



The Printer Working Group

2 November 2015  
Working Draft

## IPP System Service v1.0 (SYSTEM)

Status: Interim

Abstract: This document defines an IPP System Service binding of the PWG Semantic Model root System object and associated System Control Service that are defined in (PWG 5108.06) and the PWG Resource Service that is defined in (PWG 5108.03). This document defines IPP objects, operations, and attributes to support management of all configured Services, Subunits, and Resources on an Imaging System and monitoring of the current status of the Imaging System, Services, Subunits, and Resources. This document also defines IPP operations and attributes to support registration of an IPP System, through its IPP Proxy, with one or more Cloud Imaging Systems. This document is technically aligned with the abstract PWG Cloud Imaging Requirements and Model (PWG 5109.1) and concrete PWG IPP Shared Infrastructure Extensions (PWG 5100.18).

This document is a PWG Working Draft. For a definition of a "PWG Working Draft", see:

<http://ftp.pwg.org/pub/pwg/general/pwg-process30.pdf>

This document is available electronically at:

<http://ftp.pwg.org/pub/pwg/ipp/wd/wd-ippssystem10-20151102.pdf>

Field Code Changed

Deleted: [20151018](#)

1 Copyright © 2014-2015 The Printer Working Group. All rights reserved.

2 This document may be copied and furnished to others, and derivative works that comment  
3 on, or otherwise explain it or assist in its implementation may be prepared, copied,  
4 published and distributed, in whole or in part, without restriction of any kind, provided that  
5 the above copyright notice, this paragraph and the title of the Document as referenced  
6 below are included on all such copies and derivative works. However, this document itself  
7 may not be modified in any way, such as by removing the copyright notice or references to  
8 the IEEE-ISTO and the Printer Working Group, a program of the IEEE-ISTO.

9 Title: IPP System Service v1.0 (SYSTEM)

10 The IEEE-ISTO and the Printer Working Group DISCLAIM ANY AND ALL WARRANTIES,  
11 WHETHER EXPRESS OR IMPLIED INCLUDING (WITHOUT LIMITATION) ANY IMPLIED  
12 WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

13 The Printer Working Group, a program of the IEEE-ISTO, reserves the right to make  
14 changes to the document without further notice. The document may be updated, replaced  
15 or made obsolete by other documents at any time.

16 The IEEE-ISTO takes no position regarding the validity or scope of any intellectual  
17 property or other rights that might be claimed to pertain to the implementation or use of the  
18 technology described in this document or the extent to which any license under such rights  
19 might or might not be available; neither does it represent that it has made any effort to  
20 identify any such rights.

21 The IEEE-ISTO invites any interested party to bring to its attention any copyrights, patents,  
22 or patent applications, or other proprietary rights which may cover technology that may be  
23 required to implement the contents of this document. The IEEE-ISTO and its programs  
24 shall not be responsible for identifying patents for which a license may be required by a  
25 document and/or IEEE-ISTO Industry Group Standard or for conducting inquiries into the  
26 legal validity or scope of those patents that are brought to its attention. Inquiries may be  
27 submitted to the IEEE-ISTO by e-mail at: [ieee-isto@ieee.org](mailto:ieee-isto@ieee.org).

28 The Printer Working Group acknowledges that the IEEE-ISTO (acting itself or through its  
29 designees) is, and shall at all times, be the sole entity that may authorize the use of  
30 certification marks, trademarks, or other special designations to indicate compliance with  
31 these materials.

32 Use of this document is wholly voluntary. The existence of this document does not imply  
33 that there are no other ways to produce, test, measure, purchase, market, or provide other  
34 goods and services related to its scope.

35

36 About the IEEE-ISTO

37 The IEEE-ISTO is a not-for-profit corporation offering industry groups an innovative and  
38 flexible operational forum and support services. The IEEE-ISTO provides a forum not only  
39 to develop standards, but also to facilitate activities that support the implementation and  
40 acceptance of standards in the marketplace. The organization is affiliated with the IEEE  
41 (<http://www.ieee.org/>) and the IEEE Standards Association (<http://standards.ieee.org/>).

42 For additional information regarding the IEEE-ISTO and its industry programs visit:

43 <http://www.ieee-isto.org>

44 About the IEEE-ISTO PWG

45 The Printer Working Group (or PWG) is a Program of the IEEE Industry Standards and  
46 Technology Organization (ISTO) with member organizations including printer  
47 manufacturers, print server developers, operating system providers, network operating  
48 systems providers, network connectivity vendors, and print management application  
49 developers. The group is chartered to make printers and the applications and operating  
50 systems supporting them work together better. All references to the PWG in this  
51 document implicitly mean “The Printer Working Group, a Program of the IEEE ISTO.” In  
52 order to meet this objective, the PWG will document the results of their work as open  
53 standards that define print related protocols, interfaces, procedures and conventions.  
54 Printer manufacturers and vendors of printer related software will benefit from the  
55 interoperability provided by voluntary conformance to these standards.

56 In general, a PWG standard is a specification that is stable, well understood, and is  
57 technically competent, has multiple, independent and interoperable implementations with  
58 substantial operational experience, and enjoys significant public support.

59 For additional information regarding the Printer Working Group visit:

60 <http://www.pwg.org>

61 Contact information:

62 The Printer Working Group  
63 c/o The IEEE Industry Standards and Technology Organization  
64 445 Hoes Lane  
65 Piscataway, NJ 08854  
66 USA  
67

68 About the Internet Printing Protocol Work Group

69 The Internet Printing Protocol (IPP) working group has developed a modern, full-featured  
70 network printing protocol, which is the industry standard. IPP allows a print client to query  
71 a printer for its supported capabilities, features, and parameters to allow the selection of an  
72 appropriate printer for each print job. IPP also provides job information prior to, during, and  
73 at the end of job processing.

74 For additional information regarding IPP visit:

75 <http://www.pwg.org/ipp/>

76 Implementers of this specification are encouraged to join the IPP mailing list in order to  
77 participate in any discussions of the specification. Suggested additions, changes, or  
78 clarification to this specification, should be sent to the IPP mailing list for consideration.  
79

80	<b>Table of Contents</b>	
81	1. Introduction .....	10
82	1.1 Rationale for two IPP Protocol Endpoints .....	10
83	2. Terminology .....	11
84	2.1 Conformance Terminology .....	11
85	2.2 Protocol Role Terminology .....	11
86	2.3 Printing Terminology.....	12
87	2.4 Abbreviations.....	14
88	3. Requirements for the IPP System Service .....	14
89	3.1 Rationale for the IPP System Service.....	14
90	3.2 Use Cases.....	15
91	3.2.1 Imaging System Service Enumeration .....	15
92	3.2.2 Imaging System Monitoring .....	15
93	3.2.3 Imaging System Management .....	16
94	3.2.4 Resource Management.....	16
95	3.3 Exceptions.....	16
96	3.4 Out of Scope .....	16
97	3.5 Design Requirements .....	16
98	4. IPP Object Model .....	17
99	4.1 System Object .....	17
100	4.2 Subunit Object.....	17
101	4.3 Printer Object .....	17
102	4.4 Job Object .....	17
103	4.5 Document Object.....	17
104	4.6 Resource Object.....	18
105	4.7 Subscription Object .....	18
106	5. IPP System and Resource Objects and Operations .....	19
107	5.1 System Attribute Group .....	19
108	5.2 System Description Attributes .....	20
109	5.3 System Status Attributes .....	21
110	5.4 System Operations.....	22
111	5.5 Resource Attribute Group.....	23
112	5.6 Resource Description Attributes .....	24
113	5.7 Resource Status Attributes.....	25
114	5.8 Printer Description Attributes.....	26
115	6. IPP Operations.....	27
116	6.1 Cancel-Resource.....	27
117	6.2 Create-Printer.....	27
118	6.3 Create-Resource .....	28
119	6.4 Create-Resource-Subscriptions .....	29
120	6.5 Create-System-Subscriptions.....	29
121	6.6 Delete-Printer .....	29
122	6.7 Disable-All-Printers.....	29
123	6.8 Enable-All-Printers.....	29
124	6.9 Get-Printers.....	29
125	6.9.1 Get-Printers Request .....	29

126	6.9.2 Get-Printers Response .....	30
127	6.10 Get-Resources .....	31
128	6.11 Get-Resource-Attributes .....	31
129	6.12 Get-Subscriptions .....	31
130	6.13 Get-Subscription-Attributes .....	31
131	6.14 Get-System-Attributes .....	31
132	6.15 Install-Resource .....	31
133	6.16 Pause-All-Printers .....	32
134	6.17 Pause-All-Printers-After-Current-Job .....	32
135	6.18 Register-Output-Device .....	32
136	6.19 Restart-All-Printers .....	32
137	6.20 Restart-One-Printer .....	32
138	6.21 Restart-System .....	32
139	6.22 Resume-All-Printers .....	32
140	6.23 Send-Resource-Data .....	32
141	6.24 Set-Resource-Attributes .....	32
142	6.25 Set-System-Attributes .....	33
143	6.26 Shutdown-All-Printers .....	33
144	6.27 Shutdown-One-Printer .....	33
145	6.28 Startup-All-Printers .....	33
146	6.29 Startup-One-Printer .....	33
147	7. IPP Attributes .....	34
148	7.1 System, Printer, and Resource Operation Attributes .....	34
149	7.1.1 printer-geo-location (uri) .....	34
150	7.1.2 printer-location (text(127)) .....	34
151	7.1.3 printer-service-type (type2 keyword) .....	34
152	7.1.4 printer-service-types (1setOf (type2 keyword)) .....	34
153	7.1.5 resource-category (type2 keyword) .....	35
154	7.1.6 resource-format (mimeMediaType) .....	35
155	7.1.7 resource-id (integer(1:MAX)) .....	35
156	7.1.8 resource-job-id (integer(1:MAX)) .....	35
157	7.1.9 resource-k-octets (integer(0:MAX)) .....	35
158	7.1.10 resource-printer-uri (uri) .....	35
159	7.1.11 resource-state (type1 enum) .....	36
160	7.1.12 resource-type (type2 keyword) .....	36
161	7.1.13 system-uri (uri) .....	36
162	7.1.14 which-printers (type2 keyword): .....	36
163	7.2 System Description Attributes .....	37
164	7.2.1 charset-configured (charset) .....	37
165	7.2.2 charset-supported (1setOf charset) .....	37
166	7.2.3 ipp-versions-supported (1setOf type2 keyword) .....	37
167	7.2.4 natural-language-configured (naturalLanguage) .....	37
168	7.2.5 natural-language-supported (1setOf naturalLanguage) .....	38
169	7.2.6 operations-supported (1setOf type2 enum) .....	38
170	7.2.7 power-calendar (1setOf collection) .....	38
171	7.2.8 power-event (1setOf collection) .....	38

172	7.2.9 power-timeout (1setOf collection) .....	39
173	7.2.10 system-default-printer-uri (uri).....	39
174	7.2.11 system-device-id (text(1023)).....	39
175	7.2.12 system-geo-location (uri) .....	39
176	7.2.13 system-info (text(127)) .....	39
177	7.2.14 system-location (text(127)) .....	39
178	7.2.15 system-make-and-model (text(127)) .....	40
179	7.2.16 system-message-from-operator (text(127)) .....	40
180	7.2.17 system-name (name(127)).....	40
181	7.2.18 system-owner-uri (uri) .....	40
182	7.2.19 system-owner-vcard (1setOf text(1023)).....	40
183	7.2.20 system-xri-supported (1setOf collection).....	41
184	7.3 System Status Attributes .....	42
185	7.3.1 power-counters (1setOf collection) .....	42
186	7.3.2 power-general (collection).....	42
187	7.3.3 power-log (1setOf collection) .....	42
188	7.3.4 power-meters (1setOf collection) .....	42
189	7.3.5 power-monitor (collection).....	42
190	7.3.6 power-support (1setOf collection) .....	42
191	7.3.7 power-transition (1setOf collection).....	43
192	7.3.8 system-config-changes (integer(0:MAX)).....	43
193	7.3.9 system-configured-printers (1setOf collection).....	43
194	7.3.10 system-configured-resources (1setOf collection) .....	43
195	7.3.11 system-configured-subunits (1setOf collection) .....	43
196	7.3.12 system-current-time (dateTime) .....	43
197	7.3.13 system-health (1set of collection).....	43
198	7.3.14 system-serial-number (text(255)).....	44
199	7.3.15 system-state (type1 enum) .....	44
200	7.3.16 system-state-message (text(MAX)).....	44
201	7.3.17 system-state-reasons (1setOf type2 keyword).....	44
202	7.3.18 system-totals (1setOf collection) .....	44
203	7.3.19 system-up-time (integer(1:MAX)) .....	44
204	7.3.20 system-uuid (uri(45)).....	44
205	7.4 Printer Description Attributes .....	45
206	7.5 Printer Status Attributes.....	45
207	7.6 Resource Description Attributes .....	45
208	7.6.1 resource-info (text(127)) .....	45
209	7.6.2 resource-name (name(127)) .....	45
210	7.6.3 resource-string-version (text(127)).....	45
211	7.6.4 resource-version (octetString(16)) .....	45
212	7.7 Resource Status Attributes .....	46
213	7.7.1 date-time-at-canceled (dateTime) .....	46
214	7.7.2 date-time-at-creation (dateTime).....	46
215	7.7.3 resource-authenticator (1setOf collection) .....	46
216	7.7.4 resource-category (type2 keyword).....	46
217	7.7.5 resource-data-uri (uri) .....	47

218	7.7.6 resource-format (mimeMediaType).....	47
219	7.7.7 resource-id (integer(1:MAX)).....	47
220	7.7.8 resource-job-id (integer(1:MAX)).....	47
221	7.7.9 resource-k-octets (integer(0:MAX)).....	47
222	7.7.10 resource-originating-user-name (name(MAX)) .....	47
223	7.7.11 resource-originating-user-uri (uri).....	47
224	7.7.12 resource-printer-uri (uri).....	47
225	7.7.13 resource-state (type1 enum).....	47
226	7.7.14 resource-state-message (text(MAX)) .....	47
227	7.7.15 resource-state-reasons (1setOf type2 keyword) .....	47
228	7.7.16 resource-type (type2 keyword).....	47
229	7.7.17 resource-uuid (uri(45)) .....	47
230	7.7.18 time-at-canceled (integer(MIN:MAX)) .....	47
231	7.7.19 time-at-creation (integer(MIN:MAX)) .....	47
232	8. Additional Semantics for Existing Operations .....	48
233	8.1 Cancel-Subscription, Get-Notifications, and Renew-Subscription: system-uri (uri) and resource-id (integer(1:MAX)) .....	48
234	8.2 Get-Printer-Attributes: printer-resource-ids (1setOf integer(1:MAX)).....	48
235	8.3 Create-Job, Get-Job-Attributes: job-resource-ids (1setOf integer(1:MAX)) .....	48
236	9. Additional Values for Existing Attributes.....	48
237	9.1 notify-events (1setOf type2 keyword) .....	48
238	10. Conformance Requirements .....	49
239	10.1 Conformance Requirements for Clients.....	49
240	10.2 Conformance Requirements for Infrastructure Systems.....	49
241	10.3 Conformance Requirements for Systems .....	49
242	11. Internationalization Considerations .....	49
243	12. Security Considerations .....	50
244	13. IANA and PWG Considerations .....	50
245	14. References.....	50
246	14.1 Normative References.....	50
247	14.2 Informative References .....	54
248	15. Authors' Addresses .....	54
249	16. Change History .....	55
250	16.1 2 November 2015.....	55
251	16.2 18 October 2015.....	55
252	16.3 20 September 2015 .....	55
253	16.4 31 August 2015 .....	56
254	16.5 10 August 2015 .....	57
255	16.6 28 April 2015 .....	58
256	16.7 15 March 2015 .....	59
257	16.8 2 November 2014.....	60
258	16.9 24 August 2014 .....	61
259	16.10 11 August 2014 .....	62
260		
261		
262	<b>List of Tables</b>	
263	Table 1 – IPP System Description Attributes .....	20



264	Table 2 – IPP System Status Attributes .....	21
265	Table 3 – IPP System Service Operations .....	22
266	Table 4 – IPP Resource Description Attributes .....	24
267	Table 5 – IPP Resource Status Attributes.....	25
268	Table 6 – IPP Printer Description Attributes.....	26
269		
270		

## 271 **1. Introduction**

272 This document defines an IPP System Service binding of the PWG Semantic Model root  
273 System object and associated System Control Service that are defined in [PWG 5108.06]  
274 and the PWG Resource Service that is defined in [PWG5108.03]. This document defines  
275 IPP objects, operations, and attributes to support management of all configured Services,  
276 Subunits, and Resources on an Imaging System and monitoring of the current status of the  
277 Imaging System, Services, Subunits, and Resources. This document also defines IPP  
278 operations and attributes to support registration of an IPP System, through its IPP Proxy,  
279 with one or more Cloud Imaging Systems. This document is technically aligned with the  
280 abstract PWG Cloud Imaging Requirements and Model [PWG5109.1] and concrete PWG  
281 IPP Shared Infrastructure Extensions [PWG5100.18].

### 282 **1.1 Rationale for two IPP Protocol Endpoints**

283 This specification defines the IPP System object that represents the IPP System Service.  
284 Because the IPP operations on and the IPP attributes defined for this System object and  
285 those defined for the Printer object in [RFC2911] are disjoint, an IPP Imaging System that  
286 conforms to this specification supports both an IPP System object and (via a response to  
287 the Get-Printer-Attributes operation) an IPP Printer object, each with a separate Protocol  
288 Endpoint – i.e., separate values of IPP URI [RFC3510] or IPPS URI [RFC7472].

289 For the convenience of existing IPP Clients, this specification also includes the original  
290 Get-Printer-Attributes operation defined in IPP/1.1 Model and Semantics [RFC2911] with  
291 an extension to automatically select the implementation-defined or site-defined “default”  
292 IPP Printer object.  
293

## 294 **2. Terminology**

### 295 **2.1 Conformance Terminology**

296 Capitalized terms, such as MUST, MUST NOT, RECOMMENDED, REQUIRED, SHOULD,  
297 SHOULD NOT, MAY, and OPTIONAL, have special meaning relating to conformance as  
298 defined in Key words for use in RFCs to Indicate Requirement Levels [RFC2119]. The  
299 term CONDITIONALLY REQUIRED is additionally defined for a conformance requirement  
300 that applies to a particular capability or feature.

### 301 **2.2 Protocol Role Terminology**

302 This document defines the following protocol roles in order to specify unambiguous  
303 conformance requirements:

304 *Client*: Initiator of outgoing IPP session requests and sender of outgoing IPP operation  
305 requests (Hypertext Transfer Protocol -- HTTP/1.1 [RFC7230] User Agent).

306 *Endpoint*: Any computing device that can be connected to a network. Such devices  
307 normally are associated with a particular link layer address before joining the network and  
308 potentially an IP address once on the network. This includes: laptops, desktops, servers,  
309 cell phones, or any device that may have an IP address (or any other network layer  
310 address) [RFC5209].

311 *Infrastructure Printer*: A Printer that represents a Logical Device associated with both a  
312 Client and Proxy [PWG5100.18]. For Cloud-based implementations, the Infrastructure  
313 Printer corresponds to a Cloud Imaging Service [PWG5019.1].

314 *Infrastructure System*: A System that represents an entire Imaging System and accepts  
315 incoming requests and connections from both Clients and Proxies and contains zero or  
316 more Infrastructure Printers [PWG5100.18]. For Cloud-based implementations, the  
317 Infrastructure System corresponds to a Cloud Imaging System [PWG5019.1].

318 *Printer*: Listener for incoming IPP session requests and receiver of incoming IPP  
319 operation requests (Hypertext Transfer Protocol -- HTTP/1.1 [RFC7230] Server) that  
320 exposes a Printer object and implements an Imaging Service.

321 *Protocol Endpoint*: An application interface, typically at the transport layer or session  
322 layer, that supports: a) initiating outgoing connection requests and operation requests; b)  
323 listening for incoming connection requests and operation requests; or c) both initiating and  
324 listening. Every Client, Printer, Proxy, and System supports at least one Protocol  
325 Endpoint.

326 *Proxy*: A Client that sends configuration and status information to and retrieves and  
327 manages Jobs and Documents from an Infrastructure Printer [PWG5100.18] on behalf of

328 one or more Output Devices and also communicates internally with an Infrastructure  
329 System to register the local System and get back Infrastructure Printer URIs.

330 *System*: Listener for incoming IPP session requests and receiver of incoming IPP  
331 operation requests (Hypertext Transfer Protocol -- HTTP/1.1 [RFC7230] Server) that  
332 exposes a System object and implements a System Service.

### 333 **2.3 Printing Terminology**

334 Normative definitions and semantics of printing terms are imported IETF Printer MIB v2  
335 [RFC3805], IETF Finisher MIB [RFC3806], and IETF Internet Printing Protocol/1.1: Model  
336 and Semantics [RFC2911].

337 *Document*: An object created and managed by an Imaging Service that contains the  
338 description, processing, and status information. A Document object may have attached  
339 data and is bound to a single Job object.

340 *FaxOut Job*: An object created and managed by a FaxOut Service that contains  
341 description, processing, and status information. The FaxOut Job also contains zero or  
342 more Document objects.

343 *FaxOut Service*: An Imaging Service that accepts incoming IPP operation requests for  
344 creation of FaxOut Jobs and management of FaxOut Jobs and the service itself.

345 *IPP Binding*: The Internet Printing Protocol implementation of an abstract information  
346 model and associated set of abstract operations and data elements.

347 *Imaging Device*: A physical hardware entity (stand-alone) or logical software entity (hosted  
348 on a network server) that supports one or more Imaging Services (e.g., Print, Scan,  
349 FaxOut, etc.).

350 *Imaging Service*: A software entity that supports document or image processing (e.g.,  
351 Print, Scan, FaxOut, etc.).

352 *Imaging System*: A logical or physical system supports a System object and a System  
353 Service for monitoring and management of one or more Imaging Services (e.g., Print,  
354 Scan, FaxOut, etc.).

355 *ith*: Referring to a specific IPP '1setOf' value - the first value, the second value, and so  
356 forth.

357 *Job*: An object created and managed by an Imaging Service that contains the description,  
358 processing, and status information. A Job object also contains zero or more Document  
359 objects.

- 360 *Logical Device*: a print server, software service, or gateway that processes jobs and either  
361 forwards or stores the processed job or uses one or more Physical Devices to render  
362 output.
- 363 *Output Device*: a single Logical or Physical Device.
- 364 *Physical Device*: a hardware implementation of a endpoint device, e.g., a marking engine,  
365 a fax modem, etc.
- 366 *Print Job*: An object created and managed by a Print Service that contains description,  
367 processing, and status information. The Print Job also contains zero or more Document  
368 objects.
- 369 *Print Service*: An Imaging Service that accepts incoming IPP operation requests for  
370 creation of Print Jobs and management of Print Jobs and the service itself.
- 371 *Printer*: Synonym for Imaging Service – an object that accepts incoming IPP operation  
372 requests for creation of Imaging Jobs and management of Imaging Jobs.
- 373 *Scan Job*: An object created and managed by a Scan Service that contains description,  
374 processing, and status information. The Scan Job also contains zero or more Document  
375 objects.
- 376 *Scan Service*: An Imaging Service that accepts incoming IPP operation requests for  
377 creation of Scan Jobs and management of Scan Jobs and the service itself.
- 378 *Spooling Service*: An Imaging Service that stores all of a Job's document data so that it  
379 can be reprocessed as needed.
- 380 *Streaming Service*: An Imaging Service that stores some of a Job's document data as it is  
381 processed, output, and/or delivered.
- 382 *Subunit*: A hardware component (e.g., input tray or marker) or software component (e.g.,  
383 input channel or interpreter) of an Imaging System.
- 384 *System Service*: A software entity that supports management of all hardware and software  
385 components of an Imaging System and the System object defined in this specification.
- 386 *Transform Job*: An object created and managed by a Transform Service that contains  
387 description, processing, and status information. The Transform Job also contains zero or  
388 more Document objects.
- 389 *Transform Service*: An Imaging Service that accepts incoming IPP operation requests for  
390 creation of Transform Jobs and management of Transform Jobs and the service itself.
- 391

## 392 2.4 Abbreviations

393 *IANA*: Internet Assigned Numbers Authority, <http://www.iana.org/>

394 *IETF*: Internet Engineering Task Force, <http://www.ietf.org/>

395 *ISO*: International Organization for Standardization, <http://www.iso.org/>

396 *PWG*: Printer Working Group, <http://www.pwg.org/>

## 397 3. Requirements for the IPP System Service

### 398 3.1 Rationale for the IPP System Service

399 Existing IPP specifications define the following features and functionality:

- 400 1) IPP Version 2.0, 2.1, and 2.2 [PWG5100.12] defines:
  - 401 (a) Three profiles that cover all previous IETF and PWG IPP specifications;
  - 402 (b) Existing Printer and Job operations and attributes required for each profile;
  - 403 (c) Standard IPP version numbers for each profile (2.0, 2.1, and 2.2); and
  - 404 (d) Specific interoperability requirements, such as HTTP/1.1 support with chunking
  - 405 and IPP collection attribute support;
- 406 2) IPP: Job and Printer Extensions – Set 3 [PWG5100.13] defines operations and
- 407 attributes required for mobile printing and printing with generic drivers;
- 408 3) IPP Everywhere [PWG5100.14] defines an IPP extension to support network
- 409 printing without vendor-specific driver software, including transport protocols,
- 410 various discovery protocols, and standard document formats;
- 411 4) IPP FaxOut Service [PWG5100.15] defines an IPP extension to support the PWG
- 412 Semantic Model FaxOut Service [PWG5108.05] over IPP;
- 413 5) IPP Scan Service [PWG5100.17] defines an IPP extension to support the PWG
- 414 Semantic Model Scan Service [PWG5108.02] over IPP; and
- 415 6) IPP Shared Infrastructure Extensions [PWG5100.18] defines operations and
- 416 attributes required to allow IPP Printers to interface with shared services based in
- 417 the network infrastructure, i.e., software-defined networks, and/or through Cloud-
- 418 based solutions to remotely obtain and process Jobs and Documents, and provide
- 419 state and configuration changes to those services.

420

421 Existing PWG Semantic Model specifications define the following features and

422 functionality:

- 423 1) PWG MFD Model and Common Semantics [PWG5801.01] defines:  
424 (a) A PWG System object as the root of the PWG Semantic Model (including the  
425 associated XML Schema); and  
426 (b) An extension of the original PWG Semantic Model [PWG5105.1] (abstract print  
427 service) to support all of the typical multifunction services (Print, Scan, FaxOut,  
428 etc.);
- 429 2) PWG System object and System Control Service [PWG5108.05] defines the  
430 elements of the PWG System object and system operations of the PWG System  
431 Control Service;
- 432 3) PWG Resource Service [PWG5108.3] defines the elements of the PWG Resource  
433 object and resource operations of the PWG Resource Service; and
- 434 4) PWG Cloud Imaging Requirements and Model [PWG5109.1] defines an abstract  
435 model to support Imaging Services using the Cloud, based on the PWG Semantic  
436 Model. The IPP Binding for this abstract model is described in IPP Shared  
437 Infrastructure Extensions [PWG5100.18].

438

439 Therefore, this IPP System Service specification should define:

- 440 1) An IPP binding of the PWG System object;
- 441 2) An IPP binding of the PWG System Control Service to support management and  
442 monitoring of Imaging Systems and their configured Imaging Services; and
- 443 3) An IPP binding of the PWG Resource object and the PWG Resource Service.

## 444 3.2 Use Cases

### 445 3.2.1 Imaging System Service Enumeration

446 Jane wants to determine what services are available on an Imaging System and their  
447 capabilities. After Jane initiates service enumeration by using the IPP Client on her laptop  
448 to send a query to the Imaging System for the list of available services. After receiving the  
449 response from the Imaging System, the IPP Client sends further queries to each Imaging  
450 Service for its capabilities and configuration. Finally, the IPP Client displays the list of  
451 available Imaging Services and their capabilities.

### 452 3.2.2 Imaging System Monitoring

453 Jane wants to monitor the usage and supply levels of an Imaging System. She uses the  
454 IPP Client on her laptop to periodically query the input trays and the supply levels of  
455 relevant components on the Imaging System and the usage counters for each Imaging  
456 Service supported by the Imaging System.

**457 3.2.3 Imaging System Management**

458 Jane needs to periodically pause and resume all of the services supported by an Imaging  
459 System in order to perform maintenance. She uses the IPP Client on her laptop to send  
460 pause and resume requests to the Imaging System as needed.

**461 3.2.4 Resource Management**

462 Jane wants to install a resource (firmware, font, logo, etc.) on an Imaging System in order  
463 to extend the functionality of the Imaging System. She uses the IPP Client on her laptop to  
464 create and upload the desired resource to the Imaging System.

**465 3.3 Exceptions**

466 There are no exceptions to the use cases defined in section 3.2.

**467 3.4 Out of Scope**

468 The out-of-scope requirements for this IPP System Service specification are:

- 469 1) Configuration of Imaging Services directly through the System Service (e.g.,  
470 defaults or assigned Subunits).
- 471 2) Pause/Resume or Enable/Disable of a sparse list of specific Imaging Services on an  
472 Imaging System (because the resulting operation status would be complicated  
473 and/or ambiguous).
- 474 3) Migration of Imaging Services and/or Jobs to another Imaging System.
- 475 4) Support for any non-IPP Cloud Imaging System.

**476 3.5 Design Requirements**

477 The design requirements for this IPP System Service specification are:

- 478 1) Follow the naming conventions defined in IPP/1.1: Model and Semantics  
479 [RFC2911], including keyword value case (lower) and hyphenation requirements.
  - 480 2) Define objects, attribute groups, attributes, and values to support the System object,  
481 Resource object, and System Service.
  - 482 3) Define operations to support the System Service and the use cases defined in  
483 section 3.2.
- 484



## 485 **4. IPP Object Model**

486 This specification extends the original IPP Model defined in section 2 of IETF IPP/1.1  
487 Model and Semantics [RFC2911] from the original print service scope to include all  
488 Imaging Services on a managed Imaging System.

### 489 **4.1 System Object**

490 This specification defines a root object called a “System” that is an IPP binding of the  
491 System object defined in PWG System object and System Control Service [PWG5108.06].

492 This object contains: (a) description (e.g., name and manufacturer) including summaries  
493 of configured services, subunits, and resources; and (b) overall status (e.g., state and  
494 counters).

### 495 **4.2 Subunit Object**

496 This specification defines a component object called a “Subunit” that is an IPP binding of  
497 the Subunit object defined in PWG MFD Model and Common Semantics [PWG5801.01]  
498 and is based on the Subunit (hardware or software component) defined in IETF Printer  
499 MIB v2 [RFC3805].

500 This object contains: (a) capabilities (e.g., max tray capacity); (b) description (e.g., name);  
501 and (c) component status (e.g., state and counters).

### 502 **4.3 Printer Object**

503 This specification extends the original IPP Printer object defined in IETF IPP/1.1 Model  
504 and Semantics [RFC2911] to represent any Imaging Service (print, scan, etc.), in order to  
505 reuse existing IPP Printer operations and attributes in the individual Imaging Services, but  
506 NOT directly in this specification.

### 507 **4.4 Job Object**

508 This specification extends the original IPP Job object defined in IETF IPP/1.1 Model and  
509 Semantics [RFC2911] to represent a Job on any Imaging Service (Print, Scan, etc.), in  
510 order to reuse existing IPP Job operations and attributes in the individual Imaging  
511 Services, but NOT directly in this specification.

### 512 **4.5 Document Object**

513 This specification extends the original IPP Document object defined in IETF IPP/1.1 Model  
514 and Semantics [RFC2911] to represent a Document contained in a Job on any Imaging

515 Service (Print, Scan, etc.), in order to reuse existing IPP Document operations and  
516 attributes in the individual Imaging Services, but NOT directly in this specification.

#### 517 **4.6 Resource Object**

518 This specification extends the original Resource object defined in PWG Network Resource  
519 Service [PWG5108.03], in order to incorporate Resource operations directly into the IPP  
520 System Service. Resources are managed by the System and each Resource has a  
521 system-wide unique status attribute “resource-id”. Resource persistence is determined  
522 directly by the System: (a) System scope Resources persist for the life of the System; (b)  
523 Printer (service) scope Resources persist for the life of the Printer; (c) Job scope  
524 Resources persist for the life of the Job document data. Activation (for use) of Resources  
525 (e.g., firmware, software, fonts, etc.) is supported via the Install-Resource operation.  
526 Resources do not have leases and expiration times (as they formerly did in  
527 [PWG5108.03]).

#### 528 **4.7 Subscription Object**

529 This specification extends the original IPP Subscription object defined in IPP Event  
530 Notifications and Subscriptions [RFC3995] to allow subscriptions to the IPP System object  
531 for event notifications.

532 **5. IPP System and Resource Objects and Operations**

533 This specification combines and maps the PWG SM System and PWG System Control  
534 Service objects [PWG5801.01] into the IPP System object, which is the target of all IPP  
535 system-level and resource-level operations. This is consistent with Print Service  
536 operations targeted at original IPP Printer object.

537 This specification maps the PWG SM Resource object [PWG5108.03] into the IPP  
538 Resource object and defines a set of resource-level operations.

539 This specification maps a summary of PWG SM SystemConfiguration group into the IPP  
540 “system-configured-subunits” attribute defined in section 5.4 System Status.

541 **5.1 System Attribute Group**

542 This document defines the system-attributes-tag (0x0A) for attribute groups.  
543

544 **5.2 System Description Attributes**

545 The READ-WRITE attributes in the IPP System Description group are listed in Table 1.

546 **Table 1 – IPP System Description Attributes**

Conformance	IPP Attribute Name	SM Element Name	Reference
REQUIRED	charset-configured	CharsetConfigured[1]	[PWG5108.06]
REQUIRED	charset-supported	CharsetSupported[1]	[PWG5108.06]
REQUIRED	ipp-versions-supported	VersionsSupported[1]	[PWG5108.06]
REQUIRED	natural-language-configured	NaturalLanguageConfigured[1]	[PWG5108.06]
REQUIRED	natural-language-supported	NaturalLanguageSupported[1]	[PWG5108.06]
REQUIRED	operations-supported	OperationsSupported[1]	[PWG5108.06]
OPTIONAL	power-calendar	PowerCalendar	[PWG5108.06]
OPTIONAL	power-event	PowerEvent	[PWG5108.06]
RECOMMENDED	power-timeout	PowerTimeout[3]	[PWG5108.06]
REQUIRED	system-default-printer-uri	<none>[5]	<none>
REQUIRED	system-device-id	DeviceId[2]	[PWG5108.06]
REQUIRED	system-geo-location	SystemGeoLocation[2]	[PWG5108.06]
REQUIRED	system-info	SystemInfo[2]	[PWG5108.06]
REQUIRED	system-location	SystemLocation[2]	[PWG5108.06]
REQUIRED	system-make-and-model	MakeAndModel[2]	[PWG5108.06]
OPTIONAL	system-message-from-operator	MessageFromOperator	[PWG5108.06]
REQUIRED	system-name	SystemName[2]	[PWG5108.06]
CONDITIONALLY REQUIRED	system-owner-uri	OwnerUri[4]	[PWG5108.06]
CONDITIONALLY REQUIRED	system-owner-vcard	OwnerVCard[4]	[PWG5108.06]
REQUIRED	system-xri-supported	XriSupported	[PWG5108.06]

547 Notes:

548 1) REQUIRED for a Printer per IETF IPP/1.1 Model and Semantics [RFC2911].

549 2) REQUIRED for a Printer per PWG IPP Everywhere [PWG5100.14].

550 3) REQUIRED or RECOMMENDED for a System per PWG Power Management  
551 Model [PWG5106.4].552 4) CONDITIONALLY REQUIRED for a System that supports the Set-System-  
553 Attributes operation – also “owner-uri” and “owner-vcard” MUST be updated  
554 simultaneously if specified in a Set-System-Attributes operation (to preserve  
555 consistency).556 5) REQUIRED for a System to support the Get-Printer-Attributes operation which uses  
557 the implementation-defined or administratively-configured “default” Printer object as  
558 a target.  
559

560 **5.3 System Status Attributes**

561 The READ-ONLY attributes in the IPP System Status group are listed in Table 2. These  
 562 attributes are inherently READ-ONLY and can only be modified indirectly as a side effect  
 563 of one or more IPP System Service operations, but NOT by a Set-System-Attributes  
 564 operation.

565 **Table 2 – IPP System Status Attributes**

Conformance	IPP Attribute Name	SM Element Name	Reference
OPTIONAL	power-counters	PowerCounters	[PWG5108.06]
RECOMMENDED	power-general	PowerGeneral[3]	[PWG5108.06]
RECOMMENDED	power-log	PowerLog[3]	[PWG5108.06]
OPTIONAL	power-meters	PowerMeters	[PWG5108.06]
RECOMMENDED	power-monitor	PowerMonitor[3]	[PWG5108.06]
OPTIONAL	power-support	PowerSupport	[PWG5108.06]
OPTIONAL	power-transition	PowerTransition	[PWG5108.06]
REQUIRED	system-config-changes	SystemConfigChangeNumber[5]	[PWG5108.06]
REQUIRED	system-configured-printers	ConfiguredServices	[PWG5108.06]
<del>REQUIRED</del>	system-configured-resources	ConfiguredResources	[PWG5108.06]
REQUIRED	system-configured-subunits	SystemConfiguration[4]	[PWG5108.06]
REQUIRED	system-current-time	CurrentTime[2]	[PWG5108.06]
RECOMMENDED	system-health	SystemHealth	[PWG5108.06]
OPTIONAL	system-serial-number	SerialNumber[5]	[PWG5108.06]
REQUIRED	system-state	State[1]	[PWG5108.06]
REQUIRED	system-state-message	StateMessages[2]	[PWG5108.06]
REQUIRED	system-state-reasons	StateReasons[2]	[PWG5108.06]
RECOMMENDED	system-totals	SystemTotals[6]	[PWG5108.06]
REQUIRED	system-up-time	UpTime[2]	[PWG5108.06]
REQUIRED	system-uuid	<del>Service</del> Juid[2] [7]	[PWG5108.01]

Deleted: RECOMMENDED

Deleted: 01

Deleted: S

Deleted: system

Deleted: 06

566 Notes:

- 567 1) REQUIRED for a Printer per IETF IPP/1.1 Model and Semantics [RFC2911].
- 568 2) REQUIRED for a Printer per PWG IPP Everywhere [PWG5100.14].
- 569 3) REQUIRED or RECOMMENDED for a System per PWG Power Management  
 570 Model [PWG5106.4].
- 571 4) Summary of SystemConfiguration group (subunits) – similar to ConfiguredServices  
 572 in [PWG5108.06].
- 573 5) REQUIRED for a Printer per IETF Printer MIB v2 [RFC3805].
- 574 6) REQUIRED for a System per PWG Imaging System Counters [PWG5106.1].
- 575 7) The System object “system-uuid” attribute identifies the System Service. The  
 576 Printer object “printer-uuid” identifies a specific Imaging Service (e.g., Print, Scan,  
 577 FaxOut, etc.).

583 **5.4 System Operations**

584 The operations for an IPP System Service conforming to this specification are listed in  
 585 Table 3.

586 **Table 3 – IPP System Service Operations**

Code	IPP Operation Name	SM Operation Name	Reference
0x00nn	Cancel-Resource	DeleteResource	[PWG5108.03]
0x00nn	Cancel-Subscription	<none>	[RFC3995]
0x00nn	Create-Printer	<none>[5]	[ISO10175-3]
0x00nn	Create-Resource	StoreResource[3]	[PWG5108.03]
0x00nn	Create-Resource-Subscriptions	<none>	[RFC3995]
0x00nn	Create-System-Subscriptions	<none>	[RFC3995]
0x00nn	Delete-Printer	DeleteService	[PWG5108.06]
0x00nn	Disable-All-Printers	DisableAllServices[2]	[PWG5108.06]
0x00nn	Enable-All-Printers	EnableAllServices[2]	[PWG5108.06]
0x00nn	Get-Notifications	<none>	[RFC3995]
0x00nn	Get-Printers	ListAllServices	[PWG5108.06]
0x00nn	Get-Printer-Attributes	GetServiceElements[4]	[PWG5108.06]
0x00nn	Get-Resources	ListResources	[PWG5108.03]
0x00nn	Get-Resource-Attributes	GetResourceElements	[PWG5108.03]
0x00nn	Get-Subscriptions	<none>	[RFC3995]
0x00nn	Get-Subscription-Attributes	<none>	[RFC3995]
0x00nn	Get-System-Attributes	GetSystemElements	[PWG5108.06]
0x00nn	Install-Resource	<none>	<none>
0x00nn	Pause-All-Printers	PauseAllServices	[PWG5108.06]
0x00nn	Pause-All-Printers-After-Current-Job	PauseAllServicesAfterCurrentJob[1]	[PWG5108.06]
0x00nn	Register-Output-Device	<none>[6]	[PWG5109.1]
0x00nn	Renew-Subscription	<none>	[RFC3995]
0x00nn	Restart-All-Printers	RestartAllServices	[PWG5108.06]
<none>	Restart-One-Printer	RestartService	[PWG5108.06]
0x00nn	Restart-System	<none>	<none>
0x00nn	Resume-All-Printers	ResumeAllServices	[PWG5108.06]
0x00nn	Send-Resource-Data	StoreResource[3]	[PWG5108.03]
<none>	Set-Resource-Attributes	SetResourceElements	[PWG5108.03]
<none>	Set-System-Attributes	SetSystemElements	[PWG5108.06]
0x00nn	Shutdown-All-Printers	ShutdownAllServices	[PWG5108.06]
<none>	Shutdown-One-Printer	ShutdownService	[PWG5108.06]
0x00nn	Startup-All-Printers	StartupAllServices	[PWG5108.06]
<none>	Startup-One-Printer	StartupService	[PWG5108.06]

587 Notes:

588 1) Pause-All-Printers-After-Current-Job is a useful operation for graceful stopping of all  
 589 Printers (Imaging Services) on an Imaging System, but it can be an arbitrarily long  
 590 duration operation.

- 591 2) [Enable/Disable]-Printer and [Pause/Resume]-Printer are intentionally left out of this  
592 specification – they should be directed to the specific Imaging Service that is  
593 enumerated in the “configured-printers” attribute defined in section 5.x above.
- 594 3) Create-Resource and Send-Resource-Data are intentionally decomposed from the  
595 original ambiguously scoped StoreResource operation specified in PWG Resource  
596 Service [PWG5108.03]. Create-Resource is semantically equivalent to Create (for  
597 a Resource object) defined in ISO Document Printing Application (DPA) Part 3:  
598 Management Abstract Service Definition and Procedures [ISO10175-3] where a  
599 newly created Resource object has the special initial state of ‘unknown’ (which is  
600 NOT defined or used in this specification).
- 601 4) Install-Resource is to activate (for use) firmware, software, fonts, etc. after Create-  
602 Resource and Send-Resource-Data.
- 603 5) Create-Printer is semantically equivalent to Create (for a Printer object) defined in  
604 ISO Document Printing Application (DPA) Part 3: Management Abstract Service  
605 Definition and Procedures [ISO10175-3] where a newly created Printer object has  
606 the special initial state of ‘unknown’ (which is NOT defined or used in this  
607 specification).
- 608 6) Register-Output-Device is semantically equivalent to Register-System defined in  
609 PWG Cloud Imaging Model [PWG5109.1] with the difference that the System itself  
610 is not registered, but rather the associated Output Devices are registered.

## 611 **5.5 Resource Attribute Group**

612 This document defines the resource-attributes-tag (0x08) for attribute groups.  
613

614 **5.6 Resource Description Attributes**

615 The READ-WRITE attributes in the IPP Resource Description group are listed in Table 4.

616 **Table 4 – IPP Resource Description Attributes**

<b>Conformance</b>	<b>IPP Attribute Name</b>	<b>SM Element Name</b>	<b>Reference</b>
REQUIRED	resource-info	ResourceInfo	[PWG5108.03]
REQUIRED	resource-name	ResourceName	[PWG5108.03]
REQUIRED	resource-string-version	FirmwareStringVersion[1]	[PWG5110.1]
REQUIRED	resource-version	FirmwareVersion[1]	[PWG5110.1]

617 Notes:

618 1) REQUIRED for a Resource by analogy to PWG Hardcopy Device Health  
619 Assessment Attributes [PWG5110.1].

620



621 **5.7 Resource Status Attributes**

622 The READ-ONLY attributes in the IPP Resource Status group are listed in Table 5. These  
 623 attributes are inherently READ-ONLY and can only be modified indirectly as a side effect  
 624 of one or more IPP System Service operations, but NOT by a Set-Resource-Attributes  
 625 operation.

626 **Table 5 – IPP Resource Status Attributes**

Conformance	IPP Attribute Name	SM Element Name	Reference
REQUIRED	date-time-at-canceled	DateTimeOfExpiration[1]	[PWG5108.03]
REQUIRED	date-time-at-creation	DateTimeAtCreation[1]	[PWG5108.03]
REQUIRED	resource-authenticator	<none>[7]	<none>
REQUIRED	resource-category	ResourceCategory	[PWG5108.03]
REQUIRED	resource-data-uri	<none>	<none>
REQUIRED	resource-format	ResourceFormat	[PWG5108.03]
REQUIRED	resource-id	ResourceId[4]	[PWG5108.03]
REQUIRED	resource-job-id	<none>[2][5]	[RFC2911]
REQUIRED	resource-k-octets	<none>[2][8]	[RFC2911]
REQUIRED	resource-originating-user-name	<none>[2]	[RFC2911]
REQUIRED	resource-originating-user-uri	<none>[3]	[PWG5100.13]
REQUIRED	resource-printer-uri	<none>[2][6]	[RFC2911]
REQUIRED	resource-state	<none>[2]	[RFC2911]
REQUIRED	resource-state-reasons	<none>[2]	[RFC2911]
REQUIRED	resource-type	ResourceType	[PWG5108.03]
REQUIRED	resource-uuid	<none>[3]	[PWG5100.13]
REQUIRED	time-at-canceled	<none>[2]	[RFC2911]
REQUIRED	time-at-creation	<none>[2]	[RFC2911]

627 Notes:

- 628 1) REQUIRED for a Resource by analogy to PWG Network Resource Service  
 629 Semantic Model and Service Interface [PWG5108.03].
- 630 2) REQUIRED for a Resource by analogy to a Job in IETF IPP/1.1 Model and  
 631 Semantics [RFC2911].
- 632 3) REQUIRED for a Resource by analogy to a Job in PWG IPP: Job and Printer  
 633 Extensions – Set 3 (JPS3) [PWG5100.13].
- 634 4) REQUIRED for a Resource by analogy to a Job in IETF IPP/1.1 Model and  
 635 Semantics [RFC2911]. See section 7.6 of this specification for details of the  
 636 “resource-id” attribute which MUST be monotonically increasing (as is “job-id”) to  
 637 avoid re-use of a “resource-id” values and resulting ambiguity in log files.
- 638 5) REQUIRED for a Resource that is Job-scoped.
- 639 6) REQUIRED for a Resource that is Printer-scoped.

- 640 7) REQUIRED for a Resource to allow for verification of the validity and source of  
 641 Resource data after a Send-Resource-Data operation. See section 7.6 of this  
 642 specification for details of the “resource-authenticator” attribute.
- 643 8) REQUIRED for a Resource by analogy to a “job-k-octets” in a Job in IETF IPP/1.1  
 644 Model and Semantics [RFC2911].

## 645 5.8 Printer Description Attributes

646 The additional READ-WRITE attributes in the IPP Printer Description group are listed in  
 647 [Table 6](#).

648 **Table 6 – IPP Printer Description Attributes**

Conformance	IPP Attribute Name	SM Element Name	Reference
REQUIRED	printer-owner-uri	OwnerUri	[PWG5108.06]
REQUIRED	printer-owner-vcard	OwnerVCard	[PWG5108.06]

649

## 650 **6. IPP Operations**

### 651 **6.1 Cancel-Resource**

652 [rename of DeleteResource – change resource-state (for history) – also delete any  
653 associated Resource data?]

### 654 **6.2 Create-Printer**

- 655 - Drop printer-state and printer-is-accepting-jobs
- 656 - Initial state is stopped, "down" reason
- 657 - Initial printer-is-accepting-jobs is false.
- 658 - Requires Startup-Printer call to bring the service up, followedby Enable-Printer to set  
659 printer-is-accepting-jobs to true
- 660 - How to provide resources?
- 661 - Create resource in system and reference them (resource-data-uri)
- 662 - PUT them after creating the service
- 663 - How to associate with Subunits?
- 664 - Could use list of Subunit types and IDs
- 665 - Semantic Model does not go into great detail
- 666 - One of the envisioned uses is to create "copies" of a service with restricted capabilities,  
667 e.g. a service for guests that only allowed B&W printing
- 668 - Default (modulo extensions) is to create a Printer that is associated with all of the  
669 subunits applicable to the printer service-type
- 670 - Extensions for Printers:
- 671 - system-uri-supported (1setOf uri) Printer Description attribute pointing to System service
- 672 - Get-Resources, Create-Resource, Send-Resource-Data, Cancel-Resource using printer-  
673 uri
- 674 - Create-Job with resource-attributes-tag group, a la subscriptions

- 675 - Response includes resource IDs
- 676 - Upload resource with Send-Resource-Data operation or reference existing resource-id to
- 677 do a fast copy whose life is limited to the job
- 678 - No Cancel-Resource for jobs - just cancel the job to do it
- 679 - Send-Resource-Data before Send-Document/URI
- 680 - job-resource-ids (1setOf integer(1:MAX)) Job Status attribute that lists the resource IDs
- 681 associated with a Job.
- 682 - Job resources persist with the Job/Document data
- 683 **6.3 Create-Resource**
- 684 [rename of \*part\* of original StoreResource to create resource metadata but NOT resource
- 685 data]
- 686 - Good, add type and category attributes to Resource Description attributes
- 687 - Resources are managed by the System - IDs are unique across all services of a system
- 688 - Persistence is decided by System
- 689 - System-wide resources typically persisted for life of system
- 690 - Printer/service resources persist for life of printer/service
- 691 - Job resource persist for life of job
- 692 - Residence (after restart) depends on use/implementation
- 693 - Job resources retained for as long as document data
- 694 - Installation/use of resources through separate operation ("Install-Resource")
- 695 - Firmware, software, fonts, etc.
- 696 - No expiration/lease like in PWG Network Resource Service
- 697 - Too much like DRM, still manual maintenance
- 698 - Just cancel resource at the right time
- 699 - Avoids resource race conditions

**700 6.4 Create-Resource-Subscriptions****701 6.5 Create-System-Subscriptions****702 6.6 Delete-Printer**

703 [actual delete is intended to completely remove a Printer (service)]

**704 6.7 Disable-All-Printers****705 6.8 Enable-All-Printers****706 6.9 Get-Printers**

707 This REQUIRED operation allows a Client to retrieve a filtered list of the Printer objects  
708 (i.e., Job processing services) on the target System object. A Printer URI will be returned  
709 for each matching Printer object.

**710 6.9.1 Get-Printers Request**

711 The Client submits a Get-Printers operation request to a System object. The following  
712 groups of attributes are part of a Get-Printers request.

713 Group 1: Operation Attributes

714 "attributes-charset" (charset) [RFC2911] and  
715 "attributes-natural-language" (naturalLanguage) [RFC2911]:

716 The Client MUST supply and the System MUST support both of these  
717 attributes.

718 "system-uri" (uri) [PWG5108.06]:

719 The Client MUST supply and the System MUST support the "system-uri"  
720 operation attribute which is the target for the operation.

721 "requesting-user-name" (name(MAX)) [RFC2911] and  
722 "requesting-user-uri" (uri) [PWG5100.13]:

723 The Client SHOULD supply and the System MUST support both of these  
724 attributes.

725 "first-index" (integer(1:MAX)) [PWG5100.13]:

726 The Client MAY supply and the System MUST support this attribute.

- 727 "limit" (integer(1:MAX)) [RFC2911]:  
728 The Client MAY supply and the System MUST support this attribute.
- 729 "printer-geo-location" (uri) [PWG5100.13]:  
730 The Client MAY supply and the System MUST support this attribute.
- 731 "printer-location" (text(127)) [RFC2911]:  
732 The Client MAY supply and the System MUST support this attribute.
- 733 "printer-service-types" (1setOf (type2 keyword)) [PWG5108.06]:  
734 The Client MAY supply and the System MUST support this attribute.
- 735 "requested-attributes" (1setOf type2 keyword) [RFC2911]:  
736 The Client MAY supply and the System MUST support this attribute.
- 737 Note: The Printer attributes listed in the IETF LDAP Schema for Printer  
738 Services [RFC7612] describe the most important characteristics of a Printer.
- 739 "which-printers" (type2 keyword) [RFC2911]:  
740 The Client MAY supply and the System MUST support this attribute.

#### 741 **6.9.2 Get-Printers Response**

- 742 The System MUST return a Get-Printers operation response to the Client up to the number  
743 specified by the "limit" operation attribute that match the filter criteria as specified by the  
744 attribute values supplied by the Client in the request. If no Printers match the specified  
745 filter criteria, then the Printer MUST return a "status-code" of 'successful-ok'.

#### 746 Group 1: Operation Attributes

- 747 "status-code" (type2 enum):  
748 The System MUST return this attribute.
- 749 "status-message" (text(255)) [RFC2911] and/or  
750 "detailed-status-message" (text(MAX)) [RFC2911]:  
751 The System MAY return one or both of these attributes.
- 752 "attributes-charset" (charset) [RFC2911] and  
753 "attributes-natural-language" (naturalLanguage) [RFC2911]:

754                   The System MUST return both of these attributes, unless no Printers match  
755                   the filter criteria specified by the Client.

756 Group 2: Unsupported Attributes

757                   See [RFC2911] for details on returning Unsupported Attributes.

758 Groups 3 to N: Printer Attributes

759                   See [RFC2911] for details on returning Printer Attributes.

760 **6.10 Get-Resources**

761 [rename of ListResources]

762 - modeled on Get-Jobs with “requested-attributes” for which attributes to return – default is  
763 “resource-id” and “resource-state”

764 **6.11 Get-Resource-Attributes**

765 [rename of GetResourceElements]

766 - modeled on Get-Job-Attributes with “requested-attributes” for which attributes to return –  
767 default is “resource-id” and “resource-state”

768 **6.12 Get-Subscriptions**

769 **6.13 Get-Subscription-Attributes**

770 **6.14 Get-System-Attributes**

771 - modeled on 2911 Get-Printer-Attributes with “requested-attributes” for which attributes to  
772 return – default is all

773 **6.15 Install-Resource**

774 [To activate (for use) firmware, software, font, etc. after Create-Resource and Send-  
775 Resource-Data]

776 **6.16 Pause-All-Printers**

777 **6.17 Pause-All-Printers-After-Current-Job**

778 **6.18 Register-Output-Device**

779 [for IPP Infra/Cloud Model]

780 - Drop system attributes in request? Continue discussion later (from PWG F2F 4/29/15)

781 - Put static resource attributes in the printer groups of the response

782 **6.19 Restart-All-Printers**

783 **6.20 Restart-One-Printer**

784 **6.21 Restart-System**

785 [operation to restart an entire System with existing firmware or different firmware (from  
786 Install-Resource after Create-Resource and Send-Resource-Data) – added for normal  
787 System maintenance and also System remediation based on health monitoring]

788 **6.22 Resume-All-Printers**

789 **6.23 Send-Resource-Data**

790 [rename of \*part\* of original StoreResource]

791 - Agreement on not supporting replacement of resource data

792 **6.24 Set-Resource-Attributes**

793 [rename of SetResourceElements for Resource description attributes – MUST NOT  
794 change Resource status attributes or Resource data]



795 **6.25 Set-System-Attributes**

796 **6.26 Shutdown-All-Printers**

797 **6.27 Shutdown-One-Printer**

798 **6.28 Startup-All-Printers**

799 **6.29 Startup-One-Printer**

800

801 **7. IPP Attributes**802 **7.1 System, Printer, and Resource Operation Attributes**803 **7.1.1 printer-geo-location (uri)**

804 This operation attribute specifies a filter for the applicable Printers for the operation as  
 805 used in the Get-Printers operation defined in section 6. This attribute is semantically  
 806 analogous to the “printer-geo-location” attribute as described in [PWG5100.13].

Deleted: s the set of

807 **7.1.2 printer-location (text(127))**

808 This operation attribute specifies a filter for the applicable Printers for the operation as  
 809 used in the Get-Printers operation defined in section 6. This attribute is semantically  
 810 analogous to the “printer-location” attribute as described in [RFC2911].

Deleted: s the set of

811 **7.1.3 printer-service-type (type2 keyword)**

812 This operation attribute specifies the service type for a Printer as used in the Create-  
 813 Printer operation defined in section 6. This attribute is semantically analogous to the  
 814 ServiceType element as described in [PWG5108.06]. See “printer-service-type” in section  
 815 7.5 Printer Status Attributes. The values for this attribute are specified below in “printer-  
 816 service-types”.

Formatted: IEEEStd Paragraph

817 **7.1.4 printer-service-types (1setOf (type2 keyword))**

818 This operation attribute specifies a filter for the applicable Printers for the operation as  
 819 used in the Get-Printers operation defined in section 6. This attribute is semantically  
 820 analogous to the ServiceType element as described in [PWG5108.06]. See “printer-  
 821 service-type” in section 7.5 Printer Status Attributes. The values for this attribute are:

Deleted: s which selects the set of

Deleted: attribute

822 ‘copy’: A Copy service as described in [PWG5108.04].

823 ‘emailin’: An EmailIn service as described in [PWG5108.01].

824 ‘emailout’: An EmailOut service as described in [PWG5108.01].

825 ‘faxin’: A FaxIn service as described in [RFC2707] and [PWG5108.01].

826 ‘faxout’: A FaxOut service as described in [PWG5100.15].

827 ‘print’: A Print service as described in [RFC2911].

828 ‘scan’: A Scan service as described in [PWG5100.17].

829 ‘transform’: A Transform service as described in [PWG5108.01].

834 'vendor': A vendor-specific service.

835 **7.1.5 resource-category (type2 keyword)**

836 This operation attribute specifies a filter for the applicable Resource objects for the  
 837 operation as used in the Get-Resources operation defined in section 6. This attribute is  
 838 semantically equivalent to the ResourceCategory element as described in [PWG5108.03].  
 839 See "resource-category" in section 7.7 Resource Status Attributes.

840 **7.1.6 resource-format (mimeMediaType)**

841 This operation attribute specifies a filter for the applicable Resource objects for the  
 842 operation as used in the Get-Resources operation defined in section 6. This attribute is  
 843 semantically equivalent to the ResourceFormat element as described in [PWG5108.03].  
 844 This attribute is semantically analogous to the "document-format" attribute as described in  
 845 [RFC2911]. See "resource-format" in section 7.7 Resource Status Attributes.

846 **7.1.7 resource-id (integer(1:MAX))**

847 This operation attribute specifies the target Resource object for the operation [as used in](#)  
 848 [the Get-Resource-Attributes operation defined in section 6.](#) This attribute is semantically  
 849 equivalent to the ResourceId element as described in [PWG5108.03]. This attribute is  
 850 semantically analogous to the "job-id" attribute as described in [RFC2911]. See "resource-  
 851 id" in section 7.7 Resource Status Attributes.

852 **7.1.8 resource-job-id (integer(1:MAX))**

853 This operation attribute specifies a filter for the applicable Job scope Resource objects for  
 854 the operation as used in the Get-Resources operation defined in section 6. This attribute  
 855 is semantically analogous to the "job-id" attribute as described in [RFC2911]. See  
 856 "resource-job-id" in section 7.7 Resource Status Attributes.

857 **7.1.9 resource-k-octets (integer(0:MAX))**

858 This operation attribute specifies the size of the data for the target Resource object for the  
 859 operation as used in the [Create-Resource operation](#) defined in section 6. This attribute is  
 860 semantically analogous to the "job-k-octets" attribute as described in [RFC2911]. See  
 861 "resource-format" in section 7.7 Resource Status Attributes.

**Comment [11]:** Is this attribute supplied at Create-Resource time (suggested best practice) or deferred until Send-Resource-Data (not as reasonable, since resource-k-octets would be sent with Create-Resource to warn receiving System of the required storage and allow rejection for resource too large).

862 **7.1.10 resource-printer-uri (uri)**

863 This operation attribute specifies a filter for the applicable Printer scope Resource objects  
 864 for the operation as used in the Get-Resources operation defined in section 6. This  
 865 attribute is semantically analogous to the "job-printer-uri" attribute as described in  
 866 [RFC2911]. See "resource-printer-uri" in section 7.7 Resource Status Attributes.

867 **7.1.11 resource-state (type1 enum)**

868 This operation attribute specifies a filter for the applicable Resource objects for the  
 869 operation as used in the Get-Resources operation defined in section 6. This attribute  
 870 replaces the semantically analogous DateTimeAtExpiration (Resource lease time) and  
 871 ResourceIsExpired elements as described in [PWG5108.03]. This attribute is semantically  
 872 analogous to the “job-state” attribute as described in [RFC2911]. See “resource-state” in  
 873 section 7.7 Resource Status Attributes.

874 **7.1.12 resource-type (type2 keyword)**

875 This operation attribute specifies a filter for the applicable Resource objects for the  
 876 operation as used in the Get-Resources operation defined in section 6. This attribute  
 877 replaces the semantically analogous DateTimeAtExpiration (Resource lease time) element  
 878 as described in [PWG5108.03]. See “resource-type” in section 7.7 Resource Status  
 879 Attributes.

880 **7.1.13 system-uri (uri)**

881 This operation attribute specifies the target System object for the operation as used in the  
 882 Get-Printers operation defined in section 6. This attribute is semantically analogous to the  
 883 “printer-uri” attribute as described in [RFC2911] and is semantically equivalent to the  
 884 “SystemURI” attribute as described in [PWG5108.06].

885 **7.1.14 which-printers (type2 keyword):**

886 This operation attribute specifies a filter for the applicable Printers for the operation as  
 887 used in the Get-Printers operation defined in section 6. This attribute is semantically  
 888 analogous to the “which-jobs” attribute as described in [RFC2911]. The values for this  
 889 attribute are:

890 ‘accepting’: All Printers with “printer-state” of ‘idle’ or ‘processing’ and “printer-is-  
 891 accepting-jobs” of ‘true’.

892 ‘all’: All Printers configured on this System object.

893 ‘idle’: All Printers with “printer-state” of ‘idle’.

894 ‘not-accepting’: All Printers with “printer-is-accepting-jobs” of ‘false’.

895 ‘processing’: All Printers with “printer-state” of ‘processing’.

896 ‘stopped’: All Printers with “printer-state” of ‘stopped’.

Deleted: s

Deleted: the set of

Deleted: and

Deleted: New

900 **7.2 System Description Attributes**901 **7.2.1 charset-configured (charset)**

902 This REQUIRED System attribute identifies the charset that the System object has been  
 903 configured to represent 'text' and 'name' System attributes that are set by the operator,  
 904 system administrator, or manufacturer, e.g., for "system-name" (name) and "system-info"  
 905 (text). Therefore, the value of the System object's "charset-configured" attribute MUST  
 906 also be among the values of the System object's "charset-supported" attribute.

907 This attribute is semantically analogous to the "charset-configured" Printer attribute defined  
 908 in [RFC2911].

909 **7.2.2 charset-supported (1setOf charset)**

910 This REQUIRED System attribute identifies the set of charsets that the System object  
 911 supports in attributes with attribute syntax 'text' and 'name'. At least the value 'utf-8' MUST  
 912 be present, since IPP objects MUST support the UTF-8 [RFC3629] charset. If a System  
 913 object supports a charset, it means that for all attributes of syntax 'text' and 'name' the IPP  
 914 object MUST (1) accept the charset in requests and return the charset in responses as  
 915 needed.

916 If more charsets than UTF-8 are supported, the System object MUST perform charset  
 917 conversion between the charsets as described in [RFC2911].

918 This attribute is semantically analogous to the "charset-supported" Printer attribute defined  
 919 in [RFC2911].

920 **7.2.3 jpp-versions-supported (1setOf type2 keyword)**

921 This REQUIRED attribute identifies the IPP protocol version(s) that this System supports,  
 922 including major and minor versions, i.e., the version numbers for which this System  
 923 implementation meets the conformance requirements. For version number validation, the  
 924 System matches the (two-octet binary) "version-number" parameter supplied by the Client  
 925 in each request [RFC2911] with the keyword values of this attribute.

926 Standard keyword values are defined in the IANA IPP Registry [IANAIPP].

927 This attribute is semantically analogous to the "ipp-versions-supported" Printer attribute  
 928 defined in [RFC2911].

929 **7.2.4 natural-language-configured (naturalLanguage)**

930 This REQUIRED System attribute identifies the natural language that the System object  
 931 has been configured to represent 'text' and 'name' System attributes that are set by the  
 932 operator, system administrator, or manufacturer, e.g., for "system-name" (name) and  
 933 "system-info" (text). When returning these System attributes, the System object MAY

Deleted: ¶  
<#>make-and-model (text(127))¶  
<#>message-from-operator (text(127))¶

939 return them in the configured natural language specified by this attribute, instead of the  
940 natural language requested by the Client in the "attributes-natural-language" operation  
941 attribute. See [RFC2911] for the specification of the OPTIONAL multiple natural language  
942 support. Therefore, the value of the System object's "natural-language-configured"  
943 attribute MUST also be among the values of the System object's "natural-language-  
944 supported" attribute.

945 This attribute is semantically analogous to the "natural-language-configured" Printer  
946 attribute defined in [RFC2911].

947 **7.2.5 natural-language-supported (1setOf naturalLanguage)**

948 This REQUIRED System attribute identifies the natural language(s) that the System object  
949 supports in attributes with attribute syntax 'text' and 'name'. The natural language(s)  
950 supported depends on implementation and/or configuration. Unlike charsets, System  
951 objects MUST accept requests with any natural language or any Natural Language  
952 Override whether the natural language is supported or not.

953 This attribute is semantically analogous to the "generated-natural-language-supported"  
954 Printer attribute defined in [RFC2911].

955 **7.2.6 operations-supported (1setOf type2 enum)**

Deleted: ¶

956 This REQUIRED System attribute specifies the set of supported operations for this System  
957 object.

958 Standard enum and "operation-id" values are defined in the IANA IPP Registry [IANAIPP].

Formatted: IEEEStd Paragraph

959 This attribute is semantically analogous to the "operations-supported" Printer attribute  
960 defined in [RFC2911].

961 **7.2.7 power-calendar (1setOf collection)**

Deleted: ¶  
<#>owner-uri (uri)¶  
<#>owner-vcard (1setOf text(1023))¶

962 This OPTIONAL System attribute specifies the list of configured calendar-based power  
963 state change policies for the System.

964 This attribute is semantically equivalent to the Power Calendar group defined in  
965 [PWG5106.4].

966 **7.2.8 power-event (1setOf collection)**

Deleted: ¶

967 This OPTIONAL System attribute specifies the list of configured event-based power state  
968 change policies for the System.

969 This attribute is semantically equivalent to the Power Event group defined in [PWG5106.4].

Deleted: 1

975 **7.2.9 power-timeout (1 setOf collection)**

976 This RECOMMENDED System attribute specifies the list of configured timeout-based  
977 power state change policies for the System.

978 This attribute is semantically equivalent to the Power Timeout group defined in  
979 [PWG5106.4].

980 **7.2.10 system-default-printer-uri (uri)**

981 This REQUIRED System attribute specifies the default Printer URI configured by the  
982 operator, administrator, or manufacturer and is used by the User operation Get-Printer-  
983 Attributes defined in this specification.

984 **7.2.11 system-device-id (text(1023))**

985 This REQUIRED System attribute specifies the IEEE 1284 Device ID of the overall System  
986 as defined in [IEEE1284] and further refined in [PWG5107.2].

987 This attribute is semantically analogous to the "printer-device-id" Printer attribute defined in  
988 [PWG5107.2].

989 **7.2.12 system-geo-location (uri)**

990 This REQUIRED System attribute specifies location of the associated System using the  
991 World Geodetic System 1984 [WGS84]. The means for expressing the location information  
992 is a "geo:" URI scheme [RFC5870]. When the information is unknown, Systems MUST  
993 return the "system-geo-location" attribute using the unknown out-of-band value. Systems  
994 MUST allow the operator or administrator to set the location manually.

995 This attribute is semantically analogous to the "printer-geo-location" Printer attribute  
996 defined in [PWG5100.13].

997 **7.2.13 system-info (text(127))**

998 This REQUIRED System attribute identifies the descriptive information about this System  
999 object, e.g., "This System can be used for printing color transparencies for HR  
1000 presentations."

1001 This attribute is semantically analogous to the "printer-info" Printer attribute defined in  
1002 [RFC2911].

1003 **7.2.14 system-location (text(127))**

1004 This REQUIRED System attribute identifies the location of the System, e.g., "in Room  
1005 123A, second floor of building XYZ."

1007 This attribute is semantically analogous to the "printer-location" Printer attribute defined in  
1008 [RFC2911].

1009 **7.2.15 system-make-and-model (text(127))**

1010 This REQUIRED System attribute identifies the make and model of the System. The  
1011 manufacturer may initially populate this attribute.

1012 This attribute is semantically analogous to the "printer-make-and-model" Printer attribute  
1013 defined in [RFC2911].

1014 **7.2.16 system-message-from-operator (text(127))**

1015 This OPTIONAL System attribute provides a message from an operator, system  
1016 administrator or "intelligent" process to indicate to the reasons for modification or other  
1017 management action taken on a System.

1018 This attribute is semantically analogous to the "printer-message-from-operator" Printer  
1019 attribute defined in [RFC2911].

1020 **7.2.17 system-name (name(127))**

1021 This REQUIRED System attribute contains the name of the System object. It is a name  
1022 that is more end-user friendly than a URI. An administrator determines a System's name  
1023 and sets this attribute to that name. This name may be the last part of the System's URI or  
1024 it may be unrelated. In non-US-English locales, a name may contain characters that are  
1025 not allowed in a URI.

1026 This attribute is semantically analogous to the "printer-name" Printer attribute defined in  
1027 [RFC2911].

1028 **7.2.18 system-owner-uri (uri)**

1029 This CONDITIONALLY REQUIRED System attribute contains a URI for the Owner of this  
1030 System object, e.g., "mailto:bob@example.com," and is REQUIRED if the System  
1031 supports the Set-System-Attributes operation. If specified in a Set-System-Attributes  
1032 operation, then the "system-owner-vcard" attribute MUST also be specified (to preserve  
1033 consistency).

1034 **7.2.19 system-owner-vcard (1setOf text(1023))**

1035 This CONDITIONALLY REQUIRED System attribute contains a vCard [RFC6350] for the  
1036 Owner of this System object and is REQUIRED if the System supports the Set-System-  
1037 Attributes operation. If specified in a Set-System-Attributes operation, then the "system-  
1038 owner-uri" attribute MUST also be specified (to preserve consistency).



1039 **7.2.20 system-xri-supported (1setOf collection)**

1040 This REQUIRED System attribute specifies a list of supported XRI (URI, authentication,  
1041 and security tuples) for the System.

1042 This attribute is semantically analogous to the "printer-xri-supported" Printer attribute  
1043 defined in [RFC3380].

1044 **7.3 System Status Attributes**1045 **7.3.1 power-counters (1setOf collection)**

1046 This OPTIONAL System attribute specifies the list of power counters (total usage) for the  
 1047 System.

1048 This attribute is semantically equivalent to the Power Counter group defined in  
 1049 [PWG5106.4].

1050 **7.3.2 power-general (collection)**

1051 This RECOMMENDED System attribute specifies the power general scalars (capabilities)  
 1052 for the System.

1053 This attribute is semantically equivalent to the Power General group defined in  
 1054 [PWG5106.4].

1055 **7.3.3 power-log (1setOf collection)**

1056 This RECOMMENDED System attribute specifies the list of power log entries (events) for  
 1057 the System.

1058 This attribute is semantically equivalent to the Power Log group defined in [PWG5106.4].

1059 **7.3.4 power-meters (1setOf collection)**

1060 This OPTIONAL System attribute specifies the list of power meters (current usage) for the  
 1061 System.

1062 This attribute is semantically equivalent to the Power Meter group defined in [PWG5106.4].

1063 **7.3.5 power-monitor (collection)**

1064 This RECOMMENDED System attribute specifies the power monitor scalars (status) for  
 1065 the System.

1066 This attribute is semantically equivalent to the Power Monitor group defined in  
 1067 [PWG5106.4].

1068 **7.3.6 power-support (1setOf collection)**

1069 This OPTIONAL System attribute specifies the list of power support entries (capabilities  
 1070 per power state) for the System.

1071 This attribute is semantically equivalent to the Power Support group defined in  
 1072 [PWG5106.4].

Deleted: New

Deleted: <#>configured-printers (1setOf collection)¶  
<#>configured-resources (1setOf collection)¶  
<#>configured-subunits (1setOf collection)¶  
<#>current-time (dateTime)¶

1079 **7.3.7 power-transition (1setOf collection)**

1080 This OPTIONAL System attribute specifies the list of power transition entries (capabilities  
1081 for state transitions) for the System.

1082 This attribute is semantically equivalent to the Power Transition group defined in  
1083 [PWG5106.4].

1084 **7.3.8 system-config-changes (integer(0:MAX))**

1085 This REQUIRED System attribute specifies the count of configuration changes for the  
1086 System. This attribute is semantically equivalent to the SystemConfigChangeNumber  
1087 element defined in [PWG5108.06]. This attribute is semantically analogous to the  
1088 prtGeneralConfigChanges object defined in [RFC3805].

1089 **7.3.9 system-configured-printers (1setOf collection)**

1090 This REQUIRED System attribute specifies the summary of all configured Printers for the  
1091 System. This attribute is semantically equivalent to the ConfiguredServices element  
1092 defined in [PWG5108.06].

1093 **7.3.10 system-configured-resources (1setOf collection)**

1094 This REQUIRED System attribute specifies the summary of all configured Resources for  
1095 the System. This attribute is semantically equivalent to the ConfiguredResources element  
1096 defined in [PWG5108.06].

1097 **7.3.11 system-configured-subunits (1setOf collection)**

1098 This REQUIRED System attribute specifies the summary of all configured Subunits for the  
1099 System. This attribute is semantically analogous to the SystemConfiguration element  
1100 defined in [PWG5108.06].

1101 **7.3.12 system-current-time (dateTime)**

1102 This REQUIRED System attribute specifies the current date and time for the System. This  
1103 attribute is semantically equivalent to the CurrentTime element defined in [PWG5108.06].

1104 **7.3.13 system-health (1set of collection)**

1105 This RECOMMENDED System attribute specifies the list of health (posture) properties for  
1106 the System. This attribute is semantically analogous to the standard system health  
1107 attributes defined in [HCD-TNC].

1108 **[[[ ISSUE: Reference HCD TNC sections 5.x for serialized canonical health attributes?]]]**

1109 **7.3.14 system-serial-number (text(255))**

1110 This OPTIONAL System attribute specifies the serial number for the System. This  
1111 attribute is semantically equivalent to the SerialNumber element defined in [PWG5108.06].

1112 **7.3.15 system-state (type1 enum)**

1113 This REQUIRED System attribute specifies the current state for the System. This attribute  
1114 is semantically equivalent to the State element defined in [PWG5108.06].

1115 **7.3.16 system-state-message (text(MAX))**

1116 This REQUIRED System attribute specifies the list of state messages for the System. This  
1117 attribute is semantically equivalent to the StateMessages element defined in  
1118 [PWG5108.06].

1119 **7.3.17 system-state-reasons (1setOf type2 keyword)**

1120 This REQUIRED System attribute specifies the list of state reasons for the System. This  
1121 attribute is semantically equivalent to the StateReasons element defined in [PWG5108.06].

1122 **7.3.18 system-totals (1setOf collection)**

1123 This RECOMMENDED System attribute specifies the list of aggregate counters for all  
1124 Printers configured on the System. This attribute is semantically equivalent to the  
1125 SystemTotals element defined in [PWG5108.06].

1126 **7.3.19 system-up-time (integer(1:MAX))**

1127 This REQUIRED System attribute specifies the time in seconds since last boot for the  
1128 System. This attribute is semantically equivalent to the UpTime element defined in  
1129 [PWG5108.06].

1130 **7.3.20 system-uuid (uri(45))**

1131 This REQUIRED System attribute specifies the UUID as a URI [RFC4122] for the System.  
1132 This attribute is semantically equivalent to the ServiceUuid element defined in  
1133 [PWG5108.01].

1134 **7.4 Printer Description Attributes**

1135 **7.5 Printer Status Attributes**

1136 **7.6 Resource Description Attributes**

1137 **7.6.1 resource-info (text(127))**

1138 **7.6.2 resource-name (name(127))**

1139 **7.6.3 resource-string-version (text(127))**

1140 [follow HCD-TNC]

1141 **7.6.4 resource-version (octetString(16))**

1142 [follow HCD-TNC ~~–~~ but no infix periods allowed as separators]

1143

Deleted: <#>New Resource Operation  
Attributes¶  
[TBD]¶  
New

Deleted: 20

Deleted: -

Deleted: allow for

1151 **7.7 Resource Status Attributes**

Deleted: New

1152 **7.7.1 date-time-at-canceled (dateTime)**

1153 **7.7.2 date-time-at-creation (dateTime)**

1154 **7.7.3 resource-authenticator (1setOf collection)**

1155 - hash, signature, etc. of Resource data for verification after a Send-Resource-Data  
1156 operation.

Formatted: No underline, Font color: Auto, Highlight

1157 **[[[ ISSUE: Define this collection to allow broad choices for Resource data verification**  
1158 **methods ]]]**

Formatted: No underline, Font color: Auto, Highlight

1159 **7.7.4 resource-category (type2 keyword)**

- 1160 - Static resources already supported in INFRA
- 1161 - Executable resources: focus on firmware and applications,  
1162 but not code that runs as part of a job (ew!)
- 1163 - Template resources: define what an IPP Job Ticket resource  
1164 looks like, need to have a way to differentiate between Print  
1165 and FaxOut and Scan job tickets
- 1166 - IPP Job Ticket has a few select operation attributes  
1167 (destination-uri, etc.) + Job Template attributes
- 1168 - Looks like a Create-Job request?
- 1169 - No document template attributes - those can be  
1170 inferred from Job Template as needed.

- 1172 **7.7.5 resource-data-uri (uri)**
- 1173 **7.7.6 resource-format (mimeMediaType)**
- 1174 **7.7.7 resource-id (integer(1:MAX))**
- 1175 **7.7.8 resource-job-id (integer(1:MAX))**
- 1176 **7.7.9 resource-k-octets (integer(0:MAX))**
- 1177 **7.7.10 resource-originating-user-name (name(MAX))**
- 1178 **7.7.11 resource-originating-user-uri (uri)**
- 1179 **7.7.12 resource-printer-uri (uri)**
- 1180 **7.7.13 resource-state (type1 enum)**
- 1181 **7.7.14 resource-state-message (text(MAX))**
- 1182 **7.7.15 resource-state-reasons (1setOf type2 keyword)**
- 1183 **7.7.16 resource-type (type2 keyword)**
- 1184 **7.7.17 resource-uuid (uri(45))**
- 1185 **7.7.18 time-at-canceled (integer(MIN:MAX))**
- 1186 **7.7.19 time-at-creation (integer(MIN:MAX))**

1187 **8. Additional Semantics for Existing Operations**

1188 **8.1 Cancel-Subscription, Get-Notifications, and Renew-Subscription:**  
1189 **system-uri (uri) and resource-id (integer(1:MAX))**

Deleted: Create-Subscription,

Deleted: s

1190 **8.2 Get-Printer-Attributes: printer-resource-ids (1setOf integer(1:MAX))**

1191 for compatibility with legacy IPP Clients – choose implementation-dependent “default”  
1192 Printer object. “redirect” operation to that Printer object, and relay response to Client]

1193 **8.3 Create-Job, Get-Job-Attributes: job-resource-ids (1setOf**  
1194 **integer(1:MAX))**

1195

1196 **9. Additional Values for Existing Attributes**

1197 **9.1 notify-events (1setOf type2 keyword)**

1198



## 1201 **10. Conformance Requirements**

1202 Provide numbered lists of conformance requirements for the document.

### 1203 **10.1 Conformance Requirements for Clients**

### 1204 **10.2 Conformance Requirements for Infrastructure Systems**

### 1205 **10.3 Conformance Requirements for Systems**

1206

## 1207 **11. Internationalization Considerations**

1208 For interoperability and basic support for multiple languages, conforming implementations  
1209 MUST support the Universal Character Set (UCS) Transformation Format -- 8 bit (UTF-8)  
1210 [RFC3629] encoding of Unicode [UNICODE] [ISO10646] and the Unicode Format for  
1211 Network Interchange [RFC5198].

1212 Implementations of this specification SHOULD conform to the following standards on  
1213 processing of human-readable Unicode text strings, see:

- 1214 • Unicode Bidirectional Algorithm [UAX9] – left-to-right, right-to-left, and vertical
- 1215 • Unicode Line Breaking Algorithm [UAX14] – character classes and wrapping
- 1216 • Unicode Normalization Forms [UAX15] – especially NFC for [RFC 5198]
- 1217 • Unicode Text Segmentation [UAX29] – grapheme clusters, words, sentences
- 1218 • Unicode Identifier and Pattern Syntax [UAX31] – identifier use and normalization
- 1219 • Unicode Collation Algorithm [UTS10] – sorting
- 1220 • Unicode Locale Data Markup Language [UTS35] – locale databases

1221 Implementations of this specification are advised to also review the following informational  
1222 documents on processing of human-readable Unicode text strings:

- 1223 • Unicode Character Encoding Model [UTR17] – multi-layer character model
- 1224 • Unicode in XML and other Markup Languages [UTR20] – XML usage
- 1225 • Unicode Character Property Model [UTR23] – character properties

- 1226
- Unicode Conformance Model [UTR33] – Unicode conformance basis

1227 **12. Security Considerations**

1228 The IPP extensions defined in this document require the same security considerations as  
1229 defined in the IPP/1.1: Model and Semantics [RFC2911] and PWG System Object and  
1230 System Control Service Semantics [PWG5108.06].

1231 Implementations of this specification SHOULD conform to the following standard on  
1232 processing of human-readable Unicode text strings, see:

- 1233
- Unicode Security Mechanisms [UTS39] – detecting and avoiding security attacks

1234 Implementations of this specification are advised to also review the following informational  
1235 document on processing of human-readable Unicode text strings:

- 1236
- Unicode Security FAQ [UNISECFAQ] – common Unicode security issues

1237

1238 **13. IANA and PWG Considerations**

1239 TBD

1240 **14. References**

1241 **14.1 Normative References**

- 1242 [IANAIPP] IANA IPP Registry,  
1243 [http://www.iana.org/assignments/ipp-registrations/ipp-](http://www.iana.org/assignments/ipp-registrations/ipp-registrations.xhtml)  
1244 [registrations.xhtml](http://www.iana.org/assignments/ipp-registrations/ipp-registrations.xhtml)
- 1245 [IEEE1284] Standard Signaling Method for a Bi-directional Parallel Peripheral  
1246 Interface for Personal Computers, IEEE 1284, January 2000.
- 1247 [ISO10175-1] T. Hastings et al, “ISO Document Printing Application (DPA) Part 1:  
1248 Abstract Service Definition and Procedures”, ISO 10175-1, 1996
- 1249 [ISO10175-3] T. Hastings et al, “ISO Document Printing Application (DPA) Part 3:  
1250 Management Abstract Service Definition and Procedures”, ISO 10175-  
1251 1, 1996
- 1252 [PWG5100.12] R. Bergman, H. Lewis, I. McDonald, M. Sweet, “IPP Version 2.0, 2.1,  
1253 and 2.2”, PWG 5100.12-2015, work-in-progress,  
1254 <http://ftp.pwg.org/pub/pwg/ipp/wd/wd-ipp20-20150812.pdf>

- 1255 [PWG5100.13] M.Sweet, I. McDonald, P. Zehler, “IPP Job and Printer Extensions –  
1256 Set 3”, PWG 5100.13-2012, July 2012,  
1257 [http://ftp.pwg.org/pub/pwg/candidates/cs-ippjobprinterext3v10-  
1258 20120727-5100.13.pdf](http://ftp.pwg.org/pub/pwg/candidates/cs-ippjobprinterext3v10-20120727-5100.13.pdf)
- 1259 [PWG5100.14] M. Sweet, I. McDonald, A. Mitchell, J. Hutchings, “IPP Everywhere”,  
1260 PWG 5100.14-2013, January 2013,  
1261 [http://ftp.pwg.org/pub/pwg/candidates/cs-ippeve10-20130128-  
1262 5100.14.pdf](http://ftp.pwg.org/pub/pwg/candidates/cs-ippeve10-20130128-5100.14.pdf)
- 1263 [PWG5100.15] M. Sweet, “IPP FaxOut Service”, PWG 5100.15-2014, June 2014,  
1264 [http://ftp.pwg.org/pub/pwg/candidates/cs-ippfaxout10-20140618-  
1265 5100.15.pdf](http://ftp.pwg.org/pub/pwg/candidates/cs-ippfaxout10-20140618-5100.15.pdf)
- 1266 [PWG5100.17] P. Zehler, M. Sweet, “IPP Scan Service”, PWG 5100.17-2014,  
1267 October 2014,  
1268 [http://ftp.pwg.org/pub/pwg/candidates/cs-ippscan10-20140918-  
1269 5100.17.pdf](http://ftp.pwg.org/pub/pwg/candidates/cs-ippscan10-20140918-5100.17.pdf)
- 1270 [PWG5100.18] M. Sweet, I. McDonald, “IPP Shared Infrastructure Extensions  
1271 (INFRA)”, PWG 5100.18-2015, June 2015,  
1272 [http://ftp.pwg.org/pub/pwg/candidates/cs-ippinfra10-20150619-  
1273 5100.18.pdf](http://ftp.pwg.org/pub/pwg/candidates/cs-ippinfra10-20150619-5100.18.pdf)
- 1274 [PWG5105.1] P. Zehler, T. Hastings, S. Albright, “Semantic Model v1.0”, PWG  
1275 5105.1-2004, January 2004,  
1276 <http://ftp.pwg.org/pub/pwg/candidates/cs-sm10-20040120-5105.1.pdf>
- 1277 [PWG5106.1] P. Zehler, H. Lewis, I. McDonald, J. Thrasher, W. Wagner,  
1278 “Standardized Imaging Counters 1.1”, PWG 5106.1-2007, April 2007,  
1279 [http://ftp.pwg.org/pub/pwg/candidates/cs-wimscount11-20070427-  
1280 5106.1.pdf](http://ftp.pwg.org/pub/pwg/candidates/cs-wimscount11-20070427-5106.1.pdf)
- 1281 [PWG5106.4] I. McDonald, “Power Management Model for Imaging Systems 1.0”,  
1282 PWG 5106.4-2011, February 2011,  
1283 <http://ftp.pwg.org/pub/pwg/general/pwg-process-30.pdf>
- 1284 [PWG5107.2] I. McDonald, “PWG Command Set Format for IEEE 1284 Device ID  
1285 v1.0”, PWG 5107.2-2010, May 2010,  
1286 [http://ftp.pwg.org/pub/pwg/candidates/cs-pmp1284cmdset10-  
1287 20100531-5107.2.pdf](http://ftp.pwg.org/pub/pwg/candidates/cs-pmp1284cmdset10-20100531-5107.2.pdf)
- 1288 [PWG5108.01] W. Wagner, P. Zehler, “MFD Model and Common Semantics”, PWG  
1289 5801.01-2011, April 2011,  
1290 [http://ftp.pwg.org/pub/pwg/candidates/cs-sm20-mfdmodel10-  
1291 20110415-5801.1.pdf](http://ftp.pwg.org/pub/pwg/candidates/cs-sm20-mfdmodel10-20110415-5801.1.pdf)

- 1292 [PWG5108.02] N. Chen, P. Zehler, "Network Scan Service Semantic Model and  
1293 Service Interface", PWG 5108.02, April 2009,  
1294 [http://ftp.pwg.org/pub/pwg/candidates/cs-sm20-scan10-20090410-  
1295 5108.02.pdf](http://ftp.pwg.org/pub/pwg/candidates/cs-sm20-scan10-20090410-5108.02.pdf)
- 1296 [PWG5108.03] N. Chen, I. McDonald, P. Zehler, "Network Resource Service  
1297 Semantic Model and Service Interface", PWG 5108.03, July 2009,  
1298 [http://ftp.pwg.org/pub/pwg/candidates/cs-sm20-resource10-20090703-  
1299 5108.03.pdf](http://ftp.pwg.org/pub/pwg/candidates/cs-sm20-resource10-20090703-5108.03.pdf)
- 1300 [PWG5108.05] P. Zehler, "FaxOut Service Semantic Model and Service Interface",  
1301 PWG 5108.05-2011, August 2011,  
1302 [http://ftp.pwg.org/pub/pwg/candidates/cs-sm20-faxout10-20110809-  
1303 5108.05.pdf](http://ftp.pwg.org/pub/pwg/candidates/cs-sm20-faxout10-20110809-5108.05.pdf)
- 1304 [PWG5108.06] P. Zehler, "System Object and System Control Service Semantics",  
1305 PWG 5108.06-2012, February 2012,  
1306 [http://ftp.pwg.org/pub/pwg/candidates/cs-sm20-system10-20120217-  
1307 5108.06.pdf](http://ftp.pwg.org/pub/pwg/candidates/cs-sm20-system10-20120217-5108.06.pdf)
- 1308 [PWG5109.1] R. Nevo, W. Wagner, "Cloud Imaging Requirements and Model  
1309 (IMAGINGMODEL)", PWG 5109.1-2015, June 2015,  
1310 [http://ftp.pwg.org/pub/pwg/candidates/cs-cloudimagingmodel10-  
1311 20150619-5109.1.pdf](http://ftp.pwg.org/pub/pwg/candidates/cs-cloudimagingmodel10-20150619-5109.1.pdf)
- 1312 [RFC2119] S. Bradner, "Key words for use in RFCs to Indicate Requirement  
1313 Levels", RFC 2119/BCP 14, March 1997,  
1314 <http://www.ietf.org/rfc/rfc2119.txt>
- 1315 [~~RFC2707~~] ~~R. Bergman, T. Hastings, S. Isaacson, H. Lewis, "Job Monitoring MIB  
1316 - V1.0, RFC 2707, November 1999,  
1317 <http://www.ietf.org/rfc/rfc2707.txt>~~
- 1318 [RFC2911] T. Hastings, R. Herriot, R. deBry, S. Isaacson, P. Powell, "Internet  
1319 Printing Protocol/1.1: Model and Semantics", RFC 2911, September  
1320 2000, <http://www.ietf.org/rfc/rfc2911.txt>
- 1321 [RFC3380] T. Hastings, R. Herriot, C. Kugler, H. Lewis, "Internet Printing Protocol  
1322 (IPP): Job and Printer Set Operations", RFC 3380, September 2002,  
1323 <http://www.ietf.org/rfc/rfc3380.txt>
- 1324 [RFC3382] R. deBry, R. Herriot, T. Hastings, K. Ocke, P. Zehler, "Internet Printing  
1325 Protocol (IPP): The 'collection' Attribute Syntax", RFC 3382,  
1326 September 2002, <http://www.ietf.org/rfc/rfc3382.txt>
- 1327 [RFC3510] R. Herriot, I. McDonald, "Internet Printing Protocol/1.1: IPP URL  
1328 Scheme", RFC 3510, April 2003, <http://www.ietf.org/rfc/rfc3510.txt>

- 1329 [RFC3995] R. Herriot, T. Hastings, “Internet Printing Protocol (IPP): Event  
1330 Notifications and Subscriptions”, RFC 3995, March 2005,  
1331 <http://www.ietf.org/rfc/rfc3995.txt>
- 1332 [RFC3996] R. Herriot, T. Hastings, H. Lewis, “Internet Printing Protocol (IPP): The  
1333 'ippget' Delivery Method for Event Notifications”, RFC 3996, March  
1334 2005, <http://www.ietf.org/rfc/rfc3996.txt>
- 1335 [RFC6350] S. Perreault, “vCard Format Specification”, RFC 6350, August 2011,  
1336 <http://www.ietf.org/rfc/rfc6350.txt>
- 1337 [RFC7472] I. McDonald, M. Sweet, “Internet Printing Protocol (IPP) over HTTPS  
1338 Transport Binding and the 'ipps' URI Scheme”, RFC 7472, March  
1339 2015, <http://www.ietf.org/rfc/rfc7472.txt>
- 1340 [UAX9] Unicode Consortium, “Unicode Bidirectional Algorithm”, UAX#9, June  
1341 2014,  
1342 <http://www.unicode.org/reports/tr9/tr9-31.html>
- 1343 [UAX14] Unicode Consortium, “Unicode Line Breaking Algorithm”, UAX#14,  
1344 June 2014,  
1345 <http://www.unicode.org/reports/tr14/tr14-33.html>
- 1346 [UAX15] Unicode Consortium, “Normalization Forms”, UAX#15, June 2014,  
1347 <http://www.unicode.org/reports/tr15/tr15-41.html>
- 1348 [UAX29] Unicode Consortium, “Unicode Text Segmentation”, UAX#29, June  
1349 2014,  
1350 <http://www.unicode.org/reports/tr29/tr29-25.html>
- 1351 [UAX31] Unicode Consortium, “Unicode Identifier and Pattern Syntax”,  
1352 UAX#31, June 2014,  
1353 <http://www.unicode.org/reports/tr31/tr31-21.html>
- 1354 [UNICODE] Unicode Consortium, “Unicode Standard”, Version 8.0.0, June 2015,  
1355 <http://unicode.org/versions/Unicode8.0.0/>
- 1356 [UTS10] Unicode Consortium, “Unicode Collation Algorithm”, UTS#10, June  
1357 2014,  
1358 <http://www.unicode.org/reports/tr10/tr10-30.html>
- 1359 [UTS35] Unicode Consortium, “Unicode Locale Data Markup Language”,  
1360 UTS#35, September 2014,  
1361 <http://www.unicode.org/reports/tr35/tr35-37/tr35.html>
- 1362 [UTS39] Unicode Consortium, “Unicode Security Mechanisms”, UTS#39,  
1363 September 2014,  
1364 <http://www.unicode.org/reports/tr39/tr39-9.html>

1365

1366 **14.2 Informative References**

- 1367 [RFC5209] P. Sangster, H. Khosravi, M. Mani, K. Narayan, J. Tardo, “Network  
1368 Endpoint Assessment (NEA): Overview and Requirements”, RFC  
1369 5209, June 2008, <http://www.ietf.org/rfc/rfc5209.txt>
- 1370 [UTR17] Unicode Consortium “Unicode Character Encoding Model”, UTR#17,  
1371 November 2008,  
1372 <http://www.unicode.org/reports/tr17/tr17-7.html>
- 1373 [UTR20] Unicode Consortium “Unicode in XML and other Markup Languages”,  
1374 UTR#20, January 2013,  
1375 <http://www.unicode.org/reports/tr20/tr20-9.html>
- 1376 [UTR23] Unicode Consortium “Unicode Character Property Model”, UTR#23,  
1377 November 2008,  
1378 <http://www.unicode.org/reports/tr23/tr23-9.html>
- 1379 [UTR33] Unicode Consortium “Unicode Conformance Model”, UTR#33,  
1380 November 2008,  
1381 <http://www.unicode.org/reports/tr33/tr33-5.html>
- 1382 [UNISECFAQ] Unicode Consortium “Unicode Security FAQ”, November 2013,  
1383 <http://www.unicode.org/faq/security.html>

1384 **15. Authors' Addresses**

1385 Primary authors:

1386 Ira McDonald  
1387 High North  
1388 PO Box 221  
1389 Grand Marais, MI 49839

1391 Michael Sweet  
1392 Apple Inc.  
1393 1 Infinite Loop  
1394 Cupertino, CA 95014

1395 The authors would also like to thank the following individuals for their contributions to this  
1396 standard:

1397 Peter Zehler (Xerox)

**1398 16. Change History****1399 16.1 2 November 2015**

- 1400 - Interim draft – new content after IPP WG review on 5 October 2015
- 1401 - global – kept all redlines from previous version for review at PWG November F2F
- 1402 - revised section 7.1 System, Printer, and Resource Operation Attributes to add Resource
- 1403 operation attributes resource-category, resource-format, resource-id, resource-job-id,
- 1404 resource-k-octets, resource-printer-uri, resource-state, and resource-type
- 1405 - revised section 7.3 System Status Attributes to add power-counters, power-general,
- 1406 power-log, power-meters, power-monitor, power-support, power-transition, system-config-
- 1407 changes, system-configured-printers, system-configured-resources, system-configured-
- 1408 subunits, system-current-time, system-health, system-serial-number, system-state,
- 1409 system-state-messages, system-state-reasons, system-totals, system-up-time, and
- 1410 system-uuid

**1411 16.2 18 October 2015**

- 1412 - Interim draft – changes per IPP WG review on 5 October 2015
- 1413 - global - accepted all changes up to and through section 6.9 (from previous review)
- 1414 - revised section 7.1 title to “System, Printer, and Resource Operation Attributes” to allow
- 1415 for Printer operation attributes in future such as “printer-service-type” for Create-Printer
- 1416 - revised sections 7.1.x to change “filters the set of Printers” to “specifies a filter for the
- 1417 applicable Printers”
- 1418 - added section 7.1.3 printer-service-type for Create-Printer operation
- 1419 - revised section 7.1.4 printer-service-types to change “Service Type attribute” to “Service
- 1420 Type element”, add forward reference to “printer-service-type” in section 7.5 Printer Status
- 1421 Attributes, and add emailin, emailout, and faxin (references to PWG 5108.01 and RFC
- 1422 2707)
- 1423 - revised section 7.1.5 resource-id to add forward reference to “resource-id” in section 7.7
- 1424 Resource Status Attributes
- 1425 - revised section 7.1.11 system-uri to change “attribute the target” to “attribute specifies the
- 1426 target”
- 1427 - revised section 7.1.12 which-printers to change “This attribute and is” to “This attribute is”
- 1428 (drop “and”)
- 1429 - revised section 14 References to accept all changes and add PWG Job Monitoring MIB
- 1430 (RFC 2707)

**1431 16.3 20 September 2015**

- 1432 - Interim draft - changes per PWG F2F review on 31 August 2015
- 1433 - global - accepted all changes up to and through section 6.9 (from previous review)
- 1434 - revised Abstract and section 1 Introduction to add explicit references to Cloud & Infra
- 1435 - deleted section 5.2 System Operation Attributes and section 5.7 Resource Operation
- 1436 Attributes

- 1437 - added section 5.8 Printer Description Attributes and table for “printer-owner-[uri|vcard]”
- 1438 - revised section 6.9.1 Get-Printers Request to make “attributes-charset” and “attributes-
- 1439 natural-language” REQUIRED for Client (per RFC 2911)
- 1440 - revised section 6.9.1 Get-Printers Request to add note to “requested-attributes” about the
- 1441 primary Printer attributes in the IETF LDAP Printer Schema (RFC 7612)
- 1442 - revised section 7.2 System Description Attributes to add new attribute definitions
- 1443 - revised section 14.1 Normative References to add references for new attribute definitions

#### 1444 **16.4 31 August 2015**

- 1445 - Interim draft – changes per PWG F2F review on 10 August 2015
- 1446 - global – deleted redundant “new” and “now” and “below” in several dozen places
- 1447 - revised Table of Contents to delete List of Figures (all now deleted in this version)
- 1448 - revised section 2.2 Protocol Role Terminology to correct “Infrastructure System” from
- 1449 “PWG5109.CLOUD” to “PWG5109.1”, add “Printer”, and correct typos in “Protocol
- 1450 Endpoint”
- 1451 - revised section 2.2 Protocol Role Terminology to add references to IPP INFRA (PWG
- 1452 5100.18) to “Infrastructure Printer”, “Infrastructure System”, and “Proxy”
- 1453 - revised section 2.3 Printing Terminology to add “Printer” (synonym for “Imaging Service”)
- 1454 with RFC 2911 reference
- 1455 - revised section 3.1 Rationale for the IPP System Service to correct title of IPP/2.0
- 1456 - revised section 3.1 Rationale for the IPP System Service to add paragraphs for IPP
- 1457 INFRA [PWG5100.18] and Cloud Imaging Model [PWG5109.1]
- 1458 - revised section 5 IPP System and Resource Objects and Operations for clarity and
- 1459 deleted redundant Figure 1 through Figure 4 (PWG SM abstract objects) and text
- 1460 - revised section 5.1 System Attribute Groups and section 5.6 Resource Attribute Groups
- 1461 titles to be singular (only one of each)
- 1462 - revised section 5.2 System Operation Attributes and section 5.7 Resource Operation
- 1463 Attributes to be just forward references to section 7.1 System and Resource Operation
- 1464 Attributes
- 1465 - revised section 5.3 System Description Attributes Table 1 and section 7.2 System
- 1466 Description Attributes to add “system-default-printer-uri” to support the enhanced “Get-
- 1467 Printer-Attributes” operation
- 1468 - revised and reordered (alphabetized) section 5.3 System Description Attributes Table 1
- 1469 and section 7.2 System Description Attributes to insert “system” prefix on several attributes
- 1470 for consistency with Printer object in RFC 2911
- 1471 - revised and reordered (alphabetized) section 5.4 System Status Attributes Table 2 and
- 1472 section 7.3 System Status Attributes to insert “system” prefix on several attributes and add
- 1473 “system-up-time” for consistency with Printer object in RFC 2911
- 1474 - revised section 5.5 System Operations Table 3 to add missing references and change
- 1475 “Cancel-Subscriptions” and “Renew-Subscriptions” to singular per RFC 3995
- 1476 - revised section 5.5 System Operations Table 3 to update note for Create-Resource and
- 1477 add note for Create-Printer referring to the semantically equivalent Create operation in ISO
- 1478 10175-3
- 1479 - revised section 5.5 System Operations Table 3 to add note that Register-Output-Device
- 1480 is semantically equivalent to Register-System in PWG 5109.1 (with differences explained)



- 1481 - revised section 5.9 Resource Status Attributes Table 5 to add note for “resource-id”  
1482 analogous to “job-id” in RFC 2911.  
1483 - revised section 5.9 Resource Status Attributes Table 5 to add note for “resource-k-octets”  
1484 analogous to “job-k-octets” in RFC 2911.  
1485 - revised section 5.9 Resource Status Attributes Table 5 to add notes for “resource-job-id”  
1486 and “resource-printer-uri” which are required for Job and Printer scoped Resource objects,  
1487 respectively  
1488 - revised section 5.9 Resource Status Attributes Table 5 to add “resource-authenticator” for  
1489 verification of Resource data after a Send-Resource-Data operation  
1490 - deleted redundant sections 6.x Cancel-Subscription, Get-Notifications, Get-Printer-  
1491 Attributes, and Renew-Subscription and moved to sections 8.x for existing operations with  
1492 new semantics  
1493 - revised section 6.x Get-Printers to change “selected” to “matching” and make sure that  
1494 each attribute has a colon (:) at the end and put the reference(s) at the end of each  
1495 attribute name  
1496 - revised section 6.x Get-Printers to use “the Client [MUST|SHOULD|MAY] supply and the  
1497 System MUST support” for clarity – “OPTIONALLY” is NOT a defined conformance  
1498 keyword  
1499 - revised section 6.x Get-Printers and section 7.1.x “printer-geo-location” to remove  
1500 ‘unknown’ value (never appropriate in this specification)  
1501 - revised section 6.x Get-Printers and section 7.1.x “printer-service-types” to change  
1502 singular to plural (i.e., multiple printers can be chosen by the filter)  
1503 - revised sections 6.x Get-Resources and Get-Resource-Attributes to note that they are  
1504 modeled on Get-Jobs and Get-Job-Attributes with default returns of “resource-id” and  
1505 “resource-state”  
1506 - revised section 6.x Get-System-Attributes to note that it is modeled on Get-Printer-  
1507 Attributes with default return of all System attributes  
1508 - revised section 7.1 title to be “System and Resource Operation Attributes” (since some  
1509 apply to operations on both objects)  
1510 - revised section 7.1.x to change “selects” to “filters” and “selected” to “matching” for clarity  
1511 - added sections 7.1.x for “resource-category”, “resource-id”, “resource-job-id”, “resource-  
1512 printer-uri”, “resource-state”, and “resource-type” operation attributes  
1513 - revised section 14.1 Normative References to update IPP/2.0 title and reference (work-in-  
1514 progress) and add IPP INFRA (PWG 5100.18-2015) and Cloud Imaging Model (PWG  
1515 5109.1-2015)  
1516

## 1517 **16.5 10 August 2015**

- 1518 - Interim draft – changes per PWG F2F review on 29 April 2015  
1519 - global – added working notes from PWG F2F at appropriate operations and attributes to  
1520 capture discussion and agreements  
1521 - revised Abstract and section 1 Introduction to say “support registration of an IPP System,  
1522 through its IPP Proxy, with one or more Cloud Imaging Systems”  
1523 - revised section 1.1 Rationale for two IPP Protocol Endpoints to titlecase “Protocol  
1524 Endpoint” in first paragraph

- 1525 - revised section 2.2 Protocol Role Terminology, to add “Endpoint” (whole computing
- 1526 device) from IETF NEA Overview [RFC5209], clarify “Infrastructure System”, and rewrite
- 1527 “Protocol Endpoint” (an application interface) based on standard IETF usage.
- 1528 - revised section 3.4 Out-of-Scope to add support for any non-IPP Cloud Imaging System.
- 1529 - revised section 5.3 System Description Attributes to delete issue about cardinality of
- 1530 “owner-uri” and “owner-vcard” (they are single-valued) and to remove Register-System
- 1531 operation from Table 1 Note 4
- 1532 - revised section 5.5 System Operations Table 3 to replace “Cancel-Xxx-Subscriptions”
- 1533 with “Cancel-Subscriptions” and “Renew-Xxx-Subscriptions” with “Renew-Subscriptions”
- 1534 and reference RFC 3995
- 1535 - revised section 5.5 System Operations Table 3 to delete “Renew-Resource”, add “Get-
- 1536 Subscriptions” and “Get-Subscription-Attributes, and replace “Get-Xxx-Notifications” with
- 1537 “Get-Notifications” and reference RFC 3996
- 1538 - revised section 5.5 System Operations Table 3 to add new “Install-Resource” operation
- 1539 to activate (for use) firmware, software, fonts, etc. after Create-Resource and Send-
- 1540 Resource-Data have completed
- 1541 - added section 5.6 Resource Attribute Groups
- 1542 - added section 5.7 Resource Operation Attributes
- 1543 - added section 5.8 Resource Description Attributes and Table 4
- 1544 - added section 5.9 Resource Status Attributes and Table 5
- 1545 - revised sections 6.x to align with current set of operations
- 1546 - added section 6.x Get-Printers in complete detail for review
- 1547 - added section 7 New IPP Attributes and sections 7.x for all System and Resource
- 1548 operation, description, and status attributes
- 1549 - revised sections 14.x to add or update several references

## 1550 **16.6 28 April 2015**

- 1551 - Interim draft – changes per IPP WG review on 30 March 2015
- 1552 - global – replaced “IPP System Control Service” with “IPP System Service” (but NOT in
- 1553 the abstract PWG equivalent), per IPP WG review
- 1554 - global – replaced titlecase “Object” with lowercase “object” (except in section title or PWG
- 1555 SM spec titles), per IPP WG review
- 1556 - revised Abstract to change “[PWG510x.y]” document references to “(PWG 510x.y)”,
- 1557 consistent with IETF RFC styles and change “Cloud Imaging services” to “Cloud Imaging
- 1558 Systems”, per IPP WG review
- 1559 - revised section 1 Introduction to replace with expanded scope text from Abstract, per IPP
- 1560 WG review
- 1561 - revised section 1.1 Rationale for two IPP Protocol Endpoints to clarify that a conforming
- 1562 IPP System Service supports both a URI for an IPP System object and a \*separate\* URI
- 1563 for the implementation defined “default” IPP Printer returned from Get-Printer-Attributes,
- 1564 per IPP WG review
- 1565 - revised section 2.2 Protocol Role Terminology to add definitions of Infrastructure System
- 1566 and Protocol Endpoint, remove the “IPP” prefix from the definitions of Client, Infrastructure
- 1567 Printer, Proxy, and System terms, and enhance the definition of Proxy, per IPP WG review
- 1568 - revised section 3.1 Rationale for the IPP System Service, to replace period “.” with semi-

- 1569 colon “;” in non-terminal members of both numbered lists, per IPP WG review  
1570 - revised section 5.3 System Description Attributes in Table 1 to change owner-uri from  
1571 RECOMMENDED to CONDITIONALLY REQUIRED and owner-vcard from OPTIONAL to  
1572 CONDITIONALLY REQUIRED for systems that support the Set-System-Attributes and  
1573 Register-System operations and added **issue** about possible multi-valued ordered sets for  
1574 multiple owners (whose semantics are presently undefined in any PWG spec), per IPP WG  
1575 review  
1576 - revised section 5.4 System Status Attributes in Table 2, note (7) to delete sentence about  
1577 already removed device-uuid attribute, per IPP WG review  
1578 - revised section 5.5 System Operations to add Create/Cancel/Renew-Resource-  
1579 Subscriptions, Create/Cancel/Renew-System-Subscriptions, Get-Notifications, Get-Printer-  
1580 Attributes (for implementation-defined “default” Printer), RestartSystem (for restart with  
1581 existing or new firmware Resource for remediation based on health monitoring), and to  
1582 divide original StoreResource into Create-Resource and Send-Resource-Data (to correct  
1583 scope ambiguity of original PWG Resource Service operation), per IPP WG review  
1584 - added (blank placeholder) section 10.2 Conformance Requirements for Infrastructure  
1585 Systems, per IPP WG review  
1586 - revised section 11 Internationalization Considerations to add new Unicode boilerplate  
1587 from JDFMAP, per IPP WG review  
1588 - revised section 12 Security Considerations to add new Unicode boilerplate from  
1589 JDFMAP, per IPP WG review  
1590 - revised section 14.1 Normative References and section 14.2 Informative References to  
1591 add new Unicode boilerplate specs from JDFMAP, per IPP WG review  
1592 - TODO – add various spec references, per IPP WG review

## 1593 **16.7 15 March 2015**

- 1594 - Interim draft – changes per PWG F2F and IPP WG reviews on 4 November 2014, 17  
1595 November 2014, 19 January 2015, and 3 February 2015  
1596 - revised title to “IPP System Service”, per IPP WG review on 4 November 2014  
1597 - revised Abstract to include management and status of Services, Subunits, and  
1598 Resources and Cloud registration extensions, per IPP WG review on 4 November 2014  
1599 - revised section 1.1 Rationale for two IPP Protocol Endpoint to mention of inclusion of  
1600 original Get-Printer-Attributes that automatically selects the implementation-defined or site-  
1601 defined “default” IPP Printer object for the convenience of existing IPP Clients, per IPP WG  
1602 review on 4 November 2014  
1603 - revised section 2.2 Protocol Role Terminology to add definitions of Infrastructure Printer  
1604 and IPP Proxy from IPP Shared Infrastructure Extensions, per IPP WG review on 3  
1605 February 2015  
1606 - revised section 2.3 Printing Terminology to delete Resource Service and revise the  
1607 definitions of Spooling Service and Streaming Service, per IPP WG review on 4 November  
1608 2014  
1609 - revised section 2.3 Printing Terminology to add definitions of Logical Device, Output  
1610 Device, and Physical Device from IPP Shared Infrastructure Extensions, per IPP WG  
1611 review on 3 February 2015  
1612 - renamed section 2.4 from “Acronyms and Organizations” to simply “Abbreviations”, for

- 1613 consistency with RFC 7472, per RFC Editor on 5 March 2015
- 1614 - revised section 3.1 Rationale for the IPP System Service to add the Resource Service
- 1615 functionality (objects, operations, and attributes), per IPP WG review on 4 November 2014
- 1616 - added new use case in section 3.2.4 Resource Management, per IPP WG review on 4
- 1617 November 2014
- 1618 - revised section 3.4 Out-of-Scope, to delete creation/deletion of Imaging Services, per IPP
- 1619 WG review on 3 February 2015
- 1620 - revised section 3.5 Design Requirements, to add Resource object, per IPP WG review on
- 1621 4 November 2014
- 1622 - added section 4.6 Resource Service, to add Resource object, per IPP WG review on 4
- 1623 November 2014
- 1624 - revised section 5.1 Attribute Groups to define the system-attributes-tag and resource-
- 1625 attributes-tag, per IPP WG review on 19 January 2015
- 1626 - revised section 5.2 Operation Attributes to define system-uri and resource-uri, per IPP
- 1627 WG review on 19 January 2015
- 1628 - revised title of section 5.3 to System Description Attributes, per IPP WG review on 19
- 1629 January 2015
- 1630 - revised section 5.3 System Description Attributes in Table 1 to raise owner-uri from
- 1631 OPTIONAL to RECOMMENDED, per IPP WG review on 19 January 2015
- 1632 - revised section 5.3 System Description Attributes to delete redundant original Figure 3
- 1633 and Figure 4, per IPP WG review on 19 January 2015
- 1634 - revised title of section 5.4 to System Status Attributes, per IPP WG review on 19 January
- 1635 2015
- 1636 - revised section 5.4 to System Status Attributes in Table 2 to delete redundant device-
- 1637 uuid, per IPP WG review on 19 January 2015
- 1638 - revised section 5.4 to System Status Attributes to delete redundant original Figure 4,
- 1639 Figure 5, Figure 6, and Figure 7, per IPP WG review on 19 January 2015
- 1640 - revised section 5.5 System Operations to delete issue about Subscription operations, per
- 1641 IPP WG review on 3 February 2015
- 1642 - revised section 5.5 System Operations in Table 3 to add Create/Delete-Printer and
- 1643 Resource operations, per IPP WG review on 3 February 2015

## 1644 **16.8 2 November 2014**

- 1645 - Interim draft – changes per IPP WG review on 29 September 2014
- 1646 - corrected typos and wording
- 1647 - revised cover page and headers to change “IPPSYSTEM” to “SYSTEM”, per IPP WG
- 1648 review
- 1649 - globally changed “Imaging Device” to “Imaging System” where appropriate (most
- 1650 instances), per IPP WG review
- 1651 - globally changed “[RFC2616]” to “[RFC7230]”, per IPP WG review
- 1652 - globally changed “[PWG5100.SCAN]” to “PWG5100.17]” and corrected reference in
- 1653 section 10.1, per PWG approval of IPP Scan Service
- 1654 - added section 1.1 Rationale for two IPP Protocol Endpoints to explain the reason for
- 1655 separate URI for System and Printer objects, per IPP WG review
- 1656 - revised section 2.2 to change title from “Printing Terminology” to “Protocol Roles”, per

- 1657 IPP WG review
- 1658 - revised section 2.2 to delete “IPP Printer” (and thus Logical Device and Physical Device
- 1659 definitions and details) as not applicable to System Control Service and to add “IPP
- 1660 System”, per IPP WG review
- 1661 - revised section 2.3 to change title from “Other Terminology” to “Printing Terminology”, per
- 1662 IPP WG review
- 1663 - moved first sentence of section 2.2 (sources of terms) to section 2.3, per IPP WG review
- 1664 - revised section 2.3 to add new terms, including “Document”, “FaxOut Job/Service”, “ith”,
- 1665 “Job”, “Print Job/Service”, “Scan Job/Service”, “Spooling Service”, “Streaming Service”,
- 1666 “Subunit”, “Transform Job/Service”, per IPP WG review
- 1667 - revised section 2.3 to improve “Imaging System” definition, per IPP WG review
- 1668 - revised section 3.1 Rationale to clarify various paragraphs and add numbered lists, per
- 1669 IPP WG review
- 1670 - revised section 3.2 Use Cases to clarify various paragraphs, per IPP WG review
- 1671 - revised section 3.3 to change “TBD” to “There are no exceptions to the use cases defined
- 1672 in section 3.2”, per IPP WG review
- 1673 - revised section 3.4 Out of Scope to clarify first sentence, per IPP WG review
- 1674 - revised section 3.4 Out of Scope to clarify several statements, per IPP WG review
- 1675 - revised section 3.4 Design Requirements to clarify first sentence, per IPP WG review
- 1676 - added section 4.5 Document Object, per IPP WG review
- 1677 - revised section 5.3 System Description to change “READ-ONLY” to “READ-WRITE”
- 1678 (because Set-System-Attributes was restored in this draft), per IPP WG review and Cloud
- 1679 Imaging WG recommendations
- 1680 - revised section 5.4 System Status to clarify the “READ-ONLY” cannot be modified by a
- 1681 Set-System-Attributes operation, per IPP WG review and Cloud Imaging WG
- 1682 recommendations
- 1683 - revised section 5.4 System Status to clarify the meaning of “system-uuid” (SCS), “printer-
- 1684 uuid” (Imaging Service), and “device-uuid” (physical hardware, i.e., network device), per
- 1685 IPP WG review
- 1686 - revised section 5.4 System Status Table 2 to change “configured-services” to
- 1687 “configured-printers”, per IPP WG review
- 1688 - revised section 5.5 System Operations Table 3 to add back Restart-One-Printer, Startup-
- 1689 One-Printer, Shutdown-One-Printer, and Set-System-Elements, per IPP WG review and
- 1690 Cloud Imaging WG recommendations
- 1691 - revised section 6 New IPP Operations to add back Restart-One-Printer, Startup-One-
- 1692 Printer, Shutdown-One-Printer, and Set-System-Elements, per IPP WG review and Cloud
- 1693 Imaging WG recommendations
- 1694 - revised section 8.1 title to add “Create-Subscription” operation, per IPP WG review
- 1695 - revised section 13 to change title from “IANA Considerations” to “IANA and PWG
- 1696 Considerations”, per IPP WG review
- 1697

1698 **16.9 24 August 2014**

- 1699 - Interim draft
- 1700 - corrected typos and wording

- 1701 - revised section 5.3 and added Table 1 – Attributes in IPP System Description group with
- 1702 notes for rationale of all conformance requirements
- 1703 - revised section 5.4 and added Table 2 – Attributes in IPP System Status group with notes
- 1704 for rationale of all conformance requirements
- 1705 - added section 6 New IPP Operations (empty)
- 1706 - added section 7 New IPP Attributes (empty)

1707 **16.10 11 August 2014**

- 1708 - Initial draft
- 1709 - based on Mike Sweet's presentation at PWG F2F meeting in October 2013
- 1710 - added Abstract and Introduction
- 1711 - added Terminology, including new and refined terms for clarity
- 1712 - added Requirements (rationale, use cases, out-of-scope, design requirements)
- 1713 - added IPP Object Model (extensions to RFC 2911)
- 1714 - added IPP System Object (still a sketch)
- 1715 - combined System object and System Control Service object (separation was artificial)
- 1716 - added References (normative and informative)