Subj: Event notifications for the IPP print protocol [and JMP]
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***There are several issues indicated in the document that we should cover at the upcoming meeting, as well as review the proposal. See color highlighting.** [Items in square brackets relate to the PWG JMP MIB trapping and will be removed when this document is made into an IPP Internet-Draft.]*

1   Introduction

In IPP/1.0, the user can determine what is happening to submitted jobs by using the Get--Attributes and Get-Jobs operations to poll for results. This document describes an OPTIONAL extension to the IPP/1.0 Model document for subscribing for event notifications using IPP, but which are delivered over some other protocol. See the IPP Notification Requirements document [req] for further details. See also "General Event Notification Architecture Base [cohen] for terminology and framework.

IPP is considering the definition and use of event notifications (see terminology section) for two main purposes. First, when used to achieve printing over a wide area network, or the Internet, the end-user experience is similar to today's FAX paradigm, so we want to provide notification that the job has completed successfully (or not). This notification may traverse the Internet as an e-mail message or end up on someone's pager. Second, and more widely, when used as a standard LAN print submission protocol (i.e., LPR replacement), the end-user will have the desire and opportunity for a much more dynamic interaction with the printer and the print job. Here, notification should consist of a local area network messaging scheme that addresses unsolicited events related to the printer, the job's position in the server or printer queue, start of processing, printing progress and job completion, including forms of cancellation. This paper proposes MANDATORY IPP attributes to be used for both purposes, and OPTIONAL attributes and values that are appropriate only for one or the other.

[The notification events and content are also intended to apply to the PWG Job Monitoring MIB (JMP). See sections 5.1.1.2 and 8.]

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1.1 Summary of the proposal

34 This paper proposes the following:

35 1. One OPTIONAL "job-notify" Operation attribute for use with the Print-Job, Print-
36   URI, and Create-Job operation. The "job-notify" Operation attribute has an attribute
37   syntax of '1setOf collection' so that the client can request different events for different
38   notification recipients for the same job. Each collection value SHALL contain the
39   "job-notify-recipients" and MAY contain any of the following remaining member
40   attributes with the indicated syntax and support by the IPP object if it supports the
41   "job-notify" Operation attribute at all:

Member attribute name	syntax	in request	support
"job-notify-event-groups"	1setOf type2 keyword	MAY	mandatory
"job-notify-recipients"	1setOf uri	SHALL	mandatory
"job-notify-content-type"	mimeMediaType	MAY	mandatory
"job-notify-charset"	charset	MAY	mandatory
"job-notify-natural-language"	naturalLanguage	MAY	optional
"job-notify-additional-attributes"	1setOf keyword	MAY	optional

51 2. One "job-notify" Job Description attribute which is populated with the supplied
52   Operation attribute.

53 3. Six "xxx-supported" Printer object attributes that correspond to these six member
54   attributes. See the IPP Model for the semantics of xxx-supported Printer attributes.

55 4. Two new Register-For-Event-Notifications and Un-Register-For-Event-Notifications
56   operations on the Printer object. These operations are intended for
57   operator/administrators and servers for long term registration for Printer object events
58   that are independent of job submission. The servers may be involved with (1) job
59   submission to IPP Printer objects and/or (2) collecting accounting data using the
60   event notification mechanism. ISSUE: Ok to add these two new notification
61   operations as discussed on the telecon?

2   Terminology

It is necessary to define a set of terms in order to be able to clearly express the requirements for notification services in an IPP System. These terms are from the requirements document [req]. Cohen [cohen] has similar terminology, with some differences. ==ISSUE: Which terminology should we use?==

2.1   Job Submitting End User

A human end user who submits a print job to an IPP Printer. This person may or may not be within the same security domain as the Printer. This person may or may not be geographically near the printer.

2.2   Job Submitting Application

An application (for example a batch application), acting on behalf of an end user, which submits a print job to an IPP Printer. The application may or may not be within the same security domain as the Printer. This application may or may not be geographically near the printer.

2.3   Security Domain

For the purposes of this discussion, the set of network components which can communicate without going through a proxy or firewall. A security domain may be geographically very large, for example - anyplace within IBM.COM.

2.4   IPP Client

The software component on the client system which implements the IPP protocol. 65

2.5   Job Recipient

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

2.6   Job Recipient Proxy

A person acting on behalf of the Job Recipient. In particular, the Job Recipient Proxy physically picks up the printed document from the Printer, if the Job Recipient cannot perform that function. The Proxy is **by definition** geographically near and in the same security domain as the printer. For example, I submit a print job from home to be printed on a printer at work. I'd like my secretary to pick up the print job and put it on my desk.

99　In this case, I am acting as both Job Submitting End User and Job Recipient. My
100　secretary is acting as a Job Recipient Proxy. An issue that needs to be considered in the
101　notification architecture is the impact of a third party receiving many unwanted
102　notifications.

2.7　Notification Recipient

104　Any of: Job Submitting End User, Job Submitting Application, Job Recipient, or Job
105　Recipient Proxy.

2.8　Notification Recipient Agent

107　A program which receives events on behalf of the notification recipient. The agent may
108　take some action on behalf of the recipient, forward the notification to the recipient via
109　some alternative means (for example, page the recipient), or queue the notification for
110　later retrieval by the recipient.

2.9　Notification Events

112　Any of the following constitute events that a Job Submitting End User can specify
113　notifications be sent for. Notifications are sent to an end user only for that end user's job,
114　or for events that affect the processing of that end user's job:

115　　• Any standard Printer MIB alert (i.e. device events that impact the end user's
116　　job)

117　　• Job Received (transition from Unknown to Pending or Pending-held)

118　　• Job Started (Transition from Pending to Processing)

119　　• Page Complete (Page is stacked)

120　　• Collated Copy Complete (last sheet of collated copy is stacked)

121　　• Job Complete (transition from Processing or Processing-stopped to Completed)

122　　• Job aborted (transition from Pending, Pending-held, Processing, or Processing-
123　　stopped to Aborted)

124　　• Job canceled (transition from Pending, Pending-held, Processing, or Processing-
125　　held to Canceled)

126　　• The job has not ended (Completed, Aborted, Canceled, etc.) within a specified
127　　time limit.

2.10　Notification Registration

129　It should be possible for end users to "Register" for notifications of certain types of
130　events. These include any of those described in the preceding section.

131　ISSUE: Cohen's paper [cohen] uses the terms "subscribe" and "unsubscribe". Which
132　should we use? If we change to use the terms "subscribe" and "unsubscribe", the we
133　should also change the name of the new operations from Register-For-Event-

136   *2.11 **Notification Attributes***

137   IPP Objects (for example, a print job) from which notification are being sent may have
138   attributes associated with them. A user may want to have one or more of these associated
139   attributes returned along with a particular notification. In general, these may include any
140   attribute associated with the object emitting the notification. Examples include:

141   number-of-intervening jobs
142   job-k-octets
143   job-k-octets processed
144   job impressions
145   job-impressions-interpreted
146   job-impressions-completed
147   impressionsCompletedCurrentCopy (job MIB)
148   sheetCompletedCopyNumber (job MIB)
149   sheetsCompletedDocumentNumber (job MIB)
150   Copies-requested
151   Copy-type
152   Output-destination
153   Job-state-reasons

154   *2.12 **Immediate Notification***

155   Notifications sent to the notification recipient or the notification recipient's agent in such
156   a way that the notification arrives immediately , within the limits of common addressing,
157   routing, network congestion and quality of service.

158   *2.13 **Queued Notification***

159   Notifications which are not necessarily sent immediately, but are queued for delivery by
160   some intermediate network application, or for later retrieval. Email with store and
161   forward is an example of queued notification.

162   *2.14 **Notification with Reliable Delivery***

163   Notifications which are delivered by a reliable, sequenced delivery of packets or
164   character stream, with acknowledgment and retry, such that delivery of the notification is
165   guaranteed within some reasonable time limits. For example, if the notification recipient
166   has logged off and gone home for the day, an immediate notification cannot be
167   guaranteed to be delivered, even when sent over a reliable transport, because there is
168   nothing there to catch it. Guaranteed delivery requires both queued notification and a
169   reliable transport. If delivery of the notification requires process to process
170   communications, each session is managed in a reliable manner, assuring fully ordered,
171   end-to-end delivery.

172 ## *2.15* **Notification with Unreliable Delivery**

173 Notifications are delivered via the fundamental transport address and routing framework,
174 but no acknowledgment or retry is required. Process to process communications, if
175 involved, are unconstrained.

176 ## *2.16* **Quality of Service**

177 Some notification delivery methods may allow users to select quality of service
178 parameters. These will depend upon the specific delivery method chosen, and may
179 include parameters such as priority, security, number of retries, and the like.

180 ## *2.17* **Human Consumable Notification**

181 Notifications which are intended to be consumed by human end users **only**. They contain
182 no machine readable encodings of the event. Email would be an example of a Human
183 consumable notification.

184 ## *2.18* **Machine Consumable Notification**

185 Notifications which are intended for consumption by a program **only**, such as an IPP
186 Client. Machine Consumable notifications may not contain human readable information.

187 ## *2.19* **Mixed Notification**

188 A mixed notification may contain both human readable and human readable information.

189 # 3 Model for Job and Printer Event Notification

190 The following pictures from the IPP/1.0 Model and Semantics [ipp-model] are enhanced
191 to show registration for event notification (1) as part of IPP job submission and (2) using
192 the new IPP Register-For-Event-Notifications operations event notifications to (multiple)
193 end-user notification-recipients and a system operator.

194 NOTE: The event notifications are shown coming from the IPP Printer object. An
195 implementation option is for the IPP Printer object to forward the registration requests
196 received in the job submission and with Register-For-Event-Notification operations to a
197 notification service transparently to the requester. The IPP object then passes events to
198 this notification service to distribute the event notifications to the notification recipients.
199 To keep the drawings simple, this implementation option is not shown.

200 ISSUE: Should we show the notification service case too?

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```
202                 Model for Job and Printer Notification
203
204    Legend:
205
206         ##### indicates a Printer object which is
207               either embedded in an output device or is
208               hosted in a server.  The Printer object
209               might or might not be capable of queuing/spooling.
210
211         any   indicates any network protocol or direct
212               connect, including IPP
213
214      O   +----------+
215     /|\  | client/  |----IPP Register-For-Notification--+
216     / \  | notif.   |                                   |
217    oper-| recip.   |<---Printer object---------+        |
218    ator +----------+    event notification     |        |
219                                                 +        |
220                                                  \       v
221      O   +----------+                             \##########
222     /|\  | client/  |----IPP job submission------># IPP     #
223     / \  | notif.   |                             # Printer #
224    end- | recip.   |<---job event notification---# Object  #
225    user +----------+                             /##########
226                                                 /
227      O   +----------+                          +
228     /|\  | notifi-  |                          |
229     / \  | cation   |<---job event notification-+
230    end- | recipient|
231    user +----------+
232
233
234                    +----IPP Register-For-Notification-----+
235                    |                                      |
236                    |                                      v
237    IPP        +----------+                          ##########
238    jobs----->| server/  |----IPP job submission--># IPP     #
239              | notif.   |                          # Printer #
240    other---->| recipient|<---Printer object-------# Object  #
241    jobs      +----------+    event notification  /##########
242                                                 /        ^
243              +----------+    Printer object     +        |
244              | server/  |<--event notification-+         |
245              | notif.   |                                |
246              | recipient|--IPP Register-For-Notification--+
247              +----------+
248               accounting
249
```
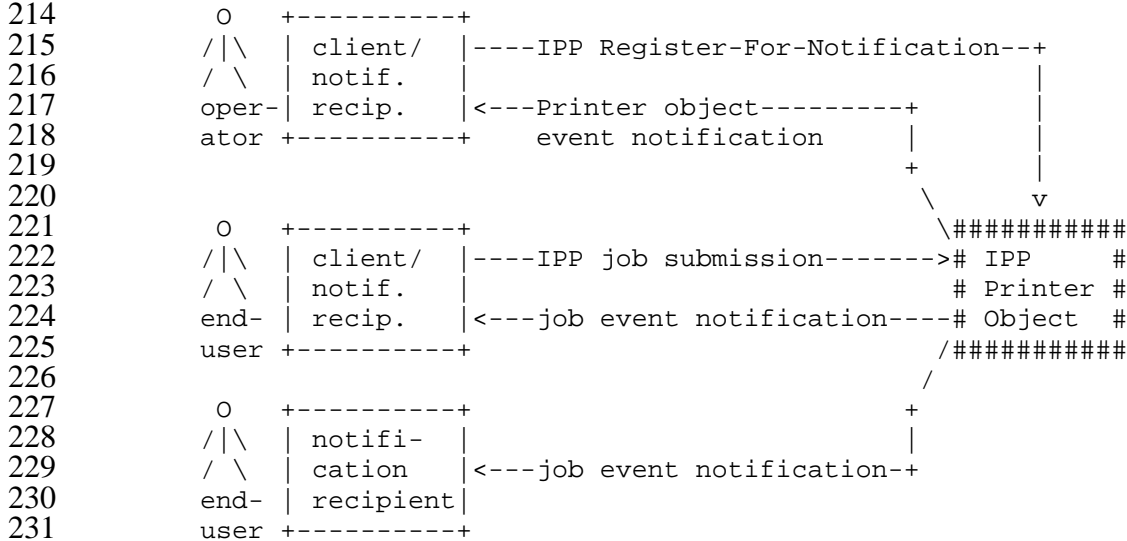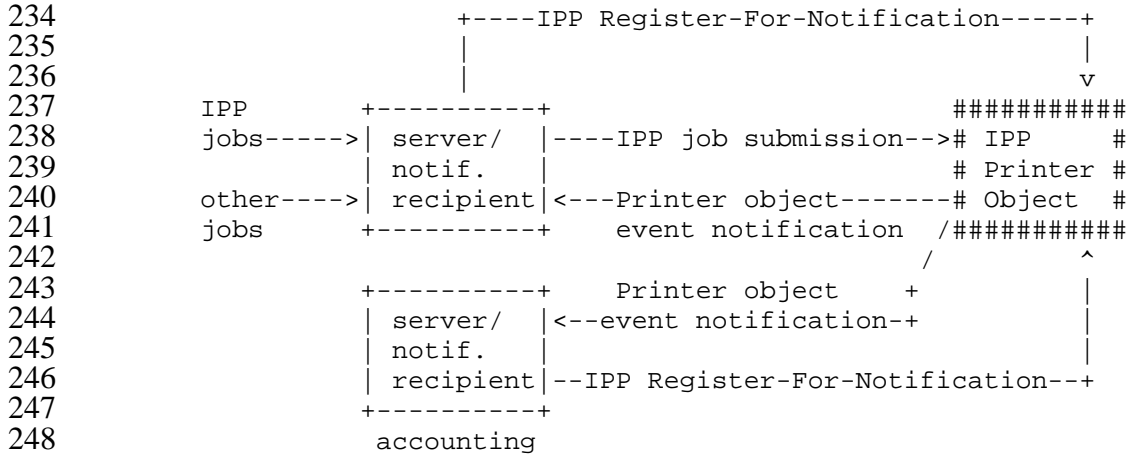
4 Registration for notification

4.1 End-user and server-to-device registration as part of job submission

Registration for notifications is accomplished via IPP for end-user and server-to-device
notifications related to the jobs being submitted. This proposal includes specifics for

254   these types of registrations. Here the registration information is submitted with the job
255   and an implementation SHALL store the information with the Job object so that it may be
256   queried with the Get-Job-Attributes operation. In addition, an implementation MAY
257   employ an event notification service to keep the event notification registration
258   information and to actually deliver the event notifications. In this case, the IPP object
259   passes each event as it occurs to the event notification service for event notification
260   delivery to the notification recipients for which the Printer object had previously
261   forwarded event notification registrations.

262   When the IPP Printer removes the job from the system, the registration is automatically
263   removed with such an implementation. If the IPP Printer object implementation uses a
264   notification server, then the IPP object will have to un-register with that notification
265   server when the job completes.

4.2   Registration by servers and third parties for device and/or job monitoring

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268   Registration by servers that control IPP Printers and by 3^{rd} party accounting or job
269   monitoring applications, which are independent of job submissions, is accomplished by
270   using the Register-For-Event-Notification operation .

5   New Operation attributes for the create operations

271

272   While e-mail notifications may be freeform and flexible, for applications to make use of
273   the server-to-device protocol notifications there needs to be a defined (extendable) set of
274   notification methods. The following IPP Job and Printer attributes are proposed to meet
275   the requirements for notification and querying of supported capabilities, including human
276   readable and program processable forms. The events are taken from Ron's and Harry's
277   previously published lists, as well as the original set in the IPP Model from last October.
278   The create operation attributes are intended to meet the requirements in the requirements
279   document [req].

5.1 job-notify (1setOf collection)

The client OPTIONALLY supplies this Operation attribute as a *collection* attribute as part of the Print-Job, Print-URI, and Create-Job operations. The Printer object OPTIONALLY supports this Operation attribute as part of the Print-Job, Print-URI, and Create-Job operations. If the Printer object supports this attribute for any of these create operations, it MUST support it for all of these create operations that it supports.

ISSUE: Include the definition for the collection attribute syntax in this specification or keep separate. The current white paper has the encoding updates and example that corresponds to the IPP Protocol document, but could be put in this document as an appendix.

The value of this attribute is one or more collection values. Each collection value SHALL contain a "job-notify-recipients" member attribute and MAY contain any of the remaining following *member* attributes with the indicated syntax:

Member attribute name	syntax	in request	support
"job-notify-event-groups"	1setOf type2 keyword	MAY	mandatory
"job-notify-recipients"	1setOf uri	SHALL	mandatory
"job-notify-content-type"	mimeMediaType	MAY	mandatory
"job-notify-charset"	charset	MAY	mandatory
"job-notify-natural-language"	naturalLanguage	MAY	optional
"job-notify-additional-attributes"	1setOf keyword	MAY	optional

The "support" column indicates the support required by the IPP object if it supports the "job-notify" Operation attribute at all.

If the client does not supply the "job-notify" Operation attribute, the Printer object SHALL reject the request and return the 'client-error-bad-request' status code, since the syntax is not correct.

For this attribute (like the "job-k-octets", "job-impressions", and "job-media-sheets" Operation attributes, see [ipp-model]), if the client supplies the attribute, but the Printer object does not support the "job-notify" Operation attribute or some of its member attributes, the Printer object ignores the client-supplied "job-notify" value or the member attributes, respectively.

If the client supplies the "job-notify" Operation attribute and the Printer object supports the "job-notify" Operation attribute, the collection value(s) of the attribute are used to populate the job object's "job-notify" Job Description attribute (see section 6) according to the following conditions:

> If the values of the member attributes are within the range of the corresponding Printer object's "xxx-supported" attributes (see section 7.1), the Printer object SHALL use the collection value(s) to populate the job object's "job-notify" Job Description attribute.

> If some of the member attributes are not supported, the Printer object SHALL copy such member attributes to the Unsupported Attributes response group with the out-of-band value of 'not-supported', copy the remaining (supported) member

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322   attributes to the job object's "job-notify" Job Description attribute, accept the
323   request, and return the 'successful-ok-ignored-or-substituted-attributes' status
324   code.

325   If some of the member attribute values are outside the range of the corresponding
326   Printer object's "xxx-supported" attributes (see section 7.1), the Printer object
327   SHALL copy such member attributes and their values to the Unsupported
328   Attributes response group, substitute or ignore the supplied values, copy the
329   remaining (supported) member attribute values to the job object's "job-notify" Job
330   Description attribute, accept the request, and return the 'successful-ok-ignored-or-
331   substituted-attributes' status code.

332 "The following attributes are defined for use in one or more collection values of the "job-
333 notify" Operation attribute:

334 5.1.1 job-notify-event-groups (1setOf type2 keyword)

335 The client OPTIONALLY supplies this attribute as a member of the "job-notify"
336 Operation attribute. The Printer object SHALL support this attribute if it supports the
337 "job-notify" Operation attribute. This attribute specifies one or more event groups for
338 which the end user desires some sort of notification to be sent to one or more notification
339 recipients that the client supplies in the same "job-notify" collection value in the create
340 request for this job.

341 Each event is assigned a keyword value (see section 5.1.1.2). Each of the events is
342 assigned to one of the standard event groups. Each standard group is also assigned a
343 keyword (see section 5.1.1.1), in order to simplify (1) client registration for the events
344 supplied by the client and (2) event filtering by the notification mechanism.
345 Implementers MAY add additional events to a group. Therefore, notification recipients
346 SHOULD check the event that is sent in the notification content (see section 8) to make
347 sure that it is an event that is wanted.

348 5.1.1.1 Job Notification Groups

349 This section defines the event groups that a client may register for in the create operation.
350 These event group keywords (not the actual event keywords themselves) are passed as
351 attribute values in the "job-notify-event-groups" Operation attribute in the create request.

352 Standard event group values are:
353   'none': the Printer SHALL not notify on any notification events for this job. This
354   value is useful to prevent notifications when the client has default notification
355   attributes configured.
356   'all': the Printer SHALL notify when any of the supported notification events occur
357   for this job.
358   'delivery': the Printer SHALL notify on any of the following events which, in
359   general, pertain to the progress of delivering the job to the Printer:
360   'job-received', 'job-started-processing'
361   'progress': the Printer SHALL notify on any of the following events which, in
362   general, pertain to the progress of pending or actually interpreting, marking,
363   finishing or otherwise processing the job by the Printer object:

364	'job-held', 'job-released', 'sheet-completed', 'collated-copy-completed'

365 'problems': the Printer SHALL notify on any of the following events which, in
366   general, pertain to problems with the job or the Printer. The notification recipient
367   is able to check the "job-state" attribute in the notification content to determine
368   whether this job caused the problem:

369   'problems'

370 'completion': the Printer SHALL notify on any of the following events which, in
371   general, pertain to ways that a job can end:

372   'job-completed', 'job-aborted', 'job-canceled'

373 'management': the Printer SHALL notify on any of the following events which, in
374   general, pertain to the logistics of print job management and accounting:

375   'job-entry-expired'

376 ISSUE: What event groups are MANDATORY for a Printer to support?

377 In a create request, if the client supplies 'none' along with any other combination of
378 values, it is the same as if only that other set of values had been supplied (i.e., the 'none'
379 value has no affect). If the client supplies 'all' along with any other combination of
380 values, it is the same as if only 'all' had been supplied (i.e., the 'all' value subsumes all
381 other values).

382 Note: the group 'progress' is intended for those who wish to receive more frequent, "real-
383 time" progress notifications on a page and copy boundary basis. This is why 'job-started-
384 printing' is in the 'delivery' group, rather than the 'progress' group, for example. An
385 application which was interested in less granular milestones of print job progress would
386 likely register for 'completion' and 'problems' (only).

387 5.1.1.2 Job Notification Events

388 This section defines the notification events. Each event is a member of an event group.
389 When an event occurs, the event keyword, not the event group, is included in the
390 notification content (see section 8).

391 The standard event values are:

392 'job-received': the Printer SHALL notify when it accepts this job (i.e., when the job is
393   created entering the 'pending' or 'pending-held' (JMP 'pendingHeld' states) (JMP:
394   issued by the agent when the agent creates a row in the MIB for that job).
395 'job-started-processing': the Printer SHALL notify when the Printer starts processing
396   this Job (i.e., when the job leaves the 'pending' state and enters the 'processing'
397   state).
398 'sheet-completed': the Printer SHALL notify when each sheet in this job is completed
399   (i.e., stacked in the output bin).
400 'collated-copy-completed': the Printer SHALL notify when each document copy in
401   this job is completed (i.e., last sheet of a collated copy is stacked in an output bin)
402 'job-held': The Printer SHALL notify when this job enters the 'pending-held' (JMP
403   pendingHeld) state (using some protocol operation not defined in IPP/1.0, but
404   perhaps in another protocol or added as an extension), or the system or device

| 405 | holds the job because of some requirement that cannot be met and other jobs |
| 406 | could be processed, if there are any. |

'job-released': the Printer SHALL notify when this job leaves the 'pending-held' (JMP pendingHeld) state entering the 'pending' or 'processing' states due to the user, operator, or system releasing the held job (using some protocol operation not defined in IPP/1.0, but perhaps in another protocol or added as an extension).

'problems': the Printer SHALL notify when this job encounters a problem (i.e., when the job leaves the 'processing' state and enters the 'processing-stopped' state) OR when this job is affected by a Printer problem caused by another job (i.e., when the Printer enters the 'stopped' state while this job is in any of the 'pending' or 'pending-held' states, even though the job remains in the 'pending' or 'pending-held' job state). The job attributes sent in the notification content (see section 8) SHALL be for the job that was processing when the problem occurred, not the job for which the registration was submitted. Thus a number of jobs may have registered for this event, and their specified notification recipients will all get the same notification content.

> ***ISSUE 1: Ok to have combined these two events into one event (and one event group) for simplicity and specified that the notification content is the same for all notification recipients receiving this event?***

'job-completed': 'the Printer SHALL notify when this job completes processing (with or without errors or warnings) and enters the 'completed' state.

'job-aborted': 'the Printer SHALL notify when this job was aborted by the system while in the 'processing' or 'processing-stopped' state, due to some encountered problem that cannot be remedied by human intervention.

'job-canceled': 'the Printer SHALL notify when this job was canceled by the user or operator using the Cancel-Job operation while the job was in any state .

'job-entry-expired': - the Printer SHALL notify when the Printer (or SNMP agent) removes the job from the system so that the job is no longer available via the Get-Jobs or Get-Job-Attributes operations after being in the 'completed', 'aborted', or 'canceled' states for a time period that depends on implementation and site policy (JMP: when agent removes the MIB row).

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5.1.2 job-notify-recipients (1setOf uri)

The client OPTIONALLY supplies this attribute as a member of the "job-notify"
Operation attribute. The Printer object SHALL support this attribute if it supports the
"job-notify" Operation attribute. This attribute describes both where (the address) and
how (the mechanism for delivery) events are to be delivered. The Printer object SHALL
use this attribute as the set of addresses and methods for sending notifications when one
of the events occurs that the client supplied in the "job-notify-event-groups" member
attribute in the same "job-notify" collection value "in the create request for this job. The
Printer object MAY achieve the registration and event notification delivery either (1)
itself or (2) by using some (unspecified) notification service that supports the requested
mechanism of notifying the notification recipients. Either implementation choice
SHALL be transparent to clients and notification-recipients.

Standard uriScheme values are:

    'mailto': a text message via email to the specified email address
    'http': an HTML formatted message via an HTTP POST method to the specified URI
    'ftp': a text message via an FTP 'append' command to the specified remote file.

The following values are not yet standardized or registered. Some of them represent
    work in progress. They will be registered following the procedures [url-reg]. See
    also [cohen] for HTTP URL schemes for notification.
ISSUE: Which schemes do we want to progress?

    'page': a pager phone number to call as specified by the /phone-number parameter in
       the URL.
    'tcp-ip-sockets': a notification via a TCP/IP socket that is opened by the Printer object
       on the IP address specified in the URI (using IP address dot notation) using the
       port on that host specified using the /port=nnn keyword. For example:
          tcp-ip-socket:13.240.120.138/port=6000
       would cause the Printer object to open the TCP/IP port 6000 at IP address
       13.240.120.138.
    'snmpv1': a notification as an SNMPv1 trap to the host specified as the address in the
       URI.
       Note: by specifying different port numbers for each registration on different
       Printers, a notification recipient can differentiate between events from different
       Printers, even when the "job-notify-additional-attributes" attribute is not
       supported.
    'snmpv2': a notification as an SNMPv2 inform to the host specified as the address in
       the URI.
    'snmpv3': a notification as an SNMPv3 inform to the host specified as the address in
       the URI.
    'sense': a notification as a SENSE UDP data gram that is opened by the Printer object
       on the IP address specified in the URI (using IP address dot notation) using the
       port on that host specified using the /port=nnn keyword. See the tcp-ip-socket
       example.

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The Printer object SHALL validate that the schemes supplied in the "job-notify-recipients" is supported by comparing with the Printer object's "job-notify-schemes-supported".

If the Printer object supports the "job-notify" Operation attribute, it MUST support the 'mailto' scheme for "job-notify-recipients". ISSUE: Is it too hard to require and embedded device to include sending e-mail?

489

5.1.3 job-notify-content-type (mimeMediaType)

The client OPTIONALLY supplies this attribute as a member of the "job-notify" Operation attribute. The Printer object SHALL support this attribute if it supports the "job-notify" Operation attribute. This attribute specifies the type of content that is sent in the notification. Thus the client can control whether the event notification content is human readable, machine readable, or both.

Standard values are:

'multi-part/alternative' - contains both human consumable notification content using the 'text/plain' MIME media type and machine consumable notification content using the 'application/ipp' MIME media type with the Get-Job-Attributes response encoding of the attributes listed in Table 1. This value SHALL be supported and is the default, if the client does not supply the "job-notify-content-type" member attribute.

'application/ipp' - the machine consumable notification content using the 'application/ipp' MIME media type [ipp-model] with the Get-Job-Attributes response encoding of the attributes listed in Table 1.

'text/plain' - the human consumable notification content. If the charset is other than US-ASCII, the /charset parameter SHALL be included in the event notification content. RFC 2046 indicates that the absence of the charset parameter SHALL mean US-ASCII rather than simply unspecified [RFC2046].

5.1.4 job-notify-charset (charset)

The client OPTIONALLY supplies this attribute as a member of the "job-notify" Operation attribute. The Printer object SHALL support this attribute if it supports the "job-notify" Operation attribute. This attribute specifies the charset for the IPP object to use in the human readable part of the notification content that is sent to the notification recipients that the client supplied in this same collection value. If the attribute is not supplied, the charset supplied in the "attributes-charset" Operation attribute SHALL be used, if the charset value is supported by the Printer, else the Printer object shall use the Printer's "charset-configured" value.

5.1.5 job-notify-natural-language (naturalLanguage)

The client OPTIONALLY supplies this attribute as a member of the "job-notify" Operation attribute. The Printer object OPTIONALLY supports this attribute if it supports the "job-notify" Operation attribute. This attribute specifies the natural language for the IPP object to use in the human readable part of the notification content is sent to the notification recipients that the client supplied in this same collection value. If this attribute is not supported or the supplied value is not supported, the IPP Printer SHALL return the attribute in the Unsupported Attributes Group but still accept the operation, as with all create operations. If this attribute is not supplied or the attribute or value is not supported by the Printer object, the natural language supplied in the "attributes-natural-

532　language" create operation attribute SHALL be used, if that natural language value is
533　supported by the Printer, else the Printer object SHALL use the Printer's "natural-
534　language-configured" value. See the Print-Job operation in [ipp-model].

535　**5.1.6　job-notify-additional-attributes (1setOf keyword)**

536　The client OPTIONALLY supplies this attribute as a member of the "job-notify"
537　Operation attribute. The Printer object OPTIONALLY supports this attribute if it
538　supports the "job-notify" Operation attribute. This attribute specifies the additional
539　attributes that the requester wishes to be included in the notification content, in addition
540　to the fixed set that depends on the event as shown in the table in section 8. If this
541　attribute is not supported or not supplied by the client, the Printer object SHALL supply
542　the fixed set of attributes indicated in section 8 depending on the event being requested.

543

6 Job Object attributes for Job Notification

6.1 "job-notify" (1setOf collection)

This attribute specifies one or more collections of events, notification-recipients, and
other member attributes that the client supplied in the "job-notify" Operation attribute of
the create request. The Printer object SHALL support this Job attribute if it supports the
"job-notify" Operation attribute. See the description of the "job-notify" Operation
attribute for the complete specification of the semantics of this Job Description attribute.

7 Printer Object attributes for Job Notification

If the Printer object supports the "job-notify" Operation attribute for the Print-Job, Print-
URI, and Create-Job operations, then the Printer object SHALL support the following
supported Printer object attributes that correspond to the "job-notify" member attributes
supported.

Note: These Printer attributes are specified as separate Printer object attributes, rather
than as member attributes of a Printer object's collection attribute, since any combination
of values may be used for any of the attributes.

```
+==================+=====================+
| Operation and    |  Printer: Supported |
| Job Attribute    |    Values Attribute |
+==================+=====================+
| job-notify-event-|  job-notify-event-  |
|    groups        |    groups-supported |
| (1setOf type2    |(1setOf type2 keyword|
|    keyword)      |                     |
+------------------+---------------------+
| job-notify-      |  job-notify-schemes |
|    recipients    |  -supported |       |
|   (1setOf uri)   |  (1setOf uriScheme) |
+------------------+---------------------+
| job-notify-      |  job-notify-content-|
|    content-type  |    type-supported   |
|   (mimeMediaType)|(1setOf mimeMediaType)|
+------------------+---------------------+
| job-notify-charset|  job-notify-charset- |
|   (1setOf charset) |   supported        |
|                   | (1setOf charset)   |
+------------------+---------------------+
| job-notify-      |  job-notify-natural-|
|   natural-language|   language-supported |
| (naturalLanguage) | (1setOf            |
|                   |    naturalLanguage) |
+------------------+---------------------+
| job-notify-      |  job-notify-        |
|    additional-   |    additional-      |
|    attributes    | attributes-supported|
|  (1setOf keyword)|   (1setOf keywords) |
+------------------+---------------------+
```

590

7.1   Notification Supported Printer attributes

The value of the Printer object's "job-notify-recipients-supported" attribute is a
'uriScheme'. The Printer object SHALL use the values of this attribute to validate the
scheme supplied by the client in the "job-notify-recipients" member attribute. These
Printer object attributes specify the supported values for the corresponding member
attributes of the "job-notify" Operation collection attribute.

For example, if a Printer object supports:
1) 'mailto:' method for the 'job-completed', 'job-canceled', and 'job-aborted' events
    using English, French, U.S. English, and German and supporting additional
    attributes: "job-uri", "job-name", "job-originating-user-name", "number-of-
    documents", "job-state", "sides", "finishing"
2)   'sense' and 'tcp/ip-socket' methods for the 'job-received', 'job-started', 'job-
    completed', 'job-aborted', 'job-canceled' events in English only

a system administrator could configure the following Printer attributes":

"job-notify-schemes-supported" =   'mailto', 'sense', 'tcp-ip-sockets'

"job-notify-event-groups-supported" =   'delivery', 'completed'

"job-notify-natural-language-supported" =   'en', 'fr', 'en-us', 'de'

"job-notify-additional-attributes-supported" = 'job-uri', 'job-name',
              'job-originating-user-name', 'number-of-documents',
              'job-state', 'sides', 'finishing'

Note: the fact that not all events are supported for the mailto scheme, or that not all
languages are supported for the 'sense' and 'tcp-ip-sockets' methods is not represented,
since the collection mechanism is not used to represent the supported attributes. If the
client supplies a combination that is not supported, the Printer object SHALL accept the
create request (independent of the value of the "ipp-attribute-fidelity" attribute supplied
by the client), make suitable substitutions, and return the attributes that are ignored or
substituted in the create operation response.

8   Operations to Register and Un-register for notifications

There are two new OPTIONAL operations to allow a client or server to register for
Printer object events without submitting a job. These new operations are intended for use
by servers that control printers, by clients used by operators/administrators that manage
printers, and by applications that collect accounting data.

8.1   Register-For-Event-Notifications Operation

This OPTIONAL operation allows a client to register with the Printer object to be
notified when identified events happen to the device(s) that the Printer object is
representing without requiring that the client submit jobs. In the request, the client
supplies the set of Printer event group names in which the notification-recipient is
interested. In the response, the Printer object returns a list of the current registrations,
including the new one requested by this operation.

630 This operation is intended for use by system operators and administrators that have a long
631 term interest in the events without submitting jobs. It is also intended to be used by
632 servers that control IPP Printers. Finally, it is also intended to be used by accounting
633 applications that need to be notified when jobs complete.

634 For Printer objects, the possible names of event groups are the same as for use in the
635 "job-notify" Operation attribute in create requests.

636 It is NOT REQUIRED that a Printer object support all event groups or all events within
637 the supported event groups.

8.1.1 Register-For-Event-Notifications Request

639 The following sets of attributes are part of the Register-For-Event-Notifications Request:

640 Group 1: Operation Attributes

641 Target:
642 The "printer-uri" operation attribute which is the target for this operation as
643 described in section **Error! Reference source not found.**.
644
645 Natural Language and Character Set:
646 The "attributes-charset" and "attributes-natural-language" attributes as described
647 in section **Error! Reference source not found.**.
648
649 Requesting User Name:
650 The "requesting-user-name" attribute SHOULD be supplied by the client as
651 described in section **Error! Reference source not found.**.
652
653 "printer-notify" (1setOf collection) :
654 The client SHALL supply a "printer-notify" Operation attribute that MUST
655 specify the notification-recipient(s), and MAY specify additional information
656 about the registration. The value of this attribute is one or more collection values.
657 Each collection value SHALL contain a "job-notify-recipients" member attribute
658 and MAY contain any of the other *member* attributes defined for use with the
659 "job-notify" Operation attribute in create operations. The Printer object MUST
660 support this Operation attribute (if it supports this OPTIONAL operation). If the
661 client omits this attribute, the Printer SHALL reject the operation and return the
662 'client-error-bad-request' status code.
663
664 ISSUE: If we agree to these operations, we should remove the "job-" prefix on all
665 the member attributes in the "job-notify" collection attribute, so that the same
666 collection can be used with the "printer-notify" Printer attribute as well.
667
668 The Printer object SHALL validate that this client is permitted to register for
669 notifications. The means for configuring the permissions is outside the scope of this
670 specification. If a requester is not permitted to register for notifications, the IPP Printer
671 SHALL reject the request and return the 'client-error-authenticated' or 'client'-error-not-
672 authorized' status code.

673 If the IPP Printer object accepts the request, it SHALL add the registration to the Printer
674 object's "printer-notify" attribute. The Printer object SHALL add a "notify-registration-
675 id" member attribute with a unique integer id for each collection value added. This id is
676 used to un-register using the Un-Register-For-Event-Notifications operations. If this
677 client had already registered, this registration will be added to the value of the "printer-
678 notify" attribute anyway. Clients SHOULD remove registrations that are no longer
679 wanted using the Un-Register-For-Event-Notifications operation.

680 **8.1.2 Register-For-Event-Notifications Response**

681 The Printer object returns the following sets of attributes as part of Register-For-Event-
682 Notifications Response:

683 Group 1: Operation Attributes

684   Status Code and Message:
685   The response includes the MANDATORY status code and an OPTIONAL
686   "status-message" (text) operation attribute as described in section **Error!**
687   **Reference source not found.**.
688
689   Natural Language and Character Set:
690   The "attributes-charset" and "attributes-natural-language" attributes as described
691   in section **Error! Reference source not found.**.
692
693 Group 2: Unsupported Attributes

694   This is a set of Operation (member) attributes supplied by the client (in the
695   request) that are not supported by the Printer object or that conflict with one
696   another (see sections **Error! Reference source not found.** and **Error! Reference**
697   **source not found.**).
698
699 Group 3: Printer Object Attributes

700   The updated "printer-notify" attribute that contains the requested registration(s)
701   supplied in this operation request, along with any that have been previously
702   registered by any client.
703

704 *8.2   Un-Register-For-Event-Notifications Operation*

705 This OPTIONAL operation allows a client to un-register with the Printer object for event
706 notifications that had been registered previously using the Register-For-Event-
707 Notification operation. In the request, the client supplies the notify-registration-id
708 attribute that the Printer object created in the Register-For-Event-Notifications operation.
709 In the response, the Printer object returns a list of the current registrations which SHALL
710 NOT include the ones removed by this operation.

711 This operation is intended for use by system operators and administrators that have a long
712 term interest in the events without submitting jobs. It is also intended to be used by

713 servers that control IPP Printers. Finally, it is also intended to be used by accounting
714 applications that need to be notified when jobs complete.

8.2.1 Un-Register-For-Event-Notifications Request

716 The following sets of attributes are part of the Un-Register-For-Event-Notifications
717 Request:

718 Group 1: Operation Attributes

719   Target:
720   The "printer-uri" operation attribute which is the target for this operation as
721   described in section **Error! Reference source not found.**.
722

723   Natural Language and Character Set:
724   The "attributes-charset" and "attributes-natural-language" attributes as described
725   in section **Error! Reference source not found.**.
726

727   Requesting User Name:
728   The "requesting-user-name" attribute SHOULD be supplied by the client as
729   described in section **Error! Reference source not found.**.
730

731   "notify-registration-id" (integer(1:MAX)) :
732   The client SHALL supply a "notify-registration-id" Operation attribute that
733   specifies a registration id assigned by the Printer object in a previous Register-
734   For-Event-Notifications. The Printer object MUST support this Operation
735   attribute (if it supports this OPTIONAL operation). If the client omits this
736   attribute, the Printer SHALL reject the operation and return the 'client-error-bad-
737   request' status code.
738

739 The Printer object SHALL validate that this client is permitted to un-register notifications
740 in general and this notification registration in particular. The means for configuring the
741 permissions is outside the scope of this specification. If a requester is not permitted to
742 un-register for notifications in general or for the requested registration, the IPP Printer
743 SHALL reject the request and return the 'client-error-authenticated' or 'client'-error-not-
744 authorized' status code. If the value of the "notify-registration-id" is not found, the IPP
745 Printer SHALL reject the request and return the 'client-error-not-found' status code.

746 If the IPP Printer object accepts the request, it SHALL remove the requested event
747 notification registration from the Printer object's "printer-notify" attribute. Clients
748 SHOULD remove registrations that are no longer wanted using this operation.

8.2.2 Un-Register-For-Event-Notifications Response

750 The Printer object returns the following sets of attributes as part of Register-For-Event-
751 Notifications Response:

752 Group 1: Operation Attributes

753   Status Code and Message:
754   The response includes the MANDATORY status code and an OPTIONAL
755   "status-message" (text) operation attribute as described in section **Error!**
756   **Reference source not found.**.
757
758   Natural Language and Character Set:
759   The "attributes-charset" and "attributes-natural-language" attributes as described
760   in section **Error! Reference source not found.**.
761
762 Group 2: Unsupported Attributes

763   This is a set of Operation (member) attributes supplied by the client (in the
764   request) that are not supported by the Printer object or that conflict with one
765   another (see sections **Error! Reference source not found.** and **Error! Reference**
766   **source not found.**).
767
768 Group 3: Printer Object Attributes

769   The updated "printer-notify" attribute that no longer contains the event
770   notification registration that was requested to be removed.

9   Printer Object Attributes for Printer Notification

772 If the Printer object supports the Register-For-Event-Notifications operations, then the
773 Printer object SHALL support the following supported Printer object attributes that
774 correspond to the "printer-notify" member attributes supported.

775 Note: These Printer attributes are specified as separate Printer object attributes, rather
776 than as member attributes of a Printer object's collection attribute, since any combination
777 of values may be used for any of the attributes.

778 NOTE: The following assumes that we have removed the "job-" prefix on the collection
779 member attributes.

```
      +==================+==========================+
      | Operation        |    Printer: Supported    |
      | Attribute        |    Values Attribute      |
      +==================+==========================+
      | notify-event-    |  printer-notify-event-   |
      |   groups         |   groups-supported       |
      | (1setOf type2    | (1setOf type2 keyword    |
      |   keyword)       |                          |
      +------------------+--------------------------+
      | notify-recipients| printer-notify-schemes   |
      |                  | -supported               |
      |  (1setOf uri)    | (1setOf uriScheme)       |
      +------------------+--------------------------+
      | notify-          | printer-notify-content-  |
      |   content-type   |   type-supported         |
      |  (mimeMediaType) |(1setOf mimeMediaType)    |
      +------------------+--------------------------+
      | notify-charset   | printer-notify-charset-  |
      |  (1setOf charset)|   supported              |
      |                  | (1setOf charset)         |
```

```
800    +------------------+------------------------+
801    | notify-          | printer-notify-natural-|
802    |   natural-language|   language-supported  |
803    | (naturalLanguage)| (1setOf               |
804    |                  |    naturalLanguage)    |
805    +------------------+------------------------+
806    | notify-          | printer-notify-        |
807    |   additional-    |   additional-          |
808    |   attributes     | attributes-supported   |
809    | (1setOf keyword) |  (1setOf keywords)     |
810    +------------------+------------------------+
```

10 Notification Content definitions

Just as applications need a defined (extendable) set of notifications, they also need a fixed structure and reliable notification content. The notification content depends on the event. For all events, except the 'problems' event, the job to which the event occurred is the same as the job for which the registration was specified in the create job operation. For the 'problems' event, the attributes that are included in the notification content are for the job that caused the event, not the jobs that registered for the event. Thus when a queue of jobs all register for the 'problem' event, their specified notification-recipients all receive the same notification content (for the job that caused the problem event on the Printer).

An IPP Printer object MAY also implement the "job-notify-additional-attributes" Operation member attribute in order to allow a client to request additional attributes over and above the fixed set shown in Table 1. Note: a client may wish to request the "printer-uri" attributes in order for the recipient to receive the URI of the printer, in case the recipient needs to obtain additional job and printer attributes using the Get-Job-Attributes and Get-Printer-Attributes operation.

[Some delivery methods, such as SNMP, do not support the requester requesting additional attributes; the notification recipient will have to explicitly use a Get-Job-Attributes or Get-Printer-Attributes operation to get additional attributes about the job or device.]

All IPP delivery methods SHALL support (via the "job-notify-content-type" member attribute) the ability to encode the notification content as a 'multi-part/alternative' MIME media type in order to represent both (1) the human processable 'text/plain' MIME media type alternative and (2) a machine processable alternative using the 'application/ipp' MIME media type [ipp-model] with the Get-Job-Attributes response encoding of the attributes listed in Table 1. The client MAY select the content type by supplying the "job-notify-content-type" member attribute in the "job-notify" collection attribute.

[IPP does not have some of the job progress attributes that the PWG Job Monitoring has. These are indicated with "-" in the IPP attribute column.]

840

841 **Table 1 - Mandatory attributes sent in notification content depending on the event**

IPP attribute (content)	JMP attribute (content)	Event				

842

		job-received	job-started-processing, job-held, job-released	job-problems	printer-problems	sheet-completed, collated-copy-completed, job-completed, job-aborted, job-canceled, job-entry-expired
job-uri	jmJobSubmissionID	Yes	Yes	Yes	Yes***	-
job-id	jmJobIndex	Yes	Yes	Yes	Yes***	Yes
number-of-intervening-jobs	jmNumberOfInterveningJobs	Yes	Yes	Yes	Yes	-
job-k-octets	jmJobKOctetsPerCopyRequested	-	Yes	Yes	Yes	Yes
job-k-octets-processed	jmJobKOctetsProcessed	-	-	Yes	Yes	Yes
job-impressions	jmJobImpressionsPerCopyRequested	-	Yes*	Yes*	Yes*	Yes*
-	impressionsInterpreted	-	-	Yes	Yes	Yes
job-impressions-completed	jmJobImpressionsCompleted	-	-	Yes	Yes	Yes
copies	jobCopiesRequested	-	-	Yes	Yes	Yes
-	impressionsCompletedCurrentCopy	-	-	Yes	Yes	Yes
-	sheetCompletedCopyNumber	-	-	Yes	Yes	Yes
-	sheetCompletedDocumentNumber	-	-	Yes	Yes	Yes
-	jobCollationType	-	-	Yes	Yes	Yes
-	outputBin	-	-	-	-	Yes**
job-state	jmJobState	-	-	Yes	Yes	-

		job-received	job-started-processing, job-held, job-released	job-problems	printer-problems	sheet-completed, collated-copy-completed, job-completed, job-aborted, job-canceled, job-entry-expired
job-state-reasons	jmJobStateReasons1	Yes	Yes			Yes

843

844 '-' indicates that the attribute SHALL NOT be included in the notification content.

845 * The IPP Printer object will treat jmJobImpressionsPerCopyRequested in the following
846 manner. If explicitly *passed in on submission,* this will be the value used. If there is no
847 value passed in on submission, then the *implicit value, derived from the final number of*
848 *impressionsInterpreted for the first copy will be used.*

849
850 ** `outputBin` may be multi-valued

851 *** Depending on the security policy in force, the "job-uri" and "job-id" attributes MAY
852 NOT be sent to some notification-recipients. <mark>ISSUE: The above table does not contain a</mark>
853 <mark>number of attributes that the Printer MIB generates on an alert: prtAlertSeverityLevel,</mark>
854 <mark>prtAlertTrainingLevel, prtAlertLocation, prtAlertDescription, prtAlertTime. Should we</mark>
855 <mark>add them? To which event?</mark>

856 Note: the 'delivery' group has different patterns of attributes sent in the notification
857 content, so that the IPP Printer object would have to register with the SNMP agent using
858 several different SNMP trap OIDs because the VarBind lists must be different.

859 NOTE: The following objects and attributes have not been included in the fixed set of
860 attributes that SHALL be returned for the indicated reasons (they MAY be requested in
861 implementations that support the "ipp-notify-additional-attributes" attribute):

862   1) "job-state" (JMP jmJobState) - the event indicates the job's new state.

863   2) "job-owner" (JMP jobOwner) - the notification recipient should know who the
864   owner is. Also the owner is a string, so it can be long. The total size of the
865   content must fit in the maximum size of a PDU for any transport, which is
866   about 500 octets or so (for IPX).

867   3) For an IPP device, the jmJobSubmissionID is "job-uri", at least the last 47
868   octets of it.

869 # 11 Encoding

870 The new 'collection' attribute syntax will use the 0x34 tag value that has been reserved in
871 the IPP/1.0: Protocol Specification for this purpose.

872

12 References

873

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