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

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29 **Abstract**

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

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

41 The full set of IPP documents includes:

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

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

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

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

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

47 Mapping between LPD and IPP Protocols [IPP LPD]

48

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

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

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

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

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

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

75  
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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

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

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

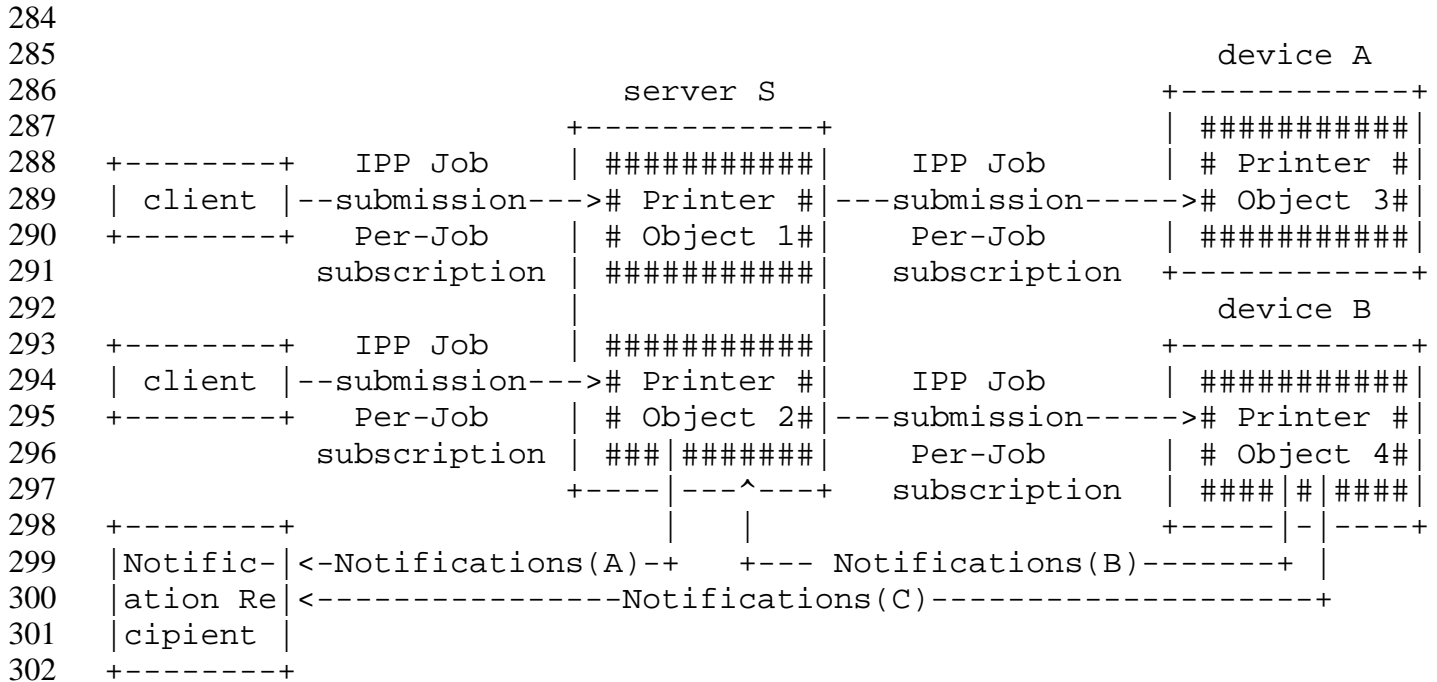


Figure 2 - Client-Server-Printer Per-Job Subscription and Notification Model

## 2.2 Model for Per-Printer Subscription and Notification

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

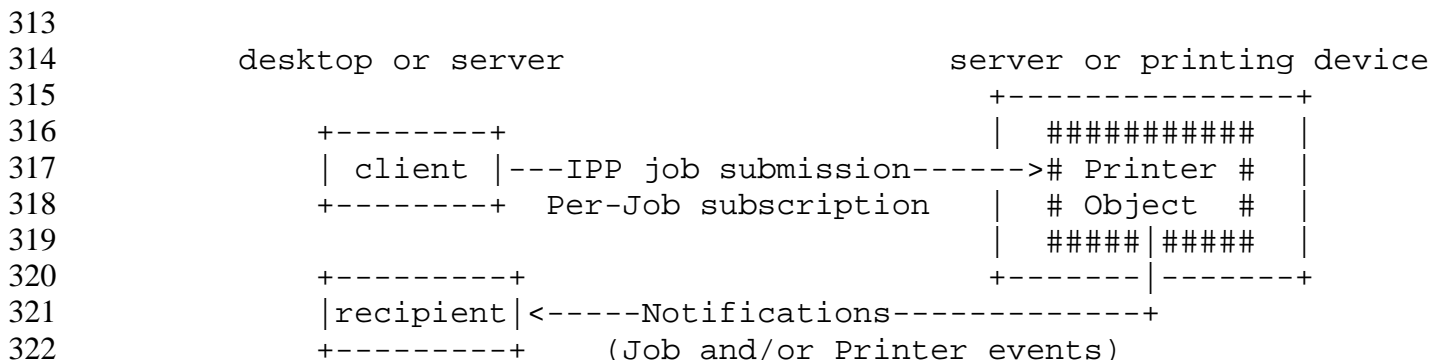
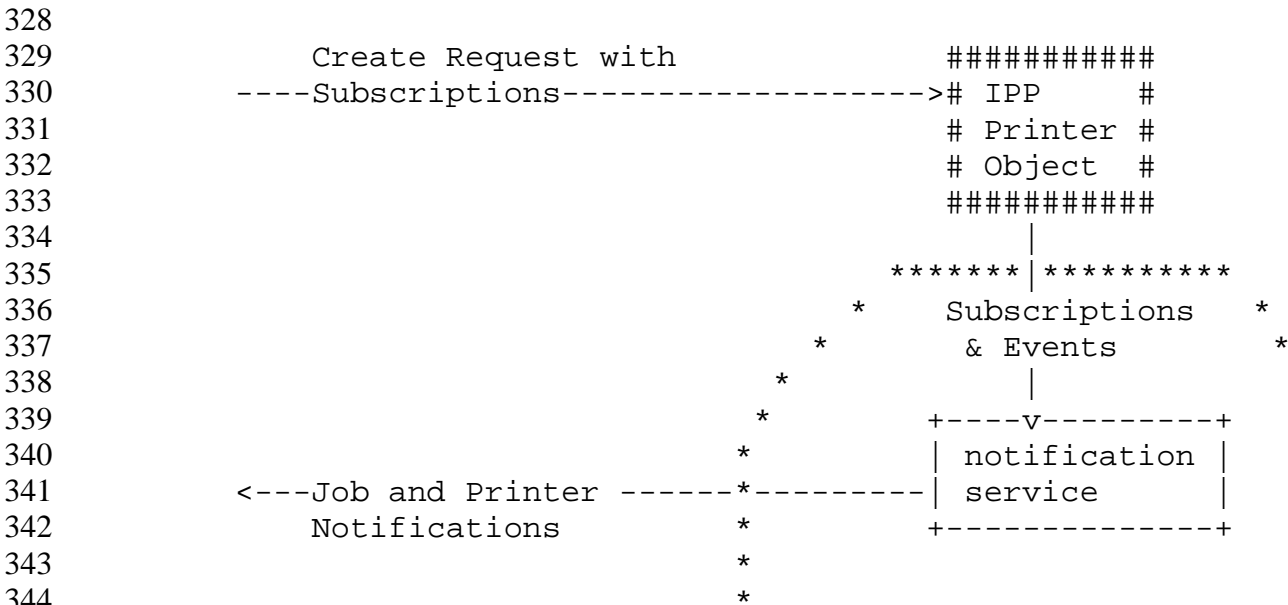


Figure 3 - Client-Printer Per-Printer Subscription and Notification Model

324 **2.3 Relationship between the Printer object and the Notification Delivery Service**

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



346 \*\*\* = Implementation configuration opaque boundary

348 **Figure 4 - Opaque Use of a Notification Service**

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

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

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

358 **3 Terminology**

359 This section defines terminology used throughout this document.

360 **3.1 Conformance Terminology**

361 Capitalized terms, such as MUST, MUST NOT, REQUIRED, SHOULD, SHOULD NOT, MAY,  
362 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.

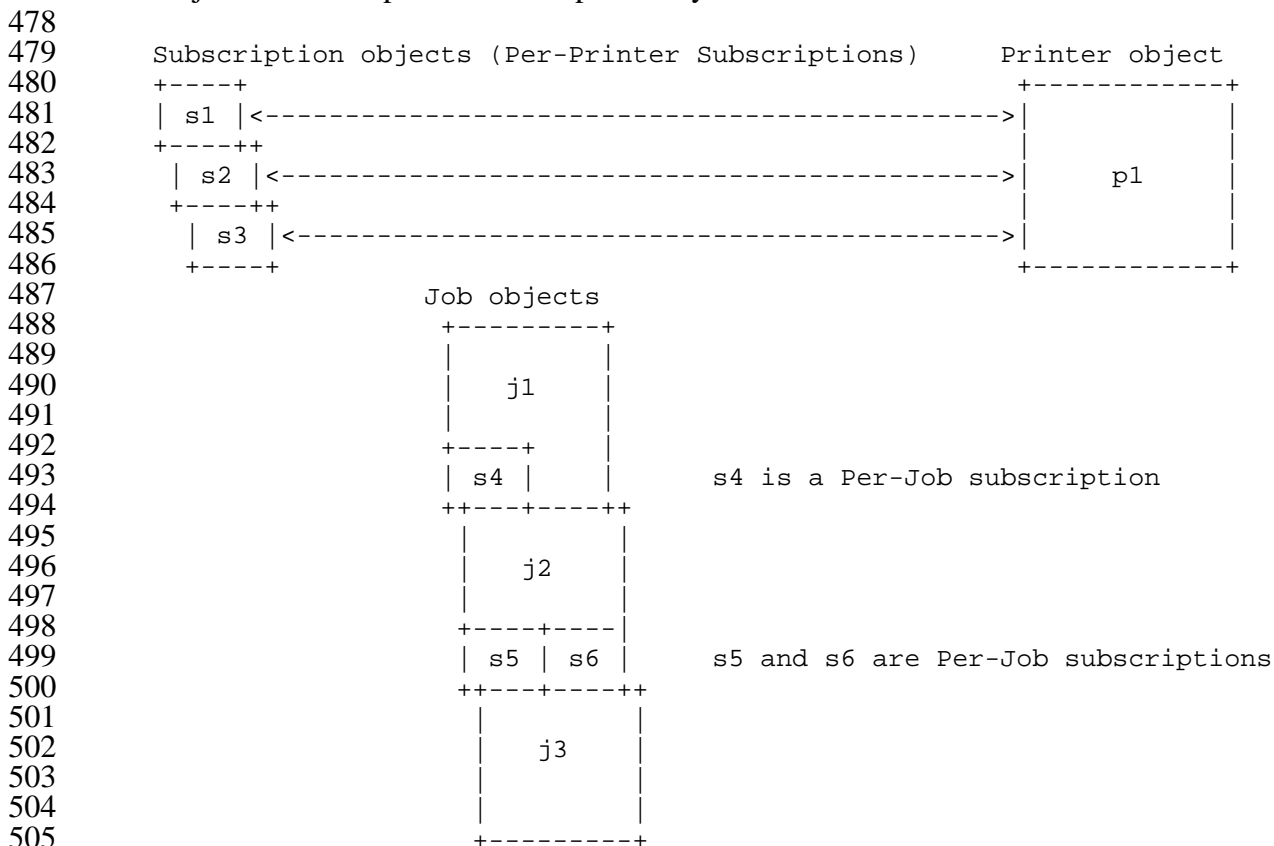
468 **Machine Consumable Notification** - Notifications that are intended for consumption by a program  
469 only. They use the encoding of an IPP response. The Notification Recipient must localize the  
470 contents, if displaying it to a human.

## 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:



506 **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-attributes-charset (charset)	O	job creation operation, Set-Job-Attributes
notify-attributes-natural-language (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 (mimeType)	R	client - Create-Printer-Subscription
subscriber-user-data (octetString(63))	R	client - Create-Printer-Subscription
notify-attributes-charset (charset)	O	client - Create-Printer-Subscription
notify-attributes-natural-languages (1setOf naturalLanguage)	O	client - Create-Printer-Subscription

547

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

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?**

### 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.

681

### 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 mimeMediaType 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 (mimeMediaType)" 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-iig]).

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

### 789 **5.4.5 notify-printer-up-time (integer(1:MAX))**

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

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

## 800 **5.5 Printer Description Attributes related to Notification**

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



802

**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

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

### 806 **5.5.1 notify-schemes-supported (1setOf uriScheme)**

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

### 809 **5.5.2 notify-events-default (1setOf type2 keyword)**

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

### 813 **5.5.3 notify-events-supported (1setOf type2 keyword)**

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

### 816 **5.5.4 max-events-supported (integer(5:MAX))**

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

**823 5.5.5 max-job-subscriptions-supported (integer(1:MAX))**

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

**830 5.5.6 max-printer-subscriptions-supported (integer(0:MAX))**

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

**837 5.5.7 notify-lease-time-supported (rangeOfInteger(0:MAX))**

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

**844 5.5.8 notify-lease-time-default (integer(0:MAX))**

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

**848 5.5.9 persistent-jobs-supported (boolean)**

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

**853 5.5.10 persistent-subscriptions-supported (boolean)**

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

### 859 **5.5.11 printer-state-change-time (integer(1:MAX))**

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

### 863 **5.5.12 printer-state-change-date-time (dateTime)**

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

## 867 **6 Notification Content**

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

### 874 **6.1 Notification content MIME media type formats**

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

877 Notifications are generated using the following content formats:

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

888 An implementation MAY extend the contents of the Machine Consumable notification by  
889 adding additional attributes.

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

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

## 896 6.2 Notification content attributes common to Job and Printer events

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

903 **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

904 Attribute Notes:

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

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

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

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

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

### 926 **6.3 Additional Notification content attributes for Job events *only***

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

929 **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		

## 930 **6.4 Additional Notification content attributes for Printer events *only***

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

932 **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

933

## 934 **7 Operations for Per-Job Subscriptions**

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

### 938 **7.1 Job Creation Operations (Create-Job, Print-Job, Print-URI) and Validate-Job**

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

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

948 **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

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

951 The following rules apply to Per-Job subscriptions:

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

## 986 **7.2 Get-Printer-Attributes operation**

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

### 989 7.3 Get-Job-Attributes operation

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

### 992 7.4 Set-Job-Attributes operation

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

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

999 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

1000 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

1001 The "job-notify" operation attribute is copied to the "job-notify" Job Description attribute. See section 5.1  
1002 for a definition of the "job-notify" Job Description attribute.

## 1003 8 Per-Printer Subscriptions and the Subscription object

1004 This section lists the REQUIRED Per-Printer Subscriptions operation requests and responses and the  
1005 Subscription object that MUST be supported.

### 1006 8.1 Create-Printer-Subscription operation

1007 The REQUIRED Create-Printer-Subscription operation creates a Per-Printer subscription by creating a Per-  
1008 Printer Subscription object which is added to the Printer object. The client can specify one or more job  
1009 and/or printer events to be delivered as notifications to one Notification Recipient. The job events are for  
1010 any job submitted to the Printer. The printer events are any events generated by that Printer.

1011 The Printer returns a subscription id and the length of time for which it has granted a lease for the  
1012 subscription. The client must renew the subscription using the Renew-Printer-Subscription operation (see



1013 section 8.4) before the lease runs out in order to maintain the subscription. A client can unsubscribe using  
 1014 the Cancel-Printer-Subscription operation (section 8.5) and the subscription id.

1015 Two Create-Printer-Subscription operations with the same events and same Notification Recipient **MUST**  
 1016 be kept as distinct subscriptions and be assigned distinct subscription ids. A Printer **MUST** allow such  
 1017 duplicate subscriptions such that Cancel-Printer-Subscription doesn't unsubscribe both subscriptions and  
 1018 **MUST** send the Notifications twice to the Notification Recipient, since the "request-id" is supposed to  
 1019 count monotonically for each subscription.

1020 If the Printer has a bounded set of concurrent subscriptions, the printer rejects the operation and returns the  
 1021 'server-error-too-many-subscriptions' status code. The client **SHOULD** try again later.

1022 Access Rights: The authenticated user (see [IPP-MOD] section 8.3) performing this operation **MUST** have  
 1023 Per-Printer subscription creation rights for this Printer. Otherwise the IPP object **MUST** reject the  
 1024 operation and return: client-error-forbidden, client-error-not-authenticated, and client-error-not-authorized  
 1025 as appropriate.

1026 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" (mimeType)]	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

1027 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

1028 Attribute Notes:

1029 "notify-recipient" (uri) - the client **MUST** supply this attribute in order to have a subscription.

- 1030 "notify-lease-time-requested" (integer(0:MAX)) - the number of seconds requested for the Per-Printer  
1031 subscription lease. A value of 0 indicates a request that the Per-Printer Subscription lease never  
1032 expire. Supplying a 0 value MAY require authentication in order to be used, if 0 is supported at all.  
1033 If the client does not supply this attribute, the Printer uses its "notify-lease-time-default" value (see  
1034 section 5.5.8).
- 1035 "notify-persistence-requested" (boolean) - whether or not the Per-Printer Subscription is to be persistent,  
1036 i.e., saved across power cycles. Note: Persistent trap registrations is a client option in SNMPv3  
1037 [RFC2573].
- 1038 "notify-lease-expiration-time" (integer(0:MAX)) - The Printer object MUST return this attribute which is  
1039 the time in the future at which the subscription lease will expire, i.e., the "printer-up-time" value (in  
1040 time ticks - see [ipp-mod] section 4.4.29) at which the Printer will delete the Subscription. A value  
1041 of 0 indicates that the lease subscription will never expire.
- 1042 "notify-lease-time-granted" (integer(0:MAX)) - The Printer object MUST return this attribute which is the  
1043 number of seconds of time actually granted. The value of "notify-lease-time-granted" may be less  
1044 than the requester requested in the "notify-lease-time-requested" if it was greater than the MAX  
1045 supported or more than the requester requested if it was less than the MIN supported, as indicated in  
1046 the Printer's "notify-lease-time-supported" (rangeOfInteger(0:MAX)) attribute.
- 1047 **ISSUE 6 - Instead of Create-Printer-Subscription response returning "notify-lease-time-granted" which is**  
1048 **NOT a Subscription object attribute, it is cleaner for implementation to return the "notify-printer-up-time"**  
1049 **Subscription attribute instead, which is a Subscription object attribute. The client subtracts the "notify-**  
1050 **printer-up-time" from the "notify-lease-expiration-time" to get the number of second remaining in the lease,**  
1051 **just as it would for a Get-Subscript-Attributes response. OK to replace the "notify-lease-time-granted" with**  
1052 **the "notify-printer-up-time" attribute in the response?**
- 1053 "notify-persistence-granted" - whether or not this Per-Printer Subscription object instance is persistent.  
1054 This attribute MUST be returned whether "notify-persistence-requested" is supported or not, so that  
1055 the client knows which.
- 1056 **ISSUE 7 - Should "notify-persistence-granted" be a Subscription object attribute too, so that all attributes**  
1057 **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

1075

1076 Attribute Notes: This operation is similar to the Get-Jobs operation (see [ipp-mod]). If the client wants any  
 1077 attributes returned, including the "subscription-id", it must include the attribute keyword name in the  
 1078 "requested-attributes" operation attribute. If the "requested-attributes" operation attribute is omitted, the  
 1079 Printer MUST respond as if the client supplied the value: 'subscription-id'.

1080 "my-subscriptions" (boolean) - If the client supplies the "my-subscriptions" with a 'false' value or omits it,  
 1081 the Printer returns all subscriptions, subject to the security policy in force.

1082 Groups 3 to N: Subscription Object Attributes: The Printer object responds with one set of Subscription  
 1083 Object Attributes for each returned Subscription object. The Printer object ignores (does not  
 1084 respond with) any requested attribute or value which is not supported or which is restricted by the  
 1085 security policy in force, including whether the requesting user is the user that created the  
 1086 Subscription object (subscribing user) or not (see [ipp-mod] section 8).

## 1087 8.4 Renew-Printer-Subscription operation

1088 The REQUIRED Renew-Printer-Subscription operation permits a client to request the IPP Printer to extend  
 1089 the lease on a Per-Printer Subscription object instance. There is no way to renew a Per-Job subscription,  
 1090 since they are automatically canceled after the job completes and no longer has any documents, i.e., the job  
 1091 is no longer retained (see [ipp-mod] section 4.3.7.2).

1092 *Access Rights:* The authenticated user (see [IPP-MOD] section 8.3) performing this operation MUST either  
 1093 be the owner of the Subscription object or have operator or administrator access rights for the Printer object  
 1094 (see [IPP-MOD] sections 1 and 8.5). Otherwise the IPP object MUST reject the operation and return:  
 1095 client-error-forbidden, client-error-not-authenticated, and client-error-not-authorized as appropriate.

1096 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

1097 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

1098 Attribute Notes:

1099 "notify-lease-time-requested" (integer(0:MAX) - the number of seconds requested for the Per-Printer  
1100 subscription lease. Same as Create-Printer-Subscriptions (see section 8.1).

1101 "notify-lease-expiration-time" - the time in the future when the subscription will expire. Same as for the  
1102 Create-Printer-Subscription operation (see section 7.1).

1103 "notify-lease-time-granted" - the lease time (number of seconds) actually granted. Same as for the Create-  
1104 Printer-Subscription operation (see section 7.1).

1105 **ISSUE 8 - Instead of Renew-Subscription response returning "notify-lease-time-granted" which is NOT a**  
1106 **Subscription object attribute, it is cleaner for implementation to return the "notify-printer-up-time"**  
1107 **Subscription attribute instead, which is a Subscription object attribute. Ok to replace the "notify-lease-**  
1108 **time-granted" with the "notify-printer-up-time" attribute in the response?**

1109 Note: There is no way to change any of the Subscription object attributes, except the "notify-lease-  
1110 expiration-time" attribute. In order to change other attributes, a client can create a new Subscription object  
1111 and then use the Cancel-Printer-Subscription operation to cancel the old one (or do this in the other order,  
1112 in case there is a limit on the number of Subscription object instances, as long as a short window with no  
1113 Notifications is ok).

1114 Note: There is no need to renew a Per-Job Subscription, since it is effectively the time that the Job is active  
1115 (see section 7.1).

## 1116 8.5 Cancel-Printer-Subscription operation

1117 The REQUIRED Cancel-Printer-Subscription operation allows a client to remove a Per-Printer  
1118 Subscription object from the Printer. No more Notifications are delivered for that Subscription. Once  
1119 performed, there is no way to use that Subscription in the future. Subscription-ids should not be reused  
1120 immediately, so that a stale reference situation is not created. Same as for Cancel-Job and job-ids.

1121 *Access Rights:* The authenticated user (see [IPP-MOD] section 8.3) performing this operation MUST either  
1122 be the owner of the Subscription object or have operator or administrator access rights for the Printer object  
1123 (see [IPP-MOD] sections 1 and 8.5). Otherwise the IPP object MUST reject the operation and return:  
1124 client-error-forbidden, client-error-not-authenticated, and client-error-not-authorized as appropriate.

1125 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

1126 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

## 1128 9 Comparison of Per-Job Submission Subscriptions versus Per-Printer 1129 Subscriptions

1130 Per-Job and Per-Printer subscriptions are quite similar. However, there are some semantic differences  
1131 between Per-Job subscriptions and Per-Printer subscriptions. A Per-Job Submission Subscription is  
1132 established by the client when submitting a job. A Per-Printer Subscription is established between a client  
1133 and a Printer using the new Create-Printer-Subscription operation. Some specific differences are:

- 1134 1. Either type of subscription can subscribe to Job events, Printer events, or both.
- 1135 2. For Per-Job Subscriptions, the subscription is only valid while the job is "not-complete" (see sections  
1136 6.2 and 6.3).
- 1137 3. For the Per-Printer Subscriptions, the subscription is valid until it is explicitly canceled with a Cancel-  
1138 Printer-Subscription operation or the time (in seconds) that the Printer returned in the "notify-lease-  
1139 time-granted" operation attribute expires, whichever occurs first.
- 1140 4. Job Events in a Per-Job Subscription apply only to "one job" (the Job created by the job creation  
1141 operation).
- 1142 5. Job Events in a Per-Printer-Subscription apply to ALL jobs contained in the IPP Printer object.
- 1143 6. Printer Events in both kinds of subscriptions apply no matter which job is being processed, if any.  
1144

## 1145 10 Conformance Requirements

1146 This section further enhances the Conformance Requirements detailed in [IPP-MOD] section 5. Extensions  
1147 made to the events herein must be made such that new events or event attributes are backward compatible  
1148 to clients who implemented early versions of this notification specification.

1149 It is OPTIONAL to implement this Event Notification specification. If implemented, IPP objects MUST  
 1150 support all of the REQUIRED object attributes as defined in this document in the indicated sections.

1151 If IPP Notification is implemented, the operations described in this document must be supported as  
 1152 described in Table 10:

1153 **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

1154

## 1155 **11 IANA Considerations**

1156 IANA will be called on to register URL schemes for notification delivery for use in the "notification-  
 1157 recipient" attribute, using the same procedures outlined in [ipp-mod].

## 1158 **12 Internationalization Considerations**

1159 This IPP notification specification continues the internationalization of [ipp-mod] for attributes containing  
 1160 text strings and names. A subscribing client can specify a different natural language and charset for each  
 1161 Notification content delivered to a Notification Recipient.

1162 The Human Consumable Notification content is a 'text/plain; charset=utf-8' by default where the  
 1163 Notification Sender has localized the text message as requested by the subscriber for the intended  
 1164 Notification Recipient.

## 1165 **13 Security Considerations**

1166 By far the biggest security concern is the abuse of notification: sending unwanted notifications to third  
 1167 parties (i.e., spam). The problem is made worse by notification addresses that may be redistributed to  
 1168 multiple parties (e.g. mailing lists). There exist scenarios where third party notification is required (see  
 1169 Scenario #2 and #3 in [ipp-not-req]). The fully secure solution would require active agreement of all  
 1170 recipients before sending out anything. However, requirement #9 in [ipp-req] ("There is no requirement for  
 1171 IPP Printer receiving the print request to validate the identity of an event recipient") argues against this.  
 1172 Certain systems may decide to disallow third party notifications (a traditional fax model).

1173 Clients submitting notification requests to the IPP Printer has the same security issues as submitting an  
 1174 IPP/1.1 print job request. The same mechanisms used by IPP/1.1 can therefore be used by the client

1175 notification submission. Operations that require authentication can use the HTTP authentication.  
1176 Operations that require privacy can use the HTTP/TLS privacy.

1177 The notification access control model should be similar to the IPP access control model for Jobs. Creating  
1178 a Per-Printer Notification Subscription object is associated with a user. Only the creator or an operator can  
1179 cancel the subscription. The system may limit the listing of items to only those items owned by the user.  
1180 Some subscriptions (e.g. those that have a lifetime longer than a job) can be done only by privileged users  
1181 (users having operator and/or administrator access rights), if that is the authorization policy.

1182 The standard security concerns (delivery to the right user, privacy of content, tamper proof content) apply  
1183 to the notification delivery. IPP should use the security mechanism of the delivery method used. Some  
1184 delivery mechanisms are more secure than others. Therefore, sensitive notifications should use the delivery  
1185 method that has the strongest security.

## 1186 **14 Status Codes**

1187 The following status codes are defined as extensions for notification:

### 1188 **14.1 client-error-uri-notification-scheme-not-supported (0x04??)**

1189 The scheme of the client-supplied URI in a "notify-recipient" operation attribute in a Create-Printer-  
1190 Subscription operation is not supported. See [ipp-mod] section 3.1.7.

1191 Note: There is no corresponding Per-Job subscription error, since the Printer object MUST ignore any  
1192 errors in the "job-notify" operation attribute, MUST return the "notify-recipient" attribute in the  
1193 Unsupported Attributes Group, and perform the Job Creation operation (see section 5.1), since the job can  
1194 still be printed.

### 1195 **14.2 server-error-too-many-subscriptions (0x04??)**

1196 The bounded set of concurrent Per-Printer subscriptions supported by the Printer object would be exceeded  
1197 if this request were accepted.

1198 Note: There is no corresponding Per-Job subscription error, since the Printer object MUST ignore any  
1199 errors in the "job-notify" operation attribute and perform the Job Creation operation (see section 5.1), since  
1200 the job can still be printed.

### 1201 **14.3 server-error-too-many-events (0x04??)**

1202 The client supplied more events in the "notify-events" operation attribute in a Create-Printer-Subscription  
1203 that the Printer supports, as indicated in its "max-events-supported" attribute (see section 5.5.4).

1204 There is no corresponding Per-Job subscription error, since the Printer object MUST ignore any errors in  
1205 the "job-notify" operation attribute, MUST return the "notify-events" attribute in the Unsupported  
1206 Attributes Group with only the excess events that are being ignored, and perform the Job Creation  
1207 operation (see section 5.1), since the job can still be printed.



## 15 Additions to the IPP Encoding and Transport Document

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

### 3.7.1 Delimiter Tags

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
0x06	subscription-attributes-tag
0x07-0x0e	reserved for future delimiters
0x0F	reserved for future chunking-end-of-attributes-tag

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

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

Add a reference to [ipp-not].

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1301

## A. Appendix - Summary of Notification Attribute Usage

1302

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

1303

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

1304

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

1305

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

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)	O	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)	O	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

1306 Legend: "R" - REQUIRED for Printer to support; "O" - OPTIONAL for Printer to support; "[ ]" - OPTIONAL for sender to send;  
1307 Return - Printer MUST return; \* - Job object, not collection;  
1308 \*\* - 1setOf collection index is the implicit subscription-id for a Per-Job subscription and is sent in the Notification.

1309

Attributes	Objects		Notification		Job operations		Subscription operations		
	Job	Subscription	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]						

- 1310 Legend: "R" - REQUIRED for Printer to support; "O" - OPTIONAL for Printer to support; [ ] - OPTIONAL for sender to send;  
 1311 "Per-Jb" - REQUIRED if Notification from a Per-Job subscription;  
 1312 "[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	Printer	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							

1313 Legend: "R" - REQUIRED for Printer to support; "O" - OPTIONAL for Printer to support; .

1314

## 1315 **18 Appendix C: Full Copyright Statement**

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