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7 Internet Printing Protocol (IPP):  
8 Job and Printer Administrative Operations  
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20  
21 Abstract

22 This document specifies the following 16 additional OPTIONAL operations for use with the Internet  
23 Printing Protocol/1.0 (IPP) [RFC2565, RFC2566] and IPP/1.1 [RFC2910, RFC2911]:

Printer operations:	Job operations:
Enable-Printer and Disable-Printer	Reprocess-Job
Pause-Printer-After-Current-Job	Cancel-Current-Job
Hold-New-Jobs and Release-Held-New-Jobs	Suspend-Current-Job and Resume-Job
Deactivate-Printer and Activate-Printer	Promote-Job
Restart-Printer	Schedule-Job-After
Shutdown-Printer and Startup-Printer	

24  
25 New Job Description attributes: “original-requesting-user-name”  
26 New Printer Description attributes: “subordinate-printers-supported” and “parent-printers-supported”.  
27 New “printer-state-reasons” values: ‘hold-new-jobs’ and ‘deactivated’.  
28 New “job-state-reasons” attribute values: ‘job-suspended’.  
29 New Job event keyword: ‘job-forwarded-operation-failed’.  
30 New status code: ‘server-error-printer-is-deactivated’.  
31

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## 129 **1 Introduction**

130 The Internet Printing Protocol (IPP) is an application level protocol that can be used for distributed  
131 printing using Internet tools and technologies. IPP version 1.1 ([RFC2911, RFC2910]) focuses on end  
132 user functionality with a few administrative operations included. This document defines additional  
133 OPTIONAL end user, operator, and administrator operations used to control Jobs and Printers. In  
134 addition, this document extends the semantic model of the Printer object by allowing them to be  
135 configured into trees and/or inverted trees that represent Printer object Fan-Out and Printer object Fan-  
136 In, respectively. The special case of a tree with only a single Subordinate node represents Chained  
137 Printers. This document is a registration proposal for an extension to IPP/1.0 and IPP/1.1 following the  
138 registration procedures in those documents.

139 The requirements and use cases for this document are defined in [ipp-ops-admin-req].

## 140 **2 Terminology**

141 This section defines terminology used throughout this document.

### 142 **2.1 Conformance Terminology**

143 Capitalized terms, such as MUST, MUST NOT, REQUIRED, SHOULD, SHOULD NOT, MAY,  
144 NEED NOT, and OPTIONAL, have special meaning relating to conformance as defined in RFC 2119  
145 [RFC2119] and [RFC2911] section 12.1. If an implementation supports the extension defined in this  
146 document, then these terms apply; otherwise, they do not. These terms define conformance to *this*  
147 *document only*; they do not affect conformance to other documents, unless explicitly stated otherwise.

### 148 **2.2 Other terminology**

149 This document uses terms such as “client”, “Printer”, “Job”, “attributes”, “keywords”, and “support”.  
150 These terms have special meaning and are defined in the model terminology [RFC2911] section 12.2.

151 In addition, the following capitalized terms are defined:

152 **IPP Printer object (or Printer for short)** - a software abstraction defined by [RFC2911].

153 **Printer Operation** - an operation whose target is an IPP Printer object and whose effect is on the  
154 **Printer object**.

155 **Output Device** - the physical imaging mechanism that an IPP Printer controls. Note: while this term is  
156 capitalized in this specification (but not in [RFC2911]), there is no formal object called an Output  
157 Device defined in this document (or [RFC2911]).

158 **Output Device Fan-Out** - a configuration in which an IPP Printer controls more than one output-  
159 device.

160 **Printer Fan-Out** - a configuration in which an IPP Printer object controls more than one Subordinate  
161 IPP Printer object.

162 **Printer Fan-In** - a configuration in which an IPP Printer object is controlled by more than one IPP  
163 Printer object.

164 **Subordinate Printer** - an IPP Printer object that is controlled by another IPP Printer object. Such a  
165 Subordinate Printer MAY have one or more Subordinate Printers.

166 **Leaf Printer** - a Subordinate Printer that has no Subordinate Printers.

167 **Non-Leaf Printer** - an IPP Printer object that has one or more Subordinate Printers.

168 **Chained Printer** - a Non-Leaf Printer that has exactly one Subordinate Printer.

169 **Job Creation operations** - IPP operations that create a Job object: Print-Job, Print-URI, and Create-  
170 Job.

### 171 **3 Definition of the Printer Operations**

172 All Printer Operations are directed at Printer objects. A client MUST always supply the “printer-uri”  
173 operation attribute in order to identify the correct target of the operation. These descriptions assume all  
174 of the common semantics of IPP/1.1 Model and Semantics document [RFC2911] section 3.1.

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175

176 The Printer Operations defined in this document are summarized in Table 1:

177

**Table 1 - Printer Operation Operation-Id assignments**

Operation Name	Operation-Id	Brief description
Enable-Printer	0x22	Allows the target Printer to accept Job Creation operations
Disable-Printer	0x23	Prevents the target Printer from accepting Job Creation operations
Pause-Printer-After-Current-Job	0x24	Pause the Printer after the current job has been sent to the Output Device.
Hold-New-Jobs	0x25	Finishes processing all currently pending jobs. Any new jobs are placed in the 'pending-held' state.
Release-Held-New-Jobs	0x26	Release all jobs to the 'pending' state that had been held by the effect of a previous Hold-New-Jobs operation and condition the Printer to no longer hold new jobs.
Deactivate-Printer	0x27	Puts the Printer into a read-only deactivated state.
Activate-Printer	0x28	Restores the Printer to normal activity
Restart-Printer	0x29	Restarts the target Printer and re-initializes the software
Shutdown-Printer	0x2A	Shuts down the target Printer so that it cannot be restarted or queried
Startup-Printer	0x2B	Starts up the instance of the Printer object

178

179 All of the operations in this document are OPTIONAL for an IPP object to support. Unless the  
 180 specification of an OPTIONAL operation requires support of another OPTIONAL operation,  
 181 conforming implementations may support any combination of these operations. Many of the operations  
 182 come in pairs and so both are REQUIRED if either one is implemented.

### 183 3.1 The Disable and Enable Printer Operations

184 This section defines the OPTIONAL Disable-Printer and Enable-Printer operations that stop and start  
 185 the IPP Printer object from accepting new IPP jobs. If either of these operations are supported, both  
 186 MUST be supported.

187 These operations allow the operator to control whether or not the Printer will accept new Job Creation  
 188 (Print-Job, Print-URI, and Create-Job) operations. These operations have no other effect on the  
 189 Printer, so that the Printer continues to accept all other operations and continues to schedule and  
 190 process jobs normally. In other words, these operation control the "input of new jobs" to the IPP  
 191 Printer while the Pause and Resume operations (see section 3.2) independently control the "output of  
 192 new jobs" from the IPP Printer to the Output Device.

### 193 3.1.1 Disable-Printer Operation

194 This OPTIONAL operation allows a client to stop the Printer object from accepting new jobs, i.e.,  
195 cause the Printer to reject subsequent Job Creation operations and return the 'server-error-not-  
196 accepting-jobs' status code. The Printer still accepts all other operations, including Validate-Job, Send-  
197 Document and Send-URI operations. Thus a Disable-Printer operation allows a client to continue  
198 submitting multiple documents of a multiple document job if the Create-Job operation had already been  
199 accepted. All previously created or submitted Jobs and currently processing Jobs continue unaffected.

200 The IPP Printer MUST accept the request in any state. The Printer sets the value of its "printer-is-  
201 accepting-jobs" READ-ONLY Printer Description attribute to 'false' (see [RFC2911] section 4.4.20),  
202 no matter what the previous value was. This operation has no immediate or direct effect on the  
203 Printer's "printer-state" and "printer-state-reasons" attributes.

204 *Access Rights:* The authenticated user (see [RFC2911] section 8.3) performing this operation must be  
205 an operator or administrator of the Printer object (see [RFC2911] Sections 1 and 8.5).

206 The Disable-Printer Request and Disable-Printer Response have the same attribute groups and attributes  
207 as the Pause-Printer operation (see [RFC2911] sections 3.2.7.1 and 3.2.7.2), including the new "printer-  
208 message-from-operator" operation attribute (see section 6).

### 209 3.1.2 Enable-Printer Operation

210 This OPTIONAL operation allows a client to start the Printer object accepting jobs, i.e., cause the  
211 Printer to accept subsequent Job Creation operations. The Printer still accepts all other operations. All  
212 previously submitted Jobs and currently processing Jobs continue unaffected.

213 The IPP Printer MUST accept the request in any state. The Printer sets the value of its "printer-is-  
214 accepting-jobs" READ-ONLY Printer Description attribute to 'true' (see [RFC2911] section 4.4.20),  
215 no matter what the previous value was. This operation has no immediate or direction effect on the  
216 Printer's "printer-state" and "printer-state-reasons" attributes.

217 *Access Rights:* The authenticated user (see [RFC2911] section 8.3) performing this operation must be  
218 an operator or administrator of the Printer object (see [RFC2911] Sections 1 and 8.5).

219 The Enable-Printer Request and Enable-Printer Response have the same attribute groups and attributes  
220 as the Pause-Printer operation (see [RFC2911] sections 3.2.8.1 and 3.2.8.2), including the new "printer-  
221 message-from-operator" operation attribute (see section 6).

## 222 3.2 The Pause and Resume Printer Operations

223 This section leaves the OPTIONAL IPP/1.1 Pause-Printer (see [RFC2911] sections 3.2.7) to be  
224 ambiguous as to whether or not it stops the Printer immediately or after the current job and defines the  
225 OPTIONAL Pause-Printer-After-Current-Job operation to be after the current job. These operations



226 affect the scheduling of IPP jobs. If either of these Pause Printer operations are supported, then the  
 227 Resume-Printer operation **MUST** be supported.

228 These operations allow the operator to control whether or not the Printer will send new IPP jobs to the  
 229 associated Output Device(s) that the IPP Printer object represents. These operations have no other  
 230 effect on the Printer, so that the Printer continues to accept all operations. In other words, these  
 231 operation control the “output of new jobs” to the Output Device(s) while the Disable and Enable Printer  
 232 Operations (see section 3.1) independently control the “input of new jobs” to the IPP Printer.

233 **Table 2 - Pause and Resume Printer Operations**

Pause and Resume Printers	Description
IPP/1.1 Pause Printer	Stops the IPP Printer from sending new IPP Jobs to the Output Device(s) either immediately or after the current job completes, depending on implementation, as defined in [RFC2911].
Pause-Printer-After-Current-Job	Stops the IPP Printer from sending new IPP Jobs to the Output Device(s) after the current jobs finish
Resume-Printer	Starts the IPP Printer sending IPP Jobs to the Output Device again.

### 234 3.2.1 Pause-Printer-After-Current-Job operation

235 This OPTIONAL operation allows a client to stop the Printer object from starting to send IPP jobs to  
 236 any of its Output Devices or Subordinate Printers. If the IPP Printer is in the middle of sending an IPP  
 237 job to an Output Device or Subordinate Printer, the IPP Printer **MUST** complete sending that Job.  
 238 However, after receiving this operation, the IPP Printer **MUST NOT** start to send any additional IPP  
 239 jobs to any of its Output Devices or Subordinate Printers. In addition, after having received this  
 240 operation, the IPP Printer **MUST NOT** start processing any more jobs, so additional jobs **MUST NOT**  
 241 enter the ‘processing’ state.

242 If the IPP Printer is not sending an IPP Job to the Output Device or Subordinate Printer (whether or not  
 243 the Output Device or Subordinate Printer is busy processing any jobs), the IPP Printer object transitions  
 244 immediately to the ‘stopped’ state by setting its “printer-state” attribute to ‘stopped’, removing the  
 245 ‘moving-to-paused’ value, if present, from its “printer-state-reasons” attribute, and adding the ‘paused’  
 246 value to its “printer-state-reasons” attribute.

247 If the implementation will take appreciable time to complete sending an IPP job that it has started  
 248 sending to an Output Device or Subordinate Printer, the IPP Printer adds the ‘moving-to-paused’ value  
 249 to the Printer object’s “printer-state-reasons” attribute (see section [RFC2911] 4.4.12). When the IPP  
 250 Printer has completed sending IPP jobs that it was in the process of sending, the Printer object  
 251 transitions to the ‘stopped’ state by setting its “printer-state” attribute to ‘stopped’, removing the  
 252 ‘moving-to-paused’ value, if present, from its “printer-state-reasons” attribute, and adding the ‘paused’  
 253 value to its “printer-state-reasons” attribute.

254 This operation MUST NOT affect the acceptance of Job Creation requests (see Disable-Printer section  
255 3.1.1).

256 For any jobs that are ‘pending’ or ‘pending-held’, the ‘printer-stopped’ value of the jobs’ “job-state-  
257 reasons” attribute also applies. However, the IPP Printer NEED NOT update those jobs’ “job-state-  
258 reasons” attributes and only need return the ‘printer-stopped’ value when those jobs are queried using  
259 the Get-Job-Attributes or Get-Jobs operations (so-called “lazy evaluation”).

260 The IPP Printer MUST accept the request in any state and transition the Printer to the indicated new  
261 “printer-state” and MUST add the indicated value to “printer-state-reasons” attribute before returning  
262 as follows:

263 **Table 3 - State Transition Table for Pause-Printer-After-Current-Job operation**

Current “printer-state”	New “printer-state”	“printer- state- reasons”	IPP Printer’s response status code and action:  REQUIRED/OPTIONAL state transition for a Printer to support
‘idle’	‘stopped’	‘paused’	REQUIRED: ‘successful-ok’
‘processing’	‘processing’	‘moving-to- paused’	OPTIONAL: ‘successful-ok’; Later, when the IPP Printer has finished sending IPP jobs to an Output Device, the “printer-state” becomes ‘stopped’, and the ‘paused’ value replaces the ‘moving-to- paused’ value in the “printer-state-reasons” attribute
‘processing’	‘stopped’	‘paused’	REQUIRED: ‘successful-ok’; the IPP Printer wasn’t in the middle of sending an IPP job to an Output Device
‘stopped’	‘stopped’	‘paused’	REQUIRED: ‘successful-ok’

264

265 *Access Rights:* The authenticated user (see [RFC2911] section 8.3) performing this operation must be  
266 an operator or administrator of the Printer object (see [RFC2911] Sections 1 and 8.5).

267 The Pause-Printer-After-Current-Job Request and Pause-Printer-After-Current-Job Response have the  
268 same attribute groups and attributes as the Pause-Printer operation (see [RFC2911] sections 3.2.7.1 and  
269 3.2.7.2), including the new “printer-message-from-operator” operation attribute (see section 6).

### 270 3.3 Hold and Release New Jobs operations

271 This section defines operations to condition the Printer to hold any new jobs and to release them.

### 272 3.3.1 Hold-New-Jobs operation

273 This OPTIONAL operation allows a client to condition the Printer to complete the current ‘pending’  
274 and ‘processing’ IPP Jobs but not start processing any subsequently created IPP Jobs. If the IPP  
275 Printer is in the middle of sending an IPP job to an Output Device or Subordinate Printer, the IPP  
276 Printer MUST complete sending that Job. Furthermore, the IPP Printer MUST send all of the current  
277 ‘pending’ IPP Jobs to the Output Device(s) or Subordinate IPP Printer object(s). Any subsequently  
278 received Job Creation operations will cause the IPP Printer to put the Job into the ‘pending-held’ state  
279 with the ‘job-held-on-create’ value being added to the job’s “job-state-reasons” attribute. Thus all  
280 newly accepted jobs will be automatically held by the Printer.

281 When the Printer completes all of the ‘pending’ and ‘processing’ jobs, it enters the ‘idle’ state as usual.  
282 An operator that is monitoring Printer state changes will know when the Printer has completed all  
283 current jobs because the Printer enters the ‘idle’ state.

284 This operation MUST NOT affect the acceptance of Job Creation requests (see Disable-Printer section  
285 3.1.1), except to put the Jobs into the ‘pending-held’ state, instead of the ‘pending’ or ‘processing’  
286 state.

287 The IPP Printer MUST accept the request in any state, MUST NOT transition the Printer to any other  
288 “printer-state”, and MUST add the ‘hold-new-jobs’ value to the Printer’s “printer-state-reasons”  
289 attribute (whether the value was present or not).

290 *Access Rights:* The authenticated user (see [RFC2911] section 8.3) performing this operation must be  
291 an operator or administrator of the Printer object (see [RFC2911] Sections 1 and 8.5).

292 The Hold-New-Jobs Request and Hold-New-Jobs Response have the same attribute groups and  
293 attributes as the Pause-Printer operation (see [RFC2911] sections 3.2.7.1 and 3.2.7.2), including the  
294 new “printer-message-from-operator” operation attribute (see section 6).

### 295 3.3.2 Release-Held-New-Jobs operation

296 This OPTIONAL operation allows a client to undo the effect of a previous Hold-New-Jobs operation.  
297 In particular, the Printer releases all of the jobs that it had held as a consequence of a Hold-New-Jobs  
298 operations, i.e., while the ‘hold-new-jobs’ value was present in the Printer’s “printer-state-reasons”  
299 attribute. In addition, the Printer MUST accept this request in any state, MUST NOT transition the  
300 Printer to any other “printer-state”, and MUST remove the ‘hold-new-jobs’ value from its “printer-  
301 state-reasons” attribute (whether the value was present or not) so that the Printer no longer holds newly  
302 created jobs.

303 *Access Rights:* The authenticated user (see [RFC2911] section 8.3) performing this operation must be  
304 an operator or administrator of the Printer object (see [RFC2911] Sections 1 and 8.5).

305 The Release-Held-New-Jobs Request and Release-Held-New-Jobs Response have the same attribute  
306 groups and attributes as the Pause-Printer operation (see [RFC2911] sections 3.2.7.1 and 3.2.7.2),  
307 including the new “printer-message-from-operator” operation attribute (see section 6).

### 308 **3.4 Deactivate and Activate Printer Operations**

309 This section defines the OPTIONAL Deactivate-Printer and Activate-Printer operations that stop and  
310 start the IPP Printer object from accepting all requests except queries and performing work. If either of  
311 these operations are supported, both MUST be supported.

312 These operations allow the operator to put the Printer into a dormant read-only condition and to take it  
313 out of such a condition. These operations are a combination of the Deactivate and Pause operations,  
314 plus preventing the acceptance of any other requests, except queries.

#### 315 **3.4.1 Deactivate-Printer operation**

316 This OPTIONAL operation allows a client to stop the Printer object from starting to send IPP jobs to  
317 any of its Output Devices or Subordinate Printers (Pause-Printer-After-Current-Job) and stop the  
318 Printer object from accepting any, but query requests. The Printer performs a Disable-Printer and a  
319 Pause-Printer-After-Current-Job operation immediately, including use of all of the “printer-state-  
320 reasons” if these two operations cannot be completed immediately. In addition, the Printer MUST  
321 immediately reject all requests, except Activate-Printer, queries (Get-Printer-Attributes, Get-Job-  
322 Attributes, Get-Jobs, etc.), Send-Document, and Send-URI (so that partial job submission can be  
323 completed - see section 3.1.1) and return the ‘server-error-service-unavailable’ status code.

324 The IPP Printer MUST accept the request in any state. Immediately, the Printer MUST set the  
325 ‘deactivated’ value in its “printer-state-reasons” attribute. Note: neither the Disable-Printer nor the  
326 Pause-Printer-After-Current-Job set the ‘deactivated’ value.

327 *Access Rights:* The authenticated user (see [RFC2911] section 8.3) performing this operation must be  
328 an operator or administrator of the Printer object (see [RFC2911] Sections 1 and 8.5).

329 The Deactivate-Printer Request and Deactivate-Printer Response have the same attribute groups and  
330 attributes as the Pause-Printer operation (see [RFC2911] sections 3.2.7.1 and 3.2.7.2), including the  
331 new “printer-message-from-operator” operation attribute (see section 6).

#### 332 **3.4.2 Activate-Printer operation**

333 This OPTIONAL operation allows a client to undo the effects of the Deactivate-Printer, i.e., allow the  
334 Printer object to start sending IPP jobs to any of its Output Devices or Subordinate Printers (Pause-  
335 Printer-After-Current-Job) and start the Printer object from accepting any requests. The Printer  
336 performs an Enable-Printer and a Resume-Printer operation immediately. In addition, the Printer  
337 MUST immediately start accepting all requests.

338 The IPP Printer MUST accept the request in any state. Immediately, the Printer MUST immediately  
339 remove the ‘deactivated’ value from its “printer-state-reasons” attribute (whether present or not).

340 *Access Rights:* The authenticated user (see [RFC2911] section 8.3) performing this operation must be  
341 an operator or administrator of the Printer object (see [RFC2911] Sections 1 and 8.5).

342 The Activate-Printer Request and Activate-Printer Response have the same attribute groups and  
343 attributes as the Pause-Printer operation (see [RFC2911] sections 3.2.7.1 and 3.2.7.2), including the  
344 new “printer-message-from-operator” operation attribute (see section 6).

### 345 **3.5 Restart-Printer, Shutdown-Printer, and Startup-Printer operations**

346 This section defines the OPTIONAL Restart-Printer, Shutdown-Printer, and Startup-Printer operations  
347 that initialize, shutdown, and startup the Printer object, respectively. Each of these operations is  
348 OPTIONAL and any combination MAY be supported.

#### 349 **3.5.1 Restart-Printer operation**

350 This OPTIONAL operation allows a client to restart a Printer object whose operation is in need of  
351 initialization because of incorrect or erratic behavior, i.e., perform the effect of a software re-boot. The  
352 implementation MUST attempt to save any information about Jobs and the Printer object before re-  
353 initializing. However, this operation MAY have drastic consequences on the running system, so the  
354 client SHOULD first try the Deactivate-Printer operation to minimize the effect on the current state of  
355 the system. The effects of previous Disable-Printer, Pause Printer, and Deactivate-Printer operations  
356 are lost.

357 The IPP Printer MUST accept the request in any state. The Printer object MUST initialize its Printer’s  
358 “printer-state” to ‘idle’, remove the state reasons from its “printer-state-reasons” attribute, and its  
359 “printer-is-accepting-jobs” attribute to ‘true’.

360 *Access Rights:* The authenticated user (see [RFC2911] section 8.3) performing this operation must be  
361 an operator or administrator of the Printer object (see [RFC2911] Sections 1 and 8.5).

362 The Restart-Printer Request and Restart-Printer Response have the same attribute groups and attributes  
363 as the Pause-Printer operation (see [RFC2911] sections 3.2.8.1 and 3.2.8.2), including the new “printer-  
364 message-from-operator” operation attribute (see section 6).

#### 365 **3.5.2 Shutdown-Printer Operation**

366 This OPTIONAL operation allows a client to shutdown a Printer, i.e., stop processing jobs without  
367 losing any jobs and make the Printer object no longer available for any operations using the IPP  
368 protocol. There is no way to bring the instance of the Printer object back to being used, except for the  
369 Startup-Printer (see section 3.5.3) which starts up a new instance of the Printer object for hosted  
370 implementations. The purpose of Shutdown-Printer is to shutdown the Printer for an extended period,  
371 not to reset the device(s) or modify a Printer attribute. See Restart-Printer (section 3.5.1) and Startup-  
372 Printer (section 3.5.3) for the way to initialize the software. See the Disable-Printer operation (section  
373 3.1) for a way for the client to stop the Printer from accepting Job Creation requests without stopping  
374 processing or shutting down.

375 The Printer MUST add the 'shutdown' value (see [RFC2911] section 4.4.11) immediately to its  
376 "printer-state-reasons" Printer Description attribute and performs a Deactivate-Printer operation (see  
377 section 3.4.1) which performs a Disable-Printer and Pause-Printer-After-Current-Job operation).

378 Note: In order to shutdown the Printer after all the currently submitted jobs have completed, the  
379 operator issues a Disable-Printer operation (see section 3.1.1) and then waits until all the jobs have  
380 completed and the Printer goes into the 'idle' state before issuing the Shutdown-Printer operation.

381 The Printer object MUST accept this operation in any state and transition the Printer object through the  
382 "printer-states" and "printer-state-reasons" defined for the Pause-Printer-After-Current-Job operation  
383 until the activity is completed and the Printer object disappears.

384 *Access Rights:* The authenticated user (see [RFC2911] section 8.3) performing this operation must be  
385 an operator or administrator of the Printer object (see [RFC2911] Sections 1 and 8.5).

386 The Shutdown-Printer Request and Shutdown-Printer Response have the same attribute groups and  
387 attributes as the Pause-Printer operation (see [RFC2911] sections 3.2.7.1 and 3.2.7.2), including the  
388 new "printer-message-from-operator" operation attribute (see section 6).

### 389 3.5.3 Startup-Printer operation

390 This OPTIONAL operation allows a client to startup an instance of a Printer object, provided that there  
391 isn't one already instantiated. The purpose of Startup-Printer is to allow a hosted implementation of the  
392 IPP Printer object (i.e., a Server that implements an IPP Printer on behalf of a networked or local  
393 Output Device) to be started after the host is available (by means outside this document). See Restart-  
394 Printer (section 3.5.1) for the way to initialize the software or reset the Output Device(s) when the IPP  
395 Printer object has already been instantiated.

396 The host MUST accept this operation only when the Printer object has not been instantiated. If the  
397 Printer object already exists, the host must return the 'client-error-not-possible' status code.

398 The result of this operation MUST be with the Printer object's "printer-state" set to 'idle', the state  
399 reasons removed from its "printer-state-reasons" attribute, and its "printer-is-accepting-jobs" attribute  
400 set to 'false'. Then the operator can reconfigure the Printer before performing an Enable-Printer  
401 operation. However, when a Printer is first powered up, it is RECOMMENDED that its "printer-is-  
402 accepting-jobs" attribute be set to 'true' in order to achieve easy "out of the box" operation.

403 *Access Rights:* The authenticated user (see [RFC2911] section 8.3) performing this operation must be  
404 an operator or administrator of the Printer object (see [RFC2911] Sections 1 and 8.5).

405 The Shutdown-Printer Request and Shutdown-Printer Response have the same attribute groups and  
406 attributes as the Pause-Printer operation (see [RFC2911] sections 3.2.7.1 and 3.2.7.2), including the  
407 new "printer-message-from-operator" operation attribute (see section 6).

## 408 4 Definition of the Job Operations

409 All Job operations are directed at Job objects. A client **MUST** always supply some means of identifying  
 410 the Job object in order to identify the correct target of the operation. That job identification **MAY**  
 411 either be a single Job URI or a combination of a Printer URI with a Job ID. The IPP object  
 412 implementation **MUST** support both forms of identification for every job.

413 The Job Operations defined in this document are summarized in Table 4:

414 **Table 4 - Job operation Operation-Id assignments**

Operation Name	Operation-Id	Brief description
Reprocess-Job	0x2C	Creates a copy of a completed target job with a new Job ID and processes it
Cancel-Current-Job	0x2D	Cancels the current job on the target Printer or the specified job if it is the current job
Suspend-Current-Job	0x2E	Suspends the current processing job on the target Printer or the specified job if it is the current job, allowing other jobs to be processed instead
Resume-Job	0x2F	Resume the suspended target job
Promote-Job	0x30	Promote the pending target job to be next after the current job(s) complete
Schedule-Job-After	0x31	Schedule the target job immediately after the specified job, all other scheduling factors being equal.

415

### 416 4.1 Reprocess-Job Operation

417 This **OPTIONAL** operation is a create job operation that allows a client to re-process a copy of a job  
 418 that had been retained in the queue after processing completed, was canceled, or was aborted (see  
 419 [RFC2911] section 4.3.7.2). This operation is the same as the Restart-Job operation (see [RFC2911]  
 420 section 3.3.7), except that the Printer creates a new job that is a copy of the target job and the target job  
 421 is unchanged. The new job is assigned new values to the “job-uri” and “job-id” attributes and the new  
 422 job’s Job Description attributes that accumulate job progress, such as “job-impressions-completed”,  
 423 “job-media-sheets-completed”, and “job-k-octets-processed”, are initialized to 0 as with any create job  
 424 operation. The target job moves to the Job History after a suitable period, independent of whether one  
 425 or more Reprocess-Job operations have been performed on it.

426 If the Set-Job-Attributes operation is supported, then the “job-hold-until” operation attribute **MUST** be  
 427 supported with at least the ‘indefinite’ value, so that a client can modify the new job before it is  
 428 scheduled for processing using the Set-Job-Attributes operation. After modifying the job, the client can  
 429 release the job for processing, by using the Release-Job operation specifying the newly assigned “job-  
 430 uri” or “job-id” for the new job.

## 431 **4.2 Cancel-Current-Job Operation**

432 This OPTIONAL operation allows a client to cancel the current job on the target Printer or the  
433 specified job if it is the current job on the Printer. See [RFC2911] section 3.3.3 for the semantics of  
434 canceling a job. Since a Job might already be marking by the time a Cancel-Current-Job is received,  
435 some media sheet pages might be printed before the job is actually terminated.

436 If the client does not supply a “job-id” operation attribute, the Printer MUST accept the request and  
437 cancel the current job if there is a current job in the ‘processing’ or ‘processing-stopped’ state;  
438 otherwise, it MUST reject the request and return the ‘client-error-not-possible’ status code. If more  
439 than one job is in the ‘processing’ or ‘processing-stopped’ states, the one that is marking is canceled  
440 and the others are unaffected.

441 **Warning:** On a shared printer, there is a race condition. Between the time that a user issues this  
442 operation and its acceptance, the current job might change to a different job. If the user or operator is  
443 authenticated to cancel the new job, the wrong job is canceled. To prevent this race from canceling the  
444 wrong job, the client MAY supply the “job-id” operation attribute which is checked against the current  
445 job’s job-id. If the job identified by the “job-id” attribute is not the current job on the Printer, i.e., is not  
446 in the ‘processing’ or ‘processing-stopped’ states, the Printer MUST reject this operation and return the  
447 ‘client-error-not-possible’ status code. Otherwise, the Printer cancels the specified job.

448 *Access Rights:* The authenticated user (see [RFC2911] section 8.3) performing this operation must  
449 either be the job owner (as determined in the Job Creation operation) or an operator or administrator of  
450 the Printer object (see [RFC2911] Sections 1 and 8.5).

451 The Cancel-Current-Job Request and Cancel-Current-Job Response have the same attribute groups and  
452 attributes as the Resume-Printer operation (see [RFC2911] section 3.2.8), including the new “job-  
453 message-from-operator” operation attribute (see section 6), with the addition of the following Group 1  
454 Operation attributes in the request:

455 “job-id” (integer(1:MAX)):

456 The client OPTIONALLY supplies this Operation attribute in order to verify that the identified job is  
457 still the current job on the target Printer object. The IPP object MUST support this operation  
458 attribute, if it supports this operation.

## 459 **4.3 Suspend and Resume Job operations**

460 This section defines the Suspend-Current-Job and Resume-Job operations. These operations allow an  
461 operator or user to suspend a job while it is processing and allow other jobs to be processed and the  
462 resume the suspended job at a later point in time without losing any of the output.

463 If either of these operations is supported, they both MUST be supported.

464 The Hold-Job and Release-Job operations ([RFC2911] section 3.3.5) are for holding and releasing held  
465 jobs, not suspending and resuming suspended jobs.



### 466 **4.3.1 Suspend-Current-Job operation**

467 This OPTIONAL operation allows a client to stop the current job on the target Printer or the specified  
468 job if it is the current job on the Printer, and allow other jobs to be processed instead. The Printer  
469 moves the current job or the target job to the 'processing-stopped' state and sets the 'job-suspended'  
470 value (see section 9.1) in the job's "job-state-reasons" attribute and processes other jobs.

471 If the client does not supply a "job-id" operation attribute, the Printer MUST accept the request and  
472 suspend the current job if there is a current job in the 'processing' or 'processing-stopped' state;  
473 otherwise, it MUST reject the request and return the 'client-error-not-possible' status code. If more  
474 than one job is in the 'processing' or 'processing-stopped' states, all of them are suspended.

475 **Warning:** On a shared printer, there is a race condition. Between the time that a user issues this  
476 operation and its acceptance, the current job might change to a different job. If the user or operator is  
477 authenticated to suspend the new job, the wrong job is suspended. To prevent this race from pausing  
478 the wrong job, the client MAY supply the "job-id" operation attribute which is checked against the  
479 current job's job-id. If the job identified by the "job-id" attribute is not the current job on the Printer,  
480 i.e., is not in the 'processing' or 'processing-stopped' states, the Printer MUST reject this operation and  
481 return the 'client-error-not-possible' status code. Otherwise, the Printer suspends the specified job and  
482 processed other jobs.

483 The Printer MUST reject a Resume-Job request (and return the 'client-error-not-possible') for a job  
484 that has been suspended, i.e., for a job in the 'processing-stopped' state, with the 'job-suspended' value  
485 in its "job-state-reasons" attribute.

486 *Access Rights:* The authenticated user (see [RFC2911] section 8.3) performing this operation must  
487 either be the job owner (as determined in the Job Creation operation) or an operator or administrator of  
488 the Printer object (see [RFC2911] Sections 1 and 8.5).

489 The Suspend-Current-Job Request and Suspend-Current-Job Response have the same attribute groups  
490 and attributes as the Pause-Printer operation (see [RFC2911] section 3.2.8), including the new "job-  
491 message-from-operator" operation attribute (see section 6), with the addition of the following Group 1  
492 Operation attributes in the request:

493 "job-id" (integer(1:MAX)):

494 The client OPTIONALLY supplies this Operation attribute in order to verify that the identified  
495 job is still the current job on the target Printer object. The IPP object MUST supports this  
496 operation attribute, if it supports this operation.

### 497 **4.3.2 Resume-Job operation**

498 This OPTIONAL operation allows a client to resume the target job at the point where it was suspended.  
499 The Printer moves the target job to the 'pending' state and removes the 'job-suspended' value from the  
500 job's "job-state-reasons" attribute.

501 If the target job is not in the ‘processing-stopped’ state with the ‘job-suspended’ value in the job’s “job-  
502 state-reasons” attribute, the Printer MUST reject the request and return the ‘client-error-not-possible’  
503 status code, since the job was not suspended.

504 *Access Rights:* The authenticated user (see [RFC2911] section 8.3) performing this operation must  
505 either be the job owner (as determined in the Job Creation operation) or an operator or administrator of  
506 the Printer object (see [RFC2911] Sections 1 and 8.5).

507 The Resume-Job Request and Resume-Job Response have the same attribute groups and attributes as  
508 the Release-Job operation (see [RFC2911] section 3.3.6), including the new “job-message-from-  
509 operator” operation attribute (see section 6).

## 510 **4.4 Job Scheduling Operations**

511 This section defines jobs that allow an operator to control the scheduling of jobs.

### 512 **4.4.1 Promote-Job operation**

513 This OPTIONAL operation allows a client to make the pending target job be processed next after the  
514 current job completes. This operation is specially useful in a production printing environment where the  
515 operator is involved in job scheduling.

516 If the target job is in the ‘pending’ state, this operation does not change the job’s state, but causes the  
517 job to be processed after the current job(s) complete. If the target job is not in the ‘pending’ state, the  
518 Printer MUST reject the request and return the ‘client-error-not-possible’ status code.

519 If the Printer implements the “job-priority” Job Template attribute (see [RFC2911] section 4.2.1), the  
520 Printer sets the job’s “job-priority” to the highest value supported (so that the job will print before any  
521 of the other pending jobs). The Printer returns the target job immediately after the current job(s) in a  
522 Get-Jobs response (see [RFC2911] section 3.2.6) for the ‘not-completed’ jobs.

523 When the current job completes, is canceled, suspended (see section 4.3.1), or aborted, the target of this  
524 operation is processed next.

525 If a client issues this request (again) before the target of the operation of the original request started  
526 processing, the target of this new request is processed before the previous job that was to be processed  
527 next.

528 IPP is specified not to require queues for job scheduling, since there are other implementation  
529 techniques for scheduling multiple jobs, such as re-evaluating a criteria function for each job on a  
530 scheduling cycle. However, if an implementation does implement queues for jobs, then the Promote-  
531 Job puts the specified job at the front of the queue. A subsequent Promote-Job before the first job  
532 starts processing puts that specified job at the front of the queue, so that it is “in front” of the previously  
533 promoted job.

534 *Access Rights:* The authenticated user (see [RFC2911] section 8.3) performing this operation must be  
535 an operator or administrator of the Printer object (see [RFC2911] Sections 1 and 8.5).

536 The Promote-Job Request and Promote-Job Response have the same attribute groups and attributes as  
537 the Cancel-Job operation (see [RFC2911] section 3.3.3), including the new “job-message-from-  
538 operator” operation attribute (see section 6).

#### 539 **4.4.2 Schedule-Job-After operation**

540 This OPTIONAL operation allows a client to request the Printer to schedule the target job so that it will  
541 be processed immediately after the specified predecessor job, all other scheduling factors being equal.  
542 This operation is specially useful in a production printing environment where the operator is involved in  
543 job scheduling.

544 If the target job is in the ‘pending’ state, this operation does not change the job’s state, but causes the  
545 job to be processed after the predecessor job completes. The predecessor job can be in the ‘pending’,  
546 ‘processing’, or ‘processing-stopped’ states. If the target job is not in the ‘pending’ state or the  
547 predecessor job is not in the ‘pending’, ‘processing’, or ‘processing-stopped’ states, the Printer MUST  
548 reject the request and returns the ‘client-error-not-possible’ status code, since the job cannot have its  
549 position changed.

550 If the Printer implements the “job-priority” Job Template attribute (see [RFC2911] section 4.2.1), the  
551 Printer sets the job’s “job-priority” to that of the predecessor job (so that the job will print after the  
552 predecessor job). The Printer returns the target job immediately after the predecessor in a Get-Jobs  
553 response (see [RFC2911] section 3.2.6) for the ‘not-completed’ jobs.

554 When the predecessor job completes processing or is canceled or aborted while processing, the target of  
555 this operation is processed next.

556 If the client does not supply a predecessor job, this operation has the same semantics as Promote-Job  
557 (see section 4.4).

558 IPP is specified not to require queues for job scheduling, since there are other implementation  
559 techniques for scheduling multiple jobs, such as re-evaluating a criteria function for each job on a  
560 scheduling cycle. However, if an implementation does implement queues for jobs, then the Schedule-  
561 Job-After operation puts the specified job immediately after the specified job in the queue. A  
562 subsequent Schedule-Job-After operation specifying the same job will cause its target job to be placed  
563 after that job, even though it is between the first target job and the specified job. For example, suppose  
564 the job queue consisted of jobs: A, B, C, D, and E, in that order. A Schedule-Job-After with job E as  
565 the target and B as the specified job would result in the following queue: A, B, E, C, D. A subsequent  
566 Schedule-Job-After with Job D as the target and B as the specified job would result in the following  
567 queue: A, B, D, E, C. In other words, the link between the two jobs in a Schedule-Job-After operation  
568 is not retained, i.e., there is no attribute on either job that points to the other job as a result of this  
569 operation.

570 *Access Rights:* The authenticated user (see [RFC2911] section 8.3) performing this operation must be  
571 operator or administrator of the Printer object (see [RFC2911] Sections 1 and 8.5).

572 The Schedule-Job-After Request have the same attribute groups and attributes as the Cancel-Job  
573 operation (see [RFC2911] section 3.3.3), plus the new “job-message-from-operator” operation attribute  
574 (see section 6). In addition, the following operation attributes are defined:

575 “predecessor-job-id”:

576 The client **OPTIONALLY** supplies this attribute. The Printer **MUST** support it, if it supports  
577 this operation. This attribute specifies the job after which the target job is to be processed. If  
578 the client omits this attribute, the Printer **MUST** process the target job next, i.e., after the  
579 current job, if any.

580 The Schedule-Job-After Response has the same attribute groups, attributes, and status codes as the  
581 Cancel-Job operation (see [RFC2911] section 3.3.3). The following status codes have particular  
582 meaning for this operation:

583 ‘client-error-not-possible’ - the target job was not in the ‘pending’ state or the predecessor job was  
584 no in the ‘pending’, ‘processing’, or ‘processing-stopped’ states.

585 ‘client-error-not-found’ - either the target job or the predecessor job was not found.

## 586 **5 Additional status codes**

587 This section defines new status codes used by the operations defined in this document.

### 588 **5.1 ‘server-error-printer-is-deactivated’ (0x050A)**

589 The Printer has been deactivated using the Deactivate-Printer operation and is only accepting the  
590 Activate-Printer (see section 3.5.1), Get-Job-Attributes, Get-Jobs, Get-Printer-Attributes, and any other  
591 Get-Xxxx operations. An operator can perform the Activate-Printer operation to allow the Printer to  
592 accept other operations.

## 593 **6 Use of Operation Attributes that are Messages from the Operator**

594 This section summarizes the usage of the “printer-message-from-operator” and “job-message-from-  
595 operator” operation attributes that set the corresponding Printer and Job Description attributes (see  
596 [ipp-set-ops] for the definition of these operation attributes). These operation attributes are defined for  
597 most of the Printer and Job operations that operators are likely to perform, respectively, so that  
598 operators can indicate the reasons for their actions.

599 Table 5 shows the operation attributes that are defined for use with the Printer Operations.

600 **Table 5 - Operation attribute support for Printer Operations**

Operation Attribute	A	B	C	D	E	F	G
attributes-charset	REQ	REQ	REQ	REQ	REQ	REQ	REQ
attributes-natural-language	REQ	REQ	REQ	REQ	REQ	REQ	REQ
printer-uri	REQ	REQ	REQ	REQ	REQ	REQ	REQ
requesting-user-name	REQ	REQ	REQ	REQ	REQ	REQ	REQ
printer-message-from-operator	OPT	OPT	OPT		OPT	OPT	OPT

601

602 Legend:

603 A: Pause-Printer, Pause-Printer-After-Current-Job, Resume-Printer

604 B: Hold-New-Jobs, Release-Held-New-Jobs

605 C: Purge-Jobs

606 D: Get-Printer-Attributes, Set-Printer-Attributes

607 E: Enable-Print, Disable-Printer

608 F: Restart-Printer

609 G: Shutdown-Printer, Startup-Printer

610 REQ - REQUIRED for a Printer to support

611 OPT - OPTIONAL for a Printer to support; the Printer ignores the attribute if not supported

612 <blank> - not defined for use with the operation; the Printer ignores the attribute

613

614 Table 6 shows the operation attributes that are defined for use with the Job operations.

615 **Table 6 - Operation attribute support for Job operations**

Operation Attribute	A	B	C	D	E	F	G	H	I	J
attributes-charset	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ
attributes-natural-language	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ
printer-uri	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ
job-uri	REQ		REQ		REQ	REQ	REQ	REQ	REQ	REQ
job-id	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ
requesting-user-name	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ
job-message-from-operator	OPT	OPT	OPT	OPT	OPT		OPT	OPT	OPT	OPT
message [to-operator]	OPT		OPT	OPT	OPT		OPT	OPT	OPT	OPT
job-hold-until			OPT *					OPT **		

616

617 Legend:

618

A: Cancel-Job

619

B: Cancel-Current-Job

620

C: Hold-Job, Release-Job

621

D: Suspend-Current-Job

622

E: Resume-Job

623

F: Get-Job-Attributes, Set-Job-Attributes

624

G: Restart-Job

625

H: Reprocess-Job

626

I: Promote-Job

627

J: Schedule-Job-After

628

629 REQ - REQUIRED for a Printer to support

630

O - OPTIONAL for a Printer to support; the Printer ignores the attribute if supplied, but not supported

631

<blank> - not defined for use with the operation; the Printer ignores the attribute

632

\* The Printer MUST support the "job-hold-until" operation attribute if it supports the "job-hold-until" Job Template attribute.

633

\*\* The Printer MUST support the "job-hold-until" operation attribute if it supports the Set-Job-

634

Attributes operation, so that the client can hold the job with the Reprocess-Job operation and the modify the job before releasing it to be processed.

636

## 637 7 New Printer Description Attributes

638

The following new Printer Description attributes are needed to support the new operations defined in this document and the concepts of Printer Fan-Out (see section 11).

639

## 640 **7.1 subordinate-printers-supported (1setOf uri)**

641 This Printer attribute is REQUIRED if an implementation supports Subordinate Printers (see section  
642 11) and contains the URIs of the immediate Subordinate Printer object(s) associated with this Printer  
643 object. Each Non-Leaf Printer object MUST support this Printer Description attribute. A Leaf Printer  
644 object either does not support the “subordinate-printers-supported” attribute or does so with the ‘no-  
645 value’ out-of-band value (see [RFC2911] section 4.1), depending on implementation.

646 The precise format of the Subordinate Printer URIs is implementation dependent (see section 11.4).

647 If the Printer object does not have an associated Output Device, the Printer MAY automatically copy  
648 the value of the Subordinate Printer object’s “printer-name” attribute to the Job object’s “output-  
649 device-assigned” attribute (see [RFC2911] section 4.3.13). The “output-device-assigned” Job attribute  
650 identifies the Output Device to which the Printer object has assigned a job, for example, when a single  
651 Printer object is supporting Device Fan-Out or Printer Fan-Out.

## 652 **7.2 parent-printers-supported (1setOf uri)**

653 This Printer attribute is REQUIRED if an implementation supports Subordinate Printers (see section  
654 11) and contains the URI of the Non-Leaf printer object(s) for which this Printer object is the immediate  
655 Subordinate, i.e., this Printer’s immediate “parent” or “parents”. Each Subordinate Printer object  
656 MUST support this Printer Description attribute. A Printer that has no parents, either does not support  
657 the “parent-printers-supported” attribute or does so with the ‘no-value’ out-of-band value (see  
658 [RFC2911] section 4.1), depending on implementation.

## 659 **8 Additional Values for the “printer-state-reasons” Printer Description attribute**

660 This section defines additional values for the “printer-state-reasons” Printer Description attribute.

### 661 **8.1 ‘hold-new-jobs’ value**

662 ‘hold-new-jobs’: The operator has issued the Hold-New-Jobs operation (see section 3.3.1) or other  
663 means, but the output-device(s) are taking an appreciable time to stop. Later, when all output has  
664 stopped, the “printer-state” becomes ‘stopped’, and the ‘paused’ value replaces the ‘moving-to-  
665 paused’ value in the “printer-state-reasons” attribute. This value MUST be supported, if the Hold-  
666 New-Jobs operation is supported and the implementation takes significant time to pause a device in  
667 certain circumstances.

### 668 **8.2 ‘deactivated’ value**

669 ‘deactivated’: A client has issued a Deactivate-Printer operation for the Printer object (see section  
670 3.4.1) and the Printer is in the process of becoming deactivated or has become deactivated. The  
671 Printer MUST reject all requests except Activate-Printer, queries (Get-Printer-Attributes, Get-Job-

672 Attributes, Get-Jobs, etc.), Send-Document, and Send-URI (so that partial job submission can be  
673 completed - see section 3.1.1) and return the 'server-error-service-unavailable' status code.

## 674 **9 Additional Values for the “job-state-reasons” Job Description attribute**

675 This section defines additional values for the “job-state-reasons” Job Description attribute.

### 676 **9.1 ‘job-suspended’ value**

677 ‘job-suspended’: The job has been suspended while processing using the Suspend-Current-Job  
678 operation and other jobs can be processed on the Printer. The Job can be resumed using the  
679 Resume-Job operation which removes this value.

## 680 **10 Additional events**

681 The following Job events are defined for use with [ipp-ntfy]:

682 ‘job-forwarded-operation-failed’ - an operation that a Printer forwarded to a Subordinate Printer  
683 (see section 11.7) failed.

## 684 **11 Use of the Printer object to represent IPP Printer Fan-Out and IPP Printer 685 Fan-In**

686 This section defines how the Printer object MAY be used to represent IPP Printer Fan-Out and IPP  
687 Printer Fan-In. Fan-Out is where an IPP Printer is used to represent other IPP Printer objects. Fan-In  
688 is where several IPP Printer objects are used to represent another IPP Printer object.

### 689 **11.1 IPP Printer Fan-Out**

690 The IPP/1.1 Model and Semantics introduces the semantic concept of an IPP Printer object that  
691 represents more than one Output Device (see [RFC2911] section 2.1). This concept is called “Output  
692 Device Fan-Out”. However, there was no way to represent the individual states of the Output Devices  
693 or to perform operations on a specific Output Device when there was Fan-Out. This document  
694 generalizes the semantics of the Printer object to represent such Subordinate Fan-Out Output Devices  
695 as IPP Printer objects. This concept is called “Printer object Fan-Out”. A Printer object that has a  
696 Subordinate Printer object is called a Non-Leaf Printer object. Thus a Non-Leaf Printer object supports  
697 one or more Subordinate Printer objects in order to represent Printer object Fan-Out. A Printer object  
698 that does not have any Subordinate Printer objects is called a Leaf Printer object.

699 Each Non-Leaf Printer object submits jobs to its immediate Subordinate Printers and otherwise controls  
700 the Subordinate Printers using IPP or other protocols. Whether pending jobs are kept in the Non-Leaf  
701 Printer until a Subordinate Printer can accept them or are kept in the Subordinate Printers depends on  
702 implementation and/or configuration policy. Furthermore, a Subordinate Printer object MAY, in turn,



703 have Subordinate Printer objects. Thus a Printer object can be both a Non-Leaf Printer and a  
704 Subordinate Printer.

705 A Subordinate Printer object MUST be a conforming Printer object, so it MUST support all of the  
706 REQUIRED [RFC2911] operations and attributes. However, with access control, the Subordinate  
707 Printer MAY be configured so that end-user clients are not permitted to perform any operations (or just  
708 Get-Printer-Attributes) while one or more Non-Leaf Printer object(s) are permitted to perform any  
709 operation.

## 710 11.2 IPP Printer Fan-In

711 The IPP/1.1 Model and Semantics did not preclude the semantic concept of multiple IPP Printer objects  
712 that represent a single Output Device (see [RFC2911] section 2.1). However, there was no way for the  
713 client to determine that there was a Fan-In configuration, nor was there a way to perform operations on  
714 the Subordinate device. This specification generalizes the semantics of the Printer object to allow  
715 several Non-Leaf IPP Printer objects to represent a single Subordinate Printer object. Thus a Non-Leaf  
716 Printer object MAY share a Subordinate Printer object with one or more other Non-Leaf Printer objects  
717 in order to represent IPP Printer Fan-In.

718 As with Fan-Out (see section 11.1), when a Printer object is a Non-Leaf Printer, it MUST NOT have an  
719 associated Output Device. As with Fan-Out, a Leaf Printer object has one or more associated Output  
720 Devices. As with Fan-Out, the Non-Leaf Printer objects submit jobs to their Subordinate Printer  
721 objects and otherwise control the Subordinate Printer. As with Fan-Out, whether pending jobs are kept  
722 in the Non-Leaf Printers until the Subordinate Printer can accept them or are kept in the Subordinate  
723 Printer depends on implementation and/or configuration policy.

## 724 11.3 Printer object attributes used to represent Printer Fan-Out and Printer Fan-In

725 The following Printer Description attributes are defined to represent the relationship between Printer  
726 object(s) and their Subordinate Printer object(s):

- 727 1. "subordinate-printers-supported" (1setOf uri) - contains the URI of the immediate Subordinate  
728 Printer object(s).
- 729 2. "parent-printers-supported (1setOf uri) - contains the URI of the Non-Leaf printer object(s) for  
730 which this Printer object is the immediate Subordinate, i.e., this Printer's immediate "parent" or  
731 "parents".

## 732 11.4 Subordinate Printer URI

733 Each Subordinate Printer object has a URI which is used as the target of each operation on the  
734 Subordinate Printer. The means for configuring URIs for Subordinate Printer objects is  
735 implementation-dependent as are all URIs. However, there are two distinct approaches:

736 a. When the implementation wants to make sure that no operation on a Subordinate Printer object as  
737 a target “sneaks by” the parent Printer object (or the Subordinate Printer is fronting for a device that  
738 is not networked), the host part of the URI specifies the host of the parent Printer. Then the parent  
739 Printer object can easily reflect the state of the Subordinate Printer objects in the parent’s Printer  
740 object state and state reasons as the operation passes “through” the parent Printer object.

741 b. When the Subordinate Printer is networked and the implementation allows operations to go  
742 directly to the Subordinate Printer (with proper access control) without knowledge of the parent  
743 Printer object, the host part of the URI is different than the host part of the parent Printer object. In  
744 such a case, the parent Printer object **MUST** keep its “printer-state” and “printer-state-reasons” up  
745 to date, either by polling the Subordinate Printer object or by subscribing to events with the  
746 Subordinate Printer object (see [ipp-not-spec] for means to subscribe to event notification when the  
747 Subordinate Printer object supports IPP notification).

## 748 **11.5 Printer object attributes used to represent Output Device Fan-Out**

749 Only Leaf IPP Printer objects are allowed to have one or more associated Output Devices. Each Leaf  
750 Printer object **MAY** support the “output-devices-supported” (1setOf name(127)) to indicate the user-  
751 friendly name(s) of the Output Device(s) that the Leaf Printer object represents. It is  
752 **RECOMMENDED** that each Leaf Printer object have only one associated Output Device, so that the  
753 individual Output Devices can be represented completely and controlled completely by clients. In other  
754 words, the Leaf Printer’s “output-devices-supported” attribute **SHOULD** have only one value.

755 Non-Leaf Printer **MUST NOT** have associated Output Devices. However, a Non-Leaf Printer  
756 **SHOULD** support an “output-devices-supported” (1setOf name(127)) Printer Description attribute that  
757 contains all the values of its immediate Subordinate Printers. Since such Subordinate Printers **MAY** be  
758 Leaf or Non-Leaf, the same rules apply to them, etc. Thus any Non-Leaf Printer **SHOULD** have an  
759 “output-devices-supported” (1setOf name(127)) attribute that contains all the values of the Output  
760 Devices associated with Leaf Printers of its complete sub-tree.

761 When adding, removing, or changing a configuration of Printers and Output Devices, there can be  
762 moments in time when the tree structure is not consistent. In other words, times when a Non-Leaf  
763 Printer’s “subordinate-printers-supported” does not agree with the Subordinate Printer’s “parent-  
764 printers-supported”. Therefore, the operator **SHOULD** first Deactivate all Printers that are being  
765 configured in this way, update all pointer attributes, and then reactivate. A useful client tool would  
766 validate a tree structure before Activating the Printers involved.

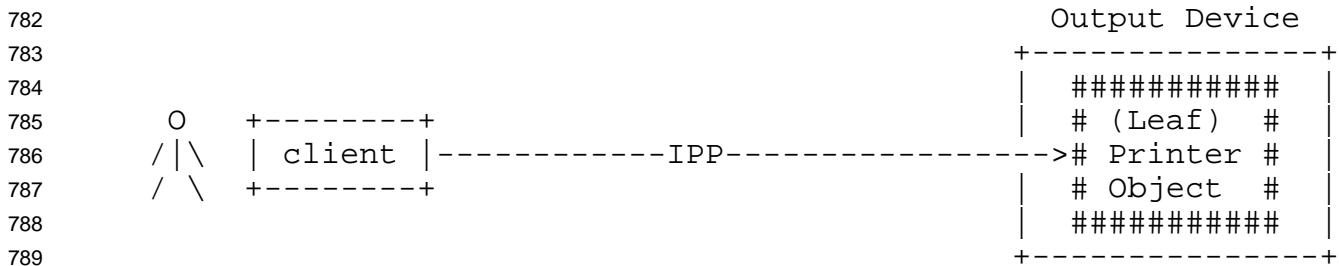
767

767

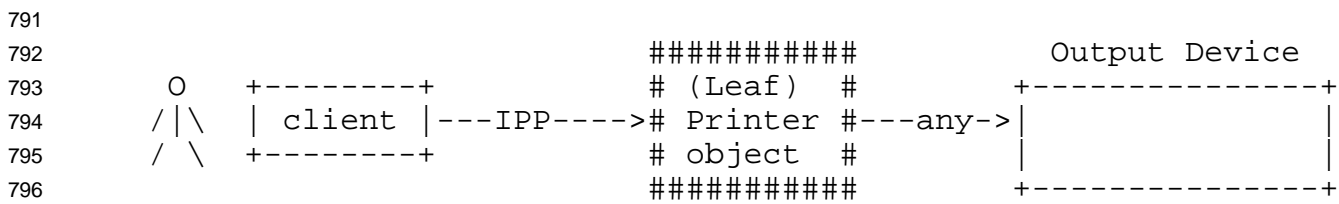
768 **11.6 Figures to show all possible configurations**

769 Figure 1, Figure 2, and Figure 3 are taken from [RFC2911] to show the configurations possible with  
770 IPP/1.0 and IPP/1.1 where all Printer objects are Leaf Printer objects. The remaining figures show  
771 additional configurations that this document defines using Non-Leaf and Leaf Printer objects. Legend  
772 for all figures:

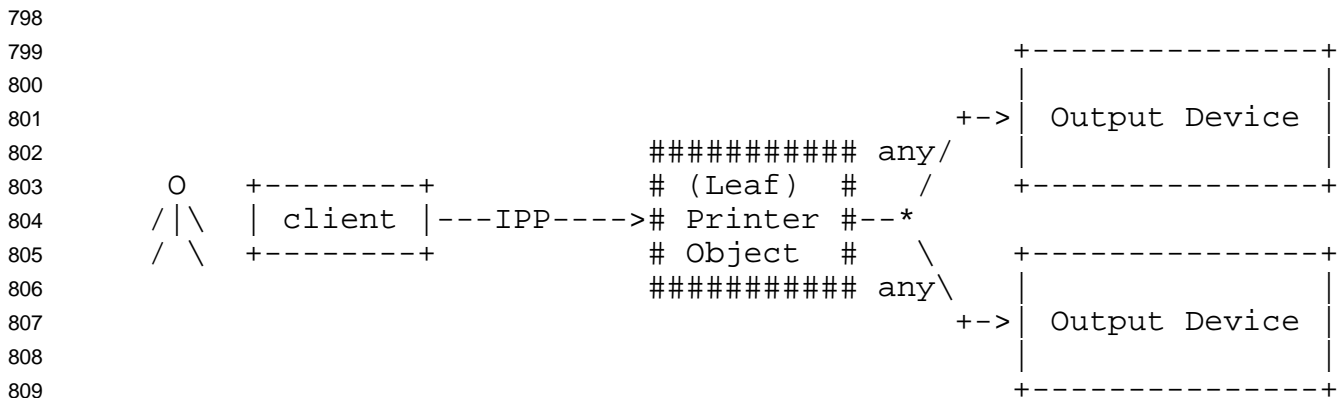
773 ----> indicates a network protocol with the direction of its requests  
 774  
 775 ##### indicates a Printer object which is either:  
 776 - embedded in an Output Device or  
 777 - hosted in a server. The Printer object  
 778 might or might not be capable of queuing/spooling.  
 779  
 780 any indicates any network protocol or direct  
 781 connect, including IPP



790 **Figure 1 - Embedded Printer object**



797 **Figure 2 - Hosted Printer object**



810 **Figure 3 - Output Device Fan-Out**

811

```

811          #####
812      O    +-----+          # Non-Leaf#          #####
813      /|\  | client |---IPP---># Printer #---IPP---># Printer #
814      / \  +-----+          # object #          #####
815          #####
816

```

817 The Subordinate Printer can be a Non-Leaf Printer as in Figure 4 to  
818 Figure 6, or can be a Leaf Printer as in Figure 1 to Figure 3.

819 **Figure 4 - Chained IPP Printer Objects**

```

820
821          +-----IPP----->#####
822          /
823          /
824          /
825      O    +-----+          ##### any          #####
826      /|\  | client |---IPP---># Printer #--*
827      / \  +-----+          # object # \
828          \
829          \
830          \
831          \
832          \
833          \
834          \
835          \
836          \
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834 The Subordinate Printer can be a Non-Leaf Printer as in Figure 4 to  
835 Figure 6, or can be a Leaf Printer as in Figure 1 to Figure 3.

836 **Figure 5 - IPP Printer Object Fan-Out**

```

837
838          (Non-Leaf)
839          #####
840          # Non-Leaf#
841          +---># Printer #--+
842          /
843          /
844      O    +-----+          /
845      /|\  | client |---+-----IPP-----># Printer #
846      / \  +-----+          \
847          \
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```

853 The Subordinate Printer can be a Non-Leaf Printer as in Figure 4,  
854 Figure 5, or Figure 6, or can be a Leaf Printer as in Figure 1,  
855 Figure 2, or Figure 3.

856 **Figure 6 - IPP Printer Object Fan-In**

857 **11.7 Forwarding requests**

858 This section describes the forwarding of Job and Printer requests to Subordinate Printer objects.

859 **11.7.1 Forwarding requests that affect Printer objects**

860 In Printer Fan-Out, Printer Fan-In, and Chained Printers, the Non-Leaf IPP Printer object **MUST NOT**  
 861 forward the operations that affect Printer objects to its Subordinate Printer objects. If a client wants to  
 862 explicitly target a Subordinate Printer, the client **MUST** specify the URI of the Subordinate Printer.  
 863 The client can determine the URI of any Subordinate Printers by querying the Printer's "subordinate-  
 864 printers-supported (1setOf uri) attribute (see section 7.1).

865 Table 7 lists the operations that affect Printer objects and the forwarding behavior that a Non-Leaf  
 866 Printer **MUST** exhibit to its immediate Subordinate Printers. Operations that affect jobs have a different  
 867 forwarding rule (see section 11.7.2 and Table 8):

868 **Table 7 - Forwarding operations that affect Printer objects**

Printer Operation	Non-Leaf Printer action
Printer Operations:	
Enable-Printer	<b>MUST NOT</b> forward to any of its Subordinate Printers
Disable-Printer	<b>MUST NOT</b> forward to any of its Subordinate Printers
Hold-New-Jobs	<b>MUST NOT</b> forward to any of its Subordinate Printers
Release-Held-New-Jobs	<b>MUST NOT</b> forward to any of its Subordinate Printers
Deactivate-Printer	<b>MUST NOT</b> forward to any of its Subordinate Printers
Activate-Printer	<b>MUST NOT</b> forward to any of its Subordinate Printers
Restart-Printer	<b>MUST NOT</b> forward to any of its Subordinate Printers
Shutdown-Printer	<b>MUST NOT</b> forward to any of its Subordinate Printers
Startup-Printer	<b>MUST NOT</b> forward to any of its Subordinate Printers
IPP/1.1 Printer Operations:	See [RFC2911]
Get-Printer-Attributes	<b>MUST NOT</b> forward to any of its Subordinate Printers
Pause-Printer	<b>MUST NOT</b> forward to any of its Subordinate Printers
Resume-Printer	<b>MUST NOT</b> forward to any of its Subordinate Printers
Set operations:	See [ipp-set-ops]
Set-Printer-Attributes	<b>MUST NOT</b> forward to any of its Subordinate Printers

869

870 **11.7.2 Forwarding requests that affect Jobs**

871 Unlike Printer Operations that only affect Printer objects (see section 11.7.1), a Non-Leaf Printer object  
 872 **MUST** forward operations that directly affect jobs to the appropriate Job object(s) in one or more of its  
 873 immediate Subordinate Printer objects. Forwarding is **REQUIRED** since the purpose of such a Job  
 874 operation is to affect the indicated job which itself may have been forwarded. Such forwarding **MAY**

875 be immediate or queued, depending on the operation and the implementation. For example, a Non-Leaf  
876 Printer object MAY queue/spool jobs, feeding a job at a time to its Subordinate Printer(s), or MAY  
877 forward jobs immediately to one of its Subordinate Printers. In either case, the Non-Leaf Printer object  
878 is forwarding Job Creation operations to one of its Subordinate Printers. Only the time of forwarding of  
879 the Job Creation operations depends on whether the policy is to queue/spool jobs in the Non-Leaf  
880 Printer or the Subordinate Printer.

881 When a Non-Leaf Printer object creates a Job object in its Subordinate Printer, whether that Non-Leaf  
882 Printer object keeps a fully formed Job object or just keeps a mapping from the “job-ids” that it assigned  
883 to those assigned by its Subordinate Printer object is IMPLEMENTATION-DEPENDENT. In either  
884 case, the Non-Leaf Printer MUST be able to accept and carry out future Job operations that specify the  
885 “job-id” that the Non-Leaf Printer assigned and returned to the job submitting client.

886 Table 8 lists the operations that directly affect jobs and the forwarding behavior that a Non-Leaf Printer  
887 MUST exhibit to its Subordinate Printers:

888

**Table 8 - Forwarding operations that affect Jobs objects**

Job operation	Non-Leaf Printer action
Job operations:	
Reprocess-Job	MUST forward to the appropriate Job in one of its Subordinate Printers
Cancel-Current-Job	MUST NOT forward
Resume-Job	MUST forward to the appropriate Job in one of its Subordinate Printers
Promote-Job	MUST forward to the appropriate Job in one of its Subordinate Printers
IPP/1.1 Printer Operations:	
Print-Job	MUST forward immediately or queue to the appropriate Subordinate Printer
Print-URI	MUST forward immediately or queue to the appropriate Subordinate Printer
Validate-Job	MUST forward to the appropriate Subordinate Printer
Create-Job	MUST forward immediately or queue to the appropriate Subordinate Printer
Get-Jobs	MUST forward to <i>all</i> its Subordinate Printers
Purge-Jobs	MUST forward to <i>all</i> its Subordinate Printers
IPP/1.1 Job operations:	
Send-Document	MUST forward immediately or queue to the appropriate Job in one of its Subordinate Printers
Send-URI	MUST forward immediately or queue to the appropriate Job in one of its Subordinate Printers
Cancel-Job	MUST forward to the appropriate Job in one of its Subordinate Printers
Get-Job-Attributes	MUST forward to the appropriate Job in one of its Subordinate Printers, if the Non-Leaf Printer doesn't know the complete status of the Job object
Hold-Job	MUST forward to the appropriate Job in one of its Subordinate Printers
Release-Job	MUST forward to the appropriate Job in one of its Subordinate Printers
Restart-Job	MUST forward to the appropriate Job in one of its Subordinate Printers
IPP Set operations:	See [ipp-set-ops]
Set-Job-Attributes	MUST forward to the appropriate Job in one of its Subordinate Printers

889

890 When a Printer receives a request that REQUIRES forwarding, it does so on a “best efforts basis”, and  
891 returns a response to its client without waiting for responses from any of its Subordinate Printers. Such  
892 forwarded requests could fail. In order for a client to become aware of such a condition, a new ‘job-  
893 forwarded-operation-failed’ Job event is defined, which a client can subscribe to (see section 10 and  
894 [ipp-ntfy]).

## 895 11.8 Additional attributes to help with fan-out

896 The following Job Description attributes are defined to help represent Job relationships for Fan-Out and  
897 forwarding of jobs:



**898 11.8.1 output-device-assigned (name(127)) Job Description attribute - from [RFC2911]**

899 This attribute identifies the Output Device to which the Printer object has assigned this job. If an  
900 Output Device implements an embedded Printer object, the Printer object NEED NOT set this attribute.  
901 If a print server implements a Printer object, the value MAY be empty (zero-length string) or not  
902 returned until the Printer object assigns an Output Device to the job. This attribute is particularly useful  
903 when a single Printer object supports multiple devices (so called "Device Fan-Out").

**904 11.8.2 original-requesting-user-name (name(MAX)) operation attribute**

905 The operation attribute containing the user name of the original user, i.e., corresponds to the  
906 "requesting-user-name" operation attribute that the original client supplied to the first Printer object.  
907 The IPP/1.1 "requesting-user-name" operation attribute (see [RFC2911]) is updated by each client to be  
908 itself on each hop, i.e., the "requesting-user-name" is the client forwarding the request, not the original  
909 client. The "job-originating-user-name" Job Description attribute remains as the authenticated original  
910 user, not the parent Printer's authenticated host, and is forwarded by each client without changing the  
911 value.

**912 12 Conformance Requirements**

913 The Job and Printer Administrative operations defined in this document are OPTIONAL operations.  
914 However, some operations MUST be implemented if others are implemented as shown in Table 9.

915

**Table 9 - Conformance Requirement Dependencies for Operations**

Operations REQUIRED	If any of these operations are supported:
Enable-Printer	Disable-Printer
Disable-Printer	Enable-Printer
Pause-Printer	Resume-Printer
Resume-Printer	Pause-Printer, Pause-Printer-After-Current-Job
Hold-New-Jobs	Release-Held-New-Jobs
Release-Held-New-Jobs	Hold-New-Jobs
Activate-Printer, Disable-Printer, Pause-Printer-After-Current-Job	Deactivate-Printer
Deactivate-Printer, Enable-Printer, Resume-Printer	Activate-Printer
Restart-Printer	none
Shutdown-Printer	none
Startup-Printer	none
Reprocess-Job	none
Cancel-Current-Job	none
Resume-Job	Suspend-Current-Job
Suspend-Current-Job	Resume-Job
Promote-Job	none
Schedule-Job-After	Promote-Job

916

917 Table 10 and Table 11 list the “printer-state-reasons” and “job-state-reasons” values that are  
 918 REQUIRED if the indicated operations are supported.

919

**Table 10- Conformance Requirement Dependencies for “printer-state-reasons” Values**

“printer-state-reasons” values:	Conformance Requirement	If any of the following Printer Operations are supported:
‘paused’	REQUIRED	Pause-Printer, Pause-Printer-After-Current-Job, or Deactivate-Printer
‘hold-new-jobs’	REQUIRED	Hold-New-Jobs
‘moving-to-paused’	OPTIONAL	Pause-Printer, Pause-Printer-After-Current-Job, Deactivate-Printer
‘deactivated’	REQUIRED	Deactivate-Printer

920

921

**Table 11- Conformance Requirement Dependencies for "job-state-reasons" Values**

"job-state-reasons" values:	Conformance Requirement	If any of the following Job operations are supported:
'job-suspended'	REQUIRED	Suspend-Current-Job
'printer-stopped'	REQUIRED	always REQUIRED

922

923

## 13 IANA Considerations

924

925

926

### 13.1 This section contains the registration information for IANA to add to the various IPP Registries according to the procedures defined in RFC 2911 [RFC2911] section 6 to cover the definitions in this document. Attribute Registrations

927

928

The following table lists all the attributes defined in this document. These are to be registered according to the procedures in RFC 2911 [RFC2911] section 6.2.

929

930

931

Job Description attributes:	Ref.	Section:
output-device-assigned (name(127))	RFC NNNN	11.8.1

932

933

934

935

Printer Description attributes:	Ref.	Section:
subordinate-printers-supported (1setOf uri)	RFC NNNN	7.1
parent-printers-supported (1setOf uri)	RFC NNNN	7.2

936

937

938

Operation attributes:	Ref.	Section:
original-requesting-user-name (name(MAX))	RFC NNNN	11.8.2

939

940

941

942

The resulting attribute registrations will be published in the <ftp://ftp.iana.org/in-notes/iana/assignments/ipp/attributes/> area.

943

### 13.2 Attribute Value Registrations

944

This section lists the additional values that are defined in this document for existing attributes.

945

946

#### 13.2.1 Additional Keyword Attribute Value Registrations for the "job-state-reasons" attribute

947

948

949

The following table the new keyword attribute value defined in this document as an additional type2 keyword value for use with the "job-state-reasons" Job Description attribute. This is to be registered according to the procedures in RFC 2911 [RFC2911] section 6.1.

950

951

type2 keyword Attribute Values:	Ref.	Section:
job-suspended	RFC NNNN	9.1

952  
953  
954  
955  
956

The resulting enum attribute value registration will be published in the  
ftp://ftp.iana.org/in-notes/iana/assignments/ipp/attribute-values/job-state-reasons/  
area.

### 957 **13.2.2 Additional Keyword Attribute Value Registrations for the "printer-state-reasons"** 958 **attribute**

959 The following table all the new keyword attribute values defined in this document as additional type2  
960 keyword values for use with the "printer-state-reasons" Printer Description attribute. These are to be  
961 registered according to the procedures in RFC 2911 [RFC2911] section 6.1.

962 type2 keyword Attribute Values:	Ref.	Section:
963 hold-new-jobs	RFC NNNN	8.1
964 deactivated	RFC NNNN	8.2

965  
966 The resulting enum attribute value registrations will be published in the  
967 ftp://ftp.iana.org/in-notes/iana/assignments/ipp/attribute-values/printer-state-reasons/  
968 area.  
969

### 970 **13.3 Additional Enum Attribute Value Registrations for the "operations-supported" Printer** 971 **Attribute**

972 The following table lists all the new enum attribute values defined in this document as additional type2  
973 enum values for use with the "operations-supported" Printer Description attribute. These are to be  
974 registered according to the procedures in RFC 2911 [RFC2911] section 6.1.

975 type2 enum Attribute Values:	Value	Ref.	Section:
976 Enable-Printer	0x22	RFC NNNN	3
977 Disable-Printer	0x23	RFC NNNN	3
978 Pause-Printer-After-Current-Job	0x24	RFC NNNN	3
979 Hold-New-Jobs	0x25	RFC NNNN	3
980 Release-Held-New-Jobs	0x26	RFC NNNN	3
981 Deactivate-Printer	0x27	RFC NNNN	3
982 Activate-Printer	0x28	RFC NNNN	3
983 Restart-Printer	0x29	RFC NNNN	3
984 Shutdown-Printer	0x2A	RFC NNNN	3
985 Startup-Printer	0x2B	RFC NNNN	3

986  
987 The resulting enum attribute value registrations will be published in the  
988 ftp://ftp.iana.org/in-notes/iana/assignments/ipp/attribute-values/operations-supported/  
989 area.  
990

### 991 13.4 Additional keyword Attribute Value Registrations for the “notify-events” Subscription 992 Template Attribute

993 The following table lists the event keyword defined in this document as an additional type2 keyword  
994 value for use with the “notify-events” Subscription Template attribute, i.e., the “notify-events”, “notify-  
995 events-default”, and “notify-events-supported” attributes. This is to be registered according to the  
996 procedures in RFC 2911 [RFC2911] section 6.1 and [ipp-ntfy] section 13.6.

997	type2 keyword Attribute Value:	Ref.	Section:
998	job-forwarded-operation-failed	RFC NNNN	10

999  
1000 The resulting status code registration will be published in the  
1001 <ftp://ftp.iana.org/in-notes/iana/assignments/ipp/attribute-values/notify-events/>  
1002 area.  
1003

### 1004 13.5 Operation Registrations

1005 The following table lists all of the operations defined in this document. These are to be registered  
1006 according to the procedures in RFC 2911 [RFC2911] section 6.4.

1007	Operations:	Ref.	Section:
1008	Enable-Printer Operation	RFC NNNN	3.1.2
1009	Disable-Printer Operation	RFC NNNN	3.1.1
1010	Pause-Printer-After-Current-Job Operation	RFC NNNN	3.2.1
1011	Hold-New-Jobs Operation	RFC NNNN	3.3.1
1012	Release-Held-New-Jobs Operation	RFC NNNN	3.3.2
1013	Deactivate-Printer Operation	RFC NNNN	3.4.1
1014	Activate-Printer Operation	RFC NNNN	3.4.2
1015	Restart-Printer Operation	RFC NNNN	3.5.1
1016	Shutdown-Printer Operation	RFC NNNN	3.5.2
1017	Startup-Printer Operation	RFC NNNN	3.5.3

1018  
1019 The resulting enum attribute value registrations will be published in the  
1020 <ftp://ftp.iana.org/in-notes/iana/assignments/ipp/attribute-values/operations/>  
1021 area.  
1022

### 1023 13.6 Status code Registrations

1024 The following table lists the status code defined in this document. This is to be registered according to  
1025 the procedures in RFC 2911 [RFC2911] section 6.6.

1026	Status codes:	Ref.	Section:
1027	server-error-printer-is-deactivated	RFC NNNN	5.1

1028  
1029 The resulting status code registration will be published in the  
1030 <ftp://ftp.iana.org/in-notes/iana/assignments/ipp/status-codes/>

1031 area.

1032

## 1033 **14 Internationalization Considerations**

1034 This document has the same localization considerations as the [RFC2911].

## 1035 **15 Security Considerations**

1036 The IPP Model and Semantics document [RFC2911] discusses high level security requirements (Client  
1037 Authentication, Server Authentication and Operation Privacy). Client Authentication is the mechanism  
1038 by which the client proves its identity to the server in a secure manner. Server Authentication is the  
1039 mechanism by which the server proves its identity to the client in a secure manner. Operation Privacy is  
1040 defined as a mechanism for protecting operations from eavesdropping.

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1068 IPP Mailing List: [ipp@pwg.org](mailto:ipp@pwg.org)

1069  
1070 To subscribe to the ipp mailing list, send the following email:

- 1071 1) send it to majordomo@pwg.org  
1072 2) leave the subject line blank  
1073 3) put the following two lines in the message body:  
1074 subscribe ipp  
1075 end  
1076

1077 Implementers of this specification document are encouraged to join the IPP Mailing List in order to  
1078 participate in any discussions of clarification issues and review of registration proposals for additional  
1079 attributes and values. In order to reduce spam the mailing list rejects mail from non-subscribers, so you  
1080 must subscribe to the mailing list in order to send a question or comment to the mailing list.

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1101 [ftp://ftp.pwg.org/pub/pwg/ipp/new\\_OPS/ipp-ops-set2-change-history.txt](ftp://ftp.pwg.org/pub/pwg/ipp/new_OPS/ipp-ops-set2-change-history.txt)

## 1102 **18 Summary of Base IPP Documents**

1103 The base set of IPP documents includes:

- 1104 Design Goals for an Internet Printing Protocol [RFC2567]
- 1105 Rationale for the Structure and Model and Protocol for the Internet Printing Protocol [RFC2568]
- 1106 Internet Printing Protocol/1.1: Model and Semantics [RFC2911]
- 1107 Internet Printing Protocol/1.1: Encoding and Transport [RFC2910]
- 1108 Internet Printing Protocol/1.1: Implementer's Guide [ipp-iig]
- 1109 Mapping between LPD and IPP Protocols [RFC2569]
- 1110 Internet Printing Protocol (IPP): IPP Event Notifications and Subscriptions [ipp-ntfy]

1111  
1112 The "Design Goals for an Internet Printing Protocol" document takes a broad look at distributed  
1113 printing functionality, and it enumerates real-life scenarios that help to clarify the features that need to  
1114 be included in a printing protocol for the Internet. It identifies requirements for three types of users:  
1115 end users, operators, and administrators. It calls out a subset of end user requirements that are satisfied  
1116 in IPP/1.0. A few OPTIONAL operator operations have been added to IPP/1.1.

1117 The "Rationale for the Structure and Model and Protocol for the Internet Printing Protocol" document  
1118 describes IPP from a high level view, defines a roadmap for the various documents that form the suite of  
1119 IPP specification documents, and gives background and rationale for the IETF working group's major  
1120 decisions.

1121 The "Internet Printing Protocol/1.1: Model and Semantics" document describes a simplified model with  
1122 abstract objects, their attributes, and their operations that are independent of encoding and transport. It  
1123 introduces a Printer and a Job object. The Job object optionally supports multiple documents per Job.  
1124 It also addresses security, internationalization, and directory issues.

1125 The "Internet Printing Protocol/1.1: Encoding and Transport" document is a formal mapping of the  
1126 abstract operations and attributes defined in the model document onto HTTP/1.1 [RFC2616]. It defines  
1127 the encoding rules for a new Internet MIME media type called "application/ipp". This document also  
1128 defines the rules for transporting over HTTP a message body whose Content-Type is "application/ipp".  
1129 This document defines the 'ippget' scheme for identifying IPP printers and jobs.

1130 The "Internet Printing Protocol/1.1: Implementer's Guide" document gives insight and advice to  
1131 implementers of IPP clients and IPP objects. It is intended to help them understand IPP/1.1 and some  
1132 of the considerations that may assist them in the design of their client and/or IPP object  
1133 implementations. For example, a typical order of processing requests is given, including error checking.  
1134 Motivation for some of the specification decisions is also included.

1135 The "Mapping between LPD and IPP Protocols" document gives some advice to implementers of  
1136 gateways between IPP and LPD (Line Printer Daemon) implementations.

1137 The "IPP Event Notifications and Subscriptions" document defines an extension to IPP/1.0 [RFC2566,  
1138 RFC2565] and IPP/1.1 [RFC2911, RFC2910]. This extension allows a client to subscribe to printing  
1139 related Events and defines the semantics for delivering asynchronous *Event Notifications* to the



1140 specified *Notification Recipient* via a specified *Delivery Method* (i.e., protocols) defined in (separate)  
1141 Delivery Method documents.

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