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

25 This document specifies the following 16 additional OPTIONAL system administration operations for  
26 use with the Internet Printing Protocol/1.1 (IPP) [RFC2910, RFC2911]:

Printer operations:

Enable-Printer and Disable-Printer  
Pause-Printer-After-Current-Job  
Hold-New-Jobs and Release-Held-New-Jobs  
Deactivate-Printer and Activate-Printer  
Restart-Printer  
Shutdown-Printer and Startup-Printer

Job operations:

Reprocess-Job  
Cancel-Current-Job  
Suspend-Current-Job  
Resume-Job  
Promote-Job  
Schedule-Job-After

27 plus a few associated attributes, values, and status codes and using the IPP Printer object to manage  
28 printer fan-out and fan-in.  
29

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123

## 124 **1 Introduction**

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

134 The requirements and use cases for this document are defined in [RFC3239].

## 135 **2 Terminology**

136 This section defines terminology used throughout this document.

### 137 **2.1 Conformance Terminology**

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

### 143 **2.2 Other terminology**

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

147 In addition, the following capitalized terms are defined:

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

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

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

- 154       **Output Device Fan-Out** - a configuration in which an IPP **Printer** controls more than one **Output**  
155       **Device**.
- 156       **Printer Fan-Out** - a configuration in which an IPP **Printer** object controls more than one  
157       **Subordinate IPP Printer** object.
- 158       **Printer Fan-In** - a configuration in which an IPP **Printer** object is controlled by more than one IPP  
159       **Printer** object.
- 160       **Subordinate Printer** - an IPP **Printer** object that is controlled by another IPP **Printer** object. Such a  
161       **Subordinate Printer** MAY have zero or more **Subordinate Printers**.
- 162       **Leaf Printer** - an IPP **Printer** object that has no **Subordinate Printers**.
- 163       **Non-Leaf Printer** - an IPP **Printer** object that has one or more **Subordinate Printers**. A **Non-Leaf**  
164       **Printer** is also called a **Parent Printer**.
- 165       **Chained Printer** - a **Non-Leaf Printer** that has exactly one **Subordinate Printer**.
- 166       **Job Creation operations** - IPP **operations** that create a **Job** object: Print-Job, Print-URI, and Create-  
167       **Job**.

### 168   **3 Definition of the Printer Operations**

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

172

172

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

174

**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

175

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

### 180 3.1 The Disable and Enable Printer Operations

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

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

### 190 3.1.1 Disable-Printer Operation

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

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

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

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

### 207 3.1.2 Enable-Printer Operation

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

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

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

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

## 220 3.2 The Pause and Resume Printer Operations

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

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

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

231 **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.

### 232 3.2.1 Pause-Printer-After-Current-Job operation

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

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

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

252 This operation MUST NOT affect the acceptance of Job Creation requests (see Disable-Printer section  
253 3.1.1).

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

258 The IPP Printer MUST accept the request in any state and transition the Printer to the indicated new  
259 "printer-state" and MUST add the indicated value to "printer-state-reasons" attribute before returning  
260 as follows:

261 **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'

262

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

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

### 268 3.3 Hold and Release New Jobs operations

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

### 270 3.3.1 Hold-New-Jobs operation

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

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

282 This operation MUST NOT affect the acceptance of Job Creation requests (see Disable-Printer section  
283 3.1.1), except to put the Jobs into the ‘pending-held’ state, instead of the ‘pending’ or ‘processing’  
284 state.

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

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

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

### 293 3.3.2 Release-Held-New-Jobs operation

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

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

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

### 306 **3.4 Deactivate and Activate Printer Operations**

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

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

#### 313 **3.4.1 Deactivate-Printer operation**

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

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

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

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

#### 330 **3.4.2 Activate-Printer operation**

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

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

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

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

### 343 **3.5 Restart-Printer, Shutdown-Printer, and Startup-Printer operations**

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

#### 347 **3.5.1 Restart-Printer operation**

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

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

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

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

#### 363 **3.5.2 Shutdown-Printer Operation**

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

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

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

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

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

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

### 387 3.5.3 Startup-Printer operation

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

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

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

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

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

## 406 4 Definition of the Job Operations

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

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

412 **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.

413

### 414 4.1 Reprocess-Job Operation

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

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

## 429 4.2 Cancel-Current-Job Operation

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

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

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

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

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

453 “job-id” (integer(1:MAX)):

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

## 457 4.3 Suspend and Resume Job operations

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

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

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

#### 464 **4.3.1 Suspend-Current-Job operation**

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

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

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

481 The Printer MUST reject a Resume-Job request (and return the ‘client-error-not-possible’) for a job  
482 that has been suspended , i.e., for a job in the ‘processing-stopped’ state, with the ‘job-suspended’  
483 value in its “job-state-reasons” attribute.

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

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

491 “job-id” (integer(1:MAX)):

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

#### 495 **4.3.2 Resume-Job operation**

496 This OPTIONAL operation allows a client to resume the target job at the point where it was  
497 suspended. The Printer moves the target job to the ‘pending’ state and removes the ‘job-suspended’  
498 value from the job’s “job-state-reasons” attribute.

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

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

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

## 508 **4.4 Job Scheduling Operations**

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

### 510 **4.4.1 Promote-Job operation**

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

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

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

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

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

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

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

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

#### 537 **4.4.2 Schedule-Job-After operation**

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

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

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

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

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

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

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

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

573           “predecessor-job-id”:

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

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

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

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

## 584 **5 Additional status codes**

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

### 586 **5.1 ‘server-error-printer-is-deactivated’ (0x050A)**

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

## 591 **6 Use of Operation Attributes that are Messages from the Operator**

592       This section summarizes the usage of the “printer-message-from-operator” and “job-message-from-  
593 operator” operation attributes [RFC3380] that set the corresponding Printer and Job Description  
594 attributes (see [RFC2911] for the definition of these Description attributes). These operation attributes  
595 are defined for most of the Printer and Job operations that operators are likely to perform, respectively,  
596 so that operators can indicate the reasons for their actions.

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

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

Operation Attribute	A	B
attributes-charset	REQ	REQ
attributes-natural-language	REQ	REQ
printer-uri	REQ	REQ
requesting-user-name	REQ	REQ
printer-message-from-operator	Note	OPT

599

600 Legend:

601

A: Get-Printer-Attributes, Set-Printer-Attributes

602

B: All other Printer administrative operations, including, but not limited to: Pause-Printer, Pause-Printer-After-Current-Job, Resume-Printer, Hold-New-Jobs, Release-Held-New-Jobs, Purge-Jobs, , Enable-Print, Disable-Printer, Restart-Printer, Shutdown-Printer, and Startup-Printer.

603

604

605

606

REQ - REQUIRED for a Printer to support

607

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

608

Note - According to [RFC3380], the Client MUST NOT supply the “printer-message-from-operator” operation attribute in a Get-Printer-Attributes or Set-Printer-Attributes operation; the Printer MUST ignore this operation attribute in these two operations.

609

610

Instead, the client when used by an operator MUST supply the “printer-message-from-operator” as (one of the) explicit attributes being set on the Printer object with the Set-Printer-Attributes operation.

611

612

613

614

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

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

Operation Attribute	A	B	C	F
attributes-charset	REQ	REQ	REQ	REQ
attributes-natural-language	REQ	REQ	REQ	REQ
printer-uri	REQ	REQ	REQ	REQ
job-uri	REQ		REQ	REQ
job-id	REQ	REQ	REQ	REQ
requesting-user-name	REQ	REQ	REQ	REQ
job-message-from-operator	OPT	OPT	OPT	Note
message***	OPT	OPT	OPT	n/a
job-hold-until	n/a	n/a	OPT*	n/a

617 Legend:

618 A: Cancel-Job, Resume-Job, Restart-Job, Promote-Job, Schedule-Job-After

619 B: Cancel-Current-Job, Suspend-Current-Job

620 C: Hold-Job, Release-Job, Reprocess-Job

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

622

623 REQ - REQUIRED for a Printer to support

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

626 n/a - not applicable for use with the operation; the Printer ignores the attribute

627 Note - According to [RFC3380], the Client MUST NOT supply the “job-message-from-operator”  
628 operation attribute in a Get-Job-Attributes or Set-Job-Attributes operation; the Printer MUST  
629 ignore this operation attribute in these two operations. Instead, the client when used by an  
630 operator MUST supply the “job-message-from-operator” as (one of the) explicit attributes  
631 being set on the Job object with the Set-Job-Attributes operation.

632 \* - The Printer MUST support the “job-hold-until” operation attribute if it supports the “job-hold-  
633 until” Job Template attribute. For the Reprocess-Job operation the client can hold the job and  
634 then modify the job before releasing it to be processed.

635 \*\* - In [RFC2911] the “message” operation attribute is defined to contain a message *to* the operator  
636 but [RFC2911] does not define a Job Description to store the message.

## 637 7 New Printer Description Attributes

638 The following new Printer Description attributes are needed to support the new operations defined in  
639 this document and the concepts of Printer Fan-Out (see section 10).

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

641 This Printer attribute is REQUIRED if an implementation supports Subordinate Printers (see section  
642 10) 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 10.4).

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 10) and contains the URI of the Non-Leaf printer object(s) for which this Printer object is the  
655 immediate Subordinate, i.e., this Printer’s immediate “parent” or “parents”. Each Subordinate Printer  
656 object MUST support this Printer Description attribute. A Printer that has no parents, either does not  
657 support 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 660 attribute**

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

### 662 **8.1 ‘hold-new-jobs’ value**

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

### 669 **8.2 ‘deactivated’ value**

670 ‘deactivated’: A client has issued a Deactivate-Printer operation for the Printer object (see section  
671 3.4.1) and the Printer is in the process of becoming deactivated or has become deactivated. The  
672 Printer MUST reject all requests except Activate-Printer, queries (Get-Printer-Attributes, Get-Job-  
673 Attributes, Get-Jobs, etc.), Send-Document, and Send-URI (so that partial job submission can be  
674 completed - see section 3.1.1) and return the ‘server-error-service-unavailable’ status code.

## 675 **9 Additional Values for the “job-state-reasons” Job Description attribute**

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

### 677 **9.1 ‘job-suspended’ value**

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

## 681 **10 Use of the Printer object to represent IPP Printer Fan-Out and IPP Printer** 682 **Fan-In**

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

### 686 **10.1 IPP Printer Fan-Out**

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

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

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

## 707 10.2 IPP Printer Fan-In

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

715 As with Fan-Out (see section 10.1), when a Printer object is a Non-Leaf Printer, it MUST NOT have  
716 an associated Output Device. As with Fan-Out, a Leaf Printer object has one or more associated  
717 Output Devices. As with Fan-Out, the Non-Leaf Printer objects submit jobs to their Subordinate  
718 Printer objects and otherwise control the Subordinate Printer. As with Fan-Out, whether pending jobs  
719 are kept in the Non-Leaf Printers until the Subordinate Printer can accept them or are kept in the  
720 Subordinate Printer depends on implementation and/or configuration policy.

## 721 10.3 Printer object attributes used to represent Printer Fan-Out and Printer Fan-In

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

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

## 729 10.4 Subordinate Printer URI

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

- 733 a. When the implementation wants to make sure that no operation on a Subordinate Printer object as  
734 a target "sneaks by" the parent Printer object (or the Subordinate Printer is fronting for a device that  
735 is not networked), the host part of the URI specifies the host of the parent Printer. Then the parent  
736 Printer object can easily reflect the state of the Subordinate Printer objects in the parent's Printer  
737 object state and state reasons as the operation passes "through" the parent Printer object.
- 738 b. When the Subordinate Printer is networked and the implementation allows operations to go  
739 directly to the Subordinate Printer (with proper access control) without knowledge of the parent  
740 Printer object, the host part of the URI is different than the host part of the parent Printer object. In  
741 such a case, the parent Printer object MAY keep its "printer-state" and "printer-state-reasons" up to  
742 date, either by polling the Subordinate Printer object or by subscribing to events with the

743 Subordinate Printer object (see [ipp-ntfy] for means to subscribe to event notification when the  
744 Subordinate Printer object supports IPP notification). Alternatively, the parent Printer MAY wait  
745 until its “printer-state” and “printer-state-reasons” attributes are queried and then query all its  
746 Subordinate Printers in order to return the correct values.

## 747 **10.5 Printer object attributes used to represent Output Device Fan-Out**

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

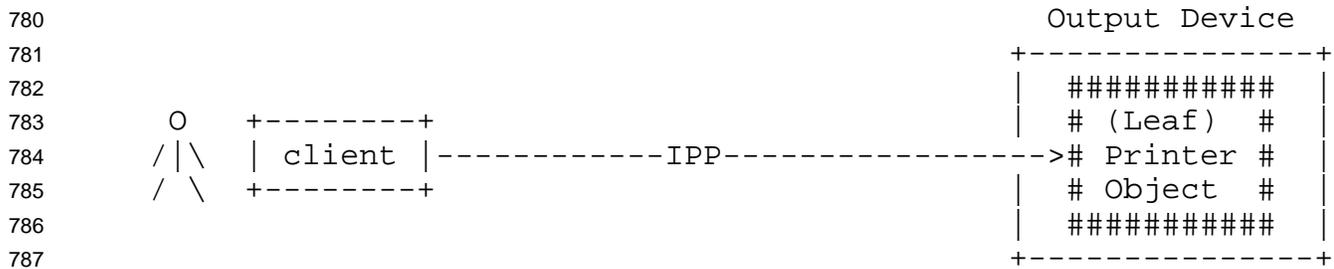
754 Non-Leaf Printer MUST NOT have associated Output Devices. However, a Non-Leaf Printer  
755 SHOULD support an “output-devices-supported” (1setOf name(127)) Printer Description attribute that  
756 contains all the values of its immediate Subordinate Printers. Since such Subordinate Printers MAY be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

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

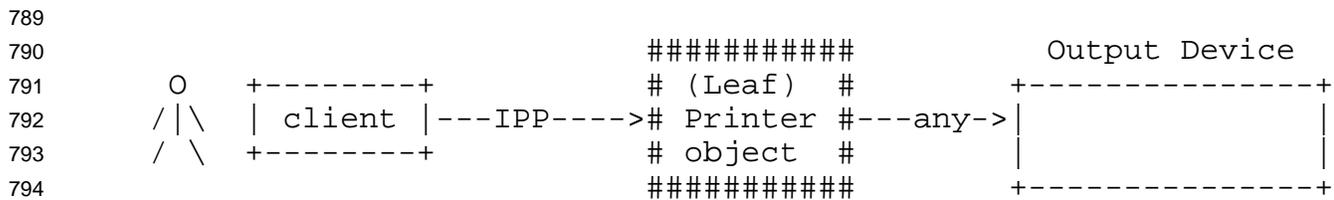
## 766 **10.6 Figures to show all possible configurations**

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

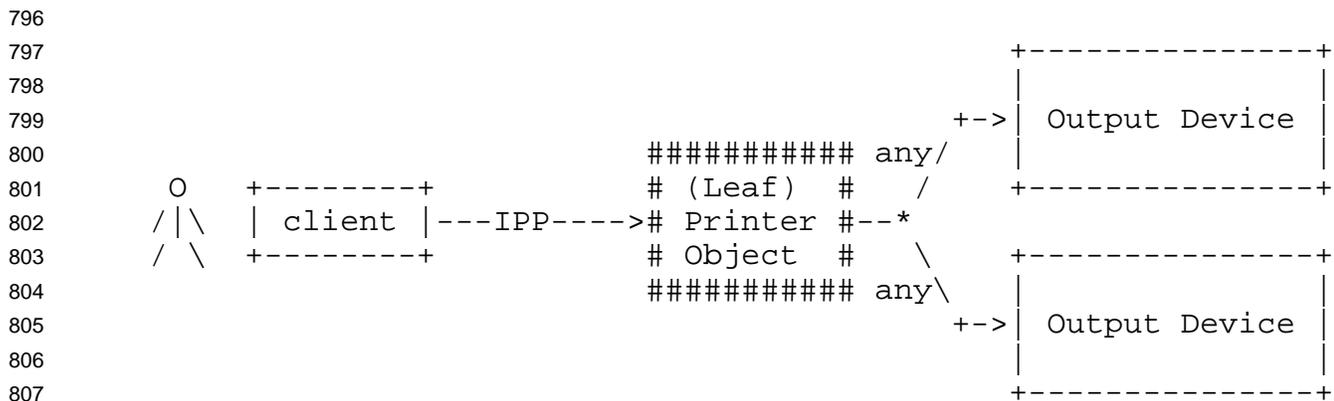
771 ----> indicates a network protocol with the direction of its requests  
 772  
 773 ##### indicates a Printer object which is either:  
 774 - embedded in an Output Device or  
 775 - hosted in a server. The Printer object  
 776 might or might not be capable of queuing/spooling.  
 777  
 778 any indicates any network protocol or direct  
 779 connect, including IPP



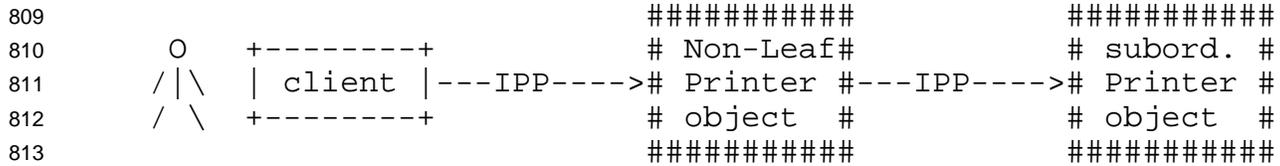
788 **Figure 1 - Embedded Printer object**



796 **Figure 2 - Hosted Printer object**

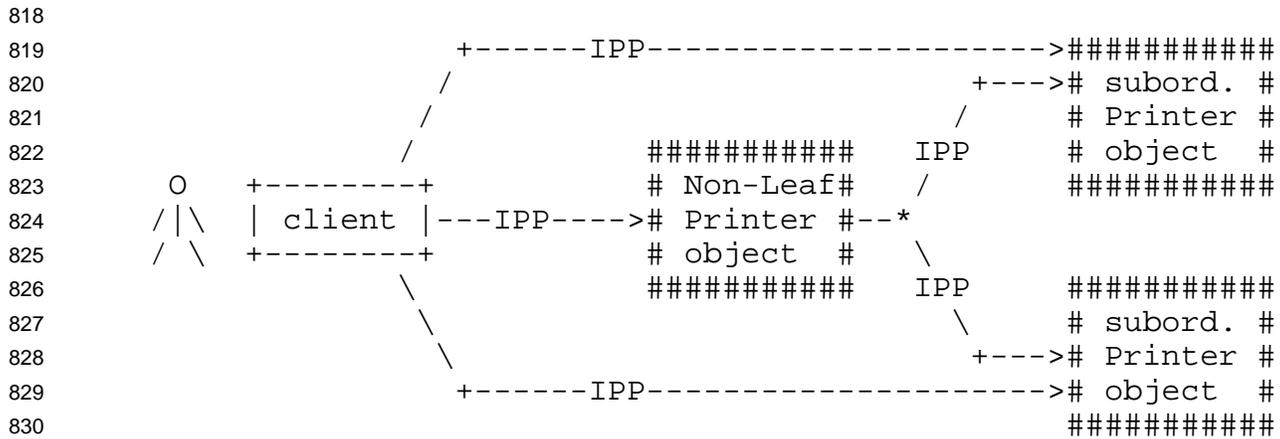


808 **Figure 3 - Output Device Fan-Out**



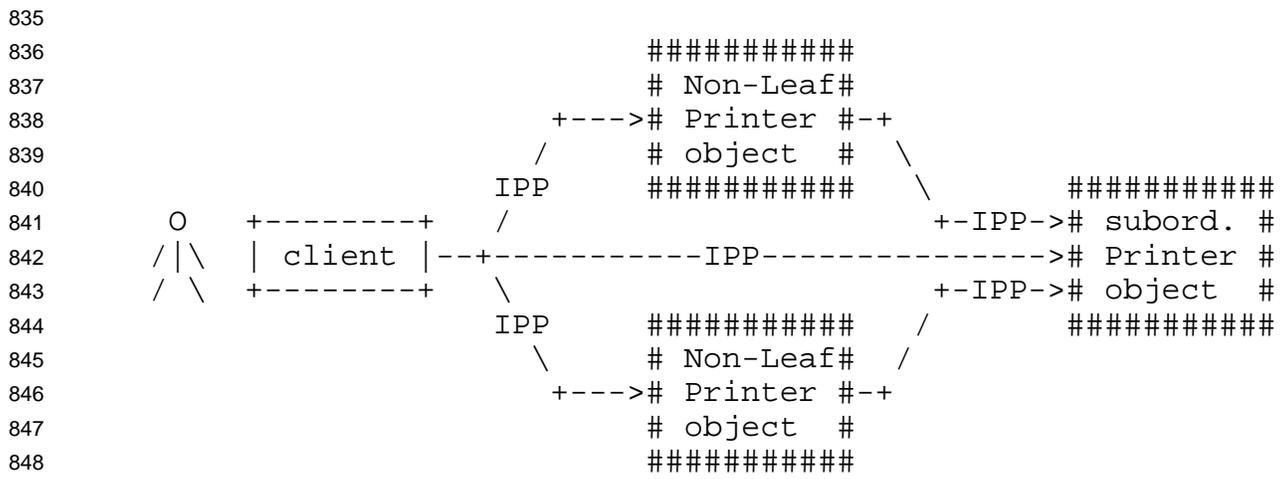
The Subordinate Printer can be a Non-Leaf Printer as in Figure 4 to Figure 6, or can be a Leaf Printer as in Figure 1 to Figure 3.

**Figure 4 - Chained IPP Printer Objects**



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

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



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

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

853 **10.7 Forwarding requests**

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

855 **10.7.1 Forwarding requests that affect Printer objects**

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

861 Table 7 lists the operations that affect Printer objects and the forwarding behavior that a Non-Leaf  
 862 Printer **MUST** exhibit to its immediate Subordinate Printers. Operations that affect jobs have a  
 863 different forwarding rule (see section 10.7.2 and Table 8):

864 **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 [RFC3380]
Set-Printer-Attributes	<b>MUST NOT</b> forward to any of its Subordinate Printers

865

**866 10.7.2 Forwarding requests that affect Jobs**

867 Unlike Printer Operations that only affect Printer objects (see section 10.7.1), a Non-Leaf Printer  
868 object **MUST** forward operations that directly affect jobs to the appropriate Job object(s) in one or  
869 more of its immediate Subordinate Printer objects. Forwarding is **REQUIRED** since the purpose of  
870 such a Job operation is to affect the indicated job which itself may have been forwarded. Such  
871 forwarding **MAY** be immediate or queued, depending on the operation and the implementation. For  
872 example, a Non-Leaf Printer object **MAY** queue/spool jobs, feeding a job at a time to its Subordinate  
873 Printer(s), or **MAY** forward jobs immediately to one of its Subordinate Printers. In either case, the  
874 Non-Leaf Printer object is forwarding Job Creation operations to one of its Subordinate Printers. Only  
875 the time of forwarding of the Job Creation operations depends on whether the policy is to queue/spool  
876 jobs in the Non-Leaf Printer or the Subordinate Printer.

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

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

884

**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 [RFC3380]
Set-Job-Attributes	MUST forward to the appropriate Job in one of its Subordinate Printers

885

886 When a Printer receives a request that REQUIRES forwarding, it does so on a “best efforts basis”, and  
887 returns a response to its client without waiting for responses from any of its Subordinate Printers.  
888 Such forwarded requests could fail.

## 889 10.8 Additional attributes to help with fan-out

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

**892 10.8.1 output-device-assigned (name(127)) Job Description attribute - from [RFC2911]**

893 [RFC2911] defines “output-device-assigned” as: “This attribute identifies the Output Device to which  
894 the Printer object has assigned this job. If an Output Device implements an embedded Printer object,  
895 the Printer object NEED NOT set this attribute. If a print server implements a Printer object, the value  
896 MAY be empty (zero-length string) or not returned until the Printer object assigns an Output Device to  
897 the job. This attribute is particularly useful when a single Printer object supports multiple devices (so  
898 called “Device Fan-Out” see [RFC2911] section 2.1).” See also section 10.1 in this specification.

**899 10.8.2 original-requesting-user-name (name(MAX)) operation and Job Description attribute**

900 The operation attribute containing the user name of the original user, i.e., corresponds to the  
901 “requesting-user-name” operation attribute (see [RFC2911] section 3.2.1.1) that the original client  
902 supplied to the first Printer object. The Printer copies the “original-requesting-user-name” operation  
903 attribute to the corresponding Job Description attribute.

**904 10.8.3 requesting-user-name (name(MAX)) operation attribute - additional semantics**

905 The IPP/1.1 “requesting-user-name” operation attribute (see [RFC2911] section 3.2.1.1) is updated by  
906 each client to be itself on each hop, i.e., the “requesting-user-name” is the client forwarding the  
907 request, not the original client.

**908 10.8.4 job-originating-user-name (name(MAX)) Job Description attribute - additional  
909 semantics**

910 The “job-originating-user-name” Job Description attribute (see [RFC2911] section 4.3.6) remains as  
911 the authenticated original user, not the parent Printer’s authenticated host, and is forwarded by each  
912 client without changing the value.

**913 11 Conformance Requirements**

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

916

**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

917

918

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

919

920

**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

921

922

**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

923

924

**12 Normative References**

925

[RFC2910]

926

Herriot, R., Butler, S., Moore, P., Tuner, R., “Internet Printing Protocol/1.1: Encoding and Transport”, RFC 2910, September 2000.

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[RFC2911]

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R. deBry, T. Hastings, R. Herriot, S. Isaacson, P. Powell, “Internet Printing Protocol/1.0: Model and Semantics”, RFC 2911, September 2000.

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931

[RFC3380]

932

Hastings, T., Herriot, R., Kugler, C., and H. Lewis, "Internet Printing Protocol (IPP): Job and Printer Set Operations", RFC 3380, September 2002.

933

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**13 Informative References**

935

[ipp-ntfy]

936

Herriot, R., and T. Hastings, "Internet Printing Protocol/1.1: Event Notifications and Subscriptions", <draft-ietf-ipp-not-spec-12.txt>, June 21, 2004.

937

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[RFC2566]

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

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[RFC3196]

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Hastings, T., Manros, C., Zehler, P., Kugler, C., and H. Holst, “Internet Printing Protocol/1.1: Implementer’s Guide”, RFC 3196, November 2001.

943

944

[RFC3239]

945

Kugler, C., Lewis, H., and T. Hastings, "Internet Printing Protocol (IPP): Requirements for Job, Printer, and Device Administrative Operations", RFC 3239, February 2002.

946

947

Change History of this document is available at:

948

[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)

## 949 14 IANA Considerations

950 This section contains the registration information for IANA to add to the IPP Registry according to the  
 951 procedures defined in RFC 2911 [RFC2911] section 6 to cover the definitions in this document. The  
 952 resulting registrations will be published as additions to the  
 953 <http://www.iana.org/assignments/ipp-registrations> file.

954

955 *Note to RFC Editors: Replace [RFCnnnn] below with the RFC number for this document, so that it*  
 956 *accurately reflects the content of the information for the IANA Registry.*

### 957 14.1 Attribute Registrations

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

960	Name	Reference	Section
961	-----	-----	-----
962	Job Description attributes:		
963	original-requesting-user-name (name(MAX))	[RFCnnnn]	10.8.2
964	Printer Description attributes:		
965	subordinate-printers-supported (1setOf uri)	[RFCnnnn]	7.1
966	parent-printers-supported (1setOf uri)	[RFCnnnn]	7.2
967	Operation attributes:		
968	original-requesting-user-name (name(MAX))	[RFCnnnn]	10.8.2
969			
970			
971			

### 972 14.2 Attribute Value Registrations

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

974	Attribute	Reference	Section
975	Value	-----	-----
976	-----		
977	job-state-reasons (1setOf type2 keyword)		
978	job-suspended	[RFCnnnn]	9.1
979			
980	printer-state-reasons (1setOf type2 keyword)		
981	hold-new-jobs	[RFCnnnn]	8.1
982	deactivated	[RFCnnnn]	8.2
983			
984			
985			

### 986 14.3 Additional Enum Attribute Value Registrations

987 The following table lists all the new enum attribute values defined in this document. These are to be  
 988 registered according to the procedures in RFC 2911 [RFC2911] section 6.1.

989	Attribute (attribute syntax)			
990	Value	Name	Reference	Section
991	-----	-----	-----	-----
992	operations-	supported (1setOf type2 enum)	[RFC2911]	4.4.1
993	0x0022	Enable-Printer	[RFCnnnn]	3
994	0x0023	Disable-Printer	[RFCnnnn]	3
995	0x0024	Pause-Printer-After-Current-Job	[RFCnnnn]	3
996	0x0025	Hold-New-Jobs	[RFCnnnn]	3
997	0x0026	Release-Held-New-Jobs	[RFCnnnn]	3
998	0x0027	Deactivate-Printer	[RFCnnnn]	3
999	0x0028	Activate-Printer	[RFCnnnn]	3
1000	0x0029	Restart-Printer	[RFCnnnn]	3
1001	0x002A	Shutdown-Printer	[RFCnnnn]	3
1002	0x002B	Startup-Printer	[RFCnnnn]	3
1003	0x002C	Reprocess-Job	[RFCnnnn]	4
1004	0x002D	Cancel-Current-Job	[RFCnnnn]	4
1005	0x002E	Suspend-Current-Job	[RFCnnnn]	4
1006	0x002F	Resume-Job	[RFCnnnn]	4
1007	0x0030	Promote-Job	[RFCnnnn]	4
1008	0x0031	Schedule-Job-After	[RFCnnnn]	4

### 1009 14.4 Operation Registrations

1010 The following table lists all of the operations defined in this document. These are to be registered  
 1011 according to the procedures in RFC 2911 [RFC2911] section 6.4.

1012	Name	Reference	Section
1013	-----	-----	-----
1014	Activate-Printer	[RFCnnnn]	3.4.2
1015	Cancel-Current-Job	[RFCnnnn]	4.2
1016	Deactivate-Printer	[RFCnnnn]	3.4.1
1017	Disable-Printer	[RFCnnnn]	3.1.1
1018	Enable-Printer	[RFCnnnn]	3.1.2
1019	Hold-New-Jobs	[RFCnnnn]	3.3.1
1020	Pause-Printer-After-Current-Job	[RFCnnnn]	3.2.1
1021	Promote-Job	[RFCnnnn]	4.4.1
1022	Release-Held-New-Jobs	[RFCnnnn]	3.3.2
1023	Reprocess-Job	[RFCnnnn]	4.1
1024	Restart-Printer	[RFCnnnn]	3.5.1
1025	Resume-Job	[RFCnnnn]	4.3.2
1026	Schedule-Job-After	[RFCnnnn]	4.4.2
1027	Shutdown-Printer	[RFCnnnn]	3.5.2
1028	Startup-Printer	[RFCnnnn]	3.5.3
1029	Suspend-Current-Job	[RFCnnnn]	4.3.1
1030			

## 1031 14.5 Status code Registrations

1032 The following table lists the status code defined in this document. This is to be registered according to  
 1033 the procedures in RFC 2911 [RFC2911] section 6.6.

1034	Value	Name	Reference	Section
1035	-----	-----	-----	-----
1036	0x0000:0x00FF	- "successful"		
1037		none at this time		
1038				
1039	0x0100:0x01FF	- "informational"		
1040		none at this time		
1041				
1042	0x0300:0x03FF	- "redirection"	- -- See RFC 2911 Errata	
1043		none at this time		
1044				
1045	0x0400:0x04FF	- "client-error"		
1046		none at this time		
1047				
1048	0x0500:0x05FF	- "server-error"		
1049	0x050A	server-error-printer-is-deactivated	[RFCnnnn]	5.1
1050				

## 1051 15 Internationalization Considerations

1052 This document has the same localization considerations as the [RFC2911].

## 1053 16 Security Considerations

1054 The IPP Model and Semantics document [RFC2911] discusses high level security requirements (Client  
 1055 Authentication, Server Authentication and Operation Privacy). Client Authentication is the mechanism  
 1056 by which the client proves its identity to the server in a secure manner. Server Authentication is the  
 1057 mechanism by which the server proves its identity to the client in a secure manner. Operation Privacy  
 1058 is defined as a mechanism for protecting operations from eavesdropping.

1059 Printer operations defined in this specification (see section 3) and Pause-Printer, Resume-Printer, and  
 1060 Purge-Job (defined in [RFC2911]) are intended for use by an operator and/or administrator. Job  
 1061 operations defined in this specification (see section 4) and Cancel-Job, Hold-Job, Release-Job defined  
 1062 in [RFC2911]) are intended for use by the job owner or may be an operator or administrator of the  
 1063 Printer object. These operator and administrative operations affect the service of all users. In  
 1064 appropriate use of an administrative operation by an un-authenticated end user could affect the quality  
 1065 of service for all users. Therefore, for both inter-net and intra-net, conformance to this specification  
 1066 REQUIRES that initial configuration of IPP Printer implementations MUST require successful  
 1067 certificate-based TLS [RFC2246] client authentication and successful operator and administrator  
 1068 authorization (see [RFC2911] sections 5.2.7 and 8 and [RFC2910]) for any administrative operations  
 1069 defined in this document. [RFC2910] REQUIRES the IPP Printer to support the minimum cypher

1070 suite required for TLS/1.0. The means for authorizing an operator or administrator of the Printer  
1071 object are outside the scope of this specification, [RFC2911], and [RFC2910].

1072 The use of TLS and Client Authentication solves the Denial of Service, Man in the Middle, and  
1073 Masquerading security threats.

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## 1115 **19 Summary of Base IPP Documents**

1116 The base set of IPP documents includes:

1117 Design Goals for an Internet Printing Protocol [RFC2567]  
1118 Rationale for the Structure and Model and Protocol for the Internet Printing Protocol [RFC2568]  
1119 Internet Printing Protocol/1.1: Model and Semantics [RFC2911]  
1120 Internet Printing Protocol/1.1: Encoding and Transport [RFC2910]  
1121 Internet Printing Protocol/1.1: Implementer's Guide [RFC3196]  
1122 Mapping between LPD and IPP Protocols [RFC2569]  
1123

1124 The "Design Goals for an Internet Printing Protocol" document takes a broad look at distributed  
1125 printing functionality, and it enumerates real-life scenarios that help to clarify the features that need to  
1126 be included in a printing protocol for the Internet. It identifies requirements for three types of users:  
1127 end users, operators, and administrators. It calls out a subset of end user requirements that are satisfied  
1128 in IPP/1.0. A few OPTIONAL operator operations have been added to IPP/1.1.

1129 The "Rationale for the Structure and Model and Protocol for the Internet Printing Protocol" document  
1130 describes IPP from a high level view, defines a roadmap for the various documents that form the suite  
1131 of IPP specification documents, and gives background and rationale for the IETF working group's  
1132 major decisions.

1133 The "Internet Printing Protocol/1.1: Model and Semantics" document describes a simplified model  
1134 with abstract objects, their attributes, and their operations that are independent of encoding and  
1135 transport. It introduces a Printer and a Job object. The Job object optionally supports multiple  
1136 documents per Job. It also addresses security, internationalization, and directory issues.

1137 The "Internet Printing Protocol/1.1: Encoding and Transport" document is a formal mapping of the  
1138 abstract operations and attributes defined in the model document onto HTTP/1.1 [RFC2616]. It  
1139 defines the encoding rules for a new Internet MIME media type called "application/ipp". This  
1140 document also defines the rules for transporting over HTTP a message body whose Content-Type is  
1141 "application/ipp". This document defines the 'ippget' scheme for identifying IPP printers and jobs.

1142 The "Internet Printing Protocol/1.1: Implementer's Guide" document gives insight and advice to  
1143 implementers of IPP clients and IPP objects. It is intended to help them understand IPP/1.1 and some  
1144 of the considerations that may assist them in the design of their client and/or IPP object

1145 implementations. For example, a typical order of processing requests is given, including error  
1146 checking. Motivation for some of the specification decisions is also included.

1147 The “Mapping between LPD and IPP Protocols” document gives some advice to implementers of  
1148 gateways between IPP and LPD (Line Printer Daemon) implementations.

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