

The following rules apply to Per-Job subscriptions created as part of the Job Creation operations:

- Any subscription can contain job events, printer events, or both.
- The Job Submission Subscription is only valid while the job is "not-completed". The job is "not-completed" while it is in the 'pending', 'pending-held', 'processing', and 'processing-stopped' states. The job changes from being "not-completed" to "retained" when it is done processing and enters any of the 'completed', 'canceled', or 'aborted' states. The job becomes "not-completed" again when it is restarted using the Restart-Job operation (see [ipp-mod]).
- Since no job is created for the Validate-Job operation, the only purpose of supplying the subscription operation attributes in the Validate-Job operation is to validate that the values are supported; the Printer object does not establish a notification subscription as a result of the Validate-Job operation.
- Since a Job Submission Subscription is included within a job submission operation, any interest in job events is limited to "this job" only (the Job object created because of this job creation operation). There

- 1162 is no mechanism to subscribe to events for all jobs or specifically some job other than this job in a
1163 create operation. But see the Create-Printer-Subscription operation (section 8.2.1) for an explicit
1164 operation to subscribe for job and/or printer events independently of any particular job submission, i.e.,
1165 Per-Printer subscriptions.
- 1166 5. Event reporting only occurs when a notification recipient has specified a subscription to any event(s).
- 1167 6. The notification implementation MAY allow an administrator to configure a policy on what events may
1168 be dropped.
- 1169 7. ** The client MUST supply the "subscriber-user-data" (octetString(63)) attribute, if the definition of the
1170 delivery method specified in the "notify-recipient" attribute REQUIRES the client to supply it.
- 1171 8. If the OPTIONAL "notify-charset" attribute is not supported or the supplied value is not supported, the
1172 IPP Printer MUST return the attribute in the Unsupported Attributes Group but still accept the
1173 operation, as with all Job create operations. In this case, the Printer MUST use the natural language
1174 supplied in the "attributes-charset" Job creation operation attribute, if that natural language value is
1175 supported by the Printer, else the Printer object MUST use the Printer's "charset-configured" value. See
1176 the Print-Job operation in [ipp-mod].
- 1177 9. If the OPTIONAL "notify-natural-language" attribute is not supported or the supplied value is not
1178 supported, the IPP Printer MUST return the attribute in the Unsupported Attributes Group but still
1179 accept the operation, as with all Job create operations. In this case, the Printer MUST use the natural
1180 language supplied in the "attributes-natural-language" Job creation operation attribute, if that natural
1181 language value is supported by the Printer, else the Printer object MUST use the Printer's "natural-
1182 language-configured" value. See the Print-Job operation in [ipp-mod].
- 1183 10. If a collection contains other unrecognized, unsupported member attributes and/or conflicting values,
1184 the attribute returned in the Unsupported Group is a collection containing the unrecognized,
1185 unsupported member attributes, and/or conflicting values. The Printer MUST return the unrecognized
1186 member attributes with the out-of-band value of 'unsupported'. The Printer MUST return the
1187 unsupported member attributes and conflicting values with their unsupported values. See [ipp-coll].
- 1188 11. If the number of events supplied in the "notify-events" attribute exceeds the Printer's "max-events-
1189 supported" attribute, the Printer MUST accept the request with the status code 'successful-ok-ignored-
1190 or-substituted-attributes' and return the "job-notify" collection in the Unsupported Attributes Group
1191 with only the "job-events" member attribute containing the events that exceed the maximum.
- 1192 12. If the Per-Job subscriptions would exceed the limit of Per-Job subscriptions supported per job as
1193 specified by the Printer's "max-job-subscriptions-supported" attribute or would exceed some
1194 implementation-defined limit on the total number of Per-Job subscriptions for the Printer (if any), the
1195 Printer MUST accept the request with the status code 'successful-ok-ignored-subscriptions', MUST
1196 return the "job-notify" attribute in the Unsupported Attributes Group with only the collection value(s)
1197 that represent the excess subscriptions that are being ignored, and MUST perform the Job Creation
1198 operation (see section 8.1.1), since the job can still be printed.
- 1199 If the job is accepted and one or more subscriptions are ignored, the status code returned is 'successful-
1200 ok-ignored-subscriptions'. This status code is returned even if other job attributes are unsupported or in
1201 conflict. That is, if an IPP Printer finds a warning that would allow it to return 'successful-ok-ignored-
1202 subscriptions' and either 'successful-ok-ignored-or-substituted-attributes' and/or 'successful-ok-
1203 conflicting-attributes', it must return 'successful-ok-ignored-subscriptions'. In other words, the

1204 precedence for returning success codes is: 'successful-ok-ignored-subscriptions', 'successful-ok-
1205 conflicting-attributes', and 'successful-ok-ignored-or-substituted-attributes'.

1206 **8.1.2 Create-Job-Subscription operation**

1207 The OPTIONNAL Create-Job-Subscription operation creates a Per-Job Subscription object . The client
1208 can specify one or more job and/or printer events to be delivered as notifications to one Notification
1209 Recipient. For the Per-Job subscription objects, the Job events are for this job only. The printer events are
1210 any events generated by that Printer for any job or when no job is involved at all (same as for Per-Job
1211 Subscriptions).

1212 The Printer returns a subscription id and the length of time for which it has granted a lease for the
1213 subscription.

1214 A client can unsubscribe using the Cancel-Subscription operation (section 8.3.4) and the subscription id.

1215 Two Create-Job-Subscription operations with the same events and same Notification Recipient MUST be
1216 kept as distinct subscriptions and be assigned distinct subscription ids. A Printer MUST allow such
1217 duplicate subscriptions such that Cancel-Subscription doesn't unsubscribe both subscriptions and MUST
1218 send the Notifications twice to the Notification Recipient, since the "request-id" is supposed to count
1219 monotonically for each Subscription object.

1220 If the Printer has a bounded set of concurrent Per-Job subscriptions and the request would exceed that
1221 bound, the Printer rejects the operation and returns the 'client-error-too-many-subscriptions' status code.
1222 The client SHOULD try again later.

1223 Access Rights: To create Per-Job subscription objects, the authenticated user (see [IPP-MOD] section 8.3)
1224 performing this operation MUST either be the job owner or have operator or administrator access rights for
1225 the Printer object (see [IPP-MOD] sections 1 and 8.5). Otherwise the IPP object MUST reject the
1226 operation and return: the 'client-error-forbidden', 'client-error-not-authenticated', or 'client-error-not-
1227 authorized' status code as appropriate.

1228 Request :

Group 1: Operation Attributes	Reference [ipp-mod]	client MUST supply	Printer support
"attributes-charset" (charset)	3.1.4.1	yes	REQUIRED
"attributes-natural-language" (naturalLanguage)	3.1.4.1	yes	REQUIRED
"printer-uri" (uri)	3.1.5	yes	REQUIRED
"job-id" (integer(1:MAX))	3.1.5	yes	REQUIRED
"job-uri" (uri)	3.1.5	if not "printer- uri" and "job-id"	REQUIRED
"requesting-user-name" (name(MAX))	8.3	RECOMMEND ED	REQUIRED

1229

Group 2: Subscription Attributes		Reference	client MUST supply	Printer support
"notify-recipient" (uri)	5.1	yes	REQUIRED	
"notify-events" (1setOf type2 keyword)	5.2	no	REQUIRED	
"notify-format" (mimeMediaType)	5.3	no	REQUIRED	
"subscriber-user-data" (octetString(63))	5.4	depends on delivery method	REQUIRED	
"notify-charset" (charset)	5.5	no	OPTIONAL	
"notify-natural-language" (naturalLanguage)	5.6	no	OPTIONAL	
"notify-persistence-requested" (boolean)		no	OPTIONAL	

1230 Response:

Group 1: Operation Attributes		Reference [ipp-mod]	REQUIRED in response
"status-code" (type2 enum)	3.1.6.1	REQUIRED	
"attributes-charset" (charset)	3.1.4.2	REQUIRED	
"attributes-natural-language" (naturalLanguage)	3.1.4.2	REQUIRED	
"status-message" (text(255))	3.1.6.2	OPTIONAL	
"detailed-status-message" (text(MAX))	3.1.6.3	OPTIONAL	

1231

Group 2: Unsupported Attributes (see [ipp-mod] section 3.1.7)	REQUIRED if unsupported attributes
---	------------------------------------

1232

Group 3: Subscriptions Attributes		Reference	REQUIRED in response
"subscription-id" (integer(1:MAX))	5.8	REQUIRED	
"notify-persistence-granted" (boolean)	5.13	REQUIRED	

1233 Attribute Notes:

1234 "job-id" (integer(1:MAX)) - the client MUST either (1) supply this attribute, in combination with the
 1235 "printer-uri" attribute, in order to create a Per-Job subscription for the Job identified by the "job-id"
 1236 value or supply the "job-uri" instead, as with any Job operation:

1237 "job-uri" (uri) - the client MUST supply this attribute, if the "printer-uri" and "job-id" are not supplied, in
 1238 order to identify the Job to which the Per-Job Subscription is being created.

1239 "notify-recipient" (uri) - the client MUST supply this attribute in order to have a subscription.

1240 "notify-event" (1setOf type2 keyword) - if the client does not supply this attribute, the Printer populates the
 1241 "notify-events" Subscription Description attribute from its "notify-events-default" Printer
 1242 Description attribute.

1243 "notify-format" (mimeMediaType) - if the client supplies this attribute, the value indicates which Human
 1244 Consumable text format is requested for use in the Notification using the delivery method that the

1245 client supplies in the "notify-recipient" attribute. If the client does not supply this attribute, the
1246 Machine-Consumable form of the delivery method that the client supplies in the "notify-recipient"
1247 attribute is used.

1248 "subscriber-user-data" (octetString(63)) - the client **MUST** supply this attribute, if the definition of the
1249 delivery method specified in the "notify-recipient" attribute **REQUIRES** the client to supply it.

1250 "notify-persistence-requested" (boolean) - whether or not the Per-Job Subscription is to be persistent, i.e.,
1251 saved across power cycles. Note: Persistent trap registrations is a client option in SNMPv3
1252 [RFC2573].

1253 "notify-persistence-granted" (boolean) - whether or not this Subscription object instance is persistent. This
1254 attribute **MUST** be returned whether "notify-persistence-requested" is supported or not, so that the
1255 client knows which.

1256

1257 **8.2 Operations for Per-Printer Subscriptions *only***

1258 This section defines the operation requests and responses associated with the Per-Printer subscription and
1259 its Subscription object.

1260 **8.2.1 Create-Printer-Subscription operation**

1261 The **REQUIRED** Create-Printer-Subscription operation creates a Per-Printer Subscription object . The
1262 client can specify one or more job and/or printer events to be delivered as notifications to one Notification
1263 Recipient. For the Per-Printer subscription objects, the job events are for any job submitted to the Printer.
1264 The printer events are any events generated by that Printer for any job or when no job is involved at all.

1265 The Printer returns a subscription id and the time at which the subscription lease expires (which may be
1266 earlier or later than the client requested).

1267 The client **MUST** renew the Per-Printer subscription using the Renew-Subscription operation (see section
1268 8.3.3) before the lease runs out in order to maintain the subscription. A client can unsubscribe using the
1269 Cancel-Subscription operation (section 8.3.4) and the subscription id.

1270 Two Create-Printer-Subscription operations with the same events and same Notification Recipient **MUST**
1271 be kept as distinct subscriptions and be assigned distinct subscription ids. A Printer **MUST** allow such
1272 duplicate subscriptions such that Cancel-Subscription doesn't unsubscribe both subscriptions and **MUST**
1273 send the Notifications twice to the Notification Recipient, since the "request-id" is supposed to count
1274 monotonically for each subscription.

1275 If the Printer has a bounded set of concurrent Per-Printer subscriptions and the request would exceed that
1276 bound, the Printer rejects the operation and returns the 'client-error-too-many-subscriptions' status code.
1277 The client **SHOULD** try again later.

1278 Access Rights: To create Per-Printer subscription objects, the authenticated user performing this operation
1279 **MUST** have Per-Printer subscription rights for this Printer. Otherwise the IPP object **MUST** reject the
1280 operation and return: the 'client-error-forbidden', 'client-error-not-authenticated', or 'client-error-not-
1281 authorized' status code as appropriate.

1282 Request:

Group 1: Operation Attributes		Reference [ipp-mod]	client MUST supply	Printer support
"attributes-charset" (charset)		3.1.4.1	yes	REQUIRED
"attributes-natural-language" (naturalLanguage)		3.1.4.1	yes	REQUIRED
"printer-uri" (uri)		3.1.5	yes	REQUIRED
"requesting-user-name" (name(MAX))		8.3	RECOMME NDED	REQUIRED

1283

Group 2: Subscription Attributes		Reference	client MUST supply	Printer support
"notify-recipient" (uri)		5.1	yes	REQUIRED
"notify-events" (1setOf type2 keyword)		5.2	no	REQUIRED
"notify-format" (mimeType)		5.3	no	REQUIRED
"subscriber-user-data" (octetString(63))		5.4	depends on the delivery method	REQUIRED
"notify-charset" (charset)		5.5	no	OPTIONAL
"notify-natural-language" (naturalLanguage)		5.6	no	OPTIONAL
"notify-lease-time-requested" (integer(0:MAX))			no	REQUIRED
"notify-persistence-requested" (boolean)			no	OPTIONAL

1284 Response:

Group 1: Operation Attributes		Reference	REQUIRED in response
"status-code" (type2 enum)		3.1.6.1	REQUIRED
"attributes-charset" (charset)		3.1.4.2	REQUIRED
"attributes-natural-language" (naturalLanguage)		3.1.4.2	REQUIRED
"status-message" (text(255))		3.1.6.2	OPTIONAL
"detailed-status-message" (text(MAX))		3.1.6.3	OPTIONAL

1285

Group 2: Unsupported Attributes (see [ipp-mod] section 3.1.7)	REQUIRED if unsupported attributes
---	--

1286

Group 3: Subscription Attributes		Reference	REQUIRED in response
"subscription-id" (integer(1:MAX))		5.8	REQUIRED
"notify-lease-expiration-time" (integer(0:MAX))		5.9	REQUIRED
"notify-server-up-time" (integer(1:MAX))		5.12	REQUIRED
"notify-persistence-granted" (boolean)		5.13	REQUIRED

1287 Attribute Notes:

- 1288 "notify-recipient" (uri) - the client **MUST** supply this attribute in order to have a subscription.
- 1289 "notify-lease-time-requested" (integer(0:MAX)) - the number of seconds requested for the subscription
1290 lease. A value of 0 indicates a request that the Per-Printer Subscription lease never expire.
1291 Supplying a 0 value **MAY** require authentication in order to be used, if 0 is supported at all.
1292 If the client does not supply this attribute, the Printer uses its "notify-lease-time-default" Printer
1293 Description attribute value (see section 6.9).
- 1294 "notify-event" (1setOf type2 keyword) - if the client does not supply this attribute, the Printer populates the
1295 "notify-events" Subscription Description attribute from its "notify-events-default" Printer
1296 Description attribute.
- 1297 "notify-format" (mimeMediaType) - if the client supplies this attribute, the value indicates which Human
1298 Consumable text format is requested for use in the Notification using the delivery method that the
1299 client supplies in the "notify-recipient" attribute. If the client does not supply this attribute, the
1300 Machine-Consumable form of the delivery method that the client supplies in the "notify-recipient"
1301 attribute is used.
- 1302 "subscriber-user-data" (octetString(63)) - the client **MUST** supply this attribute, if the definition of the
1303 delivery method specified in the "notify-recipient" attribute **REQUIRES** the client to supply it.
- 1304 "notify-persistence-requested" (boolean) - whether or not the Per-Printer Subscription is to be persistent,
1305 i.e., saved across power cycles. Note: Persistent trap registrations is a client option in SNMPv3
1306 [RFC2573].
- 1307 "notify-lease-expiration-time" (integer(0:MAX)) - The Printer object **MUST** return this attribute which is
1308 the time in the future at which the subscription lease will expire, i.e., the "printer-up-time" value (in
1309 time ticks - see [ipp-mod] section 4.4.29) at which the Printer will delete the Subscription. A value
1310 of 0 indicates that the lease subscription will never expire.
- 1311 "notify-server-up-time" (integer(1:MAX)) - The Printer object **MUST** return this attribute which is an alias
1312 for the Printer's "printer-up-time" Printer Description attribute. The client subtracts this value from
1313 the "notify-lease-expiration-time" value returned in order to determine the number of second in the
1314 future that the subscription will expire. This computed value may be less than the requester
1315 requested in the "notify-lease-time-requested" if it was greater than the MAX supported or more
1316 than the requester requested if it was less than the MIN supported, as indicated in the Printer's
1317 "notify-lease-time-supported" (rangeOfInteger(0:MAX)) attribute (see section 6.8).
- 1318 "notify-persistence-granted" - whether or not this Subscription object instance is persistent. This attribute
1319 **MUST** be returned whether "notify-persistence-requested" is supported or not, so that the client
1320 knows which.

1321

1322 **8.3 Common Operations for Per-Job and Per-Printer Subscriptions**

1323 This section defines the operations that are common to both Per-Job and Per-Printer subscriptions.

8.3.1 Get-Subscription-Attributes operation

The REQUIRED Get-Subscription-Attributes returns the requested attributes of the identified Subscription object. See section 5.

Request:

Group 1: Operation Attributes	Reference [ipp-mod]	client MUST supply	Printer support
-------------------------------	------------------------	-----------------------	--------------------

"attributes-charset" (charset)	3.1.4.1	yes	REQUIRED
"attributes-natural-language" (naturalLanguage)	3.1.4.1	yes	REQUIRED
"printer-uri" (uri)	3.1.5	yes	REQUIRED
"requesting-user-name" (name(MAX))	8.3	RECOMME NDED	RECOMME NDED

Group 2: Subscription Attributes	Reference	client MUST supply	Printer support
"subscription-id" (integer(1:MAX))	5.8	yes	REQUIRED
"requested-attributes" (1setOf type2 keyword)		no	REQUIRED

Response:

Group 1: Operation Attributes	Reference [ipp-mod]	REQUIRED in response
"status-code" (type2 enum)	3.1.6.1	REQUIRED
"attributes-charset" (charset)	3.1.4.2	REQUIRED
"attributes-natural-language" (naturalLanguage)	3.1.4.2	REQUIRED
"status-message" (text(255))	3.1.6.2	OPTIONAL
"detailed-status-message" (text(MAX))	3.1.6.3	OPTIONAL

Group 2: Unsupported Attributes (see [ipp-mod] section 3.1.7)	REQUIRED if unsupported attributes
---	--

Group 3: <the requested Subscription object attributes>	REQUIRED
---	----------

This operation is similar to the Get-Printer-Attributes operation. If the client omits the "requested-attributes" operation attribute, the Printer MUST respond as if the client had supplied the 'all' value, i.e., return all of the attributes supported for the Subscription object.

1336 **8.3.2 Get-Subscriptions operation**

1337 The REQUIRED Get-Subscriptions operation returns the requested attributes of the Subscription objects
 1338 (see section 5).

1339 Request:

Group 1: Operation Attributes	Reference [ipp-mod]	client MUST supply	Printer support
"attributes-charset" (charset)	3.1.4.1	yes	REQUIRED
"attributes-natural-language" (naturalLanguage)	3.1.4.1	yes	REQUIRED
"printer-uri" (uri)	3.1.5	yes	REQUIRED
"job-id" (integer(1:MAX))	3.1.5	yes, if Per-Job Subscription	REQUIRED
"requesting-user-name" (name(MAX))	8.3	RECOMMENDED	RECOMMENDED
"limit" (integer(1:MAX))		OPTIONAL	REQUIRED
"requested-attributes" (1setOf type2 keyword)		OPTIONAL	REQUIRED
"my-subscriptions" (boolean)		OPTIONAL	REQUIRED

1340 Response:

Group 1: Operation Attributes	Reference [ipp-mod]	REQUIRED in response
"status-code" (type2 enum)	3.1.6.1	REQUIRED
"attributes-charset" (charset)	3.1.4.2	REQUIRED
"attributes-natural-language" (naturalLanguage)	3.1.4.2	REQUIRED
"status-message" (text)	3.1.6.2	OPTIONAL
"detailed-status-message" (text(MAX))	3.1.6.3	OPTIONAL

1341

Group 2: Unsupported Attributes (see [ipp-mod] section 3.1.7)	REQUIRED if unsupported attributes
---	------------------------------------

1342

Group 3 to N:<the requested Subscription Attributes for each Subscription object in a separate group>	REQUIRED
---	----------

1343

1344 Attribute Notes:

1345 This operation is similar to the Get-Jobs operation (see [ipp-mod]). If the client wants any attributes
 1346 returned, including the "subscription-id", it must include the attribute keyword name in the "requested-
 1347 attributes" operation attribute. If the "requested-attributes" operation attribute is omitted, the Printer MUST
 1348 respond as if the client supplied the value: 'subscription-id'.

1349 "job-id" (integer(1:MAX)) - If the client supplies this attribute, all of the Per-Job Subscription objects for
 1350 the identified job are candidates for return. If this attribute is omitted, all of the Per-Printer
 1351 Subscription objects are candidates for return.

1352 "limit" (integer(1:MAX)): The client OPTIONALLY supplies this attribute. The Printer object MUST
1353 support this attribute. It is an integer value that determines the maximum number of Subscription
1354 objects that a client will receive from the Printer even if "my-subscriptions" constrain which
1355 subscriptions are returned. The limit is a "stateless limit" in that if the value supplied by the client is
1356 'N', then only the first 'N' Subscriptions are returned in the Get-Subscriptions Response. There is no
1357 mechanism to allow for the next 'M' Subscriptions after the first 'N' Subscriptions. If the client does
1358 not supply this attribute, the Printer object responds with all applicable Subscriptions.

1359 "requested-attributes" (1setOf keyword): The client OPTIONALLY supplies this attribute. The Printer
1360 object MUST support this attribute. It is a set of Subscription attribute names and/or the 'all'
1361 attribute group name in whose values the requester is interested. This set of attributes is returned
1362 for each Job object that is returned. If the client does not supply this attribute, the Printer MUST
1363 respond as if the client had supplied this attribute with the value: 'all'.

1364 "my-subscriptions" (boolean): The client OPTIONALLY supplies this attribute. The Printer object MUST
1365 support this attribute. It indicates whether Subscriptions from all users or just the Subscriptions
1366 submitted by the requesting user of this request MUST be returned by the Printer object. If the
1367 client does not supply this attribute, the Printer object MUST respond as if the client had supplied
1368 the attribute with a value of 'false', i.e., Subscriptions from all users. The means for authenticating
1369 the requesting user and matching the Subscription objects is the same as for jobs as described in
1370 [ipp-mod] section 8.

1371 Groups 3 to N: Subscription Object Attributes: The Printer object responds with one set of Subscription
1372 Object Attributes for each returned Subscription object. The Printer object ignores (does not
1373 respond with) any requested attribute or value which is not supported or which is restricted by the
1374 security policy in force, including whether the requesting user is the user that created the
1375 Subscription object (subscribing user) or not (see [ipp-mod] section 8).

1376 **8.3.3 Renew-Subscription operation**

1377 The REQUIRED Renew-Subscription operation permits a client to request the IPP Printer to extend the
1378 lease on a Subscription object instance. There is no way to renew a Per-Job subscription, since they are
1379 automatically canceled after the job completes and no longer has any documents, i.e., the job is no longer
1380 retained (see [ipp-mod] section 4.3.7.2). If the requested subscription object is a Per-Job subscription, the
1381 Printer MUST grant an infinite lease by returning a 0 value for the "notify-lease-expiration-time".

1382 *Access Rights:* The authenticated user (see [IPP-MOD] section 8.3) performing this operation MUST either
1383 be the owner of the Subscription object or have operator or administrator access rights for the Printer object
1384 (see [IPP-MOD] sections 1 and 8.5). Otherwise the IPP object MUST reject the operation and return: the
1385 'client-error-forbidden', 'client-error-not-authenticated', or 'client-error-not-authorized' status code as
1386 appropriate.

1387 Request:

Group 1: Operation Attributes		Reference [ipp-mod]	client MUST supply	Printer support
"attributes-charset" (charset)		3.1.4.1	yes	REQUIRED
"attributes-natural-language" (naturalLanguage)		3.1.4.1	yes	REQUIRED
"printer-uri" (uri)		3.1.5	yes	REQUIRED
"requesting-user-name" (name(MAX))		8.3	RECOMME NDED	RECOMME NDED

1388

Group 2: Subscription Attributes		Reference	client MUST supply	Printer support
"subscription-id" (integer(1:MAX))		5.8	yes	REQUIRED
"notify-lease-time-requested" (integer(0:MAX))			no	REQUIRED

1389 Response:

Group 1: Operation Attributes		Reference [ipp-mod]	REQUIRED in response
"status-code" (type2 enum)		3.1.6.1	REQUIRED
"attributes-charset" (charset)		3.1.4.2	REQUIRED
"attributes-natural-language" (naturalLanguage)		3.1.4.2	REQUIRED
"status-message" (text(255))		3.1.6.2	OPTIONAL
"detailed-status-message" (text(MAX))		3.1.6.3	OPTIONAL

1390

Group 2: Unsupported Attributes (see [ipp-mod] section 3.1.7)		REQUIRED if unsupported attributes

1391

Group 3: Subscriptions Attributes		Reference	REQUIRED in response
"notify-lease-expiration-time" (integer(0:MAX))		5.9	REQUIRED
"notify-server-up-time" (integer(1:MAX))		5.12	REQUIRED

1392

1393 Attribute Notes:

1394 "notify-lease-time-requested" (integer(0:MAX)) - the number of seconds requested for the Per-Printer
1395 subscription lease. Same as Create-Printer-Subscriptions (see section 8.2.1).

1396 "notify-lease-expiration-time" - the time in the future when the subscription will expire. Same as for the
1397 Create-Printer-Subscription operation (see section 8.2.1).

1398 "notify-server-up-time" - the Printer object MUST return this attribute which is an alias for the Printer's
1399 "printer-up-time" Printer Description attribute. The client subtracts this value from the "notify-
1400 lease-expiration-time" value returned in order to determine the number of second in the future that
1401 the subscription will expire (see further explanation in section 8.2.1).

1402 Note: There is no way to change any of the Subscription object attributes, except the "notify-lease-
 1403 expiration-time" attribute (using the Renew-Subscription operation). In order to change other attributes, a
 1404 client can create a new Subscription object and then use the Cancel-Subscription operation to cancel the old
 1405 one (or do this in the other order, in case there is a limit on the number of Subscription object instances, as
 1406 long as a short window with no Notifications is ok).

1407 Note: There is no need to renew a Per-Job Subscription, since it is effectively the time that the Job is active
 1408 (see section 8.1).

1409 **8.3.4 Cancel-Subscription operation**

1410 The REQUIRED Cancel- Subscription operation allows a client to remove a Subscription object. No more
 1411 Notifications are delivered for that Subscription. Once performed, there is no way to use that Subscription
 1412 in the future. Subscription-ids should not be reused immediately, so that a stale reference situation is not
 1413 created. Same as for Cancel-Job and job-ids.

1414 *Access Rights:* The authenticated user (see [IPP-MOD] section 8.3) performing this operation MUST either
 1415 be the owner of the Subscription object or have operator or administrator access rights for the Printer object
 1416 (see [IPP-MOD] sections 1 and 8.5). Otherwise the IPP object MUST reject the operation and return: the
 1417 'client-error-forbidden', 'client-error-not-authenticated', or 'client-error-not-authorized' status code as
 1418 appropriate.

1419 Request :

Group 1: Operation Attributes	Reference [ipp-mod]	client MUST supply	Printer support
"attributes-charset" (charset)	3.1.4.1	yes	REQUIRED
"attributes-natural-language" (naturalLanguage)	3.1.4.1	yes	REQUIRED
"printer-uri" (uri)	3.1.5	yes	REQUIRED
"requesting-user-name" (name(MAX))	8.3	RECOMME NDED	RECOMME NDED

1420

Group 2: Subscription Attributes	Reference	client MUST supply	Printer support
"subscription-id" (integer(1:MAX))	5.8	yes	REQUIRED

1421 Response :

Group 1: Operation Attributes	Reference [ipp-mod]	REQUIRED in response
"status-code" (type2 enum)	3.1.6.1	REQUIRED
"attributes-charset" (charset)	3.1.4.2	REQUIRED
"attributes-natural-language" (naturalLanguage)	3.1.4.2	REQUIRED
"status-message" (text(255))	3.1.6.2	OPTIONAL
"detailed-status-message" (text(MAX))	3.1.6.3	OPTIONAL

1422

Group 2: Unsupported Attributes (see [ipp-mod] section 3.1.7)	REQUIRED if unsupported attributes
---	--

1423

9 Comparison of Per-Job versus Per-Printer Subscriptions

Per-Job and Per-Printer subscriptions are quite similar. Either type of subscription can subscribe to Job events, Printer events, or both. Both types of subscriptions can be queried using the Get-Subscriptions and Get-Subscription-Attributes operations and canceled using the Cancel-Subscription operation. Both types of subscriptions create Subscription objects which have the same attributes defined. However, there are some semantic differences between Per-Job subscriptions and Per-Printer subscriptions. A Per-Job Submission Subscription is established by the client when submitting a job and after creating the job using the Create-Job-Subscription operation by specifying the "job-id" of the job. A Per-Printer Subscription is established between a client and a Printer using the Create-Printer-Subscription operation. Some specific differences are:

1. A client usually creates a Per-Job subscription as part of the Job Creation operations (Create-Job, Print-Job, and Print-URI), rather than using the OPTIONAL Create-Job-Subscription operation, especially since Printer implementations NEED NOT support the Create-Job-Subscription operation, since it is OPTIONAL.
2. For Per-Job subscriptions, the subscription is only valid while the job is "not-complete" (see sections 7.2 and 7.3) while for the Per-Printer subscriptions, the subscription is valid until the time (in seconds) that the Printer returned in the "notify-lease-expiration-time" operation attribute expires.
3. Job Events in a Per-Job subscription apply only to "one job" (the Job created by the job creation operation or references by the Create-Job-Subscription operation) while Job Events in a Per-Printer subscription apply to ALL jobs contained in the IPP Printer object.

10 Out of Band Values

This section defines out-of-band values (see [ipp-mod] section 4.1) for use with attributes defined in this and other documents.

10.1 'none'

11 The specified attribute in the request MUST NOT be applied to the job. Specifically, this value overrides the Printer's "xxx-default" attribute value for the attribute, if one exists. This out-of-band value is needed since attributes that are of the 'collection', 'uri', and 'mimeMediaType' need a way for a client to specify that the Printer MUST NOT apply the value of an "xxx-default" attribute to the job. See [ipp-coll] for a complete specification, including encoding. Conformance Requirements

It is OPTIONAL to implement this Event Notification specification. An implementation conforming to this specification MUST also meet the Conformance Requirements detailed in [IPP-MOD] section 5. If this Event Notification specification is implemented, IPP objects MUST support all of the REQUIRED object attributes as defined in this document in the indicated sections:

- 1459 1. REQUIRED Subscription object attributes in section 5.
 1460 2. REQUIRED Printer Description object attributes in section 6.
 1461 3. REQUIRED attributes in Notification content in section 7.

1462 In addition, the Printer MUST support the 'collection' attribute syntax (see [ipp-coll]).

1463 Extensions made to the events herein must be made such that new events or event attributes are backward
 1464 compatible to clients who implemented early versions of this notification specification.

1465 If this Event Notification specification is implemented, the operations described in section 8 MUST be
 1466 supported as described in Table 8:

1467 **Table 8 - Conformance Requirements for Operations**

Attribute	Conformance requirements
"job-notify" (1setOf collection) in Job Creation operations (section 8.1.1)	REQUIRED
Create-Printer-Subscription (section 8.2.1)	REQUIRED
Create-Job-Subscription (section 8.1.2)	OPTIONAL
Get-Subscription-Attributes (section 8.3.1)	REQUIRED
Get-Subscriptions (section 8.3.2)	REQUIRED
Renew-Subscription (section 8.3.3)	REQUIRED
Cancel-Subscription (section 8.3.4)	REQUIRED

1468

1469 **12 IANA Considerations**

1470 IANA will be called on to register URL schemes for notification delivery for use in the "notification-
 1471 recipient" attribute, using the same procedures outlined in [ipp-mod].

1472 **13 Internationalization Considerations**

1473 This IPP notification specification continues the internationalization of [ipp-mod] for attributes containing
 1474 text strings and names. A subscribing client can specify a different natural language and charset for each
 1475 Notification content delivered to a Notification Recipient.

1476 The Human Consumable Notification content is a 'text/plain; charset=utf-8' by default where the
 1477 Notification Sender has localized the text message as requested by the subscriber for the intended
 1478 Notification Recipient.

1479 **14 Security Considerations**

1480 By far the biggest security concern is the abuse of notification: sending unwanted notifications to third
 1481 parties (i.e., spam). The problem is made worse by notification addresses that may be redistributed to
 1482 multiple parties (e.g. mailing lists). There exist scenarios where third party notification is required (see
 1483 Scenario #2 and #3 in [ipp-not-req]). The fully secure solution would require active agreement of all
 1484 recipients before sending out anything. However, requirement #9 in [ipp-req] ("There is no requirement for

1485 IPP Printer receiving the print request to validate the identity of an event recipient”) argues against this.
1486 Certain systems may decide to disallow third party notifications (a traditional fax model).

1487 Clients submitting notification requests to the IPP Printer has the same security issues as submitting an
1488 IPP/1.1 print job request. The same mechanisms used by IPP/1.1 can therefore be used by the client
1489 notification submission. Operations that require authentication can use the HTTP authentication.
1490 Operations that require privacy can use the HTTP/TLS privacy.

1491 The notification access control model should be similar to the IPP access control model for Jobs. Creating
1492 a Per-Printer Notification Subscription object is associated with a user. Only the creator or an operator can
1493 cancel the subscription. The system may limit the listing of items to only those items owned by the user.
1494 Some subscriptions (e.g. those that have a lifetime longer than a job) can be done only by privileged users
1495 (users having operator and/or administrator access rights), if that is the authorization policy.

1496 The standard security concerns (delivery to the right user, privacy of content, tamper proof content) apply
1497 to the notification delivery. IPP should use the security mechanism of the delivery method used. Some
1498 delivery mechanisms are more secure than others. Therefore, sensitive notifications should use the delivery
1499 method that has the strongest security.

1500 **15 Status Codes**

1501 The following status codes are defined as extensions for notification:

1502 **15.1 'successful-ok-ignored-subscriptions' (0x0003)**

1503 The number of subscriptions supplied in a Job Creation operation (Create-Job, Print-Job, Print-URI)
1504 exceeds either the limit of Per-Job subscriptions supported per job as specified by the Printer's "max-job-
1505 subscriptions-supported" attribute or some implementation-defined limit on the total number of Per-Job
1506 subscriptions for the Printer (if any). The Printer MUST accept the request with this status code, MUST
1507 return the "job-notify" attribute in the Unsupported Attributes Group with only the collection value(s) that
1508 represent the excess subscriptions that are being ignored, and MUST perform the Job Creation operation
1509 (see section 8.1.1), since the job can still be printed.

1510 This status code is returned even if other job attributes are unsupported or in conflict. That is, if an IPP
1511 Printer finds a warning that would allow it to return 'successful-ok-ignored-subscriptions' and either
1512 'successful-ok-ignored-or-substituted-attributes' and/or 'successful-ok-conflicting-attributes', it must return
1513 'successful-ok-ignored-subscriptions'. In other words, the precedence for returning success codes is:
1514 'successful-ok-ignored-subscriptions', 'successful-ok-conflicting-attributes', and 'successful-ok-ignored-or-
1515 substituted-attributes'.

1516 **15.2 client-error-uri-notification-scheme-not-supported (0x0414)**

1517 The scheme of the client-supplied URI in a "notify-recipient" operation attribute in a Create-Printer-
1518 Subscription or Create-Printer-Subscription operation is not supported. See [ipp-mod] section 3.1.7.

1519 There is no corresponding Per-Job subscription error for a Job Creation operation, since the Printer object
1520 MUST ignore any errors in the "job-notify" operation attribute, MUST return the "notify-recipient"
1521 attribute in the Unsupported Attributes Group, and perform the Job Creation operation (see section 8.1.1),
1522 since the job can still be printed.

1523 **15.3 client-error-too-many-subscriptions (0x0415)**

1524 The bounded set of concurrent Per-Printer subscriptions supported by the Printer object would be exceeded
 1525 if this Create-Printer-Subscription request were accepted or the bounded set of concurrent Per-Job
 1526 subscriptions supported by the Printer object would be exceeded if this Create-Job-Subscriptions request
 1527 were accepted.

1528 Note: There is no corresponding Per-Job subscription error on a Job Creation operation, since the Printer
 1529 object MUST ignore any errors in the "job-notify" operation attribute and perform the Job Creation
 1530 operation (see section 8.1.1), since the job can still be printed.

1531 **15.4 client-error-too-many-events (0x0416)**

1532 The client supplied more events in the "notify-events" operation attribute in a Create-Job-Subscription or
 1533 Create-Printer-Subscription operation than the Printer supports, as indicated in its "max-events-supported"
 1534 attribute (see section 6.4).

1535 There is no corresponding Per-Job subscription error for a Job Creation operation, since the Printer object
 1536 MUST ignore any errors in the "job-notify" operation attribute, MUST return the "notify-events" attribute
 1537 in the Unsupported Attributes Group with only the excess events that are being ignored, and perform the
 1538 Job Creation operation (see section 8.1.1), since the job can still be printed.

1539 **16 Addition attribute tag encodings**

1540 The Subscription attributes tag and the Notification attributes tag are assigned the following delimiter tag
 1541 values as extensions to the encoding defined in [ipp-pro]) for use in requests and responses to delimit
 1542 Subscription object attribute Groups and Notification Content attribute Groups:

Tag Value (Hex)	Delimiter
0x06	subscription-attributes-tag
0x07	notification-attributes-tag

1543 **17 References**

1544 [ipp-coll]

1545 deBry, R., , Hastings, T., Herriot, R., "Internet Printing Protocol/1.0 & 1.1: collection attribute
 1546 syntax", <draft-ietf-ipp-collection-01.doc>, work in progress, February 22, 2000.

1547 [ipp-mod]

1548 deBry, R., , Hastings, T., Herriot, R., Isaacson, S., Powell, P., "Internet Printing Protocol/1.1: Model
 1549 and Semantics", <draft-ietf-ipp-model-v11-06.txt>, work in progress, March 1, 2000.

1550 [ipp-not-hist]

1551 deBry, R., Lewis, H., Hastings, T., "Internet Printing Protocol/1.1: Change History for IPP
 1552 Notifications", <draft-ietf-ipp-not-change-history-00.txt>, work in progress, August 22, 1999.

- 1553 [ipp-method-indp]
1554 Parra, H., Hastings, T., "Internet Printing Protocol (IPP): The INDP Event Notification Delivery
1555 Method", <draft-ietf-indp-method-00.txt>, work in progress, February 29, 2000.
- 1556 [ipp-method-ipp]
1557 Manros, C., Hastings, T., Herriot, R., Lewis, H., "Internet Printing Protocol (IPP): The 'ipp'
1558 Notification Delivery Polling Method", <draft-ietf-ipp-not-get-poll-00.txt>, work in progress,
1559 February 2, 2000.
- 1560 [ipp-method-mailto]
1561 Holst, H. and Hastings, T., "Internet Printing Protocol (IPP): The 'mailto' Notification Delivery
1562 Method", <draft-ietf-ipp-notify-mailto-00.txt>, work in progress, March 3, 2000.
- 1563 [ipp-method-snmp]
1564 McDonald, I., Hastings, T., "Internet Printing Protocol (IPP): Notifications over SNMP", <draft-
1565 ietf-ipp-not-over-snmp-01.txt>, work in progress, September 1, 1999.
- 1566 **ISSUE 01 again - Ok to include references to the notification delivery documents that are in progress?**
- 1567 [ipp-not-req]
1568 deBry, R., Lewis, H., Hastings, T., "Internet Printing Protocol/1.1: Requirements for IPP
1569 Notifications", <draft-ietf-ipp-not-03.txt>, work in progress, August 11, 1999.
- 1570 [ipp-pro]
1571 Herriot, R., Butler, S., Moore, P., Tuner, R., "Internet Printing Protocol/1.1: Encoding and
1572 Transport", <draft-ietf-ipp-protocol-v11-05.txt>, work in progress, March 1, 2000.
- 1573 [ipp-prog]
1574 Hastings, T., Bergman, R., Lewis, H., "Proposed Job Progress Attributes for IPP", <draft-ietf-ipp-
1575 job-prog.txt> work in progress, February 2, 2000.
- 1576 [ipp-set]
1577 Kugler, C., , Hastings, T., Herriot, R., Lewis, H., "Internet Printing Protocol (IPP): Job and Printer
1578 Set Operations", <draft-ietf-ipp-job-printer-set-ops-00.txt>, work in progress, March 1, 2000.
- 1579 [ipp-set2]
1580 Kugler, C., , Hastings, T., Lewis, H., "Internet Printing Protocol (IPP): Additional Operations, Set
1581 2", <draft-ietf-ipp-ops-set2.txt>, work in progress, February 3, 2000.
- 1582 [RFC1866]
1583 Berners-Lee, T., Connolly, D., "Hypertext Markup Language - 2.0", RFC 1866, November 1995.
- 1584 [RFC2046]
1585 Multipurpose Internet Mail Extensions (MIME) Part Two: Media Types. N. Freed & N. Borenstein.
1586 November 1996. (Obsoletes RFC1521, RFC1522, RFC1590), RFC 2046.
- 1587 [RFC2119]
1588 S. Bradner, "Key words for use in RFCs to Indicate Requirement Levels", RFC 2119 , March 1997

- 1589 [RFC2279]
1590 F. Yergeau , "UTF-8, a transformation format of ISO 10646", RFC 2279. January 1998.
- 1591 [RFC2302]
1592 Parsons, G., et. al., "Tag Image File Format (TIFF) - image/tiff", RFC 2302, March 1998.
- 1593 [RFC2376]
1594 Whitehead, E., Murata, M., "XML Media Types", RFC 2376, July 1998.
- 1595 [RFC2566]
1596 deBry, R., , Hastings, T., Herriot, R., Isaacson, S., Powell, P., "Internet Printing Protocol/1.0: Model
1597 and Semantics", RFC 2566, April 1999.
- 1598 [RFC2567]
1599 Wright, D., "Design Goals for an Internet Printing Protocol", RFC 2567, April 1999.
- 1600 [RFC2568]
1601 Zilles, S., "Rationale for the Structure and Model and Protocol for the Internet Printing Protocol",
1602 RFC 2568, April 1999.
- 1603 [RFC2569]
1604 Herriot, R., Hastings, T., Jacobs, N., Martin, J., "Mapping between LPD and IPP Protocols", RFC
1605 2569, April 1999.

18 Author's Addresses

- 1607 Scott A. Isaacson (Editor)
1608 Novell, Inc.
1609 122 E 1700 S
1610 Provo, UT 84606
1611
1612 Phone: 801-861-7366
1613 Fax: 801-861-2517
1614 e-mail: sisaacson@novell.com
1615
1616 Tom Hastings
1617 Xerox Corporation
1618 737 Hawaii St. ESAE 231
1619 El Segundo, CA 90245
1620
1621 Phone: 310-333-6413
1622 Fax: 310-333-5514
1623 e-mail: hastings@cp10.es.xerox.com
1624
1625 Roger deBry
1626 Utah Valley State College

1627 Orem, UT 84058
1628
1629 Phone: (801) 222-8000
1630 EMail: debryro@uvsc.edu
1631
1632 Jay Martin
1633 e-mail: jkm@underscore.com
1634
1635 Michael Shepherd
1636 Xerox Corporation
1637 800 Phillips Road MS 128-51E
1638 Webster, NY 14450
1639
1640 Phone: 716-422-2338
1641 Fax: 716-265-8871
1642 e-mail: mshepherd@crt.xerox.com
1643
1644 Ron Bergman (Editor)
1645 Dataproducts Corp.
1646 1757 Tapo Canyon Road
1647 Simi Valley, CA 93063-3394
1648
1649 Phone: 805-578-4421
1650 Fax: 805-578-4001
1651 Email: rbergman@dpc.com
1652

1653 A. Appendix - Summary of Notification Attribute Usage

1654 This appendix summarizes the usage of Notification attributes in the Job operation attribute collection, Job
1655 object, Subscription object, Notification content, Job operations, and Subscriptions operations. The legend
1656 for the notation used in the tables is given following each table.

Attributes	Objects		Notification content		Job operations		Subscription operations		
	Job	Subscription	Job Notification Content	Printer Notification Content	Job Creation Validate -Job	Create-Job-Subscription	Create-Printer-Subscription	Renew - Subscription	Cancel - Subscription
1. notify-recipient (uri)		R			R	R	R		
2. notify-events (1setOf type2 keyword)		R			[R]	[R]	[R]		
3. notify-format (mimeMediaType)		R	[O]	[O]	[R]	[R]	[R]		
4. human-readable-report (text(MAX))			[O]	[O]					
5. subscriber-user-data (octetString(63))		R	R	R	[R]*	[R]*	[R]*		
6. attributes-charset (charset)	R		R (7)	R (7)	R	R	R	R	R
7. notify-charset (charset)		O			[O]	[O]	[O]		
8. attributes-natural-language (naturalLanguage)	R		R (9)	R (9)	R	R	R	R	R
9. notify-natural-language (naturalLanguage)		O			[O]	[O]	[O]		
10. notify-lease-time-requested (integer(0:MAX))							[R]	[R]	
11. notify-lease-expiration-time (integer(0:MAX))		R**					Return	Return	
12. notify-persistence-requested (boolean)						[O]	[O]		
13. notify-persistence-granted (boolean)		R				Return	Return		
14. trigger-event (type2 keyword)			R (2)	R (2)					
15. trigger-time (integer(MIN:MAX))			R	R					
16. trigger-date-time (dateTime)			[O]	[O]					
17. subscription-request-id (integer (0:MAX))		R	R	R					
18. subscription-id (integer(1:MAX))		R	R	R			Return	R	R

1657 Legend: "R" - REQUIRED for Printer to support; "O" - OPTIONAL for Printer to support; "[]" - OPTIONAL for sender to send;
1658 Return - Printer MUST return; * the client MUST supply for some delivery methods; ** - MUST be 0 for Per-Job Subscription
1659 objects; (n) means the value comes from the indicated Subscription Attribute

	Objects		Notification		Job operations		Subscription operations		
	Job	Subscription	Job Notification	Printer Notification	Job Creation-Validate-Job	Create-Job-Subscription	Create-Printer-Subscription	Renew-Subscription	Cancel-Subscription
19. version-number (integer (0:32767))			R	R					
20. operation-id (integer (0:32767)) or status-code (integer (0:32767))			0x600	0x601					
21. job-printer-uri (uri)	R								
22. printer-uri (uri)		R	R	R	R	R	R	R	R
23. printer-name (name(127))			R	R					
24. job-id (integer(1:MAX))	R		R	Per-Jb		R			
25. job-name (name(MAX)) [SNMP can truncate]	R		R	Per-Jb					
26. requesting-user-name (name(MAX))	R								
27. subscriber-user-name (name(MAX))		R	R	R					
28. job-state (type1 enum)	R		R						
29. job-state-reasons (1setOf type2 keyword)	R		R						
30. notify-server-up-time (integer(1:MAX))		R				Return	Return		
31. job-k-octets (integer(0:MAX))									
32. job-k-octets-processed (integer(0:MAX))	O		[pg/cp]						
33. job-impressions (integer(0:MAX))									
34. job-impressions-completed (integer(0:MAX))	O		[pg/cp]						
35. impressions-completed-current-copy (integer(0:MAX))	O		[pg/cp]						
36. job-media-sheets (integer(0:MAX))									
37. job-media-sheets-completed (integer(0:MAX))	O		[pg/cp]						
38. job-collation-type (type2 enum)	O		[pg/cp]						
39. sheet-completed-copy-number (integer(0:MAX))	O		[pg/cp]						
40. sheet-completed-document-number(integer(0:MAX))	O		[pg/cp]						

1661 Legend: "R" - REQUIRED for Printer to support; "O" - OPTIONAL for Printer to support; "[]" - OPTIONAL for sender to send;
1662 "[pg/cp]" - REQUIRED in a 'job-progress' or 'job-completed' notification if the corresponding Job attributes are supported ; (nn) - an
1663 alternate source of the data in a Notification.

1664

Attributes	Objects		Notification		Job operations		Subscription operations		
		Printer object	Job Notification	Printer Notification	Job Creation, Validate-Job	Create-Printer-Subscription	Renew-Subscription	Cancel-Subscription	
41. printer-state (type1 enum)		R		R					
42. printer-state-reasons (1setOf type2 keyword)		R		R					
43. printer-is-accepting-jobs (boolean)		R		R					
44. notify-schemes-supported (1setOf uriScheme)		R							
45. notify-events-default (1setOf type2 keyword)		R							
46. notify-events-supported (1setOf type2 keyword)		R							
47. max-events-supported (integer(5:MAX))		R							
48. notify-format-supported (1setOf mimeType)		CR							
49. max-job-subscriptions-supported (integer(1:MAX))		R							
50. max-printer-subscriptions-supported (integer(0:MAX))		R							
51. notify-lease-time-supported (rangeOfInteger(0:MAX))		R							
52. notify-lease-time-default (integer(0:MAX))		R							
53. persistent-jobs-supported (boolean)		O							
54. persistent-subscriptions-supported (boolean)		O							
55. printer-state-change-time (integer(1:MAX))		O							
56. printer-state-change-date-time (dateTime)		O							

1665 Legend: "R" - REQUIRED for Printer to support; "O" - OPTIONAL for Printer to support; "[]" - OPTIONAL for sender to send;

1666 "CR" - CONDITIONALLY REQUIRED, i.e., REQUIRED if Human Consumable format supported;

1667

1668 **B. Appendix: Change History**

1669 This section summarizes the changes to the document. Each sub-section is in reverse chronological order.
1670 Adding or removing ISSUES that don't change the document are not listed here.

1671 **18.1 Changes to the February 2, 2000 version to create the March 6, 2000 version**

1672 The following changes were made to the February 2, 2000 version to create the March 6, 2000 version
1673 based on the agreements reached on the mailing list, at the February IPP WG meetings, and reflected in the
1674 minutes:

- 1675 1. Clarified that this extension is intended as an extension to IPP/1.0, IPP/1.1, and future versions.
- 1676 2. Allocated the operation-id 0x0016 to 0x001B values for the Notification operations defined in the
1677 document.
- 1678 3. Pre-pended the word "subscription-" on the front of the "request-id" Subscription object attribute to
1679 distinguish it from the "request-id" parameter that is sent in every request and response.
- 1680 4. Added the term "settable" for describing attributes that are not READ-ONLY.
- 1681 5. Added the term "Subscription Creation operation" to stand for any operation that can create a
1682 Subscription object: Job Creation operations (Create-Job, Print-Job, and Print-URI), Create-Job-
1683 Subscription, and Create-Printer-Subscription.
- 1684 6. Changed the "subscriber-user-name" (name(MAX)) Subscription object attribute from OPTIONAL to
1685 REQUIRED.
- 1686 7. Changed the name and semantics of "notify-printer-up-time(integer(1:MAX)) to notify-server-up-time
1687 so that it can be either the Printer's uptime or a Notification Delivery Service uptime.
- 1688 8. Added the 'ipp:', 'indp:', 'mailto:', and 'snmp:' notification delivery schemes to the definition of the
1689 "notify-recipients" to indicate possible schemes.
- 1690 9. Changed the name and semantics of "notify-text-format" (mimeMediaType) to "notify-format" so that it
1691 can be used to specify either Human Consumable or Machine Consumable formats where the
1692 implementation supports both. Clarified that this attribute controls whatever variable Notification
1693 Content that the implementation supports, which may be an attachment to the fixed content format or
1694 the contents of the "human-readable-report" (text(MAX)) attribute. Clarified that an implementation
1695 NEED NOT support all of its supported Notification Content formats with all of its supported delivery
1696 methods.
- 1697 10. Added 'text/xml', 'application/ipp', 'application/postscript', and 'image/tiff' and additional example
1698 MIME media types for "notify-format" (mimeMediaType).
- 1699 11. Clarified that the recommend way for a client to determine whether or not a Printer supports Per-Job
1700 Subscriptions is to query the Printer's "max-job-subscriptions-supported" attribute, since Create-Job-
1701 Subscriptions is an OPTIONAL operation.

- 1702 12. Clarified that the recommend way for a client to determine whether or not a Printer supports Per-Printer
1703 Subscriptions is to query the Printer's "operations-supported" attribute to see if the Create-Printer-
1704 Subscriptions operations is supported, since this is the usual way to determine a Printer's capabilities.
- 1705 13. Clarified that if "persistent-jobs-supported" (boolean) and "persistent-subscriptions-supported"
1706 (boolean) are settable, then setting them must affect whether or not jobs and subscriptions are
1707 persistent.
- 1708 14. Allowed delivery methods to send operations with or without a response, depending on the definition of
1709 the delivery method.
- 1710 15. Indicated that a deliver method definition is free to REQUIRE that the client supply the "subscriber-
1711 user-data" attribute.
- 1712 16. Required that the Printer support the "job-uri" operation attribute as a target, in addition to "printer-
1713 uri"&"job-id", i.e., keep consistent with all Job operations.
- 1714 17. Changed the 'none' out-of-band value to be a reference to the collection document [ipp-coll], since the
1715 use for it in this document is with the 'collection' attribute syntax.
- 1716 18. Clarified that a conforming implementation MUST support the 'collection' attribute syntax, since that is
1717 required in Job Creation operations.
- 1718 19. Allocated the values to the new status codes defined in this document.
- 1719 20. Allocated the [ipp-pro] subscription-attributes-tag and notification-attributes-tag delimiter tags to
1720 delimit Subscription attributes and Notification Content attributes in requests and responses.
- 1721 21. Changed the 'server-error-too-many-subscriptions' and 'server-error-too-many-events' to be client
1722 errors, i.e., 'client-error-too-many-subscriptions' and 'client-error-too-many-events', since other errors of
1723 this type are client errors.

1724

1725 **18.2 Changes to the October 14, 1999 version to create the February 2, 2000 version**

1726 The following changes were made to the October 14, 1999 version to create the February 2, 2000 version
1727 based on the agreements reached at the October and December IPP WG meetings and reflected in the
1728 minutes:

- 1729 1. Added a Java Listener as an example of a Notification Recipient.
- 1730 2. Clarified the object relationships in section 4.1.
- 1731 3. Clarified how job events differ for Per-Job versus Per-Printer Subscriptions.
- 1732 4. Added the ability for the Machine Consumable form to contain a Human Readable "human-readable-
1733 report" (text) attribute so that both forms could be sent in the same Notification.
- 1734 5. Clarified that the 'none' value for notify-text-format (mimeMediaType) has to be out-of-band, not the
1735 text string 'none' as a mimeMediaType.
- 1736 6. Clarified that 'none' means send the Machine Consumable form without the "human-readable-report"
1737 (text) attribute, if it is defined.
- 1738 7. Clarified that Notification Recipients MUST be able to accept unrecognized attributes.

- 1739 8. Allowed the notification delivery method definition to be modeled as (1) a request with an operation
1740 code without a response, (2) a request with a operation code with a response or (3) a response with a
1741 status code.
- 1742 9. Added "notify-text-format" (mimeType) and "human-readable-report" (text(MAX)) to be able to
1743 be sent in a Notification content, if the notification delivery method document permits it.
- 1744 10. Added "job-k-octets" (integer(0:MAX)), "job-impressions" (integer(0:MAX)), and "job-media-sheets"
1745 (integer(0:MAX)) as OPTIONAL for Notification content for use in job-progress events to show the
1746 target values so that the Notification Recipient can show a thermometer.
- 1747 11. Added a Subscription Attributes group (and subscription-attributes tag) the Create-Job-Subscription and
1748 Create-Printer-Subscription requests and responses.
- 1749 12. Added the 'none' out-of-band value for use with "notify-text-format" (mimeType) attribute.
- 1750 13. Changed the job progress attributes from using -2 to mean 'unknown' as in the PWG Job Monitoring
1751 MIB, to use the 'unknown' out-of-band value.

1752

C. Appendix: Full Copyright Statement1753
1754 Copyright (C) The Internet Society (1998,1999,2000). All Rights Reserved

1755 This document and translations of it may be copied and furnished to others, and derivative works that
1756 comment on or otherwise explain it or assist in its implementation may be prepared, copied, published and
1757 distributed, in whole or in part, without restriction of any kind, provided that the above copyright notice
1758 and this paragraph are included on all such copies and derivative works. However, this document itself
1759 may not be modified in any way, such as by removing the copyright notice or references to the Internet
1760 Society or other Internet organizations, except as needed for the purpose of developing Internet standards in
1761 which case the procedures for copyrights defined in the Internet Standards process must be followed, or as
1762 required to translate it into languages other than English.

1763 The limited permissions granted above are perpetual and will not be revoked by the Internet Society or its
1764 successors or assigns.

1765 This document and the information contained herein is provided on an "AS IS" basis and THE INTERNET
1766 SOCIETY AND THE INTERNET ENGINEERING TASK FORCE DISCLAIMS ALL WARRANTIES,
1767 EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY WARRANTY THAT THE USE
1768 OF THE INFORMATION HEREIN WILL NOT INFRINGE ANY RIGHTS OR ANY IMPLIED
1769 WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

1770