INTERNET-DRAFT  <mark>- 10 ISSUES are numbered and highlighted like this</mark>    Carl Kugler
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                                                                              December 8, 1999

Internet Printing Protocol/1.1: Set2 Operations

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Abstract

This document specifies 16 additional OPTIONAL operations for use with the Internet Printing Protocol/1.0 (IPP) [RFC2565, RFC2566] and IPP/1.1 [ipp-mod, ipp-pro]. These operations are 9 Printer object operations that operators/administrators may perform on a Printer object:

        Set-Printer-Attributes
        Enable-Printer
        Disable-Printer
        Pause-Printer-After-Current-Job (IPP/1.1 Pause-Printer clarified)
        Pause-Printer-After-All-Current-Jobs
        Deactivate-Printer
        Activate-Printer
        Restart-Printer
        Shutdown-Printer
        Startup-Printer

and 7 Job object operations that end-users may perform on their jobs and operators/administrators may perform on any job, depending on circumstances:

        Set-Job-Attributes

38          Reprocess-Job
39          Cancel-Current-Job  (though the target is the Printer object)
40          Suspend-Current-Job  (though the target is the Printer object)
41          Resume-Job
42          Promote-Job

43    The Interpreter object is added for those implementations that make a distinction on the values of some
44    Printer attributes depending on the document-format, such as "resolution-supported".

45    In addition, two operation attributes are defined:  "printer-message-from-operator" and "job-message-from-
46    operator" are included to set the corresponding Printer and Job Description attributes with the same names.
47    And the "when" operation attribute is added to the IPP/1.1 Pause-Printer operation as well as some of the
48    Set2 Printer operations.

49    New Printer Description attributes are added, along with additional values for the "printer-state-reasons"
50    and "job-state-reasons" attributes.

51    New status codes: 'client-error-attributes-not-settable' and 'server-error-printer-is-in-standby-mode' are
52    added.

53    Finally, the 'not-settable' out-of-band value is added for use with the Set-Printer-Attributes and Set-Job-
54    Attributes operations.

55    The scope of IPP, is characterized in RFC2526 "Design Goals for an Internet Printing Protocol".  It is not
56    the intent of this document to revise or clarify this scope or conjecture as to the degree of industry adoption
57    or trends related to IPP within printing systems.  It is the intent of this document to extend the original set
58    of operations - in a similar fashion to the Set1 extensions which referred to IPP/1.0 and were later
59    incorporated into IPP/1.1.

60    This document is intended for registration following the registration procedures of IPP/1.0 [RFC2566] and
61    IPP/1.1 [ipp-mod].  This version includes the comments discussed at the IPP telecon, on 6/23/1999,
62    6/30/1999, at the IETF IPP WG meeting, 7/7/99-7/8/99, in Copenhagen, and the IPP telecon, 7/17/1999, the
63    August, 1999 IPP meeting in Alaska and subsequent phone conferences and discussions.  Specifically, the
64    9/16 update refers to this set of extensions simply as "Set2" rather than using the term "Administrative"
65    which was misleading, controversial and incorrect as an overall description. Also, two new attributes have
66    been proposed to clarify the intent of each operation in terms of its target, the Printer vs. the Print Job.
67    Unresolved ISSUES are highlighted like this in the .doc and .pdf files.

68    The full set of IPP documents includes:
69        Design Goals for an Internet Printing Protocol [RFC2567]
70        Rationale for the Structure and Model and Protocol for the Internet Printing Protocol [RFC2568]
71        Internet Printing Protocol/1.1: Model and Semantics (this document)
72        Internet Printing Protocol/1.1: Encoding and Transport [IPP-PRO]
73        Internet Printing Protocol/1.1: Implementer's Guide [IPP-IIG]
74        Mapping between LPD and IPP Protocols [RFC2569]
75

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

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

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

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

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

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196 1 Introduction

197 The Internet Printing Protocol (IPP) is an application level protocol that can be used for distributed printing
198 using Internet tools and technologies. IPP version 1.1 (IPP/1.1) focuses on end user functionality with a
199 few administrative operations included. This document defines additional OPTIONAL end user, operator,
200 and administrator operations used to control Jobs and Printers. This document is a registration proposal for
201 an extension to IPP/1.0 and IPP/1.1 following the registration procedures in those documents.

202 2 Terminology

203 This section defines terminology used throughout this document.

204 2.1 Conformance Terminology

205 Capitalized terms, such as MUST, MUST NOT, REQUIRED, SHOULD, SHOULD NOT, MAY, NEED
206 NOT, and OPTIONAL, have special meaning relating to conformance. These terms are defined in [ipp-
207 mod] section 12.1 on conformance terminology, most of which is taken from RFC 2119 [RFC2119].

208 The following specialization of these terms apply to this document:

209 REQUIRED: if an implementation supports the extensions described in this document, it MUST
210 support a REQUIRED feature.
211 OPTIONAL: if an implementation supports the extensions described in this document, it MAY support
212 an OPTIONAL feature.

213 2.2 Other terminology

214 This document uses terms such as "attributes", "keywords", and "support". These terms have special
215 meaning and are defined in the model terminology [ipp-mod] section 12.2.

216 **IPP Printer object (or Printer for short) -** a software abstraction defined by [ipp-mod].
217 **Output-Device** - the physical imaging mechanism that an IPP Printer controls.
218 **Output-Device fan-out** - a configuration in which an IPP Printer controls more that one output-device.
219 **Printer fan-out** - a configuration in which an IPP Printer object controls more than one subordinate IPP
220 Printer object.
221 **Printer fan-in** - a configuration in which an IPP Printer object is controlled by more than one IPP
222 Printer object.
223 **Subordinate Printer** - an IPP Printer object that is controlled by another IPP Printer object. Such a
224 Subordinate Printer MAY have one or more Subordinate Printers.
225 **Leaf Printer** - a Subordinate Printer that has no Subordinate Printers.
226 **Non-Leaf Printer** - an IPP Printer object that has one or more Subordinate Printers.
227 **Chained Printer** - a Non-Leaf Printer that has exactly one Subordinate Printer.

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


230    3    Requirements and Use Cases


231    The following requirements and usage cover both the Set2 and Set3 [ipp-set3] operations.  They are
232    presented here together to show the parallelism.

233    1.  Have separate operations for affecting the IPP Printer versus affecting the output-device, so its clear
234        what the intent of each is and implementers can implement one or the other or both.

235    2.  Support fan-out of Printer objects.

236    3.  Support fan-out of output-devices.

237    4.  Support fan-in of Printer objects, as long as it doesn't make the semantics more complicated when not
238        supporting fan-in.

239    5.  Instead of having operation attributes that alter the behavior of the operation significantly, have separate
240        operations, so that it is simple and clear to a client which semantics the Printer is supporting (by
241        querying the "operations-supported" attribute) and it is simple to describe the capabilities of a Printer
242        implementation in written documentation.

243    6.  Need a Printer operation to prevent a Printer object from accepting new IPP jobs, but currently accepted
244        jobs continue unaffected to be scheduled and processed.  Need a companion one to restore the Printer
245        object to accept new IPP jobs.

246        Usage:  Operator is preparing to take the IPP Printer out of service.

247        Suggested name and operations:  **Disable-Printer** and **Enable-Printer**

248    7.  Need a Device operation to prevent an output device from accepting any new jobs from any job
249        submission protocol and a companion one to restore the output device to accepting any jobs.

250        Usage:  Operator is preparing to take the output device out of service.

251        Suggested name and operations:  **Disable-Device** and **Enable Device**

252    8.  Need a Printer operation to stop the processing after the current IPP job completes and not start
253        processing any additional IPP jobs, but continue to accept new IPP jobs.  Need a companion operation
254        to start processing IPP jobs again.

255        Usage:  Operator wants to gracefully stop the IPP Printer as the next job boundary. This operation is
256        also invoked implicitly by the Deactivate-Printer and the Shutdown-Printer.

257        Suggested name and operations:  **Pause-Printer-After-Current-Job**, **Resume-Printer**

258   9. Need a Device operation to stop the processing the current job "immediately", no matter what protocol.
259      Its like the Pause button on the output device. This operation is for emergencies. The stop point
260      depends on implementation, but can be mid page, end of page, end of sheet, or after a few sheets for
261      output devices that can't stop that quickly. The paper path isn't run out. Need a companion operation to
262      start processing the current any-protocol job without losing any thing.

263      Usage: Operator sees something bad about to happen, such as the paper is about to jam, or the toner is
264      running out, or the device is overheating or wants to add more paper.

265      Suggested name and operations: **Pause-Device-Now**, **Resume-Device**

266   10. Need a Printer operation to stop the processing of IPP jobs after all of the currently accepted jobs that
267      have been processed, but any newly accepted jobs go into the 'processing-held' state.

268      Usage: This allows an operator to reconfigure the output device in order to let jobs that are held waiting
269      for resources, such as special media, to get a chance. Then the operator uses Resume-Printer after
270      reconfiguring. He repeats the two operations to restore the output device to its normal media.

271      Suggested name and operations: **Pause-Device-After-All-Current-Jobs**, **Resume-Device**

272   11. Need a Device operation to stop the processing the current any-protocol job at a convenient point, such
273      as after the current copy (or end of job if last or only copy). Need a companion operation to start
274      processing the current any-protocol job or next job without losing any thing.

275      Usage: The operator wants to empty the output bin that is near full. The paper path is run out.

276      Suggested name and operations: **Pause-Device-After-Current-Copy**, **Resume-Devic**e

277   12. Need a Device operation that always pauses on a job boundary, no matter how many copies, in order to
278      not break up a job. Need a companion operation to start processing the current any-protocol job or next
279      job without losing any thing.

280      Usage: The operator wants to empty the output bin that is near full, but he doesn't want to break up a
281      job in case it has multiple copies. The paper path is run out.

282      Suggested name and operations: **Pause-Device-After-Current-Job**, **Resume-Device**

283   13. Need a Printer operation that combines Disable-Printer, Pause-Printer-After-Current-Job, and rejects all
284      other Job, Printer, and Device operations, except Job and Printer queries, System Administrator Set-
285      Printer-Attributes, and the companion operation to resume activity. In other words, this operation
286      makes the Printer a read-only object in a graceful manner for end-users and the operator.

287      Usage: The administrator wants to reconfigure the Printer object using the Set-Printer-Attributes
288      operation without disturbing the current in process work, but wants to make sure that the operator isn't
289      also trying to change the Printer object as part of running the Printer.

290      Suggested name and operation: **Deactivate-Printer, Activate-Printe**r

291   14. Need a Device operation that combines Disable-Device, Pause-Device-After-Current-Copy (Current-
292       Job?), and rejects all other Device operations, except Job and Printer queries and the companion
293       operation to resume activity.  In other words, this operation makes the output-device a read-only object
294       in a graceful manner.

295       Usage:  The field service person wants to open up the device without disturbing the current in process
296       work, perhaps to replace staples, or replace the toner cartridge.

297       Suggested name and operation:  **Deactivate-Device, Activate-Device**

298   15. Need a Printer operation to recover from the IPP Printer software that has gotten confused (run out of
299       heap memory or gotten into a state that it doesn't seem to be able to get out of).  This is a condition that
300       shouldn't happen, but does in real life.  Any volatile information is saved if possible before the software
301       is re-initialized.  No companion operation is needed to undo this.  We don't want to go back to the
302       "confused" state :-).

303       Usage:  The IPP Printer software has gotten confused or isn't responding properly.

304       Suggested name and operation:  **Restart-Printer**

305   16. Need a Device operation to recover from the output device hardware and software that has gotten
306       confused (gotten into a state that it doesn't seem to be able to get out of, run out of heap memory, etc.).
307       This is a condition that shouldn't happen, but does in real life.  Any volatile information is saved if
308       possible before the software and hardware is re-initialized.  This is the same and has the same options as
309       the Printer MIB reset.  No companion operation is needed to undo this.  We don't want to go back to the
310       "confused" state :-).

311       Usage:  The output device has gotten confused or need resetting to some initial conditions.

312       Suggested name and operation:  **Reset-Device**

313   17. Need a Printer operation to put the IPP Printer object out of business with no way in the protocol to
314       bring that instantiation back to life. (but see Startup-Printer which brings a new instantiation to life
315       with the same URL).

316       Usage:  The Printer is being moved or the building's power is being shut off.

317       Suggested name and operation:  **Shutdown-Printer**

318   18. Need a Printer operation to bring an IPP Printer to life when there is an already running host.  Note:
319       This operation is unlikely to be supported for the embedded Printer configuration.

320       Usage:  After the host is started (by means outside the IPP protocol), the operator is able to ask the host
321       to bring up any number of Printer objects (that the host has been configured in some way) each with
322       distinct URLs.

323       Suggested name and operation:  **Startup-Printer**

324  19. Need a Device operation to power off the output device after writing out any software state. It is
325      assumed that other operations have more gracefully prepared the output device for this drastic and
326      immediate. There is no companion Device operation to bring the power back on.

327      Usage: The output device is going to be moved, the power in the building is going to be shutoff, the
328      repair man has arrived and needs to take the output device apart.

329      Suggested name and operation: **Power-Off-Device**

330  3.1    List of the Printer and Device operations

331  The list of Printer and Device operations are:

| Printer operation | Corresponding Device operation equivalent |
|---|---|
| Get-Printer-Attribute | no |
| Set-Printer-Attributes | no |
| Disable-Printer | Disable-Device |
| Enable-Printer | Enable-Device |
| no | Pause-Device-Now |
| no | Pause-Device-After-Current-Copy |
| Pause-Printer-After-Current-Job (= IPP/1.1 Pause-Job??) | Pause-Device-Current-Job |
| Pause-Printer-After-All-Current-Jobs | no |
| Resume-Printer | Resume-Device |
| Deactivate-Printer | Deactivate-Device |
| Activate-Printer | Activate-Device |
| Purge-Jobs | Purge-Device |
| Restart-Printer | Reset-Device |
| Shutdown-Printer | Power-Off-Device |
| Startup-Printer | no |

332  4    New objects and new relationships of existing objects

333  This section defines the new Interpreter object and the use of the IPP Printer object to represent IPP Printer
334  fan-out and IPP Printer fan-in.

335  4.1    Interpreter object

336  The Interpreter object models the document format interpreters that are contained in the Printer object. The
337  purpose of the Interpreter object is to model those Printer attributes whose value depends on which
338  interpreter is being used to process the document. Depending on implementation, the Printer object

339 attributes whose values ("xxx-supported" and "xxx-default") depend on the interpreter, i.e., on the
340 "document-format" of the document being processed, are considered to be Interpreter object attributes
341 instead.  A Get-Printer-Attributes operation returns Printer and Interpreter attributes as specified in the
342 "requested-attributes" operation attribute supplied by the client.  Depending on the value of the "document-
343 format" attribute supplied by the client in the Get-Printer-Attributes request (or the "document-format-
344 default", if the client omits the "document-format" attribute), selects the corresponding Interpreter object.

345 If an implementation does not make a distinction on the values of Printer attributes by document format,
346 say, for purposes of job validation (see [ipp-mod] Get-Printer-Attributes), there is no need to implement or
347 support the Interpreter object.  The Interpreter object is introduced to provide a means to model an
348 implementation in which some attributes do depend on the document format.  Those attributes are then sub-
349 classed to be Interpreter object attributes.

350 Note:  the addition of the Interpreter object is completely compatible with IPP/1.0 and IPP/1.1 (see the
351 description of the "document-format" operation attribute in [ipp-mod] section 3.2.5.1 Get-Printer-Attributes
352 request).  The protocol and semantics are the same whether or not the Interpreter object is used to
353 distinguish attributes that depend on the "document-format".  Consequently, there is no "interpreters-
354 supported" Printer Description attribute.  In order to determine which Interpreter objects there MAY be, the
355 client can request the values of the Printer's "document-format-supported" attribute.

356 Note:  The Interpreter object is really a sub-class of the Printer object, rather than being a full fledged object
357 in the sense that the Job and Printer objects are.  There are no operations defined solely for the Interpreter
358 object.  The Get-Printer-Attributes and Set-Printer-Attributes operations operate on the Interpreter object if
359 the implementation has the concept of an Interpreter object.  However, if the IPP Printer implementation
360 does not contain Interpreter objects, the same Interpreter object attributes are considered Printer object
361 attributes, instead.

362 4.2    Use of the Printer object to represent IPP Printer fan-out and IPP Printer fan-in

363 This section defines how the Printer object MAY be used to represent IPP Printer fan-out and IPP Printer
364 fan-in.  Fan-out is where an IPP Printer is used to represent other IPP Printer objects.  Fan-in is where
365 several IPP Printer objects are used to represent another IPP Printer object.

366 4.2.1   IPP Printer fan-out

367 The IPP/1.1 Model and Semantics introduces the semantic concept of an IPP Printer object that represents
368 more than one output device (see [ipp-mod] section 2.1).  This concept is called "output device fan-out".
369 However, there was no way to represent the individual states of the output devices or to perform operations
370 on a specific output device when there was fan-out.  This specification generalizes the semantics of the
371 Printer object to represent such "subordinate" fan-out output devices as IPP Printer objects.  This concept is
372 called "Printer object fan-out".  A Printer object that has a subordinate Printer object is called a "non-leaf"
373 Printer object.  Thus a "non-leaf" Printer object MAY support one or more subordinate Printer objects in
374 order to represent Printer object fan-out. A Printer object that does not have any subordinate Printer objects
375 is called a "leaf" Printer object.

4.2.2   IPP Printer fan-in

The IPP/1.1 Model and Semantics did not preclude the semantic concept of multiple IPP Printer objects that represent a single output device (see [ipp-mod] section 2.1). However, there was no way for the client to determine that there was a fan-in configuration, nor was there a way to perform operations on the subordinate device. This specification generalizes the semantics of the Printer object to allow several "non-leaf" IPP Printer objects to represent a single "subordinate" Printer object. Thus a "non-leaf" Printer object MAY share a subordinate Printer object with one or more other non-leaf Printer objects in order to represent IPP Printer fan-in. As with fan-out (see section 4.2), when a Printer object is a non-leaf, it MUST NOT have an associated output device. As with fan-out, a leaf Printer object has an associated output device(s). As with fan-out, the non-leaf Printer objects submit jobs to their subordinate Printer objects and otherwise control the subordinate Printer. As with fan-out, whether pending jobs are kept in the non-leaf Printers until the subordinate Printer can accept them or are kept in the subordinate Printer depends on implementation and/or configuration policy.

4.2.3   Printer object attributes used to represent Printer fan-out and Printer fan-in

Each non-leaf Printer object submits jobs to its immediate subordinate Printers and otherwise controls the subordinate Printers using IPP or other protocols. Whether pending jobs are kept in the non-leaf Printer until a subordinate Printer can accept them or are kept in the subordinate Printers depends on implementation and/or configuration policy. Furthermore, a subordinate Printer object MAY, in turn, have subordinate Printer objects. Thus a Printer object can be both a non-leaf Printer and a subordinate Printer.

A subordinate Printer object MUST be a conforming Printer object, so it MUST support all of the REQUIRED operations and attributes. However, with access control, the subordinate Printer MAY be configured so that end-user clients are not permitted to perform any operations (or just Get-Printer-Attributes) while one or more non-leaf Printer object(s) are permitted to perform any operation.

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

1.  "subordinate-printers-supported" (1setOf uri) - contains the URI of the immediate subordinate Printer object(s). Each non-leaf Printer object MUST support this Printer Description attribute. A leaf Printer object either does not support the "subordinate-printers-supported" attribute or does so with the 'no-value' out-of-band value (see [ipp-mod] section 4.1), depending on implementation.

2.  "parent-printers-supported (1setOf uri) - contains the URI of the non-leaf printer object(s) for which this Printer object is the immediate subordinate, i.e., this Printer's immediate "parent" or "parents". Each subordinate Printer object MUST support this Printer Description attribute. A Printer that has no parents, either does not support the "parent-printers-supported" attribute or does so with the 'no-value' out-of-band value (see [ipp-mod] section 4.1), depending on implementation.

410    4.2.4    Subordinate Printer URI

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

414            a. When the implementation wants to make sure that no operation on a subordinate Printer object as
415            a target "sneaks by" the parent Printer object (or the subordinate Printer is fronting for a device that
416            is not networked), the host part of the URI specifies the host of the parent Printer.  Then the parent
417            Printer object can easily reflect the state of the subordinate Printer objects in the parent's Printer
418            object state and state reasons as the operation passes "through" the parent Printer object.

419            b. When the subordinate Printer is networked and the implementation allows operations to go
420            directly to the subordinate Printer (with proper access control) without knowledge of the parent
421            Printer object, the host part of the URI is different than the host part of the parent Printer object.  In
422            such a case, the parent Printer object MUST keep its "printer-state" and "printer-state-reasons" up to
423            date, either by polling the subordinate Printer object or by subscribing to events with the subordinate
424            Printer object (see [ipp-not-spec] for means to subscribe to event notification when the subordinate
425            Printer object supports IPP notification).

426    4.2.5    Printer object attributes used to represent output device fan-out

427    When a Printer object is a non-leaf, it MUST NOT have an associated output device.  Only leaf IPP Printer
428    objects are allowed to have one or more associated output devices.  Each leaf Printer object MAY support
429    the "output-devices-supported" (1setOf name(127)) to indicate the user-friendly name(s) of the output
430    device(s) that the leaf Printer object represents.  It is RECOMMENDED that each leaf Printer object have
431    only one associated output device, so that the individual output devices can be represented completely and
432    controlled completely by clients.  In other words, the Printer's "output-devices-supported" attribute
433    SHOULD have only one value.

434


435    4.2.6   Figures to show all possible configurations

436    Figure 1, Figure 2, and Figure 3 are taken from [ipp-mod] to show the configurations possible with IPP/1.0
437    and IPP/1.1 where all Printer objects are leaf Printer objects.  The remaining figures show additional
438    configurations that this document defines using non-leaf and leaf Printer objects. Legend for all figures:

```
439    ----> indicates a network protocol with the direction of its requests
440
441    ##### indicates a Printer object which is either:
442             - embedded in an output device or
443             - hosted in a server.  The Printer object
444          might or might not be capable of queuing/spooling.
445
446    any    indicates any network protocol or direct
447           connect, including IPP
448                                                           output device
449                                                      +--------------+
450                                                      |  ########## |
451     O    +--------+                                  |  # (leaf)  # |
452    /|\   | client |------------IPP---------------->#  Printer  # |
453    / \   +--------+                                  |  # Object  # |
454                                                      |  ########## |
455                                                      +--------------+
```
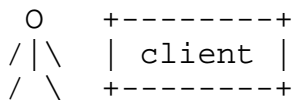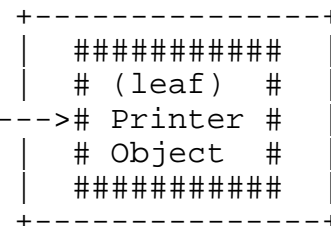
**Figure 1 - embedded Printer object**

```
457
458                                ##########      output device
459     O    +--------+           # (leaf)  #    +--------------+
460    /|\   | client |---IPP---->#  Printer #---any->|              |
461    / \   +--------+           # object   #    |              |
462                                ##########      +--------------+
463
```
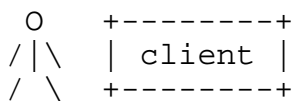
**Figure 2 - hosted Printer object**

```
465
466                                                      +--------------+
467                                                      |              |
468                                               +->|  output device |
469                                ########## any/    |              |
470     O    +--------+           # (leaf)  #   /    +--------------+
471    /|\   | client |---IPP---->#  Printer #--*
472    / \   +--------+           # Object   #   \    +--------------+
473                                ########## any\    |              |
474                                               +->|  output device |
475                                                      |              |
476                                                      +--------------+
```
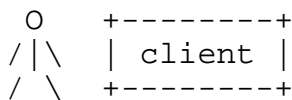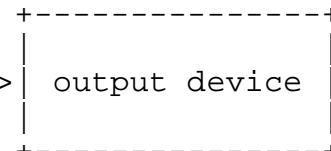
**Figure 3 - output device fan out**

```
478                              ##########            ##########
479    O    +--------+          # non-leaf#          # subord. #
480   /|\   | client |---IPP---># Printer #---IPP---># Printer #
481   / \   +--------+          # object  #          # object  #
482                              ##########            ##########
483
```

484   The subordinate Printer can be a non-leaf Printer as in Figure 4 to
485   Figure 6, or can be a leaf Printer as in Figure 1 to Figure 3.

**Figure 4 - Chained IPP Printer**

```
487
488               +------IPP-------------------->##########
489              /                      +---># subord. #
490             /                      /       # Printer #
491            /            ##########  any     # object  #
492    O    +--------+      # non-leaf#  /       ##########
493   /|\   | client |---IPP---># Printer #--*
494   / \   +--------+      # object  #   \
495            \            ##########  any     ##########
496             \                      \       # subord. #
497              \                      +---># Printer #
498               +------IPP-------------------># object  #
499                                              ##########
500
```

501   The subordinate Printer can be a non-leaf Printer as in Figure 4 to
502   Figure 6, or can be a leaf Printer as in Figure 1 to Figure 3.

**Figure 5 - IPP Printer fan out**

```
504
505                         (non-leaf)
506                         ##########
507                         # non-leaf#
508                +---># Printer #-+
509               /         # object  #  \
510             IPP        ##########   \        ##########
511    O    +--------+   /                      +-IPP-># subord. #
512   /|\   | client |--+----------IPP-------------># Printer #
513   / \   +--------+   \                      +-IPP-># object  #
514             IPP        ##########    /        ##########
515               \        # non-leaf#  /
516                +---># Printer #-+
517                         # object  #
518                         ##########
519                         (non-leaf)
```

520   The subordinate Printer can be a non-leaf Printer as in Figure 4, Figure
521   5, or Figure 6, or can be a leaf Printer as in Figure 1, Figure 2, or
522   Figure 3.

**Figure 6 - IPP Printer fan in**

<sub>524</sub>   4.3    Forwarding requests

<sub>525</sub>   This section describes the forwarding of Job and Printer requests to subordinate Printer objects.

<sub>526</sub>   4.3.1    Forwarding requests that affect Printer objects

<sub>527</sub>   In Printer fan-out, Printer fan-in, and Chained Printers, the non-leaf IPP Printer object MUST NOT forward
<sub>528</sub>   the Printer operations that affect Printer objects to its subordinate Printer objects.  If a client wants to
<sub>529</sub>   explicitly target a subordinate Printer, the client MUST specify the URI of the subordinate Printer.   The
<sub>530</sub>   client can determine the URI of any subordinate Printers by querying the Printer's "subordinate-printers-
<sub>531</sub>   supported (1setOf uri) attribute (see section 6.6).

<sub>532</sub>   Table 1 lists the operations that affect Printer objects and the forwarding behavior that a non-leaf Printer
<sub>533</sub>   MUST exhibit to its immediate subordinate Printers.  Printer operations that affect jobs have a different
<sub>534</sub>   forwarding rule (see section 4.3.2 and Table 2):

<sub>535</sub>                           **Table 1 - Forwarding operations that affect Printer objects**

| Printer operation | Non-leaf Printer action |
|---|---|
| Set2 Printer operations: | |
| Set-Printer-Attributes | MUST NOT forward to any of its subordinate Printers |
| Enable-Printer | MUST NOT forward to any of its subordinate Printers |
| Disable-Printer | MUST NOT forward to any of its subordinate Printers |
| Pause-Printer-After-All-Current-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: | |
| 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 |

<sub>536</sub>

<sub>537</sub>   4.3.2    Forwarding requests that affect Jobs

<sub>538</sub>   Unlike Printer operations that only affect Printer objects (see section 4.3.1), a non-leaf Printer object MUST
<sub>539</sub>   forward operations that directly affect jobs to the appropriate Job object(s) in one or more of its immediate
<sub>540</sub>   subordinate Printer objects.  Forwarding is REQUIRED since the purpose of such a Job operation is to
<sub>541</sub>   affect the indicated job which itself may have been forwarded.  Such forwarding MAY be immediate or
<sub>542</sub>   queued, depending on the operation and the implementation.  For example, a non-leaf Printer object MAY
<sub>543</sub>   queue/spool jobs, feeding a job at a time to its subordinate Printer(s), or MAY forward jobs immediately to

544 one of its subordinate Printers.  In either case, the non-leaf Printer object is forwarding Job Creation
545 operations to one of its subordinate Printers.  Only the time of forwarding of the Job Creation operations
546 depends on whether the policy is to queue/spool jobs in the non-leaf Printer or the subordinate Printer.

547 When a non-leaf Printer object creates a Job object in its subordinate Printer, whether that non-leaf Printer
548 object keeps a fully formed Job object or just keeps a mapping from the "job-ids" that it assigned to those
549 assigned by its subordinate Printer object is IMPLEMENTATION-DEPENDENT.  In either case, the non-
550 leaf Printer MUST be able to accept and carry out future Job operations that specify the "job-id" that the
551 non-leaf Printer assigned and returned to the job submitting client.

552 Table 2 lists the operations that directly affect jobs and the forwarding behavior that a non-leaf Printer
553 MUST exhibit to its subordinate Printers:

554                    **Table 2 - Forwarding operations that affect Jobs objects**

| Job operation | Non-leaf Printer action |
|---|---|
| Set2 Job operations: | |
| Set-Job-Attributes | MUST forward to the appropriate Job in one of its subordinate Printers |
| Reprocess-Job | MUST forward to the appropriate Job in one of its subordinate Printers |
| Cancel-Current-Job | MUST forward to the appropriate Job in one of its subordinate Printers |
| Suspend-Current-Job | MUST forward to the appropriate Job in one of its subordinate Printers |
| 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 *all* its subordinate Printers |
| Purge-Jobs | MUST forward to *all* 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 |

555  ISSUE 01:  Do we want to define whether the response to the client for Job operations can happen before
556  the non-leaf Printer gets the response from its subordinate Printer or MUST the non-leaf Printer wait until
557  its gets the response from its subordinate Printer?

558  The following Job Description attributes are defined to help represent Job relationships for fan-out and
559  forwarding of jobs:

560  1.  "output-device-assigned" (name(127)) - from [ipp-mod]: This attribute identifies the output device to
561      which the Printer object has assigned this job.  If an output device implements an embedded Printer
562      object, the Printer object NEED NOT set this attribute.  If a print server implements a Printer object, the
563      value MAY be empty (zero-length string) or not returned until the Printer object assigns an output
564      device to the job.  This attribute is particularly useful when a single Printer object supports multiple
565      devices (so called "fan-out").

566  2.  "original-requesting-user-name" (name(MAX)) - operation attribute containing the user name of the
567      original user, i.e., corresponds to the "requesting-user-name" operation attribute that the original client
568      supplied to the first Printer object.

569  ISSUE 02 - The "requesting-user-name" operation attribute is the parent Printer's host, not the original
570  requesting user, correct?)

571  ISSUE 03 - Presumably the "job-originating-user-name" remains as the authenticated original user, not the
572  parent Printer's authenticated host, correct?

573  5    New Operation attributes

574  This section defines the new "printer-message-from-operation" and "job-message-from-operator" operation
575  attributes that set the corresponding Printer and Job Description attributes.

576  5.1    "printer-message-from-operator" (text(127))

577  The client OPTIONALLY supplies this attribute.  The Printer object SHOULD supports this operation
578  attribute if it supports the corresponding Printer Description attribute.  The value of this attribute is a
579  message from the operator about the Printer object on which the operator is performing the operation.  If
580  supported, the Printer copies the value to the Printer's "printer-message-from-operator" Printer Description
581  attribute (see [ipp-mod] section 4.4.25), automatically sets the value of the Printer's "printer-message-time"
582  with the current value of the Printer's "printer-up-time" attribute, the value of the "printer-message-date-
583  time" with the current value of the Printer's printer-current-date-time" attribute, and the value of the
584  Printer's "printer-message-operation" with the operation-id value of this operation (see [ipp-mod] section
585  4.4.15).
586
587  If the client omits this attribute, the Printer does not change the value of its "printer-message-from-
588  operator", "printer-message-time", "printer-message-date-time", and "printer-message-operation" Printer
589  Description attributes.

590

591 If the client supplies this attribute with a zero-length text value or with a value consisting solely of white
592 space, the Printer copies that value as any other value to the Printer's "printer-message-from-operator" and
593 sets the "printer-message-time", "printer-message-date-time", and "printer-message-operation" attributes.
594 Supplying such a value is the way that the operator indicates that there is no longer a printer message from
595 the operator (rather than using the "out-of-band" 'no-value' value).

596

597 This operation attribute is defined for use with the following operator operations on the Printer object:

598        Pause-Printer - see [ipp-mod] section 3.2.7
599        Resume-Printer - see [ipp-mod] section 3.2.8
600        Purge-Jobs - see [ipp-mod] section 3.2.9
601        Disable-Printer - see section 11.2
602        Enable-Printer - see section 11.2.2
603        Pause-Printer-After-Current-Job (IPP/1.1 Pause-Printer clarified) - see section 11.3.2
604        Pause-Printer-After-All-Current-Jobs - see section
605        Deactivate-Printer - see section 11.4.1
606        Activate-Printer - see section 11.4.2
607        Restart-Printer - see section 11.5.1
608        Shutdown-Printer - see section 11.5.2
609        Startup-Printer - see section 11.5.3

610

611 The "printer-message-from-operator" operation attribute MUST NOT be supported as an operation attribute
612 for the Set-Printer-Attributes operation. If the operator wants to set the Printer's "printer-message-from-
613 operator" Printer Description attribute when issuing the Set-Printer-Attributes operation, the client supplies
614 the "printer-message-from-operator" with its new value as one of the Printer Description attributes in Group
615 2 in the request. The Printer also updates the Printer's "printer-message-date-time" and "printer-message-
616 operation" Printer Description attributes. If the client does not explicitly supply the "printer-message-from-
617 operator" with its new value, the Printer leaves the value of the Printer's "printer-message-from-operator"
618 Printer Description attribute unchanged.

619 5.2   "job-message-from-operator" (text(127))

620 The client OPTIONALLY supplies this attribute. The Printer object SHOULD supports this operation
621 attribute if it supports the corresponding Job Description attribute. The value of this attribute is a message
622 from the operator about the Job object on which the operator has just performed an operation. If supported,
623 the Printer copies the value to the Job's "job-message-from-operator" Job Description attribute (see [ipp-
624 mod] section 4.3.16).

625 If the client omits this attribute, the Printer does not change the value of its "printer-message-from-operator"
626 Job Description attribute.

627 If the client supplies this attribute with a zero-length text value or with a value consisting solely of white
628 space, the Printer copies that value as any other value to the job's "job-message-from-operator". Supplying

629 such a value is the way that the operator indicates that there is no longer a job message from the operator
630 (rather than using the "out-of-band" 'no-value' value).

631 Note:  There are no corresponding 'job-message-time", "job-message-date-time", and "job-message-
632 operation" Job Description attributes, since the usual lifetime of a job is limited.

633 This operation attribute is defined for use with the following operator operations on the Job object:

634          Cancel-Job - see [ipp-mod] section 3.2.4
635          Hold-Job - see [ipp-mod] section 3.3.5
636          Release-Job - see [ipp-mod] section 3.3.6
637          Restart-Job - see [ipp-mod] section 3.3.7
638          Reprocess-Job - see section 12.2
639          Cancel-Current-Job - see section 12.3
640          Suspend-Current-Job - see section 12.4
641          Resume-Job - see section 12.4.2
642          Promote-Job - see section 12.5
643

644 The "job-message-from-operator" operation attribute MUST NOT be supported as an operation attribute for
645 the Set-Job-Attributes operation.  If the operator wants to set the Job's "job-message-from-operator" Job
646 Description attribute when issuing the Set-Job-Attributes operation, the client supplies the "job-message-
647 from-operator" with its new value as one of the Job Description attributes in Group 2 in the request.
648 Otherwise, the Printer leaves the value of the Job's "job-message-from-operator" Job Description attribute
649 unchanged by not explicitly setting the attribute.

650 5.3    "factory-settings" (boolean) - new operation attribute for Get-Printer-Attributes:

651 The client OPTIONALLY supplies this attribute.  The Printer object OPTIONALLY supports this attribute,
652 if it supports the Set-Printer-Attributes operation.  If the client omits this attribute or supplies the 'false'
653 value, the Printer returns the current values of the requested attributes that are settable, i.e., the values that
654 have been set by previous Set-Printer-Attributes.  If the client supplies the 'true' value, the Printer returns
655 the factory settings, i.e., the inherent values supported by the implementation as shipped from the
656 manufacturer or established at install time.  This operation attribute allows an operator to determine which
657 values are supported in an implementation after having modified a settable attribute.  Attributes that are not
658 settable are not affected by this operation attribute, so that the Printer returns the same values for non-
659 settable attribute when either the 'true' or 'false' value has been supplied.  If this operation attribute is
660 supported, both 'true' and 'false' values MUST be supported.

661 5.4    Summary of the operation attributes for the Printer operations

662 The following table shows the operation attributes for the Printer operations that a client MAY supply in a
663 request.  Operation parameters and attributes that a client MUST supply are not shown.  Also "requesting-
664 user-name" is not shown, though it is RECOMMENDED that a client supply it in every request.
665 Legend:
666          R - REQUIRED for a Printer to support

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

| Operation Attribute | Pause-Printer | Resume-Printer | Purge-Jobs | Get-Printer-Attributes | Set-Printer-Attributes | Enable-Print | Disable-Printer | Restart-Printer | Shut down-Printer |
|---|---|---|---|---|---|---|---|---|---|
| document-format | | | | R | R | | | | |
| factory-settings | | | | O | | | | | |
| printer-message-from-operator | O | O | O | | | | O | O | O | O |
| job-type | | | | | | O | O | | |
| | | | | | | | | | |
| reset-function | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |

668    5.5    Summary of the operation attributes for the Job operations

669    The following table shows the operation attributes for the Job operations that a client MAY supply in a
670    request.  Operation attributes that specify the Printer or Job object as the target are shown in the first two
671    rows, respectively.  Other operation attributes and parameters that a client MUST supply are not shown.
672    Also "requesting-user-name" is not shown, though it is RECOMMENDED that a client supply it in every
673    request.
674    Legend:
675           R - REQUIRED for a Printer to support
676           O - OPTIONAL for a Printer to support; the Printer ignores the attribute if not supported

| Operation Attribute | Cancel-Job | Cancel-Current-Job | Hold-Job | Release-Job | Suspend-Current-Job | Resume-Job | Get-Job-Attributes | Set-Job-Attributes | Restart-Job | Reprocess-Job | Promote-Job |
|---|---|---|---|---|---|---|---|---|---|---|---|
| printer-uri | | R | | | R | | | | | | |
| printer-uri/job-id or job-uri | R | | R | R | | R | R | R | R | R | R |
| job-id | | R | | | R | | | | | | |
| requested-attributes | | | | | | | R | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| job-message-from-operator | O | O | O | O | O | O | | | O | O | O |
| message [to-operator] | O | | O | O | O | O | | | O | O | O |
| job-hold-until | | | O* | O* | | | | | | O** | |

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

679  ** The Printer MUST support the "job-hold-until" operation attribute if it supports the Set-Job-Attributes
680  operation, so that the client can hold the job with the Reprocess-Job operation and the modify the job before
681  releasing it to be processed.


682  6    New Printer Description Attributes


683  The following new Printer Description attributes are needed to support the new operations defined in this
684  document.


685  6.1    printer-settable-attributes (1setOf type2 keyword)

686  This READ-ONLY Printer attribute identifies the Printer object attributes that are settable in this
687  implementation, i.e., that are settable using the Set-Printer-Attributes operations (see section 11.1).  This
688  attribute MUST be supported if the Set-Printer-Attributes operations is supported.  The Printer MUST
689  reject attempts to set any Printer attributes that are not one of the values of this attribute, returning the
690  'client-error-attributes-not-settable' status code (see section 9.1).  The value of this attribute MAY depend
691  on the value of the "document-format" operation attribute supplied in the Get-Printer-Attributes operation
692  (see [ipp-mod] section 3.2.5.1).

693  Standard keyword values are:

694      'none':  There are no settable Printer attributes.
695      'xxx':   Where 'xxx' is any of the keyword attribute names in the list defined in section 11.1.1

696  6.2    job-settable-attributes (1setOf type2 keyword)

697  This READ-ONLY Printer attribute identifies the Job object attributes that are settable in this
698  implementation, i.e., that are settable using the Set-Job-Attributes operation (see section 12.1).  This
699  attribute MUST be supported if the Set-Job-Attributes operations is supported.  The Printer MUST reject
700  attempts to set any Job attributes that are not one of the values of this attribute, returning the 'client-error-
701  attributes-not-settable' status code (see section 9.1).

702  Standard keyword values are:

703      'none':  There are no settable Job attributes.
704      'xxx':   Where 'xxx' is any of the keyword attribute names in the list defined in section 12.1.1

705  6.3    printer-message-time (integer(MIN:MAX))

706  This READ-ONLY Printer Description attribute contains the time that the Printer's "printer-message-from-
707  operator" was changed by the operator using any operation where the client supplied the "printer-message-
708  from-operator" operation attribute (see section 5.1) or was explicitly set using the Set-Printer-Attributes
709  operation (see section 11.1).  This attribute allows the users to know when the "printer-message-from-
710  operator" attribute was last set.

711 The Printer sets the value of this attribute by copying the value of the Printer's "printer-up-time" attribute
712 (see [ipp-mod] section 4.3.14). If the Printer resets its "printer-up-time" attribute to 1 on power-up, then it
713 MUST change the value of the "printer-message-time" to 0 or a negative number as specified in [ipp-mod]
714 section 4.3.14.

715 Note: This attribute helps users better understand the context for the "printer-message-from-operator"
716 message.

717 6.4    printer-message-date-time (dateTime)

718 This READ-ONLY Printer Description attribute contains the date and time that the Printer's "printer-
719 message-from-operator" was changed by the operator using any operation where the client supplied the
720 "printer-message-from-operator" operation attribute (see section 5.1) or was explicitly set using the Set-
721 Printer-Attributes operation (see section 11.1). This attribute allows the users to know when the "printer-
722 message-from-operator" attribute was last set. This attribute MUST be supported if the Printer supports
723 both the "printer-message-from-operator" and the "printer-current-date-time" attributes.

724 Note: This attribute helps users better understand the context for the "printer-message-from-operator"
725 message.

726 6.5    printer-message-operation (type2 keyword)

727 This READ-ONLY Printer Description attribute contains the operation that was used to changed the
728 Printer's "printer-message-from-operator" by the operator using any operation where the client supplied the
729 "printer-message-from-operator" operation attribute (see section 5.1) or explicitly set using the Set-Printer-
730 Attributes operation (see section 11.1). This attribute allows the users to know which operation was used to
731 change the "printer-message-from-operator" attribute when it was last set.

732 Note: This attribute helps users better understand the context for the "printer-message-from-operator".

733 6.6    subordinate-printers-supported (1setOf uri)

734 This Printer attribute is REQUIRED if an implementation supports subordinate Printers (see section 4.2)
735 and contains the URIs of the immediate subordinate Printer object(s) associated with this Printer object.

736 The precise format of the subordinate Printer URIs is implementation dependent (see section 4.2.4).

737 If the Printer object does not have an associated output device, the value of the subordinate Printer object's
738 "printer-name" MAY be used to populate the Job object's  "output-device-assigned" attribute (see [ipp-mod]
739 section 4.3.13). The "output-device-assigned" Job attribute identifies the output device to which the Printer
740 object has assigned a job, for example, when a single Printer object is supporting Device fan-out or Printer
741 fan-out.

742 7    Additional Values for "printer-state-reasons"

743 This section defines additional values for the "printer-state-reasons" Printer Description attribute.

744 7.1    'deactivated'

745 'deactivated':  The Printer has been deactivated.  Only the Activate-Printer, Get-Job-Attributes, Get-
746        Jobs, Get-Printer-Attributes, and any other Get-Xxx operations that may be defined are accepted in
747        this state;  all other operations are rejected with the 'server-error-printer-is-deactivated.
748        ISSUE 04 - What new 'moving-to-xxx' and 'xxx' values do we need to support the new operations
749        defined in this document?

750 7.2    'moving-to-paused-all'

751 'moving-to-paused-all': Someone has paused the Printer object using the Pause-Printer-After-All-
752        Current-Jobs operation (see section 11.3.3) or other means, but the output-device(s) are taking an
753        appreciable time to stop.  Later, when all output has stopped, the "printer-state" becomes 'stopped',
754        and the 'paused' value replaces the 'moving-to-paused' value in the "printer-state-reasons" attribute.
755        This value MUST be supported, if the Pause-Printer-After-All-Current-Jobs operation is supported
756        and the implementation takes significant time to pause a device in certain circumstances.

757 7.3    'printer-deactivated'

758 'printer-deactivated':  Someone has issued a Deactivate-Printer operation for the Printer object (see
759        section 11.4.1) and the Printer is in the process of becoming deactivated or has become deactivated.
760        The Printer MUST reject all requests except Activate-Printer, queries (Get-Printer-Attributes, Get-
761        Job-Attributes, Get-Jobs, etc.), Send-Document, and Send-URI (so that partial job submission can
762        be completed - see section 11.2.1) and return the 'server-error-service-unavailable' status code.
763
764

765 8    Additional Values for "job-state-reasons"

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

767 8.1    'job-suspended'

768 'job-suspended':  The job has been suspended while processing using the Suspend-Current-Job
769        operation and other jobs can be processed on the Printer.  The Job can be resumed using the
770        Resume-Job operation which removes this value.
771

772   9    Additional status codes

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

774   9.1    'client-error-attributes-not-settable' (0x0413)

775   In a Set-Printer-Attributes or Set-Job-Attributes request, if the Printer object does not support one or more
776   attributes as settable, the Printer object MUST return this status code.  The Printer object MUST also return
777   in the Unsupported Attributes Group all the attributes and/or values supplied by the client that are not
778   settable.  See [ipp-mod] section 3.1.7.  For example, if the request indicates 'job-state', all implementations
779   MUST reject the request.  As another example, if the request indicates an attribute that is supported, but not
780   settable by this implementation, such as, say, "printer-name", the implementation rejects the request.

781   9.2    'server-error-printer-is-deactivated' (0x????)

782   The Printer has been deactivated using the Deactivate-Printer operation and is only accepting the Activate-
783   Printer (see section 11.5.1), Get-Job-Attributes, Get-Jobs, Get-Printer-Attributes, and any other Get-Xxxx
784   operations.  An operator can perform the Activate-Printer operation to allow the Printer to accept other
785   operations.

786   10    Additional out-of-band values

787   This section defines additional out-of-band values that can be used with any attribute in principle.  See the
788   beginning of [ipp-mod] section 4.1.

789   10.1   'not-settable' out of band value

790   The 'not-settable' out of band value is used by the IPP Printer in a Set-Job-Attributes or Set-Printer-
791   Attributes response to indicate an attribute that was supplied, is supported but is defined to be a READ-
792   ONLY attribute, is not settable in that implementation or as defined by the policy for that system, because it
793   is not in the "job-settable-attributes" or "printer-settable-attributes", respectively.

794   11    Definition of the Set 2 Printer operations

795   All Printer operations are directed at Printer objects.  A client MUST always supply the "printer-uri"
796   operation attribute in order to identify the correct target of the operation.  These descriptions assume all of
797   the common semantics of IPP/1.1 Model and Semantics document [ipp-mod] section 3.1.

798   The Set 2 Printer operations are summarized in Table 3:

<sub>799</sub>                           **Table 3 - Printer operation Operation-Id assignments**

| Operation Name | Operation-Id | Brief description |
|---|---|---|
| Set-Printer-Attributes | 0x?? | Sets attribute values of the target Printer object |
| Enable-Printer | 0x?? | Allows the target Printer to accept Job Creation operations |
| Disable-Printer | 0x?? | Prevents the target Printer from accepting Job Creation operations |
| Pause-Printer-After-All-Current-Jobs | 0x?? | Finishes processing all currently pending jobs.  Any new jobs are placed in the 'pending-held' state. |
| Deactivate-Printer | 0x?? | Puts the Printer into a read-only deactivated state. |
| Activate-Printer | 0x?? | Restores the Printer to normal activity |
| Restart-Printer | 0x?? | Restarts the target Printer and re-initializes the software |
| Shutdown-Printer | 0x?? | Shuts down the target Printer so that it cannot be restarted or queried |
| Startup-Printer | 0x?? | Starts up the instance of the Printer object |

<sub>800</sub> All of the operations in this document are OPTIONAL for an IPP object to support.  Unless the
<sub>801</sub> specification of an OPTIONAL operation requires support of another OPTIONAL operation, conforming
<sub>802</sub> implementations may support any combination of these operations.  Many of the operations come in pairs
<sub>803</sub> and so both are REQUIRED if either one is implemented.

804

805     11.1  Set-Printer-Attributes Operation

806     This OPTIONAL operation allows a client to set the values of the attributes of a Printer object.   In the
807     request, the client supplies the set of Printer attribute names and values that are to be set.  In the response,
808     the Printer object returns success or rejects the request with indications of which attribute or attributes
809     could not be set.

810     How the Printer object validates the client-supplied attributes in the Set-Printer-Attributes request is
811     implementation-dependent, since there are no corresponding Printer attributes that specify the allowed
812     values that may be set on the Printer object.

813     The Printer MUST accept this operation in any state, i.e., for any of the values of the Printer object's
814     "printer-state" attribute.

815     11.1.1  Settable and READ-ONLY Printer Description attributes

816     If the Printer supports the "printer-message-from-operator" Printer Description attribute (see [ipp-mod]
817     section 4.4.25) and the client explicitly supplies a new value for the "printer-message-from-operator" in the
818     request, then the Printer MUST set the "printer-message-from-operator" Printer attribute to this new value
819     and MUST also set the "printer-message-time", "printer-message-date-time", and "printer-message-
820     operation" attributes, if supported (see sections 6.3, 6.4, and 6.5).

821     If the Printer supports the Set-Printer-Attributes operation, then it SHOULD support setting of:

822             all Job Template Default ("xxx-default") attributes
823             all Job Template Supported ("xxx-supported") attributes
824             all Job Template Ready ("xxx-ready") attributes

825     that the implementation supports (see [ipp-mod] section 4.2 and extensions).

826     The following Printer Description attributes (see [ipp-mod] section 4.4) MUST NOT be settable, i.e., they
827     are READ-ONLY:

828             printer-state
829             printer-state-reasons
830             printer-state-message
831             printer-is-accepting-jobs - see Enable-Printer/Disable-Printer
832             queued-job-count
833             printer-up-time

834     The following Set2 Printer Description attributes are READ-ONLY:

835     printer-message-time - see Set-Printer-Attributes when setting "printer-message-from-operator"
836     printer-message-date-time - see Set-Printer-Attributes when setting "printer-message-from-operator"
837     printer-message-operation - see Set-Printer-Attributes when setting "printer-message-from-operator"

838  Note:  From now on, all extensions that define new object attributes will indicate whether or not they are
839  READ-ONLY, by including the "READ-ONLY" adjective in their descriptions.  If "READ-ONLY" is
840  omitted, it is assumed that the attribute MAY be settable by the appropriate Set-Xxx operation.

841  The remaining Printer Description attributes MAY be settable using the Set-Printer-Attributes operation,
842  depending on implementation.  If "xxx-supported" Printer Description attribute are settable, then they
843  MUST affect the behavior of the implementation.  If they are READ-ONLY then they reflect the
844  implementation and cannot be changed using the Set-Printer-Attributes operation.  Consider the following
845  examples:

846     For example, if the "operations-supported" Printer Description attribute (see [ipp-mod] section
847     4.4.15) is settable in a particular implementation, then changing its value with a Set-Printer-
848     Attributes operation MUST affect the operations that the implementation accepts or rejects.  Such
849     an implementation will need to be able to reject values for operations that it contains no code
850     support for.  If the "operations-supported" Printer Description attribute is not settable in a particular
851     implementation, then that implementation MUST reject an attempt to set it with a Set-Printer-
852     Attributes operation and return the 'client-error-attributes-not-settable' status code (see section 9.1).

853     As another example, if the "ipp-versions-supported" Printer Description attribute (see [ipp-mod]
854     section 4.4.14) is settable in a particular implementation, then changing its value with a Set-Printer-
855     Attributes operation MUST affect the protocol versions that are accepted or rejected.  Such an
856     implementation will need to be able to reject values for versions that it contains no code support for.

857  See the "factory-settings" operation attribute (see section 5.3) for a way to query the implementation
858  supported values using the Get-Printer-Attributes operation.

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

861  Most Printer attributes will require administrator privileges to set, such as "xxx-supported", while some will
862  require operator privileges only, such as "media-ready" and "printer-message-from-operator".  Which
863  attributes require which privileges depends on implementation and MAY depend on site policy.

864  11.1.2  Set-Printer-Attributes Request

865  The following sets of attributes are part of the Set-Printer-Attributes Request:

866  Group 1: Operation Attributes

867     Natural Language and Character Set:
868        The "attributes-charset" and "attributes-natural-language" attributes as described in [ipp-mod]
869        section 3.1.4.1.
870

871    Target:
872        The "printer-uri" (uri) operation attribute which is the target for this operation as described in [ipp-
873        mod] section 3.1.5.
874
875    Requesting User Name:
876        The "requesting-user-name" (name(MAX)) attribute SHOULD be supplied by the client as
877        described in [ipp-mod] section 8.3.
878
879    "document-format" (mimeMediaType):
880        The client SHOULD supply this attribute.  The Printer object MUST support this attribute.  This
881        attribute is useful for a client to select the Interpreter object to which the attribute modification
882        should be applied.  Each Printer object is modeled to contain one or more Interpreter objects.  Those
883        Printer attributes whose values vary from Interpreter to Interpreter, are modeled as Interpreter
884        objects, while those that do not are Printer object attributes.  Thus the target of a Get-Printer-
885        Attributes or Set-Printer-Attributes operation is either the Printer object or the Interpreter object
886        identified by the "document-format" operation attribute supplied by the client.  Except for Get-
887        Printer-Attributes and Set-Printer-Attributes, there are no other operations with the Interpreter object
888        as a target.  See [ipp-mod] section 3.2.5.1 "Get-Printer-Attributes Request".
889
890        If a client wants to set an attribute for all of the Interpreter objects to the same value, it can query the
891        Printer's "document-format-supported" Printer Description attribute and perform separate Set-
892        Printer-Attributes for each document format supported.
893
894        If the Printer object does not distinguish between different sets of supported values for each
895        different document format when validating jobs in the create and Validate-Job operations, it MUST
896        NOT distinguish between different document formats in the Set-Printer-Attributes operation.  If the
897        Printer object does distinguish between different sets of supported values for each different
898        document format specified by the client, this specialization applies only to the same Printer
899        attributes as the Get-Printer-Attributes operation (see [ipp-mod] section 3.2.5.1).
900
901        If the client omits this "document-format" operation attribute, the Printer object MUST respond as if
902        the attribute had been supplied with the value of the Printer object's "document-format-default"
903        attribute.  It is recommended that the client always supply a value for "document-format", since the
904        Printer object's "document-format-default" may be 'application/octet-stream', in which case the set
905        attributes and values are for the union of the document formats that the Printer can automatically
906        sense.  For more details, see the description of the 'mimeMediaType' attribute syntax in [ipp-mod]
907        section 4.1.9.
908
909        If the client supplies a value for the "document-format" Operation attribute that is not supported by
910        the Printer, i.e., is not among the values of the Printer object's "document-format-supported"
911        attribute, the Printer object MUST reject the operation and return the 'client-error-document-format-
912        not-supported' status code.
913
914    Group 2: Printer Attributes

915   The client MUST supply a set of Printer attributes as defined in [ipp-mod] section 4.2 Job Template
916   Attributes ("xxx-default", "xxx-supported", and "xxx-ready" attributes), section 4.4 Printer
917   Description Attributes, and any attribute extensions supported by the Printer.  Each Printer attribute
918   supplied in Group 2 replaces the value(s) of the corresponding Printer attribute on the target Printer
919   object.  If a Printer object attribute had not been configured yet and so had the 'no-value' out-of-band
920   value (see [ipp-mod] 4.1), the supplied value(s) replace the 'no-value' value.  For attributes that can
921   have multiple values (1setOf), all values supplied by the client replace all values of the
922   corresponding Printer object attribute.

923

924   11.1.3  Set-Printer-Attributes Response

925   The Printer object returns the following sets of attributes as part of the Get-Printer-Attributes Response:

926   Group 1: Operation Attributes

927   Status Message:
928       In addition to the REQUIRED status code returned in every response, the response OPTIONALLY
929       includes a "status-message" (text(255)) and/or a "detailed-status-message" (text(MAX)) operation
930       attribute as described in [ipp-mod] sections 13 and 3.1.6.

931

932   Natural Language and Character Set:
933       The "attributes-charset" and "attributes-natural-language" attributes as described in [ipp-mod]
934       section 3.1.4.2.

935

936   Group 2: Unsupported Attributes

937       See [ipp-mod] section 3.1.7 for details on returning Unsupported Attributes.

938

939       In the case of attributes that are supported, but are not settable by the implementation, i.e., are not
940       among the values of the Printer's "printer-settable-attributes" Printer Description attribute (see
941       section 6.1), the Printer object returns the client-supplied attribute(s) with a substituted out-of-band
942       value of 'not-settable' (see section 10.1).  This value's syntax type is "out-of-band" and its encoding
943       is defined by special rules for "out-of-band" values in the "Encoding and Transport" document [IPP-
944       PRO].  Its value indicates that the attribute is supported, but is not settable.

945

## 11.2  The Disable and Enable Printer Operations

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

These operations allow the operator to control whether or not the Printer will accept new Job Creation (Print-Job, Print-URI, and Create-Job) operations.  These operations have no other effect on the Printer, so that the Printer continues to accept all other operations and continues to schedule and process jobs normally.  In other words, these operation control the "input of new jobs" to the IPP Printer while the Pause and Resume operations (see section 11.3) independently control the "output of new jobs" from the IPP Printer to the output device.

The Disable and Enable Printer operations MUST NOT affect the submission of jobs using other job submission protocols to the associated output device; the Disable and Enable Device operations (see [ipp-set3]) are intended to stop the acceptance of all jobs by the associated output device(s).

### 11.2.1  Disable-Printer Operation

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

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

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

> The Disable-Printer Request and Disable-Printer Response have the same attribute groups and attributes as the Pause-Printer operation (see [ipp-mod] sections 3.2.7.1 and 3.2.7.2), including the new "printer-message-from-operator" operation attribute (see section 5.1).

976

977    11.2.2  Enable-Printer Operation

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

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

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

987                          The Enable-Printer Request and Enable-Printer Response have the same attribute groups and
988                          attributes as the Resume-Printer operation (see [ipp-mod] sections 3.2.8.1
989                          and 3.2.8.2), including the new "printer-message-from-operator"
990                          operation attribute (see section 5.1).

991    11.3   The Pause and Resume Printer operations

992    This section clarifies the OPTIONAL IPP/1.1 Pause-Printer (to be Pause-Printer-After-Current-Job) and
993    Resume-Printer (see [ipp-mod] sections 3.2.7 and 3.2.8) and defines the OPTIONAL Pause-Printer-After-
994    All-Current-Jobs operations.  These operations affect the scheduling of IPP jobs.  If either of the Pause
995    operations are supported, then the Resume-Printer operation MUST be supported.

996    These operations allow the operator to control whether or not the Printer will send new IPP jobs to the
997    associated output device(s) that the IPP Printer object represents.  These operations have no other effect on
998    the Printer, so that the Printer continues to accept all operations.  In other words, these operation control the
999    "output of new jobs" to the output device(s) while the Disable and Enable Printer operations (see section
1000   11.2) independently control the "input of new jobs" to the IPP Printer.

1001   The Pause and Resume Printer operations MUST NOT affect jobs that were submitted using other job
1002   submission protocols to the associated output device; the Pause and Resume Device operations (see [ipp-
1003   set3]) are intended to stop the acceptance of all jobs by the associated output device(s).

1004   11.3.1  IPP/1.1 Pause-Printer operation clarified to be Pause-Printer-After-Current-Job

1005   IPP/1.1 defines the Pause-Printer operation (see [ipp-mod] section 3.2.7) with a number of implementation
1006   options:

1007                          This OPTIONAL operation allows a client to stop the Printer object from scheduling jobs on all its
1008                          devices.  Depending on implementation, the Pause-Printer operation MAY also stop the Printer
1009                          from processing the current job or jobs.  Any job that is currently being printed is either stopped as

1010    soon as the implementation permits or is completed, depending on implementation.  The Printer
1011    object MUST still accept create operations to create new jobs, but MUST prevent any jobs from
1012    entering the 'processing' state.

1013    If the Pause-Printer operation is supported, then the Resume-Printer operation MUST be supported,
1014    and vice-versa.

1015    The IPP Printer stops the current job(s) on its device(s) that were in the 'processing' or 'processing-
1016    stopped' states as soon as the implementation permits.  If the implementation will take appreciable
1017    time to stop, the IPP Printer adds the 'moving-to-paused' value to the Printer object's "printer-state-
1018    reasons" attribute (see section [ipp-mod] 4.4.12).  When the device(s) have all stopped, the IPP
1019    Printer transitions the Printer object to the 'stopped' state, removes the 'moving-to-paused' value, if
1020    present, and adds the 'paused' value (see [ipp-mod] 4.4.12) to the Printer object's "printer-state-
1021    reasons" attribute.

1022    The Set2 and Set3 documents define distinct operations in order to disambiguate the Pause-Printer
1023    operation as shown in Table 4.  Set2 Printer operations affect only Jobs submitted using IPP, while Set3
1024    Device operations affect all jobs no matter what job submission protocol was used to submit them to the
1025    output device.

1026    **Table 4 - Set2 and Set3 Pause and Resume operations**

| Set2 and Set3 Pause and Resume Printer and Device operations | Description |
|---|---|
| Pause-Printer-After-Current-Job | Stops the IPP Printer from sending new IPP Jobs to the output device(s) after the current jobs finish |
| Pause-Printer-After-All-Current-Jobs | Stops the IPP Printer from sending IPP Jobs that are accepted subsequently to the output device(s).  All currently pending jobs are scheduled and printed. |
| Resume-Printer | Starts the IPP Printer sending IPP Jobs to the output device again. |
| Pause-Device-Now | Stops the output device immediately from producing marked media (current page, sheet, depending on implementation) for any job. Like the Pause button on the output device. |
| Pause-Device-After-Current-Copy | Stops the output device from producing marked media after the current copy of the current job. |
| Pause-Device-After-Current-Job | Stops the output device from producing marked media after the current job. |
| Resume-Device | Starts the output device processing any jobs again. |

1027    ISSUE 05 - Should Pause-Printer-After-Current-Job be a new operation with a new operation-id code or be
1028    a clarification of the existing IPP/1.1 Pause-Printer operation and use its operation-id?  Or should the
1029    Pause-Device-Now operation be a new operation-id code or be the clarification of the existing IPP/1.1
1030    Pause-Printer operation and use its operation-id?  Or should both Pause-Printer-After-Current-Job and

1031  Pause-Device-Now be new operation-id codes and leave the IPP/1.1 Pause-Printer with its current
1032  ambiguous (implementer free-for-all) semantics?

1033  11.3.2  Pause-Printer-After-Current-Job

1034  This OPTIONAL operation allows a client to stop the Printer object from starting to send IPP jobs to any of
1035  its output devices or subordinate Printers.  If the IPP Printer is in the middle of sending an IPP job to an
1036  output device or subordinate Printer, the IPP Printer MUST complete sending that Job.  However, after
1037  receiving this operation, the IPP Printer MUST NOT start to send any additional IPP jobs to any of its
1038  output devices or subordinate Printers.  In addition, after having received this operation, the IPP Printer
1039  MUST NOT start processing any more jobs, so additional jobs MUST NOT enter the 'processing' state.

1040  If the IPP Printer is not sending an IPP Job to the output device or subordinate Printer (whether or not the
1041  output device or subordinate Printer is busy processing any jobs), the IPP Printer object transitions
1042  immediately to the 'stopped' state by setting its "printer-state" attribute to 'stopped', removing the 'moving-
1043  to-paused' value, if present, from its "printer-state-reasons" attribute, and adding the 'paused' value to its
1044  "printer-state-reasons" attribute.

1045  If the implementation will take appreciable time to complete sending an IPP job that it has started sending
1046  to an output device or subordinate Printer, the IPP Printer adds the 'moving-to-paused' value to the Printer
1047  object's "printer-state-reasons" attribute (see section [ipp-mod] 4.4.12).  When the IPP Printer has
1048  completed sending IPP jobs that it was in the process of sending, the Printer object transitions to the
1049  'stopped' state by setting its "printer-state" attribute to 'stopped', removing the 'moving-to-paused' value, if
1050  present, from its "printer-state-reasons" attribute, and adding the 'paused' value to its "printer-state-reasons"
1051  attribute.

1052  This operation MUST NOT affect the acceptance of Job Creation requests (see Disable-Printer section
1053  11.2.1).

1054  For any jobs that are 'pending' or 'pending-held', the 'printer-stopped' value of the jobs' "job-state-reasons"
1055  attribute also applies.  However, the IPP Printer NEED NOT update those jobs' "job-state-reasons"
1056  attributes and only need return the 'printer-stopped' value when those jobs are queried using the Get-Job-
1057  Attributes or Get-Jobs operations (so-called "lazy evaluation").

1058  The IPP Printer MUST accept the request in any state and transition the Printer to the indicated new
1059  "printer-state" before returning as follows:

| Current "printer-state" | New "printer-state" | "printer-state-reasons" | IPP Printer's response status code and action: |
|---|---|---|---|
| 'idle' | 'stopped' | 'paused' | 'successful-ok' |
| 'processing' | 'processing' | 'moving-to-paused' | 'successful-ok'; Later, when the IPP Printer has finished sending IPP jobs, the "printer-state" becomes 'stopped', and the 'paused' value replaces the 'moving-to-paused' value in the "printer-state-reasons" attribute |
| 'processing' | 'stopped' | 'paused' | 'successful-ok'; the IPP Printer wasn't in the middle of sending an IPP job to the output device |
| 'stopped' | 'stopped' | 'paused' | 'successful-ok' |

1060  ISSUE 06 - Or should the Printer's "printer-state" attribute be independent of the Pause Printer operations
1061  so that the Pause Printer operations don't set the "printer-state" to 'stopped', i.e., the "printer-state" tries to
1062  reflect 'idle', 'processing', or 'stopped' of the output device(s) as best it can independent of whether the IPP
1063  Printer object is paused or not?

1064  *Access Rights:* The authenticated user (see [ipp-mod] section 8.3) performing this operation must be an
1065  operator or administrator of the Printer object (see [ipp-mod] Sections 1 and 8.5).

1066  The Pause-Printer-After-Current-Job Request and Pause-Printer-After-Current-Job Response have the same
1067  attribute groups and attributes as the Pause-Printer operation (see [ipp-mod] sections 3.2.7.1 and 3.2.7.2),
1068  including the new "printer-message-from-operator" operation attribute (see section 5.1).

1069  11.3.3  Pause-Printer-After-All-Current-Jobs

1070  ISSUE 07:  Would a better name for Pause-Printer-After-All-Current-Jobs be Hold-Future-Jobs?
1071  Unfortunately, unlike Pause-Printer-After-All-Current-Jobs which gets to 'paused', the state transition
1072  would just be to 'idle' when all of the current jobs have completed?  But what operation would undo this
1073  condition?  Do-Not-Hold-Future-Jobs, Release-All-Jobs?  Or how about having a single Schedule-Jobs
1074  operation that has a parameter that says whether to hold all future jobs or not?

1075  This OPTIONAL operation allows a client to complete the current 'pending' IPP Jobs but not start
1076  processing any subsequently received IPP Jobs.  If the IPP Printer is in the middle of sending an IPP job to
1077  an output device or subordinate Printer, the IPP Printer MUST complete sending that Job.  Furthermore, the
1078  IPP Printer MUST send all of the current 'pending' IPP Jobs to the output device(s) or subordinate IPP
1079  Printer object(s).  Any subsequently received Job Creation operations will cause the IPP Printer to put the
1080  Job into the 'pending-held' state until the Printer is resumed using the Resume-Printer operation.

1081  If the IPP Printer has no 'pending' IPP Jobs and is not sending an IPP Job to an output device or subordinate
1082  Printer (whether or not the output device or subordinate Printer is busy processing any jobs), the IPP Printer
1083  object transitions immediately to the 'stopped' state by setting its "printer-state" attribute to 'stopped',
1084  removing the 'moving-to-paused-all' value, if present, from its "printer-state-reasons" attribute, and adding
1085  the 'paused' value to its "printer-state-reasons" attribute.

1086   ISSUE 08: Any better name than 'moving-to-paused-all' Printer state reason to distinguish Pause-Printer-
1087   After-All-Current-Jobs from Pause-Printer-After-Current-Job which uses 'moving-to-paused'?

1088   If the IPP Printer has 'pending' jobs or the implementation will take appreciable time to complete sending
1089   an IPP job that it has started sending to an output device or subordinate Printer, the IPP Printer adds the
1090   'moving-to-paused-all' value to the Printer object's "printer-state-reasons" attribute (see section [ipp-mod]
1091   4.4.12). When the IPP Printer has completed sending IPP jobs that it was in the process of sending and all
1092   its 'pending' jobs, the Printer object transitions to the 'stopped' state by setting its "printer-state" attribute to
1093   'stopped', removing the 'moving-to-paused-all' value, if present, from its "printer-state-reasons" attribute,
1094   and adding the 'paused' value to its "printer-state-reasons" attribute.

1095   This operation MUST NOT affect the acceptance of Job Creation requests (see Disable-Printer section
1096   11.2.1), except to put the Jobs into the 'pending-held' state, instead of the 'pending' or 'processing' state.

1097   For any jobs that are 'pending' or 'pending-held', the 'printer-stopped' value of the jobs' "job-state-reasons"
1098   attribute also applies. However, the IPP Printer NEED NOT update those jobs' "job-state-reasons"
1099   attributes and only need return the 'printer-stopped' value when those jobs are queried using the Get-Job-
1100   Attributes or Get-Jobs operations (so-called "lazy evaluation").

1101   The IPP Printer MUST accept the request in any state and transition the Printer to the indicated new
1102   "printer-state" before returning as follows:

| Current "printer-state" | New "printer-state" | "printer-state-reasons" | IPP Printer's response status code and action: |
|---|---|---|---|
| 'idle' | 'stopped' | 'paused' | 'successful-ok' |
| 'processing' | 'processing' | 'paused' 'moving-to-paused-all' | 'successful-ok'; Later, when the IPP Printer has finished sending IPP jobs, the "printer-state" becomes 'stopped', and the 'paused' value replaces the 'moving-to-paused-all' value in the "printer-state-reasons" attribute |
| 'processing' | 'stopped' | 'paused' | 'successful-ok'; the IPP Printer didn't have any 'pending' jobs and wasn't in the middle of sending an IPP job to the output device |
| 'stopped' | 'stopped' | 'paused' | 'successful-ok' |

1103   ISSUE 09: Or should the Printer's "printer-state" attribute be independent of the Pause Printer operations
1104   so that the Pause Printer operations don't set the "printer-state" to 'stopped', i.e., the "printer-state" tries to
1105   reflect 'idle', 'processing', or 'stopped' of the output device(s) as best it can independent of whether the IPP
1106   Printer object is paused or not?

1107   *Access Rights:* The authenticated user (see [ipp-mod] section 8.3) performing this operation must be an
1108   operator or administrator of the Printer object (see [ipp-mod] Sections 1 and 8.5).

1109   The Pause-Printer-After-All-Current-Jobs Request and Pause-Printer-After-All-Current-Jobs Response
1110   have the same attribute groups and attributes as the Pause-Printer operation (see [ipp-mod] sections 3.2.7.1
1111   and 3.2.7.2), including the new "printer-message-from-operator" operation attribute (see section 5.1).

1112    11.4  Deactivate and Activate Printer operations

1113    This section defines the OPTIONAL Deactivate-Printer and Activate-Printer operations that stop and start
1114    the IPP Printer object from accepting all requests except queries and performing work.  If either of these
1115    operations are supported, both MUST be supported.

1116    These operations allow the operator to put the Printer into a dormant read-only condition and to take it out
1117    of such a condition.  These operations are a combination of the Deactivate and Pause operations, plus
1118    preventing the acceptance of any other requests, except queries.

1119    The Deactivate and Activate Printer operations MUST NOT affect the submission of jobs using other job
1120    submission protocols to the associated output device; the Deactivate and Activate Device operations (see
1121    [ipp-set3]) are intended to stop the associated output device(s) from performing work and accepting
1122    operations, except query operations.

1123    11.4.1  Deactivate-Printer operation

1124    This OPTIONAL operation allows a client to stop the Printer object from starting to send IPP jobs to any of
1125    its output devices or subordinate Printers (Pause-Printer-After-Current-Job) and stop the Printer object from
1126    accepting any, but query requests.  The Printer performs a Disable-Printer and a Pause-Printer-After-
1127    Current-Job operation immediately, including use of all of the "printer-state-reasons" if these two
1128    operations cannot be completed immediately.  In addition, the Printer MUST immediately reject all
1129    requests, except Activate-Printer, queries (Get-Printer-Attributes, Get-Job-Attributes, Get-Jobs, etc.), Send-
1130    Document, and Send-URI (so that partial job submission can be completed - see section 11.2.1) and return
1131    the 'server-error-service-unavailable' status code.

1132    The IPP Printer MUST accept the request in any state.  Immediately, the Printer MUST set the 'printer-
1133    deactivated' value in its "printer-state-reasons" attribute.

1134    *Access Rights:* The authenticated user (see [ipp-mod] section 8.3) performing this operation must be an
1135    operator or administrator of the Printer object (see [ipp-mod] Sections 1 and 8.5).

1136    The Deactivate-Printer Request and Deactivate-Printer Response have the same attribute groups and
1137    attributes as the Pause-Printer operation (see [ipp-mod] sections 3.2.7.1 and 3.2.7.2), including the new
1138    "printer-message-from-operator" operation attribute (see section 5.1).

1139    11.4.2  Activate-Printer operation

1140    This OPTIONAL operation allows a client to undo the effects of the Deactivate-Printer, i.e., allow the
1141    Printer object to start sending IPP jobs to any of its output devices or subordinate Printers (Pause-Printer-
1142    After-Current-Job) and start the Printer object from accepting any requests.  The Printer performs an
1143    Enable-Printer and a Resume-Printer operation immediately.  In addition, the Printer MUST immediately
1144    start accepting all requests.

1145   The IPP Printer MUST accept the request in any state.  Immediately, the Printer MUST immediately
1146   remove the 'printer-deactivated' value from its "printer-state-reasons" attribute.

1147   *Access Rights:* The authenticated user (see [ipp-mod] section 8.3) performing this operation must be an
1148   operator or administrator of the Printer object (see [ipp-mod] Sections 1 and 8.5).

1149   The Activate-Printer Request and Activate-Printer Response have the same attribute groups and attributes
1150   as the Pause-Printer operation (see [ipp-mod] sections 3.2.7.1 and 3.2.7.2), including the new "printer-
1151   message-from-operator" operation attribute (see section 5.1).

1152   11.5   Restart-Printer, Shutdown-Printer, and Startup-Printer operations

1153   This section defines the OPTIONAL Restart-Printer, Shutdown-Printer, and Startup-Printer operations that
1154   initialize, shutdown, and startup the Printer object, respectively.  Each of these operations is OPTIONAL
1155   and any combination MAY be supported.

1156   The Restart-Printer, Shutdown-Printer, and Startup-Printer operations MUST NOT affect the submission of
1157   jobs using other job submission protocols to the associated output device; the Reset-Device and Power-Off-
1158   Device operations (see [ipp-set3]) are intended to initialize or power off the associated output device(s).

1159   11.5.1   Restart-Printer operation

1160   This OPTIONAL operation allows a client to restart a Printer object whose operation is in need of
1161   initialization because of incorrect or erratic behavior, i.e., perform the effect of a software re-boot.  The
1162   implementation MUST attempt to save any information about Jobs and the Printer object before re-
1163   initializing.  However, this operation MAY have drastic consequences on the running system, so the
1164   operator should first try the Deactivate-Printer to minimize the effect on the current state of the system.
1165   The effects of previous Disable-Printer, Pause Printer, and Deactivate-Printer operations are lost.

1166   The IPP Printer MUST accept the request in any state.  The Printer object MUST initialize its Printer's
1167   "printer-state" to 'idle', remove the state reasons from its "printer-state-reasons" attribute, and its "printer-is-
1168   accepting-jobs" attribute to 'true'.

1169   *Access Rights:* The authenticated user (see [ipp-mod] section 8.3) performing this operation must be an
1170   operator or administrator of the Printer object (see [ipp-mod] Sections 1 and 8.5).

1171   The Restart-Printer Request and Restart-Printer Response have the same attribute groups and attributes as
1172   the Pause-Printer operation (see [ipp-mod] sections 3.2.8.1 and 3.2.8.2), including the new "printer-
1173   message-from-operator" operation attribute (see section 5.1).

1174

1175   11.5.2  Shutdown-Printer Operation

1176   This OPTIONAL operation allows a client to shutdown a Printer, i.e., stop processing jobs and make the
1177   Printer object no longer available for any operations using the IPP protocol.  There is no way to bring the
1178   instance of the Printer object back to being used, except for the Startup-Printer (see section 11.5.3) which
1179   starts up a new instance of the Printer object for hosted implementations.  The purpose of Shutdown-Printer
1180   is to shutdown the Printer for an extended period, not to reset the device(s) or modify a Printer attribute.
1181   See Restart-Printer (section 11.5.1), Startup-Printer (section ), and Reset-Device [ipp-set3] for the way to
1182   initialize the software or reset the output device(s).  See the Disable-Printer operation (section 11.2) for a
1183   way for the client to stop the Printer from accepting Job Creation requests without stopping processing or
1184   shutting down.

1185   The Printer adds the 'shutdown' value (see [ipp-mod] section 4.4.11) immediately to its "printer-state-
1186   reasons" Printer Description attribute and performs a Deactivate-Printer operation (see section 11.4.1).

1187   The Printer object MUST accept this operation in any state and transition the Printer object through the
1188   "printer-states" and "printer-state-reasons" defined for the Deactivate-Printer operation until the activity is
1189   completed and the Printer object disappears..

1190   *Access Rights:* The authenticated user (see [ipp-mod] section 8.3) performing this operation must be an
1191   operator or administrator of the Printer object (see [ipp-mod] Sections 1 and 8.5).

1192          The Shutdown-Printer Request and Shutdown-Printer Response have the same attribute groups and
1193          attributes as the Pause-Printer operation (see [ipp-mod] sections 3.2.7.1 and 3.2.7.2), including the
1194          new "printer-message-from-operator" operation attribute (see section 5.1).

1195   11.5.3  Startup-Printer operation

1196   This OPTIONAL operation allows a client to startup an instance of a Printer object, provided that there isn't
1197   already one instantiated.  The purpose of Startup-Printer is to allow a hosted implementation of the IPP
1198   Printer object to be started after the host is available (by means outside this document).  See Restart-Printer
1199   (section 11.5.1) and Reset-Device [ipp-set3] for the way to initialize the software or reset the output
1200   device(s) when the IPP Printer object has already been instantiated.

1201   The host MUST accept this operation only when the Printer object has not been instantiated.  If the Printer
1202   object already exists, the host must return the 'client-error-not-possible' status code.

1203   The result of this operation MUST be with the Printer object's "printer-state" set to 'idle', the state reasons
1204   removed from its "printer-state-reasons" attribute, and its "printer-is-accepting-jobs" attribute set to 'true'.

1205   *Access Rights:* The authenticated user (see [ipp-mod] section 8.3) performing this operation must be an
1206   operator or administrator of the Printer object (see [ipp-mod] Sections 1 and 8.5).

1207   The Shutdown-Printer Request and Shutdown-Printer Response have the same attribute groups and
1208   attributes as the Pause-Printer operation (see [ipp-mod] sections 3.2.7.1 and 3.2.7.2), including the new
1209   "printer-message-from-operator" operation attribute (see section 5.1).

1210

1211    12   Definition of the Set2 Job Operations

1212    All Job operations are directed at Job objects.  A client MUST always supply some means of identifying the
1213    Job object in order to identify the correct target of the operation.  That job identification MAY either be a
1214    single Job URI or a combination of a Printer URI with a Job ID.  The IPP object implementation MUST
1215    support both forms of identification for every job.

1216    The Set2 Job Operations are summarized in Table 5:

1217    **Table 5 - Job operation Operation-Id assignments**

| Operation Name | Operation-Id | Brief description |
|---|---|---|
| Set-Job-Attributes | 0x?? | Sets attribute values of the target Job object |
| Reprocess-Job | 0x?? | Creates a copy of a completed target job with a new Job ID and processes it |
| Cancel-Current-Job | 0x?? | Cancels the current job on the target Printer or the specified job if it is the current job |
| Suspend-Current-Job | 0x?? | 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 | 0x?? | Resume the paused target job |
| Promote-Job | 0x?? | Promote the pending target job to be next after the current job(s) complete |

1218

1219    12.1  Set-Job-Attributes

1220    This OPTIONAL operation allows a client to set the values of the attributes of a Job object.   In the request,
1221    the client supplies the set of Job attribute names and values that are to be set.  In the response, the IPP
1222    object returns success or rejects the request with indications of which attribute or attributes could not be set.

1223    This operation is almost identical to the Set-Printer-Attributes operation (see section 11.1).  The only
1224    differences are that the Set-Job-Attributes operation is directed at a Job object rather than a Printer object,
1225    there is no "document-format" operation attribute used when setting a Job object, and the validation is the
1226    same as the create job operations, i.e., depends on the "xxx-supported" Printer Description attributes.

1227    The validation of the Set-Job-Attributes request is performed as if the job had been submitted originally
1228    with the new values and with "ipp-attribute-fidelity" set to 'true', i.e., all modified attributes MUST be
1229    supported along with the attributes not modified.  If such a create job operation would have been accepted,
1230    then the Set-Job-Attributes MUST be accepted.  If such a create job operation would have been rejected,
1231    then the Set-Job-Attributes MUST be rejected and the Job MUST be unchanged.

1232   The IPP object MUST accept or reject the request based on the job's current state and transition the job to
1233   the indicated new state as follows:

| Current "job-state" | New "job-state" | IPP object's response status code and action: |
|---|---|---|
| 'pending' | 'pending' | 'successful-ok' |
| 'pending' | 'pending-held' | 'successful-ok' - needed resources are not ready |
| 'pending-held' | 'pending-held' | 'successful-ok' |
| 'pending-held' | 'pending' | 'successful-ok' - needed resources are ready |
| 'processing' | 'processing' | 'successful-ok'  or 'client-error-not-possible' depending on the attributes being set, whether the job has started marking media, and/or implementation |
| 'processing-stopped' | 'processing-stopped' | 'successful-ok'  or 'client-error-not-possible' depending on the attributes being set, whether the job has started marking media, and/or implementation |
| 'completed' | 'completed' | 'client-error-not-possible' |
| 'canceled' | 'canceled' | 'client-error-not-possible' |
| 'aborted' | 'aborted' | 'client-error-not-possible' |

1234   12.1.1  Settable and READ-ONLY Job Description attributes

1235   If the Printer supports the "job-message-from-operator" Job Description attribute (see [ipp-mod] section
1236   4.3.16) and the client explicitly supplies a new value for the "job-message-from-operator" in the request,
1237   then the Printer MUST set the "job-message-from-operator" Job attribute to this new value.

1238   If the Printer supports the Set-Job-Attributes operation, then it SHOULD support setting of:

1239        all Job Template ("xxx") attributes (see [ipp-mod] section 4.2 and extensions)

1240   that the implementation supports.

1241   The following Job Description attributes (see [ipp-mod] section 4.3) MUST NOT be settable, i.e., they are
1242   READ-ONLY:

1243            job-uri
1244            job-id
1245            job-printer-uri
1246            job-more-info
1247            job-originating-user-name - set in create operation
1248            job-state
1249            job-state-reasons
1250            job-state-message
1251            number-of-documents
1252            output-device-assigned
1253            time-at-creation
1254            time-at-processing
1255            time-at-completed
1256            job-printer-up-time
1257            date-time-at-creation
1258            date-time-at-processing
1259            date-time-at-completed
1260            number-of-intervening-jobs
1261            job-k-octets
1262            job-k-octets-processed
1263            job-impressions-completed
1264            job-media-sheets-completed
1265            attributes-charset - set in Job Creation operation
1266            attributes-natural-language - set in Job Creation operation

1267    The following Set2 Job Description attributes are READ-ONLY:

1268            original-requesting-user-name - set in Job Creation operation

1269    Note:  From now on, all extensions that define new object attributes will indicate whether or not they are
1270    READ-ONLY, by including the "READ-ONLY" adjective in their descriptions.  If "READ-ONLY" is
1271    omitted, it is assumed that the attribute MAY be settable by the appropriate Set-Xxx operation.

1272    The remaining Job Description attributes MAY be settable using the Set-Job-Attributes operation,
1273    depending on implementation.

1274    *Access Rights:* The authenticated user (see [ipp-mod] section 8.3) performing this operation must either be
1275    the job owner (as determined in the Job Creation operation) or an operator or administrator of the Printer
1276    object (see [ipp-mod] Sections 1 and 8.5).

1277    12.1.2  Set-Job-Attributes Request

1278    The following sets of attributes are part of the Set-Job-Attributes Request:

1279    Group 1: Operation Attributes

1280        Natural Language and Character Set:
1281            The "attributes-charset" and "attributes-natural-language" attributes as described in [ipp-mod]
1282            section 3.1.4.1.
1283

1284    Target:
1285        Either (1) the "printer-uri" (uri) plus "job-id" (integer(1:MAX)) or (2) the "job-uri" (uri) operation
1286        attribute(s) which define the target for this operation as described in [ipp-mod] section 3.1.5.
1287
1288    Requesting User Name:
1289        The "requesting-user-name" (name(MAX)) attribute SHOULD be supplied by the client as
1290        described in [ipp-mod] section 8.3.
1291
1292

1293    Group 2: Job Attributes

1294        The client MUST supply a set of Job attributes as defined in [ipp-mod] section 4.2 Job Template
1295        Attributes ("xxx" attributes), section 4.3 Job Description Attributes, and any attribute extensions
1296        supported by the Printer.  Each Job attribute supplied in Group 2 replaces the value(s) of the
1297        corresponding Job attribute on the target Job object.  For attributes that can have multiple values
1298        (1setOf), all values supplied by the client replace all values of the corresponding Job object
1299        attribute.
1300

1301    12.1.3  Set-Job-Attributes Response

1302    The Printer object returns the following sets of attributes as part of the Set-Job-Attributes Response:

1303    Group 1: Operation Attributes

1304    Status Message:
1305        In addition to the REQUIRED status code returned in every response, the response OPTIONALLY
1306        includes a "status-message" (text(255)) and/or a "detailed-status-message" (text(MAX)) operation
1307        attribute as described in [ipp-mod] sections 13 and 3.1.6.
1308
1309    Natural Language and Character Set:
1310        The "attributes-charset" and "attributes-natural-language" attributes as described in [ipp-mod]
1311        section 3.1.4.2.
1312

1313    Group 2: Unsupported Attributes

1314        See [ipp-mod] section 3.1.7 for details on returning Unsupported Attributes.
1315
1316        In the case of attributes that are supported, but are not settable by the implementation, i.e., are not
1317        among the values of the Printer's "job-settable-attributes" Printer Description attribute (see section
1318        6.1), the Printer object returns the client-supplied attribute(s) with a substituted out-of-band value of
1319        'not-settable' (see section 10.1).  This value's syntax type is "out-of-band" and its encoding is defined
1320        by special rules for "out-of-band" values in the "Encoding and Transport" document [IPP-PRO].  Its
1321        value indicates that the attribute is supported, but is not settable.

1322

## 12.2  Reprocess-Job Operation

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

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

1338

1339    12.3   Cancel-Current-Job Operation

1340    This OPTIONAL operation allows a client to cancel the current job on the target Printer or the specified job
1341    if it is the current job on the Printer.  See [ipp-mod] section 3.3.3 for the semantics of canceling a job.
1342    Since a Job might already be marking by the time a Cancel-Current-Job is received, some media sheet
1343    pages might be printed before the job is actually terminated.

1344    ISSUE 10:  Should Cancel-Current-Job really be moved to Set3 as a Device operation, i.e., Cancel-Current-
1345    Device-Job or do we need both a Printer and a Device operation that cancels the current job?

1346    If the client does not supply a "job-id" operation attribute, the Printer MUST accept the request and cancel
1347    the current job if there is a current job in the 'processing' or 'processing-stopped' state; otherwise, it MUST
1348    reject the request and return the 'client-error-not-possible' status code.  If more than one job is in the
1349    'processing' or 'processing-stopped' states, the one that is marking is canceled and the others are unaffected.

1350    Warning:  On a shared printer, there is a race condition.  Between the time that a user issues this operation
1351    and its acceptance, the current job might change to a different job.  If the user or operator is authenticated to
1352    cancel the new job, the wrong job is canceled.  To prevent this race from canceling the wrong job, the client
1353    MAY supply the "job-id" operation attribute which is checked against the current job's job-id.  If the job
1354    identified by the "job-id" attribute is not the current job on the Printer, i.e., is not in the 'processing' or
1355    'processing-stopped' states, the Printer MUST reject this operation and return the 'client-error-not-possible'
1356    status code.  Otherwise, the Printer cancels the specified job.

1357    *Access Rights:* The authenticated user (see [ipp-mod] section 8.3) performing this operation must either be
1358    the job owner (as determined in the Job Creation operation) or an operator or administrator of the Printer
1359    object (see [ipp-mod] Sections 1 and 8.5).

1360    The Cancel-Current-Job Request and Cancel-Current-Job Response have the same attribute groups and
1361    attributes as the Resume-Printer operation (see [ipp-mod] section 3.2.8), including the new "job-message-
1362    from-operator" operation attribute (see section 5.2), with the addition of the following Group 1 Operation
1363    attributes in the request:

1364        "job-id" (integer(1:MAX)):

1365            The client OPTIONALLY supplies this Operation attribute in order to verify that the identified job
1366            is still the current job on the target Printer object.  The IPP object MUST supports this operation
1367            attribute, if it supports this operation.

1368

12.4  Suspend and Resume Job operations

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

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

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

12.4.1  Suspend-Current-Job operation

This OPTIONAL operation allows a client to stop the current job on the target Printer or the specified job if it is the current job on the Printer, and allow other jobs to be processed instead.  The Printer moves the current job or the target job to the 'processing-stopped' state and sets the 'job-suspended' value (see section 8.1) in the job's "job-state-reasons" attribute and processes other jobs.

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

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

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

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

The Suspend-Current-Job Request and Suspend-Current-Job Response have the same attribute groups and attributes as the Pause-Printer operation (see [ipp-mod] section 3.2.8 ), including the new "job-message-from-operator" operation attribute (see section 5.2), with the addition of the following Group 1 Operation attributes in the request:

1402    "job-id" (integer(1:MAX)):

1403        The client OPTIONALLY supplies this Operation attribute in order to verify that the identified job
1404        is still the current job on the target Printer object.  The IPP object MUST supports this operation
1405        attribute, if it supports this operation.

1406

1407    12.4.2  Resume-Job operation

1408    This OPTIONAL operation allows a client to resume the target job at the point where it was suspended.
1409    The Printer moves the target job to the 'pending' state and removes the 'job-syspended' value from the job's
1410    "job-state-reasons" attribute.

1411    If the target job is not in the 'processing-stopped' state with the 'job-suspended' value in the job's "job-state-
1412    reasons" attribute, the Printer rejects the request and returns the 'client-error-not-possible' status code, since
1413    the job was not suspended.

1414    *Access Rights:* The authenticated user (see [ipp-mod] section 8.3) performing this operation must either be
1415    the job owner (as determined in the Job Creation operation) or an operator or administrator of the Printer
1416    object (see [ipp-mod] Sections 1 and 8.5).

1417    The Resume-Job Request and Resume-Job Response have the same attribute groups and attributes as the
1418    Release-Job operation (see [ipp-mod] section 3.3.6), including the new "job-message-from-operator"
1419    operation attribute (see section 5.2).

1420

1421    12.5  Promote-Job operation

1422    This OPTIONAL operation allows a client to make the pending target job be processed next after the
1423    current job completes.  This operation is specially useful in a production printing environment where the
1424    operator is involved in job scheduling.

1425    If the target job is in the 'pending' state, this operation does not change the job's state, but causes the job to
1426    be processed after the current job(s) complete.  If the target job is not in the 'pending' state, the Printer
1427    rejects the request and returns the 'client-error-not-possible' status code.  The Printer returns the target job
1428    immediately after the current job(s) in a Get-Jobs response (see [ipp-mod] section 3.2.6) for the 'not-
1429    completed' jobs.

1430    When the current job completes, is canceled, suspended, or aborted, the target of this operation is processed
1431    next.

1432    If a client issues this request (again) before the target of the operation of the original request started
1433    processing, the target of this new request is scheduled before the previous job that was to be processed next.

1434    IPP is specified not to require queues for job scheduling, since there are other implementation techniques
1435    for scheduling multiple jobs, such as re-evaluating a criteria function for each job on a scheduling cycle.
1436    However, if an implementation does implement queues for jobs, then the Promote-Job puts the specified
1437    job at the front of the queue.  A subsequent Promote-Job before the first job starts processing puts that
1438    specified job at the front of the queue, so that it is "in front" of the previously promoted job.

1439    *Access Rights:* The authenticated user (see [ipp-mod] section 8.3) performing this operation must be an
1440    operator or administrator of the Printer object (see [ipp-mod] Sections 1 and 8.5).

1441    The Promote-Job Request and Promote-Job Response have the same attribute groups and attributes as the
1442    Cancel-Job operation (see [ipp-mod] section 3.3.3), including the new "job-message-from-operator"
1443    operation attribute (see section 5.2).

1444

## 13   IANA Considerations

The operations and attributes in this registration proposal will be published by IANA according to the procedures in RFC 2566 [rfc2566] section 6.4 for operations with the following URL:

ftp.isi.edu/iana/assignments/ipp/operations/set2.txt

## 14   Internationalization Considerations

This document has the same localization considerations as the [ipp-mod].

## 15   Security Considerations

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

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## 17   References

[ipp-mod]
R. deBry, T. Hastings, R. Herriot, S. Isaacson, P. Powell, "Internet Printing Protocol/1.0: Model and Semantics", <draft-ietf-ipp-model-v11-03.txt>, June, 1999.

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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.


## 18   Change History

This section summarizes the changes. Each sub-section is in reverse chronological order. Adding or removing ISSUES that don't change the document are not listed here.

18.1   Changes to the November 16, 1999 version to make the December 8, 1999 version

The following changes to the November 16, 1999 version to make the December 8, 1999 version as a result of the IPP WG telecons and mailing list discussion:

1.  Introduced the separation of Printer operation from Device operations. Removed the "printer-controls-other-protocols" (boolean) Printer Description attribute. Printer operations affect only IPP jobs and objects, while the Device operations affect the output device. Set2 has the Printer operations and Set3 has the Device operations. But do both sets of operations with only the Printer object and only the "printer-uri" target.

2.  Remove the "when" operation attribute and added distinct Pause operations instead: Pause-Printer-After-Current-Job (IPP/1.1 Pause-Printer clarified), Pause-Printer-After-All-Current-Jobs

3.  Added Deactivate-Printer and Activate-Printer which do Disable-Printer, Pause-Printer-After-Current-Job, and only allow query, Send-Document, Send-URI, and Activate-Printer operations. This is a clearer "shutdown" that can be brought back up using the protocol.

4.  Clarified that Shutdown-Printer cannot be brought back via the protocol, though added Startup-Printer for hosted implementations to instantiate a fresh copy of the Printer object.

5.  Changed the name of Pause-Current-Job to Suspend-Current-Job, since other jobs can be processed on the Printer (unlike Pause-Printer).

1510    6.   Added the Terminology section

1511    7.   Added the Requirements and Use Cases section

1512    8.   Added pictures of chained Printers, Printer fan-out, and Printer fan-in.

1513    9.   Added the concept of subordinate Printers and the "subordinate-printers-supported" (1setOf uri) Printer
1514         Description attribute to describe the configuration.

1515    10.  Added the forwarding rules:  IPP Printer objects MUST NOT forward Printer operations to subordinate
1516         IPP Printer objects, except for the chained Printer configuration.  IPP Printer objects MUST forward
1517         Job operations to the intended Job object.

1518    11.  Removed the "synchronize" operation attribute from all operations.

1519    12.  Renamed 'standby' to 'deactivated' Printer state reason.

1520    13.  Added 'moving-to-paused-all' Printer state reason for use with Pause-Printer-After-All-Current-Jobs

1521    14.  Added 'printer-deactivated' Printer state reason for use with Deactivate-Printer.

1522    15.  Renamed job-paused' to 'job-suspended' to go with the rename Suspend-Current-Job operation.

1523    16.  Renamed 'server-error-printer-is-in-standby-mode' status code to 'server-error-printer-is-deactivate'.

1524    17.  Grouped attributes that come in pairs.

1525    18.  Changed Shutdown-Printer so that there is no operation to come back to life, except Startup-Printer
1526         which starts a new instance (but there can only be one instance per Printer object).

1527    18.2  Changes to the November 1, 1999 version to make the November 16, 1999 version

1528    1.   Formally defined IPP Printer fan-out, IPP Printer fan-in, and output device fan-out.  Added figures to
1529         show IPP Printer fan-out and IPP Printer fan-in.

1530    2.   Added "parent-printers-supported (1setOf uri) Printer Description attribute to point back up the Printer
1531         hierarchy.

1532    3.   Added the requirements for forwarding operations that affect Jobs and for not forwarding operations
1533         that affect Printers.

1534    4.   Added "original-requesting-user-name" (name(MAX)) to represent the original end user, not the parent
1535         Printer's host.

1536    5.   Changed the default for "when" for the Pause-Printer operation from 'after-current-job' to 'now', since
1537         that is the behavior in IPP/1.1 where the "when" operation attribute is not defined.

1538    6.  Allowed a non-leaf Printer to have only one subordinate Printer.

1539    7.  Changed most of the "parent" Printer terminology to "non-leaf" Printer to contrast more clearly with
1540        "leaf" Printer objects.  The term "parent" is only used when talking about a subordinate's immediate
1541        parent Printer object.

1542    8.  Added "original-requesting-user-name" (name (MAX)) to the list of READ-ONLY Job Description
1543        attributes.

1544    18.3  Changes to the October 22, 1999 version to make the November 1, 1999 version

1545    The following changes to the October 22, 1999 version to make the November 1, 1999 version as a result of
1546    the IPP WG meeting in Durham, 10/99:

1547    1.  Removed the Reset-Printer, Non-Process-Run-Out, and Space-Current-Job operations from this Set2
1548        spec and moved them to a new Set3 spec for use with the new Device object, renaming them
1549        appropriately, to Reset-Device, Non-Process-Run-Out-Device, and Space-Device.

1550    2.  Added the concept of parent and subordinate Printer objects to formally represent fan-out.  Mentioned
1551        the Device object that is in a new [ipp-set3] spec.

1552    3.  Distributed the definition of the "when" operation attribute to the Pause-Printer (IPP/1.1), Shutdown-
1553        Printer, and Pause-Current-Job operations and listed the values that are appropriate to that operation
1554        only:
1555        Pause-Printer: 'now', 'after-current-copy', 'after-current-job' (default), and 'after-all'.
1556        Shutdown-Printer:  'now', 'after-current-job' (default), and 'after-all'
1557        Pause-Current-Job: 'now', 'after-current-copy' (default)

1558    4.  Deleted the "device-name" operation attribute and the "device-names-supported" (1setOf name(127))
1559        Printer Description attribute.  The latter will be part of the [ipp-set3] document.

1560    5.  Kept the "job-settable-attributes" (1setOf type2 keyword) and "printer-settable-attributes" (1setOf type2
1561        keyword), but deleted the "interpreter-settable-attributes (1setOf type2 keyword), since the Interpreter
1562        object and its attributes are really a sub-class of the Printer object.

1563    6.  Deleted the "when-values-supported" (1setOf type2 keyword) Printer Description attribute.

1564    7.  Added the "subordinate-printers-supported" (1setOf uri) Printer Description attribute.

1565    18.4  Changes to the September 19, 1999 version to make the October 22, 1999 version

1566    Adding or removing ISSUES that don't change the document are not listed here.  The following changes to
1567    the September 19, 1999 version to make the October 22, 1999 version as a result of the IPP WG meeting in
1568    Denver, 9/99:

1569    1.  Added the Interpreter object.

1570    2.  Added the "device-name" operation attribute to handle passing operations through the IPP Printer object
1571        to the device.

1572    3.  Added the out-of-band 'not-settable' to allow the Set-Job-Attributes and Set-Printer-Attributes response
1573        to indicate the difference between an unsupported attribute and a supported, but not settable, attribute in
1574        the Unsupported Attributes Group.

1575    4.  Removed "when-values-supported" and "job-settable-attributes" and "printer-settable-attributes" and
1576        "interpreter-settable-attributes" from the list of attributes that MUST be read-only.  So an administrator
1577        could sub-set the policy on what when values are supported or which attributes can be set.

1578    18.5  Changes to the July 19, 1999 version to make the September 19, 1999 version

1579    The following changes to the July 19, 1999 version to make the September 19, 1999 version as a result of
1580    the IPP WG meeting in Alaska, 8/99:

1581    1.  Refer to proposal as "Set2" rather than "Administrative" operations.

1582    2.  Revise the emphasis on administrator throughout the document, although the word administrator
1583        remains wherever appropriate.

1584    3.  Convert non-process-run-out from an operations attribute to an operation.

1585    4.  Added  Issue 21: For all these "access" caveats, why not just say... 'authentication and access control
1586        (see ipp-mod sections 1, 8.3 and 8.5) applies to this operation".?

1587    5.  Added Issue 22: Why? This is backward, if you ask me (HRL).

1588    6.  Per resolution of Issue 2, the "settable-attributes" Printer Description attribute, was replaced with three
1589        Printer Description attributes:  "printer-settable-attributes", "job-settable-attributes", and "interpreter-
1590        settable-attributes".  The latter for those implementations that have different values for Printer attributes
1591        in the Get-Printer-Attributes and Set-Printer-Attributes operations, depending on the value of the
1592        "document-format" operation attribute supplied by the client.  If and when we get a Document object,
1593        then we can add a "document-settable-attributes" Printer Description attribute.

1594    18.6  Changes to the June 30, 1999 version to make the July 19, 1999 version

1595    The following changes to the June 30, 1999 version to make the July 19, 1999 version as a result of the IPP
1596    WG meeting in Copenhagen, 7/7/99-7/8/99, and the IPP telecon, 7/14/1999:

1597    1.  Sections 2.1 and 2.2:  Clarified that the way to remove a message from the operator was for the client to
1598        supply a zero-length or all white space text string which is copied as usual to the "xxx-message-from-
1599        operator" attribute.

2.  Section 2.3:  Added "factory-settings" (boolean) operation attribute to the Get-Printer-Attributes operation.

3.  Section 2.4:  Added the "when" operation attribute to the Pause-Current-Job operation.

4.  Section 2.4:  Made the "when" operation attribute OPTIONAL for use in operations (Pause-Printer, Reset-Printer, Shutdown-Printer, and Pause-Current-Job operations).

5.  Sections 2.5:  Added table of operation attributes for the Printer operations to make it easy to compare.

6.  Sections 2.6:  Added table of operation attributes for the Job operations to make it easy to compare.

7.  Section 3.1:  Added "settable-attributes" (1setOf type2 keyword) READ-ONLY Printer Description attribute.

8.  Section 3.2:  Added "printer-controls-other-protocols" (boolean) Printer Description attribute

9.  Section 3.3:  Added the READ-ONLY "printer-message-time" (integer(MIN:MAX)) Printer Description attribute to keep time message updated in time ticks.

10. Section 4.2:  Deleted the 'process-next' "job-state-reasons" value, so that repeated Promote-Job operations promote each job "to the front of the queue".

11. Sections 6.1.1.1 and 6.2.1.1:  Replaced the table that listed all attributes with one that lists only the attributes that MUST be READ-ONLY.

12. Section 6.1.1.1:  Indicated that attributes that are not specified as READ-ONLY in this document MAY be settable.  If they control behavior, that changing their values MUST change the behavior.

13. Section 6.1.1.2 and 6.2.1.2:  Deleted the "ipp-attribute-fidelity" operation attribute from the Set-Printer-Attributes and Set-Job-Attributes operations.  All set operations are atomic.

14. Section 6.1.1.2:  Add the concept of the Interpreter object to handle attributes whose values vary in the Set-Printer-Attributes and Get-Printer-Attributes, depending on the value of the "document-format" operation attribute.

15. Sections 6.1.1.3 and 6.2.1.2:  Changed the "out-of-band" 'not-settable' value back to the existing 'not-supported' value.

16. Section 6.1.2 and 6.1.3:  Added "job-type" operation attribute to Disable-Printer and Enable-Printer operations with values: 'network-jobs', 'walk-up-jobs', and 'all-jobs'.

17. Section 6.1.5:  Clarified that Restart-Printer brings up the Printer disabled and paused, since that is the eventual state that Shutdown-Printer leaves the printer in.

18. Section 6.1.5:  Indicated that if Restart-Printer is supported, then Shutdown-Printer MUST be supported.

19. Section 6.1.6:  Deleted Space-Printer operation.  Keep Space-Current-Job operation only which has a "job-id" operation attribute that a client MAY supply.

20. Section 6.1.6:  Clarified that Shutdown-Printer is for a long period of time, not just to reset the device or change attribute values.  Also that Shutdown performs an immediate Disable-Printer and an eventual Pause-Printer.

21. Sections 6.2.3, 6.2.4, and 6.2.7 :  Added a "job-id" operation attribute to Cancel-Current-Job, Pause-Current-Job, and Space-Current-Job that a client MAY supply to check for race condition where current job changes

22. Section 6.2.4:  Combined Pause-Job into Pause-Current-Job operation.

23. Sections 6.2.4 and 6.2.5:  Pause-Current-Job puts job in 'processing-stopped' state, not 'pending-held' state.

24. Section 6.2.6:  Simplified Promote-Job, so that it behaves as if the job were put at the front of the queue.

19   Appendix A: Full Copyright Statement