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17 Internet Printing Protocol (IPP):
18 **IPP Event Notification Specification**

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32 **Abstract**

33 This document describes an extension to the IPP/1.0, IPP/1.1, and future versions that allows a client to
34 subscribe to printing related events. Subscriptions are either associated with a particular Job (called "Per-
35 Job subscriptions") or with the Printer (called "Per-Printer subscriptions"). A client can create a Per-Job
36 subscription when submitting a job. A client can also create Per-Job and Per-Printer subscriptions by
37 performing separate explicit Create-Job-Subscription Create-Printer-Subscription operations, respectively.

- 38 Subscriptions are modeled as Subscription objects. Four other operations are defined for Subscription
39 objects: Get-Attributes, Get-Subscriptions, Renew-Subscription, and Cancel-Subscription.
- 40 A subscription request and the Subscription object include for example: the names of Job and/or Printer
41 events and the Notification Recipient URL. When the event occurs, a notification is generated and delivered
42 using the information in the subscription.

43 The full set of IPP documents includes:

44 Design Goals for an Internet Printing Protocol [RFC2567]

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

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

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

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

49 Mapping between LPD and IPP Protocols [RFC2569]

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

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

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

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

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

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

76

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208 **1 Introduction**

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

- 212 Internet Printing Protocol/1.0 & 1.1: "Job Progress Attributes" [ipp-prog]
- 213 Internet Printing Protocol/1.0 & 1.1: "Notification Change History" [ipp-not-hist]

214

215

216 Refer to the Table of Contents for the layout of this document.

217 **1.1 Notification Overview**

218 A client can establish an Event Notification subscription so that when one of the specified events occurs, an
219 asynchronous Event Notification is sent to a specified Notification Recipient.

220 A client MAY create a subscription associated with a particular job (called a Per-Job Subscription) when
221 submitting a job or performing the Create-Job-Subscription operation. A client MAY create a subscription
222 associated with the Printer as a whole (called Per-Printer Subscription) by performing the Create-Printer-
223 Subscriptions operation.

224 A Per-Job or Per-Printer subscription request includes, for example:

- 225 1. the names of Job and/or Printer events that are of interest to the Notification Recipient
- 226 2. the delivery method and address (URL) to use to deliver the Event Notification to one Notification
227 Recipient
- 228 3. the format of the Human Consumable text portion of the Event Notification
- 229 4. some opaque data that the subscriber wants to be sent to the Notification Recipient in the Event
230 Notification, perhaps to identify either the subscriber or the ultimate recipient
- 231 5. the charset to use in the Event Notification
- 232 6. the natural language to use in the Human Consumable Event Notification and in name or text
233 attributes in the Machine Consumable Event Notification
- 234 7. the requested lease time in seconds for the subscription
- 235 8. whether or not the subscription is requested to be persistent across power cycles.

236 When a client performs a Job Creation operation (Print-Job, Print-URI, and Create-Job), a client can create
237 a single Subscription object for receiving Event Notifications by using the "notify-xxx" operation attributes.
238 The "notify-xxx" operation attributes may be submitted to the Validate-Job in order to be validated. The
239 "notify-xxx" attributes are copied to a newly created Subscription to populate the corresponding

240 Subscription Description attributes. If a client wants more than one Per-Job subscription, it MUST use the
 241 Create-Job-Subscription operation if the Printer supports it. To avoid race conditions, a client SHOULD
 242 perform the Create-Job-Subscription between a Create-Job operation and the first Send-Document or Send-
 243 URI operation.

244 When a client performs the Create-Job-Subscription operation, the operation creates a Subscription object
 245 and associates it with a job that already exists. When a client performs the Create-Printer-Subscription
 246 operation, the operation creates a Subscription object and associates with the Printer as a whole instead of a
 247 particular job. Both of these operations return a notify-subscription-id (analogous to a job-id for a Job
 248 object). The Printer copies the operation attributes of these two operations to the Subscription object as
 249 Subscription Description attributes. The Subscription object attributes may be queried using the Get-
 250 Subscription-Attributes and Get-Subscriptions operations. The subscriber requests a lease time for each
 251 Per-Printer subscription which MAY be infinite. The Printer grants a lease time according to its configured
 252 policy. A client MUST renew the Subscription before the granted lease time expires using the Renew-
 253 Subscription operation.

254 Table 1 summarizes the Per-Job Subscription operations. Table 2 summarizes the Per-Printer Subscription
 255 operations. Table 3 summarizes the operations that work with both Per-Job and Per-Printer Subscriptions.
 256 Each table contains the following columns:

- 257 a) Operation: the name of the operation
- 258 b) ID: the assigned operation-id (see [ipp-mod] section 4.4.15). The value of 'mod' means that the
 259 operation-id is assigned in [ipp-mod].
- 260 c) Brief Description: information about the operation

261

262 **Table 1 - Summary of Operations that Create Per-Job Subscriptions**

Operation:	ID	Brief Description
Print-Job, Print-URI, Create-Job	mod	Create at most one Per-Job Subscriptions as part of the Job Creation operation
Validate-Job	mod	Check that the Job Creation operation would be accepted including the Subscription
Create-Job-Subscription	0x0017	Create a Per-Job Subscription

263

264

Table 2 - Summary of Operations that Create Per-Printer Subscriptions

Operation:	ID	Brief Description
Create-Printer-Subscription	0x0016	Create a Per-Printer Subscription

265

Table 3 - Summary of Operations that act on Per-Job and Per-Printer Subscriptions

Operation:	ID	Brief Description
Get-Subscription-Attributes	0x0018	Get specified Subscription attributes of the specified Subscription object
Get-Subscriptions	0x0019	Get the specified Subscription attributes from all specified Subscription objects
Renew-Subscription	0x001A	Renew the Subscription lease
Cancel-Subscription	0x001B	Cancel the Subscription

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268 The following is an example of how a Printer could implement Event Notifications. When an event occurs,
 269 the Printer searches the all of its Subscription objects for any interest in the event. For each Subscription
 270 object found, the Printer

271

a) increments the Subscription object's "notify-sequence-id" (integer (0:MAX)) attribute, and

272

b) generates an Event Notification, and

273

c) either

274

i) delivers the Event Notification using the delivery method and target address identified in the
 275 Subscription object's "notify-recipient-uri" attribute if the delivery method is a "push"
 276 delivery method, or

277

ii) saves Event Notification for an event-lease time if the delivery method is a "pull", i.e. the
 278 client is expected to fetch the Event Notifications.

279

The "notify-sequence-id" sequence number permits a Notification Recipient to detect duplicate Event
 280 Notifications due either to duplicate subscriptions or retries and to detect dropped Event Notifications.

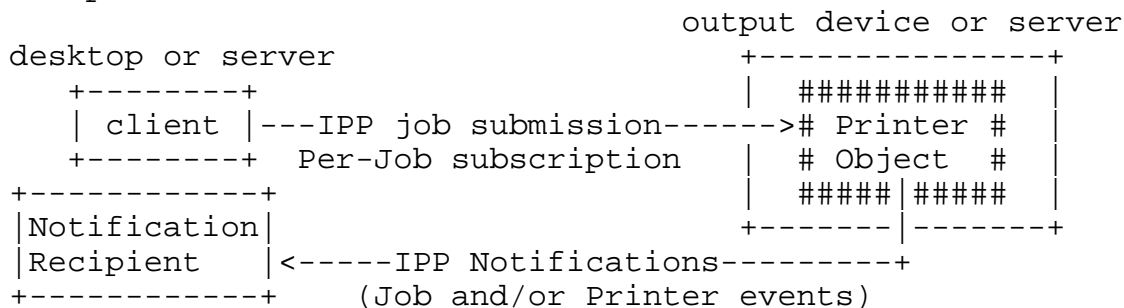
281 2 Model for Per-Job and Per-Printer Subscription and Event Notification

282 2.1 Model for Per-Job Subscription and Event Notification

283 Per-Job subscriptions are created by a client (desktop or server acting as a client) as part of creation of the
 284 job in an IPP Printer (printing device or server). At most one subscription may be submitted with a job.
 285 Additional subscriptions may be associated with the job using the Create-Job-Subscription operation. The
 286 IPP Printer object delivers an Event Notification to the Notification Recipient supplied by the Client in each
 287 subscription. A Notification Recipient can be the Job submitter or a third party.

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

289 embedded printer:



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

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

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

long term Per-Printer subscription with Printer D to that Server S can have Printer B's state track (shadow) that of Printer D or Server S could poll Printer D when queried about Printer B).

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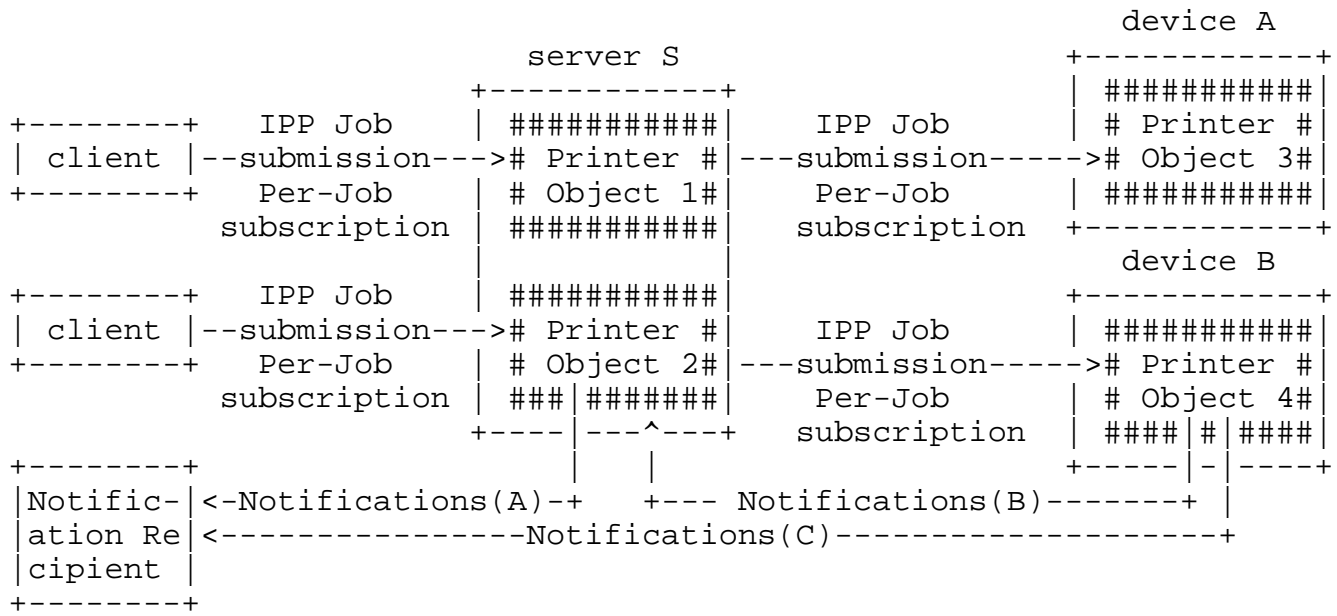


Figure 2 - Client-Server-Printer Per-Job Subscription and Notification Model

2.2 Model for Per-Printer Subscription and Event Notification

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

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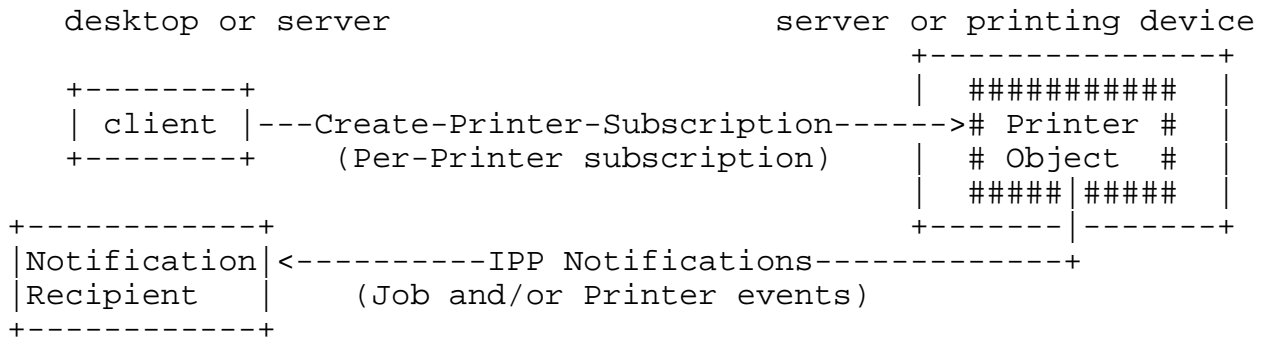


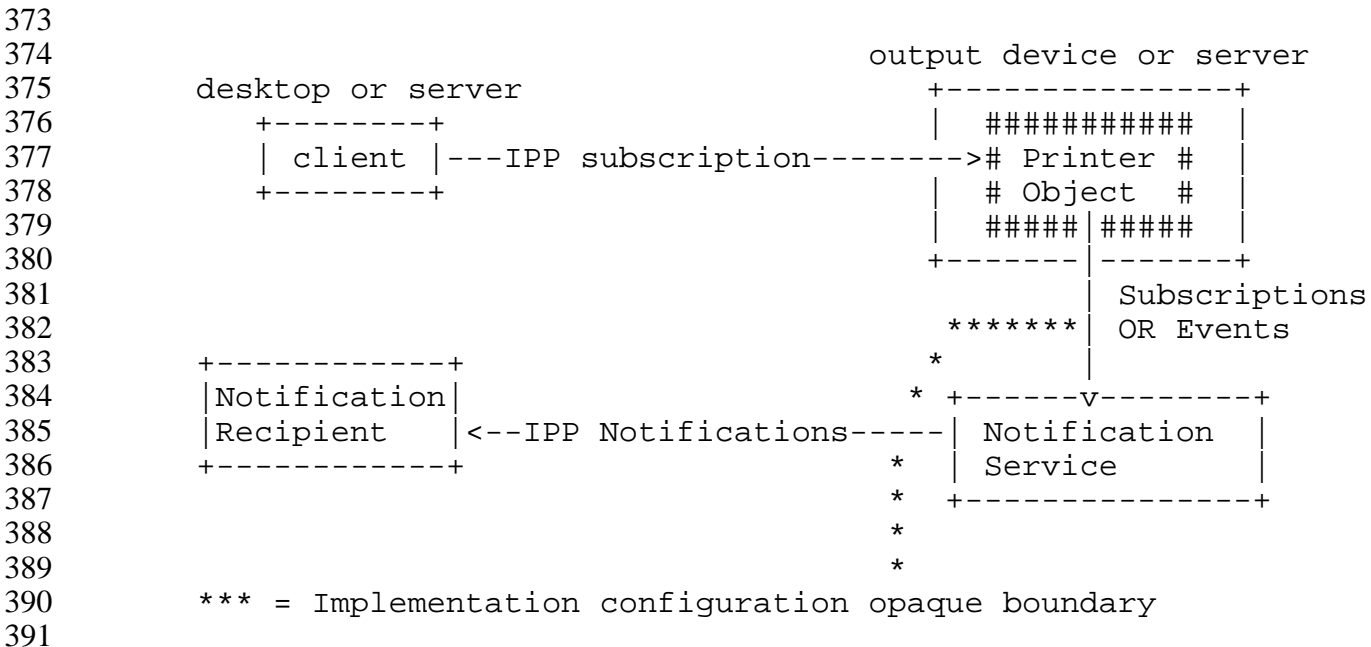
Figure 3 - Client-Printer Per-Printer Subscription and Notification Model

362 **2.3 Relationship between the Printer object and the Notification Delivery Service**

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

367 **2.3.1 Use of a Notification Service transparently to clients**

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



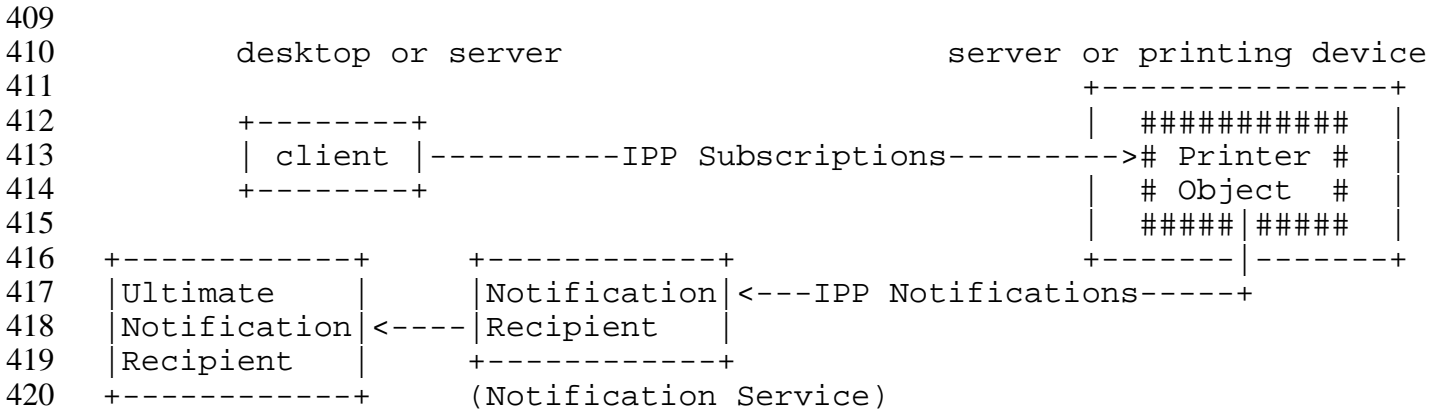
392 **Figure 4 - Opaque Use of a Notification Service Transparent to the Client**

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

395 **2.3.2 Use of Notification Service transparently to the IPP Printer**

396 Another way that a Notification Service can be used is if the Notification Recipient indicated in the IPP
 397 Subscription is a notification service (transparent to the IPP Printer), which in turn forwards the Event
 398 Notification to the Ultimate Notification Recipient using additional parameters in the IPP Subscription
 399 (URI parameters or subscriber user data). In such cases, the Ultimate Notification Recipient has also
 400 subscribed directly with the other notification service (by means outside this document). As far as the IPP
 401 Printer is concerned, the IPP Subscription indicated that the IPP Printer is to delivery Event Notifications to

402 the Notification Recipient (Notification Service) using the specified notification delivery method. The
 403 method that the Notification Recipient uses for delivering the Event Notification to the Ultimate
 404 Notification Recipient is beyond the scope of this document and is transparent to the IPP Printer. However,
 405 the client does have to know how to pass additional information to the Notification Recipient in the IPP
 406 Subscription using either extra parameters in the URI or subscriber user data. Examples of this latter
 407 approach are paging, immediate messaging services, and NOS vendors infrastructure. Figure 5 shows this
 408 approach.



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

422 **3 Terminology**

423 This section defines terminology used throughout this document.

424 **3.1 Conformance Terminology**

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

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

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

439 *document means "RECOMMENDED if this OPTIONAL notification specification is*
440 *implemented".*

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

444 **READ-ONLY** - an adjective used in an attribute definition to indicate that an IPP Printer MUST NOT
445 allow the attribute's value to be modified with the Set-Job-Attributes or Set-Printer-Attributes
446 operations (see [ipp-set]).

447 3.2 Other terminology

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

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

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

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

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

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

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

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

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

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

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

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

490 **Per-Job Subscription** - A Subscription object that is associated with a single Job. A client creates such
491 a Subscription object as part of a create-job operation (Print-Job, Print-URI, Create-Job), a Validate-
492 Job operation, or an explicit Create-Job-Subscription operation with a Job object as the target.

493 **Per-Printer Subscription** - A Subscription object that is associated with the Printer as a whole. A
494 client creates such a Subscription object using an explicit Create-Printer-Subscription operation with
495 a Printer object as the target.

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

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

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

507 **Event** - An event is some occurrence (either expected or unexpected) within the printing system of a
508 change of state, condition, or configuration of a Job or Printer object. A property of an event is that

509 it only occurs at one instant in time and does not span the time the physical event takes place. For
510 instance, jam-occurred and jam-cleared are two distinct events. The jam-occurred event is reported
511 only when the jam initially occurs and only if there is one or more event subscriptions outstanding
512 for that event.

513 Events can be classified along two dimensions:

- 514 - Either as Job Events or Printer Events, and
- 515 - Either as Errors, Warnings, or Reports

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

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

522 An event occurs for a job or printer whether any entity has subscribed to be notified for that event or
523 not. An Event Notification is only generated depending on the set of subscriptions outstanding.

524 **Event Notification** - When an event occurs, an Event Notification is generated that fully describes the
525 event (what the event was, where it occurred, when it occurred, etc.). Event Notifications are
526 delivered to each Notification Recipient that has a subscription that includes the event, if any. The
527 Event Notification is delivered to the address of the Notification Recipient using the notification
528 delivery method defined in the subscription. However, an Event Notification is sent ONLY if there
529 is a corresponding subscription. Note: sometimes "Event Notification" is shortened to
530 "Notification".

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

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

536 **Store and Forward Event Notification** - An Event Notification which are not necessarily delivered to
537 Notification Recipients immediately, but is queued for delivery by some intermediate network
538 application, for later retrieval. Email and Instant Messaging services are examples of a store and
539 forward notification delivery method.

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

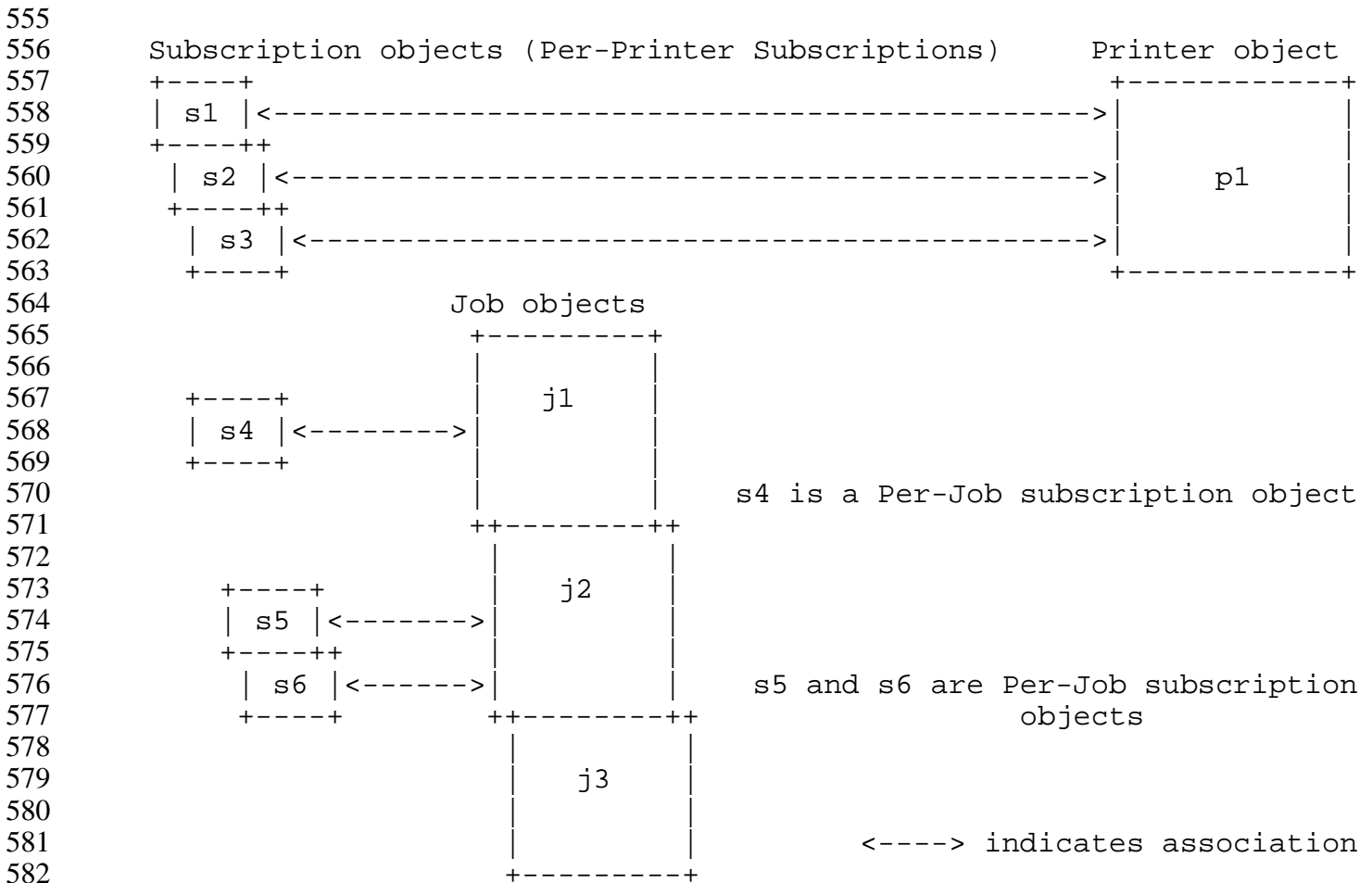
545 **Machine Consumable Event Notification** - Event Notifications that are intended for consumption by a
 546 program only. They use the encoding of an IPP response. The Notification Recipient must localize
 547 the contents, if displaying it to a human.

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

551 **4 Object Model for Notification**

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

554 The object relationships can be seen pictorially as:



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

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

586 4.1 Object relationships

587 This sub-section defines the object relationships between the Printer, Job, and Subscription objects.
588 Whether Per-Printer Subscription objects are actually contained in a Printer object or are just bi-
589 directionally associated with them in some way is IMPLEMENTATION DEPENDENT and is transparent
590 to the client. Similarly, whether Per-Job Subscription objects are actually contained in a Job object or are
591 just bi-directionally associated with them in some way is IMPLEMENTATION DEPENDENT and is
592 transparent to the client. The object relationships are defined as follows:

593 4.1.1 Printer object and Per-Printer Subscription objects

- 594 1. The Printer object contains (is associated with) zero or more Per-Printer Subscription objects (p1
595 contains s1-s3 Per-Printer Subscription objects).
- 596 2. A Per-Printer Subscription object (s1-s3) cannot be contained in (or associated with) more than one
597 Printer object (p1).
- 598 3. Each Per-Printer Subscription object (s1, s2, and s3) is contained in (or is associated with) one
599 Printer object (p1) and each represents one Per-Printer subscription.
- 600 4. Each Per-Printer Subscription object identifies one or more Job and/or Printer events. Such Job
601 events are for *all* jobs on the Printer. Such Printer events are for *any* Printer event, no matter which
602 job is processing and when no jobs are processing.

603 4.1.2 Job object and Per-Job Subscription objects

- 604 1. A Job object (j1, j2, j3) contains (is associated with) zero or more Per-Job subscription objects (s4-
605 s6). Job j1 is associated with Per-Job subscription object s4, Job j2 is associated with Per-Job
606 subscription objects s5 and s6, and Job j3 is not associated with any Per-Job subscription object.
- 607 2. A Per-Job Subscription object cannot be contained in (or associated with) more than one Job object.
- 608 3. Each Per-Job Subscription object is contained in (or associated with) one Job object and each
609 represents one Per-Job Subscription.
- 610 4. Each Per-Job Subscription object identifies one or more Job and/or Printer events. Such Job events
611 are only for *this* job (different than "per-Printer" Subscriptions). Such Printer events are for *any*
612 Printer event, no matter which job and when no jobs are processing (same as for "per-Printer"
613 Subscriptions).

614 5 Subscription Object attributes

615 **ISSUE** Should we consolidate this section and several others into a single Subscription Template section
616 (like the Job Template section in the IPP/1.1 model document [ipp-mod]. Much information is replicated
617 four times, here and in each of the three operations.

618 **ISSUE:** To further simplify, the document should we have the Job Creation operations use a Subscription
619 group like the Create-Job-Subscription and Create-Printer-Subscription operations. This would reduce text
620 and reduce code because of the added commonality.

621 Table 4 lists the Subscription object attributes defined in this section and the related Printer Description
622 attributes defined in section 6, if any. The definitions of the object attributes are specified in this section so
623 that they can be referred to from the subsequent definitions of the operations that set them. None of the
624 Subscription object attributes can be modified after a Subscription object is created because this
625 specification does not define a Set-Subscription-Attributes operation. The attributes, that are inherently un-
626 modifiable even if there were a Set-Subscription-Attributes operation are marked as READ-ONLY. They
627 can be set only by specific operations that create or perform operations on Subscription objects (see section
628 8).

629 If a Printer supports an attribute, the Printer MUST

- 630 a) accept the attribute in a Subscription creation operation (Job-Creation, Create-Job-Subscription
631 and Create-Printer-Subscription), and
- 632 b) store the attribute on the created Subscription object, and
- 633 c) return the attribute in the Get-Subscription-Attributes operations.

634 Table 4 below contains the following columns:

- 635 a) Subscription object attributes: the name of a Subscription object attribute.
- 636 b) Client MUST supply: the value is 'yes' if the client MUST supply the Subscription attribute in an
637 operation that creates a Subscription object. The value is 'no' if the client MAY supply the
638 Subscription attribute in an operation that creates a Subscription object. If a client MAY supply
639 the Subscription attribute, the default value is specified in the section describing the attribute.
- 640 c) Printer MUST support: the value is 'yes' if the Printer MUST support the Subscription attribute
641 (as defined above) and 'no' if the Printer MAY support the Subscription.
- 642 d) Related Printer Description attribute(s): this columns lists the related attributes, such as the
643 "xxx-supported" and "xxx-default" attributes. The value 'n/a' means that the attribute has no
644 related attributes.

645

Table 4 - Subscription object attributes supplied directly by the client

Subscription object attributes	Client MUST supply	Printer MUST support	Related Printer Description attribute(s)
notify-recipient-uri (uri)	yes	yes	notify-schemes-supported (1setOf uriScheme)
notify-events (1setOf type2 keyword)	no	yes	notify-events-default (1setOf type2 keyword) notify-events-supported (1setOf type2 keyword) notify-max-events-supported (integer(5:MAX))
notify-text-format (mimeMediaType)	no	yes	notify-text-format-supported (1setOf mimeMediaType)
notify-additional-formats (1setOf mimeMediaType)	no	no	notify-additional-formats-supported (1setOf mimeMediaType)
notify-requested-attributes	no	no	notify-requested-attributes-supported (1 setOf type2 keyword)
notify-user-data (octetString(63))	no	yes	n/a
notify-charset (charset)	no	yes	charset-supported (1setOf charset)
notify-natural-languages (naturalLanguage)	no	yes	generated-natural-language-supported (1setOf naturalLanguage)

646

647 Table 5 contains the same columns as table two except for the second column ('Client MUST supply')
648 which is omitted because a client MUST NOT supply any of the attributes in the table. The Printer supplies
649 them all from a source defined for the attribute.

650

Table 5 - Subscription object attributes supplied the Printer

651

Subscription object attributes:	Printer MUST support	Related Printer Description attribute(s)
notify-sequence-id(integer(0:MAX))	yes	n/a
notify-subscription-id (integer(1:MAX))	yes	n/a
notify-lease-expiration-time (integer(0:MAX))	yes	notify-lease-time-default (integer(0:MAX)) notify-lease-time-supported (rangeOfInteger(0:MAX))
printer-uri (uri)	yes	printer-uri-supported
subscriber-user-name (name(MAX))	yes	n/a
notify-server-up-time (integer(1:MAX))	yes	printer-up-time (integer(1:MAX))
notify-persistence-granted (boolean)	yes	persistent-subscriptions-supported (boolean)

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

658 **5.1 notify-recipient-uri (uri)**

659 This Subscription object attribute describes both where (the address of the Notification Recipient) and how
660 (the delivery method) notifications are to be delivered to the Notification Recipient when any of the events
661 specified in the "notify-events" attribute occur. A Printer MUST support this attribute and a client MUST
662 supply this attribute as an operation attribute when it creates a Subscription object with the Create Job,
663 Create-Job-Subscription or Create-Printer-Subscription operation.

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

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

- 668 1) The URI scheme used.
- 669 2) The default delivery format, and additional delivery formats if any. If the delivery method supports
670 additional delivery formats, the Printer MUST support the "notify-additional-formats" for them to
671 be accessible to clients
- 672 3) Whether the Event Notification Content is intended to Machine Consumable or Human
673 Consumable.
- 674 4) If the attribute "notify-text" is supported for the Machine Consumable content.
- 675 5) Any content length restrictions imposed by the delivery protocol.
- 676 6) The latency of the delivery protocol used.
- 677 7) The reliability of the transport and delivery protocol used.
- 678 8) The security aspects of the transport and delivery protocol used, e.g. how it is handled in firewalls.
- 679 9) How the delivery protocol is initiated, e.g. does it have to be initiated by the receiving user (pull), or
680 is it initiated by the notification service (push).

681 Although this specification does not define any notification delivery schemes, the following sorts of
682 notification delivery schemes are expected:

683 The Notification Recipient uses server directed polling to pull Event Notifications

684 The Notification Source sends Event Notifications to the Notification Recipient using http as the
685 transport.

686 The Notification Source sends an email message.

687 This list of notification delivery schemes will be added to as needed using the registration procedures
688 defined in [ipp-mod]. See the section on IANA Considerations in this specification for more details.

689 **5.2 notify-events (1setOf type2 keyword)**

690 This Subscription object attribute identifies the job and/or printer events that are to be delivered to the
691 Notification Recipient as Event Notifications as defined in section 7. A Printer MUST support this attribute
692 and a client MAY supply this attribute as an operation attribute when it creates a Subscription object with
693 the Create Job, Create-Job-Subscription or Create-Printer-Subscription operation. If the client does not
694 supply this attribute in one of the aforementioned operations, the Printer object MUST populate this
695 attribute with its "notify-events-default" attribute value (see section 6.2).

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

699 Job events: The semantics for job events depends on whether the subscription is a Per-Job
700 Subscription or a Per-Printer Subscription. For Per-Job Subscriptions, the Printer MUST
701 generate Event Notifications only for the job events of the job with which the Subscription is
702 associated. For Per-Printer Subscriptions, the Printer MUST generate Event Notifications
703 for the job events for any job submitted to the Printer.

704 For example, consider the event when there are 10 'pending' jobs, one 'processing' job, and
705 30 'completed' jobs and the 'processing' job completes. The Printer MUST generate a 'job-
706 completed' job Event Notification if the job is associated with a Per-Job Subscription that
707 contained the 'job-completed' event in this attribute of it the Printer is associated with a Per-
708 Printer Subscription that contained the 'job-completed' event in this attribute. The Printer
709 MUST NOT generate Event Notifications for any other jobs whose Per-Job Subscriptions
710 contain the 'job-completed' event in this attribute.

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

715 For example, consider the event when there are 10 'pending' jobs, one 'processing' job, and
716 30 'completed' jobs and the Printer enters the 'stopped' state. The Printer MUST generate a
717 'printer-state-changed' printer Event Notification for each of the 11 'pending' and 'processing'
718 jobs whose Per-Job Subscriptions contain the 'printer-state-changed' event in this attribute.
719 The Printer MUST NOT generate Event Notifications for any of the 'completed' jobs' whose
720 Per-Job Subscriptions contain the 'printer-state-changed' event in this attribute.

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

724 A Printer MUST support the events indicated as "REQUIRED" and MAY support of the events indicated as
725 "OPTIONAL".

726 The standard event keyword value for the "notify-events-default" and "notify-events-default" attributes
727 only:

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

730 The standard job event keyword values are:

731 **'job-created':** REQUIRED - the Printer object has accepted a Job Creation operation (Print-Job, Print-
732 URI, or Create-Job) and the job's "time-at-creation" attribute value is set (see [ipp-mod] section
733 4.3.14.1). The Printer puts the job in the 'pending', 'pending-held' or 'processing' states.

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

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

737 **'job-completed'**: REQUIRED - the job has reached one of the completed states, i.e., the value of the
738 job's "job-state" attribute has changed to: 'completed', 'aborted', or 'canceled'. The Job's "time-at-
739 completed" and "date-time-at-completed" (if supported) attributes are set (see [ipp-mod] section
740 4.3.14).

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

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

748
749 This event also indicates that one or more values have been added to or removed from the Job's
750 "job-state-reasons" attribute, such as 'job-queued' or 'job-printing', whether or not the job's state has
751 changed. If job state reasons are added when the job is created, only the 'job-created' event is
752 generated, in order to keep the events disjoint. If job state reasons are added or removed when the
753 job is completed, only the 'job-completed' event is generated, in order to keep the events disjoint.

754
755 A client that wants to subscribe to all job state changes, including creation and completion, includes
756 the 'job-created', 'job-state-changed', and 'job-completed' in the notification subscription. When a
757 job is finally removed from the Job History (see [ipp-mod] 4.3.7.1) no event is generated, i.e.,
758 neither a 'job-state-changed' event nor a 'job-purged' event is generated.

759 **'job-config-changed'**: OPTIONAL - when the configuration of a job has changed, i.e., the value of the
760 "job-message-from-operator" or any of the "configuration" Job attributes have changed. A
761 "configuration" Job attribute is an attribute that 1) can change value because of some human
762 interaction either direct or indirect, and that 2) is not covered by one of the other events in this
763 section. Examples of "configuration" Job attributes are any of the job template attributes and the
764 "job-name" attribute. Often, such a change is the result of the user or the operator performing a Set-
765 Job-Attributes operation (see [ipp-set]) on the Job object. The client performs a Get-Job-Attributes
766 to find out the new values of the changed attributes. This event is useful for GUI clients and drivers
767 to update the job information to the user. **'job-purged'**: OPTIONAL - when a 'not-completed' job
768 (i.e., not 'completed', 'canceled', or 'aborted') was purged from the printer using the Purge-Jobs
769 operation. No event, including this event, is generated when a job is aged out of the Job History or
770 moved out explicitly with the Purge-Jobs operation.

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

772 The standard Printer event keywords values are:

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

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

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

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

783 **'printer-state-changed'**: REQUIRED - the Printer changed state, i.e., the value of the Printer's
784 "printer-state", "printer-state-reasons" (whether "printer-state" changed or not), and/or "printer-is-
785 accepting-jobs" attributes changed, except when the Printer starts up or is shutdown. If printer state
786 reasons are added when the Printer is started up, only the 'printer-restarted' event is generated, in
787 order to keep the events disjoint. If printer state reasons are added or removed when the printer is
788 powered-down or shutdown, only the 'printer-shutdown' event is generated, in order to keep the
789 events disjoint.

790
791 A client that wants to subscribe to all printer state changes, including restart and power-
792 down/shutdown, includes the 'printer-restarted', 'printer-state-changed', and 'printer-shutdown' in the
793 notification subscription. If a Printer does not support 'printer-restarted' or 'printer-shutdown', these
794 attributes do not become accessible via this attribute.

795 **ISSUE: is above fix correct?**

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

801 **'printer-config-changed'**: OPTIONAL - when the configuration of a Printer has changed, i.e., the
802 value of the "printer-message-from-operator" or any "configuration" Printer attribute has changed, A
803 "configuration" Printer attribute is an attribute which can change value because of some human
804 interaction either direct or indirect, and which is not covered by one of the other events in this
805 section. Examples of "configuration" Printer attributes are any of the job template attributes, such as
806 "xxx-supported" and "xxx-default",. The "media-ready" attribute is an example of an attribute
807 covered by another event: **'printer-media-changed'**. Often, such a change is the result of the user
808 or the operator performing a Set-Printer-Attributes operation (see [ipp-set]) on the Printer object
809 The client has to perform a Get-Printer-Attributes to find out the new values of these changed
810 attributes. This event is useful for GUI clients and drivers to update the available printer
811 capabilities to the user. **ISSUE: if printer-media-changed is not supported, does printer-config-
812 changed support it? Same question for attributes below.**

813 **'printer-queue-changed'**: OPTIONAL - the order of jobs in the Printer's queue has changed, so that an
814 application that is monitoring the queue can perform a Get-Jobs operation to determine the new

815 order. This event does not include when a job enters the queue (the 'job-created' event covers that)
816 and does not include when a job leaves the queue (the 'job-completed' event covers that).

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

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

828 **5.3 notify-text-format (mimeMediaType)**

829 This Subscription object attribute indicates the MIME Media type of the value of the "notify-text" attribute
830 (see section 8.2) to be sent in the Event Notifications. Support of the "notify-text" attribute is REQUIRED
831 for some delivery methods and not for others. See the documents for each delivery methods for details.

832 A Printer MUST support this attribute and a client MAY supply this attribute as an operation attribute when
833 it creates a Subscription object with the Create Job, Create-Job-Subscription or Create-Printer-Subscription
834 operation.

835 If the Subscriber does not supply this attribute when requesting the subscription, the Printer object
836 populates this Subscription object attribute with 'text/plain'.

837 The value of this attribute MUST be a subtype of 'text', and it MUST be a value in the MIME registry. The
838 charset for these formats is specified by the "notify-charset" attribute. If the value of this attribute contains a
839 'charset' parameter, it is ignored. The attribute "notify-charset" specifies the charsetExamples are:

840 'text/plain': plain text .
841 'text/html': HTML data [RFC1866].
842 'text/xml': XML data [RFC2376].
843 'text/vnd.wap.wml': wml data. See IANA registry [IANA]
844 'text/richtext': rich text data [RFC2046]

845 **5.4 notify-additional-formats (1setOf mimeMediaType)**

846 This Subscription object attribute indicates the MIME Media types of additional Machine Consumable
847 contents to be sent in the Event Notifications for those delivery methods that make use of this attribute.
848 This attribute is intended for delivery methods that can send multiple formats.

849 For example, an email delivery method might support "notify-text-formats" of 'text/plain' only. If the user
850 specifies the "notify-text-format" attribute and not this attribute, the Event Notification content consists of
851 an email message that is just plain text. If a Subscriber specifies values of 'text/html' and 'image/tiff' for this
852 attribute, the Event Notification content consists of a multipart/mixed value with 3 parts, one that is
853 'text/plain' (the one specified by the "notify-text-format" attribute), another that is 'text/html' and a third
854 that is 'image/tiff'.

855 A Printer MAY support this attribute and a client MAY supply this attribute as an operation attribute when
856 it creates a Subscription object with the Create Job, Create-Job-Subscription or Create-Printer-Subscription
857 operation.

858 If a Printer is generating an Event Notification for a delivery method whose definition

859 a) does not mention this attribute, the Printer MUST use the single format specified in the delivery
860 method's definition whether this attribute is present or not in the Subscription object.

861 b) does mention this attribute and this attribute is

862 i) supported by the Printer and present on the Subscription object, the Printer MUST generate
863 an Event Notification in the single default format (specified by the delivery method's
864 definition) plus the formats requested in this attribute

865 ii) not supported by the Printer or not present on the Subscription object, the Printer MUST
866 generate an Event Notification in the single default format that is specified in the delivery
867 method's definition.

868 If the Subscriber does not supply this attribute when creating the subscription, the Printer does not put this
869 attribute on the Subscription object, and the Printer behaves as described in items a) or b)ii) above.

870 If a particular value appears more than once in the union of this attributes and the "notify-text-format"
871 attribute, the Printer MUST send the requested format at least once, but it MAY send the requested format
872 more than once. For example, if the value of "notify-text-format" is 'text/html' and the values of this
873 attribute are 'text/html' and 'image/tiff', a client could get two 'text/html' values or one.

874 The value of this attributes MAY be any value in the MIME registry that the Printer supports except
875 'text/plain' (because it is the default value of "notify-text-format"). If the value of this attribute contains a
876 'charset' parameter, it is ignored. The attribute "notify-charset" specifies the charset.

877 Examples are:

878 'text/html': Human Consumable HTML data [RFC1866].

879 'text/xml': Human Consumable XML data [RFC2376].

880 'text/vnd.wap.wml': wml data. See IANA registry [IANA]

881 'text/richtext': Human Consumable rich text data [RFC2046]

882 'application/ipp': Machine Consumable IPP request as in [ipp-pro].

883 'application/postscript': Human Consumable PostScript [RFC2046]

884 'image/tiff': Human Consumable image data [RFC2302]

885 'multipart/mixed': Machine Consumable data [RFC2046]. In this context, this value acts as a wild card
886 and requests all formats supported by Printer for the delivery method.

887

888 **5.5 notify-requested-attributes (1setOf type2 keyword)**

889 This Subscription object attributes holds the set of additional attributes for the Printer to include in each
890 Machine Consumable Event Notification.

891 A Printer MAY support this attribute and a client MAY supply this attribute as an operation attribute when
892 it creates a Subscription object with the Create Job, Create-Job-Subscription or Create-Printer-Subscription
893 operation.

894 A Printer MUST include the attributes specified in section 7.1 in each Event Notification whether it
895 supports this attribute or not.

896 If a Printer supports this attribute and a Subscription object contains this attribute and the delivery method
897 generates a Machine Consumable Event Notification, the Printer MUST include in each Event Notification:

898 a) the attributes specified in section 7.1 and

899 b) each attribute contained in this attribute and contained in the "notify-requested-attributes-
900 supported" attribute. That is, if an attribute is contained in this attribute but not in the "notify-
901 requested-attributes-supported" attribute, it is an unsupported value.

902 If the delivery method generates a Human Consumable Event Notification, this attribute is ignored and the
903 Printer generates the information specified in section 7.2.

904 If a Printer does not support this attribute or a client does not supply this attribute, then a Printer MUST
905 include in each Event Notification the attributes specified in section section 7.1 and the Printer NEED
906 NOT supply any additional attributes.

907 **5.6 notify-user-data (octetString(63))**

908 This Subscription object attribute holds opaque information being sent from the Subscriber to the
909 Notification Recipient, such as the identity of the Subscriber or a path or index to some Subscriber
910 information. Or it MAY contain a key that the Notification Recipient needs in order to process the Event
911 Notification. They key might be the ultimate recipient to which the Notification Recipient forward Event
912 Notifications. An Instant Messaging Service is an example of such a general application where the "notify-
913 user-data" might be the user's id and the "notify-recipient-uri" is the URL of the messaging service.

914 A Printer MAY support this attribute and a client MAY supply this attribute as an operation attribute when
915 it creates a Subscription object with the Create Job, Create-Job-Subscription or Create-Printer-Subscription
916 operation. If the client does not supply this attribute, the Printer does not add it to the Subscription object. If

917 a delivery method requires this attribute and the Subscription object does not have it, the delivery method
918 uses an octet-string of length 0.

919

920 **5.7 notify-charset (charset)**

921 This Subscription object attribute specifies the charset to be used in the Event Notification content sent to
922 the Notification Recipient, whether the Event Notification content is Machine Consumable or Human
923 Consumable..

924 A Printer MUST support this attribute and a client MAY supply this attribute as an operation attribute when
925 it creates a Subscription object with the Create Job, Create-Job-Subscription or Create-Printer-Subscription
926 operation. If the client does not supply this attribute, the Printer MUST copy the value of the "attributes-
927 charset" operation attribute to this attribute on the Subscription object.

928 **5.8 notify-natural-language (naturalLanguage)**

929 This Subscription object attribute specifies the natural language for the IPP object to use in any human
930 readable text in the Event Notification content that is sent to the Notification Recipient, whether the Event
931 Notification content is Machine Consumable or Human Consumable.

932 A Printer MUST support this attribute and a client MAY supply this attribute as an operation attribute when
933 it creates a Subscription object with the Create Job, Create-Job-Subscription or Create-Printer-Subscription
934 operation. If the client does not supply this attribute, the Printer MUST copy the value of the "attributes-
935 natural-language" operation attribute to this attribute on the Subscription object.

936 **5.9 notify-sequence-id**

937 This READ-ONLY Subscription object attribute holds the most recent "notify-sequence-id" sequence
938 number delivered in an Event Notification content to the Notification Recipient.

939 A Printer MUST support this attribute and a client MUST NOT supply this attribute as an operation
940 attribute when it creates a Subscription object with the Create Job, Create-Job-Subscription or Create-
941 Printer-Subscription operation.

942 **5.10 A value of 0 indicates that no Event Notifications have been sent for this**
943 **subscription. The first "notify-sequence-id" sent for a subscription MUST be 1.**
944 **Each Notification Recipient receives its own monotonically increasing series of**
945 **"notify-sequence-id"s, i.e., no gaps, in order to be able to detect a missing Event**
946 **Notification.notify-subscription-id (integer (1:MAX))**

947 This READ-ONLY Subscription object attribute uniquely identifies this Subscription object instance on
948 this Printer object or this Job object.

949 A Printer MUST support this attribute and a client MUST NOT supply this attribute as an operation
950 attribute when it creates a Subscription object with the Create Job, Create-Job-Subscription or Create-
951 Printer-Subscription operation.

952 The Printer object, on acceptance of a Create-Job-Subscription or Create-Printer-Subscription request,
953 generates an ID that identifies the new Subscription object on that Printer or Job. The Printer returns the
954 value of the "notify-subscription-id" attribute as part of the response to a Create-Job-Subscription or Create-
955 Printer-Subscription request. The 0 value is not included to allow for compatibility with "job-id" and with
956 SNMP index values, which also cannot be 0. It is RECOMMENDED that Per-Printer Subscription objects
957 be persistent. Then the Subscription objects including the notify-subscription-id remains unique across
958 power-cycles. Even if an implementation does not make Per-Printer subscription objects persist, the
959 implementation SHOULD make every attempt not to re-use subscription ids that subscribers might still
960 think are valid. In other words, the Printer SHOULD at least keep the next notify-subscription-id to be
961 assigned in non-volatile memory. Note: it is assumed that Per-Job subscriptions are persistent if Jobs are
962 persistent, in order to be consistent with the persistency of Job objects. The [ipp-mod] RECOMMENDS
963 that Job objects be persistent.

964 **5.11 notify-lease-expiration-time (integer(0:MAX))**

965 This READ-ONLY Subscription object attribute specifies the time in the future when the subscription lease
966 will expire, i.e., the "printer-up-time" value at which the lease will expire.

967 A Printer MUST support this attribute and a client MUST NOT supply this attribute as an operation
968 attribute when it creates a Subscription object with the Create Job, Create-Job-Subscription or Create-
969 Printer-Subscription operation.

970 When the Printer object creates a Per-Printer Subscription object, it populates this attribute with the
971 appropriate value. When the indicated time arrives, the Printer MUST delete the Per-Printer Subscription
972 object. Per-Job Subscription objects always return a value of 0 since Per-Job Subscriptions don't have a
973 lease, but exist for the life-time of the Job instead. A client is able to extend a lease of a Per-Printer
974 subscription using the Renew-Subscription operation (see section 9.3.3). A value of 0 indicates an infinite
975 time, if such a policy is supported as indicated in the "notify-lease-time-supported" (integer(0:MAX))
976 Printer Description attribute (see section 6.7) and the subscriber is authorized to request an infinite lease. A
977 Per-Job subscription cannot be renewed.

978 Note: In order to compute the number of seconds remaining in a Per-Printer Subscription lease, a client can
979 subtract the "notify-server-up-time" Subscription object attribute (see section 5.14) from the "notify-lease-
980 expiration-time" Subscription object attribute.

981 **5.12 printer-uri (uri)**

982 This READ-ONLY Subscription object attribute identifies the Printer object that created this Subscription
983 object.

984 A Printer MUST support this attribute and a client MUST NOT supply this attribute as an operation
985 attribute when it creates a Subscription object with the Create Job, Create-Job-Subscription or Create-
986 Printer-Subscription operation.

987 When a Printer object creates a Subscription object, it populates this attribute with the Printer object URI
988 that was used in the create request. This attribute permits a client to identify the Printer object URI that was
989 used to create this Subscription object, i.e., what security scheme was used.

990 **5.13 subscriber-user-name (name(MAX))**

991 This READ-ONLY Subscription object attribute contains the name of the user that created the Subscription
992 object.

993 A Printer MUST support this attribute and a client MUST NOT supply this attribute as an operation
994 attribute when it creates a Subscription object with the Create Job, Create-Job-Subscription or Create-
995 Printer-Subscription operation.

996 The Printer object sets this attribute to the most authenticated printable name that it can obtain from the
997 authentication service over which the IPP operation was received. This attribute is intended to help a
998 human user determine for which Per-Printer Subscriptions they are the Subscriber. Only if such is not
999 available, does the Printer object use the value supplied by the client in the "requesting-user-name"
1000 operation attribute of the create operation (see [IPP-MOD] Sections 4.4.2, 4.4.3, and 8). For Per-Job
1001 subscriptions created as part of the Job creation operation, the value of the "subscriber-user-name" is the
1002 same as the "job-originating-user-name" Job attribute (see [ipp-mod] section 4.3.6). The value of the
1003 "subscriber-user-name" is implementation dependent when a server accepts a request and forwards it to a
1004 downstream IPP Printer (see Figure 2 and the [ipp-iig]).

1005 Note: The Printer object needs to keep an internal originating user id of some form, typically as a credential
1006 of a principal, with the Subscription object. Since such an internal attribute is implementation-dependent
1007 and not of interest to clients, it is not specified as a Subscription Description attribute. This originating user
1008 id is used for authorization checks (if any) on all subsequent operations.

1009 **5.14 notify-server-up-time (integer(1:MAX))**

1010 This READ-ONLY Subscription object attribute indicates the amount of time (in seconds) that the Printer
1011 or Notification Delivery Service implementation has been up and running.

1012 A Printer MUST support this attribute and a client MUST NOT supply this attribute as an operation
1013 attribute when it creates a Subscription object with the Create Job, Create-Job-Subscription or Create-
1014 Printer-Subscription operation.

1015 This attribute is an alias for the Printer's "printer-up-time" attribute" (see [ipp-mod] section 4.4.29) if the
1016 Printer is keeping the Subscription objects or is the up time for the Notification Delivery Service if the
1017 Printer has delegated the responsibility for keeping Subscription objects to a notification delivery service, in

1018 an analogous way that the Job's "job-printer-up-time" is an alias for "printer-up-time" Printer attribute (see
1019 [ipp-mod] section 4.3.13.4).

1020 Note: The purpose of this attribute is so that a client can request this attribute in a Get-Subscription-
1021 Attributes or Get-Subscriptions request and use the value returned in combination with the "notify-lease-
1022 expiration-time" (see section 5.11) in order to display the wall clock time equivalent to the user. The
1023 difference between this attribute and the 'integer' value of the "notify-lease-expiration-time" attribute is the
1024 number of seconds in the future that the subscription will expire. A client can compute the wall-clock time
1025 at which the subscription will expire by adding this difference to the client's wall-clock time.

1026 **5.15 notify-persistence-granted (boolean)**

1027 This READ-ONLY Subscription object attribute indicates whether or not the Per-Job or Per-Printer
1028 Subscription is persistent, i.e., saved across power cycles in an implementation-define manner.

1029 A Printer MUST support this attribute and a client MUST NOT supply this attribute as an operation
1030 attribute when it creates a Subscription object with the Create Job, Create-Job-Subscription or Create-
1031 Printer-Subscription operation.

1032 **6 Printer Description Attributes related to Notification**

1033 **This section defines the Printer Description attributes that are related to Notification. Table 6 –**
1034 **REQUIRED non-READ-ONLY Printer Description attributes associated with Notification**

Printer object attributes:
notify-schemes-supported (1setOf uriScheme)
notify-events-default (1setOf type2 keyword)
notify-events-supported (1setOf type2 keyword)
notify-max-events-supported (integer(5:MAX))
notify-text-format-supported (1setOf mimeType)
notify-max-printer-subscriptions-supported (integer(0:MAX))
notify-lease-time-supported (rangeOfInteger(0:MAX))
notify-lease-time-default (integer(0:MAX))

1035 Table 6 lists the Printer Description attributes that a Printer MUST conditionally support and that are not
1036 READ-ONLY. A Printer MUST support the listed attribute if it supports the Create-Job-Subscriptions
1037 operation.

1038 **Table 7 – Conditionally REQUIRED non-READ-ONLY Printer Description attributes associated**
 1039 **with Notification**

Printer object attributes:
notify-max-job-subscriptions-supported (integer(0:MAX))

1040

1041 Table 8 lists the Printer Description attributes that a Printer MAY support and that are not READ-ONLY.

1042 **Table 8 - OPTIONAL non-READ-ONLY Printer Description attributes associated with Notification**

Printer object attributes:
notify-additional-formats-supported (1setOf mimeType)
notify-requested-attributes-supported (1setOf type2 keyword)
persistent-jobs-supported (boolean)
persistent-subscriptions-supported (boolean)

1043 Table 8 lists the Printer Description attributes that a Printer MAY support and that are READ-ONLY.

1044 Table 9 lists the Printer Description attributes and indicates the Printer support required for conformance
 1045 and whether or not the attribute is READ-ONLY:

1046 Table 6 lists the Printer Description attributes that a Printer MUST support and that are not READ-ONLY.

1047 **Table 6 – REQUIRED non-READ-ONLY Printer Description attributes associated with Notification**

Printer object attributes:
notify-schemes-supported (1setOf uriScheme)
notify-events-default (1setOf type2 keyword)
notify-events-supported (1setOf type2 keyword)
notify-max-events-supported (integer(5:MAX))
notify-text-format-supported (1setOf mimeType)
notify-max-printer-subscriptions-supported (integer(0:MAX))

Printer object attributes:
notify-lease-time-supported (rangeOfInteger(0:MAX))
notify-lease-time-default (integer(0:MAX))

1048 Table 6 lists the Printer Description attributes that a Printer MUST conditionally support and that are not
 1049 READ-ONLY. A Printer MUST support the listed attribute if it supports the Create-Job-Subscriptions
 1050 operation.

1051 **Table 7 – Conditionally REQUIRED non-READ-ONLY Printer Description attributes associated**
 1052 **with Notification**

Printer object attributes:
notify-max-job-subscriptions-supported (integer(0:MAX))

1053

1054 Table 8 lists the Printer Description attributes that a Printer MAY support and that are not READ-ONLY.

1055 **Table 8 - OPTIONAL non-READ-ONLY Printer Description attributes associated with Notification**

Printer object attributes:
notify-additional-formats-supported (1setOf mimeType)
notify-requested-attributes-supported (1setOf type2 keyword)
persistent-jobs-supported (boolean)
persistent-subscriptions-supported (boolean)

1056 Table 8 lists the Printer Description attributes that a Printer MAY support and that are READ-ONLY.

1057 **Table 9 - OPTIONAL READ-ONLY Printer Description attributes associated with Notification**

Printer object attributes:
printer-state-change-time (integer(1:MAX))
printer-state-change-date-time (dateTime)

1058 **6.1 notify-schemes-supported (1setOf uriScheme)**

1059 This REQUIRED Printer attribute describes the notification delivery methods supported by this Printer
1060 object. Standard values are defined in Section 5.1.

1061 The usual way for a client to determine whether an IPP Printer supports a feature is to query the Printer's
1062 "operations-supported" attribute. If a client wants to determine if a Printer supports the "notify-xxx"
1063 operation attributes, it could check for the value of Create-Printer-Subscription in the "operations-
1064 supported" attribute, but the RECOMMENDED way is for the client to check for the existence of this
1065 attribute.

1066 **6.2 notify-events-default (1setOf type2 keyword)**

1067 This REQUIRED Printer attribute identifies the event values if the client does not supply the "notify-
1068 events" operation attribute in a Subscription Creation operation. Any value in this attribute MUST also
1069 appear in the "notify-events-supported" attribute, i.e., be a supported event.

1070 **6.3 notify-events-supported (1setOf type2 keyword)**

1071 This REQUIRED Printer attribute identifies the events supported by this Printer object for both Per-Job and
1072 Per-Printer subscriptions, which MUST be the same. Standard values are defined in Section 5.2.

1073 **6.4 notify-max-events-supported (integer(5:MAX))**

1074 This REQUIRED Printer attribute specifies the maximum number of events that are supported in a single
1075 Per-Job or Per-Printer subscription, which must be the same. A Printer MUST support at least 5 events per
1076 subscription, so that clients can depend on at least 5 events in a single subscription. If the number of events
1077 supplied by a client in a subscription exceeds the value of this attribute, the Printer MUST reject the request
1078 and returns the 'client-error-too-many-events (see section 15.4). If notification is not supported, this
1079 attribute MUST NOT be supported.

1080 **6.5 notify-text-format-supported (1setOf mimeType)**

1081 This REQUIRED Printer attribute identifies the MIME media types supported for the value of the "notify-
1082 text-format" attribute. See section 5.3 for details and some example values.

1083 If a delivery method supports the "notify-text" attribute or a Human Consumable form, then it must support
1084 all values of this attribute.

1085 **6.6 notify-max-printer-subscriptions-supported (integer(0:MAX))**

1086 This REQUIRED Printer attribute specifies the maximum number of Per-Printer subscriptions that are
1087 supported by multiple Create-Printer-Subscription requests, i.e., the maximum number of un-expired Per-
1088 Printer Subscription objects that the Printer supports at a time. A value of 0 indicates no effective

1089 maximum. A Printer MUST support at least 1 Per-Printer subscription. If the number of Per-Printer
1090 subscriptions exceeds the value of this attribute or would exceed some implementation-defined total
1091 number of Per-Printer Subscriptions for the Printer (if any), the Printer rejects the Create-Printer-
1092 Subscription request and returns the 'client-error-too-many-subscriptions' (see section 15.3).

1093 **6.7 notify-lease-time-supported (rangeOfInteger(0:MAX))**

1094 This REQUIRED Printer attribute specifies the range of values in seconds that are supported for the
1095 "notify-lease-time-requested" operation attribute in a Create-Printer-Subscription or Renew-Subscription
1096 request for a Per-Printer subscription. When the lease time expires for a Per-Printer Subscription without
1097 renewing, the Printer MUST delete the Subscription object. If the client requests a value outside this range,
1098 the Printer MUST grant a value that is in this range (see section 5.11). A value of 0 indicates an infinite
1099 lease, i.e., one that does not expire.

1100 **6.8 notify-lease-time-default (integer(0:MAX))**

1101 This REQUIRED Printer attribute specifies the value of the lease time that the Printer object has been
1102 configured to assume if the client does not supply a "notify-lease-time-requested" operation attribute in the
1103 Create-Printer-Subscription or Renew-Subscription requests.

1104 **6.9 notify-max-job-subscriptions-supported (integer(0:MAX))**

1105 If a Printer supports the OPTIONAL Create-Job-Subscriptions operation, it MUST support this attribute,
1106 and a Printer does not support the Create-Job-Subscriptions operation, it MUST NOT support this attribute.

1107 This Printer attribute specifies the maximum number of Per-Job subscriptions that are supported for a job,
1108 i.e., the maximum number of subsequent Create-Job-Subscription operation requests in combination for a
1109 job. A value of 0 indicates no effective maximum. A Printer MUST support at least 1 Per-Job
1110 subscription. If a Create-Job-Subscription request would exceed this number, the Printer rejects the request
1111 and returns the 'client-error-too-many-subscriptions' (see section 15.3).

1112 **6.10 notify-additional-formats-supported (1setOf mimeType)**

1113 This OPTIONAL Printer attribute identifies the MIME media types supported for the value of the "notify-
1114 additional-formats" attribute. See section 5.4 for details and some example values. If a Printer supports the
1115 "notify-additional-formats" attribute, it MUST support this attribute.

1116 If a Printer does not support this attribute, then it also does not support the "notify-additional-formats"
1117 attribute and the Printer it MUST behave as described in section 5.4.

1118 **6.11 notify-requested-attributes-supported (1setOf type2 keyword)**

1119 This OPTIONAL Printer attribute specifies the attribute names that can be values of the "notify-requested-
1120 attributes" in the Create-Job, Print-Job, Validate-Job, Create-Job-Subscription and Create-Printer-

1121 Subscription operations. This attribute MAY contain any Printer attribute, Job attribute or Subscription
1122 attribute that the Printer supports in an Event Notification. It MUST NOT contain any of the attributes in
1123 Section 7.1 that a Printer automatically puts in an Event Notification; it would be redundant.

1124 **6.12 persistent-jobs-supported (boolean)**

1125 This OPTIONAL Printer attribute indicates whether or not the Printer supports persistent Jobs, i.e., Jobs
1126 object that are preserved across power cycles. If Jobs are persistent, then Per-Job Subscriptions MUST also
1127 be persistent, since they are part of the Job object. It is RECOMMENDED that Jobs (and Per-Job
1128 Subscriptions) be persistent.

1129 **6.13 persistent-subscriptions-supported (boolean)**

1130 This OPTIONAL Printer attribute indicates whether or not the Printer supports persistent Per-Printer
1131 Subscriptions, i.e., Subscription objects that are preserved across power cycles. When this value is 'true' the
1132 implementation MAY support some that are persistent and some that are not. If the value is 'false' or the
1133 attribute is not supported, Per-Printer Subscriptions MUST NOT be persistent. It is RECOMMENDED
1134 that Per-Printer subscriptions be persistent.

1135 **6.14 printer-state-change-time (integer(1:MAX))**

1136 This OPTIONAL READ-ONLY Printer attribute records the time, i.e., copy of the Printer's "printer-up-
1137 time" attribute, that the Printer's "printer-state" attribute was last changed. On power-up, the Printer
1138 populates the "printer-state-change-time" from its "printer-up-time" attribute, so that it always has a value.

1139 **6.15 printer-state-change-date-time (dateTime)**

1140 This OPTIONAL READ-ONLY Printer attribute records the date and time, i.e., copy of the Printer's
1141 "printer-current-time" (dateTime) attribute (see [ipp-mod] section 4.4.30), that the Printer's "printer-state"
1142 attribute was last changed. On power-up, the Printer populates the "printer-state-change-date-time" from its
1143 "printer-current-time" attribute, so that it always has a value.

1144 **7 Event Notification Content**

1145 This section defines the Event Notification content that the Notification Source sends asynchronously when
1146 an event occurs to each Notification Recipient based on the subscription information stored with the
1147 subscription. The Event Notification MAY be sent by the IPP Printer or a third party Notification Service
1148 (see section 2.3).

1149 When an event occurs, the Printer MUST create an Event Notification with the content that the delivery
1150 method specifies. The content contains the value of attributes specified by the delivery method. The Printer
1151 obtains the values immediately after the event occurs. For example, if the "printer-state" attribute changes
1152 from 'pending' to 'processing', the event 'printer-state-changed' occurs and the Printer puts various attributes

- 1153 into the Event Notification, including "printer-up-time" and "printer-state" with the values that they have
1154 immediately after the event occurs, i.e. the value of "printer-state" is 'processing'.
- 1155 If two events occur simultaneously, or nearly so (e.g. "printer-up-time" has the same value for both), the
1156 Printer MUST create a separate Event Notification for each event. Depending on the delivery method, the
1157 Printer MAY combine several Event Notifications into a single compound Event Notification. In this case,
1158 each Event Notification MAY have the same value of "printer-up-time", but if these two nearly-
1159 simultaneously events represent two successive 'printer-state-changed' events one from 'idle' to 'processing'
1160 and another from 'processing' to 'stopped', the Printer SHOULD accurately report the "printer-state" of the
1161 first event as 'processing' and the second event as 'stopped'.
- 1162 In either case, even if a Subscription object is listening for more than one event, and several of those events
1163 occur in quick succession, each event MUST generate a separate Event Notification.
- 1164 After the Printer has created the Event Notification, the Printer delivers it. Depending on the delivery
1165 method, the Printer delivers the Event Notification via either a
- 1166 Push: The the IPP Printer sends the Event Notification shortly after an event occurs. For some
1167 delivery methods, the Notification Recipient either MUST send a response; for others it MUST
1168 NOT send a response.
- 1169 Pull: The IPP Printer saves Event Notifications for some event-lease time and expects the
1170 Notification Recipient to request events. The IPP Printer returns the events in a response to such a
1171 request.
- 1172 The next two sections describe the attributes to be included in the content of Event Notifications.
- 1173 Each delivery method is defined in a separate document (i.e. not in this document). Such a document
1174 specifies
- 1175 a) the form of the Event Notification content: namely Human Consumable or Machine
1176 Consumable (see sections 7.1 and 7.2).
- 1177 b) whether an several Event Notifications can be combined into a compound Event Notification.
- 1178 c) the attributes to include (for Machine Consumable see sections 7.1.1, 7.1.2 and 7.1.3. for Human
1179 Consumable see sections 7.2.1, 7.2.2, and 7.2.3).
- 1180 d) the encoding of the attributes (see the document for a particular delivery method).
- 1181 \.
- 1182 .

7.1 Content of Machine Consumable Event Notifications

This section defines the REQUIRED and RECOMMENDED attributes of all delivery methods that are intended to send a Machine Consumable Event Notification. A Printer NEED NOT include the RECOMMENDED attributes if they are incompatible with a particular delivery method. The definition of the delivery method can exclude it from Event Notifications.

A client MAY request additional attributes via the "notify-requested-attributes" attribute with values in the "notify-requested-attributes-supported" attribute if a Printer supports both of these attributes. An implementation MAY extend the contents of the Machine Consumable Event Notification by adding additional attributes. Notification Recipients MUST be able to accept Event Notifications containing attributes they do not recognize. What a Notification Recipient does with an unrecognized attribute is implementation-dependent. Notification Recipients MAY attempt to display unrecognized attributes anyway or MAY ignore them. The next three sections define the attributes that are in:

- a) all Job and Printer Events Notifications
- b) Job Events Notifications only
- c) Printer Events Notifications only

7.1.1 Attributes in Event Notification content common to Job and Printer events

This section lists the attributes that a Print MUST and SHOULD include in both Job and Printer Event Notifications.

The tables in this section and following sections contain the following columns:

- a) Source of Value: the name of the attribute that supplies the value for the Event Notification
- b) Object: the object from which the source value comes. If the object is "Event Notification", the Printer fabricates the value when it sends the Event Notification. See section 8 for a description of such events.
- c) Reference: the section of this specification or the [ipp-mod] which explains the attribute. The latter section numbers are preceded by "mod"

Table 10 lists the IPP attributes that a Printer SHOULD include in each Event Notification.

Table 10 - Recommended Attributes in Event Notification Content

Source Value	Object	Reference
notify-sequence-id(integer (0:MAX))	Subscription	5.9
notify-charset (charset)	Subscription	5.7

Source Value	Object	Reference
notify-natural-language	Subscription	5.8
notify-text (text)	Event Notification	8.2
notify-text-format (mimeMediaType)	Subscription	5.3

1210

1211 Table 11 lists the IPP attributes that a Printer **MUST** include in each Event Notification.

Table 11 - Required Attributes in Event Notification Content Source Value	Object	Reference
printer-uri (uri)	Subscription	5.12
trigger-event (type2 keyword)	Event Notification	8.1
printer-up-time (integer(MIN:MAX))	Printer	Error! Reference source not found.

1212 notify-subscription-idTable 12 lists the IPP attributes that a Printer **MUST** include in each Event
1213 Notification if it supports the attribute named in the "Source Value" column.

1214 **Table 12 – Conditionally Required Attributes in Event Notification Content**

Source Value	Object	Reference
printer-current-time (dateTime)	Printer	Error! Reference source not found.

1215

1216 **7.1.2 Additional Attributes in Notification Content for Job events *only***

1217 This section lists the additional attributes that a Print **MUST** include in Job Event Notifications.

1218 **Error! Reference source not found. Error! Reference source not found..**

1219 Table 13 lists the additional attributes that a Printer **MUST** include in all Job Event Notification.

1220

Table 13 – Additional Required Attributes in Job Event Notification Content

Source Value	Object	Reference
job-id (integer(1:MAX))	Job	mod 4.3.2
job-state (type1 enum)	Job	mod 4.3.7
job-state-reasons (1setOf type2 keyword)	Job	mod 4.3.8

1221

1222 Table 13 lists the additional attributes that a Printer **MUST** include in each Job Event Notification when the
 1223 job event is a 'job-progress' or 'job-completed'. It **MUST** not include these attributes for other events.

1224 **Table 14 – Additional Required Attributes in Job Event Notification Content for 'job-progress' or**
 1225 **'job-completed' events**

Source Value	Object	Reference
job-impressions-completed (integer(0:MAX))	Job	mod 4.3.18.2

1226 **7.1.3 Additional Attributes in Notification content for Printer events *only***

1227 This section lists the additional attributes that a Print **MUST** include in Printer Event Notifications.

1228

1229 Table 15 lists the additional attributes that a Printer **MUST** include in each Printer Event Notification.

1230 **Table 15 – Additional Required Attributes in Printer Event Notification Content**

Source Value	Object	Reference
printer-state (type1 enum)	Printer	mod 4.4.11
printer-state-reasons (1setOf type2 keyword)	Printer	mod 4.4.12
printer-is-accepting-jobs (boolean)	Printer	mod 4.4.23

1231 **7.2 Content of Human Consumable Event Notification**

1232 This section defines the **RECOMMENDED** and **OPTIONAL** attributes of all delivery methods that are
 1233 intended to send a Human Consumable Event Notification or the "notify-text" attribute in a Machine
 1234 Consumable Event Notification. If a **RECOMMENDED** attribute is incompatible with a particular delivery
 1235 method, the definition of the delivery method **NEED NOT** include it in Event Notifications.

1236 A client MUST NOT request additional attributes via the "notify-requested-attributes" attribute because this
 1237 attribute works only for Machine Consumable Event Notifications..

1238 An implementation MAY extend the contents of a Human Consumable Event Notification by adding
 1239 additional information. Notification Recipients MUST NOT expect to be able to parse the Human
 1240 Consumable contents.

1241 The next three sections define the attributes that are in:

1242 a) all Job and Printer Events Notifications

1243 b) Job Events Notifications only

1244 c) Printer Events Notifications only

1245 **7.2.1 Information in Notification Content Common to Job and Printer Events**

1246 This section lists the information that a Printer SHOULD include in both Job and Printer Event
 1247 Notifications.

1248 There is a separate table for each piece of information. Each row in the table represents a source value for
 1249 the information and the values are listed in order of preference, with the first one being the preferred one.
 1250 An implementation SHOULD use the source value from the earliest row in the table.. The tables in this
 1251 section and following contain the following columns for each piece of information:

1252 a) Source of Value: the name of the attribute that supplies the value for the Event Notification

1253 b) Object: the object from the which the source value comes.

1254 c) Reference: the section of this specification or the [ipp-mod] which explains the attribute. The
 1255 latter section numbers are preceded by "mod"

1256 An Event Notification SHOULD contain the following information:

1257 a) the Printer name

1258 b) the event and/or state information

1259 c) the job identity for a Job event

1260 Table 16 lists the source of the information for the Printer Name. The "printer-name" is more user friendly
 1261 unless the Notification Receiver is in a place where the Printer name is not meaningful.

1262 **Table 16 – Printer Name in Event Notification Content**

Source Value	Object	Reference
--------------	--------	-----------

Source Value	Object	Reference
printer-name (name(127))	Printer	Mod 4.4.4
printer-uri (uri)	Subscription	5.12

1263

1264 Table 17 lists the source of the information for the event name. A Printer MAY combine this information
1265 with state information described in sections 7.2.2 and 7.2.3.

1266

Table 17 – Event Name in Event Notification Content

Source Value	Object	Reference
trigger-event (type2 keyword)	Subscription	8.1

1267

1268 Table 18 lists the source of the information for the time that the event occurred. If a Printer supports
1269 the "printer-current-time" attribute, a Printer MAY include this attribute. If a Printer does not support
1270 the "printer-current-time" attribute, it MUST NOT support this attribute because the "printer-up-time" is not
1271 an allowed option.

1272

Table 18 – OPTIONAL Event Time in Event Notification Content

Source Value	Object	Reference
printer-current-time (dateTime)	Printer	Error! Reference source not found.

1273

1274 **7.2.2 Additional Information in Event Notification Content for Job events *only***

1275 This section lists the additional information that a Print SHOULD include in Job Event Notifications. The
1276 "job-name" is likely more meaningful to a user than "job-id".

1277 Table 19 lists the source of the information for the job name.

1278

Table 19 – Job Name in Job Event Notification Content

Source Value	Reference
--------------	-----------

Source Value	Reference
job-name (name(MAX))	mod 4.3.5
job-id (integer(1:MAX))	mod 4.3.2

1279

1280 Table 20 lists the source of the information for the job state. If a Printer supports the "job-state-message"
 1281 and "job-detailed-state-message" attributes, it SHOULD use those attributes for the job state information,
 1282 otherwise it should fabricate such information from the "job-state" and "job-state-reasons". For some
 1283 events, a Printer MAY combine this information with event information.

1284

Table 20 – Job State in Job Event Notification Content

Source Value	Object	Reference
job-state-message (text(MAX))	Job	mod 4.3.9
job-detailed-status-messages (1setOf text(MAX))	Job	mod 4.3.8
job-state (type1 enum)	Job	mod 4.3.7
job-state-reasons (1setOf type2 keyword)	Job	mod 4.3.8

1285

1286 **7.2.3 Additional Information in Event Notification Content for Printer events *only***

1287 Table 21 lists the source of the information for the printer state. If a Printer supports the "printer-state-
 1288 message", it SHOULD use that attribute for the job state information, otherwise it should fabricate such
 1289 information from the "printer-state" and "printer-state-reasons". For some events, a Printer MAY combine
 1290 this information with event information.

1291

Table 21 – Printer State in Printer Event Notification Content

Source Value	Reference
printer-state-message (text(MAX))	mod 4.4.13
printer-state (type1 enum)	mod 4.4.11
printer-state-reasons (1setOf type2 keyword)	mod 4.4.12
printer-is-accepting-jobs (boolean)	mod 4.4.23

1292

1293 **8 Attributes only in Event Notifications**

1294 This section contains those attributes that exist only in Event Notifications.

1295 **8.1 trigger-event (type2 keyword)**

1296 This REQUIRED Event Notification Content attribute indicates the event that caused this Event
1297 Notification to be delivered.

1298 This attribute exists only in Event Notifications and its value is generated by the Notification Source.

1299 **8.2 notify-text (text(MAX))**

1300 This OPTIONAL Event Notification Content attribute contains the Human Consumable text message (see
1301 section 7.2) that describes the event and is represented in the text format specified by the "notify-text-
1302 format" attribute. Whether or not this attribute is defined depends on the delivery method definition
1303 document. If this attribute is defined for use in delivery method that a Printer supports, then a Printer
1304 MUST support this attribute.

1305 **9 Operations for Notification**

1306 This section defines all of the operations for notification which are summarized in Table 3 in section 1.1,
1307 including the assignment of the operation-id.

1308 **9.1 Operations for Per-Job Subscriptions *only***

1309 This section defines the operation requests and responses that are related to Per-Job subscriptions and its
1310 Subscription object. Section 9.3 defines the REQUIRED operation requests and responses associated with
1311 the REQUIRED Per-Printer subscription and its Subscription object.

1312 **9.1.1 Job Creation Operations (Create-Job, Print-Job, Print-URI) and Validate-Job**

1313 The usual method for a client to associate one subscription with a Job is to specify the subscription when
1314 the job is created. The client supplies several "notify-xxx" operation attributes as specified in Table 22 with
1315 any of the Job Creation operations (Create-Job, Print-Job, Print-URI), plus Validate-Job (which doesn't
1316 create a job or subscription). If the client does not supply the "notify-xxx" attributes in the create operation,
1317 there is no subscription made (either implicitly or explicitly).

1318 If a Printer does not support this notification specification, then it MUST ignore the "notify-xxx" operation
1319 attributes and return them in the response indicated as attributes that are not supported. See [ipp-mod]
1320 section 3.1.7 for details on returning Unsupported Attributes.

1321 The mechanism described in this section can create at most one Per-Job subscription. If a client wants to
 1322 create more than one Per-Job subscription (e.g. 3 of them), it **MUST** perform one or more Create-Job-
 1323 Subscription operations between a Create-Job operation and the first Send-Document or Send-URI
 1324 operation for the job created by the Create-Job operation. The Create-Job **MAY** have "notify-xxx" attributes
 1325 to create one Per-Job subscription. The Create-Job-Subscription operations create all Per-Job subscriptions
 1326 except the optional one in the Create-Job operation. If a client uses Print-Job, it is not possible to use
 1327 Create-Job-Subscription operations without either running into race conditions or using Job-Hold/Job-
 1328 Release, which the Printer **MAY NOT** support.

1329 Table 22 below contains the following columns:

- 1330 a) notify-xxx attributes: the name of a Subscription object attribute.
- 1331 b) Reference: the section where the attribute is defined
- 1332 c) Client **MUST** supply: the value is 'yes' if the client **MUST** supply the operation attribute in an
 1333 operation. The value is 'no' if the client **MAY** supply the Subscription attribute in an operation.
 1334 If a client **MAY** supply the Subscription attribute, the default value is specified in the section
 1335 describing the attribute.
- 1336 d) Printer **MUST** support: the value is 'yes' if the Printer **MUST** support the operation attribute and
 1337 'no' if the Printer **MAY** support the operation attribute.

1338

1339 **Table 22 - The "notify-xxx" operation attributes**

notify-xxx attributes	Reference	client MUST supply	Printer MUST support
notify-recipient-uri (uri)	5.1	yes	yes
notify-events (1setOf type2 keyword)	5.2	no	yes
notify-text-format (mimeMediaType)	5.3	no	yes
notify-user-data (octetString(63))	5.4	no	yes
notify-charset (charset)	5.7	no	yes
notify-natural-language (naturalLanguage)	5.8	no	yes
notify-additional-formats (1setOf mimeMediaType)	5.4	no	no
notify-requested-attributes (1setOf type2 keyword)	5.4	no	no

1340

1341 Table 23 shows the "notify-xxx" attributes with their corresponding "xxx-default" and "xxx-supported"
 1342 attributes. The Printer uses the "xxx-default" values if the client omits the attribute in the request. The
 1343 "xxx-supported" attributes are used by the Printer to validate the request. The client can query to determine
 1344 supported values.

1345 **Table 23 – The "notify-xxx" supported and default attributes**

"notify-xxx" member attribute	"xxx-default", if any	"xxx-supported"
notify-recipient-uri (uri)	none	notify-schemes-supported (1setOf uriScheme)
notify-events (1setOf type2 keyword)	notify-events-default (1setOf type2 keyword)	notify-events-supported (1setOf type2 keyword) notify-max-events-supported (integer(5:MAX))
notify-text-format (mimeMediaType)	none	notify-text-format-supported (1setOf mimeMediaType)
notify-additional-formats (1setOf mimeMediaType)	none	notify-additional-formats-supported (1setOf mimeMediaType)
notify-user-data (octetString(63))	none	none
notify-charset (charset)	charset-configured (charset)	charset-supported (1setOf charset)
notify-natural-language (naturalLanguage)	natural-language-configured (naturalLanguage)	generated-natural-language-supported (1setOf naturalLanguage)
notify-requested-attributes (1setOf type2 keyword)	none	notify-requested-attributes-supported (1setOf type2 keyword)

1346 See the referenced sections for a definition of these operation attributes, since they are copied to the
 1347 Subscription object as the Subscription Description attributes described in section 5.

1348 The following rules apply to Per-Job subscriptions created as part of the Job Creation operations:

- 1349 1. Any subscription can contain job events, printer events, or both.
- 1350 2. The Job Submission Subscription is only valid while the job is "not-completed". The job is "not-
 1351 completed" while it is in the 'pending', 'pending-held', 'processing', and 'processing-stopped' states.
 1352 The job changes from being "not-completed" to "retained" when it is done processing and enters any
 1353 of the 'completed', 'canceled', or 'aborted' states. The job becomes "not-completed" again when it is
 1354 restarted using the Restart-Job operation (see [ipp-mod]).

- 1355 3. Since no job is created for the Validate-Job operation, the only purpose of supplying the subscription
1356 operation attributes in the Validate-Job operation is to validate that the values are supported; the
1357 Printer object does not establish a notification subscription as a result of the Validate-Job operation.
- 1358 4. Since a Job Submission Subscription is included within a job submission operation, any interest in
1359 job events is limited to "this job" only (the Job object created because of this job creation operation).
1360 There is no mechanism to subscribe to events for all jobs or specifically some job other than this job
1361 in a create operation. But see the Create-Printer-Subscription operation (section 9.2.1) for an explicit
1362 operation to subscribe for job and/or printer events independently of any particular job submission,
1363 i.e., Per-Printer subscriptions.
- 1364 5. Event reporting only occurs when a Notification Recipient has specified a subscription to any
1365 event(s).
- 1366 6. The notification implementation MAY allow an administrator to configure a policy on what events
1367 may be dropped.
- 1368 7. ** The client MUST supply the "notify-user-data" (octetString(63)) attribute, if the definition of the
1369 delivery method specified in the "notify-recipient-uri" attribute REQUIRES the client to supply it.
- 1370 8. If the supplied value of "notify-charset" attribute is not supported, the IPP Printer MUST return the
1371 attribute in the Unsupported Attributes Group but still accept the operation, as with all Job create
1372 operations. In this case, the Printer MUST use the natural language supplied in the "attributes-
1373 charset" Job creation operation attribute, if that natural language value is supported by the Printer,
1374 else the Printer object MUST use the Printer's "charset-configured" value. See the Print-Job
1375 operation in [ipp-mod].
- 1376 9. If the supplied value of "notify-natural-language" attribute is not supported, the IPP Printer MUST
1377 return the attribute in the Unsupported Attributes Group but still accept the operation, as with all Job
1378 create operations. In this case, the Printer MUST use the natural language supplied in the "attributes-
1379 natural-language" Job creation operation attribute, if that natural language value is supported by the
1380 Printer, else the Printer object MUST use the Printer's "natural-language-configured" value. See the
1381 Print-Job operation in [ipp-mod].
- 1382 10. If the IPP Printer does not support the OPTIONAL "notify-requested-attributes" or does not support is
1383 for the specified delivery method (e.g. it is a Human Consumable delivery method), it MUST return
1384 the attribute in the Unsupported Attributes Group. If IPP Printer supports the OPTIONAL "notify-
1385 requested-attributes" attribute, but does not support some of the supplied values, the IPP Printer
1386 MUST return the attribute with its unsupported values in the Unsupported Attributes Group. In either
1387 case, the Printer MUST still accept the Job creation operation and create a Per-Job subscription
1388 without the attributes that are unsupported.
- 1389 11. If the number of events supplied in the "notify-events" attribute exceeds the Printer's "notify-max-
1390 events-supported" attribute, the Printer MUST accept the request with the status code 'successful-ok-
1391 ignored-or-substituted-attributes' and return the "notify-xxx" attributes in the Unsupported Attributes
1392 Group with only the "job-events" member attribute containing the events that exceed the maximum.

- 1393 12. If the Per-Job subscriptions would exceed some implementation-defined limit on the total number of
1394 Per-Job subscriptions for the Printer (if any), the Printer **MUST** accept the request with the status
1395 code 'successful-ok-ignored-subscriptions', **MUST** return the all submitted "notify-xxx" attributes in
1396 the Unsupported Attributes Group with their values, and **MUST** perform the Job Creation operation
1397 (see section 9.1.1), since the job can still be printed.
- 1398 13. If the job is accepted the subscription is ignored, the status code returned is 'successful-ok-ignored-
1399 subscriptions. This status code is returned even if other job attributes are unsupported or in conflict.
1400 That is, if an IPP Printer finds a warning that would allow it to return 'successful-ok-ignored-
1401 subscriptions' and either 'successful-ok-ignored-or-substituted-attributes' and/or 'successful-ok-
1402 conflicting-attributes', it must return 'successful-ok-ignored-subscriptions'. In other words, the
1403 precedence for returning success codes is: 'successful-ok-ignored-subscriptions', 'successful-ok-
1404 conflicting-attributes', and 'successful-ok-ignored-or-substituted-attributes'.

1405 **9.1.2 Create-Job-Subscription operation**

1406 The **OPTIONNAL** Create-Job-Subscription operation creates a Per-Job Subscription object. The client can
1407 specify one or more job and/or printer events to be delivered as Event Notifications to one Notification
1408 Recipient. For the Per-Job subscription objects, the Job events are for this job only. The printer events are
1409 any events generated by that Printer for any job or when no job is involved at all (same as for Per-Job
1410 Subscriptions).

1411 The Printer returns a subscription id and the length of time for which it has granted a lease for the
1412 subscription.

1413 A client can unsubscribe using the Cancel-Subscription operation (section 9.3.4) and the subscription id.

1414 Two Create-Job-Subscription operations with the same events and same Notification Recipient **MUST** be
1415 kept as distinct subscriptions and be assigned distinct subscription ids. A Printer **MUST** allow such
1416 duplicate subscriptions such that Cancel-Subscription doesn't unsubscribe both subscriptions and **MUST**
1417 send the Event Notifications twice to the Notification Recipient, since the "request-id" is supposed to count
1418 monotonically for each Subscription object.

1419 If the Printer has a bounded set of concurrent Per-Job subscriptions and the request would exceed that
1420 bound, the Printer **MUST** reject the operation and returns the 'client-error-too-many-subscriptions' status
1421 code. The client **SHOULD** try again later.

1422 Access Rights: To create Per-Job subscription objects, the authenticated user (see [IPP-MOD] section 8.3)
1423 performing this operation **MUST** either be the job owner or have operator or administrator access rights for
1424 the Printer object (see [IPP-MOD] sections 1 and 8.5). Otherwise the IPP object **MUST** reject the operation
1425 and return: the 'client-error-forbidden', 'client-error-not-authenticated', or 'client-error-not-authorized' status
1426 code as appropriate.

1427 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	RECOMMENDED	REQUIRED

1428

Group 2: Subscription Attributes		Reference	client MUST supply	Printer support
	notify-recipient-uri (uri)	5.1	yes	REQUIRED
	notify-events (1setOf type2 keyword)	5.2	no	REQUIRED
	notify-text-format (mimeMediaType)	5.3	no	REQUIRED
	notify-additional-formats (1setOf mimeMediaType)	5.3	no	OPTIONAL
	notify-requested-attributes (1setOf type2 keyword)	5.4	no	OPTIONAL
	notify-user-data (octetString(63))	5.4	depends on delivery method	REQUIRED
	notify-charset (charset)	5.7	no	REQUIRED
	notify-natural-language (naturalLanguage)	5.8	no	REQUIRED
	notify-persistence-requested (boolean)	see below	no	OPTIONAL

1429 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

1430

Group 2: Unsupported Attributes (see [ipp-mod] section 3.1.7)	REQUIRED if unsupported attributes
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1431

Group 3: Subscriptions Attributes	Reference	REQUIRED in response
notify-subscription-id (integer(1:MAX))	5.10	REQUIRED
notify-persistence-granted (boolean)	5.15	REQUIRED

1432 Attribute Notes:

- 1433 "job-id" (integer(1:MAX)) - the client **MUST** either (1) supply this attribute, in combination with the
 1434 "printer-uri" attribute, in order to create a Per-Job subscription for the Job identified by the "job-id"
 1435 value or supply the "job-uri" instead, as with any Job operation:
- 1436 "job-uri" (uri) - the client **MUST** supply this attribute, if the "printer-uri" and "job-id" are not supplied, in
 1437 order to identify the Job to which the Per-Job Subscription is being created.
- 1438 "notify-recipient-uri" (uri) - the client **MUST** supply this attribute in order to have a subscription.
- 1439 "notify-event" (1setOf type2 keyword) - if the client does not supply this attribute, the Printer populates the
 1440 "notify-events" Subscription Description attribute from its "notify-events-default" Printer
 1441 Description attribute.
- 1442 "notify-text-format" (mimeMediaType) - if the client supplies this attribute and the delivery method
 1443 specifies a Human Consumable form, this attribute indicates the format of the Event Notification
 1444 content. If the client supplies this attribute and the delivery method specifies a Machine
 1445 Consumable form, this attribute indicates the format of the "notify-text" attribute. If the client does
 1446 not supply this attribute, the Printer behaves as if this attribute were submitted with the value of
 1447 'text/plain'.
- 1448 "notify-additional-formats" (1setOf mimeMediaType) - if the client supplies this attribute and the delivery
 1449 method supports additional formats in the Event Notification content, this attribute indicates the
 1450 additional formats to include in the Event Notification content. If the client does not supply this
 1451 attribute, the Printer includes only the delivery method's default format in the Event Notification
 1452 content.
- 1453 "notify-requested-attributes" (1setOf type2 keyword) - if the client supplies this **OPTIONAL** attribute, the
 1454 value indicates which additional attributes to include in each Event Notification associated with this
 1455 subscription beyond those attributes specified in Section 7.
- 1456 "notify-user-data" (octetString(63)) - the client **MUST** supply this attribute, if the definition of the delivery
 1457 method specified in the "notify-recipient-uri" attribute **REQUIRES** the client to supply it.
- 1458 "notify-persistence-requested" (boolean) - whether or not the Per-Job Subscription is to be persistent, i.e.,
 1459 saved across power cycles. Note: Persistent trap registrations is a client option in SNMPv3
 1460 [RFC2573].
- 1461 "notify-persistence-granted" (boolean) - whether or not this Subscription object instance is persistent. This
 1462 attribute **MUST** be returned whether "notify-persistence-requested" is supported or not, so that the
 1463 client knows which.

9.2 Operations for Per-Printer Subscriptions *only*

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

9.2.1 Create-Printer-Subscription operation

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

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

The client MUST renew the Per-Printer subscription using the Renew-Subscription operation (see section 9.3.3) before the lease runs out in order to maintain the subscription. A client can unsubscribe using the Cancel-Subscription operation (section 9.3.4) and the subscription id.

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

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

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

Request :

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

Group 2: Subscription Attributes		Reference	client MUST supply	Printer support
	notify-recipient-uri (uri)	5.1	yes	REQUIRED
	notify-events (1setOf type2 keyword)	5.2	no	REQUIRED
	notify-text-format (mimeType)	5.3	no	REQUIRED
	notify-additional-formats (1setOf mimeType)	5.4	no	OPTIONAL
	notify-requested-attributes (1setOf type2 keyword)	5.4	no	OPTIONAL
	notify-user-data (octetString(63))	5.4	depends on the delivery method	REQUIRED
	notify-charset (charset)	5.7	no	REQUIRED
	notify-natural-language (naturalLanguage)	5.8	no	REQUIRED
	notify-lease-time-requested (integer(0:MAX))	see below	no	REQUIRED
	notify-persistence-requested (boolean)	see below	no	OPTIONAL

1492 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

1493

Group 2: Unsupported Attributes (see [ipp-mod] section 3.1.7)	REQUIRED if unsupported attributes
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1494

Group 3: Subscription Attributes		Reference	REQUIRED in response
	notify-subscription-id (integer(1:MAX))	5.10	REQUIRED
	notify-lease-expiration-time (integer(0:MAX))	5.11	REQUIRED
	notify-server-up-time (integer(1:MAX))	5.14	REQUIRED
	notify-persistence-granted (boolean)	5.15	REQUIRED

1495 Attribute Notes:

1496 "notify-recipient-uri" (uri) - the client MUST supply this attribute in order to have a subscription.

1497 "notify-lease-time-requested" (integer(0:MAX)) - the number of seconds requested for the subscription
 1498 lease. A value of 0 indicates a request that the Per-Printer Subscription lease never expire.

- 1499 Supplying a 0 value MAY require authentication in order to be used, if 0 is supported at all.
1500 If the client does not supply this attribute, the Printer uses its "notify-lease-time-default" Printer
1501 Description attribute value (see section 6.8).
- 1502 "notify-event" (1setOf type2 keyword) - if the client does not supply this attribute, the Printer populates the
1503 "notify-events" Subscription Description attribute from its "notify-events-default" Printer
1504 Description attribute.
- 1505 "notify-text-format" (mimeMediaType) - if the client supplies this attribute and the delivery method
1506 specifies a Human Consumable form, this attribute indicates for format of the Event Notification
1507 content. If the client supplies this attribute and the delivery method specifies a Machine
1508 Consumable form, this attribute indicates format of the "notify-text" attribute. If the client does not
1509 supply this attribute, the Printer behaves as if this attribute were submitted with the value of
1510 'text/plain'. "notify-additional-formats" (1setOf mimeMediaType) - if the client supplies this attribute
1511 and the delivery method supports additional formats in the Event Notification content, this attribute
1512 indicates the additional formats to include in the Event Notification content. If the client does not
1513 supply this attribute, the Printer includes only the delivery method's default format in the Event
1514 Notification content.
- 1515 "notify-requested-attributes" (1setOf type2 keyword) - if the client supplies this OPTIONAL attribute, the
1516 value indicates which additional attributes to include in each Event Notification associated with this
1517 subscription beyond those attributes specified in Section 7.
- 1518 "notify-user-data" (octetString(63)) - the client MUST supply this attribute, if the definition of the delivery
1519 method specified in the "notify-recipient-uri" attribute REQUIRES the client to supply it.
- 1520 "notify-persistence-requested" (boolean) - whether or not the Per-Printer Subscription is to be persistent,
1521 i.e., saved across power cycles. Note: Persistent trap registrations is a client option in SNMPv3
1522 [RFC2573].
- 1523 "notify-lease-expiration-time" (integer(0:MAX)) - The Printer object MUST return this attribute which is
1524 the time in the future at which the subscription lease will expire, i.e., the "printer-up-time" value (in
1525 time ticks - see [ipp-mod] section 4.4.29) at which the Printer will delete the Subscription. A value
1526 of 0 indicates that the lease subscription will never expire.
- 1527 "notify-server-up-time" (integer(1:MAX)) - The Printer object MUST return this attribute which is an alias
1528 for the Printer's "printer-up-time" Printer Description attribute. The client subtracts this value from
1529 the "notify-lease-expiration-time" value returned in order to determine the number of second in the
1530 future that the subscription will expire. This computed value may be less than the requester
1531 requested in the "notify-lease-time-requested" if it was greater than the MAX supported or more
1532 than the requester requested if it was less than the MIN supported, as indicated in the Printer's
1533 "notify-lease-time-supported" (rangeOfInteger(0:MAX)) attribute (see section 6.7).
- 1534 "notify-persistence-granted" - whether or not this Subscription object instance is persistent. This attribute
1535 MUST be returned whether "notify-persistence-requested" is supported or not, so that the client
1536 knows which.

1537

1538 **9.3 Common Operations for Per-Job and Per-Printer Subscriptions**

1539 This section defines the operations that are common to both Per-Job and Per-Printer subscriptions.

1540 **9.3.1 Get-Subscription-Attributes operation**1541 The REQUIRED Get-Subscription-Attributes returns the requested attributes of the identified Subscription
1542 object. See section 5.

1543 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

1544

Group 2: Subscription Attributes		Reference	client MUST supply	Printer support
	notify-subscription-id (integer(1:MAX))	5.10	yes	REQUIRED
	requested-attributes (1setOf type2 keyword)	see below	no	REQUIRED

1545 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

1546

Group 2: Unsupported Attributes (see [ipp-mod] section 3.1.7)	REQUIRED if unsupported attributes
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1547

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

1548 This operation is similar to the Get-Printer-Attributes operation.

1549 "requested-attributes" (1setOf keyword): The client OPTIONALLY supplies this attribute. The Printer
 1550 object MUST support this attribute. It is a set of Subscription attribute names and/or the 'all'
 1551 attribute group name in whose values the requester is interested. This set of attributes is returned for
 1552 each Job object that is returned. If the client does not supply this attribute, the Printer MUST
 1553 respond as if the client had supplied this attribute with the value: 'all'.

1554 **9.3.2 Get-Subscriptions operation**

1555 The REQUIRED Get-Subscriptions operation returns the requested attributes of the Subscription objects
 1556 (see section 5).

1557 Request :

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

1558 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

1559

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

1560

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

1561

1562 Attribute Notes:

- 1563 This operation is similar to the Get-Jobs operation (see [ipp-mod]). If the client wants any attributes
1564 returned, including the "notify-subscription-id", it must include the attribute keyword name in the
1565 "requested-attributes" operation attribute. If the "requested-attributes" operation attribute is omitted, the
1566 Printer MUST respond as if the client supplied the value: 'notify-subscription-id'.
- 1567 "job-id" (integer(1:MAX)) - If the client supplies this attribute, all of the Per-Job Subscription objects for
1568 the identified job are candidates for return. If this attribute is omitted, all of the Per-Printer
1569 Subscription objects are candidates for return.
- 1570 "limit" (integer(1:MAX)): The client OPTIONALLY supplies this attribute. The Printer object MUST
1571 support this attribute. It is an integer value that determines the maximum number of Subscription
1572 objects that a client will receive from the Printer even if "my-subscriptions" constrain which
1573 subscriptions are returned. The limit is a "stateless limit" in that if the value supplied by the client is
1574 'N', then only the first 'N' Subscriptions are returned in the Get-Subscriptions Response. There is no
1575 mechanism to allow for the next 'M' Subscriptions after the first 'N' Subscriptions. If the client does
1576 not supply this attribute, the Printer object responds with all applicable Subscriptions.
- 1577 "requested-attributes" (1setOf keyword): The client OPTIONALLY supplies this attribute. The Printer
1578 object MUST support this attribute. It is a set of Subscription attribute names and/or the 'all'
1579 attribute group name in whose values the requester is interested. This set of attributes is returned for
1580 each Job object that is returned. If the client does not supply this attribute, the Printer MUST
1581 respond as if the client had supplied this attribute with the value: 'all'.
- 1582 "my-subscriptions" (boolean): The client OPTIONALLY supplies this attribute. The Printer object MUST
1583 support this attribute. It indicates whether Subscriptions from all users or just the Subscriptions
1584 submitted by the requesting user of this request MUST be returned by the Printer object. If the
1585 client does not supply this attribute, the Printer object MUST respond as if the client had supplied
1586 the attribute with a value of 'false', i.e., Subscriptions from all users. The means for authenticating
1587 the requesting user and matching the Subscription objects is the same as for jobs as described in
1588 [ipp-mod] section 8.
- 1589 Groups 3 to N: Subscription Object Attributes: The Printer object responds with one set of Subscription
1590 Object Attributes for each returned Subscription object. The Printer object ignores (does not
1591 respond with) any requested attribute or value which is not supported or which is restricted by the
1592 security policy in force, including whether the requesting user is the user that created the
1593 Subscription object (subscribing user) or not (see [ipp-mod] section 8).

1594 **9.3.3 Renew-Subscription operation**

1595 The REQUIRED Renew-Subscription operation permits a client to request the IPP Printer to extend the
 1596 lease on a Subscription object instance. There is no way to renew a Per-Job subscription, since they are
 1597 automatically canceled after the job completes and no longer has any documents, i.e., the job is no longer
 1598 retained (see [ipp-mod] section 4.3.7.2). If the requested subscription object is a Per-Job subscription, the
 1599 Printer MUST grant an infinite lease by returning a 0 value for the "notify-lease-expiration-time".

1600 *Access Rights:* The authenticated user (see [IPP-MOD] section 8.3) performing this operation MUST either
 1601 be the owner of the Subscription object or have operator or administrator access rights for the Printer object
 1602 (see [IPP-MOD] sections 1 and 8.5). Otherwise the IPP object MUST reject the operation and return: the
 1603 'client-error-forbidden', 'client-error-not-authenticated', or 'client-error-not-authorized' status code as
 1604 appropriate.

1605 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

1606

Group 2: Subscription Attributes		Reference	client MUST supply	Printer support
"notify-subscription-id" (integer(1:MAX))		5.10	yes	REQUIRED
"notify-lease-time-requested" (integer(0:MAX))		see below	no	REQUIRED

1607 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

1608

Group 2: Unsupported Attributes (see [ipp-mod] section 3.1.7)	REQUIRED if unsupported attributes
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1609

Group 3: Subscriptions Attributes	Reference	REQUIRED in response
"notify-lease-expiration-time" (integer(0:MAX))	5.11	REQUIRED
"notify-server-up-time" (integer(1:MAX))	5.14	REQUIRED

1610

1611 Attribute Notes:

1612 "notify-lease-time-requested" (integer(0:MAX) - the number of seconds requested for the Per-Printer
1613 subscription lease. Same as Create-Printer-Subscriptions (see section 9.2.1).

1614 "notify-lease-expiration-time" - the time in the future when the subscription will expire. Same as for the
1615 Create-Printer-Subscription operation (see section 9.2.1).

1616 "notify-server-up-time" - the Printer object MUST return this attribute which is an alias for the Printer's
1617 "printer-up-time" Printer Description attribute. The client subtracts this value from the "notify-
1618 lease-expiration-time" value returned in order to determine the number of second in the future that
1619 the subscription will expire (see further explanation in section 9.2.1).

1620 Note: There is no way to change any of the Subscription object attributes, except the "notify-lease-
1621 expiration-time" attribute (using the Renew-Subscription operation). In order to change other attributes, a
1622 client can create a new Subscription object and then use the Cancel-Subscription operation to cancel the old
1623 one (or do this in the other order, in case there is a limit on the number of Subscription object instances, as
1624 long as a short window with no Notifications is ok).

1625 Note: There is no need to renew a Per-Job Subscription, since it is effectively the time that the Job is active
1626 (see section 9.1).

1627 **9.3.4 Cancel-Subscription operation**

1628 The REQUIRED Cancel- Subscription operation allows a client to remove a Subscription object. No more
1629 Event Notifications are delivered for that Subscription. Once performed, there is no way to use that
1630 Subscription in the future. Notify-subscription-ids should not be reused immediately, so that a stale
1631 reference situation is not created. Same as for Cancel-Job and job-ids.

1632 *Access Rights:* The authenticated user (see [IPP-MOD] section 8.3) performing this operation MUST either
1633 be the owner of the Subscription object or have operator or administrator access rights for the Printer object
1634 (see [IPP-MOD] sections 1 and 8.5). Otherwise the IPP object MUST reject the operation and return: the
1635 'client-error-forbidden', 'client-error-not-authenticated', or 'client-error-not-authorized' status code as
1636 appropriate.

1637 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

1638

Group 2: Subscription Attributes		Reference	client MUST supply	Printer support
"notify-subscription-id" (integer(1:MAX))		5.10	yes	REQUIRED

1639

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

1640

Group 2: Unsupported Attributes (see [ipp-mod] section 3.1.7)	REQUIRED if unsupported attributes
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1641

1642 10 Comparison of Per-Job versus Per-Printer Subscriptions

1643 Per-Job and Per-Printer subscriptions are quite similar. Either type of subscription can subscribe to Job
 1644 events, Printer events, or both. Both types of subscriptions can be queried using the Get-Subscriptions and
 1645 Get-Subscription-Attributes operations and canceled using the Cancel-Subscription operation. Both types
 1646 of subscriptions create Subscription objects which have the same attributes defined. However, there are
 1647 some semantic differences between Per-Job subscriptions and Per-Printer subscriptions. A Per-Job
 1648 Submission Subscription is established by the client when submitting a job and after creating the job using
 1649 the Create-Job-Subscription operation by specifying the "job-id" of the job. A Per-Printer Subscription is
 1650 established between a client and a Printer using the Create-Printer-Subscription operation. Some specific
 1651 differences are:

- 1652 1. A client usually creates a Per-Job subscription as part of the Job Creation operations (Create-Job, Print-
 1653 Job, and Print-URI), rather than using the OPTIONAL Create-Job-Subscription operation, especially
 1654 since Printer implementations NEED NOT support the Create-Job-Subscription operation, since it is
 1655 OPTIONAL.

- 1656 2. For Per-Job subscriptions, the subscription is only valid while the job is "not-complete" (see sections
 1657 7.1.1 and 7.1.2) while for the Per-Printer subscriptions, the subscription is valid until the time (in
 1658 seconds) that the Printer returned in the "notify-lease-expiration-time" operation attribute expires.
- 1659 3. Job Events in a Per-Job subscription apply only to "one job" (the Job created by the job creation
 1660 operation or references by the Create-Job-Subscription operation) while Job Events in a Per-Printer
 1661 subscription apply to ALL jobs contained in the IPP Printer object.

1662 11 Conformance Requirements

1663 It is OPTIONAL to implement this Event Notification specification. An implementation conforming to this
 1664 specification MUST also meet the Conformance Requirements detailed in [IPP-MOD] section 5. If this
 1665 Event Notification specification is implemented, IPP objects MUST support all of the REQUIRED object
 1666 attributes as defined in this document in the indicated sections:

- 1667 1. REQUIRED Subscription object attributes in section 5.
 1668 2. REQUIRED Printer Description object attributes in section 6.
 1669 3. REQUIRED attributes in Event Notification content in section 7.

1670 Extensions made to the events herein must be made such that new events or event attributes are backward
 1671 compatible to clients who implemented early versions of this notification specification.

1672 If this Event Notification specification is implemented, the operations described in section 8 MUST be
 1673 supported as described in Table 24:

1674 **Table 24 - Conformance Requirements for Operations**

Attribute	Conformance requirements
"notify-xxx"	REQUIRED
Create-Printer-Subscription (section 9.2.1)	REQUIRED
Create-Job-Subscription (section 9.1.2)	OPTIONAL
Get-Subscription-Attributes (section 9.3.1)	REQUIRED
Get-Subscriptions (section 9.3.2)	REQUIRED
Renew-Subscription (section 9.3.3)	REQUIRED
Cancel-Subscription (section 9.3.4)	REQUIRED

1675

1676 12 IANA Considerations

1677 IANA will be called on to register URL schemes for notification delivery methods, such as 'snmpnotify', for
 1678 use in the "notify-recipient-uri" attribute, using the same procedures outlined in [ipp-mod].

1679 **ISSUE: we need to work out the details on the registration procedure.**

13 Internationalization Considerations

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

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

14 Security Considerations

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

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

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

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

15 Status Codes

The following status codes are defined as extensions for notification:

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

The subscription supplied in a Job Creation operation (Create-Job, Print-Job, Print-URI) exceeds some implementation-defined limit on the total number of Per-Job subscriptions for the Printer (if any). The Printer MUST accept the request with this status code, MUST NOT return the "notify-xxx" attributes in the Unsupported Attributes Group (unless they are unsupported for some other reason),, and MUST perform the Job Creation operation (see section 9.1.1), since the job can still be printed.

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

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

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

There is no corresponding Per-Job subscription error for a Job Creation operation, since the Printer object MUST ignore any errors in the "notify-xxx" operation attribute, MUST return the "notify-recipient-uri" attribute in the Unsupported Attributes Group, and perform the Job Creation operation (see section 9.1.1), since the job can still be printed.

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

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

Note: There is no corresponding Per-Job subscription error on a Job Creation operation, since the Printer object MUST ignore any errors in the "notify-xxx" operation attribute and perform the Job Creation operation (see section 9.1.1), since the job can still be printed.

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

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

There is no corresponding Per-Job subscription error for a Job Creation operation, since the Printer object MUST ignore any errors in the "notify-xxx" operation attribute, MUST return the "notify-events" attribute

1743 in the Unsupported Attributes Group with only the excess events that are being ignored, and perform the
1744 Job Creation operation (see section 9.1.1), since the job can still be printed.

1745 **16 Encodings of Additional Attribute Tags**

1746 The Subscription attributes tag and the Event Notification attributes tag are assigned the following delimiter
1747 tag values as extensions to the encoding defined in [ipp-pro]) for use in requests and responses to delimit
1748 Subscription object attribute Groups and Event Notification Content attribute Groups:

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

1749 **17 References**

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1851 **A. Appendix - Summary of Notification Attribute Usage**

1852 This appendix summarizes the usage of Notification attributes in the Job operation attributes, Job object,
1853 Subscription object, Event Notification content, Job operations, and Subscriptions operations. The legend
1854 for the notation used in the tables is given following each table.

	Objects		Event Notification content		Job operations		Subscription operations		
Attributes	Job	Subscription	Job Event Notification Content	Printer Event Notification Content	Job Creation Validate -Job	Create-Job-Subscription	Create-Printer-Subscription	Renew - Subscription	Cancel - Subscription

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

1855 Legend: "R" - REQUIRED for Printer to support; "O" - OPTIONAL for Printer to support; "[]" - OPTIONAL for sender to send;
1856 Return - Printer MUST return; * the client MUST supply for some delivery methods; ** - MUST be 0 for Per-Job Subscription
1857 objects; (n) means the value comes from the indicated Subscription Attribute

1858

Attributes	Objects		Event Notification		Job operations		Subscription operations		
	Job	Subscription	Job Event Notification	Printer Event Notification	Job Creation Validate -Job	Create -Job-Subscription	Create-Printer-Subscription	Renew - Subscription	Cancel - Subscription
20. printer-uri (uri)		R	R	R	R	R	R	R	R
21. printer-name (name(127))			Humn	Huma n					
22. job-id (integer(1:MAX))	R		R	Per-Jb		R			
23. job-name (name(MAX)) [SNMP can truncate]	R		Humn	Huma n					
24. requesting-user-name (name(MAX))	R								
25. subscriber-user-name (name(MAX))		R							
26. job-state (type1 enum)	R		R	Per Jb					
27. job-state-reasons (1setOf type2 keyword)	R		R	Per Jb					
28. notify-server-up-time (integer(1:MAX))		R				Return	Return		
29. job-impressions-completed (integer(0:MAX))	O		R						

1859 Legend: "R" - REQUIRED for Printer to support; "O" - OPTIONAL for Printer to support; "[]" - OPTIONAL for sender to send;
1860 "[pg/cp]" - REQUIRED in a 'job-progress' or 'job-completed' notification if the corresponding Job attributes are supported ; (nn) - an
1861 alternate source of the data in an Event Notification.

1862

Attributes	Objects		Event Notification		Job operations		Subscription operations		
		Printer object	Job Event Notification	Printer Event Notification	Job Creation, Validate -Job	Create -Job-Subscription	Create-Printer-Subscription	Renew - Subscription	Cancel - Subscription
30. printer-state (type1 enum)		R		R					
31. printer-state-reasons (1setOf type2 keyword)		R		R					
32. printer-is-accepting-jobs (boolean)		R		R					
33. notify-schemes-supported (1setOf uriScheme)		R							
34. notify-events-default (1setOf type2 keyword)		R							
35. notify-events-supported (1setOf type2 keyword)		R							
36. notify-max-events-supported (integer(5:MAX))		R							
37. notify-text-format-supported (1setOf mimeType)		O							
38. notify-additional-formats-supported (1setOf mimeType)		O							
39. notify-max-job-subscriptions-supported (integer(1:MAX))		CR							
40. notify-max-printer-subscriptions-supported (integer(0:MAX))		R							
41. notify-lease-time-supported (rangeOfInteger(0:MAX))		R							
42. notify-lease-time-default (integer(0:MAX))		R							
43. persistent-jobs-supported (boolean)		O							
44. persistent-subscriptions-supported (boolean)		O							
45. printer-state-change-time (integer(1:MAX))		O							
46. printer-state-change-date-time (dateTime)		O							

- 1863 Legend: "R" - REQUIRED for Printer to support; "O" - OPTIONAL for Printer to support; "[]" - OPTIONAL for sender to send;
- 1864 "CR" - CONDITIONALLY REQUIRED, i.e., REQUIRED if Human Consumable format supported;

1865 **B. Appendix: Change History**

1866 This section summarizes the changes to the document. Each sub-section is in reverse chronological order.
1867 Adding or removing ISSUES that don't change the document are not listed here.

1868 **18.1 Changes to the March 6, 2000 version to create the March 8, 2000 version**

1869 The following changes were made to the March 6, 2000 version to create the March 8, 2000 version based
1870 on the agreements reached on the mailing list:

- 1871 1. Changed the name of the SNMP delivery method from 'snmp' to 'snmpnotify', since the Notification
1872 Recipient isn't an SNMP agent.
- 1873 2. Clarified that an implementation with only a single value for persistent-jobs-supported (boolean) or
1874 persistent-subscriptions-supported (boolean) MAY make it settable to the single value or make it not-
1875 settable.

1876 **18.2 Changes to the February 2, 2000 version to create the March 6, 2000 version**

1877 The following changes were made to the February 2, 2000 version to create the March 6, 2000 version
1878 based on the agreements reached on the mailing list, at the February IPP WG meetings, and reflected in the
1879 minutes:

- 1880 1. Clarified that this extension is intended as an extension to IPP/1.0, IPP/1.1, and future versions.
- 1881 2. Allocated the operation-id 0x0016 to 0x001B values for the Notification operations defined in the
1882 document.
- 1883 3. Pre-pended the word "subscription-" on the front of the "request-id" Subscription object attribute to
1884 distinguish it from the "request-id" parameter that is sent in every request and response.
- 1885 4. Added the term "settable" for describing attributes that are not READ-ONLY.
- 1886 5. Added the term "Subscription Creation operation" to stand for any operation that can create a
1887 Subscription object: Job Creation operations (Create-Job, Print-Job, and Print-URI), Create-Job-
1888 Subscription, and Create-Printer-Subscription.
- 1889 6. Changed the "subscriber-user-name" (name(MAX)) Subscription object attribute from OPTIONAL to
1890 REQUIRED.
- 1891 7. Changed the name and semantics of "notify-printer-up-time(integer(1:MAX)) to notify-server-up-time
1892 so that it can be either the Printer's uptime or a Notification Delivery Service uptime.
- 1893 8. Added the 'ipp:', 'indp:', 'mailto:', and 'snmp:' notification delivery schemes to the definition of the
1894 "notify-recipients" to indicate possible schemes.

- 1895 9. Changed the name and semantics of "notify-text-format" (mimeMediaType) to "notify-format" so that it
1896 can be used to specify either Human Consumable or Machine Consumable formats where the
1897 implementation supports both. Clarified that this attribute controls whatever variable Notification
1898 Content that the implementation supports, which may be an attachment to the fixed content format or
1899 the contents of the "human-readable-report" (text(MAX)) attribute. Clarified that an implementation
1900 NEED NOT support all of its supported Notification Content formats with all of its supported delivery
1901 methods.
- 1902 10. Added 'text/xml', 'application/ipp', 'application/postscript', and 'image/tiff' and additional example
1903 MIME media types for "notify-format" (mimeMediaType).
- 1904 11. Clarified that the recommend way for a client to determine whether or not a Printer supports Per-Job
1905 Subscriptions is to query the Printer's "notify-max-job-subscriptions-supported" attribute, since Create-
1906 Job-Subscriptions is an OPTIONAL operation.
- 1907 12. Clarified that the recommend way for a client to determine whether or not a Printer supports Per-Printer
1908 Subscriptions is to query the Printer's "operations-supported" attribute to see if the Create-Printer-
1909 Subscriptions operations is supported, since this is the usual way to determine a Printer's capabilities.
- 1910 13. Clarified that if "persistent-jobs-supported" (boolean) and "persistent-subscriptions-supported"
1911 (boolean) are settable, then setting them must affect whether or not jobs and subscriptions are persistent.
- 1912 14. Allowed delivery methods to send operations with or without a response, depending on the definition of
1913 the delivery method.
- 1914 15. Indicated that a deliver method definition is free to REQUIRE that the client supply the "notify-user-
1915 data" attribute.
- 1916 16. Required that the Printer support the "job-uri" operation attribute as a target, in addition to "printer-
1917 uri"&"job-id", i.e., keep consistent with all Job operations.
- 1918 17. Changed the 'none' out-of-band value to be a reference to the collection document [ipp-coll], since the
1919 use for it in this document is with the 'collection' attribute syntax.
- 1920 18. Clarified that a conforming implementation MUST support the 'collection' attribute syntax, since that is
1921 required in Job Creation operations.
- 1922 19. Allocated the values to the new status codes defined in this document.
- 1923 20. Allocated the [ipp-pro] subscription-attributes-tag and notification-attributes-tag delimiter tags to
1924 delimit Subscription attributes and Notification Content attributes in requests and responses.
- 1925 21. Changed the 'server-error-too-many-subscriptions' and 'server-error-too-many-events' to be client errors,
1926 i.e., 'client-error-too-many-subscriptions' and 'client-error-too-many-events', since other errors of this
1927 type are client errors.

1928

1929 **18.3 Changes to the October 14, 1999 version to create the February 2, 2000 version**

1930 The following changes were made to the October 14, 1999 version to create the February 2, 2000 version
1931 based on the agreements reached at the October and December IPP WG meetings and reflected in the
1932 minutes:

- 1933 1. Added a Java Listener as an example of a Notification Recipient.
- 1934 2. Clarified the object relationships in section 4.1.
- 1935 3. Clarified how job events differ for Per-Job versus Per-Printer Subscriptions.
- 1936 4. Added the ability for the Machine Consumable form to contain a Human Readable "human-readable-
1937 report" (text) attribute so that both forms could be sent in the same Notification.
- 1938 5. Clarified that the 'none' value for notify-text-format (mimeType) has to be out-of-band, not the
1939 text string 'none' as a mimeType.
- 1940 6. Clarified that 'none' means send the Machine Consumable form without the "human-readable-report"
1941 (text) attribute, if it is defined.
- 1942 7. Clarified that Notification Recipients MUST be able to accept unrecognized attributes.
- 1943 8. Allowed the notification delivery method definition to be modeled as (1) a request with an operation
1944 code without a response, (2) a request with a operation code with a response or (3) a response with a
1945 status code.
- 1946 9. Added "notify-text-format" (mimeType) and "human-readable-report" (text(MAX)) to be able to
1947 be sent in a Notification content, if the notification delivery method document permits it.
- 1948 10. Added "job-k-octets" (integer(0:MAX)), "job-impressions" (integer(0:MAX)), and "job-media-sheets"
1949 (integer(0:MAX)) as OPTIONAL for Notification content for use in job-progress events to show the
1950 target values so that the Notification Recipient can show a thermometer.
- 1951 11. Added a Subscription Attributes group (and subscription-attributes tag) the Create-Job-Subscription and
1952 Create-Printer-Subscription requests and responses.
- 1953 12. Added the 'none' out-of-band value for use with "notify-text-format" (mimeType) attribute.
- 1954 13. Changed the job progress attributes from using -2 to mean 'unknown' as in the PWG Job Monitoring
1955 MIB, to use the 'unknown' out-of-band value.

1956 **18.4 Changes to the February 2, 2000 version to create the May 10, 2000 version**

1957 The following changes were made to the February 2, 2000 version to create the May 10, 2000 version based
1958 on the agreements reached at the April IPP WG meetings and subsequent teleconferences:

- 1959 1. Change "notify-format" to "notify-text-format" and made it apply only to the format of the "notify-text"
1960 (formerly called "human-readable-report") and Human Consumable form. A new attribute "notify-
1961 additional-formats" specifies the formats for the Machine Consumable contents of delivery methods that
1962 support multiple formats.
- 1963 2. Change the "job-notify" collection attribute in Job Creation operations to be multiple "notify-xxx"
1964 attributes. This change eliminates the need for collection values. It also means that a Job Creation
1965 operation can create only one Subscription object.
- 1966 3. Change the Machine Consumable form to be transport independent.
- 1967 4. Reduce the set of REQUIRED attributes in the Machine Consumable form and add the OPTIONAL
1968 "notify-requested-attributes" attribute that allows a client to request additional attributes.
- 1969 5. Specify the information that SHOULD be in the Human Consumable form

1970

1971 **C. Appendix: Full Copyright Statement**

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