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15 Internet Printing Protocol (IPP):
16 **IPP Event Notification Specification**

17
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19

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30 **Abstract**

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

38 A subscription request and the Subscription object includes: the names of Job and/or Printer events, the
39 Notification Recipient URL, the Notification Content format, if several are supported, possibly some
40 opaque data, and the charset and natural language. In addition, the subscription request includes: the
41 requested lease time and persistency for the subscription. When the event occurs, a notification is
42 generated and delivered using the information specified in the subscription.

43 The full set of IPP documents includes:

44 Design Goals for an Internet Printing Protocol [RFC2567]

45 Rationale for the Structure and Model and Protocol for the Internet Printing Protocol [RFC2568]

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

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

48 Internet Printing Protocol/1.1: Implementer's Guide [IPP-IIG]

49 Mapping between LPD and IPP Protocols [RFC2569]

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

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

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

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

69 The "Internet Printing Protocol/1.1: Implementer's Guide" document gives insight and advice to
70 implementers of IPP clients and IPP objects. It is intended to help them understand IPP/1.0 and some of the
71 considerations that may assist them in the design of their client and/or IPP object implementations. For
72 example, a typical order of processing requests is given, including error checking. Motivation for some of
73 the specification decisions is also included.

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

76

77

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183

184 **1 Introduction**

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

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

191

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

194

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

197

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

199

- The rest of Section 1.1 is an overview of IPP Notification.

200

- Section 2 is the model for network entities that use IPP notification, including clients (desktop and servers), IPP Printers (servers and devices), and Notification Recipients.

201

202

- Section 3 is the terminology used throughout the document.

203

- Section 4 is the object model for notification, including Job, Printer, and Subscription objects.

204

- Section 5 defines the Subscription object and its attributes.

205

- Section 6 defines the Printer Description attributes

206

- Section 7 defines the Notification content of Human Consumable and Machine Consumable Event formats.

207

208

- Sections 8 and 9 define the Per-Job and Per-Printer Subscription operations.

209

- Section 10 defines the out-of-band values.

210

- Section 11 and 12 define the conformance requirements and IANA requirements, respectively.

211

- Section 13 - 15 cover Internationalization, Security, and Status codes.

212

- Appendix A is a summary of the Notification Attribute usage

213

- Appendix B is a Change History

214 **1.1 Notification Overview**

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

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

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

- 221 1. the names of Job and/or Printer events that are of interest to the Notification Recipient
- 222 2. the delivery method and address to use to deliver the notification to one Notification Recipient
- 223 3. if Human Consumable notification content is to be sent, which text format
- 224 4. some opaque data that the subscriber wants to be sent to the Notification Recipient in the
225 Notification, perhaps to identify either the subscriber or the ultimate recipient
- 226 5. the charset to use in the Notification, if it is to be different than the one used in the request that
227 created the subscription
- 228 6. the natural language to use in the Human Consumable Notification, if it is to be different than the
229 one used in the request that created the subscription
- 230 7. the requested lease time in seconds for the subscription
- 231 8. whether or not the subscription is requested to be persistent across power cycles.

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

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

250 Table 1 summarizes the Per-Job and Per-Printer Subscription operations, assigns their operation-id (see
251 [ipp-mod] section 4.4.15) and their salient input operation attributes.

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

Operation:	Oper. ID	Per-Job	Per-Printer	Brief Description salient inputs beside printer-uri:
Print-Job, Print-URI, Create-Job	see [ipp-mod]	yes	no	Create one or more Per-Job Subscriptions as part of the Job Creation operations 1setOf {recipient, [events,] [format,] [user-data,] [charset,] [natural-language]}
Validate-Job	see [ipp-mod]	yes	no	Check that the Job Creation operation would be accepted including the Subscription 1setOf {recipient, [events,] [format,] [user-data,] [charset,] [natural-language]}
Create-Printer-Subscription	0x0016	no	yes	Create a Per-Printer Subscription recipient, [events,] [format,] [user-data,] [charset,] [natural-language,] [lease-time-requested,] [persistence-requested]
Create-Job-Subscription	0x0017	yes	no	Create a Per-Job Subscription recipient, job-id, [events,] [format,] [user-data,] [charset,] [natural-language,]
Get-Subscription-Attributes	0x0018	yes	yes	Get specified Subscription attributes of the specified Subscription object subscription-id, [requested-attributes]
Get-Subscriptions	0x0019	yes	yes	Get the specified Subscription attributes from all my or all of the Subscription objects [job-id], [my-subscriptions,] [requested-attributes]
Renew-Subscription	0x001A	yes	yes	Renew the Subscription lease subscription-id, [lease time-requested]
Cancel-Subscription	0x001B	yes	yes	Cancel the Subscription subscription-id

253

254 There are two steps that IPP notification must take regarding each event - an internal event recording, and
255 an external notification:

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

259 2) As an events occurs, the Printer searches the set of subscriptions for any interest in that event. As
 260 the Printer finds that some notification recipient is interested in that event (the notification recipient
 261 is subscribed to the event), the Printer increments the Subscription object's "subscription-request-id"
 262 (integer (0:MAX)) attribute and a notification is generated and delivered using the methods and
 263 target addresses identified in the subscription, passing the incremented "request-id". The
 264 "subscription-request-id" sequence number permits a Notification Recipient to detect duplicate
 265 notifications due either to duplicate subscriptions or retries and to detect dropped notifications.

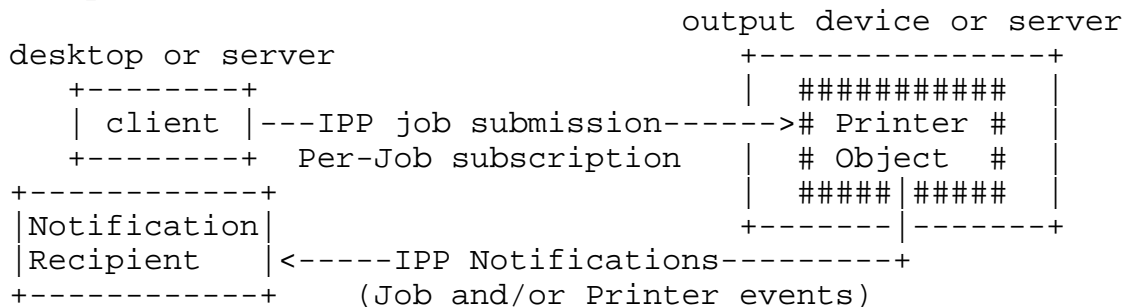
266 2 Model for Per-Job and Per-Printer Subscription and Event Notification

267 2.1 Model for Per-Job Subscription and Notification

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

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

274
 275 embedded printer:



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

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

- 290 1. forward the Per-Job subscriptions to the down stream IPP Printer and let it perform the
 291 notification directly to the Notification Recipients supplied by the Client (Notifications(C)) and
 292 use Per-Printer Subscriptions for the Server's own purposes.

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

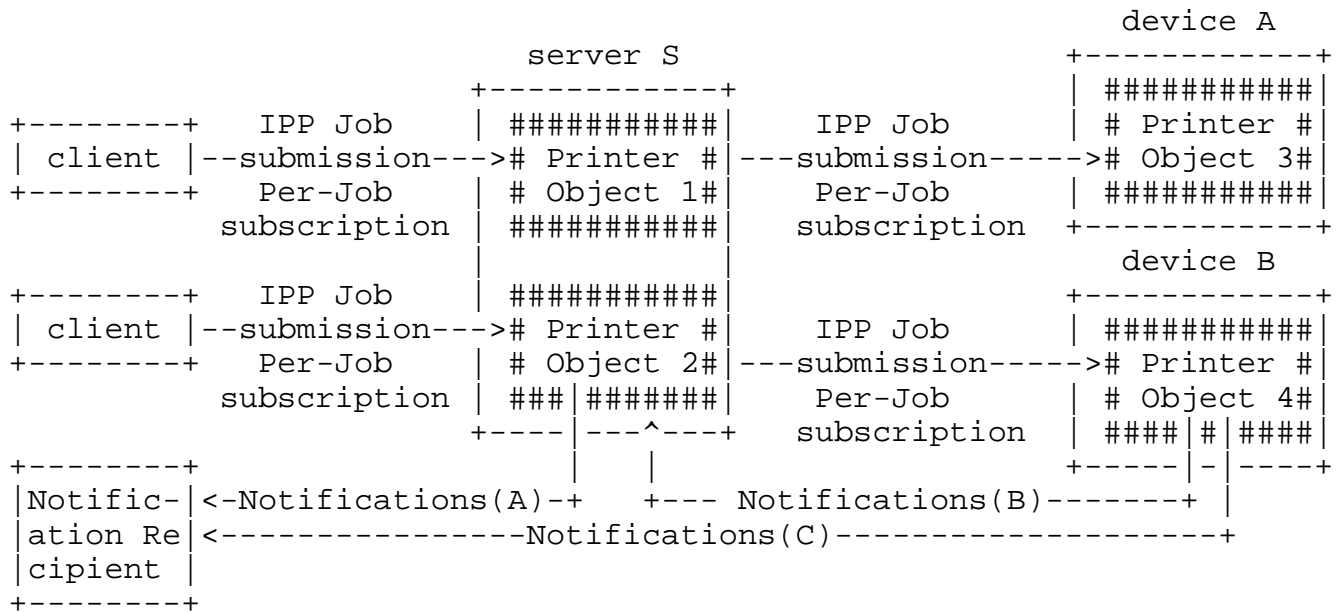


Figure 2 - Client-Server-Printer Per-Job Subscription and Notification Model

2.2 Model for Per-Printer Subscription and Notification

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

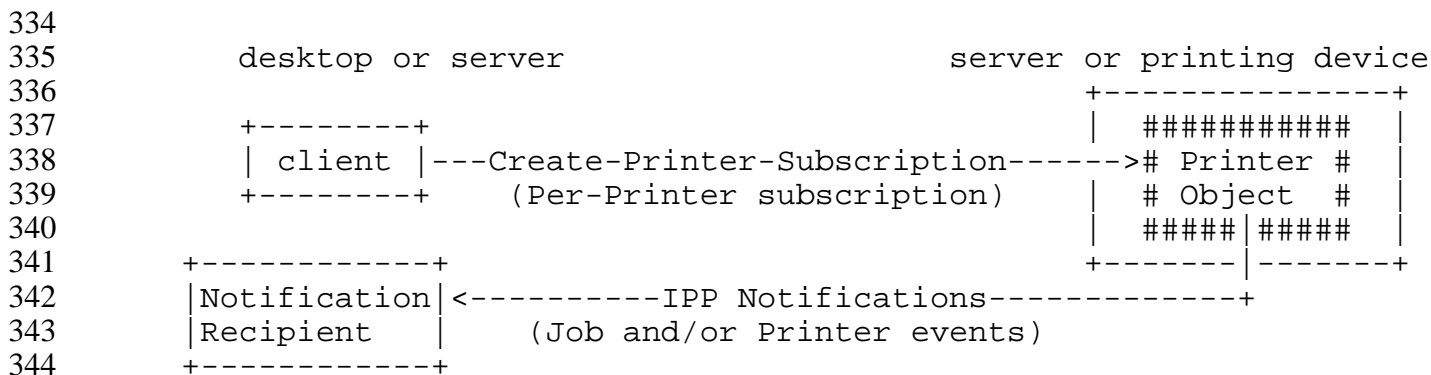


Figure 3 - Client-Printer Per-Printer Subscription and Notification Model

2.3 Relationship between the Printer object and the Notification Delivery Service

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

2.3.1 Use of a Notification Service transparently to clients

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

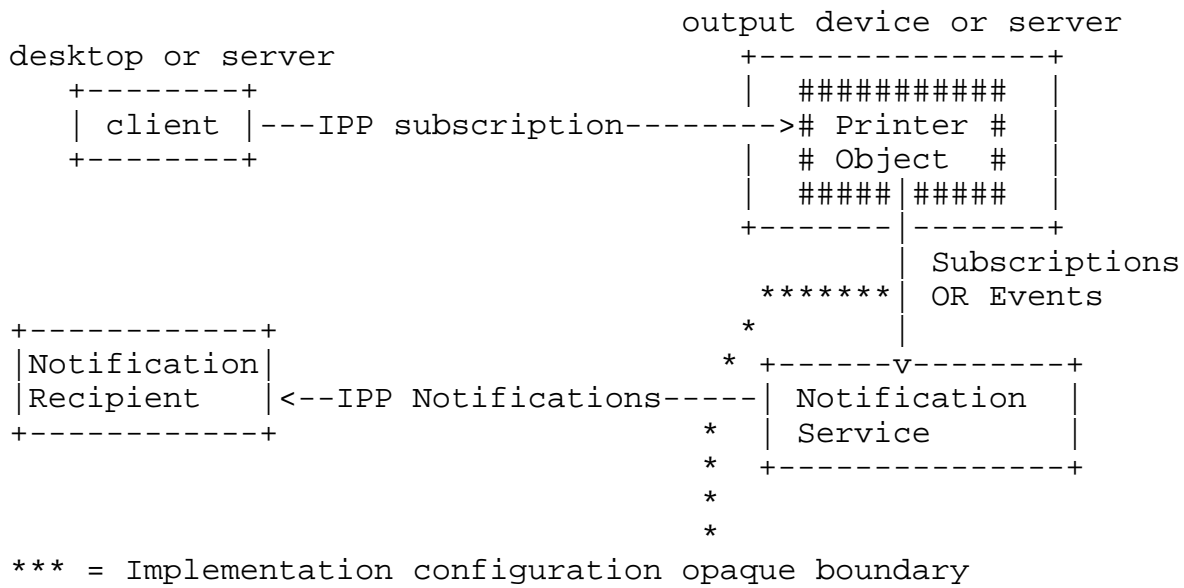


Figure 4 - Opaque Use of a Notification Service Transparent to the Client

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

2.3.2 Use of Notification Service transparently to the IPP Printer

Another way that a Notification Service can be used is if the Notification Recipient indicated in the IPP Subscription is a notification service (transparent to the IPP Printer), which in turn forwards the Notification to the Ultimate Notification Recipient using additional parameters in the IPP Subscription (URI parameters or subscriber user data). In such cases, the Ultimate Notification Recipient has also subscribed directly with the other notification service (by means outside this document). As far as the IPP Printer is concerned, the IPP Subscription indicated that the IPP Printer is to delivery Notifications to the Notification Recipient (Notification Service) using the specified notification delivery method. The method that the Notification Recipient uses for delivering the notification to the Ultimate Notification Recipient is beyond the scope of this document and is transparent to the IPP Printer. However, the client does have to know how to pass additional information to the Notification Recipient in the IPP Subscription using either extra parameters in the URI or subscriber user data. Examples of this latter approach are paging, immediate messaging services, and NOS vendors infrastructure. Figure 5 shows this approach.

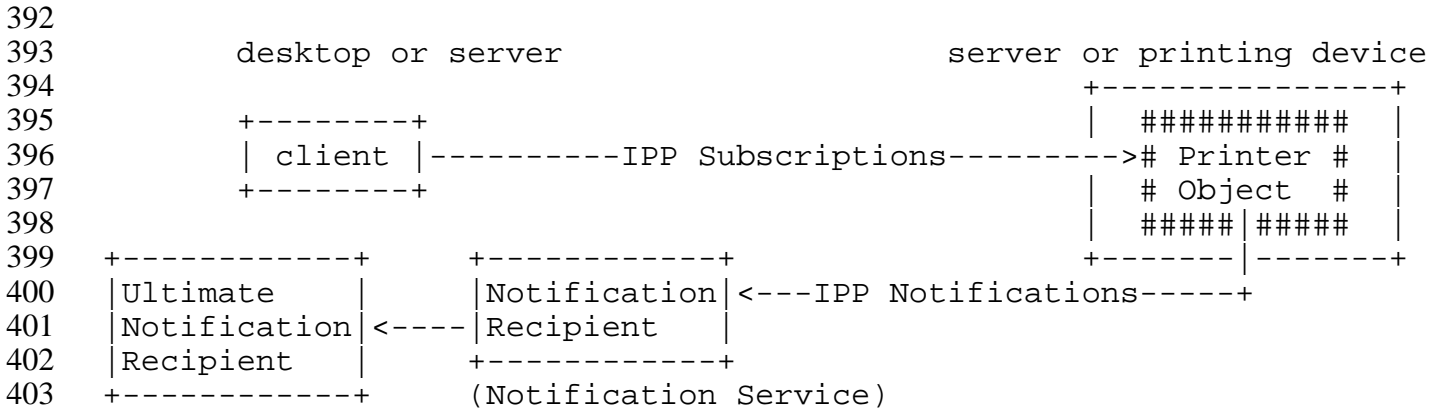


Figure 5 - Use of a Notification Service transparent to the IPP Printer

3 Terminology

This section defines terminology used throughout this document.

3.1 Conformance Terminology

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

REQUIRED - an adjective used to indicate that a conforming IPP Printer implementation **MUST** support the indicated operation, object, attribute, attribute value, status code, or out-of-band value in requests and responses. See [ipp-mod] "Appendix A - Terminology for a definition of "support". *Since support of this entire notification specification is **OPTIONAL** for conformance to IPP/1.0 or IPP/1.1, the use of the term **REQUIRED** in this document means "REQUIRED if this **OPTIONAL** notification specification is implemented".*

RECOMMENDED - an adjective used to indicate that a conforming IPP Printer implementation is recommended to support the indicated operation, object, attribute, attribute value, status code, or out-of-band value in requests and responses. *Since support of this entire notification specification is **OPTIONAL** for conformance to IPP/1.0 or IPP/1.1, the use of the term **REQUIRED** in this document means "RECOMMENDED if this **OPTIONAL** notification specification is implemented".*

OPTIONAL - an adjective used to indicate that a conforming IPP Printer implementation **MAY**, but is **NOT REQUIRED** to, support the indicated operation, object, attribute, attribute value, status code, or out-of-band value in requests and responses.

settable - an adjective used to indicate that a Printer implementation supports setting the value(s) of an attribute using the Set-Job-Attributes or Set-Printer-Attributes operations (see [ipp-set]).

429 **READ-ONLY** - an adjective used in an attribute definition to indicate that an IPP Printer **MUST NOT**
430 support the attribute as being settable using the Set-Job-Attributes or Set-Printer-Attributes
431 operations (see [ipp-set]).

432 **3.2 Other terminology**

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

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

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

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

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

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

449 **Job Recipient** - A human who is the ultimate consumer of the print job. In many cases this will be the
450 same person as the Job Submitting End User, but need not be.
451 Example: If I use IPP to print a document on a printer in a business partner's office, I am the Job
452 Submitting End User, while the person I intend the document for in my business partner's office is
453 the Job Recipient. Since one of the goals of IPP is to be able to print near the Job Recipient of the
454 printed output, we would normally expect that person to be in the same security domain as, and
455 geographically near, the Printer. However, this may not always be the case. For example, I submit a
456 print job across the Internet to a Kinko's print shop. I am both the Submitting End User and the Job
457 Recipient, but I am neither near nor in the same security domain as the Printer.

458 **Job Recipient Proxy** - A human acting on behalf of the Job Recipient. In particular, the Job Recipient
459 Proxy physically picks up the printed document from the Printer, if the Job Recipient cannot
460 perform that function. The Proxy is **by definition** geographically near and in the same security
461 domain as the printer.
462 Example: I submit a print job from home to be printed on a printer at work. I'd like my secretary to
463 pick up the print job and put it on my desk. In this case, I am acting as both Job Submitting End
464 User and Job Recipient. My secretary is acting as a Job Recipient Proxy

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

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

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

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

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

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

483 **Notification Recipient** - The entity identified as a recipient within a subscription that receives IPP
484 Notifications about Job and/or Printer events (see Figure 4 and Figure 5). A Notification Recipient
485 may be a: Job Submitting End User, Job Submitting Application (desktop or server), Job Recipient,
486 Job Recipient Proxy, a Notification Service, an Operator, or Administrator, etc., and their
487 representative or log file or usage statistics gathering application or other active or passive entities.
488 A Java Listener is an example of a Notification Recipient.

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

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

497 Events can be classified along two dimensions:

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

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

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

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

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

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

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

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

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

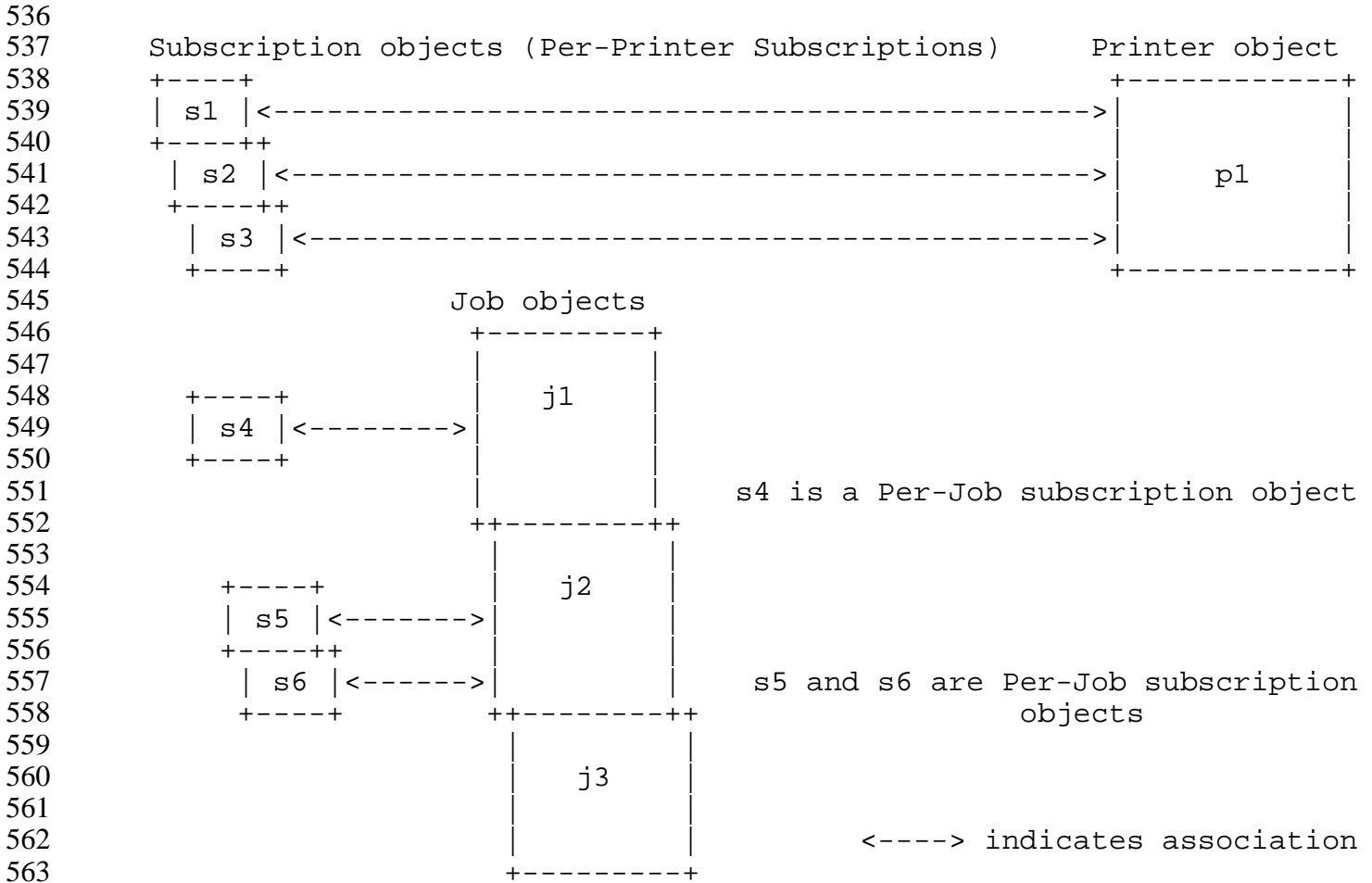
526 **Machine Consumable Notification** - Notifications that are intended for consumption by a program
527 only. They use the encoding of an IPP response. The Notification Recipient must localize the
528 contents, if displaying it to a human.

529 **Subscription Creation operation** - One of the operations that creates a Subscription object: Job
530 Creation operations (Create-Job, Print-Job, and Print-URI), Create-Job-Subscription, and Create-
531 Printer-Subscription.

532 4 Object Model for Notification

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

535 The object relationships can be seen pictorially as:



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

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

567 4.1 Object relationships

568 This sub-section defines the object relationships between the Printer, Job, and Subscription objects.
569 Whether Per-Printer Subscription objects are actually contained in a Printer object or are just bi-
570 directionally associated with them in some way is IMPLEMENTATION DEPENDENT and is transparent
571 to the client. Similarly, whether Per-Job Subscription objects are actually contained in a Job object or are
572 just bi-directionally associated with them in some way is IMPLEMENTATION DEPENDENT and is
573 transparent to the client. The object relationships are defined as follows:

574 **4.1.1 Printer object and Per-Printer Subscription objects**

- 575 1. The Printer object contains (is associated with) zero or more Per-Printer Subscription objects (p1
576 contains s1-s3 Per-Printer Subscription objects).
- 577 2. A Per-Printer Subscription object (s1-s3) cannot be contained in (or associated with) more than one
578 Printer object (p1).
- 579 3. Each Per-Printer Subscription object (s1, s2, and s3) is contained in (or is associated with) one
580 Printer object (p1) and each represents one Per-Printer subscription.
- 581 4. Each Per-Printer Subscription object identifies one or more Job and/or Printer events. Such Job
582 events are for *all* jobs on the Printer. Such Printer events are for *any* Printer event, no matter which
583 job is processing and when no jobs are processing.

584 **4.1.2 Job object and Per-Job Subscription objects**

- 585 1. A Job object (j1, j2, j3) contains (is associated with) zero or more Per-Job subscription objects (s4-
586 s6). Job j1 is associated with Per-Job subscription object s4, Job j2 is associated with Per-Job
587 subscription objects s5 and s6, and Job j3 is not associated with any Per-Job subscription object.
- 588 2. A Per-Job Subscription object cannot be contained in (or associated with) more than one Job object.
- 589 3. Each Per-Job Subscription object is contained in (or associated with) one Job object and each
590 represents one Per-Job Subscription.
- 591 4. Each Per-Job Subscription object identifies one or more Job and/or Printer events. Such Job events
592 are only for *this* job (different than "per-Printer" Subscriptions). Such Printer events are for *any*
593 Printer event, no matter which job and when no jobs are processing (same as for "per-Printer"
594 Subscriptions).

595 **5 Subscription Object attributes**

596 Table 2 lists the Subscription object attributes defined in this section and the related Printer Description
597 attributes defined in section 6, if any. The definitions of the object attributes are specified in this section so
598 that they can be referred to from the subsequent definitions of the operations that set them. All of the
599 Subscription object attributes are READ-ONLY. They can be set only by specific operations that create or
600 perform operations on Subscription objects (see section 8).

601

Table 2 - Subscription object attributes

Subscription object attributes: Set by client input to a Subscription Creation operation	Printer support	Related Printer Description attribute(s)
notify-recipient (uri)	REQUIRED	notify-schemes-supported (1setOf uriScheme)
notify-events (1setOf type2 keyword)	REQUIRED	notify-events-default (1setOf type2 keyword) notify-events-supported (1setOf type2 keyword) max-events-supported (integer(5:MAX))
notify-format (mimeMediaType)	REQUIRED	notify-format-supported (1setOf mimeMediaType)
subscriber-user-data (octetString(63))	REQUIRED	n/a
notify-charset (charset)	OPTIONAL	charset-supported (1setOf charset)
notify-natural-languages (1setOf naturalLanguage)	OPTIONAL	generated-natural-language-supported (1setOf naturalLanguage)

602

Subscription object attributes: Printer initializes to 0, increments at beginning of each event	Printer support	Related Printer Description attribute(s)
subscription-request-id (integer(0:MAX))	REQUIRED	n/a

603

Subscription object attributes: Printer sets as part of Subscription Creation operation	Printer support	Related Printer Description attribute(s)
subscription-id (integer(1:MAX))	REQUIRED	max-job-subscriptions-supported (integer(0:MAX)) max-printer-subscriptions-supported (integer(0:MAX))
notify-lease-expiration-time (integer(0:MAX))	REQUIRED	notify-lease-time-default (integer(0:MAX)) notify-lease-time-supported (rangeOfInteger(0:MAX))
printer-uri (uri)	REQUIRED	printer-uri-supported
subscriber-user-name (name(MAX))	REQUIRED	n/a

604

Subscription object attributes: Returned by Printer on Subscription Creation operation	Printer support	Related Printer Description attribute(s)
notify-server-up-time (integer(1:MAX))	REQUIRED	printer-up-time (integer(1:MAX))
notify-persistence-granted (boolean)	REQUIRED	persistent-subscriptions-supported (boolean)

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

611 5.1 notify-recipient (uri)

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

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

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

- 619 1) The URI scheme used.
- 620 2) The supported and default delivery format, and if not one of the specified types in Section 5.3,
621 description of the notification content.
- 622 3) Any content length restrictions imposed by the delivery protocol.
- 623 4) The latency of the delivery protocol used.
- 624 5) The reliability of the transport and delivery protocol used.
- 625 6) The security aspects of the transport and delivery protocol used, e.g. how it is handled in firewalls.
- 626 7) How the delivery protocol is initiated, e.g. does it have to be initiated by the receiving user (pull), or
627 is it initiated by the notification service (push).

628 The following notification delivery schemes are defined in other documents for use as part of the URI value
629 of this attribute:

630 'ipp:' - The Notification Recipient uses server directed polling to pull Notifications [ipp-method-poll]

631 'indp:' - The Notification Source sends Send-Notifications operations to the Notification Recipient [ipp-
632 method-indp]

633 'mailto:' - The Notification Source sends a email message using SMTP with possible attachments
634 containing Machine Consumable Notification Content [ipp-method-mailto]

635 'snmpnotify:' - The Notification Source sends SNMP traps and/or informs to the Notification Recipient
636 [ipp-method-snmp]

637 This list of notification delivery schemes will be added to as needed using the registration procedures
638 defined in [ipp-mod].

639 **ISSUE 01** - Once a number of delivery solutions have been developed and evaluated, we may want to
640 make one or several of them REQUIRED for implementation to ensure a minimum set of interoperability.
641 Which one or ones should be REQUIRED?

642 **5.2 notify-events (1setOf type2 keyword)**

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

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

650 Job events: The semantics for job events depends on whether the subscription is a Per-Job
651 Subscription or a Per-Printer Subscription. For Per-Job Subscriptions, the Printer MUST
652 generate Notifications only for the job events of the job with which the Subscription is
653 associated. For Per-Printer Subscriptions, the Printer MUST generate Notifications for the
654 job events for any job submitted to the Printer.

655 For example, consider the event when there are 10 'pending' jobs, one 'processing' job, and
656 30 'completed' jobs and the 'processing' job completes. The Printer MUST generate a 'job-
657 completed' job event Notification if the job has a Per-Job Subscription that contained the
658 'job-completed' event in this attribute. The Printer MUST NOT generate Notifications for
659 any other jobs whose Per-Job Subscriptions contain the 'job-completed' event in this
660 attribute.

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

665 For example, consider the event when there are 10 'pending' jobs, one 'processing' job, and
666 30 'completed' jobs and the Printer enters the 'stopped' state. The Printer MUST generate a
667 'printer-state-changed' printer event Notification for each of the 11 'pending' and 'processing'
668 jobs whose Per-Job Subscriptions contain the 'printer-state-changed' event in this attribute.
669 The Printer MUST NOT generate Notifications for any of the 'completed' jobs' whose Per-
670 Job Subscriptions contain the 'printer-state-changed' event in this attribute.

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

674 A Printer MUST support the events indicated as "REQUIRED" and MAY support of the events indicated as
675 "OPTIONAL".

676 The standard job event keyword values are:

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

679 **'job-created':** REQUIRED - the Printer object has accepted a Job Creation operation (Print-Job, Print-
680 URI, or Create-Job) and the job's "time-at-creation" attribute value is set (see [ipp-mod] section
681 4.3.14.1). The Printer puts the job in the 'pending', 'pending-held' or 'processing' states.

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

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

685 **'job-completed'**: REQUIRED - the job has reached one of the completed states, i.e., the value of the
686 job's "job-state" attribute has changed to: 'completed', 'aborted', or 'canceled'. The Job's "time-at-
687 completed" and "date-time-at-completed" (if supported) attributes are set (see [ipp-mod] section
688 4.3.14).

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

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

696
697 This event also indicates that one or more values have been added to or removed from the Job's
698 "job-state-reasons" attribute, such as 'job-queued' or 'job-printing', whether or not the job's state has
699 changed. If job state reasons are added when the job is created, only the 'job-created' event is
700 generated, in order to keep the events disjoint. If job state reasons are added or removed when the
701 job is completed, only the 'job-completed' event is generated, in order to keep the events disjoint.
702

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

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

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

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

718 The standard Printer event keywords values are:

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

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

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

726 **'printer-shutdown'**: OPTIONAL - when the device is being powered down or the Shutdown-Printer
727 operation has been performed (see [ipp-set2]).

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

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

738
739 A client that wants to subscribe to all printer state changes, including restart and power-
740 down/shutdown, includes the 'printer-restarted', 'printer-state-changed', and 'printer-shutdown' in the
741 notification subscription.

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

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

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

759 **'printer-no-longer-full'**: OPTIONAL - when the Printer can now accept a Print-Job, Print-URI,
760 Create-Job, Send-Document, or Send-URI request. This event is used when there is more than one

761 client feeding a printer/server (fan-in), and the Printer may still be printing but has acquired more
762 buffer space to accept jobs. This event only occurs when the Printer did not have room to accept
763 jobs previously and rejected a Print-Job, Print-URI, Create-Job, Send-Document, or Send-URI
764 operation.

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

770 **5.3 notify-format (mimeMediaType)**

771 This REQUIRED READ-ONLY Subscription object attribute indicates the MIME Media type of Human
772 Consumable and/or Machine Consumable format content that is to be sent in the Notifications for the
773 Notification Content that is under control of the Subscriber. Depending on the delivery method definition
774 document, this attribute MAY specify the MIME Media type for the entire Notification Content, or just a
775 portion that is controllable by the subscriber, if there is a fixed part as well. For example, if the entire
776 Notification Content is always a fixed Machine Consumable MIME Media type, such as the 'ipp:' delivery
777 method which uses the 'application/ipp' MIME Media type (see [indp-method]), then this attribute controls
778 the format of the "human-readable-report" (text(MAX)) Notification Content attribute (see section 7.2) in
779 the Machine Consumable form. As another example, if the Notification Content is always a Human
780 Consumable format content with a MIME Media attachment, such as with the 'mailto:' delivery method
781 [ipp-method-mailto], this attribute controls the format of the attachment.

782 If the 'text' MIME media type registration permits a charset parameter, than such a specification MUST be
783 used (instead of the "notify-charset" attribute - see section 5.5) in order to indicate the charset to be used in
784 the notification content.

785 If the Subscriber did not supply this attribute when requesting the subscription, the Printer object populates
786 this Subscription object attribute with either the 'none' out-of-band value (see section 10.1) or one of the
787 values of the Printer's "notify-format-supported" attribute (see section 6.5), depending on the delivery
788 method and implementation, since there is no "notify-format-default" defined in this document.

789 Standard mimeMediaType values are:

790 'none': This out-of-band value (see section 10.1) indicates that the Subscriber-controllable part of the
791 Notification content is not to be sent.
792 'text/plain; charset=utf-8': Human Consumable plain text containing characters from ISO 10646
793 represented as UTF-8 [RFC2279] as defined in section 7.1.1.
794 'text/html': Human Consumable HTML data [RFC1866] as defined in section 7.1.1.
795 'text/xml': Machine Consumable XML data [RFC2376] as defined in section 7.1.2.
796 'application/ipp': Machine Consumable IPP request as defined in section 7.1.2 data encoded as in [ipp-
797 pro].
798 'application/postscript': Human Consumable PostScript [RFC2046]
799 'image/tiff': Human Consumable image data [RFC2302]

800 **5.4 subscriber-user-data (octetString(63))**

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

809 **5.5 notify-charset (charset)**

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

814 **5.6 notify-natural-language (naturalLanguage)**

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

818 **5.7 subscription-request-id**

819 This REQUIRED READ-ONLY Subscription object attribute holds the most recent request-id sequence
820 number delivered in a Notification content to the Notification Recipient. A value of 0 indicates that no
821 Notifications have been sent for this subscription. The first request-id sent for a subscription MUST be 1.
822 Each Notification Recipient receives its own monotonically increasing series of request-ids operation
823 parameters (see [ipp-mod] section 3.1.2), i.e., no gaps, in order to be able to detect a missing notification.

824 **5.8 subscription-id (integer (1:MAX))**

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

831 It is RECOMMENDED that Per-Printer Subscription objects be persistent. Then the Subscription objects
832 including the subscription-id remains unique across power-cycles. Even if an implementation does not
833 make Per-Printer subscription objects persist, the implementation SHOULD make every attempt not to re-

834 use subscription ids that subscribers might still think are valid. In other words, the Printer SHOULD at
835 least keep the next subscription-id to be assigned in non-volatile memory. Note: it is assumed that Per-Job
836 subscriptions are persistent if Jobs are persistent, in order to be consistent with the persistency of Job
837 objects. The [ipp-mod] RECOMMENDS that Job objects be persistent.

838 **5.9 notify-lease-expiration-time (integer(0:MAX))**

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

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

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

852 **5.10 printer-uri (uri)**

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

857 **5.11 subscriber-user-name (name(MAX))**

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

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

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

872 **5.12 notify-server-up-time (integer(1:MAX))**

873 This REQUIRED READ-ONLY Subscription object attribute indicates the amount of time (in seconds) that
874 the Printer or Notification Delivery Service implementation has been up and running. This attribute is an
875 alias for the Printer's "printer-up-time" attribute" (see [ipp-mod] section 4.4.29) if the Printer is keeping the
876 Subscription objects or is the up time for the Notification Delivery Service if the Printer has delegated the
877 responsibility for keeping Subscription objects to a notification delivery service, in an analogous way that
878 the Job's "job-printer-up-time" is an alias for "printer-up-time" Printer attribute (see [ipp-mod] section
879 4.3.13.4).

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

886 **5.13 notify-persistence-granted (boolean)**

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

889 **6 Printer Description Attributes related to Notification**

890 This section defines the Printer Description attributes that are related to Notification. Table 3 lists the
891 Printer Description attributes and indicates the Printer support required for conformance and whether or not
892 the attribute is READ-ONLY: .

893

Table 3 - Printer Description attributes associated with Notification

Printer object attributes:	Printer support	READ-ONLY?
notify-schemes-supported (1setOf uriScheme)	REQUIRED	no
notify-events-default (1setOf type2 keyword)	REQUIRED	no
notify-events-supported (1setOf type2 keyword)	REQUIRED	no
max-events-supported (integer(5:MAX))	REQUIRED	no
notify-format-supported (1setOf mimeType)	REQUIRED	no
max-job-subscriptions-supported (integer(0:MAX))	REQUIRED	no
max-printer-subscriptions-supported (integer(0:MAX))	REQUIRED	no
notify-lease-time-supported (rangeOfInteger(0:MAX))	REQUIRED	no
notify-lease-time-default (integer(0:MAX))	REQUIRED	no
persistent-jobs-supported (boolean)	OPTIONAL	no
persistent-subscriptions-supported (boolean)	OPTIONAL	no
printer-state-change-time (integer(1:MAX))	OPTIONAL	yes
printer-state-change-date-time (dateTime)	OPTIONAL	yes

894 **6.1 notify-schemes-supported (1setOf uriScheme)**

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

897 **6.2 notify-events-default (1setOf type2 keyword)**

898 This REQUIRED Printer attribute identifies the event values if the client does not supply the "notify-
899 events" operation attribute in a Subscription Creation operation. Any value in this attribute MUST also
900 appear in the "notify-events-supported" attribute, i.e., be a supported event.

901 **6.3 notify-events-supported (1setOf type2 keyword)**

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

904 **6.4 max-events-supported (integer(5:MAX))**

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

911 **6.5 notify-format-supported (1setOf mimeType)**

912 This REQUIRED Printer attribute identifies the MIME media types supported for Human Consumable
913 and/or Machine Consumable notification content that the subscriber can control, if any. If the Notification
914 content is fixed by the implementation, then the value of this attribute is that MIME media type, if it has
915 been registered, or the 'none' out-of-band value (see section 10.1) otherwise. See the definition of the
916 "notify-format" attribute in section 5.3 for details and some example values.

917 Not all formats listed in the "notify-format-supported" attribute need be available with all delivery methods
918 specified in the "notify-schemes-supported". However, all Human Consumable formats, if any, SHOULD
919 be available with all delivery methods. It is much harder to support a Human Consumable format because
920 of localization issues. Once the code is written to support a particular Human Consumable format, it is easy
921 to transmit it on any of the supported notify-schemes. Thus, if a vendor decides to support a notify-scheme,
922 it has already committed to implement the Machine Consumable format. This may be simple if existing
923 code can be reused, e.g. application/ipp and or more difficult if new code must be written, e.g., it is SNMP.

924 **6.6 max-job-subscriptions-supported (integer(0:MAX))**

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

934 If a Printer does not support Per-Job Subscriptions, it MUST NOT support this attribute. The usual way for
935 a client to determine whether an IPP Printer supports a feature is to query the Printer's "operations-
936 supported" attribute. However, there is no new REQUIRED operation for Per-Job Subscriptions.
937 Therefore, the RECOMMENDED way for a client to determine whether or not a Printer supports Per-Job
938 Subscriptions is to query this attribute to see if it is supported (since the Create-Job-Subscriptions is an
939 OPTIONAL operation).

940 **6.7 max-printer-subscriptions-supported (integer(0:MAX))**

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

948 If a Printer does not support Per-Printer Subscriptions, then it MUST NOT support this attribute. None the
949 less, the RECOMMENDED way for a client to determine whether or not a Printer supports Per-Printer
950 Subscriptions is to query the "operations-supported" to see if the Create-Printer-Subscriptions operation is
951 supported, rather than querying this attribute.

952 **6.8 notify-lease-time-supported (rangeOfInteger(0:MAX))**

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

959 **6.9 notify-lease-time-default (integer(0:MAX))**

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

963 **6.10 persistent-jobs-supported (boolean)**

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

968 As with any settable attribute, if the Printer supports setting this attribute to more than one value, then the
969 value being set MUST control whether or not the Printer keeps Jobs persistently as per the rules in [ipp-
970 set]). As with any settable attribute, if the Printer only supports one value, it MAY support this attribute
971 either (1) as settable to that one value, or as not-settable, depending on implementation (see [ipp-set]).

972 **6.11 persistent-subscriptions-supported (boolean)**

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

978 As with any settable attribute, if the Printer supports setting this attribute to more than one value, then the
979 value being set MUST control whether or not the Printer keeps Jobs persistently as per the rules in [ipp-
980 set]). As with any settable attribute, if the Printer only supports one value, it MAY support this attribute
981 either (1) as settable to that one value, or as not-settable, depending on implementation (see [ipp-set]).

982 **6.12 printer-state-change-time (integer(1:MAX))**

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

986 **6.13 printer-state-change-date-time (dateTime)**

987 This OPTIONAL READ-ONLY Printer attribute records the date and time, i.e., copy of the Printer's
988 "printer-current-time" (dateTime) attribute (see [ipp-mod] section 4.4.30), that the Printer's "printer-state"
989 attribute was last changed. On power-up, the Printer populates the "printer-state-change-date-time" from its
990 "printer-current-time" attribute, so that it always has a value.

991 **7 Notification Content**

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

994 There are two notification content types: Machine Consumable and Human Consumable, i.e., 'text' MIME
995 media type. For most notification delivery methods both content types are defined. Each Notification
996 Content type will either define one specific Machine Consumable form (usual) or indicate that no Machine
997 Consumable form is defined. In addition, each Notification Content type will indicate whether (usual) or
998 not Human Consumable forms are permitted. But the definition will not define the Human Consumable
999 forms. For those Human Consumable forms that a Printer implementation supports as indicated in the
1000 Printer's "notify-format-supported" attribute, it MUST support for all Notification Content formats
1001 supported that permit Human Consumable form.

7.1 Notification content MIME media type formats

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

7.1.1 Human Consumable form

If the notification delivery method is defined to permit Human Consumable forms such as the entire Notification Content or a portion of the Notification Content, such as either an attachment or the "human-readable-report" attribute (see section 7.2) then the following RECOMMENDATIONS apply:

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

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

7.1.2 Machine Consumable form

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

1. The notification content MUST use the 'application/ipp' MIME media type [ipp-mod] using one of: (1) the Get-Job-Attributes response encoding for job events, (2) Get-Printer-Attributes response for printer events, or (3) a new Sent-Notifications operation for both job and printer events.
2. The attributes listed in sections 7.2 and 7.3 are sent in a Notification for Job events.
3. The attributes listed in sections 7.2 and 7.4 are sent in a Notification for Printer events.
4. For any 'text' or 'name' attribute value in any notification, the charset and natural language rules that apply to all IPP operations apply to these attributes as well, since they are represented as operation responses.
5. The "human-readable-report" attribute can be defined to be REQUIRED, OPTIONAL, or MUST NOT be sent.
6. If the values of any of the attributes sent in an notification content are not known, the value sent in the report content is the out-of-band 'unknown' value, rather than omitting the attribute (see the beginning of [ipp-mod] section 4.1).

An implementation MAY extend the contents of the Machine Consumable notification by adding additional attributes. Notification Recipients MUST be able to accept Notifications containing attributes they do not recognize. What a Notification Recipient does with an unrecognized attribute is implementation-

1035 dependent. Notification Recipients MAY attempt to display unrecognized attributes anyway or MAY
1036 ignore them.

1037 7.2 Notification content attributes common to Job and Printer events

1038 This section lists the parameters and attributes that are included in both Job and Printer event Notifications.

1039 The notification delivery method either models the Notification as a (1) request if the IPP Printer sends the
1040 Notification to the Notification Recipient when the event occurs or as a (2) response if the IPP Printer is
1041 queried for the Notification by a Notification Recipient:

1042 Request: If the delivery method defines that the IPP Printer sends the Notification, then the delivery
1043 method also defines whether or not the Notification Recipient returns a response. If the IPP Printer
1044 sends a Notification request, it uses the "operation-id alternative for item #0 in Table 4:

1045 Response: If the delivery method defines that the IPP Printer supports an operation that returns a
1046 Notification as a response to the Notification Recipient, it uses the "status-code" alternative for item
1047 #0 in Table 4.

1048 Some events do not include all of these attributes as shown in Table 4. Each notification content contains a
1049 single Job or Printer event, whether that event was subscribed using the Job Submission Subscription
1050 mechanism or the Per-Printer subscription mechanism. If either kind of Subscription subscribed to both
1051 Job and Printer events, then the Printer will send or return them as separate Job Notification content and
1052 Printer Notification contents to the same Notification Recipient.

1053 Table 4 lists the attributes that are defined for use in Notifications and indicates the Printer support required
1054 for conformance: References of the form "mod m.n.o" refer to [ipp-mod] sections.

1055 **Table 4 - Common Job and Printer Notification content attributes**

Attributes	Reference	Events	
		'job-progress'	all others
The following attributes MUST occur in this order:			
version-number (integer (0:32767))	mod 3.1.1	REQUIRED	REQUIRED
operation-id (integer (0:32767)) or status-code (integer (0:32767))	mod 3.1.1	REQUIRED	REQUIRED
request-id (integer (0:MAX))	5.7 & mod 3.1.1	REQUIRED	REQUIRED
attributes-charset (charset)	5.5 & mod 3.1.4	REQUIRED	REQUIRED
attributes-natural-language (naturalLanguage)	5.6 & mod 3.1.4	REQUIRED	REQUIRED

Attributes	Reference	Events	
		'job-progress'	all others
printer-uri (uri)	5.10	REQUIRED	REQUIRED
The following attribute MAY occur in any order:			
printer-name (name(127))	mod 4.4.4	n/a	REQUIRED
job-id (integer(1:MAX))	mod 4.3.2	REQUIRED	REQUIRED**
job-name (name(MAX))	mod 4.3.5	n/a	REQUIRED**
trigger-event (type2 keyword)	7.2.1	REQUIRED	REQUIRED
trigger-time (integer(MIN:MAX))	7.2.2	REQUIRED	REQUIRED
trigger-date-time (dateTime)	7.2.3	n/a	OPTIONAL
subscription-id (integer(1:MAX))	5.8	REQUIRED	REQUIRED
subscriber-user-name (name(MAX))	5.11	REQUIRED	REQUIRED
subscriber-user-data (octetString(63))	5.4	REQUIRED	REQUIRED
notify-format (mimeType)	5.3	OPTIONAL	OPTIONAL
human-readable-report (text(MAX))	7.2.4	OPTIONAL	OPTIONAL

1056 Attribute Notes:

1057 "version-number" - the major and minor version number.

1058 "operation-id" - the operation id if the delivery method document models the Notification as the Printer
 1059 sending the Notification to the Notification Recipient (whether the Notification Recipient returns a
 1060 response or not).

1061 "status-code" - a value of 0x600 (hexadecimal 600) for a Job event and 0x601 (hexadecimal 601) for a
 1062 Printer event if the delivery method document models the Notification as the Printer returning the
 1063 Notification to the Notification Recipient as a response to a request.

1064 "request-id" - the sequence number for this subscription, starting at 1, for each subscription, i.e., the Printer
 1065 copies the current value of the "subscription-request-id" Subscription object attribute to the
 1066 Notification request content.

1067 "attributes-charset" - the value comes from the "notify-charset" attribute in the Subscription object.

- 1068 "attributes-natural-language" - the value comes from the "notify-natural-language" attribute in the
1069 Subscription object.
- 1070 "printer-uri" - the value comes from the "job-printer-uri" Job attribute for Per-Job subscriptions.
- 1071 ****"job-id" and "job-name"** - included in Printer event Notifications only for Per-Job subscriptions.
- 1072 "job-name" - SNMP delivery method can truncate to less than 255 octets, since the Notification needs to fit
1073 into 484 octets or so on some transports that SNMP is defined for. See [ipp-method-snmp]
- 1074 "subscription-id" - the unique identifier for the Subscription object on this Printer.
- 1075 "subscriber-user-name" - the subscriber user name that created the Subscription object. SNMP delivery
1076 method can truncate to less than 255 octets, since the Notification needs to fit into 484 octets or so
1077 on some transports that SNMP is defined for. See [ipp-method-snmp]
- 1078 "subscriber-user-data" - opaque user data that may identify either the Subscriber and/or the ultimate
1079 Notification Recipient. The client **MUST** supply this attribute, if the definition of the delivery
1080 method specified in the "notify-recipient" attribute **REQUIRES** the client to supply it.
- 1081 "notify-format (mimeMediaType)" - indicates the text MIME media type (see section 5.3) for the "human-
1082 readable-report" attribute. This attribute **MUST** be present if the "human-readable-report"
1083 (text(MAX)) attribute is present in order to unambiguously identify the format of its text value to
1084 the Notification Recipient.

1085 **7.2.1 "trigger-event" (type2 keyword)**

1086 This **REQUIRED** Notification Content attribute indicates the event that caused this Notification to be
1087 delivered.

1088 **7.2.2 "trigger-time" (integer(MIN:MAX))**

1089 This **REQUIRED** Notification Content attribute indicates the time at which the event occurred, i.e., the
1090 "printer-up-time" value (see [ipp-mod] section 4.4.29) when the event occurred.

1091 **7.2.3 "trigger-date-time" (dateTime)**

1092 This **OPTIONAL** Notification Content attribute indicates the date and time at which the event occurred, i.e.,
1093 the "printer-current-time" value (see [ipp-mod] section 4.4.30) when the event occurred.

1094 **7.2.4 "human-readable-report" (text(MAX))**

1095 This **OPTIONAL** Notification Content attribute contains the human consumable text message (see section
1096 7.1.1) that describes the event and is represented in the text format specified by the "notify-format"
1097 attribute. Whether or not this attribute is defined depends on the delivery method definition document and
1098 **MUST** be defined only for use in the Machine Consumable format. If this attribute is defined for use in the

1099 Machine Consumable Notification, then whether this attribute is REQUIRED or OPTIONAL also depends
 1100 on the delivery method definition document.

1101 7.3 Additional Notification content attributes for Job events *only*

1102 Table 5 lists the additional attributes that are included only in Job event Notifications and indicates the
 1103 Printer support required for conformance: "R" indicates REQUIRED, "O" indicates OPTIONAL, and "CR"
 1104 indicates CONDITIONALLY REQUIRED, i.e., REQUIRED in a Notification if the corresponding Job
 1105 attributes are supported. Some events do not include all of these attributes as shown in Table 5.

1106 **Table 5 - Additional Notification content attributes for Job events *only***

Attributes	Reference	Events		
		'job-progress'	'job-completed'	all others
job-state (type1 enum)	mod 4.3.7	R	R	R
job-state-reasons (1setOf type2 keyword)	mod 4.3.8	R	R	R
job-k-octets (integer(0:MAX))	mod 4.3.17.1	O	O	
job-k-octets-processed (integer(0:MAX))	mod 4.3.18.1	O	O	
job-impressions (integer(0:MAX))	mod 4.2.17.2	O	O	
job-impressions-completed (integer(0:MAX))	mod 4.3.18.2	CR	CR	
impressions-completed-current-copy (integer(0:MAX))	[ipp-prog]	R		
job-media-sheets (integer(0:MAX))	mod 4.3.17.3	O	O	
job-media-sheets-completed (integer(0:MAX))	mod 4.3.18.3	CR	CR	
job-collation-type (type2 enum)	[ipp-prog]	R		
sheet-completed-copy-number (integer(0:MAX))	[ipp-prog]	R		
sheet-completed-document-number(integer(0:MAX))	[ipp-prog]	R		

1107 7.4 Additional Notification content attributes for Printer events *only*

1108 Table 6 lists the additional attributes that are included only in Printer event Notifications and indicates the
 1109 Printer support required for conformance:

1110 **Table 6 - Additional Notification content attributes for Printer events *only***

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

1111 **8 Operations for notification**

1112 This section defines all of the operations for notification which are summarized in Table 1 in section 1.1,
 1113 including the assignment of the operation-id.

1114 **8.1 Operations for Per-Job Subscriptions *only***

1115 This section defines the operation requests and responses that are related to Per-Job subscriptions and its
 1116 Subscription object. Section 8.3 defines the REQUIRED operation requests and responses associated with
 1117 the REQUIRED Per-Printer subscription and its Subscription object.

1118 **8.1.1 Job Creation Operations (Create-Job, Print-Job, Print-URI) and Validate-Job**

1119 The usual method for a client to associate one subscription with a Job is to specify the subscription when
 1120 the job is created. For a Per-Job Subscription, the client supplies the "job-notify (1setOf collection)"
 1121 operation attribute with the member attributes listed in Table 7 with any of the Job Creation operations
 1122 (Create-Job, Print-Job, Print-URI), plus Validate-Job (which doesn't create a job or subscription). If the
 1123 client does not supply the "job-notify" attribute in the create operation, there is no subscription made (either
 1124 implicitly or explicitly).

1125 If a Printer does not support this notification specification, then it MUST ignore the "job-notify" operation
 1126 attribute and return it in the response indicated as an attribute that is not supported. See [ipp-mod] section
 1127 3.1.7 for details on returning Unsupported Attributes.

1128

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

Member attribute of "job-notify" collection	Reference	client MUST supply	Printer support
notify-recipient (uri)	5.1	yes	REQUIRED
notify-events (1setOf type2 keyword)	5.2	no	REQUIRED
notify-format (mimeType)	5.3	no	REQUIRED
subscriber-user-data (octetString(63))	5.4	depends on delivery method **	REQUIRED
notify-charset (charset)	5.5	no	OPTIONAL
notify-natural-language (naturalLanguage)	5.6	no	OPTIONAL

1129

1130 Table 8 shows the "job-notify" (collection) member attributes with their corresponding "xxx-default" and
 1131 "xxx-supported" attributes. The Printer uses the "xxx-default" values if the client omits the member
 1132 attribute in the request. The "xxx-supported" attributes are used by the Printer to validate the request. The
 1133 client can query to determine supported values.

1134

Table 8 - "job-notify" supported and default attributes

"job-notify" member attribute	"xxx-default", if any	"xxx-supported"
notify-recipient (uri)	none	notify-schemes-supported (1setOf uriScheme)
notify-events (1setOf type2 keyword)	notify-events-default (1setOf type2 keyword)	notify-events-supported (1setOf type2 keyword) max-events-supported (integer(5:MAX))
notify-format (mimeType)	none	notify-format-supported (1setOf mimeType)
subscriber-user-data (octetString(63))	none	none
notify-charset (charset)	charset-configured (charset)	charset-supported (1setOf charset)
notify-natural-language	natural-language-configured	generated-natural-language-supported

"job-notify" member attribute	"xxx-default", if any	"xxx-supported"
(naturalLanguage)	(naturalLanguage)	(1setOf naturalLanguage)

- 1135 See the referenced sections for a definition of these operation attributes, since they are copied to the
 1136 Subscription object as the Subscription Description attributes described in section 5.
- 1137 The following rules apply to Per-Job subscriptions created as part of the Job Creation operations:
- 1138 1. Any subscription can contain job events, printer events, or both.
 - 1139 2. The Job Submission Subscription is only valid while the job is "not-completed". The job is "not-
 1140 completed" while it is in the 'pending', 'pending-held', 'processing', and 'processing-stopped' states.
 1141 The job changes from being "not-completed" to "retained" when it is done processing and enters any
 1142 of the 'completed', 'canceled', or 'aborted' states. The job becomes "not-completed" again when it is
 1143 restarted using the Restart-Job operation (see [ipp-mod]).
 - 1144 3. Since no job is created for the Validate-Job operation, the only purpose of supplying the subscription
 1145 operation attributes in the Validate-Job operation is to validate that the values are supported; the
 1146 Printer object does not establish a notification subscription as a result of the Validate-Job operation.
 - 1147 4. Since a Job Submission Subscription is included within a job submission operation, any interest in
 1148 job events is limited to "this job" only (the Job object created because of this job creation operation).
 1149 There is no mechanism to subscribe to events for all jobs or specifically some job other than this job
 1150 in a create operation. But see the Create-Printer-Subscription operation (section 8.2.1) for an explicit
 1151 operation to subscribe for job and/or printer events independently of any particular job submission,
 1152 i.e., Per-Printer subscriptions.
 - 1153 5. Event reporting only occurs when a notification recipient has specified a subscription to any event(s).
 - 1154 6. The notification implementation MAY allow an administrator to configure a policy on what events
 1155 may be dropped.
 - 1156 7. ** The client MUST supply the "subscriber-user-data" (octetString(63)) attribute, if the definition of
 1157 the delivery method specified in the "notify-recipient" attribute REQUIRES the client to supply it.
 - 1158 8. If the OPTIONAL "notify-charset" attribute is not supported or the supplied value is not supported,
 1159 the IPP Printer MUST return the attribute in the Unsupported Attributes Group but still accept the
 1160 operation, as with all Job create operations. In this case, the Printer MUST use the natural language
 1161 supplied in the "attributes-charset" Job creation operation attribute, if that natural language value is
 1162 supported by the Printer, else the Printer object MUST use the Printer's "charset-configured" value.
 1163 See the Print-Job operation in [ipp-mod].
 - 1164 9. If the OPTIONAL "notify-natural-language" attribute is not supported or the supplied value is not
 1165 supported, the IPP Printer MUST return the attribute in the Unsupported Attributes Group but still
 1166 accept the operation, as with all Job create operations. In this case, the Printer MUST use the natural
 1167 language supplied in the "attributes-natural-language" Job creation operation attribute, if that natural

- 1168 language value is supported by the Printer, else the Printer object MUST use the Printer's "natural-
1169 language-configured" value. See the Print-Job operation in [ipp-mod].
- 1170 10. If a collection contains other unrecognized, unsupported member attributes and/or conflicting values,
1171 the attribute returned in the Unsupported Group is a collection containing the unrecognized,
1172 unsupported member attributes, and/or conflicting values. The Printer MUST return the unrecognized
1173 member attributes with the out-of-band value of 'unsupported'. The Printer MUST return the
1174 unsupported member attributes and conflicting values with their unsupported values. See [ipp-coll].
- 1175 11. If the number of events supplied in the "notify-events" attribute exceeds the Printer's "max-events-
1176 supported" attribute, the Printer MUST accept the request with the status code 'successful-ok-ignored-
1177 or-substituted-attributes' and return the "job-notify" collection in the Unsupported Attributes Group
1178 with only the "job-events" member attribute containing the events that exceed the maximum.
- 1179 12. If the Per-Job subscriptions would exceed the limit of Per-Job subscriptions supported per job as
1180 specified by the Printer's "max-job-subscriptions-supported" attribute or would exceed some
1181 implementation-defined limit on the total number of Per-Job subscriptions for the Printer (if any), the
1182 Printer MUST accept the request with the status code 'successful-ok-ignored-subscriptions', MUST
1183 return the "job-notify" attribute in the Unsupported Attributes Group with only the collection value(s)
1184 that represent the excess subscriptions that are being ignored, and MUST perform the Job Creation
1185 operation (see section 8.1.1), since the job can still be printed.
- 1186 13. If the job is accepted and one or more subscriptions are ignored, the status code returned is
1187 'successful-ok-ignored-subscriptions. This status code is returned even if other job attributes are
1188 unsupported or in conflict. That is, if an IPP Printer finds a warning that would allow it to return
1189 'successful-ok-ignored-subscriptions' and either 'successful-ok-ignored-or-substituted-attributes'
1190 and/or 'successful-ok-conflicting-attributes', it must return 'successful-ok-ignored-subscriptions'. In
1191 other words, the precedence for returning success codes is: 'successful-ok-ignored-subscriptions',
1192 'successful-ok-conflicting-attributes', and 'successful-ok-ignored-or-substituted-attributes'.

1193 **8.1.2 Create-Job-Subscription operation**

1194 The OPTIONNAL Create-Job-Subscription operation creates a Per-Job Subscription object . The client can
1195 specify one or more job and/or printer events to be delivered as notifications to one Notification Recipient.
1196 For the Per-Job subscription objects, the Job events are for this job only. The printer events are any events
1197 generated by that Printer for any job or when no job is involved at all (same as for Per-Job Subscriptions).

1198 The Printer returns a subscription id and the length of time for which it has granted a lease for the
1199 subscription.

1200 A client can unsubscribe using the Cancel-Subscription operation (section 8.3.4) and the subscription id.

1201 Two Create-Job-Subscription operations with the same events and same Notification Recipient MUST be
1202 kept as distinct subscriptions and be assigned distinct subscription ids. A Printer MUST allow such
1203 duplicate subscriptions such that Cancel-Subscription doesn't unsubscribe both subscriptions and MUST
1204 send the Notifications twice to the Notification Recipient, since the "request-id" is supposed to count
1205 monotonically for each Subscription object.

1206 If the Printer has a bounded set of concurrent Per-Job subscriptions and the request would exceed that
 1207 bound, the Printer rejects the operation and returns the 'client-error-too-many-subscriptions' status code.
 1208 The client SHOULD try again later.

1209 Access Rights: To create Per-Job subscription objects, the authenticated user (see [IPP-MOD] section 8.3)
 1210 performing this operation MUST either be the job owner or have operator or administrator access rights for
 1211 the Printer object (see [IPP-MOD] sections 1 and 8.5). Otherwise the IPP object MUST reject the operation
 1212 and return: the 'client-error-forbidden', 'client-error-not-authenticated', or 'client-error-not-authorized' status
 1213 code as appropriate.

1214 Request :

Group 1: Operation Attributes		Reference [ipp-mod]	client MUST supply	Printer support
"attributes-charset" (charset)		3.1.4.1	yes	REQUIRED
"attributes-natural-language" (naturalLanguage)		3.1.4.1	yes	REQUIRED
"printer-uri" (uri)		3.1.5	yes	REQUIRED
"job-id" (integer(1:MAX))		3.1.5	yes	REQUIRED
"job-uri" (uri)		3.1.5	if not "printer- uri" and "job-id"	REQUIRED
"requesting-user-name" (name(MAX))		8.3	RECOMMEND ED	REQUIRED

1215

Group 2: Subscription Attributes		Reference	client MUST supply	Printer support
"notify-recipient" (uri)		5.1	yes	REQUIRED
"notify-events" (1setOf type2 keyword)		5.2	no	REQUIRED
"notify-format" (mimeMediaType)		5.3	no	REQUIRED
"subscriber-user-data" (octetString(63))		5.4	depends on delivery method	REQUIRED
"notify-charset" (charset)		5.5	no	OPTIONAL
"notify-natural-language" (naturalLanguage)		5.6	no	OPTIONAL
"notify-persistence-requested" (boolean)		see below	no	OPTIONAL

1216 Response :

Group 1: Operation Attributes		Reference [ipp- mod]	REQUIRED in response
"status-code" (type2 enum)		3.1.6.1	REQUIRED
"attributes-charset" (charset)		3.1.4.2	REQUIRED
"attributes-natural-language" (naturalLanguage)		3.1.4.2	REQUIRED
"status-message" (text(255))		3.1.6.2	OPTIONAL
"detailed-status-message" (text(MAX))		3.1.6.3	OPTIONAL

1217

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

1218

Group 3: Subscriptions Attributes	Reference	REQUIRED in response
"subscription-id" (integer(1:MAX))	5.8	REQUIRED
"notify-persistence-granted" (boolean)	5.13	REQUIRED

1219

Attribute Notes:

1220

"job-id" (integer(1:MAX)) - the client MUST either (1) supply this attribute, in combination with the "printer-uri" attribute, in order to create a Per-Job subscription for the Job identified by the "job-id" value or supply the "job-uri" instead, as with any Job operation:

1221

1222

1223

"job-uri" (uri) - the client MUST supply this attribute, if the "printer-uri" and "job-id" are not supplied, in order to identify the Job to which the Per-Job Subscription is being created.

1224

1225

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

1226

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

1227

1228

1229

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

1230

1231

1232

1233

1234

"subscriber-user-data" (octetString(63)) - the client MUST supply this attribute, if the definition of the delivery method specified in the "notify-recipient" attribute REQUIRES the client to supply it.

1235

1236

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

1237

1238

1239

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

1240

1241

1242 **8.2 Operations for Per-Printer Subscriptions *only***

1243

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

1244

8.2.1 Create-Printer-Subscription operation

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

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

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

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

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

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

Request :

Group 1: Operation Attributes	Reference [ipp-mod]	client MUST supply	Printer support
"attributes-charset" (charset)	3.1.4.1	yes	REQUIRED
"attributes-natural-language" (naturalLanguage)	3.1.4.1	yes	REQUIRED
"printer-uri" (uri)	3.1.5	yes	REQUIRED
"requesting-user-name" (name(MAX))	8.3	RECOMMENDED	REQUIRED

Group 2: Subscription Attributes		Reference	client MUST supply	Printer support
"notify-recipient" (uri)	5.1	yes	REQUIRED	
"notify-events" (1setOf type2 keyword)	5.2	no	REQUIRED	
"notify-format" (mimeMediaType)	5.3	no	REQUIRED	
"subscriber-user-data" (octetString(63))	5.4	depends on the delivery method	REQUIRED	
"notify-charset" (charset)	5.5	no	OPTIONAL	
"notify-natural-language" (naturalLanguage)	5.6	no	OPTIONAL	
"notify-lease-time-requested" (integer(0:MAX))	see below	no	REQUIRED	
"notify-persistence-requested" (boolean)	see below	no	OPTIONAL	

1269 Response :

Group 1: Operation Attributes		Reference	REQUIRED in response
"status-code" (type2 enum)	3.1.6.1	REQUIRED	
"attributes-charset" (charset)	3.1.4.2	REQUIRED	
"attributes-natural-language" (naturalLanguage)	3.1.4.2	REQUIRED	
"status-message" (text(255))	3.1.6.2	OPTIONAL	
"detailed-status-message" (text(MAX))	3.1.6.3	OPTIONAL	

1270

Group 2: Unsupported Attributes (see [ipp-mod] section 3.1.7)	REQUIRED if unsupported attributes
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1271

Group 3: Subscription Attributes		Reference	REQUIRED in response
"subscription-id" (integer(1:MAX))	5.8	REQUIRED	
"notify-lease-expiration-time" (integer(0:MAX))	5.9	REQUIRED	
"notify-server-up-time" (integer(1:MAX))	5.12	REQUIRED	
"notify-persistence-granted" (boolean)	5.13	REQUIRED	

1272 Attribute Notes:

1273 "notify-recipient" (uri) - the client MUST supply this attribute in order to have a subscription.

1274 "notify-lease-time-requested" (integer(0:MAX)) - the number of seconds requested for the subscription
 1275 lease. A value of 0 indicates a request that the Per-Printer Subscription lease never expire.
 1276 Supplying a 0 value MAY require authentication in order to be used, if 0 is supported at all.
 1277 If the client does not supply this attribute, the Printer uses its "notify-lease-time-default" Printer
 1278 Description attribute value (see section 6.9).

- 1279 "notify-event" (1setOf type2 keyword) - if the client does not supply this attribute, the Printer populates the
1280 "notify-events" Subscription Description attribute from its "notify-events-default" Printer
1281 Description attribute.
- 1282 "notify-format" (mimeMediaType) - if the client supplies this attribute, the value indicates which Human
1283 Consumable text format is requested for use in the Notification using the delivery method that the
1284 client supplies in the "notify-recipient" attribute. If the client does not supply this attribute, the
1285 Machine-Consumable form of the delivery method that the client supplies in the "notify-recipient"
1286 attribute is used.
- 1287 "subscriber-user-data" (octetString(63)) - the client **MUST** supply this attribute, if the definition of the
1288 delivery method specified in the "notify-recipient" attribute **REQUIRES** the client to supply it.
- 1289 "notify-persistence-requested" (boolean) - whether or not the Per-Printer Subscription is to be persistent,
1290 i.e., saved across power cycles. Note: Persistent trap registrations is a client option in SNMPv3
1291 [RFC2573].
- 1292 "notify-lease-expiration-time" (integer(0:MAX)) - The Printer object **MUST** return this attribute which is
1293 the time in the future at which the subscription lease will expire, i.e., the "printer-up-time" value (in
1294 time ticks - see [ipp-mod] section 4.4.29) at which the Printer will delete the Subscription. A value
1295 of 0 indicates that the lease subscription will never expire.
- 1296 "notify-server-up-time" (integer(1:MAX)) - The Printer object **MUST** return this attribute which is an alias
1297 for the Printer's "printer-up-time" Printer Description attribute. The client subtracts this value from
1298 the "notify-lease-expiration-time" value returned in order to determine the number of second in the
1299 future that the subscription will expire. This computed value may be less than the requester
1300 requested in the "notify-lease-time-requested" if it was greater than the MAX supported or more
1301 than the requester requested if it was less than the MIN supported, as indicated in the Printer's
1302 "notify-lease-time-supported" (rangeOfInteger(0:MAX)) attribute (see section 6.8).
- 1303 "notify-persistence-granted" - whether or not this Subscription object instance is persistent. This attribute
1304 **MUST** be returned whether "notify-persistence-requested" is supported or not, so that the client
1305 knows which.

1306

1307 **8.3 Common Operations for Per-Job and Per-Printer Subscriptions**

1308 This section defines the operations that are common to both Per-Job and Per-Printer subscriptions.

1309 **8.3.1 Get-Subscription-Attributes operation**

1310 The REQUIRED Get-Subscription-Attributes returns the requested attributes of the identified Subscription
 1311 object. See section 5.

1312 Request:

Group 1: Operation Attributes	Reference [ipp-mod]	client MUST supply	Printer support
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1313

"attributes-charset" (charset)	3.1.4.1	yes	REQUIRED
"attributes-natural-language" (naturalLanguage)	3.1.4.1	yes	REQUIRED
"printer-uri" (uri)	3.1.5	yes	REQUIRED
"requesting-user-name" (name(MAX))	8.3	RECOMME NDED	RECOMME NDED

1314

Group 2: Subscription Attributes	Reference	client MUST supply	Printer support
"subscription-id" (integer(1:MAX))	5.8	yes	REQUIRED
"requested-attributes" (1setOf type2 keyword)	see below	no	REQUIRED

1315 Response:

Group 1: Operation Attributes	Reference [ipp-mod]	REQUIRED in response
"status-code" (type2 enum)	3.1.6.1	REQUIRED
"attributes-charset" (charset)	3.1.4.2	REQUIRED
"attributes-natural-language" (naturalLanguage)	3.1.4.2	REQUIRED
"status-message" (text(255))	3.1.6.2	OPTIONAL
"detailed-status-message" (text(MAX))	3.1.6.3	OPTIONAL

1316

Group 2: Unsupported Attributes (see [ipp-mod] section 3.1.7)	REQUIRED if unsupported attributes
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1317

Group 3: <the requested Subscription object attributes>	REQUIRED
---	----------

1318 This operation is similar to the Get-Printer-Attributes operation.

1319 "requested-attributes" (1setOf keyword): The client OPTIONALLY supplies this attribute. The Printer
 1320 object MUST support this attribute. It is a set of Subscription attribute names and/or the 'all'
 1321 attribute group name in whose values the requester is interested. This set of attributes is returned for
 1322 each Job object that is returned. If the client does not supply this attribute, the Printer MUST
 1323 respond as if the client had supplied this attribute with the value: 'all'.

8.3.2 Get-Subscriptions operation

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

Request :

Group 1: Operation Attributes	Reference [ipp-mod]	client MUST supply	Printer support
"attributes-charset" (charset)	3.1.4.1	yes	REQUIRED
"attributes-natural-language" (naturalLanguage)	3.1.4.1	yes	REQUIRED
"printer-uri" (uri)	3.1.5	yes	REQUIRED
"job-id" (integer(1:MAX))	3.1.5	yes, if Per-Job Subscription	REQUIRED
"requesting-user-name" (name(MAX))	8.3	RECOMMENDED	RECOMMENDED
"limit" (integer(1:MAX))	see below	OPTIONAL	REQUIRED
"requested-attributes" (1setOf type2 keyword)	see below	OPTIONAL	REQUIRED
"my-subscriptions" (boolean)	see below	OPTIONAL	REQUIRED

Response :

Group 1: Operation Attributes	Reference [ipp-mod]	REQUIRED in response
"status-code" (type2 enum)	3.1.6.1	REQUIRED
"attributes-charset" (charset)	3.1.4.2	REQUIRED
"attributes-natural-language" (naturalLanguage)	3.1.4.2	REQUIRED
"status-message" (text)	3.1.6.2	OPTIONAL
"detailed-status-message" (text(MAX))	3.1.6.3	OPTIONAL

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

Group 3 to N:<the requested Subscription Attributes for each Subscription object in a separate group>	see below	REQUIRED
---	-----------	----------

Attribute Notes:

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

- 1337 "job-id" (integer(1:MAX)) - If the client supplies this attribute, all of the Per-Job Subscription objects for
1338 the identified job are candidates for return. If this attribute is omitted, all of the Per-Printer
1339 Subscription objects are candidates for return.
- 1340 "limit" (integer(1:MAX)): The client **OPTIONALLY** supplies this attribute. The Printer object **MUST**
1341 support this attribute. It is an integer value that determines the maximum number of Subscription
1342 objects that a client will receive from the Printer even if "my-subscriptions" constrain which
1343 subscriptions are returned. The limit is a "stateless limit" in that if the value supplied by the client is
1344 'N', then only the first 'N' Subscriptions are returned in the Get-Subscriptions Response. There is no
1345 mechanism to allow for the next 'M' Subscriptions after the first 'N' Subscriptions. If the client does
1346 not supply this attribute, the Printer object responds with all applicable Subscriptions.
- 1347 "requested-attributes" (1setOf keyword): The client **OPTIONALLY** supplies this attribute. The Printer
1348 object **MUST** support this attribute. It is a set of Subscription attribute names and/or the 'all'
1349 attribute group name in whose values the requester is interested. This set of attributes is returned for
1350 each Job object that is returned. If the client does not supply this attribute, the Printer **MUST**
1351 respond as if the client had supplied this attribute with the value: 'all'.
- 1352 "my-subscriptions" (boolean): The client **OPTIONALLY** supplies this attribute. The Printer object **MUST**
1353 support this attribute. It indicates whether Subscriptions from all users or just the Subscriptions
1354 submitted by the requesting user of this request **MUST** be returned by the Printer object. If the
1355 client does not supply this attribute, the Printer object **MUST** respond as if the client had supplied
1356 the attribute with a value of 'false', i.e., Subscriptions from all users. The means for authenticating
1357 the requesting user and matching the Subscription objects is the same as for jobs as described in
1358 [ipp-mod] section 8.
- 1359 Groups 3 to N: Subscription Object Attributes: The Printer object responds with one set of Subscription
1360 Object Attributes for each returned Subscription object. The Printer object ignores (does not
1361 respond with) any requested attribute or value which is not supported or which is restricted by the
1362 security policy in force, including whether the requesting user is the user that created the
1363 Subscription object (subscribing user) or not (see [ipp-mod] section 8).

1364 **8.3.3 Renew-Subscription operation**

1365 The **REQUIRED** Renew-Subscription operation permits a client to request the IPP Printer to extend the
1366 lease on a Subscription object instance. There is no way to renew a Per-Job subscription, since they are
1367 automatically canceled after the job completes and no longer has any documents, i.e., the job is no longer
1368 retained (see [ipp-mod] section 4.3.7.2). If the requested subscription object is a Per-Job subscription, the
1369 Printer **MUST** grant an infinite lease by returning a 0 value for the "notify-lease-expiration-time".

1370 *Access Rights:* The authenticated user (see [IPP-MOD] section 8.3) performing this operation **MUST** either
1371 be the owner of the Subscription object or have operator or administrator access rights for the Printer object
1372 (see [IPP-MOD] sections 1 and 8.5). Otherwise the IPP object **MUST** reject the operation and return: the
1373 'client-error-forbidden', 'client-error-not-authenticated', or 'client-error-not-authorized' status code as
1374 appropriate.

1375 Request :

Group 1: Operation Attributes		Reference [ipp-mod]	client MUST supply	Printer support
"attributes-charset" (charset)		3.1.4.1	yes	REQUIRED
"attributes-natural-language" (naturalLanguage)		3.1.4.1	yes	REQUIRED
"printer-uri" (uri)		3.1.5	yes	REQUIRED
"requesting-user-name" (name(MAX))		8.3	RECOMME NDED	RECOMME NDED

1376

Group 2: Subscription Attributes		Reference	client MUST supply	Printer support
"subscription-id" (integer(1:MAX))		5.8	yes	REQUIRED
"notify-lease-time-requested" (integer(0:MAX))		see below	no	REQUIRED

1377 Response :

Group 1: Operation Attributes		Reference [ipp-mod]	REQUIRED in response
"status-code" (type2 enum)		3.1.6.1	REQUIRED
"attributes-charset" (charset)		3.1.4.2	REQUIRED
"attributes-natural-language" (naturalLanguage)		3.1.4.2	REQUIRED
"status-message" (text(255))		3.1.6.2	OPTIONAL
"detailed-status-message" (text(MAX))		3.1.6.3	OPTIONAL

1378

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

1379

Group 3: Subscriptions Attributes		Reference	REQUIRED in response
"notify-lease-expiration-time" (integer(0:MAX))		5.9	REQUIRED
"notify-server-up-time" (integer(1:MAX))		5.12	REQUIRED

1380

1381 Attribute Notes:

1382 "notify-lease-time-requested" (integer(0:MAX)) - the number of seconds requested for the Per-Printer
1383 subscription lease. Same as Create-Printer-Subscriptions (see section 8.2.1).

1384 "notify-lease-expiration-time" - the time in the future when the subscription will expire. Same as for the
1385 Create-Printer-Subscription operation (see section 8.2.1).

1386 "notify-server-up-time" - the Printer object MUST return this attribute which is an alias for the Printer's
 1387 "printer-up-time" Printer Description attribute. The client subtracts this value from the "notify-
 1388 lease-expiration-time" value returned in order to determine the number of second in the future that
 1389 the subscription will expire (see further explanation in section 8.2.1).

1390 Note: There is no way to change any of the Subscription object attributes, except the "notify-lease-
 1391 expiration-time" attribute (using the Renew-Subscription operation). In order to change other attributes, a
 1392 client can create a new Subscription object and then use the Cancel-Subscription operation to cancel the old
 1393 one (or do this in the other order, in case there is a limit on the number of Subscription object instances, as
 1394 long as a short window with no Notifications is ok).

1395 Note: There is no need to renew a Per-Job Subscription, since it is effectively the time that the Job is active
 1396 (see section 8.1).

1397 **8.3.4 Cancel-Subscription operation**

1398 The REQUIRED Cancel- Subscription operation allows a client to remove a Subscription object. No more
 1399 Notifications are delivered for that Subscription. Once performed, there is no way to use that Subscription
 1400 in the future. Subscription-ids should not be reused immediately, so that a stale reference situation is not
 1401 created. Same as for Cancel-Job and job-ids.

1402 *Access Rights:* The authenticated user (see [IPP-MOD] section 8.3) performing this operation MUST either
 1403 be the owner of the Subscription object or have operator or administrator access rights for the Printer object
 1404 (see [IPP-MOD] sections 1 and 8.5). Otherwise the IPP object MUST reject the operation and return: the
 1405 'client-error-forbidden', 'client-error-not-authenticated', or 'client-error-not-authorized' status code as
 1406 appropriate.

1407 Request :

Group 1: Operation Attributes		Reference [ipp-mod]	client MUST supply	Printer support
"attributes-charset" (charset)		3.1.4.1	yes	REQUIRED
"attributes-natural-language" (naturalLanguage)		3.1.4.1	yes	REQUIRED
"printer-uri" (uri)		3.1.5	yes	REQUIRED
"requesting-user-name" (name(MAX))		8.3	RECOMME NDED	RECOMME NDED

1408

Group 2: Subscription Attributes		Reference	client MUST supply	Printer support
"subscription-id" (integer(1:MAX))		5.8	yes	REQUIRED

1409 Response :

Group 1: Operation Attributes	Reference [ipp-mod]	REQUIRED in response
"status-code" (type2 enum)	3.1.6.1	REQUIRED
"attributes-charset" (charset)	3.1.4.2	REQUIRED
"attributes-natural-language" (naturalLanguage)	3.1.4.2	REQUIRED
"status-message" (text(255))	3.1.6.2	OPTIONAL
"detailed-status-message" (text(MAX))	3.1.6.3	OPTIONAL

1410

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

1411

1412 9 Comparison of Per-Job versus Per-Printer Subscriptions

1413 Per-Job and Per-Printer subscriptions are quite similar. Either type of subscription can subscribe to Job
 1414 events, Printer events, or both. Both types of subscriptions can be queried using the Get-Subscriptions and
 1415 Get-Subscription-Attributes operations and canceled using the Cancel-Subscription operation. Both types
 1416 of subscriptions create Subscription objects which have the same attributes defined. However, there are
 1417 some semantic differences between Per-Job subscriptions and Per-Printer subscriptions. A Per-Job
 1418 Submission Subscription is established by the client when submitting a job and after creating the job using
 1419 the Create-Job-Subscription operation by specifying the "job-id" of the job. A Per-Printer Subscription is
 1420 established between a client and a Printer using the Create-Printer-Subscription operation. Some specific
 1421 differences are:

- 1422 1. A client usually creates a Per-Job subscription as part of the Job Creation operations (Create-Job, Print-
 1423 Job, and Print-URI), rather than using the OPTIONAL Create-Job-Subscription operation, especially
 1424 since Printer implementations NEED NOT support the Create-Job-Subscription operation, since it is
 1425 OPTIONAL.
- 1426 2. For Per-Job subscriptions, the subscription is only valid while the job is "not-complete" (see sections
 1427 7.2 and 7.3) while for the Per-Printer subscriptions, the subscription is valid until the time (in seconds)
 1428 that the Printer returned in the "notify-lease-expiration-time" operation attribute expires.
- 1429 3. Job Events in a Per-Job subscription apply only to "one job" (the Job created by the job creation
 1430 operation or references by the Create-Job-Subscription operation) while Job Events in a Per-Printer
 1431 subscription apply to ALL jobs contained in the IPP Printer object.

1432 10 Out of Band Values

1433 This section defines out-of-band values (see [ipp-mod] section 4.1) for use with attributes defined in this
 1434 and other documents.

10.1 'none'

This out-of-band value permits a client to indicate in a request that a specified attribute in the request MUST NOT be applied to the job. Specifically, this value overrides the Printer's "xxx-default" attribute value for the attribute, if one exists. This out-of-band value is needed since attributes that are of the 'collection', 'uri', and 'mimeMediaType' type need a way for a client to specify that the Printer MUST NOT apply the value of an "xxx-default" attribute to the job. See [ipp-coll] for a complete specification, including encoding.

11 Conformance Requirements

It is OPTIONAL to implement this Event Notification specification. An implementation conforming to this specification MUST also meet the Conformance Requirements detailed in [IPP-MOD] section 5. If this Event Notification specification is implemented, IPP objects MUST support all of the REQUIRED object attributes as defined in this document in the indicated sections:

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

In addition, the Printer MUST support the 'collection' attribute syntax (see [ipp-coll]).

Extensions made to the events herein must be made such that new events or event attributes are backward compatible to clients who implemented early versions of this notification specification.

If this Event Notification specification is implemented, the operations described in section 8 MUST be supported as described in Table 9:

Table 9 - Conformance Requirements for Operations

Attribute	Conformance requirements
"job-notify" (1setOf collection) 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

12 IANA Considerations

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

13 Internationalization Considerations

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

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

14 Security Considerations

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

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

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

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

15 Status Codes

The following status codes are defined as extensions for notification:

15.1 'successful-ok-ignored-subscriptions' (0x0003)

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

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

15.2 client-error-uri-notification-scheme-not-supported (0x0414)

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

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

15.3 client-error-too-many-subscriptions (0x0415)

The bounded set of concurrent Per-Printer subscriptions supported by the Printer object would be exceeded if this Create-Printer-Subscription request were accepted or the bounded set of concurrent Per-Job subscriptions supported by the Printer object would be exceeded if this Create-Job-Subscriptions request were accepted.

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

1519 **15.4 client-error-too-many-events (0x0416)**

1520 The client supplied more events in the "notify-events" operation attribute in a Create-Job-Subscription or
 1521 Create-Printer-Subscription operation than the Printer supports, as indicated in its "max-events-supported"
 1522 attribute (see section 6.4).

1523 There is no corresponding Per-Job subscription error for a Job Creation operation, since the Printer object
 1524 MUST ignore any errors in the "job-notify" operation attribute, MUST return the "notify-events" attribute in
 1525 the Unsupported Attributes Group with only the excess events that are being ignored, and perform the Job
 1526 Creation operation (see section 8.1.1), since the job can still be printed.

1527 **16 Addition attribute tag encodings**

1528 The Subscription attributes tag and the Notification attributes tag are assigned the following delimiter tag
 1529 values as extensions to the encoding defined in [ipp-pro]) for use in requests and responses to delimit
 1530 Subscription object attribute Groups and Notification Content attribute Groups:

Tag Value (Hex)	Delimiter
0x06	subscription-attributes-tag
0x07	notification-attributes-tag

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1640 **A. Appendix - Summary of Notification Attribute Usage**

1641 This appendix summarizes the usage of Notification attributes in the Job operation attribute collection, Job
1642 object, Subscription object, Notification content, Job operations, and Subscriptions operations. The legend
1643 for the notation used in the tables is given following each table.

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

1644 Legend: "R" - REQUIRED for Printer to support; "O" - OPTIONAL for Printer to support; "[]" - OPTIONAL for sender to send;
1645 Return - Printer MUST return; * the client MUST supply for some delivery methods; ** - MUST be 0 for Per-Job Subscription
1646 objects; (n) means the value comes from the indicated Subscription Attribute

1647

Attributes	Objects		Notification		Job operations		Subscription operations		
	Job	Subscription	Job Notification	Printer Notification	Job Creation Validate -Job	Create -Job-Subscription	Create-Printer-Subscription	Renew - Subscription	Cancel - Subscription
19. version-number (integer (0:32767))			R	R					
20. operation-id (integer (0:32767)) or status-code (integer (0:32767))			0x600	0x601					
21. job-printer-uri (uri)	R								
22. printer-uri (uri)		R	R	R	R	R	R	R	R
23. printer-name (name(127))			R	R					
24. job-id (integer(1:MAX))	R		R	Per-Jb		R			
25. job-name (name(MAX)) [SNMP can truncate]	R		R	Per-Jb					
26. requesting-user-name (name(MAX))	R								
27. subscriber-user-name (name(MAX))		R	R	R					
28. job-state (type1 enum)	R		R						
29. job-state-reasons (1setOf type2 keyword)	R		R						
30. notify-server-up-time (integer(1:MAX))		R				Return	Return		
31. job-k-octets (integer(0:MAX))									
32. job-k-octets-processed (integer(0:MAX))	O		[pg/cp]						
33. job-impressions (integer(0:MAX))									
34. job-impressions-completed (integer(0:MAX))	O		[pg/cp]						
35. impressions-completed-current-copy (integer(0:MAX))	O		[pg/cp]						
36. job-media-sheets (integer(0:MAX))									
37. job-media-sheets-completed (integer(0:MAX))	O		[pg/cp]						
38. job-collation-type (type2 enum)	O		[pg/cp]						
39. sheet-completed-copy-number (integer(0:MAX))	O		[pg/cp]						
40. sheet-completed-document-	O		[pg/cp]						

	Objects		Notification		Job operations		Subscription operations		
Attributes	Job	Subscription	Job Notification	Printer Notification	Job Creation Validate -Job	Create -Job-Subscription	Create-Printer-Subscription	Renew - Subscription	Cancel - Subscription
number(integer(0:MAX))									

1648 Legend: "R" - REQUIRED for Printer to support; "O" - OPTIONAL for Printer to support; "[]" - OPTIONAL for sender to send;
 1649 "[pg/cp]" - REQUIRED in a 'job-progress' or 'job-completed' notification if the corresponding Job attributes are supported ; (nn) - an
 1650 alternate source of the data in a Notification.

1651

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

1652 Legend: "R" - REQUIRED for Printer to support; "O" - OPTIONAL for Printer to support; "[]" - OPTIONAL for sender to send;

1653 "CR" - CONDITIONALLY REQUIRED, i.e., REQUIRED if Human Consumable format supported;

1654

1655 **B. Appendix: Change History**

1656 This section summarizes the changes to the document. Each sub-section is in reverse chronological order.
1657 Adding or removing ISSUES that don't change the document are not listed here.

1658 **18.1 Changes to the March 6, 2000 version to create the March 8, 2000 version**

1659 The following changes were made to the March 6, 2000 version to create the March 8, 2000 version based
1660 on the agreements reached on the mailing list:

- 1661 1. Changed the name of the SNMP delivery method from 'snmp' to 'snmpnotify', since the Notification
1662 Recipient isn't an SNMP agent.
- 1663 2. Clarified that an implementation with only a single value for persistent-jobs-supported (boolean) or
1664 persistent-subscriptions-supported (boolean) MAY make it settable to the single value or make it not-
1665 settable.

1666 **18.2 Changes to the February 2, 2000 version to create the March 6, 2000 version**

1667 The following changes were made to the February 2, 2000 version to create the March 6, 2000 version
1668 based on the agreements reached on the mailing list, at the February IPP WG meetings, and reflected in the
1669 minutes:

- 1670 1. Clarified that this extension is intended as an extension to IPP/1.0, IPP/1.1, and future versions.
- 1671 2. Allocated the operation-id 0x0016 to 0x001B values for the Notification operations defined in the
1672 document.
- 1673 3. Pre-pended the word "subscription-" on the front of the "request-id" Subscription object attribute to
1674 distinguish it from the "request-id" parameter that is sent in every request and response.
- 1675 4. Added the term "settable" for describing attributes that are not READ-ONLY.
- 1676 5. Added the term "Subscription Creation operation" to stand for any operation that can create a
1677 Subscription object: Job Creation operations (Create-Job, Print-Job, and Print-URI), Create-Job-
1678 Subscription, and Create-Printer-Subscription.
- 1679 6. Changed the "subscriber-user-name" (name(MAX)) Subscription object attribute from OPTIONAL to
1680 REQUIRED.
- 1681 7. Changed the name and semantics of "notify-printer-up-time(integer(1:MAX)) to notify-server-up-time
1682 so that it can be either the Printer's uptime or a Notification Delivery Service uptime.
- 1683 8. Added the 'ipp:', 'indp:', 'mailto:', and 'snmp:' notification delivery schemes to the definition of the
1684 "notify-recipients" to indicate possible schemes.

- 1685 9. Changed the name and semantics of "notify-text-format" (mimeMediaType) to "notify-format" so that it
1686 can be used to specify either Human Consumable or Machine Consumable formats where the
1687 implementation supports both. Clarified that this attribute controls whatever variable Notification
1688 Content that the implementation supports, which may be an attachment to the fixed content format or
1689 the contents of the "human-readable-report" (text(MAX)) attribute. Clarified that an implementation
1690 NEED NOT support all of its supported Notification Content formats with all of its supported delivery
1691 methods.
- 1692 10. Added 'text/xml', 'application/ipp', 'application/postscript', and 'image/tiff' and additional example
1693 MIME media types for "notify-format" (mimeMediaType).
- 1694 11. Clarified that the recommend way for a client to determine whether or not a Printer supports Per-Job
1695 Subscriptions is to query the Printer's "max-job-subscriptions-supported" attribute, since Create-Job-
1696 Subscriptions is an OPTIONAL operation.
- 1697 12. Clarified that the recommend way for a client to determine whether or not a Printer supports Per-Printer
1698 Subscriptions is to query the Printer's "operations-supported" attribute to see if the Create-Printer-
1699 Subscriptions operations is supported, since this is the usual way to determine a Printer's capabilities.
- 1700 13. Clarified that if "persistent-jobs-supported" (boolean) and "persistent-subscriptions-supported"
1701 (boolean) are settable, then setting them must affect whether or not jobs and subscriptions are persistent.
- 1702 14. Allowed delivery methods to send operations with or without a response, depending on the definition of
1703 the delivery method.
- 1704 15. Indicated that a deliver method definition is free to REQUIRE that the client supply the "subscriber-
1705 user-data" attribute.
- 1706 16. Required that the Printer support the "job-uri" operation attribute as a target, in addition to "printer-
1707 uri"&"job-id", i.e., keep consistent with all Job operations.
- 1708 17. Changed the 'none' out-of-band value to be a reference to the collection document [ipp-coll], since the
1709 use for it in this document is with the 'collection' attribute syntax.
- 1710 18. Clarified that a conforming implementation MUST support the 'collection' attribute syntax, since that is
1711 required in Job Creation operations.
- 1712 19. Allocated the values to the new status codes defined in this document.
- 1713 20. Allocated the [ipp-pro] subscription-attributes-tag and notification-attributes-tag delimiter tags to
1714 delimit Subscription attributes and Notification Content attributes in requests and responses.
- 1715 21. Changed the 'server-error-too-many-subscriptions' and 'server-error-too-many-events' to be client errors,
1716 i.e., 'client-error-too-many-subscriptions' and 'client-error-too-many-events', since other errors of this
1717 type are client errors.

1718

1719 **18.3 Changes to the October 14, 1999 version to create the February 2, 2000 version**

1720 The following changes were made to the October 14, 1999 version to create the February 2, 2000 version
1721 based on the agreements reached at the October and December IPP WG meetings and reflected in the
1722 minutes:

- 1723 1. Added a Java Listener as an example of a Notification Recipient.
- 1724 2. Clarified the object relationships in section 4.1.
- 1725 3. Clarified how job events differ for Per-Job versus Per-Printer Subscriptions.
- 1726 4. Added the ability for the Machine Consumable form to contain a Human Readable "human-readable-
1727 report" (text) attribute so that both forms could be sent in the same Notification.
- 1728 5. Clarified that the 'none' value for notify-text-format (mimeType) has to be out-of-band, not the
1729 text string 'none' as a mimeType.
- 1730 6. Clarified that 'none' means send the Machine Consumable form without the "human-readable-report"
1731 (text) attribute, if it is defined.
- 1732 7. Clarified that Notification Recipients MUST be able to accept unrecognized attributes.
- 1733 8. Allowed the notification delivery method definition to be modeled as (1) a request with an operation
1734 code without a response, (2) a request with a operation code with a response or (3) a response with a
1735 status code.
- 1736 9. Added "notify-text-format" (mimeType) and "human-readable-report" (text(MAX)) to be able to
1737 be sent in a Notification content, if the notification delivery method document permits it.
- 1738 10. Added "job-k-octets" (integer(0:MAX)), "job-impressions" (integer(0:MAX)), and "job-media-sheets"
1739 (integer(0:MAX)) as OPTIONAL for Notification content for use in job-progress events to show the
1740 target values so that the Notification Recipient can show a thermometer.
- 1741 11. Added a Subscription Attributes group (and subscription-attributes tag) the Create-Job-Subscription and
1742 Create-Printer-Subscription requests and responses.
- 1743 12. Added the 'none' out-of-band value for use with "notify-text-format" (mimeType) attribute.
- 1744 13. Changed the job progress attributes from using -2 to mean 'unknown' as in the PWG Job Monitoring
1745 MIB, to use the 'unknown' out-of-band value.

1746

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