



The Printer Working Group

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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-ippssystem10-20151018.pdf>

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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:

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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

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266

## 267 **1. Introduction**

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

### 278 **1.1 Rationale for two IPP Protocol Endpoints**

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

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

## 290 **2. Terminology**

### 291 **2.1 Conformance Terminology**

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

### 297 **2.2 Protocol Role Terminology**

298 This document defines the following protocol roles in order to specify unambiguous  
299 conformance requirements:

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

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

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

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

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

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

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

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

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

## 329 **2.3 Printing Terminology**

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

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

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

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

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

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

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

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

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

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

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

## 388 2.4 Abbreviations

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

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

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

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

## 393 3. Requirements for the IPP System Service

### 394 3.1 Rationale for the IPP System Service

395 Existing IPP specifications define the following features and functionality:

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

416

417 Existing PWG Semantic Model specifications define the following features and

418 functionality:

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

434

435 Therefore, this IPP System Service specification should define:

- 436 1) An IPP binding of the PWG System object;
- 437 2) An IPP binding of the PWG System Control Service to support management and  
438 monitoring of Imaging Systems and their configured Imaging Services; and
- 439 3) An IPP binding of the PWG Resource object and the PWG Resource Service.

## 440 3.2 Use Cases

### 441 3.2.1 Imaging System Service Enumeration

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

### 448 3.2.2 Imaging System Monitoring

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

**453 3.2.3 Imaging System Management**

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

**457 3.2.4 Resource Management**

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

**461 3.3 Exceptions**

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

**463 3.4 Out of Scope**

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

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

**472 3.5 Design Requirements**

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

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

480



## 481 **4. IPP Object Model**

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

### 485 **4.1 System Object**

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

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

### 491 **4.2 Subunit Object**

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

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

### 498 **4.3 Printer Object**

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

### 503 **4.4 Job Object**

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

### 508 **4.5 Document Object**

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

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

#### 513 **4.6 Resource Object**

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

#### 524 **4.7 Subscription Object**

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

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

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

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

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

537 **5.1 System Attribute Group**

538 This document defines the system-attributes-tag (0x0A) for attribute groups.  
539

540 **5.2 System Description Attributes**

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

542 **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]

543 Notes:

- 544 1) REQUIRED for a Printer per IETF IPP/1.1 Model and Semantics [RFC2911].
- 545 2) REQUIRED for a Printer per PWG IPP Everywhere [PWG5100.14].
- 546 3) REQUIRED or RECOMMENDED for a System per PWG Power Management  
547 Model [PWG5106.4].
- 548 4) CONDITIONALLY REQUIRED for a System that supports the Set-System-  
549 Attributes operation – also “owner-uri” and “owner-vcard” MUST be updated  
550 simultaneously if specified in a Set-System-Attributes operation (to preserve  
551 consistency).
- 552 5) REQUIRED for a System to support the Get-Printer-Attributes operation which uses  
553 the implementation-defined or administratively-configured “default” Printer object as  
554 a target.  
555

556 **5.3 System Status Attributes**

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

561 **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]
RECOMMENDED	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]	[PWG5108.01]
REQUIRED	system-uuid	SystemUuid[2] [7]	[PWG5108.06]

562 Notes:

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

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

565 3) REQUIRED or RECOMMENDED for a System per PWG Power Management  
566 Model [PWG5106.4].567 4) Summary of SystemConfiguration group (subunits) – similar to ConfiguredServices  
568 in [PWG5108.06].

569 5) REQUIRED for a Printer per IETF Printer MIB v2 [RFC3805].

570 6) REQUIRED for a System per PWG Imaging System Counters [PWG5106.1].

571 7) The System object “system-uuid” attribute identifies the System Service. The  
572 Printer object “printer-uuid” identifies a specific Imaging Service (e.g., Print, Scan,  
573 FaxOut, etc.).

574 **5.4 System Operations**

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

577 **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]

578 Notes:

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

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

## 602 5.5 Resource Attribute Group

603 This document defines the resource-attributes-tag (0x08) for attribute groups.  
604

605 **5.6 Resource Description Attributes**

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

607 **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]

608 Notes:

609 1) REQUIRED for a Resource by analogy to PWG Hardcopy Device Health  
610 Assessment Attributes [PWG5110.1].  
611



612 **5.7 Resource Status Attributes**

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

617 **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]

618 Notes:

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

631 7) REQUIRED for a Resource to allow for verification of the validity and source of  
 632 Resource data after a Send-Resource-Data operation. See section 7.6 of this  
 633 specification for details of the “resource-authenticator” attribute.

634 8) REQUIRED for a Resource by analogy to a “job-k-octets” in a Job in IETF IPP/1.1  
 635 Model and Semantics [RFC2911].

## 636 5.8 Printer Description Attributes

637 The additional READ-WRITE attributes in the IPP Printer Description group are listed in  
 638 Table 6.

639 **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]

640

## 641 **6. IPP Operations**

### 642 **6.1 Cancel-Resource**

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

### 645 **6.2 Create-Printer**

646 - Drop printer-state and printer-is-accepting-jobs

647 - Initial state is stopped, "down" reason

648 - Initial printer-is-accepting-jobs is false.

649 - Requires Startup-Printer call to bring the service up, followedby Enable-Printer to set  
650 printer-is-accepting-jobs to true

651 - How to provide resources?

652 - Create resource in system and reference them (resource-data-uri)

653 - PUT them after creating the service

654 - How to associate with Subunits?

655 - Could use list of Subunit types and IDs

656 - Semantic Model does not go into great detail

657 - One of the envisioned uses is to create "copies" of a service with restricted capabilities,  
658 e.g. a service for guests that only allowed B&W printing

659 - Default (modulo extensions) is to create a Printer that is associated with all of the  
660 subunits applicable to the printer service-type

661 - Extensions for Printers:

662 - system-uri-supported (1setOf uri) Printer Description attribute pointing to System service

663 - Get-Resources, Create-Resource, Send-Resource-Data, Cancel-Resource using printer-  
664 uri

665 - Create-Job with resource-attributes-tag group, a la subscriptions

- 666 - Response includes resource IDs
- 667 - Upload resource with Send-Resource-Data operation or reference existing resource-id to
- 668 do a fast copy whose life is limited to the job
- 669 - No Cancel-Resource for jobs - just cancel the job to do it
- 670 - Send-Resource-Data before Send-Document/URI
- 671 - job-resource-ids (1setOf integer(1:MAX)) Job Status attribute that lists the resource IDs
- 672 associated with a Job.
- 673 - Job resources persist with the Job/Document data
- 674 **6.3 Create-Resource**
- 675 [rename of \*part\* of original StoreResource to create resource metadata but NOT resource
- 676 data]
- 677 - Good, add type and category attributes to Resource Description attributes
- 678 - Resources are managed by the System - IDs are unique across all services of a system
- 679 - Persistence is decided by System
- 680 - System-wide resources typically persisted for life of system
- 681 - Printer/service resources persist for life of printer/service
- 682 - Job resource persist for life of job
- 683 - Residence (after restart) depends on use/implementation
- 684 - Job resources retained for as long as document data
- 685 - Installation/use of resources through separate operation ("Install-Resource")
- 686 - Firmware, software, fonts, etc.
- 687 - No expiration/lease like in PWG Network Resource Service
- 688 - Too much like DRM, still manual maintenance
- 689 - Just cancel resource at the right time
- 690 - Avoids resource race conditions

**691 6.4 Create-Resource-Subscriptions****692 6.5 Create-System-Subscriptions****693 6.6 Delete-Printer**

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

**695 6.7 Disable-All-Printers****696 6.8 Enable-All-Printers****697 6.9 Get-Printers**

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

**701 6.9.1 Get-Printers Request**

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

704 Group 1: Operation Attributes

705 "attributes-charset" (charset) [RFC2911] and  
706 "attributes-natural-language" (naturalLanguage) [RFC2911]:

707 The Client MUST supply and the System MUST support both of these  
708 attributes.

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

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

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

714 The Client SHOULD supply and the System MUST support both of these  
715 attributes.

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

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

- 718 "limit" (integer(1:MAX)) [RFC2911]:  
719 The Client MAY supply and the System MUST support this attribute.
- 720 "printer-geo-location" (uri) [PWG5100.13]:  
721 The Client MAY supply and the System MUST support this attribute.
- 722 "printer-location" (text(127)) [RFC2911]:  
723 The Client MAY supply and the System MUST support this attribute.
- 724 "printer-service-types" (1setOf (type2 keyword)) [PWG5108.06]:  
725 The Client MAY supply and the System MUST support this attribute.
- 726 "requested-attributes" (1setOf type2 keyword) [RFC2911]:  
727 The Client MAY supply and the System MUST support this attribute.
- 728 Note: The Printer attributes listed in the IETF LDAP Schema for Printer  
729 Services [RFC7612] describe the most important characteristics of a Printer.
- 730 "which-printers" (type2 keyword) [RFC2911]:  
731 The Client MAY supply and the System MUST support this attribute.

### 732 6.9.2 Get-Printers Response

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

#### 737 Group 1: Operation Attributes

- 738 "status-code" (type2 enum):  
739 The System MUST return this attribute.
- 740 "status-message" (text(255)) [RFC2911] and/or  
741 "detailed-status-message" (text(MAX)) [RFC2911]:  
742 The System MAY return one or both of these attributes.
- 743 "attributes-charset" (charset) [RFC2911] and  
744 "attributes-natural-language" (naturalLanguage) [RFC2911]:

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

747 Group 2: Unsupported Attributes

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

749 Groups 3 to N: Printer Attributes

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

751 **6.10 Get-Resources**

752 [rename of ListResources]

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

755 **6.11 Get-Resource-Attributes**

756 [rename of GetResourceElements]

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

759 **6.12 Get-Subscriptions**

760 **6.13 Get-Subscription-Attributes**

761 **6.14 Get-System-Attributes**

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

764 **6.15 Install-Resource**

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

767 **6.16 Pause-All-Printers**

768 **6.17 Pause-All-Printers-After-Current-Job**

769 **6.18 Register-Output-Device**

770 [for IPP Infra/Cloud Model]

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

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

773 **6.19 Restart-All-Printers**

774 **6.20 Restart-One-Printer**

775 **6.21 Restart-System**

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

779 **6.22 Resume-All-Printers**

780 **6.23 Send-Resource-Data**

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

782 - Agreement on not supporting replacement of resource data

783 **6.24 Set-Resource-Attributes**

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



786 **6.25 Set-System-Attributes**

787 **6.26 Shutdown-All-Printers**

788 **6.27 Shutdown-One-Printer**

789 **6.28 Startup-All-Printers**

790 **6.29 Startup-One-Printer**

791

792 **7. IPP Attributes**793 **7.1 System, Printer, and Resource Operation Attributes**794 **7.1.1 printer-geo-location (uri)**

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

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798 **7.1.2 printer-location (text(127))**

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

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802 **7.1.3 printer-service-type (type2 keyword)**

803 | This operation attribute specifies the service type for a Printer as used in the Create-  
 804 | Printer operation defined in section 6. This attribute is semantically analogous to the  
 805 | ServiceType element as described in [PWG5108.06]. See “printer-service-type” in section  
 806 | 7.5 Printer Status Attributes. The values for this attribute are specified below in “printer-  
 807 | service-types”.

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808 **7.1.4 printer-service-types (1setOf (type2 keyword))**

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

Deleted: s which selects the set of

Deleted: attribute

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

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

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

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

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

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

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

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

825 'vendor': A vendor-specific service.

#### 826 7.1.5 resource-id (integer(1:MAX))

827 This operation attribute specifies the target Resource object for the operation. This  
 828 attribute is semantically analogous to the "job-id" attribute as described in [RFC2911]. See  
 829 "resource-id" in section 7.7 Resource Status Attributes.

#### 830 7.1.6 resource-category (type2 keyword)

#### 831 7.1.7 resource-job-id (integer(1:MAX))

#### 832 7.1.8 resource-printer-uri (uri)

#### 833 7.1.9 resource-state (type1 enum)

#### 834 7.1.10 resource-type (type2 keyword)

#### 835 7.1.11 system-uri (uri)

836 This operation attribute specifies the target System object for the operation as used in the  
 837 Get-Printers operation defined in section 6. This attribute is semantically analogous to the  
 838 "printer-uri" attribute as described in [RFC2911] and is semantically equivalent to the  
 839 "SystemURI" attribute as described in [PWG5108.06].

#### 840 7.1.12 which-printers (type2 keyword):

841 This operation attribute specifies a filter, for the applicable, Printers for the operation as  
 842 used in the Get-Printers operation defined in section 6. This attribute is semantically  
 843 analogous to the "which-jobs" attribute as described in [RFC2911]. The values for this  
 844 attribute are:

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845 'accepting': All Printers with "printer-state" of 'idle' or 'processing' and "printer-is-  
 846 accepting-jobs" of 'true'.

847 'all': All Printers configured on this System object.

848 'idle': All Printers with "printer-state" of 'idle'.

849 'not-accepting': All Printers with "printer-is-accepting-jobs" of 'false'.

850 'processing': All Printers with "printer-state" of 'processing'.

851 'stopped': All Printers with "printer-state" of 'stopped'.

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855 **7.2 System Description Attributes**856 **7.2.1 charset-configured (charset)**

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

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

864 **7.2.2 charset-supported (1setOf charset)**

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

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

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

875 **7.2.3 jpp-versions-supported (1setOf type2 keyword)**

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

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

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

884 **7.2.4 natural-language-configured (naturalLanguage)**

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

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

894 return them in the configured natural language specified by this attribute, instead of the  
895 natural language requested by the Client in the "attributes-natural-language" operation  
896 attribute. See [RFC2911] for the specification of the OPTIONAL multiple natural language  
897 support. Therefore, the value of the System object's "natural-language-configured"  
898 attribute MUST also be among the values of the System object's "natural-language-  
899 supported" attribute.

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

902 **7.2.5 natural-language-supported (1setOf naturalLanguage)**

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

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

910 **7.2.6 operations-supported (1setOf type2 enum)**

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911 This REQUIRED System attribute specifies the set of supported operations for this System  
912 object.

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

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

916 **7.2.7 power-calendar (1setOf collection)**

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

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

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

921 **7.2.8 power-event (1setOf collection)**

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

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

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930 **7.2.9 power-timeout (1 setOf collection)**

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

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

935 **7.2.10 system-default-printer-uri (uri)**

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

939 **7.2.11 system-device-id (text(1023))**

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

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

944 **7.2.12 system-geo-location (uri)**

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

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

952 **7.2.13 system-info (text(127))**

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

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

958 **7.2.14 system-location (text(127))**

959 This REQUIRED System attribute identifies the location of the System, e.g., "in Room  
960 123A, second floor of building XYZ."

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

#### 964 **7.2.15 system-make-and-model (text(127))**

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

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

#### 969 **7.2.16 system-message-from-operator (text(127))**

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

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

#### 975 **7.2.17 system-name (name(127))**

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

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

#### 983 **7.2.18 system-owner-uri (uri)**

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

#### 989 **7.2.19 system-owner-vcard (1setOf text(1023))**

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

994 **7.2.20 system-xri-supported (1setOf collection)**

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

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

999

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- 1001 **7.3 System Status Attributes**
- 1002 **7.3.1 power-counters (1setOf collection)**
- 1003 **7.3.2 power-general (collection)**
- 1004 **7.3.3 power-log (1setOf collection)**
- 1005 **7.3.4 power-meters (1setOf collection)**
- 1006 **7.3.5 power-support (1setOf collection)**
- 1007 **7.3.6 power-transition (1setOf collection)**
- 1008 **7.3.7 serial-number (text(255))**
- 1009 **7.3.8 system-config-changes (integer(0:MAX))**
- 1010 **7.3.9 system-configured-printers (1setOf collection)**
- 1011 **7.3.10 system-configured-resources (1setOf collection)**
- 1012 **7.3.11 system-configured-subunits (1setOf collection)**
- 1013 **7.3.12 system-current-time (dateTime)**
- 1014 **7.3.13 system-health (1set of collection)**
- 1015 **7.3.14 system-state (type1 enum)**
- 1016 **7.3.15 system-state-message (text(MAX))**
- 1017 **7.3.16 system-state-reasons (1setOf type2 keyword)**
- 1018 **7.3.17 system-up-time (integer(1:MAX))**
- 1019 **7.3.18 system-uuid (uri(45))**
- 1020 **7.4 Printer Description Attributes**
- 1021 **7.5 Printer Status Attributes**
- 1022 **7.6 Resource Description Attributes**
- 1023 **7.6.1 resource-info (text(127))**
- 1024 **7.6.2 resource-name (name(127))**

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

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

1036 **7.6.3 resource-string-version (text(127))**

1037 [follow HCD-TNC]

1038 **7.6.4 resource-version (octetString(16))**

1039 [follow HCD-TNC, ~~–~~ but no infix periods allowed as separators]

1040

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1044 **7.7 Resource Status Attributes**

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1045 **7.7.1 date-time-at-canceled (dateTime)**

1046 **7.7.2 date-time-at-creation (dateTime)**

1047 **7.7.3 resource-authenticator (1setOf collection)**

1048 - hash, signature, etc. of Resource data for verification after a Send-Resource-Data  
1049 operation.

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1050 **[[[ ISSUE: Define this collection to allow broad choices for Resource data verification**  
1051 **methods ]]]**

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1052 **7.7.4 resource-category (type2 keyword)**

- 1053 - Static resources already supported in INFRA
- 1054 - Executable resources: focus on firmware and applications,  
1055 but not code that runs as part of a job (ew!)
- 1056 - Template resources: define what an IPP Job Ticket resource  
1057 looks like, need to have a way to differentiate between Print  
1058 and FaxOut and Scan job tickets
- 1059 - IPP Job Ticket has a few select operation attributes  
1060 (destination-uri, etc.) + Job Template attributes
- 1061 - Looks like a Create-Job request?
- 1062 - No document template attributes - those can be  
1063 inferred from Job Template as needed.

- 1065 **7.7.5 resource-data-uri (uri)**
- 1066 **7.7.6 resource-format (mimeMediaType)**
- 1067 **7.7.7 resource-id (integer(1:MAX))**
- 1068 **7.7.8 resource-job-id (integer(1:MAX))**
- 1069 **7.7.9 resource-k-octets (integer(0:MAX))**
- 1070 **7.7.10 resource-originating-user-name (name(MAX))**
- 1071 **7.7.11 resource-originating-user-uri (uri)**
- 1072 **7.7.12 resource-printer-uri (uri)**
- 1073 **7.7.13 resource-state (type1 enum)**
- 1074 **7.7.14 resource-state-message (text(MAX))**
- 1075 **7.7.15 resource-state-reasons (1setOf type2 keyword)**
- 1076 **7.7.16 resource-type (type2 keyword)**
- 1077 **7.7.17 resource-uuid (uri(45))**
- 1078 **7.7.18 time-at-canceled (integer(MIN:MAX))**
- 1079 **7.7.19 time-at-creation (integer(MIN:MAX))**

1080 **8. Additional Semantics for Existing Operations**

1081 **8.1 Cancel-Subscription, Get-Notifications, and Renew-Subscription;**  
1082 **system-uri (uri) and resource-id (integer(1:MAX))**

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Deleted: s

1083 **8.2 Get-Printer-Attributes: printer-resource-ids (1 setOf integer(1:MAX))**

1084 for compatibility with legacy IPP Clients – choose implementation-dependent “default”  
1085 Printer object. “redirect” operation to that Printer object, and relay response to Client]

1086 **8.3 Create-Job, Get-Job-Attributes: job-resource-ids (1 setOf**  
1087 **integer(1:MAX))**

1088

1089 **9. Additional Values for Existing Attributes**

1090 **9.1 notify-events (1 setOf type2 keyword)**

1091

## 1094 **10. Conformance Requirements**

1095 Provide numbered lists of conformance requirements for the document.

### 1096 **10.1 Conformance Requirements for Clients**

### 1097 **10.2 Conformance Requirements for Infrastructure Systems**

### 1098 **10.3 Conformance Requirements for Systems**

1099

## 1100 **11. Internationalization Considerations**

1101 For interoperability and basic support for multiple languages, conforming implementations  
1102 MUST support the Universal Character Set (UCS) Transformation Format -- 8 bit (UTF-8)  
1103 [RFC3629] encoding of Unicode [UNICODE] [ISO10646] and the Unicode Format for  
1104 Network Interchange [RFC5198].

1105 Implementations of this specification SHOULD conform to the following standards on  
1106 processing of human-readable Unicode text strings, see:

- 1107 • Unicode Bidirectional Algorithm [UAX9] – left-to-right, right-to-left, and vertical
- 1108 • Unicode Line Breaking Algorithm [UAX14] – character classes and wrapping
- 1109 • Unicode Normalization Forms [UAX15] – especially NFC for [RFC 5198]
- 1110 • Unicode Text Segmentation [UAX29] – grapheme clusters, words, sentences
- 1111 • Unicode Identifier and Pattern Syntax [UAX31] – identifier use and normalization
- 1112 • Unicode Collation Algorithm [UTS10] – sorting
- 1113 • Unicode Locale Data Markup Language [UTS35] – locale databases

1114 Implementations of this specification are advised to also review the following informational  
1115 documents on processing of human-readable Unicode text strings:

- 1116 • Unicode Character Encoding Model [UTR17] – multi-layer character model
- 1117 • Unicode in XML and other Markup Languages [UTR20] – XML usage
- 1118 • Unicode Character Property Model [UTR23] – character properties

- 1119
- Unicode Conformance Model [UTR33] – Unicode conformance basis

## 1120 12. Security Considerations

1121 The IPP extensions defined in this document require the same security considerations as  
1122 defined in the IPP/1.1: Model and Semantics [RFC2911] and PWG System Object and  
1123 System Control Service Semantics [PWG5108.06].

1124 Implementations of this specification SHOULD conform to the following standard on  
1125 processing of human-readable Unicode text strings, see:

- 1126
- Unicode Security Mechanisms [UTS39] – detecting and avoiding security attacks

1127 Implementations of this specification are advised to also review the following informational  
1128 document on processing of human-readable Unicode text strings:

- 1129
- Unicode Security FAQ [UNISECFAQ] – common Unicode security issues

1130

## 1131 13. IANA and PWG Considerations

1132 TBD

## 1133 14. References

### 1134 14.1 Normative References

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1289 standard:

1290 Peter Zehler (Xerox)

## 1291 16. Change History

### 1292 **16.1 18 October 2015**

- 1293 - Interim draft – changes per IPP WG reviews on 5 October 2015
- 1294 - global - accepted all changes up to and through section 6.9 (from previous review)
- 1295 - revised section 7.1 title to “System, Printer, and Resource Operation Attributes” to allow
- 1296 for Printer operation attributes in future such as “printer-service-type” for Create-Printer
- 1297 revised sections 7.1.x to change “filters the set of Printers” to “specifies a filter for the
- 1298 applicable Printers”
- 1299 - added section 7.1.3 printer-service-type for Create-Printer operation
- 1300 - revised section 7.1.4 printer-service-types to change “Service Type attribute” to “Service
- 1301 Type element”, add forward reference to “printer-service-type” in section 7.5 Printer Status
- 1302 Attributes, and add emailin, emailout, and faxin (references to PWG 5108.01 and RFC
- 1303 2707)
- 1304 - revised section 7.1.5 resource-id to add forward reference to “resource-id” in section 7.7
- 1305 Resource Status Attributes
- 1306 - revised section 7.1.11 system-uri to change “attribute the target” to “attribute specifies the
- 1307 target”
- 1308 - revised section 7.1.12 which-printers to change “This attribute and is” to “This attribute is”
- 1309 (drop “and”)
- 1310 - revised section 14 References to accept all changes and add PWG Job Monitoring MIB
- 1311 (RFC 2707)

### 1312 **16.2 20 September 2015**

- 1313 - Interim draft - changes per PWG F2F review on 31 August 2015
- 1314 - global - accepted all changes up to and through section 6.9 (from previous review)
- 1315 - revised Abstract and section 1 Introduction to add explicit references to Cloud & Infra
- 1316 - deleted section 5.2 System Operation Attributes and section 5.7 Resource Operation
- 1317 Attributes
- 1318 - added section 5.8 Printer Description Attributes and table for “printer-owner-[uri|vcard]”
- 1319 - revised section 6.9.1 Get-Printers Request to make “attributes-charset” and “attributes-
- 1320 natural-language” REQUIRED for Client (per RFC 2911)
- 1321 - revised section 6.9.1 Get-Printers Request to add note to “requested-attributes” about the
- 1322 primary Printer attributes in the IETF LDAP Printer Schema (RFC 7612)
- 1323 - revised section 7.2 System Description Attributes to add new attribute definitions
- 1324 - revised section 14.1 Normative References to add references for new attribute definitions

### 1325 **16.3 31 August 2015**

- 1326 - Interim draft – changes per PWG F2F review on 10 August 2015
- 1327 - global – deleted redundant “new” and “now” and “below” in several dozen places
- 1328 - revised Table of Contents to delete List of Figures (all now deleted in this version)
- 1329 - revised section 2.2 Protocol Role Terminology to correct “Infrastructure System” from

- 1330 “PWG5109.CLOUD” to “PWG5109.1”, add “Printer”, and correct typos in “Protocol  
1331 Endpoint”
- 1332 - revised section 2.2 Protocol Role Terminology to add references to IPP INFRA (PWG  
1333 5100.18) to “Infrastructure Printer”, “Infrastructure System”, and “Proxy”
- 1334 - revised section 2.3 Printing Terminology to add “Printer” (synonym for “Imaging Service”)  
1335 with RFC 2911 reference
- 1336 - revised section 3.1 Rationale for the IPP System Service to correct title of IPP/2.0  
1337 - revised section 3.1 Rationale for the IPP System Service to add paragraphs for IPP  
1338 INFRA [PWG5100.18] and Cloud Imaging Model [PWG5109.1]
- 1339 - revised section 5 IPP System and Resource Objects and Operations for clarity and  
1340 deleted redundant Figure 1 through Figure 4 (PWG SM abstract objects) and text
- 1341 - revised section 5.1 System Attribute Groups and section 5.6 Resource Attribute Groups  
1342 titles to be singular (only one of each)
- 1343 - revised section 5.2 System Operation Attributes and section 5.7 Resource Operation  
1344 Attributes to be just forward references to section 7.1 System and Resource Operation  
1345 Attributes
- 1346 - revised section 5.3 System Description Attributes Table 1 and section 7.2 System  
1347 Description Attributes to add “system-default-printer-uri” to support the enhanced “Get-  
1348 Printer-Attributes” operation
- 1349 - revised and reordered (alphabetized) section 5.3 System Description Attributes Table 1  
1350 and section 7.2 System Description Attributes to insert “system” prefix on several attributes  
1351 for consistency with Printer object in RFC 2911
- 1352 - revised and reordered (alphabetized) section 5.4 System Status Attributes Table 2 and  
1353 section 7.3 System Status Attributes to insert “system” prefix on several attributes and add  
1354 “system-up-time” for consistency with Printer object in RFC 2911
- 1355 - revised section 5.5 System Operations Table 3 to add missing references and change  
1356 “Cancel-Subscriptions” and “Renew-Subscriptions” to singular per RFC 3995
- 1357 - revised section 5.5 System Operations Table 3 to update note for Create-Resource and  
1358 add note for Create-Printer referring to the semantically equivalent Create operation in ISO  
1359 10175-3
- 1360 - revised section 5.5 System Operations Table 3 to add note that Register-Output-Device  
1361 is semantically equivalent to Register-System in PWG 5109.1 (with differences explained)
- 1362 - revised section 5.9 Resource Status Attributes Table 5 to add note for “resource-id”  
1363 analogous to “job-id” in RFC 2911.
- 1364 - revised section 5.9 Resource Status Attributes Table 5 to add note for “resource-k-octets”  
1365 analogous to “job-k-octets” in RFC 2911.
- 1366 - revised section 5.9 Resource Status Attributes Table 5 to add notes for “resource-job-id”  
1367 and “resource-printer-uri” which are required for Job and Printer scoped Resource objects,  
1368 respectively
- 1369 - revised section 5.9 Resource Status Attributes Table 5 to add “resource-authenticator” for  
1370 verification of Resource data after a Send-Resource-Data operation
- 1371 - deleted redundant sections 6.x Cancel-Subscription, Get-Notifications, Get-Printer-  
1372 Attributes, and Renew-Subscription and moved to sections 8.x for existing operations with  
1373 new semantics
- 1374 - revised section 6.x Get-Printers to change “selected” to “matching” and make sure that  
1375 each attribute has a colon (:) at the end and put the reference(s) at the end of each

1376 attribute name  
1377 - revised section 6.x Get-Printers to use “the Client [MUST|SHOULD|MAY] supply and the  
1378 System MUST support” for clarity – “OPTIONALLY” is NOT a defined conformance  
1379 keyword  
1380 - revised section 6.x Get-Printers and section 7.1.x “printer-geo-location” to remove  
1381 ‘unknown’ value (never appropriate in this specification)  
1382 - revised section 6.x Get-Printers and section 7.1.x “printer-service-types” to change  
1383 singular to plural (i.e., multiple printers can be chosen by the filter)  
1384 - revised sections 6.x Get-Resources and Get-Resource-Attributes to note that they are  
1385 modeled on Get-Jobs and Get-Job-Attributes with default returns of “resource-id” and  
1386 “resource-state”  
1387 - revised section 6.x Get-System-Attributes to note that it is modeled on Get-Printer-  
1388 Attributes with default return of all System attributes  
1389 - revised section 7.1 title to be “System and Resource Operation Attributes” (since some  
1390 apply to operations on both objects)  
1391 - revised section 7.1.x to change “selects” to “filters” and “selected” to “matching” for clarity  
1392 - added sections 7.1.x for “resource-category”, “resource-id”, “resource-job-id”, “resource-  
1393 printer-uri”, “resource-state”, and “resource-type” operation attributes  
1394 - revised section 14.1 Normative References to update IPP/2.0 title and reference (work-in-  
1395 progress) and add IPP INFRA (PWG 5100.18-2015) and Cloud Imaging Model (PWG  
1396 5109.1-2015)  
1397

#### 1398 **16.4 10 August 2015**

1399 - Interim draft – changes per PWG F2F review on 29 April 2015  
1400 - global – added working notes from PWG F2F at appropriate operations and attributes to  
1401 capture discussion and agreements  
1402 - revised Abstract and section 1 Introduction to say “support registration of an IPP System,  
1403 through its IPP Proxy, with one or more Cloud Imaging Systems”  
1404 - revised section 1.1 Rationale for two IPP Protocol Endpoints to titlecase “Protocol  
1405 Endpoint” in first paragraph  
1406 - revised section 2.2 Protocol Role Terminology, to add “Endpoint” (whole computing  
1407 device) from IETF NEA Overview [RFC5209], clarify “Infrastructure System”, and rewrite  
1408 “Protocol Endpoint” (an application interface) based on standard IETF usage.  
1409 - revised section 3.4 Out-of-Scope to add support for any non-IPP Cloud Imaging System.  
1410 - revised section 5.3 System Description Attributes to delete issue about cardinality of  
1411 “owner-uri” and “owner-vcard” (they are single-valued) and to remove Register-System  
1412 operation from Table 1 Note 4  
1413 - revised section 5.5 System Operations Table 3 to replace “Cancel-Xxx-Subscriptions”  
1414 with “Cancel-Subscriptions” and “Renew-Xxx-Subscriptions” with “Renew-Subscriptions”  
1415 and reference RFC 3995  
1416 - revised section 5.5 System Operations Table 3 to delete “Renew-Resource”, add “Get-  
1417 Subscriptions” and “Get-Subscription-Attributes”, and replace “Get-Xxx-Notifications” with  
1418 “Get-Notifications” and reference RFC 3996  
1419 - revised section 5.5 System Operations Table 3 to add new “Install-Resource” operation

- 1420 to activate (for use) firmware, software, fonts, etc. after Create-Resource and Send-  
1421 Resource-Data have completed  
1422 - added section 5.6 Resource Attribute Groups  
1423 - added section 5.7 Resource Operation Attributes  
1424 - added section 5.8 Resource Description Attributes and Table 4  
1425 - added section 5.9 Resource Status Attributes and Table 5  
1426 - revised sections 6.x to align with current set of operations  
1427 - added section 6.x Get-Printers in complete detail for review  
1428 - added section 7 New IPP Attributes and sections 7.x for all System and Resource  
1429 operation, description, and status attributes  
1430 - revised sections 14.x to add or update several references

1431 **16.5 28 April 2015**

- 1432 - Interim draft – changes per IPP WG review on 30 March 2015  
1433 - global – replaced “IPP System Control Service” with “IPP System Service” (but NOT in  
1434 the abstract PWG equivalent), per IPP WG review  
1435 - global – replaced titlecase “Object” with lowercase “object” (except in section title or PWG  
1436 SM spec titles), per IPP WG review  
1437 - revised Abstract to change “[PWG510x.y]” document references to “(PWG 510x.y)”,  
1438 consistent with IETF RFC styles and change “Cloud Imaging services” to “Cloud Imaging  
1439 Systems”, per IPP WG review  
1440 - revised section 1 Introduction to replace with expanded scope text from Abstract, per IPP  
1441 WG review  
1442 - revised section 1.1 Rationale for two IPP Protocol Endpoints to clarify that a conforming  
1443 IPP System Service supports both a URI for an IPP System object and a \*separate\* URI  
1444 for the implementation defined “default” IPP Printer returned from Get-Printer-Attributes,  
1445 per IPP WG review  
1446 - revised section 2.2 Protocol Role Terminology to add definitions of Infrastructure System  
1447 and Protocol Endpoint, remove the “IPP” prefix from the definitions of Client, Infrastructure  
1448 Printer, Proxy, and System terms, and enhance the definition of Proxy, per IPP WG review  
1449 - revised section 3.1 Rationale for the IPP System Service, to replace period “.” with semi-  
1450 colon “;” in non-terminal members of both numbered lists, per IPP WG review  
1451 - revised section 5.3 System Description Attributes in Table 1 to change owner-uri from  
1452 RECOMMENDED to CONDITIONALLY REQUIRED and owner-vcard from OPTIONAL to  
1453 CONDITIONALLY REQUIRED for systems that support the Set-System-Attributes and  
1454 Register-System operations and added **issue** about possible multi-valued ordered sets for  
1455 multiple owners (whose semantics are presently undefined in any PWG spec), per IPP WG  
1456 review  
1457 - revised section 5.4 System Status Attributes in Table 2, note (7) to delete sentence about  
1458 already removed device-uuid attribute, per IPP WG review  
1459 - revised section 5.5 System Operations to add Create/Cancel/Renew-Resource-  
1460 Subscriptions, Create/Cancel/Renew-System-Subscriptions, Get-Notifications, Get-Printer-  
1461 Attributes (for implementation-defined “default” Printer), RestartSystem (for restart with  
1462 existing or new firmware Resource for remediation based on health monitoring), and to  
1463 divide original StoreResource into Create-Resource and Send-Resource-Data (to correct

- 1464 scope ambiguity of original PWG Resource Service operation), per IPP WG review  
1465 - added (blank placeholder) section 10.2 Conformance Requirements for Infrastructure  
1466 Systems, per IPP WG review  
1467 - revised section 11 Internationalization Considerations to add new Unicode boilerplate  
1468 from JDFMAP, per IPP WG review  
1469 - revised section 12 Security Considerations to add new Unicode boilerplate from  
1470 JDFMAP, per IPP WG review  
1471 - revised section 14.1 Normative References and section 14.2 Informative References to  
1472 add new Unicode boilerplate specs from JDFMAP, per IPP WG review  
1473 - TODO – add various spec references, per IPP WG review

1474 **16.6 15 March 2015**

- 1475 - Interim draft – changes per PWG F2F and IPP WG reviews on 4 November 2014, 17  
1476 November 2014, 19 January 2015, and 3 February 2015  
1477 - revised title to “IPP System Service”, per IPP WG review on 4 November 2014  
1478 - revised Abstract to include management and status of Services, Subunits, and  
1479 Resources and Cloud registration extensions, per IPP WG review on 4 November 2014  
1480 - revised section 1.1 Rationale for two IPP Protocol Endpoint to mention of inclusion of  
1481 original Get-Printer-Attributes that automatically selects the implementation-defined or site-  
1482 defined “default” IPP Printer object for the convenience of existing IPP Clients, per IPP WG  
1483 review on 4 November 2014  
1484 - revised section 2.2 Protocol Role Terminology to add definitions of Infrastructure Printer  
1485 and IPP Proxy from IPP Shared Infrastructure Extensions, per IPP WG review on 3  
1486 February 2015  
1487 - revised section 2.3 Printing Terminology to delete Resource Service and revise the  
1488 definitions of Spooling Service and Streaming Service, per IPP WG review on 4 November  
1489 2014  
1490 - revised section 2.3 Printing Terminology to add definitions of Logical Device, Output  
1491 Device, and Physical Device from IPP Shared Infrastructure Extensions, per IPP WG  
1492 review on 3 February 2015  
1493 - renamed section 2.4 from “Acronyms and Organizations” to simply “Abbreviations”, for  
1494 consistency with RFC 7472, per RFC Editor on 5 March 2015  
1495 - revised section 3.1 Rationale for the IPP System Service to add the Resource Service  
1496 functionality (objects, operations, and attributes), per IPP WG review on 4 November 2014  
1497 - added new use case in section 3.2.4 Resource Management, per IPP WG review on 4  
1498 November 2014  
1499 - revised section 3.4 Out-of-Scope, to delete creation/deletion of Imaging Services, per IPP  
1500 WG review on 3 February 2015  
1501 - revised section 3.5 Design Requirements, to add Resource object, per IPP WG review on  
1502 4 November 2014  
1503 - added section 4.6 Resource Service, to add Resource object, per IPP WG review on 4  
1504 November 2014  
1505 - revised section 5.1 Attribute Groups to define the system-attributes-tag and resource-  
1506 attributes-tag, per IPP WG review on 19 January 2015  
1507 - revised section 5.2 Operation Attributes to define system-uri and resource-uri, per IPP



- 1508 WG review on 19 January 2015  
1509 - revised title of section 5.3 to System Description Attributes, per IPP WG review on 19  
1510 January 2015  
1511 - revised section 5.3 System Description Attributes in Table 1 to raise owner-uri from  
1512 OPTIONAL to RECOMMENDED, per IPP WG review on 19 January 2015  
1513 - revised section 5.3 System Description Attributes to delete redundant original Figure 3  
1514 and Figure 4, per IPP WG review on 19 January 2015  
1515 - revised title of section 5.4 to System Status Attributes, per IPP WG review on 19 January  
1516 2015  
1517 - revised section 5.4 to System Status Attributes in Table 2 to delete redundant device-  
1518 uuid, per IPP WG review on 19 January 2015  
1519 - revised section 5.4 to System Status Attributes to delete redundant original Figure 4,  
1520 Figure 5, Figure 6, and Figure 7, per IPP WG review on 19 January 2015  
1521 - revised section 5.5 System Operations to delete issue about Subscription operations, per  
1522 IPP WG review on 3 February 2015  
1523 - revised section 5.5 System Operations in Table 3 to add Create/Delete-Printer and  
1524 Resource operations, per IPP WG review on 3 February 2015

## 1525 **16.7 2 November 2014**

- 1526 - Interim draft – changes per IPP WG review on 29 September 2014  
1527 - corrected typos and wording  
1528 - revised cover page and headers to change “IPPSYSTEM” to “SYSTEM”, per IPP WG  
1529 review  
1530 - globally changed “Imaging Device” to “Imaging System” where appropriate (most  
1531 instances), per IPP WG review  
1532 - globally changed “[RFC2616]” to “[RFC7230]”, per IPP WG review  
1533 - globally changed “[PWG5100.SCAN]” to “[PWG5100.17]” and corrected reference in  
1534 section 10.1, per PWG approval of IPP Scan Service  
1535 - added section 1.1 Rationale for two IPP Protocol Endpoints to explain the reason for  
1536 separate URI for System and Printer objects, per IPP WG review  
1537 - revised section 2.2 to change title from “Printing Terminology” to “Protocol Roles”, per  
1538 IPP WG review  
1539 - revised section 2.2 to delete “IPP Printer” (and thus Logical Device and Physical Device  
1540 definitions and details) as not applicable to System Control Service and to add “IPP  
1541 System”, per IPP WG review  
1542 - revised section 2.3 to change title from “Other Terminology” to “Printing Terminology”, per  
1543 IPP WG review  
1544 - moved first sentence of section 2.2 (sources of terms) to section 2.3, per IPP WG review  
1545 - revised section 2.3 to add new terms, including “Document”, “FaxOut Job/Service”, “ith”,  
1546 “Job”, “Print Job/Service”, “Scan Job/Service”, “Spooling Service”, “Streaming Service”,  
1547 “Subunit”, “Transform Job/Service”, per IPP WG review  
1548 - revised section 2.3 to improve “Imaging System” definition, per IPP WG review  
1549 - revised section 3.1 Rationale to clarify various paragraphs and add numbered lists, per  
1550 IPP WG review  
1551 - revised section 3.2 Use Cases to clarify various paragraphs, per IPP WG review

- 1552 - revised section 3.3 to change “TBD” to “There are no exceptions to the use cases defined  
1553 in section 3.2”, per IPP WG review  
1554 - revised section 3.4 Out of Scope to clarify first sentence, per IPP WG review  
1555 - revised section 3.4 Out of Scope to clarify several statements, per IPP WG review  
1556 - revised section 3.4 Design Requirements to clarify first sentence, per IPP WG review  
1557 - added section 4.5 Document Object, per IPP WG review  
1558 - revised section 5.3 System Description to change “READ-ONLY” to “READ-WRITE”  
1559 (because Set-System-Attributes was restored in this draft), per IPP WG review and Cloud  
1560 Imaging WG recommendations  
1561 - revised section 5.4 System Status to clarify the “READ-ONLY” cannot be modified by a  
1562 Set-System-Attributes operation, per IPP WG review and Cloud Imaging WG  
1563 recommendations  
1564 - revised section 5.4 System Status to clarify the meaning of “system-uuid” (SCS), “printer-  
1565 uuid” (Imaging Service), and “device-uuid” (physical hardware, i.e., network device), per  
1566 IPP WG review  
1567 - revised section 5.4 System Status Table 2 to change “configured-services” to  
1568 “configured-printers”, per IPP WG review  
1569 - revised section 5.5 System Operations Table 3 to add back Restart-One-Printer, Startup-  
1570 One-Printer, Shutdown-One-Printer, and Set-System-Elements, per IPP WG review and  
1571 Cloud Imaging WG recommendations  
1572 - revised section 6 New IPP Operations to add back Restart-One-Printer, Startup-One-  
1573 Printer, Shutdown-One-Printer, and Set-System-Elements, per IPP WG review and Cloud  
1574 Imaging WG recommendations  
1575 - revised section 8.1 title to add “Create-Subscription” operation, per IPP WG review  
1576 - revised section 13 to change title from “IANA Considerations” to “IANA and PWG  
1577 Considerations”, per IPP WG review  
1578

1579 **16.8 24 August 2014**

- 1580 - Interim draft  
1581 - corrected typos and wording  
1582 - revised section 5.3 and added Table 1 – Attributes in IPP System Description group with  
1583 notes for rationale of all conformance requirements  
1584 - revised section 5.4 and added Table 2 – Attributes in IPP System Status group with notes  
1585 for rationale of all conformance requirements  
1586 - added section 6 New IPP Operations (empty)  
1587 - added section 7 New IPP Attributes (empty)

1588 **16.9 11 August 2014**

- 1589 - Initial draft  
1590 - based on Mike Sweet’s presentation at PWG F2F meeting in October 2013  
1591 - added Abstract and Introduction  
1592 - added Terminology, including new and refined terms for clarity

- 1593 - added Requirements (rationale, use cases, out-of-scope, design requirements)
- 1594 - added IPP Object Model (extensions to RFC 2911)
- 1595 - added IPP System Object (still a sketch)
- 1596 - combined System object and System Control Service object (separation was artificial)
- 1597 - added References (normative and informative)