

1 IPP Notification New Model

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5 This document is a new proposal to simplify the IPP Notification Model. It uses Harry Lewis's suggested
6 terminology of Per-Job subscriptions and Per-Printer subscriptions. The Subscription object is defined only
7 for use as Per-Printer subscriptions. Per-Job subscriptions are done entirely with Job attributes and use an
8 exclude event mask (like SNMPv3 trap subscriptions) in order to allow different recipients to get different
9 events. I've also added conformance requirements for operations and attributes, so that we can more
10 properly reason about the model, before updating the specification document.

11 This document also includes the results of the 8/11/99 IPP telecon.

12 **There are 14 issues highlighted like this that need to be resolved.**

13 This paper uses object modeling techniques to describe the current IPP Notification Specification object
14 model (July 22, 1999):

15 ftp://ftp.pwg.org/pub/pwg/ipp/new_NOT/ipp-notification-990722.pdf

16 Review of this object model before writing the complete spec will help speed up the production of the spec
17 and will also help with the understanding of the semantics. I suggest that this modeling be kept in the final
18 spec in some form similar to this paper.

19 This paper also gives an outline of how the final spec might be presented, including being divided into two
20 parts. After describing the additional object attributes for the Job, Printer, and Subscription objects, the
21 order of the spec is suggested to be:

- 22 1. the REQUIRED first part (sections 5, 6, and 7) defines the extensions to the Job and Printer object
23 and its operations for Per-Job subscriptions of Job and Printer events and their notification content.
- 24 2. the OPTIONAL second part (section 8) defines the Per-Printer subscription mechanism and the
25 Subscription object and its operations and attributes.

26 ***NOTE - Throughout this model document, the notation [] indicates that the sender (client in a
27 request, IPP object in a response, Notification Sender in a notification) MAY omit the attribute
28 inside the square brackets if there is not data to send. In addition, IPP Printer conformance
29 requirements for operation and attribute support are indicated in this document with the words and
30 codes:***

31 ***REQUIRED (R) to support notification at all***

32 ***CONDITIONALLY REQUIRED (C) - REQUIRED if Per-Printer subscription is supported***

33 ***OPTIONAL (O) - not required for either Per-Job or Per-Printer Subscriptions.***

34 ***Therefore, the [] do NOT mean OPTIONAL support and should not be confused with support
35 requirements.***

36

37

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71

72 1 Current IPP Notification Operations

73 The current IPP Notification specification (July 22, 1999) consists of the Job object and the Printer object.
74 A Job object contains zero or one Per-Job Subscription which specifies Job and/or Printer events. The Job
75 events apply only to this Job. The Printer events apply no matter which job. A Printer object contains zero
76 or more Per-Printer Subscriptions which specify Job and/or Printer events. The Job and Printer events
77 apply no matter which job.

78 The following operations are defined for Per-Job Subscriptions and Per-Printer Subscriptions:

79 1.1 Per-Job Subscriptions - previous model

Job object related:	salient inputs besides printer-uri:
job creation operations	recipients, [events,] [user-data]
Subscribe-Job	job-id, recipients, [events]
Get-Job-Attributes	job-id, [requested-attributes]
Unsubscribe-Job	job-id, subscription-id

80 1.2 Per-Printer Subscriptions - previous model

Printer object related:	salient inputs beside printer-uri:
Get-Printer-Attributes	[requested-attributes]
Renew-Printer-Subscription	[lease time]
Get-Printer-Subscriptions	[my-subscriptions]

81 2 New IPP Notification Operations

82 This new proposed IPP object model add the Subscription object (to the Job and Printer objects), but only
83 for the Per-Printer subscriptions.

84 The following operations are defined for Per-Job Subscriptions and Per-Printer Subscriptions:

85 2.1 Per-Job Subscriptions - new model

Job object related:	salient inputs besides printer-uri
job creation operations	recipients, [events,] [user-data,] [exclude-event-mask]
Get-Job-Attributes	job-id, [requested-attributes]
Set-Job-Subscription	job-id, [recipients,] [events,] [user-data,] [exclude-event-mask]

86

87 **2.2 Per-Printer Subscriptions - new model**

Printer object related:	salient inputs beside printer-uri:
Get-Printer-Attributes	[requested-attributes]
Subscription object related:	salient inputs besides printer-uri:
Create-Printer-Subscription	recipients, [events,] [user-data,] [exclude-event-mask,] [lease-time-requested]
Get-Printer-Subscription-Attributes	subscription-id, [requested-attributes]
Get-Printer-Subscriptions	[my-printer-subscriptions,] [requested-attributes]
Renew-Printer-Subscription	subscription-id, [lease time-requested]
Cancel-Printer-Subscription	subscription-id

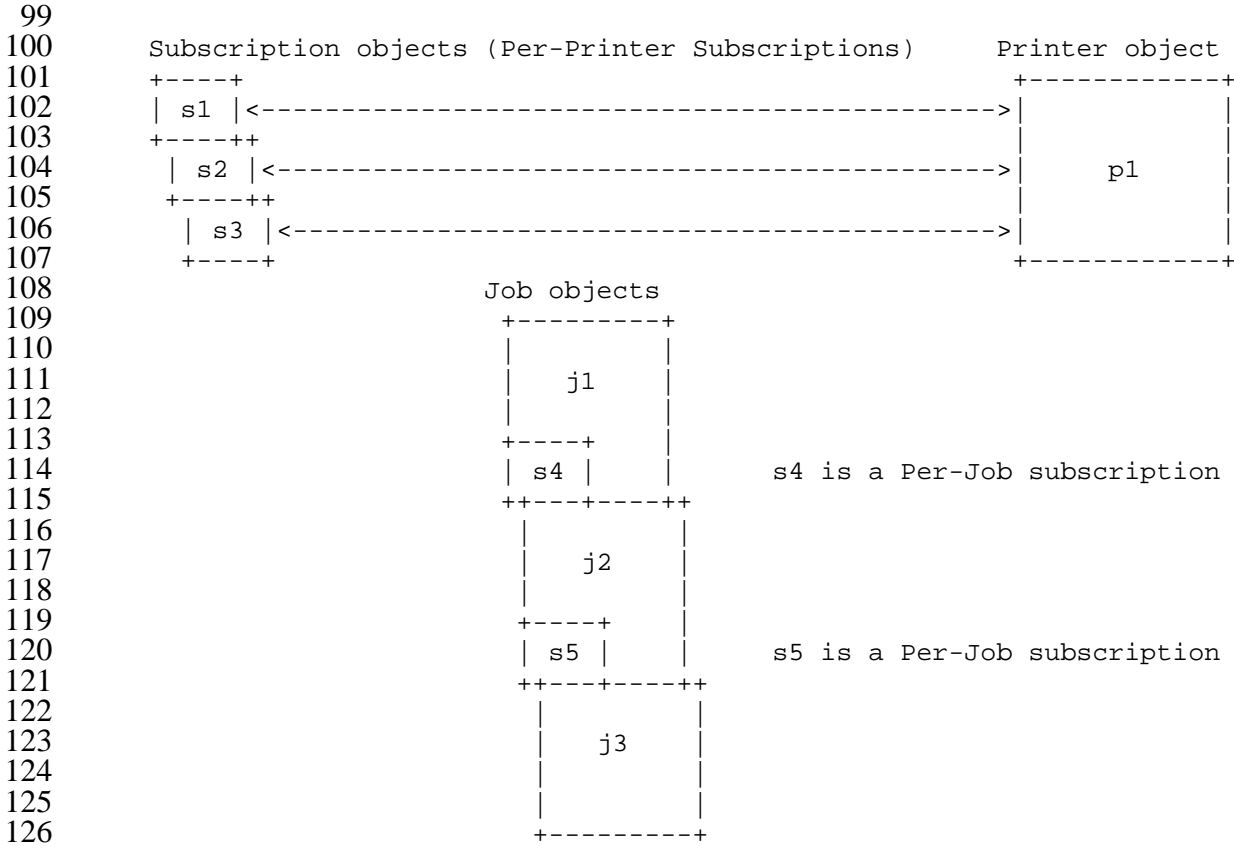
88 **ISSUE 1 - If IPP is generalized to multi-function devices, will we regret having "Printer" in the names of**
 89 **these operations that could work for any type of device?**

90 **3 Job, Printer, and Subscription object relationships**

91 This section describes the new notification object model that adds a Subscription object which together
 92 with the Job and Printer object provide the complete notification semantics. The Subscription object is
 93 OPTIONAL. The Subscription object MUST be supported if Per-Printer subscriptions are supported and
 94 vice-versa.

95 Per-Job subscriptions do not use the Subscription object. Instead, a Job can have one Per-Job subscription
 96 which is represented entirely as Job attributes. A "notify-event-exclude-mask" attribute allows some of the
 97 specified events to be excluded from some of the specified Notification Recipients in the Job subscription.

98 The object relationships can be seen pictorially as:



127 s1, s2, and s3 are Per-Printer Subscription objects and can identify Printer and/or Job events.

128 s4 and s5 are Per-Job subscriptions (not objects) and can identify Printer and/or Job events.

129 3.1 Object relationships

130 The object relationships can be stated as follows:

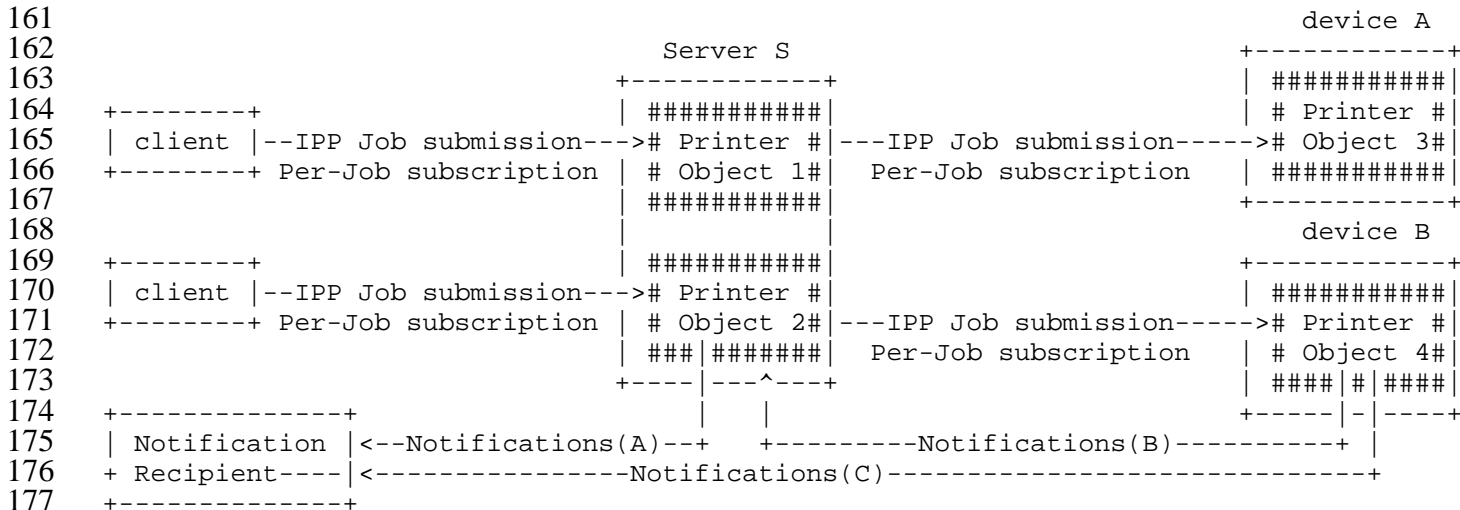
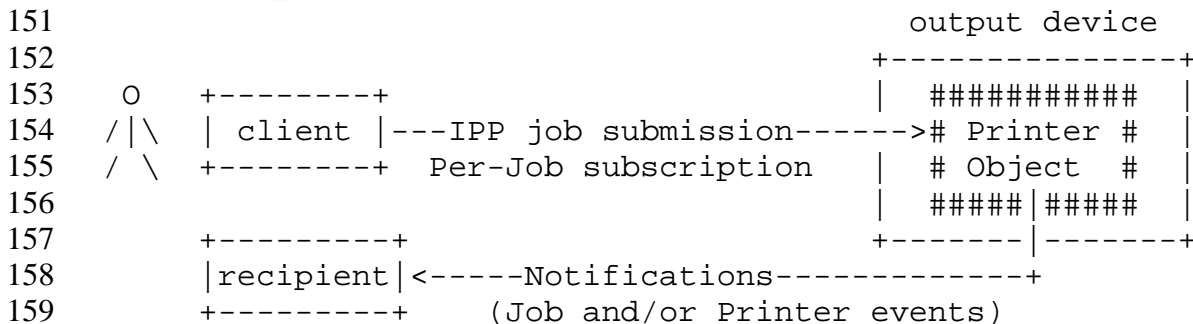
- 131 1. The Printer object contains zero or more Subscription objects (p1 contains s1-s3 Subscription
132 objects).
- 133 2. Each Subscription object (s1, s2, and s3) is contained in one Printer object (p1) and represents one
134 Per-Printer subscription.
- 135 3. Each "Per-Printer" Subscription object identifies one or more Job and/or Printer events. Such Job
136 events are for *all* jobs on the Printer. Such Printer events are for *any* Printer event, no matter which
137 job is processing and when no jobs are processing.
- 138 4. The "Per-Job" subscription (not an object by itself, but is attributes of the Job object) identifies one
139 or more Job and/or Printer events. Such Job events are only for *this* job (different than "per-Printer"
140 Subscriptions). Such Printer events are for *any* Printer event, no matter which job and when no jobs
141 are processing (same as for "per-Printer" Subscriptions).

- 142 5. A Job object contains zero or one Per-Job subscriptions (not an object). Job j1 contains Per-Job
 143 subscription s4, Job j2 contains Per-Job subscription s5, and Job j3 does not contain a Per-Job
 144 subscription.
- 145 6. A Subscription object cannot be contained in or associated with more than one Printer object.

146 **3.2 Notification Configurations for Per-Job Subscriptions**

147 This section describes several configurations of IPP Printer objects that are intended to be able to make use
 148 of Per-Job subscriptions. Per-Printer Subscriptions may be used in addition, but are not shown to simplify
 149 the pictures and understanding.

150 embedded printer:



178 The first configuration show a simple Client - Printer relationship. The Printer delivers the Notifications to
 179 the Notification Recipient(s) supplied by the Client.

180 The second configuration shows a (spooling or non-spooling) Server that implements two Printer objects (1
 181 and 2) that represent two devices that in turn each implement an IPP Printer object (3 and 4, respectively).
 182 The server implements one IPP Printer object (1 and 2) for each such device. The Server implementation
 183 has three choices for how to support Per-Job subscriptions to the client (and itself):

- 184 1. forward the Per-Job subscriptions to the down stream IPP Printer and let it perform the
 185 notification directly to the Notification Recipients supplied by the Client (Notifications(C)) and
 186 use Per-Printer Subscriptions for the Server's own purposes.
- 187 2. save the client-supplied Per-Job subscription on the Job object in the server and substitute its
 188 own Per-Job subscription with the Server as the Notification Recipient (Notifications(B)). Then
 189 the Server relays Notifications to the client-supplied Notification Recipients (Notifications(A)).
- 190 3. A combination of 1 and 2 in which the Server adds its own Per-Job subscriptions to those
 191 supplied by the client. Thus the IPP Job that goes to Printer object 4 has a combination of
 192 subscription information from both the Client and the Server. This latter approach is sometimes
 193 called "piggy-backing" because the Server is adding its Per-Job subscription information to that
 194 supplied by the client. Piggy-backing is especially useful, if device B also accepts (IPP or non-
 195 IPP) requests from other servers. Then when all the jobs from Server S have been completed by
 196 device B, there will be no more Job events sent to Server S. (Server S could still maintain a
 197 long term Per-Printer subscription with Printer D to that Server S can have Printer B's state track
 198 (shadow) that of Printer D or Server S could poll Printer D when queried about Printer B).

199 **4 Object attributes defined for Notification**

200 The following notification attributes are defined for each of the Printer, Job, and (new, but OPTIONAL)
 201 Subscription objects. The explanations about some of the object attributes are collected here so that they
 202 can be referred to from the operations that set them. All Job, Printer, and Subscription object attributes are
 203 READ-ONLY, i.e., they MUST NOT be settable with the Set-Job-Attributes or Set-Printer-Attributes
 204 operations. Instead, all of them are set as a side effect of another operation or when an event notification is
 205 delivered. Attributes and objects not in the current, July 22, spec are labeled as "new":

206 4.1.1 Job object attributes related to notification

Job object attributes:	Printer support	READ-ONLY, set by:
notify-recipients (1setOf uri)	R	job creation operation
notify-events (1setOf type2 keyword)	R	job creation operation
notify-user-data (octetString(63))	R	job creation operation
notify-exclude-event-masks (1setOf octetString(8))	R	job creation operation
notify-natural-languages" (1setOf naturalLanguage)	O	job creation operation

207

job-trigger-event (type2 keyword)	R	Printer - event occurring
job-trigger-time (integer(MIN:MAX))	R	Printer - event occurring
job-trigger-date-time (dateTime)	O	Printer - event occurring
notify-request-ids (1setOf integer(0:MAX))	C	Printer - event occurring

208 **ISSUE 2 - Is there value for a Notification Recipient (or other client) to be able to query the Job and**
209 **determine the most recent sent Event Notification and the time (and date-time) that it was sent or should**
210 **these three Job Description attributes (job-trigger-event (type2 keyword), job-trigger-time**
211 **(integer(MIN:MAX)), and job-trigger-date-time (dateTime)) be removed from the spec?**

212 Attribute Notes:

213 "notify-user-data" (octetString(63)) - information being sent from the Subscriber to the Notification
214 Recipient(s), such as the identify of the Subscriber or a path or index to some Subscriber
215 information or a key that the Notification Recipient needs in order to process the Notification. This
216 information is the same for all Notification Recipients. Per-Notification Recipient data should be
217 specified in the URL registration so that they may be sent as parameters in each URL.

218 "notify-exclude-event-masks" (1setOf octetString(8)) - a REQUIRED per-recipient event mask whose
219 values are parallel to the "notify-recipients" attribute. Each 1 bit indicates that the corresponding
220 recipient is not to receive the 'i'-th event specified in the "notify-events" attribute. The first event in
221 "notify-events" is numbered '1' which corresponds to the first bit (Big Endian network order) of the
222 event mask octetString. If an implementation only supports n events, then the maximum number of
223 octets that an implementation need support for this attribute is not really 8 octets, but is n mod 8.
224 The exclude event mask concept is also used in SNMPv3 trap registration (RFC2573).

225 "notify-natural-languages" (1setOf naturalLanguage) - an OPTIONAL per-recipient natural language
226 specification whose values are parallel to the "notify-recipients" attribute.

227 **ISSUE 3 - OK to add the OPTIONAL "notify-natural-languages" (1setOf naturalLanguage) to the Job**
228 **object and the Job Creation operations, as long as it is OPTIONAL for a Printer to support?**

229 "job-trigger-event" (type2 keyword) - the last Job event that was sent in a Notification for this Job's Per-Job
230 subscription. A value of 'none' is used if the job has not yet had a Job event Notification sent.

231 "job-trigger-time" (integer(MIN:MAX)) - the time (using the "printer-up-time" form) that the last Job event
232 was sent in a Notification for this Job's Per-Job subscription. A value of 0 is used if the job has not
233 yet had a Job event Notification sent.

234 "job-trigger-date-time" (dateTime) - the date-time that the last Job event was sent in a Notification for this
235 Job's Per-Job subscription. A value of 0 is used if the job has not yet had a Job event Notification
236 sent.

237 "notify-request-ids" (1setOf integer(0:MAX)) - the most recent request-ids delivered in a Job Notification
238 content for a Per-Job Subscription for this Job for each of the Job's Notification Recipients. In other
239 words, the "notify-request-ids" is a parallel attribute to the Job's "notify-recipients (1setOf uri)
240 attribute. A value of 0 indicates that no Notifications have been sent for this Job. The first request-
241 id sent for a job MUST be 1. The reason to have a separate request-id for each recipient is so that
242 when more than one Notification Recipient is specified in a subscription, each recipient will have its
243 own monotonically increasing set of request-ids, i.e., no gaps, in order to be able to detect a missing
244 notification

245

246 4.1.2 Printer object attributes related to notification

Printer object attributes:	Printer support	READ-ONLY, set by:
notify-schemes-supported (1setOf uriScheme)	R	Administrator/implementation
max-notification-recipients-supported (integer(1:MAX))	R	Administrator/implementation
notify-events-default (1setOf type2 keyword)	R	Administrator/implementation
notify-events-supported (1setOf type2 keyword)	R	Administrator/implementation
max-recipients-supported (integer(0:MAX))	R	Administrator/implementation
max-events-supported (integer(5:MAX))	R	Administrator/implementation
notify-lease-time-supported (rangeOfInteger(0:MAX))	C	Administrator/implementation
notify-lease-time-default (integer(0:MAX))	C	Administrator/implementation
max-printer-subscriptions-supported (integer(0:MAX))	C	Administrator/implementation
persistent-subscriptions-supported (boolean)	O	Administrator/implementation

247 Attribute Notes:

248 "notify-schemes-supported" (1setOf uriScheme) - the schemes that are supported in Per-Job and Per-Printer
 249 "notify-recipients" operation attributes.

250 "max-recipients-supported" (integer(1:MAX)) - the maximum number of Notification Recipients that are
 251 supported in a Per-Job Subscription and in each Per-Printer Subscription, if supported. A value of 0
 252 indicates no effective maximum. An implementation MUST support at least 3 Notification
 253 Recipients per subscription, so that clients can depend on at least that number of recipients in a
 254 single subscription. If notification is not supported, this attribute MUST NOT be supported.

255 "max-events-supported" (integer(0:MAX)) - the maximum number of events that are supported in a Per-Job
 256 subscription and in each Per-Printer Subscription object, if supported. A value of 0 indicates no
 257 effective maximum. An implementation MUST support at least 5 events per subscription, so that
 258 clients can depend on at least 5 events in a single subscription. If notification is not supported, this
 259 attribute MUST NOT be supported.

260 "notify-lease-time-supported" (rangeOfInteger(0:MAX)) - the minimum and maximum lease time values
 261 supported for "notify-lease-time-requested" operation attributes. When the lease time expires for a
 262 Per-Printer Subscription without renewing, the Printer MUST delete the Subscription object. A
 263 value of 0 indicates an infinite amount of time, i.e., no lease. No lease MAY require authorization.

264 "max-printer-subscriptions-supported" (integer(0:MAX)) - the maximum number of Per-Printer
 265 subscription supported. 0 means there is no limit, if Per-Printer subscriptions are supported. An
 266 implementation MUST support at least 8 Per-Printer Subscription object instances, if it supports
 267 Per-Printer subscriptions, so that clients can depend on at least 8 Per-Printer Subscriptions. If
 268 notification is not supported, this attribute MUST NOT be supported.

269 "persistent-subscriptions-supported" (boolean) - indicates whether or not the Printer supports persistent Per-
 270 Printer Subscriptions, i.e., subscriptions that are preserved across power cycles. If the value is
 271 'false' or that attribute is not supported, Per-Printer Subscriptions MUST NOT be persistent.

272 4.1.3 Subscription object attributes (new and OPTIONAL)

Subscription object attributes:	Printer support	READ-ONLY, set by:
notify-recipients (1setOf uri)	C	client - Create-Printer-Subscription
notify-events (1setOf type2 keyword)	C	client - Create-Printer-Subscription
notify-user-data (octetString(255))	C	client - Create-Printer-Subscription
notify-exclude-event-mask (1setOf octetString(8))	R	client - Create-Printer-Subscription
notify-natural-languages (1setOf naturalLanguage)	O	client - Create-Printer-Subscription

273

subscription-id (integer(1:MAX))	C	Printer - Create-Printer-Subscription
notify-lease-time (integer(0:MAX))	C	Printer - Create-Printer-Subscription
notify-lease-time-granted (integer(0:MAX))	C	Printer - Create-Printer-Subscription
subscriber-user-name (name(MAX))	C	Printer - Create-Printer-Subscription

274

notify-request-ids (1setOf integer(0:MAX))	C	Printer - event occurring
delivery-failure-count (integer(0:MAX))	C	Printer - event occurring

275

ISSUE 4 - It isn't necessary to add a "persistence (boolean)" attribute to the Subscription object in order to record the value passed in the Create-Printer-Subscription operation and to allow it to be queried?

276

277 Attribute Notes:

278 "notify-user-data" (octetString(255)) - same as the "notify-user-data" Job Description attribute (see section
279 4.1.1).

280 "notify-exclude-event-mask" (1setOf octetString(8)) - same as the "notify-exclude-event-mask" Job
281 Description attribute (see section 4.1.1).

282 "notify-natural-languages (1setOf naturalLanguage)" - same as the "notify-natural-languages" Job
283 Description attribute (see section 4.1.1).

284 ISSUE 5 - OK to add the OPTIONAL "notify-natural-languages" (1setOf naturalLanguage) to the
285 Subscription object and the Create-Printer-Subscription operation, as long as it is OPTIONAL for a
286 Printer to support?

287 "subscription-id (integer(1:MAX)) - the subscription id of this Subscription object instance.

288 "notify-lease-time" (integer(0:MAX)) - the time in the future when the subscription lease will expire, i.e.,
289 the "printer-up-time" value at which the lease will expire. When the indicated time arrives, the
290 Printer MUST delete the Per-Printer Subscription object. A client is able to extend a lease using the
291 Renew-Printer-Subscription operation (see section 8.4). A value of 0 indicates an infinite time, if
292 such a policy is supported as indicated in the "notify-lease-time-supported (integer(0:MAX)) Printer
293 Description attribute and the subscriber is authorized to request an infinite lease.

294

295 Note: In order to compute the number of seconds remaining in a Per-Printer Subscription lease, a

296 client can subtract the "printer-up-time" Printer object attribute from the "notify-lease-time"
297 Subscription object attribute.

298 **ISSUE 6 - Should we provide a way for the client to get the "printer-up-time" in a Get-Printer-**
299 **Subscriptions operation, so that the client doesn't have to make two requests?**

300 "notify-lease-time-granted" (integer(0:MAX)) - the number of seconds granted for the subscription when it
301 was created. It is used to restore the subscription on the Restart-Job and Reprocess-Job operations.
302 A 0 value indicates infinite time was granted.

303 "notify-request-ids" (1setOf integer(0:MAX)) - the request-ids that were delivered in the most recent
304 Notifications for the Per-Printer subscription for each of the Notification Recipients in the
305 corresponding parallel "notify-recipients" (1setOf uri) attribute. A value of 0 indicates that no
306 Notifications have been sent for this Per-Printer Subscription to the corresponding recipient. The
307 first request-id sent to a Recipient for this Per-Printer Subscription MUST be 1. The reason to have
308 a separate request-id for each recipient is so that when more than one Notification Recipient is
309 specified in a subscription, each recipient will have its own monotonically increasing set of request-
310 ids, i.e., no gaps, in order to be able to detect a missing notification.

311 "delivery-failure-count" (integer(0:MAX)) - the number of transport delivery failures in delivering a
312 notification to any of the "notify-recipients" using the transport indicated. Note: for the current
313 delivery methods envisioned (see Notification Requirements [ipp-req], Notification Recipients do
314 not respond to the Notification Source, so this count is not the number of unacknowledged
315 notifications.

316 **5 Events**

317 Events are defined to be non-overlapping. So for example, 'job-state-changed' doesn't include creating the
318 job or completing the job. This reduces the need to batch events together, since events tends to happen at
319 different times by definition.

320 Both Job and/or Printer events may be specified for Per-Job or Per-Printer subscriptions:

321 Job events in a Per-Job subscription indicate Job events for *this* job only
322 Job events in a Per-Printer subscription indicates Job events for *all* jobs
323 Printer events in a Per-Job subscription indicate Printer events for *any* job
324 Printer events in a Per-Printer subscription indicate Printer events for *any* job

325 **5.1 Job events**

326 '**none**': REQUIRED - no notifications of any events

327 '**job-created**': REQUIRED - the Printer object has accepted Create-Job, Print-Job, or Print-URI.

328 '**job-completed**': REQUIRED - the job has reached 'completed', 'aborted', or 'canceled'.

329 '**job-state-changed**': REQUIRED - any job state or state-reason changed, except when the job is
330 created or when the job moves to 'completed', 'aborted', or 'canceled'.

331 '**job-config-changed**' - "job-message-from-operator" or any of the non-READ-ONLY Job attributes
332 changed, typically through the Set-Job-Attributes operation.

333 '**job-purged**' - Job-Purged operation on a 'not-completed' job.

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

335 **5.2 Printer events**

336 **'none'** - REQUIRED - no notification of any events

337 **'printer-announce'** - a Per-Job or Per-Printer subscription has been accepted. Specified by a
338 Subscriber that wishes to warn the Notification Recipient that other Printer events are forth
339 coming.

340 **'printer-restarted'** - device powered up or Restart-Printer operation is performed (see [ipp-adm]).

341 **'printer-shutdown'** - device is being powered down or the Shutdown-Printer operation [ipp-adm]).

342 **'printer-state-changed'** - REQUIRED - "printer-state", "printer-state-reasons", and/or "printer-is-
343 accepting-jobs" attributes changed, except when the Printer starts up or is shutdown.

344 **'printer-media-changed'** - when the media loaded ("media-ready") on a printer has been changed.

345 **'printer-config-changed'** - "printer-message-from-operator" or any non-READ-ONLY Printer
346 attributes changed, except for "media-ready" (which has its own event), whether through the
347 Set-Printer-Attributes operation or by other means and whether initiated by a human or not.

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

352 **'printer-no-longer-full'** - the Printer may still be printing but has acquired more buffer space to
353 accept jobs. This event only occurs when the Printer did not have room to accept jobs
354 previously and rejected a Print-Job, Print-URI, Create-Job, Send-Document, or Send-URI
355 operation from any client (desktop or Server).

356 **'printer-almost-idle'** - the Printer needs another Job in order to stay busy. Typically sent to a
357 Server that has subscribed.

358 **6 Notification Content**

359 **ISSUE 7 - How is the User Friendly notification represented, such as is used with the 'mailto:' notification**
360 **delivery scheme? What parts gets translated into the Natural Language of the subscriber (presumed to be**
361 **the same as the recipient), besides the "job-trigger-message" and "printer-trigger-message"? The idea of**
362 **using multipart/report has problems going through firewalls because of attachments, so maybe we need a**
363 **single text message that can be read by humans, and still be parsed by programs for some of the (un-**
364 **translated) keywords attribute names. Perhaps, the trigger-message contains user friendly stuff like job-**
365 **name, printer-name, and the translated job-state and state-reasons values and the rest of the message is a**
366 **series of lines of the form:**

367 `keyword: text`

368 where 'keyword' is the un-translated (i.e, U.S. English) attribute keyword name and the text is the
369 representation of the attribute values. Which attributes would be required beside the "job-trigger-message"
370 and "printer-trigger-message"?

371 The notification content is the same for the current and new models. All attributes indicated are
372 REQUIRED for *all* events, unless inside [] or the comment indicates otherwise:

373 **6.1 Job Event Notification content**

374 The following notification content is sent for both Per-Job and Per-Printer Subscriptions when a Job event
375 occurs (see section 5.1 for Job events):

ISSUE 8 - Most transports only allow 500 to 1000 octets in a packet we have too much stuff.

376 version-number (integer (0:32767))
377 status-code (integer (0:32767)) - with the value: basic-job-event(600)
378 request-id (integer (1:MAX)) - used as notification delivery sequence number for each recipient
379 attributes-charset (charset)
380 attributes-natural-language (naturalLanguage) from "notify-natural-languages" if supported
381 [subscription-id (integer(1:MAX))] MUST if from a Per-Printer subscription
382 job-printer-uri (uri)
383 printer-name (name(127))
384 job-id (integer(1:MAX))
385 job-name (name(MAX))
386 job-trigger-event (type2 keyword)
387 job-trigger-time (integer(1:MAX)) SNMP traps automatically includes
388 [job-trigger-date-time (dateTime)]
389 job-state (type1 enum)
390 job-state-reasons (1setOf type2 keyword)
391 [job-impressions-completed (integer(0:MAX))] only for 'job-completed' event
392 [job-media-sheets-completed (integer(0:MAX))] only for 'job-completed' event
393 job-collation-type (type2 enum) only for 'job-progress' event
394 sheet-completed-copy-number (integer(-2:MAX)) only for 'job-progress' event
395 sheet-completed-document-number(integer(-2:MAX)) only for 'job-progress' event
396 impressions-interpreted (integer(-2:MAX)) only for 'job-progress' event
397 impressions-completed-current-copy (integer(-2:MAX)) only for 'job-progress' event
398

399 **6.2 Printer Event Notification content:**

400 The following notification content is sent for both Per-Job and Per-Printer Subscriptions when a Job event
401 occurs (see section 5.2 for Printer events):

ISSUE 10 - Most transports only allow 500 to 1000 octets in a packet so we have too much stuff here.

version-number (integer (0:32767))
status-code (integer (0:32767)) - with the value: basic-job-event(601)
request-id (integer (1:MAX)) - used as notification delivery sequence number for each recipient
attributes-charset (charset)
attributes-natural-language (naturalLanguage) from "notify-natural-languages" if supported
[subscription-id (integer(1:MAX))] MUST if from a Per-Printer subscription
printer-uri (uri)
printer-name (name(127))
[job-id (integer(1:MAX))] MUST if from a Per-Job subscription
[job-name (name(MAX))] MUST if from a Per-Job subscription
printer-trigger-event (type2 keyword)
printer-trigger-time (integer(1:MAX)) SNMP traps automatically includes
[printer-trigger-date-time (dateTime)]
printer-state (type1 enum)
printer-state-reasons (1setOf type2 keyword)
printer-is-accepting-jobs (boolean)

7 REQUIRED Per-Job Subscription mechanism

This section lists the REQUIRED operation requests and response that have some relation to notification, i.e., that are related to Per-Job subscription. Section 8 lists the OPTIONAL operation requests and responses associated with the OPTIONAL Per-Printer subscription and its Subscription object.

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

As in the current notification spec (July 22, 1999), the usual method for a client to associate one subscription with a Job is to specify the subscription when the job is created. For a Per-Job Subscription, the client supplies the following notification operation attributes with any of the job creation operations (Create-Job, Print-Job, Print-URI), plus Validate-Job (which doesn't create a job or subscription):

notify-recipients (1setOf uri)	REQUIRED for Printer to support
[notify-events (1setOf type2 keyword)]	REQUIRED for Printer to support
[notify-user-data (octetString(255))]	REQUIRED for Printer to support
[notify-exclude-event-mask (octetString(8))]	REQUIRED for Printer to support
[notify-natural-languages" (1setOf naturalLanguage)]	OPTIONAL for Printer to support

See section 4.1.1 for a definition of these operation attributes, since they are copied to the Job object as Job Description attributes.

7.2 Get-Printer-Attributes operation

The Get-Printer-Attributes can be used to request the additional Printer Description attributes that indicate the notification supported. See section 4.1.2.

440 **7.3 Get-Job-Attributes operation**

441 The Get-Job-Attributes can be used to request the additional Job Description attributes that relate to
 442 notification. See section 4.1.1.

443 **7.4 Set-Job-Subscription operation**

444 The Set-Job-Subscription operation allows a client to change the Job attributes of the Job's Per-Job
 445 subscription, including to add them in the first place and to remove them from the Job object. This
 446 operation replaces all the values of the supplied notification attributes: "notify-recipients", "notify-events",
 447 "notify-user-data", and "notify-exclude-event-mask" Job attributes. Any notification attributes not supplied
 448 are not affected. In order to cancel a Per-Job subscription, the client supplies the "notify-events" with a
 449 'none' value. **ISSUE 11 - or should canceling a Per-Job subscription be done by supplying the out-of-band**
 450 **'no-value' value for "notify-recipients" in a Set-Job-Subscription operation, instead of 'none' to "notify-**
 451 **events", since "notify-recipients" is the attribute that indicates that there is notification in a job creation**
 452 **operation?** In order to remove the user-data (octetString(63)), the client supplies an
 453 octetString with zero length. In order to remove the "notify-exclude-event-mask (octetString(8))", the
 454 client supplies a octetString with zero length.

455 Request :

Group 1: Operation Attributes		Printer support
	"attributes-charset"	R
	"attributes-natural-language"	R
	"printer-uri" (uri)	R
	"requesting-user-name" (name(MAX))	RECOMMENDED
	["notify-recipients" (1setOf uri)]	R
	["notify-events" (1setOf type2 keyword)]	R
	["notify-user-data" (octetString(255))]	R
	["notify-exclude-event-mask" (1setOf octetString(8))]	R
	["notify-natural-languages" (1setOf naturalLanguage)]	O

456 Response :

Group 1: Operation Attributes		Printer support
	"status-code" (type2 enum)	R
	"attributes-charset"	R
	"attributes-natural-language"	R
	["status-message" (text(255))]	O
	["detailed-status-message" (text(MAX))]	O
Group 2: Unsupported Attributes		R

457 See section 4.1.1 for a definition of these operation attributes, since they are copied to the Job object as Job
 458 Description attributes.

459 **8 OPTIONAL Per-Printer Subscriptions and the Subscription object**

460 This section lists the operation requests and responses that **MUST** be supported if the **OPTIONAL** Per-
 461 Printer Subscriptions are supported which **REQUIRES** that the Subscription object be supported and vice
 462 versa.

463 **8.1 Create-Printer-Subscription operation**

464 The Create-Printer-Subscription operation creates a Per-Printer subscription by creating a Per-Printer
 465 Subscription object which is added to the Printer object.

466 Request :

Group 1: Operation Attributes	Printer support
"attributes-charset" (charset)	R
"attributes-natural-language" (naturalLanguage)	R
"printer-uri" (uri)	R
["requesting-user-name" (name(MAX))]	RECOMMENDED
"notify-recipients" (1setOf uri)	R
["notify-events" (1setOf type2 keyword)]	R
["notify-user-data" (octetString(255))]	R
["notify-exclude-event-mask" (1setOf octetString(8))]	R
["notify-natural-languages" (1setOf naturalLanguage)]	O
["notify-lease-time-requested" (integer(0:MAX))]	R
["notify-persistence" (boolean)]	O

467 Response :

Group 1: Operation Attributes	Printer Support
"status-code" (type2 enum)	R
"attributes-charset" (charset)	R
"attributes-natural-language" (naturalLanguage)	R
["status-message" (text(255))]	O
["detailed-status-message" (text(MAX))]	O
"subscription-id" (integer(1:MAX))	R
"notify-lease-time" (integer(0:MAX))	R
"notify-lease-time-granted" (integer(0:MAX))	R
Group 2: Unsupported Attributes	R

468 Attribute Notes:

469 "notify-lease-time-requested" (integer(0:MAX)) - the number of seconds requested for the Per-Printer
 470 subscription lease. A value of 0 indicates a request that the Per-Printer Subscription lease never
 471 expire. Supplying a 0 value MAY require authentication in order to be used, if 0 is supported at all.

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

474 **ISSUE 12 - Ok to have added the OPTIONAL "notify-persistence" (boolean) operation attribute to**
 475 **the Create-Printer-Subscription operation?**

476 "notify-lease-time" (integer(0:MAX)) - the time in the future at which the subscription lease will expire,
 477 i.e., the "printer-up-time" value (in time ticks) at which the lease will expire. A value of 0 indicates
 478 that the lease subscription will never expire.

479 "notify-lease-time-granted" - number of seconds of time actually granted. The value of "notify-lease-time-
 480 granted" may be less than the requester requested in the "notify-lease-time-requested" if it was

481 greater than the MAX supported or more than the requester requested if it was less than the MIN
 482 supported, as indicated in the Printer's "lease-time-supported" (rangeOfInteger(0:MAX)) attribute.

483 **8.2 Get-Printer-Subscription-Attributes operation**

484 The Get-Printer-Subscription-Attributes returns the requested attributes of the identified Per-Printer
 485 Subscription object. See section 4.1.3.

486 Request:

Group 1: Operation Attributes		Printer support
	"attributes-charset"	R
	"attributes-natural-language"	R
	"printer-uri" (uri)	R
	["requesting-user-name" (name(MAX))]	RECOMMENDED
	"subscription-id" (integer(1:MAX))	R
	["requested-attributes" (1setOf type2 keyword)]	R

487 Response:

Group 1: Operation Attributes		Printer support
	"status-code" (type2 enum)	R
	["status-message" (text(255))]	O
	["detailed-status-message (text(MAX))]	O
	"attributes-charset"	R
	"attributes-natural-language"	R
Group 2: Unsupported Attributes		R
Group 3: <the requested Subscription object attributes>		R

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

491 **8.3 Get-Printer-Subscriptions operation**

492 The Get-Printer-Subscriptions operation returns Per-Printer subscriptions, i.e., Subscription objects.

493 Request :

Group 1: Operation Attributes		Printer support
	"attributes-charset"	R
	"attributes-natural-language"	R
	"printer-uri" (uri)	R
	["requesting-user-name" (name(MAX))]	RECOMMENDED
	["limit" (integer(1:MAX))]	R
	["requested-attributes" (1setOf type2 keyword)]	R
	["my-subscriptions" (boolean)]	R

494 Response :

Group 1: Operation Attributes		Printer support
	"status-code" (type2 enum)	R
	"attributes-charset"	R
	"attributes-natural-language"	R
	["status-message" (text)]	O
	["detailed-status-message" (text(MAX))]	O
Group 2: Unsupported Attributes		R
Group 3 to N:<the requested Subscription Attributes for each Subscription object in a separate group>		R

495

496 Notes: This operation is similar to the Get-Jobs operation. If the client wants any attributes returned,
 497 including the "subscription-id", it must include the attribute keyword name in the "requested-attributes"
 498 operation attribute. If the "requested-attributes" operation attribute is omitted, the Printer MUST respond as
 499 if the client supplied the value: 'subscription-id'.

500 **8.4 Renew-Printer-Subscription operation**

501 The Renew-Printer-Subscription operation permits a client to request the IPP Printer to extend the lease on
 502 a Per-Printer Subscription object instance.

503 Request :

Group 1: Operation Attributes	Printer support
"attributes-charset"	R
"attributes-natural-language"	R
"printer-uri" (uri)	R
"requesting-user-name" (name(MAX))	RECOMMENDED
"subscription-id" (integer(1:MAX))	R
"notify-lease-time-requested" (integer(0:MAX))	R

504 Response :

Group 1: Operation Attributes	Printer support
"status-code" (type2 enum)	R
"attributes-charset"	R
"attributes-natural-language"	R
["status-message" (text(255))]	O
["detailed-status-message" (text(MAX))]	O
"notify-lease-time" (integer(0:MAX))	R
"notify-lease-time-granted" (integer(0:MAX))	R
Group 2: Unsupported Attributes	R

505 Notes: The Printer object MUST return the "notify-lease-time-granted" which is the number of seconds
 506 actually granted. This value MAY be less than the requester requested if it was greater than the MAX
 507 supported or more than the requester requested if it was less than the MIN supported, as indicated in the
 508 Printer's "lease-time-supported" (rangeOfInteger(0:MAX)) attribute.

509 The Printer object MUST return the "notify-lease-time-granted" which is the number of seconds remaining
 510 in the lease and the "notify-lease-time" which is the time in the future, i.e., the value of the Printer's
 511 "printer-up-time" (time-ticks) that the notification will be canceled by the Printer.

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

517 ISSUE 13 - What happens if the client supplies a 0 for the "notify-lease-time-requested" operation
 518 attribute? Does that result in a canceling of the Subscription? Is that ok? Ok to keep Cancel-Printer-
 519 Subscription operation too?

520 ISSUE 14 - Ok that Renew-Printer-Subscription doesn't allow any modification of the Subscription object
 521 attributes, except the "notify-lease-time" attribute? If we need a way to change other attributes would we
 522 add it to this same operation and rename it to Set-Printer-Subscription? Having a Set-Printer-Subscription
 523 operation would allow a client/server to set the "notify-events" to 'none' and thereby reserve a slot using the

524 lease time, but not have any Notifications until a subsequence Set-Printer-Subscription operation was done
525 that set some events.

526 Note: There is no need to renew a Per-Job Subscription, since it is effectively the time that the Job has
527 documents.

528 **8.5 Cancel-Printer-Subscription operation**

529 The Cancel-Printer-Subscription operation allows a client to remove a Per-Printer Subscription object from
530 the Printer. No more Notifications are delivered for that Subscription. Once performed, there is no way to
531 use that Subscription in the future. Subscription-ids should not be reused immediately, so that a stale
532 reference situation is not created. Same as for Cancel-Job and job-ids.

533 Request :

Group 1: Operation Attributes		Printer support
	"attributes-charset"	R
	"attributes-natural-language"	R
	"printer-uri" (uri)	R
	["requesting-user-name" (name(MAX))]	RECOMMENDED
	"subscription-id" (integer(1:MAX))	R

534 Response :

Group 1: Operation Attributes		Printer support
	"status-code" (type2 enum)	R
	"attributes-charset"	R
	"attributes-natural-language"	R
	["status-message" (text(255))]	O
	["detailed-status-message" (text(MAX))]	O
Group 2: Unsupported Attributes		R

535

536 **9 References**

537 [ipp-mod]

538 deBry, R., , Hastings, T., Herriot, R., Isaacson, S., Powell, P., "Internet Printing Protocol/1.1: Model
539 and Semantics", <draft-ietf-ipp-model-v11-04.txt>, work in progress, June 23, 1999.

540 [ipp-prog]

541 Hastings, T., Bergman, R., Lewis, H., "Proposed Job Progress Attributes for IPP", <ipp-job-prog-
542 attr-990518.txt> work in progress, May 18, 1999.

543 [ipp-req]

544 Hastings, T., Manros, C., "Internet Printing Protocol/1.1: Requirements for IPP Notification",
545 <draft-ietf-ipp-not-03.txt> work in progress, Aug 11, 1999.

546 [RFC2573]

547 D. Levi, P. Meyer, B. Stewart, "SNMP Applications", RFC 2573, April 1999.

548 **10 Change History**

549 The following changes have been made to this Notification Model document, in reverse chronological
550 order:

551 **10.1 Changes made from 99/08/07 version to make the 99/08/11 version**

552 The following changes were made from the 99/08/07 version to make the 99/08/11 version as result of the
553 IPP telecon, 9908/11:

- 554 1. Changed the name of the Replace-Job-Subscription operation to Set-Job-Subscription, since it can add,
555 remove or change Job notification attributes, not just replace them.
- 556 2. Added the configuration pictures.
- 557 3. Reduced the size of "notify-user-data" from 255 octets to 63 octets, since it is also send in the
558 Notification content which has a limit of 480 or so octets on some transports.
- 559 4. Changed the conformance requirements for the "notify-exclude-event-masks (1setOf octetString(8))"
560 operation attributes in Job creation and Create-Printer-Subscription operations from OPTIONAL to
561 REQUIRED, since their implementation means that clients can count on it. Also the minimum number
562 of Per-Printer Subscriptions can be less, since a client won't be forced to use multiple subscriptions
563 when recipients have different events. Finally, SNMPv3 has the exclude mask mechanism.
- 564 5. Added the OPTIONAL "notify-natural-languages" (1setOf naturalLanguage) Job Description attribute
565 so that each Notification Recipient could get a requested natural language, instead of the one in the Job
566 creation request.
- 567 6. Deleted the "job-trigger-message" Job Description attribute from Job object attribute. The client can
568 localize the remaining Job attributes on its slow scan in case Notifications are dropped.
- 569 7. Added the "notify-request-ids (1setOf integer(0:MAX))" Job Description attribute to the Job object to
570 indicate (and remember) the most recent request-id delivered for each Notification Recipient.
- 571 8. Deleted "previous-job-state (type1 enum)" and "job-state-reasons-added (1setOf type2 keyword)" and
572 "job-state-reasons-deleted (1setOf type2 keyword)" from the Job object. The "job-state-reasons" value
573 has enough information about why the Job is in the current state, so that we don't need the previous
574 state and state reasons for the slow scan polling Notification Recipient that is attempting to overcome
575 possible dropped Notifications.
- 576 9. Added REQUIRED "max-recipients-supported (integer(0:MAX))" Printer Description attribute to the
577 Printer object to indicate the max number of Per-Job and Per-Printer Notification Recipients supported
578 in each subscription. REQUIRE a minimum of 3 recipients.
- 579 10. Added the requirement that at least 8 Per-Printer Subscription object instances MUST be supported, if
580 Per-Printer subscriptions are supported. With the exclude mask, such a low number as 8 isn't too
581 restrictive on clients and isn't too expensive for low end devices.

- 582 11. Added the OPTIONAL "persistent-subscriptions-supported" (boolean) Printer Description attribute to
583 the Printer object to indicate whether or not the Printer supports persistent Per-Printer Subscriptions.
- 584 12. Changed the Printer support requirements for the "notify-exclude-event-mask" (1setOf octetString(8))
585 from OPTIONAL to REQUIRED, so that clients can count on it and to reduce the number of
586 Subscription objects that a Printer MUST support.
- 587 13. Added the OPTIONAL "notify-natural-languages" (1setOf naturalLanguage) Subscription object
588 attribute so that each Notification Recipient could get a requested natural language, instead of the one in
589 the Create-Printer-Subscription request.
- 590 14. Added the "subscription-id" attribute to the Subscription object so that each object instance is identified
591 in a manner analogous to Job objects.
- 592 15. Changed the name of "most-recent-request-id" to "notify-request-ids" for consistency in naming and to
593 be the same as the corresponding Job Description attribute ("notify-request-ids").
- 594 16. Changed the name of the "notify-lease-time-remaining" Subscription object attribute to "notify-lease-
595 time". Changed the semantics from the lease time interval requested to the "printer-up-time" (time
596 ticks) that the lease expires. The client can subtract the "printer-up-time" from the "notify-lease-time"
597 to find out how much time is left on the lease. This change makes the attribute value be a constant,
598 instead of having to be recomputed on each Get-Printer-Subscription-Attribute request.
- 599 17. Changed the name of the "notify-lease-time (integer(0:MAX))" Subscription object attribute to "notify-
600 lease-time-granted (integer(0:MAX))" and indicated that it is set by the Printer not the client.
- 601 18. Added 'printer-announce' event, so that the Subscriber can have the Notification Recipient be warned
602 that other Printer events are forth coming.
- 603 19. Added 'printer-queue-changed' - so that an application that is monitoring the queue can re-fetch the
604 queue with Get-Jobs.
- 605 20. Added "attributes-charset" and "attributes-natural-language" to the Job and Printer Notification content,
606 since the content is an 'application/ipp' MIME type for an IPP response.
- 607 21. Added "printer-name (name(127))" and "job-name (name(MAX))" to Job and Printer Notification
608 Content. These are helpful to end users to identify from whence came a notification.
- 609 22. Deleted the "job-trigger-message (text(255))" from the Job Notification content since the data is already
610 available in other attributes that the recipient should localize to present to a human. Also the Human
611 Consumable form will have many of the attributes when it is used.
- 612 23. Deleted "previous-job-state (type1 enum)" and "job-state-reasons-added (1setOf type2 keyword)" and
613 "job-state-reasons-deleted (1setOf type2 keyword)" from the Job Notification content. The current
614 "job-state-reasons" value has enough information about why the Job is in the current state, so that we
615 don't need the previous state and state reasons.

- 616 24. Deleted the "printer-trigger-message (text(255))" from the Printer Notification content, since the data is
617 already available in other attributes that the recipient should localize to present to a human. Also the
618 Human Consumable form will have many of the attributes when it is used.
- 619 25. Added [job-id (integer(1:MAX))] and [job-name (name(MAX))] to the Printer Notification content for
620 when the event is from a Per-Job subscription.
- 621 26. Deleted "previous-printer-state (type1 enum)" and "printer-state-reasons-added (1setOf type2
622 keyword)" and "printer-state-reasons-deleted (1setOf type2 keyword)" from the Printer Notification
623 content. The current "printer-state-reasons" value has enough information about why the Printer is in
624 the current state, so that we don't need the previous state and state reasons.
- 625 27. Added "printer-is-accepting-jobs (boolean)" attribute to the Printer Notification content, since it is a
626 state variable and its change causes the 'printer-state-change' event.
- 627 28. Added the definition of the Set-Job-Subscription operation.
- 628 29. Changed the name of "notify-lease-time" operation attribute in the Create-Printer-Subscription
629 operation to "notify-lease-time-requested" to distinguish it from the "notify-lease-time" (uptime ticks)
630 and "notify-lease-time-granted" returned in the response.
- 631 30. Added the "notify-persistence (boolean)" operation attribute to the Create-Printer-Subscriptions to
632 indicate whether the notification content delivery is to make the Per-Printer Subscription be permanent.