

1 Design Goals for an Internet Printing Protocol
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7

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24

25 Abstract
26

27 This document is one of a set of documents, which together
28 describe all aspects of a new Internet Printing Protocol (IPP).
29 IPP is an application level protocol that can be used for
30 distributed printing using Internet tools and technologies. This
31 document takes a broad look at distributed printing functionality,
32 and it enumerates real-life scenarios that help to clarify the
33 features that need to be included in a printing protocol for the
34 Internet. It identifies requirements for three types of users:
35 end users, operators, and administrators. The design goals
36 document calls out a subset of end user requirements that are
37 satisfied in IPP/1.0. Operator and administrator requirements are
38 out of scope for version 1.0.
39
40

40 The full set of IPP documents includes:

41

42 Design Goals for an Internet Printing Protocol (this document)

43 Rationale for the Structure and Model and Protocol for the

44 Internet Printing Protocol [IPP-RAT]

45 Internet Printing Protocol/1.0: Model and Semantics [IPP-MOD]

46 Internet Printing Protocol/1.0: Encoding and Transport [IPP-PRO]

47 Internet Printing Protocol/1.0: Implementer's Guide [IPP-IIG]

48 Mapping between LPD and IPP Protocols [IPP LPD]

49

50 The "Rationale for the Structure and Model and Protocol for the

51 Internet Printing Protocol" document describes IPP from a high

52 level view, defines a roadmap for the various documents that form

53 the suite of IPP specifications, and gives background and

54 rationale for the IETF working group's major decisions.

55

56 The "Internet Printing Protocol/1.0: Model and Semantics" document

57 describes a simplified model consisting of abstract objects, their

58 attributes, and their operations that is independent of encoding

59 and transport. The model consists of a Printer and a Job object.

60 The Job optionally supports multiple documents. IPP 1.0 semantics

61 allow end-users and operators to query printer capabilities,

62 submit print jobs, inquire about the status of print jobs and

63 printers, and cancel print jobs. This document also addresses

64 security, internationalization, and directory issues.

65

66 The "Internet Printing Protocol/1.0: Encoding and Transport"

67 document is a formal mapping of the abstract operations and

68 attributes defined in the model document onto HTTP/1.1. It

69 defines the encoding rules for a new Internet media type called

70 "application/ipp".

71

72 The "Internet Printing Protocol/1.0: Implementer's Guide" document

73 gives insight and advice to implementers of IPP clients and IPP

74 objects. It is intended to help them understand IPP/1.0 and some

75 of the considerations that may assist them in the design of their

76 client and/or IPP object implementations. For example, a typical

77 order of processing requests is given, including error checking.

78 Motivation for some of the specification decisions is also

79 included.

80

81 The "Mapping between LPD and IPP Protocols" document gives some

82 advice to implementers of gateways between IPP and LPD (Line

83 Printer Daemon) implementations.

84

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152		

153 1. INTRODUCTION

154

155 The IPP protocol is heavily influenced by the printing model
 156 introduced in the Document Printing Application (DPA) [ISO10175]
 157 standard. Although DPA specifies both end user and administrative
 158 features, IPP version 1.0 (IPP/1.0) focuses only on end user
 159 functionality.

160 2. TERMINOLOGY

161

162 Internet Printing for the purposes of this document is the
 163 application of Internet tools, programs, servers and networks to
 164 allow end-users to print to a remote printer using, after initial
 165 setup or configuration, the same methods, operations and paradigms
 166 as would be used for a locally attached or a local area network
 167 attached printer. This could include the use of HTTP servers and
 168 browsers and other applications for providing static, dynamic and
 169 interactive printer locating services, user installation,
 170 selection, configuration, print job submission, printer capability
 171 inquiry and status inquiry of remote printers and jobs.

172

173 For the purposes of this document, a WEB Browser is software
 174 available from a number of sources including but not limited to

175 the following: Microsoft Internet Explorer, NCSA Mosaic, Netscape
176 Navigator, Sun Hot Java!. The major task of these products is to
177 use the Hypertext Transport Protocol (HTTP) to retrieve, interpret
178 and display Hypertext Markup Language (HTML). These products are
179 often a part of a complete Internet Printing system because they
180 are often used as a means of obtaining the status of or more
181 information about the printing system; however, they may not be
182 present in all implementations.

183
184 Throughout this document, 'printer' shall be interpreted to
185 include any device which is capable of marking on a piece of media
186 using any available technology. These design goals do not include
187 support for multi-tiered printing solutions involving servers
188 (single or multiple) logically in front of the actual printing
189 device yet all such configurations shall be supported but shall
190 appear to the end-user as only a single device.

191
192 Throughout this document 'driver' refers to the code installed in
193 some client operating system to generate the print data stream for
194 the intended printer. Some computing environments may not include
195 a separate printer driver. Rather, the generation of the proper
196 print data stream is accomplished in an application on that
197 computer. How such a computer environment or application is
198 updated to support a new printer now made available using IPP is
199 outside the scope of IPP. The actual details for installing a
200 printer driver are operating system dependent and are also outside
201 the scope of IPP. See also section 4.1 (SECURITY CONSIDERATIONS)
202 for security implications of driver download and installation.

203
204 The IPP protocol will support the following physical
205 configurations:

- 206
207 - An IPP client talking to an IPP Printer object imbedded in a
208 single, physical output device.
209 - An IPP Client talking to a server containing one or more IPP
210 Printer objects. Each Printer object is associated with exactly
211 one physical output device supported by the server. The
212 protocol between the server and the output devices is
213 undefined.
214 - An IPP Client talking to an IPP Printer object in a server. The
215 Printer object is associated with one or more physical output
216 devices, but the client only sees the Printer object, which is
217 an abstraction and represents all of the associated physical
218 output devices. The protocol between the server and the
219 physical output devices is undefined.

220
221 Throughout this document, certain design goals will be identified
222 as not being a part of version 1.0 (or V1.0) of the protocol or as
223 being satisfied by means outside of IPP. IPP is assumed to be one
224 part, an enabler, of a complete Internet Printing solution. For
225 example printer instance creation is not performed by but is
226 enabled by the protocol. Globally, none of the operator or

227 administrators wants and needs are included in the design goals
228 for version 1.0. Some of the end-user wants and needs may also be
229 excluded from version 1.0 and will be so noted in the description
230 of them. Subsequent versions of the protocol (e.g. V2.0) may
231 include support for these initially excluded wants and needs.
232

233 3. DESIGN GOALS

234
235 The next three sections identify the design goals for an Internet
236 printing protocol from three roles assumed by humans: end-user,
237 operator, and administrator. The goals defined here are only
238 those that need to be addressed by an Internet printing protocol.
239 Other wants and needs, such as that the operator needs physical
240 access to the printer (e.g. to be able to load paper or clear
241 jams) are not covered by this document. Section 5 contains
242 scenarios which provide more detailed examples of the entire
243 process including discovery, status, printing and end-of-job
244 reporting.

245 3.1. END-USER

246
247 An end-user of a printer accepting jobs through the Internet is
248 one of the roles in which humans act. The end-user is the person
249 that will submit a job to be printed on the printer.
250

251 The wants and needs of the end-user are broken down into six
252 categories: finding/locating a printer, creating a local instance
253 of a printer, viewing printer status, viewing printer
254 capabilities, submitting a print job, viewing print job status,
255 altering the attributes of a print job.
256

257 3.1.1. Finding or locating a printer.

258
259 End-users want to be able to find and locate printers to which
260 they are authorized to print. They want to be able to perform
261 this function using a standard WEB browser or other application.
262 Multiple criteria can be applied to find the printers needed.
263 These criteria include but are not limited to:

- 264
- 265 - by name (Printer 1, Joes-color-printer, etc.)
- 266 - by geographic location (bldg 1, Kentucky, etc.)
- 267 - by capability or attribute (color, duplex, legal paper, etc.)
- 268

269 Additionally, while it is outside of scope of IPP, end-users want
270 to be able to limit the scope of their searching to:

- 271
- 272 - inside a functional sub-domain
- 273 - include only a particular domain (lexmark.com)
- 274 - exclude specified domains
- 275

276 While an Internet printing protocol may not of itself include this
277 function, IPP must define and enable a directory schema which will
278 provide the necessary information for a directory service
279 implementation to consistently represent printers by their IPP
280 attributes.

281

282 3.1.2. Create an instance of the printer.

283

284 After finding the desired printer, an end-user needs to be able to
285 create a local instance of that printer within the end-user
286 operating system or desktop. This local instance will vary
287 depending upon the printing paradigm of the operating system. For
288 example, some UNIX users will only want a queue or a reference to
289 a remote printer created on their machine while other UNIX users
290 and Windows NT users will want the queue and also the necessary
291 icons and registry entries to be created and initialized. Where
292 required, drivers may need to be downloaded from some repository
293 and installed on the computer. All necessary decompressing,
294 unpacking, and other installation actions should occur without
295 end-user interaction or intervention excepting initial approval by
296 the end-user. Once the local instance of the printer has been
297 installed, it shall appear to the end-user of the operating system
298 and to the applications running there as any other printer (local,
299 local area network connected, or network operating system
300 connected) on the end-user desktop or environment. IPP's role in
301 this goal is simply to enable the creation of the printer instance
302 providing information such as where to locate a printer driver for
303 this printer, as an attribute of an IPP Printer.

304

305 3.1.3. Viewing the status and capabilities of a printer.

306

307 Before using a selected printer or, in fact at any time, the end-
308 user needs the ability to verify the characteristics and status of
309 both printers and jobs queued for that printer. When checking the
310 characteristics of a printer, the end-user typically wants to be
311 able to determine the capability of the device, e.g.:

312

- 313 - supported media, commonly paper, by size and type
- 314 - paper handling capability, e.g. duplex, collating, finishing
- 315 - color capability

316

317 When checking the status of the printer and its print jobs, the
318 end-user typically wants to be able to determine:

319

- 320 - is the printer on-line?
- 321 - what are the defaults to be used for printing?
- 322 - how many jobs are queued for the printer?
- 323 - how are job priorities assigned? (outside the scope of IPP)

324

325 3.1.4. Submitting a print job.

326

327 Once the desired printer has been located and installed, the end-
328 user wants to print to that printer from normal applications using
329 standard methods. These normal applications include such programs
330 as word processors, spreadsheets, data-base applications, WEB
331 browsers, production printing applications, etc. Additionally,
332 the end-user may want to print a file already existing on the end-
333 user's computer -- "simple push." In addition to printing from an
334 application and simple push, the end-user needs to have the
335 ability to submit a print job by reference. Printing by reference
336 is defined to mean as submitting a job by providing a reference to
337 an existing document. The reference, a URI, will be resolved
338 before the actual print process occurs. Submitting a job by
339 reference relieves the user from downloading the document from the
340 remote server and then sending it via IPP to the printer. This
341 saves both time and network bandwidth.

342
343 Some means shall be provided to determine if the format of a job
344 matches the capability of the printer. This can be done by one of
345 the following (all of which are outside of scope of the IPP
346 protocol):

- 347
- 348 - the end-user selects the correct printer driver
- 349 - the printer automatically selects the proper interpreter
- 350 - the end-user uses some other manual procedure.

351
352 A standard action shall be defined should the job's requirements
353 not match the capabilities of the printer.

354
355 Because the end-user does not want to know the details of the
356 underlying printing process, the protocol must support job-to-
357 printer capability matching (all implementations are not
358 necessarily required to implement this function.) This matching
359 capability requires knowing both the printer's capabilities and
360 attributes and those capabilities and attributes required by the
361 job. Actions taken when a print job requires capabilities or
362 attributes that are not available on the printer vary and can
363 include but are not limited to:

- 364
- 365 - rejecting the print job
- 366 - redirecting the print job to another printer (Not in V1.0)
- 367 - printing the job, accepting differences in the appearance

368
369 Print jobs will also be submitted by background or batch
370 applications without human intervention.

371
372 End-users need the ability to set certain print job parameters at
373 the time the job is submitted. These parameters include but are
374 not limited to:

- 375
- 376 - number of copies
- 377 - single or two sided printing
- 378 - finishing

379 - job priority

380
381

382 3.1.5. Viewing the status of a submitted print job.

383

384 After a job has been submitted to a printer, the end-user needs a
385 way to view the status of that job (i.e. job waiting, job
386 printing, job done) and to determine where the job is in the print
387 queue.

388

389 In addition to the need to inquire about the status of a print
390 job, automatic notification of the completion of that job is also
391 required. Notification means are not defined by the protocol but
392 the protocol must provide a means of enabling and disabling the
393 notification.

394

395 3.1.6. Canceling a Print Job

396

397 While a job is waiting to be printing or has been started but not
398 yet completed, the original creator/submitter of the print job
399 (i.e. the end-user) shall be able to cancel the job entirely (job
400 is waiting) or the remaining portion of it (job is printing.)
401 Altering the print job itself is not a V1.0 design goal.

402

403

404 3.2. OPERATOR (NOT REQUIRED FOR V1.0)

405

406 An operator of a printer accepting jobs through the Internet is
407 one of the roles in which humans act. The operator has the
408 responsibility of monitoring the status of the printer as well as
409 managing and controlling the jobs at the device. These
410 responsibilities include but are not limited to the replenishing
411 of supplies (ink, toner, paper, etc.), the clearing of minor
412 errors (paper jams, etc.) and the re-prioritization of end-user
413 jobs. Operator wants and needs will not be addressed by V1.0 of
414 the protocol.

415

416 The wants and needs of the operator include all those of the end-
417 user but may include additional privileges. For example, an
418 operator may be able to view all print jobs on a printer while the
419 end-user might only be able to see his own jobs.

420

421 3.2.1. Alerting.

422

423 One of the required operator functions is having the ability to
424 discover or to be alerted to changes in the status of a printer
425 particularly those changes that cause a printer to stop printing
426 and to be able to correct those problems. As such, an Internet
427 printing protocol shall be able to alert a designated operator or
428 operators to these conditions such as 'out of paper', 'out of
429 ink', etc. Additionally. the operator shall be able to,

430 asynchronous to other printer activity, inquire as to a printer's
431 or a job's status.

432

433 3.2.2. Changing Print and Job Status.

434

435 Another of the required operator functions is the ability to
436 affect changes to printer and job status remotely. For example,
437 the operator will need to be able to re-prioritize or cancel any
438 print jobs on a printer to which the operator has authority.

439

440 3.3. ADMINISTRATOR (NOT REQUIRED FOR V1.0)

441

442 An administrator of a printer accepting jobs through the Internet
443 is one of the roles in which humans act. The administrator has
444 the responsibility of creating the printer instances and
445 controlling the authorization of other end-users and operators.
446 Administrator wants and needs will not be addressed by V1.0 of the
447 protocol.

448

449 The wants and needs of the administrator include all those of the
450 end-user and, in some environments, some or all of those of the
451 operator. Minimally, the administrator must also have the tools,
452 programs, utilities and supporting protocols available to be able
453 to:

454

- 455 - create an instance of a printer
- 456 - create, edit and maintain the list of authorized end-users
- 457 - create, edit and maintain the list of authorized operators
- 458 - create, edit and maintain the list of authorized
- 459 - administrators
- 460 - create, customize, change or otherwise alter the manner in
- 461 - which the status capabilities and other information about
- 462 - printers and jobs are presented
- 463 - create, customize, or change other printer or job features
- 464 - administrate billing or other charge-back mechanisms
- 465 - create sets of defaults
- 466 - create sets of capabilities

467

468 The administrator must have the capability to perform all the
469 above tasks locally or remotely to the printer.

470

471 4. OBJECTIVES OF THE PROTOCOL

472

473 The protocol to be defined by an Internet printing working group
474 will address the wants and needs of the end-user (V1.0). It will
475 not, at least initially, address the operator or administrator
476 wants and needs (V2.0).

477

478 The protocol defined shall be independent of the operating system
479 of both the client and the server. Generally, any platform

480 capable of supporting a WEB Browser should be capable of being a
481 client. Generally, any platform providing a WEB/HTTP server and
482 printing services should be capable of being a server. Usage of
483 the WEB Browser and Server is not required for IPP; the operating
484 system, operating system extensions or other applications may
485 provide IPP functionality directly.
486

487 In many environments such as Windows 95, Windows NT and OS/2, the
488 print data is created and transmitted to the printer on the fly
489 rather than being created, spooled and then transmitted to the
490 printer (a typical UNIX method.) The Internet Printing Protocol
491 must properly handle either methodology and make this transparent
492 to the end-user.
493

494 4.1. SECURITY CONSIDERATIONS

495
496 It is required that the Internet Printing Protocol be able to
497 operate within a secure environment. Wherever reasonable, IPP
498 ought to make use of existing security protocols and services. IPP
499 will not invent new security features when the design goals
500 described in this document can be met by existing protocols and
501 services. Examples of such services include Secure Socket Layer
502 Version 3 (SSL3) [SSL] and HTTP Digest Access Authentication
503 [RFC2069]. Note: SSL3 is not on the IETF standards track.
504

505 Since we cannot anticipate the security levels or the specific
506 threats that any given IPP print administrator may be concerned
507 with, IPP must be capable of operating with different security
508 mechanisms and policies as required by the individual
509 installation. The initial security needs of IPP are derived from
510 two primary considerations. First, the printing environments
511 described in this document take into account that the client, the
512 Printer, and the document to be printed may each exist in
513 different security domains. When objects are in different security
514 domains the design goals for authentication and message protection
515 may be much stronger than when they are all in the same domain.
516

517 Secondly, the sensitivity and value of the content being printed
518 will vary from one instance of a print job to another. For
519 example, a publicly available document does not need the same
520 level of protection as a payroll document does. Message
521 protection design goals include data origin authentication,
522 privacy, integrity, and non-repudiation.
523

524 In many environments (e.g. Windows, OS/2) a printer driver may be
525 needed to create the proper datastream for printer. This document
526 discusses downloading such a new driver from a variety of sources.

527 Downloading and installing any software, including drivers) on a
528 computer exposes that computer to a number of security risks
529 including but not limited to:

- 530
- 531 - defective software
- 532 - malicious software (e.g. Trojan horses)
- 533 - inappropriate software (i.e. software doing something
- 534 deemed unreasonable by the user.)
- 535

536 As such, proper security considerations and actions need to be
537 taken by the user and/or a system administrator to prevent the
538 compromising of the computer. Administrators should configure
539 downloading mechanism for printer drivers in such a way as to be
540 able to verify the source of driver software and encrypt or
541 otherwise protect that software during download.

542

543 Examples including security considerations can be found in
544 sections 5 (IPP SCENARIOS) and 11 (APPENDIX - DETAILED SCENARIOS)
545 later in this document.

546 4.2. INTERACTION WITH LPD (RFC1179)

547

548 Many versions of UNIX and in fact other operating systems provide
549 a means of printing as described in [RFC1179] (Line Printer Daemon
550 Protocol.) This document describes the file formats for the
551 control and data files as well as the messages used by the
552 protocol. Because of the simplistic approach taken by this
553 protocol, many manufacturers have include proprietary enhancements
554 and extensions to 'lpd.' Because of this divergence and due to
555 other design goals described in this document, there is no
556 requirement for backward compatibility or interoperability with
557 'lpd'. However, a mapping of LPD functionality and IPP
558 functionality shall be provided so as to enable a gateway between
559 LPD and IPP.

560

561 4.3. EXTENSIBILITY

562

563 The Internet Printing Protocol shall be extensible by several
564 means that facilitate interoperability and prevent implementation
565 collisions:

- 566
- 567 - by providing a process whereby implementers can submit
568 proposals for registration of new attributes and new
569 enumerated values for existing attributes.
- 570
- 571 • that require review and approval. The Internet
572 Assigned Number Authority (IANA) will be the
573 repository for such accepted registration proposals
574 after review.

- that do not require review and approval. IANA will be the repository for such registrations.

- by providing syntax in the protocol so that implementers may add private (i.e. unregistered) attributes and enumerated attribute values.
- by providing versioning and negotiation so as to enable future implementations of IPP to interoperate with implementations of version 1.0 of IPP.

4.4. FIREWALLS

As stated in section 3 Design Goals, Internet printing shall, by definition, support printing from one enterprise to another. As such, the Internet printing protocol must be capable of passing through firewalls and/or proxy servers (where enabled by the firewall administrator) preferably without modification to the existing firewall technology.

4.5. INTERNATIONALIZATION

Users of Internet printing will come from all over the world. As such, where appropriate, internationalization and localization will be enabled for the protocol.

5. IPP SCENARIOS

Each of the scenarios in this section describes a specific IPP operation, such as submitting a print job. Section 11 contains several detailed flows for each scenario to provide additional detail. The examples should not be considered exhaustive, but illustrative of the functions and features required in the protocol. Flows are intended to be protocol neutral. It is not assumed that all of the functions and features described in these scenarios will necessarily be supported directly by IPP or in version 1.0 of IPP.

See the IPP Model and Semantics document for details on configurations of clients, servers and firewalls.

615 5.1. PRINTER DISCOVERY

616
 617 Client Directory
 618 Service Service

```
619
620 +-----+
621 | give me information on printers with these characteristics |
622 |
623 |
624 | < -----+
625 | Information on Printers matching these characteristics |
626 |
627 |
```

628 The objective of printer discovery is to locate printers that meet
 629 the client's wants and needs. The Directory Service should provide
 630 enough information for the client to make an initial choice. The
 631 client may have to connect to each individual Printer offered to
 632 get more detail. Not all information available from the Directory
 633 Service is obtained using IPP; some information may be
 634 administratively provided.

635
 636 The actual protocol used between client and Directory or Name
 637 Service is considered outside the scope of IPP. Printer Discover
 638 is included in the scenarios to provide design goals for the
 639 directory schema for IPP Printers and to further define Printer
 640 attributes.

641
 642 Characteristics that might be considered when locating a Printer
 643 include:

- 644 - capabilities of the Printer, e.g. PDLs supported
- 645 - physical location, e.g. in building 010
- 646 - driver required and location
- 647 - cost per page to print (outside the scope of IPP)
- 648 - whether or not printer is access controlled
- 649 - whether or not usage requires client authentication
- 650 - whether or not Printer can be authenticated
- 651 - whether or not payment is required for printing (outside the
- 652 scope of IPP)
- 653 - maximum job size (spool size) (outside the scope of IPP)
- 654 - whether or not Printer support compression (outside the scope
- 655 of IPP)
- 656 - whether or not Printer supports encryption
- 657 - administrative limits on this Printer
 - 658 - maximum number of copies per job
 - 659 - maximum number of pages per job

660 Responses could additionally include:

- 661 - how to get more information
- 662 - web page

666 - telephone number
 667 - help desk
 668

669 5.2. DRIVER INSTALLATION

```

670
671 Client                                     Printer
672
673 +----->
674     Where can I find a driver & software to install it?
675
676 <-----+
677     URIs for drivers and install software
678
679
680
```

681 Driver here refers to the code installed in some client operating
 682 system to generate the print data stream for the intended printer.
 683 The actual details for installing a printer driver are operating
 684 system dependent and are also outside the scope of IPP. However,
 685 an IPP printer or a directory service advertising an IPP Printer
 686 should be capable of telling a client what drivers are available
 687 and /or required, where they can be found, and provide pointers to
 688 installation instructions, installation code or initialization
 689 strings required to install the driver. See section 4.1 (SECURITY
 690 CONSIDERATIONS) for security implications of driver download and
 691 installation.
 692

693 5.3. SUBMITTING A PRINT JOB

```

694
695 Client                                     IPP Printer
696
697 +----->
698     Here is a Print Job
699     - Job attributes
700     - Print data
701
702 <-----+
703     Response
704
705
```

706 The protocol must support these sources of client data:

- 707
- 708 - Print data is a file submitted with the job
- 709 - Print data is generated on the fly by an application
- 710 - Print data is a file referenced by a URI
- 711

712 The protocol must handle overrun conditions in the printer and
 713 must support overlapped printing and downloading of the file in
 714 devices that are unable to spool files before printing them.
 715

716 Every print request will have a response. Responses will indicate
717 success or failure of the request and provide information on
718 failures when they occur. Responses would include things like:

- 719
- 720 - Got the print job and queued it
- 721 - Got the print job and am printing it
- 722 - Got the print job, started to print it, but printing failed
 - 723 - why it failed (e.g. unrecoverable PostScript error)
 - 724 - state of the printer
 - 725 - how much printed
- 726 - Got the print job but couldn't print it
 - 727 - why it can't be printed
 - 728 - state of the printer
- 729 - Got the print job but don't know what to do with it
- 730 - Didn't get a complete print job (e.g. communication failure)
- 731

732 5.4. GETTING STATUS/CAPABILITIES

```

733 Client                                                    IPP Printer
734
735 +----->
736   Get status and/or capabilities of Printer
737
738 <-----+
739
740   Status/Capabilities
741
742
743

```

744 Clients will need to get information about

- 745
- 746 - Static capabilities of the device
- 747 - Dynamic state of the Printer (e.g. out of paper)
- 748 - State of a specific job owned by this client
- 749 - State of all jobs owned by this client
 - 750 - queued
 - 751 - printing
 - 752 - completed
- 753 - Job submission attributes supported/required
 - 754 - scheduling attributes (e.g. priority)
 - 755 - production attributes (e.g. number of copies)
- 756

757 5.5. ASYNCHRONOUS NOTIFICATION

```

758 Client                                                    IPP Printer
759
760 +----->
761   Use the following method to notify me of Printer events
762
763
764
765

```



```

766
767 < -----+
768     Asynchronous notification of Printer event
769
770
771 Clients must be able to request asynchronous notification for
772 Printer events such as
773
774 - job completion
775 - a fatal error that requires the job to be resubmitted
776 - a condition that severely impacts a queued job for this client
777     e.g. printer is out of paper
778
779 Note: end-user notification is a V1.0 design goal while operator
780 notification is for V2.0.
781
782
783
784

```

785 5.6. JOB CANCELING

```

786
787 Client                               IPP Printer
788
789 +----->
790     Cancel the named job as indicated
791
792
793 < -----+
794     Response (did it or not)
795
796 Similarly clients must be able to make changes to jobs which have
797 been submitted and are queued for printing. Changing of job
798 attributes should also be supported. Job modifications, holding
799 and releasing of jobs are not included in the design goals for IPP
800 v1.0.
801

```

802 6. SECURITY CONSIDERATIONS

```

803
804 The security considerations for IPP are described in Section 4.1
805 above.

```

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```

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872

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891 11. APPENDIX - DETAILED SCENARIOS

892

893 The following are more detailed scenarios illustrating how the
894 Internet Printing Protocol is expected to be used as a part of a
895 complete Internet Printing system. Some parts of the scenarios
896 include concepts, functions and information that may be outside of
897 the scope of version 1.0 of IPP (e.g. cost per page, payments
898 means available, etc.) The information contained herein is meant
899 to be generic. There may not be an exact wording or terminology
900 match between these scenarios and the implementation documents.
901

902 11.1. PRINTER DISCOVERY WITHIN AN ENTERPRISE

903

904 A user wants to find a color Postscript printer in his/her
905 enterprise which will print transparencies. The client, directory
906 service, and printer are all behind the same corporate firewall.
907 Because color foils are expensive, printers of this type are

908 access controlled and require an account to be established so that
909 printing can be billed back to the using department. Note the
910 request to find a printer usable by Dept. J15. Drivers for all
911 supported printers are available from the server they are
912 associated with. A help desk is provided for end user support.
913 The printer is unattended.

914
915

916 Client

Directory Service

917

918 +----->

919 Find a printer with these characteristics

- 920 - prints color, prints transparencies
- 921 - prints Postscript
- 922 - is in building 003
- 923 - accessible by the client

924

925 <-----+

926 Printer "Color-A"

- 927 - prints color, prints transparencies
- 928 - prints Postscript
- 929 - in room H-6, building 003
- 930 - driver ABC-Postscript-V1.3 required, here is URI
- 931 - cost is \$.45 per page for color transparencies
- 932 - limit is 10 pages per job
- 933 - authentication required to use printer
- 934 - printer is unattended
- 935 - help desk at x5001

936

937 Printer "Color-B"

- 938 - prints color, prints transparencies
- 939 - prints Postscript
- 940 - in room J-10, building 003
- 941 - driver XYZ-Postscript-V2.4 required, here is URI
- 942 - cost is \$1.25 page for color transparencies
- 943 - limit is 5 pages per job
- 944 - authentication is required to use printer
- 945 - printer is unattended
- 946 - help desk at x5001

947

947 11.2. PRINTER DISCOVERY ACROSS ENTERPRISES

948

949

A user in Company A wants to find a public printer in a business partner's enterprise (Company B) on which to print a purchase order. The client is behind one corporate firewall and the directory service and the printer are behind a different corporate firewall. Drivers for all supported printers are available from the server they are associated with. A web page is provided for end user support for public printers.

956

957

958

Client

Company B Directory Service

959

960

+----->

961

Find a printer with these characteristics

962

- prints black and white

963

- is in El Segundo, building A

964

- is a public printer

965

966

<-----+

967

Printer "Public-A"

968

- prints black and white

969

- prints Postscript

970

- in El Segundo, room H-6, building A

971

- driver ABC-Postscript-V1.3 required, here is URI

972

- printer is public

973

- help available at <http://xerox/elSegundo/publicPrinters>

974

975

Printer "Public-B"

976

- prints black and white

977

- prints PCL/5e

978

- is in El Segundo, room J-10, building A

979

- driver XYZ-PCL-V2.4 required, here is URI

980

- printer is public

981

- help available at <http://xerox/elSegundo/publicPrinters>

982

982

983 11.3. PRINTER DISCOVERY ON THE INTERNET -LOGICAL OPERATIONS

984

985 A student wants to print a paper on a printer at his neighborhood
 986 Ink-o's print shop. The report was written using Microsoft Word.
 987 The student is interested in the cost of printing since his budget
 988 is limited. Note the use of logical operators to find this
 989 information.

990

991 Client

Ink-o's Directory Service

992

993 +----->

994 Find a Printer with these characteristics

- 995 - prints color or black and white
- 996 - costs less than \$.50 per page
- 997 - tell me about resolution and marking technology

998

999 <-----+

000 Printer "Color-A"

- 001 - prints color
- 002 - 600 dpi laser printer
- 003 - prints Postscript
- 004 - driver ABC-Postscript-V1.3 required, here is URI
- 005 - cost is \$.50 per page for color
- 006 - payment required prior to submitting print job
- 007 - here is URI for more information on Ink-o's

008

009 Printer "Mono-B"

- 010 - prints black and white
- 011 - 300 dpi inkjet printer
- 012 - prints Postscript
- 013 - driver XYZ-Postscript-V2.4 required, here is URI
- 014 - cost is \$0.35 page for black and white
- 015 - payment required prior to submitting print job
- 016 - here is URI for more information on Ink-o's

017

017

018 11.4. PRINTER DISCOVERY ON THE INTERNET - AUTHENTICATION

019

020 An executive in her hotel room is finishing an important
021 presentation on her laptop computer. She connects to a local print
022 shop through the web to get a copy of her charts printed for
023 tomorrow's presentation. She must find a print shop that is
024 convenient to her hotel and can print color transparencies. She
025 wants to be sure that the printer can be authenticated and can
026 accept encrypted data.

027

028

029

030 Client

SirZippy Directory Service

031

032

+----->

033

Find a Printer with these characteristics

034

- prints color transparencies

035

- is in Boulder, Colorado

036

- Printer can be authenticated

037

- Printer supports encryption

038

039

040 Tell me when you are open for business

041

042

<-----+

043

Printer "Color-A"

044

- prints color transparencies

045

- prints Postscript

046

- driver ABC-Postscript-V1.3 required, here is URI

047

- payment required prior to submitting print job

048

- Printer can be authenticated

049

- Data can be encrypted

050

- Located at 1670 Pearl Street, Boulder, CO

051

- This Branch is open 24 hours a day

052

053

054 Printer "Color-B"

055

- prints color transparencies

056

- prints Postscript

057

- driver ABC-Postscript-V1.3 required, here is URI

058

- payment required prior to submitting print job

059

- Printer can be authenticated

060

- Data can be encrypted

061

- Located at 1220 Arapahoe, Boulder, CO

062

- This Branch is open from 9:00 am to 6:30 pm

063

063

064 11.5. DRIVER DOWNLOAD

065

066 An end user in an enterprise wants to print a lengthy report on a
067 newly installed high speed PostScript printer. Since she will
068 likely use this printer often, she would like to download a driver
069 and install it on her workstation. She is running Windows 95.

070 Note: Driver download is not a V1.0 design goal.

071

072

073 Client

IPP Printer

074

075 +----->

076 Tell me where to find print drivers for you

077

078

079

080 <-----+

081 Driver install file is at

082 <http://www.ibm.com/drivers/NP12a/Win95>

083

083

084 11.6. SUBMITTING A PRINT JOB AS A FILE

085

086 An end-user wants to submit a print job. The print file already
087 exists on his workstation. The client and printer are behind the
088 same corporate firewall. The printer is available to anyone behind
089 the firewall and no authorization or authentication is required.
090 The data is pushed to the printer. The printer is capable of
091 spooling the output. No errors occur.

092

093 Client

IPP Printer

094

095 +----->

096 Here is a print job

- 097 - job name = MyJob
- 098 - notify me by email when done printing
- 099 - print on iso-a4-white paper
- 100 - print on both sides of the paper
- 101 - return status of the printer in response
- 102 - document is in Postscript format
- 103 - here is the document to print

104

105 <-----+

106 Print job accepted and spooled

- 107 - job id = #12345
- 108 - current state of print job = spooled
- 109 - submission time = 02/12/97, 15:35
- 110 - printer state = printing

111

112

112 11.7. SUBMITTING A PRINT JOB WITH TWO DOCUMENTS

113

114 An end-user wants to submit a print job. The print file already
 115 exists on his workstation. The client and printer are behind the
 116 same corporate firewall. The printer is available to anyone behind
 117 the firewall and no authorization or authentication is required.
 118 The data is pushed to the printer. The job consists of two
 119 separate documents. The printer is capable of spooling the output.
 120 No errors occur.

121

122 Client

IPP Printer

123

124 +----->

125 Here is a print job

126 - job name = MyJob

127 - notify me by email when done printing

128 - print on iso-a4-white paper

129 - print on both sides of the paper

130 - return status of the printer in response

131

132 <-----+

133 Print job accepted and spooled

134 - job id = #12345

135 - submission time = 02/12/97, 15:35

136 +----->

137 - here is the document to print

138

139 <-----+

140 - OK

141

142 +----->

143 - here is the document to print, it is the last document.

144

145 <-----+

146 - OK

147

147 11.8. SUBMITTING A PRINT JOB AS A FILE, PRINTING FAILS

148

149 An end-user wants to submit a print job. The print file already
 150 exists on his workstation. The client and printer are behind the
 151 same corporate firewall. The printer is available to anyone behind
 152 the firewall and no authorization or authentication is required.
 153 The data is pushed to the printer. The printer is not capable of
 154 spooling the output so it begins printing while still receiving
 155 the file. An error occurs and the printer cannot complete printing
 156 (in this case the user requires A4 paper and that paper size is
 157 not available on the printer.)

158

159 Client

IPP Printer

160

161 +----->

162 Here is a print job

163 - job name = MyJob

164 - notify me by email when done printing

165 - print on iso-a4-white paper

166 - print on both sides of the paper

167 - return status of the printer in response

168 - document is in Postscript format

169 - here is the document to print

170

171 <-----+

172 Print job accepted

173

174 - printing failed

175 - current state of print job = canceled (A4 not available)

176 - submission time = 02/12/97, 15:35

177 - printer state = ready

178 11.9. SUBMITTING A PRINT JOB WITH AUTHENTICATION, PRIVACY AND PAYMENT

179

180 A traveling executive needs to print a set of transparencies for
 181 an important business meeting. The charts are in Lotus Freelance
 182 format on his notebook computer. He has located a SirZippy print
 183 shop near his hotel that will print color transparencies. Because
 184 the information on the charts is sensitive, he wants to be sure
 185 that his data is sent to the Printer in an encrypted format. He
 186 also wants to authenticate the Printer. The Printer also
 187 authenticates the user. Payment occurs across the Internet.

188

189

190 Client

IPP Printer

191

192 +----->

193 <-----+

194

195 Mutual authentication and exchange of secret keys

196

```
197      +----->
198      Here is a print job (encrypted)
199      - job name = MyJob
200      - notify me by email when done printing
201      - print on iso-a4-white paper
202      - print on both sides of the paper
203      - return status of the printer in response
204      - tell me where to pick up output
205      - document is in Postscript format
206      - here is the document to print
207
208      <-----+
209      Print job accepted and spooled (encrypted)
210      - job id = #12345
211      - current state of print job = spooled
212      - submission time = 02/12/97, 15:35
213      - printer state = printing
214      - payment required to proceed with job
215      - pick up at 230 East Main after 3:30 pm today
216
217      +----->
218      <-----+
219      Payment transaction
220
```

220 11.10. SUBMITTING A PRINT JOB WITH DECRYPTION ERROR

221

222 A traveling executive needs to print a set of transparencies for
 223 an important business meeting. The charts are in Lotus Freelance
 224 format on his notebook computer. He has located a SirZippy print
 225 shop near his hotel that will print color transparencies. Because
 226 the information on the charts is sensitive, he wants to be sure
 227 that his data is sent to the printer in an encrypted format. He
 228 also wants to authenticate the printer. The printer also
 229 authenticates the user. Payment occurs across the Internet. An
 230 error occurs during decryption.

231

232

233 Client

IPP Printer

234

235

+----->

236

<-----+

Mutual authentication and exchange of secret keys

238

239

240

+----->

241

Here is a print job (encrypted)

242

- job name = MyJob

243

- notify me by email when done printing

244

- print on iso-a4-white paper

245

- print on both sides of the paper

246

- return status of the printer in response

247

- tell me where to pick up output

248

- document is in Postscript format

249

- here is the document to print

250

251

<-----+

252

Print job accepted and spooled (encrypted)

253

- job id = #12345

254

- current state of print job = spooled

255

- submission time = 02/12/97, 15:35

256

- printer state = printing

257

- payment required to proceed with job

258

- pick up at 230 East Main after 3:30 pm today

259

260

+----->

261

<-----+

Payment transaction

263

.

264

.

265

.

266

<-----+

267

Asynchronous response (email in this case)

268

- decryption failed on job #12345

269

- no pages printed

270

- current state of job = aborted

271
272
273

273 11.11. SUBMITTING A PRINT JOB WITH AUTHENTICATION

274

275 An end-user wants to submit a print job. The print file already
 276 exists on his workstation. The client and printer are behind the
 277 same corporate firewall. The printer is available to anyone behind
 278 the firewall but authentication and authorization is required.
 279 Authorization takes place using the authenticated end-user's name.
 280 The data is pushed to the printer. The printer is capable of
 281 spooling the output.

282

283

284 Client

IPP Printer

285

286

+----->

287

<-----+

288

Authentication

289

290 Note: An authentication failure would end the transaction at
 291 this point.

292

293

+----->

294

Here is a print job

295

- job name = MyJob

296

- notify me by email when done printing

297

- print on iso-a4-white paper

298

- print on both sides of the paper

299

- return status of the printer in response

300

- tell me where to pick up output

301

- document is in Postscript format

302

- here is the document to print

303

304

<-----+

305

Print job accepted and spooled

306

- job id = #12345

307

- current state of print job = spooled

308

- submission time = 02/12/97, 15:35

309

- printer state = printing

310

310 11.12. SUBMITTING A PRINT JOB GENERATED DYNAMICALLY

311

312 An end-user wants to submit a print job. The print data is
313 generated dynamically and is being transmitted by a printer driver
314 on the client workstation as available. The client and printer are
315 behind the same corporate firewall. The printer is available to
316 anyone behind the firewall and no authentication and authorization
317 is required. The data is pushed to the printer. The printer is
318 capable of spooling the output. No error occurs.

319

320

321 Client

IPP Printer

322

323 +-----+ >

324 Here is a print job

- 325 - job name = MyJob
- 326 - notify me by email when done printing
- 327 - print on iso-a4-white paper
- 328 - print on both sides of the paper
- 329 - return status of the printer in response
- 330 - document is in Postscript format
- 331 - here is the print job

332

333

334 <-----+ <

335 Print data accepted and spooling started

- 336 - job id = #12345
- 337 - current job state = spooled
- 338 - submission time = 02/12/97, 15:35
- 339 - printer state = printing

340

341

342

342 11.13. SUBMITTING A PRINT JOB WITH A PRINTER JAM - CANCELED

343

344

An end-user wants to submit a print job. The print data is generated dynamically and is being transmitted by a printer driver on the client workstation as available. The client and printer are behind the same corporate firewall. The printer is available to anyone behind the firewall and no authentication and authorization is required. The data is pushed to the printer. The printer is not capable of spooling the output. The printer jams notifies the user and the user chooses to cancel the job.

352

353

354

Client

IPP Printer

355

+----->

356

Here is a print job

357

- job name = MyJob

358

- notify me by email when done printing

359

- print on iso-a4-white paper

360

- print on both sides of the paper

361

- return status of the printer in response

362

- document is in Postscript format

363

- here is the document to print

364

365

<-----+

366

Print data accepted and printing started

367

- job id = #12345

368

369

+----->

370

- What is the status of print job #12345?

371

372

<-----+

373

- Job #12345 accepted but printer jammed, cannot continue

374

375

+----->

376

- Cancel job #12345

377

378

* Printer flushes remaining data

379

<-----+

380

Print job terminated

381

- current job state = canceled

382

- submission time = 02/12/97, 15:35

383

- printer state = jammed

384

384 11.14. SUBMITTING A PRINT JOB WITH A PRINTER JAM - RECOVERED

385

386 An end-user wants to submit a print job. The print data is
 387 generated dynamically and is being transmitted by a printer driver
 388 on the client workstation as available. The client and printer are
 389 behind the same corporate firewall. The printer is available to
 390 anyone behind the firewall and no authentication and authorization
 391 is required. The data is pushed to the printer. The printer is not
 392 capable of spooling the output. The printer jams, notifies the
 393 user and the user clears the jam and elects to continue.

394

395

396 Client

IPP Printer

397

398

+----->

399

Here is a print job

400

- job name = MyJob

401

- notify me by email when done printing

402

- print on iso-a4-white paper

403

- print on both sides of the paper

404

- return status of the printer in response

405

- document is in Postscript format

406

- here is the document to print

407

408

<-----+

409

Print data accepted and printing started

410

- job id = #12345

411

412

<-----+

413

- Notification: printer jammed, cannot continue

414

415

* Jam is clear by human intervention, printing continues

416

417

+----->

418

Here is the last part of the document to print

419

420

<-----+

421

Print job received

422

- current job state = printing

423

- submission time = 02/12/97, 15:35

424

- printer state = printing

425

426

426 11.15. SUBMITTING A PRINT JOB WITH SERVER PULL

427

428 An end-user wants to submit a print job. The print data is in a
 429 file and is publicly available. It is pulled by the printer. The
 430 client and printer are behind the same corporate firewall. The
 431 printer is available to anyone behind the firewall and no
 432 authentication and authorization is required. The printer is
 433 capable of spooling the output. Printing may start before the
 434 entire job has been pulled.

435

436 Client

IPP Printer

437

438 +----->

439 Here is a print job

440 - job name = MyJob

441 - notify me by email when done printing

442 - print on iso-a4-white paper

443 - print on both sides of the paper

444 - return status of the printer in response

445 - here is a reference to the data to be printed

446

447 <-----+

448 Print data accepted and printing started

449 - job id = #12345

450 - current state of job = spooled

451 - submission time = 02/12/97, 13:15

452 - printer state = printing

453

454 .

455 .

456 <-----+

457 Get the file to be printed

458

459 +----->

460 Here it is

461

462 Note: Failure to find the file, would end the transaction
 463 with an error at this point and an asynchronous
 464 notification would be send to the Client.

465

466 <-----+

467 Data received

468

469

469 11.16. SUBMITTING A PRINT JOB WITH REFERENCED RESOURCES

470

471

472

473

474

475

476

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512

An end-user wants to submit a print job. Part of the print data is on a file on the user's workstation. It is pushed by the client, but the print job requires some resource not included in the print file. The client and printer are behind the same corporate firewall. The printer is available to anyone behind the firewall and no authentication and authorization is required. The printer is capable of spooling the output. No errors occur.

Client

IPP Printer

+----->

Here is a print job

- job name = MyJob
- notify me by email when done printing
- print on iso-a4-white paper
- print on both sides of the paper
- return status of the printer in response

<-----+

Print job accepted and spooled

- job id = #12345
- submission time = 02/12/97, 15:35

+----->

- here is the document to print

<-----+

- OK

+----->

- here is the URI to print, it is the last document.

<-----+

- OK

<-----+

Get the external resource

+----->

Here it is

512 11.17. GETTING CAPABILITIES

513 11.17.1. Submission Attributes

514

515 An end-user wants to get the production and scheduling attributes
 516 that are supported or required when submitting jobs to this
 517 printer. The client will use these attributes when forming the
 518 subsequent print request.

519

520 Client

IPP Printer

521 +----->

522 I'm going to submit a Postscript job
 523 give me your job submission attributes

524

525 <-----+

526 Postscript production attributes for this Printer are:

527 - medium-select = us-letter-white, us-legal-white

528 - default is us-letter-white

529 - copies = 1,2,3,4,5

530 - default is 1

531 - print-quality = draft, normal, high

532 - default is draft

533 - sides = 1-sided, 2-sided-long-edge

534 - default is 2-sided-long-edge

535 - Job scheduling attributes for this Printer are:

536 - job-priority = 1,2,3

537 - default = 3

538

539 11.17.2. Printer Capabilities

540

541 An end-user wants to determine the resolution, marking technology,
 542 and PDLs supported by the printer.

543

544 Client

IPP Printer

545 +----->

546 Please tell me the
 547 - resolution of the printer
 548 - the marking technology of the printer
 549 - PDLs supported

550 <-----+

551 Printer resolution = 600 dpi

552 Marking Technology = laser

553 PDLs supported = Postscript level 2, PCL/6

554

554

555 11.18. GETTING STATUS

556 11.18.1. Printer State/Status

557

558 An end-user wants to determine the state or status of the printer.

559

560 Client

IPP Printer

561

562 +----->

563 What is the state of the printer?

564

565 <-----+

566 Printer state = out-of-paper

567

568 11.18.2. Job Status

569

570 An end user wants to get the status of a job he has submitted.

571

572 Client

IPP Printer

573

574 +----->

575 Please tell me the status of job #12345

576

577 <-----+

578 Job #12345 is queued

579 it is number 3 in the queue

580

580 printer state = printing

581

582

583 11.18.3. Status of All My Jobs

584

585 An end user wants to get a list of all of the jobs he has

586

586 submitted to this Printer.

587

588 Client

IPP Printer

589

590 +----->

591 Please tell me the status of my jobs

592

593 <-----+

594 Job #00012 is complete

595 Printed at 12:35 on 01/23/97

596

597 Job #09876 is printing

598

599 Job #12345 is queued

600 it is number 3 in the queue

601

602 Job #34567 is queued

603 it is number 7 in the queue

604

604 11.19. ASYNCHRONOUS NOTIFICATION

605 11.19.1. Job Completion

606

607 An end-user wants to get notification of events that affect his
608 print jobs. Print job completes without error.

609

610 Client

IPP Printer

611

612 < -----+

613 Print job #123 completed

614

615 11.19.2. Job Complete with Data

616

617 An end-user wants to get notification of events that affect his
618 print jobs. Print job completes, users asked for all end of job
619 information.

620

621 Client

IPP Printer

622

623 < -----+

624 Print job #123 completed

625 - total pages printed = 15

626 - number of copies printed = 3

627 - total cost to print = \$7.45

628 - pick up copies in room H-6, building 005

629

630 11.19.3. Print Job Fails

631

632 An end-user wants to get notification of events that affect his
633 print jobs. Print job fails. Printer is unattended.

634

635 Client

IPP Printer

636

637 < -----+

638 Print job #123 failed

639 - total pages printed = 15

640 - number of pages submitted = 25

641 - printer-state = jammed

642

642 11.20. CANCEL A JOB

643

644 The end-user submits a print job and later decides to cancel it.

645

646 Client

IPP Printer

647

648 +----->

649

< -----+

650

Authentication.

651

652

653 +----->

654

Cancel job #1234

655

656 < -----+

657

Job #1234 Canceled

658

659

660

660 11.21. END TO END SCENARIO - WITHIN AN ENTERPRISE

661

662 An office worker prints on shared departmental printers. All
 663 printers in the office are public, that is, no authentication or
 664 authorization is required. Printers are protected from external
 665 access by a firewall. No billing or accounting is required. Most
 666 printing is done from desktop applications. A help desk is
 667 provided for printing problems. Standard operating systems and
 668 applications are used. Drivers are available, but are installed
 669 manually by support personnel. This scenario assumes that drivers
 670 have been installed and that drivers are not IPP aware, that is,
 671 they cannot communicate across an IPP connection to obtain status
 672 and capabilities. IPP printers appear in application pull-down
 673 menus. Printer configuration data is hard wired into the driver.

674

675 End-user selects print from the application pull down menu. An IPP
 676 printer is selected from the list of Printers offered

677

678 The driver puts up a dialogue with hard-wired set of options
 679 for this printer. The end-user makes choices and submits job.

680

681

682 Client IPP Printer

683 +----->

684 Here is a print job

- 685 - job-name = memo-to-boss
- 686 - notify me by email when job is complete
- 687 - print on us-letter-white paper
- 688 - print 1 copy
- 689 - print at normal quality
- 690 - print on 1 side
- 691 - give me the state of the printer in response

692

693 The driver generates the print data and passes it to the IPP
 694 driver a piece at a time as it is generated.

695

696 +----->

697 Here is the print data

698

699

700 <-----+

701 Print data received, file is spooled

- 702 - printer state = printing
- 703 - time submitted = 2/12/97, 15:35
- 704 - current job state = spooled

705

706

707 Client adds this job to list of current jobs. List of jobs and
 708 state of each is available on a pull-down menu on the client.

709

```
710 End-user selects job #1234 from list and clicks on it to see its
711 status.
712
713 +----->
714 Give me the state of job #1234
715 and the state of the Printer
716
717 <-----+
718 Job #1234 state = spooled
719 - it is number 3 in the queue
720 - printer state = printing
721
722 The job completes without error
723
724 <-----+
725 Job #1234 completed
726 12 of 12 pages printed
727
```

727
728 11.22. END TO END SCENARIO - ACROSS ENTERPRISES
729

730 An office worker in Company A needs to print an office document on
731 a "public" printer at Company B, a business partner. Both
732 companies have corporate firewalls so the print request must flow
733 out of A's firewall and into B's firewall. The office worker can
734 look at public printers in Company B's directory service. The
735 document is generated by a desktop application. Since the printer
736 is "public" no authentication or authorization is required. A
737 driver is downloaded. The driver is IPP aware, that is, it can
738 communicate dynamically through the IPP protocol layer to obtain
739 information about the printer.

740
741 Client Company B's Directory Service

742
743 End user connects to B's Directory service

744
745 +----->
746 Find a Printer with these characteristics
747 - public (no authorization or authentication required)
748 - is in Lexington, building 004
749 - prints black and white

750
751 <-----+
752 Printer "Public-A"
753 - http://www.lexmark.com/pubprinter/a
754
755 Printer "Public-B"
756 - http://www.lexmark.com/pubprinter/b

757
758 End user selects Public-A

759
760 Client Public-A

761
762 +----->
763 Where can I find a driver for you?

764
765 <-----+
766 Drivers at http://www.lexmark.com/pubprinters/a/os245

767
768 End user gets driver and installs it on his PC.

769
770 End-user selects print from the application pull down menu.
771 "Public-A" is selected from the list of Printers offered

772
773 +----->
774 I'm going to submit a print job
775 give me your job submission attributes

776
777 <-----+

```
778     Production attributes for this Printer are:
779     - medium-select = us-letter-white, us-legal-white
780       - default is us-letter-white
781       - copies = 1,2,3,4,5
782       - default is 1
783         - print-quality = draft, normal, high
784       - default is draft
785         - sides = 1-sided, 2-sided-long-edge
786       - default is 2-sided-long-edge
787
788     Job scheduling attributes for this Printer are:
789     - job-priority = 1,2,3
790       default = 3
791
792     Driver puts up dialogue with available options and fills in the
793     defaults.
794
795     End-user makes choices and submits job
796
797     +----->
798     Here is a print job
799     - job-name = memo-to-Don-Wright
800     - notify me by email when job is complete
801     - print on us-letter-white paper
802     - print 1 copy
803     - print at normal quality
804     - print on 1 side
805     - give me the state of the printer in response
806
807
808     The driver generates the print data and passes it to the IPP
809     driver a piece at a time.
810
811     +----->
812     Here is the print data
813
814     <-----+
815     Print data received, and spooling started
816     print job id = #1234
817
818     Print data received, file is spooled
819
820     - printer state = printing
821     - time submitted = 2/12/97, 15:35
822     - current job state = spooled
823
824
825     Client adds this job to list of current jobs. List of jobs and
826     state of each is available on a pull-down menu on the client.
827
828     End-user selects job #1234 from list and clicks on it to see its
829     status.
```

```
830
831      +----->
832      Give me the state of job #1234
833      and the state of the Printer
834
835      <-----+
836      Job #1234 state = spooled
837      - it is number 3 in the queue
838      - printer state = printing
839
840      * The job completes without error
841      <-----+
842      Job #1234 completed
843      12 of 12 pages printed
844
845
```

845 11.23. END TO END SCENARIO - ON THE INTERNET

846

847 An executive in her hotel room is finishing an important
 848 presentation on her laptop computer. She connects to a local print
 849 shop through the web to get a copy of her charts printed for
 850 tomorrow's presentation. She must find a print shop that is
 851 convenient and can print color transparencies. She must download
 852 and temporarily install a driver in order to generate the PDL
 853 required by the print shop. Mutual authentication is required by
 854 the print shop and payment must be made in advance. The job is
 855 encrypted on the wire to prevent eavesdropping.

856

857 End-user completes presentation. She goes to the web and connects
 858 to the SirZippy home page.

859

860 Client SirZippy Directory Service

861 +----->

862

863 Find me a printer with these characteristics

864

- Near Market Street in San Jose

865

- Prints color transparencies

866

- drivers can be downloaded

867

- supports privacy (encryption)

868

-

869

870 Available Printers matching these characteristics are looked up in
 871 the Directory Service

872

873 < -----+

874

875 Printer "Color-A"

876

- located at 123 First Street in San Jose

877

- URI is <http://www.SirZippy.com/FirstStreet/Color-A>

878

- prints color transparencies

879

- 600 dpi laser

880

- driver ABC-Postscript-V1.3 available at this URI

881

- cost = \$.75 per page

882

- authentication required to use printer

883

- payment required prior to printing

884

885

886 Printer "Color-B"

887

- located at 67 San Carlos Street, San Jose

888

- URI is <http://www.SirZippy.com/SanCarlos/Color-B>

889

- prints color transparencies

890

- 1200 dpi laser

891

- driver XYZ-PostScript-V4.3 available at this URI

892

- cost = \$1.25 per page

893

- authentication required to use printer

894

- payment required prior to printing

895

-

```

896     - more information at this URI
897
898 The user decides to use the first printer because it is closer.
899 She connects to the URI given to get a driver.
900
901 Client                                Driver URI
902
903 +----->
904     I need a driver for "Color-A"
905
906 <-----+
907     Driver installer is at http://www.xerox.com/prtdrvrs
908
909     Driver is installed
910
911     User connects to
912     "Color-A"
913
914 Client                                IPP Printer "Color-A"
915
916 +----->
917 <-----+
918     Mutual authentication and exchange of secret keys
919
920 +----->
921     I'm going to submit a print job
922     give me your job submission attributes
923
924 <-----+
925     Production attributes for this Printer are:
926     - medium-select = us-letter-white, us-legal-white
927       - default is us-letter-white
928     - copies = 1,2,3,4,5
929       - default is 1
930     - print-quality = draft, normal, high
931       - default is draft
932     - sides = 1-sided, 2-sided-long-edge
933       - default is 2-sided-long-edge
934
935     Job scheduling attributes for this Printer are:
936     - job-priority = 1,2,3
937       default = 3
938
939 Driver puts up dialogue with available options and fills in the
940 defaults.
941
942 End-user makes choices and submits job
943
944 +----->
945     Here is a print job
946     - job-name = presentation
947

```


- ```

948 - notify me by email when job is complete
949 - print on us-letter-transparency
950 - print 1 copy
951 - print at high quality
952 - print by 9:00 am tomorrow morning
953 - give me the state of the printer in response
954

```

```

955 The driver generates the print data and passes it to the IPP
956 driver a piece at a time.
957

```

```

958 +----->
959 Here is the print data
960
961 <-----+
962 Print data received, and spooling started
963 print job id = #1234
964
965 Print data received, file is spooled
966 - printer state = printing
967 - time submitted = 2/12/97, 15:35
968 - current job state = held, waiting for payment
969
970 +----->
971 <-----+
972 Payment transaction
973
974 <-----+
975 Job is scheduled to print, pick up after 9:00am tomorrow
976 Thank you for using SirZippy

```