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17 Internet Printing Protocol/1.0 & 1.1: **IPP Event Notification Specification**
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19 Status of this Memo

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29 **Abstract**

30 This document describes an extension to the IPP/1.0 & IPP/1.1 model that allows a client to subscribe to
31 printing related events. Subscriptions include "Per-Job Submission subscription" and "Per-Printer
32 subscriptions". One or more Per-Job Submission subscriptions are specified by the client when submitting
33 a job. One or more Per-Printer subscriptions are created by performing separate explicit Create-Printer-
34 Subscription operations on the Printer. Four other operations are defined for Per-Printer subscription
35 objects: get attributes, get subscriptions, renew a subscription, and cancel a subscription.

36 A subscription includes: the names of Job and/or Printer events, the Notification Recipient URL, the
37 Notification content MIME type, possibly some opaque data and the charset and natural language. In
38 addition, the Per-Printer subscription includes: the requested lease time and persistency for the
39 subscription. When the event occurs, a notification is generated and delivered using the information
40 specified in the subscription.

41 The full set of IPP documents includes:

42 Design Goals for an Internet Printing Protocol [IPP-REQ]

43 Rationale for the Structure and Model and Protocol for the Internet Printing Protocol [IPP-RAT]

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

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

46 Internet Printing Protocol/1.0: Implementer's Guide [IPP-IIG]

47 Mapping between LPD and IPP Protocols [IPP LPD]

48

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

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

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

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

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

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

75
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165

166 **1 Introduction**

167 This IPP notification specification is an extension to IPP/1.0 [RFC2568, RFC2569]. This document in
168 combination with the following documents is intended to meet the notification requirements described in
169 [ipp-not-req]:

- 170 Internet Printing Protocol/1.0 & 1.1: "Collection Attribute Syntax" [ipp-coll]
- 171 Internet Printing Protocol/1.0 & 1.1: "Job Progress Attributes" [ipp-prog]
- 172 Internet Printing Protocol/1.0 & 1.1: "Notification Change History" [ipp-not-hist]

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

- 174 - The rest of Section 1.1 is an overview of IPP Notification.
- 175 - Section 2 is the model for network entities that use IPP notification, including clients (desktop and
176 servers), IPP Printers (servers and devices), and Notification Recipients.
- 177 - Section 3 is the terminology used throughout the document.
- 178 - Section 4 is the object model for notification, including Job, Printer, and Subscription objects.
- 179 - Section 5 defines the notification attributes for each of the Job, Printer, and Subscription objects.
- 180 - Section 6 defines the content of Human Consumable and Machine Consumable Event
181 Notifications.
- 182 - Sections 7, 8, and 9 define the Per-Job and Per-Printer Subscription mechanisms.
- 183 - Section 10 and 11 define the conformance requirements and IANA requirements, respectively.
- 184 - Section 12 - 14 cover Internationalization, Security, and Status codes.

185 **1.1 Notification Overview**

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

188 One or more Per-Job Submission subscriptions are specified by the client when submitting a job. One or
189 more Per-Printer subscriptions are created by performing separate explicit Create-Printer-Subscription
190 operations on the Printer.

191 A Per-Job or Per-Printer subscription includes:

- 192 1. the names of Job and/or Printer events that are of interest to the Notification Recipient
- 193 2. the delivery method and address to use to deliver the notification to one Notification Recipient
- 194 3. whether Human Consumable or Machine Consumable notification content is to be sent
- 195 4. some opaque data that the subscriber wants to be send to the Notification Recipient in the
196 Notification, perhaps to identify either the subscriber or the ultimate recipient
- 197 5. the charset to use in the Notification, if it is to be different than the one used in the request that
198 created the subscription

199 6. the natural language to use in the Human Consumable Notification, if it is to be different than the
200 one used in the request that created the subscription

201 In addition, a Per-Printer subscription includes:

202 7. the requested lease time in seconds for the subscription

203 8. whether or not the subscription is requested to be persistent across power cycles.

204 For Per-Job subscriptions, a client requests job and printer event notification using the "job-notify"
205 operation attribute when creating a job with any of the Job Creation operation: Print-Job, Print-URI, and
206 Create-Job. The "job-notify" operation attributes may be submitted to the Validate-Job in order to be
207 validated. The "job-notify" operation attribute is copied to the Job object as a Job Description attribute and
208 so may be queried using the Get-Job-Attributes and Get-Jobs operations (see [ipp-mod]). Also this "job-
209 notify" Job Description attribute may be changed using the Set-Job-Attributes (see [ipp-set2]). The "job-
210 notify" operation attribute contains one or more collection values, each consisting of a number of member
211 attributes the specify a subscription, so that a Job can contain more than one Per-Job subscription. The
212 'collection' is a new attribute syntax (see [ipp-coll]). Table 1 summarizes the Per-Job Subscription
213 operations and their salient input operation attributes. All operations are REQUIRED, except the Set-Job-
214 Attributes operation.

215 **Table 1 - Summary of Per-Job Subscription operations**

Operation:	salient inputs besides printer-uri:
Print-Job, Print-URI, Create-Job	1setOf {recipient, [events,] [content-type,] [user-data,] [charset,] [natural-language]}
Validate-Job	1setOf {recipient, [events,] [content-type,] [user-data,] [charset,] [natural-language]}
Get-Job-Attributes	job-id, [requested-attributes]
Set-Job-Attributes	job-id, 1setOf {[recipient,] [events,] [content-type,] [user-data,] [charset,] [natural-language]}

216

217 For Per-Printer subscriptions, a client requests job and printer event notification using new operations
218 independent of any job. The Printer keeps each subscription in a separate Subscription object which is
219 similar to a Job object in its operations and security. The Get-Printer-Attributes (see [ipp-mod]) returns the
220 supported notification capabilities supported. The Create-Printer-Subscription operation creates an instance
221 of the Subscription object supplying these new operation attributes and returns a subscription-id (analogous
222 to a job-id for a Job object). These operation attributes are copied to the Subscription object as
223 Subscription Description attributes and so may be queried using the Get-Subscription-Attributes and Get-
224 Subscriptions operations. The subscriber requests a lease time for each Per-Printer subscription which
225 MAY be infinite. The Printer grants a lease time according to its configured policy. A client MUST renew
226 the Subscription before the granted lease time expires using the Renew-Printer-Subscription operation.
227 Table 2 summarizes the Per-Printer-Subscription operations and their salient input operation attributes.

228

Table 2 - Summary of Per-Printer Subscription operations

Operation:	salient inputs beside printer-uri:
Get-Printer-Attributes	[requested-attributes]
Create-Printer-Subscription	recipient, [events,] [content-type,][user-data,][charset,][natural-language,][lease-time-requested,] [persistence-requested]
Get-Printer-Subscription-Attributes	subscription-id, [requested-attributes]
Get-Printer-Subscriptions	[my-printer-subscriptions,] [requested-attributes]
Renew-Printer-Subscription	subscription-id, [lease time-requested]
Cancel-Printer-Subscription	subscription-id

229

230 There are two steps that IPP notification must take regarding each event – an internal event recording, and
 231 an external notification:

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

235 2) As an events occurs, the Printer searches the set of subscriptions for any interest in that event. As
 236 the Printer finds that some notification recipient is interested in that event (the notification recipient
 237 is subscribed to the event), the "request-id" sequence number for that event is incremented and a
 238 notification is generated and delivered using the methods and target addresses identified in the
 239 subscription. The "request-id" sequence number permits a Notification Recipient to detect duplicate
 240 notifications due either to duplicate subscriptions or retries and to detect dropped notifications.

241 **2 Model for Per-Job and Per-Printer Subscription and Event Notification**

242 **2.1 Model for Per-Job Subscription and Notification**

243 Per-Job subscriptions are created by a client (desktop or server acting as a client) as part of creation of the
 244 job in an IPP Printer (printing device or server).. More than one subscription may be submitted with a job.
 245 The IPP Printer object delivers a Notifications to the Notification Recipient supplied by the Client in each
 246 subscription. A Notification Recipient can be the Job submitter or a third party.

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


```

248
249 embedded printer:
250
251 desktop or server                                output device or server
252 +-----+                                       +-----+
253 | client |---IPP job submission-----># Printer # |
254 +-----+ Per-Job subscription | # Object # |
255 |#####|#####|
256 +-----+                                       +-----+
257 |recipient|<-----Notifications-----+
258 +-----+ (Job and/or Printer events)

```

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

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

1. forward the Per-Job subscriptions to the down stream IPP Printer and let it perform the notification directly to the Notification Recipients supplied by the Client (Notifications(C)) and use Per-Printer Subscriptions for the Server's own purposes.
2. save the client-supplied Per-Job subscription on the Job object in the server and substitute its own Per-Job subscription with the Server as the Notification Recipient (Notifications(B)). Then the Server relays Notifications to the client-supplied Notification Recipients (Notifications(A)).
3. A combination of 1 and 2 in which the Server adds its own Per-Job subscriptions to those supplied by the client. Thus the IPP Job that goes to Printer object 4 has a combination of subscription information from both the Client and the Server. This latter approach is sometimes called "piggy-backing" because the Server is adding its Per-Job subscription information to that supplied by the client. Piggy-backing is especially useful, if device B also accepts (IPP or non-IPP) requests from other servers. Then when all the jobs from Server S have been completed by 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).

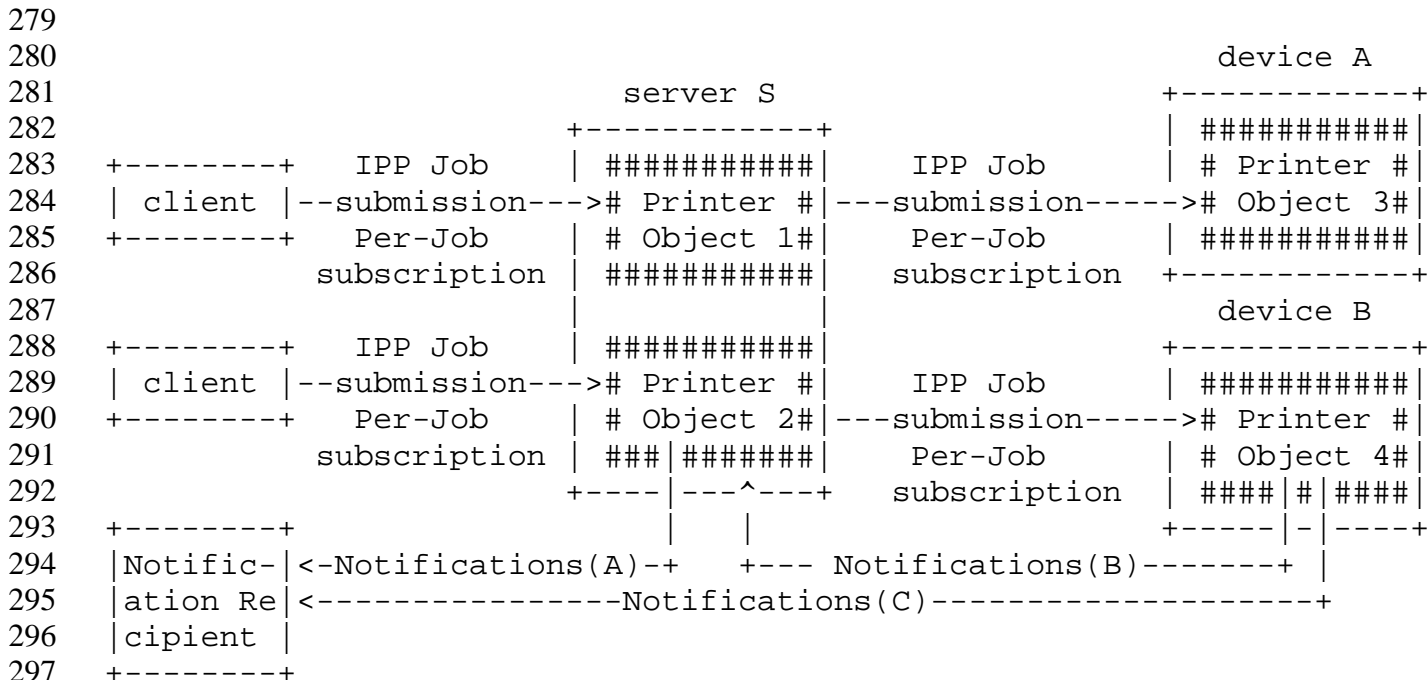


Figure 2 - Client-Server-Printer Per-Job Subscription and Notification Model

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.

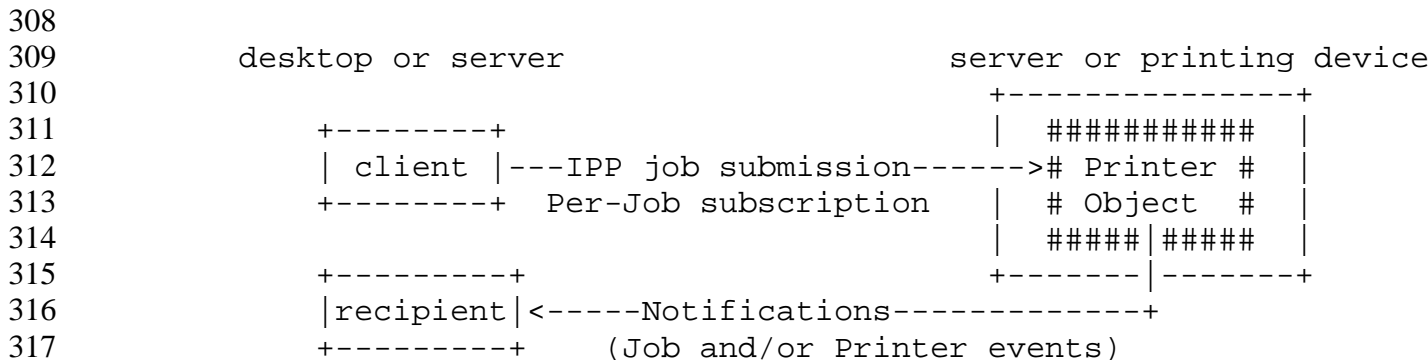
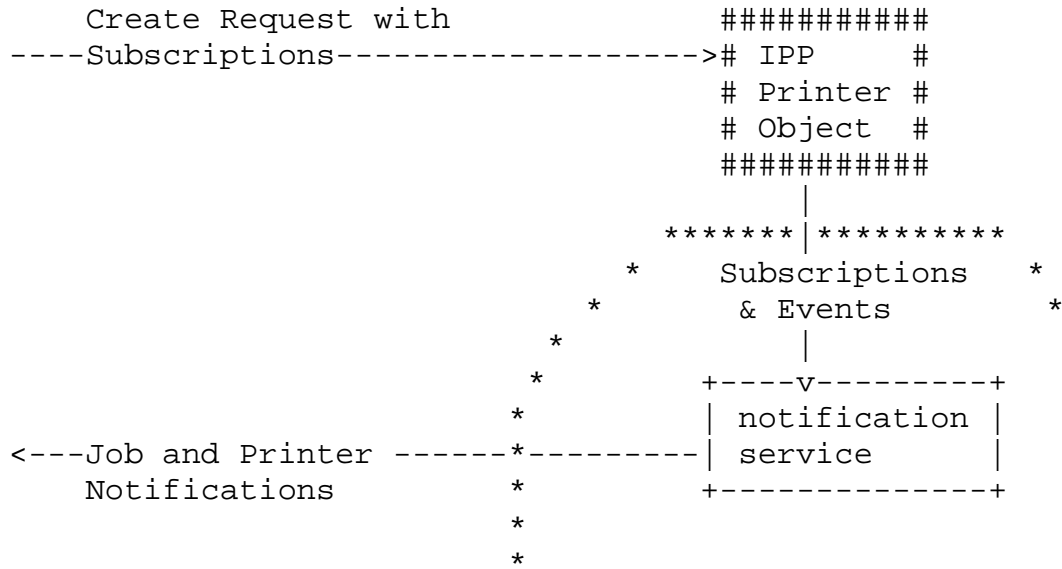


Figure 3 - Client-Printer Per-Printer Subscription and Notification Model

319 **2.3 Relationship between the Printer object and the Notification Delivery Service**

320 The IPP Notification model does not mandate that the IPP Printer object implement the full semantics of
321 subscription, report generation, and multiple delivery methods itself. An implementation may be
322 configured to use some other notification service. Figure 4 shows this partitioning.



341 *** = Implementation configuration opaque boundary

342
343 **Figure 4 - Opaque Use of a Notification Service**

344 If an IPP Printer does use some other notification service, it MAY do so in either of two ways:

- 345 1. The IPP Printer forwards the Subscriptions and the Events to the other notification service
346 which then sends the Notifications to the proper Recipients.
- 347 2. The IPP Printer keeps the subscriptions and uses them to send Notifications to the other
348 notification service which forwards them to Recipients that have also subscribed directly with
349 the other notification service. Examples of this latter approach are paging and immediate
350 messaging services.

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

353 **3 Terminology**

354 This section defines terminology used throughout this document.

355 **3.1 Conformance Terminology**

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

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

360 *Since support of this entire notification specification is OPTIONAL for conformance to*
361 *IPP/1.0 or IPP/1.1, the use of the term REQUIRED in this document means*
362 *"REQUIRED if this notification specification is implemented". Likewise, the term*
363 *RECOMMENDED means "RECOMMENDED if this notification specification is*
364 *implemented".*

365 READ-ONLY - indicates an attribute that MUST NOT be settable using the Set-Job-Attributes or Set-
366 Printer-Attributes operations (see [ipp-set2]).

367 3.2 Other terminology

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

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

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

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

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

381 **IPP Client (or client)** - The software component (desktop or server) that sends an IPP operation
382 request to an IPP Printer object (server or printing device) and accepts the resulting operation
383 response from the IPP Printer object.. **Job Recipient** - A human who is the ultimate consumer of
384 the print job. In many cases this will be the same person as the Job Submitting End User, but need
385 not be.

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

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

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

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

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

Subscription - A request by a Notification Subscriber to the IPP Printer to send Event Notifications to a specified Notification Recipient when the event occur. A Subscription is represented as a set of attributes that indicate the "what, where, who, and how" for notification. Notifications are generated for certain events (what) and delivered using various delivery methods (how) to certain addresses (where and who).

Per-Job Subscription - A Subscription that a client specifies as part of a create job operation (Print-Job, Print-URI, Create-Job), or a Validate-Job operation.

Per-Printer Subscription - A Subscription that a client specifies using an explicit Create-Printer-Subscription operation, that is attached to a Printer object.

Notification Source - The entity that sends Event Notifications.

Notification Recipient - The entity identified as a recipient within a subscription that receives IPP Notifications about Job and/or Printer events. A Notification Recipient may be a: Job Submitting End User, Job Submitting Application (desktop or server), Job Recipient, Job Recipient Proxy, Operator, or Administrator, etc., and their representative or log file or usage statistics gathering application or other active or passive entities.

Notification Recipient Agent - A program which receives Notifications on behalf of the Notification Recipient. The agent may take some action on behalf of the recipient, forward the notification to the recipient via some alternative means (for example, page the recipient), or queue the notification for later retrieval by the recipient.

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

Events can be classified along two dimensions:

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

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

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

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

Notification - When an event occurs, a Notification is generated that fully describes the event (what the event was, where it occurred, when it occurred, etc.). Notifications are delivered to each

448 Notification Recipient that has a subscription that includes the event, if any. The Notification is
449 delivered to the address of the Notification Recipient using the notification delivery method defined
450 in the subscription. However, a Notification is sent ONLY if there is a corresponding subscription.

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

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

456 Store and Forward **Notification** - A Notification which are not necessarily delivered to Notification
457 Recipients immediately, but is queued for delivery by some intermediate network application, for
458 later retrieval. Email is an example of a store and forward notification delivery method.

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

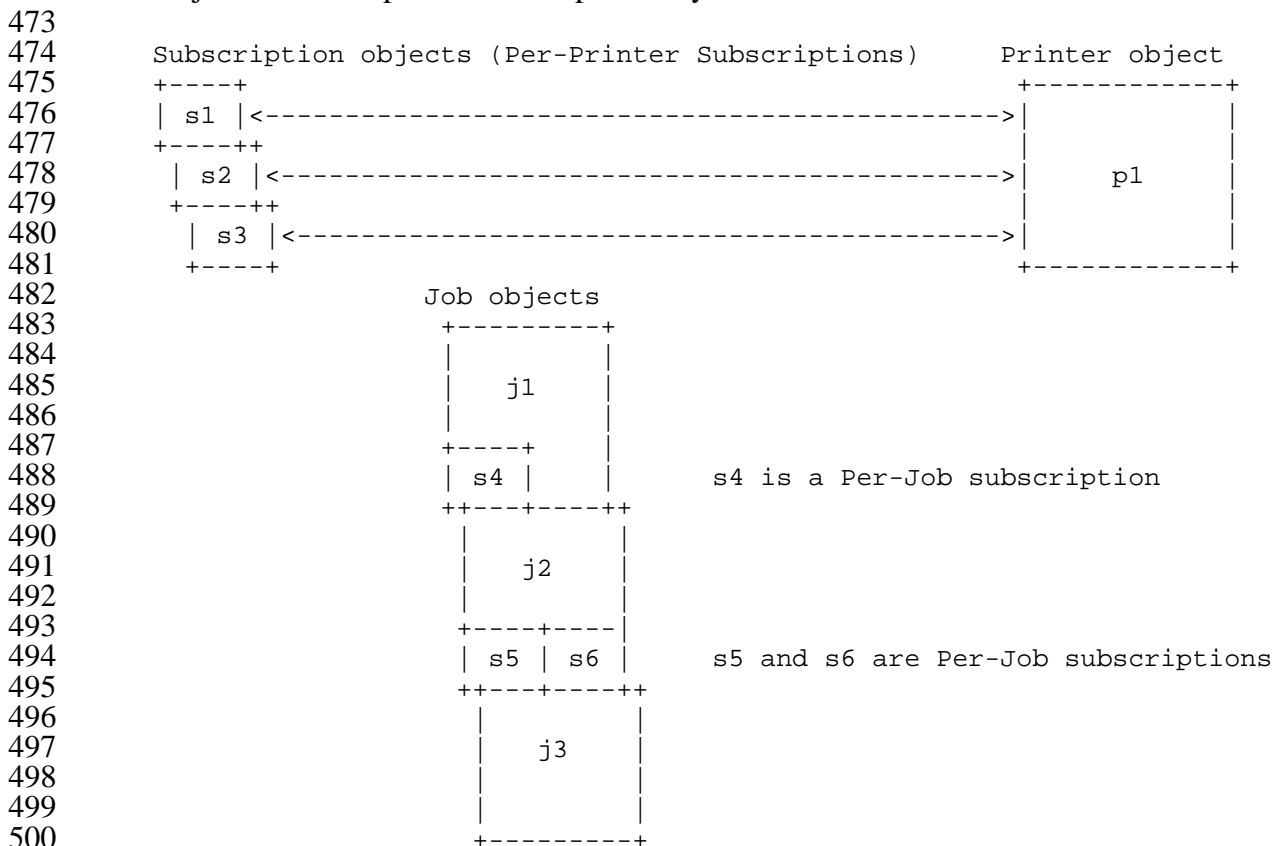
463 **Machine Consumable Notification** - Notifications that are intended for consumption by a program
464 only. They use the encoding of an IPP response. The Notification Recipient must localize the
465 contents, if displaying it to a human.

466 4 Object Model for Notification

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

469 Per-Job subscriptions do not use the Subscription object. Instead, a Job can have one or more Per-Job
470 subscription which is represented entirely as a single Job attribute. Each Per-Job subscription is
471 represented as a collection value of the "job-notify" Job attribute.

472 The object relationships can be seen pictorially as:



501 **Figure 5 - Object Model for Notification**

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

503 s4, s5, and s6 are Per-Job subscriptions (not objects) and can identify Printer and/or Job events.

504 4.1 Object relationships

505 The object relationships can be stated as follows:

- 506 1. The Printer object contains zero or more Subscription objects (p1 contains s1-s3 Subscription objects).
- 508 2. Each Subscription object (s1, s2, and s3) is contained in one Printer object (p1) and represents one Per-Printer subscription.
- 510 3. Each "Per-Printer" Subscription object identifies one or more Job and/or Printer events. Such Job events are for *all* jobs on the Printer. Such Printer events are for *any* Printer event, no matter which job is processing and when no jobs are processing.
- 513 4. Each "Per-Job" subscription (not an object by itself, but is attributes of the Job object) identifies one or more Job and/or Printer events. Such Job events are only for *this* job (different than "per-Printer" Subscriptions). Such Printer events are for *any* Printer event, no matter which job and when no jobs are processing (same as for "per-Printer" Subscriptions).

- 517 5. A Job object contains zero or more Per-Job subscriptions (not an object). Job j1 contains Per-Job
 518 subscription s4, Job j2 contains Per-Job subscription s5 and s6, and Job j3 does not contain a Per-
 519 Job subscription.
- 520 6. A Subscription object cannot be contained in or associated with more than one Printer object.
- 521 7. A Per-Job subscription cannot be contained in or associated with more than one Job object.

522 5 Object attributes defined for Notification

523 The following notification attributes are defined for each of the Printer, Job, and Subscription objects. The
 524 definitions of the object attributes are specified here so that they can be referred to from the subsequence
 525 definitions of the operations that set them.

526 5.1 "job-notify" (1setOf collection) Job Description attribute

527 In order to permit more than one Per-Job subscription, each subscription is represented as a collection value
 528 of the "job-notify (1setOf collection)" Job Description attribute. An implementation MUST support at least
 529 one collection value of the "job-notify" attribute. Table 3 lists the member attributes of the "job-notify"
 530 attribute. Section 5.3 defines each of the "job-notify" member attributes.

531 The "job-notify" Job Description attribute MAY be modified by the Set-Job-Attributes operation (see
 532 section 7.4) in which case all of its member attributes are replaced and the READ-ONLY "request-id"
 533 member attribute is reset with a value of '0' (see section 5.3.7).

534 **Table 3 - Job object 'job-notify' collection member attributes**

Job object attributes:	Printer support	set by:
notify-recipient (uri)	R	job creation operation, Set-Job-Attributes
notify-events (1setOf type2 keyword)	R	job creation operation, Set-Job-Attributes
notify-content-type (mimeMediaType)	R	job creation operation, Set-Job-Attributes
subscriber-user-data (octetString(63))	R	job creation operation, Set-Job-Attributes
notify-charset (charset)	O	job creation operation, Set-Job-Attributes
notify-natural-languages (naturalLanguage)	O	job creation operation, Set-Job-Attributes

request-id (integer(0:MAX))	R	Printer - event occurring
-----------------------------	---	---------------------------

535

536

537 5.2 Subscription object attributes

538 Each Per-Printer subscription is contained in a separate Subscription object. An implementation **MUST**
 539 support at least one Subscription object instance. Table 4 lists the Subscription attributes defined for the
 540 Subscription object. Sections 5.3 and 5.4 define each of the Subscription attributes.

541 All of the Subscription object attributes are READ-ONLY. They are set by other operations.

542 **Table 4 - Subscription object attributes**

Subscription object attributes:	Printer support	READ-ONLY, set by:
notify-recipient (uri)	R	client - Create-Printer-Subscription
notify-events (1setOf type2 keyword)	R	client - Create-Printer-Subscription
notify-content-type (mimeMediaType)	R	client - Create-Printer-Subscription
subscriber-user-data (octetString(63))	R	client - Create-Printer-Subscription
notify-charset (charset)	O	client - Create-Printer-Subscription
notify-natural-languages (1setOf naturalLanguage)	O	client - Create-Printer-Subscription

543

request-id (integer(0:MAX))	R	Printer - event occurring

544

545 Not in a Per-Job subscription:

subscription-id (integer(1:MAX))	R	Printer - Create-Printer-Subscription
notify-lease-expiration-time (integer(0:MAX))	R	Printer - Create-Printer-Subscription, Renew-Printer-Subscription
printer-uri (uri)	R	Printer - Create-Printer-Subscription
subscriber-user-name (name(MAX))	R	Printer - Create-Printer-Subscription

546

notify-printer-up-time (integer(1:MAX))	R	Printer - returned by Get-Printer-Subscription-Attributes and Get-Printer-Subscriptions
---	---	---

547 5.3 Common Per-Job and Per-Printer Subscription attributes

548 The following sub-sections define attributes that are in common to both Per-Job and Per-Printer
 549 subscriptions, i.e., are member attributes of the "job-notify" collection Job Description attribute and are
 550 Subscription object attributes. Section 5.4 defines additional attributes that are only Subscription object
 551 attributes.

552 **5.3.1 notify-recipient (uri)**

553 This REQUIRED attribute describes both where (the address of the Notification Recipient) and how (the
554 delivery method) notifications are to be delivered to the Notification Recipient when any of the events
555 specified in the "notify-events" attribute occur.

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

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

- 560 1) The URI scheme used.
- 561 2) The supported and default delivery format, and if not one of the specified types in Section 5.3.3,
562 description of the notification content.
- 563 3) Any content length restrictions imposed by the delivery protocol.
- 564 4) The latency of the delivery protocol used.
- 565 5) The reliability of the transport and delivery protocol used.
- 566 6) The security aspects of the transport and delivery protocol used, e.g. how it is handled in firewalls.
- 567 7) How the delivery protocol is initiated, e.g. does it have to be initiated by the receiving user (pull), or
568 is it initiated by the notification service (push).

569 **ISSUE 1: Once a number of delivery solutions have been developed and evaluated, we may want to make**
570 **one or several of them REQUIRED for implementation to ensure a minimum set of interoperability. Which**
571 **one or ones should be REQUIRED?**

572

573 **5.3.2 notify-events (1setOf type2 keyword)**

574 This REQUIRED attribute identifies the job and/or printer events that are to be delivered to the Notification
575 Recipient as Notifications as defined in section 6. If the client did not supply this attribute when supplying
576 the subscription, the Printer object populates this attribute with its "notify-events-default" attribute value
577 (see section 5.5.2).

578 There are both job events and printer events. Each job and printer event is assigned a keyword to use in
579 this attribute and in the Notification.

580 The events are defined to be disjoint.

581 A Printer MUST support the events indicated as "REQUIRED".

582 The standard job event keyword values are:

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

585 **'job-created':** REQUIRED - the Printer object has accepted a job creation operation (Print-Job, Print-
586 URI, or Create-Job) and the job's "time-at-creation" attribute value is set (see [ipp-mod] section
587 4.3.14.1). The Printer puts the job in the 'pending', 'pending-held' or 'processing' states.

588 Note: This event is separate from the 'job-state-changed' event so that it can be subscribed to

589 without having to get every job state change event for a Notification Recipient that is only
590 interested in when the job is first created.

591 **'job-completed'**: REQUIRED - the job has reached one of the completed states, i.e., the value of the
592 job's "job-state" attribute has changed to: 'completed', 'aborted', or 'canceled'. The Job's "time-at-
593 completed" and "date-time-at-completed" (if supported) attributes are set (see [ipp-mod] section
594 4.3.14).

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

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

602
603 This event also indicates that one or more values have been added to or removed from the Job's
604 "job-state-reasons" attribute, such as 'job-queued' or 'job-printing', whether or not the job's state has
605 changed. If job state reasons are added when the job is created, only the 'job-created' event is
606 generated, in order to keep the events disjoint. If job state reasons are added or removed when the
607 job is completed, only the 'job-completed' event is generated, in order to keep the events disjoint.

608
609 A client that wants to subscribe to all job state changes, including creation and completion, includes
610 the 'job-created', 'job-state-changed', and 'job-completed' in the notification subscription. When a
611 job is finally removed from the Job History (see [ipp-mod] 4.3.7.1) no event is generated, i.e.,
612 neither a 'job-state-changed' event nor a 'job-purged' event is generated.

613 **'job-config-changed'**: OPTIONAL - when the configuration of a job has changed, i.e., the value of
614 the "job-message-from-operator" or any of the non-READ-ONLY Job attributes have changed, such
615 as any of the job template attributes or the "job-name" attribute. Typically, such a change is the
616 result of the user or the operator performing a Set-Job-Attributes operation (see [ipp-set2]) on the
617 Job object. The client performs a Get-Job-Attributes to find out the new values of the changed
618 attributes. This event is useful for GUI clients and drivers to update the job information to the user.

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

623 **'job-progress'** - a sheet or copy has completed. See separate [ipp-prog] spec.
624

625 The standard Printer event keywords values are:

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

628 **'printer-restarted'**: OPTIONAL - when the printer is powered up or the Restart-Printer operation is
629 performed (see [ipp-set2]).

630 Note: This event is separate from the 'printer-state-changed' event so that it can be subscribed to
631 without having to get every printer state change event, for a Notification Recipient that is only
632 interested in when the Printer first comes up.

633 **'printer-shutdown'**: OPTIONAL - when the device is being powered down or the Shutdown-Printer
634 operation has been performed with either power-off or standby options (see [ipp-set2]).

635 Note: This event is separate from 'printer-state-changed' so that it can be subscribed to without
636 having to get every Printer state change event, for a Notification Recipient that is only interested in
637 when the Printer is powered down or shutdown.

638 **'printer-state-changed'**: REQUIRED - the Printer changed state, i.e., the value of the Printer's
639 "printer-state", "printer-state-reasons" (whether "printer-state" changed or not), and/or "printer-is-
640 accepting-jobs" attributes changed, except when the Printer starts up or is shutdown. If printer state
641 reasons are added when the Printer is started up, only the 'printer-restarted' event is generated, in
642 order to keep the events disjoint. If printer state reasons are added or removed when the printer is
643 powered-down or shutdown, only the 'printer-shutdown' event is generated, in order to keep the
644 events disjoint.

645
646 A client that wants to subscribe to all printer state changes, including restart and power-
647 down/shutdown, includes the 'printer-restarted', 'printer-state-changed', and 'printer-shutdown' in the
648 notification subscription.

649 **'printer-media-changed'**: OPTIONAL – when the media loaded on a printer has been changed, i.e.,
650 the "media-ready" attribute has changed. This event includes both an actual media change and
651 filling an empty input tray with the same or different media. The client must check the "media-
652 ready" Printer attribute (see [ipp-mod] section 4.2.11) separately to find out what new media was
653 loaded or filled.

654 **'printer-config-changed'**: OPTIONAL – when the configuration of a Printer has changed, i.e., the
655 value of the "printer-message-from-operator" or any non-READ-ONLY Printer attribute has
656 changed, except for "media-ready" (which has its own event), whether through the Set-Printer-
657 Attributes operation or by other means and whether initiated by a human or not. For example, any
658 "xxx-supported", "xxx-default", "printer-message-from-operator", etc. values have changed. The
659 client has to perform a Get-Printer-Attributes to find out the new values of these changed attributes.
660 This event is useful for GUI clients and drivers to update the available printer capabilities to the
661 user.

662 **'printer-queue-changed'**: OPTIONAL - the order of jobs in the Printer's queue has changed, so that an
663 application that is monitoring the queue can perform a Get-Jobs operation to determine the new
664 order. This event does not include when a job enters the queue (the 'job-created' event covers that)
665 and does not include when a job leaves the queue (the 'job-completed' event covers that).

666 **'printer-no-longer-full'**: OPTIONAL – when the Printer can now accept a Print-Job, Print-URI,
667 Create-Job, Send-Document, or Send-URI request. This event is used when there is more than one
668 client feeding a printer/server (fan-in), and the Printer may still be printing but has acquired more
669 buffer space to accept jobs. This event only occurs when the Printer did not have room to accept
670 jobs previously and rejected a Print-Job, Print-URI, Create-Job, Send-Document, or Send-URI
671 operation.

672 **'printer-almost-idle'**: OPTIONAL – when the Printer needs another Job in order to stay busy. This
673 event is used when a spooler is feeding more than one printer/server (fan-out), and the spooler holds
674 jobs until a Printer requests them, rather than committing jobs to IPP Printers before it is necessary.
675 This event MAY be used by a Printer implementation to request a new job from any subscribers
676 sufficiently ahead of time so that the device does not run out of work between jobs.

677

678 **5.3.3 notify-content-type (mimeMediaType)**

679 This REQUIRED attribute specifies the type of content that is to be sent in the notifications. Thus the
680 subscriber can control whether the event notification content is Human Readable or Machine Readable.
681 Most delivery methods support both forms of content type and MUST define one of them as the default. If
682 a delivery method only supports one form of content type, then that form is also the default.

683 If the MIME media type registration permits a charset parameter, than such a specification MUST be used
684 (instead of the "notify-charset" attribute) in order to indicate the charset to be used in the notification
685 content.

686 If the Subscriber did not supply this attribute when requesting the subscription, the Printer object populates
687 this attribute from the default value defined for the delivery method.

688 Standard mimeMediaType values are:

689 'application/ipp' - the Machine Consumable notification content using the 'application/ipp' MIME
690 media type [ipp-mod] as defined in section 6.

691
692 'text/plain; charset=utf-8': A plain text document in ISO 10646 represented as UTF-8 [RFC-2044]
693 as defined in section 6.
694

695 **5.3.4 subscriber-user-data (octetString(63))**

696 This REQUIRED attribute holds opaque information being sent from the Subscriber to the Notification
697 Recipient, such as the identify of the Subscriber or a path or index to some Subscriber information. Or it
698 MAY contain a key that the Notification Recipient needs in order to process the Notification, such as the
699 ultimate recipient, if the Notification Recipient is a general application that in turn forwards notifications.

700 **5.3.5 notify-attributes-charset (charset)**

701 This OPTIONAL attribute specifies the charset to be used in the Notification content sent to the
702 notification recipient. This attribute MUST NOT be used when the "notify-content-type" attribute value
703 specifies the charset parameter in its MIME media type value.

704 **5.3.6 notify-attributes-natural-languages (naturalLanguage)**

705 This OPTIONAL attribute specifies the natural language for the IPP object to use in the Notification
706 content that is sent to the Notification Recipient.

707 **5.3.7 request-id**

708 This REQUIRED READ-ONLY attribute holds the most recent request-id sequence number delivered in a
709 Notification content to the Notification Recipient. A value of 0 indicates that no Notifications have been
710 sent for this subscription. The first request-id sent for a subscription MUST be 1. Each Notification
711 Recipient has its own monotonically increasing series of request-ids, i.e., no gaps, in order to be able to
712 detect a missing notification.

713 For a Per-Job subscription, "request-id" is a READ-ONLY member attribute of each collection value. All
714 of the other member attributes (see section 5.1) are not READ-ONLY and MAY be modified by a Set-Job-
715 Attributes operation (see 7.4).

716 **5.4 Additional attributes for the Subscription object *only***

717 The following sub-sections define additional attributes that are only for the Subscription object and have no
718 counter part in Per-Job subscriptions.

719 **5.4.1 subscription-id (integer (1:MAX))**

720 This REQUIRED READ-ONLY Subscription object attribute uniquely identifies this Subscription object
721 instance on this Printer. The Printer object, on acceptance of a Create-Printer-Subscription request,
722 generates an ID which identifies the new Subscription object on that Printer. The Printer returns the value
723 of the "subscription-id" attribute as part of the response to a Create-Printer-Subscription request. The 0
724 value is not included to allow for compatibility with "job-id" and with SNMP index values which also
725 cannot be 0.

726 It is RECOMMENDED that Per-Printer Subscription objects be persistent. Then the Subscription objects
727 including the subscription-id remains unique across power-cycles. Even if an implementation does not
728 make Per-Printer subscription objects persist, the implementation SHOULD make every attempt not to re-
729 use subscription ids that subscribers might still think are valid. In other words, the Printer SHOULD at
730 least keep the next subscription-id to be assigned in non-volatile memory.

731 **5.4.2 notify-lease-expiration-time (integer(0:MAX))**

732 This REQUIRED READ-ONLY Subscription object attribute specifies the time in the future when the
733 subscription lease will expire, i.e., the "printer-up-time" value at which the lease will expire. When the
734 Printer object creates a Subscription object, it populates this attribute with the appropriate value. When the
735 indicated time arrives, the Printer MUST delete the Per-Printer Subscription object.

736 A client is able to extend a lease using the Renew-Printer-Subscription operation (see section 8.4). A value
737 of 0 indicates an infinite time, if such a policy is supported as indicated in the "notify-lease-time-supported"
738 (integer(0:MAX)) Printer Description attribute (see section 5.5.7) and the subscriber is authorized to
739 request an infinite lease.

740 Note: In order to compute the number of seconds remaining in a Per-Printer Subscription lease, a client can
741 subtract the "notify-printer-up-time" Printer object attribute (see section 5.4.5) from the "notify-lease-time"
742 Subscription object attribute.

743 **5.4.3 printer-uri (uri)**

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

748 **5.4.4 subscriber-user-name (name(MAX))**

749 This REQUIRED READ-ONLY Subscription object attribute contains the name of the user that created the
750 Subscription object. The Printer object sets this attribute to the most authenticated printable name that it
751 can obtain from the authentication service over which the IPP operation was received. This attribute is
752 intended to help a human user determine for which Per-Printer Subscriptions they are the Subscriber. Only
753 if such is not available, does the Printer object use the value supplied by the client in the "requesting-user-
754 name" operation attribute of the create operation (see [IPP-MOD] Sections 4.4.2, 4.4.3, and 8).

755 **ISSUE 2 - What is the value of the "subscriber-user-name" when the Subscriber is a server send a job to an**
 756 **IPP Printer? The original Job Submitting End User use name or some "user name" that identifies the**
 757 **Server?**

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

762 **5.4.5 notify-printer-up-time (integer(1:MAX))**

763 This REQUIRED READ-ONLY Subscription object attribute indicates the amount of time (in seconds)
 764 that the Printer implementation has been up and running. This attribute is an alias for the Printer's "printer-
 765 up-time" attribute" (see [ipp-mod] section 4.4.29), in an analogous way that the Job's "job-printer-up-time"
 766 is an alias for "printer-up-time" (see [ipp-mod] section 4.3.13.4).

767 Note: A client can request this attribute in a Get-Printer-Subscription-Attributes or Get-Printer-
 768 Subscriptions request and use the value returned in combination with the "notify-subscription-expiration-
 769 time" (see section 5.4.2) in order to display wall clock time equivalent to the user. The difference between
 770 this attribute and the 'integer' value of the "notify-subscription-expiration-time" attribute is the number of
 771 seconds in the future that the subscription will expire. A client can compute the wall-clock time at which
 772 the subscription will expire by adding this difference to the client's wall-clock time.

773 **5.5 Printer Description Attributes related to Notification**

774 This section defines the Printer Description attributes that are related to Notification.

775 **Table 5 - Printer Description attributes associated with Notification**

Printer object attributes:	Printer support	READ-ONLY, set by:
notify-schemes-supported (1setOf uriScheme)	R	Administrator/implementation
notify-events-default (1setOf type2 keyword)	R	Administrator/implementation
notify-events-supported (1setOf type2 keyword)	R	Administrator/implementation
max-events-supported (integer(5:MAX))	R	Administrator/implementation
max-job-subscriptions-supported (integer(1:MAX))	R	Administrator/implementation
max-printer-subscriptions-supported (integer(0:MAX))	R	Administrator/implementation
notify-lease-time-supported (rangeOfInteger(0:MAX))	R	Administrator/implementation
notify-lease-time-default (integer(0:MAX))	R	Administrator/implementation
persistent-jobs-supported (boolean)	O	Administrator/implementation
persistent-subscriptions-supported (boolean)	O	Administrator/implementation
printer-state-change-time (integer(1:MAX))	O	Administrator/implementation
printer-state-change-date-time (dateTime)	O	Administrator/implementation

776

777 5.5.1 notify-schemes-supported (1setOf uriScheme)

778 This REQUIRED Printer attribute describes the notification delivery methods supported by this Printer
779 object. Standard values are defined in Section 5.3.1).

780 5.5.2 notify-events-default (1setOf type2 keyword)

781 This REQUIRED Printer attribute identifies the event values if the client does not supply the "notify-
782 events" operation attribute in either a Job creation request or the Create-Printer-Subscription request. Any
783 value in this attribute MUST also appear in the notify-events-supported attribute, i.e., be a supported event.

784 5.5.3 notify-events-supported (1setOf type2 keyword)

785 This REQUIRED Printer attribute identifies the events supported by this Printer object for both Per-Job and
786 Per-Printer subscriptions which MUST be the same. Standard values are defined in Section 5.3.2.

787 5.5.4 max-events-supported (integer(5:MAX))

788 This REQUIRED Printer attribute specifies the maximum number of events that are supported in a single
789 Per-Job or Per-Printer subscription which must be the same. A Printer MUST support at least 5 events per
790 subscription, so that clients can depend on at least 5 events in a single subscription. If the number of events
791 supplied by a client in a subscription exceed this number, the Printer rejects the request and returns the
792 'server-error-too-many-events' (see section 14.3). If notification is not supported, this attribute MUST NOT
793 be supported.

794 5.5.5 max-job-subscriptions-supported (integer(1:MAX))

795 This REQUIRED Printer attribute specifies the maximum number of Per-Job subscriptions that are
796 supported in a single Job Creation request, i.e., the maximum number of collection values for the "job-
797 notify" operation attribute. A value of 0 indicates no effective maximum. A Printer MUST support at least
798 1 Per-Job subscription. If the number of Per-Job subscriptions supplied by a client in a Job Creation
799 request exceed this number, the Printer rejects the request and returns the 'server-error-too-many-
800 subscriptions' (see section 14.2).

801 5.5.6 max-printer-subscriptions-supported (integer(0:MAX))

802 This REQUIRED Printer attribute specifies the maximum number of Per-Printer subscriptions that are
803 supported by multiple Create-Printer-Subscription requests, i.e., the maximum number of un-expired
804 Subscription objects that the Printer supports at a time. A value of 0 indicates no effective maximum. A
805 Printer MUST support at least 1 Per-Printer subscription. If the number of Per-Printer subscriptions would
806 exceed this number, the Printer rejects the Create-Printer-Subscription request and returns the 'server-error-
807 too-many-subscriptions' (see section 14.2).

808 5.5.7 notify-lease-time-supported (rangeOfInteger(0:MAX))

809 This REQUIRED Printer attribute specifies the range of values in seconds that are supported for the
810 "notify-lease-time-requested" operation attribute in a Create-Printer-Subscription or Renew-Printer-
811 Subscription request. When the lease time expires for a Per-Printer Subscription without renewing, the
812 Printer MUST delete the Subscription object. If the client requests a value outside this range, the Printer
813 MUST grant a value that is in this range (see section 5.4.2). A value of 0 indicates an infinite lease, i.e.,
814 one that does not expire.

815 **5.5.8 notify-lease-time-default (integer(0:MAX))**

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

819 **5.5.9 persistent-jobs-supported (boolean)**

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

824 **5.5.10 persistent-subscriptions-supported (boolean)**

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

830 **5.5.11 printer-state-change-time (integer(1:MAX))**

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

834 **5.5.12 printer-state-change-date-time (dateTime)**

835 This OPTIONAL Printer attribute records the date and time, i.e., copy of the Printer's "printer-current-time"
836 attribute, that the Printer's "printer-state" attribute was last changed. On power-up, the Printer populates the
837 "printer-state-change-date-time" from its "printer-current-time" attribute, so that it always has a value.

838 **6 Notification Content**

839 This section defines the Notification content that is sent to a Notification Recipient when an event occurs.
840 The Notification MAY be sent by the IPP Printer or a third party Notification Service (see section 2.3).
841 There are two notification content types: Machine Consumable and Human Consumable. For most
842 notification delivery methods both content types are defined. Some of the notification delivery methods are
843 defined to support only one content type. A Printer MUST support all content types defined for a
844 notification delivery method, if it supports that notification delivery method.

845 **6.1 Notification content MIME media type formats**

846 This section defines the Notification content that the Notification Source sends asynchronously to each
847 Notification Recipient based on the subscription information stored with the subscription.

848 Notifications are generated using the following content formats:

849 **'application/ipp'** - Machine Consumable notification content using the 'application/ipp' MIME
850 media type [ipp-mod] using the Get-Job-Attributes response encoding for job events and Get-

851 Printer-Attributes for printer events. The attributes listed in sections 6.2 and 6.3 are sent in an
 852 notification for Job events. The attributes listed in sections 6.2 and 6.4 are sent in an
 853 notification for Printer events. For any string in any notification, the charset and natural
 854 language rules that apply to all IPP operations apply to the notification strings as well, since
 855 they are represented as operation responses. The Unsupported Attributes Group in the response
 856 is not sent. If the values of any of the attributes sent in an notification content are not known,
 857 the value sent in the report content is the out-of-band 'unknown' value, rather than omitting the
 858 attribute (see the beginning of [ipp-mod] section 4.1).

859 An implementation MAY extend the contents of the Machine Consumable notification by
 860 adding additional attributes.

861 **'text/plain; charset=utf-8'** - Human Consumable notification content type [RFC2046]. The text
 862 message SHOULD include information about the attributes in sections 6.2 and 6.3 for job
 863 events or in sections 6.2 and 6.4 for printer events. This information is localized according to
 864 the information about natural language and charset in the subscription.

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

867 6.2 Notification content attributes common to Job and Printer events

868 This section lists the parameters and attributes that are included in both Job and Printer event Notifications.
 869 Some events do not include all of these attributes as shown in Table 6. Each notification content contains a
 870 single Job or Printer event, whether that event was subscribed using the Job Submission Subscription
 871 mechanism or the Per-Printer subscription mechanism. If either kind of subscription subscribed to both Job
 872 and Printer events, then they will be sent as separate Job notification content and Printer notification
 873 contents to the same Notification Recipient.

874 **Table 6 - Common Job and Printer Notification content attributes**

	Reference	Events	
Attributes		'job-progress'	all others
1. version-number (integer (0:32767))	mod 3.1.1	R	R
2. status-code (integer (0:32767))	mod 3.1.1	R	R
3. request-id (integer (0:MAX))	5.3.7 & mod 3.1.1	R	R
4. attributes-charset (charset)	5.3.5 & mod 3.1.4	R	R
5. attributes-natural-language (naturalLanguage)	5.3.6 & mod 3.1.4	R	R
6. printer-uri (uri)	5.4.3	R	R
7. printer-name (name(127))	mod 4.4.4		R
8. job-id (integer(1:MAX))	mod 4.3.2	R	R**
9. job-name (name(MAX))	mod 4.3.5		R**

	Reference	Events	
Attributes		'job-progress'	all others
10. trigger-event (type2 keyword)	5.3.2	R	R
11. trigger-time (integer(MIN:MAX))		R	R
12. trigger-date-time (dateTime)			O
13. subscription-id (integer(1:MAX))	5.4.1	R	R
14. subscriber-user-name (name(MAX))	5.4.4		R
15. subscriber-user-data (octetString(63))	5.3.4		R

875 Attribute Notes:

876 "status-code" - a value of 600 for a Job event and 601 for a Printer event.

877 "request-id" - the sequence number for this subscription, starting at 1 for each subscription.

878 "attributes-charset" - the value comes from the "notify-attributes-charset" in the "job-notify" Per-Job
879 Subscription and the "notify-attributes-charset" in the Per-Printer Subscription object.

880 "attributes-natural-language" - the value comes from the "notify-attributes-natural-language" in the "job-
881 notify" Per-Job Subscription and the "notify-attributes-natural-language" in the Per-Printer
882 Subscription object.

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

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

885 "trigger-event" - the event that caused this Notification to be delivered.

886 "trigger-time" - the "printer-up-time" value when the event occurred.

887 "trigger-date-time" - the "printer-current-time" value when the event occurred - OPTIONAL to support.

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

890 "subscription-id" - for Per-Job subscriptions, the value is the index of the "job-notify" collection value,
891 starting with 1 for the first collection value.

892 "subscriber-user-name" - comes from "requesting-user-name" Job attribute for Per-Job subscriptions.
893 SNMP delivery method can truncate to less than 255 octets, since the Notification needs to fit into
894 484 octets or so on some transports that SNMP is defined for.

895 "subscriber-user-data" - opaque user data that may identify either the Subscriber and/or the ultimate
896 Notification Recipient.

897 **6.3 Additional Notification content attributes for Job events *only***

898 This section lists the additional attributes that are included only in Job event Notifications. Some events do
899 not include all of these attributes as shown in Table 7.

900 **Table 7 - Additional Notification content attributes for Job events *only***

		Events		
Attributes	Reference	'job-progress'	'job-completed'	all others
16. job-state (type1 enum)	mod 4.3.7		R	R
17. job-state-reasons (1setOf type2 keyword)	mod 4.3.8		R	R
18. job-k-octets-processed (integer(0:MAX))	mod 4.3.18.1	O	O	
19. job-impressions-completed (integer(0:MAX))	mod 4.3.18.2	O	O	
20. job-media-sheets-completed (integer(0:MAX))	mod 4.3.18.3	O	O	
21. job-collation-type (type2 enum)	[ipp-prog]	R		
22. sheet-completed-copy-number (integer(-2:MAX))	[ipp-prog]	R		
23. sheet-completed-document-number(integer(-2:MAX))	[ipp-prog]	R		
24. impressions-interpreted (integer(-2:MAX))	[ipp-prog]	R		
25. impressions-completed-current-copy (integer(-2:MAX))	[ipp-prog]	R		

901 **6.4 Additional Notification content attributes for Printer events *only***

902 Table 8 lists the additional attributes that are included only in Printer event Notifications.

903 **Table 8 - Additional Notification content attributes for Printer events *only***

		Events
Attributes	Reference	all printer events
26. printer-state (type1 enum)	mod 4.4.11	R
27. printer-state-reasons (1setOf type2 keyword)	mod 4.4.12	R
28. printer-is-accepting-jobs (boolean)	mod 4.4.23	R

904

905 **7 Operations for Per-Job Subscriptions**

906 This section defines the REQUIRED operation requests and responses that are related to Per-Job
907 subscriptions. Section 8 defines the REQUIRED operation requests and responses associated with the
908 REQUIRED Per-Printer subscription and its Subscription object.

909 7.1 Job Creation Operations (Create-Job, Print-Job, Print-URI) and Validate-Job

910 The usual method for a client to associate one subscription with a Job is to specify the subscription when
 911 the job is created. For a Per-Job Subscription, the client supplies the "job-notify (1setOf collection)"
 912 operation attribute with the member attributes listed in Table 9 with any of the job creation operations
 913 (Create-Job, Print-Job, Print-URI), plus Validate-Job (which doesn't create a job or subscription). If the
 914 client does not supply the "job-notify" attribute in the create operation, there is no subscription made (either
 915 implicitly or explicitly).

916 If a Printer does not support this notification specification, then it MUST ignore the "job-notify" operation
 917 attribute and return it in the response indicated as an attribute that is not supported. See [ipp-mod] section
 918 3.1.7 for details on returning Unsupported Attributes.

919 **Table 9 - Member attributes of the "job-notify" collection operation attribute**

Member attribute of "job-notify" collection	Referen ce	REQUIRED in request	Printer support
notify-recipient (uri)	5.3.1	yes	REQUIRED
notify-events (1setOf type2 keyword)	5.3.2	no	REQUIRED
notify-content-type (mimeMediaType)	5.3.3	no	REQUIRED
subscriber-user-data (octetString(63))	5.3.4	no	REQUIRED
notify-attributes-charset (charset)	5.3.5	no	OPTIONAL
notify-attributes-natural-language (naturalLanguage)	5.3.6	no	OPTIONAL

920 See the referenced sections for a definition of these operation attributes, since they are copied to the Job
 921 object as the Job Description attributes described in section 5.3.

922 The following rules apply to Per-Job subscriptions:

- 923 1. Any subscription can contain job events, printer events, or both.
- 924 2. The Job Submission Subscription is only valid while the job is "not-completed". The job is "not-
 925 completed" while it is in the 'pending', 'pending-held', 'processing', and 'processing-stopped' states. The
 926 job changes from being "not-completed" to "retained" when it is done processing and enters any of the
 927 'completed', 'canceled', or 'aborted' states. The job becomes "not-completed" again when it is restarted
 928 using the Restart-Job operation (see [ipp-mod]).
- 929 3. Since no job is created for the Validate-Job operation, the only purpose of supplying the subscription
 930 operation attributes in the Validate-Job operation is to validate that the values are supported; the Printer
 931 object does not establish a notification subscription as a result of the Validate-Job operation.
- 932 4. Since a Job Submission Subscription is included within a job submission operation, any interest in job
 933 events is limited to "this job" only (the Job object created because of this job creation operation). There
 934 is no mechanism to subscribe to events for all jobs or specifically some job other than this job in a
 935 create operation. But see the Create-Printer-Subscription operation (section 8.1) for an explicit
 936 operation to subscribe for job and/or printer events independently of any particular job submission.
- 937 5. Event reporting only occurs when a notification recipient has specified a subscription to any event(s).

- 938 6. The notification implementation MAY allow an administrator to configure a policy on what events may
939 be dropped.
- 940 7. If the OPTIONAL "notify-attributes-charset" attribute is not supported or the supplied value is not
941 supported, the IPP Printer MUST return the attribute in the Unsupported Attributes Group but still
942 accept the operation, as with all Job create operations. In this case, the Printer MUST use the natural
943 language supplied in the "attributes-charset" Job creation operation attribute, if that natural language
944 value is supported by the Printer, else the Printer object MUST use the Printer's "charset-configured"
945 value. See the Print-Job operation in [ipp-mod].
- 946 8. If the OPTIONAL "notify-attributes-natural-language" attribute is not supported or the supplied value is
947 not supported, the IPP Printer MUST return the attribute in the Unsupported Attributes Group but still
948 accept the operation, as with all Job create operations. In this case, the Printer MUST use the natural
949 language supplied in the "attributes-natural-language" Job creation operation attribute, if that natural
950 language value is supported by the Printer, else the Printer object MUST use the Printer's "natural-
951 language-configured" value. See the Print-Job operation in [ipp-mod].

952 **7.2 Get-Printer-Attributes operation**

953 The REQUIRED (by [ipp-mod]) Get-Printer-Attributes can be used to request the additional Printer
954 Description attributes that indicate the notification supported. See section 5.5.

955 **7.3 Get-Job-Attributes operation**

956 The REQUIRED (by [ipp-mod]) Get-Job-Attributes can be used to request the additional Job Description
957 attributes that relate to notification. See section 5.5.

958 7.4 Set-Job-Attributes operation

959 The OPTIONAL Set-Job-Attributes operation (see [ipp-set2]) allows a client to change the Job attributes of
 960 the Job's Per-Job subscription, including to add them in the first place if they had not been supplied in the
 961 Job creation operation and to remove them from the Job object. This operation replaces all the collection
 962 values of the supplied "job-notify" (1setOf collection) notification attribute.

963 In order to cancel all Per-Job subscriptions, the client supplies the "job-notify" attribute with an out-of-band
 964 'none' value (see [ipp-coll]).

965 Request:

Group 1: Operation Attributes		Printer support
	"attributes-charset" (charset)	R
	"attributes-natural-language" (naturalLanguage)	R
	"printer-uri" (uri)	R
	"requesting-user-name" (name(MAX))	RECOMMENDED
	"job-notify" (1setOf collection)	R

966 Response:

Group 1: Operation Attributes		Printer support
	"status-code" (type2 enum)	R
	"attributes-charset" (charset)	R
	"attributes-natural-language" (naturalLanguage)	R
	["status-message" (text(255))]	O
	["detailed-status-message" (text(MAX))]	O
Group 2: Unsupported Attributes		R

967 The "job-notify" operation attribute is copied to the "job-notify" Job Description attribute. See section 5.1
 968 for a definition of the "job-notify" Job Description attribute.

969 8 Per-Printer Subscriptions and the Subscription object

970 This section lists the REQUIRED Per-Printer Subscriptions operation requests and responses and the
 971 Subscription object that MUST be supported.

972 **ISSUE 3 - Are these abbreviated operation definitions ok for understandability and conformance, or should**
 973 **we use the more verbose definition style of the [ipp-mod]?**

974 8.1 Create-Printer-Subscription operation

975 The REQUIRED Create-Printer-Subscription operation creates a Per-Printer subscription by creating a Per-
 976 Printer Subscription object which is added to the Printer object. The client can specify one or more job
 977 and/or printer events to be delivered as notifications to one Notification Recipient. The job events are for
 978 any job submitted to the Printer. The printer events are any events generated by that Printer.

979 The Printer returns a subscription id and the length of time for which it has granted a lease for the
980 subscription. The client must renew the subscription using the Renew-Printer-Subscription operation (see
981 section 8.4) before the lease runs out in order to maintain the subscription. A client can unsubscribe using
982 the Cancel-Printer-Subscription operation (section 8.5) and the subscription id.

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

988 If the Printer has a bounded set of concurrent subscriptions (for the specified events or any events), the
989 printer rejects the operation and returns the 'server-error-too-many-subscriptions' status code. The client
990 **SHOULD** try again later.

991 Access Rights: The authenticated user (see [IPP-MOD] section 8.3) performing this operation **MUST** have
992 operator or administrator access rights for the Printer object (see [IPP-MOD] sections 1 and 8.5).
993 Otherwise the IPP object **MUST** reject the operation and return: client-error-forbidden, client-error-not-
994 authenticated, and client-error-not-authorized as appropriate.

995 Request:

Group 1: Operation Attributes	Printer support
"attributes-charset" (charset)	R
"attributes-natural-language" (naturalLanguage)	R
"printer-uri" (uri)	R
["requesting-user-name" (name(MAX))]	RECOMMENDED
["notify-recipient" (uri)]	R
["notify-events" (1setOf type2 keyword)]	R
["notify-content-type" (mimeMediaType)]	R
["subscriber-user-data" (octetString(63))]	R
["notify-attributes-charset" (charset)]	O
["notify-attributes-natural-language" (naturalLanguage)]	O
["notify-lease-time-requested" (integer(0:MAX))]	R
["notify-persistence-requested" (boolean)]	O

996 Response:

Group 1: Operation Attributes	Printer Support
"status-code" (type2 enum)	R
"attributes-charset" (charset)	R
"attributes-natural-language" (naturalLanguage)	R
["status-message" (text(255))]	O
["detailed-status-message" (text(MAX))]	O
"subscription-id" (integer(1:MAX))	R
"notify-lease-expiration-time" (integer(0:MAX))	R
"notify-lease-time-granted" (integer(0:MAX))	R
"notify-persistence-granted" (boolean)	R
Group 2: Unsupported Attributes	R

997 Attribute Notes:

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

999 "notify-lease-time-requested" (integer(0:MAX)) - the number of seconds requested for the Per-Printer
1000 subscription lease. A value of 0 indicates a request that the Per-Printer Subscription lease never
1001 expire. Supplying a 0 value MAY require authentication in order to be used, if 0 is supported at all.
1002 If the client does not supply this attribute, the Printer uses its "notify-lease-time-default" value (see
1003 section 5.5.8).

1004 "notify-persistence-requested" (boolean) - whether or not the Per-Printer Subscription is to be persistent,
1005 i.e., saved across power cycles. Note: Persistent trap registrations is a client option in SNMPv3
1006 [RFC2573].

1007 "notify-lease-expiration-time" (integer(0:MAX)) - The Printer object MUST return this attribute
1008 which is the time in the future at which the subscription lease will expire, i.e., the "printer-up-time"
1009 value (in time ticks - see [ipp-mod] section 4.4.29) at which the Printer will delete the Subscription.
1010 A value of 0 indicates that the lease subscription will never expire.

1011 "notify-lease-time-granted" - The Printer object MUST return this attribute which is the number of seconds
 1012 of time actually granted. The value of "notify-lease-time-granted" may be less than the requester
 1013 requested in the "notify-lease-time-requested" if it was greater than the MAX supported or more
 1014 than the requester requested if it was less than the MIN supported, as indicated in the Printer's
 1015 "notify-lease-time-supported" (rangeOfInteger(0:MAX)) attribute.

1016 "notify-persistence-granted" - whether or not this Per-Printer Subscription object instance is persistent.
 1017 This attribute MUST be returned whether "notify-persistence-requested" is supported or not, so that
 1018 the client knows which.

1019 8.2 Get-Printer-Subscription-Attributes operation

1020 The REQUIRED Get-Printer-Subscription-Attributes returns the requested attributes of the identified Per-
 1021 Printer Subscription object. See sections 5.3 and 5.4.

1022 Request:

Group 1: Operation Attributes	Printer support
"attributes-charset" (charset)	R
"attributes-natural-language" (naturalLanguage)	R
"printer-uri" (uri)	R
["requesting-user-name" (name(MAX))]	RECOMMENDED
"subscription-id" (integer(1:MAX))	R
["requested-attributes" (1setOf type2 keyword)]	R

1023 Response:

Group 1: Operation Attributes	Printer support
"status-code" (type2 enum)	R
"attributes-charset" (charset)	R
"attributes-natural-language" (naturalLanguage)	R
["status-message" (text(255))]	O
["detailed-status-message (text(MAX))]	O
Group 2: Unsupported Attributes	R
Group 3: <the requested Subscription object attributes>	R

1024 This operation is similar to the Get-Printer-Attributes operation. If the client omits the "requested-
 1025 attributes" operation attribute, the Printer MUST respond as if the client had supplied the 'all' value, i.e.,
 1026 return all of the attributes supported for the Subscription object.

8.3 Get-Printer-Subscriptions operation

The REQUIRED Get-Printer-Subscriptions operation returns Per-Printer subscriptions, i.e., Subscription objects.

Request:

Group 1: Operation Attributes	Printer support
"attributes-charset" (charset)	R
"attributes-natural-language" (naturalLanguage)	R
"printer-uri" (uri)	R
["requesting-user-name" (name(MAX))]	RECOMMENDED
["limit" (integer(1:MAX))]	R
["requested-attributes" (1setOf type2 keyword)]	R
["my-subscriptions" (boolean)]	R

Response:

Group 1: Operation Attributes	Printer support
"status-code" (type2 enum)	R
"attributes-charset" (charset)	R
"attributes-natural-language" (naturalLanguage)	R
["status-message" (text)]	O
["detailed-status-message" (text(MAX))]	O
Group 2: Unsupported Attributes	R
Group 3 to N:<the requested Subscription Attributes for each Subscription object in a separate group>	R

Notes: This operation is similar to the Get-Jobs operation (see [ipp-mod]). If the client wants any attributes returned, including the "subscription-id", it must include the attribute keyword name in the "requested-attributes" operation attribute. If the "requested-attributes" operation attribute is omitted, the Printer MUST respond as if the client supplied the value: 'subscription-id'. If the client supplies the "my-subscriptions" with a 'false' value or omits it, the Printer returns all subscriptions, subject to the security policy in force.

8.4 Renew-Printer-Subscription operation

The REQUIRED Renew-Printer-Subscription operation permits a client to request the IPP Printer to extend the lease on a Per-Printer Subscription object instance.

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

1046 Request:

Group 1: Operation Attributes	Printer support
"attributes-charset" (charset)	R
"attributes-natural-language" (naturalLanguage)	R
"printer-uri" (uri)	R
["requesting-user-name" (name(MAX))]	RECOMMENDED
"subscription-id" (integer(1:MAX))	R
["notify-lease-time-requested" (integer(0:MAX))]	R

1047 Response:

Group 1: Operation Attributes	Printer support
"status-code" (type2 enum)	R
"attributes-charset" (charset)	R
"attributes-natural-language" (naturalLanguage)	R
["status-message" (text(255))]	O
["detailed-status-message" (text(MAX))]	O
"notify-lease-expiration-time" (integer(0:MAX))	R
"notify-lease-time-granted" (integer(0:MAX))	R
Group 2: Unsupported Attributes	R

1048 Attribute Notes:

1049 "notify-lease-time-requested" (integer(0:MAX) - the number of seconds requested for the Per-Printer
1050 subscription lease. Same as Create-Printer-Subscriptions (see section 8.1).

1051 "notify-lease-expiration-time" - the time in the future when the subscription will expire. Same as for the
1052 Create-Printer-Subscription operation (see section 7.1).

1053 "notify-lease-time-granted" - the lease time (number of seconds) actually granted. Same as for the Create-
1054 Printer-Subscription operation (see section 7.1).

1055 Note: There is no way to change any of the Subscription object attributes, except the "notify-lease-
1056 expiration-time" attribute. In order to change other attributes, a client can create a new Subscription object
1057 and then use the Cancel-Printer-Subscription operation to cancel the old one (or do this in the other order,
1058 in case there is a limit on the number of Subscription object instances, as long as a short window with no
1059 Notifications is ok).

1060 Note: There is no need to renew a Per-Job Subscription, since it is effectively the time that the Job is active
1061 (see section 7.1).

1062 8.5 Cancel-Printer-Subscription operation

1063 The REQUIRED Cancel-Printer-Subscription operation allows a client to remove a Per-Printer
1064 Subscription object from the Printer. No more Notifications are delivered for that Subscription. Once
1065 performed, there is no way to use that Subscription in the future. Subscription-ids should not be reused
1066 immediately, so that a stale reference situation is not created. Same as for Cancel-Job and job-ids.

1067 *Access Rights:* The authenticated user (see [IPP-MOD] section 8.3) performing this operation MUST either
1068 be the owner of the Subscription object or have operator or administrator access rights for the Printer object

1069 (see [IPP-MOD] sections 1 and 8.5). Otherwise the IPP object MUST reject the operation and return:
 1070 client-error-forbidden, client-error-not-authenticated, and client-error-not-authorized as appropriate.

1071 Request:

Group 1: Operation Attributes		Printer support
	"attributes-charset" (charset)	R
	"attributes-natural-language" (naturalLanguage)	R
	"printer-uri" (uri)	R
	["requesting-user-name" (name(MAX))]	RECOMMENDED
	"subscription-id" (integer(1:MAX))	R

1072 Response:

Group 1: Operation Attributes		Printer support
	"status-code" (type2 enum)	R
	"attributes-charset" (charset)	R
	"attributes-natural-language" (naturalLanguage)	R
	["status-message" (text(255))]	O
	["detailed-status-message" (text(MAX))]	O
Group 2: Unsupported Attributes		R

1073

1074 9 Comparison of Per-Job Submission Subscriptions versus Per-Printer 1075 Subscriptions

1076 Per-Job and Per-Printer subscriptions are quite similar. However, there are some semantic differences
 1077 between Per-Job subscriptions and Per-Printer subscriptions. A Per-Job Submission Subscription is
 1078 established by the client when submitting a job. A Per-Printer Subscription is established between a client
 1079 and a Printer using the new Create-Printer-Subscription operation. Some specific differences are:

- 1080 1. Either type of subscription can subscribe to Job events, Printer events, or both.
- 1081 2. For Per-Job Subscriptions, the subscription is only valid while the job is "not-complete" (see sections
 1082 6.2 and 6.3).
- 1083 3. For the Per-Printer Subscriptions, the subscription is valid until it is explicitly canceled with a Cancel-
 1084 Printer-Subscription operation or the time (in seconds) that the Printer returned in the "notify-lease-
 1085 time-granted" operation attribute expires, whichever occurs first.
- 1086 4. Job Events in a Per-Job Subscription apply only to "one job" (the Job created by the job creation
 1087 operation).
- 1088 5. Job Events in a Per-Printer-Subscription apply to ALL jobs contained in the IPP Printer object.
- 1089 6. Printer Events in both kinds of subscriptions apply no matter which job is being processed, if any.

1090

10 Conformance Requirements

This section further enhances the Conformance Requirements detailed in [IPP-MOD] section 5. Extensions made to the events herein must be made such that new events or event attributes are backward compatible to clients who implemented early versions of this notification specification.

It is OPTIONAL to implement this Event Notification specification. If implemented, IPP objects MUST support all of the REQUIRED object attributes as defined in this document in the indicated sections.

If IPP Notification is implemented, the operations described in this document must be supported as described in Table 10:

Table 10 - Conformance Requirements for Operations

Attribute	Conformance requirements
"job-notify" in Job Creation operations (section 7.1)	REQUIRED
Set-Job-Attributes (see [ipp-set2])	OPTIONAL
Create-Printer-Subscription (section 8.1)	REQUIRED
Get-Printer-Subscription-Attributes (section 8.2)	REQUIRED
Get-Printer-Subscriptions (section 8.3)	REQUIRED
Renew-Printer-Subscription (section 8.4)	REQUIRED
Cancel-Printer-Subscription (section 8.5)	REQUIRED

11 IANA Considerations

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

12 Internationalization Considerations

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

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

13 Security Considerations

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

1117 IPP Printer receiving the print request to validate the identity of an event recipient”) argues against this.
1118 Certain systems may decide to disallow third party notifications (a traditional fax model).

1119 Clients submitting notification requests to the IPP Printer has the same security issues as submitting an
1120 IPP/1.1 print job request. The same mechanisms used by IPP/1.1 can therefore be used by the client
1121 notification submission. Operations that require authentication can use the HTTP authentication.
1122 Operations that require privacy can use the HTTP/TLS privacy.

1123 The notification access control model should be similar to the IPP access control model for Jobs. Creating
1124 a Per-Printer Notification Subscription object is associated with a user. Only the creator or an operator can
1125 cancel the subscription. The system may limit the listing of items to only those items owned by the user.
1126 Some subscriptions (e.g. those that have a lifetime longer than a job) can be done only by privileged users
1127 (users having operator and/or administrator access rights), if that is the authorization policy.

1128 The standard security concerns (delivery to the right user, privacy of content, tamper proof content) apply
1129 to the notification delivery. IPP should use the security mechanism of the delivery method used. Some
1130 delivery mechanisms are more secure than others. Therefore, sensitive notifications should use the delivery
1131 method that has the strongest security.

1132 **14 Status Codes**

1133 The following status codes are defined as extensions for notification:

1134 **14.1 client-error-uri-notification-scheme-not-supported (0x04??)**

1135 The scheme of the client-supplied URI in a "notify-recipient" operation attribute in a Create-Printer-
1136 Subscription operation is not supported. See [ipp-mod] section 3.1.7.

1137 Note: There is no corresponding Per-Job subscription error, since the Printer object MUST ignore any
1138 errors in the "job-notify" operation attribute and perform the Job Creation operation (see section 5.1), since
1139 the job can still be printed.

1140 **ISSUE 4 - The client-error-uri-scheme-not-supported is already an IPP/1.1 status code and section 3.1.6.1**
1141 **indicates that the "document-uri" attribute NEED NOT be returned in the Unsupported Attributes group,**
1142 **otherwise, we could use that error code and REQUIRE that offending "xxx-uri" attribute(s) to be returned.**

1143 **14.2 server-error-too-many-subscriptions (0x04??)**

1144 The bounded set of concurrent Per-Printer subscriptions supported by the Printer object would be exceeded
1145 if this request were accepted.

1146 Note: There is no corresponding Per-Job subscription error, since the Printer object MUST ignore any
1147 errors in the "job-notify" operation attribute and perform the Job Creation operation (see section 5.1), since
1148 the job can still be printed.

1149 **14.3 server-error-too-many-events (0x04??)**

1150 The client supplied more events in the "notify-events" operation attribute in a Create-Printer-Subscription
1151 that the Printer supports, as indicated in its "max-events-supported" attribute (see section 5.5.4).

1152 Note: There is no corresponding Per-Job subscription error, since the Printer object MUST ignore any
1153 errors in the "job-notify" operation attribute and perform the Job Creation operation (see section 5.1), since
1154 the job can still be printed.

1155 **ISSUE 5 - Should the entire "job-notify" operation attribute be ignored, if one of its member attributes has**
1156 **a problem, or should just that member attribute be ignored? If the latter, then is just the member attribute**
1157 **returned in the Unsupported Attributes group?**

1158 **15 References**

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1232 **A. Appendix - Summary of Notification Attribute Usage**

1233 This appendix summarizes the usage of Notification attributes in the Job operation attribute collection, Job
1234 object, Subscription object, Notification content, Job operations, and Subscriptions operations.

1235 **ISSUE 6 - Should this appendix be kept in the spec or moved to the Implementer's Guide?**

Attributes	Objects		Notification content		Job operations		Subscription operations		
	Job object	Subscription object	Job Notification Content	Printer Notification Content	Job Creation Validate -Job	Set-Job-Subscription	Create-Printer-Subscription	Renew - Subscription	Cancel - Subscription
1. notify-recipient (uri)	R	R			[R]	[R]	[R]		
2. notify-events (1setOf type2 keyword)	R	R		100	[R]	[R]	[R]		
3. notify-content-type (mimeMediaType)	R	R			[R]	[R]	[R]		
4. subscriber-user-data (octetString(63))	R	R	R	R	[R]	[R]	[R]		
5. attributes-charset (charset)	R*		R (6)	R (6)	R	R	R	R	R
6. notify-attributes-charset (charset)	R	O			[O]	[O]	[O]		
7. attributes-natural-language (naturalLanguage)	R*		R (8)	R (8)	R	R	R	R	R
8. notify-attributes-natural-language (naturalLanguage)	R	O			[O]	[O]	[O]		
9. notify-lease-time-requested (integer(0:MAX))							[R]	[R]	
10. notify-lease-time-granted (integer(0:MAX))							Return	Return	
11. notify-lease-expiration-time (integer(0:MAX))		R					Return	Return	
12. notify-persistence-requested (boolean)							[O]		
13. notify-persistence-granted (boolean)							Return		
14. trigger-event (type2 keyword)			R (2)	R (2)					
15. trigger-time (integer(MIN:MAX))			R	R					
16. trigger-date-time (dateTime)			[]	[]					
17. request-id (integer (0:MAX))	R	R	R	R					
18. subscription-id (integer(1:MAX))	**	R	R	R			Return	R	R

1236 Legend: "R" - REQUIRED for Printer to support; "O" - OPTIONAL for Printer to support; "[]" - OPTIONAL for sender to send;
1237 Return - Printer MUST return; "Per-Pr" - REQUIRED if Notification from a Per-Printer subscription; * - Job object, not collection;
1238 "Per-Job" - REQUIRED if Notification from a Per-Job subscription; (nn) indicates source of value in a Notification;
1239 ** - 1setOf collection index is the implicit subscription-id for a Per-Job subscription and is sent in the Notification.

1240

Attributes	Objects		Notification		Job operations		Subscription operations		
	Job object	Subscription object	Job Notification	Printer Notification	Job Creation-Validate-Job	Set-Job-Subscription	Create-Printer-Subscription	Renew-Subscription	Cancel-Subscription
19. version-number (integer (0:32767))			R	R					
20. status-code (integer (0:32767))			(600)	(601)					
21. job-printer-uri (uri)	R								
22. printer-uri (uri)		R	R (21)	R	R	R	R	R	R
23. printer-name (name(127))			R	R					
24. job-id (integer(1:MAX))	R		R	Per-Jb					
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 (26)	R (26)					
28. job-state (type1 enum)	R		R						
29. job-state-reasons (1setOf type2 keyword)	R		R						
30. notify-printer-up-time (integer(1:MAX))		R							
31. job-k-octets-processed (integer(0:MAX))	O		[pg/cp]						
32. job-impressions-completed (integer(0:MAX))	O		[pg/cp]						
33. job-media-sheets-completed (integer(0:MAX))	O		[pg/cp]						
34. job-collation-type (type2 enum)	O		[pg/cp]						
35. sheet-completed-copy-number (integer(-2:MAX))	O		[pg/cp]						
36. sheet-completed-document-number(integer(-2:MAX))	O		[pg/cp]						
37. impressions-interpreted (integer(-2:MAX))	O		[pg/cp]						
38. impressions-completed-current-copy (integer(-2:MAX))	O		[pg/cp]						

- 1241 Legend: "R" - REQUIRED for Printer to support; "O" - OPTIONAL for Printer to support; []" - OPTIONAL for sender to send;
1242 "Return - Printer MUST return; "Per-Pr" - REQUIRED if Notification from a Per-Printer subscription;
1243 "Per-Jb" - REQUIRED if Notification from a Per-Job subscription;
1244 "[pg/cp]" - OPTIONAL in a 'job-progress' or 'job-completed' notification; (nn) - an alternate source of the data in a Notification.

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

1245 Legend: "R" - REQUIRED for Printer to support; "O" - OPTIONAL for Printer to support; "[]" - OPTIONAL for sender to send;
1246 Return - Printer MUST return; "Per-Pr" - REQUIRED if Notification from a Per-Printer subscription;
1247 "Per-Jb" - REQUIRED if Notification from a Per-Job subscription;
1248 "[pg/cp]" - OPTIONAL in a 'job-progress' or 'job-completed' notification; (nn) - an alternate source of the data in a Notification.

1249

1250 **17 Appendix C: Full Copyright Statement**

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