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17 Internet Printing Protocol/1.0 & 1.1: **IPP Event Notification Specification**
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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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167

168 1 Introduction

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

- 172 Internet Printing Protocol/1.0 & 1.1: "Collection Attribute Syntax" [ipp-coll]
- 173 Internet Printing Protocol/1.0 & 1.1: "Job Progress Attributes" [ipp-prog]
- 174 Internet Printing Protocol/1.0 & 1.1: "Notification Change History" [ipp-not-hist]
- 175 [Internet Printing Protocol/1.0 & 1.1: "Notification Delivery Method xxx \[TBD\]](#)
- 176 [Internet Printing Protocol/1.0 & 1.1: "Notification Delivery Method yyy \[TBD\]](#)
- 177

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

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

190 1.1 Notification Overview

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

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

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

- 197 1. the names of Job and/or Printer events that are of interest to the Notification Recipient
- 198 2. the delivery method and address to use to deliver the notification to one Notification Recipient
- 199 3. whether Human Consumable or Machine Consumable notification content is to be sent
- 200 4. some opaque data that the subscriber wants to be send to the Notification Recipient in the
201 Notification, perhaps to identify either the subscriber or the ultimate recipient

- 202 5. the charset to use in the Notification, if it is to be different than the one used in the request that
203 created the subscription
- 204 6. the natural language to use in the Human Consumable Notification, if it is to be different than the
205 one used in the request that created the subscription

206 In addition, a Per-Printer subscription includes:

- 207 7. the requested lease time in seconds for the subscription
- 208 8. whether or not the subscription is requested to be persistent across power cycles.

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

220 **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]}

221

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

233

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

234

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

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

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

246 **2 Model for Per-Job and Per-Printer Subscription and Event Notification**

247 **2.1 Model for Per-Job Subscription and Notification**

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

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


```

253
254 embedded printer:
255
256 desktop or server                                output device or server
257 +-----+                                       +-----+
258 | client |---IPP job submission-----># Printer # |
259 +-----+ Per-Job subscription | # Object # |
260 |                                     | #####|##### |
261 +-----+                                       +-----+
262 |recipient|<-----Notifications-----+
263 +-----+ (Job and/or Printer events)

```

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

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

- 269 1. forward the Per-Job subscriptions to the down stream IPP Printer and let it perform the
 270 notification directly to the Notification Recipients supplied by the Client (Notifications(C)) and
 271 use Per-Printer Subscriptions for the Server's own purposes.
- 272 2. save the client-supplied Per-Job subscription on the Job object in the server and substitute its
 273 own Per-Job subscription with the Server as the Notification Recipient (Notifications(B)). Then
 274 the Server relays Notifications to the client-supplied Notification Recipients (Notifications(A)).
- 275 3. A combination of 1 and 2 in which the Server adds its own Per-Job subscriptions to those
 276 supplied by the client. Thus the IPP Job that goes to Printer object 4 has a combination of
 277 subscription information from both the Client and the Server. This latter approach is sometimes
 278 called "piggy-backing" because the Server is adding its Per-Job subscription information to that
 279 supplied by the client. Piggy-backing is especially useful, if device B also accepts (IPP or non-
 280 IPP) requests from other servers. Then when all the jobs from Server S have been completed by
 281 device B, there will be no more Job events sent to Server S. (Server S could still maintain a
 282 long term Per-Printer subscription with Printer D to that Server S can have Printer B's state track
 283 (shadow) that of Printer D or Server S could poll Printer D when queried about Printer B).

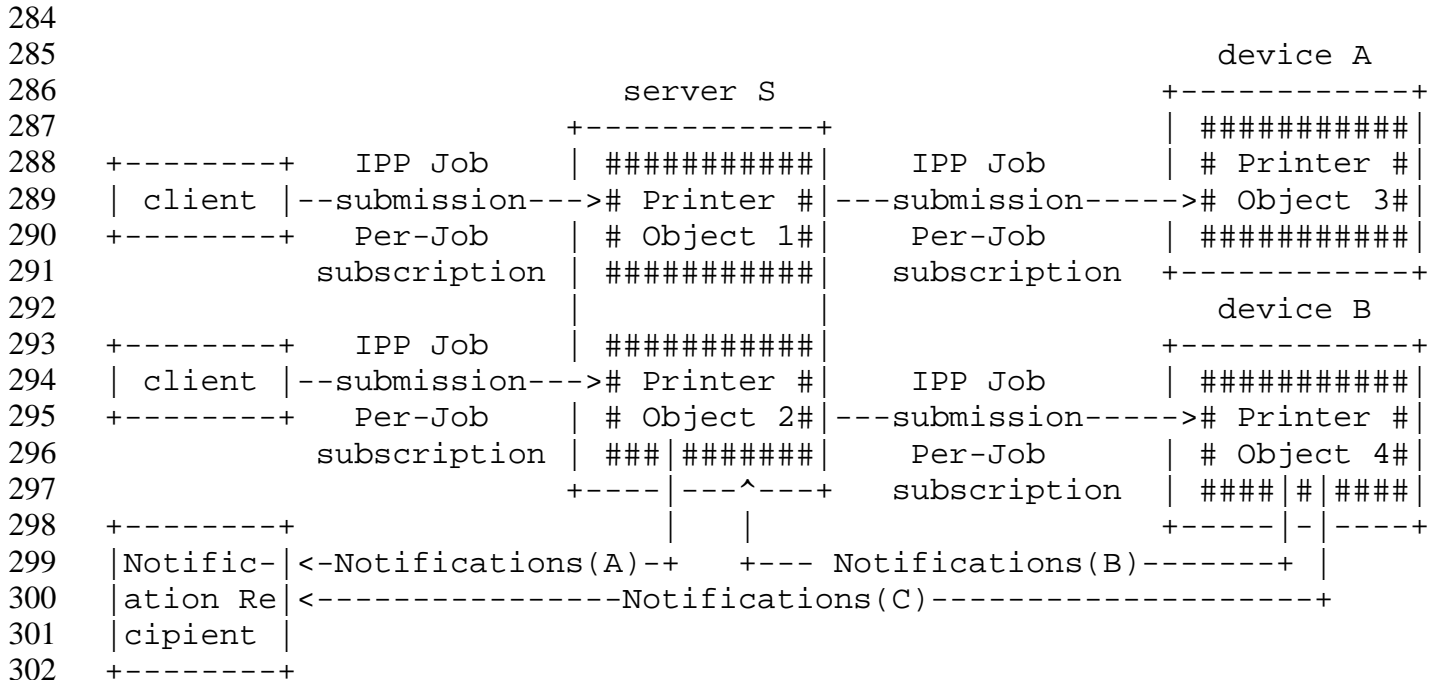


Figure 2 - Client-Server-Printer Per-Job Subscription and Notification Model

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.

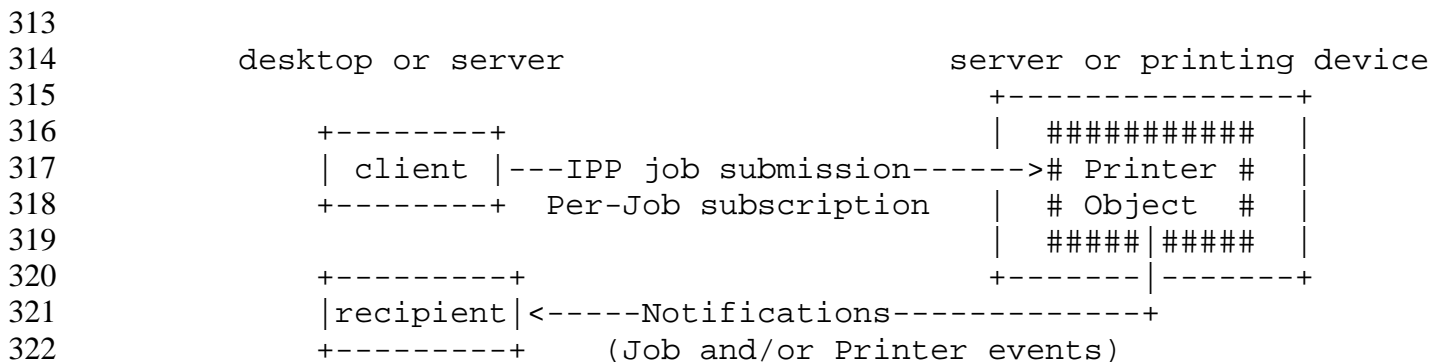
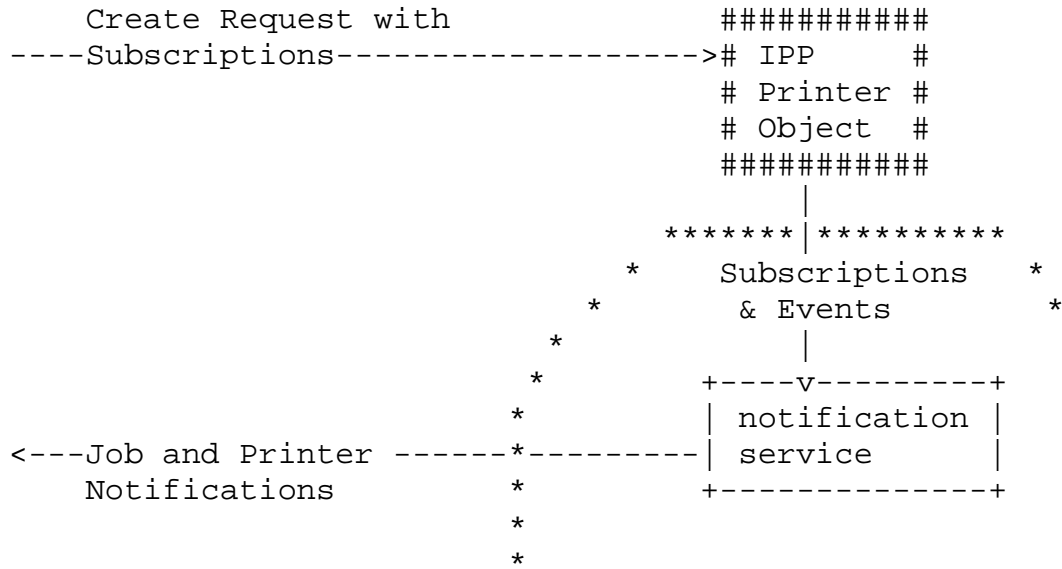


Figure 3 - Client-Printer Per-Printer Subscription and Notification Model

2.3 Relationship between the Printer object and the Notification Delivery Service

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



*** = Implementation configuration opaque boundary

Figure 4 - Opaque Use of a Notification Service

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

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

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

3 Terminology

This section defines terminology used throughout this document.

3.1 Conformance Terminology

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

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

365 *Since support of this entire notification specification is OPTIONAL for conformance to*
366 *IPP/1.0 or IPP/1.1, the use of the term REQUIRED in this document means*
367 *"REQUIRED if this notification specification is implemented". Likewise, the term*
368 *RECOMMENDED means "RECOMMENDED if this notification specification is*
369 *implemented".*

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

372 3.2 Other terminology

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

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

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

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

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

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

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

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

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

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

405 **Notification Subscriber (or Subscriber)** - A client that requests the IPP Printer to send Event
406 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

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

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

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

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

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

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

471 4 Object Model for Notification

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

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

477 The object relationships can be seen pictorially as:

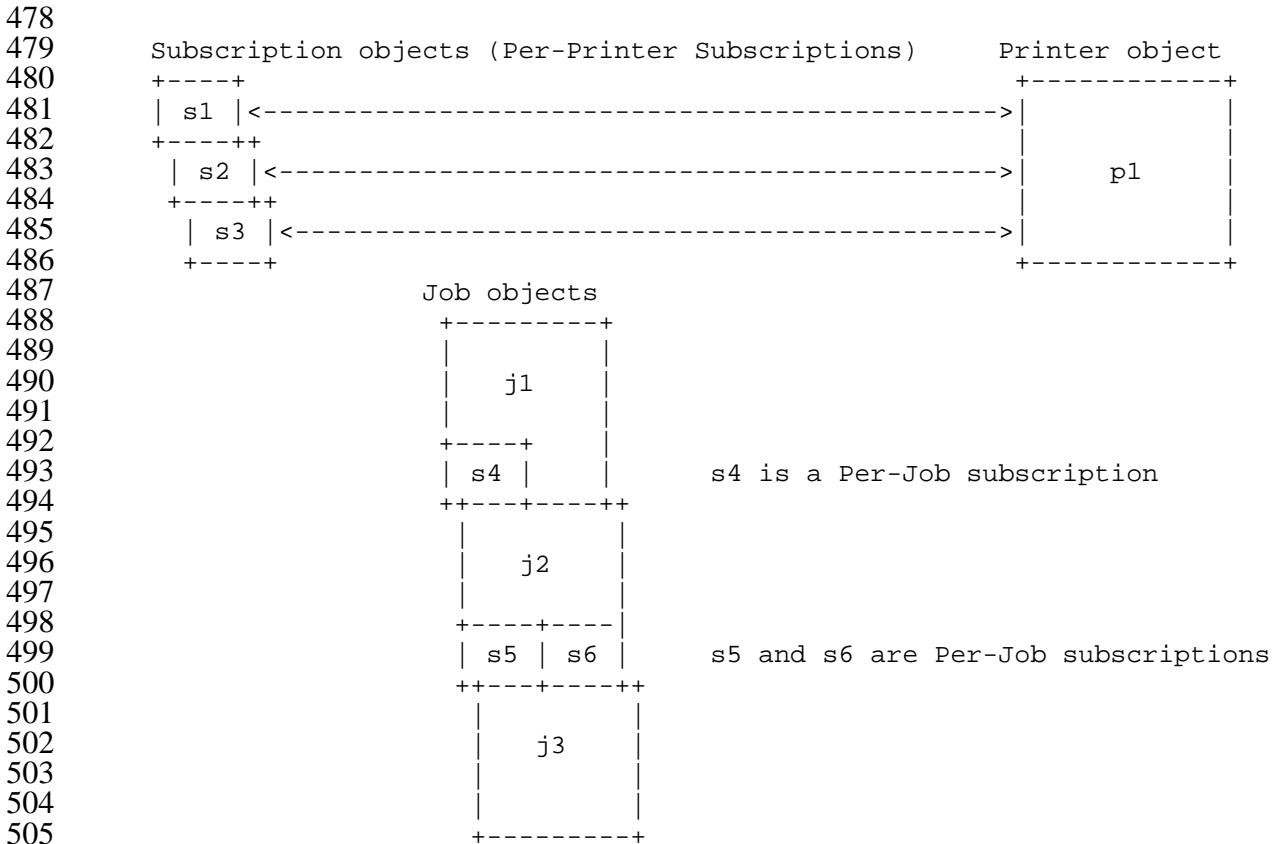


Figure 5 - Object Model for Notification

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

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

509 4.1 Object relationships

510 The object relationships can be stated as follows:

- 511 1. The Printer object contains zero or more Subscription objects (p1 contains s1-s3 Subscription objects).
- 512
- 513 2. Each Subscription object (s1, s2, and s3) is contained in one Printer object (p1) and represents one Per-Printer subscription.
- 514
- 515 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.
- 516
- 517
- 518 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).
- 519
- 520
- 521

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

527 **5 Object attributes defined for Notification**

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

531 **5.1 "job-notify" (1setOf collection) Job Description attribute**

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

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

539

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- <u>attributes</u> -charset (charset)	O	job creation operation, Set-Job-Attributes
notify- <u>attributes</u> -natural-languages (naturalLanguage)	O	job creation operation, Set-Job-Attributes

540

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

541 5.2 Subscription object attributes

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

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

546

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- <u>attributes</u> -charset (charset)	O	client - Create-Printer-Subscription
notify- <u>attributes</u> -natural-languages (1setOf naturalLanguage)	O	client - Create-Printer-Subscription

547

request-id (integer(0:MAX))	R	<u>initialized to 0, incremented by</u> Printer - <u>beginning of each</u> event <u>occurring</u>
-----------------------------	---	---

548

549 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

550

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

551 **5.3 Common Per-Job and Per-Printer Subscription attributes**

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

556 **5.3.1 notify-recipient (uri)**

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

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

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

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

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

576

577 5.3.2 notify-events (1setOf type2 keyword)

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

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

584 The events are defined to be disjoint.

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

586 The standard job event keyword values are:

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

589 **'job-created':** REQUIRED - the Printer object has accepted a job creation operation (Print-Job, Print-
590 URI, or Create-Job) and the job's "time-at-creation" attribute value is set (see [ipp-mod] section
591 4.3.14.1). The Printer puts the job in the 'pending', 'pending-held' or 'processing' states.

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

595 **'job-completed':** REQUIRED - the job has reached one of the completed states, i.e., the value of the
596 job's "job-state" attribute has changed to: 'completed', 'aborted', or 'canceled'. The Job's "time-at-
597 completed" and "date-time-at-completed" (if supported) attributes are set (see [ipp-mod] section
598 4.3.14).

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

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

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

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

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

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

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

628
629 The standard Printer event keywords values are:

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

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

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

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

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

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

648 events disjoint.

649
650 A client that wants to subscribe to all printer state changes, including restart and power-
651 down/shutdown, includes the 'printer-restarted', 'printer-state-changed', and 'printer-shutdown' in the
652 notification subscription.

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

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

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

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

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

682 5.3.3 notify-content-type (mimeMediaType)

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

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

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

692 Standard mimeType values are:

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

695
696 'text/plain; charset=utf-8': A plain text document in ISO 10646 represented as UTF-8 [RFC-2044]
697 as defined in section 6.

698 **ISSUE 2 - Should "notify-content-type (mimeType)" be changed to notify-content-type (type2**
699 **keyword), with values: 'human-consumable' and 'machine-readable'? Then content types that are**
700 **neither 'application/ipp' or 'text-plain; charset=utf-8' could be handled without having to be registered.**
701 **For example, the 'snmp-ipp' is a trap MIB Machine Consumable format wouldn't not need to be**
702 **registered (or have some special rule since the 'snmp-ipp' value doesn't have a registered MIME type**
703 **and doesn't fit either 'application/ipp' or 'text/plain'. Another advantage is that the charset would always**
704 **be indicated in the "notify-attributes-charset" attribute, even for plain text.**

705 **ISSUE 3 - There is no good way for a client to discover which "notify-content-type" values are supported**
706 **for each delivery method "notify-schemes-supported". Adding "notify-content-type-supported" doesn't**
707 **work, since the delivery methods have to be paired with the content types. Instead, how about only**
708 **having each scheme support one or the other content type? Then we don't need "notify-content-type" as**
709 **all. For the 'mailto' scheme, we specify it is human-consumable, i.e., text, and then register a 'mailto-**
710 **ipp' scheme which is the 'application/ipp' scheme.**

711

712 **5.3.4 subscriber-user-data (octetString(63))**

713 This REQUIRED attribute holds opaque information being sent from the Subscriber to the Notification
714 Recipient, such as the identify of the Subscriber or a path or index to some Subscriber information. Or it
715 MAY contain a key that the Notification Recipient needs in order to process the Notification, such as the
716 ultimate recipient, if the Notification Recipient is a general application that in turn forwards notifications
717 and the ultimate recipient isn't included in the value of the "notify-recipient" attribute. An Instant
718 Messaging Service is an example of such a general application where the "subscriber-user-data" might be
719 the user's id for that messaging service and the "notification-recipient" is the URL of the messaging service.

720 **5.3.5 notify-attributes-charset (charset)**

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

724 **ISSUE 4 - Should the Subscription object attributes "notify-attributes-charset (charset)" and "notify-**
725 **attributes-natural-languages (naturalLanguage)" be renamed to simply "attributes-charset (charset)" and**
726 **"attributes-natural-languages (naturalLanguage)" so that all IPP requests and objects have the same names?**
727 **Then the "notify-attributes-charset (charset)" and "notify-attributes-natural-languages (naturalLanguage)"**
728 **would only be operation attributes that set or reflect the "attributes-charset (charset)" and "attributes-**
729 **natural-languages (naturalLanguage)" Subscription object attributes.**

730 **5.3.6 notify-attributes-natural-languages (naturalLanguage)**

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

733 **5.3.7 request-id**

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

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

742 **5.4 Additional attributes for the Subscription object *only***

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

745 **5.4.1 subscription-id (integer(1:MAX))**

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

752 It is RECOMMENDED that Per-Printer Subscription objects be persistent. Then the Subscription objects
753 including the subscription-id remains unique across power-cycles. Even if an implementation does not
754 make Per-Printer subscription objects persist, the implementation SHOULD make every attempt not to re-
755 use subscription ids that subscribers might still think are valid. In other words, the Printer SHOULD at
756 least keep the next subscription-id to be assigned in non-volatile memory. Note: it is assumed that Per-Job
757 subscriptions are persistent if Jobs are persistent, since it is assumed that Per-Job subscriptions are stored in
758 Job objects.

759 **5.4.2 notify-lease-expiration-time (integer(0:MAX))**

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

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

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

771 **5.4.3 printer-uri (uri)**

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

776 **5.4.4 subscriber-user-name (name(MAX))**

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

783 The value of the "subscriber-user-name" is implementation dependent when a server accepts a request and
784 forwards it to a downstream IPP Printer (see Figure 2 and the [ipp-ii]). ~~ISSUE 2—What is the value of the~~
785 ~~"subscriber-user-name" when the Subscriber is a server send a job to an IPP Printer? The original Job~~
786 ~~Submitting End User use name or some "user name" that identifies the Server?~~

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

791 **5.4.5 notify-printer-up-time (integer(1:MAX))**

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

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

802 **5.5 Printer Description Attributes related to Notification**

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

804

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

805 **ISSUE 5** - Shouldn't we add a "number-of-printer-subscriptions" Printer Description attribute, since the
806 client is NOT assured that it can determine the number of outstanding Per-Printer Subscriptions by doing
807 Get-Printer-Subscriptions because of access control?

808 **5.5.1 notify-schemes-supported (1setOf uriScheme)**

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

811 **5.5.2 notify-events-default (1setOf type2 keyword)**

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

815 **5.5.3 notify-events-supported (1setOf type2 keyword)**

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

818 **5.5.4 max-events-supported (integer(5:MAX))**

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

825 5.5.5 max-job-subscriptions-supported (integer(1:MAX))

826 This REQUIRED Printer attribute specifies the maximum number of Per-Job subscriptions that are
827 supported in a single Job Creation request, i.e., the maximum number of collection values for the "job-
828 notify" operation attribute. A value of 0 indicates no effective maximum. A Printer MUST support at least
829 1 Per-Job subscription. If the number of Per-Job subscriptions supplied by a client in a Job Creation
830 request exceed this number, the Printer rejects the request and returns the 'server-error-too-many-
831 subscriptions' (see section 14.2).

832 5.5.6 max-printer-subscriptions-supported (integer(0:MAX))

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

839 5.5.7 notify-lease-time-supported (rangeOfInteger(0:MAX))

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

846 5.5.8 notify-lease-time-default (integer(0:MAX))

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

850 5.5.9 persistent-jobs-supported (boolean)

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

855 5.5.10 persistent-subscriptions-supported (boolean)

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

861 **5.5.11 printer-state-change-time (integer(1:MAX))**

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

865 **5.5.12 printer-state-change-date-time (dateTime)**

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

869 **6 Notification Content**

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

876 **6.1 Notification content MIME media type formats**

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

879 Notifications are generated using the following content formats:

880 **'application/ipp'** - Machine Consumable notification content using the 'application/ipp' MIME
881 media type [ipp-mod] using the Get-Job-Attributes response encoding for job events and Get-
882 Printer-Attributes for printer events. The attributes listed in sections 6.2 and 6.3 are sent in an
883 notification for Job events. The attributes listed in sections 6.2 and 6.4 are sent in an
884 notification for Printer events. For any string in any notification, the charset and natural
885 language rules that apply to all IPP operations apply to the notification strings as well, since
886 they are represented as operation responses. The Unsupported Attributes Group in the response
887 is not sent. If the values of any of the attributes sent in an notification content are not known,
888 the value sent in the report content is the out-of-band 'unknown' value, rather than omitting the
889 attribute (see the beginning of [ipp-mod] section 4.1).

890 An implementation MAY extend the contents of the Machine Consumable notification by
891 adding additional attributes.

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

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

898 6.2 Notification content attributes common to Job and Printer events

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

905 **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**
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

906 Attribute Notes:

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

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

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

911 "attributes-natural-language" - the value comes from the "notify-attributes-natural-language" in the "job-
 912 notify" Per-Job Subscription and the "notify-attributes-natural-language" in the Per-Printer
 913 Subscription object.

- 914 "printer-uri" - the value comes from the "job-printer-uri" Job attribute for Per-Job subscriptions.
- 915 **"job-id" and "job-name" - included in Printer event Notifications only for Per-Job subscriptions.
- 916 "trigger-event" - the event that caused this Notification to be delivered.
- 917 "trigger-time" - the "printer-up-time" value when the event occurred.
- 918 "trigger-date-time" - the "printer-current-time" value when the event occurred - OPTIONAL to support.
- 919 "job-name" - SNMP delivery method can truncate to less than 255 octets, since the Notification needs to fit
920 into 484 octets or so on some transports that SNMP is defined for.
- 921 "subscription-id" - for Per-Job subscriptions, the value is the index of the "job-notify" collection value,
922 starting with 1 for the first collection value.
- 923 "subscriber-user-name" - comes from "requesting-user-name" Job attribute for Per-Job subscriptions.
924 SNMP delivery method can truncate to less than 255 octets, since the Notification needs to fit into
925 484 octets or so on some transports that SNMP is defined for.
- 926 "subscriber-user-data" - opaque user data that may identify either the Subscriber and/or the ultimate
927 Notification Recipient.

928 **6.3 Additional Notification content attributes for Job events *only***

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

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

Attributes	Reference	Events	'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			

932 6.4 Additional Notification content attributes for Printer events *only*

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

934 **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

935

936 7 Operations for Per-Job Subscriptions

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

940 7.1 Job Creation Operations (Create-Job, Print-Job, Print-URI) and Validate-Job

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

947 If a Printer does not support this notification specification, then it MUST ignore the "job-notify" operation
 948 attribute and return it in the response indicated as an attribute that is not supported. See [ipp-mod] section
 949 3.1.7 for details on returning Unsupported Attributes.

950 **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 (mimeType)	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

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

953 The following rules apply to Per-Job subscriptions:

- 954 1. Any subscription can contain job events, printer events, or both.
- 955 2. The Job Submission Subscription is only valid while the job is "not-completed". The job is "not-
956 completed" while it is in the 'pending', 'pending-held', 'processing', and 'processing-stopped' states. The
957 job changes from being "not-completed" to "retained" when it is done processing and enters any of the
958 'completed', 'canceled', or 'aborted' states. The job becomes "not-completed" again when it is restarted
959 using the Restart-Job operation (see [ipp-mod]).
- 960 3. Since no job is created for the Validate-Job operation, the only purpose of supplying the subscription
961 operation attributes in the Validate-Job operation is to validate that the values are supported; the Printer
962 object does not establish a notification subscription as a result of the Validate-Job operation.
- 963 4. Since a Job Submission Subscription is included within a job submission operation, any interest in job
964 events is limited to "this job" only (the Job object created because of this job creation operation). There
965 is no mechanism to subscribe to events for all jobs or specifically some job other than this job in a
966 create operation. But see the Create-Printer-Subscription operation (section 8.1) for an explicit
967 operation to subscribe for job and/or printer events independently of any particular job submission.
- 968 5. Event reporting only occurs when a notification recipient has specified a subscription to any event(s).
- 969 6. The notification implementation MAY allow an administrator to configure a policy on what events may
970 be dropped.
- 971 7. If the OPTIONAL "notify-attributes-charset" attribute is not supported or the supplied value is not
972 supported, the IPP Printer MUST return the attribute in the Unsupported Attributes Group but still
973 accept the operation, as with all Job create operations. In this case, the Printer MUST use the natural
974 language supplied in the "attributes-charset" Job creation operation attribute, if that natural language
975 value is supported by the Printer, else the Printer object MUST use the Printer's "charset-configured"
976 value. See the Print-Job operation in [ipp-mod].
- 977 8. If the OPTIONAL "notify-attributes-natural-language" attribute is not supported or the supplied value is
978 not supported, the IPP Printer MUST return the attribute in the Unsupported Attributes Group but still
979 accept the operation, as with all Job create operations. In this case, the Printer MUST use the natural
980 language supplied in the "attributes-natural-language" Job creation operation attribute, if that natural
981 language value is supported by the Printer, else the Printer object MUST use the Printer's "natural-
982 language-configured" value. See the Print-Job operation in [ipp-mod].
- 983 9. If a collection contains other unrecognized, unsupported member attributes and/or conflicting value, the
984 attribute returned in the Unsupported Group is a collection containing the unrecognized, unsupported
985 member attributes, and/or conflicting values. The unrecognized member attributes have an out-of-band
986 value of unsupported. The unsupported member attributes and conflicting values have their unsupported
987 values. See [ipp-coll].

988 7.2 Get-Printer-Attributes operation

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

991 7.3 Get-Job-Attributes operation

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

994 7.4 Set-Job-Attributes operation

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

999 In order to cancel all Per-Job subscriptions, the client supplies the "job-notify" attribute with an out-of-band
1000 'none' value (see [ipp-coll]).

1001 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

1002 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

1003 The "job-notify" operation attribute is copied to the "job-notify" Job Description attribute. See section 5.1
1004 for a definition of the "job-notify" Job Description attribute.

1005 8 Per-Printer Subscriptions and the Subscription object

1006 This section lists the REQUIRED Per-Printer Subscriptions operation requests and responses and the
1007 Subscription object that MUST be supported.

1008 [ISSUE 3—Are these abbreviated operation definitions ok for understandability and conformance, or should
1009 we use the more verbose definition style of the \[ipp-mod\]?](#)

1010 8.1 Create-Printer-Subscription operation

1011 The REQUIRED Create-Printer-Subscription operation creates a Per-Printer subscription by creating a Per-
1012 Printer Subscription object which is added to the Printer object. The client can specify one or more job
1013 and/or printer events to be delivered as notifications to one Notification Recipient. The job events are for
1014 any job submitted to the Printer. The printer events are any events generated by that Printer.

1015 The Printer returns a subscription id and the length of time for which it has granted a lease for the
 1016 subscription. The client must renew the subscription using the Renew-Printer-Subscription operation (see
 1017 section 8.4) before the lease runs out in order to maintain the subscription. A client can unsubscribe using
 1018 the Cancel-Printer-Subscription operation (section 8.5) and the subscription id.

1019 Two Create-Printer-Subscription operations with the same events and same Notification Recipient MUST
 1020 be kept as distinct subscriptions and be assigned distinct subscription ids. A Printer MUST allow such
 1021 duplicate subscriptions such that Cancel-Printer-Subscription doesn't unsubscribe both subscriptions and
 1022 MUST send the Notifications twice to the Notification Recipient, since the "request-id" is supposed to
 1023 count monotonically for each subscription.

1024 If the Printer has a bounded set of concurrent subscriptions (~~for the specified events or any events~~), the
 1025 printer rejects the operation and returns the 'server-error-too-many-subscriptions' status code. The client
 1026 SHOULD try again later.

1027 Access Rights: The authenticated user (see [IPP-MOD] section 8.3) performing this operation MUST have
 1028 [Per-Printer subscription creation rights for this Printer](#) ~~operator or administrator access rights for the Printer~~
 1029 ~~object (see [IPP-MOD] sections 1 and 8.5)~~. Otherwise the IPP object MUST reject the operation and
 1030 return: client-error-forbidden, client-error-not-authenticated, and client-error-not-authorized as appropriate.

1031 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

1032 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

1033 Attribute Notes:

- 1034 "notify-recipient" (uri) - the client MUST supply this attribute in order to have a subscription.
- 1035 "notify-lease-time-requested" (integer(0:MAX) - the number of seconds requested for the Per-Printer
1036 subscription lease. A value of 0 indicates a request that the Per-Printer Subscription lease never
1037 expire. Supplying a 0 value MAY require authentication in order to be used, if 0 is supported at all.
1038 If the client does not supply this attribute, the Printer uses its "notify-lease-time-default" value (see
1039 section 5.5.8).
- 1040 "notify-persistence-requested" (boolean) - whether or not the Per-Printer Subscription is to be persistent,
1041 i.e., saved across power cycles. Note: Persistent trap registrations is a client option in SNMPv3
1042 [RFC2573].
- 1043 "notify-lease-expiration-time" (integer(0:MAX)) - The Printer object MUST return this attribute which is
1044 the time in the future at which the subscription lease will expire, i.e., the "printer-up-time" value (in
1045 time ticks - see [ipp-mod] section 4.4.29) at which the Printer will delete the Subscription. A value
1046 of 0 indicates that the lease subscription will never expire.
- 1047 "notify-lease-time-granted" (integer(0:MAX)) - The Printer object MUST return this attribute which is the
1048 number of seconds of time actually granted. The value of "notify-lease-time-granted" may be less
1049 than the requester requested in the "notify-lease-time-requested" if it was greater than the MAX
1050 supported or more than the requester requested if it was less than the MIN supported, as indicated in
1051 the Printer's "notify-lease-time-supported" (rangeOfInteger(0:MAX)) attribute.
- 1052 **ISSUE 6 - Instead of Create-Printer-Subscription response returning "notify-lease-time-granted" which is**
1053 **NOT a Subscription object attribute, it is cleaner for implementation to return the "notify-printer-up-time"**
1054 **Subscription attribute instead, which is a Subscription object attribute. The client subtracts the "notify-**
1055 **printer-up-time" from the "notify-lease-expiration-time" to get the number of second remaining in the lease,**
1056 **just as it would for a Get-Subscript-Attributes response. OK to replace the "notify-lease-time-granted" with**
1057 **the "notify-printer-up-time" attribute in the response?**
- 1058 "notify-persistence-granted" - whether or not this Per-Printer Subscription object instance is persistent.
1059 This attribute MUST be returned whether "notify-persistence-requested" is supported or not, so that
1060 the client knows which.
- 1061 **ISSUE 7 - Should "notify-persistence-granted" be a Subscription object attribute too, so that all attributes**
1062 **returned in a response are Subscription object attributes?**

8.2 Get-Printer-Subscription-Attributes operation

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

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

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

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

Group 3: Subscription object attributes: This is the set of requested attributes and their current values. The IPP object ignores (does not respond with) any requested attribute or value which is not supported or which is restricted by the security policy in force, including whether the requesting user is the user that created the Subscription object (subscribing user) or not (see [ipp-mod] section 8).

8.3 Get-Printer-Subscriptions operation

The REQUIRED Get-Printer-Subscriptions operation returns Per-Printer subscriptions, i.e., the requested attributes of the Subscription objects (see sections 5.3 and 5.4).

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

Attribute 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'.

"my-subscriptions" (boolean) - 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.

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

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. There is no way to renew a Per-Job subscription, since they are automatically canceled after the job completes and no longer has any documents, i.e., the job is no longer retained (see [ipp-mod] section 4.3.7.2).

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.

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

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

1103 Attribute Notes:

1104 "notify-lease-time-requested" (integer(0:MAX) - the number of seconds requested for the Per-Printer
1105 subscription lease. Same as Create-Printer-Subscriptions (see section 8.1).

1106 "notify-lease-expiration-time" - the time in the future when the subscription will expire. Same as for the
1107 Create-Printer-Subscription operation (see section 7.1).

1108 "notify-lease-time-granted" - the lease time (number of seconds) actually granted. Same as for the Create-
1109 Printer-Subscription operation (see section 7.1).

1110 **ISSUE 8 - Instead of Renew-Subscription response returning "notify-lease-time-granted" which is NOT a**
1111 **Subscription object attribute, it is cleaner for implementation to return the "notify-printer-up-time"**
1112 **Subscription attribute instead, which is a Subscription object attribute. Ok to replace the "notify-lease-**
1113 **time-granted" with the "notify-printer-up-time" attribute in the response?**

1114 Note: There is no way to change any of the Subscription object attributes, except the "notify-lease-
1115 expiration-time" attribute. In order to change other attributes, a client can create a new Subscription object
1116 and then use the Cancel-Printer-Subscription operation to cancel the old one (or do this in the other order,
1117 in case there is a limit on the number of Subscription object instances, as long as a short window with no
1118 Notifications is ok).

1119 Note: There is no need to renew a Per-Job Subscription, since it is effectively the time that the Job is active
1120 (see section 7.1).

1121 8.5 Cancel-Printer-Subscription operation

1122 The REQUIRED Cancel-Printer-Subscription operation allows a client to remove a Per-Printer
1123 Subscription object from the Printer. No more Notifications are delivered for that Subscription. Once
1124 performed, there is no way to use that Subscription in the future. Subscription-ids should not be reused
1125 immediately, so that a stale reference situation is not created. Same as for Cancel-Job and job-ids.

1126 *Access Rights:* The authenticated user (see [IPP-MOD] section 8.3) performing this operation MUST either
1127 be the owner of the Subscription object or have operator or administrator access rights for the Printer object
1128 (see [IPP-MOD] sections 1 and 8.5). Otherwise the IPP object MUST reject the operation and return:
1129 client-error-forbidden, client-error-not-authenticated, and client-error-not-authorized as appropriate.

1130 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

1131 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

1133 9 Comparison of Per-Job Submission Subscriptions versus Per-Printer 1134 Subscriptions

1135 Per-Job and Per-Printer subscriptions are quite similar. However, there are some semantic differences
1136 between Per-Job subscriptions and Per-Printer subscriptions. A Per-Job Submission Subscription is
1137 established by the client when submitting a job. A Per-Printer Subscription is established between a client
1138 and a Printer using the new Create-Printer-Subscription operation. Some specific differences are:

- 1139 1. Either type of subscription can subscribe to Job events, Printer events, or both.
- 1140 2. For Per-Job Subscriptions, the subscription is only valid while the job is "not-complete" (see sections
1141 6.2 and 6.3).
- 1142 3. For the Per-Printer Subscriptions, the subscription is valid until it is explicitly canceled with a Cancel-
1143 Printer-Subscription operation or the time (in seconds) that the Printer returned in the "notify-lease-
1144 time-granted" operation attribute expires, whichever occurs first.
- 1145 4. Job Events in a Per-Job Subscription apply only to "one job" (the Job created by the job creation
1146 operation).
- 1147 5. Job Events in a Per-Printer-Subscription apply to ALL jobs contained in the IPP Printer object.
- 1148 6. Printer Events in both kinds of subscriptions apply no matter which job is being processed, if any.
1149

1150 10 Conformance Requirements

1151 This section further enhances the Conformance Requirements detailed in [IPP-MOD] section 5. Extensions
1152 made to the events herein must be made such that new events or event attributes are backward compatible
1153 to clients who implemented early versions of this notification specification.

1154 It is OPTIONAL to implement this Event Notification specification. If implemented, IPP objects MUST
 1155 support all of the REQUIRED object attributes as defined in this document in the indicated sections.
 1156 If IPP Notification is implemented, the operations described in this document must be supported as
 1157 described in Table 10:

1158 **Table 10 - Conformance Requirements for Operations**

Attribute	Conformance requirements
"job-notify" in Job Creation operations (section 7.1)	REQUIRED
"job-notify" in Validate-Job operation (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

1159

1160 **11 IANA Considerations**

1161 IANA will be called on to register URL schemes for notification delivery for use in the "notification-
 1162 recipient" attribute, using the same procedures outlined in [ipp-mod].

1163 **12 Internationalization Considerations**

1164 This IPP notification specification continues the internationalization of [ipp-mod] for attributes containing
 1165 text strings and names. A subscribing client can specify a different natural language and charset for each
 1166 Notification content delivered to a Notification Recipient.

1167 The Human Consumable Notification content is a 'text/plain; charset=utf-8' by default where the
 1168 Notification Sender has localized the text message as requested by the subscriber for the intended
 1169 Notification Recipient.

1170 **13 Security Considerations**

1171 By far the biggest security concern is the abuse of notification: sending unwanted notifications to third
 1172 parties (i.e., spam). The problem is made worse by notification addresses that may be redistributed to
 1173 multiple parties (e.g. mailing lists). There exist scenarios where third party notification is required (see
 1174 Scenario #2 and #3 in [ipp-not-req]). The fully secure solution would require active agreement of all
 1175 recipients before sending out anything. However, requirement #9 in [ipp-req] ("There is no requirement for
 1176 IPP Printer receiving the print request to validate the identity of an event recipient") argues against this.
 1177 Certain systems may decide to disallow third party notifications (a traditional fax model).

1178 Clients submitting notification requests to the IPP Printer has the same security issues as submitting an
 1179 IPP/1.1 print job request. The same mechanisms used by IPP/1.1 can therefore be used by the client

1180 notification submission. Operations that require authentication can use the HTTP authentication.
1181 Operations that require privacy can use the HTTP/TLS privacy.

1182 The notification access control model should be similar to the IPP access control model for Jobs. Creating
1183 a Per-Printer Notification Subscription object is associated with a user. Only the creator or an operator can
1184 cancel the subscription. The system may limit the listing of items to only those items owned by the user.
1185 Some subscriptions (e.g. those that have a lifetime longer than a job) can be done only by privileged users
1186 (users having operator and/or administrator access rights), if that is the authorization policy.

1187 The standard security concerns (delivery to the right user, privacy of content, tamper proof content) apply
1188 to the notification delivery. IPP should use the security mechanism of the delivery method used. Some
1189 delivery mechanisms are more secure than others. Therefore, sensitive notifications should use the delivery
1190 method that has the strongest security.

1191 14 Status Codes

1192 The following status codes are defined as extensions for notification:

1193 14.1 client-error-uri-notification-scheme-not-supported (0x04??)

1194 The scheme of the client-supplied URI in a "notify-recipient" operation attribute in a Create-Printer-
1195 Subscription operation is not supported. See [ipp-mod] section 3.1.7.

1196 Note: There is no corresponding Per-Job subscription error, since the Printer object MUST ignore any
1197 errors in the "job-notify" operation attribute, MUST return the "notify-recipient" attribute in the
1198 Unsupported Attributes Group, and perform the Job Creation operation (see section 5.1), since the job can
1199 still be printed.

1200 ~~ISSUE 4—The client-error-uri-scheme-not-supported is already an IPP/1.1 status code and section 3.1.6.1~~
1201 ~~indicates that the "document-uri" attribute NEED NOT be returned in the Unsupported Attributes group,~~
1202 ~~otherwise, we could use that error code and REQUIRE that offending "xxx-uri" attribute(s) to be returned.~~

1203 14.2 server-error-too-many-subscriptions (0x04??)

1204 The bounded set of concurrent Per-Printer subscriptions supported by the Printer object would be exceeded
1205 if this request were accepted.

1206 Note: There is no corresponding Per-Job subscription error, since the Printer object MUST ignore any
1207 errors in the "job-notify" operation attribute and perform the Job Creation operation (see section 5.1), since
1208 the job can still be printed.

1209 14.3 server-error-too-many-events (0x04??)

1210 The client supplied more events in the "notify-events" operation attribute in a Create-Printer-Subscription
1211 that the Printer supports, as indicated in its "max-events-supported" attribute (see section 5.5.4).

1212 ~~Note:~~ There is no corresponding Per-Job subscription error, since the Printer object MUST ignore any
1213 errors in the "job-notify" operation attribute, MUST return the "notify-events" attribute in the Unsupported
1214 Attributes Group with only the excess events that are being ignored, and perform the Job Creation
1215 operation (see section 5.1), since the job can still be printed.

1216 ~~ISSUE 5—Should the entire "job-notify" operation attribute be ignored, if one of its member attributes has~~
 1217 ~~a problem, or should just that member attribute be ignored? If the latter, then is just the member attribute~~
 1218 ~~returned in the Unsupported Attributes group?~~

1219 **15 Additions to the IPP Encoding and Transport Document**

1220 The Subscription object tag needs to be assigned in section 3.7.1 Delimiter Tags:

1221 **3.7.1 Delimiter Tags**

1222 The following table specifies the values for the delimiter tags:

Tag Value (Hex)	Delimiter
0x00	reserved
0x01	operation-attributes-tag
0x02	job-attributes-tag
0x03	end-of-attributes-tag
0x04	printer-attributes-tag
0x05	unsupported-attributes-tag
<u>0x06</u>	<u>subscription-attributes-tag</u>
0x07-0x0e	reserved for future delimiters
0x0F	reserved for future chunking-end-of-attributes-tag

1223 When an xxx-attributes-tag occurs in the protocol, it MUST mean that zero or more following attributes up
 1224 to the next delimiter tag are attributes belonging to group xxx as defined in the model document, where xxx
 1225 is operation, job, printer, unsupported, subscription.

1226 Doing substitution for xxx in the above paragraph, this means the following. When an operation-attributes-
 1227 tag occurs in the protocol, it MUST mean that the zero or more following attributes up to the next delimiter
 1228 tag are operation attributes as defined in the model document. When an job-attributes-tag occurs in the
 1229 protocol, it MUST mean that the zero or more following attributes up to the next delimiter tag are job
 1230 attributes or job template attributes as defined in the model document. When a printer-attributes-tag occurs
 1231 in the protocol, it MUST mean that the zero or more following attributes up to the next delimiter tag are
 1232 printer attributes as defined in the model document. When an unsupported-attributes-tag occurs in the
 1233 protocol, it MUST mean that the zero or more following attributes up to the next delimiter tag are
 1234 unsupported attributes as defined in the model document. When a subscription-attributes-tag occurs in the
 1235 protocol, it MUST mean that the zero or more following attributes up to the next delimiter tag are
 1236 subscription attributes as defined in the [ipp-not] document.

1237 Add a reference to [ipp-not].

1238 **16 References**

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1312 A. Appendix - Summary of Notification Attribute Usage

1313 This appendix summarizes the usage of Notification attributes in the Job operation attribute collection, Job

1314 object, Subscription object, Notification content, Job operations, and Subscriptions operations. It will not

1315 be published as part of an INTERNET-DRAFT or RFC, but will be moved to the Implementer's Guide

1316 [ipp-iig]. However, it will be kept here during the revisions of this document.

1317 ~~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)	OR	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)	OR	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

1318 Legend: "R" - REQUIRED for Printer to support; "O" - OPTIONAL for Printer to support; "[]" - OPTIONAL for sender to send;
1319 Return - Printer MUST return; ~~"Per-Pr" - REQUIRED if Notification from a Per-Printer subscription;~~* - Job object, not collection;
1320 ~~"Per-Job" - REQUIRED if Notification from a Per-Job subscription;~~ (nn) indicates source of value in a Notification;
1321 ** - 1setOf collection index is the implicit subscription-id for a Per-Job subscription and is sent in the Notification.

1322

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]						

- 1323 Legend: "R" - REQUIRED for Printer to support; "O" - OPTIONAL for Printer to support; [] - OPTIONAL for sender to send;
1324 ~~"Return-Printer-MUST-return; Per-Pr"~~ REQUIRED if Notification from a Per-Printer subscription;
1325 "Per-Jb" - REQUIRED if Notification from a Per-Job subscription;
1326 "[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							

1327 Legend: "R" - REQUIRED for Printer to support; "O" - OPTIONAL for Printer to support; "[]" - OPTIONAL for sender to send;
 1328 Return-Printer-MUST return; "Per Pr" - REQUIRED if Notification from a Per Printer subscription;
 1329 "Per Jb" - REQUIRED if Notification from a Per Job subscription;
 1330 "[pg/cp]" - OPTIONAL in a 'job-progress' or 'job-completed' notification; (nn) - an alternate source of the data in a Notification.

1331

1332

18 Appendix C: Full Copyright Statement

1333

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