Internet Printing Protocol WG
INTERNET-DRAFT
<draft-ietf-ipp-job-printer-set-ops-05.txt>
Updates: RFC 2910 and 2911
[Target Category: standards track]
Expires: February 28, 2002

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August 28, 2001

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

Status of this Memo

Abstract

This document specifies 3 additional OPTIONAL operations for use with the Internet Printing Protocol/1.0 (IPP) [RFC2565, RFC2566], and IPP/1.1 [RFC2911, RFC2910]. 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 third administrator Get-Printer-Supported-Values operation returns values that the IPP Printer will accept for setting its "xxx-supported" attributes.

Three out-of-band values are defined for use with these operations: 'delete-attribute', 'admin-define', and 'not-settable', along with a 'client-error-attributes-not-settable' status code.

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.

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)

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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 section 18.

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.

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 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 operation (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 IPP/1.1 Model and Semantics document [RFC2911] section 3.1.

The Set-Job-Attributes operation (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 a 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 16 and 8.3).

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 does 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" attribute 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 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 example:

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 been configured yet and so had the 'no-value' out-of-band value (see [RFC2911] section 4.1), the supplied value(s) replace 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 13 and 3.1.6.

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 returned 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 16 and 8.3). 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 operations 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" in the Set-Job-Attributes request, then the Printer MUST set the "job-message-from-operator" Job attribute to this new value.

If the Printer supports the Set-Job-Attributes operation, then it SHOULD support 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 define 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 13 and 3.1.6.

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 returned 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] 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 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 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 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 is 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" 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" 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 [ipp-coll]) 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 (1setOf type2 keyword)	yes	yes
xri-security (1setOf type2 keyword)	yes	yes

Each collection value MUST contain a single unique value for the "xri-uri" member attribute. However, the other two member attributes are multi-valued, so that a single URI can support more than one authentication scheme and/or more than one security scheme. 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.

When performing a Set-Printer-Attributes operation, if there are multiple values for the "xri-authentication" and/or "xri-security" member attributes, the Printer MUST set the corresponding three READ-ONLY attributes with all possible combinations of values. For example, setting the "printer-xri-supported" with the following two collection values where the first URI has both 'basic' and 'digest' authentication:

```
"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 setting 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 response 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 value 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 "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.

Note to RFC Editors: Replace RFC NNNN below with the RFC number for this document, so that it accurately reflects the content of the information for the IANA 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 NNNN	4.1
Set-Job-Attributes	RFC NNNN	4.2
Get-Printer-Supported-Values	RFC NNNN	4.3

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

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 NNNN	4
Set-Job-Attributes	0x0014	RFC NNNN	4
Get-Printer-Supported-Values	0x0015	RFC NNNN	4

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

11.3 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 NNNN	5.1
job-message-from-operator (text(127))	RFC NNNN	5.2

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

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

11.4 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 NNNN       7.1
```

The resulting status code registration will be published in the ftp://ftp.iana.org/in-notes/iana/assignments/ipp/status-codes/ area.

11.5 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.

```
   Out-of-band Attribute Values:                      Ref.      Section:
   'not-settable' out-of-band value                   RFC NNNN       8.1
   'delete-attribute' out-of-band value               RFC NNNN       8.2
   'admin-define' out-of-band attribute value         RFC NNNN       8.3
```

The resulting out-of-band attribute value registrations will be published in the ftp.iana.org/in-notes/iana/assignments/ipp/out-of-band-attribute-value-tags/ area.

12 Internationalization Considerations

This document has the same localization considerations as the [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 Author's Addresses

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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.

15 References

15.1 Normative References

[ipp-coll]
deBry, R., , Hastings, T., Herriot, R., "Internet Printing Protocol (IPP): The Collection Attribute Syntax", <draft-ietf-ipp-collection-05.txt>, work in progress, July 17, 2001.

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

[RFC2566]
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[RFC2910]
Herriot, R., Butler, S., Moore, P., Turner, R., "Internet Printing Protocol/1.1: Encoding and Transport", RFC 2910, September 2000.

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

15.2 Informative References

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

[RFC2251]
Wahl, Howes, Kille. Lightweight Directory Access Protocol (v3), RFC 2251, December 1997.

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

[RFC2608]
E. Guttman, C. Perkins, J. Veizades, M. Day. Service Location Protocol, Version 2, RFC 2608, June 1999. (Updates RFC 2165)

[RFC2609]
E. Guttman, C. Perkins, J. Kempf. Service Templates and service: Schemes, RFC 2609, June 1999. (Updates RFC 2165)

16 Appendix A: Allowed Values for Set-Printer-Attributes and Set-Job-Attributes requests

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" [ipp-iig]).

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	Type of "xxx-supported" value	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" [ipp-iig]).

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.

.170 **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"

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.172 **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
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 (naturalLanguage)	READ-ONLY

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.174 **Table 9 - Values allowed for Printer Job Template Attributes in the Set-Printer-Attributes**
.175 **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 (MAX))	Any of "xxx-supported"
job-sheets-default (type3 keyword | name(MAX))	Any of "xxx-supported"
multiple-document-handling-default (type2 keyword)	Any of "xxx-supported"
copies-default (integer(1:MAX))	Any of "xxx-supported"
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
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

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.177 **Table 10 - Values allowed for Printer Description Attributes in the Set-Printer-Attributes**
.178 **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 (1setOf type2 keyword)	any keyword of "xri-authentication-supported" from Get-Printer-Attributes
xri-security (1setOf 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-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
natural-language-configured (naturalLanguage)	Any of "xxx-supported", use "generated-natural-language-supported"

Printer Description Attributes	Values allowed for Set
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
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.

17 Appendix B: Attributes returned from Get-Printer-Supported-Values

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 value 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
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.

.217 **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
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

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

.220 18 Appendix C: Description of the Base IPP Documents

.221 The base set of IPP documents includes:

.222 Design Goals for an Internet Printing Protocol [RFC2567]
.223 Rationale for the Structure and Model and Protocol for the Internet Printing Protocol [RFC2568]
.224 Internet Printing Protocol/1.1: Model and Semantics [RFC2911]
.225 Internet Printing Protocol/1.1: Encoding and Transport [RFC2910]
.226 Internet Printing Protocol/1.1: Implementer's Guide [IPP-IIG]

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 is 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.

19 Appendix D: Full Copyright Statement

Acknowledgement

Funding for the RFC Editor function is currently provided by the Internet Society.