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

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27 **Abstract**

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

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

40 The full set of IPP documents includes:

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

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

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

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

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

46 Mapping between LPD and IPP Protocols [IPP LPD]

47

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

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

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

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

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

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

74  
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174

## 175 **1 Introduction**

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

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

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

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

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

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

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

186

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

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

### 203 **1.1 Notification Overview**

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

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

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

- 210 1. the names of Job and/or Printer events that are of interest to the Notification Recipient
- 211 2. the delivery method and address to use to deliver the notification to one Notification Recipient
- 212 3. if Human Consumable notification content is to be sent, which text format
- 213 4. some opaque data that the subscriber wants to be sent to the Notification Recipient in the
- 214 Notification, perhaps to identify either the subscriber or the ultimate recipient
- 215 5. the charset to use in the Notification, if it is to be different than the one used in the request that
- 216 created the subscription
- 217 6. the natural language to use in the Human Consumable Notification, if it is to be different than the
- 218 one used in the request that created the subscription
- 219 7. the requested lease time in seconds for the subscription
- 220 8. whether or not the subscription is requested to be persistent across power cycles.

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

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

239 Table 1 summarizes the Per-Job and Per-Printer Subscription operations and their salient input operation  
240 attributes.

241

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

Operation:	Per-Job	Per-Printer	salient inputs beside printer-uri:
Print-Job, Print-URI, Create-Job	yes	no	1setOf {recipient, [events,] [text-format,] [user-data,] [charset,] [natural-language]}
Validate-Job	yes	no	1setOf {recipient, [events,] [text-format,] [user-data,] [charset,] [natural-language]}
Create-Printer-Subscription	no	yes	recipient, [events,] [text-format,] [user-data,] [charset,] [natural-language,] [lease-time-requested,] [persistence-requested]
Create-Job-Subscription	yes	no	recipient, job-id, [events,] [text-format,] [user-data,] [charset,] [natural-language,]
Get-Subscription-Attributes	yes	yes	subscription-id, [requested-attributes]
Get-Subscriptions	yes	yes	[job-id], [my-subscriptions,] [requested-attributes]
Renew-Subscription	yes	yes	subscription-id, [lease time-requested]
Cancel-Subscription	yes	yes	subscription-id

242

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

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

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

## 254 **2 Model for Per-Job and Per-Printer Subscription and Event Notification**

### 255 **2.1 Model for Per-Job Subscription and Notification**

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

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



```

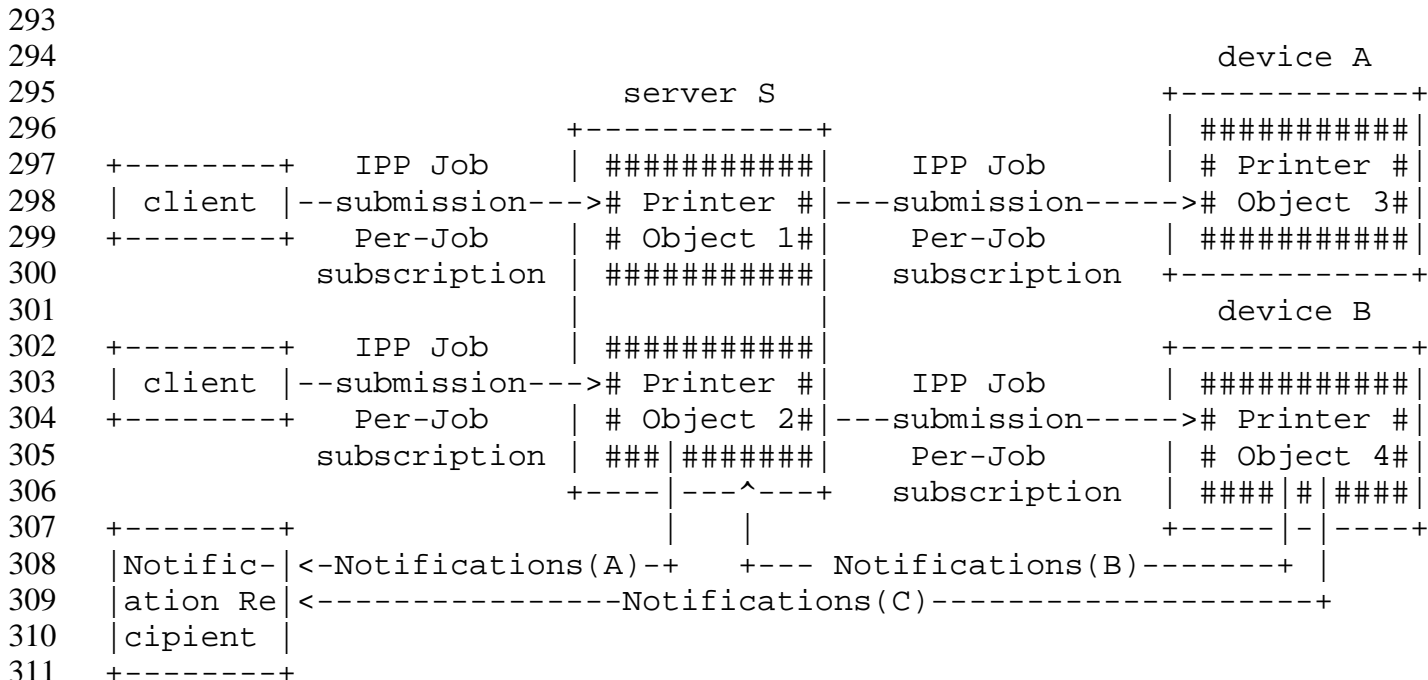
262
263 embedded printer:
264
265 desktop or server                                output device or server
266   +-----+                                     +-----+
267   | client |---IPP job submission-----># Printer # |
268   +-----+ Per-Job subscription | # Object # |
269 +-----+                                     | #####|##### |
270 |Notification|                                     +-----+-----+
271 |Recipient |<-----IPP Notifications-----+
272 +-----+                                     (Job and/or Printer events)

```

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

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

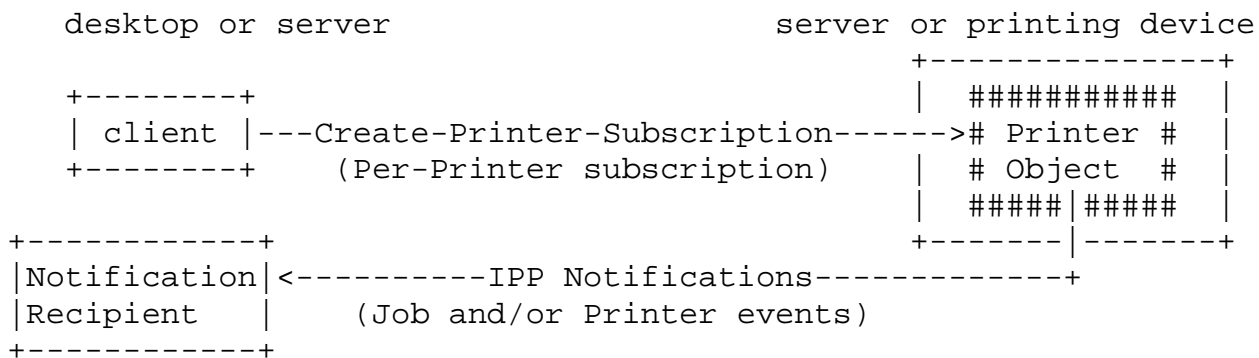
- 278 1. forward the Per-Job subscriptions to the down stream IPP Printer and let it perform the  
 279 notification directly to the Notification Recipients supplied by the Client (Notifications(C)) and  
 280 use Per-Printer Subscriptions for the Server's own purposes.
- 281 2. save the client-supplied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



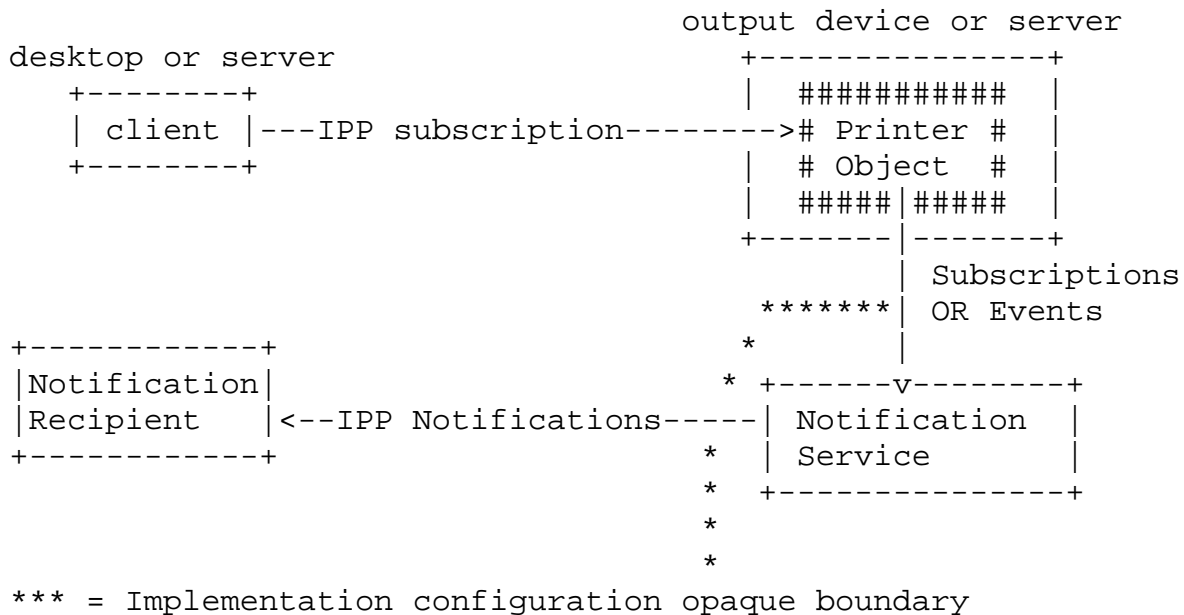
**Figure 3 - Client-Printer Per-Printer Subscription and Notification Model**

334 **2.3 Relationship between the Printer object and the Notification Delivery Service**

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

339 **2.3.1 Use of a Notification Service transparently to clients**

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



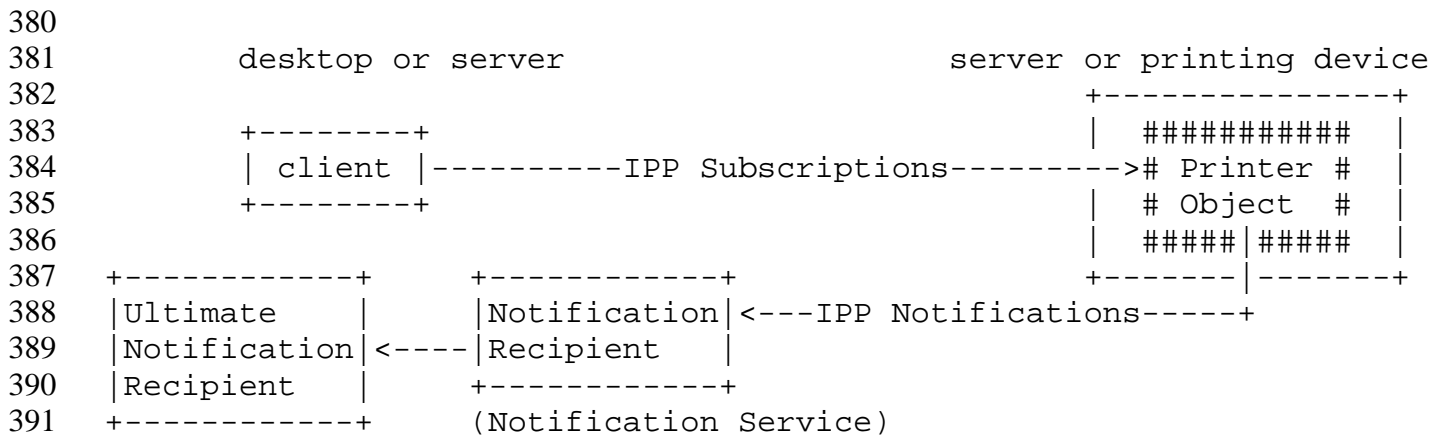
364 **Figure 4 - Opaque Use of a Notification Service Transparent to the Client**

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

367 **2.3.2 Use of Notification Service transparently to the IPP Printer**

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

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



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

### 393 3 Terminology

394 This section defines terminology used throughout this document.

#### 395 3.1 Conformance Terminology

396 Capitalized terms, such as **MUST**, **MUST NOT**, **REQUIRED**, **SHOULD**, **SHOULD NOT**, **MAY**,  
 397 **NEED NOT**, and **OPTIONAL**, have special meaning relating to conformance to this specification.  
 398 These terms are defined in [ipp-mod section 13.1 on conformance terminology, most of which is  
 399 taken from RFC 2119 [RFC2119].

400 *Since support of this entire notification specification is OPTIONAL for conformance to*  
 401 *IPP/1.0 or IPP/1.1, the use of the term REQUIRED (R) in this document means*  
 402 *"REQUIRED if this notification specification is implemented". Likewise, the term*  
 403 *RECOMMENDED means "RECOMMENDED if this notification specification is*  
 404 *implemented" and OPTIONAL (O) means OPTIONAL if this notification specification is*  
 405 *implemented.*

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

#### 408 3.2 Other terminology

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

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

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

- 415 **Job Submitting Application** - An application (for example, a batch application), acting on behalf of a  
416 Job Submitting End User, which submits a print job to an IPP Printer. The application may or may  
417 not be within the same security domain as the Printer. This application may or may not be  
418 geographically near the printer.
- 419 **Security Domain** - The set of network components which can communicate without going through a  
420 proxy or firewall. A security domain may be geographically very large, for example - anyplace  
421 within IBM.COM.
- 422 **IPP Client (or client)** - The software component (desktop or server) that sends an IPP operation  
423 request to an IPP Printer object (server or printing device) and accepts the resulting operation  
424 response from the IPP Printer object.
- 425 **Job Recipient** - A human who is the ultimate consumer of the print job. In many cases this will be the  
426 same person as the Job Submitting End User, but need not be.  
427 Example: If I use IPP to print a document on a printer in a business partner's office, I am the Job  
428 Submitting End User, while the person I intend the document for in my business partner's office is  
429 the Job Recipient. Since one of the goals of IPP is to be able to print near the Job Recipient of the  
430 printed output, we would normally expect that person to be in the same security domain as, and  
431 geographically near, the Printer. However, this may not always be the case. For example, I submit a  
432 print job across the Internet to a Kinko's print shop. I am both the Submitting End User and the Job  
433 Recipient, but I am neither near nor in the same security domain as the Printer.
- 434 **Job Recipient Proxy** - A human acting on behalf of the Job Recipient. In particular, the Job Recipient  
435 Proxy physically picks up the printed document from the Printer, if the Job Recipient cannot  
436 perform that function. The Proxy is **by definition** geographically near and in the same security  
437 domain as the printer.  
438 Example: I submit a print job from home to be printed on a printer at work. I'd like my secretary to  
439 pick up the print job and put it on my desk. In this case, I am acting as both Job Submitting End  
440 User and Job Recipient. My secretary is acting as a Job Recipient Proxy
- 441 **Notification Subscriber (or Subscriber)** - A client that requests the IPP Printer to send Event  
442 Notifications to one or more Notification Recipients. A Notification Subscriber may be:
- 443 1. a Job Submitting End User or Job Submitting Application (desktop or server) that is submitting  
444 a job or
  - 445 2. an End User, an Operator, or an Administrator that is not submitting a job.
- 446 **Subscription** - A request by a Notification Subscriber to the IPP Printer to send Event Notifications to  
447 a specified Notification Recipient when the event occur. A Subscription is represented as a set of  
448 attributes that indicate the "what, where, who, and how" for notification. Notifications are  
449 generated for certain events (what) and delivered using various delivery methods (how) to certain  
450 addresses (where and who).
- 451 **Per-Job Subscription** - A Subscription that a client specifies as part of a create job operation (Print-  
452 Job, Print-URI, Create-Job), a Validate-Job operation, or an explicit Create-Job-Subscription  
453 operation with a Job object as the target.
- 454 **Per-Printer Subscription** - A Subscription that a client specifies using an explicit Create-Printer-  
455 Subscription operation with a Printer object as the target.
- 456 **Notification Source** - The entity that sends Event Notifications. It MAY be the IPP Printer itself or the  
457 IPP Printer MAY be configured to use a Notification Service to delivery Notifications transparently  
458 to the subscribing clients (see Figure 4).
- 459 **Notification Recipient** - The entity identified as a recipient within a subscription that receives IPP  
460 Notifications about Job and/or Printer events (see Figure 4 and Figure 5). A Notification Recipient

461 may be a: Job Submitting End User, Job Submitting Application (desktop or server), Job Recipient,  
462 Job Recipient Proxy, a Notification Service, an Operator, or Administrator, etc., and their  
463 representative or log file or usage statistics gathering application or other active or passive entities.  
464 A Java Listener is an example of a Notification Recipient.

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

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

473 Events can be classified along two dimensions:

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

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

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

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

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

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

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

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

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

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

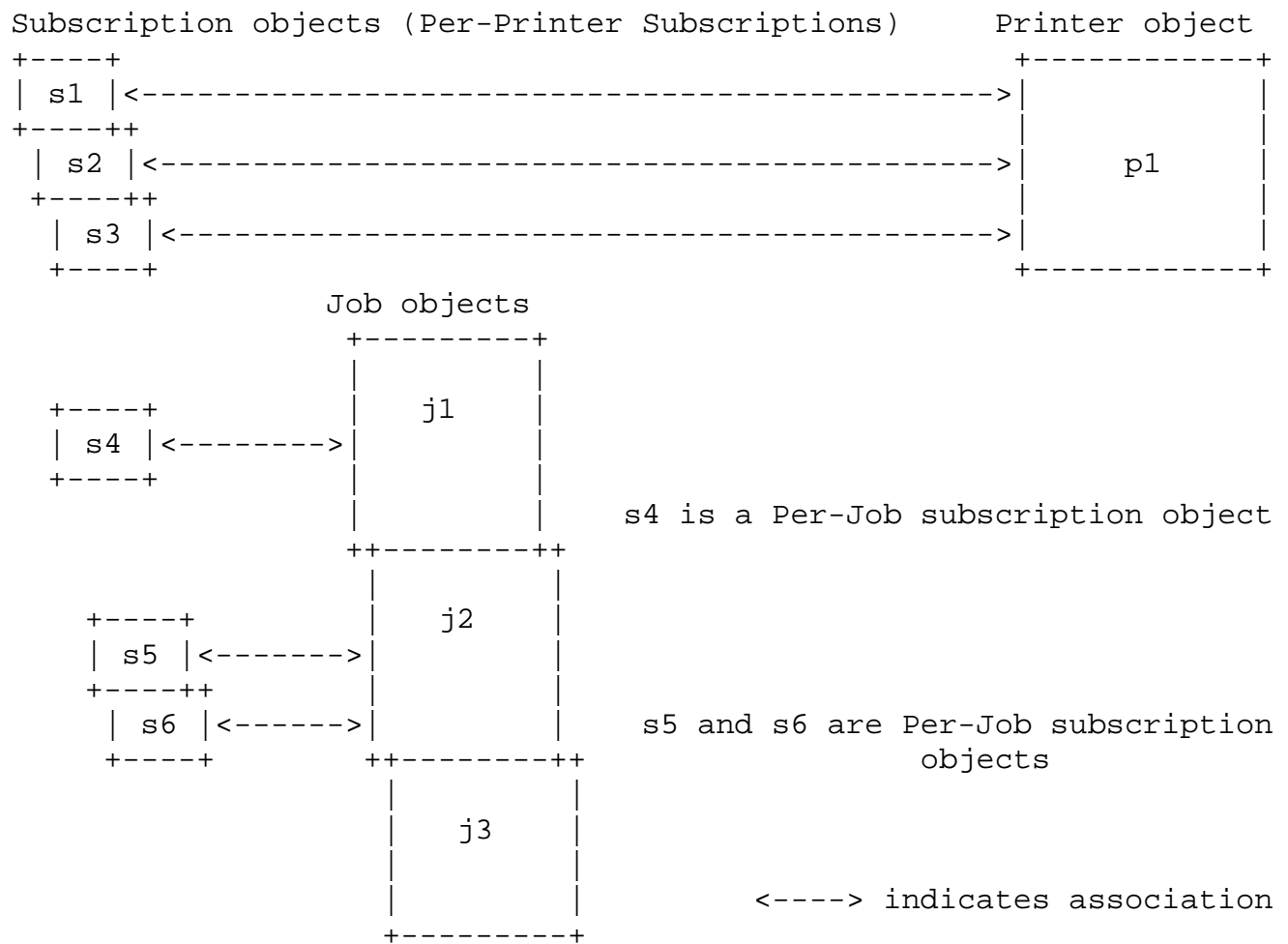
510 **4 Object Model for Notification**

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

513

514 The object relationships can be seen pictorially as:

515



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

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

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

## 546 **4.1 Object relationships**

547 This sub-section defines the object relationships between the Printer, Job, and Subscription objects.  
548 Whether Per-Printer Subscription objects are actually contained in a Printer object or are just bi-  
549 directionally associated with them in some way is IMPLEMENTATION DEPENDENT and is transparent  
550 to the client. Similarly, whether Per-Job Subscription objects are actually contained in a Job object or are  
551 just bi-directionally associated with them in some way is IMPLEMENTATION DEPENDENT and is  
552 transparent to the client. The object relationships are defined as follows:

### 553 **4.1.1 Printer object and Per-Printer Subscription objects**

- 554 1. The Printer object contains (is associated with) zero or more Per-Printer Subscription objects (p1  
555 contains s1-s3 Per-Printer Subscription objects).
- 556 2. A Per-Printer Subscription object (s1-s3) cannot be contained in (or associated with) more than one  
557 Printer object (p1).
- 558 3. Each Per-Printer Subscription object (s1, s2, and s3) is contained in (or is associated with) one  
559 Printer object (p1) and each represents one Per-Printer subscription.
- 560 4. Each Per-Printer Subscription object identifies one or more Job and/or Printer events. Such Job  
561 events are for *all* jobs on the Printer. Such Printer events are for *any* Printer event, no matter which  
562 job is processing and when no jobs are processing.

### 563 **4.1.2 Job object and Per-Job Subscription objects**

- 564 5. A Job object (j1, j2, j3) contains (is associated with) zero or more Per-Job subscription objects (s4-  
565 s6). Job j1 is associated with Per-Job subscription object s4, Job j2 is associated with Per-Job  
566 subscription objects s5 and s6, and Job j3 is not associated with any Per-Job subscription object.
- 567 6. A Per-Job Subscription object cannot be contained in (or associated with) more than one Job object.
- 568 7. Each Per-Job Subscription object is contained in (or associated with) one Job object and each  
569 represents one Per-Job Subscription.
- 570 8. Each Per-Job Subscription object identifies one or more Job and/or Printer events. Such Job events  
571 are only for *this* job (different than "per-Printer" Subscriptions). Such Printer events are for *any*  
572 Printer event, no matter which job and when no jobs are processing (same as for "per-Printer"  
573 Subscriptions).

## 574 **5 Subscription Object attributes**

575 The following notification attributes are defined for the Subscription object. The definitions of the object  
576 attributes are specified here so that they can be referred to from the subsequence definitions of the  
577 operations that set them.



578

**Table 2 - Subscription object attributes**

Subscription object attributes:	Printer support	READ-ONLY, set by:
notify-recipient (uri)	REQUIRED	client - Job Creation, Create-Job-Subscription, and Create-Printer-Subscription
notify-events (1setOf type2 keyword)	REQUIRED	client - Job Creation, Create-Job-Subscription, and Create-Printer-Subscription
notify-text-format (mimeMediaType)	REQUIRED	client - Job Creation, Create-Job-Subscription, and Create-Printer-Subscription
subscriber-user-data (octetString(63))	REQUIRED	client - Job Creation, Create-Job-Subscription, and Create-Printer-Subscription
notify-charset (charset)	OPTIONAL	client - Job Creation, Create-Job-Subscription, and Create-Printer-Subscription
notify-natural-languages (1setOf naturalLanguage)	OPTIONAL	client - Job Creation, Create-Job-Subscription, and Create-Printer-Subscription

579

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

580

subscription-id (integer(1:MAX))	REQUIRED	Printer - Job Creation, Create-Job-Subscription, and Create-Printer-Subscription
notify-lease-expiration-time (integer(0:MAX))	REQUIRED	Printer - Job Creation (set to 0) and Create-Printer-Subscription, Renew-Subscription
printer-uri (uri)	REQUIRED	Printer - Job Creation, Create-Job-Subscription, and Create-Printer-Subscription
subscriber-user-name (name(MAX))	OPTIONAL	Printer - Job Creation, Create-Job-Subscription, and Create-Printer-Subscription

581

notify-printer-up-time (integer(1:MAX))	REQUIRED	Printer - returned by Create-Printer-Subscription, Get-Subscription-Attributes, and Get-
-----------------------------------------	----------	------------------------------------------------------------------------------------------

		Subscriptions
notify-persistence-granted (boolean)	REQUIRED	Printer - returned by Create-Job-Subscription and Create-Printer-Subscription

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

## 588 **5.1 notify-recipient (uri)**

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

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

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

- 596 1) The URI scheme used.
- 597 2) The supported and default delivery format, and if not one of the specified types in Section 5.3,  
598 description of the notification content.
- 599 3) Any content length restrictions imposed by the delivery protocol.
- 600 4) The latency of the delivery protocol used.
- 601 5) The reliability of the transport and delivery protocol used.
- 602 6) The security aspects of the transport and delivery protocol used, e.g. how it is handled in firewalls.
- 603 7) How the delivery protocol is initiated, e.g. does it have to be initiated by the receiving user (pull), or  
604 is it initiated by the notification service (push).

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

## 608 **5.2 notify-events (1setOf type2 keyword)**

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

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

616 Job events: The semantics for job events depends on whether the subscription is a Per-Job  
617 Subscription or a Per-Printer Subscription. For Per-Job Subscriptions, the Printer MUST  
618 generate Notifications only for the job events of the job with which the Subscription is  
619 associated. For Per-Printer Subscriptions, the Printer MUST generate Notifications for the  
620 job events for any job submitted to the Printer.

621 For example, consider the event when there are 10 'pending' jobs, one 'processing' job, and  
622 30 'completed' jobs and the 'processing' job completes. The Printer MUST generate a 'job-  
623 completed' job event Notification if the job has a Per-Job Subscription that contained the  
624 'job-completed' event in this attribute. The Printer MUST NOT generate Notifications for  
625 any other jobs whose Per-Job Subscriptions contain the 'job-completed' event in this  
626 attribute.

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

631 For example, consider the event when there are 10 'pending' jobs, one 'processing' job, and  
632 30 'completed' jobs and the Printer enters the 'stopped' state. The Printer MUST generate a  
633 'printer-state-changed' printer event Notification for each of the 11 'pending' and 'processing'  
634 jobs whose Per-Job Subscriptions contain the 'printer-state-changed' event in this attribute.  
635 The Printer MUST NOT generate Notifications for any of the 'completed' jobs' whose Per-  
636 Job Subscriptions contain the 'printer-state-changed' event in this attribute.

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

640 A Printer MUST support the events indicated as "REQUIRED" and MAY support of the events indicated  
641 as "OPTIONAL".

642 The standard job event keyword values are:

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

645 **'job-created'**: REQUIRED - the Printer object has accepted a job creation operation (Print-Job, Print-  
646 URI, or Create-Job) and the job's "time-at-creation" attribute value is set (see [ipp-mod] section  
647 4.3.14.1). The Printer puts the job in the 'pending', 'pending-held' or 'processing' states.

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

651 **'job-completed'**: REQUIRED - the job has reached one of the completed states, i.e., the value of the  
652 job's "job-state" attribute has changed to: 'completed', 'aborted', or 'canceled'. The Job's "time-at-  
653 completed" and "date-time-at-completed" (if supported) attributes are set (see [ipp-mod] section  
654 4.3.14).

655 Note: This event is separate from 'job-state-changed' so that it can be subscribed to without having

656 to get every job state change event for a Notification Recipient that is only interested in when the  
657 job is completed.

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

662  
663 This event also indicates that one or more values have been added to or removed from the Job's  
664 "job-state-reasons" attribute, such as 'job-queued' or 'job-printing', whether or not the job's state has  
665 changed. If job state reasons are added when the job is created, only the 'job-created' event is  
666 generated, in order to keep the events disjoint. If job state reasons are added or removed when the  
667 job is completed, only the 'job-completed' event is generated, in order to keep the events disjoint.

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

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

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

683 **'job-progress'** - a sheet or copy has completed. See separate [ipp-prog] spec.  
684

685 The standard Printer event keywords values are:

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

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

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

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

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

698 **'printer-state-changed'**: REQUIRED - the Printer changed state, i.e., the value of the Printer's  
699 "printer-state", "printer-state-reasons" (whether "printer-state" changed or not), and/or "printer-is-  
700 accepting-jobs" attributes changed, except when the Printer starts up or is shutdown. If printer state  
701 reasons are added when the Printer is started up, only the 'printer-restarted' event is generated, in

702 order to keep the events disjoint. If printer state reasons are added or removed when the printer is  
703 powered-down or shutdown, only the 'printer-shutdown' event is generated, in order to keep the  
704 events disjoint.

705  
706 A client that wants to subscribe to all printer state changes, including restart and power-  
707 down/shutdown, includes the 'printer-restarted', 'printer-state-changed', and 'printer-shutdown' in the  
708 notification subscription.

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

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

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

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

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

737

### 738 **5.3 notify-text-format (mimeMediaType)**

739 This REQUIRED READ-ONLY Subscription object attribute indicates the type of Human Consumable  
740 format content that is to be sent in the Notifications. Depending on the delivery method definition  
741 document [, the Human Consumable format is represented either (1) as the entire Notification content,  
742 instead of the Machine Consumable format defined for the notification scheme, if any, (2) the value of the  
743 "human-readable-report" (text(MAX)) attribute (see section ) in the Machine Consumable form. Most  
744 delivery methods are defined to have a particular Machine Consumable forms of notification content type  
745 and to permit Human Consumable forms as well. An implementation MAY support one or more Human

746 Consumable formats, i.e., 'text' MIME media types, for those delivery methods that permit the Human  
747 Consumable form.

748 If the 'text' MIME media type registration permits a charset parameter, than such a specification **MUST** be  
749 used (instead of the "notify-charset" attribute) in order to indicate the charset to be used in the notification  
750 content.

751 If the Subscriber did not supply this attribute when requesting the subscription, the Printer object populates  
752 this Subscription object attribute with either the 'none' out-of-band value or one of the values of the  
753 Printer's "notify-text-format-supported" attribute (see section 6.5), depending on the delivery method as  
754 follows: If the delivery method defines a Machine Consumable form without a "human-readable-report"  
755 attribute, the Printer sets the 'none' out-of-band value. Otherwise, the Printer sets the attribute to one of its  
756 "notify-text-format-supported" attribute values. In the latter case, the value selected depends on the  
757 implementation, since there is no "notify-text-format-default" defined in this document.

758 Standard mimeType values are:

759 'none': This out-of-band value (see section 10.1) indicates that the Notification content is not to be  
760 any of the text types, i.e., that the Machine Consumable, not the Human Consumable, form is to be  
761 sent. Furthermore, the Machine Consumable Notification content **MUST NOT** include the "human-  
762 readable-report" attribute, if defined for the delivery method.

763  
764 'text/plain; charset=utf-8': plain text containing characters from ISO 10646 represented as UTF-8  
765 [RFC2279] as defined in section 7.1.1.

766  
767 'text/html': HTML data [rfc????] as defined in section 7.1.1.

768

#### 769 **5.4 subscriber-user-data (octetString(63))**

770 This **REQUIRED READ-ONLY** Subscription object attribute holds opaque information being sent from  
771 the Subscriber to the Notification Recipient, such as the identify of the Subscriber or a path or index to  
772 some Subscriber information. Or it **MAY** contain a key that the Notification Recipient needs in order to  
773 process the Notification, such as the ultimate recipient, if the Notification Recipient is a general application  
774 that in turn forwards notifications and the ultimate recipient isn't included in the value of the "notify-  
775 recipient" attribute. An Instant Messaging Service is an example of such a general application where the  
776 "subscriber-user-data" might be the user's id for that messaging service and the "notification-recipient" is  
777 the URL of the messaging service.

#### 778 **5.5 notify-charset (charset)**

779 This **OPTIONAL READ-ONLY** Subscription object attribute specifies the charset to be used in the  
780 Notification content sent to the Notification Recipient, whether the notification content is Machine  
781 Consumable or Human Consumable. This attribute **MUST NOT** be used when the "notify-text-format"  
782 attribute value specifies the charset parameter in its MIME media type value, e.g., 'text/plain; charset=utf-  
783 8'.

## 784 **5.6 notify-natural-language (naturalLanguage)**

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

## 788 **5.7 request-id**

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

## 794 **5.8 subscription-id (integer (1:MAX))**

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

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

## 808 **5.9 notify-lease-expiration-time (integer(0:MAX))**

809 This REQUIRED READ-ONLY Subscription object attribute specifies the time in the future when the  
810 subscription lease will expire, i.e., the "printer-up-time" value at which the lease will expire. When the  
811 Printer object creates a Per-Printer Subscription object, it populates this attribute with the appropriate value.  
812 When the indicated time arrives, the Printer MUST delete the Per-Printer Subscription object. Per-Job  
813 Subscription objects always return a value of 0 since Per-Job Subscriptions don't have a lease, but exist for  
814 the life-time of the Job instead.

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

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

## 822 **5.10 printer-uri (uri)**

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

## 827 **5.11 subscriber-user-name (name(MAX))**

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

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

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

## 842 **5.12 notify-printer-up-time (integer(1:MAX))**

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

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

## 853 **5.13 notify-persistence-granted (boolean)**

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



## 856 6 Printer Description Attributes related to Notification

857 This section defines the Printer Description attributes that are related to Notification. Table 3 lists the  
 858 Printer Description attributes and indicates the Printer support required for conformance: "R" indicates  
 859 REQUIRED, "O" indicates OPTIONAL, and "CR" indicates CONDITIONALLY REQUIRED, i.e.,  
 860 required if Human Consumable notification formats are supported.

861 **Table 3 - 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
notify-text-format-supported (1setOf mimeType)	CR	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

862

### 863 6.1 notify-schemes-supported (1setOf uriScheme)

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

### 866 6.2 notify-events-default (1setOf type2 keyword)

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

### 871 6.3 notify-events-supported (1setOf type2 keyword)

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

#### 874 **6.4 max-events-supported (integer(5:MAX))**

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

#### 881 **6.5 notify-text-format-supported (1setOf mimeType)**

882 This CONDITIONALLY REQUIRED Printer attribute identifies the MIME media types supported for  
883 Human Consumable notification content for those notification delivery methods that support Human  
884 Consumable format (most do). If an implementation supports any Human Consumable formats, it MUST  
885 support this attribute and MUST support those Human Consumable formats for all notification delivery  
886 methods that permit a Human Consumable format. If the implementation does not support any Human  
887 Consumable MIME media types, then the 'none' MUST be the only value of this attribute or this attribute  
888 MUST NOT be supported at all.

889 A client can determine what formats are supported for a notify-scheme as follows. The implementation  
890 contains a hard coding of the Machine Consumable format (obtained from the specification). If the hard  
891 coding (obtained from the specification) prohibits a Human Consumable format for the notify-scheme, or  
892 the printer doesn't support the "notify-text-format-supported" attribute, there are no Human Consumable  
893 formats for any notify-scheme. Otherwise, the attribute "notify-text-formats-supported" specifies the  
894 supported mime types for those delivery schemes that are supported and permit a Human Consumable  
895 format.

896 Note: The rationale for the "notify-text-format-supported" attribute is that the Machine Consumable format  
897 seems easy to pick for each notify-scheme and thus easy to document. It is easy for a printer to support  
898 most Machine Consumable formats. It is much harder to support a Human Consumable format because of  
899 localization issues. Once the code is written to support a particular Human Consumable format, it is easy  
900 to transmit it on any of the supported notify-schemes. Thus, if a vendor decides to support a notify-scheme,  
901 it has already committed to implement the Machine Consumable format. This may be simple if existing  
902 code can be reused, e.g. application/ipp and or more difficult if new code must be written, e.g. it is SNMP.

#### 903 **6.6 max-job-subscriptions-supported (integer(1:MAX))**

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

**913 6.7 max-printer-subscriptions-supported (integer(0:MAX))**

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

**921 6.8 notify-lease-time-supported (rangeOfInteger(0:MAX))**

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

**928 6.9 notify-lease-time-default (integer(0:MAX))**

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

**932 6.10 persistent-jobs-supported (boolean)**

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

**937 6.11 persistent-subscriptions-supported (boolean)**

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

**943 6.12 printer-state-change-time (integer(1:MAX))**

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

### 947 **6.13 printer-state-change-date-time (dateTime)**

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

## 951 **7 Notification Content**

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

954 There are two notification content types: Machine Consumable and Human Consumable, i.e., 'text' MIME  
955 media type. For most notification delivery methods both content types are defined. Each Notification  
956 Content type will either define one specific Machine Consumable form (usual) or indicate that no Machine  
957 Consumable form is defined. In addition, each Notification Content type will indicate whether (usual) or  
958 not Human Consumable forms are permitted. But the definition will not define the Human Consumable  
959 forms. For those Human Consumable forms that a Printer implementation supports as indicated in the  
960 Printer's "notify-text-format-supported" attribute, it MUST support for all Notification Content formats  
961 supported that permit Human Consumable form.

### 962 **7.1 Notification content MIME media type formats**

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

#### 966 **7.1.1 Human Consumable form**

967 If the notification delivery method is defined to permit Human Consumable forms then the following  
968 RECOMMENDATIONS apply:

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

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

#### 974 **7.1.2 Machine Consumable form**

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

- 977 1. The notification content MUST use the 'application/ipp' MIME media type [ipp-mod] using the  
978 Get-Job-Attributes response encoding for job events and Get-Printer-Attributes response for  
979 printer events.
- 980 2. The attributes listed in sections 7.2 and 7.3 are sent in a Notification for Job events.
- 981 3. The attributes listed in sections 7.2 and 7.4 are sent in a Notification for Printer events.

- 982 4. For any 'text' or 'name' attribute value in any notification, the charset and natural language rules  
 983 that apply to all IPP operations apply to these attributes as well, since they are represented as  
 984 operation responses.
- 985 5. The Unsupported Attributes Group in the response is not sent.
- 986 6. If the values of any of the attributes sent in a notification content are not known, the value sent  
 987 in the report content is the out-of-band 'unknown' value, rather than omitting the attribute (see  
 988 the beginning of [ipp-mod] section 4.1).

989 An implementation MAY extend the contents of the Machine Consumable notification by adding additional  
 990 attributes. Notification Recipients MUST be able to accept Notifications containing attributes they do not  
 991 recognize. What a Notification Recipient does with an unrecognized attribute is implementation-  
 992 dependent. Notification Recipients MAY attempt to display unrecognized attributes anyway or MAY  
 993 ignore them.

## 994 7.2 Notification content attributes common to Job and Printer events

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

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

999 Request: If the delivery method defines that the IPP Printer sends the Notification, then the delivery  
 1000 method also defines whether or not the Notification Recipient returns a response. If the IPP Printer  
 1001 sends a Notification request, it uses the "operation-id alternative for item #2 in Table 4:

1002 Response: If the delivery method defines that the IPP Printer supports an operation that returns a  
 1003 Notification as a response to the Notification Recipient, it uses the "status-code" alternative for item  
 1004 #2 in Table 4.

1005 Some events do not include all of these attributes as shown in Table 4. Each notification content contains a  
 1006 single Job or Printer event, whether that event was subscribed using the Job Submission Subscription  
 1007 mechanism or the Per-Printer subscription mechanism. If either kind of Subscription subscribed to both  
 1008 Job and Printer events, then the Printer will send or return them as separate Job Notification content and  
 1009 Printer Notification contents to the same Notification Recipient.

1010 Table 4 lists the attributes that are defined for use in Notifications and indicates the Printer support required  
 1011 for conformance: "R" indicates REQUIRED for Printers to support and "O" indicates OPTIONAL for  
 1012 Printers to support. References of the form "mod m.n.o" refer to [ipp-mod] sections.

1013 **Table 4 - Common Job and Printer Notification content attributes**

Attributes	Reference	Events	
		'job-progress'	all others
1. version-number (integer (0:32767))	mod 3.1.1	R	R
2. operation-id (integer (0:32767)) or status-code (integer (0:32767))	mod 3.1.1	R	R

Attributes	Reference	Events	
		'job-progress'	all others
3. request-id (integer (0:MAX))	5.7 & mod 3.1.1	R	R
4. attributes-charset (charset)	5.5 & mod 3.1.4	R	R
5. attributes-natural-language (naturalLanguage)	5.6 & mod 3.1.4	R	R
6. printer-uri (uri)	5.10	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)	5.2	R	R
11. trigger-time (integer(MIN:MAX))	7.2	R	R
12. trigger-date-time (dateTime)	7.2		O
13. subscription-id (integer(1:MAX))	5.8	R	R
14. subscriber-user-name (name(MAX))	5.11	O	O
15. subscriber-user-data (octetString(63))	5.4	R	R
16. notify-text-format (mimeMediaType)	5.3	O	O
17. human-readable-report (text(MAX))		O	O

1014 Attribute Notes:

1015 "version-number" - the major and minor version number.

1016 "operation-id" - the operation id if the delivery method document models the Notification as the Printer  
 1017 sending the Notification to the Notification Recipient (whether the Notification Recipient returns a  
 1018 response or not).

1019 "status-code" - a value of 0x600 (hexadecimal 600) for a Job event and 0x601 (hexadecimal 601) for a  
 1020 Printer event if the delivery method document models the Notification as the Printer returning the  
 1021 Notification to the Notification Recipient as a response to a request.

1022 "request-id" - the sequence number for this subscription, starting at 1 for each subscription.

1023 "attributes-charset" - the value comes from the "notify-charset" attribute in the Subscription object.

1024 "attributes-natural-language" - the value comes from the "notify-natural-language" attribute in the  
 1025 Subscription object.

1026 "printer-uri" - the value comes from the "job-printer-uri" Job attribute for Per-Job subscriptions.

1027 \*\*"job-id" and "job-name" - included in Printer event Notifications only for Per-Job subscriptions.

1028 "trigger-event" - the event that caused this Notification to be delivered.

- 1029 "trigger-time" - the "printer-up-time" value when the event occurred.
- 1030 "trigger-date-time" - the "printer-current-time" value when the event occurred - OPTIONAL to support.
- 1031 "job-name" - SNMP delivery method can truncate to less than 255 octets, since the Notification needs to fit  
1032 into 484 octets or so on some transports that SNMP is defined for.
- 1033 "subscription-id" - the unique identifier for the Subscription object on this Printer.
- 1034 "subscriber-user-name" - the subscriber user name that created the Subscription object. SNMP delivery  
1035 method can truncate to less than 255 octets, since the Notification needs to fit into 484 octets or so  
1036 on some transports that SNMP is defined for.
- 1037 "subscriber-user-data" - opaque user data that may identify either the Subscriber and/or the ultimate  
1038 Notification Recipient.
- 1039 "notify-text-format (mimeMediaType)" - indicates the text MIME media type (see section 5.3) for the  
1040 "human-readable-report" attribute. This attribute MUST be present if the "human-readable-report"  
1041 (text(MAX)) attribute is present in order to unambiguously identify the format of its text value to  
1042 the Notification Recipient.
- 1043 "human-readable-report (text(MAX))" - the human consumable text message (see section 7.1.1) that  
1044 describes the event and is represented in the text format specified by the "notify-text-format"  
1045 attribute. Whether or not this attribute is defined depends on the delivery method definition  
1046 document and MUST be defined only for use in the Machine Consumable format. If this attribute is  
1047 defined for use in the Machine Consumable Notification, then whether this attribute is REQUIRED  
1048 or OPTIONAL also depends on the delivery method definition document.

### 1049 **7.3 Additional Notification content attributes for Job events *only***

1050 Table 5 lists the additional attributes that are included only in Job event Notifications and indicates the  
1051 Printer support required for conformance: "R" indicates REQUIRED, "O" indicates OPTIONAL, and  
1052 "CR" indicates CONDITIONALLY REQUIRED, i.e., REQUIRED in a Notification if the corresponding  
1053 Job attributes are supported. Some events do not include all of these attributes as shown in Table 5.

1054 **Table 5 - Additional Notification content attributes for Job events *only***

Attributes	Reference	Events		
		'job-progress'	'job-completed'	all others
18. job-state (type1 enum)	mod 4.3.7	R	R	R
19. job-state-reasons (1setOf type2 keyword)	mod 4.3.8	R	R	R
20. job-k-octets (integer(0:MAX))	mod 4.3.17.1	O	O	
21. job-k-octets-processed (integer(0:MAX))	mod 4.3.18.1	O	O	
22. job-impressions (integer(0:MAX))	mod 4.2.17.2	O	O	

Attributes	Reference	Events		
		'job-progress'	'job-completed'	all others
23. job-impressions-completed (integer(0:MAX))	mod 4.3.18.2	CR	CR	
24. impressions-completed-current-copy (integer(0:MAX))	[ipp-prog]	R		
25. job-media-sheets (integer(0:MAX))	mod 4.3.17.3	O	O	
26. job-media-sheets-completed (integer(0:MAX))	mod 4.3.18.3	CR	CR	
27. job-collation-type (type2 enum)	[ipp-prog]	R		
28. sheet-completed-copy-number (integer(0:MAX))	[ipp-prog]	R		
29. sheet-completed-document-number(integer(0:MAX))	[ipp-prog]	R		

#### 7.4 Additional Notification content attributes for Printer events *only*

Table 6 lists the additional attributes that are included only in Printer event Notifications and indicates the Printer support required for conformance: "R" indicates REQUIRED and "O" indicates OPTIONAL.

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

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

## 8 Operations for notification

This section defines all of the operations for notification.

### 8.1 Operations for Per-Job Subscriptions *only*

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



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

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

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

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

Member attribute of "job-notify" collection	Reference	REQUIRED in request	Printer support
notify-recipient (uri)	5.1	yes	REQUIRED
notify-events (1setOf type2 keyword)	5.2	no	REQUIRED
notify-text-format (mimeMediaType)	5.3	no	REQUIRED
subscriber-user-data (octetString(63))	5.4	no	REQUIRED
notify-charset (charset)	5.5	no	OPTIONAL
notify-natural-language (naturalLanguage)	5.6	no	OPTIONAL

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

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

- Any subscription can contain job events, printer events, or both.
- The Job Submission Subscription is only valid while the job is "not-completed". The job is "not-completed" while it is in the 'pending', 'pending-held', 'processing', and 'processing-stopped' states. The job changes from being "not-completed" to "retained" when it is done processing and enters any of the 'completed', 'canceled', or 'aborted' states. The job becomes "not-completed" again when it is restarted using the Restart-Job operation (see [ipp-mod]).
- Since no job is created for the Validate-Job operation, the only purpose of supplying the subscription operation attributes in the Validate-Job operation is to validate that the values are supported; the Printer object does not establish a notification subscription as a result of the Validate-Job operation.
- Since a Job Submission Subscription is included within a job submission operation, any interest in job events is limited to "this job" only (the Job object created because of this job creation operation). There is no mechanism to subscribe to events for all jobs or specifically some job other than this job in a create operation. But see the Create-Printer-Subscription operation (section 8.2.1) for an explicit operation to subscribe for job and/or printer events independently of any particular job submission, i.e., Per-Printer subscriptions.

- 1096 5. Event reporting only occurs when a notification recipient has specified a subscription to any event(s).
- 1097 6. The notification implementation MAY allow an administrator to configure a policy on what events may  
1098 be dropped.
- 1099 7. If the OPTIONAL "notify-charset" attribute is not supported or the supplied value is not supported, the  
1100 IPP Printer MUST return the attribute in the Unsupported Attributes Group but still accept the  
1101 operation, as with all Job create operations. In this case, the Printer MUST use the natural language  
1102 supplied in the "attributes-charset" Job creation operation attribute, if that natural language value is  
1103 supported by the Printer, else the Printer object MUST use the Printer's "charset-configured" value. See  
1104 the Print-Job operation in [ipp-mod].
- 1105 8. If the OPTIONAL "notify-natural-language" attribute is not supported or the supplied value is not  
1106 supported, the IPP Printer MUST return the attribute in the Unsupported Attributes Group but still  
1107 accept the operation, as with all Job create operations. In this case, the Printer MUST use the natural  
1108 language supplied in the "attributes-natural-language" Job creation operation attribute, if that natural  
1109 language value is supported by the Printer, else the Printer object MUST use the Printer's "natural-  
1110 language-configured" value. See the Print-Job operation in [ipp-mod].
- 1111 9. If a collection contains other unrecognized, unsupported member attributes and/or conflicting values,  
1112 the attribute returned in the Unsupported Group is a collection containing the unrecognized,  
1113 unsupported member attributes, and/or conflicting values. The Printer MUST return the unrecognized  
1114 member attributes with the out-of-band value of 'unsupported'. The Printer MUST return the  
1115 unsupported member attributes and conflicting values with their unsupported values. See [ipp-coll].
- 1116 10. If the number of events supplied in the "notify-events" attribute exceeds the Printer's "max-events-  
1117 supported" attribute, the Printer MUST accept the request with the status code 'successful-ok-ignored-  
1118 or-substituted-attributes' and return the "job-notify" collection in the Unsupported Attributes Group  
1119 with only the "job-events" member attribute containing the events that exceed the maximum.
- 1120 11. If the Per-Job subscriptions would exceed the limit of Per-Job subscriptions supported per job as  
1121 specified by the Printer's "max-job-subscriptions-supported" attribute or would exceed some  
1122 implementation-defined limit on the total number of Per-Job subscriptions for the Printer (if any), the  
1123 Printer MUST accept the request with the status code 'successful-ok-ignored-subscriptions', MUST  
1124 return the "job-notify" attribute in the Unsupported Attributes Group with only the collection value(s)  
1125 that represent the excess subscriptions that are being ignored, and MUST perform the Job Creation  
1126 operation (see section 8.1.1), since the job can still be printed.
- 1127 If the job is accepted and one or more subscriptions are ignored, the status code returned is 'successful-  
1128 ok-ignored-subscriptions'. This status code is returned even if other job attributes are unsupported or in  
1129 conflict. That is, if an IPP Printer finds a warning that would allow it to return 'successful-ok-ignored-  
1130 subscriptions' and either 'successful-ok-ignored-or-substituted-attributes' and/or 'successful-ok-  
1131 conflicting-attributes', it must return 'successful-ok-ignored-subscriptions'. In other words, the  
1132 precedence for returning success codes is: 'successful-ok-ignored-subscriptions', 'successful-ok-  
1133 conflicting-attributes', and 'successful-ok-ignored-or-substituted-attributes'.

### 1134 **8.1.2 Create-Job-Subscription operation**

1135 The OPTIONNAL Create-Job-Subscription operation creates a Per-Job Subscription object . The client  
1136 can specify one or more job and/or printer events to be delivered as notifications to one Notification  
1137 Recipient. For the Per-Job subscription objects, the Job events are for this job only. The printer events are

1138 any events generated by that Printer for any job or when no job is involved at all (same as for Per-Job  
1139 Subscriptions).

1140 The Printer returns a subscription id and the length of time for which it has granted a lease for the  
1141 subscription.

1142 A client can unsubscribe using the Cancel-Subscription operation (section 8.3.4) and the subscription id.

1143 Two Create-Job-Subscription operations with the same events and same Notification Recipient **MUST** be  
1144 kept as distinct subscriptions and be assigned distinct subscription ids. A Printer **MUST** allow such  
1145 duplicate subscriptions such that Cancel-Subscription doesn't unsubscribe both subscriptions and **MUST**  
1146 send the Notifications twice to the Notification Recipient, since the "request-id" is supposed to count  
1147 monotonically for each subscription.

1148 If the Printer has a bounded set of concurrent Per-Job subscriptions and the request would exceed that  
1149 bound, the Printer rejects the operation and returns the 'server-error-too-many-subscriptions' status code.  
1150 The client **SHOULD** try again later.

1151 Access Rights: To create Per-Job subscription objects, the authenticated user (see [IPP-MOD] section 8.3)  
1152 performing this operation **MUST** either be the job owner or have operator or administrator access rights for  
1153 the Printer object (see [IPP-MOD] sections 1 and 8.5). Otherwise the IPP object **MUST** reject the  
1154 operation and return: client-error-forbidden, client-error-not-authenticated, and client-error-not-authorized  
1155 as appropriate.

1156 Request:

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

1157

Group 2: Subscription Attributes		Printer support
	"notify-recipient" (uri)	REQUIRED
	["notify-events" (1setOf type2 keyword)]	REQUIRED
	["notify-text-format" (mimeMediaType)]	REQUIRED
	["subscriber-user-data" (octetString(63))]	REQUIRED
	["notify-charset" (charset)]	OPTIONAL
	["notify-natural-language" (naturalLanguage)]	OPTIONAL
	["notify-persistence-requested" (boolean)]	OPTIONAL

1158 Response:

Group 1: Operation Attributes		Printer Support
	"status-code" (type2 enum)	REQUIRED
	"attributes-charset" (charset)	REQUIRED
	"attributes-natural-language" (naturalLanguage)	REQUIRED
	["status-message" (text(255))]	OPTIONAL
	["detailed-status-message" (text(MAX))]	OPTIONAL

1159

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

1160

Group 3: Subscriptions Attributes		REQUIRED
	"subscription-id" (integer(1:MAX))	REQUIRED
	"notify-persistence-granted" (boolean)	REQUIRED

1161 Attribute Notes:

1162 "job-id" (integer(1:MAX)) - the client MUST supply this attribute in order to create a Per-Job subscription  
 1163 for the Job identified by the "job-id" value.

1164 Note: Unlike all other operations on the Job object, the "job-uri" operation attribute is not defined  
 1165 for use with this operation.

1166 **ISSUE 02 - Ok that "job-uri" isn't defined for use with the Create-Job-Subscription operation?**

1167 "notify-recipient" (uri) - the client MUST supply this attribute in order to have a subscription.

1168 "notify-event" (1setOf type2 keyword) - if the client does not supply this attribute, the Printer populates the  
 1169 "notify-events" Subscription Description attribute from its "notify-events-default" Printer  
 1170 Description attribute.

1171 "notify-text-format" (mimeMediaType) - if the client supplies this attribute, the value indicates which  
 1172 Human Consumable text format is requested for use in the Notification using the delivery method  
 1173 that the client supplies in the "notify-recipient" attribute. If the client does not supply this attribute,  
 1174 the Machine-Consumable form of the delivery method that the client supplies in the "notify-  
 1175 recipient" attribute is used.

1176 "notify-persistence-requested" (boolean) - whether or not the Per-Job Subscription is to be persistent, i.e.,  
1177 saved across power cycles. Note: Persistent trap registrations is a client option in SNMPv3  
1178 [RFC2573].

1179 "notify-persistence-granted" (boolean) - whether or not this Subscription object instance is persistent. This  
1180 attribute **MUST** be returned whether "notify-persistence-requested" is supported or not, so that the  
1181 client knows which.

1182

## 1183 **8.2 Operations for Per-Printer Subscriptions *only***

1184 This section defines the operation requests and responses associated with the Per-Printer subscription and  
1185 its Subscription object.

### 1186 **8.2.1 Create-Printer-Subscription operation**

1187 The **REQUIRED** Create-Printer-Subscription operation creates a Per-Printer Subscription object . The  
1188 client can specify one or more job and/or printer events to be delivered as notifications to one Notification  
1189 Recipient. For the Per-Printer subscription objects, the job events are for any job submitted to the Printer.  
1190 The printer events are any events generated by that Printer for any job or when no job is involved at all.

1191 The Printer returns a subscription id and the time at which the subscription lease expires (which may be  
1192 earlier or later than the client requested).

1193 The client must renew the Per-Printer subscription using the Renew-Subscription operation (see section  
1194 8.3.3) before the lease runs out in order to maintain the subscription. A client can unsubscribe using the  
1195 Cancel-Subscription operation (section 8.3.4) and the subscription id.

1196 Two Create-Printer-Subscription operations with the same events and same Notification Recipient **MUST**  
1197 be kept as distinct subscriptions and be assigned distinct subscription ids. A Printer **MUST** allow such  
1198 duplicate subscriptions such that Cancel-Subscription doesn't unsubscribe both subscriptions and **MUST**  
1199 send the Notifications twice to the Notification Recipient, since the "request-id" is supposed to count  
1200 monotonically for each subscription.

1201 If the Printer has a bounded set of concurrent Per-Printer subscriptions and the request would exceed that  
1202 bound, the Printer rejects the operation and returns the 'server-error-too-many-subscriptions' status code.  
1203 The client **SHOULD** try again later.

1204 Access Rights: To create Per-Printer subscription objects, the authenticated user performing this operation  
1205 **MUST** have Per-Printer subscription rights for this Printer. Otherwise the IPP object **MUST** reject the  
1206 operation and return: client-error-forbidden, client-error-not-authenticated, and client-error-not-authorized  
1207 as appropriate.

1208 Request:

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

1209

Group 2: Subscription Attributes		Printer support
"notify-recipient" (uri)		REQUIRED
["notify-events" (1setOf type2 keyword)]		REQUIRED
["notify-text-format" (mimeType)]		REQUIRED
["subscriber-user-data" (octetString(63))]		REQUIRED
["notify-charset" (charset)]		OPTIONAL
["notify-natural-language" (naturalLanguage)]		OPTIONAL
["notify-lease-time-requested" (integer(0:MAX))]		REQUIRED
["notify-persistence-requested" (boolean)]		OPTIONAL

1210 Response:

Group 1: Operation Attributes		Printer Support
"status-code" (type2 enum)		REQUIRED
"attributes-charset" (charset)		REQUIRED
"attributes-natural-language" (naturalLanguage)		REQUIRED
["status-message" (text(255))]		OPTIONAL
["detailed-status-message" (text(MAX))]		OPTIONAL

1211

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

1212

Group 3: Subscription Attributes		Printer support
"subscription-id" (integer(1:MAX))		REQUIRED
"notify-lease-expiration-time" (integer(0:MAX))		REQUIRED
"notify-printer-up-time" (integer(1:MAX))		REQUIRED
"notify-persistence-granted" (boolean)		REQUIRED
Group 2: Unsupported Attributes	REQUIRED	

1213 Attribute Notes:

1214 "notify-recipient" (uri) - the client MUST supply this attribute in order to have a subscription.

1215 "notify-lease-time-requested" (integer(0:MAX)) - the number of seconds requested for the subscription  
 1216 lease. A value of 0 indicates a request that the Per-Printer Subscription lease never expire.  
 1217 Supplying a 0 value MAY require authentication in order to be used, if 0 is supported at all.  
 1218 If the client does not supply this attribute, the Printer uses its "notify-lease-time-default" Printer  
 1219 Description attribute value (see section 6.9).

- 1220 "notify-event" (1setOf type2 keyword) - if the client does not supply this attribute, the Printer populates the  
1221 "notify-events" Subscription Description attribute from its "notify-events-default" Printer  
1222 Description attribute.
- 1223 "notify-text-format" (mimeMediaType) - if the client supplies this attribute, the value indicates which  
1224 Human Consumable text format is requested for use in the Notification using the delivery method  
1225 that the client supplies in the "notify-recipient" attribute. If the client does not supply this attribute,  
1226 the Machine-Consumable form of the delivery method that the client supplies in the "notify-  
1227 recipient" attribute is used.
- 1228 "notify-persistence-requested" (boolean) - whether or not the Per-Printer Subscription is to be persistent,  
1229 i.e., saved across power cycles. Note: Persistent trap registrations is a client option in SNMPv3  
1230 [RFC2573].
- 1231 "notify-lease-expiration-time" (integer(0:MAX)) - The Printer object MUST return this attribute which is  
1232 the time in the future at which the subscription lease will expire, i.e., the "printer-up-time" value (in  
1233 time ticks - see [ipp-mod] section 4.4.29) at which the Printer will delete the Subscription. A value  
1234 of 0 indicates that the lease subscription will never expire.
- 1235 "notify-printer-up-time" (integer(1:MAX)) - The Printer object MUST return this attribute which is an alias  
1236 for the Printer's "printer-up-time" Printer Description attribute. The client subtracts this value from  
1237 the "notify-lease-expiration-time" value returned in order to determine the number of second in the  
1238 future that the subscription will expire. This computed value may be less than the requester  
1239 requested in the "notify-lease-time-requested" if it was greater than the MAX supported or more  
1240 than the requester requested if it was less than the MIN supported, as indicated in the Printer's  
1241 "notify-lease-time-supported" (rangeOfInteger(0:MAX)) attribute (see section 6.8).
- 1242 "notify-persistence-granted" - whether or not this Subscription object instance is persistent. This attribute  
1243 MUST be returned whether "notify-persistence-requested" is supported or not, so that the client  
1244 knows which.
- 1245

### 1246 **8.3 Common Operations for Per-Job and Per-Printer Subscriptions**

1247 This section defines the operations that are common to both Per-Job and Per-Printer subscriptions.

### 1248 8.3.1 Get-Subscription-Attributes operation

1249 The REQUIRED Get-Subscription-Attributes returns the requested attributes of the identified Subscription  
1250 object. See section 5.

1251 Request:

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

1252 Response:

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

1253 This operation is similar to the Get-Printer-Attributes operation. If the client omits the "requested-  
1254 attributes" operation attribute, the Printer MUST respond as if the client had supplied the 'all' value, i.e.,  
1255 return all of the attributes supported for the Subscription object.

### 1256 8.3.2 Get-Subscriptions operation

1257 The REQUIRED Get-Subscriptions operation returns the requested attributes of the Subscription objects  
1258 (see section 5).

1259 Request:

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

1260 Response:



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

1261

1262 Attribute Notes:

1263 This operation is similar to the Get-Jobs operation (see [ipp-mod]). If the client wants any attributes  
 1264 returned, including the "subscription-id", it must include the attribute keyword name in the "requested-  
 1265 attributes" operation attribute. If the "requested-attributes" operation attribute is omitted, the Printer MUST  
 1266 respond as if the client supplied the value: 'subscription-id'.

1267 "job-id" (integer(1:MAX)) - If the client supplies this attribute, all of the Per-Job Subscription objects for  
 1268 the identified job are candidates for return. If this attribute is omitted, all of the Per-Printer  
 1269 Subscription objects are candidates for return.

1270 "my-subscriptions" (boolean) - If the client supplies the "my-subscriptions" with a 'false' value or omits it,  
 1271 the Printer returns all subscriptions, subject to the security policy in force.

1272 Groups 3 to N: Subscription Object Attributes: The Printer object responds with one set of Subscription  
 1273 Object Attributes for each returned Subscription object. The Printer object ignores (does not  
 1274 respond with) any requested attribute or value which is not supported or which is restricted by the  
 1275 security policy in force, including whether the requesting user is the user that created the  
 1276 Subscription object (subscribing user) or not (see [ipp-mod] section 8).

### 1277 8.3.3 Renew-Subscription operation

1278 The REQUIRED Renew-Subscription operation permits a client to request the IPP Printer to extend the  
 1279 lease on a Subscription object instance. There is no way to renew a Per-Job subscription, since they are  
 1280 automatically canceled after the job completes and no longer has any documents, i.e., the job is no longer  
 1281 retained (see [ipp-mod] section 4.3.7.2). If the requested subscription object is a Per-Job subscription, the  
 1282 Printer MUST grant an infinite lease by returning a 0 value for the "notify-lease-expiration-time".

1283 *Access Rights:* The authenticated user (see [IPP-MOD] section 8.3) performing this operation MUST either  
 1284 be the owner of the Subscription object or have operator or administrator access rights for the Printer object  
 1285 (see [IPP-MOD] sections 1 and 8.5). Otherwise the IPP object MUST reject the operation and return:  
 1286 client-error-forbidden, client-error-not-authenticated, and client-error-not-authorized as appropriate.

1287 Request :

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

1288 Response :

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

1289 **ISSUE 03 - Should Renew-Subscription Request have a Group 2 for its two Subscription attributes?**1290 **ISSUE 04 - Should Renew-Subscription Response have a Group 3 for its two Subscription attributes?**

1291 Attribute Notes:

1292 "notify-lease-time-requested" (integer(0:MAX)) - the number of seconds requested for the Per-Printer  
 1293 subscription lease. Same as Create-Printer-Subscriptions (see section 8.2.1).

1294 "notify-lease-expiration-time" - the time in the future when the subscription will expire. Same as for the  
 1295 Create-Printer-Subscription operation (see section 8.2.1).

1296 "notify-printer-up-time" - the Printer object MUST return this attribute which is an alias for the Printer's  
 1297 "printer-up-time" Printer Description attribute. The client subtracts this value from the "notify-  
 1298 lease-expiration-time" value returned in order to determine the number of second in the future that  
 1299 the subscription will expire (see further explanation in section 8.2.1).

1300 Note: There is no way to change any of the Subscription object attributes, except the "notify-lease-  
 1301 expiration-time" attribute (using the Renew-Subscription operation). In order to change other attributes, a  
 1302 client can create a new Subscription object and then use the Cancel-Subscription operation to cancel the old  
 1303 one (or do this in the other order, in case there is a limit on the number of Subscription object instances, as  
 1304 long as a short window with no Notifications is ok).

1305 Note: There is no need to renew a Per-Job Subscription, since it is effectively the time that the Job is active  
 1306 (see section 8.1).

### 8.3.4 Cancel- Subscription operation

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

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

Request :

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

Response :

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

## 9 Comparison of Per-Job versus Per-Printer Subscriptions

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

1. A client usually creates a Per-Job subscription as part of the Job Creation operations (Create-Job, Print-Job, and Print-URI), rather than using the OPTIONAL Create-Job-Subscription operation, especially since some Printer implementations MAY not support the Create-Job-Subscription operation, since it is OPTIONAL.

- 1333 2. For Per-Job subscriptions, the subscription is only valid while the job is "not-complete" (see sections  
 1334 7.2 and 7.3) while for the Per-Printer subscriptions, the subscription is valid until the time (in seconds)  
 1335 that the Printer returned in the "notify-lease-expiration-time" operation attribute expires.
- 1336 3. Job Events in a Per-Job subscription apply only to "one job" (the Job created by the job creation  
 1337 operation or references by the Create-Job-Subscription operation) while Job Events in a Per-Printer  
 1338 subscription apply to ALL jobs contained in the IPP Printer object.

## 1339 10 Out of Band Values

1340 This section defines out-of-band values (see [ipp-mod] section 4.1) for use with attributes defined in this  
 1341 and other documents.

### 1342 10.1 'none'

1343 This "out-of-band" value allows a client, in a request, to specify that the value of an attribute MUST be  
 1344 semantically equivalent to 'none.' This out-of-band value is needed since attributes that are of the  
 1345 'collection', 'uri', 'mimeType', 'name', or 'text' syntax can be problematic when a client wishes to  
 1346 specify that an xxx-default attribute MUST NOT be applied to the job. Unlike the 'keyword' or 'enum'  
 1347 attribute syntax, where the value of 'none' (or its equivalent) can be a standard value, other attribute  
 1348 syntaxes have no such mechanism.

1349 A Printer MUST support the use of the "out-of-band" value for any attribute that calls for its use, such as  
 1350 any Job Template attribute that has the 'collection' attribute syntax, if the Printer supports the use of the  
 1351 'collection' attribute syntax for that attribute.

1352 When a client sends a request to the printer object, the "out-of-band" value 'none' MUST only be used for  
 1353 attributes whose definitions explicitly indicate that the use of "out-of-band" value 'none' is allowed. A  
 1354 client MUST NOT use the "out-of-band" 'none' value for attributes whose definition does not explicitly call  
 1355 out its use.

'none'	The specified attribute in the request MUST NOT be applied to the job. Specifically, this value overrides the Printer's "xxx-default" attribute value for the attribute, if one exists.
--------	-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

1356 ISSUE 05 - The out-of-band 'none' value is also defined in the PWG Production Printing document.  
 1357 Should we keep the definition here in the Notification document? And/or should we move the definition to  
 1358 the 'collection' specification (ipp-coll) which is also defining the tag for the 'collection' attribute syntax that  
 1359 is the province of the IPP Transport and Encoding document?

## 1360 11 Conformance Requirements

1361 This section further enhances the Conformance Requirements detailed in [IPP-MOD] section 5. Extensions  
 1362 made to the events herein must be made such that new events or event attributes are backward compatible  
 1363 to clients who implemented early versions of this notification specification.

1364 It is OPTIONAL to implement this Event Notification specification. If this Event Notification specification  
 1365 is implemented, IPP objects MUST support all of the REQUIRED object attributes as defined in this  
 1366 document in the indicated sections:

- 1367 1. REQUIRED Subscription object attributes in section 5.
- 1368 2. REQUIRED Printer Description object attributes in section 6.
- 1369 3. REQUIRED attributes in Notification content in section 7.

1370 If this Event Notification specification is implemented, the operations described in section 8 MUST be  
 1371 supported as described in Table 8:

1372 **Table 8 - Conformance Requirements for Operations**

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

1373

## 1374 **12 IANA Considerations**

1375 IANA will be called on to register URL schemes for notification delivery for use in the "notification-  
 1376 recipient" attribute, using the same procedures outlined in [ipp-mod].

## 1377 **13 Internationalization Considerations**

1378 This IPP notification specification continues the internationalization of [ipp-mod] for attributes containing  
 1379 text strings and names. A subscribing client can specify a different natural language and charset for each  
 1380 Notification content delivered to a Notification Recipient.

1381 The Human Consumable Notification content is a 'text/plain; charset=utf-8' by default where the  
 1382 Notification Sender has localized the text message as requested by the subscriber for the intended  
 1383 Notification Recipient.

## 1384 **14 Security Considerations**

1385 By far the biggest security concern is the abuse of notification: sending unwanted notifications to third  
 1386 parties (i.e., spam). The problem is made worse by notification addresses that may be redistributed to  
 1387 multiple parties (e.g. mailing lists). There exist scenarios where third party notification is required (see  
 1388 Scenario #2 and #3 in [ipp-not-req]). The fully secure solution would require active agreement of all  
 1389 recipients before sending out anything. However, requirement #9 in [ipp-req] ("There is no requirement for

1390 IPP Printer receiving the print request to validate the identity of an event recipient”) argues against this.  
1391 Certain systems may decide to disallow third party notifications (a traditional fax model).

1392 Clients submitting notification requests to the IPP Printer has the same security issues as submitting an  
1393 IPP/1.1 print job request. The same mechanisms used by IPP/1.1 can therefore be used by the client  
1394 notification submission. Operations that require authentication can use the HTTP authentication.  
1395 Operations that require privacy can use the HTTP/TLS privacy.

1396 The notification access control model should be similar to the IPP access control model for Jobs. Creating  
1397 a Per-Printer Notification Subscription object is associated with a user. Only the creator or an operator can  
1398 cancel the subscription. The system may limit the listing of items to only those items owned by the user.  
1399 Some subscriptions (e.g. those that have a lifetime longer than a job) can be done only by privileged users  
1400 (users having operator and/or administrator access rights), if that is the authorization policy.

1401 The standard security concerns (delivery to the right user, privacy of content, tamper proof content) apply  
1402 to the notification delivery. IPP should use the security mechanism of the delivery method used. Some  
1403 delivery mechanisms are more secure than others. Therefore, sensitive notifications should use the delivery  
1404 method that has the strongest security.

## 1405 **15 Status Codes**

1406 The following status codes are defined as extensions for notification:

### 1407 **15.1 'successful-ok-ignored-subscriptions' (0x0003)**

1408 The number of subscriptions supplied in a Job Creation operation (Create-Job, Print-Job, Print-URI)  
1409 exceeds either the limit of Per-Job subscriptions supported per job as specified by the Printer's "max-job-  
1410 subscriptions-supported" attribute or some implementation-defined limit on the total number of Per-Job  
1411 subscriptions for the Printer (if any). The Printer MUST accept the request with this status code, MUST  
1412 return the "job-notify" attribute in the Unsupported Attributes Group with only the collection value(s) that  
1413 represent the excess subscriptions that are being ignored, and MUST perform the Job Creation operation  
1414 (see section 8.1.1), since the job can still be printed.

1415 This status code is returned even if other job attributes are unsupported or in conflict. That is, if an IPP  
1416 Printer finds a warning that would allow it to return 'successful-ok-ignored-subscriptions' and either  
1417 'successful-ok-ignored-or-substituted-attributes' and/or 'successful-ok-conflicting-attributes', it must return  
1418 'successful-ok-ignored-subscriptions'. In other words, the precedence for returning success codes is:  
1419 'successful-ok-ignored-subscriptions', 'successful-ok-conflicting-attributes', and 'successful-ok-ignored-or-  
1420 substituted-attributes'.

### 1421 **15.2 client-error-uri-notification-scheme-not-supported (0x04??)**

1422 The scheme of the client-supplied URI in a "notify-recipient" operation attribute in a Create-Printer-  
1423 Subscription or Create-Printer-Subscription operation is not supported. See [ipp-mod] section 3.1.7.

1424 There is no corresponding Per-Job subscription error for a Job Creation operation, since the Printer object  
1425 MUST ignore any errors in the "job-notify" operation attribute, MUST return the "notify-recipient"  
1426 attribute in the Unsupported Attributes Group, and perform the Job Creation operation (see section 8.1.1),  
1427 since the job can still be printed.

### 1428 **15.3 server-error-too-many-subscriptions (0x04??)**

1429 The bounded set of concurrent Per-Printer subscriptions supported by the Printer object would be exceeded  
1430 if this request were accepted.

1431 Note: There is no corresponding Per-Job subscription error, since the Printer object **MUST** ignore any  
1432 errors in the "job-notify" operation attribute and perform the Job Creation operation (see section 8.1.1),  
1433 since the job can still be printed.

### 1434 **15.4 server-error-too-many-events (0x04??)**

1435 The client supplied more events in the "notify-events" operation attribute in a Create-Job-Subscription or  
1436 Create-Printer-Subscription operation than the Printer supports, as indicated in its "max-events-supported"  
1437 attribute (see section 6.4).

1438 There is no corresponding Per-Job subscription error for a Job Creation operation, since the Printer object  
1439 **MUST** ignore any errors in the "job-notify" operation attribute, **MUST** return the "notify-events" attribute  
1440 in the Unsupported Attributes Group with only the excess events that are being ignored, and perform the  
1441 Job Creation operation (see section 8.1.1), since the job can still be printed.

## 1442 **16 Additions to the IPP Encoding and Transport Document**

1443 The Subscription object tag needs to be assigned in section 3.7.1 Delimiter Tags:

### 1444 **3.7.1 Delimiter Tags**

1445 The following table specifies the values for the delimiter tags:

<b>Tag Value (Hex)</b>	<b>Delimiter</b>
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

1446 When an xxx-attributes-tag occurs in the protocol, it **MUST** mean that zero or more following attributes up  
1447 to the next delimiter tag are attributes belonging to group xxx as defined in the model document, where xxx  
1448 is operation, job, printer, unsupported, subscription.

1449 Doing substitution for xxx in the above paragraph, this means the following. When an operation-attributes-  
1450 tag occurs in the protocol, it **MUST** mean that the zero or more following attributes up to the next delimiter  
1451 tag are operation attributes as defined in the model document. When an job-attributes-tag occurs in the  
1452 protocol, it **MUST** mean that the zero or more following attributes up to the next delimiter tag are job  
1453 attributes or job template attributes as defined in the model document. When a printer-attributes-tag occurs  
1454 in the protocol, it **MUST** mean that the zero or more following attributes up to the next delimiter tag are

1455 printer attributes as defined in the model document. When an unsupported-attributes-tag occurs in the  
1456 protocol, it MUST mean that the zero or more following attributes up to the next delimiter tag are  
1457 unsupported attributes as defined in the model document. When a subscription-attributes-tag occurs in the  
1458 protocol, it MUST mean that the zero or more following attributes up to the next delimiter tag are  
1459 subscription attributes as defined in the [ipp-not] document.

1460 Add a reference to [ipp-not].

## 1461 **17 References**

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- 1491 [RFC2566]  
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## 1541 **A. Appendix - Summary of Notification Attribute Usage**

1542 This appendix summarizes the usage of Notification attributes in the Job operation attribute collection, Job  
1543 object, Subscription object, Notification content, Job operations, and Subscriptions operations.

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

1544 Legend: "R" - REQUIRED for Printer to support; "O" - OPTIONAL for Printer to support; "[ ]" - OPTIONAL for sender to send;  
1545 Return - Printer MUST return; \* - MUST be 0 for Per-Job Subscription objects; (n) means the value comes from the indicated  
1546 Subscription Attribute

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

1548 Legend: "R" - REQUIRED for Printer to support; "O" - OPTIONAL for Printer to support; "[ ]" - OPTIONAL for sender to send;  
1549 "[pg/cp]" - REQUIRED in a 'job-progress' or 'job-completed' notification if the corresponding Job attributes are supported ; (nn) - an  
1550 alternate source of the data in a Notification.

1551

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

1552 Legend: "R" - REQUIRED for Printer to support; "O" - OPTIONAL for Printer to support; "[ ]" - OPTIONAL for sender to send;

1553 "CR" - CONDITIONALLY REQUIRED, i.e., REQUIRED if Human Consumable format supported;

1554

## 1555 **B. Appendix: Change History**

1556 This section summarizes the changes to the document. Each sub-section is in reverse chronological order.  
1557 Adding or removing ISSUES that don't change the document are not listed here.

### 1558 **18.1 Changes to the October 14, 1999 version to create the February 2, 2000 version**

1559 The following changes were made to the October 14, 1999 version to create the February 2, 2000 version  
1560 based on the agreements reached at the October and December IPP WG meetings and reflected in the  
1561 minutes:

- 1562 1. Added a Java Listener as an example of a Notification Recipient.
- 1563 2. Clarified the object relationships in section 4.1.
- 1564 3. Clarified how job events differ for Per-Job versus Per-Printer Subscriptions.
- 1565 4. Added the ability for the Machine Consumable form to contain a Human Readable "human-readable-  
1566 report" (text) attribute so that both forms could be sent in the same Notification.
- 1567 5. Clarified that the 'none' value for notify-text-format (mimeType) has to be out-of-band, not the  
1568 text string 'none' as a mimeType.
- 1569 6. Clarified that 'none' means send the Machine Consumable form without the "human-readable-report"  
1570 (text) attribute, if it is defined.
- 1571 7. Clarified that Notification Recipients MUST be able to accept unrecognized attributes.
- 1572 8. Allowed the notification delivery method definition to be modeled as (1) a request with an operation  
1573 code without a response, (2) a request with a operation code with a response or (3) a response with a  
1574 status code.
- 1575 9. Added "notify-text-format" (mimeType) and "human-readable-report" (text(MAX)) to be able to  
1576 be sent in a Notification content, if the notification delivery method document permits it.
- 1577 10. Added "job-k-octets" (integer(0:MAX)), "job-impressions" (integer(0:MAX)), and "job-media-sheets"  
1578 (integer(0:MAX)) as OPTIONAL for Notification content for use in job-progress events to show the  
1579 target values so that the Notification Recipient can show a thermometer.
- 1580 11. Added a Subscription Attributes group (and subscription-attributes tag) the Create-Job-Subscription and  
1581 Create-Printer-Subscription requests and responses.
- 1582 12. Added the 'none' out-of-band value for use with "notify-text-format" (mimeType) attribute.
- 1583 13. Changed the job progress attributes from using -2 to mean 'unknown' as in the PWG Job Monitoring  
1584 MIB, to use the 'unknown' out-of-band value.

1585

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