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S. Isaacson  
Novell, Inc.  
J. Martin  
Underscore  
R. deBry  
Utah Valley State College  
T. Hastings  
Xerox Corporation  
M. Shepherd  
Xerox Corporation  
R. Bergman  
Dataproducts Corp.  
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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 a  
34 subscription, and cancel a 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.

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75

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## 169 **1 Introduction**

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

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

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

- 178 Internet Printing Protocol/1.0 & 1.1: "Notification Delivery Method xxx [TBD]
- 179 Internet Printing Protocol/1.0 & 1.1: "Notification Delivery Method yyy [TBD]

180

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

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

### 193 **1.1 Notification Overview**

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

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

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

- 200 1. the names of Job and/or Printer events that are of interest to the Notification Recipient
- 201 2. the delivery method and address to use to deliver the notification to one Notification Recipient
- 202 3. if Human Consumable notification content is to be sent, which text format

- 203 4. some opaque data that the subscriber wants to be sent to the Notification Recipient in the  
204 Notification, perhaps to identify either the subscriber or the ultimate recipient
- 205 5. the charset to use in the Notification, if it is to be different than the one used in the request that  
206 created the subscription
- 207 6. the natural language to use in the Human Consumable Notification, if it is to be different than the  
208 one used in the request that created the subscription
- 209 7. the requested lease time in seconds for the subscription
- 210 8. whether or not the subscription is requested to be persistent across power cycles.

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

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

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

231

**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

232

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

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

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

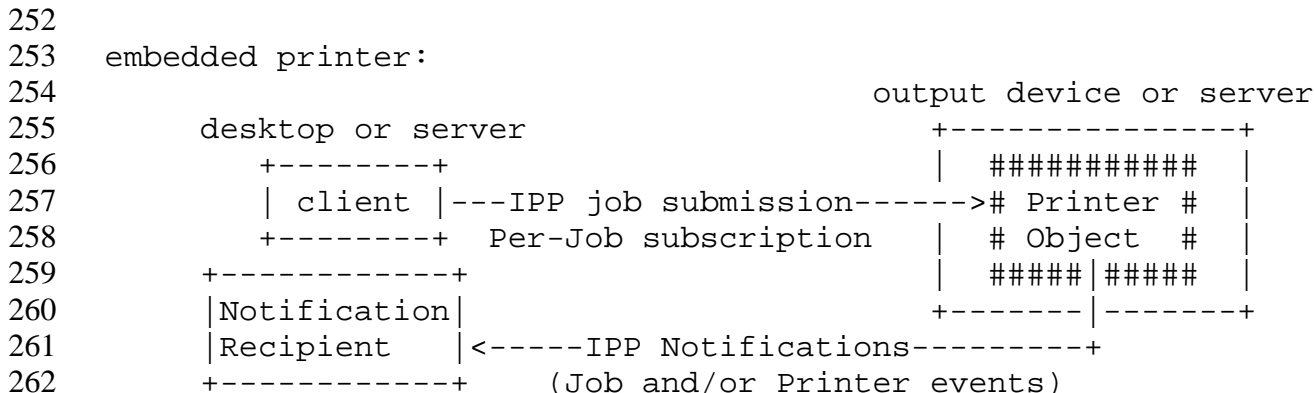
244 **2 Model for Per-Job and Per-Printer Subscription and Event Notification**

245 **2.1 Model for Per-Job Subscription and Notification**

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

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

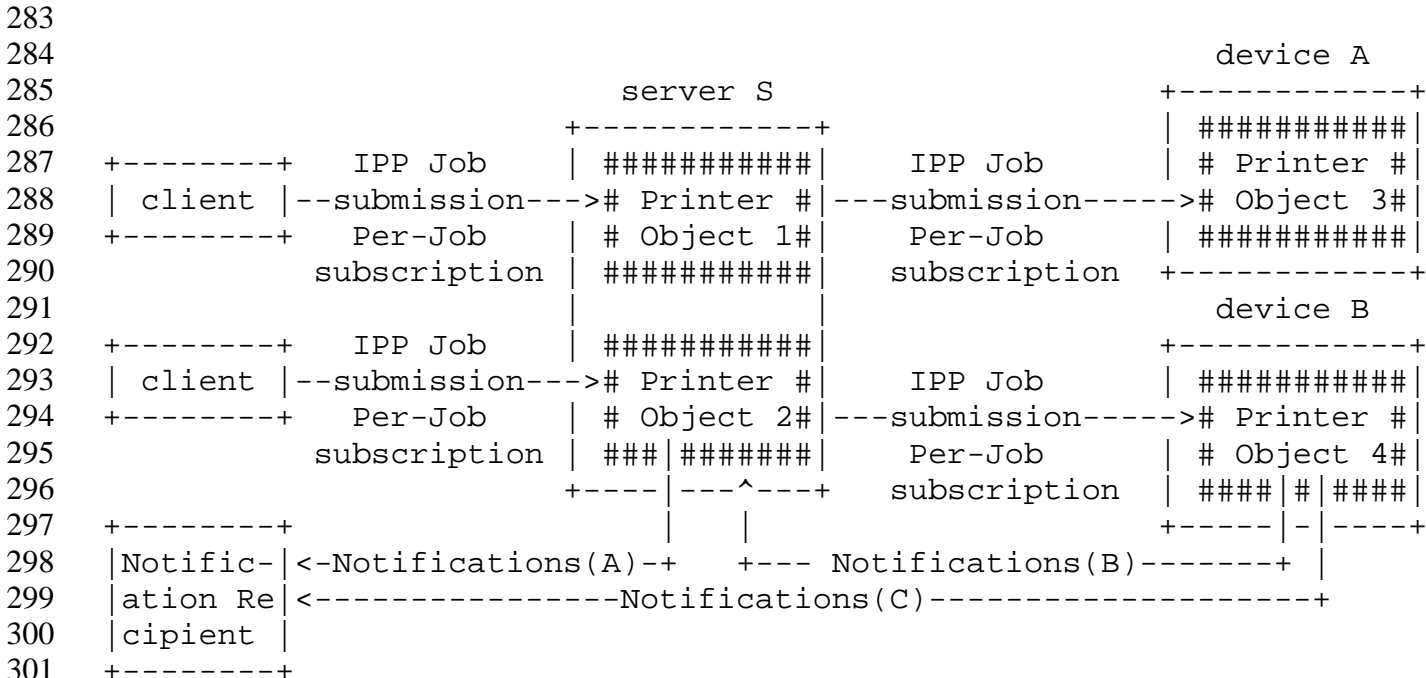




**Figure 1 - Client-Printer Per-Job Subscription and Notification Model**

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

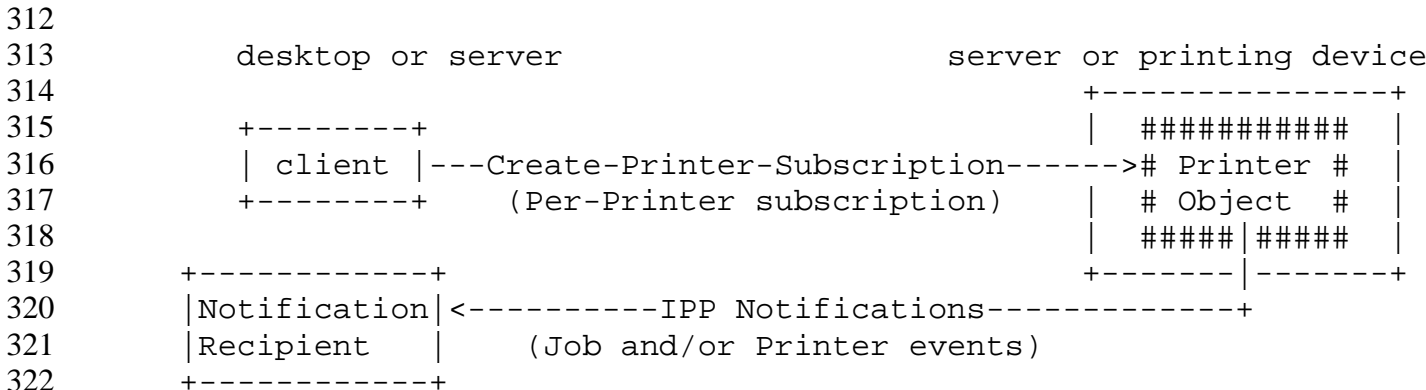
- 268 1. forward the Per-Job subscriptions to the down stream IPP Printer and let it perform the  
 269 notification directly to the Notification Recipients supplied by the Client (Notifications(C)) and  
 270 use Per-Printer Subscriptions for the Server's own purposes.
- 271 2. save the client-supplied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



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

303 **2.2 Model for Per-Printer Subscription and Notification**

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



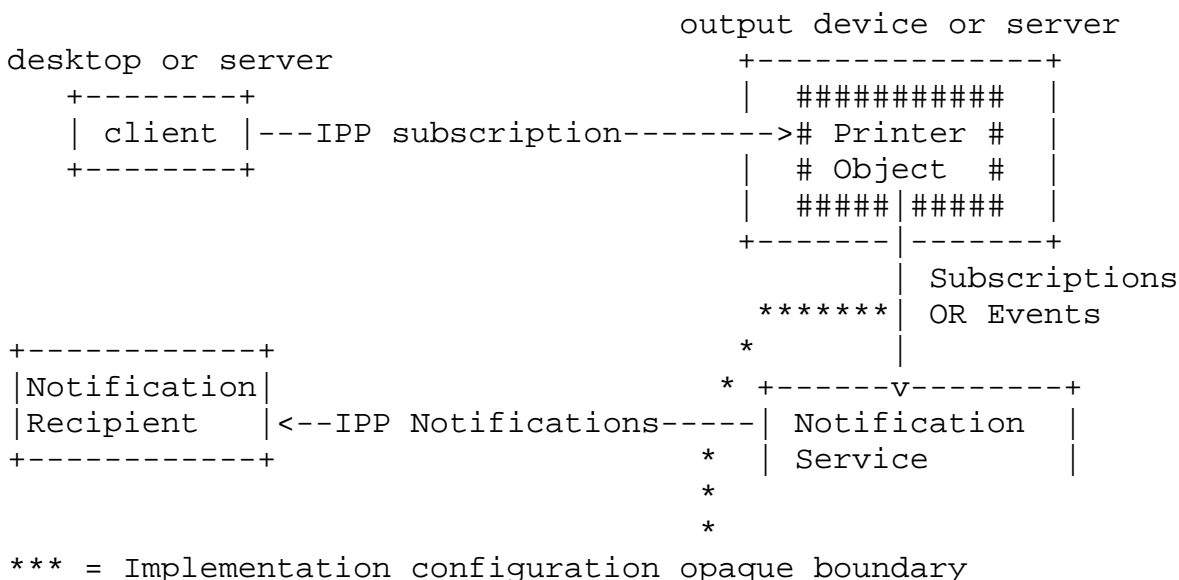
323 **Figure 3 - Client-Printer Per-Printer Subscription and Notification Model**

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

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

329 **1.1.1.2.3.1 Use of a Notification Service transparently to clients**

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



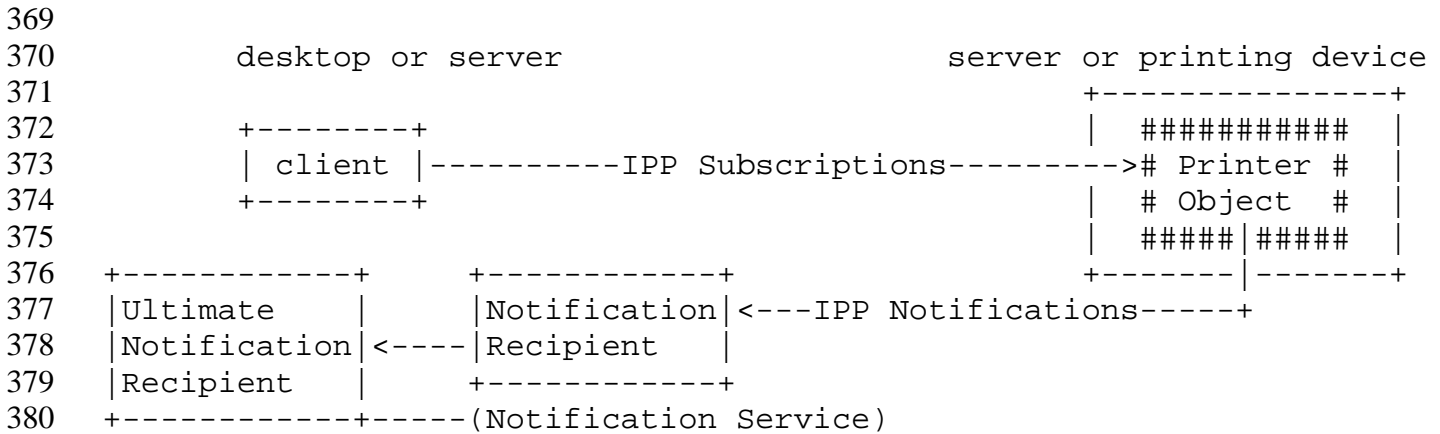
353 **Figure 4 - Opaque Use of a Notification Service Transparent to the Client**

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

356 **2.3.2 Use of Notification Service transparently to the IPP Printer**

357 Another way that a Notification Service can be used is if the Notification Recipient indicated in the IPP  
 358 Subscription is a notification service (transparent to the IPP Printer), which in turn forwards the  
 359 Notification to the Ultimate Notification Recipient using additional parameters in the IPP Subscription  
 360 (URI parameters or subscriber user data). In such cases, the Ultimate Notification Recipient has also  
 361 subscribed directly with the other notification service (by means outside this document). As far as the IPP  
 362 Printer is concerned, the IPP Subscription indicated that the IPP Printer is to delivery Notifications to the  
 363 Notification Recipient (Notification Service) using the specified notification delivery method. The method  
 364 that the Notification Recipient uses for delivering the notification to the Ultimate Notification Recipient is  
 365 beyond the scope of this document and is transparent to the IPP Printer. However, the client does have to

366 know how to pass additional information to the Notification Recipient in the IPP Subscription using either  
 367 extra parameters in the URI or subscriber user data. Examples of this latter approach are paging,  
 368 immediate messaging services, and NOS vendors infrastructure. Figure 5 shows this approach.



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

### 382 3 Terminology

383 This section defines terminology used throughout this document.

#### 384 1.13.1 Conformance Terminology

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

389 *Since support of this entire notification specification is OPTIONAL for conformance to*  
 390 *IPP/1.0 or IPP/1.1, the use of the term REQUIRED (R) in this document means*  
 391 *"REQUIRED if this notification specification is implemented". Likewise, the term*  
 392 *RECOMMENDED means "RECOMMENDED if this notification specification is*  
 393 *implemented" and OPTIONAL (O) means OPTIONAL if this notification specification is*  
 394 *implemented.*

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

#### 397 1.23.2 Other terminology

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

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

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

404 **Job Submitting Application** - An application (for example, a batch application), acting on behalf of a  
 405 Job Submitting End User, which submits a print job to an IPP Printer. The application may or may

406 not be within the same security domain as the Printer. This application may or may not be  
407 geographically near the printer.

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

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

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

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

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

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

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

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

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

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

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

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

448 **Notification Recipient** - The entity identified as a recipient within a subscription that receives IPP  
449 Notifications about Job and/or Printer events (see Figure 4 and Figure 5). A Notification Recipient  
450 may be a: Job Submitting End User, Job Submitting Application (desktop or server), Job Recipient,

451 Job Recipient Proxy, a Notification Service, an Operator, or Administrator, etc., and their  
452 representative or log file or usage statistics gathering application or other active or passive entities.

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

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

461 Events can be classified along two dimensions:

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

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

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

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

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

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

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

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

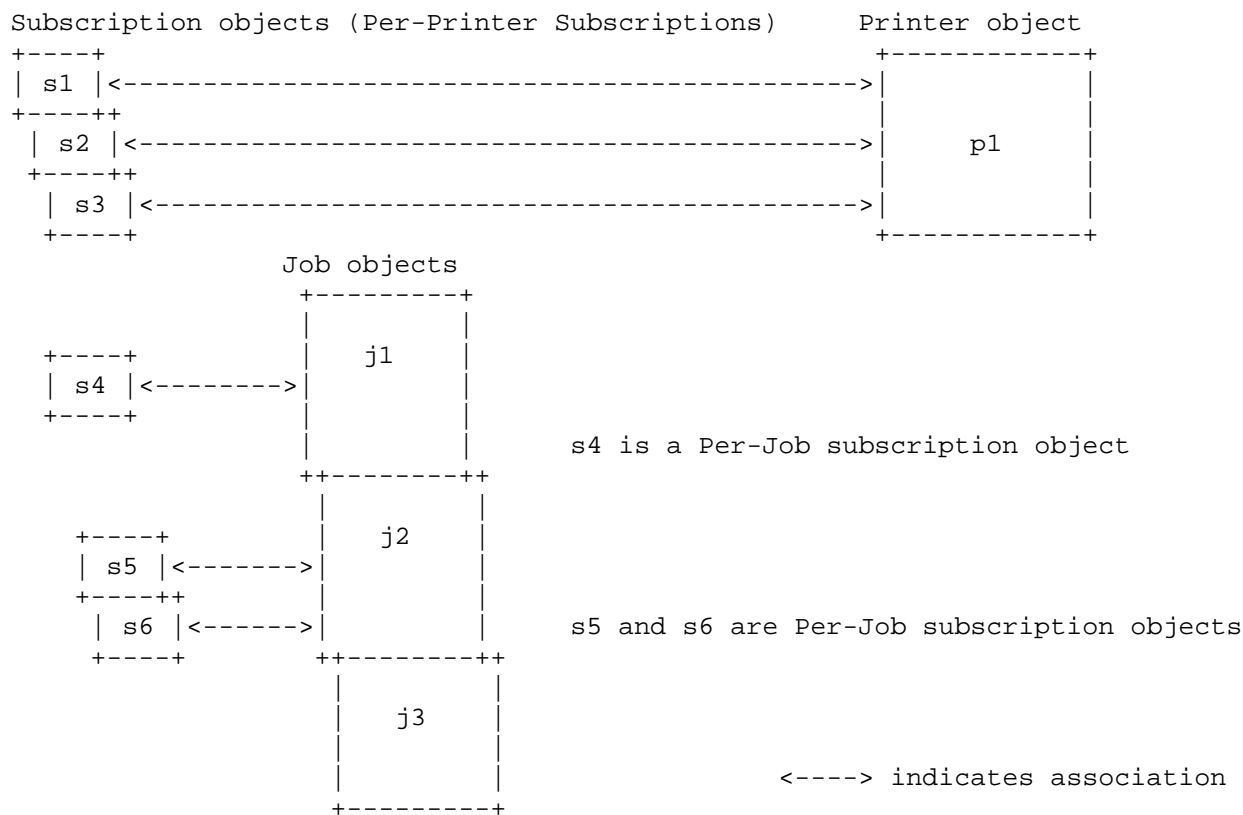
486 **Human Consumable Notification** - Notifications that are intended to be consumed by human End  
487 Users only. They are simple text that has been localized for the Notification Recipient as specified  
488 in the subscription. Programs are not intended to parse Human Consumable Notification, since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

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

## 4 Object Model for Notification

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

The object relationships can be seen pictorially as:



**Figure 6 - Object Model for Notification**

s1, s2, and s3 are Per-Printer Subscription objects and can identify Printer and/or Job events.  
 s4, s5, and s6 are Per-Job subscription objects and can identify Printer and/or Job events.

### 4.1 Object relationships

The object relationships can be stated as follows:

1. The Printer object contains zero or more Per-Printer Subscription objects (p1 contains s1-s3 Per-Printer Subscription objects).

- 538 2. Each Per-Printer Subscription object (s1, s2, and s3) is contained in one Printer object (p1) and each  
539 represents one Per-Printer subscription.
- 540 3. Each "Per-Printer" Subscription object identifies one or more Job and/or Printer events. Such Job  
541 events are for *all* jobs on the Printer. Such Printer events are for *any* Printer event, no matter which  
542 job is processing and when no jobs are processing.
- 543 4. A Job object is associated with zero or more Per-Job subscription objects. Job j1 is associated with  
544 Per-Job subscription object s4, Job j2 is associated with Per-Job subscription objects s5 and s6, and  
545 Job j3 is not associated with any Per-Job subscription object. Note: the IPP notification interface  
546 semantics are defined so that an implementation MAY associate Per-Job Subscription objects with  
547 Job objects by having the Job objects actually contain its associated Per-Job Subscription objects or  
548 MAY just use some internal bi-directional linking mechanism between the Job and Subscription  
549 objects. Either implementation technique is transparent to the client.
- 550 5. Each "Per-Job" subscription object identifies one or more Job and/or Printer events. Such Job  
551 events are only for *this* job (different than "per-Printer" Subscriptions). Such Printer events are for  
552 *any* Printer event, no matter which job and when no jobs are processing (same as for "per-Printer"  
553 Subscriptions).
- 554 6. A Per-Printer Subscription object cannot be contained in or associated with more than one Printer  
555 object.
- 556 7. A Per-Job Subscription object cannot be contained in or associated with more than one Job object.

## 557 **5 Subscription Object attributes**

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



561

**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 (mimeType)	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

562

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

563

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

564

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

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

571 **5.1 notify-recipient (uri)**

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

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

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

- 579 1) The URI scheme used.
- 580 2) The supported and default delivery format, and if not one of the specified types in Section 5.3,  
 581 description of the notification content.
- 582 3) Any content length restrictions imposed by the delivery protocol.
- 583 4) The latency of the delivery protocol used.
- 584 5) The reliability of the transport and delivery protocol used.
- 585 6) The security aspects of the transport and delivery protocol used, e.g. how it is handled in firewalls.
- 586 7) How the delivery protocol is initiated, e.g. does it have to be initiated by the receiving user (pull), or  
 587 is it initiated by the notification service (push).

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

591 **5.2 notify-events (1setOf type2 keyword)**

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

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

598 The events are defined to be disjoint.

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

600 The standard job event keyword values are:

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

603 **'job-created'**: REQUIRED - the Printer object has accepted a job creation operation (Print-Job, Print-  
604 URI, or Create-Job) and the job's "time-at-creation" attribute value is set (see [ipp-mod] section  
605 4.3.14.1). The Printer puts the job in the 'pending', 'pending-held' or 'processing' states.

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

609 **'job-completed'**: REQUIRED - the job has reached one of the completed states, i.e., the value of the  
610 job's "job-state" attribute has changed to: 'completed', 'aborted', or 'canceled'. The Job's "time-at-  
611 completed" and "date-time-at-completed" (if supported) attributes are set (see [ipp-mod] section  
612 4.3.14).

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

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

620  
621 This event also indicates that one or more values have been added to or removed from the Job's  
622 "job-state-reasons" attribute, such as 'job-queued' or 'job-printing', whether or not the job's state has  
623 changed. If job state reasons are added when the job is created, only the 'job-created' event is  
624 generated, in order to keep the events disjoint. If job state reasons are added or removed when the  
625 job is completed, only the 'job-completed' event is generated, in order to keep the events disjoint.

626  
627 A client that wants to subscribe to all job state changes, including creation and completion, includes  
628 the 'job-created', 'job-state-changed', and 'job-completed' in the notification subscription. When a  
629 job is finally removed from the Job History (see [ipp-mod] 4.3.7.1) no event is generated, i.e.,  
630 neither a 'job-state-changed' event nor a 'job-purged' event is generated.

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

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

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

642

643 The standard Printer event keywords values are:

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

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

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

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

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

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

663  
664 A client that wants to subscribe to all printer state changes, including restart and power-  
665 down/shutdown, includes the 'printer-restarted', 'printer-state-changed', and 'printer-shutdown' in the  
666 notification subscription.

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

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

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

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

688 jobs previously and rejected a Print-Job, Print-URI, Create-Job, Send-Document, or Send-URI  
689 operation.

690 **'printer-almost-idle'**: OPTIONAL – when the Printer needs another Job in order to stay busy. This  
691 event is used when a spooler is feeding more than one printer/server (fan-out), and the spooler holds  
692 jobs until a Printer requests them, rather than committing jobs to IPP Printers before it is necessary.  
693 This event MAY be used by a Printer implementation to request a new job from any subscribers  
694 sufficiently ahead of time so that the device does not run out of work between jobs.  
695

### 696 **5.3 notify-text-format (mimeMediaType)**

697 This REQUIRED READ-ONLY Subscription object attribute indicates the type of Human Consumable  
698 format content that is to be sent in the notifications, instead of the Machine Consumable format defined for  
699 the notification scheme, if any. Most delivery methods are defined to have a particular Machine  
700 Consumable forms of notification content type and to permit Human Consumable forms as well. An  
701 implementation MAY support one or more Human Consumable formats, i.e., 'text' MIME media types, for  
702 those delivery methods that permit the Human Consumable form.

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

706 If the Subscriber did not supply this attribute when requesting the subscription, the Printer object populates  
707 this Subscription object attribute with either the 'none' value or one of the values of the Printer's "notify-  
708 text-format-supported" attribute (see section 6.5), depending on whether or not the delivery method  
709 specified in the "notify-recipient" attribute is defined to have a Machine Consumable format (usual),  
710 respectively. In the latter case, the value selected depends on the implementation.

711 Standard mimeMediaType values are:

712 'none': Indicates that the notification content is not to be any of the text types, i.e., that the Machine  
713 Consumable, not the Human Consumable, form is to be sent. If the client omits supplying this  
714 attribute, the meaning is the same as if the client supplied the 'none' value.  
715

716 'text/plain; charset=utf-8': A plain text document in ISO 10646 represented as UTF-8 [RFC2279] as  
717 defined in section 7.  
718

719 'text/html': An HTML document [rfc????].  
720

### 721 **5.4 subscriber-user-data (octetString(63))**

722 This REQUIRED READ-ONLY Subscription object attribute holds opaque information being sent from  
723 the Subscriber to the Notification Recipient, such as the identify of the Subscriber or a path or index to  
724 some Subscriber information. Or it MAY contain a key that the Notification Recipient needs in order to  
725 process the Notification, such as the ultimate recipient, if the Notification Recipient is a general application  
726 that in turn forwards notifications and the ultimate recipient isn't included in the value of the "notify-  
727 recipient" attribute. An Instant Messaging Service is an example of such a general application where the

728 "subscriber-user-data" might be the user's id for that messaging service and the "notification-recipient" is  
729 the URL of the messaging service.

### 730 **5.5 notify-charset (charset)**

731 This OPTIONAL READ-ONLY Subscription object attribute specifies the charset to be used in the  
732 Notification content sent to the Notification Recipient, whether the notification content is Machine  
733 Consumable or Human Consumable. This attribute MUST NOT be used when the "notify-text-format"  
734 attribute value specifies the charset parameter in its MIME media type value, e.g., 'text/plain; charset=utf-  
735 8'.

### 736 **5.6 notify-natural-language (naturalLanguage)**

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

### 740 **5.7 request-id**

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

### 746 **5.8 subscription-id (integer (1:MAX))**

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

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

### 760 **5.9 notify-lease-expiration-time (integer(0:MAX))**

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

765 Subscription objects always return a value of 0 since Per-Job Subscriptions don't have a lease, but exist for  
766 the life-time of the Job instead.

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

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

### 774 **5.10 printer-uri (uri)**

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

### 779 **5.11 subscriber-user-name (name(MAX))**

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

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

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

### 794 **5.12 notify-printer-up-time (integer(1:MAX))**

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

799 Note: A client can request this attribute in a Get-Subscription-Attributes or Get-Subscriptions request and  
800 use the value returned in combination with the "notify-lease-expiration-time" (see section 5.9) in order to  
801 display wall clock time equivalent to the user. The difference between this attribute and the 'integer' value  
802 of the "notify-lease-expiration-time" attribute is the number of seconds in the future that the subscription

803 will expire. A client can compute the wall-clock time at which the subscription will expire by adding this  
 804 difference to the client's wall-clock time.

805 **5.13 notify-persistence-granted (boolean)**

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

808 **6 Printer Description Attributes related to Notification**

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

813 **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

814  
 815 **6.1 notify-schemes-supported (1setOf uriScheme)**

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

818 **6.2 notify-events-default (1setOf type2 keyword)**

819 This REQUIRED Printer attribute identifies the event values if the client does not supply the "notify-  
 820 events" operation attribute in either a Job creation request, Create-Job-Subscription, or the Create-Printer-



821 Subscription request. Any value in this attribute MUST also appear in the notify-events-supported  
822 attribute, i.e., be a supported event.

### 823 **6.3 notify-events-supported (1setOf type2 keyword)**

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

### 826 **6.4 max-events-supported (integer(5:MAX))**

827 This REQUIRED Printer attribute specifies the maximum number of events that are supported in a single  
828 Per-Job or Per-Printer subscription which must be the same. A Printer MUST support at least 5 events per  
829 subscription, so that clients can depend on at least 5 events in a single subscription. If the number of events  
830 supplied by a client in a subscription exceed this number, the Printer rejects the request and returns the  
831 'server-error-too-many-events' (see section 14.4). If notification is not supported, this attribute MUST NOT  
832 be supported.

### 833 **6.5 notify-text-format-supported (1setOf mimeType)**

834 This CONDITIONALLY REQUIRED Printer attribute identifies the MIME media types supported for  
835 Human Consumable notification content for those notification delivery methods that support Human  
836 Consumable format (most do). If an implementation supports any Human Consumable formats, it MUST  
837 support this attribute and MUST support those Human Consumable formats for all notification delivery  
838 methods that permit a Human Consumable format. If the implementation does not support any Human  
839 Consumable MIME media types, then the 'none' MUST be the only value of this attribute or this attribute  
840 MUST NOT be supported at all.

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

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

### 855 **6.6 max-job-subscriptions-supported (integer(1:MAX))**

856 This REQUIRED Printer attribute specifies the maximum number of Per-Job subscriptions that are  
857 supported for a job, i.e., the maximum number of collection values for the "job-notify" operation attribute,  
858 and/or the maximum number of subsequent Create-Job-Subscription operation requests in combination for

859 a job. A value of 0 indicates no effective maximum. A Printer MUST support at least 1 Per-Job  
 860 subscription. If the number of Per-Job subscriptions supplied by a client in a Job Creation request exceeds  
 861 the value of this attribute or would exceed some implementation-defined total number of Per-Job  
 862 Subscriptions for the Printer, the Printer MUST accept the Job Creation and ignore the excess  
 863 subscriptions. If a subsequent Create-Job-Subscription request would exceed this number, the Printer  
 864 rejects the request and returns the 'server-error-too-many-subscriptions' (see section 14.3).

### 865 **6.7 max-printer-subscriptions-supported (integer(0:MAX))**

866 This REQUIRED Printer attribute specifies the maximum number of Per-Printer subscriptions that are  
 867 supported by multiple Create-Printer-Subscription requests, i.e., the maximum number of un-expired Per-  
 868 Printer Subscription objects that the Printer supports at a time. A value of 0 indicates no effective  
 869 maximum. A Printer MUST support at least 1 Per-Printer subscription. If the number of Per-Printer  
 870 subscriptions exceeds the value of this attribute or would exceed some implementation-defined total  
 871 number of Per-Printer Subscriptions for the Printer (if any), the Printer rejects the Create-Printer-  
 872 Subscription request and returns the 'server-error-too-many-subscriptions' (see section 14.3).

### 873 **6.8 notify-lease-time-supported (rangeOfInteger(0:MAX))**

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

### 880 **6.9 notify-lease-time-default (integer(0:MAX))**

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

### 884 **6.10 persistent-jobs-supported (boolean)**

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

### 889 **6.11 persistent-subscriptions-supported (boolean)**

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

**895 6.12 printer-state-change-time (integer(1:MAX))**

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

**899 6.13 printer-state-change-date-time (dateTime)**

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

**903 7 Notification Content**

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

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

**914 7.1 Notification content MIME media type formats**

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

**918 7.2 Machine Consumable form**

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

921 The notification content MUST use the 'application/ipp' MIME media type [ipp-mod] using the Get-Job-  
922 Attributes response encoding for job events and Get-Printer-Attributes response for printer events. The  
923 attributes listed in sections 7.4 and 7.5 are sent in an notification for Job events. The attributes listed in  
924 sections 7.4 and 7.6 are sent in an notification for Printer events. For any 'text' or 'name' attribute value in  
925 any notification, the charset and natural language rules that apply to all IPP operations apply to these  
926 attributes as well, since they are represented as operation responses. The Unsupported Attributes Group in  
927 the response is not sent. If the values of any of the attributes sent in an notification content are not known,  
928 the value sent in the report content is the out-of-band 'unknown' value, rather than omitting the attribute  
929 (see the beginning of [ipp-mod] section 4.1).

930 **Issue 2** - Should we change the Notification Model to allow notification delivery methods that are request  
 931 and response (in addition to the current model which has only one-directional notification delivery using  
 932 the 'application/ipp' operation response format?

933 **Issue 3** - If the answer to Issue 2 is yes, should we change the format of the notification content using  
 934 'application/ipp' to always be a (new) Send-Notification operation request, whether the scheme returns a  
 935 response or not?

936 An implementation MAY extend the contents of the Machine Consumable notification by adding additional  
 937 attributes.

938 **7.3 Human Consumable form**

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

941 The text message SHOULD include information about the attributes in sections 7.4 and 7.5 for job events  
 942 or in sections 7.4 and 7.6 for printer events. This information is localized according to the information  
 943 about natural language and charset in the subscription.

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

946 **7.4 Notification content attributes common to Job and Printer events**

947 This section lists the parameters and attributes that are included in both Job and Printer event Notifications.  
 948 Some events do not include all of these attributes as shown in Table 4. Each notification content contains a  
 949 single Job or Printer event, whether that event was subscribed using the Job Submission Subscription  
 950 mechanism or the Per-Printer subscription mechanism. If either kind of subscription subscribed to both Job  
 951 and Printer events, then they will be sent as separate Job notification content and Printer notification  
 952 contents to the same Notification Recipient. References of the form "mod m.n.o" refer to [ipp-mod]  
 953 sections.

954 Table 4 lists the attributes that are defined for use in Notifications and indicates the Printer support required  
 955 for conformance: "R" indicates REQUIRED and "O" indicates OPTIONAL.

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

	Reference	Events	
Attributes		'job-progress'	all others
1. version-number (integer (0:32767))	mod 3.1.1	R	R
2. status-code (integer (0:32767))	mod 3.1.1	R	R
3. request-id (integer (0:MAX))	5.7 & 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

	Reference	Events	
Attributes		'job-progress'	all others
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))		R	R
12. trigger-date-time (dateTime)			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

957 Attribute Notes:

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

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

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

961 "attributes-natural-language" - the value comes from the "notify-natural-language" attribute in the  
 962 Subscription object.

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

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

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

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

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

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

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

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

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

976 **7.5 Additional Notification content attributes for Job events *only***

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

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

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

982 **7.6 Additional Notification content attributes for Printer events *only***

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

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

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

986

987 **8 Operations for notification**

988 This section defines all of the operations for notification.

989 **4.18.1 Operations for Per-Job Subscriptions *only***

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

993 **8.1.1 Job Creation Operations (Create-Job, Print-Job, Print-URI) and Validate-Job**

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

1000 If a Printer does not support this notification specification, then it MUST ignore the "job-notify" operation  
 1001 attribute and return it in the response indicated as an attribute that is not supported. See [ipp-mod] section  
 1002 3.1.7 for details on returning Unsupported Attributes.

1003 **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

1004  
 1005 See the referenced sections for a definition of these operation attributes, since they are copied to the  
 1006 Subscription object as the Subscription Description attributes described in section 5.

1007 The following rules apply to Per-Job subscriptions created as part of the Job Creation operations:

- 1008 1. Any subscription can contain job events, printer events, or both.
- 1009 2. The Job Submission Subscription is only valid while the job is "not-completed". The job is "not-  
 1010 completed" while it is in the 'pending', 'pending-held', 'processing', and 'processing-stopped' states. The  
 1011 job changes from being "not-completed" to "retained" when it is done processing and enters any of the  
 1012 'completed', 'canceled', or 'aborted' states. The job becomes "not-completed" again when it is restarted  
 1013 using the Restart-Job operation (see [ipp-mod]).
- 1014 3. Since no job is created for the Validate-Job operation, the only purpose of supplying the subscription  
 1015 operation attributes in the Validate-Job operation is to validate that the values are supported; the Printer  
 1016 object does not establish a notification subscription as a result of the Validate-Job operation.
- 1017 4. Since a Job Submission Subscription is included within a job submission operation, any interest in job  
 1018 events is limited to "this job" only (the Job object created because of this job creation operation). There

- 1019 is no mechanism to subscribe to events for all jobs or specifically some job other than this job in a  
 1020 create operation. But see the Create-Printer-Subscription operation (section 8.2.1) for an explicit  
 1021 operation to subscribe for job and/or printer events independently of any particular job submission, i.e.,  
 1022 Per-Printer subscriptions.
- 1023 5. Event reporting only occurs when a notification recipient has specified a subscription to any event(s).
- 1024 6. The notification implementation MAY allow an administrator to configure a policy on what events may  
 1025 be dropped.
- 1026 7. If the OPTIONAL "notify-charset" attribute is not supported or the supplied value is not supported, the  
 1027 IPP Printer MUST return the attribute in the Unsupported Attributes Group but still accept the  
 1028 operation, as with all Job create operations. In this case, the Printer MUST use the natural language  
 1029 supplied in the "attributes-charset" Job creation operation attribute, if that natural language value is  
 1030 supported by the Printer, else the Printer object MUST use the Printer's "charset-configured" value. See  
 1031 the Print-Job operation in [ipp-mod].
- 1032 8. If the OPTIONAL "notify-natural-language" attribute is not supported or the supplied value is not  
 1033 supported, the IPP Printer MUST return the attribute in the Unsupported Attributes Group but still  
 1034 accept the operation, as with all Job create operations. In this case, the Printer MUST use the natural  
 1035 language supplied in the "attributes-natural-language" Job creation operation attribute, if that natural  
 1036 language value is supported by the Printer, else the Printer object MUST use the Printer's "natural-  
 1037 language-configured" value. See the Print-Job operation in [ipp-mod].
- 1038 9. If a collection contains other unrecognized, unsupported member attributes and/or conflicting values,  
 1039 the attribute returned in the Unsupported Group is a collection containing the unrecognized,  
 1040 unsupported member attributes, and/or conflicting values. The Printer MUST return the unrecognized  
 1041 member attributes with the out-of-band value of 'unsupported'. The Printer MUST return the  
 1042 unsupported member attributes and conflicting values with their unsupported values. See [ipp-coll].
- 1043 10. If the number of events supplied in the "notify-events" attribute exceeds the Printer's "max-events-  
 1044 supported" attribute, the Printer MUST accept the request with the status code 'successful-ok-ignored-  
 1045 or-substituted-attributes' and return the "job-notify" collection in the Unsupported Attributes Group  
 1046 with only the "job-events" member attribute containing the events that exceed the maximum.
- 1047 11. If the Per-Job subscriptions would exceed the limit of Per-Job subscriptions supported per job as  
 1048 specified by the Printer's "max-job-subscriptions-supported" attribute or would exceed some  
 1049 implementation-defined limit on the total number of Per-Job subscriptions for the Printer (if any), the  
 1050 Printer MUST accept the request with the status code 'successful-ok-ignored-subscriptions', MUST  
 1051 return the "job-notify" attribute in the Unsupported Attributes Group with only the collection value(s)  
 1052 that represent the excess subscriptions that are being ignored, and MUST perform the Job Creation  
 1053 operation (see section 8.1.1), since the job can still be printed.
- 1054 If the job is accepted and one or more subscriptions are ignored, the status code returned is 'successful-  
 1055 ok-ignored-subscriptions'. This status code is returned even if other job attributes are unsupported or in  
 1056 conflict. That is, if an IPP Printer finds a warning that would allow it to return 'successful-ok-ignored-  
 1057 subscriptions' and either 'successful-ok-ignored-or-substituted-attributes' and/or 'successful-ok-  
 1058 conflicting-attributes', it must return 'successful-ok-ignored-subscriptions'. In other words, the  
 1059 precedence for returning success codes is: 'successful-ok-ignored-subscriptions', 'successful-ok-  
 1060 conflicting-attributes', and 'successful-ok-ignored-or-substituted-attributes'.



## 1061 **8.1.2 Create-Job-Subscription operation**

1062 The OPTIONNAL Create-Job-Subscription operation creates a Per-Job Subscription object . The client  
1063 can specify one or more job and/or printer events to be delivered as notifications to one Notification  
1064 Recipient. For the Per-Job subscription objects, the Job events are for this job only. The printer events are  
1065 any events generated by that Printer for any job or when no job is involved at all (same as for Per-Job  
1066 Subscriptions).

1067 The Printer returns a subscription id and the length of time for which it has granted a lease for the  
1068 subscription.

1069 A client can unsubscribe using the Cancel-Subscription operation (section 8.3.4) and the subscription id.

1070 Two Create-Job-Subscription operations with the same events and same Notification Recipient MUST be  
1071 kept as distinct subscriptions and be assigned distinct subscription ids. A Printer MUST allow such  
1072 duplicate subscriptions such that Cancel-Subscription doesn't unsubscribe both subscriptions and MUST  
1073 send the Notifications twice to the Notification Recipient, since the "request-id" is supposed to count  
1074 monotonically for each subscription.

1075 If the Printer has a bounded set of concurrent Per-Job subscriptions and the request would exceed that  
1076 bound, the Printer rejects the operation and returns the 'server-error-too-many-subscriptions' status code.  
1077 The client SHOULD try again later.

1078 Access Rights: To create Per-Job subscription objects, the authenticated user (see [IPP-MOD] section 8.3)  
1079 performing this operation MUST either be the job owner or have operator or administrator access rights for  
1080 the Printer object (see [IPP-MOD] sections 1 and 8.5). Otherwise the IPP object MUST reject the  
1081 operation and return: client-error-forbidden, client-error-not-authenticated, and client-error-not-authorized  
1082 as appropriate.

1083 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
"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

1084 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
"subscription-id" (integer(1:MAX))		REQUIRED
"notify-persistence-granted" (boolean)		REQUIRED
Group 2: Unsupported Attributes		REQUIRED

1085 Attribute Notes:

1086 "job-id" (integer(1:MAX)) - the client MUST supply this attribute in order to create a Per-Job subscription  
 1087 for the Job identified by the "job-id" value.

1088 Note: Unlike all other operations on the Job object, the "job-uri" operation attribute is not defined  
 1089 for use with this operation.

1090 **ISSUE 4 - Ok that "job-uri" isn't defined for use with the Create-Job-Subscription operation?**

1091 "notify-recipient" (uri) - the client MUST supply this attribute in order to have a subscription.

1092 "notify-event" (1setOf type2 keyword) - if the client does not supply this attribute, the Printer populates the  
 1093 "notify-events" Subscription Description attribute from its "notify-events-default" Printer  
 1094 Description attribute.

1095 "notify-text-format" (mimeMediaType) - if the client supplies this attribute, the value indicates which  
 1096 Human Consumable text format is requested for use in the Notification using the delivery method  
 1097 that the client supplies in the "notify-recipient" attribute. If the client does not supply this attribute,

1098 the Machine-Consumable form of the delivery method that the client supplies in the "notify-  
1099 recipient" attribute is used.

1100 "notify-persistence-requested" (boolean) - whether or not the Per-Job Subscription is to be persistent, i.e.,  
1101 saved across power cycles. Note: Persistent trap registrations is a client option in SNMPv3  
1102 [RFC2573].

1103 "notify-persistence-granted" (boolean) - whether or not this Subscription object instance is persistent. This  
1104 attribute MUST be returned whether "notify-persistence-requested" is supported or not, so that the  
1105 client knows which.

1106

## 1107 **8.2 Operations for Per-Printer Subscriptions *only***

1108 This section defines the operation requests and responses associated with the Per-Printer subscription and  
1109 its Subscription object.

### 1110 **1.1.18.2.1 Create-Printer-Subscription operation**

1111 The REQUIRED Create-Printer-Subscription operation creates a Per-Printer Subscription object . The  
1112 client can specify one or more job and/or printer events to be delivered as notifications to one Notification  
1113 Recipient. For the Per-Printer subscription objects, the job events are for any job submitted to the Printer.  
1114 The printer events are any events generated by that Printer for any job or when no job is involved at all.

1115 The Printer returns a subscription id and the time at which the subscription lease expires (which may be  
1116 earlier or later than the client requested).

1117 The client must renew the Per-Printer subscription using the Renew-Subscription operation (see section  
1118 8.3.3) before the lease runs out in order to maintain the subscription. A client can unsubscribe using the  
1119 Cancel-Subscription operation (section 8.3.4) and the subscription id.

1120 Two Create-Printer-Subscription operations with the same events and same Notification Recipient MUST  
1121 be kept as distinct subscriptions and be assigned distinct subscription ids. A Printer MUST allow such  
1122 duplicate subscriptions such that Cancel-Subscription doesn't unsubscribe both subscriptions and MUST  
1123 send the Notifications twice to the Notification Recipient, since the "request-id" is supposed to count  
1124 monotonically for each subscription.

1125 If the Printer has a bounded set of concurrent Per-Printer subscriptions and the request would exceed that  
1126 bound, the Printer rejects the operation and returns the 'server-error-too-many-subscriptions' status code.  
1127 The client SHOULD try again later.

1128 Access Rights: To create Per-Printer subscription objects, the authenticated user performing this operation  
1129 MUST have Per-Printer subscription rights for this Printer. Otherwise the IPP object MUST reject the  
1130 operation and return: client-error-forbidden, client-error-not-authenticated, and client-error-not-authorized  
1131 as appropriate.

1132 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
"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-lease-time-requested" (integer(0:MAX))]		REQUIRED
["notify-persistence-requested" (boolean)]		OPTIONAL

1133 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
"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

1134 **ISSUE 5** - Ok that we aren't passing the operation attributes that are copied to the Subscription object in the  
 1135 new Subscription object attributes group? Some of the "notify-xxx" attributes aren't Subscription  
 1136 object attributes.

1137 Attribute Notes:

1138 "notify-recipient" (uri) - the client **MUST** supply this attribute in order to have a subscription.

1139 "notify-lease-time-requested" (integer(0:MAX)) - the number of seconds requested for the subscription  
 1140 lease. A value of 0 indicates a request that the Per-Printer Subscription lease never expire.  
 1141 Supplying a 0 value **MAY** require authentication in order to be used, if 0 is supported at all.  
 1142 If the client does not supply this attribute, the Printer uses its "notify-lease-time-default" Printer  
 1143 Description attribute value (see section 6.9).

1144 "notify-event" (1setOf type2 keyword) - if the client does not supply this attribute, the Printer populates the  
 1145 "notify-events" Subscription Description attribute from its "notify-events-default" Printer  
 1146 Description attribute.

- 1147 "notify-text-format" (mimeType) - if the client supplies this attribute, the value indicates which
- 1148 Human Consumable text format is requested for use in the Notification using the delivery method
- 1149 that the client supplies in the "notify-recipient" attribute. If the client does not supply this attribute,
- 1150 the Machine-Consumable form of the delivery method that the client supplies in the "notify-
- 1151 recipient" attribute is used.
  
- 1152 "notify-persistence-requested" (boolean) - whether or not the Per-Printer Subscription is to be persistent,
- 1153 i.e., saved across power cycles. Note: Persistent trap registrations is a client option in SNMPv3
- 1154 [RFC2573].
  
- 1155 "notify-lease-expiration-time" (integer(0:MAX)) - The Printer object MUST return this attribute which is
- 1156 the time in the future at which the subscription lease will expire, i.e., the "printer-up-time" value (in
- 1157 time ticks - see [ipp-mod] section 4.4.29) at which the Printer will delete the Subscription. A value
- 1158 of 0 indicates that the lease subscription will never expire.
  
- 1159 "notify-printer-up-time" (integer(1:MAX)) - The Printer object MUST return this attribute which is an alias
- 1160 for the Printer's "printer-up-time" Printer Description attribute. The client subtracts this value from
- 1161 the "notify-lease-expiration-time" value returned in order to determine the number of second in the
- 1162 future that the subscription will expire. This computed value may be less than the requester
- 1163 requested in the "notify-lease-time-requested" if it was greater than the MAX supported or more
- 1164 than the requester requested if it was less than the MIN supported, as indicated in the Printer's
- 1165 "notify-lease-time-supported" (rangeOfInteger(0:MAX)) attribute (see section 6.8).
  
- 1166 "notify-persistence-granted" - whether or not this Subscription object instance is persistent. This attribute
- 1167 MUST be returned whether "notify-persistence-requested" is supported or not, so that the client
- 1168 knows which.

1169

1170 **8.3 Common Operations for Per-Job and Per-Printer Subscriptions**

1171 This section defines the operations that are common to both Per-Job and Per-Printer subscriptions.

1172 **1.1.18.3.1 Get-Subscription-Attributes operation**

1173 The REQUIRED Get-Subscription-Attributes returns the requested attributes of the identified Subscription

1174 object. See section 5.

1175 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

1176 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

1177 This operation is similar to the Get-Printer-Attributes operation. If the client omits the "requested-  
 1178 attributes" operation attribute, the Printer MUST respond as if the client had supplied the 'all' value, i.e.,  
 1179 return all of the attributes supported for the Subscription object.

1180 **8.3.2 Get-Subscriptions operation**

1181 The REQUIRED Get-Subscriptions operation returns the requested attributes of the Subscription objects  
 1182 (see section 5).

1183 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

1184 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

1185  
 1186 Attribute Notes:

1187 This operation is similar to the Get-Jobs operation (see [ipp-mod]). If the client wants any attributes  
 1188 returned, including the "subscription-id", it must include the attribute keyword name in the "requested-  
 1189 attributes" operation attribute. If the "requested-attributes" operation attribute is omitted, the Printer MUST  
 1190 respond as if the client supplied the value: 'subscription-id'.

1191 "job-id" (integer(1:MAX)) - If the client supplies this attribute, all of the Per-Job Subscription objects for  
 1192 the identified job are candidates for return. If this attribute is omitted, all of the Per-Printer  
 1193 Subscription objects are candidates for return.

1194 "my-subscriptions" (boolean) - If the client supplies the "my-subscriptions" with a 'false' value or omits it,  
 1195 the Printer returns all subscriptions, subject to the security policy in force.

1196 Groups 3 to N: Subscription Object Attributes: The Printer object responds with one set of Subscription  
 1197 Object Attributes for each returned Subscription object. The Printer object ignores (does not  
 1198 respond with) any requested attribute or value which is not supported or which is restricted by the  
 1199 security policy in force, including whether the requesting user is the user that created the  
 1200 Subscription object (subscribing user) or not (see [ipp-mod] section 8).

1201 **8.3.3 Renew-Subscription operation**

1202 The REQUIRED Renew-Subscription operation permits a client to request the IPP Printer to extend the  
 1203 lease on a Subscription object instance. There is no way to renew a Per-Job subscription, since they are  
 1204 automatically canceled after the job completes and no longer has any documents, i.e., the job is no longer  
 1205 retained (see [ipp-mod] section 4.3.7.2). If the requested subscription object is a Per-Job subscription, the  
 1206 Printer MUST grant an infinite lease by returning a 0 value for the "notify-lease-expiration-time".

1207 *Access Rights:* The authenticated user (see [IPP-MOD] section 8.3) performing this operation MUST either  
 1208 be the owner of the Subscription object or have operator or administrator access rights for the Printer object  
 1209 (see [IPP-MOD] sections 1 and 8.5). Otherwise the IPP object MUST reject the operation and return:  
 1210 client-error-forbidden, client-error-not-authenticated, and client-error-not-authorized as appropriate.

1211 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

1212 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

1213 Attribute Notes:

1214 "notify-lease-time-requested" (integer(0:MAX) - the number of seconds requested for the Per-Printer  
 1215 subscription lease. Same as Create-Printer-Subscriptions (see section 8.2.1).

1216 "notify-lease-expiration-time" - the time in the future when the subscription will expire. Same as for the  
 1217 Create-Printer-Subscription operation (see section 8.2.1).

1218 "notify-printer-up-time" - the Printer object MUST return this attribute which is an alias for the Printer's  
 1219 "printer-up-time" Printer Description attribute. The client subtracts this value from the "notify-  
 1220 lease-expiration-time" value returned in order to determine the number of second in the future that  
 1221 the subscription will expire (see further explanation in section 8.2.1).

1222 Note: There is no way to change any of the Subscription object attributes, except the "notify-lease-  
 1223 expiration-time" attribute (using the Renew-Subscription operation). In order to change other attributes, a  
 1224 client can create a new Subscription object and then use the Cancel-Subscription operation to cancel the old  
 1225 one (or do this in the other order, in case there is a limit on the number of Subscription object instances, as  
 1226 long as a short window with no Notifications is ok).

1227 Note: There is no need to renew a Per-Job Subscription, since it is effectively the time that the Job is active  
 1228 (see section 8.1).

1229 **8.3.4 Cancel- Subscription operation**

1230 The REQUIRED Cancel- Subscription operation allows a client to remove a Subscription object. No more  
 1231 Notifications are delivered for that Subscription. Once performed, there is no way to use that Subscription  
 1232 in the future. Subscription-ids should not be reused immediately, so that a stale reference situation is not  
 1233 created. Same as for Cancel-Job and job-ids.

1234 *Access Rights:* The authenticated user (see [IPP-MOD] section 8.3) performing this operation MUST either  
 1235 be the owner of the Subscription object or have operator or administrator access rights for the Printer object  
 1236 (see [IPP-MOD] sections 1 and 8.5). Otherwise the IPP object MUST reject the operation and return:  
 1237 client-error-forbidden, client-error-not-authenticated, and client-error-not-authorized as appropriate.

1238 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

1239 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

1240

1241 **9 Comparison of Per-Job versus Per-Printer Subscriptions**

1242 Per-Job and Per-Printer subscriptions are quite similar. Either type of subscription can subscribe to Job  
 1243 events, Printer events, or both. Both types of subscriptions can be queried using the Get-Subscriptions and  
 1244 Get-Subscription-Attributes operations and canceled using the Cancel-Subscription operation. Both types  
 1245 of subscriptions create Subscription objects which have the same attributes defined. However, there are



1246 some semantic differences between Per-Job subscriptions and Per-Printer subscriptions. A Per-Job  
 1247 Submission Subscription is established by the client when submitting a job and after creating the job using  
 1248 the Create-Job-Subscription operation by specifying the "job-id" of the job. A Per-Printer Subscription is  
 1249 established between a client and a Printer using the Create-Printer-Subscription operation. Some specific  
 1250 differences are:

- 1251 1. A client usually creates a Per-Job subscription as part of the Job Creation operations (Create-Job, Print-  
 1252 Job, and Print-URI), rather than using the OPTIONAL Create-Job-Subscription operation, especially  
 1253 since some Printer implementations MAY not support the Create-Job-Subscription operation, since it is  
 1254 OPTIONAL.
- 1255 2. For Per-Job subscriptions, the subscription is only valid while the job is "not-complete" (see sections  
 1256 7.4 and 7.5) while for the Per-Printer subscriptions, the subscription is valid until the time (in seconds)  
 1257 that the Printer returned in the "notify-lease-expiration-time" operation attribute expires.
- 1258 3. Job Events in a Per-Job subscription apply only to "one job" (the Job created by the job creation  
 1259 operation or references by the Create-Job-Subscription operation) while Job Events in a Per-Printer  
 1260 subscription apply to ALL jobs contained in the IPP Printer object.

1261

## 1262 **10 Conformance Requirements**

1263 This section further enhances the Conformance Requirements detailed in [IPP-MOD] section 5. Extensions  
 1264 made to the events herein must be made such that new events or event attributes are backward compatible  
 1265 to clients who implemented early versions of this notification specification.

1266 It is OPTIONAL to implement this Event Notification specification. If implemented, IPP objects MUST  
 1267 support all of the REQUIRED object attributes as defined in this document in the indicated sections.

1268 If IPP Notification is implemented, the operations described in this document must be supported as  
 1269 described in Table 8:

1270 **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

1271

## 1272 **11 IANA Considerations**

1273 IANA will be called on to register URL schemes for notification delivery for use in the "notification-  
 1274 recipient" attribute, using the same procedures outlined in [ipp-mod].

## 1275 **12 Internationalization Considerations**

1276 This IPP notification specification continues the internationalization of [ipp-mod] for attributes containing  
 1277 text strings and names. A subscribing client can specify a different natural language and charset for each  
 1278 Notification content delivered to a Notification Recipient.

1279 The Human Consumable Notification content is a 'text/plain; charset=utf-8' by default where the  
 1280 Notification Sender has localized the text message as requested by the subscriber for the intended  
 1281 Notification Recipient.

## 1282 **13 Security Considerations**

1283 By far the biggest security concern is the abuse of notification: sending unwanted notifications to third  
 1284 parties (i.e., spam). The problem is made worse by notification addresses that may be redistributed to  
 1285 multiple parties (e.g. mailing lists). There exist scenarios where third party notification is required (see  
 1286 Scenario #2 and #3 in [ipp-not-req]). The fully secure solution would require active agreement of all  
 1287 recipients before sending out anything. However, requirement #9 in [ipp-req] ("There is no requirement for  
 1288 IPP Printer receiving the print request to validate the identity of an event recipient") argues against this.  
 1289 Certain systems may decide to disallow third party notifications (a traditional fax model).

1290 Clients submitting notification requests to the IPP Printer has the same security issues as submitting an  
 1291 IPP/1.1 print job request. The same mechanisms used by IPP/1.1 can therefore be used by the client  
 1292 notification submission. Operations that require authentication can use the HTTP authentication.  
 1293 Operations that require privacy can use the HTTP/TLS privacy.

1294 The notification access control model should be similar to the IPP access control model for Jobs. Creating  
 1295 a Per-Printer Notification Subscription object is associated with a user. Only the creator or an operator can  
 1296 cancel the subscription. The system may limit the listing of items to only those items owned by the user.  
 1297 Some subscriptions (e.g. those that have a lifetime longer than a job) can be done only by privileged users  
 1298 (users having operator and/or administrator access rights), if that is the authorization policy.

1299 The standard security concerns (delivery to the right user, privacy of content, tamper proof content) apply  
 1300 to the notification delivery. IPP should use the security mechanism of the delivery method used. Some  
 1301 delivery mechanisms are more secure than others. Therefore, sensitive notifications should use the delivery  
 1302 method that has the strongest security.

## 1303 **14 Status Codes**

1304 The following status codes are defined as extensions for notification:

### 1305 **1.114.1 'successful-ok-ignored-subscriptions' (0x0003)**

1306 The number of subscriptions supplied in a Job Creation operation (Create-Job, Print-Job, Print-URI)  
 1307 exceeds either the limit of Per-Job subscriptions supported per job as specified by the Printer's "max-job-  
 1308 subscriptions-supported" attribute or some implementation-defined limit on the total number of Per-Job  
 1309 subscriptions for the Printer (if any). The Printer MUST accept the request with this status code, MUST  
 1310 return the "job-notify" attribute in the Unsupported Attributes Group with only the collection value(s) that

1311 represent the excess subscriptions that are being ignored, and MUST perform the Job Creation operation  
1312 (see section 8.1.1), since the job can still be printed.

1313 This status code is returned even if other job attributes are unsupported or in conflict. That is, if an IPP  
1314 Printer finds a warning that would allow it to return 'successful-ok-ignored-subscriptions' and either  
1315 'successful-ok-ignored-or-substituted-attributes' and/or 'successful-ok-conflicting-attributes', it must return  
1316 'successful-ok-ignored-subscriptions'. In other words, the precedence for returning success codes is:  
1317 'successful-ok-ignored-subscriptions', 'successful-ok-conflicting-attributes', and 'successful-ok-ignored-or-  
1318 substituted-attributes'.

#### 1319 **14.2 client-error-uri-notification-scheme-not-supported (0x04??)**

1320 The scheme of the client-supplied URI in a "notify-recipient" operation attribute in a Create-Printer-  
1321 Subscription or Create-Printer-Subscription operation is not supported. See [ipp-mod] section 3.1.7.

1322 There is no corresponding Per-Job subscription error for a Job Creation operation, since the Printer object  
1323 MUST ignore any errors in the "job-notify" operation attribute, MUST return the "notify-recipient"  
1324 attribute in the Unsupported Attributes Group, and perform the Job Creation operation (see section 8.1.1),  
1325 since the job can still be printed.

#### 1326 **14.3 server-error-too-many-subscriptions (0x04??)**

1327 The bounded set of concurrent Per-Printer subscriptions supported by the Printer object would be exceeded  
1328 if this request were accepted.

1329 Note: There is no corresponding Per-Job subscription error, since the Printer object MUST ignore any  
1330 errors in the "job-notify" operation attribute and perform the Job Creation operation (see section 8.1.1),  
1331 since the job can still be printed.

#### 1332 **14.4 server-error-too-many-events (0x04??)**

1333 The client supplied more events in the "notify-events" operation attribute in a Create-Job-Subscription or  
1334 Create-Printer-Subscription operation than the Printer supports, as indicated in its "max-events-supported"  
1335 attribute (see section 6.4).

1336 There is no corresponding Per-Job subscription error for a Job Creation operation, since the Printer object  
1337 MUST ignore any errors in the "job-notify" operation attribute, MUST return the "notify-events" attribute  
1338 in the Unsupported Attributes Group with only the excess events that are being ignored, and perform the  
1339 Job Creation operation (see section 8.1.1), since the job can still be printed.

### 1340 **15 Additions to the IPP Encoding and Transport Document**

1341 The Subscription object tag needs to be assigned in section 3.7.1 Delimiter Tags:

#### 1342 **3.7.1 Delimiter Tags**

1343 The following table specifies the values for the delimiter tags:

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

1344    When an xxx-attributes-tag occurs in the protocol, it MUST mean that zero or more following attributes up  
 1345    to the next delimiter tag are attributes belonging to group xxx as defined in the model document, where xxx  
 1346    is operation, job, printer, unsupported, subscription.

1347    Doing substitution for xxx in the above paragraph, this means the following. When an operation-attributes-  
 1348    tag occurs in the protocol, it MUST mean that the zero or more following attributes up to the next delimiter  
 1349    tag are operation attributes as defined in the model document. When an job-attributes-tag occurs in the  
 1350    protocol, it MUST mean that the zero or more following attributes up to the next delimiter tag are job  
 1351    attributes or job template attributes as defined in the model document. When a printer-attributes-tag occurs  
 1352    in the protocol, it MUST mean that the zero or more following attributes up to the next delimiter tag are  
 1353    printer attributes as defined in the model document. When an unsupported-attributes-tag occurs in the  
 1354    protocol, it MUST mean that the zero or more following attributes up to the next delimiter tag are  
 1355    unsupported attributes as defined in the model document. When a subscription-attributes-tag occurs in the  
 1356    protocol, it MUST mean that the zero or more following attributes up to the next delimiter tag are  
 1357    subscription attributes as defined in the [ipp-not] document.

1358    Add a reference to [ipp-not].

## 1359    **16 References**

- 1360    [ipp-coll]  
 1361        deBry, R., , Hastings, T., Herriot, R., "Internet Printing Protocol/1.0 & 1.1: collection attribute  
 1362        syntax", <draft-ietf-ipp-collection-00.doc>, work in progress, September 9, 1999.
- 1363    [ipp-mod]  
 1364        deBry, R., , Hastings, T., Herriot, R., Isaacson, S., Powell, P., "Internet Printing Protocol/1.1: Model  
 1365        and Semantics", < draft-ietf-ipp-model-v11-04.txt>, work in progress, June 23, 1999.
- 1366    [ipp-not-hist]  
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## 1391 **17 Author's Addresses**

- 1392 Scott A. Isaacson (Editor)  
1393 Novell, Inc.  
1394 122 E 1700 S  
1395 Provo, UT 84606  
1396  
1397 Phone: 801-861-7366  
1398 Fax: 801-861-2517  
1399 e-mail: [sisaacson@novell.com](mailto:sisaacson@novell.com)  
1400
- 1401 Tom Hastings  
1402 Xerox Corporation  
1403 737 Hawaii St. ESAE 231  
1404 El Segundo, CA 90245  
1405  
1406 Phone: 310-333-6413  
1407 Fax: 310-333-5514  
1408 e-mail: [hastings@cp10.es.xerox.com](mailto:hastings@cp10.es.xerox.com)  
1409

1410 Roger deBry  
1411 Utah Valley State College  
1412 Orem, UT 84058

1413  
1414 Phone: (801) 222-8000  
1415 EMail: debryro@uvsc.edu

1416  
1417 Jay Martin  
1418 e-mail: [jkm@underscore.com](mailto:jkm@underscore.com)

1419  
1420 Michael Shepherd  
1421 Xerox Corporation  
1422 800 Phillips Road MS 128-51E  
1423 Webster, NY 14450

1424  
1425 Phone: 716-422-2338  
1426 Fax: 716-265-8871  
1427 e-mail: [mshepherd@crt.xerox.com](mailto:mshepherd@crt.xerox.com)

1428  
1429 Ron Bergman (Editor)  
1430 Dataproducts Corp.  
1431 1757 Tapo Canyon Road  
1432 Simi Valley, CA 93063-3394

1433  
1434 Phone: 805-578-4421  
1435 Fax: 805-578-4001  
1436 Email: rbergman@dpc.com

1437

## 1438 A. Appendix - Summary of Notification Attribute Usage

1439 This appendix summarizes the usage of Notification attributes in the Job operation attribute collection, Job  
1440 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		100	[R]	[R]	[R]		
3. notify-text-format (mimeMediaType)		R			[R]	[R]	[R]		
4. subscriber-user-data (octetString(63))		R	R	R	[R]	[R]	[R]		
5. attributes-charset (charset)	R		R (6)	R (6)	R	R	R	R	R
6. notify-charset (charset)		O			[O]	[O]	[O]		
7. attributes-natural-language (naturalLanguage)	R		R (8)	R (8)	R	R	R	R	R
8. notify-natural-language (naturalLanguage)		O			[O]	[O]	[O]		
9. notify-lease-time-requested (integer(0:MAX))							[R]	[R]	
10.									
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

1441 Legend: "R" - REQUIRED for Printer to support; "O" - OPTIONAL for Printer to support; "[ ]" - OPTIONAL for sender to send;  
 1442 Return - Printer MUST return; \* - MUST be 0 for Per-Job Subscription objects; (n) means the value comes from the indicated  
 1443 Subscription Attribute

1444

	Objects	Notification	Job operations	Subscription operations
--	---------	--------------	----------------	-------------------------

Attributes	Job	Subsc ription	Job Notific ation	Printer Notific ation	Job Creation Validate -Job	Create -Job- Subscr -ption	Create- Printer- Subscri -ption	Renew - Subscr -ption	Cancel - Subscr -ption
19. version-number (integer (0:32767))			R	R					
20. status-code (integer (0:32767))			(600)	(601)					
21. job-printer-uri (uri)	R								
22. printer-uri (uri)		R	R	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-processed (integer(0:MAX))	O		[pg/cp]						
32. job-impressions-completed (integer(0:MAX))	O		[pg/cp]						
33. job-media-sheets-completed (integer(0:MAX))	O		[pg/cp]						
34. job-collation-type (type2 enum)	O		[pg/cp]						
35. sheet-completed-copy-number (integer(-2:MAX))	O		[pg/cp]						
36. sheet-completed-document-number(integer(-2:MAX))	O		[pg/cp]						
37. impressions-interpreted (integer(-2:MAX))	O		[pg/cp]						
38. impressions-completed-current-copy (integer(-2:MAX))	O		[pg/cp]						

1445 Legend: "R" - REQUIRED for Printer to support; "O" - OPTIONAL for Printer to support; [ ] - OPTIONAL for sender to send;  
 1446  
 1447 "[pg/cp]" - REQUIRED in a 'job-progress' or 'job-completed' notification if the corresponding Job attributes are supported ; (nn) - an  
 1448 alternate source of the data in a Notification.



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
39. printer-state (type1 enum)		R		R					
40. printer-state-reasons (1setOf type2 keyword)		R		R					
41. printer-is-accepting-jobs (boolean)		R		R					
42. notify-schemes-supported (1setOf uriScheme)		R							
43. notify-events-default (1setOf type2 keyword)		R							
44. notify-events-supported (1setOf type2 keyword)		R							
45. max-events-supported (integer(5:MAX))		R							
46. notify-text-format-supported (1setOf mimeType)		CR							
47. max-job-subscriptions-supported (integer(1:MAX))		R							
48. max-printer-subscriptions-supported (integer(0:MAX))		R							
49. notify-lease-time-supported (rangeOfInteger(0:MAX))		R							
50. notify-lease-time-default (integer(0:MAX))		R							
51. persistent-jobs-supported (boolean)		O							
52. persistent-subscriptions-supported (boolean)		O							
53. printer-state-change-time (integer(1:MAX))		O							
54. printer-state-change-date-time (dateTime)		O							

1449 Legend: "R" - REQUIRED for Printer to support; "O" - OPTIONAL for Printer to support; "[ ]" - OPTIONAL for sender to send;  
 1450 "CR" - CONDITIONALLY REQUIRED, i.e., REQUIRED if Human Consumable format supported;

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