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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 [operation and](#) 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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125 1 Introduction

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

135 The requirements and use cases for this document are defined in [~~ipp-ops-admin-req~~[RFC3239](#)].

136 2 Terminology

137 This section defines terminology used throughout this document.

138 2.1 Conformance Terminology

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

144 2.2 Other terminology

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

148 In addition, the following capitalized terms are defined:

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

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

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

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

169 3 Definition of the Printer Operations

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

173

173

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

175

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

176

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

181 3.1 The Disable and Enable Printer Operations

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

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

191 3.1.1 Disable-Printer Operation

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

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

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

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

208 3.1.2 Enable-Printer Operation

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

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

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

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

221 3.2 The Pause and Resume Printer Operations

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

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

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

232 **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.

233 3.2.1 Pause-Printer-After-Current-Job operation

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

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

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

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

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

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

262 **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’

263

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

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

269 3.3 Hold and Release New Jobs operations

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

271 3.3.1 Hold-New-Jobs operation

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

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

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

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

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

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

294 3.3.2 Release-Held-New-Jobs operation

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

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

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

307 **3.4 Deactivate and Activate Printer Operations**

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

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

314 **3.4.1 Deactivate-Printer operation**

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

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

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

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

331 **3.4.2 Activate-Printer operation**

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

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

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

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

344 **3.5 Restart-Printer, Shutdown-Printer, and Startup-Printer operations**

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

348 **3.5.1 Restart-Printer operation**

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

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

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

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

364 **3.5.2 Shutdown-Printer Operation**

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

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

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

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

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

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

388 3.5.3 Startup-Printer operation

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

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

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

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

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

407 4 Definition of the Job Operations

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

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

413 **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.

414

415 4.1 Reprocess-Job Operation

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

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

430 4.2 Cancel-Current-Job Operation

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

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

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

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

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

454 “job-id” (integer(1:MAX)):

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

458 4.3 Suspend and Resume Job operations

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

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

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

465 **4.3.1 Suspend-Current-Job operation**

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

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

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

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

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

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

492 “job-id” (integer(1:MAX)):

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

496 **4.3.2 Resume-Job operation**

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

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

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

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

509 **4.4 Job Scheduling Operations**

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

511 **4.4.1 Promote-Job operation**

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

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

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

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

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

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

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

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

538 **4.4.2 Schedule-Job-After operation**

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

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

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

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

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

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

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

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

574 “predecessor-job-id”:

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

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

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

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

585 **5 Additional status codes**

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

587 **5.1 ‘server-error-printer-is-deactivated’ (0x050A)**

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

592 **6 Use of Operation Attributes that are Messages from the Operator**

593 This section summarizes the usage of the “printer-message-from-operator” and “job-message-from-
594 operator” operation attributes [RFC3380] that set the corresponding Printer and Job Description
595 attributes (see [~~ipp-set-ops~~RFC2911] for the definition of these ~~operation~~ Description attributes).

596 These operation attributes are defined for most of the Printer and Job operations that operators are
597 likely to perform, respectively, so that operators can indicate the reasons for their actions.

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

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

Operation Attribute	A	B	C	A D	B 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	Note	OPT	OPT	OPT

600

601 Legend:

602

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

603

B: All other Printer administrative operations, including, but not limited to: Pause-Printer, Pause-Printer-After-Current-Job, Resume-Printer,

604

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, and Startup-Printer.~~

610

611

612 REQ - REQUIRED for a Printer to support

612

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

613

614 ~~<blank>~~ Note - not defined for use with the operation According to [RFC3380], the Client MUST
 615 NOT supply the “printer-message-from-operator” operation attribute in a Get-Printer-
 616 Attributes or Set-Printer-Attributes operation; the Printer MUST ignore theis operation
 617 attribute in these two operations. Instead, the client when used by an operator MUST
 618 supply the “printer-message-from-operator” as (one of the) explicit attributes being set
 619 on the Printer object with the Set-Printer-Attributes operation.

614

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

622 **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	Note	OPT	OPT	OPT	OPT
message***[to-operator]	OPT	OPT	OPT	OPT	OPT	n/a	OPT	OPT	OPT	OPT
job-hold-until	n/a	n/a	OPT *			n/a		OPT **		

623

624 Legend:

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

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

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

628 ~~D: Suspend-Current-Job~~

629 ~~E: Resume-Job~~

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

631 ~~G: Restart-Job~~

632 ~~H: Reprocess-Job~~

633 ~~I: Promote-Job~~

634 ~~J: Schedule-Job-After~~

635

636 REQ - REQUIRED for a Printer to support

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

638 ~~<blank>n/a~~ - not ~~defined-applicable~~ for use with the operation; the Printer ignores the attribute

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

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

647

648 ~~** The Printer MUST support the “job-hold-until” operation attribute if it supports the Set-Job-~~
649 ~~Attributes operation, so that the client can hold the job with the Reprocess-Job operation and the~~
650 ~~modify the job before releasing it to be processed.~~

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

653 7 New Printer Description Attributes

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

656 7.1 subordinate-printers-supported (1setOf uri)

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

662 The precise format of the Subordinate Printer URIs is implementation dependent (see section 10.4).

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

668 7.2 parent-printers-supported (1setOf uri)

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

675 8 Additional Values for the “printer-state-reasons” Printer Description 676 attribute

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

678 8.1 'hold-new-jobs' value

679 'hold-new-jobs': The operator has issued the Hold-New-Jobs operation (see section 3.3.1) or other
680 means, but the output-device(s) are taking an appreciable time to stop. Later, when all output has
681 stopped, the "printer-state" becomes 'stopped', and the 'paused' value replaces the 'moving-to-
682 paused' value in the "printer-state-reasons" attribute. This value MUST be supported, if the Hold-
683 New-Jobs operation is supported and the implementation takes significant time to pause a device
684 in certain circumstances.

685 8.2 'deactivated' value

686 'deactivated': A client has issued a Deactivate-Printer operation for the Printer object (see section
687 3.4.1) and the Printer is in the process of becoming deactivated or has become deactivated. The
688 Printer MUST reject all requests except Activate-Printer, queries (Get-Printer-Attributes, Get-Job-
689 Attributes, Get-Jobs, etc.), Send-Document, and Send-URI (so that partial job submission can be
690 completed - see section 3.1.1) and return the 'server-error-service-unavailable' status code.

691 9 Additional Values for the "job-state-reasons" Job Description attribute

692 This section defines additional values for the "job-state-reasons" Job Description attribute.

693 9.1 'job-suspended' value

694 'job-suspended': The job has been suspended while processing using the Suspend-Current-Job
695 operation and other jobs can be processed on the Printer. The Job can be resumed using the
696 Resume-Job operation which removes this value.

697 ~~10~~Additional events

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

699 ~~'job-forwarded-operation-failed'—an operation that a Printer forwarded to a Subordinate Printer~~
700 ~~(see section 11.7) failed.~~

701 ~~11~~10 Use of the Printer object to represent IPP Printer Fan-Out and IPP Printer 702 Fan-In

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

706 ~~11.1~~10.1 IPP Printer Fan-Out

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

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

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

727 ~~11.2~~10.2 IPP Printer Fan-In

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

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

741 **11.310.3 Printer object attributes used to represent Printer Fan-Out and Printer Fan-In**

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

- 744 1. “subordinate-printers-supported” (1setOf uri) - contains the URI of the immediate Subordinate
745 Printer object(s).
- 746 2. “parent-printers-supported (1setOf uri) - contains the URI of the Non-Leaf printer object(s) for
747 which this Printer object is the immediate Subordinate, i.e., this Printer’s immediate “parent” or
748 “parents”.

749 **11.410.4 Subordinate Printer URI**

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

- 753 a. When the implementation wants to make sure that no operation on a Subordinate Printer object as
754 a target “sneaks by” the parent Printer object (or the Subordinate Printer is fronting for a device that
755 is not networked), the host part of the URI specifies the host of the parent Printer. Then the parent
756 Printer object can easily reflect the state of the Subordinate Printer objects in the parent’s Printer
757 object state and state reasons as the operation passes “through” the parent Printer object.
- 758 b. When the Subordinate Printer is networked and the implementation allows operations to go
759 directly to the Subordinate Printer (with proper access control) without knowledge of the parent
760 Printer object, the host part of the URI is different than the host part of the parent Printer object. In
761 such a case, the parent Printer object **MUST-MAY** keep its “printer-state” and “printer-state-
762 reasons” up to date, either by polling the Subordinate Printer object or by subscribing to events with
763 the Subordinate Printer object (see [ipp-not-specintfy] for means to subscribe to event notification
764 when the Subordinate Printer object supports IPP notification). **Alternatively, the parent Printer
765 MAY wait until its “printer-state” and “printer-state-reasons” attributes are queried and then query
766 all its Subordinate Printers in order to return the correct values.**

767 **11.510.5 Printer object attributes used to represent Output Device Fan-Out**

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

774 Non-Leaf Printer MUST NOT have associated Output Devices. However, a Non-Leaf Printer
775 SHOULD support an “output-devices-supported” (1setOf name(127)) Printer Description attribute that
776 contains all the values of its immediate Subordinate Printers. Since such Subordinate Printers MAY be

777 Leaf or Non-Leaf, the same rules apply to them, etc. Thus any Non-Leaf Printer SHOULD have an
778 “output-devices-supported” (1setOf name(127)) attribute that contains all the values of the Output
779 Devices associated with Leaf Printers of its complete sub-tree.

780 When adding, removing, or changing a configuration of Printers and Output Devices, there can be
781 moments in time when the tree structure is not consistent. In other words, times when a Non-Leaf
782 Printer’s “subordinate-printers-supported” does not agree with the Subordinate Printer’s “parent-
783 printers-supported”. Therefore, the operator SHOULD first Deactivate all Printers that are being
784 configured in this way, update all pointer attributes, and then reactivate. A useful client tool would
785 validate a tree structure before Activating the Printers involved.
786

786

787 **11.610.6 Figures to show all possible configurations**

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

```

792 ----> indicates a network protocol with the direction of its requests
793
794 ##### indicates a Printer object which is either:
795     - embedded in an Output Device or
796     - hosted in a server. The Printer object
797     might or might not be capable of queuing/spooling.
798
799 any indicates any network protocol or direct
800 connect, including IPP
801
802                                     Output Device
803                                     +-----+
804                                     | ##### |
805 O  +-----+ | client |-----IPP-----># Printer # |
806 /|\ |         |         |         |         |         |
807 / \ +-----+ | # Object # |         |         |         |
808                                     | ##### |
809                                     +-----+

```

Figure 1 - Embedded Printer object

```

810
811                                     ##### Output Device
812 O  +-----+ | client |---IPP---># Printer #---any->|
813 /|\ |         |         |         |         |         |
814 / \ +-----+ | # object # |         |         |         |
815                                     | ##### |
816                                     +-----+

```

Figure 2 - Hosted Printer object

```

817
818                                     +-----+
819                                     |         |
820                                     +->| Output Device |
821                                     | ##### any/ |
822 O  +-----+ | client |---IPP---># Printer #--* |
823 /|\ |         |         |         |         |         |
824 / \ +-----+ | # Object # \ |         |         |         |
825                                     | ##### any\ |
826                                     +->| Output Device |
827                                     |         |
828                                     +-----+

```

Figure 3 - Output Device Fan-Out

829
830

876 **11.7.10.7 Forwarding requests**

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

878 **11.7.110.7.1 Forwarding requests that affect Printer objects**

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

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

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

Printer Operation	Non-Leaf Printer action
Printer Operations:	
Enable-Printer	MUST NOT forward to any of its Subordinate Printers
Disable-Printer	MUST NOT forward to any of its Subordinate Printers
Hold-New-Jobs	MUST NOT forward to any of its Subordinate Printers
Release-Held-New-Jobs	MUST NOT forward to any of its Subordinate Printers
Deactivate-Printer	MUST NOT forward to any of its Subordinate Printers
Activate-Printer	MUST NOT forward to any of its Subordinate Printers
Restart-Printer	MUST NOT forward to any of its Subordinate Printers
Shutdown-Printer	MUST NOT forward to any of its Subordinate Printers
Startup-Printer	MUST NOT forward to any of its Subordinate Printers
IPP/1.1 Printer Operations:	See [RFC2911]
Get-Printer-Attributes	MUST NOT forward to any of its Subordinate Printers
Pause-Printer	MUST NOT forward to any of its Subordinate Printers
Resume-Printer	MUST NOT forward to any of its Subordinate Printers
Set operations:	See [ipp-set-ops RFC3380]
Set-Printer-Attributes	MUST NOT forward to any of its Subordinate Printers

888

889 **11.7.210.7.2 Forwarding requests that affect Jobs**

890 Unlike Printer Operations that only affect Printer objects (see section 10.7.1), a Non-Leaf Printer
 891 object MUST forward operations that directly affect jobs to the appropriate Job object(s) in one or
 892 more of its immediate Subordinate Printer objects. Forwarding is REQUIRED since the purpose of
 893 such a Job operation is to affect the indicated job which itself may have been forwarded. Such

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

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

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

907

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-opsRFC3380]
Set-Job-Attributes	MUST forward to the appropriate Job in one of its Subordinate Printers

908

909 When a Printer receives a request that REQUIRES forwarding, it does so on a “best efforts basis”, and
910 returns a response to its client without waiting for responses from any of its Subordinate Printers.
911 Such forwarded requests could fail. In order for a client to become aware of such a condition, a new
912 ‘job-forwarded-operation-failed’ Job event is defined, which a client can subscribe to (see [section 10](#)
913 [and \[ipp-ntfy\]](#)). **ISSUE: Can this reference to [ipp-ntfy] be Informative or should this reference be**
914 **removed, in order to progress this specification without waiting for [ipp-ntfy]?**

915 **11.8.10.8 Additional attributes to help with fan-out**

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

918 **11.8.110.8.1 output-device-assigned (name(127)) Job Description attribute - from**
919 **[RFC2911]**

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

926 **11.8.210.8.2 original-requesting-user-name (name(MAX)) operation and Job Description**
927 **attribute**

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

932 **10.8.3 requesting-user-name (name(MAX)) operation attribute - additional semantics**

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

936 **10.8.4 job-originating-user-name (name(MAX)) Job Description attribute - additional**
937 **semantics**

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

941 **1211 Conformance Requirements**

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

944

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

945

946

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

947

948

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

949

950

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

951

952 **1312 Normative References**

953

[ipp-iig]

954

~~Hastings, T., Manros, C., “Internet Printing Protocol/1.1: draft-ietf-ipp-implementers-guide-v11-03.txt, work in progress, July 17, 2001.~~

955

956

[ipp-ops-admin-req]

957

~~Hastings, T., “Internet Printing Protocol (IPP): Requirements for Job, Printer, and Device~~

958

~~Administrative Operations”, <draft-ietf-ipp-ops-admin-req-01.txt>, work in progress, July 17, 2001.~~

959

[RFC2566]

960

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

961

962

[RFC2910]

963

Herriot, R., Butler, S., Moore, P., Tuner, R., “Internet Printing Protocol/1.1: Encoding and

964

Transport”, RFC 2910, September 2000.

965

[RFC2911]

966

R. deBry, T. Hastings, R. Herriot, S. Isaacson, P. Powell, “Internet Printing Protocol/1.0: Model and

967

Semantics”, RFC 2911, September 2000.

968

[RFC3380]

969

~~Hastings, T., Herriot, R., Kugler, C., and H. Lewis, “Internet Printing Protocol (IPP): Job and~~

970

~~Printer Set Operations”, RFC 3380, September 2002.~~

971

~~Change History of this document is available at:~~

972

~~ftp://ftp.pwg.org/pub/pwg/ipp/new_OPS/ipp-ops-set2-change-history.txt~~

973 **1413 Informative References**

974

[ipp-ntfy]

975

~~Herriot, R., and T. Hastings, “Internet Printing Protocol/1.1: Event Notifications and~~

976

~~Subscriptions”, <draft-ietf-ipp-not-spec-09.txt>, June 27, 2002 Isaacson, S., Martin, J., deBry, R.,~~

977

~~Hastings, T., Shepherd, M., Bergman, R., “Internet Printing Protocol/1.1: IPP Event Notification~~

978

~~Specification”, <draft-ietf-ipp-not-spec-07.txt>, July 17, 2001. **ISSUE: Or remove this reference**~~

979

~~**altogether, since the Internet-Draft is out-of-date.**~~

980 [\[RFC2566\]](#)
 981 [R. deBry, T. Hastings, R. Herriot, S. Isaacson, P. Powell, "Internet Printing Protocol/1.0: Model and](#)
 982 [Semantics", RFC 2566, April 1999.](#)

983 [\[RFC3196\]](#)
 984 [Hastings, T., Manros, C., Zehler, P., Kugler, C., and H. Holst, "Internet Printing Protocol/1.1:](#)
 985 [Implementer's Guide", RFC 3196, November 2001.](#)

986 [\[RFC3239\]](#)
 987 [Kugler, C., Lewis, H., and T. Hastings, "Internet Printing Protocol \(IPP\): Requirements for Job,](#)
 988 [Printer, and Device Administrative Operations", RFC 3239, February 2002.](#)

989 [Change History of this document is available at:](#)
 990 [ftp://ftp.pwg.org/pub/pwg/ipp/new_OPS/ipp-ops-set2-change-history.txt](#)

991 [1514](#) IANA Considerations

992 This section contains the registration information for IANA to add to the ~~various~~ IPP Registryies
 993 according to the procedures defined in RFC 2911 [RFC2911] section 6 to cover the definitions in this
 994 document. [The resulting registrations will be published as additions to the](#)
 995 <http://www.iana.org/assignments/ipp-registrations> file.

996
 997 *[Note to RFC Editors: Replace \[RFCnnnn\] below with the RFC number for this document, so that it](#)*
 998 *[accurately reflects the content of the information for the IANA Registry.](#)*

999 [15.14.1](#) Attribute Registrations

1000 The following table lists all the attributes defined in this document. These are to be registered
 1001 according to the procedures in RFC 2911 [RFC2911] section 6.2.

Name	Reference	Section
-----	-----	-----
Job Description attributes:	Ref.	Section:
output-device-assigned (name (127))	[RFCnnnn]	11.8.1
original-requesting-user-name (name (MAX))	[RFCnnnn]	10.8.2
Printer Description attributes:	Ref.	Section:
subordinate-printers-supported (1setOf uri)	[RFCnnnn]	7.1
parent-printers-supported (1setOf uri)	[RFCnnnn]	7.2
Operation attributes:	Ref.	Section:
original-requesting-user-name (name (MAX))	[RFCnnnn]	10.8.2

1015 ~~The resulting attribute registrations will be published in the~~
 1016 ~~<ftp://ftp.iana.org/in-notes/iana/assignments/ipp/attributes/>~~
 1017 ~~area.~~

1018

1019 **15.214.2 Attribute Value Registrations**

1020

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

1021

Attribute

1022

ValueReferenceSection

1023

1024

~~type2 keyword Attribute Values:~~~~Ref.~~~~Section:~~

1025

job-state-reasons (1setOf type2 keyword)

1026

__job-suspended[RFCnnnn]9.1

1027

1028

~~The resulting operation registrations will be published in the~~

1029

~~ftp://ftp.iana.org/in-notes/iana/assignments/ipp/operations/~~

1030

~~area.~~

1031

1032

printer-state-reasons (1setOf type2 keyword)

1033

~~type2 keyword Attribute Values:~~~~Ref.~~~~Section:~~

1034

__hold-new-jobs[RFCnnnn]8.1

1035

__deactivated[RFCnnnn]8.2

1036

1037

~~notify-events (1setOf type2 keyword)~~~~[ipp-ntfy]~~~~5.3.3~~

1038

~~notify-events-default (1setOf type2 keyword)~~~~[ipp-ntfy]~~~~5.3.3.1~~

1039

~~notify-events-supported (1setOf type2 keyword)~~~~[ipp-ntfy]~~~~5.3.3.2~~

1040

~~__job-forwarded-operation-failed~~~~[RFCnnnn]~~~~10~~

1041

1042

~~The resulting operation registrations will be published in the~~

1043

~~ftp://ftp.iana.org/in-notes/iana/assignments/ipp/operations/~~

1044

~~area.~~

1045

1046

**15.314.3 Additional Enum Attribute Value Registrations for the “operations-supported”
Printer Attribute**

1047

1048

The following table lists all the new enum attribute values defined in this document ~~as additional type2~~

1049

~~enum values for use with the “operations-supported” Printer Description attribute.~~ These are to be

1050

registered according to the procedures in RFC 2911 [RFC2911] section 6.1.

1051

Attribute (attribute syntax)

1052

ValueNameReferenceSection

1053

	operations-supported (1setOf type2 enum)	[RFC2911]	4.4.1
	type2 enum Attribute Value:	Value	Ref. Section:
1054	0x0022	Enable-Printer	[RFCnnnn] 3
1055	0x0023	Disable-Printer	[RFCnnnn] 3
1056	0x0024	Pause-Printer-After-Current-Job	[RFCnnnn] 3
1057	0x0025	Hold-New-Jobs	[RFCnnnn] 3
1058	0x0026	Release-Held-New-Jobs	[RFCnnnn] 3
1059	0x0027	Deactivate-Printer	[RFCnnnn] 3
1060	0x0028	Activate-Printer	[RFCnnnn] 3
1061	0x0029	Restart-Printer	[RFCnnnn] 3
1062	0x002A	Shutdown-Printer	[RFCnnnn] 3
1063	0x002B	Startup-Printer	[RFCnnnn] 3
1064	0x002C	Reprocess-Job	[RFCnnnn] 4
1065	0x002D	Cancel-Current-Job	[RFCnnnn] 4
1066	0x002E	Suspend-Current-Job	[RFCnnnn] 4
1067	0x002F	Resume-Job	[RFCnnnn] 4
1068	0x0030	Promote-Job	[RFCnnnn] 4
1069	0x0031	Schedule-Job-After	[RFCnnnn] 4
1070			
1071			
1072			
1073			
1074			
1075			

~~The resulting operation registrations will be published in the
ftp://ftp.iana.org/in-notes/iana/assignments/ipp/operations/
area.~~

~~15.4 Additional keyword Attribute Value Registrations for the “notify-events” Subscription Template Attribute~~

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

type2 keyword Attribute Value:	Ref.	Section:
-------------------------------------------	-----------------	---------------------

~~The resulting operation registrations will be published in the
ftp://ftp.iana.org/in-notes/iana/assignments/ipp/operations/
area.~~

~~15.4.14.4 Operation Registrations~~

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

	<u>Name</u>	<u>Reference</u>	<u>Section</u>
1091			
1092	-----	-----	-----
1093	<u>Operations:</u>	<u>Ref.</u>	<u>Section:</u>
1094	Activate-Printer	[RFCnnnn]	3.4.2
1095	Cancel-Current-Job	[RFCnnnn]	4.2
1096	Deactivate-Printer	[RFCnnnn]	3.4.1
1097	Disable-Printer	[RFCnnnn]	3.1.1
1098	Enable-Printer	[RFCnnnn]	3.1.2
1099	Hold-New-Jobs	[RFCnnnn]	3.3.1
1100	Pause-Printer-After-Current-Job	[RFCnnnn]	3.2.1
1101	Promote-Job	[RFCnnnn]	4.4.1
1102	Release-Held-New-Jobs	[RFCnnnn]	3.3.2
1103	Reprocess-Job	[RFCnnnn]	4.1
1104	Restart-Printer	[RFCnnnn]	3.5.1
1105	Resume-Job	[RFCnnnn]	4.3.2
1106	Schedule-Job-After	[RFCnnnn]	4.4.2
1107	Shutdown-Printer	[RFCnnnn]	3.5.2
1108	Startup-Printer	[RFCnnnn]	3.5.3
1109	Suspend-Current-Job	[RFCnnnn]	4.3.1
1110			

1111 [The resulting operation registrations will be published in the](ftp://ftp.iana.org/in-notes/iana/assignments/ipp/operations/)
 1112 <ftp://ftp.iana.org/in-notes/iana/assignments/ipp/operations/>
 1113 [area.](ftp://ftp.iana.org/in-notes/iana/assignments/ipp/operations/)
 1114

1115 **15.514.5 Status code Registrations**

1116 The following table lists the status code defined in this document. This is to be registered according to
 1117 the procedures in RFC 2911 [RFC2911] section 6.6.

	<u>Status codes:</u>	<u>Ref.</u>	<u>Section:</u>
	<u>Value Name</u>	<u>Reference</u>	<u>Section</u>
1118			
1119	-----	-----	-----
1120			
1121	<u>0x0000:0x00FF - "successful"</u>		
1122	<u>none at this time</u>		
1123			
1124	<u>0x0100:0x01FF - "informational"</u>		
1125	<u>none at this time</u>		
1126			
1127	<u>0x0300:0x03FF - "redirection" - -- See RFC 2911 Errata</u>		
1128	<u>none at this time</u>		
1129			
1130	<u>0x0400:0x04FF - "client-error"</u>		
1131	<u>none at this time</u>		
1132			
1133	<u>0x0500:0x05FF - "server-error"</u>		
1134	<u>0x050A server-error-printer-is-deactivated</u> _ [RFCnnnn] - 5.1		
1135			
1136			

1136 [The resulting operation registrations will be published in the](#)

1137 <ftp://ftp.iana.org/in-notes/iana/assignments/ipp/operations/>
1138 [area.](#)
1139

1140 **1615 Internationalization Considerations**

1141 This document has the same localization considerations as the [RFC2911].

1142 **1716 Security Considerations**

1143 The IPP Model and Semantics document [RFC2911] discusses high level security requirements (Client
1144 Authentication, Server Authentication and Operation Privacy). Client Authentication is the mechanism
1145 by which the client proves its identity to the server in a secure manner. Server Authentication is the
1146 mechanism by which the server proves its identity to the client in a secure manner. Operation Privacy
1147 is defined as a mechanism for protecting operations from eavesdropping.

1148 Printer operations defined in this specification (see section 3) and Pause-Printer, Resume-Printer, and
1149 Purge-Job (defined in [RFC2911]) are intended for use by an operator and/or administrator. Job
1150 operations defined in this specification (see section 4) and Cancel-Job, Hold-Job, Release-Job defined
1151 in [RFC2911]) are intended for use by the job owner or may be an operator or administrator of the
1152 Printer object. These operator and administrative operations affect the service of all users. In
1153 appropriate use of an administrative operation by an un-authenticated end user could affect the quality
1154 of service for all users. Therefore, for both inter-net and intra-net, conformance to this specification
1155 REQUIRES that initial configuration of IPP Printer implementations MUST require successful
1156 certificate-based TLS [RFC2246] client authentication and successful operator and administrator
1157 authorization (see [RFC2911] sections 5.2.7 and 8 and [RFC2910]) for any administrative operations
1158 defined in this document. [RFC2910] REQUIRES the IPP Printer to support the minimum cypher
1159 suite required for TLS/1.0. The means for authorizing an operator or administrator of the Printer
1160 object are outside the scope of this specification, [RFC2911], and [RFC2910].

1161 The use of TLS and Client Authentication solves the Denial of Service, Man in the Middle, and
1162 Masquerading security threats.

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1189 IPP Web Page: <http://www.pwg.org/ipp/>
1190 IPP Mailing List: ipp@pwg.org

1191
1192 To subscribe to the ipp mailing list, send the following email:

- 1193 1) send it to majordomo@pwg.org
1194 2) leave the subject line blank
1195 3) put the following two lines in the message body:
1196 subscribe ipp
1197 end

1198
1199 Implementers of this specification document are encouraged to join the IPP Mailing List in order to
1200 participate in any discussions of clarification issues and review of registration proposals for additional
1201 attributes and values. In order to reduce spam the mailing list rejects mail from non-subscribers, so
1202 you must subscribe to the mailing list in order to send a question or comment to the mailing list.

1203 **1918 Summary of Base IPP Documents**

1204 The base set of IPP documents includes:

- 1205 Design Goals for an Internet Printing Protocol [RFC2567]
1206 Rationale for the Structure and Model and Protocol for the Internet Printing Protocol [RFC2568]
1207 Internet Printing Protocol/1.1: Model and Semantics [RFC2911]
1208 Internet Printing Protocol/1.1: Encoding and Transport [RFC2910]
1209 Internet Printing Protocol/1.1: Implementer's Guide [[RFC3196ipp-ig](#)]
1210 Mapping between LPD and IPP Protocols [RFC2569]
1211 [Internet Printing Protocol \(IPP\): IPP Event Notifications and Subscriptions \[ipp-ntfy\]](#)
1212

1213 The “Design Goals for an Internet Printing Protocol” document takes a broad look at distributed
1214 printing functionality, and it enumerates real-life scenarios that help to clarify the features that need to
1215 be included in a printing protocol for the Internet. It identifies requirements for three types of users:
1216 end users, operators, and administrators. It calls out a subset of end user requirements that are satisfied
1217 in IPP/1.0. A few OPTIONAL operator operations have been added to IPP/1.1.

1218 The “Rationale for the Structure and Model and Protocol for the Internet Printing Protocol” document
1219 describes IPP from a high level view, defines a roadmap for the various documents that form the suite
1220 of IPP specification documents, and gives background and rationale for the IETF working group’s
1221 major decisions.

1222 The “Internet Printing Protocol/1.1: Model and Semantics” document describes a simplified model
1223 with abstract objects, their attributes, and their operations that are independent of encoding and
1224 transport. It introduces a Printer and a Job object. The Job object optionally supports multiple
1225 documents per Job. It also addresses security, internationalization, and directory issues.

1226 The “Internet Printing Protocol/1.1: Encoding and Transport” document is a formal mapping of the
1227 abstract operations and attributes defined in the model document onto HTTP/1.1 [RFC2616]. It
1228 defines the encoding rules for a new Internet MIME media type called “application/ipp”. This
1229 document also defines the rules for transporting over HTTP a message body whose Content-Type is
1230 “application/ipp”. This document defines the ‘ippget’ scheme for identifying IPP printers and jobs.

1231 The “Internet Printing Protocol/1.1: Implementer’s Guide” document gives insight and advice to
1232 implementers of IPP clients and IPP objects. It is intended to help them understand IPP/1.1 and some
1233 of the considerations that may assist them in the design of their client and/or IPP object
1234 implementations. For example, a typical order of processing requests is given, including error
1235 checking. Motivation for some of the specification decisions is also included.

1236 The “Mapping between LPD and IPP Protocols” document gives some advice to implementers of
1237 gateways between IPP and LPD (Line Printer Daemon) implementations.

1238 ~~The “IPP Event Notifications and Subscriptions” document defines an extension to IPP/1.0 [RFC2566,
1239 RFC2565] and IPP/1.1 [RFC2911, RFC2910]. This extension allows a client to subscribe to printing
1240 related Events and defines the semantics for delivering asynchronous *Event Notifications* to the
1241 specified *Notification Recipient* via a specified *Delivery Method* (i.e., protocols) defined in (separate)
1242 *Delivery Method* documents.~~

1243 **2019 Appendix A: Full Copyright Statement**

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1262

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