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8	
9	Internet Printing Protocol (IPP): Requirements for IPP Notifications
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11	
12	
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14	
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18	
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26	
27	ABSTRACT
28	
29	This document is one of a set of documents which together describe all aspects of a new Internet Printing
30	Protocol (IPP). IPP is an application level protocol that can be used for distributed printing on the Internet.
31	There are multiple parts to IPP, but the primary architectural components are the Model, the Protocol and an
32	interface to Directory Services. This document provides a statement of the requirements for notifications as
33	part of an IPP Service.
34	

34 35	Th	e full set of IPP documents include:
36 37		Design Goals for an Internet Printing Protocol [RFC2567] Rationale for the Structure and Model and Protocol for the Internet Printing Protocol [RFC2568]
38		Internet Printing Protocol/1.0: Model and Semantics [RFC2566]
39		Internet Printing Protocol/1.0: Encoding and Transport [RFC2565]
40		Internet Printing Protocol/1.0: Implementer's Guide [RFC 2639]
41		Mapping between LPD and IPP Protocols [RFC2569]
42		
43		e 'Design Goals for an Internet Printing Protocol' document takes a broad look at distributed printing
44		nctionality, and it enumerates real-life scenarios that help to clarify the features that need to be included in a
45	-	nting protocol for the Internet. It identifies requirements for three types of users: end users, operators, and
46		ministrators. It calls out a subset of end user requirements that are satisfied in IPP/1.0. Operator and
47	ad	ministrator requirements are out of scope for version 1.0.
48		
49 50		e 'Rationale for the Structure and Model and Protocol for the Internet Printing Protocol' document
50		scribes IPP from a high level view, defines a roadmap for the various documents that form the suite of IPP
51 52	spe	ecifications, and gives background and rationale for the IETF working group's major decisions.
52 53	Th	e 'Internet Printing Protocol/1.0: Encoding and Transport' document is a formal mapping of the abstract
55 54		erations and attributes defined in the model document onto HTTP/1.1. It defines the encoding rules for a
55	-	w Internet media type called 'application/ipp'.
56	пс	w memer media type cancer appreations pp.
57	Th	e 'Internet Printing Protocol/1.0: Implementer's Guide' document gives insight and advice to implementers of
58		P clients and IPP objects. It is intended to help them understand IPP/1.0 and some of the considerations
59 60	tha	at may assist them in the design of their client and/or IPP object implementations. For example, a typical der of processing requests is given, including error checking. Motivation for some of the specification
61 62		cisions is also included.
63	Th	e 'Mapping between LPD and IPP Protocols' document gives some advice to implementers of gateways
64		tween IPP and LPD (Line Printer Daemon) implementations.
65		
66		Table of Contents
67		
68	1	Scope4
69	2	Terminology
70	3	Scenarios
71	4	Requirements
		-
72	5	Security considerations for IPP Notifications requirements

deBry, Lewis, Hastings

79

[Page 3]

73	6	Internationalization Considerations	13
74	7	IANA Considerations	13
75	8	References	13
76	9	Author's Address	14
77 78	10	Appendix A: Full Copyright Statement	15

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79 80	1	Scope
81		The scope of this requirements document covers functionality used by the following kinds of IPP Users: End
82		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 same
92 93		security domain as the Printer. This person may or may not be geographically near the printer.
94	2.2	Administrator
95		
96		A human user who established policy for and configures the print system.
97		
98	2.3	Operator
99		
00		A human user who carries out the policy established by the Administrator and controls the day to day running
01		of the print system.
.02		
.03	2.4	Job Submitting Application
.04		
.05		An application (for example, a batch application), acting on behalf of a Job Submitting End User, which
.06		submits a print job to an IPP Printer. The application may or may not be within the same security domain as
.07		the Printer. This application may or may not be geographically near the printer.
.08	25	
.09	2.5	Security Domain
10		For the numbers of this discussion, the set of naturally components which can communicate without going
11		For the purposes of this discussion, the set of network components which can communicate without going through a proxy or firewall. A security domain may be geographically very large, for example - anyplace within
12		IBM.COM.
13 14		IBM:COM.
15	26	IPP Client
16	2.0	
17		The software component that sends IPP requests to an IPP Printer object and accepts IPP responses from an
18		IPP Printer.
19		
.20	2.7	Job Recipient
21		1

.22	A human who is the ultimate consumer of the print job. In many cases this will be the same person as the Job
.23	Submitting End User, but this need not always be the case. For example, if I use IPP to print a document on a
.24	printer in a business partner's office, I am the Job Submitting End User, while the person I intend the document
.25	for in my business partner's office is the Job Recipient. Since one of the goals of IPP is to be able to print near
.26	the Job Recipient of the printed output, we would normally expect that person to be in the same security
.27	domain as, and geographically near, the Printer. However, this may not always be the case. For example, I
.28	submit a print job across the Internet to a Kinko's print shop. I am both the Submitting end User and the Job
.29	Recipient, but I am neither near nor in the same security domain as the Printer.
.30	
.31	2.8 Job Recipient Proxy
.32	
.33	A person acting on behalf of the Job Recipient. In particular, the Job Recipient Proxy physically picks up the
.34	printed document from the Printer, if the Job Recipient cannot perform that function. The Proxy is by
.35	definition geographically near and in the same security domain as the printer. For example, I submit a print
.36	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
.37	my desk. In this case, I am acting as both Job Submitting End User and Job Recipient. My secretary is acting
.38	as a Job Recipient Proxy.
.39	
.40	2.9 Notification Subscriber
.41	
.42	A client that requests the IPP Printer to send Event Notifications to one or more Notification Recipients. A
.43	Notification Subscriber may be a Job Submitting End User or an End User, an Operator, or an Administrator
.44	that is not submitting a job.
.45	
.46	2.10 Notification Source
.47	
.48	The entity that sends Event Notifications.
.49	
.50	2.11 Notification Recipient
.51	
.52	The entity that receives IPP Notifications about Job and/or Printer events. A Notification Recipient may be a:
.53	Job Submitting End User, Job Submitting Application, Job Recipient, Job Recipient Proxy, Operator, or
.54	Administrator, etc., and their representatives or log file or usage statistics gathering application or other active
.55	or passive entities.
.56	
.57	2.12 Notification Recipient Agent
.58	
.59	A program which receives Event Notifications on behalf of the Notification Recipient. The agent may take
.60	some action on behalf of the recipient, forward the notification to the recipient via some alternative means (for
.61	example, page the recipient), or queue the notification for later retrieval by the recipient.
.62	
.63	2.13 Event
.64	

.65	A Event is some occurrence (either expected or unexpected) within the printing system of a change of state,
.66	condition, or configuration of a Job or Printer object.
.67	
.68	2.14 Event Notification
.69	
.70	When an event occurs, an Event Notification is generated that fully describes the event (what the event was,
.71	where it occurred, when it occurred, etc.). Event Notifications are delivered to all the Notification Recipients
.72	that are subscribed to that Event, if any. The Event Notification is delivered to the address of the Notification
.73	Recipient using the notification delivery method defined in the subscription. However, an Event Notification is
.74 .75	sent ONLY if there is a corresponding subscription.
.75	2.15 Notification Subscription
.77	2.15 Notification Subscription
.78	A Notification Subscription is a request by a Notification Subscriber to the IPP Printer to send Event
.79	Notifications to specified Notification Recipient(s) when the event occur.
.80	Notifications to specifica Notification Recipicit(s) when the event occur.
.81	2.16 Notification Attributes
.82	
.83	IPP Objects (for example, a print job) from which notification are being sent may have attributes associated
.84	with them. A user may want to have one or more of these associated attributes returned along with a particular
.85	notification. In general, these may include any attribute associated with the object emitting the notification.
.86	Examples include:
.87	
.88	number-of-intervening jobs
.89	job-k-octets
.90	job-k-octets processed
.91	job impressions
.92	job-impressions-interpreted
.93	job-impressions-completed
.94	impressionsCompletedCurrentCopy (job MIB)
.95	sheetCompletedCopyNumber (job MIB)
.96	sheetsCompletedDocumentNumber (job MIB)
.97	Copies-requested
.98	Copy-type
.99	Output-destination
200	Job-state-reasons
201	Job ID
202	Printer URI
203	Subscription ID (for job independent subscription)
204	2.17 Matting Deling method (as Delin - Matting 1, 1)
205	2.17 Notification Delivery Method (or Delivery Method for short)
206	Event Natifications are delivered using a method such as area it TCD/ID ata
207	Event Notifications are delivered using a method, such as email, TCP/IP, etc.

208	
209	2.18 Immediate Notification
210	
211	Notifications sent to the Notification Recipient or the Notification Recipient's agent in such a way that the
212	notification arrives immediately, within the limits of common addressing, routing, network congestion and
213	quality of service.
214	
215	2.19 Store and Forward Notification
216	
217	Notifications which are not necessarily delivered to Notification Recipients immediately, but are queued for
218	delivery by some intermediate network application, for later retrieval. Email is an example of a store and
219	forward notification delivery method.
220	
221	2.20 Reliable Delivery of Notifications
222	
223	Notifications which are delivered by a reliable delivery of packets or character stream, with acknowledgment
224	and retry, such that delivery of the notification is guaranteed within some determinate time limits. For example,
225	if the Notification Recipient has logged off and gone home for the day, an immediate notification cannot be
226	guaranteed to be delivered, even when sent over a reliable transport, because there is nothing there to catch it.
227	Guaranteed delivery requires both store and forward notification and a reliable transport.
228	
229	2.21 Notification over Unreliable Transport
230	
231	Notifications are delivered via the fundamental transport address and routing framework, but no
232	acknowledgment or retry is required. Process to process communications, if involved, are unconstrained.
233	
234	
235	2.22 Human Consumable Notification
236	
237	Notifications which are intended to be consumed by human end users only. Email would be an example of a
238	Human consumable notification, though it could also contain Machine Consumable Notification.
239	
240	2.23 Machine Consumable Notification
241	
242	Notifications which are intended for consumption by a program only , such as an IPP Client. Machine
243	Consumable notifications may not contain human readable information. Do we need both human and machine?
244	Machine readable is intended for application to application only. The Notification Recipient could process the
245	machine readable Event Notification into human readable format.
246	
247	2.24 Mixed Notification
248	
249	A mixed notification contains both Human Consumable and Machine Consumable information.
250	

251 252	3	Scenarios
253 254 255 256 257		1. I am sitting in my office and submit a print job to the printer down the hall. I am in the same security domain as the printer and of course, geographically near. I want to know immediately when my print job will be completed (or if there is a problem) because the document I am working on is urgent. I submit the print job with the following attributes:
257 258		 Notification Recipient - me
.50 259		 Notification Events - all
260		 Notification Attributes - job-state-reason
261		 Notification Type - immediate
262		
263 264 265 266 267 268		2. I am working from home and submit a print job to the same printer as in the previous example. However, since I am not at work, I cannot physically get the print file or do anything with it. It can wait until I get to work this afternoon. However, I'd like my secretary to pick up the output and put it on my desk so it doesn't get lost or miss-filed. I'd also like a store and forward notification sent to my email so 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 following attributes:
269 270		Notification Desirient my secretary
270 271		 Notification Recipient - my secretary Notification Events - print complete
271		 Notification Type - immediate
272		- Nouncation Type - miniculae
274 274		 Notification Recipient - me
275		 Notification Events - print complete
276		 Notification Attributes - impressions completed
277		 Notification Type - store and forward
278		
279 280 281 282		3. I am sitting in my office and submit a print job to a client at an engineering firm we work with on a daily basis. The engineering firm is in Belgium. I would like my client to know when the print job is complete, so that she can pick it up from the printer in her building. It is important that she review it right away and get her comments back to me. I submit the print job with the following attributes:
283 284 285 286 287 288		 Notification Recipient - client at engineering firm Notification Events - print complete Notification Type - immediate Notification Language - French
288 289 290 291		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 printed report for the meeting I am attending in the morning. Since I'm going out to dinner after I get this job submitted, an immediate notification won't do me much good. However, I'd like to check in the

292		morning before I drive to the Kinko's store to see if the file has been printed. An email notification is
293		sufficient for this purpose. I submit the print job with the following attributes:
294		
295		 Notification Recipient - me
296		 Notification Events - print complete
297		– Notification Type - store and forward
298		
299	5.	I am printing a large, complex print file. I want to have some immediate feedback on the progress of the
300		print job as it prints. I submit the print job with the following attributes:
301		
302		 Notification Recipient - me
303		– Notification Type - immediate
304		 Notification Events - all state transitions
305		 Notification Attributes - impression completed
306		
307	6.	I am an operator and my duties is to keep the printer running. I subscribe independently from a job
308		submission so that my subscription outlasts any particular job. I subscribe with the following attributes:
309		
310		 Notification Recipient - me
311		 Notification Type - immediate
312		 Notification Events - all Printer state transitions
313		 Notification Attributes - Printer state, printer state reasons, device powering up, device powering
314		down.
315		
316	7.	I am a usage statistics gathering application. I subscribe independently from a job submission so that my
317		subscription outlasts any particular job. My subscription may persists across power cycles. I subscribe
318		with the following attributes:
319		
320		 Notification Recipient - me
321		 Notification Type - immediate
322		- Notification Events - job completion
323		 Notification Attributes - impression completed, sheets completed, time submitted, time started, time
324		completed, job owner, job size in octets, etc.
325		T, J, , J, , J, ,,
326	8.	I am a client application program that displays a list of jobs currently queued for printing on a printer. I
327		display the "job-name", "job-state", "job-state-reasons", "page-count", and "intervening-jobs" either for the
328		user's jobs or for all jobs. The window displaying the job list remains open for an independent amount of
329		time, and it is desired that it represent the current state of the queue. It is desired that the application only
30		need to perform a slow poll in order to recover from any missed notifications. So the event delivery
31		mechanism provides the means to update the screen on all needed changes, including querying for some
31		attributes that may not be delivered in the Notification.
33		

- I am a client application program that displays a list of printers. For each Printer I display the current state
 and configuration. The window displaying the printer list remains open for an independent amount of time,
 and it is desired that it represent the current state of each printer. It is desired that the application only
 need to perform a slow poll in order to recover from any missed notifications. So the event delivery
 mechanism provides the means to update the screen on all needed changes, including querying for some
 attributes that may not be delivered in the Notification.
- 10. I am an IPP Server that controls one or more devices and implements an IPP Printer object to represent
 each device. I want to support IPP Notification for each of the IPP Printer objects that I implement.
 Many of these devices do not support notification (or IPP). So I need to support the IPP Notification
 semantics specified for each IPP Printer object myself on behalf of each of the devices that each of the
 IPP Printer objects represent. When I accept IPP job creation requests, I convert the request to what the
 device will accept. In some cases, I must poll the devices in order to be informed of their job and device
 state and state changes in order to be able to send IPP Notifications to subscribed Notification Recipients.
- 349 11. I am an IPP Server that controls one or more devices and implements an IPP Printer object to represent 350 each device. I want to support IPP Notification for each of the IPP Printer objects that I implement. 351 These devices all support IPP, including IPP Notification. I would like the design choice for supporting 352 IPP Notification for these IPP Printer objects that I implement either (1) by forwarding the notification to 353 the IPP Printers that I alone control and have them send the notifications to the intended Notification 354 Recipients without my involvement or (2) replace the notification submitted with the Job to indicate me as 355 the Notification Recipient and I will in turn forward Notifications to the Notification Recipients requested 356 by my clients. Most of the rest of the contents of the IPP Job that I send to the IPP Printers that I control 357 will be the same as the IPP Job that I receive from my IPP clients.
- 359 12. I am an IPP Server that controls one or more devices and implements an IPP Printer object to represent 360 each device. I want to support IPP Notification for each of the IPP Printer objects that I implement. These devices all support IPP, including IPP Notification. Because these IPP Printers MAY also be being 361 362 controlled by other servers (using IPP or other protocols), I only want job events for the jobs that I send, but do want Printer events all the time, so that I can show proper Printer state to my clients. So I 363 364 subscribe to these IPP Printers for Printer events with a long standing subscription with myself to as the 365 Notification Recipient. When I get a Job Creation request, I decide to which IPP Printer to send the job. 366 When I do so, I also add a job subscription for Job events with me as the Notification Recipient to the 367 job's job subscriptions supplied by my clients (this usage is called "piggy-backing"). These IPP Printers 368 automatically remove their job subscriptions when the job completes as for all job subscriptions so that I no longer get Job events when my jobs are completed. 369

370

372

340

348

358

K71 **4 Requirements**

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

376

1. must indicate which of these requirements are REQUIRED and which are OPTIONAL for a conforming

377 implementation to support. See [RFC2911] section 12.1 for the definition of these important 378 conformance terms. 379 380 2. must be designed to that an IPP Printer can *transparently* support the IPP Notification semantics using third party notification services that exist today or that may be standardized in the future. 381 382 383 3. must define means for a Job Submitting End User to specify zero or more Notification Recipients when submitting a print job. A Submitter will not be able to prevent out of band subscriptions from authorized 384 persons, such as Operators. 385 386 387 4. must define means when specifying a Notification Recipient, for a Notification Subscriber to be able to specify one or more notification events for that Notification Recipient, subject to administrative and 388 security policy restrictions. Any of the following constitute Job or Printer Events that a Job Submitting End 389 390 User can specify notifications be sent for: 391 • Any standard Printer MIB alert (i.e. device alerts) (critical and warning?) (state change 392 notifications)? 393 • Job Received (transition from Unknown to Pending) 394 • Job Started (Transition from Pending to Processing) 395 • Page Complete (Page is stacked) • Collated Copy Complete (last sheet of collated copy is stacked) 396 397 Job Complete (transition from Processing or Processing-stopped to Completed) • Job aborted (transition from Pending, Pending-held, Processing, or Processing-stopped to 398 399 Aborted) • Job canceled (transition from Pending, Pending-held, Processing, or Processing-held to Canceled) 100 -01 • Other job state changes like 'paused', purged? • Device problems for which the job is destined 102103 • Job (interpreter) issues 104 -05 5. must define how an End User or Operator subscribes for: • Any set of Job Events for a specific job. 106 • Any set of Printer Events while a specific job is not complete. 107 108 -09 6. must define how an End User or Operator subscribes for the following without having to submit a Job: 10 Any set of Printer Events for a defined period. • -11 Any set of Job Events for all jobs with no control over which jobs. • 112 13 7. must define how the Notification Subscriber is able to specify either immediate or store and forward 14 notification independently for each Notification Recipient. The means may be explicit, or implied by the 15 method of delivery chosen by the Job Submitting End User. 16 17 8. must define common delivery methods, e.g. email, must be defined.

18		
19		9. must define how an IPP Printer validates its ability to deliver an Event using the specified delivery scheme.
120		If it does not support the specified scheme, or the specified scheme is invalid for some reason, then the
21		IPP Printer accepts and performs the request anyway and responds indicating the unsupported attribute
122		values. There is no requirement for the IPP Printer receiving the print request to validate the identity of an
23		Notification Recipient, nor the ability of the system to deliver an event to that recipient as requested (for
124		example, if the Notification Recipient is not at work today).
25		
26		10. must define a class of IPP event notification delivery methods which can flow through corporate firewalls.
127		However, an IPP printer need not test to guarantee delivery of the notification through a firewall before
28		accepting a print job.
29		11. may define means for delivering a notification to the submitting client when the delivery of an event
130		notification to a specified Notification Recipient fails. Fall back means of subscribers determining if
31		notifications have failed, i.e. polling, may be provided.
132		
133		12. must define a mechanism for localizing Human Consumable notifications by the Notification Source.
134		
135		13. may define a way to specify whether or not event delivery requires acknowledgement back to the
36		Notification Source.
137		
138		14. There must be a mechanism defined so that job independent subscriptions do not become stale and do not
139		require human intervention to remove stale subscriptions. However, stale must not be the inability to
40		deliver an Event Notification, since temporary Notification delivery problems must be tolerated.
41		
42		15. A mechanism must be defined so that an Event Subscriber is able to add an Event Subscription to a Job
43		after the Job has been submitted.
44		
45		16. A mechanism must be defined so that a client is able to cancel an Event Subscription on a job or printer
46		after the job has been submitted.
47		
48		17. A mechanism must be defined so that a client can obtain the set of current Subscriptions.
49		
150	5	Security considerations for IPP Notifications requirements
151		
152		By far the biggest security concern is the abuse of notification: sending unwanted notifications to third parties
153		(i.e., spam). The problem is made worse by notification addresses that may be redistributed to multiple
154		parties (e.g. mailing lists). There exist scenarios where third party notification is required (see Scenario #2 and
155		#3). The fully secure solution would require active agreement of all recipients before sending out anything.
156		However, requirement #9 ("There is no requirement for IPP Printer receiving the print request to validate the
157		identity of an event recipient") argues against this. Certain systems may decide to disallow third party
158		notifications (a traditional fax model).
159		

160		Clients submitting notification requests to the IPP Printer has the same security issues as submitting an IPP/1.1
61		print job request. The same mechanisms used by IPP/1.1 can therefore be used by the client notification
62		submission. Operations that require authentication can use the HTTP authentication. Operations that require
63		privacy can use the HTTP/TLS privacy.
64		
65		The notification access control model should be similar to the IPP access control model. Creating a
66		notification subscription is associated with a user. Only the creator or an operator can cancel the subscription.
67		The system may limit the listing of items to only those items owned by the user. Some subscriptions (e.g. those
68		that have a lifetime longer than a job) can be done only by privileged users (operators and/or administrators), if
69		that is the authorization policy.
170		
171		The standard security concerns (delivery to the right user, privacy of content, tamper proof content) apply to
172		the notification delivery. IPP should use the security mechanism of the delivery method used. Some delivery
173		mechanisms are more secure than others. Therefore, sensitive notifications should use the delivery method that
174		has the strongest security.
175		
176	6	Internationalization Considerations
177		The Universe Community and in a localized to the network low many and showed that Netification
178		The Human Consumable notification must be localized to the natural language and charset that Notification
179		Subscriber specifies within the choice of natural languages and charsets that the IPP Printer supports.
180 181		The Machine Consumable notification data uses the 'enplication/inp' MIME madie type. It contains some
182		The Machine Consumable notification data uses the 'application/ipp' MIME media type. It contains some attributes whose text values are required to be in the natural language and charset that the Notification
183		Subscriber specifies within the choice of natural languages and charsets that the IPP Printer supports. See
184		[RFC2566].
185		[Kr-C2500].
186	7	IANA Considerations
187	,	
188		There will be some notification delivery methods registered with IANA for use in URLs. These will be defined
189		in other documents.
190		
191	8	References
192	-	
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