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16 July 22, 1999

17 Internet Printing Protocol/1.0 & 1.1: **IPP Event Notification**  
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19  
20 **Status of this Memo**

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30 **Abstract**

31 This document describes an extension to the IPP/1.0 & IPP/1.1 model that allows end users to subscribe  
32 to printing related events. Subscriptions include "Job Submission Subscription" and "Explicit  
33 Subscriptions".

34 "Job Submission Subscriptions" are specified by the end-user when submitting a job. "Explicit  
35 Subscriptions" are created by performing explicit subscription operations on the Printer or an identified  
36 Job object.

37 A subscription includes:

- 38 - the names of events that are of interest to the subscriber
- 39 - the delivery methods and addresses to use for notifications (socket, email, etc.)

40 Job Submission Subscriptions: A simple method is provided for subscribing to printing related events  
41 when a job is submitted:

- 42 - Two new subscription attributes are supplied by the client as part of an IPP create request (Print-  
43 Job, Print-URI, Create-Job, Validate-Job): "notify-recipients (1setOf uri)" and "notify-events  
44 (1setOf type2 keyword)".

45 An event is some occurrence (either expected or unexpected) within the printing system. Events can be  
46 classified along two dimensions:

- 47 - Either as Job Events or Printer Events, and
- 48 - Either as Errors, Warnings, or Reports

49

50 "Explicit Subscriptions": Three new Printer operations are specified: Subscribe-Job, Subscribe-Printer,  
51 Renew-Subscription, and Unsubscribe. The semantics of the two subscription Operation attributes  
52 ("notify-events" and "notify-recipients") used in create operations is preserved. These two subscription  
53 attributes are supplied by the client as operation attributes in this new Subscribe operation, along with a  
54 new "notify-lease-time" operation attribute.

55 A client can remove a subscription explicitly using the Unsubscribe operation or can let the lease time  
56 expire. A client can extend the lease time for a subscription using the Renew-Subscription operation.

57

58 When the event occurs, a notification is generated and delivered using the information specified in the  
59 job's subscription which was submitted with the job.

60

61 The full set of IPP documents includes:

- 62 Design Goals for an Internet Printing Protocol [IPP-REQ]
- 63 Rationale for the Structure and Model and Protocol for the Internet Printing Protocol [IPP-RAT]
- 64 Internet Printing Protocol/1.1: Model and Semantics [IPP-MOD]
- 65 Internet Printing Protocol/1.1: Encoding and Transport [IPP-PRO]
- 66 Internet Printing Protocol/1.0: Implementer's Guide [IPP-IIG]
- 67 Mapping between LPD and IPP Protocols [IPP LPD]

68

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

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

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

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

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

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

95  
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167

168 **1 Model for Job and Printer Event Notification**

169 "Job Submission Subscriptions" are created by the end-user upon creation of the job. "Explicit  
170 Subscriptions" are accomplished by performing independent operations on the printer or a certain job.

171 Figure 1 shows the "Job Submission Subscription" model.

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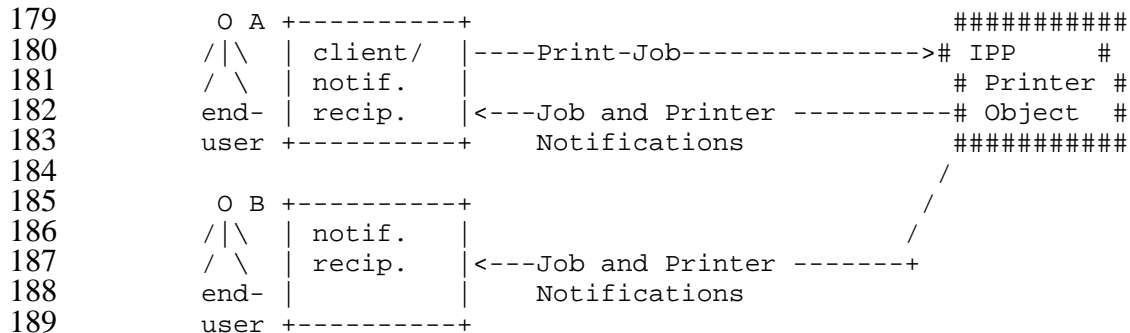
174 Legend:

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176 A = Client and Notification Recipient

177 B = Notification Recipient

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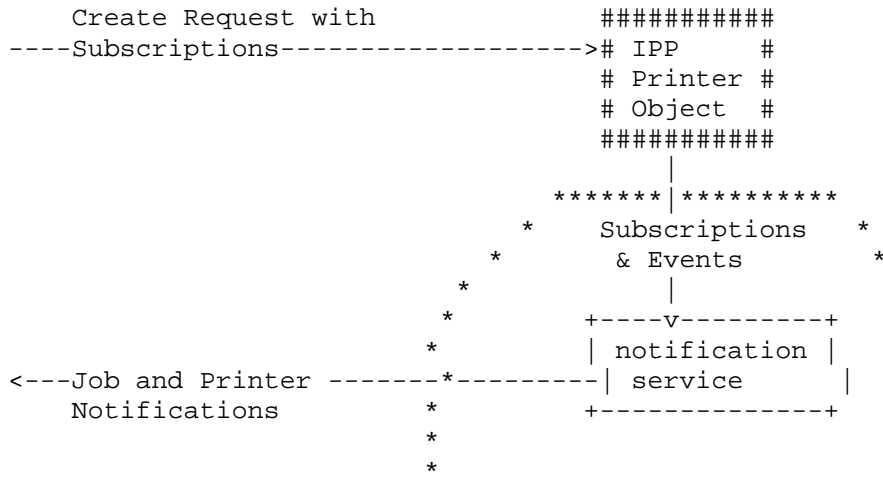
191

192 **Figure 1 - Model for "Job Submission" Notification**

193 Note: This model does not mandate that the IPP Printer object implement the full semantics of  
194 subscription, report generation, and multiple delivery methods. A simple (embedded) implementation  
195 may be configured to use some notification service. Figure 2 shows this partitioning.

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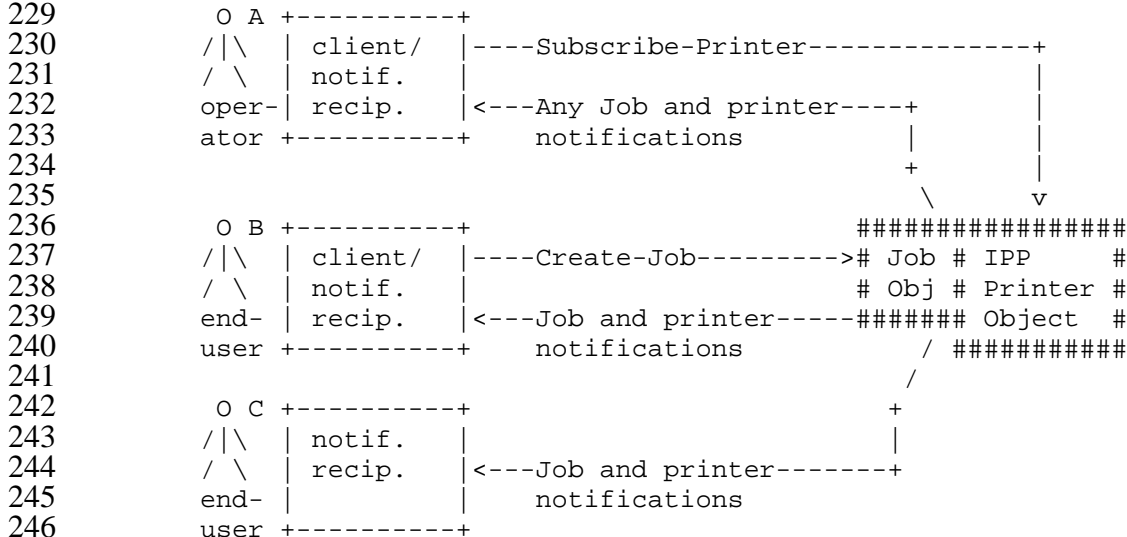
\*\*\* = Implementation configuration opaque boundary

**Figure 2 - Opaque Use of a Notification Service**

219 Figure 3 shows the "Explicit Subscription" model.

220  
221 Legend:

- 222 A = Explicit Subscription Client and
- 223 Notification Recipient
- 224 B = Job Submission Subscription Client and
- 225 Notification Recipient
- 226 C = Notification Recipient (subscription by some third party)



248 An accounting application may be used as Element A which subscribes to the events  
249 of a printer and receives all job and printer notifications.

251 **ISSUE 1:** Do we need to add a Subscription object that contains the "notify-recipients", "notify-events",  
252 "subscription-id", and "lease-time" attributes (and possibly the opaque subscription attribute, if we add  
253 it)? The Subscription object is contained in the Printer or Job object for each Explicit Printer or Job  
254 subscription created. In the case of Job Submission Subscription, the Subscription object is degenerate  
255 and the Job has only the "notify-recipients" and the "notify-events" attributes. The subscription-id is  
256 used in operations on the Subscription object, in addition to the Job or Printer object target.

257 **Figure 3 - Model for "Explicit Subscription" Notification**

258

259 **2 Summary of the Event Notification specification**

260 This Event Notification specification MAY be implemented by IPP clients and objects.  
261 Implementations conforming to this notification specification MUST support the following new  
262 REQUIRED attributes and MAY support the following new OPTIONAL attributes:

- 263 1. Two new REQUIRED multi-valued subscription Operation attributes and Job Description attributes:

264 <b>attribute name</b>	<b>Syntax</b>
265 -----	-----



266 "notify-recipients" 1setOf uri  
267 "notify-events" 1setOf type2 keyword

268  
269 The presence of the "notify-recipients" indicates that notification is desired. The values of "notify-  
270 recipients" are URIs that identify the notification delivery method and delivery address to use for  
271 notifications (See Section 5.1.1). The delivery method dictates the notification content type to be  
272 used. For example, 'mailto' uses "multipart/report" and 'ipp-tcp-notify' uses "application/ipp". The  
273 values for "notify-events" are keywords representing job events or printer events (See Section 5.1.2).  
274 Each event implies a set of attributes to be sent in the notification.

275  
276 These subscription operation attributes can be supplied by the client in any of the IPP job submission  
277 operations: Print-Job, Print-URI, Create-Job, and Validate-Job. Subscriptions that include interest in  
278 job events apply only to the job being submitted and no other job.

279 A subscription does *not* include:

- 280 - complicated lists and sets of names of individual events that are of interest to the subscriber
- 281 - arbitrary lists of additional attributes to be returned in the notification
- 282 - specification of which format to use in the notification

- 283  
284
- 285 2. REQUIRED "notify-recipients" and "notify-events" Job Description attributes are populated from  
286 the corresponding create request Operation attributes of the same names.
  - 287 3. REQUIRED Printer Description attributes: "notify-recipients-schemes-supported" and "notify-  
288 events-supported" that describe the notification delivery methods and the events that it supports,  
289 respectively.
  - 290 4. REQUIRED Job Description attributes: "job-trigger-events" and "job-trigger-time" that store the  
291 current/last job event and its time in seconds since the printer was started; "previous-job-state" and "  
292 job-state-reasons-added" and "job-state-reasons-deleted" that present what values changed regarding  
293 job state.
  - 294 5. OPTIONAL Job Description attribute: "job-trigger-date-time"
  - 295 6. CONDITIONAL Job Description attribute: "job-trigger-message" if "status-message" is supported as  
296 an Operation attribute.
  - 297 7. REQUIRED Printer Description attributes: "printer-trigger-events" and "printer-trigger-time" that  
298 store the current/last printer event and its time in seconds since the printer was started; "previous-  
299 printer-state" and "printer-state-reasons-added" and "printer-state-reasons-deleted" that present what  
300 values changed regarding printer state.
  - 301 8. OPTIONAL Printer Description attribute: "printer-trigger-date-time"
  - 302 9. CONDITIONAL Printer Description attribute: "printer-trigger-message" that MUST be supported if  
303 "status-message" is supported as an Operation attribute.

304 There are two steps that IPP notification must take regarding each event – an internal event recording,  
305 and an external notification. 1) As events occur, the printer internally records in the job objects and the  
306 printer objects those events which are required to be supported by the system and those that are  
307 subscribed to by a notification recipient. 2) As events occur, for each event the Printer searches the set

308 of subscriptions for any interest in that event. As the Printer finds that some notification recipient is  
309 interested in that event (the notification recipient is subscribed to the event), the sequence number for  
310 that event is incremented and a notification is generated and delivered using the methods and target  
311 addresses identified in the subscription. The sequence number permits a Notification Recipient to detect  
312 duplicate notifications due either to duplicate subscriptions or retries and to detect dropped notifications.  
313 If "Explicit Subscription" is implemented, the IPP Printer MUST support three new Printer operations:  
314 Subscribe-Printer, Renew-Subscription, and Unsubscribe. These operations allow a client that is not  
315 submitting a job to subscribe, renew a subscription, and to unsubscribe independently from job  
316 submission. In addition, the Subscribe-Job operation permits a client to add a subscription to an already  
317 submitted job.

318 A REQUIRED operation attribute, "notify-lease-time", specifies the length of time in seconds that the  
319 subscription is to be in effect, after which the subscription is automatically canceled.

320 A REQUIRED operation attribute, "subscription-id", allows a client to maintain a reference to the  
321 applicable subscriptions made and know which notifications were generated as a result of this  
322 subscription.

323 The subscription created by a Subscribe-Job or Subscribe-Printer operation is called an "Explicit  
324 Subscription". Just like Job Submission Subscriptions, these subscriptions can include job and/or printer  
325 events. Subscriptions for Job Events in Subscribe-Job operation apply to that job only, while Job events  
326 in the Subscribe-Printer operation apply to all jobs. For the Subscribe-Printer subscriptions, it is most  
327 likely that the subscribing entity is either a server-based device management application submitting jobs  
328 to a device which has IPP embedded in it or an accounting application collecting accounting data.

### 329 3 Terminology

330  
331 Capitalized terms, such as MUST, MUST NOT, REQUIRED, SHOULD, SHOULD NOT, MAY,  
332 NEED NOT, and OPTIONAL, have special meaning relating to conformance to this  
333 specification. These terms are defined in [ipp-mod section 13.1 on conformance terminology,  
334 most of which is taken from RFC 2119 [RFC2119].

335 READ-ONLY - indicates an attribute the MUST NOT be settable using the Set-Job-Attributes or  
336 Set-Printer-Attributes operations.

337 **Job Submitting End User** - A end user who submits a print job to an IPP Printer.

338 **IPP Client** - The software component on the client system which implements the IPP protocol.

339 **Job Recipient** - A human who is the ultimate consumer of the print job. In many cases this will be  
340 the same person as the Job Submitting End User, but need not be.

341 **Job Recipient Proxy** - A human acting on behalf of the Job Recipient. In particular, the Job  
342 Recipient Proxy physically picks up the printed document from the Printer, if the Job Recipient  
343 cannot perform that function.

344 **Subscription** - The set of attributes that indicate the "what, where, who, and how" for notification.  
345 Notifications are generated for certain events (what) and delivered using various delivery  
346 methods (how) to certain addresses (where and who).

347 **Job Submission Subscription** - A Subscription that a client specifies as part of a create job  
348 operation (Print-Job, Print-URI, Create-Job, and Validate-Job).

349 **Explicit Subscription** - A Subscription that a client specifies using an explicit operation, Subscribe-  
350 Job, Subscribe-Printer, that is attached to a Job or Printer object, respectively.

351 **Notification Recipient** - Any entity identified as a recipient within a subscription. Some  
352 notification recipients are Job Submitting End Users and others are interested third parties, such  
353 as the Job Recipient or Job Recipient Proxy.

354 **Notification Recipient Agent** - A program which receives notifications on behalf of the notification  
355 recipient.

356 **Event** - An event is some occurrence (either expected or unexpected) within the printing system. A  
357 property of an event is that it only occurs at one instant in time and does not span the time the  
358 physical event takes place. For instance, jam-occurred and jam-cleared are two distinct events.  
359 The jam-occurred event is reported only when the jam initially occurs. Each event is recorded  
360 internally when it occurs. In addition the event is reported externally if there is one or more  
361 event subscriptions outstanding for that event.

362

363 Events can be classified along two dimensions:  
364 - Either as Job Events or Printer Events, and  
365 - Either as Errors, Warnings, or Reports  
366

367 A Job event is some interesting state change in the Job object, and a Printer event is some  
368 interesting change in the Printer object.  
369

370 A report event is purely informational, such as 'job-completed' or 'accepting-jobs'. A warning is  
371 not serious and processing continues. An error is serious and either the job is aborted or the  
372 printer stops. These are typical uses of the terms report, warning, and error, although the actual  
373 usage is implementation dependent.  
374

375 An event occurs for a job or printer whether any entity is registered to be notified for that event  
376 or not. The most recent event(s) of all possible events are recorded in a job object and a printer  
377 object, and a notification is only generated depending on the set of subscriptions outstanding.  
378

379 **Notification** - When an event occurs, a notification is generated that fully describes the event (what  
380 the event was, where it occurred, when it occurred, etc.). Notifications are delivered to all the  
381 Notification Recipients that are subscribed to that event, if any. The notification is delivered to  
382 the address of the Notification Recipient using the notification delivery method defined in the  
383 subscription. However, a Notification is sent ONLY if there is a corresponding subscription.

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

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

389 **Queued Notification** - Notifications that are delivered using a delivery method which has some sort  
390 of store-and-forward mechanism (e.g., email).

391 **Human Consumable Notification** - Notifications that are intended to be consumed by human end  
392 users only. (Further define)

393 **Machine Consumable Notification** - Notifications that are intended for consumption by a program  
394 only. (Further define)

395 **Mixed Format Notification** - A mixed notification may contain both human consumable and  
396 machine consumable information.

## 397 **4 Job Submission Subscriptions versus Explicit Subscriptions**

398 There are semantic differences between job submission subscriptions and explicit subscriptions. A "Job  
399 Submission Subscription" is established between the client and the device when a job create request is  
400 made. The attributes as specified in this document are sent to the device and the response includes  
401 attributes telling the client if the subscription was successful or not. An "Explicit Subscription" is  
402 established between a client and a device using the four new operations: Subscribe-Job, Subscribe-  
403 Printer, Unsubscribe, and Renew-Subscription. Some specific differences are:

- 404 1. Either type of subscription can register for job events, printer events, or both.
- 405 2. For "Job Submission Subscriptions" and the Subscribe-Job operation, the subscription is only valid  
406 while the job is "not-complete" (see sections 5 and 6).
- 407 3. For the Subscribe-Printer operation, the subscription is valid until it is explicitly canceled with an  
408 Unsubscribe operation or the time (in seconds) that was specified in the "notify-lease-time"  
409 operation attribute expires, whichever occurs first.
- 410 4. Job Events in a "Job Submission Subscription" and Subscribe-Job operation apply only to "one job"  
411 (the Job specified within the create-job or subscribe-job operation).
- 412 5. Job Events in a Printer-Subscription operation apply to ALL jobs contained in the IPP Printer object.
- 413 6. Printer Events in all subscriptions apply no matter which job is being processed.

414

## 415 **5 Job Submission Subscription**

416 "Job Submission Subscriptions" are specified by the end-user when submitting a job to the Printer using  
417 two new subscription operation attributes described in this section. A client subscribes to events by  
418 supplying these attributes in any create request (i.e., a Print-Job Request, Print-URI Request, Validate-  
419 Job Request, or a Create-Job Request). These attributes are multi-valued attributes; the client can supply  
420 more than one value. If the client does not supply these attributes in the create operation, there is no  
421 subscription made (either implicitly or explicitly). However, a client can add a subscription to a  
422 previously created Job object using the Subscribe-Job operation (see section 6.1).

423 The following rules apply:

- 424 1. Any subscription can contain job events, printer events, or both.
- 425 2. The Job Submission Subscription is only valid while the job is "not-completed". The job is "not-  
426 completed" while it is in the 'pending', 'pending-held', 'processing', and 'processing-stopped' states.  
427 The job changes from being "not-completed" to "retained" when it is done processing and enters any  
428 of the 'completed', 'canceled', or 'aborted' states. The job becomes "not-completed" again when it is  
429 restarted using the Restart-Job operation (see [ipp-mod]). Since no job is created for the Validate-  
430 Job operation, the only purpose of supplying the subscription operation attributes in the Validate-Job

- 431 operation is to validate that the values are supported; the Printer object does not establish a  
432 notification subscription as a result of the Validate-Job operation.
- 433 3. Since a Job Submission Subscription is included within a job submission operation, any interest in  
434 job events is limited to "this job" only (the Job object created because of this job creation operation).  
435 There is no mechanism to subscribe to events for all jobs or specifically some job other than this job  
436 in a create operation. But see the Subscribe-Printer operation (section 6.2) for an explicit operation  
437 to subscribe persistently for job and/or printer events independently of any particular job submission.
  - 438 4. Event recording internal to the system must always occur for required events and subscribed events.  
439 Event reporting only occurs when a notification recipient has specified a subscription to any  
440 event(s).
  - 441 5. The notification implementation MAY allow an administrator to configure a policy on what events  
442 may be dropped.

443

## 444 **5.1 Subscription operation attributes**

445 Two subscription operation attributes are OPTIONALLY supplied by the client in create operations:  
446 Print-Job, Print-URI, Create-Job, and Validate-Job. Both operation attributes are REQUIRED to be  
447 supported by Printer objects that support this notification specification. These operation attributes  
448 permit a client to specify a single subscription consisting of one or more job and/or printer events that  
449 are to be delivered to one or more Notification Recipients. In order to specify additional sets of events  
450 to be delivered to different Notification Recipients during the lifetime of the job, see the Subscribe-Job  
451 operation (section 6.1).

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

### 455 **5.1.1 notify-recipients (1setOf uri)**

456 The client supplies this operation attribute in a create request in order to subscribe for job and/or printer  
457 events while this job is "not-completed". In order to claim conformance to this notification  
458 specification, the Printer object MUST support this attribute. This attribute describes both where (the  
459 address of the Notification Recipients) and how (the delivery method) notifications are to be delivered  
460 when any of the events specified in the "notify-events" attribute occur. If the client does not supply this  
461 attribute in a create request, the Printer object MUST NOT provide any Job Submission Subscription  
462 notification for this job.

463 Unless specified otherwise, a delivery method may be used with any event and an even may be used  
464 with any delivery method.

465 **ISSUE 2: Delete previous sentence that says that some delivery methods can defined to not use some**  
466 **events?**

467 IPP Printer objects MUST support the 'ipp-tcp-notify' and 'ipp-udp-notify' delivery methods in order  
468 to conform to this notification specification. Support of the other methods is OPTIONAL.

469 Standard uriScheme values are:

470 **'mailto':** a 'multipart/report' [RFC1892] message is sent via email to the specified email address. It  
471 MUST consist of both a "text/plain" part for display to a user and an 'application/ipp' part which  
472 is a notification that a program can process (see Section 6). This delivery method ignores the  
473 supplied values of the "notify-events" attribute and implies the 'job-completed' event (new state  
474 is 'completed', 'aborted', or 'canceled'). The notification recipient does not acknowledge receipt  
475 of the mail message.

476 **'http':** an IPP notification is sent using an HTTP POST to the indicated URL.

477  
478

479 **'ipp-tcp-notify':** (REQUIRED) an IPP notification is sent via a TCP/IP socket that is opened by the  
480 Printer object on the IP address specified in the URI using the specified port using the "host:port"  
481 HTTP convention. For example:

482 `ipp-tcp-notify://foo.com:6000`

483 If the port is omitted, the default port is TBD (see Registration of ipp-tcp-notify scheme for use  
484 with IPP). The "application/ipp" notification content format is used for this method (see Section  
485 7.1).

486 The event recipient does not respond or acknowledge the notification.

487 **ISSUE 3:** For TCP/IP delivery, what about leaving the connection open versus having to  
488 reestablish a connection for each event? Who specifies: client in subscription, Printer  
489 implementation, Notification Recipient, Administrator?

490 **'snmpv1-notify':** a notification is sent as an SNMPv1 trap to the host specified as the address in the  
491 URI. The notification recipient does not acknowledge receipt of the notification (trap).

492 **'snmpv2-notify':** a notification is sent as an SNMPv2 inform to the host specified as the address in  
493 the URI. The notification recipient does acknowledge receipt of the notification (inform).

494 **'snmpv3-notify':** a notification is sent as an SNMPv3 inform to the host specified as the address in  
495 the URI. The notification recipient does acknowledge receipt of the notification (inform).

496 **ISSUE 4 – Move SNMP trap delivery methods to another document? Which one?**

497

498 **'ipp-udp-notify':** (REQUIRED) an IPP notification is sent via a UDP datagram that is opened by  
499 the Printer object on the IP address specified in the URI using the specified port using the  
500 "host:port" HTTP convention. For example:

501 `ipp-udp-notify://bar.com:6000`

502 If the port is omitted, the default port is TBD (see Registration of ipp-udp-notify scheme for use  
503 with IPP). The UDP datagram contains the "application/ipp" notification content format (see  
504 Section 6). The notification recipient does not acknowledge receipt of the notification.

505

506 If the client specifies a "notify-recipients" URI scheme that is not supported by the printer, the Printer  
507 MUST return the [new] 'client-error-notify-uri-scheme-not-supported' in the IPP response in reply to the  
508 create request.

509

510 **ISSUE 5 - Which URL parameters should we mention (which like SLP) are removed before being used?**

511

512

### 513 **5.1.2 notify-events (1setOf type2 keyword)**

514 The client OPTIONALLY supplies this operation attribute in a create request. In order to claim  
515 conformance to this notification specification, the Printer object MUST support this attribute. This  
516 attribute identifies the job and/or printer events that are to be delivered to the Notification Recipients as  
517 notifications. If the client does not supply this attribute in a create request, but does supply the "notify-  
518 recipients", the Printer object uses its "notify-events-default" attribute value (see section 9.9).

519 There are both job events and printer events. Each job and printer event is assigned a keyword to use in  
520 this attribute and in the notification.

521 Standard event keyword values are:

522 See the values of the "job-trigger-events" Job Description attribute and the "printer-trigger-events"  
523 Printer Description attribute.

524 **ISSUE 6 - Should we add a third operation attribute to Job Submission Subscriptions, Subscribe-Job,  
525 and Subscript-Printer that is an opaque octet-string that is passed to the Notification Recipient on every  
526 notification, as in Jini? This operation attribute would be OPTIONAL for the client to supply and the  
527 Printer to support.**

## 528 **6 Explicit Subscriptions**

529 "Explicit Subscriptions" are created by performing explicit subscription operations on the Printer or an  
530 identified Job object. These operations are: Subscribe-Job, Subscribe-Printer, Renew-Subscription, and  
531 Unsubscribe. These operations are like any other IPP operation with respect to common operation  
532 attributes (target, charset, "requesting-user-name", natural language, unsupported attributes, etc.).

533 If a printer crashes or is rebooted, an attempt should be made for the Printer object to maintain all of the  
534 subscriptions currently active.

535 **ISSUE 7 - Rather than adding the Subscribe-Job operation (and possibly corresponding Renew-Job-  
536 Subscription and Unsubscribe-Job-Subscription operations), why not go back to the original proposal  
537 that has a 1setOf collection for the create job operations. The collection contains the two simple "notify-  
538 recipients" (1setOf uri) and "notify-events (1setOf type2 keyword). We could say that only one  
539 collection value is sufficient for conformance to help the low end. Supporting additional values would  
540 give the same functionality as the Subscribe-Job operation, but would happen when the job was  
541 submitted.**

### 542 **6.1 Subscribe-Job Operation**

543 This OPTIONAL operation allows a client to add an explicit notification subscription to a Job object  
544 after the job has been created, in case the client did not supply a Job Submission Subscription when the  
545 job was submitted. Also this operation allows a client to set up multiple Job Subscriptions with different  
546 sets of events for different Notification Recipients. With the Job Submission Subscription (section 5) all  
547 Notification Recipients receive the same set of events. If this operation is supported, then Job  
548 Submission Subscription MUST be supported, as well as the other Explicit Subscription operations  
549 (Subscribe-Printer, Renew-Subscription, and Unsubscribe).

550 The Printer returns a subscription id so that a client can unsubscribe to the explicit subscription using the  
551 Unsubscribe operation (section 6.4) before the job completes. The Printer does not return a lease time,  
552 since the subscription lasts until the job completes.

553 Two Subscribe-Job operations with the same events and same Notification Recipients **MUST** be kept as  
554 distinct subscriptions and be assigned distinct subscription ids. A Printer **MAY** suppress sending  
555 duplicate notifications to the same Notification Recipient, but the printer **MUST** allow duplicate  
556 subscriptions such that Unsubscribe doesn't unsubscribe both subscriptions.

557 The subscription expires after the job completes (enters the 'completed', 'canceled', or 'aborted' job  
558 states) just as with the Job Submission Subscription. See section 5 for more detail.

559 *Access Rights:* The authenticated user (see [ipp-mod] section 8.3) performing this operation must either  
560 be the job owner of the current job or an operator or administrator of the Printer object (see [ipp-mod]  
561 sections 1 and 8.5). Otherwise, the IPP object **MUST** reject the operation and return: 'client-error-  
562 forbidden', 'client-error-not-authenticated', or 'client-error-not-authorized' as appropriate.

### 563 **6.1.1 Subscribe-Job Request**

564 The following groups of attributes are part of the Subscribe Request:

565 Group 1: Operation Attributes

566 Natural Language and Character Set:

567 The "attributes-charset" and "attributes-natural-language" attributes as described in [ipp-mod]  
568 section 3.1.4.1.

569

570 Target:

571 Either (1) the "printer-uri" (uri) plus "job-id" (integer(1:MAX)) or (2) the "job-uri" (uri)  
572 operation attribute(s) which define the target for this operation as described in [ipp-mod] section  
573 3.1.5.

574

575 Requesting User Name:

576 The "requesting-user-name" (name(MAX)) attribute **SHOULD** be supplied by the client as  
577 described in [ipp-mod] section 8.3.

578

579 "notify-recipients" (1setOf uri):

580 The client **MUST** supply this attribute. The Printer object **MUST** support this attribute, if it  
581 supports this operation. This attribute describes both where (the address of the Notification  
582 Recipients) and how (the delivery method) notifications are to be delivered as notifications when  
583 any of the events specified in the "notify-events" attribute occur. See section 5.1.1.

584

585 "notify-events" (1setOf type2 keyword):

586 The client **OPTIONALLY** supplies this attribute. The Printer object **MUST** support this  
587 attribute, if it supports this operation. This attribute identifies the job and/or printer events that  
588 are to be delivered to the Notification Recipients as notifications (see section 5.1.2). If the client  
589 does not supply this attribute, then the Printer object uses its "notify-events-default" attribute  
590 value (see section 9.9).

591



### 592 **6.1.2 Subscribe-Job Response**

593 The following groups of attributes are part of the Subscribe-Job Response:

594 Group 1: Operation Attributes

595 Status Message:

596 In addition to the REQUIRED status code returned in every response, the response  
597 OPTIONALLY includes a "status-message" (text(255)) and/or a "detailed-status-message"  
598 (text(MAX)) operation attribute as described in [ipp-mod] sections 13 and 3.1.6.  
599

600 Natural Language and Character Set:

601 The "attributes-charset" and "attributes-natural-language" attributes as described in [ipp-mod]  
602 section 3.1.4.2.  
603

604 "subscription-id" (integer(1:MAX)):

605 The Printer object MUST support this attribute and return it in the response. It contains an  
606 integer subscription identifier assigned by the Printer object for use in notifications and  
607 Unsubscribe operations. There is no need to renew, since the lease is the same as for Job  
608 Submission operations, i.e., until the Job is completed.  
609

610 Group 2: Unsupported Attributes

611 See [ipp-mod] section 3.1.7 for details on returning Unsupported Attributes.  
612

## 613 **6.2 Subscribe-Printer Operation**

614 This OPTIONAL operation allows a client to add an explicit notification subscription to a Printer object  
615 at any time, whether or not the client has submitted a job to that Printer. The client can specify one or  
616 more job and/or printer events to be delivered as notifications to one or more Notification Recipients.  
617 The job events are for any job submitted to the Printer. The printer events are any events generated by  
618 that Printer. If "Explicit Subscriptions" is implemented, this operation is REQUIRED to be supported  
619 by the Printer.

620 The Printer returns a subscription id and the length of time for which it has granted a lease for the  
621 subscription. The client must renew the subscription using the Renew-Subscription operation (see  
622 section 6.3) before the lease runs out in order to maintain the subscription. A client can unsubscribe  
623 using the Unsubscribe operation (section 6.4) and the subscription id.

624 Two Subscribe-Printer operations with the same events and same Notification Recipients MUST be kept  
625 as distinct subscriptions and be assigned distinct subscription ids. A Printer MAY suppress sending  
626 duplicate notifications to the same Notification Recipient, but the printer MUST allow duplicate  
627 subscriptions such that Unsubscribe doesn't unsubscribe both subscriptions.

628 If the Printer has a bounded set of concurrent subscriptions (for the specified events or any events), the  
629 printer rejects the operation and returns the 'server-error-too-many-subscriptions' status code. The client  
630 SHOULD try again later.

631 Access Rights: The authenticated user (see [IPP-MOD] section 8.3) performing this operation must be  
632 an operator or administrator of the printer object (see [IPP-MOD] sections 1 and 8.5). Otherwise the

633 IPP object must reject the operation and return: client-error-forbidden, client-error-not-authenticated,  
634 and client-error-not-authorized as appropriate.

### 635 **6.2.1 Subscribe-Printer Request**

636 The following groups of attributes are part of the Subscribe-Printer Request:

637 Group 1: Operation Attributes

638 Natural Language and Character Set:

639 The "attributes-charset" and "attributes-natural-language" attributes as described in [ipp-mod]  
640 section 3.1.4.1.

641

642 Target:

643 The "printer-uri" (uri) operation attribute which is the target for this operation as described in  
644 [ipp-mod] section 3.1.5.

645

646 Requesting User Name:

647 The "requesting-user-name" (name(MAX)) attribute SHOULD be supplied by the client as  
648 described in [ipp-mod] section 8.3.

649

650 "notify-recipients" (1setOf uri):

651 The client MUST supply this attribute. The Printer object MUST support this attribute, if it  
652 supports this operation. This attribute describes both where (the address of the Notification  
653 Recipients) and how (the delivery method) notifications are to be delivered as notifications when  
654 any of the events specified in the "notify-events" attribute occur. See section 5.1.1.

655

656 "notify-events" (1setOf type2 keyword):

657 The client OPTIONALLY supplies this attribute. The Printer object MUST support this  
658 attribute, if it supports this operation. This attribute identifies the job and/or printer events that  
659 are to be delivered to the Notification Recipients as notifications (see section 5.1.2). If the client  
660 does not supply the attribute, then the Printer object uses its "notify-events-default" attribute  
661 value (see section 9.9).

662

663 "notify-lease-time" (integer(0:MAX)):

664 The client OPTIONALLY supplies this attribute. The printer object MUST support this  
665 attribute, if it supports this operation. This attribute requests a lease time for the subscription,  
666 i.e., the number of seconds before the subscription expires.

667

668 There is no way to query the outstanding subscriptions. Instead, every subscription has a lease  
669 time, so that no subscription can be carried too long and become a dead subscription because the  
670 Notification Recipient has gone away.

671

672 If the client does not supply this attribute in the request, the Printer object uses its "notify-lease-  
673 time-default" attribute value (see section 9.12).

674

675 "printer-message-from-operator":  
676 If the client supplies this attribute, the Printer copies its value to the Printer's "printer-message-  
677 from-operator" Printer Description attribute.  
678

### 679 **6.2.2 Subscribe-Printer Response**

680 The following groups of attributes are part of the Subscribe-Printer Response:

681 Group 1: Operation Attributes

682 Status Message:

683 In addition to the REQUIRED status code returned in every response, the response  
684 OPTIONALLY includes a "status-message" (text) operation attribute as described in [ipp-mod]  
685 section 3.1.6.

686  
687 Natural Language and Character Set:

688 The "attributes-charset" and "attributes-natural-language" attributes as described in [ipp-mod]  
689 section 3.1.4.1.

690  
691  
692 "subscription-id" (integer(1:MAX)):

693 The Printer object MUST support this attribute and return it in the response. It contains an  
694 integer subscription identifier assigned by the Printer object for use in notifications and Renew-  
695 Subscription/Unsubscribe operations.

696  
697 "notify-lease-time" (integer(0:MAX)):

698 The Printer object MUST support this attribute and return it in the response. It contains the  
699 actual lease time granted, which MUST be in the range specified by the Printer's "notify-lease-  
700 time-supported" attribute. If the client supplied a value that is less than the minimum or greater  
701 than the maximum, the Printer sets the actual lease time to the minimum or maximum value,  
702 respectively, but otherwise accepts and performs the operation normally and no special status  
703 code is returned. It is up to the client to check this returned value, if it cares.

704  
705 "initial-sequence-numbers" (1setOf integer(1:MAX)):

706 The Printer object MUST support this attribute and return it in the response. It contains the  
707 sequence number values that will be sent in the first notification for each of the events in the  
708 "notify-events" operation attribute in the request. The order of the values of this attribute  
709 correspond to the order of the values in the "notify-events" operation attribute. Since the event  
710 sequence numbers are associated with the event, not the subscription, there is a single sequence  
711 number attribute for the Printer for each event, which is counting monotonically for each event  
712 separately. Therefore, a Notification Recipient that is concerned about missing notifications,  
713 needs to know the first value to expect.

714 Note: The subscribing client needs to convey this value to the Notification Recipient, in case the  
715 Notification Recipient cares.

716  
717 **ISSUE 8 - Should the event sequence number be associated with the event (see section 7.1) as in**  
718 **Jini, or with the Subscription object? If the latter, then notification batching could happen for the**

719 same subscription. Then "xxx-trigger-event" could be changed back to 1setOf to agree with the  
720 "notify-events" operation, Job Description, and Printer Description attributes. Then event  
721 sequence numbers always start with 1 for Explicit Printer Subscriptions, just like for Explicit Job  
722 and Job Submission Subscriptions and there is no need to return the starting sequence number for  
723 Printer events.

724 "detailed-status-message" (text(MAX))

725 The OPTIONAL "detailed-status-message" operation attribute provides additional more detailed  
726 technical and implementation-specific information about the operation. The "detailed-status-  
727 message" attribute's syntax is "text(MAX)". See [ipp-mod] section 3.1.6.3 for more information.

728

729 Group 2: Unsupported Attributes

730 See [ipp-mod] section 3.1.7 for details on returning Unsupported Attributes.

### 731 **6.3 Renew-Subscription**

732 This OPTIONAL operation allows a client to renew the lease time on an already established explicit  
733 subscription. The client supplies the "subscription-id" for this operation that was returned in the  
734 previous Subscribe-Job or Subscribe-Printer operation that created the subscription. If "Explicit  
735 Subscriptions" is implemented, this operation is REQUIRED to be supported by the Printer.

736 The Subscription-id MUST NOT change upon renewal of the lease.

#### 737 **6.3.1 Renew-Subscription Request**

738 The following groups of attributes are part of the Subscribe Request:

739 Group 1: Operation Attributes

740 Natural Language and Character Set:

741 The "attributes-charset" and "attributes-natural-language" attributes as described in [ipp-mod]  
742 section 3.1.4.1.

743

744 Target:

745 The "printer-uri" (uri) operation attribute which is the target for this operation as described in  
746 [ipp-mod] section 3.1.5.

747

748 **ISSUE 9 - A "printer-uri" plus "subscription-id" isn't enough to target an Explicit Job  
749 Subscription? Do we really need both Renew-Printer-Subscription and Renew-Job-Subscription,  
750 both which require a "subscription-id", but the former has a Printer object target and the latter  
751 has a Job object target?**

752

753 Requesting User Name:

754 The "requesting-user-name" (name(MAX)) attribute SHOULD be supplied by the client as  
755 described in [ipp-mod] section 8.3.

756

757 "subscription-id" (integer(1:MAX)):

758 The client MUST supply this attribute. The printer object MUST support this attribute. It  
759 identifies the subscription to be renewed, i.e., it is the integer subscription identifier returned by  
760 the Printer object in a previous Subscribe or Renew-Subscription operation.

761  
762 The Printer returns a 'client-error-not-found' status code, if the subscription id is not found (or  
763 has expired).

764  
765 "notify-lease-time" (integer(0:MAX)):

766 See the description of "notify-lease-time" for the Subscribe operation request in Section .6.2.1.

767

768

### 769 **6.3.2 Renew-Subscription Response**

770 The following groups of attributes are part of the Subscribe Response:

771 Group 1: Operation Attributes

772 Status Message:

773 In addition to the REQUIRED status code returned in every response, the response

774 OPTIONALLY includes a "status-message" (text) operation attribute as described in [ipp-mod]  
775 section 3.1.6.

776

777 Natural Language and Character Set:

778 The "attributes-charset" and "attributes-natural-language" attributes as described in [ipp-mod]  
779 section 3.1.4.1.

780

781 "notify-lease-time" (integer(0:MAX)):

782 See the description of "notify-least-time" for the Subscribe operation response in Section 6.2.2.

783

784 Group 2: Unsupported Attributes

785 See section 3.1.7 for details on returning Unsupported Attributes.

786

787 *Access Rights:* The authenticated user (see [IPP-MOD] section 8.3) performing this operation must be an  
788 operator or administrator of the printer object (see [IPP-MOD] sections 1 and 8.5). Otherwise the IPP  
789 object must reject the operation and return: client-error-forbidden, client-error-not-authenticated, and  
790 client-error-not-authorized as appropriate.

791 **ISSUE 10 - Can't we have authentication for subscriptions as we have for jobs? Then the owner of the**  
792 **subscription, i.e., the user that performed the Explicit Subscription can Renew or Unsubscribe.**

### 793 **6.4 Unsubscribe**

794 This OPTIONAL operation allows a client to unsubscribe explicit notification subscription. The  
795 "subscription-id" is required to perform this operation. Once a client performs an Unsubscribe  
796 operation, the Printer (or an associated notification service) immediately stops sending notifications to  
797 the associated Notification Recipient(s) for that subscription. If "Explicit Subscriptions" is  
798 implemented, this operation is REQUIRED to be supported by the Printer.

799 **ISSUE 11 - Add way to the Unsubscribe operation to unsubscribe all subscriptions? all "my"**  
800 **subscriptions?**

801 *Access Rights:* The authenticated user (see [IPP-MOD] section 8.3) performing this operation must be an  
802 operator or administrator of the printer object (see [IPP-MOD] sections 1 and 8.5). Otherwise the IPP

803 object must reject the operation and return: client-error-forbidden, client-error-not-authenticated, and  
804 client-error-not-authorized as appropriate.

805 **ISSUE 12 - Can't we have authentication for subscriptions as we have for jobs? Then the owner of the**  
806 **subscription, i.e., the user that performed the Explicit Subscription can Renew or Unsubscribe. Or does**  
807 **the lease and sequence number concepts mean that only operators need to be able to Unsubscribe?**

#### 808 **6.4.1 Unsubscribe Request**

809 The following groups of attributes are part of the Unsubscribe Request:

810 Group 1: Operation Attributes

811 Natural Language and Character Set:

812 The "attributes-charset" and "attributes-natural-language" attributes as described in [ipp-mod]  
813 section 3.1.4.1.

814

815 Target:

816 The "printer-uri" (uri) operation attribute which is the target for this operation as described in  
817 [ipp-mod] section 3.1.5.

818

819 **ISSUE 13 - A "printer-uri" plus "subscription-id" isn't enough to target an Explicit Job**  
820 **Subscription? Do we really need both Unsubscribe-Printer and Unsubscribe-Job, both which**  
821 **require a "subscription-id", but the former has a Printer object target and the latter has a Job**  
822 **object target?**

823

824 Requesting User Name:

825 The "requesting-user-name" (name(MAX)) attribute SHOULD be supplied by the client as  
826 described in [ipp-mod] section 8.3.

827

828 "subscription-id" (integer(1:MAX)):

829 The client MUST supply this attribute. The printer object MUST support this attribute. It  
830 identifies the subscription to be removed, i.e., it is the integer subscription identifier returned by  
831 the Printer object in a previous Subscribe or Renew-Subscription operation.

832

833 The Printer returns a 'client-error-not-found' status code, if the subscription id is not found (or  
834 has expired).

835

#### 836 **6.4.2 Unsubscribe Response**

837 The following groups of attributes are part of the Unsubscribe Response:

838 Group 1: Operation Attributes

839 Status Message:

840 In addition to the REQUIRED status code returned in every response, the response  
841 OPTIONALLY includes a "status-message" (text) operation attribute as described in [ipp-mod]  
842 section 3.1.6.

843

844 Natural Language and Character Set:

845 The "attributes-charset" and "attributes-natural-language" attributes as described in [ipp-mod]  
846 section 3.1.4.1.

847

848 Group 2: Unsupported Attributes

849 See section 3.1.7 for details on returning Unsupported Attributes.

850

851 **ISSUE 14 - Do we need a Get-Printer-Subscriptions operation that returns a list of explicit subscriptions**  
852 **to the Printer object? Jini has such an operation. This operation could be used by a client that has**  
853 **forgotten the subscription id of a long standing subscription. On the other hand, the lease concept was**  
854 **introduced to eliminate the need for a Get-Printer-Subscriptions operation. Also the sequence number**  
855 **mechanism also helps with filtering out duplicate subscriptions that send the same event more than once,**  
856 **since the same sequence number is send in each. If we do add a Get-Printer-Subscriptions operation,**  
857 **then probably need to include a "which-subscriptions" operation attribute with values: 'my-subscriptions'**  
858 **and 'all-subscriptions', just like Get-Jobs?**

## 859 7 Notification Content

860 Some of the notification delivery methods dictate the notification content type to be used. For example,  
861 'mailto' uses "multipart/report" and 'http' and 'ipp-tcp-notify' use "application/ipp".

### 862 7.1 Notification content MIME media type formats

863 Once a client's create job request, Subscribe-Job, or Subscribe-Printer is successful, the Printer adds the  
864 "notify-recipients" and "notify-events" attribute values to its subscription information on the Job, Job, or  
865 Printer object, respectively, and returns the appropriate response. Subsequently, notifications are  
866 asynchronously sent based on the subscription information stored by the Printer. The following  
867 descriptions give more detail on how the notifications are formed for each type.

868 An implementation MUST NOT extend the contents of a notification.

869 Notifications are generated using the following content formats:

870 **'application/ipp'** - machine consumable notification content using the 'application/ipp' MIME media  
871 type [ipp-mod] using the Get-Job-Attributes response encoding for job events and Get-Printer-  
872 Attributes for printer events. The attributes listed in section 7.2 are sent in a notification for job  
873 events. The attributes listed in section 7.3 are sent in a notification for printer events. For any  
874 string in any notification, the charset and natural language rules that apply to all IPP operations  
875 apply to the notification strings as well, since they are represented as operation responses. The  
876 event content is filled in as follows:

877 Response Parameters:

878 "version-number" - the same version number as returned in the create response.

879 "status-code" parameter - the status code: 'basic-job-event' - 0x600 for job events, and  
880 'basic-printer-event' - 0x601 for printer events.

881 "request-id" - a sequence number so that each type of event has a running event counter  
882 that increments by 1. For job subscriptions, the event count is kept separately for  
883 each job and job event pair and the first value passed in a notification MUST be 1.

884 The Notification Recipient can detect events that arrive out of order or are dropped.  
885 For the Explicit Printer subscriptions, the sequence number is kept for each event  
886 separately and it counts up from 1 starting with initial power-up.

887 **ISSUE 15 - What happens to the event sequence numbers on Shutdown to 'suspend'**  
888 **versus 'power-down'? Are they started over or do they continue? What about a**  
889 **power failure? Are subscriptions automatically Unsubscribed on power up? What**  
890 **about Restart-Printer operation? Or are subscriptions kept across power cycles?**  
891 **Subscription Id shouldn't be re-used on power up, if possible. Or is either behavior**  
892 **implementation dependent? Any recommendations for which?**

893

894

895 Operation attributes:

896 "attributes-charset" and "attributes-natural-language" Operation attributes - the same  
897 charset and natural language as the response to the original create request.

898 "status-message" - is not sent as an Operation attribute (the "job-trigger-message" and  
899 "printer-trigger-message" are sent in the Job Object Attributes and the Printer Object  
900 Attributes groups, respectively.

901 Unsupported Attributes Group:

902 Is not sent.

903 Job Object Attributes Group and Printer Object Attributes Group:

904 See section 7.2 and 7.3, respectively.

905

906 **'text/plain'** - human consumable notification content type. The text message SHOULD include  
907 information about the attributes in section 7.2 for job events or in section 7.3 for printer events.  
908 If the charset to be used in the mail message is other than US-ASCII, the /charset parameter must  
909 be included in the value of this content-type header and in the notification content [RFC2046].

## 910 **7.2 Basic Job notification content**

911 This section lists the parameters and attributes that are included in the Basic Job notification content.  
912 Additional job event definitions can be registered which use the Basic Job Notification content. If  
913 additional attributes are needed, additional Job Notification content formats will be defined and assigned  
914 a new status code to be used in the report in order to distinguish each report format. For example of  
915 another Job Notification content format, see [ipp-prog] for 'job-progress-events'.

916 Each Basic Job notification content contains a single job event, whether that event was subscribed using  
917 the Job Submission Subscription mechanism or the Explicit Subscription (Subscribe-Job or Subscribe-  
918 Printer). If either kind of subscription subscribed to both job and printer events, then they will be send  
919 as separate Basic Job notification content and Basic Printer notification contents (see section 7.3) to the  
920 same Notification Recipients.

921 If notification is supported, the implementation MUST support the following REQUIRED job object  
922 attributes, MUST support the following CONDITIONAL job object attributes, if the condition is true,  
923 and MAY support the following OPTIONAL job object attributes. Any of the following Job  
924 Description attributes that are supported MUST be included in a notification. All job notifications  
925 MUST use the Get-Job-Attributes response syntax.



926 **ISSUE 16 - Should a notification have a response that the Notification Recipient returns to the**  
 927 **Notification Source like Jini, i.e., a notification is like an operation that has a request and a response,**  
 928 **instead of just being a one way transfer of information? Should that depend on the URL scheme or a**  
 929 **URL scheme parameter? Is having responses a Quality of Service that the subscriber can specify?**

930 The Basic Job Notification MUST include the following response parameters and job object attributes.  
 931 The Job Attributes MAY be in any order:

Job object parameter/attribute	REQUIRED IN REPORT?	reference
version-number	REQUIRED	[ipp-mod] 3.1.1
status-code (with the value: basic-job-event(600))	REQUIRED	[ipp-mod] 3.1.1
request-id (used as sequence number see section 7.1)	REQUIRED	[ipp-mod] 3.1.1
job-printer-uri (uri)	REQUIRED	[ipp-mod] 4.3.3
job-id (integer(1:MAX))	REQUIRED	[ipp-mod] 4.3.2
job-trigger-event (type2 keyword)	REQUIRED	8.3
job-trigger-message* (text(255))	CONDITIONAL	8.4
job-trigger-time (integer(1:MAX))	REQUIRED	8.5
job-trigger-date-time (dateTime)	RECOMMENDED	8.6
job-state (type1 enum)	REQUIRED	[ipp-mod] 4.3.7
previous-job-state (type1 enum)	REQUIRED	8.7
job-state-reasons (1setOf type2 keyword)	REQUIRED	[ipp-mod] 4.3.8
job-state-reasons-added (1setOf type2 keyword)	REQUIRED	8.8
job-state-reasons-deleted (1setOf type2 keyword)	REQUIRED	8.9
subscription-id** (integer(1:MAX))	CONDITIONAL	6

973

974 **Figure 4 - Basic Job Notification Content**

975 Conditional attributes in the notification:

976 \*If "status-message" is supported as an Operation attribute in operation responses, then "job-trigger-  
977 message" MUST be supported in the notification content.

978 \*\* If the Subscribe-Job or Subscribe-Printer operation is implemented and the notification is caused by  
979 an explicit subscription request, the "subscription-id" MUST be supplied in the notification content.

980 If the values of any of the attributes sent in an notification content are not known, the value sent in the  
981 report content is the out-of-band 'unknown' value, rather than omitting the attribute. See [ipp-mod]  
982 section 4.1.

983 **ISSUE 17 - Should we copy in the [ipp-prog] Job Progress notification content into this Event**  
984 **Notification specification?**

### 985 **7.3 Basic Printer notification content**

986 This section lists the parameters and attributes that are included in the Basic Printer notification content.  
987 Additional printer events can be registered which use the Basic Job Notification content. If additional  
988 attributes are needed, additional Printer Notification content formats will be registered and assigned a  
989 new status code to be used in the report in order to distinguish each report format.

990 Each Basic Printer notification content contains a single printer event, whether that event was subscribed  
991 using the Job Submission Subscription mechanism or the Explicit Subscription (Subscribe-Job or  
992 Subscribe-Printer). If either kind of subscription subscribed to both job and printer events, then they  
993 will be send as separate Basic Job notification content (see section 7.2) and Basic Printer notification  
994 contents to the same Notification Recipients.

995 If notification is supported, the implementation MUST supported the following REQUIRED attributes,  
996 MUST supported the following CONDITIONAL job object attributes, if the condition is true, and MAY  
997 supported the following OPTIONAL Printer object attributes in any printer notification. Any of the  
998 following Printer Description attributes that are supported MUST be included in an notification. All  
999 printer notifications MUST use the Get-Printer-Attributes response syntax. The Basic Printer  
1000 Notification MUST include the following response parameters and Printer object attributes. The Printer  
1001 Attributes MAY be in any order:

1002	+	-----+	+	-----+
1003		Printer object paramater/attribute		REQUIRED
1004				IN REPORT?
1005				reference
1006		version-number		REQUIRED
1007				[ipp-mod] 3.1.1
1008		status-code (with the value:		REQUIRED
1009		basic-printer-event(601))		[ipp-mod] 3.1.1
1010				
1011		request-id (used as sequence number		REQUIRED
1012		see section 7.1		[ipp-mod] 3.1.1
1013				
1014		printer-uri-supported (uri)		REQUIRED
1015				[ipp-mod] 4.4.1
1016		printer-trigger-event		REQUIRED
1017		(type2 keyword)		9.1
1018				
1019		printer-trigger-message*(text(255))		CONDITIONAL
1020				9.2
1021		printer-trigger-time		REQUIRED
1022		(integer(1:MAX))		9.3
1023				
1024		printer-trigger-date-time(dateTime)		RECOMMENDED
1025				9.4
1026		printer-state (type1 enum)		REQUIRED
1027				[ipp-mod] 4.4.10
1028		previous-printer-state (type1 enum)		REQUIRED
1029				9.5
1030		printer-state-reasons		REQUIRED
1031		(lsetOf type2 keyword)		[ipp-mod] 4.4.11
1032				
1033		printer-state-reasons-added		REQUIRED
1034		(lsetOf type2 keyword)		9.6
1035				
1036		printer-state-reasons-deleted		REQUIRED
1037		(lsetOf type2 keyword)		9.6
1038				
1039		subscription-id** (integer(1:MAX))		CONDITIONAL
1040				6
1041				
1042				

**Figure 5 - Basic Printer Notification Content**

1043 Conditional attributes in the notification:

1044 \* If "status-message" is supported as an Operation attribute in operation responses, then "printer-trigger-  
1045 message" MUST be supported in the notification content.

1046 \*\* If the Subscribe-Printer operation is implemented and the notification is caused by an explicit  
1047 subscription request, the "subscription-id" MUST be supplied in the notification content.

1048 If the values of any of the attributes sent in an notification content are not known, the value sent in the  
1049 report content is the out-of-band 'unknown' value, rather than omitting the attribute. See [ipp-mod]  
1050 section 4.1.

## 1051 8 Job Description Attributes

1052 The following Job Description attributes are defined for use with notification:

### 1053 8.1 *notify-recipients (1setOf uri)*

1054 This REQUIRED READ-ONLY attribute describes both where (the address) and how (the delivery  
1055 method) notifications are to be delivered when any of the events specified in the "notify-events" attribute  
1056 occur. The Printer object MUST populate this Job Description attribute from the corresponding  
1057 Operation attribute supplied by the client in the create request. See section 5.1.1 for more description of  
1058 this attribute.

1059 Note: There is no way to query the recipients that have been subscribed using the Subscribe-Job  
1060 operation.

1061 **ISSUE 18 - How many individuals, recipients can be established to be notified of a particular event?**  
1062 **The number of recipients should have a minimum number required for support. We did not agree on a**  
1063 **such a number. This needs more discussion. If the maximum number required is 1, then clients might**  
1064 **not bother supporting more than one recipient in a subscription.**

### 1065 8.2 *notify-events (1setOf type2 keyword)*

1066 This REQUIRED READ-ONLY attribute identifies the events for which a notification notification is  
1067 desired for this job. The Printer object MUST populate this Job Description attribute from the  
1068 corresponding Operation attribute supplied by the client in the create request. If the client does not  
1069 supply this attribute in a create request, but does supply the "notify-recipients" attribute, the Printer  
1070 object populates this attribute with the notify-events-default' event value. See section 5.1.2 for more  
1071 description of this attribute.

1072 Note: There is no way to query the events that have been subscribed using the Subscribe-Job operation.

### 1073 8.3 *job-trigger-event (type2 keyword)*

1074 This REQUIRED READ-ONLY attribute indicates the most recent job event that occurred for this job.  
1075 In order to claim conformance to this notification specification, the Printer object MUST support this  
1076 Job Description attribute. The Printer object supplies this attribute in every job notification that it sends  
1077 to a Notification Recipient. This attribute is also available to any client using a Get-Job-Attributes or  
1078 Get-Jobs operation for this job. The first job event for a job is the 'job-created' event, so this Job  
1079 Description attribute always has a value.

1080 The following events are defined to be disjoint. Therefore, the "job-trigger-event" attribute is single  
1081 valued, since two events cannot be sent in the same notification content.

1082 A Printer MUST support the events indicated as "REQUIRED". The standard keyword values are:

1083 **'none'**: REQUIRED - no notifications of any events (an IPP object can use this value to indicate  
1084 that it is configured not to support event notification; a client would not subscribe to this event).  
1085 **'job-created'**: REQUIRED - the Printer object has accepted the create operation and the job's "job-  
1086 time-at-creation" attribute value is set (i.e., when the job is created no matter whether it puts the  
1087 job in the 'pending' or 'pending-held' or 'processing' states). The IPP Printer MUST record this  
1088 event.

1089 Note: This event is separate from the 'job-state-changed' event so that it can be subscribed to  
1090 without having to get every job state change event, for a Notification Recipient that is only  
1091 interested in when the job is first created.

1092 **'job-completed'**: REQUIRED - the job has reached one of the completed states, i.e., the value of the  
1093 job's "job-state" attribute has changed to: 'completed', 'aborted', or 'canceled'. The job's "time-at-  
1094 completed" and/or "date-time-at-completed" attributes are set. The IPP Printer MUST record  
1095 this event.

1096 Note: This event is separate from 'job-state-changed' so that it can be subscribed to without  
1097 having to get every job state change event, for a Notification Recipient that is only interested in  
1098 when the job is completed.

1099  
1100 **ISSUE 19 - Should there be more job attributes in the 'job-completed' notification content, such as**  
1101 **"impressions-completed" and "sheets-completed"?**

1102  
1103 **'job-state-changed'**: the job has changed from any state or state-reason to any other state or state-  
1104 reason, except when the job is created or when the job moves to any of the "completed" job  
1105 states, i.e., the value of the job's "job-state" attribute changes to any value, except 'completed',  
1106 'aborted', or 'canceled'

1107  
1108 This event also indicates that one or more values have been added to or removed from the Job's  
1109 "job-state-reasons" attribute, such as 'job-queued' or 'job-printing', whether or not the job's state  
1110 has changed. If job state reasons are added when the job is created, only the 'job-created' event is  
1111 generated, in order to keep the events disjoint. If job state reasons are added or removed when  
1112 the job is completed, only the 'job-completed' event is generated, in order to keep the events  
1113 disjoint. This event is REQUIRED to be recorded if the job-state-reason is an error.

1114  
1115 A client that wants to subscribe to all job state changes, including creation and completion,  
1116 includes the 'job-created', 'job-state-changed', and 'job-completed' in the notification subscription.  
1117 When a job is finally removed from the Job History (see [ipp-mod] 4.3.7.1) no event is  
1118 generated, i.e., neither a 'job-state-changed' event nor a 'job-purged' event is generated.

1119 **ISSUE 20 - Should 'job-state-changed' event be REQUIRED to support, since 'printer-state-**  
1120 **changed' is?**

1121  
1122  
1123 **'job-config-changed'** – when the configuration of a job has changed, i.e., the value of the "job-  
1124 message-from-operator" or any of the non-READ-ONLY Job attributes have changed, such as  
1125 any of the job template attributes or the "job-name" attribute. The client would have to perform  
1126 a Get-Job-Attributes to find out the new values of the changed attributes. This event would be  
1127 useful for GUI clients and drivers to update the job information to the user.

1128 **'job-purged'**: when a 'not-completed' job was purged from the printer using the Purge-Jobs  
1129 operation. No event, including this event, is generated when a job is aged out of the Job History.

1130  
1131 **ISSUE 21 - any other job events to be defined and added?**

1132 **ISSUE 22 - should any more events be REQUIRED to be supported?**

1133

#### 1134 **8.4 job-trigger-message (text(255))**

1135 This OPTIONAL READ-ONLY attribute provides a short textual description of the most recent job  
1136 event(s). The "job-trigger-events" attribute is intended for use by automata, and the "job-trigger-  
1137 message" is intended for the human end user. If job-trigger-events is multi-valued, then it is left up to  
1138 the implementation if it concatenates event messages or combines the events to provide a single  
1139 message.

1140 If the Printer object supports the "job-trigger-message" Job Description attribute, the Printer object  
1141 MUST be able to generate this message in any of the natural languages identified by the Printer object's  
1142 "generated-natural-language-supported" attribute (see the "attributes-natural-language" operation  
1143 attribute specified in [ipp-mod] section 3.1.4.1). As described in [ipp-mod] section 3.1.4.1 for any  
1144 returned 'text' attribute, if there is a choice for generating this message, the Printer object uses the natural  
1145 language indicated by the value of the "attributes-natural-language" in the client create request if  
1146 supported, otherwise the Printer object uses the value in the Printer object's own "natural-language-  
1147 configured" attribute.

#### 1148 **8.5 job-trigger-time (integer(MIN:MAX))**

1149 This REQUIRED READ-ONLY attribute indicates the point in time specified in seconds since the  
1150 printer was last started at which the most recent job event occurred for this job. In order to populate this  
1151 attribute, the Printer object uses the value in its "printer-up-time" attribute at the time the event occurred.  
1152 Since the printer could support persistent jobs, a value of zero or less is available to show that the last  
1153 event occurred before the last printer restart.

1154 In order to claim conformance to this notification specification, the Printer object MUST support this  
1155 Job Description attribute. The Printer object MUST supply this attribute in every notification that it  
1156 sends to a notification recipient. This attribute is also available to any client using a Get-Job-Attributes  
1157 or Get-Jobs operation for this job. The first job event for a job is the 'job-received' event when the job is  
1158 created. Therefore, this job attribute always has a value.

1159 If IPP Printers relay jobs to other IPP Printers, the time of the event is intended to be at the IPP Printer  
1160 object at which the event occurred, not subsequent times of relaying jobs in the forward direction or  
1161 relaying notifications in the reverse direction. Therefore, each Printer along the request/response path  
1162 MUST adjust the values of the time tick attributes accordingly.

#### 1163 **8.6 job-trigger-date-time (dateTime)**

1164 This OPTIONAL READ-ONLY attribute indicates the point in time at which the most recent job event  
1165 occurred for this job. In order to claim conformance to this notification specification, the Printer object  
1166 MUST support this Job Description attribute if it also supports the "printer-current-time" Printer  
1167 Description attribute (which also requires a date). The Printer object MUST supply this attribute in  
1168 every notification that it sends to a notification recipient, if it supports this attribute. This attribute is  
1169 also available to any client using a Get-Job-Attributes or Get-Jobs operation for this job. The first job  
1170 event for a job is the 'job-received' event when the job is created. Therefore, this job attribute always  
1171 has a value.

1172 If IPP Printers relay jobs to other IPP Printers, the time of the event is intended to be at the IPP Printer  
1173 object at which the event occurred, not subsequent times of relaying jobs in the forward direction or  
1174 relaying notifications in the reverse direction. However, since the date and time are absolute, each

1175 Printer does not need to change the values of the dateTime attributes as they are passed along the  
1176 request/response path.

### 1177 **8.7 previous-job-state (type1 enum)**

1178 This REQUIRED READ-ONLY attribute contains the previous state of the job, i.e., the value of the  
1179 job's "job-state" attribute before the event occurred. See [ipp-mod] section 4.3.7 for the description of  
1180 the values for this attribute. In a notification, the "job-state" attribute contains the current state of the  
1181 job, i.e., the state of the job after the event occurred. This attribute is also available to any client using a  
1182 Get-Job-Attributes or Get-Jobs operation for this job.

### 1183 **8.8 job-state-reasons-added (1setOf type2 keyword)**

1184 This REQUIRED READ-ONLY attribute contains the values of the job's "job-state-reasons" attribute  
1185 which were added since the last 'job-state-change' event for this job. See [ipp-mod] section 4.3.8 for the  
1186 description of the values for this attribute. In a notification, the "job-state-reasons" attribute contains the  
1187 current values of the job's "job-state-reasons" attribute, i.e., the values after the event occurred. This  
1188 attribute is also available to any client using a Get-Job-Attributes or Get-Jobs operation for this job.

1189 **ISSUE 23 - What meaning do the -added and -deleted job state reason attributes have for the 'job-**  
1190 **completed' notification? Is that a problem? What about other events, besides 'job-config-change'?**

### 1191 **8.9 job-state-reasons-deleted (1setOf type2 keyword)**

1192 This REQUIRED READ-ONLY attribute contains the values of the job's "job-state-reasons" attribute  
1193 which were deleted since the last 'job-state-change' event for this job. See [ipp-mod] section 4.3.8 for  
1194 the description of the values for this attribute. In a notification, the "job-state-reasons" attribute contains  
1195 the current values of the job's "job-state-reasons" attribute, i.e., the values after the event occurred. This  
1196 attribute is also available to any client using a Get-Job-Attributes or Get-Jobs operation for this job.

1197 **ISSUE 24 - Should we copy in the [ipp-prog] Job Progress Job Description attributes and notification**  
1198 **format into this Event Notification specification?**

## 1199 **9 Printer Description Attributes**

1200 The following Printer Description attributes are defined for use with notification:

### 1201 **9.1 printer-trigger-event (type2 keyword)**

1202 This REQUIRED READ-ONLY attribute indicates the most recent printer event that occurred for this  
1203 Printer. In order to claim conformance to this notification specification, the Printer object MUST  
1204 support this Printer Description attribute. The Printer object supplies this attribute in every printer  
1205 notification that it sends to a notification recipient. This attribute is also available to any client using a  
1206 Get-Printer-Attributes request for this Printer object. The first printer event for a Printer is 'powered-up',  
1207 so this printer attribute always has a value. When all the Job Submission Subscriptions from a particular  
1208 Notification Recipient on a printer expire, and that recipient has no Explicit Subscriptions on this  
1209 Printer, the printer notifications are no longer sent to that Notification Recipient.

1210 The following events are defined to be disjoint. Therefore, the "printer-trigger-event" attribute is single  
1211 valued, since two events cannot be sent in the same notification content.

1212 A Printer MUST support the events indicated as "REQUIRED". The standard keyword values are:

1213 Printer-report events include:

1214 **'none'** - REQUIRED - no notification of any events (an IPP object can use this value to indicate  
1215 that it is configured not to support event notification; a client would not subscribe to this  
1216 event.

1217 **'printer-restarted'** - when the printer is powered up or the Restart-Printer operation is  
1218 performed (see [ipp-adm]). The IPP Printer MUST record this event.

1219 Note: This event is separate from the 'printer-state-changed' event so that it can be  
1220 subscribed to without having to get every printer state change event, for a Notification  
1221 Recipient that is only interested in when the Printer first comes up.

1222 **'printer-shutdown'** - when the device is being powered down or the Shutdown-Printer operation  
1223 has been performed with either power-off or standby options (see [ipp-adm]).

1224 Note: This event is separate from 'printer-state-changed' so that it can be subscribed to  
1225 without having to get every Printer state change event, for a Notification Recipient that is  
1226 only interested in when the Printer is powered down or shutdown.

1227 **'printer-state-changed'** - REQUIRED - the Printer changed state, i.e., the value of the Printer's  
1228 "printer-state", "printer-state-reasons", and/or "printer-is-accepting-jobs" attributes changed,  
1229 except when the Printer starts up or is shutdown. If the "printer-state-reasons" changed, then  
1230 one or more values have been added to or removed from the Printer's "printer-state-reasons"  
1231 attribute, such as 'moving-to-paused' or 'connecting-to-printer'.

1232  
1233 This event also indicates that one or more values have been added to or removed from the  
1234 Printer's "printer-state-reasons" attribute, such as 'moving-to-paused', 'toner-low', or 'media-  
1235 jam', whether or not the Printer's state has changed. If printer state reasons are added when  
1236 the Printer is started up, only the 'printer-restarted' event is generated, in order to keep the  
1237 events disjoint. If printer state reasons are added or removed when the printer is powered-  
1238 down or shutdown, only the 'printer-shutdown' event is generated, in order to keep the events  
1239 disjoint. This event is REQUIRED to be recorded if the printer-state-reason is an error.

1240  
1241 A client that wants to subscribe to all printer state changes, including restart and power-  
1242 down/shutdown, includes the 'printer-restarted', 'printer-state-changed', and 'printer-  
1243 shutdown' in the notification subscription.

1244 **'printer-media-changed'** - when the media loaded on a printer has been changed. The client  
1245 must check the "media-ready" Printer attribute (see [ipp-mod] section 4.2.11) separately to  
1246 find out what new media was loaded.

1247 **'printer-config-changed'** - when the configuration of a Printer has changed, i.e., the value of  
1248 the "printer-message-from-operator" or any non-READ-ONLY Printer attribute has changed,  
1249 except for "media-ready" (which has its own event), whether through the Set-Printer-  
1250 Attributes operation or by other means and whether initiated by a human or not. For  
1251 example, any "xxx-supported", "xxx-default", "printer-message-from-operator", etc. values  
1252 have changed. The client would have to perform a Get-Printer-Attributes to find out the new  
1253 values of these changed attributes. This event would be useful for GUI clients and drivers to  
1254 update the available printer capabilities to the user.



1255        '**printer-no-longer-full**' – when there is more than one client feeding a printer/server (fan-in),  
1256            and the Printer may still printing but has acquired more buffer space to accept jobs. This  
1257            event only occurs when the Printer did not have room to accept jobs previously and rejected a  
1258            Print-Job, Print-URI, Create-Job, Send-Document, or Send-URI operation.  
1259        '**printer-almost-idle**' – when a spooler is feeding more than one printer/server (fan-out), and the  
1260            spooler holds jobs until a Printer requests them, rather than committing jobs to IPP Printers  
1261            before it is necessary. This event MAY be used for a printer to request a new job from any  
1262            subscribers sufficiently ahead of time so that the device does not run out of work between  
1263            jobs.

## 1264    **9.2 printer-trigger-message (text(255))**

1265    This OPTIONAL READ-ONLY attribute provides a short textual description of the most recent printer  
1266    event(s). The "printer-trigger-events" attribute is intended for use by automata, and the "printer-trigger-  
1267    message" is intended for the human end user. If printer-trigger-events is multi-valued, then it is left up to  
1268    the implementation if it concatenates event messages or combines the events to provide a single  
1269    message.

1270

1271    If the Printer object supports the "printer-trigger-message" Printer Description attribute, the Printer  
1272    object MUST be able to generate this message in any of the natural languages identified by the Printer  
1273    object's "generated-natural-language-supported" attribute (see the "attributes-natural-language"  
1274    operation attribute specified in [ipp-mod] section 3.1.4.1). As described in [ipp-mod] section 3.1.4.1 for  
1275    any returned 'text' attribute, if there is a choice for generating this message, the Printer object uses the  
1276    natural language indicated by the value of the "attributes-natural-language" in the client create request if  
1277    supported, otherwise the Printer object uses the value in the Printer object's own "natural-language-  
1278    configured" attribute.

## 1279    **9.3 printer-trigger-time (integer(MIN:MAX))**

1280    This REQUIRED READ-ONLY attribute indicates the point in time specified in seconds since the  
1281    printer was last started at which the most recent printer event occurred for this printer. In order to  
1282    populate this attribute, the Printer object uses the value in its "printer-up-time" attribute at the time the  
1283    event occurred. Since the printer could possibly store its most recent event(s), a value of zero or less is  
1284    available to show that the last event occurred before the last printer restart.

1285    In order to claim conformance to this notification specification, the Printer object MUST support this  
1286    Printer Description attribute. The Printer object MUST supply this attribute in every notification that it  
1287    sends to a notification recipient. This attribute is also available to any client using a Get-Printer-  
1288    Attributes request for this Printer object. The first printer event for a Printer is when it is powered up.  
1289    Therefore, this printer attribute always has a value.

1290    If IPP Printers relay jobs to other IPP Printers, the time of the event is intended to be at the IPP Printer  
1291    object at which the event occurred, not subsequent times of relaying jobs in the forward direction or  
1292    relaying notifications in the reverse direction.

1293 **9.4 printer-trigger-date-time (dateTime)**

1294 This OPTIONAL READ-ONLY attribute indicates the point in time at which the most recent printer  
1295 event occurred for this printer. In order to claim conformance to this notification specification, the  
1296 Printer object MUST support this Printer Description attribute if it also supports the "printer-current-  
1297 time" Printer Description attribute (which also requires a date). The Printer object MUST supply this  
1298 attribute in every notification that it sends to a notification recipient, if it supports this attribute. This  
1299 attribute is also available to any client using a Get-Printer-Attributes request for this Printer object. The  
1300 first printer event for a Printer is when it is powered up. Therefore, this printer attribute always has a  
1301 value.

1302 If IPP Printers relay jobs to other IPP Printers, the time of the event is intended to be at the IPP Printer  
1303 object at which the event occurred, not subsequent times of relaying jobs in the forward direction or  
1304 relaying notifications in the reverse direction.

1305 **9.5 previous-printer-state (type1 enum)**

1306 This REQUIRED READ-ONLY attribute contains the previous state of the printer, i.e., the value of the  
1307 Printer's "printer-state" attribute before the event occurred. See [ipp-mod] section 4.4.11 for the  
1308 description of the values for this attribute. In a notification, the "printer-state" attribute contains the  
1309 current state of the printer, i.e., the state of the printer after the event occurred.

1310 **9.6 printer-state-reasons-added (1setOf type2 keyword)**

1311 This REQUIRED READ-ONLY attribute contains the values of the printer's "printer-state-reasons"  
1312 attribute that were added since the last 'printer-state-changed' event for this Printer. See [ipp-mod]  
1313 section 4.4.12 for the description of the values for this attribute. In a notification, the "printer-state-  
1314 reasons" attribute contains the current values of the Printer's "printer-state-reasons" attribute, i.e., the  
1315 values after the event occurred.

1316 **ISSUE 25 - What meaning do the -added and -deleted job state reason attributes have for the 'printer-  
1317 shutdown' notification? Is that a problem? What about other events, besides 'printer-config-change'?**

1318 **9.7 printer-state-reasons-deleted (1setOf type2 keyword)**

1319 This REQUIRED READ-ONLY attribute contains the values of the printer's "printer-state-reasons"  
1320 attribute that were deleted since the last 'printer-state-changed' event notification. See [ipp-mod] section  
1321 4.4.12 for the description of the values for this attribute. In a notification, the "printer-state-reasons"  
1322 attribute contains the current values of the printer's "printer-state-reasons" attribute, i.e., the values after  
1323 the event occurred.

1324 **9.8 notify-recipients-schemes-supported (1setOf uriScheme)**

1325 This REQUIRED attribute describes the notification delivery methods supported by this Printer object.  
1326 Standard values are defined in Section 5.1.1). In order to claim conformance to this notification  
1327 specification, the Printer object MUST support this Printer Description attribute.

1328 **9.9 *notify-events-default (1setOf type2 keyword)***

1329 This REQUIRED attribute identifies the event values if the client does not supply the "notify-events"  
1330 operation attribute. All the values in this attribute must also appear in the notify-events-supported  
1331 attribute.

1332 **9.10 *notify-events-supported (1setOf type2 keyword)***

1333 This REQUIRED attribute identifies the events supported by this Printer object. In order to claim  
1334 conformance to this notification specification, the Printer object MUST support this Printer Description  
1335 attribute. Standard values are defined in Section 5.1.2.

1336 **9.11 *notify-lease-time-supported (rangeOfInteger(0:MAX))***

1337 This Printer attribute specifies the range of values in seconds that are supported for the "notify-lease-  
1338 time" operation attribute. A Printer MUST support this attribute if it supports the Subscribe-Printer  
1339 operation. See section 6.2.2 for the behavior if the client-supplied value is outside this range.

1340 **9.12 *notify-lease-time-default (integer(0:MAX))***

1341 This Printer attribute specifies the value of the lease time that the Printer object has been configured to  
1342 assume if the client does not supply a "notify-lease-time" operation attribute in the Subscribe-Printer or  
1343 Renew-Subscription operations. A Printer MUST support this attribute if it supports the Subscribe-  
1344 Printer operation.

1345 **9.13 *number-of-subscriptions-supported (integer(1:MAX))***

1346 This OPTIONAL attribute identifies the number of explicit subscriptions using the Subscribe-Printer  
1347 operation that this Printer object can handle at once. The Printer object MUST support this Printer  
1348 Description attribute, if it supports the Subscribe-Printer operation.

1349 NOTE: An event for subscription expiration is not defined. It is the client's responsibility to set up a  
1350 renew timer. Such a timer will not depend on the reliability of notification delivery, and so will be more  
1351 reliable.

1352 **10 Conformance Requirements**

1353 This section further enhances the Conformance Requirements detailed in [IPP-MOD] section 5.  
1354 Extensions made to the events herein must be made such that new events or event attributes are  
1355 backward compatible to clients who implemented early versions of this notification specification.

1356 It is OPTIONAL to implement this Event Notification specification. If implemented, IPP objects MUST  
1357 support all of the REQUIRED object attributes as defined in this document in the indicated sections.

1358 If an object supports an attribute, it MUST support only those values specified in this document or  
1359 through the extension mechanism described in [IPP-MOD] section 5.2.4.

1360 If IPP Notification is implemented, it is OPTIONAL to support the "Explicit Subscriptions" operations.  
1361 If "Explicit Subscriptions" is implemented, the operations described in this document must be supported  
1362 as described below:

1363 Subscribe-Job (section 6.1) OPTIONAL  
1364 Subscribe-Printer (section 6.2) REQUIRED  
1365 Renew-Subscription (section 6.3) REQUIRED  
1366 Unsubscribe-Printer (section 6.4) REQUIRED

1367  
1368 **ISSUE 26 - Can there be registered event extensions as well as private event extensions?**  
1369

## 1370 **11 Security Considerations**

1371 **ISSUE 27 - Waiting for security requirements in the IPP/1.1 Notification Requirements, such as**  
1372 **authorization and authentication for Renew-Subscription and Unsubscribe.**

## 1373 **12 Status Codes**

1374 Add the following status codes:

### 1375 **12.1 client-error-uri-scheme-not-supported (0x04??)**

1376 The scheme of the client-supplied URI in a "notify-recipients" operation attribute in a create job,  
1377 Subscribe-Job, or Subscribe-Printer operation is not supported. See [ipp-mod] section 3.1.7.

### 1378 **12.2 server-error-too-many-subscriptions (0x04??)**

1379 The bounded set of concurrent subscriptions on the Printer object using Subscribe-Printer has been  
1380 exceeded.

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## 1460 **15 Appendix A: Registration Forms to be filled out and submitted to IANA**

### 1461 ***15.1 Registration of ipp-tcp-notify scheme for use with IPP***

1462 This appendix contains the information that IANA requires for registering a URL scheme for use with  
1463 the "application/ipp" MIME media type. The information following this paragraph will be forwarded to  
1464 IANA to register 'ipp-tcp-notify' whose contents are defined in Section 5.1.1 "notify-recipients (1setOf  
1465 uri)" in this document:

1466 **TBD**

1467

1468 **Required parameters:** none

1469 **Optional parameters:** none

1470 **Encoding considerations:**

1471 **Security considerations:**

1472 IPP/1.0 protocol requests/responses do not introduce any security risks not already inherent in the  
1473 underlying transport protocols. Protocol mixed-version interworking rules in [ipp-mod] as well as  
1474 protocol encoding rules in [ipp-pro] are complete and unambiguous.

1475 **Interoperability considerations:**

1476 **TBD**

1477

1478 **Published specification:**

1479 [ipp-not] Isaacson, S., Martin, J., deBry, R., Hastings, T., Shepherd, M., "Internet Printing Protocol/1.0  
1480 & 1.1: IPP Event Notification" draft-ietf-ipp-not-02.txt, May, 1999.

1481 **Applications which use this URL scheme:**

1482 **TBD**

1483 **Person & email address to contact for further information:**

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1492 **15.2 Registration of ipp-udp-notify scheme for use with IPP**

1493 This appendix contains the information that IANA requires for registering a URL scheme for use with  
1494 the "application/ipp" MIME media type. The information following this paragraph will be forwarded to  
1495 IANA to register 'ipp-udp-notify' whose contents are defined in Section 5.1.1 "notify-recipients (1setOf  
1496 uri)" in this document:

1497 **TBD**

1498

1499 **Required parameters:** none

1500 **Optional parameters:** none

1501 **Encoding considerations:**

1502 **Security considerations:**

1503 IPP/1.0 protocol requests/responses do not introduce any security risks not already inherent in the  
1504 underlying transport protocols. Protocol mixed-version interworking rules in [ipp-mod] as well as  
1505 protocol encoding rules in [ipp-pro] are complete and unambiguous.

1506 **Interoperability considerations:**1507 **TBD**

1508

1509 **Published specification:**

1510 [ipp-not] Isaacson, S., Martin, J., deBry, R., Hastings, T., Shepherd, M., "Internet Printing Protocol/1.0  
1511 & 1.1: IPP Event Notification" draft-ietf-ipp-not-02.txt, May, 1999.

1512 **Applications which use this URL scheme:**1513 **TBD**1514 **Person & email address to contact for further information:**

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1522 Email: [hastings@cp10.es.xerox.com](mailto:hastings@cp10.es.xerox.com)1523 **15.3 Registration of multipart/report type, 'print-notification'**

1524 We may have to register a particular report sub-type for use with 'multipart/report' [RFC 1892]. See  
1525 RFC 2298 for a similar kind of registration. **The use of 'multipart/report' needs more understanding and**  
1526 **work.**

1527 **16 Appendix B: Change History**

1528 Changes are listed in reverse chronological order:

1529 **16.1 Changes to the July 21, 1999 to make the July 22, 1999 (T Hastings)**

1530 1. Added the REQUIRED "initial-sequence-numbers" (1setOf integer(1:MAX)) to the Subscribe-  
1531 Printer response to indicate the sequence number to be used in the first notification for each event  
1532 subscribed.

1533 2. Added a number of issues and renumbered.

1534 **16.2 Changes to the July 20, 1999 to make the July 21, 1999 (T Hastings)**

1535 The following changes were made to the July 20, 1999 to make the July 21, 1999 version:

1536 1. Changed the "job-trigger-events (1setOf type2 keyword)" Job Description attribute "job-trigger-  
1537 event (type2 keyword), since events cannot be batched in a notification.



- 1538 2. Changed the "printer-trigger-events (1setOf type2 keyword)" Printer Description attribute "printer-  
1539 trigger-event (type2 keyword), since events cannot be batched in a notification.
- 1540 3. Changed Subscribe-Job from REQUIRED to OPTIONAL if implementing "Explicit Subscription".
- 1541 4. Clarified that events are defined to be disjoint, since the job-trigger-event is now single-valued.  
1542 Thus only the 'job-created' event is generated even if job state reasons are added. Similarly, only the  
1543 'job-completed' event is generated even if job state reasons are added or removed.
- 1544 5. Indicated which Job Description and Printer Description attributes are READ-ONLY, i.e., MUST  
1545 NOT be settable with Set-Job-Attributes or Set-Printer-Attributes operations.
- 1546 6. Clarified which Job attributes cause 'job-config-changed' event: "job-message-from-operator" and  
1547 any non-READ-ONLY Job attributes.
- 1548 7. Clarified which Printer attributes cause 'printer-config-changed' event: "printer-message-from-  
1549 operator" and any non-READ-ONLY Printer attributes, except "media-ready" which has its own  
1550 event.
- 1551 8. Renamed 'ready-for-job' event to 'printer-is-no-longer-full' and clarified that it is generated only  
1552 when a previous Print-Job, Print-URI, Create-Job, Send-Document, or Send-URI operation had been  
1553 rejected due to no more room.
- 1554 9. Renamed 'ready-for-just-in-time-job' to 'printer-almost-idle', to make it clearer how this event differs  
1555 from 'printer-is-no-longer-full'.
- 1556 10. Kept 'printer-shutdown' and 'printer-restarted' as separate and disjoint from 'printer-state-changed'  
1557 event, so that they can be subscribed without having to get all state change events. Also parallel  
1558 with 'job-created', 'job-state-change', and 'job-completed'. Also clarified that shutdown means either  
1559 using the Shutdown-Printer operation with 'standby' or 'power-down' options or power-down by  
1560 other means. Same for 'printer-restarted' being with the Restart-Printer operation or a power-up  
1561 sequence.

1562 **16.3 Changes to the May 18, 1999 to make the July 20, 1999 (M Shepherd)**

1563 The following changes were made to the May 18, 1999 to make the July 20, 1999 version:

- 1564 1. Added new section Conformance Requirements
- 1565 2. Changed 'event report' to 'notification'
- 1566 3. Changed 'request-id' to be used as a sequence number inside each notification.
- 1567 4. Combined job-state-changed and job-state-reason-change into one notification trigger-event.
- 1568 5. Combined printer-state-changed and printer-state-reason-change into one notification trigger event.
- 1569 6. Added "job-config-changed" event
- 1570 7. Moved "device-powering-down" event to be encompassed by "printer-state-change"
- 1571 8. Combined this spec with the Job Independent Subscriptions spec (which was renamed to Explicit  
1572 Subscriptions).
- 1573 9. Added operation Subscribe-Job.
- 1574 10. Added server-error-too-many-subscriptions to Status Codes.

**1575 16.4 Changes to the May 17, 1999 to make the May 18, 1999 (T Hastings, R Bergman)**

- 1576 1. Removed concept of event groups. Subscribe to individual events. Much simpler. The event  
1577 determines what data is sent in the event report. Also allows the client to query the printer to see  
1578 what events are supported, rather than which groups.
- 1579 2. Replaced all of the job state transition events with a single 'job-state-changed' event. The report  
1580 contains the old job state and the new job state.
- 1581 3. Removed the notification-format attribute to keep the proposal simple.
- 1582 4. Added the 'client-error-notify-uri-scheme-not-supported' status code.
- 1583 5. Added REQUIRED "previous-job-state", "previous-job-state-reasons", "previous-printer-state", and  
1584 "previous-printer-state-reasons" Job Description attributes.
- 1585 6. Removed the "job-impressions-completed" from the Basic Job Event Report Content. Bring it back  
1586 with the "job-progress" events.
- 1587 7. Removed the "printer-is-accepting-jobs" from the Basic Printer Event Report Content. Its changing  
1588 is part of the "config-change" event.
- 1589 8. Changed the 'job-state-changed' event, so that it doesn't include 'job-created', 'job-completed', or 'job-  
1590 purged' events.
- 1591 9. Made the event names mostly consistent by being in the past tense to reflect the fact that events  
1592 reports happen after the internal event has completed.
- 1593 10. Combined the 'job-state-reasons-added' and 'job-state-reasons-removed' into a single event: 'job-  
1594 state-reasons-changed'. Same for 'printer-state-reasons-changed'.
- 1595 11. Changed 'mailto' notification method to REQUIRE 'multipart/report' which all mail agents  
1596 understand, at least the text part.
- 1597 12. Deleted the 'job-warning' and 'job-error' events, since they are covered by the 'job-state-reasons-  
1598 changed, 'job-state-changed' and/or 'job-completed' events.

**1599 16.5 Changes to the January 20, 1999 to make the May 17, 1999 version (M Shepherd)**

- 1600 1. Changed references to IPP 1.0 to IPP 1.1
- 1601 2. Implementing the notification specification is optional.
- 1602 3. Refined the definition of Event
- 1603 4. Changed 'notification report' to 'event report' for consistent terminology
- 1604 5. Changed the terminology of an 'active' job to 'not-complete'. Included the 'pending-held' state in the  
1605 'not-complete' super-state.
- 1606 6. Introduced notify-event-groups-default.
- 1607 7. Changed job-trigger-message and job-impressions-completed to be CONDITIONAL in the event  
1608 report, job-trigger-date-time to be RECOMMENDED, and job-state-reasons to be REQUIRED.
- 1609 8. Changed printer-trigger-message to be CONDITIONAL in the event report, and printer-state-reasons  
1610 to be REQUIRED.

- 1611 9. Created a table to map job-trigger-events keywords to event-groups and required status.
- 1612 10. Modified job-continued to be job-resumed-processing, and job-received to be job-created. Added  
1613 job-purged, job-state-reason-removed, and job-state-reason-added keywords.
- 1614 11. Modified job-trigger-time and printer-trigger-time to use values less than zero.
- 1615 12. Created a table to map printer-trigger-events keywords to event-groups and their required status.
- 1616 13. Added ready-for-job and printer-state-reason-added to printer-trigger-events keywords.
- 1617 14. Updated References section
- 1618 15. Added notify-format and notify-format-supported attributes.
- 1619 16. Added subscription-id to the event report attributes of job and printer.
- 1620 17. Made job-errors-basic and printer-errors-basic REQUIRED to be supported.
- 1621 18. Added printer-media-changed, printer-config-changed, and ready-for-just-in-time-job to printer  
1622 events.
- 1623 19. Added Author's Addresses.

1624 **16.6 Changes to the January 18, 1999 to make the January 20, 1999 version**

1625 The following changes were made to the January 18, 1999 to make the January 20, 1999 version:

- 1626 1. Made this an INTERNET-DRAFT.
- 1627 2. Indicated that a new default port is needed for the delivery methods.
- 1628 3. Added Appendices in which to put the registration information for the URL schemes for each  
1629 delivery method.
- 1630 4. Clarified which parameters, Operation attributes, and Job/Printer attributes are supplied in an event  
1631 content: the request-id is 0, the status-code is new 'job-event' 0x600 or 'printer-event' 0x601.
- 1632 5. Changed "job-trigger-event" and "printer-trigger-event" to be 1setOf so that multiple events that  
1633 occur at the same time MAY be send as one event content.
- 1634 6. Added "job-trigger-time" as a REQUIRED Job Description and event content attribute which is in  
1635 seconds since power up.
- 1636 7. Changed "job-trigger-date-time" and "job-state-reasons" to OPTIONAL.
- 1637 8. Changed "status-message" to be an OPTIONAL "job-trigger-message" event content attribute and  
1638 also made it a Job Description attribute.
- 1639 9. Added "printer-trigger-time" as a REQUIRED Printer Description and event content attribute which  
1640 is in seconds since power up.
- 1641 10. Changed "printer-trigger-date-time" and "printer-state-reasons" to OPTIONAL.
- 1642 11. Changed "status-message" to be an OPTIONAL "printer-trigger-message" event content attribute  
1643 and also made it a Printer Description attribute.
- 1644 12. Removed the "job-id" attribute from the printer event content.

1645 **16.7 Changes to the December 10, 1998 to make the January 18, 1999 version**

1646 The following changes were made to the December 10, 1998 to make the January 18, 1999 version:

- 1647 1. Changed the names of the REQUIRED notify-recipient keywords from: 'ipp-tcp-socket' and 'ipp-  
1648 udp-socket' to 'ipp-tcp-notify' and 'ipp-udp-notify'.
- 1649 2. Added '-notify' to the OPTIONAL 'snmpv1', 'snmpv2', and 'snmpv3' delivery method names.
- 1650 3. Changed the OPTIONAL 'sense-datagram' to 'sense-notify' to be consistent.
- 1651 4. Added 'ndps-notify' as an OPTIONAL keyword.
- 1652 5. Deleted the 'all-basic', 'all-job-events-basic', and 'all-printer-events-basic'. Clients should be explicit  
1653 about which groups they want. If new groups are added, the clients won't know what to do with  
1654 them, if they had subscribed to 'all-xxx' groups.
- 1655 6. Changed the names of "job-last-event" and "job-last-date-time-of-event" to "job-trigger-event" and  
1656 "job-trigger-date-time" events, since the events trigger the notification delivery, but the attribute  
1657 values remain after the event has been delivered.
- 1658 7. Added "status-message" as an OPTIONAL event report content attribute.
- 1659 8. Changed "job-impressions-completed" to OPTIONAL.
- 1660 9. Indicated that OPTIONAL attributes are not sent in the event report content if they are not  
1661 supported.
- 1662 10. Required that "status-message" and/or "job-impressions-completed" be sent in an event report  
1663 content if they are supported as an Operation attribute and a Job Description attribute, respectively.
- 1664 11. Added REQUIRED "printer-trigger-event", REQUIRED "job-id", and OPTIONAL "status-message"  
1665 to the printer event report content.
- 1666 12. Specified the "printer-trigger-event" Printer Description attribute, naming each event.
- 1667 13. Deleted the 'sheet-completed' and 'collated-copy-completed', since these events are not part of any  
1668 'xxx-basic' event group. They can be added back when we have an event group that uses them.

1669 **16.8 Changes to the July 1, 1998 to make the December 10, 1998 version**

1670 The following changes made from the July 1, 1998 to make the December 10, 1998 version:

- 1671 1. Clarified the terminology so that an "event" doesn't necessarily mean that a notification report is  
1672 delivered.
- 1673 2. Removed many of the job and printer attributes for being sent in a notification event report, so that  
1674 we can get agreement on a basic set of event report content. Only attributes really needs are  
1675 included, including what may be needed for FAX. Changed the names of the event groups by  
1676 adding the suffix '-basic' to indicate that these event groups return only basic information.  
1677 Additional event groups can be registered in order to get more attributes as needed for accounting  
1678 and more detailed job monitoring purposes.
- 1679 3. Deleted the "job-progress" event group. We can bring it back when we agree to all of the extra  
1680 attributes. Its not very useful with only the basic attributes.

- 1681 4. The printer events are indicted using the "printer-state-reasons" values, instead of the Printer MIB  
1682 alert codes. Since most of the Printer MIB alert codes, except for the generic ones, have equivalent  
1683 IPP keyword reason values, this should be a problem and makes IPP more readably implemented in  
1684 a server that doesn't have the Printer MIB.
- 1685 5. Added the "job-last-event" job description attribute to give the job event some persistence.
- 1686 6. Changed the job's "time-at-event (integer)" to "job-last-date-time-of-event (dateTime)" to give an  
1687 absolute date and time, in case events are being relayed back through multiple servers, such as in  
1688 FAX. Also made it a Job Description attribute to give it persistence.
- 1689 7. Changed the printer's "time-at-event(integer)" to "printer-last-date-time-of-event(dateTime)" to give  
1690 an absolute date and time, in case events are being relayed back through multiple servers, such as in  
1691 FAX. Also made it a Printer Description attribute to give it persistence.
- 1692 8. Added the IPP/1.0 "printer-is-accepting-jobs" to the event report, since changes in its value are really  
1693 printer state changes.
- 1694 9. Added the complete semantics for each job event under the "last-job-event" Job Description  
1695 attribute.

## 1696 **17 Appendix C: Full Copyright Statement**

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