                  Internet Printing Protocol (IPP):
                   Job and Printer Set Operations

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Abstract

   This document is an OPTIONAL extension to the Internet Printing
   Protocol (IPP/1.0 and IPP/1.1). This document specifies 3 additional
   OPTIONAL operations for use with the Internet Printing Protocol/1.0
   (IPP) and IPP/1.1. The end user, operator, and administrator Set-
   Job-Attributes and Set-Printer-Attributes operations are used to
   modify IPP Job objects and Printer objects, respectively. The Get-
   Printer-Supported-Values administrative operation returns values that
   the IPP Printer will accept for setting its "xxx-supported"
   attributes.

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1 Introduction

   This document is an OPTIONAL extension to IPP/1.0 [RFC2565, RFC2566]
   and IPP/1.1 [RFC2911, RFC2910]. For a description of the base IPP
   documents see Appendix C.

   The Internet Printing Protocol (IPP) is an application level protocol
   that can be used for distributed printing using Internet tools and
   technologies. IPP version 1.1 [RFC2911, RFC2910] focuses on end user
   functionality with a few administrative operations included. This
   document defines additional OPTIONAL end user, operator, and
   administrator Set-Job-Attributes and Set-Printer-Attributes
   operations used to modify IPP Job objects and Printer objects,
   respectively. It also defines a third Get-Printer-Supported-Values
   administrator operation that returns values that the IPP Printer will
   accept for setting its "xxx-supported" attributes. The Get-Printer-
   Supported-Values operation MUST be supported, if the implementation
   supports setting any "xxx-supported" Printer attributes using the
   Set-Printer-Attributes operation.

   Nine Printer Description attributes are defined:

   printer-settable-attributes-supported (1setOf type2 keyword)
   job-settable-attributes-supported (1setOf type2 keyword)
   document-format-varying-attributes (1setOf type2 keyword)
   printer-message-time (integer(MIN:MAX))
   printer-message-date-time (dateTime)
   printer-xri-supported (1setOf collection)
   xri-uri-scheme-supported (1setOf uriScheme)
   xri-authentication-supported (1setOf type2 keyword)
   xri-security-supported (1setOf type2 keyword)

   Three out-of-band values are defined for use with these three
   operations: 'delete-attribute' for deleting Job attributes with the
   Set-Job-Attributes request, 'not-settable' for use in either the
   Set-Job-Attributes or Set-Printer-Attributes responses, and 'admin-
   define' for use in the Get-Printer-Supported-Values response.

   Two operation attributes: "printer-message-from-operator" (text) and
   "job-message-from-operator" (text) are defined to set the
   corresponding IPP/1.1 Printer and Job Description attributes with the
   same names. These operation attributes may be used with any
   operation that affect the Printer or Job object for which an
   operation might want to indicate a message. For the Set-Job-
   Attributes and Set-Printer-Attributes operations, the client MUST
   explicitly set them, rather than using these operation attributes.

A Printer implementation can make the value of some attributes
dependent on the document-format, e.g., "resolution-supported".

2 Terminology

This section defines terminology used throughout this document.

2.1 Conformance Terminology

Capitalized terms, such as MUST, MUST NOT, REQUIRED, SHOULD, SHOULD
NOT, MAY, NEED NOT, and OPTIONAL, have special meaning relating to
conformance as defined in BCP 14, RFC 2119 [RFC2119] and [RFC2911]
section 12.1. If an implementation supports the extension defined in
this document, then these terms apply; otherwise, they do not. These
terms define conformance to this document only; they do not affect
conformance to other documents, unless explicitly stated otherwise.

2.2 Other terminology

This document uses terms such as Job object (or Job), IPP Printer
object (or Printer), "operation", "request", response", "attributes",
"keywords", and "support". These terms have special meaning and are
defined in the model terminology [RFC2911], section 12.2. The
following additional terms are introduced in this document:

  READ-ONLY: used in an attribute definition document to indicate that
     the attribute MUST NOT be settable using an IPP protocol Set
     operation. In other words, the attribute is not settable by
     definition.

  not-settable: an implementation does not support setting an attribute
     (whether or not the attribute's definition is READ-ONLY).

3 Requirements and Use Cases

The following requirements and usage are intended to be met by the
specification in this document.

  1. The end-user and the operator need a way to modify a Job that is
     in the 'pending' or 'pending-held' state.

     Usage: The end-user discovers that he/she forgot to include a
     print instruction, such as "finishings" = 'staple' after
     submitting a job. Rather than canceling the job and resubmitting
     it to the same IPP Printer, the end-user is able to modify the job
     on the IPP Printer.

The operator needs to modify a job because it is requesting a
particular kind of media for which there is no more, but the
policy is to print the job on a comparable medium.

2. The system administrator needs a way to re-configure or change the
   policy of the IPP Printer remotely.

   Usage: The system administrator is adding additional named media
   to the supported media list (setting 'name' values to the "media-
   supported" Printer attribute).

   The system administrator is reducing the capability of the IPP
   Printer by removing one of the operations from the supported
   operations list, such as Cancel-Job, because the policy is to run
   the IPP Printer like a public facsimile machine. After having
   removed Cancel-Job from the list of supported operations, an
   administrative client needs to be able to display to an
   administrator that the implementation is capable of being
   reconfigured to support Cancel-Job once again.

   The system administrator is remotely configuring the IPP Printer
   after installing it, and so is replacing the Printer Description
   attributes that have the out-of-band 'no-value' value (see
   [RFC2911], section 4.1) with the proper values.

   The operator is changing the media loaded in the input tray, and
   so is replacing the "media-ready" Job Template Printer attribute
   value with the proper values.

4 Definition of the Set operations

   The Set-Printer-Attributes operations (as are all Printer operations)
   are directed at Printer objects. A client MUST always supply the
   "printer-uri" operation attribute in order to identify the correct
   target of the operation. These descriptions assume all of the common
   semantics of the IPP/1.1 Model and Semantics document [RFC2911],
   section 3.1.

   The Set-Job-Attributes operations (as are all Job operations) are
   directed at Job objects. A client MUST always supply some means of
   identifying the Job object in order to identify the correct target of
   the operation. That job identification MAY either be a single Job
   URI or a combination of a Printer URI with a Job ID, as defined in
   [RFC2911]. The IPP object implementation MUST support both forms of
   identification for every job. If possible, a client SHOULD use the
   Printer URI with a Job ID rather than a Job URI, since the 32-bit

"job-id" is more readily translated to and from other print protocols
that MAY be serving as gateways into or out of the IPP
implementation.

The Set Printer operations are summarized in Table 1:

Table 1 - Operation-Id assignments

Operation Name	Operation-Id	Brief description
Set-Printer-Attributes	0x0013	Sets attribute values of the target Printer object
Set-Job-Attributes	0x0014	Sets attribute values of the target Job object
Get-Printer-Supported-Values	0x0015	Gets values that are valid for setting "xxx-supported" attributes using the Set-Printer-Attributes operation

4.1 Set-Printer-Attributes Operation

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

The Printer object validates the client-supplied attributes in the
Set-Printer-Attributes request. For an attribute to validate, it
MUST meet all of the following rules:

1. The number of attributes supplied by the client MUST NOT exceed
   the maximum number that the Printer supports in a Set-Printer-
   Attributes request. A Printer MUST accept at least one attribute,
   but SHOULD accept a reasonable number in a single Set-Printer-
   Attributes request.

   Note: There is no way for the client to determine the maximum
   number of attributes that the Printer supports in a Set-Printer-
   Attributes request, except to try a reasonable number.

2. The Printer MUST support the attribute.

3. The attribute MUST NOT be READ-ONLY, i.e., the definition of the
   attribute MUST NOT indicate that the attribute is READ-ONLY (see
   Appendix A for an indication of which IPP/1.1 attributes are
   READ-ONLY).

4. The attribute MUST be settable in this implementation.

5. The Printer MUST support the value, according to the rules defined
   in Appendix A, i.e., each value of each supplied "xxx" attribute
   MUST be validated against the value of a corresponding "xxx-
   supported" Printer attribute. One of those rules permits an
   administrator to set arbitrary 'name' values to those "xxx-
   supported" Printer attributes that include the 'name' attribute
   syntax if the implementation supports the 'admin-define' out-of-
   band value for that "xxx-supported" attribute (see section 8.3 and
   Appendix A).

6. The attribute's values MUST NOT conflict with the values of other
   Printer attributes, including ones being set in this same
   operation.

If any of the supplied attributes are not validate, the Printer
object MUST reject the entire operation; the Printer object MUST NOT
partially set some of the supplied attributes. In other words, after
the operation, all the supplied attributes MUST be set or none of
them MUST be set, thus making the Set-Printer-Attributes an atomic
operation.

The Printer MUST accept this operation when its READ-ONLY "printer-
state" attribute (see [RFC2911], section 4.4.11) is 'idle' or
'stopped', and SHOULD accept it when the value is 'processing'. The
Printer MUST accept this operation for any of the values of the
Printer object's READ-ONLY "printer-state-reasons" and "printer-is-
accepting-jobs" attributes, unless explicitly defined otherwise in
the definition of these attributes' values.

This operation MUST NOT change the value of attributes not specified
in the operation unless the definition of the attribute explicitly
specifies such side-effects. For example, this document explicitly
specifies that when this operation sets "printer-message-from-
operator", the Printer also MUST set the READ-ONLY "printer-message-
time" and READ-ONLY "printer-message-date-time" attributes to the
time of the operation as a side effect. In particular, if this
operation changes an "xxx-default" attribute, the new value MUST be
in the "xxx-supported" attributes or the request MUST contain a new
value for "xxx-supported", which contains the new value for the
"xxx-default". Otherwise, the Printer MUST reject the operation. In
general, Printer attribute definitions that are settable will not

define side-effects on other attributes that are settable, only side
effects on READ-ONLY attributes, if any.

4.1.1 Settable and READ-ONLY Printer Description attributes

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

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

that the implementation supports (see [RFC2911] section 4.2 and
extensions).

Some Printer Description attributes (see [RFC2911] section 4.4) MUST
NOT be settable, i.e., they are defined to be READ-ONLY. An
attribute marked as "READ-ONLY" in the Printer Description attribute
table in Appendix A is such an attribute. The Printer attributes
that are not marked as "READ-ONLY" MAY be settable using the Set-
Printer-Attributes operation, depending on implementation.

Note: From now on, all extensions that define new object attributes
will indicate whether or not the attributes are READ-ONLY, by
including the "READ-ONLY" adjective in their descriptions and/or
explicitly stating whether they MAY be settable.

The current values of each "xxx-supported" Printer attribute MUST
reflect the current policy for support of the corresponding "xxx"
attribute. If an "xxx-supported" Printer attribute is settable in an
implementation, then its value(s) MUST affect the behavior of the
implementation. If an "xxx-supported" Printer attribute is defined
to be READ-ONLY or is not-settable in an implementation, then its
values MUST NOT be settable using the Set-Printer-Attributes
operation. Consider the following examples:

    For example, if the "operations-supported" Printer Description
    attribute (see [RFC2911] section 4.4.15) is settable in a
    particular implementation, then changing its value with a Set-
    Printer-Attributes operation MUST affect the operations that the
    implementation accepts or rejects. Such an implementation will
    need to be able to reject values for operations that it contains
    no code support for (see section 4.3). If the "operations-
    supported" Printer Description attribute is not settable in a
    particular implementation, then that implementation MUST reject an
    attempt to set it with a Set-Printer-Attributes operation, return
    the 'client-error-attributes-not-settable' status code (see
    section 7.1), and return the "operations-supported" attribute,

with the out-of-band 'not-settable' value in the Unsupported
Attributes Group.

As another example, consider an implementation in which the
"media-default" and "media-supported" are settable. If a client
supplies a Set-Printer-Attributes request that contains the
"media-default" attribute with a value that is not a member of the
Printer's "media-supported" attribute, the Printer MUST reject the
request and return the "client-error-conflicting-attributes"
status code with the "media-default" and "media-supported"
attributes and their values (see [RFC2911] section 3.1.7).

As a third example, if a client supplies a Set-Printer-Attributes
request that contains both the "media-default" and the "media-
supported" attributes, but includes a value in the "media-default"
that is not a member of the supplied "media-supported" attribute,
the Printer MUST reject the request and return the "client-error-
conflicting-attributes" status code with the "media-default" and
"media-supported" attributes and their values (see [RFC2911]
section 3.1.7).

Access Rights: The authenticated user (see [RFC2911] section 8.3)
performing this operation must be an operator or administrator of the
Printer object (see [RFC2911] Sections 1 and 8.5). Most Printer
attributes will require administrator access rights to set, such as
"xxx-supported", while some will require operator access rights only,
such as "media-ready" and "printer-message-from-operator". Which
attributes require which access rights depends on implementation, and
MAY depend on site policy.

4.1.2 Set-Printer-Attributes Request

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

Group 1: Operation Attributes

Natural Language and Character Set:
The "attributes-charset" and "attributes-natural-language"
attributes, as described in [RFC2911], section 3.1.4.1.

Target:
The "printer-uri" (uri) operation attribute, which is the
target for this operation, as described in [RFC2911], section
3.1.5.

Requesting User Name:
    The "requesting-user-name" (name(MAX)) attribute SHOULD be
    supplied by the client, as described in [RFC2911], section 8.3.

"document-format" (mimeMediaType):
    The client OPTIONALLY supplies this attribute. The Printer
    object MUST support this attribute. This attribute is useful
    for a client to select the document-format to which the
    attribute modification should be applied. A Printer
    implementation MAY allow some attributes to have different
    values for each document format that it supports. See
    [RFC2911], section 3.2.5.1 "Get-Printer-Attributes Request".

    If the client includes this attribute, the Printer MUST change
    the supplied attributes for the document format specified by
    this attribute. If a supplied attribute is a member of the
    "document-format-varying-attributes" (i.e., the attribute
    varies by document format, see section 6.3), the Printer MUST
    change the supplied attribute for the document format specified
    by this attribute, but not for other document formats. If a
    supplied attribute isn't a member of the "document-format-
    varying-attributes" (i.e., it doesn't vary by document format),
    the Printer MUST change the supplied attribute for all document
    formats.

    If the client omits this attribute, the Printer MUST change the
    supplied attributes for all document formats, whether or not
    they vary by document-format.

    If the client supplies a value for the "document-format"
    Operation attribute, that is either 'application/octet-stream'
    or not supported by the Printer, i.e., is not among the values
    of the Printer object's "document-format-supported" attribute,
    the Printer object MUST reject the operation and return the
    'client-error-document-format-not-supported' status code.
    Note: the document-format 'application/octet-stream' is the
    union of several document-formats (see [RFC2911] section
    3.2.5.1, Get-Printer-Attributes) and is not a true document-
    format.

Group 2: Printer Attributes

    The client MUST supply a set of Printer attributes with one or
    more values (including explicitly allowed out-of-band values) as
    defined in [RFC2911] section 4.2 Job Template Attributes ("xxx-
    default", "xxx-supported", and "xxx-ready" attributes), section
    4.4 Printer Description Attributes, and any attribute extensions
    supported by the Printer. The value(s) of each Printer attribute

supplied in Group 2 replaces the value(s) of the corresponding
Printer attribute on the target Printer object. For attributes
that can have multiple values (1setOf), all values supplied by the
client replace all values of the corresponding Printer object
attribute. If a Printer object attribute had not yet been
configured, and so assumed the 'no-value' out-of-band value (see
[RFC2911] section 4.1), the supplied value(s) replaces the 'no-
value' value.

4.1.3 Set-Printer-Attributes Response

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

   Group 1: Operation Attributes

      Status Message:
         In addition to the REQUIRED status code returned in every
         response, the response OPTIONALLY includes a "status-message"
         (text(255)) and/or a "detailed-status-message" (text(MAX))
         operation attribute, as described in [RFC2911] sections 3.1.6
         and 13.

      Natural Language and Character Set:
         The "attributes-charset" and "attributes-natural-language"
         attributes, as described in [RFC2911], section 3.1.4.2.

   Group 2: Unsupported Attributes

      See [RFC2911], section 3.1.7, for details on returning Unsupported
      Attributes.

      If some of the attributes in the operation fail to validate, the
      Printer MUST reject the operation, MUST NOT change any Printer
      attributes, and MUST return the indicated status code below. In
      this group, the Printer MUST also return all attributes that fail
      to validate. The following are the reasons that an attribute
      fails to validate and the value returns for the attribute, along
      with the indicated status code and order of detection:

      1. The number of attributes supplied by the client exceeds the
         maximum number that the Printer supports in a Set-Printer-
         Attributes request: return the 'client-error-request-entity-
         too-large' (see [RFC2911], section 13.1.4.9).

2. The Printer doesn't support the attribute: return the attribute
   with the "out-of-band" value 'unsupported' (see [RFC2911]
   section 3.1.7 and [RFC2910]) and the 'client-error-attributes-
   or-values-not-supported (see [RFC2911], section 13.1.4.12).

3. The attribute is either READ-ONLY (in its definition) or is
   not-settable in this implementation: return the attribute with
   the "out-of-band" value 'not-settable' (see section 8.1) and
   the 'client-error-attributes-not-settable' status code (see
   section 7.1).

4. The Printer doesn't support the value: if the attribute in the
   operation has a single value, return it. If the attribute in
   the operation is multi-valued, return only those values in a
   1setOf that are not supported. Return the 'client-error-
   attributes-or-values-not-supported' status code (see [RFC2911],
   section 13.1.4.12).

5. The values of some of the supplied attributes conflict with one
   another and/or other Printer attribute values not being set: if
   the conflicting attribute in the operation has a single value,
   return the attribute and the value. If the attribute in the
   operation is multi-valued, return only the attribute and those
   values in a 1setOf that are conflicting with other attributes.
   Return the 'client-error-conflicting-attributes' status code
   (see [RFC2911], section 13.1.4.15).

4.2 Set-Job-Attributes Operation

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

   This operation is almost identical to the Set-Printer-Attributes
   operation and follows the same rules for validation (see section
   4.1). The only differences are that the Set-Job-Attributes operation
   is directed at a Job object rather than a Printer object, there is no
   "document-format" operation attribute used when setting a Job object,
   the operation can add an attribute to the (Job) object, the 'delete-
   attributes' out-of-band value is permitted to remove an attribute,
   and the validation is the same as the Job Creation operations
   (Print-Job, Print-URI, and Create-Job), i.e., depends on the "xxx-
   supported" Printer Description attributes (see [RFC2911] section
   3.1). Using the Set-Printer-Attributes operation, the administrator
   can set arbitrary 'name' values to those "xxx-supported" Printer

attributes, that include the 'name' attribute syntax, if the
implementation supports the 'admin-define' out-of-band value for that
"xxx-supported" attribute (see section 8.3 and Appendix A). However,
the Set-Job-Attributes cannot be used to add unsupported names to the
Job object.

If a client supplies a job attribute in a Set-Job-Attributes request
that the Printer supports, and the job was originally submitted
without supplying that attribute, the Printer adds the attribute to
the Job object.

If the client supplies a job attribute with the "out-of-band" value
'delete-attribute' (see section 8.2), then the Printer MUST remove
the attribute and all of its values from the Job object, if present.
The semantic effect of the client supplying the 'delete-attribute'
value in a Set-Job-Attributes operation MUST be the same as if the
attribute had not been supplied with the Job object in the Job
Creation operation, i.e., the Printer applies its default attribute
or behavior with lower precedence that the PDL (see the beginning of
[RFC2911] section 4.2 and [RFC2911] 3.2.1.1). Any subsequent query
of the Job object using Get-Job-Attributes or Get-Jobs, MUST NOT
return any attribute that has been deleted using the 'delete-
attribute' out-of-band value. However, a client can re-establish
such a deleted Job attribute with any supported value(s), using a
subsequent Set-Job-Attributes operation.

If the client supplies an attribute in a Set-Job-Attributes request
with the 'delete-attribute' value and that attribute is not present
on the Job object, the Printer ignores that supplied attribute in the
request, does not return the attribute in the Unsupported Attributes
group, and returns the 'successful-ok' status code, if there are no
other problems with the request.

The validation of the Set-Job-Attributes request is performed by the
Printer as if the job had been submitted originally with the new
attribute values (and the deleted attributes removed) and with "ipp-
attribute-fidelity" set to 'true', i.e., all modified attributes Job
attributes and values MUST be supported in combination with the Job
attributes not modified. If such a Job Creation operation would have
been accepted, then the Set-Job-Attributes MUST be accepted. If such
a Job Creation operation would have been rejected, then the Set-Job-
Attributes MUST be rejected and the Job MUST be unchanged. In
addition, if any of the supplied attributes are not supported, are
not settable, or the values are not supported, the Printer object
MUST reject the entire operation; the Printer object MUST NOT
partially set some of the supplied attributes. In other words, after

the operation, all the supplied attributes MUST be set or none of
them MUST be set, thus making the Set-Job-Attributes an atomic
operation.

The IPP object MUST accept or reject this operation when the Job's
READ-ONLY "job-state" attribute has the values shown in Table 2. The
job's current state MUST affect whether the IPP object accepts or
rejects the request. For example, in the case where the operation
creates a request for unavailable resources, the Job transitions to a
new state. Table 2 shows the allowed behaviors in each job state and
the transitions.

Table 2 - Job State Transition Table for the Set-Job-Attributes
operation

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 implementation, including the attributes being set, whether the job has started marking media, etc.
'processing-stopped'	'processing-stopped'	'successful-ok' or 'client-error-not-possible' depending on implementation, including the attributes being set, whether the job has started marking media, etc.
'completed'	'completed'	'client-error-not-possible'
'canceled'	'canceled'	'client-error-not-possible'
'aborted'	'aborted'	'client-error-not-possible'

   This operation MUST NOT change the value of attributes not specified
   in the operation unless the definition of the attribute explicitly
   specifies such side-effects. In general, Job attribute definitions
   that are settable will not define side-effects on other attributes
   that are settable, only side effects on READ-ONLY attributes, if any.

4.2.1 Settable and READ-ONLY Job Description attributes

   If the Printer supports the "job-message-from-operator" Job
   Description attribute (see [RFC2911] section 4.3.16) and the client
   explicitly supplies a new value for the "job-message-from-operator"
   Job Description attribute in Group 2 in the Set-Job-Attributes
   request, then the Printer MUST set the "job-message-from-operator"
   Job Description attribute to this new value.

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

      all Job Template job ("xxx") attributes

   that the implementation supports (see [RFC2911] section 4.2 and
   extensions).

   Some Job Description attributes (see [RFC2911] section 4.3) MUST NOT
   be settable, i.e., they are defined to be READ-ONLY. An attribute
   marked as "READ-ONLY" in the Job Description attribute table in
   Appendix A is such an attribute. The Job attributes not marked as
   "READ-ONLY" MAY be settable using the Set-Job-Attributes operation,
   depending on implementation.

   Note: From now on, all extensions that define new object attributes
   will indicate whether or not the attributes are READ-ONLY, by
   including the "READ-ONLY" adjective in their descriptions and/or
   explicitly stating whether they MAY be settable.

   Access Rights: The authenticated user (see [RFC2911] 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 [RFC2911] Sections 1 and 8.5).

4.2.2 Set-Job-Attributes Request

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

   Group 1: Operation Attributes

      Natural Language and Character Set:
         The "attributes-charset" and "attributes-natural-language"
         attributes as described in [RFC2911], section 3.1.4.1.

      Target:
         Either (1) the "printer-uri" (uri) plus "job-id"
         (integer(1:MAX)) or (2) the "job-uri" (uri) operation
         attribute(s), which defines the target for this operation as
         described in [RFC2911], section 3.1.5.

      Requesting User Name:
         The "requesting-user-name" (name(MAX)) attribute SHOULD be
         supplied by the client, as described in [RFC2911], section 8.3.

   Group 2: Job Attributes

      The client MUST supply a set of Job attributes with one or more
      values (including explicitly allowed out-of-band values) as
      defined in [RFC2911], section 4.2, Job Template Attributes ("xxx"
      attributes), section 4.3, Job Description Attributes, and any
      attribute extensions supported by the Printer. The value(s) of
      each Job attribute supplied in Group 2 replaces the value(s) of
      the corresponding Job attribute on the target Job object. For
      attributes that can have multiple values (1setOf), all values
      supplied by the client replace all values of the corresponding Job
      object attribute.

      If the client supplies an "xxx" attribute with the 'delete-
      attribute' out-of-band value (see section 8.2), the Printer MUST
      remove the "xxx" attribute from the Job object, if present.

4.2.3 Set-Job-Attributes Response

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

   Group 1: Operation Attributes

      Status Message:
         In addition to the REQUIRED status code returned in every
         response, the response OPTIONALLY includes a "status-message"
         (text(255)) and/or a "detailed-status-message" (text(MAX))
         operation attribute as described in [RFC2911], sections 3.1.6
         and 13.

      Natural Language and Character Set:
         The "attributes-charset" and "attributes-natural-language"
         attributes as described in [RFC2911], section 3.1.4.2.

   Group 2: Unsupported Attributes

      See [RFC2911], section 3.1.7, for details on returning Unsupported
      Attributes.

      If some of the attributes in the operation fail to validate, the
      Printer MUST reject the operation, MUST NOT change any Job
      attributes, and MUST return the indicated status code below. In
      this group, the Printer MUST also return all attributes that fail
      to validate. The following are the reasons that an attribute
      fails to validate and the value returns for the attribute, along
      with the indicated status code and order of detection:

      1. The number of attributes supplied by the client exceeds the
         maximum number that the Printer supports in a Set-Printer-
         Attributes request: return the 'client-error-request-entity-
         too-large' (see [RFC2911], section 13.1.4.9).

      2. The Printer doesn't support the attribute: return the attribute
         with the 'unsupported' out-of-band attribute value (see
         [RFC2911], section 3.1.7 and [RFC2910]) and the 'client-error-
         attributes-or-values-not-supported (see [RFC2911], section
         13.1.4.12).

      3. The attribute is READ-ONLY (in its definition) or is not-
         settable in this implementation: return the attribute with the
         'not-settable' out-of-band attribute value (see section 8.1)
         and the 'client-error-attributes-not-settable' status code (see
         section 7.1).

   4. The Printer doesn't support the value: if the attribute in the
      operation has a single value return it. If the attribute in
      the operation is multi-valued, return only those values in a
      1setOf that are not supported. Return the 'client-error-
      attributes-or-values-not-supported' status code (see [RFC2911],
      section 13.1.4.12).

   5. The values of some of the supplied attributes conflict with one
      another and/or other Job attribute values not being set: if
      the conflicting attribute in the operation has a single value,
      return the attribute and the value. If the attribute in the
      operation is multi-valued, return only the attribute and those
      values in a 1setOf that are conflicting with other attributes.
      Return the 'client-error-conflicting-attributes' status code
      (see [RFC2911],y section 13.1.4.15).

4.3 Get-Printer-Supported-Values Operation

   This OPTIONAL operation allows a client to request the values that
   the Printer allows in the Set-Printer-Attributes operation for "xxx-
   supported" attributes. If the Printer supports the Set-Printer-
   Attributes operation AND some of its "xxx-supported" Printer
   attributes are settable, then the Printer MUST also support this
   operation.

   The Printer MUST return in the Get-Printer-Supported-Values response,
   those, and only those, "xxx-supported" Printer attributes that it
   supports setting with the Set-Printer-Attributes operation.
   Furthermore, if a client requests the value of an attribute that is
   not settable or is not supported (as in the Get-Printer-Attributes
   response), the Unsupported Attributes Group of the response NEED NOT
   contain the "requested-attributes" operation attribute with any such
   requested (attribute keyword) values.

   This operation has identical request/response attributes to the Get-
   Printer-Attributes operation in IPP/1.1 [RFC2911]. The operation
   also behaves identically to the Get-Printer-Attributes operation in
   IPP/1.1 [RFC2911], with the following exceptions:

   1. The Get-Printer-Supported-Values operation supports only "xxx-
      supported" attributes.

   2. The Get-Printer-Attributes operation returns the few "xxx-
      supported" attributes that are defined to be single valued, such
      as "page-ranges-supported" (boolean) or "pdl-override-supported"
      (type2 keyword), as single values, while Get-Printer-Supported-

Values returns the possible values that can be set as a 1setOf of
the same attribute syntax type (See Appendix B: Attributes
returned from Get-Printer-Supported-Values).

3. The Get-Printer-Attributes operation returns the current values of
   requested attributes, while the Get-Printer-Supported-Values
   operation returns the values that are inherently supported by the
   implementation code, i.e., the values that an administrative
   client can set in a Set-Printer-Attributes request.

4. The Get-Printer-Attributes operation returns the current values of
   requested "xxx-supported" attributes that the Printer is
   configured to accept in Job Creation operations, including
   additional values defined by the administrator, while the Get-
   Printer-Supported-Values operation returns only the values of
   "xxx-supported" attributes that are inherently supported by the
   implementation and does not return any additional values defined
   by the administrator, where the implementation supports the
   'admin-define' out-of-band value.

5. The Get-Printer-Attributes never returns the 'admin-define' out-
   of-band attribute value, while the Get-Printer-Supported-
   Attributes operation does, if the implementation allows the
   administrator to define name values by setting that "xxx-
   supported" attribute with any 'name' value(s).

6. The Get-Printer-Attributes operation only requires end-user access
   rights, while the Get-Printer-Supported-Values requires
   administrator access rights.

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

4.3.1 Definition of the usage of the 'admin-define' out-of-band
      attribute value

If the Set-Printer-Attributes operation allows the System
Administrator to define arbitrary 'name' values for an "xxx-
supported" attribute, then the Get-Printer-Supported-Values operation
MUST return the 'admin-define' out-of-band attribute value (see
section 8.3) as one of the values of the "xxx-supported" attribute.
In other words, the 'admin-define' out-of-band attribute value
indicates that the Printer implementation supports clients setting
arbitrary 'name' attribute syntax values for that "xxx-supported"
attribute using the Set-Printer-Attributes operation, as long as the
attribute is defined with the 'name' attribute syntax.

For example, if the Get-Printer-Supported-Values operation returns
several keywords as the value of the "media-supported" attribute,
then the Set-Printer-Attributes operation MUST accept any of these
keywords as values for the "media-supported" attribute. If the Get-
Printer-Supported-Values operation returns an 'admin-define' out-of-
band attribute value as one of the values of the "media-supported"
attribute, then the Set-Printer-Attributes operation MUST accept any
value whose attribute syntax is 'name', as a value for the "media-
supported" attribute (provided that the user is properly
authenticated to use the Set-Printer-Attributes operation, e.g., has
administrative access rights).

The Get-Printer-Supported-Values MAY return the 'admin-define' out-
of-band attribute value for any IPP/1.1 or extension Job Template
attribute if the implementation supports allowing the System
Administrator to add values to the "xxx-supported" attribute using
the Set-Printer-Attributes operation. In this case, the Printer MUST
accept any 'name' value of the correct attribute syntax in a Set-
Printer-Attributes operation that is setting that attribute. For
"xxx-supported" attributes that are defined with a choice of
attribute syntaxes, such as 'keyword | name', it is the 'name'
attribute syntax that the System Administrator can use to add new
values, not the 'keyword' attribute syntax. For IPP/1.1, this
requirement includes the following Job Template attributes:

    media-supported
    job-hold-until-supported
    job-sheets-supported

Implementations that support additional Job Template attributes that
include the 'name' attribute syntax, MAY use the 'admin-define' out-
of-band value with them.

If the 'admin-define' out-of-band attribute value is not one of the
values of an "xxx-supported" attribute returned in a Get-Printer-
Supported-Values response, then the Printer MUST NOT allow the Set-
Printer-Attributes operation for that attribute to contain a value
that is not one of the explicit 'keyword' or 'name' values returned
in a Get-Printer-Supported-Values response.

See Appendix B: Attributes returned from Get-Printer-Supported-Values
for a full list of values returned by this operation.

5 New Operation attributes

   This section defines new operation attributes for use with the
   IPP/1.1 operations indicated. As new operations are defined, they
   will also indicate explicitly whether these operation attributes are
   defined for use with them.

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

   The Printer SHOULD support this Operation attribute in following
   operations if it supports the corresponding "printer-message-from-
   operator" Printer Description attribute.

      Pause-Printer
      Resume-Printer
      Purge-Jobs

   The client OPTIONALLY supplies this Operation attribute in the above
   operations. The value of this attribute is a message from the
   operator about the Printer object on which the operator is performing
   the operation. If this operation attribute is supported, the Printer
   copies the value to its "printer-message-from-operator" Printer
   Description attribute (see [RFC2911], section 4.4.25), even if this
   Operation attribute is a zero-length text value or consists solely of
   white space.

   If the Printer supports this operation attribute, it MUST support
   both a zero-length text value and the 'no-value' out-of-band value
   (see [RFC2911] section 4.1) to indicate that the operator has sent no
   message. In this case, the Printer sets the value of the "printer-
   message-from-operator" to the zero-length value or 'no-value' out-
   of-band value, respectively. If the client queries the "printer-
   message-from-operator" Printer attribute, the Printer returns the
   attribute with the zero-length value or the 'no-value' value,
   respectively.

   In addition, the Printer automatically copies:

   1. the value of its "printer-up-time" attribute (see [RFC2911],
      section 4.4.29) to its "printer-message-time" attribute,

   2. the value of its printer-current-time" (dateTime) attribute (see
      [RFC2911], section 4.4.30) to its "printer-message-date-time"
      attribute, if supported.

   If the client omits this operation attribute, the Printer does not
   change the value of its "printer-message-from-operator", "printer-
   message-time" and "printer-message-date-time" Printer Description
   attributes.

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

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

   The Printer SHOULD support this Operation attribute in following
   operations if it supports the corresponding "job-message-from-
   operator" Job Description attribute.

      Cancel-Job
      Hold-Job
      Release-Job
      Restart-Job

   The client OPTIONALLY supplies this attribute in the above
   operations. The value of this attribute is a message from the
   operator about the Job object on which the operator has just
   performed an operation. If supported, the Printer copies the value
   to the Job's "job-message-from-operator" Job Description attribute
   (see [RFC2911], section 4.3.16) (even if this Operation attribute is
   a zero-length text value or consists solely of white space).

   If the Printer supports this operation attribute, it MUST support
   both a zero-length text value and the 'no-value' out-of-band value
   (see [RFC2911], section 4.1), to indicate that the operator has sent
   no message. In this case, the Printer sets the value of the "job-
   message-from-operator" to the zero-length value or 'no-value' out-
   of-band value, respectively. If the client queries the "job-
   message-from-operator" Job attribute, the IPP object returns the
   attribute with the zero-length value or the 'no-value' value,
   respectively.

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

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

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

6 New Printer Description Attributes

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

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

This REQUIRED READ-ONLY Printer Description attribute identifies the
Printer object attributes that are settable in this implementation,
i.e., that are settable using the Set-Printer-Attributes operations
(see section 4.1). This attribute MUST be supported if the Set-
Printer-Attributes operations is supported. The Printer MUST reject
attempts to set any Printer attributes that are not one of the values
of this attribute, returning the 'client-error-attributes-not-
settable' status code (see section 7.1). The value of this attribute
MAY depend on the value of the "document-format" operation attribute
supplied in the Get-Printer-Attributes operation (see [RFC2911],
section 3.2.5.1).

Standard keyword values are:

    'none': There are no settable Printer attributes.
    'xxx': Where 'xxx' is any of the keyword attribute names allowed
       by section 4.1.1.

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

   This REQUIRED READ-ONLY Printer Description attribute identifies the
   Job object attributes that are settable in this implementation, i.e.,
   that are settable using the Set-Job-Attributes operation (see section
   4.2). This attribute MUST be supported if the Set-Job-Attributes
   operations are supported. The Printer MUST reject attempts to set
   any Job attributes that are not one of the values of this attribute,
   returning the 'client-error-attributes-not-settable' status code (see
   section 7.1).

   Standard keyword values are:

      'none': There are no settable Job attributes.
      'xxx': Where 'xxx' is any of the keyword attribute names allowed
        by section 4.2.1.

6.3 document-format-varying-attributes (1setOf type2 keyword)

   This OPTIONAL READ-ONLY Printer Description attribute contains a set
   of attribute name keywords. This attribute SHOULD be supported by a
   Printer object if the Printer object has Printer attributes whose
   value vary depending on document format (see [RFC2911], Get-Printer-
   Attributes operation). This attribute specifies which attribute
   values can vary by document-format. If an attribute's name, "xxx",
   is a member of this attribute and the value of attribute "xxx" is
   changed with the Set-Printer-Attributes operation that included the
   "document-format" operation attribute, then the Printer MUST change
   the value for the specified document format and no other document
   formats (see section 4.1.2). If an attribute's name, "xxx", is not a
   member of this attribute and the value of attribute "xxx" is changed
   with the Set-Printer-Attributes operation, then the attribute is
   changed for all document formats (whether or not the client supplied
   the "document-format" operation attribute).

6.4 printer-message-time (integer(MIN:MAX))

   This OPTIONAL READ-ONLY Printer Description attribute contains the
   time that the Printer's "printer-message-from-operator" was changed
   by the operator using any operation where the client supplied the
   "printer-message-from-operator" operation attribute (see section 5.1)
   or was explicitly set using the Set-Printer-Attributes operation (see
   section 4.1). This attribute allows the users to know when the
   "printer-message-from-operator" Printer Description attribute was
   last set.

The Printer sets the value of this attribute by copying the value of
the Printer's "printer-up-time" attribute (see [RFC2911], section
4.3.14). If the Printer resets its "printer-up-time" attribute to 1
on power-up, then it MUST change the value of the "printer-message-
time" to 0 or a negative number as specified in [RFC2911], section
4.3.14.

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

6.5 printer-message-date-time (dateTime)

This OPTIONAL READ-ONLY Printer Description attribute contains the
date and time that the Printer's "printer-message-from-operator" was
changed by the operator, using any operation where the client
supplied the "printer-message-from-operator" operation attribute (see
section 5.1) or was explicitly set using the Set-Printer-Attributes
operation (see section 4.1). This attribute allows the users to know
when the "printer-message-from-operator" Printer Description
attribute was last set.

This attribute MUST be supported if the Printer supports both the
"printer-message-time" and the "printer-current-time" (dateTime)
attributes (see [RFC2911], section 4.4.30).

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

6.6 printer-xri-supported (1setOf collection)

This OPTIONAL Printer Description attribute is a multi-valued
attribute where each value has the 'collection' attribute syntax (see
[RFC3382]), containing member attributes with the same semantics as
the following IPP/1.1 READ-ONLY Printer Description attributes,
except for cardinality:

    printer-uri-supported (1setOf uri)
        - see [RFC2911], section 4.4.1
    uri-authentication-supported (1setOf type2 keyword)
        - see [RFC2911], section 4.4.2.
    uri-security-supported (1setOf type2 keyword)
        - see [RFC2911], section 4.4.3.

When setting the "printer-xri-supported" attribute with a Set-
Printer-Attributes request, the Printer MUST also set these three
IPP/1.1 READ-ONLY Printer Description attributes as a defined side

effect. Thus, this collection attribute provides the means to set
these three IPP/1.1 READ-ONLY attributes atomically so that they are
never left in a partially inconsistent state.

An IPP Printer MUST NOT provide any other way, using IPP, to set
these three IPP/1.1 READ-ONLY Printer Description attributes, since
they are READ-ONLY and MUST have consistent values at all times.
Note: The "printer-xri-supported" (1setOf collection) attribute can
be put into a directory schema that requires a single text string
value, such as could be used with SLPv2 [RFC2608], [RFC2609] or
LDAPv3 [RFC2251], [RFC2252], [RFC2926], by using suitable delimiting
characters to separate member attributes of the collection and/or
terminating collection values.

The member attributes of the "printer-xri-supported" (1setOf
collection) are given in Table 3.

         Table 3 - Member attributes of "printer-xri-supported" (1setOf
                          collection)

Member attribute	client MUST supply	Printer MUST support
xri-uri (uri)	yes	yes
xri-authentication (type2 keyword)	yes	yes
xri-security (type2 keyword)	yes	yes

Other than the uniqueness and the cardinality requirements, the
semantics of these three member attributes is given in [RFC2911]
sections 4.4.1, 4.4.2, and 4.4.3, respectively.

A client can query the current values using the Get-Printer-
Attributes operation by supplying either:

1. the three IPP/1.1 attribute names: "printer-uri-supported", "uri-
   authentication-supported", "uri-security-supported" and getting
   back the parallel values OR

2. the single attribute name: "printer-xri-supported" and getting
   back the 1setOf collection which contains the same information
   semantically, but in a different form.

A client can query what member attribute values can be set by
supplying the three attribute names: "xri-uri-scheme-supported",
"xri-authentication-supported", and "xri-security-supported" in a

    Get-Printer-Supported-Values request and getting back the uriScheme
    and type2 keyword values that can be set. Since the "printer-xri-
    supported", "uri-authentication-supported", and "uri-security-
    supported" attributes are READ-ONLY, they are not queriable with the
    Get-Printer-Supported-Values operation (see section 4.3). See Table
    16.

    For example:

        "printer-xri-supported =
            {   "xri-uri" = ipp://abc.com/p1
                "xri-authentication" = basic
                "xri-security" = tls
            },
            {   "xri-uri" = ipp://abc.com/p2
                "xri-authentication" = digest
                "xri-security" = tls
            },
            {   "xri-uri" = ipp://abc.com/p3
                "xri-authentication" = none
                "xri-security" = none
            }

    would cause the Printer to set the three corresponding IPP/1.1 READ-
    ONLY attributes, each with three parallel values as follows:

        "printer-uri-supported" = { ipp://abc.com/p1, ipp://abc.com/p2,
                                    ipp://abc.com/p3 }
        "uri-authentication-supported" = { basic, digest, none }
        "uri-security-supported" = { tls, tls, none }

6.7 xri-uri-scheme-supported (1setOf uriScheme)

    This OPTIONAL READ-ONLY Printer Description attribute identifies the
    URI schemes that the implementation supports for use in the
    "printer-uri-supported" (1setOf uri) Printer Description attribute
    (see [RFC2911] section 4.4.1) and the "xri-uri" member attribute of
    the "printer-xri-supported" (1setOf collection) Printer Description
    attribute (see section 6.6).

    A Printer MUST support this attribute if it supports the setting of
    the "printer-xri-supported" (1setOf collection) with the Set-
    Printer-Attributes operation.

6.8 xri-authentication-supported (1setOf type2 keyword)

    This OPTIONAL READ-ONLY Printer Description attribute identifies the
    Client Authentication mechanisms that the implementation supports for
    use in the "uri-authentication-supported" (1setOf type2 keyword)
    Printer Description attribute (see [RFC2911], section 4.4.2) and the
    "xri-authentication" member attribute of the "printer-xri-supported"
    (1setOf collection) Printer Description attribute (see section 6.6).

    A Printer MUST support this attribute if it supports setting the
    "printer-xri-supported" (1setOf collection) with the Set-Printer-
    Attributes operation.

6.9 xri-security-supported (1setOf type2 keyword)

    This OPTIONAL READ-ONLY Printer Description attribute identifies the
    URI schemes that the implementation supports for use in the "uri-
    security-supported" (1setOf type2 keyword) Printer Description
    attribute (see [RFC2911], section 4.4.3) and the "xri-security"
    member attribute of the "printer-xri-supported" (1setOf collection)
    Printer Description attribute (see section 6.6).

    A Printer MUST support this attribute if it supports setting the
    "printer-xri-supported" (1setOf collection) with the Set-Printer-
    Attributes operation.

7 Additional status codes

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

7.1 client-error-attributes-not-settable (0x0413)

    The Set-Printer-Attributes or Set-Job-Attributes operation failed
    because one or more of the specified attributes cannot be set, either
    because the attribute is defined to be READ-ONLY or the attribute is
    not settable in this implementation (see sections 4.1.3 and 4.2.3).
    The Printer MUST return this error code and the attribute keyword
    name(s) and the 'not-settable' out-of-band value (see section 8.1) in
    the Unsupported Attributes Group (see [RFC2911], section 3.1.7) for
    all of the attributes that could not be set. When the Printer
    returns this status, it MUST NOT change any of the attributes
    supplied in the operation.

8 Additional out-of-band values

   This section defines additional out-of-band values. As with all
   out-of-band values, a client or a Printer MUST NOT use an out-of-band
   value unless the definition of the attribute in an operation request
   and/or response explicitly allows such usage. See the beginning of
   [RFC2911], section 4.1.

8.1 'not-settable' out-of-band value

   The 'not-settable' out-of-band attribute value is returned by the IPP
   Printer in the Unsupported Attributes group of a response to indicate
   that the attribute supplied by the client in the request is READ-ONLY
   by definition or is not settable in this implementation.

   The 'not-settable' out-of-band attribute value is defined for use
   with the Set-Job-Attributes and Set-Printer-Attributes responses
   only. If a future additional "set" operation allows the 'not-
   settable' out-of-band value, its definition document MUST indicate
   such use explicitly, including with which attributes.

   An IPP object MUST support the 'not-settable' out-of-band value in a
   Set-Job-Attributes or Set-Printer-Attributes request if it supports
   those operations. A client MUST NOT supply the 'not-settable' out-
   of-band value in any request. An IPP object MUST NOT support the
   'not-settable' out-of-band value in other operations, unless the
   operations' definition document explicitly defines such usage. If a
   Printer receives this out-of-band value in any operation request, the
   Printer MUST either (1) reject the entire request and return the
   'client-error-bad-request' status code or (2) ignore the attribute
   and return it with the 'unsupported' out-of-band value.

   See sections 4.1.3 and 4.2.3 in this document for an example
   definition of the usage of the 'not-settable' out-of-band value in
   the Set-Printer-Attributes and Set-Job-Attributes responses.

8.1.1 Encoding of the 'not-settable' out-of-band attribute value

   The encoding of the 'not-settable' out-of-band value is 0x15 (see
   [RFC2910]). The value-length MUST be 0 and the value empty.

8.2 'delete-attribute' out-of-band value

   The 'delete-attribute' out-of-band attribute value is supplied by the
   client in a request to indicate that the Printer is to remove the
   supplied attribute and all of its values from the target object, if
   present.

The 'delete-attribute' out-of-band attribute value is defined for use
with the Set-Job-Attributes request only. If a future additional
"set" operation allows the 'delete-attribute' out-of-band value, its
definition document MUST indicate such use explicitly, including with
which attributes.

An IPP Printer MUST support the 'delete-attribute' out-of-band value
if it supports the Set-Job-Attributes operation. A client MUST NOT
supply, and an IPP object MUST NOT support, the 'delete-attribute'
out-of-band value in other operations, unless the operations'
definition document explicitly defines such usage. For example, the
'delete-attribute' out-of-band value MUST NOT be used in the Set-
Printer-Attributes operation, where the absence of an attribute from
an IPP object indicates that the attribute is not supported. If a
Printer receives this out-of-band value in other operation requests,
the Printer MUST either (1) reject the entire request and return the
'client-error-bad-request' status code or (2) ignore the attribute
and return it with the 'unsupported' out-of-band value.

See section 4.2 in this document for the definition of the usage of
the 'delete-attribute' out-of-band value in the Set-Job-Attributes
request.

8.2.1 Encoding of the 'delete-attribute' out-of-band value

The encoding of the 'delete-attribute' out-of-band value is 0x16 (see
[RFC2910]). The value-length MUST be 0 and the value empty.

8.3 'admin-define' out-of-band attribute value

Section 4.3 defines the Get-Printer-Supported-Values response to
contain the values of an "xxx-supported" attribute that are supported
by the implementation before any additional values are defined by the
administrator. The 'admin-define' out-of-band attribute value is
returned as an additional value of an "xxx-supported" attribute in a
Get-Printer-Supported-Values response to indicate that the
implementation supports allowing an administrator to define
additional arbitrary 'name' values for that "xxx-supported"
attribute.

For example, if the "media-supported" (1setOf (type3 keyword | name))
attribute contains this value, then the Printer MUST permit an
administrator to add new media names to the Printer's "media-
supported" attribute. In order for an administrator to add new
values to a Printer's "xxx-supported" attribute, the client supplies
the existing and new values in a Set-Printer-Attributes request for

that attribute. The client MUST supply any such administratively
defined values in the Set-Printer-Attributes request, using the
'name' attribute syntax.

The 'admin-define' out-of-band attribute value is defined for use
with the Get-Printer-Supported-Values response only. A Printer MUST
NOT return the 'admin-define' out-of-band value in a Get-Printer-
Attributes response, since such a response indicates what an end-user
client can supply in a Job Creation operation. If a future
additional "get" operation allows the 'admin-define' out-of-band
value, its definition document MUST indicate such use explicitly,
including with which attributes.

An IPP Printer MUST support the 'admin-define' out-of-band value, if
it supports a client setting arbitrary 'name' values of an "xxx-
supported" Printer attribute using the Set-Printer-Attributes
operation. A client MUST NOT supply the 'admin-define' out-of-band
value in any request. An IPP object MUST NOT support the 'admin-
define' out-of-band value in other operations, unless the operations'
definition document explicitly defines such usage. If a Printer
receives this out-of-band value in any operation request, the Printer
MUST either (1) reject the entire request and return the 'client-
error-bad-request' status code or (2) ignore the attribute and return
it with the 'unsupported' out-of-band value.

This document defines that the 'admin-define' out-of-band value MUST
be used only with "xxx-supported" attributes that are defined to
include the 'name' attribute syntax. This out-of-band value is not
intended to be used with "xxx-supported" attributes of other
attribute syntaxes, such as 'uri', even though the administrator
defines arbitrary values for such attributes. If other documents
extend the use of the 'admin-define' out-of-band value to other
attribute syntaxes, such a document MUST define such use explicitly,
including with which attributes.

See section 4.3 in this document for an example definition of the
usage of the 'admin-define' out-of-band attribute value in any "xxx-
supported" attribute returned in a Get-Printer-Supported-Values
response that is defined to include the 'name' attribute syntax.

8.3.1 Encoding of the 'admin-define' out-of-band attribute value

The encoding of the 'admin-define' out-of-band attribute value is
0x17 (see [RFC2910]). The value-length MUST be 0 and the value
empty.

9 New Values for Existing Printer Description Attributes

   This section contains those attributes for which additional values
   are added.

9.1 operations-supported (1setOf type2 enum)

   The following "operation-id" values are added in order to support the
   new operations defined in this document:

                  Table 4 - Operation-id assignments

            Value   Operation Name

            0x0013   Set-Printer-Attributes

            0x0014   Set-Job-Attributes

            0x0015   Get-Printer-Supported-Values

10 Conformance Requirements

   This section specifies the conformance requirements for clients and
   IPP objects.

   Both the Set-Job-Attributes and the Set-Printer-Attributes operations
   defined in the document are OPTIONAL for an IPP object to support.
   Either one MAY be supported without the other or both MAY be
   supported. However, if the Set-Printer-Attributes operation is
   supported, then the Get-Printer-Supported-Values operation MUST be
   supported if any "xxx-supported" attributes are settable. Otherwise,
   the Get-Printer-Supported-Values operation is OPTIONAL for an IPP
   Printer to support.

   If the Set-Printer-Attributes operation is supported, then the
   Printer MUST support the following additional items:

      1. the Get-Printer-Supported-Values operation (see section 5), if
         any "xxx-supported" attributes are settable.

      2. the "printer-settable-attributes-supported" Printer Description
         attribute (see section 6.1).

      3. the 'not-settable' out-of-band value in responses (see section
         8.1).

      4. the 'client-error-not-settable' status code (see section 7.1).

   5. if the "printer-message-from-operator" Printer Description
      attribute is supported (see [RFC2911], section 4.4.25), then it
      MUST be settable.

   6. the Get-Printer-Supported-Values operation (see section 4.3),
      if any "xxx-supported" attributes are settable.

   7. If a client can set a value with the 'name' attribute syntax
      for one or more "xxx-supported" attributes, then the 'admin-
      define' out-of-band attribute value (see section 8.3) MUST be
      supported in the Get-Printer-Supported-Values response for each
      such settable attribute (see section 4.3)

   If the Set-Job-Attributes operation is supported, then the Printer
   MUST support the following additional items:

   1. the "job-settable-attributes-supported" Printer Description
      attribute (see section 6.2).

   2. the 'not-settable' out-of-band value in responses (see section
      8.1).

   3. the 'delete-attribute' out-of-band value in requests (see
      section 8.2).

   4. the 'client-error-not-settable' status code (see section 7.1).

   5. if the "job-message-from-operator" Printer Description
      attribute is supported (see [RFC2911], 4.3.16), then it MUST be
      settable.

   It is OPTIONAL for the Printer object to support the "printer-
   message-time" (integer) and "printer-message-date-time" (dateTime)
   Printer Description attributes. If both the "printer-message-time"
   (integer) and the "printer-current-time" (dateTime) (see [RFC2911],
   section 4.4.30) attributes are supported, then the "printer-message-
   date-time" (dateTime) Printer Description attribute MUST be
   supported.

   As with all out-of-band values, a client or a Printer MUST NOT use an
   out-of-band value, unless the definition document for the attribute
   in an operation request and/or response explicitly allows such usage.

11 IANA Considerations

   This section contains registration information for IANA to add to the
   various IPP Registries according to the procedures defined in RFC
   2911 [RFC2911], section 6. The resulting registrations will be
   published in the http://www.iana.org/assignments/ipp-registrations
   registry.

11.1 Operation Registrations

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

   Operations: Ref.   Section:
   Set-Printer-Attributes   RFC 3380   4.1
   Set-Job-Attributes   RFC 3380   4.2
   Get-Printer-Supported-Values   RFC 3380   4.3

11.2 Additional Enum Attribute Value Registrations for the
     "operations-supported" Printer Attribute

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

   Enum Attribute Values: Value   Ref.   Section:
   Set-Printer-Attributes   0x0013   RFC 3380   4
   Set-Job-Attributes   0x0014   RFC 3380   4
   Get-Printer-Supported-Values   0x0015   RFC 3380   4

11.3 Keyword attribute value registrations

   The following table lists all of the attributes defined in this
   standard which have keywords values defined:

   printer-settable-attributes-supported (1setOf type2 keyword)
                                               RFC 3380   6.1
     none   RFC 3380   6.1
     <Any other Printer attribute keyword name>
   job-settable-attributes-supported (1setOf type2 keyword)
                                               RFC 3380   6.2
     none   RFC 3380   6.2
     <Any other Job attribute keyword name>
   document-format-varying-attributes (1setOf type2 keyword)
                                               RFC 3380   6.3
     none
     <Any Printer attribute keyword name>
   xri-security-supported (1setOf type2 keyword)   RFC 3380   6.9
     none   RFC 2911   4.4.3
     ssl3   RFC 2911   4.4.3
     tls'   RFC 2911   4.4.3
   xri-authentication-supported (1setOf type2 keyword)
     none   RFC 2911   4.4.2
     requesting-user-name   RFC 2911   4.4.2
     basic   RFC 2911   4.4.2
     digest   RFC 2911   4.4.2
     certificate   RFC 2911   4.4.2

11.4 Attribute Registrations

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

   Operation attributes: Ref.   Section:
   printer-message-from-operator (text(127))   RFC 3380   5.1
   job-message-from-operator (text(127))   RFC 3380   5.2

   Printer Description attributes: Ref.   Section:
   printer-settable-attributes-supported (1setOf type2 keyword)
                                                    RFC 3380   6.1
   job-settable-attributes-supported (1setOf type2 keyword)
                                                    RFC 3380   6.2
   document-format-varying-attributes (1setOf type2 keyword)
                                                    RFC 3380   6.3
   printer-message-time (integer(MIN:MAX))   RFC 3380   6.4
   printer-message-date-time (dateTime)   RFC 3380   6.5
   printer-xri-supported (1setOf collection)   RFC 3380   6.6
     xri-uri (uri)   RFC 3380   6.6
     xri-authentication (type2 keyword)   RFC 3380   6.6
     xri-security (type2 keyword)   RFC 3380   6.6
   xri-uri-scheme-supported (1setOf uriScheme)   RFC 3380   6.7
   xri-authentication-supported (1setOf type2 keyword)   6.8
   xri-security-supported (1setOf type2 keyword)   RFC 3380   6.9

11.5 Status code Registrations

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

   Status codes: Ref.   Section:
   client-error-attributes-not-settable (0x0413)   RFC 3380   7.1

11.6 Out-of-band Attribute Value Registrations

   The following table lists all of the out-of-band attribute values
   defined in this document. These are to be registered according to
   the procedures in RFC 2911 [RFC2911] section 6.7.

   Value: Out-of-band Attribute value name: Ref.   Section:
   0x15   not-settable   RFC 3380   8.1
   0x16   delete-attribute   RFC 3380   8.2
   0x17   admin-define   RFC 3380   8.3

12 Internationalization Considerations

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

13 Security Considerations

   The IPP Model and Semantics document ([RFC2911], section 8) 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.

   In addition, the introduction of the Set-Printer-Attributes and Set-
   Job-Attributes operations creates another security threat, since the
   client is able to modify the Printer and Job attributes stored in the
   Printer. Such modifications could lead to denial of service.

   A malicious user could alter the policy established by the system
   administrator and stored in the Printer attributes. Such alteration
   could either grant access to more resources or deny access to
   resources that the system administrator has established. For
   example, the malicious user could remove all of the document-format
   values from the "document-format-supported" Printer attribute so that
   the Printer would refuse to accept all jobs.

   The general remedy for such malicious user actions against Printer
   attributes is to have strong Client Authentication coupled with
   Printer access control, to limit the users who have System
   Administrator or Operator privileges.

   A malicious user could modify the Job Template attributes of another
   user's Job, such as the "copies" attribute. For example, setting the
   number of copies to a large number.

   The general remedy for such malicious user actions against another
   user's job is to have strong Client Authentication coupled with
   Printer access control to limit the users who have System
   Administrator or Operator privileges who can modify any job and, in
   addition, store the Client Authentication with each Job so that only
   the job owner End User can modify his/her own job.

14 References

14.1 Normative References

   [RFC2565]   Herriot, R., Butler, S., Moore, P. and R. Tuner, "Internet
               Printing Protocol/1.0: Encoding and Transport", RFC 2565,
               April 1999.

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

   [RFC2910]   Herriot, R., Butler, S., Moore, P. and R. Turner,
               "Internet Printing Protocol/1.1: Encoding and Transport",
               RFC 2910, September 2000.

   [RFC2911]   Hastings, T., Herriot, R., deBry, R., Isaacson, S. and P.
               Powell, "Internet Printing Protocol/1.0: Model and
               Semantics", RFC 2911, September 2000.

   [RFC3382] deBry, R., Hastings, T., Herriot, R., Ocke, K. and P.
               Zehler, "Internet Printing Protocol (IPP): The
               'collection' attribute syntax", RFC 3382, September 2002.

14.2 Informative References

   [RFC2251]   Wahl, M., Howes, T. abd S. Kille, "Lightweight Directory
               Access Protocol (v3)", RFC 2251, December 1997.

   [RFC2252]   Wahl, M., Coulbeck, A., Howes, T. and S. Kille,
               "Lightweight Directory Access Protocol (v3): Attribute
               Syntax Definitions", RFC 2252, December 1997.

   [RFC2608]   Guttman, E., Perkins, C., Veizades, J. and M. Day,
               "Service Location Protocol, Version 2", RFC 2608, June
               1999.

   [RFC2609]   Guttman, E., Perkins, C. and J. Kempf, "Service Templates
               and service: Schemes", RFC 2609, June 1999.

   [RFC3196] Hastings, T., Manros, C., Zehler, P., Kugler, C. and H.
               Holst, "Internet Printing Protocol/1.1: Implementor's
               Guide", RFC 3196, November 2001.

Appendix A: Allowed Values for Set-Printer-Attributes and
           Set-Job-Attributes requests (Normative)

   This appendix is a normative part of this document and contains a
   table of all IPP/1.1 attributes. Each row contains:

      - an attribute and

      - the values allowed in the Set-Printer-Attributes or Set-Job-
        Attributes request for the attribute. The entry in each cell
        is the name (first few words) of each item below 1, 2, 3, 4a-g,
        and 5.

   The allowed values include the following cases:

      1. READ-ONLY: the Set-Printer-Attributes or Set-Job-Attributes
         operation MUST NOT change this attribute and MUST reject the
         entire operation (see section 7.1).

      2. Any of "xxx-supported": the Set-Printer-Attributes or Set-
         Job-Attributes operation accepts values that are allowed
         according to the IPP/1.1 rules for validating the value(s) of
         an "xxx" Printer or Job attribute against the value(s) of the
         corresponding "xxx-supported" Printer attribute. Table 5
         summarizes those validation rules depending on each attribute
         syntax and value of an "xxx" attribute supplied in the request
         and that of the corresponding "xxx-supported" Printer
         attribute. The "xxx-supported" attribute syntax type and
         value(s) are obtained from a Get-Printer-Supported-Values
         response (see the tables in this Appendix).

Table 5 - Validation rules for 'Any of "xxx-supported" '

Type of "xxx" value to be set	Type of "xxx-supported" value	Validates if:
integer	rangeOfInteger	each value is in one of the "xxx-supported" ranges
uri	uriScheme	each uri scheme matches one of the "xxx-supported" schemes
any	boolean	if the boolean "xxx-supported" is 'true'
any	same type	each value matches an "xxx-supported" value of the same type

For additional non-normative explanatory information see section 3.1.2.3 of the "Internet Printing Protocol/1.1: Implementer's Guide" [RFC3196].

3. From Get-Printer-Supported-Values: the Set-Printer-Attributes operation accepts values that are allowed according to the IPP/1.1 rules for validating the value(s) of an "xxx" Printer attribute against the value(s) of the corresponding "xxx-supported" Printer attribute. Table 6 summarizes those validation rules depending on each attribute syntax and value of an "xxx" attribute supplied in the request and that of the corresponding "xxx-supported" Printer attribute. The "xxx-supported" attribute syntax type and attribute value(s) are obtained from a Get-Printer-Supported-Values response (see Appendix B: Attributes returned from Get-Printer-Supported-Values below).

Table 6 - Validation rules for 'From Get-Printer-Supported-Values'

Type of "xxx" value to be set	- supported" value Type of "xxx	Validates if:
integer	rangeOfInteger	each 'integer' value is in one of the "xxx-supported" ranges
uri	uriScheme	the uri scheme of each value matches one of the "xxx-supported" schemes
any	boolean	if the boolean "xxx-supported" is 'true'
name	'admin-define' out-of-band value	any 'name' value matches
any	same type	each value matches an "xxx-supported" value of the same type

For additional non-normative explanatory information see section 3.1.2.3 of the "Internet Printing Protocol/1.1: Implementer's Guide" [RFC3196].

4. Any value of the proper attribute syntax: the Set-Printer-Attributes or Set-Job-Attributes operation accepts any value of the specified attribute syntax. The attribute syntaxes supported are enumerated below.

    a. Any text(127)
    b. Any name(127)
    c. Any uri
    d. Any boolean
    e. Any positive integer
    f. Any dateTime
    g. 1setOf any uri

5. Combination of 'Any of "xxx-supported"' or 'Any name'. If a Printer implementation doesn't want to allow setting values indicated in this Appendix as "any xxx", it can make the value be not-settable.

Table 7 – Values allowed for Job Template Attributes in the
Set-Job-Attributes Operation

Job Template Attributes	Values allowed for Set
job-priority (integer(1:100))	Any of "xxx-supported"
job-hold-until (type3 keyword | name (MAX))	Any of "xxx-supported"
job-sheets (type3 keyword | name(MAX))	Any of "xxx-supported"
multiple-document-handling (type2 keyword)	Any of "xxx-supported"
copies (integer(1:MAX))	Any of "xxx-supported"
finishings (1setOf type2 enum)	Any of "xxx-supported"
page-ranges (1setOf rangeOfInteger (1:MAX))	Any of "xxx-supported"
sides (type2 keyword)	Any of "xxx-supported"
number-up (integer(1:MAX))	Any of "xxx-supported"
orientation-requested (type2 enum)	Any of "xxx-supported"
media (type3 keyword | name(MAX))	Any of "xxx-supported"
printer-resolution (resolution)	Any of "xxx-supported"
print-quality (type2 enum)	Any of "xxx-supported"

Table 8 - Values allowed for Job Description Attributes in the
Set-Job-Attributes Operation

Job Description Attributes	Values allowed for Set
job-uri (uri)	READ-ONLY
job-id (integer(1:MAX))	READ-ONLY
job-printer-uri (uri)	READ-ONLY
job-more-info (uri)	READ-ONLY
job-name (name(MAX))	Any name(MAX)
job-originating-user-name (name(MAX))	READ-ONLY
job-state (type1 enum)	READ-ONLY
job-state-reasons (1setOf type2 keyword)	READ-ONLY
job-state-message (text(MAX))	READ-ONLY
job-detailed-status-messages (1setOf text(MAX))	READ-ONLY
job-document-access-errors (1setOf text(MAX))	READ-ONLY
number-of-documents (integer(0:MAX))	READ-ONLY
output-device-assigned (name(127))	READ-ONLY
time-at-creation (integer(MIN:MAX))	READ-ONLY
time-at-processing (integer(MIN:MAX))	READ-ONLY
time-at-completed (integer(MIN:MAX))	READ-ONLY
job-printer-up-time (integer(1:MAX))	READ-ONLY
date-time-at-creation (dateTime)	READ-ONLY

Job Description Attributes   Values allowed for
                                          Set

date-time-at-processing (dateTime)   READ-ONLY

date-time-at-completed (dateTime)   READ-ONLY

number-of-intervening-jobs (integer(0:MAX)) READ-ONLY

job-message-from-operator (text(127))   Any text(127)

job-k-octets (integer(0:MAX))   READ-ONLY

job-impressions (integer(0:MAX))   READ-ONLY

job-media-sheets (integer(0:MAX))   READ-ONLY

job-k-octets-processed (integer(0:MAX))   READ-ONLY

job-impressions-completed (integer(0:MAX)) READ-ONLY

job-media-sheets-completed (integer(0:MAX)) READ-ONLY

attributes-charset (charset)   READ-ONLY

attributes-natural-language   READ-ONLY
(naturalLanguage)

Table 9 - Values allowed for Printer Job Template Attributes in
              the Set-Printer-Attributes Operation

Printer Job Template Attributes   Values allowed
                                          for Set

job-priority-default (integer(1:100))   Any of "xxx-
                                          supported"

job-hold-until-default (type3 keyword | name   Any of "xxx-
(MAX))   supported"

job-sheets-default (type3 keyword | name(MAX)) Any of "xxx-
                                          supported"

multiple-document-handling-default (type2   Any of "xxx-
keyword)   supported"

copies-default (integer(1:MAX))   Any of "xxx-
                                          supported"

Printer Job Template Attributes	Values allowed for Set
finishings-default (1setOf type2 enum)	Any of "xxx-supported"
sides-default (type2 keyword)	Any of "xxx-supported"
number-up-default (integer(1:MAX))	Any of "xxx-supported"
orientation-requested-default (type2 enum)	Any of "xxx-supported"
media-default (type3 keyword | name(MAX))	Any of "xxx-supported"
printer-resolution-default (resolution)	Any of "xxx-supported"
print-quality-default (type2 enum)	Any of "xxx-supported"
job-priority-supported (integer(1:100))	From Get-Printer-Supported-Values
job-hold-until-supported (1setOf(type3 keyword | name (MAX)))	From Get-Printer-Supported-Values
job-sheets-supported (1setOf(type3 keyword | name(MAX)))	From Get-Printer-Supported-Values
multiple-document-handling-supported (1setOf type2 keyword)	From Get-Printer-Supported-Values
copies-supported (rangeOfInteger(1:MAX))	From Get-Printer-Supported-Values
finishings-supported (1setOf type2 enum)	From Get-Printer-Supported-Values

Printer Job Template Attributes	Values allowed for Set
page-ranges-supported (boolean)	From Get-Printer-Supported-Values
sides-supported (1setOf type2 keyword)	From Get-Printer-Supported-Values
number-up-supported (1setOf (integer(1:MAX) | rangeOfInteger(1:MAX)))	From Get-Printer-Supported-Values
orientation-requested-supported (1setOf type2 enum)	From Get-Printer-Supported-Values
media-supported (1setOf (type3 keyword | name(MAX)))	From Get-Printer-Supported-Values
printer-resolution-supported (1setOf resolution)	From Get-Printer-Supported-Values
print-quality-supported (1setOf type2 enum)	From Get-Printer-Supported-Values
media-ready (type3 keyword | name(MAX))	From Get-Printer-Supported-Values

Table 10 - Values allowed for Printer Description Attributes in
                 the Set-Printer-Attributes Operation

Printer Description Attributes	Values allowed for Set
printer-uri-supported (1setOf uri)	READ-ONLY
uri-authentication-supported (1setOf type2 keyword)	READ-ONLY
uri-security-supported (1setOf type2 keyword)	READ-ONLY
printer-xri-supported (1setOf collection) member attributes:	
xri-uri (uri)	any uriScheme of "xri-uri-scheme-supported" from Get-Printer-Attributes
xri-authentication (type2 keyword)	any keyword of "xri-authentication-supported" from Get-Printer-Attributes
xri-security (type2 keyword)	any keyword of "xri-security-supported" from Get-Printer-Attributes
xri-uri-scheme-supported (1setOf uriScheme)	READ-ONLY
xri-authentication-supported (1setOf type2 keyword)	READ-ONLY
xri-security-supported (1setOf type2 keyword)	READ-ONLY

Printer Description Attributes	Values allowed for Set
printer-name (name(127))	Any name(127)
printer-location (text(127))	Any text(127)
printer-info (text(127))	Any text(127)
printer-more-info (uri)	Any uri
printer-driver-installer (uri)	Any uri
printer-make-and-model (text(127))	Any text(127)
printer-more-info-manufacturer (uri)	Any uri
printer-state (type1 enum)	READ-ONLY
printer-state-reasons (1setOf type2 keyword)	READ-ONLY
printer-state-message (text(MAX))	READ-ONLY
ipp-versions-supported (1setOf type2 keyword)	From Get-Printer-Supported-Values
operations-supported (1setOf type2 enum)	From Get-Printer-Supported-Values
multiple-document-jobs-supported (boolean)	From Get-Printer-Supported-Values
charset-configured (charset)	Any of "xxx-supported", use "charset-supported"
charset-supported (1setOf charset)	From Get-Printer-Supported-Values

Printer Description Attributes	Values allowed for Set
natural-language-configured (naturalLanguage)	Any of "xxx-supported", use "generated-natural-language-supported"
generated-natural-language-supported (1setOf naturalLanguage)	From Get-Printer-Supported-Values
document-format-default (mimeMediaType)	Any of "xxx-supported"
document-format-supported (1setOf mimeMediaType)	From Get-Printer-Supported-Values
printer-is-accepting-jobs (boolean)	READ-ONLY
queued-job-count (integer(0:MAX))	READ-ONLY
printer-message-from-operator (text(127))	Any text(127)
color-supported (boolean)	From Get-Printer-Supported-Values
reference-uri-schemes-supported (1setOf uriScheme)	From Get-Printer-Supported-Values
pdl-override-supported (type2 keyword)	From Get-Printer-Supported-Values
printer-up-time (integer(1:MAX))	READ-ONLY
printer-current-time (dateTime)	Any dateTime **
multiple-operation-time-out (integer(1:MAX))	any positive integer
compression-supported (1setOf type3 keyword)	From Get-Printer-Supported-Values
job-k-octets-supported (rangeOfInteger(0:MAX))	From Get-Printer-Supported-Values

Printer Description Attributes	Values allowed for Set
job-impressions-supported (rangeOfInteger(0:MAX))	From-Get-Printer-Supported-Values
job-media-sheets-supported (rangeOfInteger(0:MAX))	From Get-Printer-Supported-Values
pages-per-minute (integer(0:MAX))	READ-ONLY
pages-per-minute-color (integer(0:MAX))	READ-ONLY
printer-settable-attributes-supported (1setOf type2 keyword)	From Get-Printer-Supported-Values
job-settable-attributes-supported (1setOf type2 keyword)	From Get-Printer-Supported-Values
document-format-varying-attributes (1setOf type2 keyword)	READ-ONLY
printer-message-time (integer(MIN:MAX))	READ-ONLY
printer-message-date-time(dateTime)	READ-ONLY

   ** - The "printer-current-time" (dateTime) attribute is settable in
   order to allow an administrator to correct an incorrect dateTime or
   time zone.

Appendix B: Attributes returned from Get-Printer-Supported-Values
            (Normative)

   This Appendix is a normative part of this document and lists all the
   attributes that are possible for an implementation to return in a
   Get-Printer-Supported-Values response, i.e., all the "xxx-supported"
   attributes that can be supplied in a Set-Printer-Attributes request.
   READ-ONLY attributes MUST NOT be returned in a Get-Printer-
   Supported-Values response and are indicated in the tables as "READ-
   ONLY - MUST NOT be returned."

   For the following attributes, the value allowed by the Set-Printer-
   Attributes operation MUST be a single integer value in the range
   specified by the value returned by the Get-Printer-Supported-Values
   operation.

Table 11 - Printer Job Template Attributes returned from
                  Get-Printer-Supported-Values

Printer Job Template Attributes	Values Returned
job-priority-supported (integer(1:100))	rangeOfInteger(1:100)

For the following attributes, the value allowed by the Set-Printer-
Attributes operation MUST be a single rangeOfInteger value whose
bounds do not exceed those of the range specified by the value
returned by the Get-Printer-Supported-Values operation.

Table 12 - Printer Job Template Attributes returned from
                  Get-Printer-Supported-Values

Printer Job Template Attributes	Values Returned
copies-supported (rangeOfInteger(1:MAX))	rangeOfInteger(1:MAX)

The following table has the same criteria as the last, but is for
Printer Description attributes.

Table 13 - Printer Description Attributes returned from
                  Get-Printer-Supported-Values

Printer Description Attributes	Values allowed for Set
job-k-octets-supported (rangeOfInteger(0:MAX))	rangeOfInteger(0:MAX)
job-impressions-supported (rangeOfInteger(0:MAX))	rangeOfInteger(0:MAX)
job-media-sheets-supported (rangeOfInteger(0:MAX))	rangeOfInteger(0:MAX)

For the following attributes, the value allowed by the Set-Printer-
Attributes operation MUST be one or more integers and rangeOfInteger
values, such that the integer values described by these integers and
rangeOfInteger is the same as or a subset of the integers described
by the integers and rangeOf Integer of values returned by the Get-
Printer-Supported-Values operation.

Table 14 - Printer Job Template Attributes returned from
             Get-Printer-Supported-Values

Printer Job Template Attributes	Values Returned
number-up-supported (1setOf (integer(1:MAX) | rangeOfInteger(1:MAX)))	1setOf (integer(1:MAX) | rangeOfInteger(1:MAX))

For the following attributes, the value allowed by the Set-Printer-
Attributes operation MUST be one or more values, where each such
value matches a value returned by the Get-Printer-Supported-Values
operation. A keyword, enum, boolean, charset, naturalLanguage,
uriScheme, mimeMediaType or resolution value matches if it is equal.
For Job Template attributes, with the attribute syntax 'type3 keyword
| name', any 'name' attribute syntax value matches the 'admin-define'
out-of-band value, if the implementation allows the administrator to
set any name values for the attribute.

Table 15 - Printer Job Template Attributes returned from
             Get-Printer-Supported-Values

Printer Job Template Attributes	Values Returned
job-hold-until-supported (1setOf(type3 keyword | name (MAX)))	1setOf (type3 keyword | 'admin-define')
job-sheets-supported (1setOf(type3 keyword | name(MAX)))	1setOf (type3 keyword | 'admin-define')
multiple-document-handling-supported (1setOf type2 keyword)	1setOf type2 keyword
finishings-supported (1setOf type2 enum)	1setOf type2 enum
page-ranges-supported (boolean)	1setOf boolean **
sides-supported (1setOf type2 keyword)	1setOf type2 keyword
orientation-requested-supported (1setOf type2 enum)	1setOf type2 enum

Printer Job Template Attributes	Values Returned
media-supported (1setOf (type3 keyword | name(MAX)))	1setOf (type3 keyword | 'admin-define')
printer-resolution-supported (1setOf resolution)	1setOf resolution
print-quality-supported (1setOf type2 enum)	1setOf type2 enum

** Note: the Get-Printer-Supported-Values returns a '1setOf boolean'
so that all possible values are indicated, while ** Get-Printer-
Attributes returns only a single 'boolean' value.

The following table has the same criteria as the last, but is for
Printer Description attributes.

Table 16 - Printer Description Attributes returned from
Get-Printer-Supported-Values

Printer Description Attributes	Values allowed for Set
printer-uri-supported (1setOf uri)	READ-ONLY - MUST NOT be returned
uri-authentication-supported (1setOf type2 keyword)	READ-ONLY - MUST NOT be returned
uri-security-supported (1setOf type2 keyword)	READ-ONLY - MUST NOT be returned
printer-xri-supported (1setOf collection)	MUST NOT be returned; see next three attributes returned with Get-Printer-Attributes:
xri-uri-scheme-supported (1setOf uriScheme)	READ-ONLY - MUST NOT be returned
xri-authentication-supported (1setOf type2 keyword)	READ-ONLY - MUST NOT be returned
xri-security-supported (1setOf type2 keyword)	READ-ONLY - MUST NOT be returned

Printer Description Attributes	Values allowed for Set
ipp-versions-supported (1setOf type2 keyword)	1setOf type2 keyword
operations-supported (1setOf type2 enum)	1setOf type2 keyword
multiple-document-jobs-supported (boolean)	1setOf boolean **
charset-supported (1setOf charset)	1setOf charset
generated-natural-language-supported (1setOf naturalLanguage)	1setOf naturalLanguage
document-format-supported (1setOf mimeMediaType)	1setOf mimeMediaType
color-supported (boolean)	1setOf boolean **
reference-uri-schemes-supported (1setOf uriScheme)	1setOf uriScheme
pdl-override-supported (type2 keyword)	1setOf type2 keyword **
compression-supported (1setOf type3 keyword)	1setOf type3 keyword
printer-settable-attributes-supported (1setOf type2 keyword)	1setOf type2 keyword
job-settable-attributes-supported (1setOf type2 keyword)	1setOf type2 keyword

** Note: the Get-Printer-Supported-Values returns a '1setOf X' so
that all possible values are indicated, while Get-Printer-Attributes
returns only a single 'X' value.

Appendix C: Description of the Base IPP Documents (Informative)

    The base set of IPP documents includes:

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

    The "Design Goals for an Internet Printing Protocol" document takes a
    broad look at distributed printing functionality, and it enumerates
    real-life scenarios that help to clarify the features that need to be
    included in a printing protocol for the Internet. It identifies
    requirements for three types of users: end users, operators, and
    administrators. It calls out a subset of end user requirements that
    are satisfied in IPP/1.0 [RFC2566, RFC2565]. A few OPTIONAL operator
    operations have been added to IPP/1.1 [RFC2911, RFC2910].

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

    The "Internet Printing Protocol/1.1: Model and Semantics" document
    describes a simplified model with abstract objects, their attributes,
    and their operations. The model introduces a Printer and a Job. The
    Job supports multiple documents per Job. The model document also
    addresses how security, internationalization, and directory issues
    are addressed.

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

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

and/or IPP object implementations. For example, a typical order of
processing requests is given, including error checking. Motivation
for some of the specification decisions are also included.

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

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IPP Web Page: http://www.pwg.org/ipp/
IPP Mailing List: ipp@pwg.org

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

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

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