                   Internet Printing Protocol (IPP):
     Requirements for Job, Printer, and Device Administrative Operations

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   not specify an Internet standard of any kind. Distribution of this
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Abstract

   This document specifies the requirements and uses cases for some
   optional administrative operations for use with the Internet Printing
   Protocol (IPP) version 1.0 and version 1.1. Some of these
   administrative operations operate on the IPP Job and Printer objects.
   The remaining operations operate on a new Device object that more
   closely models a single output device.

Table of Contents

List of Tables

1 Introduction

   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 (for
   a description of the base IPP documents, see Appendix A). This
   document defines the requirements and use cases for additional
   optional end user, operator, and administrator operations used to
   control Job objects, Printer objects (see [RFC2911]) and a new Device
   object. The new Device object more closely models a single output
   device and has no notion of a job, while the Printer object models a
   print service which understands jobs and may represent one or more
   output devices.

   The scope of IPP is characterized in RFC 2567 [RFC2567] "Design Goals
   for an Internet Printing Protocol". It is not the intent of this
   document to revise or clarify this scope or conjecture as to the
   degree of industry adoption or trends related to IPP within printing
   systems. It is the intent of this document to extend the original
   set of operations - in a similar fashion to the Set1 extensions which
   referred to IPP/1.0 and were later incorporated into IPP/1.1.

2 Terminology

   This section defines terminology used throughout this document and
   the corresponding documents that define the Administrative operations
   on Job, Printer, and Device objects.

   This document uses terms such as "client", "Printer", "Job",
   "attributes", "keywords", and "support". These terms have special
   meaning and are defined in the model terminology [RFC2911] section
   12.2.

   In addition, the following capitalized terms are defined:

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

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

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

Device Operation - an operation whose target is an IPP Printer
   object and whose defined effect is on an Output Device.

Output Device Fan-Out - a configuration in which an IPP Printer
   controls more that one output-device.

Printer fan-out - a configuration in which an IPP Printer object
   controls more than one Subordinate IPP Printer object.

Printer fan-in - a configuration in which an IPP Printer object is
   controlled by more than one IPP Printer object.

Subordinate Printer - an IPP Printer object that is controlled by
   another IPP Printer object. Such a Subordinate Printer may
   have one or more Subordinate Printers.

Leaf Printer - a Subordinate Printer that has no Subordinate
   Printers.

Non-Leaf Printer - an IPP Printer object that has one or more
   Subordinate Printers.

Chained Printer - a Non-Leaf Printer that has exactly one
   Subordinate Printer.

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

3 Requirements and Use Cases

The Administrative operations for Job and Printer objects will be
defined in one document [ipp-ops-set2]. The Administrative
operations for Device objects will be defined in a separate document.
The requirements are presented here together to show the parallelism.

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

2.   Support fan-out of Printer objects.

3.   Support fan-out of Output Devices.

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

5.   Support fan-in of output objects, as long as it doesn't make
        the semantics more complicated when not supporting fan-in.

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

7.   Need a Printer Operation to prevent a Printer object from
        accepting new IPP jobs, but currently accepted jobs continue
        unaffected to be scheduled and processed. Need a companion
        one to restore the Printer object to accept new IPP jobs.

        Usage: Operator is preparing to take the IPP Printer out of
        service or to change the configuration of the IPP Printer.

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

8.   Need a Device Operation to prevent an Output Device from
        accepting any new jobs from any job submission protocol and
        a companion one to restore the Output Device to accepting
        any jobs.

        Usage: Operator is preparing to take the Output Device out
        of service.

        Suggested name and operations: Disable-Device and Enable
        Device

9.   Need a Printer Operation to stop the processing after the
        current IPP job completes and not start processing any
        additional IPP jobs (either by scheduling the jobs or
        sending them to the Output Device), but continue to accept
        new IPP jobs. Need a companion operation to start
        processing/sending IPP jobs again.

        Usage: Operator wants to gracefully stop the IPP Printer at
        the next job boundary. The Pause-Printer-After-Current-Job
        operation is also invoked implicitly by the Deactivate-
        Printer and the Shutdown-Printer Operations.

        Suggested name and operations: Pause-Printer-After-
        Current-Job, (IPP/1.1) Resume-Printer

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

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

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

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

      Usage: This allows an operator to reconfigure the Output
      Device in order to let jobs that are held waiting for
      resources, such as special media, get a chance. Then the
      operator uses another operation after reconfiguring. He
      repeats the two operations to restore the Output Device to
      its normal media.

      Suggested name and operations: Hold-New-Jobs, Release-
      Held-New-Jobs

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

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

      Suggested name and operations: Pause-Device-After-Current-
      Copy, Resume-Device

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

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

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

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

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

     Suggested name and operation: Deactivate-Printer,
     Activate-Printer

15. Need a Device Operation that combines Disable-Device,
     Pause-Device-After-Current-Job, and rejects all other Device
     Operations, except Job and Printer queries and the companion
     operation to resume activity. In other words, this
     operation makes the Output Device a read-only object in a
     graceful manner.

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

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

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

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

       Suggested name and operation: Restart-Printer

17.   Need a Device Operation to recover from the Output Device
       hardware and software that has gotten confused (gotten into
       a state that it doesn't seem to be able to get out of, run
       out of heap memory, etc.). This is a condition that
       shouldn't happen, but does in real life. This is the same
       and has the same options as the Printer MIB reset. No
       companion operation is needed to undo this. We don't want
       to go back to the "confused" state :-).

       Usage: The Output Device has gotten confused or need
       resetting to some initial conditions.

       Suggested name and operation: Reset-Device

18.   Need a Printer Operation to put the IPP Printer object out
       of business with no way in the protocol to bring that
       instantiation back to life (but see Startup-Printer which
       brings up exactly one new instantiation to life with the
       same URL). Any volatile information is saved if possible.

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

       Suggested name and operation: Shutdown-Printer

19.   Need a Printer Operation to bring an IPP Printer to life
       when there is an already running host.

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

       Suggested name and operation: Startup-Printer

20.   Need a Device Operation to power off the Output Device after
       writing out any software state. It is assumed that other
       operations have more gracefully prepared the Output Device
       for this drastic and immediate. There is no companion
       Device Operation to bring the power back on.

       Usage: The Output Device is going to be moved, the power in
       the building is going to be shutoff, the repair man has
       arrived and needs to take the Output Device apart.

       Suggested name and operation: Power-Off-Device

21.   Need a Device Operation to startup a powered-off device.

       Usage: After a Power-Off-Device, if the device can be
       powered back up (possibly by an intervening host that
       supports the Device Operation).

       Suggest name and operation: Power-On-Device

The tentative list of Printer and the corresponding Device Operations
is shown in Table 1:

Table 1 - List of Printer Operations and corresponding Device
          Operations

Printer Operation	Corresponding Device Operation equivalent
Disable-Printer	Disable-Device
Enable-Printer	Enable-Device
Pause-Printer (IPP/1.1 - [RFC2911] - one interpretation)	Pause-Device-Now
no	Pause-Device-After-Current-Copy
Pause-Printer-After-Current-Job	Pause-Device-After-Current-Job
Resume-Printer (IPP/1.1 - [RFC2911])	Resume-Device
Hold-New-Jobs	no
Release-Held-New-Jobs	no
Deactivate-Printer	Deactivate-Device
Activate-Printer	Activate-Device
Purge-Jobs (IPP/1.1 - [RFC2911])	Purge-Device
Restart-Printer	Reset-Device
Shutdown-Printer	Power-Off-Device
Startup-Printer	Power-On-Device

There are no conformance dependencies between Printer Operations and
Device Operations. Either may be supported without supporting the
corresponding operations.

4 IANA Considerations

   This document does not define anything to be registered. When a
   document is produced that defines operations that meet the
   requirements in this document, those operations will be registered
   according to the procedures in [RFC2911] section 6.4.

5 Internationalization Considerations

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

6 Security Considerations

   This document defines the requirements for operations that are
   intended to be used by an operator or system administrator. These
   operations, when defined, would affect how the Printer behaves and
   establish policy and/or operating behavior that ordinary users
   shouldn't be able to perform. Printer implementations that support
   such operations should authenticate users and authorized them as
   being an operator or a system administrator for the system.
   Otherwise, unprivileged users could affect the policy and behavior of
   IPP Printers, thereby affecting other users. Similarly clients that
   supports such operations should be prepared to provide the necessary
   authentication information. See the security provisions in [RFC2911]
   for authentication, such as TLS.

7 References

   [ipp-ntfy]   Herriot, R., Hastings, T., Isaacson, S., Martin, J.,
                    deBry, R., Shepherd, M. and R. Bergman, "Internet
                    Printing Protocol/1.1: IPP Event Notifications and
                    Subscriptions", Work in Progress.

   [ipp-ops-set2] Kugler, C., Hastings, T. and H. Lewis, "Internet
                    Printing Protocol (IPP): Job and Printer
                    Administrative Operations", Work in Progress.

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

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

   [RFC2567]   Wright, D., "Design Goals for an Internet Printing
                    Protocol", RFC 2567, April 1999.

   [RFC2568]   Zilles, S., "Rationale for the Structure and Model and
                    Protocol for the Internet Printing Protocol", RFC
                    2568, April 1999.

   [RFC2569]   Herriot, R., Hastings, T., Jacobs, N. and J. Martin,
                    "Mapping between LPD and IPP Protocols", RFC 2569,
                    April 1999.

   [RFC2616]   Fielding, R., Gettys, J., Mogul, J., Frystyk, H.,
                    Masinter, L., Leach, P. and T. Berners-Lee, "Hypertext
                    Transfer Protocol - HTTP/1.1", RFC 2616, June 1999.

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

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

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

Appendix A: Description of base IPP documents

   The base set of IPP documents includes:

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

   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. A few optional operator operations have
   been added to IPP/1.1.

   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 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 that are independent of encoding and transport.
   It introduces a Printer and a Job object. The Job object optionally
   supports multiple documents per Job. It also addresses security,
   internationalization, and directory issues.

   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 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 'ippget' 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.

The "IPP Event Notifications and Subscriptions" document defines an
extension to IPP/1.0 [RFC2566, RFC2565] and IPP/1.1 [RFC2911,
RFC2910]. This extension allows a client to subscribe to printing
related Events and defines the semantics for delivering asynchronous

Event Notifications to the specified Notification Recipient via a
specified Delivery Method (i.e., protocols) defined in (separate)
Delivery Method documents.

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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.