                 Mapping between LPD and IPP Protocols

Status of this Memo

   This memo defines an Experimental Protocol for the Internet
   community.  It does not specify an Internet standard of any kind.
   Discussion and suggestions for improvement are requested.
   Distribution of this memo is unlimited.

IESG Note

   This document defines an Experimental protocol for the Internet
   community.  The IESG expects that a revised version of this protocol
   will be published as Proposed Standard protocol.  The Proposed
   Standard, when published, is expected to change from the protocol
   defined in this memo.  In particular, it is expected that the
   standards-track version of the protocol will incorporate strong
   authentication and privacy features, and that an "ipp:" URL type will
   be defined which supports those security measures.  Other changes to
   the protocol are also possible.  Implementors are warned that future
   versions of this protocol may not interoperate with the version of
   IPP defined in this document, or if they do interoperate, that some
   protocol features may not be available.

   The IESG encourages experimentation with this protocol, especially in
   combination with Transport Layer Security (TLS) [RFC 2246], to help
   determine how TLS may effectively be used as a security layer for
   IPP.

Abstract

   This document is one of a set of documents, which together describe
   all aspects of a new Internet Printing Protocol (IPP). IPP is an
   application level protocol that can be used for distributed printing
   using Internet tools and technologies. This document gives some
   advice to implementers of gateways between IPP and LPD (Line Printer
   Daemon). This document describes the mapping between (1) the commands
   and operands of the 'Line Printer Daemon (LPD) Protocol' specified in
   RFC 1179 and (2) the operations, operation attributes and job
   template attributes of the Internet Printing Protocol/1.0 (IPP).  One
   of the purposes of this document is to compare the functionality of
   the two protocols.  Another purpose is to facilitate implementation
   of gateways between LPD and IPP.

   WARNING: RFC 1179 was not on the IETF standards track.  While RFC
   1179 was intended to record existing practice, it fell short in some
   areas.  However, this specification maps between (1) the actual
   current practice of RFC 1179 and (2) IPP.  This document does not
   attempt to map the numerous divergent extensions to the LPD protocol
   that have been made by many implementers.

   The full set of IPP documents includes:

       Design Goals for an Internet Printing Protocol [RFC2567]
       Rationale for the Structure and Model and Protocol for the
       Internet Printing Protocol [RFC2568]
       Internet Printing Protocol/1.0: Model and Semantics [RFC2566]
       Internet Printing Protocol/1.0: Encoding and Transport [RFC2565]
       Internet Printing Protocol/1.0: Implementors Guide [ipp-iig]
       Mapping between LPD and IPP Protocols (this document)

   The document, "Design Goals for an Internet Printing Protocol", 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. Operator and administrator requirements are
   out of scope for version 1.0.

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

The document, "Internet Printing Protocol/1.0: Model and Semantics",
describes a simplified model with abstract objects, their attributes,
and their operations. It introduces a Printer and a Job object. The
Job object supports multiple documents per Job. It also addresses
security, internationalization, and directory issues.

The document, "Internet Printing Protocol/1.0: Encoding and
Transport", is a formal mapping of the abstract operations and
attributes defined in the model document onto HTTP/1.1. It defines
the encoding rules for a new Internet media type called '
application/ipp'.

This document "Internet Printing Protocol/1.0: Implementer's Guide",
gives advice to implementers of IPP clients and IPP objects.

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1. Introduction

   The reader of this specification is expected to be familiar with the
   IPP Model and Semantics specification [RFC2566], the IPP Encoding and
   Transport [RF2565], and the Line Printer Daemon (LPD) protocol
   specification [RFC1179] as described in RFC 1179.

   RFC 1179 was written in 1990 in an attempt to document existing LPD
   protocol implementations.  Since then, a number of undocumented
   extensions have been made by vendors to support functionality
   specific to their printing solutions.  All of these extensions
   consist of additional control file commands.  This document does not
   address any of these vendor extensions.  Rather it addresses existing
   practice within the context of the features described by RFC 1179.
   Deviations of existing practice from RFC 1179 are so indicated.

   Other LPD control file commands in RFC 1179 are obsolete. They are
   intended to work on "text" only formats and are inappropriate for
   many contemporary document formats that completely specify each page.
   This document does not address the support of these obsolete
   features.

   In the area of document formats, also known as page description
   languages (PDL), RFC 1179 defines a fixed set with no capability for
   extension.  Consequently, some new PDL's are not supported, and some
   of those that are supported are sufficiently unimportant now that
   they have not been registered for use with the Printer MIB [RFC1759]
   and IPP [RFC2566] [RFC2565], though they could be registered if
   desired.  See the Printer MIB specification [RFC1759] and/or the IPP
   Model specification [RFC2566] for instructions for registration of
   document-formats with IANA.  IANA lists the registered document-
   formats as "printer languages".

   This document addresses the protocol mapping for both directions:
   mapping of the LPD protocol to the IPP protocol and mapping of the
   IPP protocol to the LPD protocol. The former is called the "LPD-to-
   IPP mapper" and the latter is called the "IPP-to-LPD mapper".

   This document is an informational document that is not on the
   standards track.  It is intended to help implementers of gateways
   between IPP and LPD.  It also provides an example, which gives
   additional insight into IPP.

2. Terminology

   The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT",
   "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this
   document are to be interpreted as described in RFC 2119 [RFC2119].

   RFC 1179 uses the word "command" in two contexts: for over-the-wire
   operations and for command file functions. This document SHALL use
   the word "command" for the former and the phrase "functions" for the
   latter.  The syntax of the LPD commands is given using ABNF
   [RFC2234].

   The following tokens are used in order to make the syntax more
   readable:

      LF stands for %x0A (linefeed)
      SP stands for %x20.  (space)
      DIGIT stands for %x30-39 ("0" to "9")

3. Mapping from LPD Commands to IPP Operations

   This section describes the mapping from LPD commands to IPP
   operations.  Each of the following sub-sections appear as sub-
   sections of section 5 of RFC 1179.

   The following table summarizes the IPP operation that the mapper uses
   when it receives an LPD command. Each section below gives more
   detail:

      LPD command                   IPP operation


      print-any-waiting-jobs      ignore
      receive-a-printer-job       Print-Job or Create-Job/Send-Document
          send queue state          Get-Printer-Attributes and Get-Jobs
            (short or long)
          remove-jobs             Cancel-Job

3.1 Print any waiting jobs

    Command syntax:

      print-waiting-jobs = %x01 printer-name LF

    This command causes the LPD daemon check its queue and print any
    waiting jobs. An IPP printer handles waiting jobs without such a
    nudge.

    If the  mapper receives this LPD command, it SHALL ignore it and send
    no IPP operation.

3.2 Receive a printer job

    Command syntax:

      receive-job = %x02 printer-name LF

    The control file and data files mentioned in the following paragraphs
    are received via LPD sub-commands that follow this command. Their
    mapping to IPP commands and attributes is described later in this
    section.

    The mapper maps the 'Receive a printer job' command to either:

        - the Print-Job operation which includes a single data file or
        - the Create-Job operation followed by one Send-Document operation
          for each data file.

    If the IPP printer supports both Create-Job and Send-Document, and if
    a job consists of:

        - a single data file, the mapper SHOULD use the Print-Job
          operation, but MAY use the Create-Job and Send-Document
          operations.
        - more than one data file, the mapper SHALL use Create-Job
          followed by one Send-Document for each received LPD data file.

    If the IPP printer does not support both Create-Job and Send-
    Document, and if a job consists of:

        - a single data file, the mapper SHALL use the PrintJob
          operation.
        - more than one data file, the mapper SHALL submit each received
          LPD data file as a separate Print-Job operation (thereby
          converting a single LPD job into multiple IPP jobs).

   If the mapper uses Create-Job and Send-Document, it MUST send the
   Create-Job operation before it sends any Send-Document operations
   whether the LPD control file, which supplies attributes for Create-
   Job, arrives before or after all LPD data files.

   NOTE: This specification does not specify how the mapper maps: the
   LPD Printer-name operand to the IPP "printer-uri" operation
   attribute.

   The following three sub-sections gives further details about the
   mapping from LPD receive-a-printer-job sub-commands.  Each of the
   following subsections appear as sub-sections of section 6 of RFC
   1179.

## 3.2.1 Abort job

   Sub-command syntax:

      abort-job = %x1 LF

   This sub-command of receive-a-printer-job is intended to abort any
   job transfer in process.

   If the mapper receives this sub-command, it SHALL cancel the job that
   it is in the process of transmitting.

   If the mapper is in the process of sending a Print-Job or Create-Job
   operation, it terminates the job either by closing the connection, or
   performing the Cancel-Job operation with the job-uri that it received
   from the Print-Job or Create-Job operation.

   NOTE: This sub-command is implied if at any time the connection
   between the LPD client and server is terminated before an entire
   print job has been transferred via an LPD Receive-a-printer-job
   request.

## 3.2.2 Receive control file

   Sub-command syntax:

   receive-control-file = %x2 number-of-bytes SP name-of-control-file LF
   number-of-bytes = 1*DIGIT
   name-of-control-file = "cfA" job-number client-host-name
                          ; e.g. "cfA123woden"
   job-number = 3DIGIT
   client-host-name = <a host name>

This sub-command is roughly equivalent to the IPP Create-Job
operation.

The mapper SHALL use the contents of the received LPD control file to
create IPP operation attribute and job template attribute values to
transmit with the Print-Job or Create-Job operation.

3.2.3 Receive data file

Sub-command syntax:  %x3 number-of-bytes-in-data-file Name-of-data-file

    receive-data-file = %x03 number-of-bytes SP name-of-data-file LF
    number-of-bytes = 1*DIGIT
    name-of-data-file = "df" letter job-number client-host-name
                ; e.g. "dfA123woden for the first file
    letter = %x41-5A /  %x61-7A     ;  "A" to "Z", "a" to "z"
                                    ;  first file is "A",
                                    ; second "B", and  52nd file is "z"
    job-number = 3DIGIT
    client-host-name = <a host name>

    This sub-command is roughly equivalent to the IPP Send-Document
    operation.

    The mapper SHALL use the contents of the received LPD data file as
    the data to transmit with the IPP Print-Job or Send-Document
    operation.

    Although RFC 1179 alludes to a method for passing an unspecified
    length data file by using an octet-count of zero, no implementations
    support this feature. The mapper SHALL reject a job that has a value
    of 0 in the number-of-bytes field.

3.3 Send queue state (short)

    Command syntax:

send-queue-short  = %x03 printer-name *(SP(user-name / job-number)) LF

    The mapper's response to this command includes information about the
    printer and its jobs. RFC 1179 specifies neither the information nor
    the format of its response. This document requires the mapper to
    follow existing practice as specified in this document.

    The mapper SHALL produce a response in the following format which
    consists of a printer-status line optionally followed by a heading
    line, and a list of jobs. This format is defined by examples below.
    Appendix A contains the ABNF syntax.

For an printer with no jobs, the response starts in column 1 and is:

     no entries

For a printer with jobs, an example of the response is:

```
  killtree is ready and printing
  Rank   Owner      Job         Files          Total Size
  active fred       123         stuff          1204 bytes
  1st    smith      124         resume, foo    34576 bytes
  2nd    fred       125         more           99 bytes
  3rd    mary       126         mydoc          378 bytes
  4th    jones      127         statistics.ps  4567 bytes
  5th    fred       128         data.txt       9 bytes
```

The column numbers of above headings and job entries are:

```
  |      |          |           |              |
  01     08         19          35             63
```

The mapper SHALL produce each field above from the following IPP attribute:

| LPD field | IPP attribute | special conversion details |
|---|---|---|
| printer-status | printer-state and printer-state-reasons | For a printer-state of idle or processing, the mapper SHALL use the formats above. For stopped, the mapper SHALL use printer-state-reasons to produce an unspecified format for the error. |
| rank | number-of-intervening-jobs | the mapper SHALL the format above |
| owner | job-originating-user-name | unspecified conversion; job-originating-user-name may be the mapper's user-name |
| job | job-id | the mapper shall use the job-id |
| files | document-name | the mapper shall create a comma separated list of the document-names and then truncate this list to the first 24 characters |
| total-size | job-k-octets*copies*1024 | the mapper shall multiple the value of job-k-octets by 1024 and by the value of the "copies" attribute. |

A mapper SHOULD use the job attribute number-of-intervening-jobs
rather than the job's position in a list of jobs to determine 'rank'
because a Printer may omit jobs that it wants to keep secret. If a
printer doesn't support the job attribute number-of-intervening-jobs,
a mapper MAY use the job's position.

Note: a Printer may set the value of job-originating-user-name to the
authenticated user or to the value of "requesting-user-name",
depending on the implementation and configuration. For a gateway, the
authenticated user is the user-id of the gateway, but the
"requesting-user-name" may contain the name of the user who is the
gateway's client.

In order to obtain the information specified above, The LPD-to-IPP
mapper SHALL use the Get-Printer-Attributes operation to get
printer-status and SHOULD use the Get-Jobs operation to get
information about all of the jobs. If the LPD command contains job-
numbers or user-names, the mapper MAY handle the filtering of the
response. If the LPD command contains job-numbers but no user-names,
the mapper MAY use Get-Job-Attributes on each converted job-number
rather than Get-Jobs. If the LPD command contains a single user-name
but no job-numbers, the mapper MAY use Get-Jobs with the my-jobs
option if the server supports this option and if the server allows
the client to be a proxy for the LPD user.

NOTE: This specification does not define how the mapper maps the LPD
Printer-name operand to the IPP "printer-uri" operation attribute.

3.4 Send queue state (long)

    Command syntax:

    send-queue-long = %x04 printer-name *(SP(user-name / job-number)) LF

    The mapper's response to this command includes information about the
    printer and its jobs. RFC 1179 specifies neither the information nor
    the format of its response. This document requires the mapper to
    follow existing practice as specified in this document.

    The mapper SHALL produce a response in the following format which
    consists of a printer-status line optionally followed a list of jobs,
    where each job consists of a blank line, a description line, and one
    line for each file. The description line contains the user-name,
    rank, job-number and host. This format is defined by examples below.
    Appendix B contain the ABNF syntax.

For an printer with no jobs the response is:

    no entries

For a printer with jobs, an example of the response is:

    killtree is ready and printing

    fred: active                        [job 123 tiger]
          2 copies of stuff             602 bytes

    smith: 1st                          [job 124 snail]
          2 copies of resume            7088 bytes
          2 copies of foo               10200 bytes

    fred: 2nd                           [job 125 tiger]
            more                        99 bytes

    The column numbers of above headings and job entries are:

    |       |                           |
    01      09                          41

Although the format of the long form is different from the format of
the short form, their fields are identical except for a) the copies
and host fields which are only in the long form, and b) the "size"
field contains the single copy size of each file.  Thus the sum of
the file sizes in the "size" field times the value of the "copies"
field produces the value for the "Total Size" field in the short
form. For fields other than the host and copies fields, see the
preceding section.  For the host field see the table below.

| LPD field | IPP attribute | special conversion details |
|-----------|---------------|----------------------------|
| host |  | unspecified conversion; job-originating-host may be the mapper's host |
| copies | copies | the mapper shall assume the value of copies precedes the string "copies of "; otherwise, the value of copies is 1. |

NOTE: This specification does not define how the mapper maps the LPD
Printer-name operand to the IPP printer-uri operation attribute.

3.5 Remove jobs

   Command syntax:

      remove-jobs = %x05 printer-name SP agent
                         *(SP(user-name / job-number)) LF

   The agent operand is the user-name of the user initiating the
   remove-jobs command. The special user-name 'root' indicates a
   privileged user who can remove jobs whose user-name differs from the
   agent.

   The mapper SHALL issue one Cancel-Job operation for each job
   referenced by the remove-jobs command. Each job-number in the
   remove-jobs command references a single job. Each user-name in the
   remove-jobs command implicitly references all jobs owned by the
   specified user. The active job is implicitly referenced when the
   remove-jobs command contains neither job-numbers nor user-names. The
   mapper MAY use Get-Jobs to determine the job-uri of implicitly
   referenced jobs.

   The mapper SHALL not use the agent name of 'root' when end-users
   cancel their own jobs.  Violation of this rule creates a potential
   security violation, and it may cause the printer to issue a
   notification that misleads a user into thinking that some other
   person canceled the job.

   If the agent of a remove-jobs command for a job J is the same as the
   user name specified with the 'P' function in the control file for job
   J, then the mapper SHALL ensure that the initiator of the Cancel-Job
   command for job J is the same as job-originating-user for job J.

   Note: This requirement means that a mapper must be consistent in who
   the receiver perceives as the initiator of IPP operations. The mapper
   either acts as itself or acts on behalf of another user. The latter
   is preferable if it is possible. This consistency is necessary
   between Print-Job/Create-Job and Cancel-Job in order for Cancel-Job
   to work, but it is also desirable for other operations. For example,
   Get-Jobs may give more information about job submitted by the
   initiator of this operation.

   NOTE: This specification does not define how the mapper maps: (1) the
   LPD printer-name to the IPP "printer-uri" or (2) the LPD job-number
   to the IPP "job-uri".

   NOTE: This specification does not specify how the mapper maps the LPD
   user-name to the IPP job-originating-user because the mapper may use
   its own user-name with jobs.

4. Mapping of LPD Control File Lines to IPP Operation and Job Template
   Attributes

   This section describes the mapping from LPD control file lines
   (called 'functions') to IPP operation attributes and job template
   attributes.  The mapper receives the control file lines via the LPD
   receive-control-file sub-command.  Each of the LPD functions appear
   as sub-sections of section 7 of RFC 1179.

   In LPD control file lines, the text operands have a maximum length of
   31 or 99 while IPP operation attribute and job template attribute
   values have a maximum of 255 or 1023 octets, depending on the
   attribute syntax.  Therefore, no data is lost.

   The mapper converts each supported LPD function to its corresponding
   IPP operation or job template attribute as defined by tables in the
   subsections that follow. These subsections group functions according
   to whether they are:

       - required with a job,
       - optional with a job
       - required with each document.

   In the tables below, each LPD value is given a name, such as 'h'. If
   an IPP value uses the LPD value, then the IPP value column contains
   the LPD name, such as 'h' to denote this.  Otherwise, the IPP value
   column specifies the literal value.

4.1 Required Job Functions

   The following LPD functions MUST be in a received LPD job. The mapper
   SHALL receive each of the following LPD functions and SHALL include
   the information as a operation or job template attribute with each
   IPP job.  The functions SHOULD be in the order 'H', 'P' and they
   SHOULD be the first two functions in the control file, but they MAY
   be anywhere in the control file and in any order:

| LPD function | | | IPP | |
| name | value | description | name | value |
|------|-------|-------------|------|-------|
| H | h | Originating Host | | h (in security layer) |
| P | u | User identification | requesting-user-name | u (and in security layer) |
| | none | | ipp-attribute-fidelity | 'true' |

A mapper MAY send its own host rather than the client's host, and a
mapper MAY send its own user-name as user identification rather than
the client user. But in any case, the values sent SHALL be compatible
with the Cancel-Job operation. The IPP operation MAY have no way to
specify an originating host-name.

The mapper SHALL include ipp-attribute-fidelity = true so that it
doesn't have to determine which attributes a printer supports.

4.2 Optional Job Functions

The following LPD functions MAY be present in a received job. These
functions SHOULD follow the required job functions and precede the
document functions, but they MAY be anywhere in the control file.

If the mapper receives such an LPD function, the mapper SHALL include
the corresponding IPP attribute with the value converted as specified
in the table below.  If the mapper does not receive such an LPD
attribute, the mapper SHALL NOT include the corresponding IPP
attribute, except the 'L' LPD function whose absence has a special
meaning as noted in the table.

| LPD function | | | IPP | |
|------|-------|-------------|------|-------|
| name | value | description | name | value |
| J | j | Job name for banner page | job-name | j |
| L | l | Print banner page | job-sheets | 'standard' if 'L' is present 'none' if 'L' is present |
| M | m | Mail When Printed | | IPP has no notification mechanism. To support this LPD feature, the gateway must poll using the Get-Job-Attributes operation. |

4.3 Required Document Functions

The mapper SHALL receive one set of the required document functions
with each copy of a document, and SHALL include the converted
information as operation or job template attributes with each IPP
document.

If the control file contains required and recommended document
functions, the required functions SHOULD precede the recommended ones
and if the job contains multiple documents, all the functions for

each document are grouped together as shown in the example of section
6.3 "Required Document Functions". However, the document functions
MAY be in any order.

| LPD function | | | IPP | |
|---|---|---|---|---|
| name | value | description | name | value |
| f | fff | Print formatted file | document-format | 'application/octet-stream' |
| l | fff | Print file leaving control characters | document-format | 'application/octet-stream' |
| o | fff | Print Postscript output file | document-format | 'application/PostScript' |
| | | | copies | see note |

Note: In practice, the 'f' LPD function is often overloaded. It is
often used with any format of document data including PostScript and
PCL data.

Note: In practice, the 'l' LPD function is often used as a rough
equivalent to the 'f' function.

Note: When RFC 1179 was written, no implementation supported the 'o'
function; instead 'f' was used for PostScript. Windows NT now sends '
o' function for a PostScript file.

Note: the value 'fff' of the 'f', 'l' and 'o' functions is the name
of the data file as transferred, e.g. "dfA123woden".

If the mapper receives any other lower case letter, the mapper SHALL
reject the job because the document contains a format that the mapper
does not support.

The mapper determines the number of copies by counting the number of
occurrences of each 'fff' file with one of the lower-case functions
above. For example, if 'f dfA123woden' occurs 4 times, then copies
has a value of 4. Although the LPD protocol allows the value of
copies to be different for each document, the commands and the
receiving print systems don't support this.

4.4 Recommended Document Functions

   The mapper SHOULD receive one set of the recommended document
   functions with each document, and SHOULD include the converted
   information as an operation or job template attribute with each IPP
   document. The functions SHOULD be received in the order 'U' and 'N',
   but they MAY arrive in any order.

```
LPD function                            IPP
name   value   description              name                 value

U      fff                              ignored
N      n       Name of source file document-name       n
```

   Note: the value 'fff' of the 'U' function is the name of the data
   file as transferred, e.g. "dfA123woden".

5. Mapping from IPP operations to LPD commands

   If the IPP-to-LPD mapper receives an IPP operation, the following
   table summarizes the LPD command that it uses. Each section below
   gives the detail. Each of the following sub-sections appear as sub-
   sections of section 3 in the document "Internet Printing
   Protocol/1.0: Model and Semantics" [RFC2566].

```
IPP operation                      LPD command

Print-Job or Print-URI or          receive-a-printer-job
Create-Job/Send-Document/Send-URI  and then print-any-waiting-jobs
Validate-Job                       implemented by the mapper
Cancel-Job                         remove-jobs
Get-Printer-Attributes, Get-Job-   send queue state (short or long)
Attributes or Get-Jobs
```

5.1 Print-Job

   The mapper SHALL send the following commands in the order listed
   below:

      - receive-a-printer-job command
      - both receive-control-file sub-command and receive-data-file
        sub-command (unspecified order, see Note below)
      - print-any-waiting-jobs command, except that if the mapper is
        sending a sequence of receive a printer-job commands, it MAY
        omit sending print-any-waiting-jobs after any receive a
        printer-job command that is neither the first nor last command
        in this sequence

Note: it is recommended that the order of the receive-control-file
subcommand and the receive-data-file sub-command be configurable
because either order fails for some print systems. Some print systems
assume that the control file follows all data files and start
printing immediately on receipt of the control file. When such a
print system tries to print a data file that has not arrived, it
produces an error.  Other print systems assume that the control file
arrives before the data files and start printing when the first data
file arrives. Such a system ignores the control information, such as
banner page or copies.

NOTE: This specification does not define the mapping between the IPP
printer-uri and the LPD printer-name.

The mapper SHALL send the IPP operation attributes and job template
attributes received from the operation to the LPD printer by using
the LPD receive-control-file sub-command. The mapper SHALL create the
LPD job-number for use in the control file name, but the receiving
printer MAY, in some circumstances, assign a different job-number to
the job.  The mapper SHALL create the IPP job-id and IPP job-uri
returned in the Print-Job response.

NOTE: This specification does not specify how the mapper determines
the LPD job-number, the IPP job-id or the IPP job-uri of a job that
it creates nor does it specify the relationship between the IPP job-
uri, IPP the job-id and the LPD job-number, both of which the mapper
creates.  However, it is likely that the mapper will use the same
integer value for both the LPD job-number and the IPP job-id, and
that the IPP Job-uri is the printer's URI with the job-id
concatenated on the end.

The mapper SHALL send data received in the IPP operation to the LPD
printer by using the LPD receive-data-file sub-command. The mapper
SHALL specify the exact number of bytes being transmitted in the
number-of-bytes field of the receive-data-file sub-command. It SHALL
NOT use a value of 0 in this field.

If the mapper, while it is transmitting a receive-a-printer-job
command or sub-command, either detects that its IPP connection has
closed or receives a Cancel-Job operation, the mapper SHALL terminate
the LPD job either with the abort sub-command or the remove-jobs
command.

This document does not address error code conversion.

5.2 Print-URI

   The mapper SHALL handle this operation in the same way as a Print-Job
   operation except that it SHALL obtain data referenced by the
   "document-uri" operation attribute and SHALL then treat that data as
   if it had been received via a Print-Job operation.

5.3 Validate-Job

   The mapper SHALL perform this operation directly. Because LPD
   supports very few attributes, this operation doesn't have much to
   check.

5.4 Create-Job

   The mapper SHALL handle this operation like Print-Job, except:

      - the mapper SHALL send the control file after it has received the
        last Send-Document or Send-URI operation because the control
        file contains all the document-name and document-format values
        specified in the Send-Document and Send-URI operations.
      - the mapper SHALL perform one receive-data-file sub-command for
        each Send-Document or Send-URI operation received and in the
        same order received.
      - the mapper SHALL send the control file either before all data
        files or after all data files. (See the note in the section on
        Print-Job about the dilemma of sending the control file either
        before or after the data files.

5.5 Send-Document

   The mapper performs a receive-data-file sub-command on the received
   data. See the preceding section 5.4 "Create-Job" for the details.

5.6 Send-URI

   The mapper SHALL obtain the data referenced by the "document-uri"
   operation attribute, and SHALL then treat that data as if it had been
   received via a Send-Document operation. See the preceding section 5.5
   "Send-Document" for the details.

5.7 Cancel-Job

   The mapper SHALL perform a remove-jobs command with the following
   operation attributes:

          - the printer is the one to which the job was submitted, that is
            the IPP printer-uri is mapped to an LPD printer-name by the same
            mechanism as for all commands
          - the agent is the authenticated user-name of the IPP client
          - the job-number is the job-id returned by the Print-Job command,
            that is, the LPD job-number has the same value as the IPP job-id
            for likely implementations

## 5.8 Get-Printer-Attributes

   LPD severely limits the set of attributes that the mapper is able to
   return in its response for this operation. The mapper SHALL support,
   at most, the following printer attributes:

      - printer-state
      - printer-state-reasons

   The mapper uses either the long or short form of the "send queue
   state" command.

   The mapper SHALL assume that the LPD response that it receives has
   the format and information specified in section 3.3 "Send queue state
   (short)" and section 3.4 "Send queue state (long)".  The mapper SHALL
   determine the value of each requested attribute by using the inverse
   of the mapping specified in the two aforementioned sections.

   Note: the mapper can determine the response from the printer-status
   line without examining the rest of the LPD response.

## 5.9 Get-Job-Attributes

   LPD severely limits the set of attributes that the mapper is able to
   return in its response for this operation. The mapper SHALL support,
   at most, the following job attributes:

      - number-of-intervening-jobs
      - job-originating-user-name
      - job-id
      - document-name
      - job-k-octets
      - copies

   The mapper uses either the long or short form of the "send queue
   state" command. If it receives a request for the "job-k-octets" or
   "copies" and supports the attribute it SHALL use the long form;
   otherwise, it SHALL use the short form.

Note: the value of job-k-octets is the value in the short form
divided by the number of "copies" which is on the long form only. Its
value can also be determined by adding the "size" field values for
each document in the job in the long form.

The mapper SHALL assume that the LPD response that it receives has
the format and information specified in section 3.3 "Send queue state
(short)" and section 3.4 "Send queue state (long)".  The mapper SHALL
determine the value of each requested attribute by using the inverse
of the mapping specified in the two aforementioned sections.

Note: when the mapper uses the LPD short form, it can determine the
response from the single LPD line that pertains to the job specified
by the Get-Job-Attributes operation.

Note: the mapper can use its correspondence between the IPP job-id,
job-uri and the LPD job-number.

5.10 Get-Jobs

The mapper SHALL perform this operation in the same way as Get-Job-
Attributes except that the mapper converts all the LPD job-lines, and
the IPP response contains one job object for each job-line in the LPD
response.

6. Mapping of IPP Attributes to LPD Control File Lines

This section describes the mapping from IPP operation attributes and
job template attributes to LPD control file lines (called '
functions'). The mapper receives the IPP operation attributes and job
template atributes via the IPP operation.  Each of the IPP operation
attributes and job template attributes appear as sub-sections of
section 3 and 4.2 in the IPP model document [RFC2566].

In the context of LPD control file lines, the text operands have a
maximum length of 31 or 99 while IPP operation attributes and job
template attributes have a maximum of 255 or 1023 octets, depending
on the attribute syntax.  Therefore, there may be some data loss if
the IPP operation attribute and job template attribute values exceed
the maximum length of the LPD equivalent operands.

The mapper converts each supported IPP operation attribute and job
template attribute to its corresponding LPD function as defined by
tables in the subsections that follow. These subsections group
functions according to whether they are:

       - required with a job,
       - optional with a job
       - required with each document.

   In the tables below, each IPP value is given a name, such as 'h'. If
   an LPD value uses the IPP value, then the LPD value column contains
   the IPP name, such as 'h' to denote this.  Otherwise, the LPD value
   column specifies the literal value.

6.1 Required Job Functions

   The mapper SHALL include the following LPD functions with each job,
   and they SHALL have the specified value. They SHALL be the first
   functions in the control file and they SHALL be in the order "H" and
   then "P".

   IPP                            LPD function
   name                   value   name  value        description

   (perhaps in security   h       H     gateway host Originating Host
   layer)
   requesting-user-name   u       P     u            User identification
   and in the security
   layer

   A mapper SHALL sends its own host rather than the client's host,
   because some LPD systems require that it be the same as the host from
   which the remove-jobs command comes.  A mapper MAY send its own user
   name as user identification rather than the client user. But in any
   case, the values sent SHALL be compatible with the LPD remove-jobs
   operation.

6.2 Optional Job Functions

   The mapper MAY include the following LPD functions with each job.
   They SHALL have the specified value if they are sent. These
   functions, if present, SHALL follow the require job functions, and
   they SHALL precede the required document functions.

   IPP attribute                  LPD function
   name            value          name value description

   job-name        j              J    j     Job name for banner
                                              page
   job-sheets      'standard'     L    u     Print banner page
   job-sheets      'none'                     omit 'L' function

Note: 'L' has special meaning when it is omitted. If 'J' is omitted, some undefined behavior occurs with respect to the banner page.

6.3 Required Document Functions

The mapper SHALL include one set of the following LPD functions with each document, and they SHALL have the specified values. For each document, the order of the functions SHALL be 'f', 'U' and then 'N', where 'f' is replicated once for each copy.

| IPP attribute | | LPD function | | |
|---|---|---|---|---|
| name | value | name | value | description |
| document-format | 'application/octet-stream' or 'application/PostScript' | f | fff | Print formatted file |
| copies | c | | | replicate 'f' 'c' times |
| none | | U | fff | Unlink data file |
| document-name | n | N | n | Name of source file |

Note: the value 'fff' of the 'f' and 'U' functions is the name of the data file as transferred, e.g. "dfA123woden".

Note: the mapper SHALL not send the 'o' function

ISSUE: should we register DVI, troff or ditroff?

If the mapper receives no "ipp-attribute-fidelitybest-effort" or it has a value of false, then the mapper SHALL reject the job if it specifies attributes or attribute values that are not among those supported in the above tables.

Below is an example of the minimal control file for a job with three copies of two files 'foo' and 'bar':

```
H tiger
P jones
f dfA123woden
f dfA123woden
f dfA123woden
U dfA123woden
N foo
f dfB123woden
f dfB123woden
f dfB123woden
```

```
      U dfB123woden
      N bar
```

7. Security Considerations

   There are no security issues beyond those covered in the IPP Encoding
   and Transport document [RFC2565], the IPP model document [RFC2566]
   and the LPD document [RFC1179].

8. References

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10. Appendix A: ABNF Syntax for response of Send-queue-state (short)

   The syntax in ABNF for the response to the LPD command 'send-queue-
   state (long)' is:

     status-response = empty-queue / nonempty-queue
     empty-queue = "no-entries" LF
     nonempty-queue = printer-status LF heading LF *(job LF)
     printer-status =  OK-status / error-status
     OK-status = printer-name SP "ready and printing" LF
     error-status = < implementation dependent status information >
     heading = "Rank" 3SP "Owner" 6SP "Job" 13SP "Files"
                   23SP "Total Size" LF
                      ; the column headings and their values below begin
     at the columns
                      ; 1, 8, 19, 35 and 63
     job = rank *SP owner *SP job *SP files *SP total-size "bytes"
                      ; jobs are in order of oldest to newest
     rank = "active" / "1st" / "2nd" / "3rd" / integer "th"
                      ; job that is printing is "active"
                      ; other values show position in the queue
     owner = <user name of person who submitted the job>
     job = 1*3DIGIT    ; job-number
     files = <file name> *( "," <file name>) ; truncated to 24 characters
     total-size = 1*DIGIT  ; combined size in bytes of all documents

11. Appendix B: ABNF Syntax for response of Send-queue-state (long)

   The syntax in ABNF for the response to the LPD command 'send-queue-
   state (long)' is:

```
status-response = empty-queue / nonempty-queue
empty-queue = "no-entries" LF
nonempty-queue = printer-status LF  *job
printer-status =  OK-status / error-status
OK-status = printer-name SP "ready and printing" LF
error-status = < implementation dependent status information >
job = LF line-1 LF line-2 LF
line-1 = owner ":" SP rank 1*SP "[job" job SP host "]"
line-2 =  file-name 1*SP document-size "bytes"
       ; jobs are in order of oldest to newest
rank = "active" / "1st" / "2nd" / "3rd" / integer "th"
         ; job that is printing is "active"
         ; other values show position in the queue
owner = <user name of person who submitted the job>
job = 1*3DIGIT
file-name = [ 1*DIGIT  "copies of" SP ] <file name>
                ; truncated to 24 characters
document-size = 1*DIGIT  ;size of single copy of the document.
```

12. Appendix C: Unsupported LPD functions

   The follow LPD functions have no IPP equivalent. The LPD-to-IPP
   mapper ignores them and the IPP-to-LPD mapper does not send them.

   LPD command
   name   description

   C      Class for banner page
   I      Indent Printing
   H      Host of client
   M      Mail when printed
   S      Symbolic link data
   T      Title for pr
   W      Width of output
   1      troff R font
   2      troff I font
   3      troff B font
   4      troff S font

   The follow LPD functions specify document-formats which have no IPP
   equivalent, unless someone registers them. The LPD-to-IPP mapper
   rejects jobs that request such a document format, and the IPP-to-LPD
   mapper does not send them.

   LPD command
   name    description

   c       Plot CIF file
   d       Print DVI file
   g       Plot file
   k       reserved for Kerberized clients and servers
   n       Print ditroff output file
   p       Print file with 'pr' format
   r       File to print with FORTRAN carriage control
   t       Print troff output file
   v       Print raster file
   z       reserved for future use with the Palladium
           print system

13.  Full Copyright Statement