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Internet Printing Protocol (IPP):
IPP Event Notification Specification

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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

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

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

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

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

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

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

77

78

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184

185 **1 Introduction**

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

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

192

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

195

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

198

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

200

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

201

- 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.

202

203

- Section 3 is the terminology used throughout the document.

204

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

205

- Section 5 defines the Subscription object and its attributes.

206

- Section 6 defines the Printer Description attributes

207

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

208

209

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

210

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

211

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

212

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

213

- Appendix A is a summary of the Notification Attribute usage

214

- Appendix B is a Change History

215 **1.1 Notification Overview**

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

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

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

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

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

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

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

253 **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

254

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

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

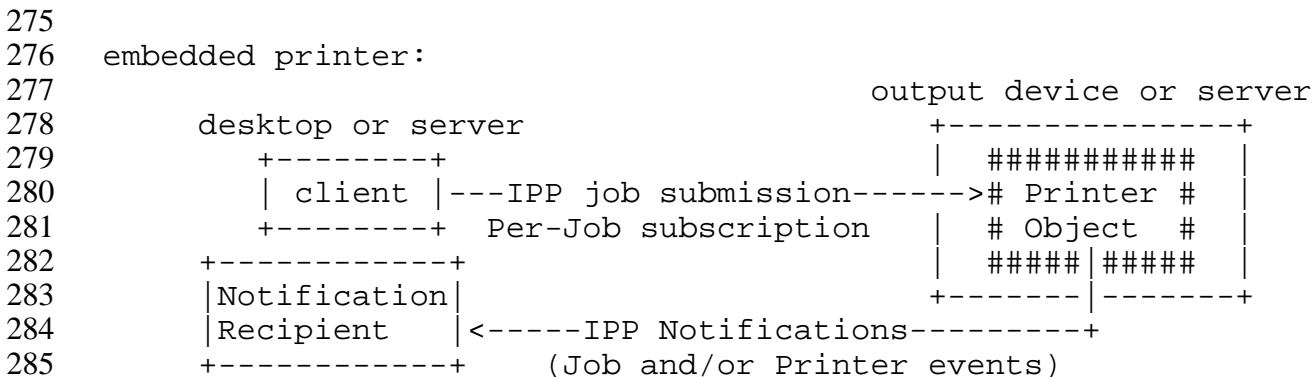
260 2) As an events occurs, the Printer searches the set of subscriptions for any interest in that event. As
 261 the Printer finds that some notification recipient is interested in that event (the notification recipient
 262 is subscribed to the event), the Printer increments the Subscription object's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

267 2 Model for Per-Job and Per-Printer Subscription and Event Notification

268 2.1 Model for Per-Job Subscription and Notification

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

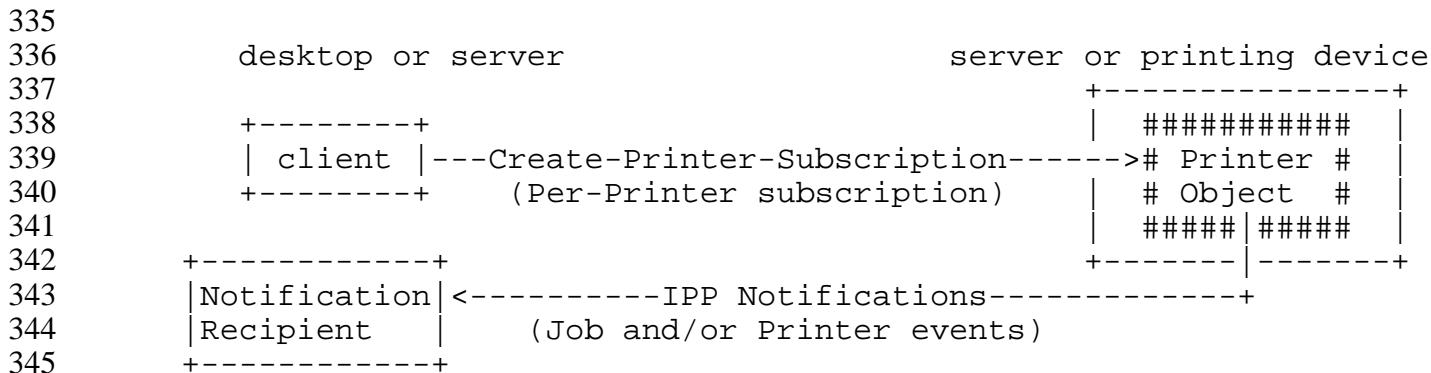
274 Figure 1 shows the Per-Job subscription notification model for a simple Client - Printer relationship.



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

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

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



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

347 2.3 Relationship between the Printer object and the Notification Delivery Service

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

352 2.3.1 Use of a Notification Service transparently to clients

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

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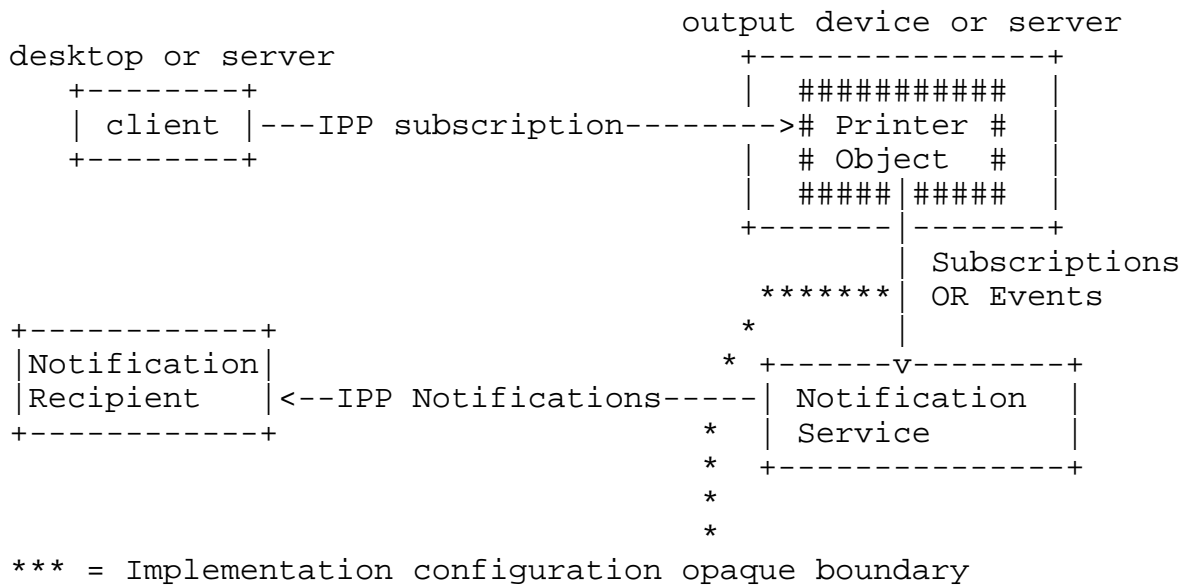


Figure 4 - Opaque Use of a Notification Service Transparent to the Client

378 In any case, the interface between the IPP Printer and the other notification service is outside the scope of
379 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

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

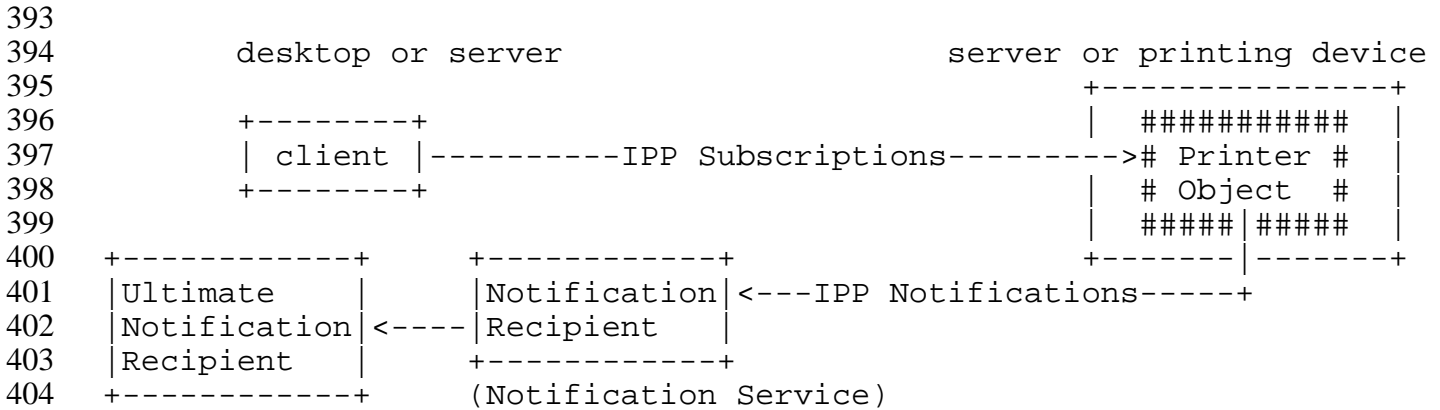


Figure 5 - Use of a Notification Service transparent to the IPP Printer

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]).

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

433 3.2 Other terminology

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

498 Events can be classified along two dimensions:

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

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

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

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

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

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

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

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

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

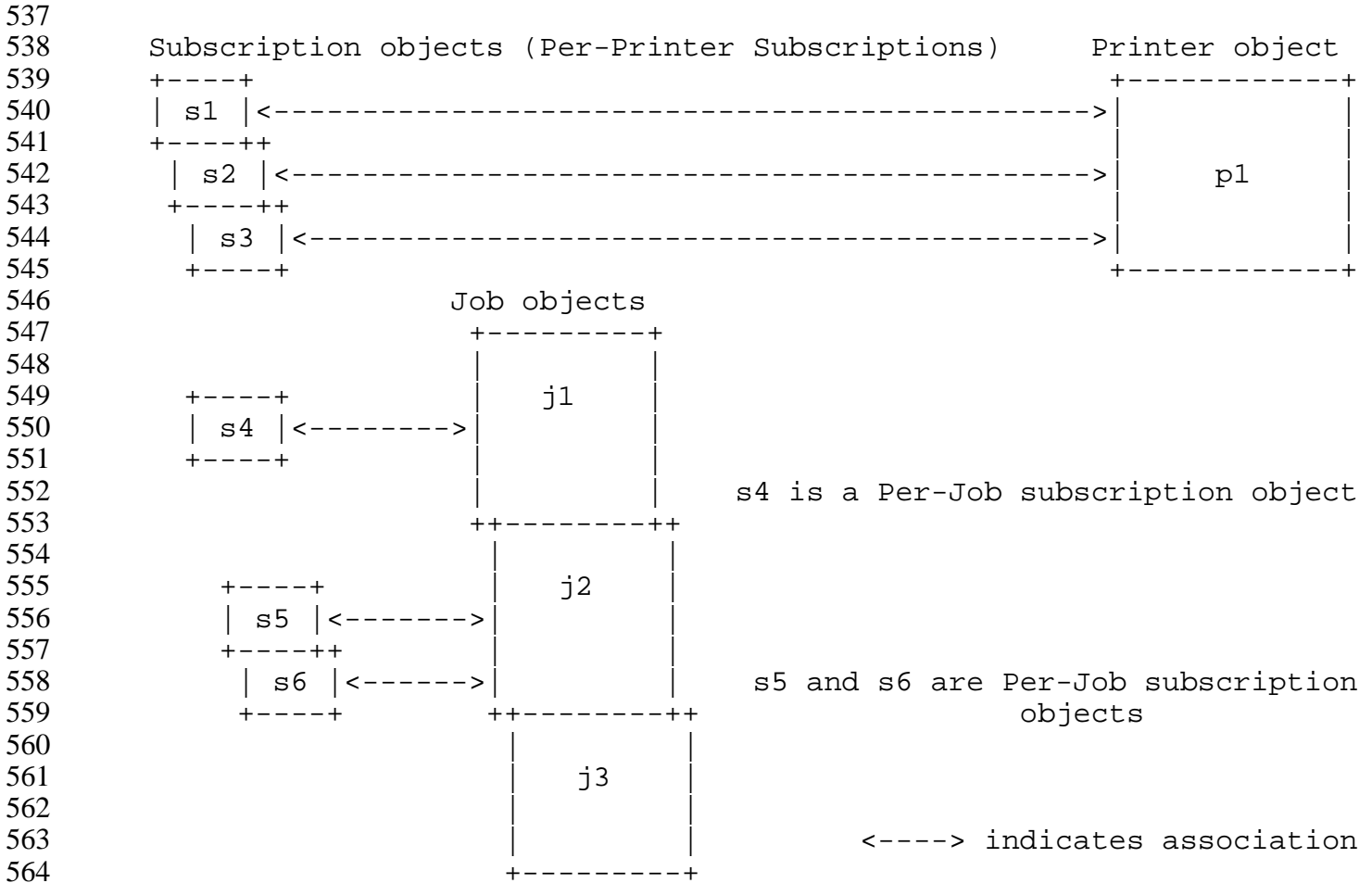
527 **Machine Consumable Notification** - Notifications that are intended for consumption by a program
528 only. They use the encoding of an IPP response. The Notification Recipient must localize the
529 contents, if displaying it to a human.

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

533 4 Object Model for Notification

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

536 The object relationships can be seen pictorially as:



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

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

568 4.1 Object relationships

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

575 **4.1.1 Printer object and Per-Printer Subscription objects**

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

585 **4.1.2 Job object and Per-Job Subscription objects**

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

596 **5 Subscription Object attributes**

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

602

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)

603

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

604

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

605

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)

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

612 5.1 notify-recipient (uri)

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

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

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

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

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

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

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

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

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

638 ~~ISSUE 01 - Ok to include the notification delivery scheme names 'ipp:', 'indp:', 'mailto:', and 'snmpnotify:'~~
639 ~~that are in progress as example values of the "notify-recipient" (uri) attribute?~~

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

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

645 5.2 notify-events (1setOf type2 keyword)

646 This REQUIRED READ-ONLY Subscription object attribute identifies the job and/or printer events that
647 are to be delivered to the Notification Recipient as Notifications as defined in section 7. If the client did not

648 supply this attribute when supplying the subscription, the Printer object populates this attribute with its
649 "notify-events-default" attribute value (see section 6.2).

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

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

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

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

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

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

677 A Printer MUST support the events indicated as "REQUIRED" and MAY support of the events indicated as
678 "OPTIONAL".

679 The standard job event keyword values are:

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

682 **'job-created'**: REQUIRED - the Printer object has accepted a Job Creation operation (Print-Job, Print-
683 URI, or Create-Job) and the job's "time-at-creation" attribute value is set (see [ipp-mod] section

684 4.3.14.1). The Printer puts the job in the 'pending', 'pending-held' or 'processing' states.

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

688 **'job-completed'**: REQUIRED - the job has reached one of the completed states, i.e., the value of the
689 job's "job-state" attribute has changed to: 'completed', 'aborted', or 'canceled'. The Job's "time-at-
690 completed" and "date-time-at-completed" (if supported) attributes are set (see [ipp-mod] section
691 4.3.14).

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

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

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

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

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

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

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

721 The standard Printer event keywords values are:

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

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

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

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

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

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

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

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

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

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

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

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

773 **5.3 notify-format (mimeMediaType)**

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

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

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

792 Standard mimeMediaType values are:

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

801 'application/postscript': Human Consumable PostScript [RFC2046]
802 'image/tiff': Human Consumable image data [RFC2302]

803 **5.4 subscriber-user-data (octetString(63))**

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

812 **5.5 notify-charset (charset)**

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

817 **5.6 notify-natural-language (naturalLanguage)**

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

821 **5.7 subscription-request-id**

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

827 **5.8 subscription-id (integer (1:MAX))**

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

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

841 **5.9 notify-lease-expiration-time (integer(0:MAX))**

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

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

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

855 **5.10 printer-uri (uri)**

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

860 **5.11 subscriber-user-name (name(MAX))**

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

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

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

875 **5.12 notify-server-up-time (integer(1:MAX))**

876 This REQUIRED READ-ONLY Subscription object attribute indicates the amount of time (in seconds) that
877 the Printer or Notification Delivery Service implementation has been up and running. This attribute is an
878 alias for the Printer's "printer-up-time" attribute" (see [ipp-mod] section 4.4.29) if the Printer is keeping the
879 Subscription objects or is the up time for the Notification Delivery Service if the Printer has delegated the
880 responsibility for keeping Subscription objects to a notification delivery service, in an analogous way that
881 the Job's "job-printer-up-time" is an alias for "printer-up-time" Printer attribute (see [ipp-mod] section
882 4.3.13.4).

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

889 **5.13 notify-persistence-granted (boolean)**

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

892 **6 Printer Description Attributes related to Notification**

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

896

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 ISSUE 03: ok to allow to be settable?
persistent-subscriptions-supported (boolean)	OPTIONAL	no ISSUE 04: ok to allow to be settable?
printer-state-change-time (integer(1:MAX))	OPTIONAL	yes
printer-state-change-date-time (dateTime)	OPTIONAL	yes

897 **6.1 notify-schemes-supported (1setOf uriScheme)**

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

900 **6.2 notify-events-default (1setOf type2 keyword)**

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

904 **6.3 notify-events-supported (1setOf type2 keyword)**

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

907 **6.4 max-events-supported (integer(5:MAX))**

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

914 **6.5 notify-format-supported (1setOf mimeType)**

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

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

927 **6.6 max-job-subscriptions-supported (integer(0:MAX))**

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

937 If a Printer does not support Per-Job Subscriptions, it MUST NOT support this attribute. The usual way for
938 a client to determine whether an IPP Printer supports a feature is to query the Printer's "operations-

939 supported" attribute. However, there is no new REQUIRED operation for Per-Job Subscriptions.
940 Therefore, the RECOMMENDED way for a client to determine whether or not a Printer supports Per-Job
941 Subscriptions is to query this attribute to see if it is supported (since the Create-Job-Subscriptions is an
942 OPTIONAL operation).

943 **6.7 max-printer-subscriptions-supported (integer(0:MAX))**

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

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

955 **6.8 notify-lease-time-supported (rangeOfInteger(0:MAX))**

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

962 **6.9 notify-lease-time-default (integer(0:MAX))**

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

966 **6.10 persistent-jobs-supported (boolean)**

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

971 As with any settable attribute, if the Printer supports setting this attribute to more than one value, then the
972 value being set MUST control whether or not the Printer keeps Jobs persistently as per the rules in [ipp-

973 ~~set]). As with any settable attribute, if the Printer only supports one value, it MAY support this attribute~~
974 ~~either (1) as settable to that one value, or as not-settable, depending on implementation (see [ipp-set]).If the~~
975 ~~Printer supports this attribute as settable, then its value MUST control whether or not the Printer keeps Jobs~~
976 ~~persistently as per the rules in [ipp-set]).~~

977 ~~ISSUE 03 again: OK to allow the "persistent jobs supported" (boolean) Printer Description attribute to be~~
978 ~~settable?~~

979 **6.11 persistent-subscriptions-supported (boolean)**

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

985 ~~As with any settable attribute, if the Printer supports setting this attribute to more than one value, then the~~
986 ~~value being set MUST control whether or not the Printer keeps Jobs persistently as per the rules in [ipp-~~
987 ~~set]). As with any settable attribute, if the Printer only supports one value, it MAY support this attribute~~
988 ~~either (1) as settable to that one value, or as not-settable, depending on implementation (see [ipp-set]).If the~~
989 ~~Printer supports this attribute as settable, then its value MUST control whether or not the Printer keeps~~
990 ~~Subscription objects persistently as per the rules in [ipp-set]).~~

991 ~~ISSUE 04 again: OK to allow the "persistent subscriptions supported" (boolean) Printer Description~~
992 ~~attribute to be settable?~~

993 **6.12 printer-state-change-time (integer(1:MAX))**

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

997 **6.13 printer-state-change-date-time (dateTime)**

998 This OPTIONAL READ-ONLY Printer attribute records the date and time, i.e., copy of the Printer's
999 "printer-current-time" (dateTime) attribute (see [ipp-mod] section 4.4.30), that the Printer's "printer-state"
1000 attribute was last changed. On power-up, the Printer populates the "printer-state-change-date-time" from its
1001 "printer-current-time" attribute, so that it always has a value.

1002 **7 Notification Content**

1003 This section defines the Notification content that is sent to a Notification Recipient when an event occurs.
1004 The Notification MAY be sent by the IPP Printer or a third party Notification Service (see section 2.3).

1005 There are two notification content types: Machine Consumable and Human Consumable, i.e., 'text' MIME
1006 media type. For most notification delivery methods both content types are defined. Each Notification
1007 Content type will either define one specific Machine Consumable form (usual) or indicate that no Machine
1008 Consumable form is defined. In addition, each Notification Content type will indicate whether (usual) or
1009 not Human Consumable forms are permitted. But the definition will not define the Human Consumable
1010 forms. For those Human Consumable forms that a Printer implementation supports as indicated in the
1011 Printer's "notify-format-supported" attribute, it MUST support for all Notification Content formats
1012 supported that permit Human Consumable form.

1013 **7.1 Notification content MIME media type formats**

1014 This section defines the Notification content that the Notification Source sends asynchronously to each
1015 Notification Recipient based on the subscription information stored with the subscription. The Notification
1016 is either in a Human Consumable or Machine Consumable form.

1017 **7.1.1 Human Consumable form**

1018 If the notification delivery method is defined to permit Human Consumable forms such as the entire
1019 Notification Content or a portion of the Notification Content, such as either an attachment or the "human-
1020 readable-report" attribute (see section 7.2) then the following RECOMMENDATIONS apply:

1021 The text message SHOULD include information about the attributes in sections 7.2 and 7.3 for job events
1022 or in sections 7.2 and 7.4 for printer events. This information is localized according to the information
1023 about natural language and charset in the subscription.

1024 An implementation MAY extend the contents of a Human Consumable notification by adding additional
1025 information.

1026 **7.1.2 Machine Consumable form**

1027 If the notification delivery method is defined to have a Machine Consumable form and that form is defined
1028 to be the 'application/ipp' MIME media type [ipp-mod], then the following rules apply:

- 1029 1. The notification content MUST use the 'application/ipp' MIME media type [ipp-mod] using one
1030 of: (1) the Get-Job-Attributes response encoding for job events, (2) Get-Printer-Attributes
1031 response for printer events, or (3) a new Sent-Notifications operation for both job and printer
1032 events.
- 1033 2. The attributes listed in sections 7.2 and 7.3 are sent in a Notification for Job events.
- 1034 3. The attributes listed in sections 7.2 and 7.4 are sent in a Notification for Printer events.
- 1035 4. For any 'text' or 'name' attribute value in any notification, the charset and natural language rules
1036 that apply to all IPP operations apply to these attributes as well, since they are represented as
1037 operation responses.

- 1038 5. The "human-readable-report" attribute can be defined to be REQUIRED, OPTIONAL, or MUST
1039 NOT be sent.
- 1040 6. If the values of any of the attributes sent in an notification content are not known, the value sent
1041 in the report content is the out-of-band 'unknown' value, rather than omitting the attribute (see
1042 the beginning of [ipp-mod] section 4.1).

1043 An implementation MAY extend the contents of the Machine Consumable notification by adding additional
1044 attributes. Notification Recipients MUST be able to accept Notifications containing attributes they do not
1045 recognize. What a Notification Recipient does with an unrecognized attribute is implementation-
1046 dependent. Notification Recipients MAY attempt to display unrecognized attributes anyway or MAY
1047 ignore them.

1048 ~~ISSUE-05—Can an implementation extend the Notification Content to include an attribute that uses the~~
1049 ~~'collection' attribute syntax? If so, should we REQUIRE that Notification Recipients that can accept~~
1050 ~~Machine Consumable Notifications, be able to accept the 'collection' attribute syntax?~~

1051 7.2 Notification content attributes common to Job and Printer events

1052 This section lists the parameters and attributes that are included in both Job and Printer event Notifications.

1053 The notification delivery method either models the Notification as a (1) request if the IPP Printer sends the
1054 Notification to the Notification Recipient when the event occurs or as a (2) response if the IPP Printer is
1055 queried for the Notification by a Notification Recipient:

1056 Request: If the delivery method defines that the IPP Printer sends the Notification, then the delivery
1057 method also defines whether or not the Notification Recipient returns a response. If the IPP Printer
1058 sends a Notification request, it uses the "operation-id alternative for item #0 in Table 4:

1059 Response: If the delivery method defines that the IPP Printer supports an operation that returns a
1060 Notification as a response to the Notification Recipient, it uses the "status-code" alternative for item
1061 #0 in Table 4.

1062 Some events do not include all of these attributes as shown in Table 4. Each notification content contains a
1063 single Job or Printer event, whether that event was subscribed using the Job Submission Subscription
1064 mechanism or the Per-Printer subscription mechanism. If either kind of Subscription subscribed to both
1065 Job and Printer events, then the Printer will send or return them as separate Job Notification content and
1066 Printer Notification contents to the same Notification Recipient.

1067 Table 4 lists the attributes that are defined for use in Notifications and indicates the Printer support required
1068 for conformance: References of the form "mod m.n.o" refer to [ipp-mod] sections.

1069 **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
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 (mimeMediaType)	5.3	OPTIONAL	OPTIONAL
human-readable-report (text(MAX))	7.2.4	OPTIONAL	OPTIONAL

1070 Attribute Notes:

1071 "version-number" - the major and minor version number.

- 1072 "operation-id" - the operation id if the delivery method document models the Notification as the Printer
1073 sending the Notification to the Notification Recipient (whether the Notification Recipient returns a
1074 response or not).
- 1075 "status-code" - a value of 0x600 (hexadecimal 600) for a Job event and 0x601 (hexadecimal 601) for a
1076 Printer event if the delivery method document models the Notification as the Printer returning the
1077 Notification to the Notification Recipient as a response to a request.
- 1078 "request-id" - the sequence number for this subscription, starting at 1, for each subscription, i.e., the Printer
1079 copies the current value of the "subscription-request-id" Subscription object attribute to the
1080 Notification request content.
- 1081 "attributes-charset" - the value comes from the "notify-charset" attribute in the Subscription object.
- 1082 "attributes-natural-language" - the value comes from the "notify-natural-language" attribute in the
1083 Subscription object.
- 1084 "printer-uri" - the value comes from the "job-printer-uri" Job attribute for Per-Job subscriptions.
- 1085 ****"job-id" and "job-name"** - included in Printer event Notifications only for Per-Job subscriptions.
- 1086 "job-name" - SNMP delivery method can truncate to less than 255 octets, since the Notification needs to fit
1087 into 484 octets or so on some transports that SNMP is defined for. [See \[ipp-method-snmp\]](#)
- 1088 "subscription-id" - the unique identifier for the Subscription object on this Printer.
- 1089 "subscriber-user-name" - the subscriber user name that created the Subscription object. SNMP delivery
1090 method can truncate to less than 255 octets, since the Notification needs to fit into 484 octets or so
1091 on some transports that SNMP is defined for. [See \[ipp-method-snmp\]](#)
- 1092 "subscriber-user-data" - opaque user data that may identify either the Subscriber and/or the ultimate
1093 Notification Recipient. The client **MUST** supply this attribute, if the definition of the delivery
1094 method specified in the "notify-recipient" attribute **REQUIRES** the client to supply it.
- 1095 "notify-format (mimeMediaType)" - indicates the text MIME media type (see section 5.3) for the "human-
1096 readable-report" attribute. This attribute **MUST** be present if the "human-readable-report"
1097 (text(MAX)) attribute is present in order to unambiguously identify the format of its text value to
1098 the Notification Recipient.
- 1099 **7.2.1 "trigger-event" (type2 keyword)**
- 1100 This **REQUIRED** Notification Content attribute indicates the event that caused this Notification to be
1101 delivered.

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

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

7.2.3 "trigger-date-time" (dateTime)

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

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

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

7.3 Additional Notification content attributes for Job events *only*

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

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	

Attributes	Reference	Events		
		'job-progress'	'job-completed'	all others
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		

1121 **7.4 Additional Notification content attributes for Printer events *only***

1122 Table 6 lists the additional attributes that are included only in Printer event Notifications and indicates the
1123 Printer support required for conformance:

1124 **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

1125 **8 Operations for notification**

1126 This section defines all of the operations for notification which are summarized in Table 1 in section 1.1,
1127 including the assignment of the operation-id.

1128 **8.1 Operations for Per-Job Subscriptions *only***

1129 This section defines the operation requests and responses that are related to Per-Job subscriptions and its
1130 Subscription object. Section 8.3 defines the REQUIRED operation requests and responses associated with
1131 the REQUIRED Per-Printer subscription and its Subscription object.

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

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

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

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

Member attribute of "job-notify" collection	Reference	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

~~ISSUE 06: Ok that "notify-charset" and "notify-natural-language" member attributes don't follow the "xxx-supported" rule for collection member attributes, since the "xxx-supported" attributes are "charset-supported" and "generated-natural-language-supported", respectively, instead of "notify-charset-supported" and "notify-natural-language-supported"?~~

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

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

<u>"job-notify" member attribute</u>	<u>"xxx-default", if any</u>	<u>"xxx-supported"</u>

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

1152 See the referenced sections for a definition of these operation attributes, since they are copied to the
 1153 Subscription object as the Subscription Description attributes described in section 5.

1154 The following rules apply to Per-Job subscriptions created as part of the Job Creation operations:

- 1155 1. Any subscription can contain job events, printer events, or both.
- 1156 2. The Job Submission Subscription is only valid while the job is "not-completed". The job is "not-
 1157 completed" while it is in the 'pending', 'pending-held', 'processing', and 'processing-stopped' states.
 1158 The job changes from being "not-completed" to "retained" when it is done processing and enters any
 1159 of the 'completed', 'canceled', or 'aborted' states. The job becomes "not-completed" again when it is
 1160 restarted using the Restart-Job operation (see [ipp-mod]).
- 1161 3. Since no job is created for the Validate-Job operation, the only purpose of supplying the subscription
 1162 operation attributes in the Validate-Job operation is to validate that the values are supported; the
 1163 Printer object does not establish a notification subscription as a result of the Validate-Job operation.
- 1164 4. Since a Job Submission Subscription is included within a job submission operation, any interest in
 1165 job events is limited to "this job" only (the Job object created because of this job creation operation).
 1166 There is no mechanism to subscribe to events for all jobs or specifically some job other than this job
 1167 in a create operation. But see the Create-Printer-Subscription operation (section 8.2.1) for an explicit
 1168 operation to subscribe for job and/or printer events independently of any particular job submission,
 1169 i.e., Per-Printer subscriptions.
- 1170 5. Event reporting only occurs when a notification recipient has specified a subscription to any event(s).
- 1171 6. The notification implementation MAY allow an administrator to configure a policy on what events
 1172 may be dropped.

- 1173 7. ** The client MUST supply the "subscriber-user-data" (octetString(63)) attribute, if the definition of
1174 the delivery method specified in the "notify-recipient" attribute REQUIRES the client to supply it.
- 1175 8. If the OPTIONAL "notify-charset" attribute is not supported or the supplied value is not supported,
1176 the IPP Printer MUST return the attribute in the Unsupported Attributes Group but still accept the
1177 operation, as with all Job create operations. In this case, the Printer MUST use the natural language
1178 supplied in the "attributes-charset" Job creation operation attribute, if that natural language value is
1179 supported by the Printer, else the Printer object MUST use the Printer's "charset-configured" value.
1180 See the Print-Job operation in [ipp-mod].
- 1181 9. If the OPTIONAL "notify-natural-language" attribute is not supported or the supplied value is not
1182 supported, the IPP Printer MUST return the attribute in the Unsupported Attributes Group but still
1183 accept the operation, as with all Job create operations. In this case, the Printer MUST use the natural
1184 language supplied in the "attributes-natural-language" Job creation operation attribute, if that natural
1185 language value is supported by the Printer, else the Printer object MUST use the Printer's "natural-
1186 language-configured" value. See the Print-Job operation in [ipp-mod].
- 1187 10. If a collection contains other unrecognized, unsupported member attributes and/or conflicting values,
1188 the attribute returned in the Unsupported Group is a collection containing the unrecognized,
1189 unsupported member attributes, and/or conflicting values. The Printer MUST return the unrecognized
1190 member attributes with the out-of-band value of 'unsupported'. The Printer MUST return the
1191 unsupported member attributes and conflicting values with their unsupported values. See [ipp-coll].
- 1192 11. If the number of events supplied in the "notify-events" attribute exceeds the Printer's "max-events-
1193 supported" attribute, the Printer MUST accept the request with the status code 'successful-ok-ignored-
1194 or-substituted-attributes' and return the "job-notify" collection in the Unsupported Attributes Group
1195 with only the "job-events" member attribute containing the events that exceed the maximum.
- 1196 12. If the Per-Job subscriptions would exceed the limit of Per-Job subscriptions supported per job as
1197 specified by the Printer's "max-job-subscriptions-supported" attribute or would exceed some
1198 implementation-defined limit on the total number of Per-Job subscriptions for the Printer (if any), the
1199 Printer MUST accept the request with the status code 'successful-ok-ignored-subscriptions', MUST
1200 return the "job-notify" attribute in the Unsupported Attributes Group with only the collection value(s)
1201 that represent the excess subscriptions that are being ignored, and MUST perform the Job Creation
1202 operation (see section 8.1.1), since the job can still be printed.
- 1203 13. If the job is accepted and one or more subscriptions are ignored, the status code returned is
1204 'successful-ok-ignored-subscriptions. This status code is returned even if other job attributes are
1205 unsupported or in conflict. That is, if an IPP Printer finds a warning that would allow it to return
1206 'successful-ok-ignored-subscriptions' and either 'successful-ok-ignored-or-substituted-attributes'
1207 and/or 'successful-ok-conflicting-attributes', it must return 'successful-ok-ignored-subscriptions'. In
1208 other words, the precedence for returning success codes is: 'successful-ok-ignored-subscriptions',
1209 'successful-ok-conflicting-attributes', and 'successful-ok-ignored-or-substituted-attributes'.

1210 8.1.2 Create-Job-Subscription operation

1211 The OPTIONNAL Create-Job-Subscription operation creates a Per-Job Subscription object . The client can
1212 specify one or more job and/or printer events to be delivered as notifications to one Notification Recipient.

1213 For the Per-Job subscription objects, the Job events are for this job only. The printer events are any events
 1214 generated by that Printer for any job or when no job is involved at all (same as for Per-Job Subscriptions).

1215 The Printer returns a subscription id and the length of time for which it has granted a lease for the
 1216 subscription.

1217 A client can unsubscribe using the Cancel-Subscription operation (section 8.3.4) and the subscription id.

1218 Two Create-Job-Subscription operations with the same events and same Notification Recipient **MUST** be
 1219 kept as distinct subscriptions and be assigned distinct subscription ids. A Printer **MUST** allow such
 1220 duplicate subscriptions such that Cancel-Subscription doesn't unsubscribe both subscriptions and **MUST**
 1221 send the Notifications twice to the Notification Recipient, since the "request-id" is supposed to count
 1222 monotonically for each Subscription object.

1223 If the Printer has a bounded set of concurrent Per-Job subscriptions and the request would exceed that
 1224 bound, the Printer rejects the operation and returns the 'client-error-too-many-subscriptions' status code.
 1225 The client **SHOULD** try again later.

1226 Access Rights: To create Per-Job subscription objects, the authenticated user (see [IPP-MOD] section 8.3)
 1227 performing this operation **MUST** either be the job owner or have operator or administrator access rights for
 1228 the Printer object (see [IPP-MOD] sections 1 and 8.5). Otherwise the IPP object **MUST** reject the operation
 1229 and return: the 'client-error-forbidden', 'client-error-not-authenticated', or 'client-error-not-authorized' status
 1230 code as appropriate.

1231 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

1232

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" (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	
"notify-persistence-requested" (boolean)	see below	no	OPTIONAL	

1233 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	

1234

Group 2: Unsupported Attributes (see [ipp-mod] section 3.1.7)	REQUIRED if unsupported attributes
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1235

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

1236 Attribute Notes:

1237 "job-id" (integer(1:MAX)) - the client MUST either (1) supply this attribute, in combination with the
 1238 "printer-uri" attribute, in order to create a Per-Job subscription for the Job identified by the "job-id"
 1239 value or supply the "job-uri" instead, as with any Job operation:

1240 "job-uri" (uri) - the client MUST supply this attribute, if the "printer-uri" and "job-id" are not supplied, in
 1241 order to identify the Job to which the Per-Job Subscription is being created.

1242 "notify-recipient" (uri) - the client MUST supply this attribute in order to have a subscription.

1243 "notify-event" (1setOf type2 keyword) - if the client does not supply this attribute, the Printer populates the
 1244 "notify-events" Subscription Description attribute from its "notify-events-default" Printer
 1245 Description attribute.

- 1246 "notify-format" (mimeMediaType) - if the client supplies this attribute, the value indicates which Human
1247 Consumable text format is requested for use in the Notification using the delivery method that the
1248 client supplies in the "notify-recipient" attribute. If the client does not supply this attribute, the
1249 Machine-Consumable form of the delivery method that the client supplies in the "notify-recipient"
1250 attribute is used.
- 1251 "subscriber-user-data" (octetString(63)) - the client **MUST** supply this attribute, if the definition of the
1252 delivery method specified in the "notify-recipient" attribute **REQUIRES** the client to supply it.
- 1253 "notify-persistence-requested" (boolean) - whether or not the Per-Job Subscription is to be persistent, i.e.,
1254 saved across power cycles. Note: Persistent trap registrations is a client option in SNMPv3
1255 [RFC2573].
- 1256 "notify-persistence-granted" (boolean) - whether or not this Subscription object instance is persistent. This
1257 attribute **MUST** be returned whether "notify-persistence-requested" is supported or not, so that the
1258 client knows which.

1259 **8.2 Operations for Per-Printer Subscriptions *only***

1260 This section defines the operation requests and responses associated with the Per-Printer subscription and
1261 its Subscription object.

1262 **8.2.1 Create-Printer-Subscription operation**

1263 The **REQUIRED** Create-Printer-Subscription operation creates a Per-Printer Subscription object . The
1264 client can specify one or more job and/or printer events to be delivered as notifications to one Notification
1265 Recipient. For the Per-Printer subscription objects, the job events are for any job submitted to the Printer.
1266 The printer events are any events generated by that Printer for any job or when no job is involved at all.

1267 The Printer returns a subscription id and the time at which the subscription lease expires (which may be
1268 earlier or later than the client requested).

1269 The client **MUST** renew the Per-Printer subscription using the Renew-Subscription operation (see section
1270 8.3.3) before the lease runs out in order to maintain the subscription. A client can unsubscribe using the
1271 Cancel-Subscription operation (section 8.3.4) and the subscription id.

1272 Two Create-Printer-Subscription operations with the same events and same Notification Recipient **MUST**
1273 be kept as distinct subscriptions and be assigned distinct subscription ids. A Printer **MUST** allow such
1274 duplicate subscriptions such that Cancel-Subscription doesn't unsubscribe both subscriptions and **MUST**
1275 send the Notifications twice to the Notification Recipient, since the "request-id" is supposed to count
1276 monotonically for each subscription.

1277 If the Printer has a bounded set of concurrent Per-Printer subscriptions and the request would exceed that
1278 bound, the Printer rejects the operation and returns the 'client-error-too-many-subscriptions' status code.
1279 The client **SHOULD** try again later.

1280 Access Rights: To create Per-Printer subscription objects, the authenticated user performing this operation
 1281 MUST have Per-Printer subscription rights for this Printer. Otherwise the IPP object MUST reject the
 1282 operation and return: the 'client-error-forbidden', 'client-error-not-authenticated', or 'client-error-not-
 1283 authorized' status code as appropriate.

1284 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	REQUIRED

1285

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

1286 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

1287

Group 2: Unsupported Attributes (see [ipp-mod] section 3.1.7)	REQUIRED if unsupported attributes
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1288

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

1289 Attribute Notes:

1290 "notify-recipient" (uri) - the client **MUST** supply this attribute in order to have a subscription.

1291 "notify-lease-time-requested" (integer(0:MAX)) - the number of seconds requested for the subscription
 1292 lease. A value of 0 indicates a request that the Per-Printer Subscription lease never expire.
 1293 Supplying a 0 value **MAY** require authentication in order to be used, if 0 is supported at all.
 1294 If the client does not supply this attribute, the Printer uses its "notify-lease-time-default" Printer
 1295 Description attribute value (see section 6.9).

1296 "notify-event" (1setOf type2 keyword) - if the client does not supply this attribute, the Printer populates the
 1297 "notify-events" Subscription Description attribute from its "notify-events-default" Printer
 1298 Description attribute.

1299 "notify-format" (mimeMediaType) - if the client supplies this attribute, the value indicates which Human
 1300 Consumable text format is requested for use in the Notification using the delivery method that the
 1301 client supplies in the "notify-recipient" attribute. If the client does not supply this attribute, the
 1302 Machine-Consumable form of the delivery method that the client supplies in the "notify-recipient"
 1303 attribute is used.

1304 "subscriber-user-data" (octetString(63)) - the client **MUST** supply this attribute, if the definition of the
 1305 delivery method specified in the "notify-recipient" attribute **REQUIRES** the client to supply it.

1306 "notify-persistence-requested" (boolean) - whether or not the Per-Printer Subscription is to be persistent,
 1307 i.e., saved across power cycles. Note: Persistent trap registrations is a client option in SNMPv3
 1308 [RFC2573].

1309 "notify-lease-expiration-time" (integer(0:MAX)) - The Printer object **MUST** return this attribute which is
 1310 the time in the future at which the subscription lease will expire, i.e., the "printer-up-time" value (in
 1311 time ticks - see [ipp-mod] section 4.4.29) at which the Printer will delete the Subscription. A value
 1312 of 0 indicates that the lease subscription will never expire.

1313 "notify-server-up-time" (integer(1:MAX)) - The Printer object **MUST** return this attribute which is an alias
 1314 for the Printer's "printer-up-time" Printer Description attribute. The client subtracts this value from
 1315 the "notify-lease-expiration-time" value returned in order to determine the number of second in the
 1316 future that the subscription will expire. This computed value may be less than the requester
 1317 requested in the "notify-lease-time-requested" if it was greater than the MAX supported or more
 1318 than the requester requested if it was less than the MIN supported, as indicated in the Printer's
 1319 "notify-lease-time-supported" (rangeOfInteger(0:MAX)) attribute (see section 6.8).

1320 "notify-persistence-granted" - whether or not this Subscription object instance is persistent. This attribute
 1321 MUST be returned whether "notify-persistence-requested" is supported or not, so that the client
 1322 knows which.

1323

1324 **8.3 Common Operations for Per-Job and Per-Printer Subscriptions**

1325 This section defines the operations that are common to both Per-Job and Per-Printer subscriptions.

1326 **8.3.1 Get-Subscription-Attributes operation**

1327 The REQUIRED Get-Subscription-Attributes returns the requested attributes of the identified Subscription
 1328 object. See section 5.

1329 Request:

Group 1: Operation Attributes	Reference [ipp-mod]	client MUST supply	Printer support
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1330

"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

1331

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

1332 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

1333

Group 2: Unsupported Attributes (see [ipp-mod] section 3.1.7)	REQUIRED if unsupported attributes
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1334

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

1335 This operation is similar to the Get-Printer-Attributes operation.

1336 "requested-attributes" (1setOf keyword): The client OPTIONALLY supplies this attribute. The Printer
 1337 object MUST support this attribute. It is a set of Subscription attribute names and/or the 'all'
 1338 attribute group name in whose values the requester is interested. This set of attributes is returned for
 1339 each Job object that is returned. If the client does not supply this attribute, the Printer MUST
 1340 respond as if the client had supplied this attribute with the value: 'all'.

1341 ~~If the client omits the "requested-attributes" operation attribute, the Printer MUST respond as if the client~~
 1342 ~~had supplied the 'all' value, i.e., return all of the attributes supported for the Subscription object.~~

1343 8.3.2 Get-Subscriptions operation

1344 The REQUIRED Get-Subscriptions operation returns the requested attributes of the Subscription objects
 1345 (see section 5).

1346 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	RECOMME NTED	RECOMME NDED
"limit" (integer(1:MAX))	see below	OPTIONAL	REQUIRED
"requested-attributes" (1setOf type2 keyword)	see below	OPTIONAL	REQUIRED
"my-subscriptions" (boolean)	see below	OPTIONAL	REQUIRED

1347 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

1348

Group 2: Unsupported Attributes (see [ipp-mod] section 3.1.7)	REQUIRED if unsupported attributes
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1349

Group 3 to N:<the requested Subscription Attributes for each Subscription object in a separate group>	see below	REQUIRED
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1350

1351 Attribute Notes:

1352 This operation is similar to the Get-Jobs operation (see [ipp-mod]). If the client wants any attributes
1353 returned, including the "subscription-id", it must include the attribute keyword name in the "requested-
1354 attributes" operation attribute. If the "requested-attributes" operation attribute is omitted, the Printer MUST
1355 respond as if the client supplied the value: 'subscription-id'.

1356 "job-id" (integer(1:MAX)) - If the client supplies this attribute, all of the Per-Job Subscription objects for
1357 the identified job are candidates for return. If this attribute is omitted, all of the Per-Printer
1358 Subscription objects are candidates for return.

1359 "limit" (integer(1:MAX)): The client OPTIONALLY supplies this attribute. The Printer object MUST
1360 support this attribute. It is an integer value that determines the maximum number of Subscription
1361 objects that a client will receive from the Printer even if "my-subscriptions" constrain which
1362 subscriptions are returned. The limit is a "stateless limit" in that if the value supplied by the client is
1363 'N', then only the first 'N' Subscriptions are returned in the Get-Subscriptions Response. There is no
1364 mechanism to allow for the next 'M' Subscriptions after the first 'N' Subscriptions. If the client does
1365 not supply this attribute, the Printer object responds with all applicable Subscriptions.

1366 "requested-attributes" (1setOf keyword): The client OPTIONALLY supplies this attribute. The Printer
1367 object MUST support this attribute. It is a set of Subscription attribute names and/or the 'all'
1368 attribute group name in whose values the requester is interested. This set of attributes is returned for
1369 each Job object that is returned. If the client does not supply this attribute, the Printer MUST
1370 respond as if the client had supplied this attribute with the value: 'all'.

1371 "my-subscriptions" (boolean): The client OPTIONALLY supplies this attribute. The Printer object MUST
1372 support this attribute. It indicates whether Subscriptions from all users or just the Subscriptions
1373 submitted by the requesting user of this request MUST be returned by the Printer object. If the
1374 client does not supply this attribute, the Printer object MUST respond as if the client had supplied
1375 the attribute with a value of 'false', i.e., Subscriptions from all users. The means for authenticating
1376 the requesting user and matching the Subscription objects is the same as for jobs as described in
1377 [ipp-mod] section 8.

1378 Groups 3 to N: Subscription Object Attributes: The Printer object responds with one set of Subscription
1379 Object Attributes for each returned Subscription object. The Printer object ignores (does not
1380 respond with) any requested attribute or value which is not supported or which is restricted by the
1381 security policy in force, including whether the requesting user is the user that created the
1382 Subscription object (subscribing user) or not (see [ipp-mod] section 8).

8.3.3 Renew-Subscription operation

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

Access Rights: The authenticated user (see [IPP-MOD] section 8.3) performing this operation MUST either be the owner of the Subscription object or have operator or administrator access rights for the Printer object (see [IPP-MOD] sections 1 and 8.5). Otherwise the IPP object MUST reject the operation and return: 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	RECOMME NDED	RECOMME NDED

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

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

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

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

1399

1400 Attribute Notes:

1401 "notify-lease-time-requested" (integer(0:MAX)) - the number of seconds requested for the Per-Printer
1402 subscription lease. Same as Create-Printer-Subscriptions (see section 8.2.1).

1403 "notify-lease-expiration-time" - the time in the future when the subscription will expire. Same as for the
1404 Create-Printer-Subscription operation (see section 8.2.1).

1405 "notify-server-up-time" - the Printer object MUST return this attribute which is an alias for the Printer's
1406 "printer-up-time" Printer Description attribute. The client subtracts this value from the "notify-
1407 lease-expiration-time" value returned in order to determine the number of second in the future that
1408 the subscription will expire (see further explanation in section 8.2.1).

1409 Note: There is no way to change any of the Subscription object attributes, except the "notify-lease-
1410 expiration-time" attribute (using the Renew-Subscription operation). In order to change other attributes, a
1411 client can create a new Subscription object and then use the Cancel-Subscription operation to cancel the old
1412 one (or do this in the other order, in case there is a limit on the number of Subscription object instances, as
1413 long as a short window with no Notifications is ok).

1414 Note: There is no need to renew a Per-Job Subscription, since it is effectively the time that the Job is active
1415 (see section 8.1).

1416 8.3.4 Cancel-Subscription operation

1417 The REQUIRED Cancel- Subscription operation allows a client to remove a Subscription object. No more
1418 Notifications are delivered for that Subscription. Once performed, there is no way to use that Subscription
1419 in the future. Subscription-ids should not be reused immediately, so that a stale reference situation is not
1420 created. Same as for Cancel-Job and job-ids.

1421 *Access Rights:* The authenticated user (see [IPP-MOD] section 8.3) performing this operation MUST either
1422 be the owner of the Subscription object or have operator or administrator access rights for the Printer object
1423 (see [IPP-MOD] sections 1 and 8.5). Otherwise the IPP object MUST reject the operation and return: the
1424 'client-error-forbidden', 'client-error-not-authenticated', or 'client-error-not-authorized' status code as
1425 appropriate.

1426 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

1427

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

1428

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

1429

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

1430

1431 9 Comparison of Per-Job versus Per-Printer Subscriptions

1432 Per-Job and Per-Printer subscriptions are quite similar. Either type of subscription can subscribe to Job
 1433 events, Printer events, or both. Both types of subscriptions can be queried using the Get-Subscriptions and
 1434 Get-Subscription-Attributes operations and canceled using the Cancel-Subscription operation. Both types
 1435 of subscriptions create Subscription objects which have the same attributes defined. However, there are
 1436 some semantic differences between Per-Job subscriptions and Per-Printer subscriptions. A Per-Job
 1437 Submission Subscription is established by the client when submitting a job and after creating the job using
 1438 the Create-Job-Subscription operation by specifying the "job-id" of the job. A Per-Printer Subscription is
 1439 established between a client and a Printer using the Create-Printer-Subscription operation. Some specific
 1440 differences are:

- 1441 1. A client usually creates a Per-Job subscription as part of the Job Creation operations (Create-Job, Print-
 1442 Job, and Print-URI), rather than using the OPTIONAL Create-Job-Subscription operation, especially
 1443 since Printer implementations NEED NOT support the Create-Job-Subscription operation, since it is
 1444 OPTIONAL.

- 1445 2. For Per-Job subscriptions, the subscription is only valid while the job is "not-complete" (see sections
 1446 7.2 and 7.3) while for the Per-Printer subscriptions, the subscription is valid until the time (in seconds)
 1447 that the Printer returned in the "notify-lease-expiration-time" operation attribute expires.
- 1448 3. Job Events in a Per-Job subscription apply only to "one job" (the Job created by the job creation
 1449 operation or references by the Create-Job-Subscription operation) while Job Events in a Per-Printer
 1450 subscription apply to ALL jobs contained in the IPP Printer object.

1451 10 Out of Band Values

1452 This section defines out-of-band values (see [ipp-mod] section 4.1) for use with attributes defined in this
 1453 and other documents.

1454 10.1 'none'

1455 **This out-of-band value permits a client to indicate in a request that** ~~The~~**a** specified attribute in the request
 1456 MUST NOT be applied to the job. Specifically, this value overrides the Printer's "xxx-default" attribute
 1457 value for the attribute, if one exists. This out-of-band value is needed since attributes that are of the
 1458 'collection', 'uri', and 'mimeType' **type** need a way for a client to specify that the Printer MUST NOT
 1459 apply the value of an "xxx-default" attribute to the job. See [ipp-coll] for a complete specification,
 1460 including encoding.

1461 11 Conformance Requirements

1462 It is OPTIONAL to implement this Event Notification specification. An implementation conforming to this
 1463 specification MUST also meet the Conformance Requirements detailed in [IPP-MOD] section 5. If this
 1464 Event Notification specification is implemented, IPP objects MUST support all of the REQUIRED object
 1465 attributes as defined in this document in the indicated sections:

- 1466 1. REQUIRED Subscription object attributes in section 5.
- 1467 2. REQUIRED Printer Description object attributes in section 6.
- 1468 3. REQUIRED attributes in Notification content in section 7.

1469 In addition, the Printer MUST support the 'collection' attribute syntax (see [ipp-coll]).

1470 Extensions made to the events herein must be made such that new events or event attributes are backward
 1471 compatible to clients who implemented early versions of this notification specification.

1472 If this Event Notification specification is implemented, the operations described in section 8 MUST be
 1473 supported as described in Table 9:

1474 **Table 9 - Conformance Requirements for Operations**

Attribute	Conformance requirements
-----------	--------------------------

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

1475

1476 12 IANA Considerations

1477 IANA will be called on to register URL schemes for notification delivery methods, such as 'snmpnotify', for
 1478 use in the "notification-recipient" attribute, using the same procedures outlined in [ipp-mod].

1479 13 Internationalization Considerations

1480 This IPP notification specification continues the internationalization of [ipp-mod] for attributes containing
 1481 text strings and names. A subscribing client can specify a different natural language and charset for each
 1482 Notification content delivered to a Notification Recipient.

1483 The Human Consumable Notification content is a 'text/plain; charset=utf-8' by default where the
 1484 Notification Sender has localized the text message as requested by the subscriber for the intended
 1485 Notification Recipient.

1486 14 Security Considerations

1487 By far the biggest security concern is the abuse of notification: sending unwanted notifications to third
 1488 parties (i.e., spam). The problem is made worse by notification addresses that may be redistributed to
 1489 multiple parties (e.g. mailing lists). There exist scenarios where third party notification is required (see
 1490 Scenario #2 and #3 in [ipp-not-req]). The fully secure solution would require active agreement of all
 1491 recipients before sending out anything. However, requirement #9 in [ipp-req] (“There is no requirement for
 1492 IPP Printer receiving the print request to validate the identity of an event recipient”) argues against this.
 1493 Certain systems may decide to disallow third party notifications (a traditional fax model).

1494 Clients submitting notification requests to the IPP Printer has the same security issues as submitting an
 1495 IPP/1.1 print job request. The same mechanisms used by IPP/1.1 can therefore be used by the client
 1496 notification submission. Operations that require authentication can use the HTTP authentication.
 1497 Operations that require privacy can use the HTTP/TLS privacy.

1498 The notification access control model should be similar to the IPP access control model for Jobs. Creating
 1499 a Per-Printer Notification Subscription object is associated with a user. Only the creator or an operator can

1500 cancel the subscription. The system may limit the listing of items to only those items owned by the user.
1501 Some subscriptions (e.g. those that have a lifetime longer than a job) can be done only by privileged users
1502 (users having operator and/or administrator access rights), if that is the authorization policy.

1503 The standard security concerns (delivery to the right user, privacy of content, tamper proof content) apply to
1504 the notification delivery. IPP should use the security mechanism of the delivery method used. Some
1505 delivery mechanisms are more secure than others. Therefore, sensitive notifications should use the delivery
1506 method that has the strongest security.

1507 **15 Status Codes**

1508 The following status codes are defined as extensions for notification:

1509 **15.1 'successful-ok-ignored-subscriptions' (0x0003)**

1510 The number of subscriptions supplied in a Job Creation operation (Create-Job, Print-Job, Print-URI)
1511 exceeds either the limit of Per-Job subscriptions supported per job as specified by the Printer's "max-job-
1512 subscriptions-supported" attribute or some implementation-defined limit on the total number of Per-Job
1513 subscriptions for the Printer (if any). The Printer **MUST** accept the request with this status code, **MUST**
1514 return the "job-notify" attribute in the Unsupported Attributes Group with only the collection value(s) that
1515 represent the excess subscriptions that are being ignored, and **MUST** perform the Job Creation operation
1516 (see section 8.1.1), since the job can still be printed.

1517 This status code is returned even if other job attributes are unsupported or in conflict. That is, if an IPP
1518 Printer finds a warning that would allow it to return 'successful-ok-ignored-subscriptions' and either
1519 'successful-ok-ignored-or-substituted-attributes' and/or 'successful-ok-conflicting-attributes', it must return
1520 'successful-ok-ignored-subscriptions'. In other words, the precedence for returning success codes is:
1521 'successful-ok-ignored-subscriptions', 'successful-ok-conflicting-attributes', and 'successful-ok-ignored-or-
1522 substituted-attributes'.

1523 **15.2 client-error-uri-notification-scheme-not-supported (0x0414)**

1524 The scheme of the client-supplied URI in a "notify-recipient" operation attribute in a Create-Printer-
1525 Subscription or Create-Printer-Subscription operation is not supported. See [ipp-mod] section 3.1.7.

1526 There is no corresponding Per-Job subscription error for a Job Creation operation, since the Printer object
1527 **MUST** ignore any errors in the "job-notify" operation attribute, **MUST** return the "notify-recipient" attribute
1528 in the Unsupported Attributes Group, and perform the Job Creation operation (see section 8.1.1), since the
1529 job can still be printed.

1530 **15.3 client-error-too-many-subscriptions (0x0415)**

1531 The bounded set of concurrent Per-Printer subscriptions supported by the Printer object would be exceeded
1532 if this Create-Printer-Subscription request were accepted or the bounded set of concurrent Per-Job

1533 subscriptions supported by the Printer object would be exceeded if this Create-Job-Subscriptions request
1534 were accepted.

1535 Note: There is no corresponding Per-Job subscription error on a Job Creation operation, since the Printer
1536 object MUST ignore any errors in the "job-notify" operation attribute and perform the Job Creation
1537 operation (see section 8.1.1), since the job can still be printed.

1538 **15.4 client-error-too-many-events (0x0416)**

1539 The client supplied more events in the "notify-events" operation attribute in a Create-Job-Subscription or
1540 Create-Printer-Subscription operation than the Printer supports, as indicated in its "max-events-supported"
1541 attribute (see section 6.4).

1542 There is no corresponding Per-Job subscription error for a Job Creation operation, since the Printer object
1543 MUST ignore any errors in the "job-notify" operation attribute, MUST return the "notify-events" attribute in
1544 the Unsupported Attributes Group with only the excess events that are being ignored, and perform the Job
1545 Creation operation (see section 8.1.1), since the job can still be printed.

1546 **16 Addition attribute tag encodings**

1547 The Subscription attributes tag and the Notification attributes tag are assigned the following delimiter tag
1548 values as extensions to the encoding defined in [ipp-pro]) for use in requests and responses to delimit
1549 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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1660 A. Appendix - Summary of Notification Attribute Usage

1661 This appendix summarizes the usage of Notification attributes in the Job operation attribute collection, Job
1662 object, Subscription object, Notification content, Job operations, and Subscriptions operations. The legend
1663 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

1664 Legend: "R" - REQUIRED for Printer to support; "O" - OPTIONAL for Printer to support; "[]" - OPTIONAL for sender to send;
1665 Return - Printer MUST return; * the client MUST supply for some delivery methods; ** - MUST be 0 for Per-Job Subscription
1666 objects; (n) means the value comes from the indicated Subscription Attribute

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]						

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
number(integer(0:MAX))									

1668 Legend: "R" - REQUIRED for Printer to support; "O" - OPTIONAL for Printer to support; "[]" - OPTIONAL for sender to send;
 1669 "[pg/cp]" - REQUIRED in a 'job-progress' or 'job-completed' notification if the corresponding Job attributes are supported ; (nn) - an
 1670 alternate source of the data in a Notification.

1671

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							

1672 Legend: "R" - REQUIRED for Printer to support; "O" - OPTIONAL for Printer to support; "[]" - OPTIONAL for sender to send;

1673 "CR" - CONDITIONALLY REQUIRED, i.e., REQUIRED if Human Consumable format supported;

1674

1675 **B. Appendix: Change History**

1676 This section summarizes the changes to the document. Each sub-section is in reverse chronological order.
1677 Adding or removing ISSUES that don't change the document are not listed here.

1678 **1.18.1 Changes to the March 6, 2000 version to create the March 8, 2000 version**

1679 The following changes were made to the March 6, 2000 version to create the March 8, 2000 version based
1680 on the agreements reached on the mailing list:

- 1681 1. Changed the name of the SNMP delivery method from 'snmp' to 'snmpnotify', since the Notification
1682 Recipient isn't an SNMP agent.
- 1683 2. Clarified that an implementation with only a single value for persistent-jobs-supported (boolean) or
1684 persistent-subscriptions-supported (boolean) MAY make it settable to the single value or make it not-
1685 settable.

1686 **18.2 Changes to the February 2, 2000 version to create the March 6, 2000 version**

1687 The following changes were made to the February 2, 2000 version to create the March 6, 2000 version
1688 based on the agreements reached on the mailing list, at the February IPP WG meetings, and reflected in the
1689 minutes:

- 1690 1. Clarified that this extension is intended as an extension to IPP/1.0, IPP/1.1, and future versions.
- 1691 2. Allocated the operation-id 0x0016 to 0x001B values for the Notification operations defined in the
1692 document.
- 1693 3. Pre-pended the word "subscription-" on the front of the "request-id" Subscription object attribute to
1694 distinguish it from the "request-id" parameter that is sent in every request and response.
- 1695 4. Added the term "settable" for describing attributes that are not READ-ONLY.
- 1696 5. Added the term "Subscription Creation operation" to stand for any operation that can create a
1697 Subscription object: Job Creation operations (Create-Job, Print-Job, and Print-URI), Create-Job-
1698 Subscription, and Create-Printer-Subscription.
- 1699 6. Changed the "subscriber-user-name" (name(MAX)) Subscription object attribute from OPTIONAL to
1700 REQUIRED.
- 1701 7. Changed the name and semantics of "notify-printer-up-time(integer(1:MAX)) to notify-server-up-time
1702 so that it can be either the Printer's uptime or a Notification Delivery Service uptime.
- 1703 8. Added the 'ipp:', 'indp:', 'mailto:', and 'snmp:' notification delivery schemes to the definition of the
1704 "notify-recipients" to indicate possible schemes.

- 1705 9. Changed the name and semantics of "notify-text-format" (mimeMediaType) to "notify-format" so that it
1706 can be used to specify either Human Consumable or Machine Consumable formats where the
1707 implementation supports both. Clarified that this attribute controls whatever variable Notification
1708 Content that the implementation supports, which may be an attachment to the fixed content format or
1709 the contents of the "human-readable-report" (text(MAX)) attribute. Clarified that an implementation
1710 NEED NOT support all of its supported Notification Content formats with all of its supported delivery
1711 methods.
- 1712 10. Added 'text/xml', 'application/ipp', 'application/postscript', and 'image/tiff' and additional example
1713 MIME media types for "notify-format" (mimeMediaType).
- 1714 11. Clarified that the recommend way for a client to determine whether or not a Printer supports Per-Job
1715 Subscriptions is to query the Printer's "max-job-subscriptions-supported" attribute, since Create-Job-
1716 Subscriptions is an OPTIONAL operation.
- 1717 12. Clarified that the recommend way for a client to determine whether or not a Printer supports Per-Printer
1718 Subscriptions is to query the Printer's "operations-supported" attribute to see if the Create-Printer-
1719 Subscriptions operations is supported, since this is the usual way to determine a Printer's capabilities.
- 1720 13. Clarified that if "persistent-jobs-supported" (boolean) and "persistent-subscriptions-supported"
1721 (boolean) are settable, then setting them must affect whether or not jobs and subscriptions are persistent.
- 1722 14. Allowed delivery methods to send operations with or without a response, depending on the definition of
1723 the delivery method.
- 1724 15. Indicated that a deliver method definition is free to REQUIRE that the client supply the "subscriber-
1725 user-data" attribute.
- 1726 16. Required that the Printer support the "job-uri" operation attribute as a target, in addition to "printer-
1727 uri"&"job-id", i.e., keep consistent with all Job operations.
- 1728 17. Changed the 'none' out-of-band value to be a reference to the collection document [ipp-coll], since the
1729 use for it in this document is with the 'collection' attribute syntax.
- 1730 18. Clarified that a conforming implementation MUST support the 'collection' attribute syntax, since that is
1731 required in Job Creation operations.
- 1732 19. Allocated the values to the new status codes defined in this document.
- 1733 20. Allocated the [ipp-pro] subscription-attributes-tag and notification-attributes-tag delimiter tags to
1734 delimit Subscription attributes and Notification Content attributes in requests and responses.
- 1735 21. Changed the 'server-error-too-many-subscriptions' and 'server-error-too-many-events' to be client errors,
1736 i.e., 'client-error-too-many-subscriptions' and 'client-error-too-many-events', since other errors of this
1737 type are client errors.

1738

1739 18.3 Changes to the October 14, 1999 version to create the February 2, 2000 version

1740 The following changes were made to the October 14, 1999 version to create the February 2, 2000 version
1741 based on the agreements reached at the October and December IPP WG meetings and reflected in the
1742 minutes:

- 1743 1. Added a Java Listener as an example of a Notification Recipient.
- 1744 2. Clarified the object relationships in section 4.1.
- 1745 3. Clarified how job events differ for Per-Job versus Per-Printer Subscriptions.
- 1746 4. Added the ability for the Machine Consumable form to contain a Human Readable "human-readable-
1747 report" (text) attribute so that both forms could be sent in the same Notification.
- 1748 5. Clarified that the 'none' value for notify-text-format (mimeType) has to be out-of-band, not the
1749 text string 'none' as a mimeType.
- 1750 6. Clarified that 'none' means send the Machine Consumable form without the "human-readable-report"
1751 (text) attribute, if it is defined.
- 1752 7. Clarified that Notification Recipients MUST be able to accept unrecognized attributes.
- 1753 8. Allowed the notification delivery method definition to be modeled as (1) a request with an operation
1754 code without a response, (2) a request with a operation code with a response or (3) a response with a
1755 status code.
- 1756 9. Added "notify-text-format" (mimeType) and "human-readable-report" (text(MAX)) to be able to
1757 be sent in a Notification content, if the notification delivery method document permits it.
- 1758 10. Added "job-k-octets" (integer(0:MAX)), "job-impressions" (integer(0:MAX)), and "job-media-sheets"
1759 (integer(0:MAX)) as OPTIONAL for Notification content for use in job-progress events to show the
1760 target values so that the Notification Recipient can show a thermometer.
- 1761 11. Added a Subscription Attributes group (and subscription-attributes tag) the Create-Job-Subscription and
1762 Create-Printer-Subscription requests and responses.
- 1763 12. Added the 'none' out-of-band value for use with "notify-text-format" (mimeType) attribute.
- 1764 13. Changed the job progress attributes from using -2 to mean 'unknown' as in the PWG Job Monitoring
1765 MIB, to use the 'unknown' out-of-band value.

1766

1767 **C. Appendix: Full Copyright Statement**

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