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9 **Internet Printing Protocol/1.1: Requirements for IPP Notifications**
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13 STATUS OF THIS MEMO

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27

28 ABSTRACT

29

30 This document is one of a set of documents which together describe all aspects of a new Internet Printing
31 Protocol (IPP). IPP is an application level protocol that can be used for distributed printing on the Internet.
32 There are multiple parts to IPP, but the primary architectural components are the Model, the Protocol and
33 an interface to Directory Services. This document provides a statement of the requirements for notifications
34 as part of an IPP Service. **Some ISSUES are indicated in the text.**

35 The full set of IPP documents include:

36

37 Design Goals for an Internet Printing Protocol [RFC2567]

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

39 Internet Printing Protocol/1.0: Model and Semantics [RFC2566]

40 Internet Printing Protocol/1.0: Encoding and Transport [RFC2565]

41 Internet Printing Protocol/1.0: Implementer's Guide [RFC 2639]

42 Mapping between LPD and IPP Protocols [RFC2569]

43

44 The 'Design Goals for an Internet Printing Protocol' document takes a broad look at distributed printing
 45 functionality, and it enumerates real-life scenarios that help to clarify the features that need to be included
 46 in a printing protocol for the Internet. It identifies requirements for three types of users: end users,
 47 operators, and administrators. It calls out a subset of end user requirements that are satisfied in IPP/1.0.
 48 Operator and administrator requirements are out of scope for version 1.0.

49

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

53

54 The 'Internet Printing Protocol/1.0: Encoding and Transport' document is a formal mapping of the abstract
 55 operations and attributes defined in the model document onto HTTP/1.1. It defines the encoding rules for a
 56 new Internet media type called 'application/ipp'.

57

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

63

64 The 'Mapping between LPD and IPP Protocols' document gives some advice to implementers of gateways
 65 between IPP and LPD (Line Printer Daemon) implementations.

66

67 Table of Contents

68

69	1	Scope.....	3
70	2	Terminology.....	3
71	3	Scenarios.....	6
72	4	Requirements	9
73	5	Security considerations for IPP Notifications requirements	11
74	6	Internationalization Considerations	12
75	7	IANA Considerations	12
76	8	References.....	12
77	9	Author's Address.....	13

78

79 **1 Scope**

80

81 The scope of this requirements document covers functionality used by the following kinds of IPP Users:
82 End Users, Print Administrators and Operators.

83

84 **2 Terminology**

85

86 It is necessary to define a set of terms in order to be able to clearly express the requirements for notification
87 services in an IPP System.

88

89 2.1 Job Submitting End User

90

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

93

94 2.2 Administrator

95

96 A human user who established policy for and configures the print system.

97

98 2.3 Operator

99

100 A human user who carries out the policy established by the Administrator and controls the day to day
101 running of the print system.

102

103 2.4 Job Submitting Application

104

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

108

109 2.5 Security Domain

110

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

114

115 2.6 IPP Client

116

117 The software component that sends IPP requests to an IPP Printer object and accepts IPP responses from an
118 IPP Printer.

119

120 2.7 Job Recipient

121

122 A human who is the ultimate consumer of the print job. In many cases this will be the same person as the
123 Job Submitting End User, but this need not always be the case. For example, if I use IPP to print a

124 document on a printer in a business partner's office, I am the Job Submitting End User, while the person I
125 intend the document for in my business partner's office is the Job Recipient. Since one of the goals of IPP
126 is to be able to print near the Job Recipient of the printed output, we would normally expect that person to
127 be in the same security domain as, and geographically near, the Printer. However, this may not always be
128 the case. For example, I submit a print job across the Internet to a Kinko's print shop. I am both the
129 Submitting end User and the Job Recipient, but I am neither near nor in the same security domain as the
130 Printer.

131

132 2.8 Job Recipient Proxy

133

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

140

141 2.9 Notification Subscriber

142

143 A client that requests the IPP Printer to send Event Notifications to one or more Notification Recipients. A
144 Notification Subscriber may be a Job Submitting End User or an End User, an Operator, or an
145 Administrator that is not submitting a job.

146

147 2.10 Notification Source

148

149 The entity that sends Event Notifications.

150

151 2.11 Notification Recipient

152

153 The entity that receives IPP Notifications about Job and/or Printer events. A Notification Recipient may be
154 a: Job Submitting End User, Job Submitting Application, Job Recipient, Job Recipient Proxy, Operator, or
155 Administrator, etc., and their representatives or log file or usage statistics gathering application or other
156 active or passive entities.

157

158 2.12 Notification Recipient Agent

159

160 A program which receives Event Notifications on behalf of the Notification Recipient. The agent may take
161 some action on behalf of the recipient, forward the notification to the recipient via some alternative means
162 (for example, page the recipient), or queue the notification for later retrieval by the recipient.

163

164 2.13 Event

165

166 A Event is some occurrence (either expected or unexpected) within the printing system of a change of state,
167 condition, or configuration of a Job or Printer object.

168

169 2.14 Event Notification

170

171 When an event occurs, an Event Notification is generated that fully describes the event (what the event was,
172 where it occurred, when it occurred, etc.). Event Notifications are delivered to all the Notification
173 Recipients that are subscribed to that Event, if any. The Event Notification is delivered to the address of
174 the Notification Recipient using the notification delivery method defined in the subscription. However, an
175 Event Notification is sent ONLY if there is a corresponding subscription.

176

177 2.15 Notification Subscription

178

179 A Notification Subscription is a request by a Notification Subscriber to the IPP Printer to send Event
180 Notifications to specified Notification Recipient(s) when the event occur.

181

182 2.16 Notification Attributes

183

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

188

189 number-of-intervening jobs

190 job-k-octets

191 job-k-octets processed

192 job impressions

193 job-impressions-interpreted

194 job-impressions-completed

195 impressionsCompletedCurrentCopy (job MIB)

196 sheetCompletedCopyNumber (job MIB)

197 sheetsCompletedDocumentNumber (job MIB)

198 Copies-requested

199 Copy-type

200 Output-destination

201 Job-state-reasons

202 Job ID

203 Printer URI

204 Subscription ID (for job independent subscription)

205

206 2.17 Notification Delivery Method (or Delivery Method for short)

207

208 Event Notifications are delivered using a method, such as email, TCP/IP, etc.

209

210 2.18 Immediate Notification

211

212 Notifications sent to the Notification Recipient or the Notification Recipient's agent in such a way that the
213 notification arrives immediately , within the limits of common addressing, routing, network congestion and
214 quality of service.

215
216 2.19 Store and Forward Notification

217
218 Notifications which are not necessarily delivered to Notification Recipients immediately, but are queued for
219 delivery by some intermediate network application, for later retrieval. Email is an example of a store and
220 forward notification delivery method.

221
222 2.20 Reliable Delivery of Notifications

223
224 Notifications which are delivered by a reliable delivery of packets or character stream, with
225 acknowledgment and retry, such that delivery of the notification is guaranteed within some determinate
226 time limits. For example, if the Notification Recipient has logged off and gone home for the day, an
227 immediate notification cannot be guaranteed to be delivered, even when sent over a reliable transport,
228 because there is nothing there to catch it. Guaranteed delivery requires both store and forward notification
229 and a reliable transport.

230
231 2.21 Notification over Unreliable Transport

232
233 Notifications are delivered via the fundamental transport address and routing framework, but no
234 acknowledgment or retry is required. Process to process communications, if involved, are unconstrained.

235
236
237 2.22 Human Consumable Notification

238
239 Notifications which are intended to be consumed by human end users only. Email would be an example of
240 a Human consumable notification, though it could also contain Machine Consumable Notification.

241
242 2.23 Machine Consumable Notification

243
244 Notifications which are intended for consumption by a program **only**, such as an IPP Client. Machine
245 Consumable notifications may not contain human readable information. Do we need both human and
246 machine? Machine readable is intended for application to application only. The Notification Recipient
247 could process the machine readable Event Notification into human readable format.

248
249 2.24 Mixed Notification

250
251 A mixed notification contains both Human Consumable and Machine Consumable information.

252
253 **3 Scenarios**

254
255 1. I am sitting in my office and submit a print job to the printer down the hall. I am in the same security
256 domain as the printer and of course, geographically near. I want to know immediately when my print

257 job will be completed (or if there is a problem) because the document I am working on is urgent. I
258 submit the print job with the following attributes:

- 259
- 260 – Notification Recipient - me
- 261 – Notification Events - all
- 262 – Notification Attributes - job-state-reason
- 263 – Notification Type - immediate
- 264

- 265 2. I am working from home and submit a print job to the same printer as in the previous example.
266 However, since I am not at work, I cannot physically get the print file or do anything with it. It can wait
267 until I get to work this afternoon. However, I'd like my secretary to pick up the output and put it on my
268 desk so it doesn't get lost or miss-filed. I'd also like a store and forward notification sent to my email so
269 that when I get to work I can tell if there was a problem with the print job. I submit a print job with the
270 following attributes:

- 271
- 272 – Notification Recipient - my secretary
- 273 – Notification Events - print complete
- 274 – Notification Type - immediate
- 275
- 276 – Notification Recipient - me
- 277 – Notification Events - print complete
- 278 – Notification Attributes - impressions completed
- 279 – Notification Type - store and forward
- 280

- 281 3. I am sitting in my office and submit a print job to a client at an engineering firm we work with on a
282 daily basis. The engineering firm is in Belgium. I would like my client to know when the print job is
283 complete, so that she can pick it up from the printer in her building. It is important that she review it
284 right away and get her comments back to me. I submit the print job with the following attributes:

- 285
- 286 – Notification Recipient - client at engineering firm
- 287 – Notification Events - print complete
- 288 – Notification Type - immediate
- 289 – Notification Language - French
- 290

- 291 4. I am in a hotel room and send a print job to a Kinko's store in the town I am working in, in order to get a
292 printed report for the meeting I am attending in the morning. Since I'm going out to dinner after I get
293 this job submitted, an immediate notification won't do me much good. However, I'd like to check in the
294 morning before I drive to the Kinko's store to see if the file has been printed. An email notification is
295 sufficient for this purpose. I submit the print job with the following attributes:

- 296
- 297 – Notification Recipient - me
- 298 – Notification Events - print complete
- 299 – Notification Type - store and forward
- 300

- 301 5. I am printing a large, complex print file. I want to have some immediate feedback on the progress of the
302 print job as it prints. I submit the print job with the following attributes:
303
- 304 – Notification Recipient - me
 - 305 – Notification Type - immediate
 - 306 – Notification Events - all state transitions
 - 307 – Notification Attributes - impression completed
- 308
- 309 6. I am an operator and my duties is to keep the printer running. I subscribe independently from a job
310 submission so that my subscription outlasts any particular job. I subscribe with the following attributes:
311
- 312 – Notification Recipient - me
 - 313 – Notification Type - immediate
 - 314 – Notification Events - all Printer state transitions
 - 315 – Notification Attributes - Printer state, printer state reasons, device powering up, device powering
316 down.
- 317
- 318 7. I am a usage statistics gathering application. I subscribe independently from a job submission so that my
319 subscription outlasts any particular job. My subscription may persists across power cycles. I subscribe
320 with the following attributes:
321
- 322 – Notification Recipient - me
 - 323 – Notification Type - immediate
 - 324 – Notification Events - job completion
 - 325 – Notification Attributes - impression completed, sheets completed, time submitted, time started, time
326 completed, job owner, job size in octets, etc.
- 327
- 328 8. I am a client application program that displays a list of jobs currently queued for printing on a printer. I
329 display the "job-name", "job-state", "job-state-reasons", "page-count", and "intervening-jobs" either for
330 the user's jobs or for all jobs. The window displaying the job list remains open for an independent
331 amount of time, and it is desired that it represent the current state of the queue. It is desired that the
332 application only need to perform a slow poll in order to recover from any missed notifications. So the
333 event delivery mechanism provides the means to update the screen on all needed changes, including
334 querying for some attributes that may not be delivered in the Notification.
335
- 336 9. I am a client application program that displays a list of printers. For each Printer I display the current
337 state and configuration. The window displaying the printer list remains open for an independent
338 amount of time, and it is desired that it represent the current state of each printer. It is desired that the
339 application only need to perform a slow poll in order to recover from any missed notifications. So the
340 event delivery mechanism provides the means to update the screen on all needed changes, including
341 querying for some attributes that may not be delivered in the Notification.
342
- 343 10. I am an IPP Server that controls one or more devices and implements an IPP Printer object to represent
344 each device. I want to support IPP Notification for each of the IPP Printer objects that I implement.
345 Many of these devices do not support notification (or IPP). So I need to support the IPP Notification

346 semantics specified for each IPP Printer object myself on behalf of each of the devices that each of the
347 IPP Printer objects represent. When I accept IPP job creation requests, I convert the request to what the
348 device will accept. In some cases, I must poll the devices in order to be informed of their job and
349 device state and state changes in order to be able to send IPP Notifications to subscribed Notification
350 Recipients.
351

- 352 11. I am an IPP Server that controls one or more devices and implements an IPP Printer object to represent
353 each device. I want to support IPP Notification for each of the IPP Printer objects that I implement.
354 These devices all support IPP, including IPP Notification. I would like the design choice for supporting
355 IPP Notification for these IPP Printer objects that I implement either (1) by forwarding the notification
356 to the IPP Printers that I alone control and have them send the notifications to the intended Notification
357 Recipients without my involvement or (2) replace the notification submitted with the Job to indicate me
358 as the Notification Recipient and I will in turn forward Notifications to the Notification Recipients
359 requested by my clients. Most of the rest of the contents of the IPP Job that I send to the IPP Printers
360 that I control will be the same as the IPP Job that I receive from my IPP clients.
361
- 362 12. I am an IPP Server that controls one or more devices and implements an IPP Printer object to represent
363 each device. I want to support IPP Notification for each of the IPP Printer objects that I implement.
364 These devices all support IPP, including IPP Notification. Because these IPP Printers MAY also be
365 being controlled by other servers (using IPP or other protocols), I only want job events for the jobs that I
366 send, but do want Printer events all the time, so that I can show proper Printer state to my clients. So I
367 subscribe to these IPP Printers for Printer events with a long standing subscription with myself to as the
368 Notification Recipient. When I get a Job Creation request, I decide to which IPP Printer to send the job.
369 When I do so, I also add a job subscription for Job events with me as the Notification Recipient to the
370 job's job subscriptions supplied by my clients (this usage is called "piggy-backing"). These IPP Printers
371 automatically remove their job subscriptions when the job completes as for all job subscriptions so that
372 I no longer get Job events when my jobs are completed.
373

374 4 Requirements

375
376 The following requirements are intended to be met by the IPP Notification specification (not the
377 implementation). The resulting IPP Notification Specification document:

- 378
- 379 1. must indicate which of these requirements are REQUIRED and which are OPTIONAL for a conforming
380 implementation to support.
381
 - 382 2. must be designed to that an IPP Printer can *transparently* support the IPP Notification semantics using
383 third party notification services that exist today or that may be standardized in the future.
384
 - 385 3. must define means for a Job Submitting End User to specify zero or more Notification Recipients when
386 submitting a print job. A Submitter will not be able to prevent out of band subscriptions from
387 authorized persons, such as Operators.
388
 - 389 4. must define means when specifying a Notification Recipient, for a Notification Subscriber to be able to
390 specify one or more notification events for that Notification Recipient, subject to administrative and

391 security policy restrictions. Any of the following constitute Job or Printer Events that a Job Submitting
392 End User can specify notifications be sent for:

- 393 • Any standard Printer MIB alert (i.e. device alerts) (critical and warning?) (state change
394 notifications)?
- 395 • Job Received (transition from Unknown to Pending)
- 396 • Job Started (Transition from Pending to Processing)
- 397 • Page Complete (Page is stacked)
- 398 • Collated Copy Complete (last sheet of collated copy is stacked)
- 399 • Job Complete (transition from Processing or Processing-stopped to Completed)
- 400 • Job aborted (transition from Pending, Pending-held, Processing, or Processing-stopped to
401 Aborted)
- 402 • Job canceled (transition from Pending, Pending-held, Processing, or Processing-held to
403 Canceled)
- 404 • Other job state changes like 'paused', purged?
- 405 • Device problems for which the job is destined
- 406 • Job (interpreter) issues

407
408 5. must define how an End User or Operator subscribes for:

- 409 • Any set of Job Events for a specific job.
- 410 • Any set of Printer Events while a specific job is not complete.

411
412 6. must define how an End User or Operator subscribes for the following without having to submit a Job:

- 413 • Any set of Printer Events for a defined period.
- 414 • Any set of Job Events for all jobs with no control over which jobs.

415 **ISSUE - Ok if there isn't a way for an End-User to submit an empty Per-Printer Subscription, in case such a**
416 **Subscription slot is a scarce commodity, and then enable the Per-Printer Subscription when the data arrives**
417 **and disable later without deleting the subscription?**

418
419 7. must define how the Notification Subscriber is able to specify either immediate or store and forward
420 notification independently for each Notification Recipient. The means may be explicit, or implied by
421 the method of delivery chosen by the Job Submitting End User.

422
423 8. must define common delivery methods, e.g. email, must be defined.

424
425 9. must define how an IPP Printer validates its ability to deliver an Event using the specified delivery
426 scheme. If it does not support the specified scheme, or the specified scheme is invalid for some reason,
427 then the IPP Printer accepts and performs the request anyway and responds indicating the unsupported
428 attribute values. There is no requirement for the IPP Printer receiving the print request to validate the
429 identity of an Notification Recipient, nor the ability of the system to deliver an event to that recipient as
430 requested (for example, if the Notification Recipient is not at work today).

431
432 10. must define a class of IPP event notification delivery methods which can flow through corporate
433 firewalls. However, an IPP printer need not test to guarantee delivery of the notification through a
434 firewall before accepting a print job.

- 435 11. may define means for delivering a notification to the submitting client when the delivery of an event
436 notification to a specified Notification Recipient fails. Fall back means of subscribers determining if
437 notifications have failed, i.e. polling, may be provided.
438
- 439 12. must define a mechanism for localizing Human Consumable notifications by the Notification Source.
440
- 441 13. may define a way to specify whether or not event delivery requires acknowledgement back to the
442 Notification Source.
- 443 **ISSUE - Ok if spec doesn't have means for a Notification Recipient acknowledging receipt of a notification**
444 **to the Notification Source?**
445
- 446 14. There must be a mechanism defined so that job independent subscriptions do not become stale and do
447 not require human intervention to remove stale subscriptions. However, stale must not be the inability
448 to deliver an Event Notification , since temporary Notification delivery problems must be tolerated.
449
- 450 15. A mechanism must be defined so that an Event Subscriber is able to add an Event Subscription to a Job
451 after the Job has been submitted.
452
- 453 16. A mechanism must be defined so that a client is able to cancel an Event Subscription on a job or printer
454 after the job has been submitted.
455
- 456 17. A mechanism must be defined so that a client can obtain the set of current Subscriptions.
457

458 **5 Security considerations for IPP Notifications requirements**

459

460 By far the biggest security concern is the abuse of notification: sending unwanted notifications to third
461 parties (i.e., spam). The problem is made worse by notification addresses that may be redistributed to
462 multiple parties (e.g. mailing lists). There exist scenarios where third party notification is required (see
463 Scenario #2 and #3). The fully secure solution would require active agreement of all recipients before
464 sending out anything. However, requirement #9 (“There is no requirement for IPP Printer receiving the
465 print request to validate the identity of an event recipient”) argues against this. Certain systems may decide
466 to disallow third party notifications (a traditional fax model).
467

468 Clients submitting notification requests to the IPP Printer has the same security issues as submitting an
469 IPP/1.1 print job request. The same mechanisms used by IPP/1.1 can therefore be used by the client
470 notification submission. Operations that require authentication can use the HTTP authentication.
471 Operations that require privacy can use the HTTP/TLS privacy.
472

473 The notification access control model should be similar to the IPP access control model. Creating a
474 notification subscription is associated with a user. Only the creator or an operator can cancel the
475 subscription. The system may limit the listing of items to only those items owned by the user. Some
476 subscriptions (e.g. those that have a lifetime longer than a job) can be done only by privileged users
477 (operators and/or administrators), if that is the authorization policy.
478

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

483

484 **6 Internationalization Considerations**

485

486 The Human Consumable notification must be localized to the natural language and charset that Notification
487 Subscriber specifies within the choice of natural languages and charsets that the IPP Printer supports.

488

489 The Machine Consumable notification data uses the 'application/ipp' MIME media type. It contains some
490 attributes whose text values are required to be in the natural language and charset that the Notification
491 Subscriber specifies within the choice of natural languages and charsets that the IPP Printer supports. See
492 [RFC2566].

493

494 **7 IANA Considerations**

495

496 There will be some notification delivery methods registered with IANA for use in URLs.

497

498 **8 References**

499

500 [ipp-mod]

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

503 [RFC2565]

504 Herriot, R., Butler, S., Moore, P., Tuner, R., "Internet Printing Protocol/1.0: Encoding and
505 Transport", RFC 2565, April 1999.

506 [RFC2566]

507 R. deBry, T. Hastings, R. Herriot, S. Isaacson, P. Powell, "Internet Printing Protocol/1.0: Model and
508 Semantics", RFC 2566, April 1999.

509 [RFC2567]

510 Wright, D., "Design Goals for an Internet Printing Protocol", draft-ietf-ipp-req-03.txt, November,
511 1998.

512 [RFC2568]

513 Zilles, S., "Rationale for the Structure and Model and Protocol for the Internet Printing Protocol",
514 draft-ietf-ipp-rat-04.txt, November, 1998.

515 [RFC2569]

516 Herriot, R., Hastings, T., Jacobs, N., Martin, J., "Mapping between LPD and IPP Protocols", draft-
517 ietf-ipp-lpd-ipp-map-05.txt, November 1998.

518 [RFC2639]

519 T. Hastings, C. Manros. "Internet Printing Protocol/1.0: Implementer's Guide", RFC 2639, July
520 1999.

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